PROJECT MANUAL II FOR
CR 136/I-75 COLLECTION &
TRANSMISSION LINES
SUWANNEE COUNTY, FLORIDA
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SECTION 312316 - EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil densification.
2. Excavating for building foundations.
3. Excavating for paving, roads, and parking areas.
4. Excavating for slabs-on-grade.
5. Excavating for site structures.

1.2 PAYMENT

A. Excavating Soil Materials:

2. Basis of Payment: Includes general excavating to required elevations, loading, placing materials in stockpile and/or removing from site. Over Excavating: Payment will not be made for over excavated work nor for replacement materials.

1.3 REFERENCES

A. Local utility standards when working within 24 inches of utility lines.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

C. Shop Drawings: Indicate soil densification grid for each size and configuration footing requiring soils densification.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Florida Department of Transportation and Suwannee County standards.
B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in the state of Florida.

PART 2 - PRODUCTS

2.1 Not Used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Call Utility Line Information service at 811 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility company to remove and relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, and other features remaining as portion of final landscaping.

F. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.2 SOIL DENSIFICATION - VIBRO-COMPACTION

A. Vibro-compact substrates below footing bearing surfaces for footings as indicated on Drawings before excavating site.

B. Densify existing subsoils with relative density rating of compact to dense to attain relative density rating of very dense.

C. Densification Equipment:

1. Depth Vibrator: Poker type with follower tubes with visible marking every 12 inches to enable insertion depth measurement.
2. Motion: radial in horizontal plane.
3. Data Acquisition System: Record amps or pressure of the vibrator motor over time and depth.

D. Perform densification in presence of Geotechnical Engineer directly under each footing with vibrator inserted in grid pattern at maximum 6 feet on center.

1. Arrange compaction grid for each footing for maximum number of insertion points and with outermost insertion points within the bearing area of footings.
2. Adjust compaction grid arrangement and spacing as directed by Geotechnical Engineer to achieve required densification.

E. Insert vibrator to maximum specified depth. Densify soils for 30 seconds or other time as directed by Geotechnical Engineer. Withdraw vibrator every 12 inches increments and repeat densification at each increment.

1. When subsurface obstruction prevents vibrator insertion to specified depth, request instructions from Geotechnical Engineer to compensate for obstruction.

F. Tolerances:

1. Maximum Deviation from Center of Completed Compaction: 8 inches from indicated position.
2. Maximum Deviation from Vertical: 4 degrees during vibrator insertion.

3.3 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation work.

B. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving, site structures and construction operations.

C. Excavate to working elevation for piling work.

D. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity.

E. Slope banks with machine to angle of repose or less until shored.

F. Do not interfere with 45 degree bearing splay of foundations.

G. Grade top perimeter of excavation to prevent surface water from draining into excavation.

H. Trim excavation. Remove loose matter.

I. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume. Remove larger material as specified.

J. Notify Architect/Engineer of unexpected subsurface conditions.
K. Remove excavated material from site.
L. Repair or replace items indicated to remain damaged by excavation.

3.4 FIELD QUALITY CONTROL

A. Request visual inspection of bearing surfaces by Engineer before installing subsequent work.

3.5 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION 312316
SECTION 312316.13 - TRENCHING

PART 4 - GENERAL

4.1 SUMMARY

A. Section Includes:
   1. Excavating trenches for utilities from 5 feet outside building to utility service.
   2. Compacted fill from top of utility bedding to subgrade elevations.
   3. Backfilling and compaction.

B. Related Sections:
   1. Section 312316 - Excavation: General building excavation.
   2. Section 333100 - Sanitary Utility Sewerage Piping: Sanitary sewer piping and bedding from building to utility service.

4.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Trenching:
   2. Basis of Payment: Includes excavating to required elevations, protecting excavation, and removing excavated materials from site. Over Excavating: Payment is not made for over excavated work nor for replacement materials.

B. Subsoil Fill:
   2. Basis of Payment: Includes furnishing fill material, stockpiling, scarifying substrate surface, placing where required, and compacting.

C. Structural Fill:
   2. Basis of Payment: Includes furnishing fill material, stockpiling, shaping substrate surface, placing where required, and compacting.

D. Granular Fill:
   2. Basis of Payment: Includes furnishing fill material, stockpiling, scarifying substrate surface, placing where required, and compacting.

E. Concrete Fill:
2. Basis of Payment: Includes furnishing materials, forming, mixing and placing where required, and curing.

4.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
   2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
   4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

4.4 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

4.5 SUBMITTALS

A. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.


C. Samples: Submit, in air-tight containers, 10 lb. sample of each type of fill to testing laboratory.

D. Materials Source: Submit name of imported fill materials suppliers.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

4.6 QUALITY ASSURANCE

A. Perform Work in accordance with Florida Department of Transportation and Suwannee County Standards.
B. Maintain one copy of each document on site.

4.7 QUALIFICATIONS
   A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced
      in design of this Work and licensed in the State of Florida.

4.8 FIELD MEASUREMENTS
   A. Verify field measurements prior to fabrication.

4.9 COORDINATION
   A. Section 013000 - Administrative Requirements: Coordination and project conditions.
   B. Verify Work associated with lower elevation utilities is complete before placing higher elevation
      utilities.

PART 5 - PRODUCTS

5.1 FILL MATERIALS
   A. Subsoil Fill: Type S3 as specified in Section 310513.
   B. Structural Fill: Type A3 as specified in Section 310513.
   C. Granular Fill: Type A3 as specified in Section 310516.
   D. Concrete: Lean concrete

5.2 ACCESSORIES

PART 6 - EXECUTION

6.1 LINES AND GRADES
   A. Lay pipes to lines and grades indicated on Drawings.
      1. Engineer reserves right to make changes in lines, grades, and depths of utilities when
         changes are required for Project conditions.
B. Use laser-beam instrument with qualified operator to establish lines and grades.

6.2 PREPARATION

A. Call Utility Line Information service at 811 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as portion of final landscaping.

D. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

6.3 TRENCHING

A. Excavate subsoil required for utilities to utility service.

B. Remove lumped subsoil, boulders, and rock up of 1/6 cubic yard, measured by volume. Remove larger material.

C. Perform excavation within 24 inches of existing utility service in accordance with utility's requirements.

D. Do not advance open trench more than 200 feet ahead of installed pipe.

E. Cut trenches to width indicated on Drawings. Remove water or materials that interfere with Work.

F. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.

G. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.

H. Do not interfere with 45 degree bearing splay of foundations.

I. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.

J. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered.
K. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill Type A3 and compact to density equal to or greater than requirements for subsequent backfill material.


M. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

N. Remove excess subsoil not intended for reuse, from site.

6.4 AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be left in place as part of the completed Work, cut off minimum 18 inches below finished grade.

6.5 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Place geotextile fabric prior to placing subsequent fill materials.

D. Place fill material in continuous layers and compact in accordance with construction drawings.

E. Employ placement method that does not disturb or damage foundation perimeter drainage or utilities in trench.

F. Maintain optimum moisture content of fill materials to attain required compaction density.

G. Do not leave more than 50 feet of trench open at end of working day.

H. Protect open trench to prevent danger to the public.

6.6 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

C. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.
6.7 FIELD QUALITY CONTROL
   A. Field inspecting, testing, adjusting, and balancing.
   B. Perform laboratory material tests in accordance with AASHTO T180.
   C. Perform in place compaction tests in accordance with the following:
   D. When tests indicate Work does not meet specified requirements: remove Work, replace, compact, and retest.
   E. Frequency of Tests: 1 every 500’.

6.8 PROTECTION OF FINISHED WORK
   A. Reshape and re-compact fills subjected to vehicular traffic during construction.

6.9 SCHEDULE
   A. Storm and Sanitary Piping:
      1. Cover pipe and bedding with Fill: To subgrade elevation.
      2. Compact uniformly to minimum 98 percent of maximum density.

END OF SECTION 312316.13
SECTION 330505.31 - HYDROSTATIC TESTING

PART 7 - GENERAL

7.1 SUMMARY

A. Section Includes: Hydrostatic testing of pressure piping.

B. Related Requirements:
   1. Section 333123 - Sanitary Sewerage Force Main Piping: Pipe materials and accessories normally encountered with municipal sanitary sewage force mains.
   2. Section 331413 - Public Water Utility Distribution Piping: Pipe materials and accessories normally encountered with pressurized water distribution systems.
   3. Section 331416 - Site Water Utility Distribution Piping: Pipe materials and accessories normally encountered with pressurized water distribution systems.

7.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

7.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Submit following items prior to start of testing:
   1. Testing procedures.
   2. List of test equipment.
   3. Testing sequence schedule.
   5. Certification of test gage calibration.

C. Test and Evaluation Reports: Indicate results of piping tests.

D. Qualifications Statement:
   1. Submit qualifications for applicator.

7.4 QUALITY ASSURANCE

A. Perform Work according to AWWA C-600 standards.

B. Maintain one copy of each standard affecting Work of this Section on Site.
7.5 QUALIFICATIONS

A. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience.

PART 8 - PRODUCTS

8.1 HYDROSTATIC TESTING

A. Equipment:
   1. Pressure pump.
   2. Pressure hose.
   3. Water meter.
   4. Test connections.
   5. Pressure relief valve.
   6. Pressure Gage: Calibrated to 0.1 psi

PART 9 - EXECUTION

9.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that piping is ready for testing.

C. Verify that trenches are backfilled.

D. Verify that pressure piping thrust restraints have been installed.

9.2 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Testing of Pressure Piping:
   1. Test system according to AWWA C600 and following:
      a. Hydrostatically test each portion of pressure piping, including valved section, at 1.5 times working pressure of piping, based on elevation of lowest point in piping corrected to elevation of test gage.
      b. Conduct hydrostatic testing for at least two hours.
      c. Slowly fill with water portion of piping to be tested, expelling air from piping at high points.
      d. Install corporation cocks at high points.
e. Close air vents and corporation cocks after air is expelled.
f. Raise pressure to specified test pressure.
g. Observe joints, fittings, and valves undergoing testing.
h. Remove and renew cracked pipes, joints, fittings, and valves that show visible leakage.
i. Retest.
j. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
k. Maintain pressure within plus or minus 5.0 psi of test pressure.
l. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of testing.
m. Compute maximum allowable leakage using following formula:

\[
L = \frac{SD \times \sqrt{P}}{C}.
\]

2) \( L \) = testing allowance, gph.
3) \( S \) = length of pipe tested, feet.
4) \( D \) = nominal diameter of pipe, inches.
5) \( P \) = average test pressure during hydrostatic testing, psig.
6) \( C = 148,000 \).
7) If pipe undergoing testing contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each pipe size.

2. If testing of piping indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within acceptable limits.
3. Correct visible leaks regardless of quantity of leakage.

END OF SECTION 330505.31
SECTION 330505.33 - INFILTRATION AND EXFILTRATION TESTING

PART 10 - GENERAL

10.1 SUMMARY

A. Section Includes:

1. Testing of Gravity Sewer Piping:
   a. Exfiltration testing.
   b. Infiltration testing.

2. Testing of Manholes: Exfiltration testing.

B. Related Requirements:
   1. Section 330561 - Concrete Manholes: Requirements for sewage and stormwater manholes.
   2. Section 333111 - Public Sanitary Sewerage Gravity Piping: Pipe materials, manholes, and accessories normally encountered with gravity sewerage piping.

10.2 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Submit following items prior to start of testing:

1. Testing procedures.
2. List of test equipment.
3. Testing sequence schedule.
5. Certification of test gage calibration.

C. Test and Evaluation Reports: Indicate results of manhole and piping tests.

D. Qualifications Statement:

1. Submit qualifications for applicator.

10.3 QUALITY ASSURANCE

A. Perform Work according to ASTM standards.

10.4 QUALIFICATIONS

A. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience.
PART 11 - PRODUCTS

11.1 EXFILTRATION TESTING

A. Equipment:
   1. Plugs.
   2. Pump.
   3. Measuring device.

11.2 INFILTRATION TESTING

A. Equipment: Weirs.

PART 12 - EXECUTION

12.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that manholes and piping are ready for testing.

C. Verify that trenches are backfilled.

12.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for preparation.

B. Lamping:
   1. Lamp gravity piping after flushing and cleaning.
   2. Perform lamping operation by shining light at one end of each pipe section between manholes.
   3. Observe light at other end.
   4. Pipe not installed with uniform line and grade will be rejected.
   5. Remove and reinstall rejected pipe sections.
   6. Clean and lamp until pipe section is installed to uniform line and grade.

C. Plugs:
   1. Plug outlets, wye branches, and laterals.
   2. Brace plugs to resist test pressures.
12.3 FIELD QUALITY CONTROL

A. Infiltration Testing:
   1. Maximum Allowable Infiltration: 100 gal./in. of pipe diameter for each mile per day for reach of piping undergoing testing.
   2. Include allowances for leakage from manholes.
   3. Perform testing with minimum positive head of 2 feet.

B. Manhole Testing:
   1. Repair both outside and inside of joint to ensure permanent seal.
   2. Test manholes with manhole frame set in place.
   3. Plug pipes in manhole.
   4. Remove water from manhole.
   5. Observe plugs over period of not less than two hours to ensure that there is no leakage into manhole.
   6. Determine ground water level outside manhole.
   7. Fill manhole with water within 4 inches of top of cover frame.
   8. Prior to testing, allow manhole to soak from minimum of four hours to maximum of 72 hours.
   9. After soak period, adjust water level inside manhole to within 4 inches of top of cover frame.
  10. Measure water level from top of manhole frame.
  11. At end of four-hour testing period, again measure water level from top of manhole frame; compute drop in water level during testing period.
  12. Manhole exfiltration test is considered satisfactory when drop in water level is less than following:

     a. Manhole Depth of 4 Feet:
        1) Diameter of 4 feet: 0.11 inch.
        2) Diameter of 5 feet: 0.14 inch.

     b. Manhole Depth of 6 Feet:
        1) Diameter of 4 feet: 0.17 inch.
        2) Diameter of 5 feet: 0.21 inch.

     c. Manhole Depth of 8 Feet:
        1) Diameter of 4 feet: 0.23 inch.
        2) Diameter of 5 feet: 0.29 inch.

     d. Manhole Depth of 10 Feet:
        1) Diameter of 4 feet: 0.28 inch.
        2) Diameter of 5 feet: 0.35 inch.

     e. Manhole Depth of 12 Feet:
1) Diameter of 4 feet : 0.34 inch.
2) Diameter of 5 feet : 0.43 inch.

f. Manhole Depth of 14 Feet:
1) Diameter of 4 feet : 0.40 inch.
2) Diameter of 5 feet : 0.50 inch.

g. Manhole Depth of 16 Feet:
1) Diameter of 4 feet : 0.45 inch.
2) Diameter of 5 feet : 0.56 inch.

h. Manhole Depth of 18 Feet:
1) Diameter of 4 feet : 0.51 inch.
2) Diameter of 5 feet : 0.64 inch.
3) .

i. Manhole Depth of 20 Feet
1) Diameter of 4 feet : 0.57 inch.
2) Diameter of 5 feet : 0.71 inch.

13. If unsatisfactory testing results are achieved, repair manhole and retest until result meets criteria.
14. Repair visible leaks regardless of quantity of leakage.

END OF SECTION 330505.33
SECTION 330505.43 - MANDREL TESTING

PART 13 - GENERAL

13.1 SUMMARY

A. Section Includes: Deflection testing of plastic sewer piping.

B. Related Requirements:
   1. Section 333111 - Public Sanitary Sewerage Gravity Piping: Pipe materials, manholes, and accessories normally encountered with gravity sewerage piping.

13.2 REFERENCE STANDARDS

A. ASTM International:

13.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Submit following items prior to start of testing:
   1. Testing procedures.
   2. List of test equipment.
   3. Testing sequence schedule.
   5. Certification of test gage calibration.
   6. Deflection mandrel drawings and calculations.

C. Test and Evaluation Reports: Indicate results of piping tests.

PART 14 - PRODUCTS

14.1 DEFLECTION TESTING

A. Equipment:
   1. "go, no go" mandrel
   2. Pull/retrieval ropes.
PART 15 - EXECUTION

15.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that piping is ready for testing.

C. Verify that trenches are backfilled.

15.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for preparation.

B. Lamping:

1. Lamp gravity piping after flushing and cleaning.
2. Perform lamping operation by shining light at one end of each pipe section between manholes.
3. Observe light at other end.
4. Pipe not installed with uniform line and grade will be rejected.
5. Remove and reinstall rejected pipe sections.
6. Clean and lamp until pipe section is installed to uniform line and grade.

C. Plugs:

1. Plug outlets, wye branches, and laterals.
2. Brace plugs to resist test pressures.

15.3 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Deflection Testing of Plastic Sewer Piping:

1. Perform vertical ring deflection testing on PVC and ABS sewer piping after backfilling has been in place for at least 30 days, but not longer than 12 months.
2. Allowable maximum deflection for installed plastic sewer pipe is no greater than five percent of original vertical internal diameter.
3. Perform deflection testing using "go, no go" mandrel.
4. Mandrel Diameter:

   a. Not less than 95 percent of base or average ID of pipe.

5. Perform testing without mechanical pulling devices.
6. Locate, excavate, replace, and retest piping that exceeds allowable deflection.
END OF SECTION 330505.43
SECTION 330507.13 - UTILITY DIRECTIONAL DRILLING

PART 16 - GENERAL

16.1 SUMMARY

A. Section Includes:
   1. Excavation for approach trenches and pits.
   2. Horizontal directional drilling.
   3. Pipe.
   4. Drilling fluid system.

B. Related Requirements:
   1. Section 312316 – Excavation: Excavation of subsoil and excavation supports as required by this section.
   2. Section 312316.13 – Trenching: Trenching as required by this section.
   3. Section 330505.31 - Hydrostatic Testing: Sanitary sewer pipe testing.
   5. Section 330505.43 - Mandrel Testing: Sanitary sewer pipe testing.
   7. Section 331413 - Public Water Utility Distribution Piping: Potable-water pipe testing.

16.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Horizontal Directional Drilling:
   2. Basis of Payment: Includes excavation, drilling, pipe, accessories, tests, and backfill.

16.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Water Works Association:
   1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   2. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.
3. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission.

C. ASTM International:

2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft³.
11. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

D. North American Society for Trenchless Technology:

1. NASTT - Horizontal Directional Drilling Good Practices Guidelines.

E. Plastics Pipe Institute:

1. PPI TR-46 - Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe.

16.4 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with FDOT, Suwannee County Public Works and utilities within construction area.
16.5 PREINSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum one week prior to commencing Work of this Section.

16.6 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Identify source of water used for drilling.
   2. Submit copy of approvals and permits for use of water source.

C. Shop Drawings:
   1. Submit technical data for equipment, method of installation, and proposed sequence of construction.
   2. Include information pertaining to pits, dewatering, method of spoils removal, and equipment size, capacity, and capabilities, including installing pipe on radius, type of drill bit, drilling fluid, method of monitoring line and grade, detection of surface movement, name plate data for drilling equipment, and mobile spoils removal unit.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statement:
   1. Submit qualifications for driller.

G. Submit FDOT and Suwanee County occupancy permit for installations under public throughways and lands.

16.7 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of pipe and invert and centerline elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

D. Record actual depth of pipe at 25-foot intervals.

E. Record actual horizontal location of installed pipe.

F. Show depth and location of abandoned bores.
G. Record depth and location of drill bits and drill stems not removed from bore.

16.8 QUALITY ASSURANCE

A. Perform Work according to following:
   1. NASST - Horizontal Directional Drilling Good Practices Guidelines.
   2. ASTM F1962.
   3. PPI TR-46.

B. Perform Work according to ASTM F1962-11 standards.

C. Maintain one copy of each standard affecting Work of this Section on Site.

16.9 QUALIFICATIONS

A. Driller: Company specializing in performing Work of this Section with minimum three years' documented experience.

16.10 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Handling:
   1. Use shipping braces between layers of stacked pipe.
   2. Support pipes with nylon slings during handling.

D. Storage:
   1. According to manufacturer instructions.
   2. Stack piping lengths no more than three layers high.
   3. Store field joint materials in original shipping containers in dry area indoors.

E. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Protect pipe from entry of foreign materials and water by installing temporary covers, completing sections of Work, and isolating parts of completed system.
   3. Provide additional protection according to manufacturer instructions.
16.11 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Maintain storage temperature of 60 to 85 degrees F.

16.12 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 17 - PRODUCTS

17.1 HORIZONTAL DIRECTIONAL DRILLING

A. Performance and Design Criteria:
   1. Drilling Steering System: Remote with continuous electronic monitoring of boring depth and location.
   2. Directional Change Capability: 90 degrees with 35-foot radius curve.
   3. Minimum distance for single bores and between boring pits: As determined by driller
      a. Pipe Size 3 to 6 Inches: 300 feet.
   4. Ratio of Reaming Diameter to Pipe OD:
      a. Nominal Pipe Diameter of 6 Inches and Smaller: Maximum of 1.5.
      b. Nominal Pipe Diameter Larger Than 6 Inches: Submit recommended ratio and reaming procedures for review by Architect/Engineer.

B. Water Source:
   1. Potable.
   2. Obtained from Contractor

C. Underground Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.

D. Materials:
   1. Drilling Fluid: Liquid bentonite clay slurry; totally inert with no environmental risk.

E. Polyethylene (PE) Piping:
   1. Pipe: Comply with AWWA C906 [ASTM D3035, DR 11 for 160psig pressure rating.
   2. Materials:
a. Comply with ASTM D3350.
b. Cell Classification: 445574C.

3. Fittings:
   a. Comply with AWWA C906.
   b. Style: Molded.

4. Joints:
   a. End Connections: plain end for mechanical joint.

F. Subsoil Fill: Type S3, as specified in Section 310513 - Soils for Earthwork; To be determined by geotechnical recommendation of driller.

17.2 MIXES

A. Grout: As specified in Section 036000 - Grouting.

B. Flowable Fill: As specified in Section 312324 - Flowable Fill.

PART 18 - EXECUTION

18.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that connections to existing piping system sizes, locations, and invert centerline elevations are according to Drawings.

18.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Local Utility:
   1. Call local utility line information service at not less than three working days before performing Work.
   2. Request underground utilities to be located and marked within and surrounding construction areas.
   3. Request utility company to remove or relocate utilities.

C. Maintain access to existing facilities and indicated to remain; modify pipe installation indicated on Drawings to maintain access to existing facilities.

D. Locate and identify utilities indicated to remain and protect from damage.
E. Identify required lines, levels, contours, and data locations.

F. Protect plant life, lawns, and other features remaining as portion of final landscaping.

G. Protect benchmarks such as: existing structures, fences, sidewalks, paving, curbs and survey control points from excavating equipment and vehicular traffic.

H. Establish pipe elevations with not less than 3 feet of cover.

I. Establish minimum separation between piping according to DEP regulations and plans and specifications.

18.3 INSTALLATION

A. Dewatering:
   1. Intercept and divert surface drainage, precipitation, and ground water away from excavation using dikes, curb walls, ditches, pipes, sumps, or other approved means.
   2. Develop and maintain substantially dry subgrade during drilling and pipe installation.
   3. Comply with State of Florida requirements for discharging water to watercourse, preventing stream degradation, and controlling erosion and sediment.

B. Excavation:
   1. Excavate subsoil as specified in Section 312316 - Excavation
   2. Excavate approach trenches and pits according to Shop Drawings and as Site conditions require; minimize number of access pits.
   3. Provide sump areas to contain drilling fluids.
   4. Install excavation supports as specified in Section 312316 - Excavation.
   5. Restore areas after completion of drilling and carrier pipe installation.

C. Drilling:
   1. Drill pilot bore with vertical and horizontal alignment as indicated on Shop Drawings.
   2. Surveying:
      a. Survey entire drill path and mark entry and exit locations with stakes.
      b. If a magnetic guidance system is used, survey drill path for surface geomagnetic variations or anomalies.
   3. Guiding:
      a. Guide drill remotely from ground surface to maintain alignment by monitoring signals transmitted from drill bit.
      b. Monitor depth, pitch, and position.
      c. Adjust drill head orientation to maintain correct alignment.
   4. Drilling Fluid:
      a. Inject drilling fluid into bore to stabilize hole, remove cuttings, and lubricate drill bit and pipe.
b. Continuously monitor drilling fluid pumping rate, pressure, viscosity, and density while drilling pilot bore, back reaming, and installing pipe to ensure adequate removal of soil cuttings and stabilization of bore.
c. Provide relief holes when required to relieve excess pressure.
d. Minimize heaving during pullback.

5. Verification of Accuracy:
a. Calibrate and verify electronic monitor accuracy during first 50 feet of bore in presence of Architect/Engineer before proceeding with other drilling.
b. Excavate minimum of four test pits spaced along first 50 feet of bore to verify required accuracy.
c. If required accuracy is not met, adjust equipment or provide new equipment capable of meeting required accuracy.

6. After completing pilot bore, remove drill bit.

D. Drilling Obstructions:
1. If obstructions are encountered during drilling, notify Engineer immediately.
2. Do not proceed around obstruction without approval of Engineer.
3. For conditions requiring more than 3 feet of deviation in horizontal alignment, submit revised Shop Drawings to Architect/Engineer for approval before resuming Work.
4. Maintain adjusted bore alignment within easement or right-of-way.

E. Piping:
1. Install reamer and pipe pulling head; select reamer with minimum bore diameter required for pipe installation.
2. Attach pipe to pipe pulling head and pull reamer and pipe to entry pit along pilot bore.
3. Inject drilling fluid through reamer to stabilize bore and lubricate pipe.
4. Install piping with horizontal and vertical alignment as shown on Shop Drawings.
5. Protect and support pipe being pulled into bore such that pipe moves freely and is not damaged during installation.
6. Do not exceed pipe manufacturer's recommended pullback forces.
7. Trace Wire:
   a. Install trace wire continuous with each bore.
   b. Splice trace wire only at intermediate bore pits.
   c. Tape or insulate trace wire to prevent corrosion and maintain integrity of pipe detection.
   d. Terminate trace wire for each pipe run at structures along pipe system.
   e. Provide extra length of trace wire at each structure such that trace wire can be pulled 3 feet out top of structure for connection to detection equipment.
   f. Test trace wire for continuity for each bore before acceptance.
8. Provide sufficient length of pipe to extend past termination point to allow connection to other pipe sections.
9. Allow minimum of 24 hours for stabilization after installing pipe before making connections to pipe.
10. Mark location and depth of bore with spray paint on paved surfaces and on wooden stakes on non-paved surfaces at 25-foot intervals.

F. Slurry Removal and Disposal:
   1. Contain excess drilling fluids at entry and exit points until recycled or removed from Site; provide recovery system to remove drilling spoils from access pits.
   2. Drilling Spoils:
      a. Remove, transport, and legally dispose of drilling spoils.
      b. Do not discharge drilling spoils in sanitary sewers, storm sewers, or other drainage systems.
      c. When drilling in suspected contaminated soil, test drilling fluid for contamination before disposal.
   3. If drilling fluid leaks to surface, immediately contain leak and barricade area from vehicular and pedestrian travel before resuming drilling operations.
   4. Complete cleanup of drilling fluid at end of each working day.

G. Backfilling:
   1. Install backfill as specified in Section 312323 - Fill.
   2. Backfill approach trenches and pits with subsoil fill to contours and elevations as indicated on Drawings.
   3. Compact subsoil fill as specified in Section 312323 - Fill to minimum 98 percent of maximum density.

18.4 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Horizontal Position: 12 inches.

C. Maximum Variation from Vertical Elevation: 2 inches.

D. Minimum Horizontal and Vertical Clearance from Other Utilities: 12 inches.

E. Deviation:
   1. If pipe installation deviates beyond specified tolerances, abandon bore, remove installed pipe, rebore, and reinstall pipe in correct alignment.
   2. Fill abandoned bores greater than 3 inches in diameter with grout or flowable fill material.

18.5 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Upon completion of pipe installation, test pipe according to following:
3. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

C. Compaction Testing:
   1. Comply with AASHTO T 180
   2. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
   3. Testing Frequency: One for each lift.

D. Frequency of Compaction Testing: Two for each lift.

E. Certify that equipment for drilling has been properly set up and is ready for drilling.

18.6 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Upon completion of drilling and pipe installation, remove drilling spoils, debris, and unacceptable material from approach trenches and pits.

C. Clean up excess slurry from ground.

D. Restore approach trenches and pits to original condition.

E. Remove temporary facilities for drilling operations as specified in Section 015000 - Temporary Facilities and Controls.

END OF SECTION 330507.13
SECTION 330509.33 - THRUST RESTRAINT FOR UTILITY PIPING

PART 19 - GENERAL

19.1 SUMMARY

A. Section Includes:
   1. Tied joint restraint system.

B. Related Requirements:
   1. Section 312316.33 – Trenching: Trenching and backfilling requirements for site utilities.
   2. Section 331413 - Public Water Utility Distribution Piping: Requirements for piping Work as required by this Section.
   3. Section 333100 - Sanitary Sewerage Piping: Requirements for piping Work as required by this Section.
   4. Section 333111 - Public Sanitary Sewerage Gravity Piping: Requirements for piping Work as required by this Section.

19.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Tied Joint Restraint System:
   2. Basis of Payment: Includes tied joint restraint system and accessories.

19.3 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

B. ASME International:
   1. ASME B1.1 - Unified Inch Screw Threads, UN and UNR Thread Form.

C. ASTM International:
   3. ASTM A588/A588M - Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi Minimum Yield Point, with Atmospheric Corrosion Resistance.

19.4 COORDINATION
A. Section 013000 - Administrative Requirements: Requirements for coordination.
B. Coordinate Work of this Section with installation of fittings and joints that require restraint.

19.5 SUBMITTALS
A. Section 013300 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit manufacturer catalog information for restrained joint details and installation instructions.
C. Shop Drawings:
   1. Indicate restrained joint details and materials being used.
   2. Submit layout drawings showing piece numbers and locations.
   3. Indicate restrained joint locations.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Delegated Design Submittals:
   1. Submit signed and sealed Shop Drawings with design calculations and assumptions for restrained lengths.
   2. Submit joint restraint details.
   3. Use joint restraint devices specifically designed for applications described in manufacturer information.
F. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
G. Qualifications Statement:
   1. Submit qualifications for manufacturer, fabricator, and licensed professional.

19.6 CLOSEOUT SUBMITTALS
A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
B. Project Record Documents: Record actual locations of joint restraints.
19.7 QUALITY ASSURANCE
   A. Perform Work according to AWWA & ASTM standards.
   B. Maintain 1 copy of each standard affecting Work of this Section on Site.

19.8 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
   B. Fabricator: Company specializing in fabricating products specified in this Section with minimum three years' documented experience.

19.9 DELIVERY, STORAGE, AND HANDLING
   A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
   B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
   C. Store materials according to manufacturer instructions.
   D. Protection:
      1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
      2. Provide additional protection according to manufacturer instructions.

19.10 EXISTING CONDITIONS
   A. Field Measurements:
      1. Verify field measurements prior to fabrication.
      2. Indicate field measurements on Shop Drawings.

PART 20 - PRODUCTS

20.1 PERFORMANCE AND DESIGN CRITERIA
   A. Provide pressure pipeline with restrained joints at each bend, tee, and change in direction.

20.2 TIED JOINT RESTRAINT SYSTEMS
   A. 1. Furnish materials according to AWWA & ASTM standards.
B. Tie Bolts:

1. Mechanical Joints on 2- and 3-Inch Pipe:
   b. Comply with ASTM A588/A588M, Grade B.
   c. Comply with ASTM A325, Type 3, except increase tensile strength of full body threaded section to 40,000 lb. minimum for 5/8 inch and 60,000 lb. minimum for 3/4 inch by heat-treating (quenching and tempering) to manufacturer's reheat and hardness specifications.

2. Mechanical and Flanged Joints on 4- to 12-Inch Pipe:
   b. Comply with ASTM A588/A588M, Grade B.
   c. Comply with ASTM A325, Type 3, except increase tensile strength of full body threaded section to 40,000 lb. minimum for 5/8 inch and 60,000 lb. minimum for 3/4 inch by heat-treating (quenching and tempering) to manufacturer's reheat and hardness specifications.

C. Tie Nut:

1. Description: Hex nut for each tie bolt and tie rods.
2. Comply with ASTM A563, Grade C3.
3. Finish: zinc plated

D. Tiepin:

2. Size and Shape: 6-inch hairpin.
3. Comply with ASME B1.1 and ASTM A588/A588M.

E. Tie Coupling:

1. Description: Extension of continuous-threaded rods.
2. Provide with center stop to aid installation.
3. Comply with ASTM A588/A588M.

F. Tie Clamp:

1. Description: Retainer clamp for ductile iron, asbestos-cement, and PVC push-on pipe.
2. Location: In front of bell.
3. Comply with ASTM A36/A36M, ASTM A307, Grade A, and ASTM A563, Grade A.

G. Tie Rod:

1. Description: Continuous-threaded rod for cutting to desired lengths.

H. Tie Bar:
   1. Description: Steel bar used to restrain push-in plugs.
   2. Comply with ASTM A36/A36M.
   3. Finish: zinc plated

I. Tie Washer:
   1. Description: Round flat washers.
   2. ASTM A588/A588M, ASTM F436, Type 1.

20.3 MATERIALS

A. Steel:
   2. High-Strength Low-Alloy Steel: Comply with ASTM A588/A588M.
   3. Carbon Steel: Comply with ASTM A36/A36M.

20.4 FINISHES

A. Zinc Plating:
   1. Factory applied.

B. Galvanizing:
   1. Factory applied.
   2. Comply with ASTM A153/A153M.

PART 21 - EXECUTION

21.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that pipe and fittings are ready to receive Work.

C. Field measure and verify conditions for installation of Work.
21.2 PREPARATION
   A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
   B. Clean surfaces of pipe and fittings that are to receive tied joint restraint systems.

21.3 INSTALLATION
   A. Installation Standards: Install Work according to AWWA & ASTM standards.

21.4 TOLERANCES
   A. Section 014000 - Quality Requirements: Requirements for tolerances.
   B. Torque 5/8-inch nuts on mating threaded fasteners from 45 to 60 ft.-lbf.
   C. Torque 3/4-inch nuts on mating threaded fasteners from 75 to 90 ft.-lbf.
   D. Torque 1-inch nuts from 100 to 120 ft.-lbf.

END OF SECTION 330509.33
SECTION 330553 - IDENTIFICATION FOR UTILITIES PIPING

PART 22 - GENERAL

22.1 SUMMARY

A. Section Includes:
   1. Pipe Warning Tape
   2. Tracing Wire

B. Related Requirements:
   2. Section 333113 - Public Sanitary Utility Sewerage Piping: Materials and methods for piping, valves, and appurtenances.

22.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

22.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's catalog literature for each product required.

22.4 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

PART 23 - PRODUCTS

2.1 Buried Warning and Identification Tape: Polyethylene plastic and metallic core or metallic-faced, acid and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3-inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously
over the entire tape length. Warning and identification to read, “CAUTION, BURIED (intended service) LINE BELOW” or similar working. Color and printing shall be permanent, unaffected by moisture or soil.

2.2 Warning Tape Color Codes: Blue (Water Systems), Green (Sanitary Force Mains)

2.3 Locate wiring shall be 10-gauge, single strand, UF-rated (direct burial), copper wire. Plastic ties for connecting to water and sewer mains shall be plastic, zipper type ties. Ground clamps shall be bronze serrated head with brass-bronze screws. Locate wiring must have the ability to conduct an electrical current; therefore, the wiring must be continuous with any breaks in the line spliced. Locate wire shall be spliced with Engineer approved wire connectors. Wire connectors shall be PinPoint wire connectors by Duraline or approved equal.

PART 24 - EXECUTION

24.1 INSTALLATION

A. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

END OF SECTION 330553
SECTION 330561 – CONCRETE MANHOLES

PART 25 - GENERAL

25.1 SUMMARY

A. Section Includes:

1. Modular precast concrete manholes and structures with tongue-and-groove joints and precast concrete ring transition to cover frame, covers, anchorage, and accessories.
2. Masonry manhole and structure sections with masonry transition to cover frame, covers, anchorage, and accessories.
3. Cast-in-place concrete manholes and structures with precast concrete ring transition to cover frame, covers, anchorage, and accessories.
4. Bedding and cover materials.

B. Related Requirements:

1. Section 031000 - Concrete Forming and Accessories: Erection and bracing of forms.
2. Section 032000 - Concrete Reinforcing: Reinforcing steel as required by this Section.
3. Section 033000 - Cast-in-Place Concrete: Concrete type for manhole and structure foundation slab construction.

7. Section 312316 - Excavation: Excavating for manholes, structures, and foundation slabs.
8. Section 312323 - Fill: Backfilling after manhole and structure installation.
10. Section 330130.61 - Packer Injection Grouting: Grout sealing as required by this Section.

25.2 DEFINITIONS

A. Bedding: Specialized material placed under manhole prior to installation and subsequent backfill operations.

25.3 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Manholes:

1. Basis of Measurement: By each manhole based on manhole type, size and depth.
2. Basis of Payment: Includes excavating, concrete foundation slab, concrete structure sections, precast adjustment rings, cover frame and cover, interior and exterior coatings and forming and sealing of pipe inlets and outlets.

25.4 REFERENCE STANDARDS

A. American Association of State Highway Transportation Officials:
   1. AASHTO M91 - Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).

B. American Concrete Institute:

C. ASTM International:
   4. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.

25.5 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

25.6 PREINSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.
25.7 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information for manhole covers, component construction, features, configuration, dimensions.

C. Shop Drawings:
   1. Indicate structure locations and elevations.
   2. Indicate sizes and elevations of piping penetrations.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Source Quality-Control Submittals: Indicate results of shop tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Qualifications Statement:
   1. Submit qualifications for manufacturer.

25.8 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of manholes and connections, and record invert elevations.

25.9 QUALITY ASSURANCE

A. Perform Work according to ASTM standards.

25.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three documented experience.

25.11 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
C. Handling: Comply with precast concrete manufacturer instructions and ASTM C913 for unloading and moving precast manholes and drainage structures.

D. Storage:
   1. Store materials according to manufacturer instructions.
   2. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property.
   3. Repair property damaged from materials storage.

E. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

25.12 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

25.13 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

25.14 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five year manufacturer's warranty for concrete manholes.

PART 26 - PRODUCTS

26.1 CONCRETE AND MASONRY MANHOLES

A. Manufacturers:
   1. Furnish materials according to ASTM standards.

B. Manhole Sections:
   1. Materials:
      a. Reinforced Precast Concrete: Comply with ASTM C478.
      b. Gaskets: Comply with ASTM C923.
2. Joints:
   b. Maximum Leakage: 0.025 gal per hour per foot of joint at 3 feet of head.

C. Reinforcement:
   1. Formed steel wire or reinforcing rods.
   2. Thickness: As called out in construction plans.
   3. Finish: Galvanized.

D. Shaft and Concentric Cone Top Sections:
   1. Pipe Sections: Reinforced precast concrete.
   2. Joints:
      a. Lipped male/female.
      b. Dry.
   3. Sleeved to receive pipe sections.

E. Shape: Cylindrical.

F. Clear Inside Dimensions:
   1. As indicated on Drawings.

G. Design Depth:
   1. As indicated on Drawings.

H. Clear Cover Opening:
   1. As indicated on Drawings.

I. Pipe Entry: Furnish openings as indicated on Drawings.

J. Structure Joint Gaskets:

26.2 FRAMES AND COVERS

A. Manufacturers:
   1. Furnish materials according to ASTM and AASHTO standards.

B. Description:
   1. Material:
      a. Cast iron.
2. Lid:
   a. Bearing Surface: Machined flat.
   b. Configuration: Removable.
   c. Security: None.

3. Cover Design: Closed.
5. Cover: Molded with identifying name and logo.
7. Nominal Lid Size: As called out in construction plans.

26.3 RISER RINGS
1. Furnish materials according to ASTM and AASHTO standards.

B. Riser Rings:
1. Thickness of 4 to 6 Inches
   a. Precast concrete.
   b. Comply with ASTM C478.

2. Thickness Less Than 4 Inches:
   a. Cast iron.
   b. Comply with AASHTO M306.

3. Rubber Seal Wraps:
   a. Wraps and Band Widths: Comply with ASTM C877 (C877M), Type III.
   b. Cone/Riser Ring Joint: Minimum 3-inch (75-mm) overlap.
   c. Frame/Riser Ring Joint: 2-inch (50-mm) overlap.
   d. Additional Bands: Overlap upper band by 2 inches (50 mm).

C. Concrete Cradle:
1. As specified in Section 033000 - Cast-in-Place Concrete.
2. Description:
   a. Type: Reinforced, as specified in Section 032000 - Concrete Reinforcing.
   b. Strength: 4,000 at 28 days.
   c. Finish: Rough troweled.

26.4 MATERIALS

A. Cover and Bedding:
1. Bedding: Fill Type A3, as specified in construction plans.
2. Cover: Fill Type A3, as specified in construction plans.
26.5 ACCESSORIES

A. Steps:
   a. As indicated on Drawings.

2. Spacing:
   a. As indicated on Drawings.

B. Foundation Slab:
   1. Cast-in-place concrete as specified in Section 033000 - Cast-in-Place Concrete
   2. Top Surface: Level.

C. Strap Anchors:
   1. Shape: Bent steel.
   2. Size: As shown in construction plans.
   3. Finish: Galvanized.

D. Joint Sealant: Comply with ASTM C990 (C990M).

E. Fasteners: Stainless steel; ASTM F593.

F. Concrete: As specified in Section 033000 - Cast-in-Place Concrete.

G. Grout: As specified in Section 033000 - Cast-in-Place Concrete.

H. Soil Backfill from Above Pipe to Finish Grade:
   1. Soil Type S1, as specified in construction plans.
   2. Subsoil: No frozen earth, or foreign matter, or rocks more than 6 inches (150 mm) in diameter.

26.6 FINISHES

A. Bituminous Interior Manhole Coating:
   1. Manufacturers:
      a. Furnish materials according to AWWA and ASTM standards.
   2. Description: As specified in Section 099000 - Painting and Coating.

B. Steel Galvanizing:
   1. Hot-dip galvanize after fabrication.
   2. Comply with ASTM A123/A123M.

26.7 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.
B. Provide shop inspection and testing of completed assembly.

C. Owner Inspection:
   1. Make completed available for inspection at manufacturer's factory prior to packaging for shipment.
   2. Notify Owner at least seven days before inspection is allowed.

D. Owner Witnessing:
   1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
   2. Notify Owner at least seven days before inspections and tests are scheduled.

E. Certificate of Compliance:
   1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
   2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 27 - EXECUTION

27.1 EXAMINATION
   A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
   B. Verify that items provided by other Sections of Work are properly sized and located.
   C. Verify that built-in items are in proper location and are ready for roughing into Work.
   D. Verify that excavation base is ready to receive Work and excavations and that dimensions and elevations are as indicated on Drawings.

27.2 PREPARATION
   A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
   B. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers as indicated on Drawings to indicate its intended use.
   C. Coordinate placement of inlet and outlet pipe or duct sleeves as required by other Sections.
   D. Do not install manholes and structures where Site conditions induce loads exceeding structural capacity of manholes or structures.
E. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.

27.3 INSTALLATION

A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface structures or utilities in immediate or adjacent areas.

B. Correct over-excavation with fine aggregate.

C. Remove large stones or other hard matter impeding consistent backfilling or compaction.

D. Protect manhole from damage or displacement while backfilling operation is in progress.

E. Excavating:
1. As specified in Section 312316 - Excavation and in indicated locations and depths.
2. Provide clearance around sidewalls of manhole or structure for construction operations granular backfill.
3. If ground water is encountered, prevent accumulation of water in excavations; place manhole or structure in dry trench.
4. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation as approved by Architect/Engineer.

F. Base and Alignment:
1. Place foundation slab and trowel top surface level.
2. Grout base of shaft sections to achieve slope to exit piping, trowel smooth, and contour to form continuous drainage channel.
3. Place manhole sections plumb and level, trim to correct elevations, and anchor to foundation slab.

G. Attachments:
1. As Work progresses, build fabricated metal items.
2. Cut and fit for pipe, conduit] and sleeves.
3. Set cover frames and covers level to correct elevations without tipping.

H. Backfilling: As specified in Section 310513 - Soils for Earthwork.

I. Coating: Paint interior with two coats of bituminous interior coating at rate of 120 sq. ft./gal.

J. Precast Concrete Manholes:
1. Lift precast components at lifting points designated by manufacturer.
2. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure that interior of pipeline and structure remains clean.
3. Assembly:
a. Assemble multisection manholes and structures by lowering each section into excavation.
b. Install rubber gasket joints between precast sections according to manufacturer recommendations.
c. Lower, set level, and firmly position base section before placing additional sections.

4. Remove foreign materials from joint surfaces and verify that sealing materials are placed properly.
5. Maintain alignment between sections by using guide devices affixed to lower section.
6. Joint sealing materials may be installed on Site or at manufacturer's plant.
7. Verify that installed manholes and structures meet required alignment and grade.
8. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe; fill annular spaces with mortar.
9. Cut pipe flush with interior of structure.
10. Shape inverts through manhole and structures as indicated on Drawings.

K. Cast-in-Place Concrete Manholes:

1. Bear firmly and fully on support system as indicated on Drawings.
2. Erect and brace forms against movement as specified in Section 031000 - Concrete Forming and Accessories.
3. Install reinforcing steel as indicated on Drawings and as specified in Section 032000 - Concrete Reinforcing.
4. Place and cure concrete as specified in Section 033000 - Cast-in-Place Concrete.
5. Frames and Covers:

a. Set frames using mortar and masonry.
b. Install radially laid concrete brick with 1/4-inch (6.35-mm-) thick, vertical joints at inside perimeter.
c. Lay concrete brick in full bed of mortar and completely fill joints.
d. If more than one course of concrete brick is required, stagger vertical joints.
e. Set frame and cover 2 inches (51 mm) above finished grade for manholes and structures with covers located within unpaved areas, to allow area to be graded away from cover beginning 1 inch (25 mm) below top surface of frame.

L. Sanitary Manhole Drop Connections:

M. Sanitary Manhole Drop Connections: As indicated on Drawings.

N. Castings:

1. Set frames using mortar and masonry as indicated on Drawings.
2. Install radially laid concrete brick with 1/4-inch thick, vertical joints at inside perimeter.
3. Lay concrete brick in full bed of mortar and completely fill joints.
4. If more than one course of concrete brick is required, stagger vertical joints.
5. Set frame and cover 2 inches above finished grade for manholes and other structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.
27.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Testing:
   1. Cast-in-Place Concrete: As specified in Section 033000 - Cast-in-Place Concrete
   2. Concrete Manhole Sections: Comply with ASTM C497 as specified in Section 330505.33 - Infiltration and Exfiltration Testing

C. Equipment Acceptance: Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.

27.5 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Vertical Adjustment of Existing Manholes and Structures:
   1. As specified in Section 330130.86 - Manhole Rim Adjustment.
   2. If required, adjust top elevation of existing manholes and structures to finished grades as indicated on Drawings.
   3. Frames, Grates, and Covers:
      a. Remove frames, grates, and covers cleaned of mortar fragments.
      b. Reset to required elevation according to requirements specified for installation of castings.
   4. Reinforcing Bars:
      a. Remove concrete without damaging existing vertical reinforcing bars if removal of existing concrete wall is required.
      b. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement as indicated on Drawings.
   5. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete as specified in Section 033000 - Cast-in-Place Concrete.

27.6 ATTACHMENTS

A. Manholes: Precast concrete sections, galvanized-steel steps, not less than 48-inch inside dimension, to depth indicated, with bolted lid.

END OF SECTION 330561
SECTION 330577 - FIBERGLASS METERING MANHOLES

PART 28 - GENERAL

28.1 SUMMARY

A. Section Includes:
   1. Fiberglass meter boxes.
   2. Bedding and cover materials.

B. Related Requirements:

28.2 DEFINITIONS

A. Bedding: Specialized material placed under meter box prior to installation and subsequent backfill operations.

B. FRP: Fiberglass-reinforced plastic.

28.3 REFERENCE STANDARDS

A. American Association of State Highway Transportation Officials:
   1. AASHTO HB-17 - Standard Specifications for Highway Bridges.

B. ASTM International:
28.4 COORDINATION
A. Section 013000 - Administrative Requirements: Requirements for coordination.
B. Coordinate Work of this Section with connection to municipal utility service and trenching.

28.5 SUBMITTALS
A. Section 013300 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit manufacturer information for covers, component construction, features, configuration and critical dimensions.
C. Shop Drawings:
   1. Indicate structure locations and elevations.
   2. Indicate sizes and elevations of piping, conduit, and penetrations.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

28.6 CLOSEOUT SUBMITTALS
A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
B. Project Record Documents: Record actual locations of meter boxes and connections, and record invert elevations.

28.7 QUALITY ASSURANCE
A. Perform Work according to AWWA & ASTM standards.
B. Maintain 1 copy of each standard affecting Work of this Section on Site.

28.8 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.
28.9  DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
C. Handling: Comply with manhole manufacturer instructions for unloading.
D. Storage:
   1. Store materials according to manufacturer instructions.
   2. Store manholes to prevent damage to Owner's property or other public or private property.
   3. Repair property damaged from materials storage.
E. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Take precautions to prevent damage to interior or exterior surfaces when handling.
   3. Provide additional protection according to manufacturer instructions.

28.10  EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

28.11  WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.
B. Furnish five-year manufacturer's warranty for fiberglass metering manholes.

PART 29 - PRODUCTS

29.1  PACKAGE FIBERGLASS METERING MANHOLES

A. Furnish materials according to AWWA & ASTM standards.
B. Surfaces:
   1. Exterior: Free of blisters larger than 1/2 inch in diameter, delamination, and exposed fibers.
   2. Interior: Resin-rich with no exposed fibers, crazing, delamination, blisters larger than 1/2 inch in diameter, and wrinkles greater than 1/4 inch in depth.
C. Walls and Floor:
   1. Material:
      a. FRP.
      b. Molded in one piece.
      c. FRP Resin: Polyester.

   2. Minimum Thickness: 1/2 inch.
   3. Surfaces:

D. Materials:
   1. Reinforcing Material: Glass mat, Grade E.
   2. Laminate: Multiple layers of glass matting and resin.

E. Covers:
   1. Furnish materials according to AWWA & ASTM standards.

29.2 MATERIALS

A. Bedding: Fill Type A3, as specified in Section 310516 - Aggregates for Earthwork.

29.3 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Inspection and Testing:
   1. Provide shop inspection and testing of completed assembly.
   2. Maintain testing records and submit to Engineer.
   3. Comply with ASTM D2563 for allowable tolerance based on defect.
      a. Pinholes or Pores in Laminate Surface: None.
      b. Exposed Glass: None.
      c. Exposure of Cut Edges: None.
      d. Scratches: None greater than 0.002 inch deep.
      e. Foreign Matter: None.

C. Certificate of Compliance:
   1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
PART 30 - EXECUTION

30.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that items provided by other Sections of Work are properly sized and located.

C. Verify that built-in items are in proper location and are ready for roughing into Work.

D. Verify correct size of manhole and structure excavation.

E. Verify that excavation base is ready to receive Work and excavations and that dimensions and elevations are as indicated on Drawings.

30.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Mark each meter box with waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers as indicated on Drawings to indicate its intended use.

C. Coordinate placement of inlet and outlet pipe as required by other Sections.

D. Do not install meter boxes where Site conditions induce loads exceeding structural capacity meter boxes.

E. Inspect meter boxes immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.

30.3 INSTALLATION

A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface structures or utilities in immediate or adjacent areas.

B. Correct over-excavation with fine aggregate

C. Remove large stones or other hard matter impeding consistent backfilling or compaction.

D. Protect manhole from damage or displacement while backfilling operation is in progress.

E. Excavating:

1. As specified in Section 312316 – Excavation and in indicated locations and depths.
2. Provide clearance around sidewalls of meter box for construction operations.
3. If ground water is encountered, prevent accumulation of water in excavations; place meter box in dry trench.
F. Installation Standards: Install Work according to AWWA & ASTM standards.

END OF SECTION 330577
SECTION 331413 - PUBLIC WATER UTILITY DISTRIBUTION PIPING

PART 31 - GENERAL

31.1 SUMMARY

A. Section Includes:
   1. Pipe and fittings for public line, including potable water lines
   2. Tapping sleeves and valves.
   3. Bedding and cover materials.

B. Related Requirements:
   2. Section 312316 - Excavation: Excavation and backfill as required by this Section.
   3. Section 312316.13 - Trenching: Excavation and backfill as required by this Section.
   4. Section 312323 - Fill: Requirements for backfill to be placed by this Section.
   7. Section 330509.33 - Thrust Restraint for Utility Piping: Tied joint restraint system to anchor and resist forces developed in underground closed pipeline systems.
   8. Section 330563 - Concrete Vaults and Chambers: Cast-in-place, precast-concrete, or masonry structures for access to subsurface drainage piping or utilities.
   10. Section 331417 - Site Water Service Utility Laterals: Water main service connections.
   11. Section 331419 - Valves and Hydrants for Water Utility Service: Fire hydrants, valves, and valve boxes for fire hydrant and water main installations.

31.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Pipe and Fittings:
   2. Basis of Payment: Includes excavation and backfill; pipe, fittings, and appurtenances; bedding; joint restraint connection and tap to Site service piping.

C. Valves:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes excavation, bedding, backfill, valve, fittings, and accessories.
D. Fire Hydrants:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes excavation, gravel sump, bedding, backfill, hydrant, valve, connection, and accessories.

E. Meters:
   1. Basis of Measurement: By each and by size.
   2. Basis of Payment: Includes meter, fittings, and accessories.

F. Taps:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes tapping sleeve, tapping valves, and accessories.

31.3 REFERENCE STANDARDS
A. American Association of State Highway and Transportation Officials:
   1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:

C. ASTM International:
   4. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lb/ft3 (600 kN-m/m3).
   5. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   8. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

D. American Water Works Association:
1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
5. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
7. AWWA C153 - Ductile-Iron Compact Fittings.
8. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
9. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
10. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
11. AWWA C606 - Grooved and Shouldered Joints.
12. AWWA C700 - Cold-Water Meters - Displacement Type, Metal Alloy Main Case.
14. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP-60 - Connecting Flange Joints between Tapping Sleeves and Tapping Valves.

F. National Fire Protection Association:
   1. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

G. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

31.4 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

31.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, valves, hydrants and meters.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
E. Preconstruction Photographs: Submit digital files of color photographs of Work areas and material storage areas, as specified in Section 017000 - Execution and Closeout Requirements.

F. Qualifications Statements:
   1. Submit qualifications for manufacturer and installer.

31.6 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, valves, connections, and centerline elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

31.7 QUALITY ASSURANCE

A. Valves: Mark valve body with manufacturer's name and pressure rating.

B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

31.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:
   1. Store materials according to manufacturer instructions.
   2. Block individual and stockpiled pipe lengths to prevent moving.
   3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
   4. Store PE and PVC materials out of sunlight.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

31.9 EXISTING CONDITIONS

A. Field Measurements:
1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

31.10 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

PART 32 - PRODUCTS

32.1 WATER PIPING

A. Ductile-Iron Pipe:

1. Comply with AWWA C151.
2. Bituminous Outside Coating: Comply with AWWA C151.
3. Pipe Mortar Lining:
   a. Comply with AWWA C104.
   b. Thickness: Double.
4. PE Encasement: Comply with AWWA C105.
5. Pipe Class:
   a. Comply with AWWA C151.
6. Fittings:
   a. Material: Ductile iron; comply with AWWA C110.
   b. Compact Fittings: Comply with AWWA C153.
   c. Coating and Lining:
      1) Bituminous Coating: Comply with AWWA C110.
      2) Cement-Mortar Lining: Comply with AWWA C104; double thickness.
7. Joints:
   a. Mechanical and Push-on Joints: Comply with AWWA C111.
   b. Flanged Joints: Comply with AWWA C115

B. PVC:

1. Comply with AWWA C 900 and C905, DR 18.
2. Fittings: Comply with AWWA C900 C905 C111.
3. Joints:
   b. Seals: PVC flexible elastomeric.
   c. Solvent-cement couplings are not permitted.
C. PE Tubing:
   1. Comply with AWWA C901 ASTM D1248, SDR 9
   2. Fittings:
      a. Comply with AWWA C901.
      b. Type: Molded.

32.2 TAPPING SLEEVES AND VALVES

A. Tapping Sleeves:
   1. Description:
      a. Material: Type 304 SS.
      b. Type: Dual compression.
      c. Outlet Flange Dimensions and Drilling: Comply with ASME B16.1, Class 125 and MSS SP-60.

B. Tapping Valves:
   1. Description:
      a. Comply with AWWA C500.
      b. Type: Double disc with non-rising stem.
      c. Inlet Flanges: Comply with ASME B16.1, Class 125 and MSS SP-60.
      d. Mechanical Joint Outlets: Comply with AWWA C111.

32.3 VALVES AND FIRE HYDRANTS

A. As specified in Section 331419 - Valves and Hydrants for Water Utility Service.

32.4 ULTRASONIC METERS

A. Manufacturers:
   Badger E-Series Ultrasonic Meter or approved equal

B. Description:
   1. Comply with AWWA C700.
   2. Type: Ultrasonic
   3. Case Material: 316 SS
   4. Register: Hermetically sealed.
C. Meter:
1. Description: 316 stainless steel Ultrasonic meter
2. Service: Cold water
3. Nominal Flow Rate: 1.25 to 100 gpm
4. Maximum Flow Rate: 100 gpm
5. Maximum Operating Pressure: 175 psig
6. Accuracy: 1.5 percent
7. Maximum Counter Reading: 100 M gal
8. Pipe Size: 1 and 2 inches

32.5 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:
1. As specified in Section 033000 - Cast-in-Place Concrete.
2. Type: Reinforced, air entrained.
3. Compressive Strength: 4,000psi at 28 days.

B. Concrete Reinforcement: As specified in Section 032000 - Concrete Reinforcing.

32.6 FINISHES

A. Steel: Hot-dip galvanized after fabrication, according to ASTM A123/A123M.

B. Protective Coating: Bituminous paint.

32.7 ACCESSORIES


B. Air-Release Valves:
1. As located on Drawings.
2. As specified in Section 400578.11 - Air Release Valves for Water Service.

C. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.

D. Vaults: As specified in Section 330563 - Concrete Vaults and Chambers.

E. Meter Boxes: As specified in Section 330577 - Fiberglass Metering Manholes

F. Steel Rods, Bolt, Lugs, and Brackets:
1. Comply with ASTM A36/A36M.
2. Grade A carbon steel.
PART 33 - EXECUTION

33.1 EXAMINATION
A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
B. Verify that existing utility water main size, location, and invert are as indicated on Drawings.

33.2 PREPARATION
A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
B. Preconstruction Site Photos:
   1. As specified in Section 017000 - Execution and Closeout Requirements.
   2. Take photographs along centerline of proposed pipe trench; minimum one photograph for each 50 feet of pipe trench.
   3. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing Site features.
   4. Include Project description, date taken, and sequential number on back of each photograph.
C. Pipe Cutting:
   1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
   2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.
   3. Grind edges smooth with beveled end for push-on connections.
D. Remove scale and dirt on inside and outside before assembly.
E. Prepare pipe connections to equipment with flanges or unions.

33.3 INSTALLATION
A. Bedding:
   1. Excavation:
      a. As specified in Section 312316 - Excavation312316.13 - Trenching
      b. Hand trim for accurate placement of pipe to elevations as indicated on Drawings.
   2. Dewater excavations to maintain dry conditions and to preserve final grades at bottom of excavation.
   3. I
   4. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches of compacted depth, and compact to 95 percent of maximum density.
B. Piping:

1. Comply with AWWA C600.
2. Handle and assemble pipe according to manufacturer instructions and as indicated on Drawings.
4. Maintain 10 feet of horizontal separation between water main and sewer piping according to FDEP requirements.
5. Ductile-Iron Piping and Fittings: Comply with AWWA C600.
6. Flanged Joints: Do not use in underground installations except within structures.
7. Route pipe in straight line and re-lay pipe that is out of alignment or grade.
8. High Points:
   a. Install pipe with no high points.
   b. If unforeseen field conditions arise that necessitate high points, install air-release valves as specified in Section 400578.11 - Air Release Valves for Water Service as indicated on Drawings.
9. Bearing:
   a. Maintain bearing along entire length of pipe.
   b. Excavate bell holes to permit proper joint installation.
   c. Do not lay pipe in wet or frozen trench.
10. Prevent foreign material from entering pipe during placement.
11. Allow for expansion and contraction without stressing pipe or joints.
13. Install access fittings to permit disinfection of water system performed under Section 330110.58 - Disinfection of Water Utility Piping Systems.
14. Cover:
   a. Establish elevations of buried piping with not less than 2.5 feet of cover.
   b. Measure depth of cover from final surface grade to top of pipe barrel.
15. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.

C. Valves and Hydrants: As specified in Section 331419 - Valves and Hydrants for Water Utility Service.

D. Tapping Sleeves and Valves: As indicated on Shop Drawings and according to manufacturer instructions.

E. PE Encasement:

1. Encase piping in PE as indicated on Drawings to prevent contact with surrounding backfill material.
2. Comply with AWWA C105.
3. Terminate encasement 3 to 6 inches above ground where pipe is exposed.

F. Thrust Restraints: As specified in Section 330509.33 - Thrust Restraint for Utility Piping.
G. Service Connections: As specified in Section 331417 - Site Water Service Utility Laterals.

H. Backfilling:
1. Backfill around sides and to top of pipe with cover fill in minimum lifts of 6 inches, tamp in place, and compact to 95 percent of maximum density.
2. Place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment.
3. Maintain optimum moisture content of bedding material to attain required compaction density.


33.4 TOLERANCES
A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Install pipe to indicated elevation within tolerance of 5/8 inch.

33.5 FIELD QUALITY CONTROL
A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Testing:
1. Pressure test piping system according to AWWA C600 and following:
   a. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.
   b. Conduct hydrostatic test for a minimum of two hours.
   c. Slowly fill section to be tested with water; expel air from piping at high points.
   d. Install corporation cocks at high points.
   e. Close air vents and corporation cocks after air is expelled.
   f. Raise pressure to specified test pressure.
   g. Observe joints, fittings, and valves under test.
   h. Remove and renew cracked pipes, joints, fittings, and valves showing visible leakage, and retest.
   i. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
   j. Maintain pressure within plus or minus 5 psi of test pressure.
   k. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
   l. Compute maximum allowable leakage using following formula:

\[
1) \quad L = SD \times \sqrt{P}/C \\
2) \quad L = \text{testing allowance, gph} \\
3) \quad S = \text{length of pipe tested, feet} \\
4) \quad D = \text{nominal diameter of pipe, inches} \\
5) \quad P = \text{average test pressure during hydrostatic test, psig}
\]
6) \( C = 148,000 \)

m. If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

n. Leakage:

1) If test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.

2) Correct visible leaks regardless of quantity of leakage.

END OF SECTION 331413
SECTION 331416 - SITE WATER UTILITY DISTRIBUTION PIPING

PART 34 - GENERAL

34.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for Site water line, including domestic water line, fire water line, and appurtenances.
   a. Tapping sleeves and valves.
   b. Valves and boxes.
   c. Fire hydrants and yard hydrants.
   d. Reduced-pressure backflow preventers.
   e. Pipe support systems.
   f. Bedding and cover materials.

B. Related Requirements:

1. Section 330509.33 - Thrust Restraint for Utility Piping: Tied joint-restraint system to anchor and resist forces developed in underground closed pipeline systems.
2. Section 312316 - Excavation: Product and execution requirements for excavation and backfill.
3. Section 312316.13 - Trenching: Execution requirements for trenching.
5. Section 330553 - Identification for Utilities Piping and Equipment.
7. Section 331419 - Valves and Hydrants for Water Utility Service: Fire hydrants, valves, and valve boxes for fire hydrant and water main installations.
8. Section 331900 - Water Utility Metering Equipment: Positive displacement meters as required by this Section.

34.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Piping:

2. Basis of Payment: Includes hand-trimming excavation, pipe and fittings, bedding, backfilling, concrete thrust restraints, supports, connection and tap to building service piping, and connection and tap to municipal utility water source.

C. Valves:

1. Basis of Measurement: By each.
2. Basis of Payment: Includes valve, fittings, and accessories.
D. Fire Hydrants:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes excavation, hand trimming, gravel sump, hydrant, valve, valve box, backfilling, connection, and accessories.

E. Yard Hydrants:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes excavation, hand trimming, gravel sump, hydrant, valve, valve box, backfilling, connection, and accessories.

F. Meters:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes meter, fittings, meter box, and accessories.

G. Backflow Preventers:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes backflow preventer, fittings, and accessories.

H. Taps:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes tapping sleeve, tapping valves, and accessories.

34.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:
   2. ASME B16.18 - Cast Copper Alloy Solder-Joint Pressure Fittings.
   3. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

C. American Society of Sanitary Engineering:
   1. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.
   2. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

D. ASTM International:
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
7. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
10. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

E. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
4. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
5. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipe.
6. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
7. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
8. AWWA C606 - Grooved and Shouldered Joints.
9. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.
10. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In.(13 mm) Through 3 In. (76 mm) for Water Service.
11. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Waterworks.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joints between Tapping Sleeves and Tapping Valves.

G. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

34.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, valves, hydrants.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

E. Qualifications Statements:
   1. Submit qualifications for manufacturer and installer.

34.5 CLOSEOUT SUBMITTALS
A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

34.6 QUALITY ASSURANCE
A. Valves: Mark valve body with manufacturer's name and pressure rating.

B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

C. Maintain one copy of each standard affecting Work of this Section on Site.

34.7 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience in installation of Work of this Section.

34.8 DELIVERY, STORAGE, AND HANDLING
A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:
   1. Store materials according to manufacturer instructions.
   2. Block individual and stockpiled pipe lengths to prevent moving.
3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
4. Store PE and PVC materials out of sunlight.

D. Protection:
1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

34.9 EXISTING CONDITIONS
A. Field Measurements:
1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

34.10 WARRANTY
A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.
B. Furnish five-year manufacturer's warranty for valves, meters and fire hydrants.

PART 35 - PRODUCTS

35.1 PIPING
A. Ductile Iron Pipe:
1. Comply with AWWA.
2. Fittings:
   a. Material: Ductile iron.
   b. Thickness: Standard.
3. Joints:
   a. Comply with AWWA C111.
   b. Provide rubber gasket with rods.
B. PVC Pipe:
1. ASTM D1785, Schedule 40.
3. Joints:
C. PVC Pipe:
   1. Comply with AWWA C900, Class 235.
   2. Fittings:
      a. Material: Cast iron.
      b. Comply with AWWA C111.
   3. Joints:
      a. Comply with ASTM D3139.
      b. Furnish compression gasket ring.

35.2 TAPPING SLEEVES AND VALVES
A. Tapping Sleeves:
   1. a. Furnish materials according to AWWA and ASTM standards.

B. Description:
   1. Material: Ductile iron.
   2. Type: Dual compression.
   3. Outlet Flange Dimensions and Drilling: Comply with ASME B16.1, Class 125, and MSS SP-60.

C. Tapping Valves:
   1. a. Furnish materials according to AWWA and ASTM standards.

D. Description:
   1. Comply with AWWA C500.
   2. Type: Double disc with non-rising stem.
   3. Inlet Flanges: Comply with ASME B16.1, Class 125, and MSS SP-60.
   4. Mechanical Joint Outlets: Comply with AWWA C111.
   5. Mark manufacturer's name and pressure rating on valve body.

35.3 VALVES AND HYDRANTS

B. Yard Hydrants:
1. Furnish materials according to AWWA and ASTM standards.

2. Description:
   a. Automatic-draining, non-freezing yard hydrant for hose connection.
   b. Inlet:
      1) Size: 1-inch NPT.
      2) Fitting: Female.
   c. Nozzle:
      1) Size: 3/4 inch.
      2) Material: Brass.
      3) Fitting: Male.
   d. Casing:
      1) Description: Galvanized-steel pipe.
      2) Size: 1-1/4 inch.
   e. Drain Hole: Tapped, 1/8-inch NPT.
   f. Operating Rod:
      1) Description: Galvanized-steel pipe.
      2) Size: 3/8 inch.
   g. Working Pressure: 125 psig.

35.4 REDUCED-PRESSURE BACKFLOW PREVENTERS

A. Furnish materials according to AWWA and ASTM standards.

B. Description:
   1. Comply with ASSE 1013.
   2. Materials:
      a. Body: Bronze.
      b. Internal Parts: Bronze.
      c. Springs: Stainless steel.
   3. Check Valves:
      a. Quantity: Two.
      b. Description: Independently operating, spring loaded.
      c. Type: Diaphragm type, differential pressure relief, located between check valves.
      d. Provide third check valve opening under back pressure in case of diaphragm failure.
      e. Vent Outlet: Non-threaded.
4. Furnish two gate valves, one strainer, and four test cocks.

C. Double Check Valve Assemblies:
   1. Comply with ASSE 1012.
   2. Description: Two independently operating check valves, with intermediate atmospheric vent.
   3. Materials:
      a. Body: Bronze.
      b. Internal Parts: Corrosion resistant.
      c. Springs: Stainless steel.

35.5 PILE SUPPORT SYSTEMS
A. Timber Piles: As specified in Section 316219 - Timber Piles.
B. Timber for Cradle:

35.6 MATERIALS
A. Bedding and Cover:
   1. Bedding: Fill Type A1 or A3 as specified in construction plans.
   2. Cover: Fill Type A1 or A3 as specified in construction plans.
   3. Soil Backfill from Above Pipe to Finish Grade:
      a. Soil Type S1 as specified in construction plans.
      b. Subsoil with no rocks greater than 3/4 inches in diameter, frozen earth, or foreign matter.

35.7 ACCESSORIES
A. Thrust Restraints: As specified in Section 330509.33 - Thrust Restraint for Utility Piping.
B. Air-Release Valves:
   1. As located on Drawings.
   2. As specified in Section 400578.11 - Air Release Valves for Water Service.
C. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.
D. Vaults: As specified in Section 330563 - Concrete Vaults and Chambers.
E. Metering Equipment: As specified in Section 331900 - Water Utility Metering Equipment.
F. Steel Rods, Bolt, Lugs, and Brackets:
2. Grade A carbon steel.

PART 36 - EXECUTION

36.1 EXAMINATION
A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
B. Verify that building service connections and municipal utility water main sizes, locations, and elevations are as indicated on Drawings.

36.2 PREPARATION
A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
C. Remove scale and dirt on inside and outside before assembly.
D. Prepare pipe connections to equipment with flanges or unions.
E. Protect and support existing distribution piping and appurtenances as Work progresses.

36.3 INSTALLATION
A. Bedding:
   1. Excavate pipe trench as specified in construction plans.
   2. Placement:
      a. Place bedding material as indicated on Drawings.
      b. Level fill materials in one continuous layer not exceeding 6 inches of compacted depth.
      c. Compact to 98 percent maximum density.
   3. Backfill around sides and to top of pipe with cover fill, tamp in place, and compact to 98 percent maximum density.
B. Pipe and Fittings:
   1. Maintain separation of water main from other piping according to Chapter 62-555.314, F.A.C.
   2. Group piping with other Site piping work whenever practical.
   3. Install pipe to elevations indicated on Drawings.
   4. Install ductile-iron piping and fittings according to AWWA C600.
5. Route pipe in straight line.
6. Install access fittings to permit disinfection of water system per AWWA and ASTM standards.
7. Thrust Restraints: See construction plans.
8. Establish elevations of buried piping with not less than three feet of cover.

C. Meters and Boxes: As specified in Section 331900 - Water Utility Metering Equipment and Section 330577 - Fiberglass Metering Manholes.

D. Disinfection: As specified in Section 330110.58 - Disinfection of Water Utility Piping Systems.

36.4 TOLERANCES
A. Section 014000 - Quality Requirements: Requirements for tolerances.
B. Install pipe within tolerance of 5/8.

36.5 FIELD QUALITY CONTROL
A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
B. Testing:
   1. Pressure test piping system according to AWWA C600.
   2. Compaction Testing:
      a. Comply with AASHTO T 180.
      b. Frequency of Compaction Tests: every 500 feet or as dictated by field conditions.
      c. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION 331416
SECTION 331417 - SITE WATER SERVICE UTILITY LATERALS

PART 37 - GENERAL

37.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for 2-inch water service connections to buildings.
2. Corporation stop assemblies.
3. Curb stop assemblies.
5. Meter setting equipment.
6. Meter boxes.
7. Trenching, bedding, and cover.

B. Related Requirements:

2. Section 330509.33 - Thrust Restraint for Utility Piping: Thrust restraints as required by this Section.
4. Section 331900 - Water Utility Metering Equipment: Water meters as required by this Section.

37.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Pipe and Fittings:

2. Basis of Payment: Includes hand-trimming excavation, pipe and fittings, bedding, thrust restraints, connection to building service piping, and municipal utility water source.

C. Corporation Stop Assemblies:

2. Basis of Payment: Includes corporation stop, fittings, and accessories.

D. Curb Stop Assemblies:

2. Basis of Payment: Includes curb stop, curb box and cover, fittings, and accessories.

E. Backflow Preventers:
2. Basis of Payment: Includes backflow preventer, fittings and accessories.

37.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:
   1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. American Society of Sanitary Engineering:
   1. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.
   2. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

D. ASTM International:
   1. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
   3. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN·m/m³)).
   4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN·m/m³)).
   5. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   8. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
   9. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

E. American Welding Society:
   1. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:
   1. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
   2. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
   3. AWWA C800 - Underground Service Line Valves and Fittings.
4. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
5. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

37.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventers, and accessories.
C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
F. Qualifications Statement:
   1. Submit qualifications for manufacturer.

37.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, pressure-pipe centerline elevations, and gravity-pipe invert elevations.
C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

37.6 QUALITY ASSURANCE

A. Perform Work according to AWWA & ASTM standards.
B. Maintain one copy of each standard affecting Work of this Section on Site.

37.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
37.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

PART 38 - PRODUCTS

38.1 WATER PIPING AND FITTINGS

A. Copper Tubing:
   2. Type: K annealed.
   3. Fittings: Cast copper; ASME B16.18 or wrought copper; ASME B16.22.
   4. Joints: Compression connection or BCuP silver braze; AWS A5.8.

B. PVC Pipe:
   1. Fittings: PVC; ASTM D2466.
   2. Joints: Solvent welded; ASTM D2855.

38.2 CORPORATION STOP ASSEMBLIES

A. Furnish materials according to AWWA & ASTM standards.

B. Corporation Stops:
   2. Body: Brass or red brass alloy.
   3. Inlet End: Threaded for tapping according to AWWA C800.
   4. Outlet End: Suitable for service pipe specified.

C. Service Saddles:
   1. Type: Double strap.
   2. Designed to hold pressures in excess of pipe working pressure.
38.3 CURB STOP ASSEMBLIES

A. Furnish materials according to AWWA & ASTM standards.

B. Curb Stops:
   1. Body: Brass or red brass alloy.
   2. Comply with ASTM B62.
   3. Valve Type: Plug.

C. Curb Boxes and Covers:
   1. Body: Cast iron.
   2. Type: Extension or Buffalo.
   3. Base: Minneapolis or arch pattern.
   4. Lid:
      a. Inscription: WATER.
      b. Plug: Pentagonal.

38.4 BACKFLOW PREVENTERS

A. Furnish materials according to AWWA & ASTM standards.

B. Reduced-Pressure Backflow Preventers:
   1. Comply with ASSE 1013.
   2. Materials:
      a. Body: Bronze.
      b. Internal Parts: Bronze.
      c. Springs: Stainless steel.
   3. Check Valves:
      a. Quantity: Two, operating independently operating.
      b. Spring-loaded.
      c. Third Check Valve: Open under back pressure in case of diaphragm failure.
   4. Differential Pressure Relief Valve:
      a. Type: Diaphragm.
      b. Location: Between check valves.
   5. Gate Valves:
      a. Type: Resilient seated.
      b. Comply with AWWA C509.
c. Quantity: Two.

6. Accessories:
   a. Non-threaded vent outlet.
   b. Strainer.
   c. Four resilient-seated ball valve test cocks.

C. Double-Check Valve Assemblies:
   1. Comply with ASSE 1012.
   2. Materials:
      a. Body: Bronze.
      b. Internal Parts: Corrosion resistant.
      c. Springs: Stainless steel.
   3. Check Valves:
      a. Quantity: Two, operating independently.
      b. Intermediate atmospheric vent.

38.5 WATER METERS
A. As specified in Section 331900 - Water Utility Metering Equipment.

38.6 METER SETTING EQUIPMENT
A. Furnish materials according to AWWA & ASTM standards.
B. Outside Meter Setting:
   1. Meter Yokes:
      a. Material: Copper or iron.
      b. Key Valves:
         1) Type: Angle inverted.
         2) Connection: Bronze pins and spring washers.
         3) Furnish test valves.
      c. Outlet: Expansion connection.
      d. End Connections: Flared copper tubing.
C. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.
D. Material and Resource Characteristics:
38.7 MATERIALS

A. Bedding and Cover:

B. Bedding: Fill Type A1, A3 as specified in Section 310516 - Aggregates for Earthwork.

C. Cover: Fill Type A3 as specified in Section 310516 - Aggregates for Earthwork.

D. Soil Backfill from Above Pipe to Finish Grade:
   1. Soil Type S1 as specified in Section 310513 - Soils for Earthwork.
   2. Subsoil: No rocks greater than \( \frac{3}{4}'' \) in diameter or foreign matter.

38.8 ACCESSORIES

A. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.

B. Precast Concrete Vaults As specified in Section 330563 - Concrete Vaults and Chambers.

C. Metering Manholes: As specified in Section 330577 - Fiberglass Metering Manholes

D. Thrust Restraints: As specified in Section 330509.33 - Thrust Restraint for Utility Piping.

PART 39 - EXECUTION

39.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that building service connections and municipal utility water main sizes, locations, and inverts are as indicated on Shop Drawings.

39.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.

C. Remove scale and dirt from inside and outside of piping before assembly.

D. Prepare pipe connections to equipment with flanges or unions.

39.3 INSTALLATION

A. Corporation Stop Assemblies:
1. Make connection for each different kind of water main, using suitable materials, equipment, and methods as approved by Architect/Engineer.
2. Provide service clamps for mains constructed of materials other than cast iron or ductile iron.
3. Location:
   a. Screw corporation stops directly into tapped and threaded iron main at 10- and 2 o'clock positions along main's circumference.
   b. Locate and stagger corporation stops at least 12 inches apart longitudinally.
4. Plastic Pipe Mains:
   a. Provide full support for service clamp for full circumference of pipe, with minimum 2-inch width of bearing area.
   b. Exercise care against crushing or causing other damage to mains at time of tapping or installation of service clamp or corporation stop.
5. Use seals or other devices such that no leaks are present in mains at points of tapping.
6. Do not backfill and cover service connections until installation has been approved by Architect/Engineer.

B. Bedding:
1. Excavate pipe trench as specified in Section 312316.13 - Trenching.
2. Placement:
   a. Place bedding material as indicated on Drawings.
   b. Level fill materials in one continuous layer not exceeding 6 inches of compacted depth.
   c. Compact to 98 percent maximum density.
3. Backfill around sides and to top of pipe with cover fill, tamp in place, and compact to 98 percent maximum density.

C. Pipe and Fittings:
1. Maintain separation of water main from other piping according to chapter 62-555,314,F.A.C.
2. Group piping with other Site piping Work whenever practical.
3. Install pipe to allow for expansion and contraction without stressing pipe or joints.
4. Install access fittings to permit disinfection of water system.
5. Thrust Restraints: Form and place concrete for thrust restraints at each elbow or change of direction of pipe.
6. Establish elevations of buried piping with not less than three feet of cover.
7. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.
8. Backfill trench as specified in Section 312323 - Fill.

D. Curb Stop Assemblies:
1. Set curb stops on solid bearing or compacted soil
2. Boxes:
a. Center and plumb curb boxes over curb stops.
b. Set box cover flush with finished grade.

E. Water Meters: Install positive displacement meters according to AWWA M6, with isolating valves on inlet and outlet as indicated on Drawings.

F. Backflow Preventers:
   1. Install backflow preventers where indicated on Drawings and according to manufacturer instructions.
   2. Testing and Installation Requirements: Comply with local water company requirements and plumbing codes.

G. Service Connections:
   1. Install water service according to as indicated on Drawings.
   2. Install water service to within 5 feet of building and connect to building water service as specified in Section 221100 - Facility Water Distribution.
   3. Metal Sleeve:
      a. Install metal sleeve surrounding service main to 6 inches above slab, and minimum 6 feet below grade.
      b. Size: Accommodate minimum 2 inches of insulation.

H. Precast-Concrete Vaults: As specified in Section 330563 - Concrete Vaults and Chambers.

I. Disinfection of Water Piping System: Flush and disinfect system as specified in Section 330110.58 - Disinfection of Water Utility Piping Systems

39.4 TOLERANCES

A. Install pipe to indicated elevation to within tolerance of 5/8 inch

39.5 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Testing:
   1. Pressure test water distribution system according to AWWA C600.

C. Perform pressure test on water distribution system according to AWWA standards.

D. Compaction Testing for Bedding: Comply with AASHTO T 180.

E. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
F. Frequency of Compaction Tests: One every 500 ft.

END OF SECTION 331417
SECTION 331419 - VALVES AND HYDRANTS FOR WATER UTILITY SERVICE

PART 40 - GENERAL

40.1 SUMMARY

A. Section Includes:
   1. Valves.
   2. Valve boxes.
   3. Fire hydrants.

B. Related Requirements:
   1. Section 09900 – Painting and Coating: Exterior finish for fire hydrants.
   2. Section 330509.33 - Thrust Restraint for Utility Piping: Thrust restraints as required by this Section.
   4. Section 331416 - Site Water Utility Distribution Piping: Pressure testing of valves and hydrants.
   5. Section 331417 - Site Water Service Utility Laterals: Piping, trenching, backfilling, and compaction requirements.

40.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Valves:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes excavation, valve, valve box, accessories, bedding, and backfill.

C. Fire Hydrants:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes excavation, hydrant, isolation valve and box, accessories, foundation bedding, and backfill.

40.3 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
   2. AWWA C502 - Dry-Barrel Fire Hydrants.
3. AWWA C503 - Wet-Barrel Fire Hydrants.
4. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
5. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.

B. National Fire Protection Association:

C. NSF International:
1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

40.4 COORDINATION
A. Section 013000 - Administrative Requirements: Requirements for coordination.
B. Coordinate Work of this Section with installation of water mains.

40.5 SUBMITTALS
A. Section 013300 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit manufacturer information regarding component materials, fittings, assembly and parts diagram, and accessories.
C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
E. Source Quality-Control Submittals: Indicate results of factory tests and inspections.
F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
G. Qualifications Statements:
   1. Submit qualifications for manufacturer and installer.
   2. Submit manufacturer's approval of installer.

40.6 CLOSEOUT SUBMITTALS
A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
B. Project Record Documents: Record actual locations of valves and hydrants.
40.7 MAINTENANCE MATERIAL SUBMITTALS
   A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance materials.
   B. Tools: Furnish one tee wrench of required length to Owner.

40.8 QUALITY ASSURANCE
   A. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.
   B. Cast manufacturer's name, pressure rating, and year of fabrication into valve body.
   C. Perform Work according to AWWA & ASTM standards.
   D. Maintain 1 copy of each standard affecting Work of this Section on Site.

40.9 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
   B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

40.10 DELIVERY, STORAGE, AND HANDLING
   A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
   B. Delivery:
      1. Seal valve and hydrant ends to prevent entry of foreign matter.
      2. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
   C. Store materials according to manufacturer instructions.
   D. Protection:
      1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
      2. Provide additional protection according to manufacturer instructions.
PART 41 - PRODUCTS

41.1 VALVES

A. Performance and Design Criteria:

1. Pressure Rating:
   a. 12-inch Diameter and Smaller: 200 psig.
   b. 14-inch Diameter and Larger: 150 psig.

2. End Connections: Mechanical joint

3. Furnish valves of diameters 16 inches and larger with bypass valves and gear operators.

4. Coatings:
   b. Application: Interior and exterior.

B. Double-Disc Gate Valves:

1. Furnish materials according to AWWA & ASTM standards.

2. Description:
   a. Comply with AWWA C500.
   b. Materials:
      1) Body: Iron.
      2) Trim: Bronze.
   c. Seat Type: Double disc; parallel.
   d. Stem:
      1) Type: Non-rising.
      2) Seals: O-ring.
   e. Operation:
      1) Hand wheel.
      2) Opening Direction: Counterclockwise.

C. Resilient-Wedge Gate Valves:

1. Furnish materials according to AWWA & ASTM standards.

2. Description:
   a. Comply with AWWA C509.
   b. Body: Ductile iron
c. Seats: Resilient.
d. Stem:
   1) Type: Non-rising.
   2) Material: Bronze.
e. Operation:
   1) Square operating nut.
   2) Opening Direction: Counterclockwise.

41.2 FIRE HYDRANTS

A. Furnish materials according to AWWA & ASTM standards.

B. Dry-Barrel, Breakaway Type:
   2. Body: Cast iron.
   3. Valve: Compression type.
   5. Inlet Connection Size: 6 inches.
   6. Valve Opening: 5-1/4 inches in diameter.
   7. End Connections: Mechanical joint.

C. Wet-Barrel Type:
   1. Comply with AWWA C503.
   2. Body: Cast iron.
   4. End Connections: Mechanical joint
   7. Opening Direction: Counterclockwise.

D. Hose Connections:
   1. One pumper, two hose nozzles.
   2. Obtain thread type and size from local fire department.
   3. Attach nozzle caps by separate chains.

E. Finishes:
   1. Primer and two coats of enamel as specified in Section 099000 - Painting and Coating.
   2. Color: Comply with requirements of AWWA & ASTM.
41.3 VALVE BOXES

A.
1. Furnish materials according to AWWA & ASTM standards.

B. Description:

1. 12-inch Diameter Valves and Smaller:
   a. Material: Cast iron.
   b. Type: Two piece; screw.

2. Valves Larger than 12-inch Diameter:
   a. Material: Cast iron.
   b. Type: Three piece; screw.
   c. Base: Round.

3. Lid Inscription: WATER.

41.4 ACCESSORIES

A. Thrust Restraints: As specified in Section 330509.33 - Thrust Restraint for Utility Piping.

B. Valve Box Aligner: High-strength plastic device designed to automatically center valve box base and to prevent it from shifting off center during backfilling.

C. Fire Hydrant Drainage Gravel: As specified in Section 310516 - Aggregates for Earthwork.

PART 42 - EXECUTION

42.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Determine exact location and size of valves from Drawings.

C. Identify required lines, levels, contours, and datum locations.

D. Verify that elevations of existing facilities prior to excavation and installation of valves and hydrants are as indicated on Drawings.

42.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
B. Locate, identify, and protect from damage utilities to remain.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

   1. Notify Architect/Engineer not less than seven days in advance of proposed utility interruption.
   2. Do not proceed without written permission from Architect/Engineer.

42.3 INSTALLATION

A. Perform trench excavation, backfilling, and compaction as specified in Section 331417 - Site Water Service Utility Laterals.

B. Install valves and hydrants in conjunction with pipe laying.

C. Provide buried valves with valve boxes installed flush with finished grade.

D. Provide support blocking and drainage gravel while installing fire hydrants; do not block drain hole.

E. Orientation:

   1. Set valves and hydrants plumb.
   2. Set fire hydrants with pumper nozzle facing roadway.
   3. Set fire hydrants with centerline of pumper nozzle 18 inches above finished grade and with safety flange not more than 6 inches nor less than 2 inches above grade.

F. After main-line pressure testing, flush fire hydrants and check for proper drainage.

G. Installation Standards: Install Work according to AWWA & ASTM standards.

H. Disinfection of Water Piping System: Flush and disinfect valves and hydrants with water mains as specified in Section 330110.58 - Disinfection of Water Utility Piping Systems.

42.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Testing: Pressure test valves and hydrants with water mains as specified in Section 331413 - Public Water Utility Distribution Piping

END OF SECTION 331419
SECTION 331900 - WATER UTILITY METERING EQUIPMENT

PART 43 - GENERAL

43.1 SUMMARY

A. Section Includes:
   1. Positive displacement meters.
   2. Propeller flow meters.
   4. Ultrasonic flow meters.
   5. Venturi flow meters.
   6. Transmitters.
   7. Indicators.
   8. Recorders.
   9. Integrators.

B. Related Requirements:
   1. Section 330577 - Fiberglass Metering Manholes: Requirements for meter boxes used to access and protect meter installation.
   2. Section 331413 - Public Water Utility Distribution Piping: Requirements for domestic water piping from supply to utility source connection at Site.
   3. Section 331416 - Site Water Utility Distribution Piping: Requirements for domestic water piping from building to utility source.

43.2 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

43.3 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Meters:
   2. Basis of Payment: Includes meter, fittings, accessories, meter box, and installation.

43.4 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:
   2. ASME PTC 19.5 - Flow Measurement.
B. American Water Works Association:
   1. AWWA C700 - Cold-Water Meters - Displacement Type, Metal Alloy Main Case.
   2. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
   3. AWWA C702 - Cold-Water Meters - Compound Type.
   4. AWWA C704 - Propeller-Type Meters for Waterworks Applications.
   5. AWWA C707 - Encoder-Type Remote-Registration Systems for Cold-Water Meters.

C. ASTM International:
   2. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings.

D. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

43.5 SUBMITTALS
   A. Section 013300 - Submittal Procedures: Requirements for submittals.
   B. Product Data: Submit manufacturer information for water meters and accessories.
   C. Manufacturer's Certificate: Certify that water meters meet or exceed specified requirements.
   D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
   E. Source Quality-Control Submittals: Indicate results of factory tests and inspections.
   F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
   G. Manufacturer Reports:
      1. Certify that equipment has been installed according to manufacturer's instructions.
      2. Indicate activities on Site, adverse findings, and recommendations.
   H. Qualifications Statements:
      1. Submit qualifications for manufacturer and installer.
43.6 CLOSEOUT SUBMITTALS
   A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
   B. Project Record Documents: Record actual locations of water meters.

43.7 QUALITY ASSURANCE
   A. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.
   B. Perform Work according to ASTM, AWWA, and ASME standards.
   C. Maintain one copy of each document on Site.

43.8 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
   B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

43.9 DELIVERY, STORAGE, AND HANDLING
   A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
   B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
   C. Store materials according to manufacturer instructions.
   D. Protection:
      1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
      2. Provide additional protection according to manufacturer instructions.

43.10 EXISTING CONDITIONS
   A. Field Measurements:
      1. Verify field measurements prior to fabrication.
      2. Indicate field measurements on Shop Drawings.

43.11 WARRANTY
   A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.
B. Furnish five-year manufacturer’s warranty for water meters.

PART 44 - PRODUCTS

44.1 POSITIVE DISPLACEMENT METERS

A. Furnish materials according to ASTM, AWWA, and ASME standards.

B. Description:

1. Brass body turbine meter with magnetic drive register.
2. Comply with AWWA C700
3. Type: Positive displacement disc.
5. Bottom Cap:
   a. Material: Cast iron.
6. Register: Hermetically sealed.
7. Remote Reading: Comply with AWWA C707.

44.2 TRANSMITTERS: CAPABILITY SHOULD BE INCLUDED SO THE METER COULD BE CONVERTED TO REMOTE READING AT A FUTURE TIME.

44.3 INDICATORS

A. Furnish materials according to ASTM, AWWA, and ASME standards.

44.4 RECORDERS

A. Furnish materials according to ASTM, AWWA, and ASME standards.

44.5 INTEGRATORS

A. Furnish materials according to ASTM, AWWA, and ASME standards.

44.6 METER BOXES

A. As specified in Section 330577 - Fiberglass Metering Manholes
44.7 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis requirements.

B. Provide shop inspection and testing of meters.

C. Test meters according to AWWA M6.

D. Certificate of Compliance:
   1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

PART 45 - EXECUTION

45.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that building service connections and municipal utility water main sizes, locations, and elevations are as indicated on Shop Drawings.

45.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Before attaching meter, ensure that pipe ends are deburred, square, and plumb and that scale and dirt on inside and outside of piping has been removed.

C. Prepare pipe connections to equipment with flanges or unions, as appropriate.

D. Protect and support existing distribution piping as Work progresses.

45.3 INSTALLATION

A. Meters:
   1. Install meters according to AWWA M6, with isolating valves on inlet and outlet.

B. Meter Boxes:
   1. Installation Standards: Install Work according to ASTM and AWWA standards.
45.4 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Testing:
   1. Test and calibrate flow meter to demonstrate specified accuracy requirements.
   2. Test meters according to AWWA M6.

C. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in maintenance of equipment.

D. Equipment Acceptance:
   1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
   2. Make final adjustments to equipment under direction of manufacturer's representative.

E. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

45.5 DEMONSTRATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 331900
SECTION 333100 - SANITARY SEWERAGE PIPING

PART 46 - GENERAL

46.1 SUMMARY

A. Section Includes:
   1. Sanitary sewerage piping.
   2. Bedding and cover materials.

B. Related Requirements:
   1. Section 312316 - Excavation: Requirements for trenching as required by this section.
   2. Section 312316.13 - Trenching: Requirements for trenching as required by this section.
   5. Section 330505.43 - Mandrel Testing: Deflection testing of plastic sewerage piping.
   7. Section 330561 - Concrete Manholes: Manholes for sanitary sewerage piping.

46.2 DEFINITIONS

A. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

46.3 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Pipe and Fittings:
   1. Basis of Measurement: By linear foot
   2. Basis of Payment: Includes excavation, hand trimming, bedding, pipe and fittings, and connections to building service piping and to municipal sewer

C. Cleanouts:
   1. Basis of Measurement: By unit
   2. Basis of Payment: Includes hand trimming, excavating, foundation pad, unit installation with accessories, to indicated depth, and connection to sewer piping.

46.4 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
5. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
7. AWWA C153 - Ductile-Iron Compact Fittings.

C. ASTM International:

4. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN·m/m³)).
5. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
11. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

46.5 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with termination of sanitary sewer connection outside building, connection to municipal sewer utility service and trenching.

46.6 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit manufacturer information indicating pipe material to be used, pipe accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statement:
   1. Submit qualifications for manufacturer and installer.

46.7 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record finished locations of pipe runs, connections, manholes, cleanouts, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

46.8 QUALITY ASSURANCE

A. Perform Work according to AWWA &ASTM standards.

B. Maintain 1 copy of each standard affecting Work of this Section on Site.

46.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum Three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum Three years' documented experience.

46.10 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:
   1. Store materials according to manufacturer instructions.
   2. Store valves in shipping containers with labeling in place.
D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Block individual and stockpiled pipe lengths to prevent moving.
3. Provide additional protection according to manufacturer instructions.

46.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 47 - PRODUCTS

47.1 SANITARY SEWERAGE PIPING

A. Ductile-Iron Pipe:

1. Comply with AWWA C150 or AWWA C151.
2. Minimum Pressure Class: 150
3. End Connections: Bell and spigot
4. Outside Coating:
   a. Type: Asphalitic.
   b. Minimum Uniform Thickness: 1 mil.
   c. Comply with AWWA C151.
5. Lining:
   a. Cement mortar lined.
   b. Comply with AWWA C104.

6. Fittings:
   a. Material: Ductile iron, Class 50 or greater.
   b. Comply with AWWA C153 or AWWA C110.
   c. Lining: Cement-mortar lined according to AWWA C104.

7. Coating:
   a. Coat pipe and fittings exposed inside of structures with two coats of bituminous paint as specified in Section 099000 - Painting and Coating.

8. Joints:
a. Rubber gasket joint devices.
b. Comply with AWWA C111.

B. Plastic Pipe:
1. Material: PVC.
2. Comply with ASTM D3034, SDR-35.
3. End Connections: Bell and spigot with rubber-ring-sealed gasket joint.
4. Fittings: PVC.
5. Joints:
   a. Elastomeric gaskets.
   b. Comply with ASTM F477.

47.2 MANHOLES
A. As specified in Section 330561 - Concrete Manholes

47.3 FLEXIBLE COUPLINGS
1. Furnish materials according to AWWA & ASTM standards.

B. Description:
1. Material: Resilient, chemical-resistant, elastomeric PVC.

47.4 FLEXIBLE PIPE BOOTS FOR MANHOLE PIPE ENTRANCES
1. Furnish materials according to AWWA & ASTM standards.

B. Description:
1. Material: EPDM.
2. Comply with ASTM C923.
3. Attachment: Series-300 stainless-steel clamp and hardware.

47.5 MATERIALS
A. Bedding and Cover:
2. Cover: Fill Type: A1, A3, as specified in Section 310516 - Aggregates for Earthwork
3. Soil Backfill from Above Pipe to Finish Grade:
   a. Soil Type S1, as specified in construction plans.
   b. Subsoil with no rocks more than \( \frac{3}{4} \)" inches (150 mm) in diameter, frozen earth, or foreign matter.

47.6 MIXES
   A. Grout: As specified in the construction plans.

47.7 ACCESSORIES
   A. Pipe Markers: As specified in Section 330553 – Identification for utility pipes and equipment.

PART 48 - EXECUTION

48.1 EXAMINATION
   A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
   B. Verify that trench cut is ready to receive Work of this Section.
   C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

48.2 PREPARATION
   A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
   B. Correct over-excavation with fine aggregate.
   C. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.
   D. Protect and support existing sewer lines, utilities, and appurtenances.
   E. Utilities:
      1. Maintain profiles of utilities.
      2. Coordinate with other utilities to eliminate interference.
      3. Notify Architect/Engineer if crossing conflicts occur.

48.3 INSTALLATION
   A. Bedding:
1. Excavate pipe trench as specified in Construction Plans.
2. Place bedding material at trench bottom.
3. Level materials in continuous layer not exceeding 6 inches.
4. Maintain optimum moisture content of bedding material to attain required compaction density.

B. Piping:

1. Installation Standards: Install Work according to AASHTO & ASTM standards.

C. Manholes: As specified in Section 330561 - Concrete Manholes.

D. Backfilling: As specified in Section 312323 - Fill.

48.4 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Indicated Slope: 1/8 inch in 10 feet.

48.5 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Request inspection by Architect/Engineer prior to and immediately after placing bedding.

C. Testing:

1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
2. Perform testing on Site sanitary sewage system according to AWWA, ASTM, AASHTO, AND TI80 standards.

48.6 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

C. Cap open ends of piping during periods of Work stoppage.

END OF SECTION 333100
SECTION 333111 - PUBLIC SANITARY SEWERAGE GRAVITY PIPING

PART 49 - GENERAL

49.1 SUMMARY

A. Section Includes:
   1. Sanitary sewerage piping.
   2. Connection to existing manholes.
   3. Wye branches and tees.
   4. Sanitary laterals.
   5. Pile support systems.

B. Related Requirements:
   1. Section 312316 - Excavation: Product and execution requirements for excavation required by this section.
   2. Section 312316.13 - Trenching: Execution requirements for trenching required by this section.
   4. Section 330505.43 - Mandrel Testing: Deflection testing of plastic sewerage piping.
   5. Section 330553 - Identification and Signage for Utilities: Pipe markers.
   6. Section 330561 - Concrete Manholes: Manholes for sanitary sewerage piping.

49.2 DEFINITIONS

A. ABS: Acrylonitrile butadiene styrene.

B. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

C. EPDM: Ethylene-propylene-diene terpolymer.

49.3 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Pipe and Fittings:
   1. Basis of Measurement: By linear foot
   2. Basis of Payment: Includes hand trimming, excavation, bedding, pipe and fittings, to indicated depth and connection to CR 136 136 WTP.
49.4 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
5. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
7. AWWA C153 - Ductile-Iron Compact Fittings.

C. ASTM International:

8. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
9. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
49.5 COORDINATION
A. Section 013000 - Administrative Requirements: Requirements for coordination.
B. Coordinate Work of this Section with Suwannee county and Engineer.
C. Notify affected utility companies at least 72 hours prior to construction.

49.6 PREINSTALLATION MEETINGS
A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.
B. Convene minimum one week prior to commencing Work of this Section.
C. Attendance Roster: Include affected utility companies, appropriate Suwannee County officials and Engineer.

49.7 SUBMITTALS
A. Section 013300 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit manufacturer catalog cuts and other information indicating proposed materials, accessories, details, and construction information.
C. Permits: Maintain copies of all associated permits onsite.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Test and Evaluation Reports: Submit reports indicating field tests made and results obtained.
F. Manufacturer Instructions:
   1. Indicate special procedures required to install specified products.
   2. Submit detailed description of procedures for pipe jacking installation.
G. Source Quality-Control Submittals: Indicate results of factory tests and inspections.
H. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
I. Qualifications Statement:
1. Submit qualifications for manufacturer and installer.

49.8 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record invert elevations and actual locations of pipe runs, connections, manholes and cleanouts.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

49.9 QUALITY ASSURANCE

A. Perform Work according to AWWA & ASTM standards.

B. Maintain 1 copy of each standard affecting Work of this Section on Site.

49.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

49.11 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:

1. Store materials according to manufacturer instructions.
2. Store valves in shipping containers with labeling in place.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Block individual and stockpiled pipe lengths to prevent moving.
3. Provide additional protection according to manufacturer instructions.
49.12 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 50 - PRODUCTS

A. Plastic Pipe:
   1. Material: PVC.
   2. Comply with ASTM D3034, SDR-35.
   4. Fittings: PVC.
   5. Joints:
      a. Elastomeric gaskets.
      b. Comply with ASTM F477.

50.2 MANHOLES

A. As specified in Section 330561 - Concrete Manholes.

50.3 FLEXIBLE COUPLINGS

A. 1. Furnish materials according to AWWA & AASTM standards.
   B. Description:
      1. Material: Resilient, chemical-resistant, elastomeric PVC.

50.4 FLEXIBLE PIPE BOOTS FOR MANHOLE PIPE ENTRANCES

A. 1. Furnish materials according to AWWA & ASTM standards.
   B. Description:
      1. Material: EPDM.
      2. Comply with ASTM C923.
      3. Attachment: Series-300 stainless-steel clamp and hardware.
50.5 MATERIALS

A. Bedding and Cover:
   1. Bedding: Fill Type A3, as specified in Section 310516 - Aggregates for Earthwork
   2. Cover: Fill Type A3, as specified in Section 310516 - Aggregates for Earthwork.
   3. Soil Backfill from Above Pipe to Finish Grade:
      a. Soil Type S1, as specified in Section 310513 - Soils for Earthwork.
      b. Subsoil with no rocks more than ¾" in diameter, frozen earth, or foreign matter.

50.6 MIXES

A. Grout: As specified in Section 330130.61 - Packer Injection Grouting.

50.7 FINISHES

A. Galvanizing:
   1. Hot dip galvanize after fabrication.
   2. Comply with ASTM A123/A123M.

50.8 ACCESSORIES

A. Pile Support Brackets: Galvanized structural steel, thoroughly coated with bituminous paint.
B. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.

50.9 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.
B. Provide shop inspection and testing of pipe.
C. Certificate of Compliance:
   1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

PART 51 - EXECUTION

51.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
B. Verify that trench cut is ready to receive Work of this Section.

C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

51.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Correct over-excavation with fine aggregate

C. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.

D. Protect and support existing sewer lines, utilities, and appurtenances.

E. Utilities:
   1. Maintain profiles of utilities.
   2. Coordinate with other utilities to eliminate interference.
   3. Notify Engineer if crossing conflicts occur.

51.3 INSTALLATION

1. Installation Standards: Install Work according to AWWA & ASTM standards.

B. Manholes: As specified in Section 330561 - Concrete Manholes.

C. Connections to Existing Manholes:
   1. Drilling:
      a. Core drill existing manhole to clean opening.
      b. Use of pneumatic hammers, chipping guns, and sledgehammers are not permitted.
   2. Install watertight neoprene gasket and seal with non-shrink concrete grout.
   3. Encasement:
      a. Concrete encase new sewer pipe to nearest pipe joint.
      b. Use epoxy binder between new and existing concrete.
   4. Prevent construction debris from entering existing sewer line when making connection.

D. Wye Branches and Tees:
   1. Concurrent with pipe-laying operations, install wye branches and pipe tees at locations indicated on Drawings.
   2. Use standard fittings of same material and joint type as sewer main.
   3. Use saddle wye or tee with stainless-steel clamps for taps into existing piping.
   4. Mount saddles with solvent cement or gasket and secure with metal bands.
   5. Lay out holes with template and cut holes with mechanical cutter.
E. Sanitary Laterals:
   1. Construct laterals from wye branch to terminal point at right-of-way
   2. Where depth of main pipeline warrants, construct riser-type laterals from wye branch.
   3. Minimum Depth of Cover over Piping: 2 feet.
   4. Minimum Separation Distance between Laterals: 5 feet.
   5. Install watertight plug, braced to withstand pipeline test pressure thrust, at termination of lateral.
   6. Marker Stake:
      a. Install temporary marker stake extending from end of lateral to 12 inches above finished grade.
      b. Paint top 6 inches of stake with fluorescent orange paint.

F. Backfilling:
   1. Backfill around sides and to top of pipe with cover fill in minimum lifts of 6 inches.
   2. Tamp fill in place and compact to 98 percent of maximum density.
   3. Place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment.
   4. Maintain optimum moisture content of bedding material as required to attain specified compaction density.

51.4 TOLERANCES
A. Section 014000 - Quality Requirements: Requirements for tolerances.
B. Maximum Variation from Indicated Slope: 1/8 inch in 10 feet.

51.5 FIELD QUALITY CONTROL
A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
B. Request inspection by Engineer prior to and immediately after placing bedding.
C. Testing:
   1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
   2. Perform testing on Site sanitary sewage system according to AWWA & ASTM standards.
   3. Compaction Testing:
      a. Comply with AASHTO T 180.
      b. Testing Frequency: Every 500’.
51.6 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

C. Cap open ends of piping during periods of Work stoppage.

51.7 ATTACHMENTS

A. Sanitary Sewer Main: Centerline of Oak Street right-of-way from between centerline intersections of First and Second Avenues.

B. Cleanouts: Extend service laterals with cleanouts to property lines. Locate cleanouts with 2-by-4 stake extending 6 inches above ground. Paint top 4 inches with orange survey paint.

END OF SECTION 333111
SECTION 333123 - SANITARY SEWERAGE FORCE MAIN PIPING

PART 52 - GENERAL

52.1 SUMMARY

A. Section Includes:
   1. Force mains.
   2. Bedding and cover materials.

B. Related Requirements:
   1. Section 312316.13 – Trenching: Excavation, backfilling, compacting, and fill over underground pipe markers.
   2. Section 330505.31 – Hydrostatic Testing: Pressure testing of completed force mains.
   3. Section 330509.33 - Thrust Restraint for Utility Piping: Thrust restraints as required by this Section.
   4. Section 330553 - Identification and Signage for Utilities: Pipe markers.

52.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Pipe and Fittings:
   2. Basis of Payment: Includes excavation, hand trimming, backfill, bedding, thrust restraints and pipe and fittings.

52.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Water Works Association:
   1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
   2. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
   4. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
   5. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.
C. ASTM International:

   1. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
   2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
   7. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

52.4 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with connection to CR 136/I-75 Wastewater Treatment Plant.

52.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information indicating pipe material used, pipe accessories, valves and restrained joint details and materials.

C. Shop Drawings:
   1. Indicate piping piece numbers and locations.
   2. Indicate restrained joint locations.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for restrained joints, including establishing lengths of restrained joint piping required.

F. Manufacturer Instructions: Submit special procedures required to install specified products.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Qualifications Statement:
   1. Submit qualifications for manufacturer, installer, and licensed professional.
52.6 CLOSEOUT SUBMITTALS
   A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
   B. Project Record Documents: Record invert elevations and actual locations of pipe runs and connections.
   C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

52.7 QUALITY ASSURANCE
   A. Perform Work according to AWWA and ASTM standards.
   B. Maintain one copy of each standard affecting Work of this Section on Site.

52.8 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
   B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

52.9 DELIVERY, STORAGE, AND HANDLING
   A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
   B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
   C. Storage:
      1. Store materials according to manufacturer instructions.
      2. Do not place materials on private property without written permission of property owner.
      3. Do not stack pipe higher than recommended by pipe manufacturer.
   D. Protection:
      1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
      2. Store gaskets for mechanical and push-on joints in cool and dry location, out of direct sunlight, and not in contact with petroleum products.
      3. Provide additional protection according to manufacturer instructions.

52.10 EXISTING CONDITIONS
   A. Field Measurements:
1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 53 - PRODUCTS

53.1 FORCE MAIN

A. Ductile-Iron Fittings:
   1. Comply with AWWA C110.
   3. Cement mortar lined, according to AWWA C104, and outside coated.

B. Joints:
   1. Comply with AWWA C111.
   2. Type: Mechanical.

C. Rubber Gaskets, Lubricants, Glands, Bolts, and Nuts: Comply with AWWA C111.

53.2 PVC PIPE

A. PVC Pressure Sewer Pipe and Fittings, 12-Inch Nominal Size and Smaller:
   1. Comply with ASTM D2241.
   2. PVC 1120 (12454) or PVC 1220 (12454) or PVC 2120 (14333).
   3. SDR: 35.

B. PVC Pressure Sewer Pipe and Fittings, 12-Inch Nominal Size and Smaller:
   1. Comply with AWWA DR18.
   2. Class 150.
   4. Color: Green

C.

53.3 MATERIALS

A. Bedding and Cover:
   1. Bedding: Fill Type A1 or A3, as specified in the construction plans.
   2. Cover: Fill Type A1 or A3, as specified in the construction plans.
   3. Soil Backfill from above Pipe to Finish Grade: Soil Type S1, as specified in the construction plans.
   4. Subsoil: No rocks more than 3/4 inches in diameter, frozen earth, or foreign matter.
53.4 MIXES
   A. Concrete: As specified in the construction plans.

53.5 ACCESSORIES
   A. Pipe Markers: As specified in Section 330553 - Identification for Utilities Piping and Equipment.

PART 54 - EXECUTION

54.1 EXAMINATION
   A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
   B. Verify that trench cut is ready to receive Work.
   C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

54.2 PREPARATION
   A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
   B. Correct over-excavation with fine aggregate.
   C. Remove large stones or other hard matter capable of damaging pipe or of impeding consistent backfilling or compaction.

54.3 INSTALLATION
   A. Bedding:
      1. Excavate pipe trench as specified in the construction plans.
      2. Place bedding material at trench bottom.
      3. Level materials in continuous layers not exceeding 6 inches in depth.
      4. Maintain optimum moisture content of bedding material to attain required compaction density.
   B. Piping:
      1. Installation Standards: Install Work according to AWWA, ASTM and AASHTO T180 standards.
   C. Thrust Restraints:
1. Provide pressure pipeline with restrained joints or concrete thrust blocking at pumps, bends, tees, and changes in direction.
2. As specified in Section 330509.33 - Thrust Restraint for Utility Piping.

54.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Inspections: Request inspection by Engineer prior to placing bedding.

D. Pressure Testing: As specified in Section 330505.31 - Hydrostatic Testing.

E. Perform pressure test on piping according to ASTM and AWWA standards.

F. Compaction Testing:
   2. Testing Frequency: every 500 feet or as dictated by field conditions.

54.5 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 333123
SECTION 333213 - PACKAGED WASTEWATER PUMPING STATIONS

PART 55 - GENERAL

55.1 SUMMARY

A. Section Includes: Packaged wastewater pumping stations.

B. Related Requirements:

1. Section 09900 - Painting and Coating: Coatings for pumps
2. Section 312316 – Excavation: Basin and related excavation. Requirements of excavation needed by this section.
3. Section – 312316.13 – Trenching: Requirement for direct burial of cable to be placed by this section.
4. Section 330561 - Concrete Manholes: Pumping station basin.

55.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Submersible Pump Basin:

1. Basis of Measurement: By each.
2. Basis of Payment: Includes excavation, basin with cover, vent and access door, inlet and discharge, rail assemblies, level controls, valve box, valves, backfilling, and startup tests.

C. Pump:

1. Basis of Measurement: By each.
2. Basis of Payment: Includes pump, pump brackets and check valve, discharge pipe, and pipe fittings in basin from pump to discharge.

D. Control Panel:

1. Basis of measurement: By each.
2. Basis of Payment: Includes enclosure, internal components, and wiring within, as well as to and from, basin.

55.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
6. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

C. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. UL Inc.:

1. UL 83 - Thermoplastic-Insulated Wires and Cables.

55.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Manufacturer information for basin, cover, hinged door, slide rail assembly, discharge piping, valves, junction box, level controls, and control panel.
2. Manufacturer information for pumps, including performance curve, breakaway fittings data, and access frame data.
3. Control panel data and panel wiring schematic.

C. Shop Drawings:

1. Indicate station layout as designed by station manufacturer.
2. Indicate size, materials, and components of system.
3. Indicate basin size, inlet and discharge locations, cover dimensions, vent location, lifting cable location, check valve locations, ball valve locations, pump locations, discharge piping location, wiring diagrams, junction box locations, guide rail assembly location, level control locations, and ballast support flange dimensions.

D. Manufacturer's Certificate: Certify that products meet or exceed specified design requirements.

E. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions.

F. Test and Evaluation Reports: Submit written report showing that factory and field pump inspections, tests, and startup have been successfully performed.
G. Manufacturer Instructions: Submit manufacturer's installation instructions and instructions for basin, pump, and panel systems procedures.

H. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

I. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

J. Manufacturer Reports:
   1. Submit report of each visit of manufacturer's representative to provide technical assistance during installation.
   2. Submit startup report before final acceptance of pumps to document that pumping station operation meets performance requirements.

K. Qualifications Statements:
   1. Submit qualifications for manufacturer and installer.

55.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of packaged pumping stations, including basins and control panel.

C. Submit certification of pumping stations after performance testing.

55.6 MAINTENANCE MATERIAL SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Spare Parts: Furnish one spare check valve and one spare plug valve.

55.7 QUALITY ASSURANCE

A. Perform Work according to manufacturer’s standards.

B. Maintain one copy of each standard affecting Work of this Section on Site.

55.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.
55.9 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer’s original packaging and inspect for damage.

C. Handling: Support basin with nylon slings connected to structural lift points when moving.

D. Store materials according to manufacturer instructions.

E. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide temporary end caps and closures on piping and fittings: maintain in place until installation.
   3. Provide additional protection according to manufacturer instructions.

55.10 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Conditions: Do not install basin and concrete basin base if bedding is wet or frozen.

55.11 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

55.12 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five-year prorated manufacturer’s warranty for pump seals.

PART 56 - PRODUCTS

56.1 SYSTEM DESCRIPTION

A. Pumping Station:
   2. Assembly: Shop.
4. Pump Type: Submersible
5. Controls:
   a. Multiple float switches.

56.2 PERFORMANCE AND DESIGN REQUIREMENTS
A. Pumps: -See sheet C-19 of construction plan set.

56.3 BASINS
A. 1. Furnish materials according to: -See sheet C-19 of construction plan set.

56.4 PUMPS
A. 1. Furnish materials according to: -See sheet C-19 of construction plan set.

56.5 CONTROL PANEL
A. 1. Furnish materials according to: -See sheet C-19 of construction plan set.

56.6 MATERIALS
A. Bedding, Ballast, and Backfill.
   1. Soil Backfill to Finish Grade:
      a. Soil Type S1, as specified in Section 310513 - Soils for Earthwork.
      b. Subsoil: No frozen earth, or foreign matter, or rocks more than 3/4 inches in diameter.

B. Fiberglass Basin Pad: Cast-in-place concrete as specified in Section 033000 - Cast-in-Place Concrete.

56.7 ACCESSORIES
A. Sealant: Industrial silicon sealant for pipe penetrations in basin.

B. Anchor Bolts, Nuts, and Washers:
   2. Nuts: Comply with ASTM A307, Grade A.
4. Galvanize bolts, nuts, and washers according to ASTM A153/A153M.

SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Provide shop inspection and testing of completed assembly.

C. Inspection:
   1. Verify that motor voltage and frequency is as shown on nameplate.
   2. Verify that motor and cable insulation test for moisture content or insulation defects comply with UL 83.

D. Testing:
   1. Submerged Pump Run: Test to determine that pump meets hydraulic performance requirements.
   2. Document and certify testing results in written report.

E. Certificate of Compliance:
   1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

EXECUTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that inlet and discharge piping connections are size, location, and elevation as indicated on Drawings.

PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Establish elevations of packaged pumping station as shown on sheet C-19 of construction plan set.

C. Protect piping system pieces systems from entry of foreign materials and water by using temporary covers, by completing sections of Work, and by isolating parts of completed system.
57.3 INSTALLATION SHALL BE ACCORDING TO MANUFACTURERS RECOMMENDATION AS SHOWN ON SHEET C-19 OF CONSTRUCTION PLAN SET

A. Basin:
   1. Place, compact, and level aggregate bedding to a minimum 8 inches.
   2. Form and place concrete base pad, and trowel top surface level.

B. Pumps:
   1. Install pumps, including fittings, brackets, discharge piping, check valve to basin rail assembly, lifting device, and discharge.
   2. Wire pump to junction box.

C. Control Panel: Mount and wire control panel, including duplex motor controls, circuit breaker, starter, control transformer, fuse box, terminal block, alternator, alarm, and running lights.

D. Backfilling:
   1. Backfill basin and direct-burial cable as specified in Section 312323 - Fill.
   2. Maintain optimum moisture content of fill material to attain required compaction density.
   3. After hydraulic test and seven days after placing cast-in-place concrete pad, evenly backfill around entire periphery of basin by hand, placing backfill material and hand tamping in 6-inch compacted layers to finish grade, and compact to 98 percent maximum density.
   4. Do not use wheeled or tracked vehicles for tamping.

57.4 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Inspection:
   1. Check pump and motor for high bearing temperature and excessive vibration.
   2. Check for motor overload by taking ampere readings.

C. Preoperational Inspection:
   1. Check pump and motor alignment.
   2. Check for proper motor rotation.
   3. Check pump and drive units for proper lubrication.

D. Startup and Performance Testing:
   1. Notify Engineer and authority having jurisdiction three days prior to startup and performance testing.
   2. Operate pump using clean water at design point for continuous period of two hours, under supervision of manufacturer's representative and in presence of Engineer.
   3. Verify pump performance by performing time/draw-down test or time/fill test.
   4. Coordinate and operate pumps in conjunction with other Work of sewer.

E. Compaction Testing:
2. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
3. Testing Frequency: One for each lift.

F. Equipment Acceptance:

1. Adjust, repair, modify, or replace system components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.
3. Document adjustments, repairs, and replacements in manufacturer's field services certification.

G. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in maintenance of equipment.

H. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

I. Furnish installation certificate from equipment manufacturer's representative attesting equipment has been properly installed and is ready for startup and testing.

57.5 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Adjust basin, pump, and control panel systems such that station operates to performance requirements and according to Specifications.

57.6 DEMONSTRATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 333213
SECTION 09900
PAINTING AND COATING

PART 1

1.1 GENERAL INTENT

A. The intent of this Specifications is to provide the material and workmanship necessary to produce complete protection of the surfaces to be coated for Suwannee County. This includes all surface preparation, pre-treatment, coating application, touch-up of factory coated surfaces, protection of surfaces not to be coated, clean-up, and appurtenant work, all in accordance with the requirements of the Contract Documents. Throughout this specification “ENGINEER” refers to North Florida Professional Services or Contract Manager. And “OWNER” refers to Suwannee County.

1.2 PURPOSE

A. The purpose of this Specification is to generally outline the work contemplated for the painting and protective coating work performed for Suwannee County, including Contract Operations, Capital Improvement Projects, and Developer Contributed Assets as defined under Scope below; together with the General Conditions, Special Provisions and all other Technical Specifications included herewith. All paints and materials used on interior tank or treatment unit surfaces shall conform to AWWA and/or Florida Department of Environmental Protection (FDEP) regulations as they may apply to potable water or wastewater service. The manufacturer furnishing the coating material may be required to furnish certification to the ENGINEER/OWNER that the materials meet these provisions.

1.3 DESCRIPTION

A. The extent of painting work is shown on the project drawings, contracts and schedules, and as specified herein.

B. The work includes painting and finishing of interior and exterior exposed items and surfaces throughout the project, except as otherwise specified or shown on the drawings.

1. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of the work.

C. The work includes field painting of exposed bare and covered pipes and ducts including color coding, and of hangers, exposed steel and iron work, tanks, vessels, and primed metal surfaces of equipment installed under the mechanical and electrical work, except as otherwise indicated.
D. Paint all exposed surfaces normally painted in the execution of a building project whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, or are not specifically excluded from the painting work, paint these the same as adjacent similar materials or areas. If color or finish is not designated, the OWNER will select these from standard colors available for the materials systems specified.

1.4 PAINTING NOT INCLUDED

A. The following categories of work are not included as part of the field-applied finish work, unless otherwise noted on the drawings or in the Contract Documents.

1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various sections for structural steel, miscellaneous metal, metal fabrications, hollow metal work, and similar items. Also, for fabricated components such as shop-fabricated or factory-built mechanical and electrical equipment or accessories.

2. Pre-Finished Items: Unless otherwise shown or specified, do not include painting when factory-finishing or installer finishing is specified for such items as, but not limited to, finished electrical equipment including light fixtures, switchgear and distribution cabinets.

3. Concealed Surfaces: Unless otherwise shown or specified, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas. Painting of galvanized work that will be concealed in the completed work is not required. Do not paint structural steel to be encased in concrete, nor structural steel specified not to be painted under Division S. Except for touch-up as specified in Part 3, painting of shop primed structural steel and ferrous metals that will be concealed in the completed work is not required.

4. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plating, copper, bronze and similar finished materials will not require finish painting, unless otherwise specified.

5. Operating and Machined Parts and Labels: Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, machined surfaces, grease fittings, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting unless otherwise specified.

   a. Do not paint over any code-requiring labels, such as Underwriter’s Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.
6. Other Surfaces: Do not apply to glass, manhole frames and covers, aluminum platform gratings, stair treads, door thresholds, concrete wearing surfaces, or other walking surfaces unless otherwise specified.

1.5 CODES, STANDARDS AND REGULATIONS

A. The work herein specified shall be performed in a legally acceptable manner, and it shall be the responsibility of the CONTRACTOR to obtain any and all licenses, permits, and legal approvals required to perform the work specified.

B. All material and work covered by this specification shall comply with all currently approved or accepted provisions of applicable codes and standards published by the following organizations:

- **ANSI** - American National Standards Institute 11
  West 42nd
  New York, NY 10036
  212-642-4900

- **API** - American Petroleum Institute
  1220 L Street N.W.
  Washington, DC 20005
  202-682-8000

- **ASTM** - American Society for Testing and Materials 100
  Barr Harbor Dr.
  West Conshohocken, PA. 19428 610-832-9500

- **AWS** - American Welding Society
  550 N.W. LeJeune Rd.
  Miami, FL 33126
  305-443-9353

- **AWWA** - American Water Works Association
  6666 West Quincy Avenue
  Denver, CO. 80235
  303-794-7711

- **FM** - Factory Mutual Research
  1151 Boston-Providence Turnpike
  Norwood, MA 02062
  617-762-4300

- **NACE** - National Association of Corrosion Engineers
  PO Box 218340
  Houston, TX 77218 1440
  South Creek Dr.
C. The CONTRACTOR shall comply with all applicable Federal, state, and local laws and ordinances.
1.6 ACCEPTABLE COATING MANUFACTURERS

A. Except as otherwise indicated herein, materials specified are from the catalog of the Kop-Coat, Inc. listed below. Materials by other manufacturers approved by the Engineer are acceptable provided that they are established to the satisfaction of the ENGINEER as being compatible with and of equal quality to the coatings of the company listed. The CONTRACTOR shall provide satisfactory documentation from the firm manufacturing the proposed material that the material meets the specified requirements and is equivalent or better than the listed materials in the following properties:

1. Quality
2. Durability
3. Resistance to abrasion and physical damage
4. Life expectancy
5. Ability to recoat in future
6. Solids content by volume
7. Dry film thickness per coat
8. Compatibility with other coatings
9. Suitability for the intended service
10. Resistance to chemical attack
11. Temperature limitations in service and during application
12. Type and quality of recommended undercoats and topcoats
13. Ease of application
14. Ease of repairing damaged areas
15. Stability of colors

B. The cost of all testing and analyzing of the proposed substitute materials that may be required by the ENGINEER, shall be paid by the CONTRACTOR. If the proposed substitution requires changes in the contract work, the CONTRACTOR shall bear all such costs involved and the costs of allied trades affected by the substitution. These substitutions for other manufacturers must be made and approved prior to the bid date opening.

C. Material Sources: Kop-Coat Inc. is the standard of quality for the industrial coating materials specified in this Section. Where paint numbers are listed, it is to show the type and quality of coatings that are required. For convenience of reference, this specification includes product designations for coatings and coating colors as manufactured by the Kop-Coat Inc., St. Louis, MO. 800-547-2468. Other acceptable manufacturers are, Keeler and Long, Watertown, CT. 203-274-6701, and Tnemec Co., Kansas City, MO. 816-483-3400, and Porter International, Louisville, Ky. 502-588-9769. Proposed substitute materials must be shown to satisfy the material descriptions and to equal or exceed the properties of the listed materials as required above in Paragraph 1-06 A.
1.7 SUBMITTALS

A. Coating Materials List: The CONTRACTOR shall provide six (6) copies of a coating materials list which indicates the manufacturer and the coating number, keyed to the coating schedule herein, for approval of the ENGINEER. The submittals shall be made sufficiently in advance of the coating operations to allow ample time for checking, correcting, resubmitting and rechecking.

B. Paint Manufacturer’s Information: For each paint system to be used, the CONTRACTOR shall submit the following listed data prior to beginning painting operations.

1. Paint manufacturer’s data sheet for each product used.
2. Paint manufacturer’s instructions and recommendations on surface preparation and application.
3. Colors available for each product (where applicable).
4. Compatibility of shop and field applied coatings (where applicable).
5. Material safety data sheet for each product used.

C. Samples and Manufacturer’s Certificate: Provide all submittals, including the following, as specified in Division 1.

1. Submit manufacturer’s standard color chart for color selection.
2. Submit specimens, approximately 8 by 10 inches in size, for custom mixed colors for approval, not including color coding colors.
3. Where equipment is customarily shipped with a standard finish, submit samples of the proposed color and finish for approval prior to shipping.
4. Furnish affidavits from the manufacturer certifying that materials furnished conform to the requirements specified and that paint products have been checked for compatibility.
5. Submit a supplementary schedule of paint products with mil thickness, and solids by volume, including all paint applied in the shop and in the field. Provide a schedule that is in accordance with the recommendations of the paint manufacturer.
6. Furnish affidavits from the manufacturer certifying that coatings in immersion service contain no water-soluble solvents or corrosion inhibitive (active) pigments with slight water solubility.

1.8 DELIVERY AND STORAGE

A. Deliver all coating materials to the job site in original, new and unbroken, sealed packages and containers bearing manufacturer’s name and label, and the following information, all of which shall be plainly legible at the time of use:

1. Name or title of material.
2. Fed. Spec. number, if applicable.
3. Manufacturer’s stock number and date of manufacturer.
4. Manufacturer’s formula or specification number.
5. Manufacturer’s batch number.
6. Manufacturer’s name.
7. Contents by volume, for major pigment and vehicle constituents.
8. Thinning instructions.
10. Color name and number.
11. Expiration date.

B. Store paint materials and painting tools and equipment, including solvents and cleaning materials, in a well ventilated, dry area and away from high heat. Do not store in building or structure being painted, nor leave overnight therein. Follow manufacturer’s recommendations for the safe storage of paints and solvents. CONTRACTOR shall store materials in compliance with all local, state, and federal regulations.

1.9 QUALITY ASSURANCE

A. Inspection by the ENGINEER, or the waiver of inspection of any particular portion of the work, shall not relieve the CONTRACTOR of his responsibility to perform the work in accordance with these Specifications.

B. Inspection Devices: The CONTRACTOR shall furnish, until final acceptance of the work, inspection devices in good working condition for the detection of holidays, measurement of surface profile, and measurement of dry film thicknesses of the protective coatings. Surface preparation comparison visual standards, profile and dry film thickness devices shall be made available for the ENGINEER’s use at all times while coating is being done. The CONTRACTOR shall provide the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the ENGINEER.

C. Surface Cleanliness: Preparation of metallic surfaces shall be based upon comparison with SSPC-VIS 1 (ASTM D2200), and as described herein. The CONTRACTOR shall furnish the photographic standards. To facilitate inspection, the CONTRACTOR shall, on the first day of abrasive blasting operations, abrasive blast metal panels to the standards specified. Plates shall measure a minimum of 8.5 inches by 11 inches. Panels meeting the requirements of the Specifications shall be initiated by the CONTRACTOR and the OWNER’S representative and coated with a clear non-yellowing finish. One of these panels shall be prepared for each type of abrasive blasting and shall be used as a comparison standard throughout the project. The CONTRACTOR shall provide SSPC-VIS 1 Surface Preparation Standards for use during the abrasive blasting operations.

D. Surface Profile: The blast abrasive shall be suitable to achieve the blast profile as required for the coating system used. The CONTRACTOR shall furnish for the ENGINEER’s use, a Keane-Tator Surface Comparator No. 372 or approved equal.
E. Film Thickness Testing: On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" (SSPC-PA2), using a magnetic-type dry film thickness gauge such as Mikrotest Model FM, Elcometer Model 111/1EZ, Positector 2000 or approved equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least eight (8) hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gauge.

F. Holiday Testing: The CONTRACTOR shall holiday test all coated ferrous surfaces inside a steel reservoir, or other surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures. Areas which contain holidays shall be marked and repaired or recoated in accordance with the coating manufacturer’s printed instructions and then retested.

1. Coatings With Thickness Exceeding 20 Mils: For surfaces having a total dry film coating thickness exceeding 20 mils: Pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or approved equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

2. Coatings With Thickness of 20 Mils or Less: For surfaces having a total dry film coating thickness of 20 mils or less: Tinker & Rasor Model M-1 non-destructive type holiday detector, K-D Bird Dog or approved equal shall be used. The unit shall operate at less than 75-volts. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as Kodak Photo-Flo, or equal shall be added to the water prior to wetting the detector sponge.

1.10 MANUFACTURER'S REPRESENTATIVE

A. The CONTRACTOR shall require the protective coating manufacturer to furnish a qualified technical representative to visit the project site for technical support and as may be necessary to resolve field problems attributable or associated with the manufacturer's products furnished under this contract or the application thereof.

1.11 SAFETY AND HEALTH REQUIREMENTS

A. General: The CONTRACTOR shall provide and require use of personal protective and safety equipment for persons working in or about the project site, in accordance with requirements of OSHA Safety and Health Standards for Construction (29CFR 1910, 1915, and 1926) its revisions, and all other applicable regulations. The CONTRACTOR shall also comply with the coating manufacturer's printed instructions, appropriate technical bulletins, manuals, and material safety data sheets in the handling of potentially hazardous or harmful materials.
B. Head and Face Protection and Respiratory Devices: The CONTRACTOR shall require all persons to wear protective helmets while in the vicinity of the work. In additions, workers engaged in or near the work during sandblasting shall wear eye and face protection devices and air purifying, half-mask or mouthpiece respirators with appropriate filters. Barrier creams shall be used on any exposed areas of skin.

C. Ventilation: Where ventilation is used to control hazardous exposure, all equipment shall be explosion proof. Forced air ventilation shall be provided to reduce the concentration of air contaminants to the degree such that a hazard does not exist and to assist in the proper curing of coatings applied in a confined area. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.

D. Sound Levels: Whenever the occupational noise exposure exceeds maximum allowable sound levels permitted under OSHA regulations, the CONTRACTOR shall provide and require the use of approved hearing protection devices.

E. Illumination: Adequate illumination shall be provided while work is in progress, including explosion-proof lights and electrical equipment. Whenever required by the ENGINEER, the CONTRACTOR shall provide additional illumination to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the ENGINEER.

F. Temporary Access: All temporary ladders and scaffolding shall conform to applicable safety requirements. Scaffolding shall be erected where requested by the ENGINEER to facilitate inspection and shall be moved by the CONTRACTOR to locations as requested by the ENGINEER.

G. Cloths and cotton waste that might constitute a fire hazard shall be placed in fire resistant closed metal containers until removed from the project site or destroyed at the end of each workday.

1.12 WARRANTY

A. All work covered under the Contract shall be guaranteed against defective workmanship and materials for a period of one (1) year after completion and acceptance of the work. A first anniversary inspection will be scheduled by the CONTRACTOR during the eleventh (11th) month following acceptance of the work. A report shall be furnished to the OWNER describing the condition of the paint system and other work covered under the Contract. Tank draining shall be coordinated with the OWNER. Any latent defects found during this inspection shall be promptly repaired by the CONTRACTOR at no additional cost to the OWNER. Any location where coats of paint have peeled off, bubbled or cracked, and any location where rusting is evident, shall be considered a failure of the paint system. The CONTRACTOR shall make repairs at all points where failures are observed by removing the deteriorated coating, cleaning the surfaces and recoating with the same paint system. Any such repair work shall be completed by the CONTRACTOR within thirty (30) days after written notice of such defects unless otherwise negotiated.
B. Failure on the part of the CONTRACTOR to schedule this warranty inspection will not relieve him of warranty responsibility and any defects found by the OWNER after the normal warranty period will be assumed to have occurred during the one (1) year while the warranty was in effect.

PART 2 PRODUCTS AND COATING SYSTEMS

2.1 GENERAL

A. Definitions: The term "paint", "coatings", or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pre-treatment, primer, intermediate coat, or finish coat. The term "DFT" means minimum dry film thickness.

B. Compatibility: In any coating system, only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to the approval of the ENGINEER, a barrier coat shall be applied between all existing prime coats and subsequent field coats to insure compatibility.

2.2 COLORS AND FINISHES

A. All colors and shades of colors for all coats of paint shall be as selected or specified. Paint colors, surface treatment, gloss, and finishes, are indicated or specified in the "schedules" of the contract documents. Color and gloss not indicated or specified will be selected by the OWNER.

B. Each coat shall be of a slightly different shade, as directed by the ENGINEER, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer’s standard color samples or shall be customer mixed to match color samples furnished by the ENGINEER. Final acceptance of colors will be from samples applied on the job.

C. Color Pigments: Pure, non-fading, applicable types to suit the substrates and service indicated.

D. Paint Coordination: Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Furnish information to manufacturers, fabricators, suppliers and others where necessary on the characteristics of the finish materials to be used, to ensure compatible prime coats of use. Provide barrier coats over incompatible primers or remove and re-prime as required.

E. Color Coding: All exposed piping in structures, aboveground or in pipe trenches, shall be color code painted in strict accordance with the color code chart presented in
Paragraph 3-15 of this section. All colors shall be as specified or as selected by the OWNER.

2.3 UNDERCOATS AND THINNERS

A. Undercoats: Provide undercoat paint produced by the same manufacturer as the finish coats.

B. Thinners: Use only thinners approved by the paint manufacturer and use only within recommended limits.

2.4 INDUSTRIAL COATING SYSTEMS

A. The CONTRACTOR shall use coating materials suitable for the intended use and recommended by their manufacturer for the intended service.

B. Protective Coating Materials: Products shall be standard coatings produced by recognized manufacturers regularly engaged in production of such materials for application on essentially identical facilities to those proposed in this project. Where requested, the CONTRACTOR shall provide the ENGINEER with the names of not less than ten (10) successful applications of the proposed manufacturer’s products, which have been proven over a three (3) year period of time, demonstrating compliance with this specification requirement.

C. System 1 - Alkyd Enamel: High quality gloss or semi-gloss, long oil alkyd finish with a minimum solids content of 57% by volume. Primer as recommended by manufacturer.

1. Painting New Construction
   a. Prime coat except wood surfaces (DFT=3.0 mils) Kop-Coat 622-LCF Primer.
   b. Prime coat for wood surfaces (DFT = 1.5 mils) Kop-Coat Rustarmor 500 enamel thinned 15% with Kop-Coat 4000 Thinner.
   c. Finish coats, two (Total DFT = 3.0 mils) Kop-Coat Rustarmor 500 Enamel.
   d. Total system DFT except wood surfaces = 6.0 mils
      Total system DFT for wood surfaces = 4.5 mils

2. Repainting Existing Surfaces
   a. The cleaned steel is to be hand brushed twice with (DFT = 4.0 mils) Kop-Coat 622-LCF Primer. Completely work the primer into all the irregular surface faces of the steel.
   b. Finish coats, two (total DFT = 3.0 mils) Kop-Coat Rustarmor 500 Enamel.
c. Total millage shall be at least 7.0 mils.

D. System 2 - Silicone Alkyd Enamel: High quality gloss alkyd, medium long oil alkyd finish. Minimum solids content of 48% by volume. Prime coat to be as recommended by manufacturer.

1. Painting New Construction
   a. Prime coat (DFT = 3.0 mils) Kop-Coat 622-LCF Primer.
   b. Finish coats, two (Total DFT = 3.0 mils) Kop-Coat Sub-Sil B
   c. Total system DFT = 6.0 mils.

2. Repainting Existing Surfaces
   a. The cleaned steel is to be hand brushed twice with (DFT = 4.0 mils) Kop-Coat 622-LCF Primer.
   b. Finish coats, two (Total DFT = 3.0 mils) Kop-Coat 1515 Silicone Alkyd.
   c. Total millage shall be at least 7.0 mils.

E. System 3 - High Build Epoxy: High build polyamide epoxy coating, resistant to splash, spillage and fumes of dilute acids, bases and salts, and with high resistance to weathering. Coating material shall have a minimum solids content of 56% by volume. Prime coat to be a rust inhibitive epoxy primer as recommended by manufacturer.

1. Prime coat (DFT = 1.5 mils) Kop-Coat 294 Epoxy Primer.
2. Finish coats, two (Total DFT = 10.0 mils) Kop-Coat Hi-Gard Epoxy Coating.
3. Total system DFT = 11.5 mils.

F. System 4 Acrylic Latex (High Sheen): Single component, water based acrylic latex with a fungicide additive and minimum solids content of 35% by volume. Prime coat to be as recommended by manufacturer.

1. Prime coat (DFT = 2.0 mils) as recommended by manufacturer, if needed.
2. Finish coats, two (Total DFT = 3.0 mils) Kop-Coat 620 Acrylic Emulsion.
3. Total system DFT = 5.0 mils (with prime coat). 3.0 mils (without prime coat).

G. System 5 - Acrylic, Concrete and Masonry (Flat): High molecular weight acrylic coating material with a minimum solids content of 41% by volume. Prime coat shall be an acrylic filler and sealer for concrete surfaces.
1. Painting New Construction
   a. Prime coat (filler/sealer) Kop-Coat Concrete and Masonry Filler.
   b. Finish coats, two (Total DFT = 3.0 mils) Kop-Coat 600 Interior-Exterior Acrylic Emulsion.
   c. Total system DFT = 3.0 mils.

2. Repainting Existing Surfaces
   a. Spot prime if needed with Kop-Coat Concrete and Masonry Filler to insure a consistent total finish appearance.
   b. Finish coats, two (Total DFT 3.0 mils) Kop-Coat 600 Interior-Exterior Acrylic Emulsion.
   c. Total millage shall be at least 3.0 mils.

H. System 6 - Coal Tar Epoxy, Steel: High build, 2-component amine or polyamide cured coal tar epoxy, solids content of at least 74% by volume, suitable for long term immersion in wastewater and for coating of buried surfaces, and conforming to or exceeding Corps of Engineers Specification C-200, or SSPC Paint 16. Prime coats are for use as a shop primer only. Prime coat shall be omitted when both surface preparation and coating are to be performed in the field.

1. Prime coat (DFT = 1.5 mils) Kop-Coat 654 Epoxy Primer.

2. Finish coats, two (Total DFT = 20.0 mils) Kop-Coat Bitumastic No. 300-M.

Note: Time between coats is critical and maximum times as stated by the manufacturer must not be exceeded.

3. Total system DFT = 21.5 mils (with prime coat). 20.0 mils (without prime coat).

Notes: a. Spot sandblast to SSPC-SP10 all areas damaged during erection, or areas not precoated before application of coating.

   b. All edges, nuts, bolts, lap joints, weld seams and the roof rim angle shall receive one brush-applied coat prior to the application of the complete spray coat.

I. System 7 - Coal Tar Epoxy, Concrete: High build, 2-component amine or polyamide cured coal tar epoxy, solids content of at least 74% by volume, suitable for long term immersion in wastewater and for coating of buried surfaces and conforming to or exceeding Corps. of Engineers Specification C-200, or SSPC Paint 16. Filler
compound shall be a 2-component epoxy material used to fill voids and provide a suitable surface for the application of the coal tar epoxy. Filler is worked into the concrete surface with a wide blade putty knife or a squeegee.

1. First coat - Kop-Coat Bitumastic No. 300-M, thinned 33 percent with Thinner 2000 and apply at the rate of 200-300 sq. ft. per gallon. Allow not more than 24 hours before applying additional coats at the normal, unthinned rate.

2. Finish coats, two (Total DFT = 20.0 mils) Kop-Coat Bitumastic No.300-M.

Note: Time between coats is critical and maximum times as stated by the manufacturer must not be exceeded.

3. Total system DFT = 20.0 mils.

J. System 8-Polyamide Cured Epoxy for Steel or Concrete Potable Water Storage Tanks or Treatment Units: High build polyamide cured epoxy coating with solids contents of at least 56% by volume and a finish coat color of white. The material shall be capable of achieving at least 5 mils dry film thickness per coat. The epoxy coating material shall be suitable for long-term immersion service in potable water. The materials used shall appear on the latest published list of approved coatings for use in potable water issued by the Florida Department of Environmental Protection. Submit a written certification that the proposed materials meet the above regulatory agency standards and policies. Apply the material with a primer if recommended by the coating manufacturer. Thinners and additives shall also be in compliance with this paragraph.

1. Steel Tanks or Treatment Units
   a. First coat (DFT=5.0 mils) Kop-Coat Hi-Gard Epoxy. See notes (1), (2) and (3)
   b. Finish coat (DFT = 5.0 mils) Kop-Coat Hi-Gard Epoxy
   c. Total system DFT = 10.0 mils

Notes:

(1) All sharp edges, weld burrs, weld spatter and surface irregularities shall be ground smooth before applying coating.

(2) Touch-up coating to be done for areas damaged during erection, or areas not pre-coated. Spot sandblast to SSPC-SP10 before application of coating.

(3) All edges, nuts, bolts, lap joints, weld seams and the roof rim angle shall receive one brush-applied coat prior to the application of the complete spray coat.
2. Concrete Tanks or Treatment Units
   a. First coat (DFT = 4.0 mils) Kop-Coat Hi-Gard Epoxy thinned 20% with Kop-Coat 2,000 Thinner.
   b. Finish coat (DFT = 6.0 mils) Kop-Coat Hi-Gard Epoxy.
   c. Total system DFT = 10.0 mils.

3. Curing Period: Prior to immersion, subject the completed system to at least 7 days of curing time with the substrate temperature at a minimum of 70 degrees F, or 10 days at a minimum of 60 degrees F. More curing time or a higher temperature shall be provided if recommended by the manufacturer. If the environmental conditions do not provide the necessary minimum temperature, use heated air to provide the necessary heat for curing. Other combinations of curing time and temperature may be used if the coating manufacturer presents satisfactory documentation and test results to substantiate that the degree of curing is equal or greater than curing for 7 days at 70 degrees F.

K. System 9 - Polyurethane: High gloss, 2 - component aliphatic polyurethane for use on steel, fiberglass and PVC. Coating material shall have a minimum solids content of 56% by volume. Prep surface as recommended by manufacture. Product is not recommended for interior building surfaces or continuous immersion.
   1. Prime coat (DFT = 3.0 mils) Hi-GARD Epoxy
   2. Finish coats, two (total DFT=3.0 mils) Kop-Coat 1122 BRS Linear Polyurethane
   3. Total system = 6.0 mils minimum

EXECUTION

PART 3 STORAGE, MIXING AND THINNING OF MATERIALS

Manufacturer’s Recommendations: Unless otherwise specified herein, the coating manufacturer’s printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed. No substitutes or other deviations will be permitted without written permission of the ENGINEER. The CONTRACTOR shall supply the ENGINEER with copies of each manufacturer’s instructions in accordance with the requirements of Paragraph 1-07, "SUBMITTALS".

A. All protective coating materials shall be used within the manufacturer's recommended shelf life.
B. Storage and mixing of paint or other coating materials shall be performed only in those areas designated by the ENGINEER.

3.2 PREPARATION FOR COATING

A. General: All surfaces to receive protective coatings shall be cleaned as specified herein prior to application of said coatings. The CONTRACTOR shall examine all surfaces to be coated, and shall correct all surface defects before application of any coating material. All marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any coating application. Do not paint over dirt, rust, scale, oil, grease, moisture, scuffed surfaces or other foreign material or in conditions otherwise detrimental to the formation of a durable paint bond and film.

B. Protection of Surfaces Not to be Coated: Surfaces which are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations. All hardware, lighting fixtures, switch plates, machined surfaces, couplings, shafts, bearings, nameplates on machinery and other surfaces not to be painted shall be removed, masked or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials.

C. Protection of Adjacent Work and Areas: Care shall be exercised not to damage adjacent work during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The CONTRACTOR shall be fully responsible for and shall promptly repair to the satisfaction of the OWNER any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

D. Protection of Painted Surfaces: Cleaning and coating shall be so programmed that dust and other contaminants from the cleaning process will not fall on wet, newly-coated surfaces.

3.3 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this Specification:

1. Solvent Cleaning (SSPC-SP1): The method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from steel surfaces through the use of solvent, vapor, emulsion, alkaline, and/or steam.
2. Hand Tool Cleaning (SSPC-SP2): The method for removing all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter through the use of non-power hand tools.

3. Power Tool Cleaning (SSPC-SP3): The method for removing all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter through the use of power assisted hand tools.

4. White Metal Blast Cleaning (SSPC-SPS): The method of preparing steel surfaces which, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, and paint.

5. Commercial Blast Cleaning (SSPC-SP6): The method of preparing steel surfaces which, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, and paint. Evenly dispersed very light shadows, streaks, and discolorations caused by stains of rust, mill scale, and previously applied paint may remain on no more than 33% of the surface.

6. Brush-off Blast Cleaning (SSPC-SP7): The method of preparing steel surfaces which, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface.

7. Near-White Blast Cleaning (SSPC-SP1O): The method of preparing steel surfaces which, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, and paint. Evenly dispersed very light shadows, streaks, and discolorations caused by stains of rust, mill scale, and previously applied paint may remain on no more than 5% of the surface.

3.4 SURFACE PREPARATION

A. General: Perform preparation and cleaning procedures in strict accordance with the paint manufacturer’s instructions and as herein specified, for each particular substrate condition.

1. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.

2. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly painted surfaces. Remove mildew in accordance with the paint manufacturer’s recommendations.
3.5 NEW FERROUS METAL SURFACE PREPARATION (UN GALVANIZED)

A. The minimum abrasive blasting surface preparation shall be as specified in the coating system schedules included at the end of this section. Where there is a conflict between these Specifications and the coating manufacturer's printed recommendations for the intended service, the higher degree of cleaning shall apply.

B. Workmanship for metal surface preparation shall be in conformance with the current SSPC Standards and this section. Blast cleaned surfaces shall match the standard samples available from the National Association of Corrosion Engineers (NACE) Standard TM-01-70.

C. All oil, grease, welding fluxes and other surface contaminants shall be removed by alkaline cleaning per SSPC-SP1 prior to blast cleaning.

D. All sharp edges shall be rounded or chamfered and all burrs, surface defects and weld splatter shall be ground smooth prior to blast cleaning.

E. The type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendation for the particular coating and service conditions. CONTRACTOR shall submit data and samples for approval on abrasives to be used on the Project. Abrasives that are used shall be designed for the specific purpose of blast cleaning. Abrasives shall be free of contaminants and chlorides. Ordinary builder's sand shall not be considered to be approved abrasive material. ENGINEER will periodically sample abrasives used at the job site for comparison with approved submitted materials.

F. The abrasive shall not be reused unless otherwise approved by the ENGINEER. For automated shop blasting systems, clean oil and moisture-free abrasives shall be maintained.

G. The CONTRACTOR shall comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.

H. Compressed air for air blast cleaning shall be supplied at adequate pressure from well-maintained compressors equipped with oil/moisture separators which remove all contaminants.

I. Surfaces shall be cleaned of all dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming or other approved method prior to painting.

J. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.

K. Damaged or defective coating shall be removed by the specified blast cleaning to meet the clean surface requirements before recoating.
If the specified abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, the SSPC-SP2, Hand Tool Cleaning, or SSPC-SP3, Power Tool Cleaning, will be permitted.

Shop applied coatings of unknown composition shall be completely removed before the specified coatings are applied. Valves, castings, ductile iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by Solvent Cleaning per SSPC-SP1 before the abrasive blast cleaning work has been started.

Shop primed equipment shall be alkaline cleaned in the field before finish coats are applied.

FERROUS METAL SURFACE PREPARATION (GALVANIZED)

A. All installation and erection caused blemishes to galvanized surfaces shall be touched up in accordance with ASTM A780 prior to coating.

B. Galvanized ferrous metal shall be alkaline cleaned per SSPC-SP1 to remove oil, grease, and other contaminants detrimental to adhesion of the protective coating system to be used.

C. Surfaces shall be pretreated with Kop-Coat 40 Passivator, one coat 0.4 mil DFT, prior to finish coating, in accordance with the printed recommendations of the coating manufacturer.

SURFACE PREPARATION OF FERROUS SURFACES WITH EXISTING COATINGS, EXCLUDING STEEL TANK OR TREATMENT UNIT INTERIORS (IN ADDITION TO REQUIREMENTS IN PARAGRAPHS 3-05 AND 3-06).

A. General: All grease, oil, heavy chalk, dirt, or other contaminants shall be removed by solvent or detergent cleaning prior to abrasive blast cleaning. The CONTRACTOR shall determine the generic type of the existing coatings by laboratory testing, at no additional cost to the OWNER.

B. Abrasive Blast Cleaning: The CONTRACTOR shall provide the degree of cleaning specified in the coating system schedule for the entire surface to be coated. If the degree of cleaning is not specified in the schedule, deteriorated coatings shall be removed by abrasive blast cleaning to SSPC-SP6, Commercial Blast Cleaning. Areas of tightly adhering coatings shall be cleaned to SSPC-SP7, Brush-Off Blast Cleaning, with the remaining thickness of existing coating not to exceed 3 mils.

C. Incompatible Coatings: If coatings to be applied are not compatible with existing coatings, the CONTRACTOR shall apply intermediate coatings per the paint
manufacturer’s recommendation for the specified abrasive blast cleaning. A small trial application shall be conducted for compatibility prior to painting large areas.

D. Unknown Coatings: Coatings of unknown composition shall be completely removed prior to application of new coatings.

3.8 SURFACE PREPARATION FOR REPAINTING EXISTING STEEL
A. The entire structure is to be completely pressure washed at 3,000 to 5,000 psi with potable water.
B. All areas shall be cleaned/sandblasted to the surface preparation standards as specified herein, or superceded by the bid form.
C. All cleaned areas are to be primed the same workday that they are cleaned and blasted.

3.9 PRESSURE WASH CLEANING FOR REPAINTING EXISTING CONCRETE
A. The entire structure is to be pressure washed at 3,000 to 5,000 psi with a solution of 50% water and bleach to yield a mixture with a minimum concentration of 2-1/2% sodium hypochlorite.
B. The entire structure is to be completely rinsed by pressure washing at 3,000 to 5,000 psi with potable water.

3.10 CONCRETE AND CONCRETE BLOCK MASONRY SURFACE PREPARATION
A. Surface preparation shall not begin until at least 30 days after the concrete has been placed.
B. All efflorescence, chalk, dust, dirt, oil and grease shall be removed by Detergent Cleaning per SSPC-SP1 before abrasive blast cleaning.
C. Concrete, concrete block masonry surfaces, previously painted concrete and masonry and deteriorated concrete and masonry surfaces to be coated shall be abrasive blast cleaned to remove laitance, paint, deteriorated concrete, and roughen the entire surface equivalent to the surface of the No. 80 grit flint sandpaper. Concrete shall have a consistent, even texture (void free) and shall be patched where needed.
D. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint. Do not paint over surfaces where the moisture content exceeds that permitted in the manufacturer’s printed directions.
E. If acid etching is required by the coating application instructions, the treatment shall be made after sandblasting. After acid etching, rinse surfaces with clean water to neutralize the acid and test the pH. The pH shall be between 7.0 and 8.0.

F. Surfaces shall be clean and dry and as recommended by the coating manufacturer before coating is started.

G. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhors Model DB, or approved equal.

3.11 PLASTIC, FIBERGLASS AND NONFERROUS METALS SURFACE PREPARATION

A. Plastic and Fiberglass surfaces shall be sanded or Brush Off Blast Cleaned, SSPC-SP7, prior to solvent cleaning with a chemical compatible with the coating system primer. If blast cleaned, use 60-80 mesh abrasive.

B. Non-ferrous metal surfaces shall be Solvent Cleaned, SSPC-SP1, followed by sanding or Brush Off Blast Cleaning, SSPC-SP7.

C. All surfaces shall be clean and dry prior to coating application.

3.12 WOOD SURFACE PREPARATION

A. Clean wood surfaces to be painted of all dust, dirt, grease, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, with either manual or mechanical means, as applicable, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of the priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic woodfiller. Sandpaper smooth when dried and dust off.

B. Prime or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood.

3.13 WORKMANSHIP

A. Skilled craftsmen and experienced supervision shall be used on all work.

B. Clean drop cloths shall be used. All damage to surfaces resulting from the work hereunder shall be leaned, repaired, and refinished to the complete satisfaction of the ENGINEER, at no cost to the OWNER.

C. All coatings shall be applied under dry and dust-free conditions. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure that they have been thoroughly cleaned and that they receive an adequate thickness of coating.
material. The finished surfaces shall be free from runs, drops, ridges, waves, laps, alligatoring, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given to insure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other approved precautionary measures.

3.14 SHOP COATING REQUIREMENTS

A. All items of equipment, or parts of equipment which are not submerged in service, shall be shop primed and then finish coated in the field after installation with the specified or approved color. The methods, materials, application, equipment and all other details of shop painting shall comply with these Specifications. If the shop primer requires top-coating within a specified period of time, the equipment shall be finish coated in the shop and then touch-up painted after installation.

B. All items of equipment, or parts and surfaces of equipment which are submerged when in service, with the exception of pumps and valves shall have all surface preparation and coating work performed in the field.

C. The interior surfaces of steel water reservoirs shall have all surface preparation and coating work performed in the field.

D. For certain pieces of equipment it may be undesirable or impractical to apply finish coatings in the field. Such equipment may include engine generator sets, equipment such as electrical control panels, switch-gear or main control boards, submerged parts of the pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the specified quality in the field. Such equipment shall be shop primed and finish coated in the field with the identical material after installation. The CONTRACTOR shall require the manufacturer of each such piece of equipment to certify as part of its shop drawings that the surface preparation is in accordance with these Specifications. The coating material data sheet shall be submitted with the shop drawings for the equipment.

E. For certain small pieces of equipment the manufacturer may have a standard coating system which is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the shop drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.

F. Shop painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 6 months before finish coating, or less time if recommended by the coating manufacturer.
G. Damage to shop-applied coatings shall be repaired in accordance with this section and the coating manufacturer's printed instructions prior to finish painting.

H. The CONTRACTOR shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this section. Copies of applicable coating manufacturer’s data sheets shall be submitted with equipment shop drawings.

3.15 APPLICATION OF COATINGS

A. The application of protective coatings to steel substrates shall be in accordance with “Paint Application Specification No. 1”, (SSPC-A-1), Steel Structures Painting Council.

B. Cleaned surfaces and all coats shall be inspected prior to each succeeding coat. The CONTRACTOR shall schedule such inspection with the ENGINEER in advance.

C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be painted in the same working day.

D. Coatings shall be prepared, mixed and applied in accordance with the manufacturer’s instructions and recommendations, and these Specifications. If directions differ, the most stringent requirements shall be followed.

E. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

F. Stir materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Do not stir surface film into the coating materials. Remove the film, and if necessary, strain the material before using.

G. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe (brushed or gloved) painting for these areas.

H. Finish coats, including touch-up and damage repair coats shall be applied in a manner which will present a uniform texture and color matched appearance.

1. Job Conditions: The following job conditions will be strictly enforced during the application of coatings for the project.

1. Apply water-base coatings only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F and 90 degrees F unless otherwise permitted by the paint manufacturer's printed instructions.
2. Apply solvent-thinned coatings only when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F and 95 degrees F unless otherwise permitted by the paint manufacturer's printed instructions.

3. Do not apply paint in dust or smoke laden atmosphere, high winds, rain, fog or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.

4. Do not apply coatings when the temperature is less than 5 degrees F above the dewpoint. Dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Weather Bureau psychrometric tables.

5. Do not apply coatings when the outside air temperature is expected to drop below 45 degrees F or less than 5 degrees F above the dewpoint, within 8 hours after application of the coating.

6. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

J. The finish coat on all work shall be applied after all concrete, masonry, and equipment installation is complete and the work areas are clean and dust-free.

K. General Considerations:

1. Apply paint as specified and in accordance with the manufacturer's directions. Use brushes for applying first coat on wood and on metals other than steel and sheet metal and items fabricated from steel and sheet metal. For other coats on wood, metal and other substrates, use applicators and techniques best suited for the type of material being applied.

2. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

3. Paint surfaces behind movable equipment the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment with prime coat only before final installation of equipment.

4. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

5. Paint the back sides of removable or hinged covers to match the exposed surfaces.
6. Finish exterior doors on tops, bottoms and side edges the same as the exterior faces, unless otherwise indicated or specified.

7. Sand lightly between each succeeding enamel coat.

8. Omit the field prime coat on shop-primed surfaces and touch up painted metal surfaces which are not to be finished painted and which will not be exposed to view in the completed work. Do not omit primer on metal surfaces specified to be finish coated or on metal surfaces that will be exposed to view in the completed work.

L. Scheduled Painting:

1. Apply the first coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

M. Minimum Coating Thickness: Apply each material at not less than the manufacturer's recommended spreading rate, to establish a total dry film thickness as specified or, if not specified, as recommended by coating manufacturer.

N. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed in mechanical equipment rooms and in occupied spaces, and on the outside or exterior of buildings or structures:

1. Mechanical items to be painted include, but are not limited to, the following:
   a. Piping, valves, pipe hangers, and supports.
   b. Pumps
   c. Tanks
   d. Duct work, insulation
   e. Motors, mechanical equipment, and supports
   f. Accessory items

2. Electrical items to be painted include, but are not limited to, the following:
   a. Conduit and fittings
   b. Switchgear

O. Prime Coats: Apply a prime coat to material, equipment and surfaces which are required to be painted or finished, and which have not been prime coated by others.
Clean and prime unprimed ferrous metals as soon as possible after delivery of the metals to the job site. Recruit primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

P. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surfaces imperfections.

Q. Pigmented, Opaque Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

R. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.16 CURING OF COATINGS

A. The CONTRACTOR shall provide curing conditions in accordance with the conditions recommended by the coating material manufacturer or by these Specifications, whichever is the more stringent requirement, prior to placing the completed coating system into service.

B. Forced Air Ventilation of Steel Reservoirs and Enclosed Hydraulic Structures: Forced air ventilation is required for the application and curing of coatings on the interior surfaces of steel reservoirs and enclosed hydraulic structures. During curing periods, continuously exhaust air from a manhole in the lowest shell ring or in the case of an enclosed hydraulic structure, from the lowest level of the structure using portable ducting. After all interior coating operations have been completed, provide a final curing period for a minimum of 10 days, during which time the forced air ventilation system shall operate continuously. For additional requirements, refer to the specific written instructions of the manufacturer for the coating system being applied.

3.17 COLOR CODING

A. All exposed piping shall be color coded. After the finish coat has been applied, label each line with stenciled legends identifying the nature of the pipe contents and the direction of flow. This stenciled identification shall appear in one or more places in the line as deemed necessary by the ENGINEER. Stencil legends shall be white for all pipe except white color-coded pipe, which shall have black legends. Labels shall occur a minimum of every 15 feet of straight piping and at all bends. Minimum stencil size shall be two-inch letters for 4-inch and larger diameter piping and one-inch letters for 2-inch to 3-1/2-inch diameter piping. Piping 1-1/2-inch diameter and smaller shall be identified using plastic wrap-around pipe markers.
B. Items to be coded but not specifically mentioned shall be coated in a color selected by the ENGINEER or OWNER.

C. All paints/coatings used in potable water contact areas must have AWWA and EPA classification and approvals.

D. All requirements of the Occupational Safety and Health Act (OSHA) concerning color coding and safety markings shall be considered part of these Specifications unless specifically excluded.

E. Any paint/coating requirements/specifications not specifically addressed in the foregoing shall be decided upon as required by the ENGINEER.

F. Every valve or connection, where it may be possible for a worker to be exposed to a hazardous substance, shall be labeled per General Industry Safety Orders, Article 112, OSHA Occupational Safety and Health Standards 29CFR1910.

G. Color Code Chart

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Lines/Piping</td>
<td></td>
</tr>
<tr>
<td>Raw</td>
<td>Olive Green - Kop-Coat OSHA Safety Green #2383</td>
</tr>
<tr>
<td>Settled or Clarified</td>
<td>Aqua - Kop-Coat Marine Green #7333</td>
</tr>
<tr>
<td>Finished or Potable</td>
<td>Dark Blue - Kop-Coat OSHA Safety Blue A#183</td>
</tr>
<tr>
<td>Reuse Water</td>
<td>Pantone Purple 522C - Kop-Coat OSHA Safety</td>
</tr>
<tr>
<td>Chemical Lines/Piping</td>
<td></td>
</tr>
<tr>
<td>Alum or Sodium Aluminate</td>
<td>Orange - Kop-Coat OSHA Safety Orange #J498</td>
</tr>
<tr>
<td>Ammonia</td>
<td>#J498 White - Kop-Coat #0800</td>
</tr>
<tr>
<td>Carbon Slurry</td>
<td>Black - Kop-Coat #C900</td>
</tr>
<tr>
<td>Chlorine (Gas/Solution)</td>
<td>Yellow - Kop-Coat OSHA Safety Yellow #625</td>
</tr>
<tr>
<td>Fluoride</td>
<td>Light Blue w/Red Band - Kop-Coat Dawn Blue #8155</td>
</tr>
<tr>
<td></td>
<td>with 6&quot; bands of Kop-Coat OSHA Safety Red #0508</td>
</tr>
<tr>
<td>Methanol</td>
<td>Red w/Yellow Band - Kop-Coat OSHA Safety Red #0508</td>
</tr>
<tr>
<td></td>
<td>with 6&quot; bands of Kop-Coat OSHA Safety Yellow #S625</td>
</tr>
<tr>
<td>Lime Slurry Odophos</td>
<td>Light Green — Kop-Coat Eye-Rest Green #2369 Violet — Kop-coat OSHA Safety Purple #S585</td>
</tr>
<tr>
<td>Sulfuric Acid or Sulfur Dioxide</td>
<td>Light Green w/Yellow Band, Kop-Coat Eye-Rest Green #2369 with 6&quot; bands of Kop-Coat OSHA Safety Yellow #S625</td>
</tr>
</tbody>
</table>
3.18 COATING SYSTEM SCHEDULES

A. COATING SYSTEM SCHEDULE, FERROUS METAL - NOT GALVANIZED (FM):

<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Item</th>
<th>Surface Prep.</th>
<th>System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM-1</td>
<td>All exposed surfaces outdoors, exposed to normal industrial exposure</td>
<td>Commercial Blast Cleaning, SSPC-SP6</td>
<td>Urethane #9</td>
</tr>
<tr>
<td>FM-2</td>
<td>All exposed surfaces indoors and outdoors, exposed to moderate and</td>
<td>Commercial Blast Cleaning, SSPC-SP6</td>
<td>(2b) Urethane #9</td>
</tr>
<tr>
<td></td>
<td>severe industrial exposure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FM-3</td>
<td>Surfaces in Chlorination room, chlorine gas exposure</td>
<td>Commercial Blast Cleaning, SSPC-SP6</td>
<td>(3) High Build Epoxy</td>
</tr>
<tr>
<td>Schedule No.</td>
<td>Item</td>
<td>Surface Prep.</td>
<td>System No.</td>
</tr>
<tr>
<td>-------------</td>
<td>------</td>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>FM-4</td>
<td>Surfaces submerged or intermittently submerged in potable water, including all surfaces lower than 2’ above high water level and all surfaces inside enclosed hydraulic structures, tanks and treatment units, and all surfaces of valves, couplings and pumps</td>
<td>Near White Metal Blast Cleaning, SSPC-SP10</td>
<td>(3) or (8) High Build Epoxy</td>
</tr>
<tr>
<td>FM-5</td>
<td>Surfaces submerged or intermittently submerged in wastewater, including all surfaces lower than 2’ above high water level and all surfaces inside enclosed hydraulic structures, tanks and treatment units and all surfaces of valves, couplings and pumps</td>
<td>Near White Metal Blast Cleaning, SSPC-SP10</td>
<td>(6) Coal Tar Epoxy or (3) High Build Epoxy (if color desired)</td>
</tr>
<tr>
<td>FM-6</td>
<td>Buried surfaces that are not specified to be coated elsewhere</td>
<td>Near White Metal Blast Cleaning, SSPC-SP10</td>
<td>(6) Coal Tar Epoxy</td>
</tr>
<tr>
<td>FM-7</td>
<td>Indoor architectural sheet metal, flashings, door frames, and exposed ducts</td>
<td>Commercial Blast Cleaning, SSPC-SP6</td>
<td>(1) Alkyd Enamel</td>
</tr>
<tr>
<td>FM-8</td>
<td>Surfaces of indoor equipment</td>
<td>Commercial Blast Cleaning, SSPC-SP6</td>
<td>Alkyd Enamel</td>
</tr>
</tbody>
</table>
### B. COATING SYSTEM SCHEDULE, FERROUS METAL - GALVANIZED (FMG):

All galvanized surfaces except for the following items shall be coated unless required by other Sections: (1) Floor gratings and frames, (2) Handrails, (3) Stair treads, (4) Chain link fencing and appurtenances.

<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Item</th>
<th>Surface Prep.</th>
<th>System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMG-1</td>
<td>All exposed surfaces indoors and outdoors, except those included below</td>
<td>Solvent Cleaning per Paragraph 3-06</td>
<td>(1) Alkyd Enamel</td>
</tr>
<tr>
<td>FMG-2</td>
<td>All exposed surfaces indoors and outdoors, including surfaces in chlorinator room and chlorine storage room, except those included below</td>
<td>Solvent Cleaning per Paragraph 3-06</td>
<td>(3) or (8) High Build Epoxy</td>
</tr>
<tr>
<td>FMG-3</td>
<td>Surfaces buried or submerged in wastewater</td>
<td>Solvent Cleaning per Paragraph 3-06 or Brush Off Grade Blast Cleaning SSPC-SP7</td>
<td>(6) Coal Tar Epoxy</td>
</tr>
<tr>
<td>FMG-4</td>
<td>Indoor architectural sheet metal, flashings, doors, frames, and exposed ducts</td>
<td>Solvent Cleaning per Paragraph 3-06</td>
<td>(1) Alkyd Enamel</td>
</tr>
</tbody>
</table>
C. COATING SYSTEM SCHEDULE, STEEL DIGESTER FLOATING COVERS AND DIGESTER GASHOLDERS (SD):

<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Item</th>
<th>Surface Prep.</th>
<th>System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD-1</td>
<td>All ferrous surfaces submerged in water or sludge, including rim plate</td>
<td>White Metal Blast Cleaning, SSPC-SPS</td>
<td>(6) Coal Tar Epoxy</td>
</tr>
<tr>
<td>SD-2</td>
<td>All ferrous surfaces exposed to digester gas</td>
<td>White Metal Blast Cleaning, SSPC-SPS</td>
<td>(6) Coal Tar Epoxy</td>
</tr>
<tr>
<td>SD-3</td>
<td>All interior ferrous surfaces of gasholder shell, including top angle</td>
<td>White Metal Blast Cleaning, SSPC-SPS</td>
<td>(6) Coal Tar Epoxy</td>
</tr>
<tr>
<td>SD-4</td>
<td>Exposed, outdoors</td>
<td>Commercial Blast Cleaning, SSPC-SP6</td>
<td>(2) Silicone Alkyd Enamel or Urethane</td>
</tr>
</tbody>
</table>

D. COATING SYSTEM SCHEDULE, NON-FERROUS METAL, PLASTIC, FIBERGLASS (NFM):

Where isolated non-ferrous parts are associated with equipment or piping, the CONTRACTOR shall use the coatings system for the adjacent connected surfaces. Do not coat handrails, gratings, frames or hatches. Only primers recommended by the coating manufacturer shall be used.

<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Item</th>
<th>Surface Prep.</th>
<th>System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFM-1</td>
<td>All exposed surfaces indoors and outdoors, except those included below</td>
<td>Solvent Cleaning per Paragraph 3-09</td>
<td>(1) Alkyd Enamel</td>
</tr>
<tr>
<td>NFM-2</td>
<td>Chlorination room and chlorine storage room</td>
<td>Solvent Cleaning per Paragraph 3-09</td>
<td>(3) or (8) High Build Epoxy</td>
</tr>
<tr>
<td>NFM-3</td>
<td>Polyvinyl chloride plastic piping, and fiberglass surfaces, indoor and outdoors, or in structures not submerged</td>
<td>Solvent Cleaning per Paragraph 3-09</td>
<td>(4) Acrylic Latex</td>
</tr>
</tbody>
</table>
E. COATING SYSTEM SCHEDULE - CONCRETE AND CONCRETE BLOCK MASONRY (C):

<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Item</th>
<th>Surface Prep.</th>
<th>System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-1</td>
<td>Exposed, indoors and outdoors, as indicated on the plans</td>
<td>Per Paragraph 3-09</td>
<td>(5b) Acrylic-Concrete Repainting</td>
</tr>
<tr>
<td>C-2</td>
<td>Submerged in wastewater as indicated on the plans</td>
<td>Per Paragraph 3-10</td>
<td>(7) Coal Tar Epoxy-Concrete</td>
</tr>
<tr>
<td>C-3</td>
<td>Interior surfaces of sewer manholes, including sidewalls, bottom, and metal appurtenances, for manholes and L/S's indicated on the plans</td>
<td>Per Paragraph 3-10</td>
<td>See Specification 09950</td>
</tr>
</tbody>
</table>

F. COATING SYSTEM SCHEDULE - WOOD (W):

<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Item</th>
<th>Surface Prep.</th>
<th>System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-1</td>
<td>Exposed indoors and outdoors as indicated on the plans</td>
<td>Per Paragraph 2-12</td>
<td>(1) Alkyd Enamel</td>
</tr>
<tr>
<td>W-2</td>
<td>Exposed indoors and outdoors as Acrylic indicated on the plans</td>
<td>Per Paragraph 3-12</td>
<td>(4) Latex</td>
</tr>
</tbody>
</table>

3.19 CLEAN-UP AND PROTECTION

A. Clean Up: During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each workday. Upon completion of painting work, clean window glass and other paint-spattered surfaces located on site and off site. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Protection: Protect work of other trades located on site and off site, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting.

1. Provide "Wet Paint" signs, as required, to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

2. At the completion of work of other trades, touch up and restore all damaged or
defaced painted surfaces.

3.20 APPEARANCE AND INSPECTION

A. All painting shall be accomplished in a workmanlike manner and shall be free of unsightly sags, runs, bubbles, drips, waves, laps, alligatoring, unnecessary brush marks and overspray or other physical defects and shall be uniform in color.

B. The CONTRACTOR shall provide all rigging, scaffolding and other equipment necessary for a satisfactory inspection of a complete paint system and acceptance by the ENGINEER/OWNER.

C. Inspection shall be conducted by an inspector selected by the ENGINEER/OWNER in the presence of the OWNER’s representative and the CONTRACTOR or his representative. Provisions for calibrated and functional test equipment is the responsibility of the CONTRACTOR.
D. The paint film shall be free of pinholes and holidays as determined by the use of an approved holiday detector as defined in Paragraph 1-09 of this Section.

E. The paint film shall be randomly checked for dry film thickness as stipulated in the "Coating System" sections of these specifications. Thicknesses shall be checked with a properly calibrated and approved magnetic gauge as defined in Paragraph 1-09 of this Section.

3.21 REPAIR OF DEFECTS IN PAINT

A. Any defects discovered during inspection, such as low film millage, holidays or pinholes, shall be repaired with the same materials as used for the original finish coat(s). Excessive low millage could require extra full coat(s) of paint.

B. A final inspection will be conducted by the ENGINEER/OWNER or his representative after any necessary repairs and prior to final acceptance of the job.

3.22 DISINFECTION OF POTABLE WATER STORAGE TANKS

A. Description: This paragraph specifies disinfection procedures for potable water storage tanks.

B. Quality Assurance: The following documents are a part of this section as specified and modified. In case of conflict between the requirements of this paragraph and those of the listed documents, the requirements of this paragraph shall prevail.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWWA D105, latest revision</td>
<td>Disinfection of Water Storage Facilities</td>
</tr>
</tbody>
</table>

C. Information to be Provided: Affidavit of Compliance as described in AWWA D105.

D. After the tank has been painted and the interior surfaces have thoroughly dried, the CONTRACTOR shall remove all visible dirt and contaminating materials. The interior of the tank shall be disinfected in accordance with Chlorination Method 2 of AWWA D105. The CONTRACTOR shall furnish all of the chlorine required.

E. The CONTRACTOR shall be responsible for obtaining proper disinfection as determined by bacteriological testing. Samples for bacterial analyses will be taken and analyzed by the OWNER. Two consecutive samples are required to pass the bacteriological tests for the tank to comply with these disinfection requirements.

F. Water for filling the tank after the initial disinfection will be provided by the OWNER. If bacteriological testing shows the presence of coliform bacteria, the tank shall be
redisinfected. The CONTRACTOR shall pay the OWNER for water required to fill the tank after the first filling at currently approved General Service water rates for the OWNER.

END OF SECTION