

CATALYST WATER MAIN EXTENSION

PROJECT MANUAL (VOLUME 2 OF 2)

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SECTION 310513 - SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Subsoil materials.
2. Topsoil materials.

B. Related Sections:

1. Section 312213 - Rough Grading.
2. Section 312316.13 - Trenching.

1.2 UNIT PRICES - MEASUREMENT AND PAYMENT

A. Subsoil:

1. Basis of Measurement: By cubic yard.
2. Basis of Payment: Includes excavating existing subsoil, supplying subsoil materials, and stockpiling.

B. Topsoil:

1. Basis of Measurement: By cubic yard.
2. Basis of Payment: Includes excavating existing topsoil, supplying topsoil materials, and stockpiling.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-in. Drop.
2. AASHTO M 145 - Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

B. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).

3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.4 QUALITY ASSURANCE

- A. Furnish each material from single source throughout the Work.
- B. Perform Work in accordance with State of Florida Department of Transportation standards.

PART 2 - PRODUCTS

2.1 SUBSOIL MATERIALS

- A. Subsoil Type Regular:
 1. Excavated and re-used material.
 2. Graded.
 3. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
 4. Conforming to AASHTO M 145 Group A-1 or A-3.
- B. Subsoil Type Borrow:
 1. Imported borrow.
 2. Graded.
 3. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
 4. Conforming to AASHTO M 145 Group A-1 or A-3.

2.2 TOPSOIL MATERIALS

- A. Topsoil Type Regular:
 1. Excavated and reused material.
 2. Graded.
 3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
 - a. Screening: Single screened.
 4. Conforming to State of Florida Department of Transportation Standard Specifications Section 987.
- B. Topsoil Type Borrow:
 1. Imported borrow.
 2. Friable loam.
 3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
 - a. Screening: Single screened.

4. Conforming to State of Florida Department of Transportation Standard Specifications Section 987.

2.3 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements.
- B. Testing and Analysis of Subsoil Material: Perform in accordance with AASHTO T180.
- C. Testing and Analysis of Topsoil Material: Analyze to determine percentage of nitrogen, phosphorus, potash, soluble salt, organic matter, and pH.
- D. When tests indicate materials do not meet specified requirements, change material and retest.
- E. Furnish materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavate subsoil and topsoil from proposed building, driveway and sidewalk areas and other designated in the Drawings. Strip topsoil to full depth of topsoil in designated areas.
- B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.
- C. Remove excess excavated subsoil and topsoil not intended for reuse, from site.

3.2 STOCKPILING

- A. Stockpile materials on site at locations designated by Owner's Representative.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Stockpile topsoil 8 feet high maximum.
- E. Prevent intermixing of soil types or contamination.
- F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- G. Stockpile any contaminated materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 310513

SECTION 311000 - SITE CLEARING

PART 4 - GENERAL

4.1 SCOPE OF WORK

- A. This Section covers clearing, grubbing and stripping along the construction sites, complete as specified herein.
- B. The Contractor shall clear and grub all of the area within the limits of construction or as required, which includes but is not limited to, utility easements. The width of the area to be cleared shall be established by the Owner's Representative prior to the beginning of any clearing.
- C. Related Sections:
 - 1. Section 312213 - Rough Grading.

4.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Site Clearing:
 - 1. Basis of Measurement: By square yard.
 - 2. Basis of Payment: Includes clearing site, loading and removing waste materials from site.

4.3 QUALITY ASSURANCE

- A. Conform to applicable Suwannee County standards.
- B. Perform Work in accordance with the State of Florida Highways standards.

PART 5 - PRODUCTS

- 5.1 Not Applicable. The use of herbicides in clearing and grubbing is specifically prohibited.

PART 6 - EXECUTION

6.1 EXAMINATION

- A. Section 013000 - Administrative Requirements.
- B. Verify existing plant life designated to remain is tagged or identified.

6.2 PREPARATION

- A. Call Local 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.
 - 2. In areas so designated, topsoil shall be stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. Any topsoil remaining after all work is in place shall be disposed of by the Contractor.

6.3 PROTECTION

- A. Locate, identify, and protect from damage all utilities indicated to remain.
- B. Protect from damage existing plant life where indicated on Drawings.
- C. Protect benchmarks, survey control points, and existing structures from damage or displacement.

6.4 CLEARING AND GRUBBING

A. Clearing

The surface of the ground, for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on or protruding through the surface of the ground. However, those trees which are designated by the Owner's Representative shall be preserved as hereinafter specified. Clearing operations shall be conducted so as to prevent damage to existing structures and installations, and to those under construction, and so as to provide for the safety of employees and others. Clearing for structures shall consist of topsoil and vegetation removal.

B. Grubbing

Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade. All depressions excavated below the original ground surface for or by the removal of such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

All organic surface soils and muck shall be removed under all structures, tanks, pipes, slabs and roads, plus a 5-foot margin all around.

6.5 REMOVAL

- A. The Contractor shall dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris away to an approved dump. Disposal by burning or burial shall not be permitted. The cost of disposal (including hauling) of cleared and grubbed material

and debris shall be considered a subsidiary obligation of the Contractor, the cost of which shall be included in the contract prices.

- B. If the land owner desires the timber or small trees, the Contractor shall cut and neatly pile it in 4-foot lengths for removal by land owner; otherwise the Contractor shall dispose of it by hauling away from the project site.
- C. Remove debris, rock, and extracted plant life from site.
- D. Partially remove paving, curbs, and, as indicated on Drawings. Neatly saw cut edges at right angle to surface.
- E. Remove abandoned utilities. Indicate removal termination point for underground utilities on Record Documents.
- F. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site and leave site in clean condition.

6.6 PRESERVATION OF TREES

- A. Those trees which are designated on the Drawings for preservation shall be carefully protected from damage. The Contractor shall erect such barricades, guards, and enclosures as may be considered necessary by him for the protection of the trees during all construction operations.

6.7 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

- A. The Contractor shall exercise extreme care to avoid unnecessary disturbance of developed private property as applicable. Trees, shrubbery, gardens, lawn and other landscaping, which in the opinion of the Owner's Representative must be removed, shall be replaced and replanted to restore the construction easement to the condition existing prior to construction.
- B. All soil preparation procedures and replanting operations shall be under the supervision of a nurseryman experienced in such operations.

6.8 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material and cover over with same material, until disposal.
- D. Remove excess topsoil not intended for reuse, from site.

6.9 SUBSOIL EXCAVATION

- A. Excavate subsoil from areas to be further excavated, relandscaped, or regraded.
- B. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.
- C. When excavating through roots, perform Work by hand and cut roots with sharp axe.
- D. Remove excess subsoil not intended for reuse, from site.
- E. Benching Slopes: Horizontally bench existing slopes greater than 1: 4 to key placed fill material to slope to provide firm bearing.
- F. Stability: Replace damaged or displaced subsoil as specified for fill.

END OF SECTION 311000

SECTION 312213 - ROUGH GRADING

PART 7 - GENERAL

7.1 SCOPE OF WORK

A. This Section includes, except as elsewhere provided, excavation, filling and grading to attain the subgrades and grades indicated on the Drawings.

B. Supplemental foundation and site preparation notes are indicated on the Drawings.

A. Related Sections:

1. Section 310513 - Soils for Earthwork.
2. Section 311000 - Site Clearing.
3. Section 312316 - Excavation.
4. Section 312316.13 - Trenching.

7.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
3. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
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 D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
6. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
7. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

7.3 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements.
- B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

7.4 QUALITY ASSURANCE

- A. Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities from possible damage which may result from settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
- C. The Contractor shall examine the site taking into consideration all conditions that may affect his work. The Owner and Engineer will not assume responsibility for variations of sub-soil quality or conditions. A Soils Report has been prepared and is attached as an Appendix to this Report.
- D. Existing Utilities: Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
- E. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the Engineer and the Owner of such piping or utility immediately for directions.
- F. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
- G. Demolish and completely remove from site existing underground utilities indicated to be removed.

PART 8 - PRODUCTS

8.1 SOIL MATERIALS

- A. Satisfactory soil materials are defined as those complying with American Association of State Highway and Transportation Officials (AASHTO) M2145, soil classification Groups A-1, A-2-4, A-2-5, and A-3.
- B. Unsatisfactory soil materials are those defined in AASHTO M145 soil classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7; also, peat and other highly organic soils.
- C. Sub-base Material: Naturally or artificially graded mixture of sand clay, natural, or crushed sand, as acceptable to Owner's Representative.
- D. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2-inches in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter.

PART 9 - EXECUTION

9.1 EXAMINATION

- A. Examine the areas and conditions under which excavating, filling, and grading are to be performed. Notify Owner's Representative of any unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Examine and accept existing grade of walks, pavements and steps prior to commencement of work and report to Owner's Representative if elevations of existing subgrade varies from elevations shown on Drawings.
- C. Verify survey benchmark and intended elevations for the Work are as indicated on Drawings.

9.2 PREPARATION

- A. Call Local 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. Protect utilities indicated to remain from damage.
- D. Protect from damage existing plant life where indicated on Drawings.
- E. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

9.3 EXCAVATION

- A. Authorized earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, material of any classification indicated in soil boring data on subsurface conditions, and other materials encountered that are not classified as rock excavation or unauthorized excavation.
- B. Unauthorized excavation consists of removal of material beyond the limits needed to establish required grade and subgrade elevations without specific direction of Owner's Representative. Unauthorized excavation, as well as remedial work directed by Owner's Representative shall be at the Contractor's expense.
 - 1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering required top elevation. Lean (unreinforced) concrete fill may be used to bring bottom elevations to proper position, when acceptable to Engineer.
 - 2. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

- C. Additional Excavation: When excavation has reached required subgrade elevations, notify the Engineer who will contact a specialized geotechnical consultant and make an inspection of conditions.
1. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material as directed by the Engineer.
 2. Removal of unsuitable material and its replacement as directed beyond the authorized limits will be paid on the basis of contract conditions relative to changes in work.
- D. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction or as shown on the Drawings. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
1. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- E. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.
1. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction. Provide design drawings of all shoring and bracing signed and sealed by a Registered Professional Engineer.
 2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
- F. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations. Maintain groundwater table level a minimum of one foot below excavation level.
 2. Convey water removed from excavations and rainwater to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.
 3. While dewatering for new Construction in the vicinity of existing structures, depletion of the groundwater level underneath these existing structures may cause settlement. To avoid this settlement, the groundwater level under these structures shall be maintained by appropriate methods of construction as approved by Owner's Representative.
- G. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
1. Locate and retain soil materials away from edge of excavations.
 2. Dispose of excess soil material and waste materials as herein specified.
- H. Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection, or as shown on the Drawings.

1. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.
- I. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

9.4 COMPACTION

- A. General: Control soil compaction during construction providing minimum percentage of density specified on the drawings for each area classification.
- B. Percentage of Maximum Density Requirements:
1. Compact soil to not less than the following percentages of maximum dry density in accordance with AASHTO T-180.
 - a. Structures and 5 feet-0-inches around Perimeter of Building: Compact top 12-inches of subgrade and each layer of backfill or fill material at 98% maximum dry density.
 - b. Building Slabs: Compact top 12-inches of subgrade and each layer of backfill or fill material at 98% maximum dry density.
 - c. Lawn or Unpaved Areas: Compact top 6-inches subgrade and each layer of backfill or fill.
 - d. Walkways: Compact top 6-inches of subgrade 95% maximum dry density.
 - e. Pavements and Steps: Compact top 6-inches of subgrade at 98% maximum dry density.
- C. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water from appearing on surface during or subsequent to compaction operations.
1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
 2. Soil material that has been removed because it is too wet to permit compaction but is otherwise satisfactory may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

9.5 BACKFILL AND FILL

- A. General: Place material in layers to required subgrade elevations, for each area classification listed below.
1. In excavations, use satisfactory excavated or borrow material.
 2. Under grassed areas, use satisfactory excavated or borrow material.
 3. Under walks and pavements, use subbase material.
 4. Under steps, use subbase material.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance by Owner's Representative of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation
 2. Inspection, testing, approval, and recording locations of underground utilities.
 3. Removal of concrete formwork
 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials
 5. Removal of trash and debris
 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls. Layout and location of bracing shall consider loads of the structure as well as the effects of the soil and groundwater.
- C. Placement and Compaction: Place backfill and fill materials in layers not more than 9-inches loose depth for material compacted by heavy compaction equipment, and not more than 4-inches loose depth for material compacted by hand-operated tampers.
1. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 2. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.
 3. Large compaction equipment shall not be used within 5 feet of walls.

9.6 GRADING

- A. General: Uniformly grade areas within limits of grading under this Section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines, as shown on the Drawings, to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:
1. Grassed or Unpaved Areas: Finish areas to not more than 0.10 feet above or below the required elevation.
 2. Walks and Drives: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 feet above or below the required subgrade.
 3. Make grade changes gradual, blending slope into level areas.
- C. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1-2-inch when tested with a 10-foot straightedge.
- D. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.
- E. Place material in continuous layers as follows:
1. Subsoil Fill: Maximum 12 inches compacted depth.

2. Structural Fill: Maximum 8 inches compacted depth.
3. Granular Fill: Maximum 6 inches compacted depth.

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

9.7 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.
- B. If, in opinion of Owner's Representative, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

9.8 MAINTENANCE

- A. Protection of Graded Areas:
 1. Protect newly graded areas from traffic and erosion. Keep areas free of trash and debris.
 2. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.
- B. Reconditioning Compacted Areas:
 1. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

9.9 SCHEDULES

- A. Structural Fill:
 1. Fill Type A-1: To subgrade elevation.
 2. Compact uniformly to minimum 97 percent of maximum density.
- B. Subsoil Fill:
 1. Fill Type A-3: To subgrade elevation.
 2. Compact uniformly to minimum 97 percent of maximum density.
- C. Topsoil Fill:
 1. Fill Type A-3: To subgrade elevation.
 2. Compact uniformly to minimum 90 percent of maximum density.

END OF SECTION 312213

SECTION 312316 - EXCAVATION

PART 10 - GENERAL

10.1 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.

10.2 PAYMENT

- A. Excavating Soil Materials:
 - 1. Basis of Measurement: By cubic yard.
 - 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.

10.3 REFERENCES

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

10.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures.
- 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.

10.5 QUALITY ASSURANCE

- A. Perform Work in accordance with Florida Department of Transportation and Suwannee County standards.

10.6 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 11 - PRODUCTS

11.1 Not Used.

PART 12 - EXECUTION

12.1 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 hold, remove and/or relocate utilities where needed.
- D. Protect utilities indicated to remain from damage.
- E. Protect from damage existing plant life where indicated on Drawings.
- F. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

12.2 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 Owner's Representative of unexpected subsurface conditions.
- K. Remove excavated material from site.
- L. Repair or replace items indicated to remain damaged by excavation.

12.3 FIELD QUALITY CONTROL

- A. Request visual inspection of bearing surfaces by Owner's Representative before installing subsequent work.

12.4 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 13 - GENERAL

13.1 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 310513 – Soils for Earthwork

13.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Trenching:

1. Basis of Measurement: By cubic yard.
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:

1. Basis of Measurement: By cubic yard.
2. Basis of Payment: Includes furnishing fill material, stockpiling, scarifying substrate surface, placing where required, and compacting.

C. Structural Fill:

1. Basis of Measurement: By cubic yard.
2. Basis of Payment: Includes furnishing fill material, stockpiling, shaping substrate surface, placing where required, and compacting.

D. Granular Fill:

1. Basis of Measurement: By cubic yard.
2. Basis of Payment: Includes furnishing fill material, stockpiling, scarifying substrate surface, placing where required, and compacting.

E. Concrete Fill:

1. Basis of Measurement: By cubic yard.
2. Basis of Payment: Includes furnishing materials, forming, mixing and placing where required, and curing.

13.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

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).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

13.4 DEFINITIONS

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

13.5 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.
- #### B. Product Data: Submit data for geotextile fabric indicating fabric and construction.
- #### 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.

13.6 QUALITY ASSURANCE

- #### A. Perform Work in accordance with Florida Department of Transportation and Suwannee County standards.

13.7 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.

13.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

13.9 COORDINATION

- A. Section 013000 - Administrative Requirements.
- B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 14 - PRODUCTS

14.1 FILL MATERIALS

- A. Structural Fill: Type A1 as specified in Section 310513.
- B. Granular Fill: Type A3 as specified in Section 310516.
- C. Concrete: Lean concrete

14.2 ACCESSORIES

- A. Materials:
 - 1. Substitutions: Not Permitted.

PART 15 - EXECUTION

15.1 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.

15.2 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.

15.3 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.

- L. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- 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.

15.4 SHEETING 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.

15.5 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.

15.6 TOLERANCES

- A. Section 014000 - Quality Requirements.
- 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.

15.7 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:
 - 1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
 - 2. Moisture Tests: ASTM D3017.
- D. When tests indicate Work does not meet specified requirements: remove Work, replace, compact, and retest.
- E. Frequency of Tests: 1 every 500'.

15.8 PROTECTION OF FINISHED WORK

- A. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION 312316.13

SECTION 330505.31 - HYDROSTATIC TESTING

PART 16 - GENERAL

16.1 SUMMARY

- A. Section Includes: Hydrostatic testing of pressure piping.
- B. Related Requirements:
 - 1. Section 330533 - High Density Polyethylene (HDPE) Pipe, Fittings & Joining.
 - 2. Section 331413 - Public Water Utility Distribution Piping.
 - 3. Section 331416 - Site Water Utility Distribution Piping.

16.2 REFERENCE STANDARDS

- A. American Water Works Association:
 - 1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
 - 2. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission.

16.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures.
- B. Submit following items prior to start of testing:
 - 1. Testing procedures.
 - 2. List of test equipment.
 - 3. Testing sequence schedule.
 - 4. Provisions for disposal of flushing and test water.
 - 5. Certification of test gage calibration.
- C. Test and Evaluation Reports: Indicate results of piping tests.
- D. Qualifications Statement:
 - 1. When requested by Owner's Representative, submit qualifications data for applicator.

16.4 QUALITY ASSURANCE

- A. Perform Work according to AWWA C600 and C906 standards and Suwannee County standards.

16.5 QUALIFICATIONS

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

PART 17 - PRODUCTS

17.1 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 18 - EXECUTION

18.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements.
- B. Verify that piping is ready for testing.
- C. Verify that trenches are backfilled.
- D. Verify that pressure piping thrust restraints have been installed.

18.2 FIELD QUALITY CONTROL

- A. Section 017000 - Execution and Closeout Requirements.
- B. Testing of Pressure Piping:
 - 1. Test ductile iron components according to AWWA C600 and the 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:
 - 1) $L = [SD \times \text{sqrt}(P)]/C$.
 - 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. Test HDPE components according to AWWA C906 and as specified in Section 330533.
- 3. If testing of piping indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within acceptable limits.
- 4. Correct visible leaks regardless of quantity of leakage.

END OF SECTION 330505.31

SECTION 330507.13 - UTILITY DIRECTIONAL DRILLING

PART 19 - GENERAL

19.1 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.
2. Section 312316.13 - Trenching.
3. Section 330505.31 - Hydrostatic Testing
4. Section 330597 - Identification and Signage for Utilities.
5. Section 331413 - Public Water Utility Distribution Piping.

19.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures.

B. Horizontal Directional Drilling:

1. Basis of Measurement: By linear foot.
2. Basis of Payment: Includes excavation, drilling, pipe, accessories, tests, and backfill.

19.3 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:

1. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort 12,400 ft-lbf/ft³ .
2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft³ .
3. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
4. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
5. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
6. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
7. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
8. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
9. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
10. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
11. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
12. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.
13. ASTM F1056 - Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings.
14. ASTM F1962 - Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings.

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.

19.4 COORDINATION

- A. Section 013000 - Administrative Requirements.
- B. Coordinate Work of this Section with FDOT, Suwannee County Public Works and utilities within construction area.

19.5 PREINSTALLATION MEETINGS

- A. Section 013000 - Administrative Requirements.

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

19.6 SUBMITTALS

- A. Section 013300 - Submittal Procedures.
- 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 data for driller.
- G. Submit FDOT and Suwannee County occupancy permit for installations under public thoroughways and lands.

19.7 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements.
- 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.

19.8 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 and Suwannee County standards.

19.9 QUALIFICATIONS

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

19.10 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements.
- 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.

19.11 AMBIENT CONDITIONS

- A. Section 015000 - Temporary Facilities and Controls.
- B. Maintain storage temperature of 60 to 85 degrees F.

19.12 EXISTING CONDITIONS

A. Field Measurements:

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

PART 20 - PRODUCTS

20.1 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 Owner's Representative.

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 160 psig 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 A-3, as specified in Section 310513 - Soils for Earthwork; to be determined by geotechnical recommendation of driller.

20.2 MIXES

- A. Grout: As specified in Section 036000 - Grouting.
- B. Flowable Fill: As specified in Section 312324 - Flowable Fill.

PART 21 - EXECUTION

21.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements.
- B. Verify that connections to existing piping system sizes, locations, and invert centerline elevations are according to Drawings.

21.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements
- B. Local Utility:
 1. Call local utility line information service at 811 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 no less than 3 feet of cover.

- I. Establish minimum separation between piping according to DEP regulations, Project drawings and Project specifications.

21.3 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 Owner's Representative immediately.
 2. Do not proceed around obstruction without approval of Owner's Representative.
 3. For conditions requiring more than 3 feet of deviation in horizontal alignment, submit revised Shop Drawings to Owner's Representative 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 312213 – Rough Grading.
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 312213 – Rough Grading, to minimum 97 percent of maximum density.

21.4 TOLERANCES

- A. Section 014000 - Quality Requirements.
- 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, rebores, and reinstall pipe in correct alignment.
 2. Fill abandoned bores greater than 3 inches in diameter with grout or flowable fill material.

21.5 FIELD QUALITY CONTROL

- A. Section 017000 - Execution and Closeout Requirements.
- B. Upon completion of pipe installation, test pipe according to following:
 1. Water Distribution Pipe Testing: As specified in Section 330505.31 - Hydrostatic Testing, and Section 330507.13 – Utility Directional Drilling.
 2. 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.

21.6 CLEANING

- A. Section 017000 - Execution and Closeout Requirements.
- 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 22 - GENERAL

22.1 SUMMARY

A. Section Includes:

1. Tied joint restraint system.

B. Related Requirements:

1. Section 312316.13 - 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.

22.2 UNIT PRICE - MEASUREMENT AND PAYMENT

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

B. Tied Joint Restraint System:

1. Basis of Measurement: By unit.
2. Basis of Payment: Includes tied joint restraint system and accessories.

22.3 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:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
5. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
6. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

7. ASTM A588 - Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi Minimum Yield Point, with Atmospheric Corrosion Resistance.
8. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
9. ASTM F436 - Standard Specification for Hardened Steel Washers.

22.4 COORDINATION

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

22.5 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. Samples: Submit two samples of joint restraint parts.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. 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.
- G. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- H. Qualifications Statement:
 1. Submit qualifications for manufacturer, fabricator, and licensed professional.

22.6 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of joint restraints.

22.7 QUALITY ASSURANCE

- A. Perform Work according to AWWA, ASTM and Suwannee County standards.

22.8 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 and approved by manufacturer.

22.9 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.

22.10 EXISTING CONDITIONS

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

PART 23 - PRODUCTS

23.1 PERFORMANCE AND DESIGN CRITERIA

- A. Provide pressure pipeline with restrained joints at each bend, tee, and change in direction.

23.2 TIED JOINT RESTRAINT SYSTEMS

- A. Materials:
 - 1. Furnish materials according to AWWA & ASTM standards.
- B. Tie Bolts:

1. Mechanical Joints on 2- and 3-Inch Pipe:
 - a. Size: 5/8 inch.
 - b. Comply with ASTM A588, 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 specifications.
 2. Mechanical and Flanged Joints on 4- to 12-Inch Pipe:
 - a. Size: 3/4 inch.
 - b. Comply with ASTM A588, 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.
 3. Mechanical Joints on 14- to 24-Inch Pipe:
 - a. Size: 3/4 inch.
 - b. Comply with ASTM A588, Grade B and ASTM A325, Type 3.
 4. Mechanical and Flanged Joints on 30-Inch and Larger Pipe:
 - a. Size: 1 inch.
 - b. Comply with ASTM A588, Grade B.
 - c. Comply with ASTM A325, Type 3, except increase tensile strength of full-body threaded section to 100,000 lb. minimum 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: Plain, zinc plated, or galvanized.
- D. Tiepin:
1. Bends and Hydrants: 3/4-inch round bar stock.
 2. Size and Shape: 6-inch hairpin.
 3. Comply with ASME B1.1 and ASTM A588.
 4. Finish: Plain, zinc plated, or galvanized.
- E. Tie Coupling:
1. Description: Extension of continuous-threaded rods.
 2. Provide with center stop to aid installation.
 3. Comply with ASTM A588
 4. Finish: Plain, zinc plated, or galvanized.
- 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, ASTM A307, Grade A, and ASTM A563, Grade A.
4. Finish: Plain, zinc plated, or galvanized.

G. Tie Rod:

1. Description: Continuous-threaded rod for cutting to desired lengths.
2. Comply with ASTM A588, Grade B, ASTM A325, Type 3, and ASME B1.1.
3. Finish: Plain, zinc plated, or galvanized.

H. Tie Bar:

1. Description: Steel bar used to restrain push-in plugs.
2. Comply with ASTM A36.
3. Finish: Plain, zinc plated, or galvanized.

I. Tie Washer:

1. Description: Round flat washers.
2. ASTM A588, ASTM F436, Type 1.
3. Finish: Plain, zinc plated, or galvanized.

23.3 MATERIALS

A. Steel:

1. High-Strength Low-Alloy Steel: Comply with ASTM A588, heat treated.
2. High-Strength Low-Alloy Steel: Comply with ASTM A588.
3. Carbon Steel: Comply with ASTM A36.

23.4 FINISHES

A. Zinc Plating:

1. Factory applied.
2. Comply with ASTM B633.

B. Galvanizing:

1. Factory applied.
2. Comply with ASTM A153.

PART 24 - EXECUTION

24.1 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.

24.2 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.

24.3 INSTALLATION

- A. Installation Standards: Install Work according to AWWA, ASTM and Suwannee County standards.

24.4 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 330533 – HIGH DENSITY POLYETHYLENE (HDPE) PIPE, FITTINGS & JOINING

PART 25 - GENERAL

25.1 SUMMARY

- A. Section Includes:
 - 1. HDPE pressure pipe and fittings for water and wastewater utility use.
 - 2. Joining methods and installation practices.
- B. Related Requirements:
 - 1. Section 312316 - Excavation.
 - 2. Section 312316.13 - Trenching.
 - 3. Section 330505.31 - Hydrostatic Testing.
 - 4. Section 330507.13 - Utility Directional Drilling.
 - 5. Section 330509.33 - Thrust Restraint for Utility Piping.
 - 6. Section 330553 - Identification and Signage for Utilities
 - 7. Section 331419 - Valves and Hydrants for Water Utility Service.

25.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Section 012000 - Price and Payment Procedures.
- B. Pipe and Fittings:
 - 1. Basis of Measurement: By linear foot.
 - 2. Basis of Payment: Includes pipe and fittings, cutting and joining, joint restraints, excavation, bedding, and backfill.

25.3 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 National Standards Institute / American Water Works Association:
 - 1. ANSI/AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm) for Water Service
 - 2. ANSI/AWWA C906 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission
 - 3. ANSI/AWWA C651 Standard for Disinfecting Water Mains
 - 4. AWWA M55 Manual of Water Supply Practices, PE Pipe—Design and Installation
- C. ASTM International:
 - 1. ASTM F 585 Standard Guide for Insertion of Flexible Polyethylene Pipe into Existing Sewers
 - 2. ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
 - 3. ASTM F 905 Standard Practice for Qualification of Polyethylene Saddle-Fused Joints

4. ASTM F 1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and
 5. ASTM F 1290 Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings
 6. ASTM F 1962 Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings
 7. ASTM F 2164 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
 8. ASTM F2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock
 9. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
 10. ASTM F 2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
 11. ASTM D 2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter- Controlled Polyethylene Pipe and Tubing
 12. ASTM D 2737 Standard Specification for Polyethylene (PE) Plastic Tubing
 13. ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping
 14. ASTM F 2880 Standard Specification for Lap-Joint Type Flange Adapters for Polyethylene Pressure Pipe in Nominal Pipe Sizes V4 in. to 65 in.
 15. ASTM F 3124 Standard Practice for Data Recording the Procedure Used to Produce Heat Butt Fusion Joints
 16. ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
 17. ASTM D 3035 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
 18. ASTM D 3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
- D. Plastics Pipe Institute
1. PPI Handbook of Polyethylene Pipe — 2009 (2ndEdition)
 2. PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe
 3. PPI Material Handling Guide for HDPE Pipe and Fittings
 4. PPI TR-33 Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe
 5. PPI TR-34 Disinfection of Newly Constructed Polyethylene Water Mains
 6. PPI TR-38 Bolt Torque for Polyethylene Flanged Joints
 7. PPI TN-42 Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects
 8. PPI TR-46 Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe
- 25.4 COORDINATION
- A. Section 013000 - Administrative Requirements.
 - B. Coordinate Work of this Section with connection to existing Catalyst WTP.
- 25.5 SUBMITTALS
- A. Section 013300 - Submittal Procedures.

- B. Product Data: Submit manufacturer information indicating pipe material used, pipe fittings, pipe accessories and joint restraint details and materials. Contractor shall also submit the following to Engineer for approval:
 - 1. Certified dimensional as-built drawings/profile of all installed pipe, specials and fittings.
 - 2. Details of fittings and specials such as elbows, tees, outlets, connections, test bulkheads, nozzles or other special items where shown on the Construction Drawings. All connections to jointed gasketed pipe materials, valves or fire hydrants must be restrained and supported independently to withstand the pressure transients, soil settlement, and external loading conditions.
 - 3. The Supplier of the material shall submit, through the Contractor, a Certificate of Compliance that the HDPE pipe and fittings furnished for this project are FM approved materials that meet or exceed the standards set forth in this specification. The Contractor shall submit these certificates to the Engineer prior to installation of the pipe materials.
 - 4. Provide a statement that personnel responsible for fusing the pipe have been trained and qualified.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit special procedures required to install specified products.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- F. Qualifications Statement:
 - 1. Submit qualifications for manufacturer and installer.

25.6 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements.
- 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.

25.7 QUALITY ASSURANCE

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

25.8 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.

25.9 DELIVERY, HANDLING AND STORAGE

- A. Section 016000 - Product Requirements
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Delivery:
 - 1. The manufacturer shall package product in a manner designed to deliver the pipe and fittings to the project neatly, intact and without physical damage. During transportation each pipe shall rest on suitable pads, strips skids, or blocks securely wedged or tied in place.
 - 2. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid. Defective, damaged, or unsound pipe will be rejected. Cuts, punctures, or gouges that penetrate or reduce the wall thickness by 10% or more are not acceptable and must be removed and discarded.
- D. Handling:
 - 1. During loading, transportation, and unloading, every precaution should be taken to prevent damage to the pipe. The handling of the pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Cuts or gouges that reduce the wall thickness by more than 10% are not acceptable and must be cut out and discarded.
 - 2. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2. All pipe and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe.
 - 3. Do not place materials on private property or in areas obstructing pedestrian or vehicle traffic.
- E. Storage:
 - 1. Materials, if stored, shall be kept safe from damage and shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Block individual and stockpiled pipe lengths to prevent moving. Store PE and PVC materials out of sunlight and away from heat sources.
 - 2. Store materials according to manufacturer instructions. The contractor shall be responsible for all security, damage and loss of pipe, excluding Acts of God.
 - 3. The interior of the pipe as well as all sealing surfaces of mating components (i.e. flange faces) shall be kept free from dirt or foreign matter at all times. The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged to prevent insects, animals, or foreign material from entering the pipeline or pipe section. The practice of stuffing cloth or paper in the open ends of the pipe will not be permitted. Use waterproof nightcaps to prevent the entrance of any type of natural precipitation into the carrier or containment pipe and will be secured to the pipe in such a manner that the wind cannot blow them loose. Where possible, the pipe shall be raised and supported at a suitable distance from the open end such that the open end will be below the level of the pipe at the point of support.
 - 4. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas. Provide additional protection according to manufacturer instructions.
 - 5. Store gaskets for mechanical and push-on joints in cool and dry location, out of direct sunlight, and not in contact with petroleum products.

25.10 EXISTING CONDITIONS

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

25.11 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements.
- B. Provide extended warranty for workmanship and integrity of fusion joints.

PART 26 - PRODUCTS

26.1 HIGH DENSITY POLYETHYLENE MATERIALS

- A. Resin and Material Requirements:
 - 1. All material shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D 3350 with a minimum cell classification of 445474C. HDPE pipe and fittings shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. HDPE products shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids or other injurious defects.
- B. HDPE Pipe
 - 1. Pipe shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2.01.A. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black of not less than 2 percent. The manufacture of the HDPE resin shall certify the cell classification indicated.
 - 2. Pipe sizes 3" and larger shall have a manufacturing standard of ASTM F 714, while pipe smaller than 3" shall be manufactured to the dimensional requirements of ASTM D 3035. Dimension Ratio (DR) and Outside Diameter (IPS/DIPS) shall be as specified on plans.
 - 3. Pipe shall meet AWWA C901 (1/2" to 3") or AWWA C906 (4" to 63") and shall be listed as meeting NSF-61.
 - 4. When required by the owner, pipe shall be color coded for the intended service. The color coding shall be permanently co-extruded stripes on the pipe outside surface as part of the pipe's manufacturing process. Color coding shall be as follows:
 - a. Sewer — green.
 - b. Water — blue.
 - c. Reclaim — purple.
- C. HDPE Fittings
 - 1. Butt Fusion Fittings
 - a. Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2.01.A. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans or accepted by owner/engineer. All fittings shall meet the requirements of AWWA C901 or C906.

- b. Molded fittings shall comply with the requirements of ASTM D 3261.
 - c. All fabricated elbows, tees, reducing tees and end caps shall be produced and meet the requirements of ASTM F 2206 by an approved ISO 9001 certified manufacturer. Each fitting will be marked per ASTM F2206 Section 10 including the nominal size and fitting EDR, which will meet or exceed the pipe DR identified for the project. Fabricated fittings shall be manufactured using a data logger to record fusion pressure and temperature and shall be stamped with unique joint number that corresponds to the joint report. A graphic representation of the temperature and pressure data for all fusion joints made producing fittings shall be maintained for a minimum of 5 years as part of the quality control and will be available upon request of owner. Test results to validate ASTM F2206 Sections 7.3 and 9 shall be provided to owner or owner's representative upon request.
 - d. Socket fittings shall meet ASTM D 2683.
2. Electrofusion Fittings - Fittings shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in 2.01.A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans. For potable water systems, all electrofusion fittings shall have AWWA approval.
 3. Bolted Connections - Flanges and MJ Adapters shall be fused onto the pipe and shall have a minimum pressure rating equal to or greater than the pipe unless otherwise specified on the drawings.
 - a. Metallic back-up rings (Van-Stone style lap joint flanges), shall have a radius on the inside diameter of the bore so as to be compatible with HDPE Flanges. Back up rings shall have bolt pattern that will mate with AWWA C207 Class D (generically known as 150-pound patterns).
 - b. Flange assemblies shall be assembled and torqued according to PPI TN-38, "Bolt Torque for Polyethylene Flanged Joints."
 - c. Four-inch and larger transitions to mechanical joint fittings and valves shall be accomplished using an MJ Adapter with kit. The D.I./HDPE mechanical joint adaptor shall consist of a fused HDPE mechanical joint transition fitting, rubber gasket, a mechanical joint backup drive ring, and Corten mechanical joint tee bolts. The kit shall also include stainless steel stiffener inserts for all mechanical joint transition fittings.
- D. Mechanical Fittings: The use of mechanical coupling and saddles shall be approved by the owner or engineer prior to installation. Mechanical Fittings shall be designed for use and compatible with HDPE pipe, including SS stiffeners when specified herein or when required by manufacturer. Mechanical fittings shall have a pressure rating equal to or greater than the pipe.
- E. Fusion Equipment Requirements
1. Butt fusion equipment must be in satisfactory working order and the hydraulic system must be leak free. Heater plates shall be free from scrapes, gouges, and have a consistent clean coated surface. The pressure gage and thermometer should be checked for accuracy. When requested by the owner, records showing a maintenance service/inspection within 3 months prior to use for this project shall be provided.
 2. Rental Butt Fusion Equipment must be maintained by a manufacturer-authorized service and repair center with at least one certified Master Mechanic on staff and must have been inspected within 3 months prior to arrival at jobsite.
 3. Electrofusion Processors shall be maintained and calibrated per manufacturer's requirements and recommendations.

F. Approved Suppliers

1. All pipe, fittings and fusion equipment shall be provided by one supplier.

26.2 ACCESSORIES

- A. Pipe Markers: As specified in Section 330553 - Identification for Utilities Piping.

26.3 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:
 - a. Soil Type A-3, as specified in the construction plans.
 - b. Subsoil: No rocks more than 3/4 inches in diameter, frozen earth, or foreign matter.

26.4 MIXES

- A. Concrete: As specified in the construction plans.

PART 27 - EXECUTION

27.1 EXAMINATION

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

27.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements.
- 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. Correct over-excavation with fine aggregate.
- D. Remove large stones or other hard matter capable of damaging pipe or of impeding consistent backfilling or compaction.

27.3 FUSION AND JOINING

A. Fusion Joining Requirements:

1. All HDPE pipe shall be joined to itself by the heat fusion process which produces homogeneous, seal, water-tight joints. Tie-ins between sections of HDPE pipe shall be made by butt fusion whenever possible.
2. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. A record or certificate of training for the fusion operator must be provided to document training in accordance with the fundamentals of ASTM F 2620. Considerations should be given to and provisions made for adverse weather conditions, such as temperatures below freezing, precipitation, or wind, which is accepted by the owner/engineer.
3. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturer's recommended procedure. Other sources of electrofusion joining information are ASTM F 1290, PPI TN 34, and PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe. The electrofusion processor must be capable of reading and storing the input parameters and the fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence electrofusion training within the past year on the equipment to be utilized for this project.

B. Fusion Operators

1. The employer of the fusion machine operator is responsible for the fusion joint quality of the fusion weld made by that individual. The employer is responsible for documenting all training and qualification records for that individual, including compliance to any code requirements for fusion/bonder operators.
2. All HDPE fusion equipment operators shall be qualified to the procedure used to perform pipe joining. Fusion equipment operators shall have current, formal training on all fusion equipment employed on the project. Training received more than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.
3. For Projects with at least 5,000 feet or with pipe larger than 24 inches, operators or their supervisor must have a current manufacturer-approved fusion training certificate for the equipment to be used on the project.

C. Butt Fusion Equipment

1. For 6" and larger pipe sizes, the pipe butt fusion machine shall be a hydraulic fusion machine capable of butt fusing HDPE pipe. The carriage must be removable from the chassis for in-ditch use. The machine must be compatible with an electronic data recording device. Accessories will include all butt fusion inserts for the specified range of pipe sizes, a pyrometer kit for checking the surface temperature of the heater, extension cord of appropriate gauge (25' minimum), and hydraulic extension hoses (minimum of four).

27.4 INSTALLATION

A. Direct Burial

1. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D 2321 or ASTM D 2774 for pressure systems and AWWA Manual of Water Supply Practices M55 Chapter 8. The Design Window identified in AWWA M55 Chapter 5 (page 65 of 2006 version) shall be considered acceptable design and installation conditions.
2. Unless required by the owner's engineer, no thrust blocks shall be placed in the HDPE pipe system since the fused system is fully restrained.

- B. Trenchless or Pull-in Installation Methods
1. For Horizontal Directional Drilling (HDD), refer to ASTM F1962, PPI TR-46, PPI PE Handbook (Chapter 12) and www.PP1BoreAid.com. See Section 330507.13 of this Specification.
 2. For sliplining, refer to ASTM F585, PPI PE Handbook (Chapter 11) and www.HDPEapp.com.
 3. For pipe bursting, refer to PPI PE Handbook (Chapter 16)
- C. Appurtenances
1. All appurtenances (tees, elbows, services, valves, air relief valves, fire hydrants, etc.), must be independently supported and shall not rely on the pipeline and its connections for this support. Excessive stresses may be encountered when appurtenances are inadequately supported.
 2. Hydrant Assemblies shall be installed and field tested according to the requirements of AWWA M17.
 3. Installation of Tracer Wire. The Contractor shall install pipe locating tracer wire along the entire section of pipeline per local and manufacturer's requirements. The tracer wire shall be installed simultaneously with the polyethylene piping system. Tracer wire shall be installed by the Contractor once backfill has been placed and compacted to at least 12 inches above the top of the pipe and not more than 18 inches above the top of the pipe. Tracer wire shall be properly spliced at each end connection and each service connection. Care should be taken to adequately wrap and protect wire at all splice locations. No bare tracer wire shall be accepted. Provide magnesium alloy anode for cathodic protection that conforms to the requirements of ASTM B843
- D. Bedding:
1. Excavation:
 - a. As specified in Section 312316 – Excavation
 - b. As specified in Section 312316.13 – Trenching.
 - c. Excavate pipe trench as specified in Drawings.
 2. Dewater excavations to maintain dry conditions and to preserve final grades at bottom of excavation.
 3. Place bedding material at trench bottom and maintain optimum moisture content of bedding material to attain required compaction density.
- E. Piping:
1. Installation Standards: Install Work according to AWWA M55 Manual and applicable ASTM and AASHTO T180 standards.
 2. Maintain 10 feet of horizontal separation between water main and sewer piping according to FDEP requirements.
 3. Install pipe with no high points. If unforeseen field conditions arise that necessitate high points, coordinate with Engineer to provide an air release valve assembly.
 4. Maintain uniform bearing along entire length of pipe.
 5. Allow for expansion and contraction without stressing pipe or joints.
 6. Close pipe openings with watertight plugs during Work stoppages.
 7. Install pipe markers as specified in Section 330553 - Identification for Utilities Piping.
- F. Backfilling:
1. Backfill around sides and to top of pipe with level fill in a continuous lift not exceeding 6 inches of compacted depth , 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.
- G. Thrust Restraints:

1. Provide pressure pipeline with restrained joints at pumps, bends, tees, and changes in direction. Refer to the requirement for fused MJ Adapters specified herein.

27.5 FLUSHING, CLEANING, AND DISINFECTING

- A. All mains shall be cleaned and flushed to remove all dirt, sand, debris and foreign matter.
- B. Disinfection:
 1. Cleaning and disinfecting of potable water systems shall be in accordance with AWWA C651 and AWWA MSS Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2"d Edition). The disinfection chemicals should be limited to less than 12% active chlorine. The duration of the disinfection should not exceed 24 hours. Chlorine tablets and powders are not permitted. Upon completion, the system should be thoroughly flushed with fresh water, and sampled to verify the disinfectant chlorine level has been reduced to potable drinking water concentrations in all service water tubing and branch lateral pipes.

27.6 TESTING AND LEAKAGE

- A. The contractor shall ensure testing can be accomplished in a safe manner, including protection of personnel, equipment, and public in the event of a failure during testing. The contractor shall restrain pipe, components, and test equipment as required. All pumps, valves, temporary connections, meters, gauges and other measuring devices shall be furnished, installed and operated by the Contractor and all such equipment and devices and their installation shall be approved by the Owner's Engineer.
- B. The test pressure shall be 1.5 times the operating pressure, based on the lowest point in elevation in the test section.
- C. Test pressures require consideration of thermal conditions. Polyethylene piping materials are typically pressure rated at 73°F (23°C) and PE piping at temperatures greater than 80°F (26°C) require reduced test pressures. (Note that higher pipe temperatures should consider both ambient temperatures and radiant solar heating of exposed black HDPE pipe) Guidance for elevated temperatures can be found in the appendix of Chapter 3 (Material Properties) of the PPI Handbook of PE Pipe.
- D. Pressure Pipelines-Pressure testing shall be conducted in accordance with requirements and recommendations of ASTM F 2164 (Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure), AWWA M55 Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2"d Edition). Pneumatic (compressed air) leakage testing of HDPE pressure piping is prohibited for safety reasons.
 1. The section of pipe to be tested shall be filled with potable or generally clean water (uncontaminated river/lake water) approved by the Owner/Engineer. While the system is being filled with water, air shall be carefully and completely exhausted.
 2. If the Contractor elects to perform hydrostatic testing against valves in an existing distribution system, it does so at his own risk and will bear the cost of any damages to the existing valve, piping system, private or public property, or the new pipeline under test.
 3. The test procedure for HDPE pipe consists of two steps: 1) the initial phase or expansion phase and 2) the test phase. During the initial/expansion phase, sufficient make-up water shall be added

hourly for 3 hours to return to the test pressure. During the test phase, the expansion phase pressure is reduced by 10 psi to test phase pressure and monitored for at least one hour (3 hours maximum).

4. Under no circumstances shall the total time under testing exceed eight (8) hours. If the test is not completed due to leakage, equipment failure or any other reason, depressurize the test section and permit the system to "relax" for eight (8) hours prior to the next testing sequence.
5. In accordance with section 9.8 of ASTM F 2164, the pipe shall pass if the final pressure is within 5% of the test phase pressure for the testing period (3 hours maximum). If the test section fails this test, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the Owner.

27.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements
- B. Section 017000 - Execution and Closeout Requirements.
- C. Inspections: Request inspection by Engineer prior to placing bedding.
- D. Pressure Testing: As specified in Section 330505.31 - Hydrostatic Testing, and as specified above in this section.
- E. Perform pressure test on piping according to ASTM and AWWA standards.
- F. Compaction Testing:
 1. Comply with AASHTO T 180.
 2. Testing Frequency: every 500 feet or as dictated by field conditions.

27.8 PROTECTION

- A. Section 017000 - Execution and Closeout Requirements.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 330533

SECTION 330553 - IDENTIFICATION FOR UTILITIES PIPING AND EQUIPMENT

PART 28 - GENERAL

28.1 SUMMARY

- A. Section Includes:
 - 1. Pipe markers.
- B. Related Requirements:
 - 1. Section 099000 - Painting and Coating: Execution requirements for painting specified by this Section.
 - 2. Section 331113 - Public Water Utility Distribution Piping: Materials and methods for piping, valves, and appurtenances.

28.2 REFERENCE STANDARDS

- A. American Society of Mechanical Engineers:
 - 1. ASME A13.1 - Scheme for the Identification of Piping Systems.

28.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer's catalog literature for each product required.

28.4 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for closeout procedures.
- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

28.5 MAINTENANCE MATERIAL SUBMITTALS

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

28.6 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.
- B. Perform Work according to AWWA, ASTM and Suwannee County standards.

PART 29 - PRODUCTS

29.1 PIPE MARKERS

- A. Color-Coding and Lettering Size: Conform to ASME A13.1. Warning Tape Color Codes: Blue (Water Systems), Green (Sanitary Force Mains)
- B. 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 wording. Color and printing shall be permanent, unaffected by moisture or soil.
- C. 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 30 - EXECUTION

30.1 PREPARATION

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

30.2 INSTALLATION

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

END OF SECTION 330553

SECTION 331413 - PUBLIC WATER UTILITY DISTRIBUTION PIPING

PART 31 - GENERAL

31.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for public utilities, including potable water mains.
2. Tapping sleeves and valves.
3. Bedding and cover materials.

B. Related Requirements:

1. Section 310513 - Soils for Earthwork.
2. Section 312316 - Excavation.
3. Section 312316.13 - Trenching.
4. Section 330507.13 - Utility Directional Drilling.
5. Section 330509.33 - Thrust Restraint for Utility Piping.
6. Section 330533 - High Density Polyethylene (HDPE) Pipe, Fittings & Joining
7. Section 331419 - Valves and Hydrants for Water Utility Service.

31.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures.

B. Pipe and Fittings:

1. Basis of Measurement: By linear foot.
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. 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:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

C. ASTM International:

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A123 (/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products).
3. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
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.
6. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
7. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
8. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
9. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

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.
3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
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.
13. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. for Water Transmission and Distribution.
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.

31.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures.
- 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. When requested by Engineer, submit qualifications data for manufacturer and installer.

31.6 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements.
- 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.
- C. Perform Work according to AWWA and ASTM standards and Suwannee County standards.

31.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements.
- 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.

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 C151.
 - 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
 - c. Restrained Joints: joint restraint independent of joint seal.

B. PVC:

1. Comply with AWWA C900 and C905, DR 18.
2. Fittings: Comply with AWWA C900, C905 and C111.
3. Joints:
 - a. Comply with ASTM D3139 and F477.
 - b. Seals: PVC flexible elastomeric.
 - c. Solvent-cement couplings are not permitted.

C. PE Tubing:

1. Comply with AWWA C901 and ASTM D1248, SDR 9
2. Fittings:
 - a. Comply with AWWA C901.
 - b. Type: Molded.
3. Joints: Compression.

32.2 TAPPING SLEEVES AND VALVES

A. Tapping Sleeves:

1. Description:

- a. Material: Type 304 SS (reduced size steel sleeves).
- b. Material: Ductile iron (“size-on-size” mechanical joint sleeves).
- c. Type: Dual compression.
- d. 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 C509.
- b. Type: Resilient wedge 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 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

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

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

32.5 FINISHES

- A. Steel: Hot-dip galvanized after fabrication, according to ASTM A123/A123M.
- B. Protective Coating: Bituminous paint.

32.6 ACCESSORIES

- A. Thrust Restraints: As specified in Section 330509.33 - Thrust Restraint for Utility Piping.
- B. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.
- C. 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
- 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
- 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 – Excavation and Section 312316.13 - 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. 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.
 3. Steel Rods, Bolts, Lugs, and Brackets: Coat buried steel before backfilling.
 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 field conditions necessitate high points, install air-release valves as indicated on Drawings and per Suwannee County standards.
 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.
 12. Close pipe openings with watertight plugs during Work stoppages.
 13. Install access fittings to permit disinfection of water system.
 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. 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.

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

33.4 TOLERANCES

- A. Section 014000 - Quality Requirements.
- B. Install pipe to indicated elevation within tolerance of 5/8 inch .

33.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements.
- 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) $L = SD \times \sqrt{P}/C$
 - 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 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 piping, including domestic water piping, fire water piping, 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.
2. Section 312316 - Excavation
3. Section 312316.13 - Trenching.
4. Section 330597 - Identification for Utilities Piping and Equipment.
5. Section 331419 - Valves and Hydrants for Water Utility Service
6. Section 331900 - Water Utility Metering Equipment

34.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures.

B. Piping:

1. Basis of Measurement: By linear foot.
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:
 - 1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
 - 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:
 - 1. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
 - 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)).
 - 4. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

5. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
6. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
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.
8. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
9. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
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.
3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
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.
- 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. When requested by Owner's Representative, submit qualifications data for manufacturer and installer.

34.5 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements
- 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. Perform Work according to AWWA and ASTM standards and Suwannee County standards.

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.
- 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.
- 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.
4. Jackets: AWWA C105 PE jacket.

B. PVC Pipe:

1. ASTM D1785, Schedule 40.
2. Fittings: PVC, ASTM D2466.
3. Joints:
 - a. Comply with ASTM D2855.
 - b. Type: Solvent weld.

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. Materials:

- a. Furnish materials according to AWWA and ASTM standards and Suwannee County 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. Materials:

- a. Furnish materials according to AWWA and ASTM standards and Suwannee County 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

A. Valves, Valve Boxes, and Fire Hydrants: As specified in Section 331419 - Valves and Hydrants for Water Utility Service.

B. Yard Hydrants:

1. Materials:

- a. Furnish materials according to AWWA and ASTM standards and Suwannee County 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. Materials:

1. Furnish materials according to AWWA and ASTM standards and Suwannee County 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 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 A-3 as specified in construction plans.
 - b. Subsoil with no rocks greater than 3/4 inches in diameter, frozen earth, or foreign matter.

35.6 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:
1. Comply with ASTM A36.
 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.
- 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 97 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.

9. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.
- C. Meters and Boxes: As specified in Section 331900 - Water Utility Metering Equipment.
- D. Disinfection: As specified in Section 330110.58 - Disinfection of Water Utility Piping Systems.

36.4 TOLERANCES

- A. Section 014000 - Quality Requirements
- B. Install pipe within tolerance of 5/8.

36.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements.
- 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 331419 - VALVES AND HYDRANTS FOR WATER UTILITY SERVICE

PART 37 - GENERAL

37.1 SUMMARY

A. Section Includes:

1. Valves.
2. Valve boxes.
3. Fire hydrants.

B. Related Requirements:

1. Section 330509.33 - Thrust Restraint for Utility Piping.
2. Section 331413 - Public Water Utility Distribution Piping
3. Section 331416 - Site Water Utility Distribution Piping.

37.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment 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.

37.3 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:

1. NFPA 291 - Recommended Practice for Fire Flow Testing and Marking of Hydrants.

C. NSF International:

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

37.4 COORDINATION

- A. Section 013000 - Administrative Requirements.
- B. Coordinate Work of this Section with installation of water mains.

37.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures.
- 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. When requested by Engineer, submit qualifications data for manufacturer and installer.
 2. When requested by Engineer, submit manufacturer's approval of installer.

37.6 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements.
- B. Project Record Documents: Record actual locations of valves and hydrants.

37.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements.
- B. Tools: Furnish one tee wrench of required length to Owner.

37.8 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 and Suwannee County standards.

37.9 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.

37.10 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements.
- 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 38 - PRODUCTS

38.1 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:
 - a. Comply with AWWA C550.
 - b. Application: Interior and exterior.

B. Resilient-Wedge Gate Valves:

1. Materials:

- a. Furnish materials according to AWWA & ASTM standards and Suwannee County standards.

2. Description:

- a. Comply with AWWA C509.
- b. Body: Ductile iron
- c. Seats: Resilient.
- d. Stem Type:
 - 1) Non-rising (buried service).
 - 2) OS&Y rising (aboveground service).
 - 3) Material: Bronze.
- e. Operation:
 - 1) Square operating nut (buried service).
 - 2) Cast iron handwheel (aboveground service).
 - 3) Opening Direction: Counterclockwise.

38.2 FIRE HYDRANTS

A. Materials:

1. Furnish materials according to AWWA & ASTM standards and Suwannee County standards.

B. Dry-Barrel, Breakaway Type:

1. Comply with AWWA C502.
2. Body: Cast iron.
3. Valve: Compression type.
4. Burial Depth: As indicated on Drawings.
5. Inlet Connection Size: 6 inches.
6. Valve Opening: 5-1/4 inches in diameter.
7. End Connections: Mechanical joint.
8. Bolts and Nuts: Stainless steel.
9. Interior Coating: Comply with AWWA C502 and C550.
10. Opening Direction: Counterclockwise.

C. 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.

D. Finishes:

1. Primer and two coats of enamel as specified in Section 09900 - Painting and Coating.
2. Color: Comply with requirements of AWWA & ASTM and Suwannee County standards.

38.3 VALVE BOXES

A. Materials:

1. Furnish materials according to AWWA & ASTM standards and Suwannee County standards.

B. Description:

1. 12-inch Diameter Valves and Smaller:
 - a. Material: Cast iron.
 - b. Type: Two piece; adjustable screw.
2. Valves Larger than 12-inch Diameter:
 - a. Material: Cast iron.
 - b. Type: Three piece; adjustable screw.
 - c. Base: Round.
3. Lid Inscription: WATER.

38.4 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 Drawings.

PART 39 - EXECUTION

39.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements
- 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.

39.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements
- 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 Owner's Representative not less than seven days in advance of proposed utility interruption.
 - 2. Do not proceed without written permission from Owner's Representative.

39.3 INSTALLATION

- A. Perform trench excavation, backfilling, and compaction as specified.
- 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 and Suwannee County 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.

39.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements.
- B. Section 017000 - Execution and Closeout Requirements.
- 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 40 - GENERAL

40.1 SUMMARY

- A. Section Includes:
 - 1. Propeller flow meters.
 - 2. Ultrasonic flow meters.
 - 3. Transmitters.
 - 4. Indicators.
 - 5. Recorders.
 - 6. Integrators.

- B. Related Requirements:
 - 1. Section 331413 - Public Water Utility Distribution Piping.
 - 2. Section 331416 - Site Water Utility Distribution Piping

40.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Section 012000 - Price and Payment Procedures.

- B. Meters:
 - 1. Basis of Measurement: By unit.
 - 2. Basis of Payment: Includes meter, fittings, accessories, meter box, and installation.

40.3 REFERENCE STANDARDS

- A. American Society of Mechanical Engineers:
 - 1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
 - 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.
 - 6. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

- C. ASTM International:
 - 1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

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.

40.4 SUBMITTALS

A. Section 013300 - Submittal Procedures.

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. When requested by Owner's Representative, submit qualifications data for manufacturer and installer.

40.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements.

B. Project Record Documents: Record actual locations of water meters.

40.6 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 and Suwannee County standards.

40.7 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.

40.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements.
- 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.

40.9 EXISTING CONDITIONS

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

40.10 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements.
- B. Furnish five-year manufacturer's warranty for water meters.

PART 41 - PRODUCTS

41.1 PROPELLER FLOW METERS

- A. Materials:
 - 1. Furnish materials according to ASTM and AWWA standards and Suwannee County standards.
- B. Description:
 - 1. Propeller-type flow meter to measure fluid velocity and convert to flow rate.

2. Flow Rate Range: 150 to 2,500 gpm.
3. Accuracy: Plus or minus 2 percent of actual flow rate over the full range.
4. Size: As indicated on Drawings.
5. Materials: Comply with AWWA C704.

C. Tube Type:

1. Working Pressure: 150 psig.
2. End Connections: Flanged, ASME B16.1 to match pipe.

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

41.3 INDICATORS

A. Materials:

1. Furnish materials according to ASTM, AWWA, and ASME standards and Suwannee County standards.

41.4 RECORDERS

A. Materials:

1. Furnish materials according to ASTM, AWWA, and ASME standards and Suwannee County standards.

41.5 INTEGRATORS

A. Materials:

1. Furnish materials according to ASTM, AWWA, and ASME standards and Suwannee County standards.

41.6 METER BOXES

- A. As specified in Section 330563 - Concrete Vaults and Chambers.

41.7 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality 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 42 - EXECUTION

42.1 EXAMINATION

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

42.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements
- 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.

42.3 INSTALLATION

- A. Meters:
 1. Install meters according to AWWA M6, with isolating valves on inlet and outlet.
- B. Meter Boxes:
 1. As specified in Section 330563 - Concrete Vaults and Chambers.
 2. Installation Standards: Install Work according to ASTM and AWWA standards and Suwannee County standards.

42.4 FIELD QUALITY CONTROL

- A. Section 017000 - Execution and Closeout Requirements.
- 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.

42.5 DEMONSTRATION

- A. Section 017000 - Execution and Closeout Requirements
- B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 331900