SECTION 02110
SITE CLEARING

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

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

1.1 SUMMARY

A. This Section includes the following:

1. Protection of existing trees indicated to remain.
2. Removal of trees and other vegetation necessary to perform Work.
3. Topsoil stripping
3. Clearing and grubbing.
4. Removing above-grade improvements.
5. Removing below-grade improvements.

B. Extent of site clearing shall remain within the right-of-way or easements, or project site limits of construction unless otherwise noted or instructed.

1.2 PROJECT CONDITIONS

A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

1. Protect facilities on adjoining properties and on Owner's property.
2. Restore damaged improvements to their original condition, as acceptable to property owners.

C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.

2. Provide protection for roots over 1-1/2 inch in diameter that are cut during construction operations. Coat cut faces with an emulsified asphalt or other acceptable coating formulated to use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

3. Salvable improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated or directed.

1.3 MONUMENTS

A. Provide protection for all land corners and monuments within the limits of construction.

B. Coordinate reference by a Florida Registered Land Surveyor of corners and monuments in conflict with work and in danger of being covered, damaged or destroyed.

C. A Florida Registered Land Surveyor shall restore disturbed corners and monuments to their original condition upon completion of the work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.0 SITE CLEARING

A. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.

1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

B. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.

1. Strip topsoil to whatever depths encountered in a manner to prevent

intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.

a. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.

2. Stockpile topsoil and other reusable soils in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion. Encircle with silt fencing to prevent water erosion.

C. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.

1. Completely remove stumps, roots, and other debris protruding through ground surface, to a depth of two (2) feet below finished grade.
2. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

a. Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact each layer to a density equal to adjacent original ground.

D. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.

1. Removing abandoned underground piping or conduits interfering with construction is included under this Section.
2. Removal of concrete or asphalt pavement shall be made along straight saw cut lines and only for such width as necessary.

3.1 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner's Property: Burning is not permitted on Owner's property.

B. Removal from Owner's Property: Remove waste materials and unsuitable or excess topsoil from Owner's property and dispose of in accordance with all applicable laws.

END OF SECTION 02110

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SECTION 02200
EARTHWORK

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

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

1.1 SUMMARY

A. This Section includes the following:

1. Preparing and grading subgrades for slabs-on-grade, walks, pavements, and landscaping.
2. Excavating and backfilling for buildings and structures.
3. Subbase course for walks and pavements.
4. Excavating and backfilling trenches within building lines.
5. Excavating and backfilling for underground mechanical and electrical utilities and appurtenances.
6. Pavement Crossings (Cased) for paved roadways.

B. Related Sections: The following Sections contain requirements that relate to this Section.

1. Division 2 Section "Site Clearing" for site stripping, grubbing, topsoil removal, and tree protection.
2. Division 2 Section "Trench Excavation, Backfill, and Compaction" for pipework installation.
3. Division 2 Section "Base Replacement and Resurfacing for Trenches" for pipework installation across roadways.

1.2 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

D. Subbase Course: The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.

E. Base Course: The layer placed between the subbase and surface pavement in a paving system.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

G. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

H. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner or its representative. Unauthorized excavation, as well as remedial work directed by the Owner or its representative, shall be at the Contractor's expense.

I. Unsuitable Material: Any material such as muck, wood, rock, organic peat, garbage, very fine soil particles unsuitable for compaction, and any other material that is considered unsuitable by the Owner or its representative shall be considered unsuitable.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Test Reports: In addition to test reports required under field quality control, submit the following:

1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources.
2. One optimum moisture-maximum density curve for each soil material.
3. Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

1.4 QUALITY ASSURANCE

A. Testing and Inspection Service: Contractor will employ a qualified independent geotechnical engineering testing agency approved by the Engineer to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.

1.5 PROJECT CONDITIONS

A. Existing Utilities: Contractor is responsible for contacting all utility companies to obtain locations of all existing utilities or obstructions which he may encounter during construction. After location of utilities by the appropriate utility company, it is the Contractor's responsibility to protect all such utility lines, including service lines and appurtenances, and to replace at his own expense any which may be damaged by the Contractor's equipment or forces during construction of the Project.

1. Provide a minimum 48-hours' notice to the Owner or its representative and receive written notice to proceed before interrupting any utility.
2. The Contractor is responsible for contacting all utility companies to verify locations of all existing utilities, utility-related obstructions, or utility relocations which he may encounter during construction.
3. Adequate provision shall be made for the flow of existing sewers, drains, and water courses encountered during construction, and structures which may be disturbed shall be satisfactorily restored by the Contractor.

B. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner, and utility companies in keeping respective services and facilities in operation. Contractor shall bear all costs of repairing damaged utilities to the satisfaction of utility owner.

C. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

D. Operate warning lights as recommended by authorities having jurisdiction.

E. Perform excavation within drip-line of large trees to remain by hand, and protect the root system from damage or dry out in the manner prescribed in Division 2 specification sections.

PART 2 - PRODUCTS

2.0 SOIL MATERIALS

A. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter. The fill material should be a sand containing little fines. Prior to placing the fill material, the existing material shall be stripped of all soils containing a significant percentage of organics and all loose soils which cannot be readily compacted.

B. Subbase and Base Material: Naturally or artificially graded mixture of natural or

crushed gravel, crushed stone, and natural or crushed sand, per the standard details.

C. Fill: In order to insure proper bond and prevent slipping between the original ground and fill, the surface of the original ground shall be scarified to a depth of at least three inches. Each layer of fill material shall be compacted until the required density is achieved.

PART 3 - EXECUTION

3.0 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Tree protection is specified in the Division 2 Section "Site Clearing."

3.1 DEWATERING

A. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

C. The Contractor shall prevent the accumulation of water in excavated areas, and shall remove by pumping or other means any water which accumulates in the excavation. The Contractor shall provide, install and operate a suitable and satisfactory dewatering system. The Contractor shall include the cost of this pumping equipment and work in the unit price bid for the work.

D. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collection or runoff areas. Do not use trench excavations as temporary drainage ditches.

C. The Contractor shall attempt to dispose of all dewatering water in contained upland areas via percolation. All dewatering discharges which result in a point source discharge to surface waters of the State, as defined by Chapter 62-620 F.A.C. shall be in accordance with the State of Florida “Notice of Intent to Use the Generic Permit for Discharge of Ground Water from Dewatering Operations”. The Contractor may use this permit if the site is non-contaminated or sample results for contaminants are below surface water standards. Some preliminary sampling may be required if there is nearby contamination in order to determine if treatment before discharge or an alternate management option, such as re-infiltration at the site, is required. All costs associated with required sampling, testing, and permitting shall be borne by the Contractor. If any of the analytical test results required by the permit are exceeded, the Contractor shall terminate the discharge as promptly as can be safely accomplished and notify the Owner or its Representative immediately.

3.2 EXCAVATION

A. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.

B. Use of Explosives: The use of explosives is not permitted.

3.3 STABILITY OF EXCAVATIONS

A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

B. All excavation work shall conform to OSHA Publication “Excavations 2226”, latest revision, and OSHA Excavation; Final Rule 29, CFR, Part 1926, latest revision, or other applicable excavation safety standards. The Contractor’s method of providing protective support to prevent cave-ins shall conform to OSHA requirements. Slope excavations, shoring and trench box usage in the field must be based on tabulated data and designed by the Contractor.

3.4 EXCAVATION FOR STRUCTURES

B. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid

base to receive other work.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

B. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavation for Utility Trenches is specified in the Division 2 Section "Trench Excavation, Backfill, and Compaction"

3.7 APPROVAL OF SUBGRADE

A. Notify Engineer when excavations have reached required subgrade.

B. When Engineer determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Engineer.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the Engineer.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees. Store in upland areas only and outside of environmentally sensitive areas. Provide erosion control measures adjacent to stockpile as required.

3.10 BACKFILL

A. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade.

2. Surveying locations of underground utilities for record documents.
3. Testing, inspecting, and approval of underground utilities.
4. Concrete formwork removal.
5. Removal of trash and debris from excavation.
6. Removal of temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. No backfill material shall be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, backfill operations shall not be resumed until the moisture content and density of the fill are as previously specified.

C. Backfill for Utility Trenches is specified in the Division 2 Section "Trench Excavation, Backfill, and Compaction"

3.11 FILL

A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.

1. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.

B. When subgrade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and re-compact to required density.

C. Place fill material in layers to required elevations for each location listed below.

1 Under grass, use satisfactory excavated or borrow soil material.
2. Under walks and pavements, use subbase or base material.
3. Under steps and ramps, use subbase material.
4. Under building slabs, use drainage fill material.
5. Under footings and foundations, use engineered fill.

3.13 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.

a. Stockpile or spread and dry removed wet satisfactory soil material.

3.14 COMPACTION

A. Unless otherwise stated in an attached Soils Report, the following conditions shall apply to this project:

1. Place backfill and fill material in layers at not more than the loose depth that can be compacted in accordance with the requirements herein. In areas of construction in FDOT right-of-way, backfill and fill shall be placed as required by FDOT standards of construction.
2. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.

B. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D 1557 (Modified Proctor):

1. Under structures, building slabs, walks, steps, and pavements, compact the top 12 inches below subgrade and each layer of backfill or fill material at 98 percent maximum dry density.
2. Perform in place density tests for each 2000 square feet but in no case fewer than three tests, under structure, building slabs, walkways, steps and pavements in each layer of backfill. Compaction shall meet or exceed 98 percent of the maximum dry density.
3. Under lawn or unpaved areas, compact the top 6 inches below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.

C. Compaction for Utility Trenches is specified in the Division 2 Section "Trench Excavation, Backfill, and Compaction"

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between existing adjacent grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 0.10 foot.
2. Walks: Plus or minus 0.10 foot.
3. Pavements: Plus or minus 1/2 inch.

C. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

D. Overall grading for which no grades are indicated: Within the limits of construction and outer limits of clearing and grubbing, all holes and other depressions shall be filled, all mounds and ridges cut down, and the area brought to sufficiently uniform contour that the Owner's subsequent mowing operations will not be hindered by irregular terrain and such that surface runoff will flow to existing or proposed drainage infrastructure. This work shall be done regardless of whether the irregularities were the result of the Contactor's operations or originally existed. Permanent ponds or other permanent water areas, as so designated by the Engineer, will not be required to be filled.

3.16 SUBBASE AND BASE COURSES

A. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbases to pavements.

1. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 98 percent of ASTM D 1557 (Modified Proctor).
2. Shape subbase and base to required crown elevations and cross-slope grades.
3. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
4. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

B. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders at least 12 inches wide of acceptable soil materials and compact simultaneously with each subbase and base layer.

C. Subbase and Base Course requirements for Utility Trenches is specified in the Division 2 Section "Base Replacement and Resurfacing for Trenches".

3.17 PAVEMENT CROSSINGS

A. In areas where open cuts are allowed, the edges shall be saw-cut. The backfilling and repaving shall be done in accordance with the applicable sections of these specifications and the construction drawings. At least one-half of the traveled portion of the roadway must be open to traffic at all times and adequate barricades and warning signs shall be provided.

3.18 FIELD QUALITY CONTROL

A. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Footing Subgrade: At footing subgrades, perform at least one test of each soil stratum to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to the Engineer.
2. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2,000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
3. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 100 feet or less of wall length, but no fewer than two tests along a wall face.
4. Lawn or Unpaved Areas: Perform three in-place density tests every 1000 feet of trench length at the following depths; 6-inches above pipe, 18-inches above pipe, and 30 inches above pipe. Locations of the tests shall be randomly selected by the owner's field representative.

B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained at no additional cost to the Owner.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, and erosion. Keep free of trash and debris.

D. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Engineer; reshape and re-compact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

D. Barricades, Guards, and Safety Provisions: To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, red lanterns and guards as required shall be placed and maintained by the Contractor during the progress of the construction work. Rules and regulations of the local authorities with respect to safety provisions shall be observed.

E. Property Protection: Trees, fences, poles, and all other property shall be protected unless their removal is authorized; and any property damaged shall be satisfactorily restored by the Contractor at the Contractor's expense.

F. Erosion Control: The Contractor shall be responsible for the prevention of erosion from the site and for maintaining filled and graded surfaces for the duration of the project. This includes but is not limited to, the erection of a silt fence and hay bale barricades at all locations requiring erosion control.

G. The Contractor shall take whatever steps necessary to prevent erosion and sedimentation and will be responsible for any damages which might occur to down-land properties as a result of run-off from the site during sitework construction.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property, unless otherwise noted.

3.21 CLEAN-UP AND FINAL INSPECTION

A. Before final inspection and acceptance the Contractor shall clean ditches, shape shoulders and restore all disturbed areas, including street crossings, grass plots, re-grassing if necessary, to as good a condition as existing before work started.

END OF SECTION 02200

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SECTION 02210
GRASSING

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.1 DESCRIPTION OF WORK:

A. Extent of grassing work is as specified or shown on the construction plans. Sodded areas disturbed during construction shall be re-sodded to match existing. All other areas disturbed during construction operations shall be seeded and mulched, unless otherwise noted on the Construction Drawings.

1.2 QUALITY ASSURANCE:

A. All seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of Invitation for Bids. All seed shall be furnished in sealed standard containers, unless exception is granted in writing by the Owner. Seed which has become wet, moldy, or otherwise damaged in transit or in storage shall not be used.

B. Fertilizer shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, shall not be used. Seed, fertilizer and other grassing materials shall be stored under cover and protected from damage which would make them unacceptable for use.

1.3 SUBMITTALS:

A. Approvals, except those required for field installations, field applications, and field tests shall be obtained before delivery of materials or equipment to the project. The results of laboratory tests performed on the topsoil material shall be submitted. The reports shall include the pH level, the amount of organic matter, and available phosphoric acid and potash of the soil intended for use in the work. Certificate of conformance will be required for the following:

1. Grass seed shall be certified by a registered, certified seed association or a registered testing laboratory not more than ten months prior to seeding.
2. Sprigs
3. Fertilizer

4. Topsoil
5. Lime
6. Mulching

PART 2 - PRODUCTS

2.0 TOPSOIL

A. If the quantity of existing stored or excavated topsoil is inadequate for planting, sufficient additional topsoil shall be furnished. Topsoil furnished shall be a natural, fertile, friable soil, possessing characteristics of representative productive soils in the vicinity. It shall be obtained from naturally well-drained areas. Topsoil shall be without admixture of subsoil and free from Johnson grass (Sorghum halepense), nut grass (Cyperus rotundus) and objectionable weeds and toxic substances.

2.1 SOIL AMENDMENTS

A. Lime: Ground limestone (Dolomite) containing not less than 85 percent of total carbonates, and shall be ground to such a fineness that 50 percent will pass a 100-mesh sieve and 90 percent will pass a 20-mesh sieve.

B. Fertilizer: 16-16-16 formulation of which 60 percent of the nitrogen is in the urea-formaldehyde form and shall conform to the applicable State Fertilizer laws. It shall be granulated so that 80 percent is held on a 16-mesh screen, uniform in composition, dry and free-flowing.

C. Mulch: Clean hay, fresh straw mulch or wood chips.

2.2 GRASS MATERIALS

A. Grass Seed: Federal Specifications JJJ-S-181 and shall satisfy the following requirements:

	Min. % Pure Seed	Germination and Hard Seed	Max. % Weed Seed
Argentine Bahia	95%	80% (min)	0.25%
Pensacola Bahia	95%	80% (total)	(for all
Bermuda	95%	85% (min)	types)
Rye	95%	90% (min)	

Seed failing to meet the purity or germination requirements by no more than twenty-five percent may be used, but the quantity shall be increased to yield the required rate of pure live seed. Seed failing to meet the weed seed requirements shall not be used.

B. Sod: Sod shall be matched to adjacent sod for all applications unless otherwise specified elsewhere in the Bid Documents. In the event sod is required but not specified and none exists to match, Centipede sod shall be required.

PART 3 - EXECUTION

3.0 GRADING

A. Areas to be grassed shall be graded to remove depressions, undulations, and irregularities in the surface before grassing.

3.1 PLACING TOPSOIL

A. Areas to be grassed shall have a minimum topsoil cover of two inches. Topsoil shall not be placed when the subgrade is excessively wet, extremely dry or in a condition otherwise detrimental to the proposed planting or proper grading.

3.2 TILLAGE

A. The area to be grassed shall be thoroughly tilled to a depth of four inches using a plow and disc harrow or rotary tilling machinery until a suitable bed has been prepared and no clods or clumps remain larger than 1-1/2 inches in diameter.

3.3 APPLICATION OF FERTILIZER

A. Fertilizer shall be applied at the rate of 6 pounds per 1,000 square feet and shall be thoroughly incorporated into the top three to four inches of soil.

3.4 PLANTING SEEDS

A. All areas disturbed during construction not specifically requiring sod, shall be seeded as specified herein. Immediately before seeds are sown and after fertilizer and lime are applied, the ground shall be scarified as necessary and shall be raked until the surface is smooth, friable, and of uniformly fine texture. Areas to be grassed shall be seeded evenly with a mechanical spreader, raked lightly, rolled with a 200-pound roller, and watered with a fine spray. Seed shall be applied at the rate of 6 lbs/1000 square feet.

1. Seeded areas shall be mulched at the rate of not less than 1-1/2" loose measurement over all seeded areas. Spread by hand, blower, or other suitable equipment. Mulch shall be cut into the soil with equipment capable of cutting the mulch uniformly into the soil. Mulching shall be done within 24 hours of the time seeding is completed or prior to a rainfall event, if one is forecast within 24 hours of planting.

3.5 HYDROSEEDING

A. Fertilizer, seed and mulch shall be applied in one operation with approved hydraulic equipment. Apply materials at the following rates:

1. Hydromulch, at 50 lbs. per 1,000 square feet.
2. Seed, at 6 lbs. per 1,000 square feet.
3. Fertilizer, at 6 lbs. per 1,000 square feet.
4. Soil Binding Agent, at 1 lb. per 1,000 square feet.

B. Hydroseeding shall not be done during windy weather or when the ground is overly wet or frozen. Contractor shall give the Owner 48 hours notice of hydroseeding operations.

C. Equipment shall use water as the carrying agent utilizing a continuous built-in agitation system. Equipment with a gear pump is not acceptable.

D. Pump a continuous, non-fluctuating supply of homogenous slurry to provide a uniform distribution of material over designated areas.

3.6 PLANTING SOD

A. The sod shall be live, fresh, and uninjured at the time of planting and shall have a thick mat of roots with enough adhering soil to assure growth. Apply sod within 24 hours of stripping. Do not plant dormant sod or if ground is frozen. Protect sod against drying and breaking of rolled strips.

B. Placement: Prepare the ground by loosening the soil. Place sod on the prepared soil to form a solid mass with tightly fitted joints. Ensure the butt ends and sides of sod strips do not overlap. Stagger strips to avoid a continuous downhill seam. Tamp or roll lightly to ensure contact with subgrade. Tamp the outer edges of the sodded area to produce a smooth contour. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass. Water sod thoroughly with a fine spray immediately after planting.

C. Watering: Keep sod continuously moist to a depth below the root zone for three weeks after placement. If there is no water available to the site, the Contractor shall provide the water for the sod.

D. Clean-Up: All excess soil, excess grass materials, stones, pallets and other waste shall be removed from the site daily and not allowed to accumulate. All paved areas shall be kept clean at all times.

E. Maintenance: Maintain sod by watering, fertilizing, weeding, mowing, trimming and other operations such as rolling, re-grading, and re-planting as required to

establish a lawn free of eroded or bare areas and acceptable to the Engineer. Where inspected work and materials do not comply with requirements, replace rejected work and continue maintenance until re-inspected by Engineer and found to be acceptable. Remove rejected materials promptly from the project site.

3.6 ROLLING

A. After seeding and mulching or sodding, a cultipacker, traffic roller, or other suitable equipment shall be used for rolling the grassed areas. Areas shall then be watered **with a fine spray.**

3.7 WINTER COVER

A. All areas to be grassed shall be protected against erosion at all times. For protection during winter months (November 1st through March 31st) Italian rye grass shall be planted at the rate of four pounds per 1,000 square feet on all areas which are not protected by permanent grass, including newly sodded areas.

3.8 CLEAN-UP

A. All excess soil, excess grass materials, stones, and other waste shall be removed from the site daily and not allowed to accumulate.

3.9 MAINTENANCE

A. Maintenance of the grass shall continue until the Owner accepts the project for use. Prior to acceptance, maintenance shall include watering, mowing, replanting and other work necessary to produce a uniform stand of grass. If during the warranty period the grass fails to grow, producing bare areas, the Contractor will replant as necessary, at no cost to the Owner.

END OF SECTION 02210

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SECTION 02221
TRENCH EVACUATION, BACKFILL, COMPACTION

PART 1 – GENERAL

1.1 GENERAL DESCRIPTION OF WORK

A. Topics Covered – Excavation, shoring, dewatering, pipe bedding, trench backfill, compaction, grading, and cleanup of all pipeline trenching for the project.

B. Requirements – All work must be done in accordance with these specifications and the safety requirements of the State and OSHA standards.

C. Contractor Visitation – Prior to submittal of bid, the Contractor shall visit the site and become thoroughly familiar with site conditions existing along the route of the planned work. The Contractor shall accept site in condition existing during Contract time frame.

D. Groundwater/Surface Water – Management of groundwater/surface water encountered during construction are conditions of the Contract and responsibility of Contractor.

PART 2 - PRODUCTS

2.1 Source Materials – Determination of source of materials for bedding and backfill shall be responsibility of Contractor, but use of such materials shall be subject to approval of Engineer.

2.2 Pipe Bedding and Backfill – Pipe bedding shall be angular material.

2.3 Sand Backfill – (Where specified on plans). Use sand or fine aggregate with source of material subject to approval of Engineering.

2.4 Cradling Rock – Use crushed rock or stone with 70-100 percent passing 1-inch sieve and no more than 50 percent passing ¾-inch sieve.

2.5 Controlled Density Fill –

A. Mixture – Use high slump mixture of Portland cement, fly ash and fine aggregate formulated, licensed and marketed as K-Krete or equal.

B. Strength – Provide mixture with minimum 28-day compressive strength of 70 psi with no measurable shrinkage or surface settlement.

2.6 Sheeting, Shoring, and Bracing – All excavation and trench safety measures shall be OSHA compliant. Use sound timber or structural steel. Use shapes and sizes as required.

PART 3 – EXECUTION

3.1 GENERAL

A. Dewatering -

1. Prevent surface and subsurface or groundwater from flowing into excavation.

2. Provide equipment for handling water encountered as required. Obtain approval of proposed method of dewatering. All dewatering discharges which result in a point source discharge to surface waters of the State, as defined by Chapter 62-620 F.A.C. shall be in accordance with the State of Florida “Notice of Intent to Use the Generic Permit for Discharge of Ground Water from Dewatering Operations”. The Contractor may use this permit if the site is non-contaminated or sample results for contaminants are below surface water standards. Some preliminary sampling may be required if there is nearby contamination in order to determine if treatment before discharge or an alternate management option, such as reinfiltration at the site, is required. All costs associated with required sampling and testing shall be borne by the Contractor. If any of the analytical test results required by the permit are exceeded, the Contractor shall terminate the discharge as promptly as can be safely accomplished and notify the Owner or its Representative immediately.

3. No sanitary sewer shall be used for disposal of trench water.

B. Protection Of Existing Utilities -

1. Notify all utilities of location and schedule of work.

2. Locations and elevations of utilities shown on plans are to be considered approximate only. Notify utility and Engineer of conflicts between existing and proposed facilities.

3. Repair, relay, or replace existing utilities damaged, destroyed, or disrupted during work. Unless specified otherwise, replacement will be at the Contractor's expense.

C. Sheeting, Shoring, And Bracing -

1. Provide as necessary, to hold walls of excavation, prevent damage to adjacent structures, and to protect workmen and property.

2. Leave sheeting and shoring in place where removal might cause damage to work or as otherwise indicated on drawings.

3. When moveable trench shield is used below spring line of pipe, it shall be lifted prior to any forward movement to avoid pipe displacement.

D. Changes in Grade – Minor adjustments to grades may be made from plan grades to suit unforeseen construction conflicts or conditions with approval from Engineer. Additional compensation will be made for such minor changes.

3.2 EXCAVATION AND TRENCHING

A. General -

1. Method of excavation at the Contractor's option.

2. The Contractor will use caution when excavating under tree roots, under and around structures and utilities. Contractor shall hand dig where appropriate.

3. Stockpile and replace topsoil equal to pre-existing depth for surface restoration in grassed or agricultural areas where specified or shown on plans.

B. Trench Characteristics -

1. Depth – As indicated for pipe installation to lines and grades required with proper allowance for thickness of pipe and type of bedding specified or indicated.

2. Width – Keep width of trench as narrow as possible and yet provide adequate room for backfilling and jointing. Maximum trench width of 30-inch or pipe O.D. plus 18 inches where soil conditions permit.

3. General -

   a. Provide bell holes for each pipe joint where pipe bears on undisturbed earth.

   b. Trench bottom shall be free of large stones, water, and other foreign material.

3.3 ORGANIC OR UNSTABLE MATERIALS

A. Guidelines – Stop work and notify Engineer. Perform remedial work as directed.

B. Unsuitable Material – If material is judged unsuitable and removal is authorized, remove and replace with trench stabilizing material as directed by Engineer.

3.4 ROCK EXCAVATION

A. Guidelines – Excavate any rock to maintain a minimum 6-inch clearance around pipe. Dispose of rock material not suitable for backfill as directed by Engineer.

B. Explosives – The use of explosives is not permitted without prior written authorization from Owner and Engineer. If authorization to use explosives is given, the Contractor must provide Special Hazard Insurance covering liability for blasting operations.

3.5 BEDDING

Place after bottom of trench has been excavated to proper depth and grade. Place, compact and shape bedding material to conform to barrel of pipe to insure continuous firm bedding for full length of pipe.

Provide bedding as described in following table unless indicated otherwise within the Construction Documents.

Pipe Bedding	
Pipe Material	Minimum Bedding Class
Ductile Iron Pipe	Class D*
Flexible or Composite Pipe	Class 1**

3.6 TRENCH BACKFILL

A. Guidelines -

1. Use excavated material backfill unless otherwise specified or directed.

2. Use suitable backfill for all trenches within 5 feet of buildings and beneath walks, parking areas, paved streets or existing exposed utilities.

3. Unless otherwise stated in the Project Soils Report, the following requirements shall be met.

B. Unless otherwise stated in the Project Soils Report, the following backfill requirements shall be met:

a. Initial Backfill -

1) Place after pipe has been bedded and checked for alignment, grade, and internal obstructions.
2) Carry out in an orderly fashion after authorization to cover pipe has been given.
3) Allow no more than 300 feet of trench to be open at one time.
4) Do not backfill until concrete or mortar has sufficiently cured.
5) Record location of connections and appurtenances before backfilling.
6) Place by hand and hand tamp to not less than 12 inches above top of pipe, in approximately 4-inch layers.

7) Backfill simultaneously on both sides of pipe to prevent displacement.
8) Place cushion of 4 feet above pipe envelope before using heavy compacting equipment.

b. Subsequent Backfill -

1) Place backfill into trench at an angle so that impact on installed pipe is minimized.
2) Subsequent backfill shall be installed in maximum six (6) inch lifts.
3) Compaction of all backfill material shall be performed in a manner that shall not crack, crush, and/or cause the installed pipe to be moved from the established grade and/or alignment.
4) Area under pavement and walks or within buildings shall be mechanically compacted to the top of the subgrade in 6-inch lifts.
5) Areas not subject to vehicular traffic shall be backfilled and compacted in layers not more than 12 inches in depth.
6) Mound excavated materials no greater than 6 inches in open areas only.
7) Fill upper portion of trench with topsoil as specified hereinbefore.
8) No trench shall be open overnight.

C. Trench Compaction -

1. Compaction method at discretion of the Contractor with following exceptions:

a. If in the Engineer's opinion compaction method presents potential damage to pipe, it will not be allowed.

b. Compaction of any backfill material by flooding or jetting is not allowed.

c. Percentage of Maximum Dry Density Requirements –

1) Perform in place density tests for each 2,000 square feet but in no case fewer than three tests under structures, building slabs, walks, steps, and pavements, compact the top twelve

(12) inches below subgrade and each layer of backfill or fill material at 98 percent of the maximum dry density.

2) For lawn or unpaved areas over trench backfill, perform in-place density tests every 1,000 feet of trench length at the following locations: i) springline of the pipe; ii) 6 inches above the pipe; iii) Every 24 inches thereafter. Locations of the tests shall be randomly selected by the Owner's field representative. Compaction shall meet or exceed the adjacent site compaction; however, in no case shall the backfill density be less than 90 percent of the maximum dry density.

D. Controlled Density Fill -

1. Use where shown on plans.

2. Provide suitable forms to limit volume of controlled density fill material.

3. Protect exposed utility lines during placement.

4. Place material in accordance with suppliers' written recommendations unless directed otherwise by Engineer.

5. Where the backfill material is deposited in water, the layer and density requirements shall not apply until a one-foot layer of comparatively dry material is obtained, but this one-foot layer shall be thoroughly compacted by tamping.

6. If the Contractor has compaction equipment with which the required density can be obtained in thicker lifts than permitted above and upon satisfactory evidence that the proposed equipment will produce work equal in quality to that produced by the specified methods, The Owner or its Representative may permit placement of granular material of soil groups A-1, A-2, or A-3 in lifts up to a maximum of three foot compacted thickness. The Contractor will be required to furnish equipment and labor to excavate and backfill test pits to be dug for the performance of density tests.

7. Use of thick lift compaction procedures will not be allowed for first stage backfilling (beneath the haunches) of pipe culverts and storm sewers.

3.7 EXCESS MATERIAL – Dispose of waste excess excavated material in off-site upland areas in accordance with all Local, State, and Federal laws.

3.8 FIELD QUALITY CONTROL

A. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work to verify compliance with requirements.

B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained.

C. In Place Density –

1. ASTM D1556 (Sand Cone)

2. ASTM D2167 (Balloon)

3. ASTM D3017 (Nuclear)

END OF SECTION 02221

SECTION 02340
RIP RAP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Florida Department of Transportation, Standard Specifications for Road and Bridge Construction (FDOT Specs), Section 530. Work shall comply with requirements of FDOT Specs as modified herein.

1.2 DESCRIPTION OF WORK

This section shall cover the work of furnishing and constructing the Riprap which shall consist of a protective course of stone or other approved materials on embankment slopes, in channels, or other work as shown on the plans or directed, in accordance with these Specifications and in conformity with the lines and grades noted in the plan details.

PART 2 - PRODUCTS

2.1 MATERIALS

Rubble\Stone Riprap shall comply with Florida Department of Transportation Standard Specification 530-2.1.3.

A. Banks and shore protection shall comply with Florida Department of Transportation Standard Specification 530-2.1.3.1.

B. Ditch lining shall comply with Florida Department of Transportation Standard Specification 530-2.1.3.2.

C. Broken stone and broken concrete shall comply with Florida Department of Transportation Standard Specification 530-2.1.3.3.

D. Geotextile fabric shall comply with Florida Department of Transportation Standard Specification 514.

E. Bedding stone shall comply with Florida Department of Transportation Standard Specification 530-2.1.4.

F. Sand/Cement Riprap: Materials and placement shall comply with Florida

Department of Transportation Standard Specification 530-2.1.2.

PART 3 - EXECUTION

3.1 EXECUTION

A. Construction Requirements:

1. General: All slopes to be treated with riprap shall be trimmed to the lines and grades indicated by the plans or directed, loose material shall be compacted by methods approved by the Owner or its representative or removed.

2. Slopes which require a filter blanket under the riprap shall, in addition to the above, shall be prepared as noted below.

3. Placement of any riprap on a filter blanket shall be by such means that will not damage or destroy the blanket. Any damage to the blanket shall be repaired without additional compensation.

4. If directed by the Owner or its representative or shown by plan details, all outer edges and the top of riprap where the riprap terminates shall be formed so that the surface of the riprap will be embedded and even with the surface of the ground and/or slope.

5. All riprap construction shall begin at the bottom of the slope and progress upward.

6. Filter Blanket: Unless otherwise specified by the plans or ordered in writing, a fabric blanket shall be provided.

7. The bedding stone shall be constructed in accordance with Florida Department of Transportation Specification 530-3.3.

8. Foundation Preparation: Areas on which filter fabrics are to be placed shall be uniformly trimmed and dressed to conform to cross-sections shown by the plans.

B. Plastic Filter Fabric:

Plastic filter fabric shall be placed in the manner and at the locations shown in the plans or as directed by the Engineer. At the time of installation, fabric shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacturing, transportation or storage. The fabric shall be placed with the long dimension parallel to the centerline of the channel or shoreline unless otherwise directed by the Owner or its representative, and shall be laid smooth and free of

tension, stress, folds, wrinkles or creases. The strips shall be placed to provide a minimum width of 24 inches of overlap for each joint with the upstream strip of fabric overlapping the downstream strip. Overlap joints and seams shall be measured as a single layer of cloth. Securing pins with washers shall be inserted through both strips of overlapped cloth at not greater than the following intervals along a line through the midpoint of the overlap.

Pin Spacing Slope
2 ft.(Steeper than 3:1)
3 ft. (3:1 to 4:1)
5 ft. (Flatter than 4:1)

The fabric shall be turned down and buried two feet at all exterior limits except where a stone-filled key is provided below natural ground.

Additional pins regardless of location shall be installed as necessary to prevent any slippage of the filter fabric. Overlaps in the fabric shall be placed so that any upstream strip of fabric will overlap the downstream strip. Should the Owner or its representative direct that the fabric be placed with the long dimension perpendicular to the centerline of the channel or shoreline, the lower strip of fabric shall underlap the next higher strip. Each securing pin shall be pushed through the fabric until the washer bears against the fabric and secures it firmly to the foundation. The fabric shall be protected at all times during construction from contamination by surface runoff and any fabric so contaminated shall be removed and replaced with uncontaminated fabric. Any damage to the fabric during its installation or during placement of riprap shall be replaced by the Contractor. The work shall be scheduled so that 5 days does not expire between placement of the fabric and the covering of the fabric with riprap.

3.2 STONE AND CONCRETE RUBBLE RIPRAP

A. General: Unless otherwise shown by plan details or directed, stone or concrete shall not be placed on slopes steeper than the natural angle of repose of the riprap material.

Placement of stone or concrete may, unless otherwise noted hereinafter, be placed by methods and equipment approved by the Owner or its representative suitable for the purpose of placing the riprap in accordance with the requirements for the class riprap involved without damaging any existing facility or construction feature.

The stone or concrete shall be placed in such a manner as to produce a reasonably well graded mass of rock with the minimum practical percentage of voids. Stone or concrete shall be laid with close broken joints and resting on the embankment slope. The riprap shall be constructed to the lines, grades and thickness shown by the plans or as directed. Riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing or damaging the filter blanket material. The larger stone or concretes shall be well distributed and the entire mass of stone or concretes in their final position shall conform to a

reasonable uniform gradation. The finished riprap shall be free from objectionable pockets of small stone or concretes and clusters of larger stone or concretes. Open joints shall be filled with spalls, or small stone or concretes in such manner that all stone or concretes are tightly wedged or keyed. Placing riprap by dumping into chutes or by other methods likely to cause segregation of sizes will not be permitted. The desired distribution of the various sizes of stone or concretes throughout the mass shall be obtained by selective loading of the material at the source, by controlled dumping of successive loads during final placing, or by other methods of placement which will produce the specified results. The individual pieces of stone or concrete in each horizontal course shall be laid so that they will not break away from embankment. Rearranging of individual stone or concretes by mechanical equipment, or by hand, will be required to the extent necessary to obtain a reasonably well graded distribution of stone or concrete as specified above.

3.3 SAND/CEMENT RIPRAP

A. Placing: Immediately following mixing, the mixture shall be placed in the bags, tied (so that when laid in position, they will flatten out and give a thickness of not less than six inches) and placed flat on the area designed. Bags shall be layered and rammed against each other to form closed joints, with tied ends of sacks all laid in the same direction. Sacks ripped or torn in placing shall be removed and replaced with sound, unbroken sacks. When required to be placed under water, special care shall be taken to see that bags are closely jointed to give the same tight joints as required on dry slopes. After the riprap is placed, it shall be sprinkled with water as directed and kept damp for not less than three days. No sand/cement riprap shall be mixed in freezing weather.

B. Grouting: Immediately after watering, all openings between sacks shall be filled with dry grout composed of one part Portland cement and five parts sand.

C. Pinned Bags: Bags shall be pinned when called for on drawings.

3.4 MAINTENANCE

The Contractor shall maintain all riprap until the contract work is accepted, and shall replace, without additional compensation for any damaged or lost riprap.

3.5 CLEAN-UP

Before final inspection and acceptance, the Contractor shall remove all excess material from site and restore all disturbed areas to as good a condition as existed before work started.

END OF SECTION 02340

SECTION 02361
TERMINTE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following for termite control: Soil treatment.

1.3 DEFINITIONS

A. EPA: Environmental Protection Agency.

B. PCO: Pest control operator.

1.4 SUBMITTALS

A. Product Data: Treatments and application instructions, including EPA-Registered Label.

B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.

C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:

1. Date and time of application.

2. Moisture content of soil before application.

3. Brand name and manufacturer of termiticide.

4. Quantity of undiluted termiticide used.

5. Dilutions, methods, volumes, and rates of application used.

6. Areas of application.

7. Water source for application.

D. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.

B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.8 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

C. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AgrEvo Environmental Health, Inc.; a Company of Hoechst and Schering, Berlin.

2. American Cyanamid Co.; Agricultural Products Group; Specialty Products Department.

3. Bayer Corp.; Garden & Professional Care.

4. DowElanco.

5. FMC Corp.; Pest Control Specialties.

6. Zeneca Professional Products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.

4. Masonry: Treat voids.

5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until round-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 02361

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SECTION 02400
GRADED AGGREGATE BASE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and other Specification Sections, apply to the work of this section.

B. Florida Department of Transportation, Standard Specifications for Road and Bridge Construction (FDOT Specs), latest edition.

1.2 DESCRIPTION OF WORK

A. This item shall consist of a base course of graded aggregate base or limerock base constructed on a subgrade prepared in accordance with the specifications and in conformity with the line, grades and typical cross-section as shown on the drawings. The construction methods shall conform to the requirements of Sections 200, 204, or 230 of the FDOT Specs for graded aggregate base or limerock base.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall be secured from sources approved by the Owner or its representative, and shall be furnished by the Contractor. Graded aggregate material shall conform to Section 901 of the FDOT Specs. Limerock material shall conform to Section 911 of the FDOT specs.

2.2 EQUIPMENT

A. The aggregate shall be spread by mechanical rock spreaders, equipped with a device which strikes off the aggregate uniformly to laying thickness, and capable of producing an even distribution of the aggregate. Spreading may be done by bulldozers or blade graders for crossovers, intersections and ramps areas; for roadway widths of 20 feet or less; for the main roadway area when forms are used; and for any other areas where the use of a mechanical spreader is not practicable. All equipment for proper construction of this project shall be in first-class working condition.

PART 3 - EXECUTION

3.1 TRANSPORTING BASE MATERIAL:

A. The graded aggregate shall be transported to the point where it is to be used, over aggregate previously placed if practicable, and dumped on the end of the preceding spread. Hauling over the subgrade and dumping on the subgrade will be permitted when, in the Engineer's opinion, these operations will not be detrimental to the base.

3.2 SPREADING BASE MATERIAL:

A. Method of Spreading: The graded aggregate shall be spread uniformly. All segregated areas of fine or coarse aggregate shall be removed and replaced with properly graded aggregate.

B. Number of Courses: When the specified compacted thickness of the base is greater than six inches, the base shall be constructed in two courses. The thickness of the first course shall be approximately one-half the total thickness of the finished based, or enough additional material added to bear the weight of the construction equipment without disturbing the subgrade. When compacted thickness is six inches or less, graded aggregate shall be placed in one lift.

3.3 COMPACTING AND FINISHING BASE:

A. GENERAL

Single-Course Base: For single-course base, after the spreading is completed, the entire surface shall be scarified and then shaped so as to produce the required grade and cross-section after compaction.

Double-Course Base: For double-course base, the first course shall be cleaned of foreign material and bladed and brought to a surface cross-section approximately parallel to that of the finished base. Prior to the spreading of any material for the upper course, the density tests for the lower course shall be made and the Owner or its representative shall have determined that the required compaction has been obtained. After the spreading of the material for the second course is completed, its surface shall be finished and shaped so as to produce the required grade and cross-section after compaction, and free of scabs and laminations.

Moisture Content: When the material does not have the proper moisture content to ensure the required density, wetting or drying will be required. When water is added, it shall be uniformly misted-in by discing to the full depth of the course which is being compacted. Wetting or drying operations shall involve manipulation, as a unit, of the entire width and depth of the course which is being compacted.

3.4 DENSITY REQUIREMENTS:

A. As soon as proper conditions of moisture are attained, the material shall be compacted to meet the density requirements of the details, the Earthwork section and/or the report of Geotechnical Investigation.

3.5 TESTING SURFACE, PROTECTION, AND MAINTENANCE

A. During final compacting operations, if blading of any areas is necessary to obtain the true grade and cross-section, the compacting operations for such areas shall be completed prior to making the density tests on the finished base.

B. Correction of Defects:

Contamination of Base Material: If, at any time, the subgrade material should become mixed with the base course materials, the Contractor shall, without additional compensation, dig out and remove the mixture, reshape and compact the subgrade and replace the materials removed with clean base material, which shall be shaped and compacted as specified above.

Cracks and Checks: If cracks or checks appear in the base, either before or after priming, which, in the opinion of the Owner or its representative, would impair the structural efficiency of the base, the Contractor shall remove the cracks or checks by re-scarifying, reshaping, adding base material where necessary, and re-compacting.

C. Compaction of Widening Strips:

Where base construction consists of widening strips and the trench width is not sufficient to permit use of standard base compaction equipment, compaction shall be accomplished by use of vibratory compactors, trench rollers or other special equipment which will achieve the density requirements specified herein.

D. Testing Surface:

The finished surface of the base course shall be checked with a template cut to the required crown and with a 15-foot straightedge laid parallel to the center line of the road. All irregularities greater than ¼ inch should be corrected by scarifying and removing or adding aggregate as required, after which the entire area shall be re-compacted as specified herein. In the testing of the surface, the measurements will not be taken in small holes caused by individual pieces of rock having been pulled out by the grader.

E. Priming and Maintaining:

Priming: The prime coat shall be applied only when the base meets the specified density requirements and the moisture content in the top half of the base does not exceed 90 percent of the optimum moisture of the base material. At the time of priming, the base shall be firm, unyielding and in such condition that no undue distortion will occur.

Maintaining: The Contractor will be responsible for assuring that the true crown and template are maintained, with no rutting or other distortion, and that the base meets all the requirements, at the time the surface course is applied.

F. Thickness Requirements:

Measurements: Thickness of the base shall be measured at intervals in such a manner that each test represents 5,000 square feet of road pavement, or as otherwise directed by the Owner or its representative. Measurements shall be taken at various points on the cross-section, through holes not less than three inches in diameter.

Areas Requiring Correction: Where the compacted base is deficient by more than ½ inch from the thickness called for in the plans, the Contractor shall correct such areas by scarifying and adding rock. The base shall be scarified and rock added for a distance of 100 feet in each direction from the edge of the deficient area. The affected areas shall then be brought to the required state of compaction and to the required thickness and cross-section.

END OF SECTION 02400

SECTION 02515

CAST-IN-PLACE CONCRETE (SITEWORK)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

B. Florida Department of Transportation, Standard Specifications for Road and Bridge Construction (FDOT Specs), latest edition.

1.2 SUMMARY

This Section includes concrete work for the following:

A. Roadways.
B. Parking lots.
C. Curbs and gutters.
D. Walkways.
E. Pads.
F. Flumes.
G. Curb Ramps.
H. Cast-in-place utility structures.

1.3 SUBMITTALS

A. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, joint systems, curing compounds, dry-shake finish materials, and others if requested by Owner or its representative.

B. Design mixes for each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

B. Material certificates in lieu of material laboratory test reports when permitted by Owner or its representative. Material certificates shall be signed by manufacturer and Contractor certifying that each material item complies with or exceeds requirements. Provide certification from admixture manufacturers that chloride content complies with requirements.

D. Sustainable Design Submittals:

1. Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from

project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Concrete shall conform to requirements of FDOT Specs, Section 346 for curbs, curb ramps, gutters, walks, structures and miscellaneous concrete.

B. Concrete for pavement shall conform to requirements of FDOT Specs, Section 350.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars and Tie Bars: ASTM A 615, Grade 60, deformed.

B. Welded Steel Wire Fabric: ASTM A 185.

1. Furnish in flat sheets, not rolls, unless otherwise acceptable to Owner or its representative.

C. Deformed-Steel Welded Wire Fabric: ASTM A 497.

D. Fabricated Bar Mats: Welded or clip-assembled steel bar mats, ASTM A 184. Use ASTM A 615, Grade 60 steel bars, unless otherwise indicated.

E. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

F. Hook Bolts: ASTM A 307, Grade A bolts, internally and externally threaded. Design hook bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

G. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications. Use supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I.

1. Use one brand of cement throughout Project unless otherwise acceptable

to Owner or its representative.

2. All concrete shall develop a 28-day compressive strength of 4000 psi. If any concrete should fail to meet the strength requirement, the structure shall be removed as necessary to remove the defective concrete and shall then be rebuilt at the contractor's expense.

B. Fly Ash: ASTM C 618, Type F.

C. Normal-Weight Aggregates: ASTM C 33, Class 4, and as follows. Provide aggregates from a single source unless otherwise approved by the Owner or its representative.

1. Maximum Aggregate Size: 1-1/2 inches.

2. Do not use fine or coarse aggregates that contain substances that cause spalling.

3. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Owner or its representative.

D. Water: Potable.

E. Fiber Reinforcement: Synthetic fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III.

2.4 ADMIXTURES

A. Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.5 CONCRETE MIX

A. Prepare design mixes for each type and strength of normal-weight concrete per

FDOT Standard Specification 346-6.2. Use a qualified independent testing laboratory for preparing and reporting proposed mix designs.

B. Fiber Reinforcement: Add to mix at rate of 1.5 lb per cu. yd., unless manufacturer recommends otherwise.

C. Adjustment to Concrete Mixes: Mix design adjustments may allowed by the Owner or its representative when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of FDOT Standard Specifications.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION FOR CONCRETE PAVING

A. Proof-roll prepared base or subgrade surface to check for unstable areas and verify need for additional compaction. Do not begin concrete work until such conditions have been corrected and are ready to receive paving.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install sufficient forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork and screeds for grade and alignment to following tolerances:

1. Top of Forms: Not more than 1/8 inch in 10 feet.

2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Maintain minimum cover to reinforcement.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.4 JOINTS

A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.

B. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as shown on Drawings. If not specified on drawings, intervals shall be not greater than 10 feet or less than 5 feet. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:

1. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into hardened concrete when cutting action will not tear, abrade, or otherwise damage surface and before development of random contraction cracks.

3. Inserts: Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully

remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris.

C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than ½ hour, unless paving terminates at isolation joints.

1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless indicated otherwise. Embed keys at least 1-1/2 inches into concrete.

2. Continue reinforcement across construction joints unless indicated otherwise.

D. Expansion Joints: Form expansion joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 25 feet, unless indicated otherwise.

2. Extend joint fillers full width and depth of joint, not less than ½ inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.

3. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

E. Filler and Sealants: Submit specifications to Engineer for approval.

F. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one half of dowel length to prevent concrete bonding to one side of joint.

3.5 CONCRETE PLACEMENT

A. Comply with requirements of FDOT Standard Specification 350-8 placing concrete.

B. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place. No concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. Deposit concrete as nearly as practical to its final location to avoid segregation. When concrete placing is

interrupted for more than ½ hour, place a construction joint.

C. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

D. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with FDOT Standard Specifications 350-9.

E. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.

F. Curbs and Gutters: Shall be constructed in accordance with FDOT Specs. When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

G. Slip-Form Pavers: When automatic machine placement is used for paving, submit revised mix design and laboratory test results that meet or exceed requirements. Produce paving to required thickness, lines, grades, finish, and jointing as required for formed paving. Compact subgrade of sufficient width to prevent displacement of paver machine during operations.

H. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength, or sufficient strength to carry loads without damage or injury.

I. Cold-Weather Placement: Comply with provisions of FDOT Standard Specifications 346.7.4. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

J. Hot-Weather Placement: Place concrete complying with FDOT Standard Specification 346.7.5 and as specified when hot weather conditions exist.

3.6 CONCRETE FINISHING

A. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/8 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across concrete surface perpendicular to line of traffic to provide a uniform fine line texture finish.

2. Tine Finish: Apply to curb cut ramps and other areas as noted on the drawings. Finish shall be applied by an approved hand method and shall consist of transverse grooves which are 0.03 to 0.12 inch in width and 0.10 to 0.15 inch in depth, spaced at approximately ½ inch center to center.

B. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces. Radius: ½ inch.

3.7 CONCRETE PROTECTION AND CURING

General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of FDOT Standard Specification 350-11 curing.

3.8 FIELD QUALITY CONTROL TESTING

A. The contractor shall be responsible for all required testing & re-testing noted herein, at his expense.

B. A qualified independent testing and inspection laboratory, under the direction of a Professional Engineer, licensed in the State of Florida, shall sample materials, perform tests, and submit test reports during concrete placement as follows:

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

   a. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
   b. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test but no less than one test for each day's pour of each type of air-entrained concrete.
   c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
   d. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class, plus one set for each additional 50 cu. yd. Test two specimens at 7 days, plus two specimens at 28 days.
f. Contractor shall replace materials removed for testing purposes. Should any work or materials fail to meet the requirements set forth in the plans and specifications, contractor shall pay for retesting of same.
g. All samples shall be made by the testing laboratory.

2. Basis for acceptance of concrete will be per FDOT Section 346-8 through 346-11.

C. Test results will be reported in writing to Engineer, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing laboratory, concrete type and class, location of concrete batch in the work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing laboratory will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Owner or its representative. Testing laboratory may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.9 REPAIRS AND PROTECTION

A. Remove and replace concrete work that is broken, damaged, or defective, or does not meet the requirements of this Section.

B. Drill test cores where directed by Owner or its representative when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory concrete areas with Portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from concrete pavement for at least 14 days after placement. When construction traffic is permitted, maintain concrete as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete work free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION 02515

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SECTION 02516
PAVEMENT MARKINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Specifications Sections, apply to work of this section.

B. Unless otherwise specified on the plan sheets or in other sections of this contract, all materials and work shall conform to the applicable requirements in the following documents:

1. Florida Department of Transportation Roadway and Traffic Design Standards, Indices 17344 through 17359, latest edition.

2. Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Sections 705, 706, 710, 711, 971, and 993, latest edition.

3. USDOT, Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways, latest edition.

1.2 DESCRIPTION OF WORK

The work under this section includes the installation of temporary and permanent pavement markings. The Contractor shall furnish all labor, materials, tools, supplies, equipment, and machinery necessary to fully complete the work shown in the plans and in these specifications.

PART 2 – PRODUCTS

2.1 MATERIALS

All materials shall be new and of good quality unless otherwise specified. The Contractor shall, if requested by the Engineer, furnish samples of material and/or shall certify that the material meets all FDOT requirements. All material or work that has been rejected shall be remedied by the Contractor at his own expense and without delay. If the Contractor fails to promptly remove and/or dispose of rejected material and replace the same, the Owner may remove and replace the same and deduct the cost of the work from the contract amount.

2.2 TEMPORARY PAVEMENT MARKINGS

Materials for temporary pavement marking shall meet all requirements of FDOT Specs, Section 710, latest edition.

2.3 PERMANENT PAVEMENT MARKINGS

Materials for permanent pavement markings shall meet all requirements of FDOT Specs, Section 710 or 711, latest edition, as noted on the plans.

PART 3 – EXECUTION

3.1 GENERAL

All pavement markings shall be applied in accordance with FDOT requirements.

3.2 PERMANENT PAVEMENT MARKINGS

Permanent pavement markings, including painted stripes, thermoplastic stripes, and reflective pavement markers, shall be installed as shown on the plans. Materials and installation shall conform to applicable standards in the documents referenced in herein. Installation of permanent markings on all final asphaltic concrete surfaces shall not be accomplished prior to 14 calendar days, nor later than 30 calendar days, after placement of the final surfaces.

END OF SECTION 02516

SECTION 02525

ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specifications sections, apply to work of this section. The Standard Specifications referenced in this section refer to the Florida Department of Transportation Standard Specifications for Road and Bridge Construction (FDOT Specs), Latest Edition.

1.2 DESCRIPTION OF WORK

A. Extent of asphalt concrete paving work is shown on drawings.

1.3 SUBMITTALS

A. Material Certificates: Provide copies of material certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.4 JOB CONDITIONS

A. Weather Limitations: Apply prime and tack coats when ambient temperature is above 40 degrees F (4 degrees C), and when temperature has not been below 35 degrees (1 degree C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

B. Construct asphalt concrete surface course when atmospheric temperature is above 40 degrees F (4 degrees C), and when base is dry.

C. Grade Control: Establish and maintain required lines and elevations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Use locally available materials and gradations which exhibit a satisfactory record of previous installations.

B. Surface Course Aggregate: Crushed stone, crushed gravel, or crushed slag, and sharp-edged natural sand.

C. Use only fine graded Type SP asphalt mixes as defined by FDOT Section 334. Fine graded mixes are defined as having a gradation that passes above the restricted zone when plotted on an FHWA 0.45 Power Gradation Chart.

1. Fine Mixes: The allowable structural layer thicknesses for fine Type SP Asphalt Concrete mixtures are as follows:

Type SP 9.5	3/4 – 1 1/4 inches
Type SP 12.5	1 1/4 – 2 1/2 inches
Type SP 19.0	2- 2 3/4 inches

2. Additional Requirements: The following requirements also apply to fine Type SP Asphalt Concrete mixtures:

a. A minimum 1 1/2 inch initial lift is required over an Asphalt Rubber Membrane Interlayer (ARMI).

b. When construction includes the paving of adjacent shoulders (5 feet wide or less), the layer thickness for the upper pavement layer and shoulder shall be the same and paved in a single pass, unless shown differently in the plans.

c. Use the minimum and maximum layer thicknesses as specified in above unless shown differently in the plans. On variable thickness overbuild layers, the minimum allowable thickness may be reduced by 1/2 inch, and the maximum allowable thickness may be increased 1/2 inch, unless shown differently in the plans.

D. Prime and tack coats shall be provided in accordance with FDOT Section 300.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Proof roll prepared base surface to check for unstable areas and areas requiring additional compaction.

B. Notify Engineer of unsatisfactory conditions. Do not begin paving work until deficient base areas have been corrected and are ready to receive paving.

C. Prime Coat: Apply at rate of 0.10 gal. per sq. yd. (minimum), over compacted base. Apply material to penetrate and seal, but not flood, surface. Cure and dry as long as necessary to attain penetration and evaporation of volatiles.

D. Tack Coat: Apply to contact surfaces of previously constructed asphalt or Portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. Distribute at rate of 0.02 to 0.08 gal. per sq. yd. of surface.

1. Allow to dry until at proper condition to receive paving.

2. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.

E. General Construction Requirements: Surface preparation and application of patching, leveling and surface courses shall conform to FDOT Specs Section 330, Paragraphs 330-8, 330-9 and 330-10.

3.2 PLANT MIX ASPHALTIC STRUCTURAL/SURFACE COURSE:

A. General: This work shall consist of a structural and/or wearing surface constructed of asphaltic concrete on a prepared base or existing asphalt pavement, in accordance with the plans and specifications.

B. Materials: The materials and construction methods shall comply with those set forth for Superpave Asphaltic Concrete in the latest edition of the Standard Specifications, Sections 330 and 334.

C. Job Mix Formula: Design the Type SP asphalt mixture in accordance with AASHTO PP-28, except as noted herein, to meet the requirements of this specification. Use only previously approved design. Prior to the production of any Type SP asphalt mixture, submit the proposed mix design with supporting test data indicating compliance with all Type SP asphalt mix design criteria.

The Engineer will consider any marked variations from original test data for a mix design or any evidence of inadequate field performance of a mix design as sufficient evidence that the properties of the mix design have changed, and the Owner or its representative will no longer allow the use of the mix design.

1. Gyratory Compaction: Compact the design mixture in accordance with AASHTO TP-4. Use the number of gyrations as defined in the Table below:

Type SP Design Gyratory Compactive Effort			
	$N_{initial}$	Ndesign	$N_{maximum}$
SP Mixes	7	75	115

2. Volumetric Criteria: Use an air void content of the mixture at design of 4.0% at the design number of gyrations (Ndesign). Meet the requirements of the Table below:

Mixture Densification Criteria % G_{mm}			
	$N_{initial}$	N_{design}	$N_{maximum}$
SP Mixes	≥89.0	96.0	≤98.0

3. VMA Criteria: Meet the requirements of the Table below for voids in the mineral aggregate (VMA) of the mixture at the design number of gyrations.

VMA Criteria	
Type Mix	Minimum VMA (%)
SP 9.5	15.0
SP 12.5	14.0
SP 19.0	13.0

4. VFA Criteria: Meet the requirements of the Table below: for voids filled with asphalt (VFA) of the mixture at the design number of gyrations.

VFA Criteria	
	Design VFA (%)
SP Mixes	65 - 75

5. Dust Proportion: Use an effective dust-to-binder ratio as defined in FDOT Section 334-3.2.5.

6. Moisture Susceptibility: Provide a mixture (4 inch specimens) having a retained tensile strength ratio of at least 0.80 and a minimum tensile strength (dry and unconditioned) of 100 psi.

7. Additional Information: In addition to the requirements listed above, provide the following information with each proposed mix design submitted for use:

   a. The design number of gyrations (N_{design}).
   b. The source and description of the materials to be used.
   c. The FDOT source number product code of the aggregate components furnished from an FDOT approved source.
   d. The gradation and proportions of the raw materials as intended to be combined in the paving mixture. The gradation of the component materials shall be representative of the material at the time of use. Compensate for any change in aggregate gradation in handling and processing as necessary.
   e. A single percentage of the combined mineral aggregate passing each specified sieve. Degradation of the aggregate due to processing (particularly –No. 200 [-75µm]) should be accounted for and identified for the applicable sieves.

f. The bulk specific gravity value for each individual aggregate (and RAP) component as identified in the FDOT aggregate control program.
g. A single percentage of asphalt binder by weight of total mix intended to be incorporated in the completed mixture, shown to the nearest 0.1%.
h. A target temperature at which the mixture is to be discharged from the plant and a target roadway temperature (per 330-6.1.3). Do not exceed a target temperature of 340˚ F for modified asphalts and 315˚ F for unmodified asphalts.
i. Evidence that the completed mixture conforms to all specified physical requirements.
j. The name of the Mix Designer.

D. Thickness: The thickness of the new pavement shall be as shown on the construction plans. This requirement shall be checked by cores and where a deficiency of more than ¼" exists, the Contractor will be required to correct the deficiency either by replacing the full thickness or overlaying the area to the satisfaction of the Engineer.

3.3 PLACING THE MIX

A. Notify the Engineer at least 48 hours prior to commencement of any paving operation.

B. General: Place asphalt concrete mixture on prepared surface, spread and strike-off. Spread mixture at minimum temperature (per FDOT). Place inaccessible and small areas by hand. Place each course to required grade, cross-section and compacted thickness.

C. Pavement Placing: Place in strips not less than 12' wide, unless otherwise acceptable to Engineer. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.

D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

3.4 ROLLING

A. General: Begin rolling when mixture will bear roller weight without excessive displacement.

1. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

C. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

D. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

E. Patching: Remove and replace paving areas mixed with foreign materials and defected areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

1. Erect barricades to protect paving from traffic until mixture has cooled enough to become marked.

3.5 TRAFFIC CONTROL

A. Temporary and permanent pavement markings shall conform to applicable Division 2 specifications.

B. Maintenance of Traffic: Suitable methods shall be used by the contractor to protect the new pavement from all types of vehicular traffic without damage. Opening to traffic does not constitute acceptance of work. Conform to requirements of applicable Division 2 specifications.

3.6 FIELD QUALITY CONTROL

A. General: Test in-place asphalt concrete courses for compliances with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Engineer. Contractor to replace asphalt removed for testing purposes.

1. Should any work or materials fail to meet the requirements set forth in the plans and specifications, Contractor shall pay for retesting of same.

2. Make at least one coring of asphalt for thickness and density for every 300 linear feet of pavement, but in no case less than 3 corings. Take two plant samples per day and 2 drilled cores for density each day.

B. Thickness: In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:

New Pavement Course: ¼", plus or minus.
Overlay Pavement Course: ¼", plus or minus.

C. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 15' straightedge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness.

1. Any Course Surface: 3/16"

2. Check surfaced areas at intervals as directed by Engineer.

END OF SECTION 02525

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SECTION 02556
POTABLE WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION OF WORK

The Contractor shall furnish and install all pipes, fittings, structures and accessories required for water transmission, distribution and/or service lines in accordance with the requirements of the Construction Plans and related Contract Documents.

1.2 COMMONLY USED ACRONYMS

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASSE	American Society of Safety Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CA	Concrete Asbestos
CI	Cast Iron
DI	Ductile Iron
DIPS	Ductile Iron Pipe Standard
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FLG	Flange
HDPE	High-Density Polyethylene
MJ	Mechanical Joint
MSS	Manufacturer's Standardization Society
NSF	National Standards Foundation
OD	Outside Diameter
PVC	Polyvinyl Chloride

SBR	Styrene Butadiene Rubber
SF	Suction Flange

1.3 QUALITY ASSURANCE

A. AWWA Standards - Construction materials and methods shall comply with the requirements of the latest published edition of American Water Works Association (AWWA) Standards. Applicable standards include, but may not be limited to, the following:

AWWA C104	Cement Mortar Lining for Ductile Iron Pipe and Fittings
AWWA C105	Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	Ductile-Iron and Gray-Iron Fittings
AWWA C111	Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
AWWA C151	Ductile Iron Pipe, Centrifugally Cast
AWWA C153	Ductile Iron Compact Fittings, For Water Service
AWWA C213	Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
AWWA C301	Pre-stressed Concrete Cylinder Pressure Pipe (PCCP), 16-in. and Larger
AWWA C502	Dry Barrel Fire Hydrants
AWWA C504	Rubber Seated Butterfly Valves 3-in. (75 mm) Through 72-in. (1,800 mm)
AWWA C509	Resilient Seated Gate Valves For Water Supply Service
AWWA C510	Double Check Valve Backflow Prevention Assembly
AWWA C511	Reduced-Pressure Principle Backflow Prevention Assembly
AWWA C515	Reduced-Wall, Resilient Seated Gate Valves For Water Supply Service
AWWA C550	Protective Interior Coatings for Valves and Hydrants
AWWA C600	Installation of Ductile Iron Water Mains & Their Appurtenances
AWWA C605	Underground Installation of Polyvinyl Chloride (PVC) And Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
AWWA C651	Disinfecting Water Mains

AWWA C800	Underground Service Line Valves and Fittings
AWWA C900	PVC Pipe And Fabricated Fittings, 4-in. Through 12-in. (100 mm through 300 mm), For Water Transmission And Distribution
AWWA C901	Polyethylene (PE) Pressure Pipe and Tubing 1/2-in. (13 mm) through 3-in. (76 mm), For Water Service
AWWA C905	Polyvinyl Chloride (PVC) Pressure Pipe & Fabricated Fittings, 14-in. through 48-in. (350 mm through 1200 mm)
AWWA C906	Polyethylene (PE) Pressure Pipe & Fittings, 4-in. (100 mm) through 63-in. (1600 mm) for Water Distribution And Transmission

B. ASTM and NSF Standards - In addition, construction materials and methods shall also comply with the requirements of the latest published editions of the American Society for Testing and Materials (ASTM) Standards, and the National Sanitation Foundation (NSF) Standard 61.

ASTM A126	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A48	Standard Specification for Gray Iron Castings
ASTM B584	Standard Specification for Copper Allow Sand Castings for General Applications
ASTM B62	Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B88	Standard Specification for Seamless Copper Water Tube
ASTM D1248	Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM D1598	Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
ASTM D1599	Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings
ASTM D1693	Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D2241	Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2737	Standard Specification for Polyethylene (PE) Plastic Tubing
ASTM D3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
ASTM D429	Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates
ASTM F477	Standards Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

C. ASME and ANSI Standards - In addition, construction materials and methods shall also comply with the requirements of the latest published editions of the American Society of Mechanical Engineers (ASME) Standards, and the American National Standards Institute (ANSI).

ASME/ANSI B16.20	Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed
ASME/ANSI B16.1	Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
ASME/ANSI B 1.1	Unified Inch Screw Threads, UN and UNR Thread Form
ASME/ANSI B 1.20.1	Pipe Threads, General Purpose (Inch)
ASME/ANSI B 1.20.3	Dryseal Pipe Threads (Inch)

PART 2 - MATERIALS AND EQUIPMENT

2.1 GENERAL

All pipe, fittings and accessories shall be new, and shall be suitable and rated for potable water use. All pipe, fittings and accessories shall be rated for a pressure of 160 psi or greater. All water pipe and fittings shall be color coded blue in accordance with FDEP and AWWA requirements, and FAC 62-555.320.

2.2 DELIVERY, STORAGE, AND HANDLING

Certificates of Compliance with the Specifications may be required for all materials used on the Project. All materials are to be transported, stored, handled, and installed in accordance with the Manufacturer's recommendations to avoid physical damage. All materials shall be stored to prevent physical deterioration due to sun and weather. The Owner or its representative reserves the right to reject material which in any way does not meet the requirements of these Specifications.

2.3 WATER MAINS

A. Polyvinyl Chloride Pipe (PVC) - PVC pipe shall meet the designations on the table below and shall be provided with push-on joints with the bell integrally cast into the pipe. PVC pipe shall be installed with elastomeric gaskets meeting ASTM Standard F477 and meet the requirements of the following table.

PVC PIPE STANDARDS				
Standard	Nominal Size	Dimension Ratio	OD Classification	Pressure Rating (Psi)
ASTM 2241	2" – 3"	SDR 21	IPS	200
AWWA C900	4" – 12"	DR 18	DIPS	200
AWWA C905	14" – 36"	DR 18	DIPS	200

1. Markings - PVC pipe shall be marked to indicate the following:
   a. Nominal pipe size and OD base
   b. Material Code Designation
   c. Dimension Ratio
   d. Pressure Class or Pressure Rating
   e. Manufacture's Name or Trademark
   f. National Sanitation Foundation Approved Marking
   g. Appropriate AWWA or ASTM Standard Number
   h. Date Pipe Was Manufactured
2. Color Coding - Entire pipe shall be colored with blue pigment.

B. Ductile Iron Pipe (DIP) - Ductile iron pipe shall meet the requirements of the table below and have a design operating pressure of up to 150 psi, installed in Class 2 Trenching conditions. Increase pressure class or bedding class as required by AWWA C151 for surface loads greater than indicated or operating pressures greater than 150 psi. DIP shall be constructed with push-on joints using rubber gaskets in accordance with AWWA Standard C111. Other methods of joint construction, such as mechanical, flanged, or ball-and-socket, may be required in special applications as appropriate. All DIP shall meet the requirements of the following table.

DIP PIPE STANDARDS			
Standard	Nominal Size	OD Classification	Pressure Rating (Psi)
AWWA C151	3" – 12"	DIPS	350
AWWA C151	14" – 20"	DIPS	250
AWWA C151	24" – 64"	DIPS	200

1. Minimum Pipe Design Criteria –

   a. The minimum internal design working pressure shall provide/ensure: (1) a 100-psi surge allowance, (2) a safety factor of 2, and (3) a total internal design pressure of 600 psi. No reduction of safety factor for transient pressures shall be allowed.

   b. The external loads design criteria shall be a minimum of 4-foot depth of cover at 120 lbs. per cubic feet soil weight, and live load based on one AASHTO H-20 truck load. The thickness design of ductile iron pipe shall be in accordance with AWWA C150.

   c. The horizontal deflection of epoxy lined ductile iron pipe resulting from external load conditions shall not exceed three percent of the pipe diameter.

2. Joint Design –

   a. General – Ductile Iron pipe and fittings shall be furnished with push-on joints, push-on restrained joints, and flanged joints, as required.

   b. Push-on Joints – Push-on joints shall conform to AWWA C111. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR). Push-on joints shall be Fastite, as manufactured by American Cast Iron Pipe Company (ACIPCO), or equivalent. The pressure rating for push-on joints shall be a minimum of 350 psi or the specified pressure rating of the pipe, whichever is less.

c. Restrained Joints – Restrained joints shall be "Flex-Ring" restrained joints as manufactured by ACIPCO or equivalent. When restrained joints require factory welding, the Manufacturer shall qualify all welding procedures and welders used to produce the product per the requirements of a documented quality assurance system based on ANSI/AWS D11.2. Unless otherwise specified, gasket material shall be standard SBR. Restrained joints and restrained joint pipe shall have a working pressure rating of 350 psi for 3 to 16-inch sizes and 250 psi for 18 to 48-inch sizes. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes. The Manufacturer shall furnish test results showing that restrained joints in the sizes specified have been successfully tested to at least twice the specified pressure rating of the joint without leakage or failure. Tests shall be performed on pipe with nominal metal thickness less than or equal to that specified for the project.

d. Flanged Joints – Ductile iron pipe and fittings 3 to 54 inches for above ground service or in below ground pits shall have flanged joints and meet the following requirements:

1) Flanged ductile-iron pipe shall conform to current AWWA/ANSI Specification C115/A21.15 and C110/A21.10 with factory-applied screwed long hub flanges except as otherwise specified hereinafter. Flanges shall be fully machined faced and drilled after being screwed tight on the pipe, with flanges true to 90 degrees with the pipe axis and shall be flush with end of pipe conforming to ANSI B161.1, 125-pound std. or Class 250, for the purpose intended. No welding of flanges or accessories in the field will be acceptable.

2) Full face type 1/16-inch-thick red rubber ring gaskets shall conform to ANSI A21.11. Ring gaskets shall be of approved composition suitable for the required service.

3. Markings - Each ductile iron pipe section shall be marked to indicate the following:

a. Weight class or nominal thickness.

b. Letters DI or DUCTILE shall be cast or stamped on the pipe.

c. The Manufacturer’s mark.

d. Country where cast.

e. Date in which the pipe was produced.

f. Date when pipe was lined.

All required markings shall be clear and legible; and all cast marks shall be on or near the bell. All letters and numerals on pipe sizes 14-inch and larger shall be not less than 0.5-inch in height.

4. Color Code -

a. Potable water pipe shall have 3 blue stripes (1/2 inch wide) with permanent ink along the entire length of pipe with the word "POTABLE" in 3/4-inch-tall letters every 21 inches along each stripe.

5. Interior Coating of Ductile Pipe - DIP shall be lined in accordance with AWWA Standard C104, unless otherwise specified and approved.

6. Exterior Coating of Ductile Iron Pipe – The options for protection of the exterior of ductile iron pipe, fittings, etc. shall consist of one of the following: (1) standard shop coating and annealing oxide layer, (2) standard coating and annealing oxide layer plus polyethylene-encasement, (3) epoxy coating, or (4) epoxy coating plus heat shrink sleeves. Options (1) and (2) are typically used for buried pipe. Option (3) is typically used for pipe that is exposed, above grade. Option (4) is typically used in exposed locations where the presence of corrosive conditions may be present (e.g. ARV vaults).

a. Standard Coating – Coating type and amount per the requirements of the pipe and appurtenance Manufacturer.

b. Encasement – DIP shall be encased in the specified polyethylene material as indicated on the project plans. DIP shall be encased in 4 mil HDCL or 8 mil LLD polyethylene material in accordance with ANSI/AWWA Standard C105, using Encasement Method A (tube wrapped).

1) Location Information – The installed locations of polyethylene encasement of the DIP shall be documented on the final as-built project plans.

c. Epoxy Exterior Coating –

1) Shop Surface Preparation – Abrasive blast to remove loose annealing oxides, all rust and other contaminants. All surfaces shall have a minimum surface profile of 1.5 mils.

2) Field Surface Preparation – All abraded areas shall be abrasive blasted to remove all loose rust and shall result in a surface preparation equal to that listed above. All edges shall be feathered. All other surfaces shall be abraded to provide a sufficient surface profile for the proposed finish coat(s).

3) Coating – Utilize products by Sherwin Williams, SherGlass FF Epoxy for exposed piping, either above grade or within underground vaults, pits, etc. For pipe remaining exposed above ground, top-coating with a urethane (Acrolon Ultra) for color and gloss retention is required. The table below does not include the standard shop applied primer coating.

Approved Coating Products			
Coat	Product	Color	Dft
1st	* SherGlass FF Epoxy **	White	10.0 – 20.0
2nd	* SherGlass FF Epoxy **	White	10.0 – 20.0
Final	* Acrolon Ultra **	Purple	2.0 – 3.0

* Lining to be applied in a single coat
** Or approved equivalent

4) Discontinuity Testing – After cure of the lining, all surfaces shall be high voltage holiday tested in accordance with NACE RPO 188 (latest edition) and the recommendations of the Manufacturer.

d. Heat Shrink Sleeves – Heat shrink sleeve shall consist of a cross-linked and pre-stretched sheet (coated with a protective heat-sensitive adhesive) which, upon heating, will shrink to its original length. The sleeve adhesive will achieve the corrosion protection by preventing moisture and air ingress to the pipe surface. Further, the adhesive shall act to hold and anchor the backing around the joint through adhesion to the substrate and the backing. Careful attention required concerning the compatibility of the sleeves with pipe coatings. AWWA C216 covers the material and application requirements of heat-shrinkable cross-linked polyolefin coatings for the exterior of special sections, connections, and fittings for steel pipelines.

C. Polyethylene Pipe (HDPE) - HDPE pipe shall meet the requirements of the table below and shall be high performance, high molecular weight, high density polyethylene pipe and shall conform to ASTM D 1248 (Type III C, Class C, Category 5). Minimum cell classification values shall be 345464C, as referenced in ASTM D 3350 - latest edition. All pipe resin shall be manufactured by the same company that manufactures the pipe itself in accordance with these specifications

to ensure complete resin compatibility and total product accountability. The fittings shall be molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe. To ensure compatibility of polyethylene resins, all fittings supplied under this specification shall be of the same Manufacturer as the pipe being supplied.

HDPE PIPE STANDARDS				
Standard	Nominal Size	Dimension Ratio	OD Classification	Pressure Rating (Psi)
AWWA C901	1.5”	DR 9	CTS	200
AWWA C901	2”	DR 9	CTS	200
AWWA C901	3”	DR 11	IPS	200
AWWA C906	4”+	DR 11	DIPS	200

1. Quality Control - Refer to the following guidelines regarding quality control:

   a. The resin used to manufacture the pipe shall be produced by the pipe Manufacturer, thus maintaining complete control of the pipe quality. The pipe shall contain no recycled compound except that generated in the Manufacturer’s own plant from resin of the same specification and from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects, and shall be identical in color, density, melt index, and other physical properties.

   b. The Engineer may request, as part of the quality control records submittal, certification that the pipe produced is represented by the quality assurance testing. Additionally, test results from Manufacturer’s testing or random Manufacturer’s representation, may be cause for rejection of pipe represented by the testing. These tests may include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D 3350, 10.1.9.

1) Verification - The Owner or the specifying Engineer may request certified lab data to verify the physical properties of the materials supplied under this specification or may take random samples and have them tested by an independent laboratory.

2) Rejection - Polyethylene pipe and fittings may be rejected for failure to meet any of the requirements of this specification.

3.2 Color Coding –

a. Potable water pipe shall have 3 blue stripes (1/2 inch wide) with permanent ink along the entire length of pipe with the word "POTABLE" in 3/4-inch-tall letters every 21 inches along each stripe.

b. Entire pipe shall be colored with blue pigment.

3. Alternate Pipe Materials - The Owner may consider other pipe materials as appropriate for the needs of the Project. Alternate pipe materials identified during design and approved for use on the Project shall be noted on the Construction Plans.

2.4 WATER MAIN APPURTENANCES

A. Water Main Fittings -

1. General – All water main fittings shall be blue in color in accordance with FDEP and AWWA requirements, and FAC 62-555.320.

2. PVC Or Ductile Iron Pipe Fittings - Water main fittings shall include Tees, Wyes, Bends, Reducers, and other appurtenances commonly used in pipe construction. Fittings shall be ductile iron meeting AWWA Standard C110 or C153 with pressure ratings of not less than that specified for adjacent pipe. Fittings shall be constructed with mechanical joints, unless otherwise specified, and shall be supplied complete with low alloy bolts and nuts, SBR gaskets and other necessary parts required for field assembly. Fittings shall be cement-mortar lined in accordance with AWWA Standard C104/A21.4.

B. HDPE Pipe Fittings -

1. Mechanical connections of HDPE pipe (4 inch and larger) to ductile Iron or PVC piping, mechanical joint fittings, or valves shall be through a self-

restraining, fusible mechanical joint adapter. Mechanical joint adapter shall be the same SDR rating as the pipe. Provide the mechanical joint adapter, including but not limited to longer tee bolts and all thread rods with nuts at the mechanical joint bell.

2. Mechanical connections of HDPE pipe sized under 4 inches to ductile iron or PVC piping, mechanical joint fittings, or valves shall be through the use of the above specified mechanical joint adapter if available. As an alternate, transition fittings of HDPE by male iron pipe threaded end installed by butt fusion may be used.

C. Pipe Couplings -

1. Pipe couplings shall be solid sleeve type with mechanical joints at each end containing a compression gasket. Couplings shall be ductile iron, 12 inches minimum in length, with low alloy bolts and nuts, and SBR gaskets. Rings and gaskets shall be sized to conform exactly to the requirements of the pipe Manufacturer.

2. For transition between asbestos cement and PVC or DI pipe types, Hymax 2000 Series, Romac Macro HP, Couplings, or approved equal, shall be used.

3. Polyethylene pipe and fittings may be joined using approved electro fusion couplings. Fittings shall be PE3408 HDPE. Electro fusion fittings shall have a pressure rating equal to the pipe.

D. Pipe Cut-In Sleeves - Cut-in sleeves shall be solid ductile iron, one end plain for insertion to female fitting, the other end flanged mechanical joint, furnished with loose attaching flange and fastener, nominal length of 20-21 inches. Specify pipe main size and type of pipe fabrication.

Approved Manufacturers – Pipe Cut-in Sleeves		
Manufacturer	**Model**	**Application**
Clow	F-1220	for centrifugally cast or sand cast pipe (special)
Clow	F-3459	for all classes of centrifugally cast pipe
Union Foundry	21-4520 21-4610 24-4800	MJ X PE FLG X PE MJ X FLG
Others as approved by Owner in writing.		

E. Repair Clamps - Repair clamps shall not be used in the installation of new pipe except with the written permission of the Engineer. Repair clamps shall be full circle and selected based on the table below.

Repair Clamp Sizes	
Pipe Diameter	
Up to 12-inch	Single Band
14-inch and above	Double Band

1. Repair clamps shall be composed of stainless-steel bands and bolts, DI lugs and full gridded virgin SBR compounded gasket.

2. Repair clamps shall be sized so that the OD of the existing pipe being repaired falls within the designated range for the clamp size. Repair clamps shall have ample length to give full gasketing at both ends.

Approved Manufacturers	
Manufacturer	Model
Ford	FS series (all SS)
Smith Blair	226, 228
Others as approved by Owner in writing.	

* See Manufacturer's catalog to complete model numbers by size.

F. Pipe And Fitting Restraints –

1. Joint restraints and thrust blocks are required for 90-degree bends, 45-degree bends, tees, tapping sleeves, dead-ends, and fire/flushing hydrants. Joint restraints shall be used in conjunction with all pipes, fittings and appurtenances. Joint restraints shall be used on pipe and fittings in each direction.

2. Restraints shall have set or anchor screws used to secure body to pipe with torque limit break away head design.

Approved Manufacturers	
Manufacturer	Model
Smith Blair	Cam-Lock 111, 120
Sigma	One-Lok
Ebba Iron	MegaLug Series

Others as approved by Owner in writing.

G. Expansion Joints -

1. Expansion joint fittings shall be used where specified on the Construction Plans. They shall be of the rigid or flexible type as specified, and manufactured of ductile iron in accordance with the DIP specified herein. They shall be capable of expanding or contracting to the extent specified by the Engineer, but in no case less than 4-inches axially, and designed to prevent separation beyond the maximum extension without the use of external tie rods.

2. Fittings shall be flanged or provided with restrained mechanical joints, individually pressure tested to a minimum of 350 psi against their own restraints, and internally coated on all exposed surfaces with a minimum of 15 millimeters of fusion bonded epoxy conforming to AWWA C116. They shall be capable of deflecting at least 15 degrees by means of an integral ball at each joint in the case of flexible types.

Approved Manufacturers		
Type	**Manufacturer**	**Model**
Rigid	EBAA Iron, Inc.	EX-TEND 200
Flexible	EBAA Iron, Inc.	Flex-Tend
Others as approved by Owner in writing.		

H. Tapping Sleeves -

3. The minimum size tapping sleeve shall be 4 inches. Connection of 3-inch lines to existing pipes 4 inches and larger shall be made by a 4-inch tapping sleeve with appropriate reducing fitting. Tapping saddles shall be used for smaller connections.

4. Tapping sleeves shall be designed for a working pressure of 200 psig without leakage. Tapping sleeves shall be all stainless steel including stainless steel flange. The outlet branch connection shall have a recessed flanged face for connection of tapping valve with standard dimensions in accordance with Manufacturers Standardization Society (MSS) SP-60. A complete set of neoprene or other elastomer gaskets shall be furnished. Sleeves shall be furnished to fit ductile iron, cement-asbestos, Class 160 or C900/905 PVC pipe with side connection as shown on plans or

specifications in standard pipe sizes. Sleeves shall be furnished with all necessary installation parts.

Approved Manufacturers	
Manufacturer	**Model**
Ford	FAST
Mueller	H-304SS
JCM Industries	432
Romac	
Smith-Blair	663, 665
Others as approved by Owner in writing.	

Note: To specify exact fitting when ordering, confirm line outside diameter and material. Confirm compatibility of selected fitting with existing main material.

I. Pipe Hangers and Supports - Hangers and supports shall be in compliance with Federal Specification WW-H-171E, or Manufacturer's Standardization Society SP-69, or UL listed. Materials of construction shall be in accordance with the requirements outlined in the table below.

Approved Materials for Construction of Pipe Hangers and Supports	
Part I.D.	**Material**
Clamps	Steel - Epoxy Coated or Galvanized Cast Iron - Galvanized Malleable Iron
Hanger Rods	Steel - Electro Galvanized Steel - Stainless 304
Roller Bases/Roller Stands	Cast Iron
Fasteners/Fittings	Galvanized Steel Stainless
Hanger Rod Inserts	Steel - Cadmium Plated Steel - Galvanized Universal Concrete Insert - Cast Iron - Galvanized
Rod Attachments	Clevis - Forged Steel Turnbuckle: 1) Forged Steel, 2) Malleable Iron Sockets, Eye Nuts, Extension - Malleable Iron
Roller Bases/Roller Stands	Cast Iron
Rollers	Steel or Iron Core, Insulated from Structure

Approved Manufacturers – Pipe Hangers and Supports		
Manufacturer	**Part I.D.**	**Model No.**
Utility Pipe Sales	Clevis Hanger	590
	Socket Clamp	224 246
	Concrete Inserts: CB-Universal Screen Insert	 282 152
	Rod Attachments: Eye Nut Forged Clevis Forged Turnbuckle Carbon Steel Couplings Socket Eye Extension	 290 299 230 233 136 110R 157
	Pipe Rolls: Adjustable Swivel Adjustable Steel Yoke	 174 181
	Pipe Roll with Base	274
	Pipe Roll and Plate	277
Others as approved by Owner in writing.		

J. Valves - All valves shall be manufactured in accordance with the current appropriate AWWA Standard and shall be NSF approved for use in potable water.

1. Resilient Seated Gate Valves - Resilient seated gate valves shall be designed and fabricated in accordance with the current AWWA Standard C-509 or C-515. The basic design of the gate valves shall have an iron body, elastomer encapsulated iron disc, bronze stem and operating nuts with non-rising stem design. Valves 16-inches and larger shall be equipped with right angle gears (bevel gearing) for horizontal installation. The valve working pressure for all sizes shall be a minimum of 250 psig with a test pressure of 500 psig.

1. Materials And Construction - Valves shall open counterclockwise with a 2-inch square iron operating nut secured to the valve stem by a corrosion resistant Type 304 stainless steel nut to threads on the valve stem. The valve stem shall be made of high tensile strength bronze and shall be of one-piece construction sealed by O-Rings. The thrust collar shall be secured in place by a stuffing box or bonnet cover with a thrust washer located above the thrust

collar. Valve construction shall be so that upper O-Rings can be replaced with the valve in service. The disc shall be cast iron encapsulated with an elastomer material bonded in accordance with ASTM D429 and shall be secured to the threaded stem by a bronze nut. The disc shall effect a seal that is bubble-tight at 250 psig.

b. Body-Disc-Bonnet-Operating Nut Material - Cast ductile iron construction in accordance with current AWWA Standard C-509 and C-515 and AWWA Standard C-153. Body bolts shall be equipped with square or hex head bolts for easy removal.

c. Corrosion Resistant Coatings - All interior and exterior cast iron surfaces shall be coated with fusion bonded epoxy in accordance with AWWA Standard C-550.

d. Body Sizing - Valve body length shall be per ASME/ANSI B16.20 for the type of end connections specified. In the fully open position, the valve internal bore shall be smooth and obstruction-free without cavities or projections that could accumulate solids. The internal cross-sectional area of the valve shall be approximately equal to the nominal cross-sectional area of the adjoining pipe.

e. End Connections -

1) Valves shall be furnished with mechanical joint end connections, complete with accessory kits, unless otherwise specified on the plans.

2) When flanged ends are specified, they shall be flat face class 125, conforming to ASME/ANSI B16.1 with bolt holes straddling the vertical center line.

Approved Manufacturers - Resilient Seated Gate Valves						
Manufacturer & Specs			**Valve Body Connections**			
			Mechanical Joint	**Flange & Mechanical Joint**	**Flanged End**	**Mechanical Joint for Tapping**
			(MJxMJ)	**(FLGxMJ)**	**(FLGxFLG)**	**(MJxSF)**
American Flow Control		Size:	2" - 12"	2" - 12"	2" - 12"	2" - 12"
		Model No.:	AFC2500	AFC2500	AFC2500	AFC2500
Clow	C-509	Size:	2" - 12"	3" - 12"	2" - 12"	3" - 12"
		Model	F-6100	F-6106	F-6102	F-6114
	C-515	Size:	4" - 48"	4" - 48"	4" - 48"	4" - 24"
		Model	F-6100	F-6106	F-6102	F-6114
Kennedy	C-509	Size:	2" - 12"	3" - 12"	2" - 12"	4" - 12"
		Model	8571SS	8572SS	8561ASS	8950SS
	C-515	Size:	2" - 12"	3" - 12"	2" - 12"	4" - 12"
		Model	7571SS	7572SS	7561SS	7950SS
M&H	C-509	Size:	2" - 12"	3" - 12"	2" - 12"	4" - 12"
		Model	4067-01	4067-13	4067-02	4751-01
	C-515	Size:	2" - 16"	3" - 16"	2" - 16"	4" - 16"
		Model	7571	7572	7561	7950
Others as approved by Owner in writing.						

2. Resilient Seated Tapping (Gate) Valves - Resilient seated tapping gate valves shall be designed and fabricated in accordance with the specifications for resilient seated gate valves noted above.

   a. Body Sizing - Valve body length shall be per ASME/ANSI B16.20 for tapping valves. Tapping valves shall conform to Specification AWWA C509 or C515, latest revision, covering gate valves except as modified for passage and clearance of tapping machine cutters. The opening through the valve shall be at least 1/4-inch larger than nominal valve diameter. Tapping valves shall allow full size shell cutters to be used.

   b. End Connections - Valves shall be furnished with one end of the body with projecting face flange in accordance with specification MSS SP-60 for tapping valve/saddle connections to bolt to a standard tapping sleeve and the other end for mechanical joint.

3. Butterfly Valves - All butterfly valves shall be of the rubber-seated, tight-closing type. They shall meet or exceed AWWA Standard C504. All valves must use full AWWA C504 Class 150B valve shaft diameter, and full Class 150B underground service operator torque rating throughout entire travel, to provide capability for operation in emergency service.

   a. Valve Construction - Valve body shall be high-strength ductile iron ASTM A126 with ASTM 276 18-8 Type 304 stainless steel body seat. Valve vane shall be high strength cast iron ASTM A126, having rubber seat mechanically secured with an integral 18-8 stainless steel clamp ring and 18-8 stainless steel self-locked screws. Shaft shall be one piece ASTM 276 Type 304 stainless steel. Bearings shall be sleeve-type, self-lubricated with O-Ring seals.

   b. Operators - Operator shall be of the traveling-nut type, sealed, gasketed, and lubricated for underground service. It shall be capable of withstanding an overload input torque of 450 ft. lbs. at full-open or closed position without damage to the valve or valve operator. Operator shall have operating nut or post indicator as specified.

   c. End Connection - End connections shall be mechanical joint, wafer-type with flange meeting ANSI B16.1 Class 125 and furnished as specified.

Approved Manufacturers	
Manufacturer	**Model**
Clow	F-53XX*
M & H	450, 1450, 4500
Others as approved by Owner in writing.	

* XX: See Manufacturer's catalog to complete model numbers by size.

K. Valve Vaults and Boxes –

1. Valve boxes shall be provided for all direct buried valves. Use nominal (5 ¼) inch cast-iron, screw-type pipe shaft with cover and base casting. The box top shall be set at finished grade and encased with a concrete ring in unpaved areas. Each valve box shall be furnished with a drop-in cover marked "WATER".

2. Valve Vaults or Chambers – All valves which are not designed for direct burial shall be installed in vaults, which shall be constructed from standard

precast concrete manhole sections. They shall be sized to allow sufficient room for maintenance and repair in situ.

L. Line Stops - Line stops are to be used where specified to temporarily stop water flow without depressurizing the entire line. The line stop parts and installation equipment are to be rated at a minimum of 150 psig working pressure unless otherwise specified.

1. Materials And Construction - Tapping saddles shall have 360-degree clamping on the main. All tapping saddles shall be fabricated of 304 Stainless Steel. All bolts and fasteners are to be 304 Stainless Steel, and the saddle shall be installed with Buna-N or neoprene rubber full facing gasket.

a. The stopping device attaching nozzle to be vendor's standard with connecting threads or flange face, and the nozzle I.D. to be manufactured with a shelf to provide a position stop for the closure plug.

b. The closure plug is to be fabricated carbon steel, ductile iron, or malleable iron with at least one Buna-N or neoprene O-Ring seal on the outside diameter.

2. Corrosion-Resistant Coatings - Non-stainless steel permanently installed parts to have Manufacturer's standard red or black water base epoxy coating.

3. Connection - Tapping saddle shall be fabricated with dimensions to fit on concrete, steel, CA, PVC, CI, DI main as specified.

4. Installation - Temporary line stops shall only be installed by vendor personnel or Contractor Personnel trained and certified for stop by the vendor.

M. Valve Insertions -

Approved Manufacturers (Main Sizes 4-inch – 42-inch)	
Manufacturer	**Contact**
Hydra-Stop, Inc.	Phone: 800-538-7867
JCM 440	Phone: 800-527-8482
Romac	Phone: 800-426-9341
Others as approved by Owner in writing.	

N. Location Aids - All new water main and service line installations shall include an approved method for locating lines from the ground surface after completion.

1. Tracer Wire - Tracer wire for water lines shall be minimum 12-gauge copper with blue PVC insulation for open trench installation. For trenchless installation, 8-gauge copper with blue PVC insulation shall be used. Tracer wire systems shall be electrically continuous covering all mains and services within the project. Wire-to-wire connections shall be made with silicone-filled wire nuts. Wire-to-appurtenance attachments shall be made with lug-type terminals. Wire shall be secured to the top of every other pipe joint with blue nylon ties or blue colored PVC tape.

Approved Manufacturers (Tracer Wire Silicone-filled Wire Nut Connectors)	
Manufacturer	**Model**
Ideal Industries	Twister® DB Plus
King Technology, Inc.	Failsafe™
Others as approved by Owner in writing.	

2. Tracer Tape - Tracer tape shall be approximately 3” wide indicator tape with aluminum inner foil sandwiched between plastic layers printed with appropriate warning; wording to be approved by the City. Tracer tape shall be Terra-Tape, or equivalent, and shall be buried directly above all non-metallic pipes no deeper than 18” below ground.

3. Curb Markers – Curb marker base material must be 30 ml. non-yellowing UVI plastic. UV resistant inks with a minimum 7-year rating will be used to decorate the marker surface. A clear urethane dome no less than 60 ml shall be applied to the surface. The dome must not yellow or pit. It must be self-healing and have a Durometer hardness of D-60. Marker must have a 12-year written warranty. Copy to be supplied by vendor. Marker must meet ADA minimum recommendations for slip resistance. Markers shall be as manufactured by DAS Manufacturing, Inc. or approved equal.

    a. Curb Marker Adhesive - Adhesive must permanently affix markers to concrete, asphalt and cast iron. Adhesive must be ready to use requiring no special surface preparation. Adhesive must have a shelf life of at least one year. Adhesive must be black in color and remain resilient for a minimum of twelve years. Adhesive must be available in a 5 oz. Re-sealable Squeeze Tube.

b. Provide curb markers per the following table:

CURB MARKER SPECIFICS			
TYPE	**Nominal Size**	**Color**	**Designation**
Potable Water Valve	2.5”	Blue	#2.5 NVA
Potable Water Meter	2.5”	Blue	#2.5 NMT

4. Composite Utility Marker

The Composite Utility Marker shall be a single piece marker capable of simple, permanent installation by one person using a manual driving tool. Upon proper installation, it shall resist displacement from wind and vehicle impact forces. The marker shall be of a constant flat "T" cross sectional design with reinforcing support ribs incorporated longitudinally along each edge to provide sheeting protection and structural rigidity. The bottom end of the marker shall be pointed for ease of ground penetration.

The Marker shall be constructed of a durable, UV resistant, continuous glass fiber and resin reinforced, thermosetting composite material which is resistant to impact, ozone, and hydrocarbons within a service temperature range of -40°F to +140°F.

The marker shall be pigmented throughout the entire cross-section so as to produce a uniform color, which is an integral part of the material. Ultraviolet resistant materials shall be incorporated in the construction to inhibit fading or cracking of the delineator upon field exposure. Color shall coincide with utility it is marking (i.e. blue for water, green for sewer, etc.).

Composite utility markers shall be as manufactured by Carsonite International Corporation or approved equal. All markers shall be installed with a decal as noted on the typical details.

2.5 HYDRANTS AND FLUSHING EQUIPMENT

A. Fire Hydrants - Fire Hydrants shall be in compliance with the AWWA Standard C-502, with rated working pressure of 250 psig. The basic design of the fire hydrant shall be of the dry barrel type of breakaway traffic design. Use 304 stainless steel bolting below grade, and use fusion bond epoxy coating on mechanical joint inlet shoe, per AWWA C-550.

1. Hydrant Construction -

   a. The hydrant inlet connection shall be 6-inch mechanical joint type complete with Accessory kit.

   b. The hydrant shall be designed with a safety feature incorporating a break-away flanged design. Split ring retainer-type breakaway design with pinch bolts is not acceptable. The hydrant design shall allow the upper barrel to be rotated 360 degrees in order to assure proper nozzle orientation.

   c. The drain valve shall assure quick and complete drainage of the hydrant and the drain hole shall be brushed with bronze if passing through ductile iron. The drain valve sealing facing shall be made of Buna N, nylon or urethane. If the valve top plate comes in contact with the bronze seat ring to facilitate draining of the hydrant, the valve top plate shall be made of bronze.

2. Main Hydrant Valve -

   a. The main hydrant valve shall be compression type, opening counterclockwise against system pressure and closing clockwise with system pressure. The main valve connection opening shall not be less than 5¼-inches. The main valve shall have a resilient seat.

   b. The hydrant shall be designed such that the operating threads on the stem are prevented from coming in contact with potable water and shall be enclosed in an operating chamber and sealed by O-Rings at the top and bottom of the chamber. The chamber shall be constructed for grease or oil lubrication with an installed grease fitting for maintenance.

   c. The operating nut shall be 1½-inches in size and pentagon in shape and of one-piece construction.

   d. The hydrant shall have one 4½-inch pumper nozzle, and two 2½-inch pumper nozzles having National Standard Hose coupling threads. The nozzles shall be field replaceable utilizing either a threaded or quarter-turn fitting with an O-Ring seal.

3. Operation And Maintenance Features -

   a. The hydrant shall not incorporate parts requiring field adjustment for proper operation.

b. The hydrant shall be designed to permit the removal of all working parts from the hydrant through the barrel without disturbing the earth around the hydrant.

c. Removal of the working parts of the hydrant shall be accomplished by use of a seat removal wrench. Hydrants requiring other special tools to perform removal of interior parts will not be accepted.

4. Materials - All operating parts including operating nut, hold-down nut, drain ring and seat ring shall be bronze. The valve seat ring shall thread into a bronze insert or drain ring to provide bronze-to-bronze seating. Breakaway stem coupling is to have bronze or stainless-steel bolts or pins.

5. Markings - The fire hydrant shall have permanent markings identifying the Manufacturer by name, initials or insignia, the size of the main valve opening, and the year of manufacture.

6. Approved Manufacturers -

Approved Manufacturers	
Manufacturer	**Model No.**
American Flow Control	B62B
M & H	129T
Mueller	A423
Others as approved by Owner in writing.	

B. Fire Hydrant Appurtenances -

1. Extensions Kits

a. Where required, hydrants shall be installed using original Manufacturer hydrant extension kits as necessary to position the hydrant breakaway flange above finish grade.

b. Stand extension shall be in standard lengths of 12, 24, 36, 48, and 60 inches.

2. Hydrant Connectors

a. Hydrant connector spools shall be ductile iron per AWWA C151 used for connection between the hydrant and lead valve, and shall incorporate joint restraints. One end of the connector spool shall have swivel flange.

b. Standard hydrant connector sizes shall be as follows:

1) 6-inch X 12-inch long

2) 6-inch X 24-inch long

3) 6-inch X 36-inch long

4) 6-inch X 48-inch long

5) 6-inch X 60-inch long

c. Hydrant Offset Connectors - When a height adjustment is required to avoid an obstruction between the hydrant shut-off valve and the hydrant, an offset fitting shall be used. Material to be ductile iron per ANSI/AWWA C153/A21.53. Sizes shall be as follows:

1) 6-inch X 18-inch long with 6-inch offset

2) 6-inch X 30-inch long with 12-inch offset

3) 6-inch X 41-inch long with 24-inch offset

3. Approved Manufacturers -

Approved Manufacturers		
Manufacturer	**Straight Hydrant Connector**	**Offset Connector**
Assured Flow Sales, Inc.	N/A	GRADELOK
Clow	✓	N/A
Others as approved by Owner in writing.		

C. Flushing Hydrants - Flushing hydrants shall be in general compliance with AWWA Standard C-502, with rated working pressure of 200 psig. A fully restrained gate valve shall be installed at each flushing hydrant per the typical details.

1. Hydrant Construction - Flushing hydrants shall meet the requirements of Paragraph 2.5.A.1 above, except the breakaway feature is not required.

2. Main Valve - Generally the same as Paragraph 2.5.A.2, except main valve opening shall be not less than 2-1/8 inches and the flushing hydrant shall have one (1) 2½-inch nozzle having national standard hose coupling threads.

3. Operation And Maintenance Features - Unless otherwise specified, the hydrant bury length shall be 30-36 inches. The bury length is the distance measured to the nearest 1/2 foot, from the bottom of the connecting pipe to the ground line of the hydrant.

4. Materials -All operating parts including operating nut, hold-down nut, drain ring and seat ring shall be bronze. The valve seat ring shall thread into a bronze insert or drain ring to provide bronze-to-bronze seating.

5. Markings - Flushing hydrant markings shall meet the requirements of Paragraph 2.5.A.2.5 above for fire hydrants.

6. Approved Manufacturers -

Approved Manufacturers	
Manufacturer	**Model**
M & H	Style 33
Mueller	A-411
Others as approved by Owner in writing.	

2.6 WATER SERVICE LINES

A. General – No galvanized pipe or fittings will be allowed. All fittings shall meet or exceed the requirements of NSF/ANSI Standard 61.

B. Polyethylene Tubing (HDPE) - Polyethylene service tubing shall meet the designations of the table below. However, only sizes up to 2 inches will be allowed. Services above 2 inches shall be PVC (refer to paragraph 2.3.C for service lines greater than 2 inches in diameter). All tubing must have a minimum cell classification of 445574 with code letter for blue colored tubing. PE tubing dimensions shall conform to ASTM D2737 with Copper Tubing OD base.

HDPE TUBING STANDARDS				
Standard	Nominal Size	Dimension Ratio	OD Classification	Pressure Rating (Psi)
AWWA C901	3/4” – 2”	DR 9	DIPS/CTS	200

1. Markings -

   a. Nominal Size

   b. Standard PE Code: 4710

   c. Tubing Dimension Ratio

   d. Pressure Class: PC200

   e. Manufacturer’s Name or Trademark

f. Tubing Shall Be Blue

g. Date Manufactured

2. Approved Manufacturers -

Approved Manufacturers	
Manufacturer	**Model**
Endot Industries	Endopoly, Endopure
Chevron – Phillips Performance Pipe	Driscoplex 5100 Series Ultra-Line
Others as approved by Owner in writing.	

C. Pipe Sleeves for Long Water Services - Long water services shall be sleeved in PVC or PE pipe color coded blue. The sleeves shall be a minimum of 2-inch diameter with no fittings and shall extend a minimum of eight-feet either side of the paved surface. The sleeve shall be one continuous leak free piece which is open on each end. The long service shall be sized according to the table shown below.

Pipe Sleeve Sizing For Long Water Services	
Service Size (inches)	**Sleeve Size (inches)**
1	2
2	4

2.7 SERVICE LINE APPURTENANCES

A. Fittings And Valves - Fittings and valves shall be manufactured in accordance with AWWA C-800 and be listed and approved by NSF for underground use in potable water service.

1. Material -

a. Fitting and valve bodies, plugs, and compression nuts shall be bronze, copper alloy no. C83600 and meet chemical and mechanical requirements of ASTM B62 or ASTM B584.

b. Component parts such as fasteners, seals, and packing may be of other materials selected for adequate endurance, corrosion resistance and strength in accordance with AWWA C-800.

2. Pressure - Fittings and valves shall be high pressure type for maximum allowable pressure of 150 PSIG, nominal operating pressure 100 psig.

3. Markings - Fittings and valves shall be marked as appropriate with the following information: Manufacturer’s name or logo; pressure rating; direction of flow; and size.

4. Thread Specifications - Refer to the following table regarding thread specifications:

Thread Specifications	
Thread Type	**Standard**
Unified Inch	ANSI/ASME B1.1
General Purpose Pipe	ANSI/ASME B1.20.1
Dryseal	ANSI/ASME B1.20.3

5. Pack Joint Couplings - Refer to the following table regarding pack joint couplings:

Pack Joint Couplings		
Type	**Manufacturer**	**Model**
Joint Couplings		
Copper or Plastic Tube X MPT	Ford Mueller	C84-XX H-15428-X
Copper or Plastic Tube X FPT	Ford Mueller	C14-XX H-15451-X
Copper or Plastic Tube to Tube	Ford Mueller	C44-XX H-15403-X
Female Copper Pipe (replaces flare nut) X Copper or Plastic Tubing	Ford Mueller	CO4-XX H-15071-X
Others as approved by Owner in writing.		

* XX: See Manufacturer's catalog to complete model numbers by size.

6. Tapping Saddles - Tapping saddles shall be either bronze or ductile iron with shop coat, with the exception of saddles for PE pipe. Saddles used to tap Class 160 PVC pipe shall be designed with mechanical features or stops to prevent over-tightening.

   a. Saddle Sizes -

      1) Main Pipe: 2-inch and above

      2) Tap Size: 1-inch, or 2-inch

   b. Refer to the following table regarding saddle sizes.

Acceptable Manufacturers		
Manufacturer	**Application**	**Model**
Ford	1-inch tap on PVC/steel OD pipe	S90-603
	1-inch tap on DI and CI Pipe	F-202
Others as approved by Owner in writing.		

7. Water Tubing Couplings - Water tubing couplings in sizes 1-inch, 1 ½-inch, and 2-inch only shall be bronze compression-type, inlet and outlet for PE or copper tubing. Crimp-type couplings are not acceptable. Refer to table below for acceptable manufacturers.

Acceptable Manufacturers	
Manufacturer	**Model**
Ford	C44-XX*
Mueller	H-15403-XX*

* XX: See Manufacturer's catalog to complete model numbers by size.

8. Meter Couplings - Meter couplings shall be bronze and sized as appropriate to accommodate the relevant meter. Inlet shall have male pipe thread. Refer to table below for acceptable manufacturers.

Acceptable Manufacturers	
Manufacturer	**Model**
Ford	C84-XX*
Mueller	H-15428-XX*

* XX: See Manufacturer's catalog to complete model numbers by size.

B. Service Line Valves

1. Corporation Stops - Corporation stops shall be lead free brass, high-pressure class, ball type, with inlet taper CC thread. Corporation stops shall be sized for the tubing as appropriate. Refer to table below for acceptable manufacturers.

Acceptable Manufacturers	
Manufacturer	**Model**
Ford	F-1003 NL
Others as approved by Owner in writing.	

2. Curb Stops - Cub stops shall be lead free brass, high pressure, ball-type with locking wings. Curb stops shall be sized for the tubing as appropriate. 2-inch valves shall be as specified in Section 2.4 J. Refer to table below for acceptable manufacturers.

Acceptable Manufacturers		
Manufacturer	**Size**	**Model**
Ford	1-inch	B43-342W-NL
Others as approved by Owner in writing.		

2.8 BACKFLOW PREVENTION ASSEMBLIES (ABOVE-GRADE)

Backflow prevention assemblies shall be manufactured in accordance with AWWA C-510 and AWWA C-511, and shall also be approved by ASSE and/or approved by NSF for use in potable water systems with a maximum continuous operating pressure of 150 psig, and capable of sustaining a hydrostatic test pressure of 300 psig. Backflow prevention devices shall be located immediately downstream of the Owner's control valve.

A. Materials And Construction - The body shall be cast iron with hot dip galvanized coating or fusion bonded epoxy on the interior and exterior, or cast bronze with a maximum lead content of 5 percent. Working parts and springs shall be bronze or stainless steel; valve discs shall be silicone rubber; diaphragms shall be fabric reinforced neoprene, and O-rings shall be Buna-N, neoprene, or silicone rubber. Check valve enclosures shall be glass-filled nylon or Teflon, or bronze or stainless steel. Other working parts shall be bronze or stainless steel.

B. Double-Check Valve - A double check valve assembly (DC) is a mechanical backflow preventer that consists of two independently acting, spring-loaded check valves. It includes shutoff valves at each end of the assembly and is equipped with test cocks. A DC is effective against backpressure backflow and back-siphonage but should be used to isolate only non-health hazards.

C. Reduced Pressure Assembly - A reduced pressure valve assembly (RP) is a mechanical backflow preventer that consists of two independently acting, spring-loaded check valves with a hydraulically operating, mechanically independent, spring-load pressure differential relief valve between the check valves and below the first check valve.

D. Pressure Vacuum Breaker - The pressure vacuum-breaker assembly (PVB) is a mechanical backflow preventer that consists of an independently acting, spring-loaded check valve and an independently acting, spring loaded, air inlet valve on the discharge side of the check valve. It includes shutoff valves at each end of the assembly and is equipped with test cocks. A PVB may be used to isolate health or non-health hazards but is effective against back-siphonage only and can only be used in an irrigation setting.

E. Appurtenances - All backflow assemblies shall be provided and installed as a complete assembly with all necessary fittings to enable testing in place. Tapped test ports shall be fitted with test petcocks in each body cavity. Inlet and outlet gate or ball valve shall be of the same line size as that of the body.

F. Approved Assemblies - The word “approved” when used with reference to a backflow prevention assembly, is an assembly which has been manufactured in full conformance with the standards established by the American Water Works Association titled: *AWWA C510-89 Standard for Double Check Valve Backflow Prevention Assembly*, or *AWWA C511-89 Standard for Reduced-Pressure Principle Backflow Prevention Assembly*, as such standards may be amended from time to time, and which comply with the laboratory and field performance specifications of the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California established by “Specification of Backflow-Prevention Assemblies: - Section 10 of the most current issue of the Manual of Cross-Connection Control.

2.9 BACKFLOW PREVENTION ASSEMBLIES (RESIDENTIAL)

Residential backflow devices shall be lead free brass, dual check, high pressure, with swivel meter nut by 3/4” female NPT. Refer to table below for acceptable manufacturers.

Manufacturer	Model
Ford	HHS-31-323-NL
Others as approved by Owner in writing.	

2.10 METER BOX

Meter boxes shall be sized to house the entire meter assembly, curb stop and backflow. Meter box lid shall be recessed to accept the touch/radio read meter antenna. Meter boxes shall be Carson HDPE as manufactured by Oldcastle, or approved equal.

PART 3 – EXECUTION

3.1 GENERAL

The Contractor shall provide all labor, equipment and materials as required to install all pipes, valves, fittings, and other appurtenances as indicated on the construction plans or as specified in the Contract documents.

3.2 POTABLE WATER LINE SEPARATION FROM SANITARY SEWER LINES

A. New or relocated water lines must be laid to provide a horizontal separation of at least three feet between the outside of the potable water main and the outside of a reclaimed water main. In locations where it is not feasible to comply with this requirement the Contractor shall refer to the conflict details on the construction plans.

3.3 PIPE INSTALLATION

The Contractor shall utilize equipment and methods in accordance with pipe Manufacturer's requirements and standard construction practices to ensure pipe installation to line and grade as indicated.

A. Trench Excavation - Contractor shall maintain a minimum of 30 inches and maximum of 36 inches of cover below finished grade unless otherwise approved by the Owner or its representative in writing.

B. Alignment - Pipe shall be installed along the alignment indicated by the construction plans. Accomplish horizontal and vertical changes in alignment of pipe with bends or other appropriate fittings. Joint deflection shall not exceed the recommendations of the pipe Manufacturer.

C. Pipe Preparation -The Contractor shall clean the interior of all pipes, fittings, and joints prior to installation. Pipes shall be inspected for defects prior to installation. Damaged pipe shall be rejected and removed from the project.

D. Pipe Installation -

1. Install pipe only when weather and trench conditions are suitable. Do not lay pipe in water. Join pipe in accordance with Manufacturer's recommendations.

2. Provide initial backfill or anchoring as necessary to prevent displacement and preserve alignment after establishing final position.

3. Encase water pipe in steel casing or use ductile iron pipe when crossing under pipe, conduit, or structure when a 6-inch separation distance cannot be maintained. This protection shall extend a minimum of 5 feet beyond crossed structure.

E. Crossings - Where the crossing of a roadway, water body, rail, or other obstacle requires trenchless installation, the materials and installation methods shall conform to Section 02300- "Horizontal Directional Drilling" or Section 02310- "Jack and Bore", as applicable.

F. Protection - Prevent the introduction of foreign matter into the pipe at all times. Close open ends of pipe with watertight fitting closures or plugs. Do not let water fill trench, but include provisions to prevent flotation should water control measures prove inadequate. Remove water, sand, mud and other undesirable materials from trench before removal of pipe closure piece.

G. Cutting - PVC or PE pipe shall be cut in a neat workmanlike manner, and the spigot end shall be beveled per Manufacturer's recommendation. Ductile iron pipe shall be cut in accordance with Manufacturer's recommendation. Do not allow

excessive heat to develop. Smooth and bevel cut end as per Manufacturer's recommendations. Use of pipe with damaged lining is unacceptable.

H. Closure Pieces - Closure pieces shall only be used where called for on plans. Closure may be accomplished with sleeve coupling as long as its length is such that gaskets are not less than 3 inches from pipe ends.

I. Restraints And Thrust Blocking - Mechanical joint restraints shall be furnished and installed for all water line fittings and appurtenances. Restraints and thrust blocks are required for 11.25-, 22.5-, 45- and 90-degree bends, tapping sleeves, tees, dead-ends, behind fire hydrants, and flushing hydrants.

3.4 APPURTENANCE INSTALLATION

A. Valves - Valves shall be installed with operating stems vertical for valves 16 inch and smaller. For valves larger than 16 inches, the valve may be installed horizontally. Horizontal valves shall be provided with a right-angle gear drive and flush port piping to the lower clean-out. Extensions shall be provided if the valve operating nut is greater than 24 inches below finish grade. Valves shall be installed on a suitable bearing surface as shown on the project plan details, to prevent vertical displacement.

1. Air release valves shall be located and installed at the down-stream end of all high points as shown in the details and on the approved construction plans.

2. Check valves, complete with vaults if applicable, shall be installed at locations shown in the approved construction plans in accordance with the Manufacturer's instructions.

B. Valve Boxes - Valve boxes shall be centered on the valve. The earth shall be compacted around each valve box to a distance of 4 feet on all sides of box, or to undisturbed trench face if less than 4 feet. An 18-inch diameter by 4-inch-thick collar shall be constructed and sloped to direct water away from the valve box. In lieu of the constructed collar, a 24-inch by 4-inch-thick pre-cast, sloped, concrete collar may be used.

C. Tracer Wire - Tracer wire shall be installed on all new water mains and on all new water service lines. The tracer wire shall be placed directly above the pipe and electrically continuous throughout the project. Tracer wire shall be secured to the pipe with PVC tape the same color as the wire insulation, at a maximum of 10-feet on center between tapings. The tracer wire shall be brought to the ground surface at each valve location in accordance with the details. Splices and/or connections in the tracer wire shall be installed with silicone-filled wire nuts designed for direct burial.

3.5 SERVICE LINE INSTALLATION

A. General - The Contractor shall install individual services with tracer wire from the new main to a convenient point on the right-of-way or property line for each house, building or unit that is currently served through a meter. New services for undeveloped lots shall be located 1 foot from the common property line.

1. This section will deal with service line tubing 1-inch and 2-inches in diameter, to serve 5/8-inch, 1-inch, 1 ½-inch, and 2-inch meters. The installation of service lines for 3-inch meters and larger shall be in accordance with the requirements for water main installation, (See Section 3.3 above).

B. Service Line Connections - Service lines shall be installed in accordance with the details. Tubing shall be installed in one continuous length from corporation stop to curb stop with no intermediate fittings. Service lines damaged after initial installation but before acceptance may be repaired by means of a single splice, except that no repair fittings will be permitted under any paving. The tap location shall be at least 10 feet from any sanitary sewer joint with less than 18 inches vertical clearance. Service taps shall be made with a tapping machine designed for the pipe material being tapped. Other types of tapping machines may be used upon prior approval by the Owner or its representative.

C. Long Service Lines - Unless otherwise noted on plans, HDPE pipe and tubing shall be installed at the shallowest depth that can safely and reasonably be achieved (but no less than 36 inches minimum). Depth shall take into account all utility conflicts, bend radius of the pipe, and bend radius of the drill stem. Where utilities cross under DOT, county and/or city roads, depth of cover shall comply with applicable permits and shall be adequate to provide reasonable measures to avoid damage to the road surface and/or road base.

3.6 TAPS ON PRESSURIZED LINES

Taps for service lines of 2-inch and smaller PE tubing shall be made using a tapping saddle. The Contractor shall perform taps on pressurized lines for the installation of pipes other than service lines of 2-inch and smaller PE tubing in accordance with these requirements:

A. Materials - All materials used for taps on pressurized lines shall meet the requirements of these specifications. Tapping sleeves shall be properly sized for the pipe being tapped. Resilient seated tapping valves shall be furnished with special end connections. All other material used to accomplish the tap shall meet the standards set forth by the AWWA for potable water construction.

B. Procedure - The Contractor shall notify the Owner or its representative three working days in advance of work. The Contractor shall in the presence of the Owner or its representative:

1. Expose the existing pipe at the location shown on the plans, and clean the section of the pipe to receive the tapping sleeve.

2. Check the tapping sleeve and valve for defects and make sure the gate fully retracts in the valve to allow the shell cutter free passage.

3. Assemble the tapping sleeve on the pipe, then install the tapping valve.

4. Hydrostatically pressure test the tapping sleeve and valve after it has been assembled on the water main using the test plug on the sleeve. The test shall be 150 psi minimum. The duration of the test shall be 2 hours.

5. Pour a thrust block behind the tapping sleeve sufficient to withstand the pressure of the new line. Also, provide a concrete pad or suitable bearing surface sufficient to support the weight of the sleeve, valve, and tapping machine. Concrete shall be in place a minimum of 24 hours prior to testing the main installation.

6. Assemble an approved tapping machine and proceed to make the necessary cut in accordance with the recommendation of the tapping machine Manufacturer. Approved tapping machines shall be:

   a. In good working condition.

   b. Designed for and have a cutting bit for the pipe material to be cut.

   c. Equipped with a depth of cut gauge.

   d. Designed to capture the coupon.

   e. Equipped with the Manufacturer’s recommended diameter shell cutter for the tap to be made.

   f. Tapping machine power head to be hydraulic or pneumatic drive; use of electric motor drives expressly prohibited.

   g. Tapping machine shall be disinfected prior to each use for potable water taps.

7. The following tapping chart may be used for field reference only:

Tap Size Reference Chart		
Nominal Main Size	**Tapping Valve ID AWWA Standard**	**Tapping Machine Shell Cutter OD**
2-inch	2 1/8-inch	1½ -inch
3-inch	3 1/8-inch	2½-inch
4-inch	4 1/4-inch	3½ -inch
6-inch	6 1/4-inch	5½ -inch
8-inch	8 1/4-inch	7½ -inch
10-inch	10 1/4-inch	9½ -inch
12-inch	12 1/4-inch	11½ -inch
14-inch	14 1/4-inch	Per Manufacturer's Recommendation.
16-inch	16 1/4-inch	Contractor shall submit shop drawings for valves and tapping machine for approval, prior to use. Per Manufacturer's Recommendation.
18-inch	18 1/4-inch	
20-inch	20 1/4-inch	
24-inch	24 1/4-inch	

8. Tap coupon shall be given to the Owner or its representative. If the coupon is lost in the main, Contractor shall, at his expense, dismantle main to retrieve the coupon. Main will be reassembled, pressure tested, and bacteriological tests retaken as required at Contractor's expense.

PART 4 - ACCEPTANCE REQUIREMENTS

4.1 INSPECTION

Upon completion of the installation, the system shall be inspected to ascertain that valves, fittings, fire hydrants, flush hydrants, etc. are located in conformance with the plans, and confirm that all 'as-built' measurements have been accurately taken. The Owner or its representative shall observe all appropriate activities related to properly placing the line in service including flushing, pressure and leakage testing, disinfection, and bacteriological sampling. Final connections and testing of fire hydrants shall be accomplished after final clearance of lines. Tracer wire shall be tested for continuity by the Contractor with the Owner or its representative present. The Contractor, with the Owner or its representative, shall make sure all main valves and hydrant valves are open.

4.2 NEW WATER MAIN CLEANING

All newly installed reclaimed water lines shall be flushed with potable water to remove any sediment, solids and/or foreign matter prior to testing. The Owner will make water available to the Contractor. Flushing shall be conducted at a sufficient velocity to clear the pipe. Discharge of flushing water must be through a 2-inch diameter pipe (or larger) and must be controlled so as not to cause any property damage. Chlorinated water must be disposed of in an acceptable manner. Flush water source connection shall incorporate backflow preventer and meter when required by the Owner or its representative.

A. If flushing is unsuccessful in satisfactorily removing debris from the line or for larger diameter lines (12" or larger) if designated on the plans, cleaning shall be performed by swabbing (pigging). Pipes shall be flushed and swabbed a minimum of 3 passes until line is clear. To facilitate this process, pigging launch stations and receiving pits shall be installed and incorporated into system as shown on the plans.

4.3 PRESSURE/LEAKAGE TEST

A. General - All newly installed water lines and appurtenances shall be pressure/leak tested to assure the strength of materials and quality of workmanship of the installation. Testing shall be conducted in accordance with the details and the requirements of AWWA Manual 23 for PVC and other flexible pipe or AWWA C600 for Ductile Iron Pipe. Leakage testing may be conducted concurrently with the pressure test.

B. Procedure -

1. Contractor shall notify the Owner or its representative three working days prior to a scheduled test. Tests are to be conducted in segments not to exceed three thousand (3,000) feet of pipe. Water in the new line shall be pumped up to a pressure of 150 psi minimum. This pressure shall be maintained for a minimum of two (2) hours by pumping a quantifiable amount of water into the line and record the amount of water added during the test period. This represents the leakage.

2. Pressure/leakage tests shall be deemed acceptable when leakage does not exceed that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133200}$$ (or 11.65 gpd/mi/inch/dia)

or $$L = \frac{ND\sqrt{P}}{7400}$$ for DI pipe 18' lengths

or $$L = \frac{ND\sqrt{P}}{6600}$$ for PVC pipe 20' lengths

where:

L = Maximum leakage, in gallons per hour.
S = Length of pipe under test, in feet.
N = Number of pipe joints in segment under test.
D = Nominal internal diameter of pipe, in inches.
P = Average actual leakage test pressure, psig.

3. Record all data for submission with as-built plans.

4. The Owner or its representative shall be present during test.

5. Refit and replace all pipe not meeting the leakage requirements. Repair clamps are not permitted.

6. Repair all visible leaks regardless of the amount of leakage.

7. When a satisfactory pressure/leakage test has been completed, reduce the pressure at or below normal line pressure, and continue on with line disinfection.

4.4 DISINFECTION

A. General - The Contractor shall provide all equipment, materials and testing apparatus required to perform disinfection in accordance with AWWA C651 and the typical details.

B. Procedure -

1. Prior to beginning disinfection, the Contractor shall submit information to the Engineer for approval of proposed materials and methods. The Owner or its representative will approve the number and location of all sampling points. Temporary sampling taps may be required consisting of a corporation cock with HDPE tubing.

2. Method of disinfection shall be the continuous feed method as described in AWWA-C651. Add chlorine to attain an initial concentration of 25 mg/l chlorine with 10 mg/l remaining after 24 hours.

3. Initial concentration is to be obtained by mixing proper amount of HTH granules (65 percent Cl) into auxiliary tank, then pump/meter into regulated flow into or through the pipe section.

4. Check the chlorine concentration at all sampling points after the line has been filled and air expelled. Check residual chlorine concentration at the end of 24 hours to confirm that 10 ppm (minimum) is present.

5. Alternate methods of disinfection such as “tablet” and “slug” methods as described in AWWA C651 will not be allowed.

C. Water Supply for Cleaning, Flushing and Disinfection - The Owner shall supply water for testing from the nearest available source. Flush main until chlorine concentration is 2 mg/l or less prior to taking bacteriological samples. Water source connection shall incorporate a backflow preventer.

1. Check concentration at all sample point locations.

2. Disposal of chlorinated water shall be the Contractor's responsibility and shall be done without damage to public or private property. Chlorinated water disposal shall meet all State, Federal and local regulations.

D. Collection Of Samples - Two (2) satisfactory bacterial sample sets taken 24 hours apart must meet State requirements before placing the main into service.

E. Repeat Testing - Repeat flushing and disinfection procedure should initial disinfection fail to yield acceptable bacteriological results at no additional cost to the Owner.

4.5 OTHER CONNECTIONS

After new system piping has been satisfactorily tested and cleared for use, make any approved additional connections to the pre-existing distribution system. Exercise care in making connection and disinfect as needed. When total system is approved for use, the Owner or its representative shall verify that the Contractor has opened all interior valves as required. Valves connecting new installations to Owner's existing distribution system shall then be opened by the Owner or its representative.

4.6 TESTING FIRE HYDRANTS

All newly installed fire hydrants shall be flow tested by the Owner or its representative prior to final acceptance in accordance with established procedures. (Refer to AWWA-M17 and AWWA C502). Static Leak Test of hydrant shall be done in conjunction with Section 4.3 with hydrant valve open. Hydrant flow tests not meeting the minimum requirements of Bid Documents or the Owner's Design Standards shall be immediately reported to the Engineer-of-Record. The system shall not be placed into service until the system meets the minimum requirements.

END OF SECTION 02556

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SECTION 02570

GRAVITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

B. Earthwork Section 02200.

C. Trench Excavation, Backfill, and Compaction: Section 02221.

1.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store materials to prevent physical damage.

B. Protect materials during transportation and installation to avoid physical damage.

1.3 GENERAL DESCRIPTION OF WORK COVERED

Furnish and install all sewer pipe, fittings and structures, and accessories required for sanitary sewer construction as indicated.

1.4 QUALITY ASSURANCE

Comply with latest published editions of American Society of Testing and Materials (ASTM) Standards:

A. ASTM C478 - Concrete Pipe Manholes.

B. ASTM D1784 - Rigid Poly (vinyl chloride) (PVC) Compounds and Chlorinated Poly (vinyl chloride (CPVC) Compounds.

C. ASTM D2321 - Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

D. ASTM D2564 - Solvent Cements for Poly Plastic Pipe and Fittings.

E. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals.

F. ASTM D3034 Type PSM - PVC Sewer Pipe and Fittings.

PART 2 - MATERIALS AND EQUIPMENT

2.1 GENERAL REQUIREMENTS

A. Pipe furnished shall be PVC for sanitary sewer construction unless shown otherwise on plans or bid forms.

B. All pipe shall be marked in accordance with applicable standard specification under which pipe is manufactured unless otherwise specified.

C. All material shall be free from defects impairing strength and durability and be of the best commercial quality for the purpose specified. It shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

D. All pipework will be inspected upon delivery and such as does not conform to the requirements of these specifications shall be rejected and must be immediately removed from the site by the Contractor. The Contractor shall furnish and provide all labor necessary to assist the Engineer in inspecting the material. The basis of rejection shall be as specified in applicable ASTM Specifications.

2.2 DELIVERY, STORAGE AND HANDLING

Certificates of Compliance with the Specifications shall be required for all materials used on the Project. All materials shall be protected during transportation, storage, handling, and installation to avoid physical deterioration due to sun and weather. The Owner reserves the right to reject material which in any way does not meet the requirements of these Specifications.

2.3 SEWER MAINS

A Polyvinyl Chloride Plastic Pipe (PVC)

1. Comply with ASTM D3034 for pipe using material conforming to ASTM D1784 for pipe and fittings. Pipe lengths shall not exceed 20 feet and provisions shall be made at each joint to accommodate expansion and contraction.

2. Minimum wall thickness shall be:

TABLE 2.3.1 – PVC PIPE MINIMUM WALL THICKNESSES						
Diameter	4"	6"	8"	10"	12"	15"
Wall Thickness	.125"	.180"	.240"	.300"	.360"	.437"

3. Use single elastomeric gasket push-on joints complying with ASTM D3212.

4. Provide pipe and fittings with minimum SDR-35 dimension ratio and a minimum "pipe stiffness" (F/Δ Y) = 46 psi at 5% deflection when tested in accordance with ASTM D2412, external loading properties of plastic pipe by paneled plate loads.

5. SDR 35 shall be used for service laterals.

6. Pipe shall be color coded by one of the following methods:

   a. Use pipe pigment to color code pipe green.
   b. 3 green stripes (½ inch high) with permanent ink along the entire length, evenly spaced around the pipe, with the word "Sewer" in ¾-inch letters every 21 inches along each stripe.

7. Each length of pipe shall be clearly marked with the following information at intervals of five feet or less:

   a. Manufacturer's name or trademark
   b. Nominal pipe size
   c. ASTM specification
   d. National Sanitation approval

B. Ductile iron pipe shall meet the requirements of ANSI A21.51, including Addenda A21.51a. Pipe dimensions shall conform to Federal Specification WW-P-421, Class 150. Each pipe shall be conspicuously marked on the outside of the barrel to readily identify it from Cast-Iron. Metal thickness shall conform to ANSI A21.51, Table 51.1, 2-1/2 to 5 feet cover.

1. Mechanical Joints: ANSI Standard Specification A21.11, Rubber Gasket Joints for Cast-Iron Pressure Pipe and Fittings.

2. Push-on Joints: ANSI Standard Specification A21.11, Rubber Gasket Joints for Cast-Iron Pressure Pipe and Fittings, Single gasket push on type.

3. Flanged Joints: ANSI Standard Specifications B16.1, Cast Iron Pipe Flanges and Flanged Fittings, 125 pounds. Screwed on flanges, faced and drilled ANSI Class 125 pound template. The flanged joints shall be assembled by threading plain end pipe and screwing on long hub flanges. The connection shall then be power tightened and refaced across both face of flange and end of pipe. Provide one-sixteenth-inch ring gaskets of red sheet rubber meeting the requirements of Grade I, Table I of ASTM Specification D1330-66, Sheet Rubber Gaskets. Connections shall be made with machine bolts and hexagonal nuts.

4. Fittings: All fittings for ductile iron pipe shall be ductile iron mechanical joint meeting the requirements of ANSI/AWWA C153/A21.53-84 ductile iron compact fittings 3 inch through 12 inch for water and other liquids.

5. Coatings for Ductile Iron Pipe: All ductile iron pipe and fittings to be installed underground shall follow the requirements set forth in the Wastewater Forcemain specification section 02576.

6. Pipe shall be as manufactured by American Cast Iron Pipe Company, McWane Pipe Company, US Pipe Company, or equal.

7. Submittals: The Contractor shall submit catalog data for approval by the Engineer for materials to be used. This submittal shall include but not be limited to the following:

   a. Pipe
   b. Fittings
   c. Interior Coating
   d. Exterior Coating

TABLE 2.3.2 - DI PRESSURE CLASSES		
Diameter	Class	Max. Depth of Bury
3-inch & 4-inch	350	32 feet
6-inch & 8-inch	350	28 feet
10-inch & 12-inch	350	14 feet
14-inch thru 20-inch	250	10 feet
24-inch thru 64-inch	200	8 feet

8. Markings

   Each ductile iron pipe section shall be marked to indicate the weight class or nominal thickness, and casting period. The manufacturer's mark, country where cast, year in which the pipe was produced, and the letters DI or DUCTILE shall be cast or stamped on the pipe. All required markings shall be clear and legible, and all cast marks shall be on or near the bell. All letters and numerals on pipe sizes 14-inch and larger shall be not less than 0.5-inch in height.

9. Encasement

   When required, DIP shall be encased in polyethylene material in accordance with AWWA Standard C105.

2.4 STRUCTURES AND PIPE ACCESSORIES

A. Fittings

1. Fittings shall be allowed only on service laterals and drop manholes.
2. Fittings shall equal or exceed quality and strength of pipe.
3. Wyes shall be long bell type.

2.5 MANHOLES & SECTIONS

A. General:

1. Construction shall be capable of sustaining an H-20 loading.

2. Leakage shall not exceed 1 gallon per day per vertical foot of manhole.

3. Manholes shall have a minimum I.D. of 48 inches, unless otherwise noted on plans.

4. The joints between the sections shall be tongue and groove with the tongue up and the groove down and shall be sealed with round or other flexible type natural rubber joint rings. In addition to the rubber ring gaskets, the interior and exterior voids in the pipe joints shall be sealed with "RAM NEK" flexible plastic gasket manufactured by K. T. Snyder Company or approved equal. "RAM NEK" shall be installed in strict accordance with the manufacturer's recommendations.

5. In every instance where pipe enters or leaves a manhole, a fitting shall be provided which will accommodate expansion and contraction of the pipe; release strain on the pipe caused by differential settlement between pipe and manhole; and provide a rubber ring water seal between pipe and manhole. Rubber ring water seals provided shall be Kore-N-Seal or approved equal. The invert of the lowest pipe shall be a minimum of 4" above the inside floor of the base section.

B. Standard Concrete:

1. Manholes shall be pre-cast constructed in accordance with ASTM C-478, using Type II or approved equivalent with a 28-day strength of 4000 lbs. per square inch.

2. Base section shall be monolithic to a point 6" above the crown of the incoming pipe with a minimum 6” thick bottom section and 5" wall section and made in accordance with ASTM C-478.

3. Cone (top) sections shall be eccentric narrowing from 48" to 24" I.D., unless otherwise noted on plans.

4. Flat top sections shall be used in place of cone sections for manholes less than 5 feet deep. The access hole shall be offset to allow easy access to steps (if used) and shall be reinforced to support an H-20 loading.

5. Manhole Admixture: XYPEX ADMIX C-1,000R (available from SteelCon Coating Systems at 205-951-2086) shall be added to the concrete during batching operation to provide chemical resistance and water proofing. The XYPEX ADMIX C-1000R shall be added at 3.5%, including dye, of the

weight of Portland Cement. The amount of cement shall remain the same and not be reduced. A colorant shall be added at the XYPEX Manufacturing Plant.

C. Glass-Fiber Reinforced Polyester (FRP) Manholes: See Specification Section 02571.

D. Polymer Concrete Manholes: See Specification Section 02572.

2.6 MANHOLE ACCESSORIES

A. Manhole Lid and Cover:

1. Gray cast iron, with nominal opening of 24 inches.

2. Cover shall be embossed with "TOWN OF CENTURY" “Sanitary Sewer” and the year of order as shown on detail drawings.

3. The lifting holes shall not extend through cover.

4. The manhole frames and covers shall be U.S. Foundry No. 170E, Neenah Foundry No. R - 1600 series, Vulcan Foundry Series 1300 or equivalent and shall weigh at least 285 pounds.

5. Frames and covers shall be machined or ground at bearing surfaces to seat firmly and prevent rocking. Any set not matching perfectly shall be removed and replaced at no additional cost.

B. Composite Manhole Ring And Cover

1. General - Provide as Noted on the Construction Drawings.

All composite moldings shall consist of a thermosetting resin matrix blended and/or combined with reinforcing fiber rovings, short fiber filaments, or equivalent nonmetallic reinforcing structure(s). The thermosetting resin matrix shall be a polyester, vinylester, or a blend of these. The moldings shall be true to pattern in form and dimension and free from cracks, pores, knit-lines, or other defects in locations affecting their strength and value for the service intended.

Before the moldings are removed from the molding operation, they shall be thoroughly de-flashed and cleaned at the parting lines, holes, notches, and all exposed edges.

Composite frames must have a wall thickness of at least 0.75 inches in sections exposed to traffic and potential traffic wheel impact. Locking/bolt down covers shall be provided in all traffic areas.

If using a lock, bolt, or latch, these must be independent of the method used to open the cover to ensure the cover can be opened in the event of

lock failure.

2. Molding Process -

Covers and frames shall be compression molded under high pressures (>0.5 tons/sq inch of x-y surface area) and high temperatures (>200 degrees F).

Metal reinforcements or metal hinges molded within the composite shall not be permitted. Small non-stress bearing pieces of metal may be encapsulated.

Composite covers and frames shall be molded in the USA.

3. Testing and performance Requirements -

General - Testing shall be performed in accordance with the following inspection criteria unless otherwise specified in the contract or purchase order. The manufacturer/supplier shall be responsible for carrying out all of the required tests and inspections. All testing shall be conducted in the United States. The manufacturer/supplier shall maintain complete records of all such tests and inspections. All testing shall be paid for by the manufacturer/supplier. Frame and Covers shall be test “Proof Load” in accordance with AASHTO M306.

a. Heavy Duty: A load of 40,000lbs shall be concentrated on a 9"x 9" block with rubber or fiber backing pad for one minute. During the load testing process, visible cracks or delamination will be cause for rejection (popping noises during this test are normal for composites and do not indicate failure). When load is removed, Permanent Set (Deflection) of more than 1/8"(.125") measured at center of load area will be cause for rejection. Al l testing shall be conducted on a NIST calibrated and Certified load test machine.

b. Ultraviolet resistance: ASTM G 154 Cycle I for 1OOOhrs. Specimens shall be tested for ultimate flexural strength (ASTM D790), retaining at least 75% of control values for load and deflection at failure.

c. Coefficient of Friction: Shall be greater than 0.6 when tested in accordance with ASTM C 1028.

d. Notched Izod Impact: Composite raw material impact results shall be greater than 5 ft.-lbs/inch when tested in accordance with ASTM D256.

e. Components for locking systems below the cover exposed to the sewer environment shall be made of noncorrosive materials such as nonmagnetic, 316 stainless steel or a polymer.

4. Markings -

   Covers and Frames shall have the following molded into the substrate of the cover:

   a. Name (or Abbreviation) Molder

   b. Country of Origin

   c. Molding Date

   d. Indication that Material is Non-metallic

   e. Covers shall be embossed with the “TOWN OF CENTURY” and “Sanitary Sewer” as noted in specification section 2570 and the details.

C. Manhole Grade Adjustment Rings:

1. Grade Adjustment Rings – The grade adjustment rings shall be manufactured from ARPRO® Expanded Polypropylene (EPP), black. 5000 series meeting ASTM D3575 and ASTM D4819-13; B6D7G4L3M24S2T17W7. The rings shall be manufactured using a high compression molding process to produce a finished density of 120 g/l ((7.5 pcf).

2. Grade” adjustment rings may contain either an upper and lower keyway (tongue and groove) for vertical alignment and/or an adhesive trench on the underside with a flat top.

3. “Finish” or “Flat” rings may either have a keyway (groove) on the underside for vertical alignment and/or an adhesive trench with a flat upper surface. These rings shall be available in heights (thicknesses) which will allow final adjustment of the frame and cover or grate to within ¼” (one quarter inch) to ½” (one half inch) of the specified final elevation.

   “Finish” rings may also have a keyway on the upper surface of the inner diameter to facilitate installation of an “Angle” ring.

4. “Angle” rings may either have an upper and lower keyway (tongue and groove) for vertical alignment and/or an adhesive trench on the underside. When required, the “Angle” ring or rings shall allow final adjustment of the frame and cover or grate to within ¼” (one quarter inch) to ½” (one half inch) of the specified final elevation.

5. Acceptable Manufacturer – PRO-RING™ by Cretex Specialty Products or approved equal.Manhole Joint Seals

D. Manhole Infill Dish

1. The dish shall be made of an ultra-high density polyethylene copolymer material that meets ASTM specifications designation D1248, Class A, Category 5, Type 111 with a minimum impact brittleness temperature of <-131° F.

2. The dish thickness shall be uniform .187 mils (3/16”). Dish size is custom to fit the casting frame and lid.

3. The dish material shall be corrosion proof from all gases associated with waste water collection systems.

4. A lift strap shall be provided. It shall be made of a woven polypropylene web and attached to the bowl of the dish by a wide head stainless steel rivet and a stainless steel 3/4" backup washer. All cut edges are seared to insure against raveling.

5. Infill dish ventilation shall be vented. The vent shall allow a maximum release of 10 gallons of water per 24 hours and shall not affected by debris that might collect in the bottom of the dish. Sewer gas shall be vented at one P.S.I. or less.

6. A neoprene gasket shall be provided. The gasket shall be 1/8” thick by 5/8” wide.

E. Adhesive/Sealant

1. Any adhesive or sealant used for watertight installation of the manhole grade adjustment rings shall be M-1 Structural Adhesive/Sealant or equal meeting the following specifications:

   ASTM C-920, Type S, Grade NS, Class 25, Uses NT, T, M, G, A and O Federal Specification TT-S-00230-C Type II, Class A, Corps of Engineers CRD-C-541, Type II, Class A Canadian Standards Board CAN 19, 13-M82, AAMA 802.3-08 Type II, AAMA 803.3-08 Type I and AAMA 805.2-08 Group C.

F. Repair Mortar

1. Repair mortar shall be a one component, quick set, high strength, non-shrink; polymer modified cementitious patching mortar, which has been formulated for vertical or overhead use meeting the requirements of ASTM C-109 for Compressive Strength, C- 348 and C-78 for Flexural Strength and C-882 for Slant Shear Bond Strength. Repair mortar shall not contain any chlorides, gypsums, plasters, iron particles, aluminum powder or gas-forming agents nor shall it promote the corrosion of any steel that it may come in contact with.

2. Repair mortar shall be manufactured by Octocrete by IPA Systems or approved equal.

G. Cementitious Grout

1. Cementitious grout shall be a premixed, non-metallic, high strength, non-shrink grout which meets the requirements of ASTM C-191 and C-827 as well as CRD-C-588 and C-621. When mixed to a mortar or "plastic" consistency, it shall have minimum one day and 28-day compressive strength of 6,000 and 9,000 psi, respectively.

2. Cementitious Grout shall be manufactured by PennGrout by IPA Systems or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

Provide all labor, equipment and materials and install all pipe, fitting, specials and appurtenances as indicated or specified.

3.2 PIPE INSTALLATION

A. Handling

1. Handle and store pipe in a manner to insure installation in sound and undamaged condition, and in accordance with pipe manufacturer’s requirements.

a. Do not drop, bump, roll or drag.
b. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements, and coatings.

2. Ship, move and store with provisions to prevent movement or shock contact with adjacent units.

3. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

B. Installation

1. Utilize equipment, methods, and materials insuring installation to lines and grades as indicated.

a. Do not lay on blocks unless pipe is to receive total concrete encasement.
b. Use calibrated laser or minimum of 3 batter boards for control of line and grade.
c. The bottom of the ditch shall be graded so that when the pipe rests on the ditch bottom it will have a uniform bearing for its entire length.

d. Bell holes shall be dug for bell placement.

2. Install pipe of size, material, strength class, and joint type with embedment shown for plan location.

3. Insofar as possible, commence laying at downstream end of line and install pipe with bell ends in direction of laying (upstream). Sewer pipe shall have spigot ends in direction of flow. Obtain approval for deviations therefrom.

4. Clean interior of all pipe, fittings and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.

   a. Close open ends of pipe with watertight plugs at the end of each work day.
   b. Do not let water enter trench. Pipe shall be laid in a dry trench. Include provisions to prevent pipe flotation and displacement should water control measures prove inadequate.
   c. Remove water, sand, mud and other undesirable materials from trench before removal of end cap or plugs.

5. Inspect pipe prior to installation to determine if any pipe defects are present.

6. Brace or anchor as required to prevent displacement after establishing final position.

7. Perform only when weather and trench conditions are suitable.

8. Observe extra precaution when hazardous atmospheres might be encountered, especially when connecting to existing, active sanitary sewers.

9. Separation of Sanitary Sewer Lines and Potable Water Lines.

   a. Water mains or sewer mains that are laid in the vicinity of each other shall meet the horizontal and vertical separations specified and shown in the General Notes and Standard Drawings section.

10. Auger or jack casing in place where shown on plans.

11. Maintain minimum of 30 inches of cover unless directed by Engineer.

12. Encase sewer pipe in steel casing or use ductile iron pipe when crossing under pipe, conduit, or structure of 24 inches in diameter or greater when a 6-inch separation distance cannot be maintained. This protection shall extend a minimum of 5 feet beyond crossed structure.

C. Jointing

General Requirements

1. Perform in accordance with manufacturer's recommendations.

2. Clean and lubricate all joint and gasket surfaces with lubricant recommended.

3. Utilize methods and equipment capable of fully homing or making up joints without damage.

4. Check joint opening and deflection for specification limits.

D. Closure Pieces

1. Connect two segments of pipelines or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.

2. Observe specifications regarding location of joints, type of joints and pipe materials and strength classifications.

E. Temporary Plugs

1. Furnish, install and secure water tight temporary plugs at each end of work for removal by others when completed ahead of adjacent contract or where indicated.

2. Remove from pipe laid under separate or prior contract in order to complete pipe connection when work by other contractor is finished prior to work at connection point under this contract.

3. Permanent Plugs

a. Use test plugs as manufactured by pipe supplier, or
b. Fabricate by Contractor of substantially same construction.
c. Must be watertight against heads up to 20 feet of water.
d. Secure in place in a manner to facilitate removal when required to connect pipe.

3.3 MANHOLE INSTALLATION

A. Precast Bases

1. Place on 12-inch layer of compacted sand, gravel or sandy material as approved by Engineer.

2. Base shall be leveled prior to installation of manhole sections.

B. Manhole Sections

1. Use precast sections sized for the application.

2. Full circumference seals between manhole sections shall use either of the following or approved equivalent.

a. Bitumastic Seal (Kent No. 2, Ram Neck)
b. Rubber "O" ring gasket

C. Cast in Place Invert Channels

1. Precast inverts in base sections are preferred.

2. Form invert channel as indicated.

3. Alternate invert and shelf may be constructed of mortar over concrete fill with approval of Engineer.

4. Make changes in direction of flow with smooth curves of as large a radius as size of manhole permits.

5. Make changes in size and grade smoothly and uniformly.

6. Slope shelf of manhole adjacent to channels, toward the channels, and rough broom finish to provide a non-slip surface.

7. Finish channel bottom smoothly without roughness, irregularity, or pockets.

8. On straight through single pipe manholes, half sections of same pipe may be used with mortar and concrete with approval of Engineer.

D. Pipe Connection into Manholes

1. Make watertight.

2. Use specified pipe to manhole seals such as Kore-N-Seal or other as approved by Owner.

E. Field applied coatings shall be applied after Engineer's approval of structure.

3.4 SERVICE CONNECTIONS

A. Service lines shall be located in accordance with details on the plans.

B. Install service connections to each residential lot or individual business lot or property, or as directed by Engineer.

C. Service laterals and fittings shall b a minimum four (4) inches in diameter with a minimum slope of 1/8 inch per foot.

D. Services wyes: install long bell type wyes, 4-inch branch diameter unless shown otherwise on plans.

E. Risers: may be used with wyes for service connections where invert of sewer is 7 feet or more below ground surface or where shown on plans. Terminate each connection as shown on plans or as directed by Engineer. Glued 45 degree bends may be used on end of lateral, within grassy, or unpaved, areas.

F. Glue cap on end of stub out.

G. Backfill trench only after recording exact location and depth of service connection.

H. Street crossings shall have a minimum of 2 feet of cover to subgrade unless approved by Engineer.

I. Drive a ½-inch metal rebar adjacent to each service connection, with top of post 1 foot below ground surface.

3.5 CONNECTION OF SERVICE LINES AND SEWER SYSTEM FACILITIES

A. Existing Service Lines and New Sewer Main:

B. Connect existing sanitary service lines which cross new sewer line through equal sized wye.

C. New Service Line Connections to Existing Manholes:

1. Insert new sewer pipe flush with inside of manhole.

2. Connect new lines to existing manholes. Seal new pipe in place to be watertight.

3. Reconstruct manhole channel and shelf to suit new connection.

4. All debris to be removed.

D. Connections to Existing Sewer

1. Build new manhole around existing sewer.

2. Break out existing sewer inside of manhole and construct channel and shelf to suit new connection.

PART 4 - ACCEPTANCE

4.1 GENERAL

A. During the test and warranty time period the manhole shall not have any leaks and shall be dry. If any infiltration (leaks) into manholes occurs, the entire structure shall be replaced with a new manhole with the new structure being subject to the same requirements. The cost of replacement shall be the responsibility of the contractor.

B. All tests to be witnessed by owner's representative.

C. All vacuum testing of the manholes shall be recorded and documented, and a detailed report by numbered manhole with test results be supplied to the owner or his representative.

4.2 ACCEPTANCE TESTS FOR SEWER PIPELINES AND MANHOLES

A. General

1. Infiltration, exfiltration or air test may be used to prove compliance with infiltration requirement.

2. Acceptance of air test or exfiltration results will not preclude rejection of work if infiltration is measured and exceeds limitation.

3. Maximum infiltration for each manhole shall not exceed 1 gallon per vertical foot per 24 hours.

B. Inspection:

1. It is imperative that all sewers and manholes be built practically watertight and that the Contractor must adhere rigidly to the specifications for material and workmanship. After completion, the sewers, or sections thereof, will be tested and gauged and if infiltration is above allowable limits specified, the sewer will be rejected.

2. On completion of each section of sewer, or such other time as the Engineer may direct, the section of sewer is to be cleaned, tested and inspected. All repairs shown necessary by the tests are to be made, broken or cracked pipe replaced, all deposits removed and the sewers left true to line and grade as herein specified, or shown on the plans, entirely clean and ready for use. Each section of the sewer between manholes is to show from either end on examination, a full circle of light. Each manhole or other appurtenance to the system shall be of the specified size and form, be watertight, neatly and substantially constructed, with the top set permanently to exact position and grade.

C. Air Test (Gravity Sewer Piping)

1. Furnish all facilities required including:

   a. Necessary piping connections.
   b. Test pumping equipment.
   c. Pressure gauges or manometers.
   d. Bulkheads.
   e. All miscellaneous items required.

2. Obtain approval from Engineer of equipment and methods proposed for use.

3. Test pipe in sections determined by Contractor and approved by Engineer.

4. Plug ends of line and cap or plug all connections to withstand internal test pressures.

5. Introduce low pressure air until internal air pressure is 4.0 psi greater than the average back pressure of ground water above the pipe. (Add 0.43 psi for each vertical foot of ground water over the top of pipe.)

6. Allow two minutes for air pressure to stabilize.

7. Time required for pressure to decrease from 3.5 to 2.5 psi greater than average back pressure of any ground water above pipe shall not be less than time in following table for given diameters.

Pipe Diameter	
(Inches)	Minutes
6	3.0
8	4.0
10	5.0
12	5.5
15	7.0
18	8.5
21	10.0
24	11.5
27	12.75
30	14.0
36	17.0

8. Repeat test as necessary after all leaks and defects have been repaired.

D. Exfiltration Test (Gravity Sewer Piping)

1. Furnish all facilities required to plug pipe sections and fill with water to attain a minimum elevation of water in upstream manhole two feet higher than

top of pipe in line being tested, or two feet above existing ground water in trench, whichever is higher elevation.

2. Maintain water level in manhole at start of test period for one hour.

3. Water added to maintain level (water lost) shall not exceed the following amounts:

a. 8" pipe - 0.63 gallon per 100 feet.
b. 10" pipe - 0.79 gallon per 100 feet.
c. 12" pipe - 0.95 gallon per 100 feet.
d. 15" pipe - 1.19 gallon per 100 feet.
e. 18" pipe - 1.42 gallon per 100 feet.
f. 21" pipe - 1.66 gallon per 100 feet.
g. 24" pipe - 1.90 gallon per 100 feet.

Allowable leakage may be increased by 5% for each foot of head above water elevation indicated above.

E. Infiltration Test (Gravity Sewer Piping)

1. May be used in lieu of air test or exfiltration test if contractor can prove that ground water conditions are such that crown of pipe is covered with not less than two feet of water at highest point in section being tested. The test head shall be maintained for not less than 24 hours before a weir measurement is made.

2. Infiltration shall be measured with weir at manhole and shall not exceed amounts stated above, Exfiltration Test.

3. Engineer will require exfiltration or air test if contractor cannot prove to satisfaction of Engineer that ground water conditions are satisfactory.

4. The allowable limit of groundwater infiltration for the entire system shall be in complete accordance with ASTM C425-71T and shall not exceed a limit of infiltration equal to 0.08 gal/inch diameter/hour/100 linear feet of pipe.

5. The test will be made by measuring the infiltration flow of water over a measuring weir set up in the invert of the sewer, or by alternate method approved by the Engineer a known distance from a temporary bulkhead or other limiting point of infiltration.

6. After the sewer or sewers have been pumped out, and normal infiltration conditions prevail, tests shall be started.

7. Tests shall be run continuously for a period of not less than three (3) hours, with weir readings taken at 20 minute intervals. The test shall be made by the Contractor. The Engineer shall be notified 24 hours in advance.

8. Where infiltration occurs in excess of the specified amount, the defective pipe or joints shall be located and repaired at the expense of the Contractor.

F. Videotaping of Lines:

All piping 8 inches in diameter and greater shall be videotaped in the presence of the Engineer. Tape shall be provided to the Engineer and approved prior to final acceptance of the system.

G. Deflection Testing (Gravity Sewer Piping):

1. All PVC sewer lines shall be tested for diametric deflection following installation.

2. A “Go-No-Go” type mandrell will be an acceptable deflection testing device. The maximum diametric deflection allowable will be 5% of the pipe base inside diameter as defined in ASTM Specification D-3034.

3. Deflection testing will be performed prior to asphalt paving after all improvements including road base are in place.

H. Manhole Vacuum Test:

1. The test shall be conducted by the Contractor in coordination with and at the direction of Engineer. The manhole shall be tested, after assembly, as follows:

a. All pipe openings shall be sealed by installing suitable plugs that completely isolate the manhole structure; any other openings, such as lifting holes, shall be permanently sealed. A suitable vacuum pump shall be connected to the manhole, and a vacuum of 10” of Hg drawn. The pump shall then be isolated from the manhole by valving, and the test period begun. The test shall be successful if the vacuum remains at 9” of Hg or greater according to the following table:

Manhole Diameter	Time Minimum (sec)
48”	60
60”	75
72”	90

2. The vacuum testing shall meet or exceed the Standard test method as described in ASTM C1244-11, C1244M-11, and C497-15.

3. All manholes which fail the test or that have visible leaks, even if they pass the test, shall be repaired or replaced at the expense of the Contractor until the manhole passes the test, to the complete satisfaction of the Engineer.

Manholes which have any visible leaks will not be accepted. (Ref. ASTM C1244-02)

END OF SECTION 02570

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SECTION 02600
STORMWATER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Florida Department of Transportation, Standard Specifications for Road and Bridge Construction (FDOT Specs), Sections 425 and 430, latest edition. Work shall comply with requirements of FDOT Specs as modified herein.

1.2 SUMMARY

A. This Section includes stormwater system piping and appurtenances. All labor, material, equipment, appurtenances, services, and other work or costs necessary to construct the facilities and place them into operation shall be furnished by the Contractor.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 2 Section 2200 “Earthwork” for excavation and backfill required for stormwater system structures.
2. Division 2 Section "Trench Excavation, Backfill, and Compaction" for pipework installation.
3. Division 2 Section "Base Replacement and Resurfacing for Trenches" for pipework installation across roadways.
4. Division 2 Section "Cast-in-Place Concrete (Sitework)" for concrete and reinforcement requirements.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract.

B. Product data for storm drainage piping and specialties.

C. Shop drawings for precast concrete storm drainage manholes and catch basins, including frames, covers, and grates.

D. Shop drawings for cast-in-place concrete or field-erected masonry storm drainage manholes and catch basins, including frames and covers.

E. Coordination drawings as required by Owner or its representative showing pipe sizes, manholes and catch basins locations and elevations. Include details of underground structures and connections. Show other piping in the same trench and clearances from stormwater system piping. Indicate interface and spatial relationship between piping and adjacent structures.

F. Sustainable Design Submittals:

1) Product Certificates: For products and materials required to comply with requirements for regional materials, indicate location and distance from project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.4 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to stormwater systems.

B. Utility Compliance: Comply with local utility regulations and standards pertaining to stormwater systems.

1.5 PROJECT CONDITIONS

A. Site Information: Perform site inspection, research public utility records, and verify existing utility locations. Verify that stormwater system piping may be installed in compliance with design plans and referenced standards.

1. Locate existing stormwater system piping and structures that are to be removed, abandoned or closed.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate connection to existing drainage system with Owner.

B. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include but are not limited to the following:

1. Roof Drain Piping System:

   a. Advanced Drainage Systems (ADS).

   b. PVC - Comply with ASTM D3034/ASTM D1784 for pipe and fittings. Use single elastomeric gasket push-on joints complying with ASTM D3212. Provide pipe and fittings with minimum SDR-35 dimension ratio.

2. Stormwater piping system – meet the requirements of FDOT specifications latest edition.

Reinforced Concrete Pipe	Section 449
Round Rubber Gaskets	Section 942
Corrugated Polyethylene Pipe Section 948	
Polyvinyle Chloride (PVC)	Section 948
Polypropylene Pipe	Section 948

   a. Pipe shall be as specified on the Construction Drawings.
   b. Concrete Pipe shall be conventional steel reinforced RCP – Class III or elliptical equivalent (excludes fiber reinforced concrete pipe). All joints shall be filter wrapped. The pipe system shall be water-tight prior to acceptance.

2.2 PIPE AND FITTINGS

A. General: Provide pipe and pipe fitting materials compatible with each other. Where more than one type of material or product is indicated, selection is installer's option.

   All pipe will be inspected upon delivery. Pipe which does not conform to the requirements of this specification shall be rejected and immediately removed by the Contractor. The Contractor shall furnish and provide all labor necessary to assist the Owner or its representative in inspecting the material.

B. Reinforced Concrete Pipe and Fittings: ASTM C 76, Class III, Wall B, for rubber gasket joints.

   1. Gaskets: ASTM C 443, rubber.

C. Couplings: Rubber or elastomeric sleeve and stainless steel band assembly fabricated to match outside diameters of pipes to be joined.

   1. Sleeves: ASTM C 443, rubber for concrete pipe; and ASTM F 477, elastomeric seal for plastic pipe. Sleeves for dissimilar or other pipe materials shall be compatible with pipe materials being joined.

2. Bands: Stainless steel, one at each pipe insert.

D. Couplings: Rubber or elastomeric compression gasket, made to match pipe inside diameter or hub, and adjoining pipe outside diameter.

1. Gaskets: ASTM C 443, rubber for concrete pipe; and ASTM F 477, elastomeric seal for plastic pipe. Gaskets for dissimilar or other pipe materials shall be compatible with pipe materials being joined.

2.3 MANHOLES

A. Precast Concrete Manholes: ASTM C 478, precast reinforced concrete, of depth indicated with provision for rubber gasket joints.

1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.
2. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
3. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone to match grade rings.
4. Grade Rings: Provide reinforced concrete rings, of 6 to 9 inches total thickness and match 24-inch diameter frame and cover.
5. Gaskets: ASTM C 443, rubber.
6. Steps: Cast into base, riser, and top sections sidewall at 12-to 16-inch intervals.
7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
8. Channel and Bench: Concrete.

B. Cast-in-Place Manholes: Reinforced concrete of dimensions and with appurtenances indicated.

1. Bottom, Walls, and Top: Reinforced concrete.
2. Channel and Bench: Concrete.
3. Steps: Cast into sidewall at 12- to 16-inch intervals.

C. Manhole Steps: Wide enough for an adult to place both feet on one step and designed to prevent lateral slippage off the step.

1. Material: Steel-reinforced plastic.

D. Manhole Frames and Covers: Castings shall be gray cast iron conforming to ASTM-A48 Class 30, free from blowholes, shrinkages or other imperfections. Units shall be of heavy duty construction capable of supporting an H-20 loading. Units used in curb inlets shall be U.S. Foundry Model 1265, Type E, or approved equal.

All other units shall be U.S. Foundry Model 170, Type E, or equal. All units shall

bear the lettering "STORM SEWER" cast into cover. All proposed substitutes must have equal or greater opening sizes and weights.

2.4 CLEANOUTS

A. In Paved Areas: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, grooved cast-iron cover.

B. In Unpaved Areas: Provide PVC cleanouts with PVC screw cap.

C. Cleanouts shall be one-way or two-way as specified on the Construction Drawings.

2.5 CATCH BASINS

A. Precast Concrete Catch Basins: Construct In accordance Florida Department of Transportation, Standard Specifications for Road and Bridge Construction (FDOT Specs) Section 449.

1. Base Section: Base riser section and separate base slab, or base riser section with integral floor.
2. Riser Sections: Sections shall be of lengths to provide depth indicated.
3. Top Section: Flat slab type with opening to match grade rings.
4. Grade Rings: Provide reinforced concrete rings, of 6 to 9 inches total thickness.
5. Gaskets: ASTM C 443, rubber.
6. Steps: Cast into riser sidewall at 12- to 16-inch intervals.
7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
8. Channel and Bench: Concrete.

B. Cast-in-Place Catch Basins: Reinforced concrete of dimensions and with appurtenances indicated.

1. Bottom, Walls, and Top: Reinforced concrete.
2. Channel and Bench: Concrete.

C. Catch Basin Steps: Wide enough for an adult to place both feet on one step and designed to prevent lateral slippage off the step.

1. Material: Steel-reinforced plastic.

D. Catch Basin Frames and Grates: Per FDOT Standard Frame and Grates.

E. Curb Inlets: Precast concrete, brick, or other materials, of dimensions conforming to FDOT standards.

2.6 OUTFALLS

A. General: Construct of reinforced concrete pipe, head wall, apron, tapered sides, and with rip rap, as indicated.

2.7 MASONRY

A. Bricks for accessories shall be hard common clay brick.

Mortar shall be one part Portland cement and three parts masonry sand to which shall be added lime putty in the amount of 50% of the volume of cement. Special commercial mortar mixes may be used if approved by the Owner or its representative. All masonry materials shall conform to the latest applicable ASTM specifications. Set all masonry units in full beds of mortar, with full joints and strike all joints flush. Masonry reinforcements shall be galvanized Dur-O-Wal, or approved equal, and shall be installed at every other bed joint.

2.8 CURING MATERIALS

A. Conform to TT-C-800, with 30-percent minimum solids content.

B. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yard, complying with AASHTO M-182, Class 2.

C. Moisture-Retaining Cover: One of the following, complying with ASTM C-171.

1. Waterproof paper
2. Polyethylene film
3. White burlap-polyethylene sheet

D. Clear Solvent-Borne Liquid Membrane-Forming Curing Compound: This is a solvent-borne membrane-forming curing compound. Revise to Type II and verify manufacturer's products when a white pigmented curing compound is required. Do not use if waterborne low-VOC emissions compounds are required. ASTM C-309, Type I, Class A or B, wax free.

E. Clear Waterborne Membrane-Forming Curing Compound: This is a waterborne membrane-forming curing compound. Use when low VOC emissions are required. ASTM C-309, Type I, Class B.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 mg per liter.

F. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete surfaces for temporary protection from rapid moisture loss.

PART 3 - EXECUTION

3.1 PREPARATION OF FOUNDATION FOR BURIED STORMWATER SYSTEMS

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid, and backfill with clean sand or pea gravel to indicated level.

C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.2 INSTALLATION - GENERAL

A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of the underground stormwater system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert, unless approved otherwise by the Owner or its representative. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

The pipe shall be carefully examined for defects and the inside cleaned. After placing pipe in the ditch, the ends shall be wiped free from all dirt, sand and foreign material. All pipe and joints shall be made, handled, and installed in strict accordance with the manufacturer's recommendations and instructions.

1. Install concrete pipe in accordance with applicable provisions of American Concrete Pipe Association "Concrete Pipe Field Manual", unless otherwise indicated.

2. Place concrete pipe with elliptical reinforcing so that the reference lines indicating top of pipe are not more than 5 degrees from vertical plane through longitudinal axis of pipe.

C. Use manholes or catch basins for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing storm sewer is indicated. The Owner or its representative shall be notified at least 24 hours before the pouring of any concrete is to be started, and such pouring shall not be started until the reinforcement has been approved as placed.

D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

E. Install piping pitched down in direction of flow, at minimum slope per plans.

F. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed, by tunneling, jacking, or a combination of both.

3.3 PIPE AND TUBE JOINT CONSTRUCTION AND INSTALLATION

A. Join concrete pipe and fittings with rubber gaskets in accordance with ASTM C 443, and install piping in accordance with applicable provisions of ACPA "Concrete Pipe Installation Manual."

C. Join different types of pipe with standard manufactured couplings and fittings intended for that purpose.

3.4 MANHOLES

A. General: Install manholes complete with accessories as indicated. Form continuous concrete or split pipe section channel and benches between inlets and outlet. Set tops of frames and covers flush with finish surface where manholes occur in pavements. Elsewhere, set tops 3 inches above finished grade, unless otherwise indicated.

B. Place precast concrete manhole sections as indicated, and install in accordance with ASTM C 891.

C. Construct cast-in-place manholes as indicated.

D. Provide rubber joint gasket complying with ASTM C 443 at joints of sections.

3.5 CATCH BASINS

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.6 OUTFALLS

A. Construct outfalls of reinforced concrete which will attain 28-day compressive strength of not less than 4000 psi.

3.7 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new

work. Connections shall be watertight.

B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap, with not less than 6 inches of 4000-psi 28-day compressive-strength concrete.

C. Make branch connections from side into existing 15 to 18-inch piping by removing section of existing pipe and installing wye fitting into existing piping. Encase entire wye with not less than 6 inches of 4000-psi 28-day compressive-strength concrete.

D. Make branch connections from side into existing 24-inch or larger piping or to underground structures by cutting opening into existing unit sufficiently large to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

1. Provide concrete that will attain minimum 28-day compressive strength of 4000 psi, unless otherwise indicated.

2. Use epoxy bonding compound as interface between new and existing concrete and piping materials.

E. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

3.8 CLOSING ABANDONED STORMWATER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping that is indicated to remain in place. Provide sufficiently strong closures to withstand hydrostatic or earth pressure that may result after ends of abandoned utilities have been closed.

1. Close open ends of concrete pipe or structures with not less than 8-inch-thick brick masonry bulkheads.

2. Close open ends of other piping with plastic plugs, or other acceptable methods suitable for size and type of material being closed. Wood plugs are not acceptable.

B. Abandoned Structures: Remove structure and close open ends of the remaining piping or remove top of structure down to not less than 3 feet below final grade; fill structure with stone, rubble, gravel, or compacted dirt, to within 1 foot of top of structure remaining, and fill remainder of structure with concrete.

3.9 FIELD QUALITY CONTROL

A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction. All sampling and testing shall be conducted by a testing laboratory under the direction of a Professional Engineer, licensed in the State of Florida, at the contractor's expense. Submit test results directly to the Owner or its representative.

B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.

2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.

3. Flush piping between manholes, to remove collected debris.

C. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes has been installed, cleaned and approximately 2 feet of backfill is in place, and again at completion of project. Each section of pipe between structures is to show from either end on examination, a full circle of light. Each appurtenance to the system shall be of the specified size and form, to be neatly and substantially constructed, with the top set permanently to exact position and grade.

2. If inspection indicates poor alignment, debris, displaced pipe, infiltration, bellies, or other defects, correct such defects and re-inspect. All repairs shown necessary by the inspections are to be made, broken or cracked pipe replaced, all deposits removed and the pipe left true to line and grade as herein specified, or shown on the plans, entirely clean and free from abnormalities and ready for use.

D. Limits of Infiltration and Methods of Testing: The allowable limit of groundwater infiltration for the entire system of new stormwater systems or any one trunk, or interceptor shall be in complete accordance with ASTM C425-71T and shall not exceed a limit of infiltration equal to 0.2 gal/inch diameter/hour/100 linear feet of pipe.

1. The test will be made by measuring the infiltrated flow of water over a measuring weir set up in the invert of the sewer, or by an alternate method approved by the Engineer, a known distance from a temporary bulkhead or other limiting point of infiltration. After the sewer or sewers have been pumped out, and normal conditions prevail, tests shall be started.

2. Tests shall be run continuously for a period of not less than three (3) hours, with weir readings taken at 20 minute intervals. The tests shall be made by the Contractor. The Engineer shall be notified 24 hours in advance. Where infiltration occurs in excess of the specified amount, the defective pipe or joints shall be located and repaired at the expense of the Contractor. If the defective portions cannot be located, the Contractor, at his own expense, shall remove and reconstruct as much of the original work as necessary to obtain a sewer within allowable infiltration limits upon such retesting as necessary.

E. Clean-up: Before final inspection and acceptance, the Contractor shall clean ditches, shape shoulders and restore all disturbed areas, including street crossings, grass plots, to as good as condition as existed before work started. All trenches shall be leveled and loose material removed from pavement gutters, sidewalks, pipe lines, and inlet sediment traps, employing hand labor, if necessary.

END OF SECTION 02600

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SECTION 02950
MAINTENANCE OF TRAFFIC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specifications Sections, apply to work of this section.

B. Unless otherwise specified on the plan sheets or in other sections of this contract, all materials and work shall conform to the applicable requirements in the following documents:

1. Florida Department of Transportation Design Standards, latest edition.

2. Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Section 102, latest edition.

3. USDOT, Federal Highway Administration Manual on Uniform Traffic Control Devices for Streets and Highways, latest edition, Part 6 Temporary Traffic Controls.

4. FDOT Minimum Specifications for Traffic Control and Devices, latest edition.

1.2 SUMMARY OF WORK

The work under this section includes the maintenance of traffic within the limits of the project for the duration of construction.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 RESPONSIBILITIES OF CONTRACTOR

A. Control and maintain traffic and provide for the safety of the work in accordance with Maintenance and Traffic Plan included in the contract documents. Conduct operations in a manner that will not interrupt pedestrian and vehicle traffic except as approved by the Engineer. Confine the work area to the smallest area practical to allow the maximum use of the street and sidewalk and to reduce any hazard to vehicles and pedestrians to a minimum.

B. Maintain access to properties that adjoin the work. Contact property owners and assure that access is coordinated prior to commencing work that may block access.

C. Furnish all labor, materials, tools, supplies, equipment, and machinery needed to fully comply with the specifications described on the plan sheets and in this Section. At all times, the Contractor shall use workers and traffic control devices necessary to comply with all applicable provisions contained in the reference documents listed in Section 1.1.

D. The Contractor shall notify the agencies and media listed below in writing, 48 hours in advance, of any work within the road right-of-way that may interfere with vehicle and/or pedestrian traffic.

1. Local Radio
2. Local News Paper
3. Walton County Life Safety/Fire Prevention Division (981-7000)
4. Walton County Road and Bridge Department (626-0191)
5. Walton County Sheriff's Office (983-1100)
6. Florida Highway Patrol (484-5000)
7. Walton County School District (983-5000)

3.2 PENALTIES AND SUSPENSION OF WORK

The Engineer may verbally direct the Contractor to immediately suspend work if violation of safety regulations is found. In such an event, Contractor shall immediately stop work and secure any potential hazards from the public until the violation is corrected to the satisfaction of the Engineer. Law enforcement officers may be called to assist the Engineer in suspending work if the Contractor is not responsive. Suspension of work for violation of safety regulations shall not be grounds for a contract time extension.

END OF SECTION 02950