STANDARD SPECIFICATIONS

EASLEY COMBINED UTILITIES

MARCH 2025

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SOUTH CAROLINA REGISTERED PROFESSIONAL NO. 31119 ENGINEER D. TYLER MORGAN
2/19/2025

dhec Healthy People. Healthy Communities.

DRINKING WATER AND RECREATIONAL WATER PROTECTION
WATER & SEWER CONSTRUCTION

STANDARD SPECIFICATIONS APPROVAL
☑ WATER ☑ SEWER
DATE APPROVED: 2/25/2025
APPROVED BY: Maia Milenkova

EASLEY COMBINED UTILITIES

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SECTION 01 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

PART 2 - PRODUCTS

2.1 SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. All submittals shall be sent electronically unless a material sample is included.

C. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Submit Product Data before or concurrent with Samples.

D. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.
m. Seal and signature of professional engineer if specified.

n. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

PART 3 - EXECUTION

3.1 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by the ECU for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

C. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

D. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

E. ECU reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

F. Submittals Schedule: Make all submittals far enough in advance of scheduled dates for installation so as to provide time for reviews, securing necessary approvals, possible revision and resubmittal, and placing orders and securing delivery.

G. For each submittal for review, allow 14 days excluding delivery time to and from Contractor.

H. Resubmittal Review: Allow the same amount of days for review of each resubmittal as for the initial review.

I. Sequential Review: Where sequential review of submittals by ECU, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

J. Identify variations in Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.

K. Submittal Identification numbering system: The Contractor shall utilize and shop drawing submittal identification numbering system in the following manner:

1. Each submittal shall be sequentially numbered beginning with one (1) through the last submittal number. Re-submittals shall list the prior submittal number followed by “Rev” and the revision number.
2. The next six (6) to nine (9) digits shall be the applicable Specification section number.
3. The next submittal identification shall be the submittal title.
4. A typical submittal number would be as follows:

a. “10-312316.13-Excavation Protection Plan” – Initial submittal
b. “10Rev1-312316.13-Excavation Protection Plan” – First re-submittal

5. Requests for Information (RFIs) shall utilize the identification numbering system as shop drawings except RFIs will have a separate sequential numbering system.

L. Identification: Place a cover page or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on cover page or title block.
2. Submittal identification number.
3. Provide a space to record Contractor’s review and approval markings and action taken by ECU.
4. Include the following information on stamp for processing and recording action taken.

a. Project name.
b. Date.
c. Name and address of Engineer.
d. Name and Address of Contractor.
e. Name of manufacturer.
f. Other necessary identification.

M. When revised for resubmission, identify changes made since previous submission.

N. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Resubmit submittals until they are marked:

a. “No Exceptions Taken”
b. “Make Corrections Noted”
c. “Note Markings”

O. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.

P. Use for Construction: Use only final submittals with mark indicating action taken by ECU as noted above.

Q. Submittals not requested will not be recognized nor processed.

R. Incomplete Submittals: ECU will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of ECU.

END OF SECTION 01

SECTIN 02 – SEEDING AND RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work described in this section includes site restoration material and general installation.

B. Grassing should match, as close as possible, the species in the landscaped area prior to construction. If sod is present, care should be taken to remove sod prior to utility installation and replace sod immediately. If sod is damaged, replacement of sod is required.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Topsoil:

1. Excavated and reused topsoil material generally occurring from the top of the ground to a depth of 6 to 18 inches.
2. Free of roots, rocks larger than 1/2 -inch, subsoil debris, large weeds, and foreign matter.

B. All seed shall meet the requirements of these specifications and comply with applicable state law. The type of grass seed to be planted shall meet the approval of ECU. Seed shall be delivered in sealed bags, properly labeled. Seeds of legumes shall be inoculated just before use with the appropriate culture. Seed mixtures shall be applied at the rate in pounds per acre and with the seasonal limitations shown in the Drawings.

C. Where turf grass is present before construction, turf grass of like species shall be replaced.

2.2 SEED MIXTURE

A. Temporary Grassing:

Schedule No.	Common Name of Seed	Lbs./Acre	Planting Dates
1	Brown Top Millet	49	April 1 - August 14
2	Rye Grain	55	August

	Annual Ryegrass[1]	15	16 - March 31

Note: 1. The use of Italian Rye Grass is prohibited on all projects.

B. Permanent Grassing:

Schedule No.	Common Name of Seed	Lbs./Acre	Planting Dates
1	Bermuda Common (hulled)	23	March 15- August 14
	Sericea Lespedeza (scarified)[1]	50	
	Kentucky 31 Fescue	60	
	Weeping Lovegrass[1]	10	
2	Kentucky 31 Fescue	80	August 16 - March 31
	Sericea Lespedeza (unhulled, unscarified)[1]	80	
	Common Bermuda (unhulled)[2]	30	
	Weeping Lovegrass[1]	10	
	Annual Rye Grass[3]	15	

Note: 1. Not required on shoulders, medians, etc. and on slopes under 5 feet in height.
2. Do not use Giant Bermuda seed including NK-37.
3. The use of Italian Rye Grass is prohibited on all projects.

2.3 SOIL MATERIALS

A. Topsoil:

1. Excavated and reused topsoil material generally occurring from the top of the ground to a depth of 6 to 18 inches.
2. Free of roots, rocks larger than 1/2 -inch, subsoil debris, large weeds, and foreign matter.

B. All seed shall meet the requirements of these specifications and comply with applicable state law. The type of grass seed to be planted shall meet the approval of ECU. Seed shall be delivered in sealed bags, properly labeled. Seeds of legumes shall be inoculated just before use with the appropriate culture. Seed mixtures shall be applied at the rate in pounds per acre and with the seasonal limitations shown in the Drawings.

C. Where turf grass is present before construction, turf grass of like species shall be replaced.

2.4 MULCHES

A. Straw Mulch:

1. Provide air-dry, clean, mildew-free, and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Fiber Mulch:

1. Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

C. Nonasphaltic Tackifier:

1. Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and fee of plant-growth or germination inhibitors.

D. Asphalt Emulsion: ASTM D977, Grade SS-1; nontoxic and fee of plant-growth or germination inhibitors.

E. Mulch shall be free from leaves, twigs, insects, grasses, weeds, plants and their seeds, other foreign material and any substances harmful to plant growth.

2.5 LIME

A. Provide agricultural grade, ground limestone conforming to the requirements of the South Carolina Department of Agriculture.

2.6 ACCESSORIES

A. Fertilizer:

1. FS O-F-241, recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil to the following proportions:

a. Nitrogen – 10 percent
b. Phosphoric Acid – 10 percent
c. Soluble Potash – 10 percent

2. Adjust proportions to more closely match recommendations from current soil test.

B. Water:

1. Clean, fresh, and fee of substances or materials which could inhibit vigorous growth of grass.

C. Herbicide: Pre-Emergent.

D. Stakes: Softwood lumber, chisel pointed.

E. String: Inorganic fiber.

PART 3 - EXECUTION

3.1 EXAMINATION

A. In residential and commercial areas where manicured yards are present, the permanent grassing used shall match the existing species as closely as possible.

B. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Perform one soil test for every 3 acres of area to be grassed. Follow general recommendation of soil test for turf grass establishment. Provide a copy of the soil test results to ECU with grassing submittal. Clemson University Public Service can provide standard soil type analysis.

3.2 SITE PREPARATION

A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6-inches. Remove stones larger than 1-inch in dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them.

B. Fertilizing:

1. Apply lime uniformly at a rate of 2,000 pounds per acre.
2. Apply fertilizer in accordance with manufacturer's instructions at a rate of 1,000 pounds per acre.
3. Apply after smooth raking of topsoil and prior to roller compaction.
4. Do not apply fertilizer at the same time or with the same machine as will be used to apply seed. Mix thoroughly into upper 2 inches of topsoil.

C. Finished Grading: After fertilizing, grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus ½-inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

D. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. In areas where sod was present, re-use existing sod wherever possible by carefully trimming the top 3-inches of sod and roots from the existing lawn and reinstalling the same day. Sod that is damaged or does not take root should be replaced with sod of similar variety.

F. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.3 SEEDING

A. Do not seed lawns that have established sod. Sod should be reused during construction or replaced with sod of similar variety.

B. Apply seed at a rate consistent with Schedule 1 or 2, Section 2.1, evenly in two intersecting directions. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Rake in lightly.

C. Do not seed areas in excess of that which can be mulched on same day.

D. Planting Season: See planting season in Section 2.1

E. Do not sow immediately following rain, when ground is too dry, or during windy periods.

F. Roll seeded area with roller not exceeding 112 pounds.

G. Immediately following seeding and compacting, apply mulch to a thickness of 1 ½-inches. Maintain clear of shrubs and trees. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into topsoil with suitable mechanical equipment.
2. Bond straw mulch by spraying with asphalt emulsion at the rate of 10 to 13 gallons per 1,000 square feet. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

H. Apply water with a fine spray immediately after each area has been mulched. Saturate top 4 inches of soil.

3.4 HYDROSEEDING

A. Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until it is uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with non-asphaltic tackifier.
2. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry application at a minimum rate of 12 pounds per 1,0-00 square feet dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 35 pounds per 1,000 square feet.

3.5 SODDING

A. Lay sod within twenty-four (24) hours of harvesting unless a suitable preservation method is accepted by ECU. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid

damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.6 SEED PROTECTION

A. Cover seeded slopes where grade is steeper than 3:1 with erosion fabric. Roll fabric onto slopes without stretching or pulling.

B. Lay fabric smoothly on surface, bury top end of each section in 6-inch deep excavated topsoil trench. Provide 12-inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

C. Secure outside edges and overlaps at 36-inch intervals with stakes.

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

3.7 CLEANUP AND PROTECTION

A. Promptly remove erosion-control measures after grass establishment period or when 70% stabilization is achieved.

B. Contractor is required to ensure that final stabilization is achieved, including re-seeding, watering, fertilizing, or other measures as necessary.

C. Work will receive final acceptance when the permanent stand of grass is established, and erosion/washing is completely checked to the satisfaction of ECU.

END OF SECTION 02

SECTION 03 - EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers the installation and maintenance of erosion control measures for the project.

B. All necessary precautions to prevent erosion and siltation, as required by the South Carolina Department of Health and Environmental Control. Stormwater best management practices shall be followed, including items specified herein, and other items as required by the Permit.

C. The Contractor shall maintain all erosion control measures installed on a regular basis. The Contractor shall repair or replace damaged measures at the direction of the Engineer at no additional cost to the Owner.

1.2 RELATED DOCUMENTS

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

B. Sedimentation and erosion control measures shall conform to the requirements of the most current:

1. South Carolina NPDES Construction General Permit (CGP)
2. SC DHEC Storm Water Management BMP handbook (BMP Handbook), and
3. South Carolina Department of Transportation Standard Specifications for Highway Construction (SCDOT).

C. An approved project SWPPP hereby incorporated by reference has been developed for this project. The Contractor will receive a copy of the SWPPP at the mandatory pre-construction meeting. The Contractor shall become the day to day operator of the SWPPP and assume responsibility for the requirements of the SWPPP including inspections and record keeping.

1.3 SUBMITTALS

A. The Contractor shall keep on-site an updated copy of the OS-SWPPP in accordance with NDPES permit requirements.

1.4 QUALITY ASSURANCE

A. All NPDES permit required inspections shall be performed by the Contractor's CEPSCI certified inspector (Inspector).

B. Any cost incurred by the Contractor for inspection due to delays in construction or overrun of the contract time shall be paid for by the Contractor and shall not be the responsibility of the Owner or Engineer.

C. Contractor shall be responsible for compliance with stormwater permit, including the SWPPP. Any fines incurred by the OWNER stemming from the stormwater permit shall be paid by the Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish Stone and Aggregate materials per SCDOT standards.

B. Stone for Check Dam: Class B erosion control stone conforming to Division 800 of the SCDOT Standard Specifications. Minimum size 5 inches, midrange size 8 inches, and maximum size 12 inches equally distributed.

C. Stone for Rip Rap: Class 1 erosion control stone conforming to Division 800 of the SCDOT Standard Specifications. Minimum size 5 inches, midrange size 10 inches, and maximum size 17 inches equally distributed.

D. Aggregate for Construction Entrance: Coarse aggregate, Gradation No. 4 or larger with maximum size of 3 inch, conforming to Division 800 of the SCDOT Specifications.

E. All rolled erosion control products (RECPs) including Temporary Erosion Control Blankets (ECB), and Turf Reinforcement Mat (TRM) shall meet the requirements of SCDOT Supplemental Technical Specification SC-M-815-9 (04/11).

1. Excelsior matting (ECB) shall be installed in all seeded drainage swales and ditches as directed by the Engineer.
2. Provide RECPs listed on the most recent edition of SCDOT Qualified Product List 55 and 56 in the appropriate category.

F. Non-Woven Geotextile Fabric underlaying construction entrances and rock ditch checks shall meet the requirements of Section 804.2.11 of the SCDOT specifications.

2.2 SILT FENCE

A. The height of a silt fence shall not exceed 36 inches (0.9 m). Storage height and ponding height shall never exceed 18 inches (0.5 m).

B. The standard-strength filter fabric shall be stapled or wired to the fence, and 6 inches (0.2 m) of the fabric shall extend into the trench.

C. When standard-strength filter fabric is used, a 4”x4” 12-x12-gauge steel wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy duty wire staples at least 1inch (25.4 mm) long, tie wires or hog rings. The wire shall extend into the trench a minimum of 2 inches (51 mm) and shall not extend more than 36 inches (0.9 m) above the original ground surface.

D. When extra-strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In such a case, the filter fabric is stapled or wired directly to the posts.

2.3 EROSION CONTROL BLANKETS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

C. Erosion-Control Mats: Cellular, nonbiodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 3-inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.

2.4 INLET FILTER

A. A filter shall be used at any stormwater inlet during construction to filter runoff where soils have been disturbed.

B. The filter shall be a weighted sediment tube filter with a diameter of 9.5-inches at the ends and tapering to 5 inches in the center. Lengths shall be 6 to 9 feet with a build-in triangular overflow for relief during high-intensity storm events.

C. Unit Weight: 13 lbs/ft

D. Interior Filter

1. Materials: Shredded, recycled tire rubber particles with less than 2% metal and the rubber shall be washed during manufacturing.
2. Particle Size: ½ inch to ¾ inch particle size

E. The geotextile bag shall have

1. Percent Open Area: 8%
2. Apparent Opening Size: 30 U.S. Sieve

3. Grab Tensile Strength: 400 lbs
4. Flow Rate: 115 gal/min/ft^2
5. Puncture Strength: 125 lbs

2.5 SEDIMENT TUBES

A. Sediment tubes shall conform to the requirements of Section 815.2.3 of the SCDOT specifications.

1. Sediment tubes shall be composed of compacted geotextile, curled excelsior wood fiber, natural coconut fiber, hardwood mulch, growing media or a mixture of these materials enclosed by a flexible netting material and utilize an outer netting that consists of seamless high-density polyethylene, photodegradable material treated with ultraviolet stabilizers or a seamless, high-density polyethylene, non-degradable material.
2. Straw, straw fiber, straw bales, pine needles and/or leaf mulch shall not be used.
3. Curled excelsior wood fiber or natural coconut fiber RECPs rolled up to create a sediment tube device shall not be used.
4. Anchor posts shall be steel posts minimum of 48” long
5. Sediment tube diameter shall be between 18” and 24”. The mass per unit length shall be 3-lb/ft for 18” tubes and 4-lb/ft for 24” tubes with a 10% margin of error.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all Erosion and Sediment Control BMPs in accordance with BMP Handbook, the project SWPPP and local requirements.

B. Check Dam

1. Determine length required for ditch or depression slope and excavate, backfill, and compact foundation area to firm, even surface.
2. Install filter fabric prior to rock installation.
3. Place Class B erosion control stone in an even distribution of rock pieces with minimum voids to the indicated shape, height, and slope.

C. Temporary Construction Entrances

1. Install construction entrances per the details shown on Drawings. Minimum thickness is 6 inches.
2. Mound aggregate near intersection with public road to prevent site runoff entering road.
3. Periodically dress entrances with 2-inch thick coarse aggregate when aggregate becomes clogged with soil.

D. Erosion Control Blanket

1. Install per manufacturer's recommendations.

E. Turf Reinforcement Mat

1. Install per manufacturer's recommendations.

F. Silt Fence

1. The fence line shall follow the contour as closely as possible.
2. If possible, the filter fabric shall be cut from a continuous roll to avoid the use of joints. When joints are necessary, filter cloth shall be spliced only at a support post, with a minimum 6 inch (0.2 m) overlap and both ends securely fastened to the post.
3. Posts shall be spaced a maximum of 10 feet (3.1 m) apart and driven securely into the ground (minimum of 12 inches (0.3 m)). When extra-strength fabric is used without the wire support fence, post spacing shall not exceed 6 feet (1.8 m).
4. Turn the ends of the fence uphill.
5. A trench shall be excavated approximately 4 inches (101 mm) wide and 6 inches (0.2 m) deep along the line of posts and upslope from the barrier.
6. The trench shall be backfilled and the soil compacted over the toe of the filter fabric.
7. Silt fences placed at the toe of a slope shall be set at least 6 feet (1.8 m) from the toe in order to increase ponding volume.
8. Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized and any sediment stored behind the silt fence has been removed.
9. Silt fences and filter barriers shall be inspected weekly after each significant storm (1 inch (25.4 mm) in 24 hour). Any required repairs shall be made immediately.
10. Sediment should be removed when it reaches 1/3 height of the fence or 9 inches (0.3 m) maximum.
11. The removed sediment shall conform to the existing grade and be vegetated or otherwise stabilized.

3.2 CLEANING

A. When sediment accumulation in sedimentation structures has reached a point one-half depth of sediment structure or device, remove and dispose of sediment.

B. Do not damage structure or device during cleaning operations.

C. Do not permit sediment to erode into construction or site areas or natural waterways.

D. Clean channels when depth of sediment reaches approximately one-half channel depth.

3.3 INSPECTION AND MAINTENANCE

A. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

B. It is the Contractor's responsibility to perform all required inspections in accordance with all Authorities having Jurisdiction.

C. Contractor is responsible for continually maintaining all temporary erosion control measures until permanent measures are properly installed and performing as required.

3.4 TEMPORARY SEEDING

A. Apply temporary or permanent seeding to restrain erosion on all disturbed areas as soon as practical but in no case longer than 14 calendar days following temporary or permanent cessation of construction whether or not the area is being used for construction access.

3.5 REMOVAL AND FINAL CLEANUP

A. Soil and erosion measures are to be maintained and remain in place until the disturbed area is stabilized and inspected by the Owner.

B. Once the Notice of Termination has been submitted by the Engineer, the Contractor shall remove and dispose offsite all erosion and sediment control device and other remaining items. Dispose of all silt and waste materials offsite in a proper manner. Complete final restoration activities.

END OF SECTION 03

SECTION 04 – UTILITY PIPE JACKING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all labor, materials, equipment, tools, and incidentals to install steel pipe to be used as a casing pipe for utility roadway crossings as shown on the Drawings and specified herein.

B. All construction operations shall be planned and performed with full regard to safety and to keep traffic interference to an absolute minimum.

C. Boring operations will be subject to review by ECU. ECU will have full authority to stop work if, in its opinion, the work may cause damage or endanger traffic.

D. The Contractor shall be responsible for repair or replacement of any roadway settlement or damage as a result of the work for a period of two (2) years after completion of boring and tunneling operations. Repairs shall be performed at no additional cost to ECU and shall be completed to the full satisfaction of ECU and authority having jurisdiction over the roadway.

1.2 SUBMITTALS

A. Shop drawings:

1. Dimensions
2. Size
3. Materials of Construction
4. Weight
5. Spiders
6. End seals

PART 2 - PRODUCTS

2.1 HIGHWAY SLEEVES

A. Unless otherwise specified in the encroachment permit, provide steel pipe for sleeves under highways conforming to ASTM A139, latest revision, Grade B, with a yield strength of 35,000 psi. Provide sleeve pipe of the lengths shown on the drawings.

B. Provide sleeve pipes that are bituminous coated on the inside and outside.

C. Minimum casing pipe diameters are provided below. Larger casings may be provided at no additional cost to ECU.

Carrier Diame-ter (in)	Casing Diameter (in)	Wall Thick-ness, inches
6	12	0.250
8	16	0.281
10	18	0.312
12	20	0.344
14	24	0.375
16	24	0.375
18	30	0.469
20	30	0.469
24	36	0.532
30	42	0.625
36	48	0.688

D. Casing pipes shall be joined by welding and shall have machine-cut ends, cut square with the long axis of the casing pipe. At least one end shall be beveled.

E. Any casing pipe damaged during jacking operations shall be repaired in place by the Contractor or filled with grout and abandoned.

2.2 CASING SPACERS

A. Provide “spider” type casing spacers for positioning carrier pipe within the casing pipe, Model SSI as manufactured by Advance Products & Systems, Inc., or approved equal. A minimum of two casing spacers will be installed per joint of pipe.

1. Shell: Bolt-on style with at least two sections
2. Band: 304 stainless steel with 90 mil EPDM liner
3. Risers: Injection molded polyethylene
4. Runners: Minimum 7 inches in length

2.3 END SEALS

A. Provide pull-on type synthetic rubber end seals for casing pipe, Model AC as manufactured by Advance Products & Systems, or approved equal.

1. Seal: 1.8-in thick neoprene rubber
2. Bands: Two (2) ½-inch wide 204 stainless steel bands with 304 stainless steel worm gear clamps

2.4 CARRIER PIPE

A. All pipe installed in casing to be restrained joint ductile iron pipe.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The casing pipe, as a minimum, shall extend to the shoulder break or five (5) feet beyond the edge of pavement, whichever is greater.

B. Activity within right-of-ways:

1. The Contractor shall be responsible for coordinating and scheduling of all construction work within the road right-of-way.
2. Boring and jacking work shall not impede the flow of traffic along the roadway being crossed.
3. All installations shall be performed to maintain free flow in existing drainage ditches, pipes, culvers, or other surface drainage facilities of the highway, street or its connections.
4. In no instance will the Contractor be permitted to leave equipment on the pavement or shoulder overnight. When equipment is not in use, equipment and vehicles shall be kept at least 30 feet from the edge of the travel lanes and the bore pit protected from vehicles.

C. Alignment and grade of the casing pipe shall be consistently maintained throughout boring and jacking operations. Tolerances for installation of the casing pipe shall be plus or minus 6 inches in the Horizontal and plus or minus 6 inches in the Vertical.

3.2 CARRIER PIPE INSTALLATION

A. Carrier pipe shall be positioned within the casing pipe by sliding on spiders or casing spacers custom-designed and fabricated by or for the Contractor. There shall be no metal-to-metal contact between the carrier pipe and any part of the spider.

B. Each end of the Casing pipe shall be sealed with pull on or wrap around end seal.

END OF SECTION 04

SECTION 05 – WATER SYSTEM PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Ductile Iron Pipe
2. PVC Pipe
3. HDPE Pipe
4. Pipe and fittings for water lines, including domestic/potable water lines.
5. Tapping sleeves and valves.
6. Valves
7. Fire hydrants and yard hydrants.
8. Accessories
9. Materials

1.2 SUBMITTALS

A. Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, valves, and hydrants. Data must indicate what product, size, and material is to be used.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements and is of domestic origin.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping mains, hydrants, valves, connections, taps, and thrust restraints. ECU personnel may require the ability to GPS appurtenances during construction but should not be relied on for record drawings.

B. Testing Information: All pressure tests, bacteriological tests, and tracer wire tests shall be completed to a satisfactory level prior to approval of water system.

1.4 DELIVERY, STORAGE, AND HANDLING

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

B. Storage

1. Store materials according to manufacturer instructions.
2. Block individual and stockpiled pipe lengths to prevent moving.

3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
4. Do not store pipe in ditch lines or areas where runoff could allow silt or other debris may easily enter pipe.
5. Store PE and PVC materials out of direct sunlight.

PART 2 - PRODUCTS

2.1 GENERAL

A. All material or products which come into contact with drinking water shall be third party certified as meeting the specifications of the American National Institute/National Sanitation Foundation Standard 61, Drinking Water System Components – Health Effects. The certifying party shall be accredited by the American National Standards Institute.

B. All pipe, fittings, packing, jointing materials, valves and fire hydrants shall conform to Section C of the AWWA Standards.

C. Natural rubber or other material which support microbiological growth may not be used for any gaskets, O-rings, and other products used for jointing pipes, setting meters or valves, or other appurtenances which will expose the material to water.

D. Any pipe, solder, or flux which is used in the installation or repair of any public water system, used in any plumbing which provides water through connection to a public water system, for human consumption, shall be lead free. Lead free, for solder and flux, means those containing not more than 0.2% lead. Lead free, for pipes and pipe fittings, as those containing not more than 8.0% lead.

2.2 PIPING

A. General

1. Ductile Iron Pipe is the primary piping material used in the ECU distribution system. PVC is acceptable on a case by case basis and must be approved by ECU prior to use.

2. PVC pipe shall not be used in locations where the pipe has a cover less than four feet, where crossing creek or ravine bottoms where the pipe may be exposed, or where sewers are laid under railroads, encasements, or roadway rights of way unless noted in Drawings.

B. Ductile Iron Pipe

1. Manufacture in accordance with ANSI 31.50/AWWAC150 & ANSI A21.51/AWWA C151, latest revision.
2. Diameter and Class: As indicated below:

Pipe Size (in)	Pressure Class
12” and Smaller	350
14” – 24”	250
30” and Larger	150

3. Interior Coating

    a. Cement-mortar lining, AWWA C104; standard thickness.

4. Outside Coating

    a. Buried: Asphaltic; 1-mil thick, minimum, in accordance with AWWA C151 / ANSO A21.51.
    b. Exposed: Shop primed and painted as specified in Drawings

5. Joints

    a. Provide ductile iron pipe with push-on joints conforming to ANSI A21.11/AWWA C111, latest revision.
    b. Joints shall be restrained where indicated on the drawings. Use American Fast-Grip® Gaskets, or approved equal for restrained joints. Provide a boltless, integral restraining system rated for the design pressure in accordance with the performance requirements of ANSI/AWWA C111/A21.11, unless noted otherwise on the Drawings.
    c. For carrier pipes, restrained joints shall be integral to the pipe. TR-Flex or approved equal shall be used in lieu of fast-grip gaskets.
    d. Gauge pipe ends (spigot end, bell, and socket) for all pipe with suitable gauges at sufficiently frequent intervals to ensure compliance to the standard dimensions of ANSI/AWWA C151/A1.5, latest addition. Manufacturer must have a recommended ovality tolerance for 18 inches and larger size pipe. Each end of each pipe 18 inches and larger shall be measured and approved by manufacturer’s quality assurance inspector to meet such out of round tolerances. Provide manufacturer’s certification that ovality has been measured and controlled in accordance with manufacturer's standard.

C. PVC Pipe

1. 4 inches and larger

    a. Pipe shall be AWWA C900 PVC pipe with a pressure class as indicated on the drawings. The pipe shall conform to the requirements of ASTM F4771 and ASTM D1784, latest revision,
    b. Provide PVC water pipe with rubber ring type joints consisting of integral, thickened, solid wall bells that maintain the same D.R. as the pipe barrel. Install joints in accordance with the manufacturer's instructions and recommendations.
    c. Elastomeric gasket bell ends and elastomeric seals shall meet the requirements of ASTM D3139.

d. Furnish pipe in standard 20-foot lengths. Ensure that pipe bears the National Sanitation Foundation seal for potable water pipe and is marked with SDR and Class Number.
e. Provide adaptor fittings where plastic pipe is connected to pipes or fittings of other materials.
f. PVC pipe shall be blue in color.
g. The use of solvent-weld PVC pipe and fittings in water mains 4 inches and larger is prohibited.

2. 1-1/2 - inches through 3 inches

a. Provide IPS SDR-21, Class 200 PVC pipe conforming to the requirements of ASTM D2241 and ASTM D1784, having elastomeric gasket bell ends and elastomeric seals meeting the requirements of ASTM D3139 and ASTM F477.
b. Provide pipe that bears the National Sanitation Foundation seal for potable water pipe and is marked with SDR and class number.
c. Provide PVC water pipe with rubber ring type joints consisting of integral, thickened, solid wall bells which maintain the same D.R. as the pipe barrel.
d. The use of solvent-weld PVC pipe and fittings in water mains 1-1/2 - inches through 3 inches is prohibited.

3. Smaller than 1-1/2”

a. Provide Schedule 80 PVC pipe, conforming to the requirements of ASTM D1785, latest revision.
b. Provide pipe which bears the National Sanitation Foundation seal for potable water pipe and is marked with SDR and class number.
c. Provide fittings for Schedule 80 PVC which meet the requirements of ASTM D2467, latest revision, with ASTM D2564, latest revision, solvent cement.

4. PVC joints shall be restrained where specified on the drawings.

a. Restrained joints shall be provided by a clamping ring and an additional ring designed to seat on the bell end of the pipe. The rings shall be connected with T-Head bolts.
b. Restraining devices shall provide full (360°) support around the circumference of the pipe. No point loading shall be permitted. Restraint of mechanical joint fittings shall be provided by a clamping ring installed on the PVC pipe and connected to the mechanical joint fitting with T-Head bolts.
c. Restraining devices shall be EBAA Series 1600 or approved equal.
d. For PVC lines smaller than 4 inches, use thrust blocks or additional restraint as shown on Drawings.

D. High Density Polyethylene Pipe

1. Pipe: Comply with AWWA C906, ASTM D2239 and ASTM D3035, DR and pressure rating as shown on the drawings.

2. Pipe shall have blue stripe to designate water.
3. 4-inches and larger shall be DR 11 ductile iron pipe size unless indicating on Drawings.
4. Smaller than 4-inches shall be SDR 9 iron pipe size.
5. HDPE for services shall be copper tubing size.
6. Fittings: DIP fittings
7. Joints: Butt fusion welded in accordance with ASTM 3261.
8. HDPE pipe shall be joined to ductile iron valves and fitting with a DIPS size MJ adapter kit. Pipe stiffeners shall be used to maintain roundness of the pipe. MJ adapter and stiffeners shall be installed in strict accordance with the manufacturer's recommendations.

E. Copper Tubing

1. Comply with ASTM B88.
2. Type K – below ground, L – above ground, annealed.
3. Fittings: ASME B16.18, cast copper
4. Joints: Compression connection

2.3 FITTINGS

A. Welded on Outlets

1. Welded-on outlets may be used in lieu of the tees shown on the plans. Provide welded-on outlets rated for a working pressure of 250 psi, with a minimum safety factor of 2.0. Welded-on outlets may be provided as a radial (tee) outlet, a tangential outlet, or a lateral outlet. Parent pipe and branch pipe shall meet hydrostatic test requirements in accordance with AWWA C151, section 51-9, prior to fabrication.
2. Provide joints on welded-on branch outlets in accordance with the latest revision of ANSI/AWWA C111/A21.11 and/or ANSI/AWWA C115/A21.15, as applicable. Fabricate all outlets from centrifugally cast ductile iron pipe designed in accordance with ANSI/AWWA C150/A21.50 and manufactured in accordance with ANSI/AWWA C151/A21.51. Produce all welds using 55 percent nickel iron welding rod or wire. Carbon steel electrodes are not acceptable. Do not use welded-on bosses. Install all welded-on outlets at manufacturer's plant.
3. Provide the type of pipe end for the branch outlet as specified or indicated on the drawings. Place and compact pipe embedment material and trench backfill under and around each side of the outlet to hold the pipe in proper position and alignment during subsequent pipe jointing, embedment, and backfilling operations.

B. Mechanical Joints

1. 4-inch and Larger

a. Provide mechanical joint type below ground fittings manufactured of ductile iron and conforming to the requirements of ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53, latest revision. Provide fittings compatible with the pipe and designed for 150 psi working pressure, unless noted

otherwise on the Drawings. Provide linings and coatings of the fittings as specified for the pipe.

b. Provide stainless T-head bolts and nuts in sufficient quantities for each fitting or valve.
c. Restrain mechanical joint fittings using EBAA Iron, Inc., Megalug or equal. Use proper Megalug based on pipe material being used. Use twist-off nuts to insure proper actuation of mechanical joint restraining devices.
d. All fittings shall be of domestic origin.

2. Smaller than 4-inch

a. Fittings shall by IPS made of ductile iron as manufactured by Harco or approved equal.
b. Thrust restraint shall be provided for all fittings less than 4-inches in diameter by installing galvanized pipe driven into solid earth, at a minimum. Concrete thrust restraint can be used in addition to galvanized pipe. Ensure fittings do not come into direct contact with concrete.

C. Flanged Joints

1. Provide flange fittings as required for above ground applications or exposed piping in vaults.
2. Flanges conforming to AWWA C110 can be joined with Class 125 B16.1 flanges shown in ANSI B16.1 but not with Class 250 B16.1 flanges.
3. Flange joints should be fitted so that the contact faces bear uniformly on the gasket. The joint should be made with relatively uniform bolt stress.
4. Bolts and nuts shall be type 316 stainless steel, conforming to ASTM A 193, Grade B8M, for bolts and ASTM A 194, Grade 8M, for nuts.
5. Set flange bolts beyond finger tightness with an indicating torque wrench to insure equal tension in all bolts. Tighten bolts such that those 180 degrees apart or directly opposite are torqued in sequence.
6. Provide at minimum one (1) restrained dismantling joint or flange coupling adaptor for disassembly in each linear run of flanged piping.
7. Pipe supports shall be provided for all flanged piping.
8. Piping in vaults shall be painted once tested and approved. Care should be taken to not paint over bolts and nuts to allow easy disassembly.

2.4 DISTRIBUTION VALVES

A. Gate Valves

1. Manufacturers

a. East Jordan Iron Works
b. Mueller Co.
c. Or Approved Equal
d. Material and manufacturer shall be consistent for entire project

2. Description

a. Comply with AWWA C509.
b. Body: Ductile iron.
c. Seats: Resilient.
d. Style

1) Buried service: Mechanical joint ends in accordance with AWWA C111.
2) Above ground service: Flanged ends with 125 lb. flanged ends faced and drilled per ANSI B16.1 standard for cast iron flanges.

e. Stem

1) Type: Non-rising for buried service. Non-rising for above ground service, unless otherwise indicated on Drawings
2) Material: Bronze.

f. Operation

1) 2-inch operating nut for buried applications
2) Handwheel for above ground applications unless otherwise indicated on Drawings.
3) Opening Direction: Counterclockwise

B. BUTTERFLY VALVES

1. Manufacturers

a. Mueller
b. Henry Pratt Company
c. Or approved equal
d. Material and manufacturer shall be consistent for entire project

2. Description

a. Comply with AWWA C504, Class 150
b. Minimum Working Pressure: 200 psig
c. Syle

1) 6 inch and smaller – Wafer
2) Larger than 6 inch – Short bodied Design
3) Buried service: Mechanical joint ends in accordance with AWWA C111.
4) Above ground service: Flanged ends with 125 lb. flanged ends faced and drilled per ANSI B16.1 standard for cast iron flanges.

d. Shaft: Bearings shall be non-metallic and permanently lubricated.
e. Seats

1) Mounting: On body for valves 24 inches and smaller
2) Type: Field replaceable for valves larger than 30 inches.

f. Packing: V-type packing with minimum of 4 sealing rings.

3. Operator

a. 2-inch operating nut for buried applications
b. Handwheel for above ground applications
c. Opening Direction: Counterclockwise.

4. Materials

a. Body: Cast iron, ASTM A126
b. Stem: Stainless Steel
c. Disc: Cast iron, ASTM A48, Class 4C
d. Seats

1) Type: Resilient and replaceable
2) Material: Buna N for water, or as required for other services

e. Seating Surfaces: Type 316 stainless steel
f. Bearings: Aluminum Bronze, ASTM B148, C954
g. Connecting Hardware: Type 316 stainless steel

C. CHECK VALVES

1. Manufacturers

a. Mueller
b. Henry Pratt Company
c. Or Approved Equal

2. Description

a. Comply with AWWA C508
b. Minimum Working Pressure: 200 psig for 2” - 12” and 150 psig for 14” - 30”
c. Check valves 6 inches and larger: Furnish with adjustable air cushion chambers.
d. Type: Swing, resilient seated with outside lever and adjustable weight.
e. Mounting: Horizontal or vertical.
f. End Connections: Integral flange ends shall be ANSI B16.1 Class 125, suitable for horizontal or vertical installation

3. Materials

a. Body and Cover: Ductile iron, ASTM A536.
b. Disc, Disc Arm: Ductile iron, ASTM A536
c. Body Seat: Replaceable, Type 316 ASTM A276 with Buna-N renewable seat ring
d. Shaft: Type 303 Stainless Steel ASTM A582
e. Disc Seat: Buna-N
f. Lever and Counterweight: Ductile Iron, ASTM A536

g. Hinge Pin and Key: Type 316 Stainless Steel
h. Rubber Components: Buna-N
i. Connecting Hardware: Type 304 stainless steel.

D. TAPPING SLEEVES AND VALVES

1. Manufacturers

a. Romac
b. Or approved equal
c. Material and manufacturer shall be consistent for entire project

2. Tapping sleeves shall be stainless steel and shall be used to make “wet” taps into the existing water mains where shown on the Drawings. The tapping sleeve shall provide a full circumferential seal and integrated threaded fasteners, and flanged outlet for connection to the tapping valve. Contractor shall verify type and size of existing main before ordering sleeve. The tapping sleeve shall be pressure tested in the field to verify pressure rating. Provide valve with box.
3. Support valve with cement bricks.

E. TAPPLING SADDLES

1. Manufacturers

a. Smith-Blair
b. Romac
c. Or approved equal
d. Material and manufacturer shall be consistent for entire project

2. Tapping saddles shall be used to make “wet” taps into the existing water mains for water services where shown on the Drawings. Tapping saddle bodies shall be made of ductile iron conforming to ASTM A 536. Straps shall be made of 304 stainless steel. All hardware shall be 304 stainless steel. Gaskets shall be made of synthetic rubber and shall be suitable for service at maximum operating temperature of piping system, and as specified in individual piping specification sections.
3. For 4-inch and larger PVC – Use Romac
4. For 2 ½-inch and smaller PVC – Use Smith-Blair
5. Tapping saddles shall only be used for PVC waterlines. For DIP, utilize direct taps.

2.5 FIRE HYDRANTS

A. Manufacturers

a. East Jordan Iron Works
b. Mueller
c. Or approved equal
d. Material and manufacturer shall be consistent for entire project

B. 3-Way Type

1. Comply with AWWA C502.
2. Body: Cast iron.
3. Valve: Compression type.
4. Burial Depth: As indicated on Drawings. Use adjustments as necessary
5. Inlet Connection Size: 6 inches.
6. Valve Opening: 4 ½ inches in diameter.
7. End Connections: Mechanical joint.
8. Bolts and Nuts: Galvanized steel.
9. Interior Coating: Comply with AWWA C550.
10. Opening Direction: Counterclockwise.

C. Hose Connections

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

D. Finishes

1. Color: ECU standard green with white bonnet

2.6 YARD HYDRANTS

1. Description

   a. Automatic-draining, non-freezing yard hydrant for hose connection.
   b. Nozzle:

      1) Size: 3/4 inch.
      2) Material: Brass.
      3) Fitting: Male.
      4) Type: Removable.

   c. Working Pressure: 125 psig.
   d. Provide vacuum breaker on all yard hydrants.

2.7 BLOW OFF HYDRANT

A. Manufacturer

1. The Kupferle Foundry Company
2. Or approved equal

B. Description

1. Model No. Eclipse No. 78 with vertical outlet or approved equal based on situation.
2. Specify blow off to match depth of bury of waterline. No spool pieces accepted.

3. Use lead free brass couplings for bends
4. Backfill with #57 stone. Ensure stone does not come in contact with plastic pipe.
5. Install meter box with #57 stone in base. Do not install in locations that are subject to vehicle traffic.

2.8 AIR VACUUM VALVES

A. Manufacturers

1. ARI Flow Control Accessories
2. Or Approved Equal

B. Unless otherwise specified or required by manufacturer, all air vacuum valves shall be model D-040 with 2-inch threaded connection.

C. All air release and vacuum valves shall be sized per the manufacturer and approved by ECU prior to installation based on the anticipated line pressures.

D. Potable water air and vacuum valves shall permit unrestricted passage of air during filling of the distribution piping. The valve body shall be reinforced nylon with stainless steel screws, unless indicated (stainless steel) in the plan set. The float and all internal metal parts shall be foamed polypropylene.

E. Taps should be made using Romac, Smith-Blair, or approved equal stainless steel tapping saddle.

F. Nipples shall be stainless steel, no galvanized nipples shall be used.

G. All air valves shall be provided with a stainless steel isolation ball valve.

2.9 PRESSURE REDUCING VALVE

A. Manufacturers
1. Apollo
2. Or Approved Equal.

B. Description

1. Pressure reducing valves to be installed on customer side of meters where indicated on Drawings.
2. use only lead free pressure reducing valves
3. Part number: 36CLF-105-01
4. Set pressure to 75 psi after installation.
5. Install turf box around pressure reducing valve and bring to final grade.

2.10 REDUCED-PRESSURE BACKFLOW PREVENTERS

A. Description

1. Provide Reduced pressure backflow preventer that is approved by SCDES.
2. Depending on size, install backflow preventer in vault or meter box as indicated on the drawings.
3. If above ground installation is required, install backflow device in hot box.

2.11 ACCESSORIES

A. Polyethylene Encasement

1. Where indicated on the Drawings ductile iron pipe shall be wrapped in 6 mil polyethylene encasement in accordance with AWWA C105. All fittings shall be wrapped in 6 mil polyethylene encasement extending 6 feet beyond the connection.
2. If steel gas lines are encountered during excavation, polyethylene encasement shall be used for all construction where DIP is parallel to steel gas line. If crossing a steel gas line, polyethylene encasement shall be used for a distance of 10-ft each side of gas line.

B. Zinc Coating

1. Where indicated on the Drawings, ductile iron pipe for buried service shall be coated with a layer of arc-sprayed zinc. The mass of the zinc applied shall be 200 g/m^2 of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils.

    a. The zinc coating system shall conform to ISO 8179 standard.
    b. All pipe shall be manufactured and zinc coated in the United States at the pipe manufacturer's facility.

C. Tracer Wire

1. Tracer wire to be Baron #545020502
2. Provide tracer wire on all underground pipe.
3. All wire connections and splices shall be connected with underground wire nuts, tied, and tightly taped with insulated electrical tape.
4. The marker wire shall be brought up the outside of the riser and then inside the valve box on all in-line valves and at 500' increments along the waterline alignment to be readily available to system operators.

D. Detection Tape

1. Blue metallic detection tape shall be provided for all PVC pipes.
2. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tape shall be marked "CAUTION WATER MAIN BURIED BELOW."
3. Tape shall be permanently printed with no surface printing allowed. Tape width shall be a minimum of 3-inches and have a minimum thickness of 5 mil.
4. Tape to be installed 1-ft below final grade and located along the centerline of the pipe.

E. Valve boxes

1. Manufacturers

a. Star Pipe Products
b. Or approved equal

2. Description

a. Material: Cast iron
b. Type: One Piece
c. Lid Inscription: WATER.
d. Provide 6-inch Class 200 PVC riser
e. Installation: Support valve box and PVC riser each on minimum of 2 cement bricks. Install tracer wire on outside of riser pipe and loop inside of valve box.
f. Provide concrete collar and valve marker as required. In asphalt, valve box shall be flush with final asphalt surface.

2.12 MATERIALS

A. Trench Types

1. Type 2 – Flat bottom trench (undisturbed earth) with backfill lightly consolidated to centerline of pipe.
2. Type 3 – Pipe bedded in minimum of 4-inches loose soil (native soil excavated from trench, free of rocks, foreign material, or frozen earth) with backfill lightly consolidated to top of pipe.

B. Bedding and Cover

1. Bedding

a. A continuous and uniform bedding shall be provided in the trench for all buried pipe.
b. Ductile Iron Pipe – Type 2 or Type 3 Trench as required based on depth.
c. PVC/HDPE – Type 2 Trench
1) No rocks or gravel are permitted to be within 1-ft of PVC pressure pipe.

2. Cover: Provide a minimum of 4 feet of cover unless shown otherwise on Drawings.
3. Soil Backfill from Above Pipe to Finish Grade:

a. Ductile Iron Pipe - Subsoil with no rocks greater than 6 inches in diameter, frozen earth, or foreign matter.
b. PVC/HDPE – Subsoil free of all rocks, earth, or foreign matter within 2 feet of pipe.
c. Backfill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe.

4. Compaction:

   a. Level fill materials in one continuous layer not exceeding 6 inches of compacted depth.
   b. Open areas - 90% Standard Proctor
   c. Paved areas – 95% Standard Proctor
   d. Roadways – 100% Standard Proctor
   e. Contractor is required to have a 3rd party complete compaction test a minimum of every 1,000 feet and a minimum of two under all roadways and areas designated to be paved.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that water main sizes, material, locations, and elevations are as indicated on Drawings.

3.2 INSTALLATION

A. Conduct installation of waterlines and all appurtenances in accordance with the appropriate Section C of the AWWA Standards, and/or manufacturer's recommended installation procedures.

B. Begin installation of the pipe immediately after the excavation is started, and keep pipe operation laying close behind the trenching. Install pipe in accordance with the manufacturer's instructions and recommendations. Remove damaged or unsound pipe or fittings and replace at no additional cost to ECU. Before jointing of the pipe, remove all lumps, blisters, excess coating material or oil from the bell and spigot ends of the pipe.

C. Joint Lubricants

   1. Provide joint lubrication as recommended by the manufacturer of the pipe and meeting the requirements of NSF 61.
   2. Do not use lubricants which support microbiological growth, including vegetable shortening, for pipe joints.

D. Seal and protect field cut ends in accordance with manufacturer's instructions.

E. Restrain water lines to prevent movement under pressure. Furnish mechanical joint restraint devices, as specified herein and as shown on the Drawings. Install thrust restraints at all bends, tees, crosses, wyes, plugs, and reducers, or as shown in details of typical thrust restraint on the Drawings. Additionally, install restraints for valves, as shown on the Drawings and specified herein.

1. Thrust blocks shall only be used in specific instances when indicated on Drawings, provide concrete thrust blocks of 2,500 psi concrete in accordance with Thrust Block Schedule unless otherwise shown on drawing.

F. Where there is no adequate natural foundation upon which to construct a pipe bed, install the pipe on a prepared stabilized subgrade.

G. Air relief valves shall be provided in accordance with sound engineering practice at high points in water mains as required. Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur.

H. Place pipe and fittings along the route of construction with the spigot ends pointing in the direction of flow. Place pipe where it will cause least interference with traffic. Handle pipe with mechanical equipment. Before it is lowered into the trench, swab or brush out the pipe to insure that no dirt or foreign material gets into the finished line. Provide a test plug to close the pipe and to keep out trench water whenever work is not in progress. Provide the means of dewatering the trench, the cost of which is included in the price of installing the pipe.

I. Do not exceed the manufacturer's recommendations regarding deflections from a straight line or grade made necessary by vertical curves, horizontal curves or offsets. If the specified or required alignment requires deflection in excess of those recommended, provide special bends.

J. Install plastic pipe in strict accordance with the provisions of ASTM D2774, including those provisions addressing compaction of bedding and haunching material.

K. No flushing device shall be directly connected to any sewer

L. Chambers, pits, or manholes containing valves, blow-offs, meters, air relief valves, or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer.

3.3 MISCELLANEOUS INSTALLATION CONDITIONS

A. Sewer and Water Main Crossing

1. Wherever possible, install water mains at least 10 feet horizontally from any existing or proposed sanitary sewer. Measure the distance from edge to edge.
2. Where water mains are laid within 10 feet horizontally of a sanitary sewer, install the water main in a separate trench or on an undisturbed earth shelf located on one side of the sewer at an elevation such that the bottom of the water main is at least 18 inches above the top of the sewer.
3. Install water mains crossing sanitary sewers, either above or below, to provide a minimum vertical separation of 18 inches between the outside of the water main and the outside of the sewer. Whenever possible, install the water main above the sewer. Provide adequate structural support for water mains crossing under sewers.
4. Do not install water mains in such a manner that they come in contact with or penetrate sewer manholes, storm sewers or catch basins.

5. Do not locate potable water mains within 25 feet horizontally of a wastewater tile field or spray field.
6. Special Conditions: When it is impossible to obtain the distances specified above, SCDES may allow an alternative design. Include the following guidelines in any alternative design or conditions.

    a. Maximize the distances between the water main and sewer line and the joints of each.
    b. Use materials for the sewer line which meet the requirements specified herein for waterlines.
    c. Allow enough distance to make repairs to one of the lines without damaging the other.

7. Above-water crossings: The pipe shall be adequately supported and anchored, protected from damage and freezing, accessible for repair or replacement.
8. Underwater crossings: A minimum of 2 feet of cover shall be provided over the pipe. When crossing water courses that are greater than 15 feet in width, the following shall be provided:

    a. The pipe material and joints shall be designed appropriately.
    b. Valves shall be located so the section can be isolated for testing or repair, the valves (on both sides of crossing) shall be easily accessible and not subject to flooding.
    c. A blow-off shall be provided on the side opposite of the supply service sized in accordance with Section R.61-58.4.(D)(7). Direct away from streams, over ground.
    d. Use DIP with mechanical joints for underwater crossings.

B. Connection to Existing Mains

1. Where connections are required between new work and existing water mains, make connections in a thorough and workmanlike manner, using proper specials and fittings to suit the actual conditions.
2. Where a connection is to be made to an existing fitting in the line, schedule the work so that digging and locating the existing fittings can be completed prior to starting trench work on the line. Perform cut-ins into lines at a time approved by ECU. Verify the dimensions of all pipe before ordering special fittings and couplings.

C. Contaminated Areas

1. Do not locate waterlines in areas of known contamination.

3.4 FLUSHING OF PIPING SYSTEM

A. Where possible, flush from the low end of the new water system to the high point.

B. ECU will be responsible for providing water to flush new distribution piping.

C. Flush such that scouring velocity is reached in the pipe line. Ensure that flushing activities do not cause erosion or have adverse impacts on neighboring properties.

3.5 DISINFECTION

A. After flushing, complete disinfection of the new waterline following ECU standards.

3.6 CROSS CONNECTION CONTROL

A. Provide air gap wherever possible.

B. Ensure that there are no connections between the distribution system and any pipes, pumps, hydrants, or tanks from which unsafe water or other contaminated materials may be discharged or drawn into the water system.

C. Do not include any bypasses, unless the bypass is equipped with an approved double check backflow prevention device.

D. Protect potable waterlines from contamination by fire line sprinkler systems and dedicated fire lines, except those in high hazard category, by an approved double check valve assembly.

E. Reduced pressure principal backflow prevention assemblies shall not be installed in any area subject to possible flooding. This includes pits or vaults which are not provided with a gravity drain to the ground's surface that is capable of exceeding the discharge rate of the relief valve. Generally, if installed in a pit, the drain line shall be 2 times the size of the line entering the backflow prevention device. The drain cannot empty into any type of ditch, storm drain, or sewer, which could flood water back into the pit.

F. All piping up to the inlet of the backflow prevention device must be suitable for potable water. The pipe must be AWWA or NSF approved. Black steel pipe cannot be used on the inlet side of the device.

3.7 FIELD QUALITY CONTROL

A. Testing:

1. Complete pressure test following ECU standard.

2. Check all valves for operability and access.

3. Test tracer wire for continuity along length of pipeline.

END OF SECTION 05

SECTION 06 – WASTEWATER SYSTEM PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ductile Iron Pipe
2. PVC Pipe
3. HDPE Pipe
4. Ductile Iron Fittings
5. Valves
6. Accessories

1.2 SUBMITTALS

A. Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, and valves. Data must indicate what product, size, and material is to be used.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements and is of domestic origin.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping mains, hydrants, valves, connections, taps, and thrust restraints. ECU personnel may require the ability to GPS appurtenances during construction but should not be relied on for record drawings.

B. Testing Information: All CCTV, pressure tests, vacuum tests, and tracer wire tests shall be completed to a satisfactory level prior to approval of sewer system.

1.4 DELIVERY, STORAGE, AND HANDLING

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

B. Storage

1. Store materials according to manufacturer instructions.
2. Block individual and stockpiled pipe lengths to prevent moving.
3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
4. Do not store pipe in ditch lines or areas where runoff could allow silt or other debris may easily enter pipe.
5. Store PE and PVC materials out of direct sunlight.

PART 2 - PRODUCTS

2.1 PIPING

A. General

1. PVC pipe shall not be used in locations where the pipe has a cover less than four feet, where crossing creek or ravine bottoms where the pipe may be exposed, or where sewers are laid under railroads, encasements, or roadway rights of way unless noted in Drawings.

B. Ductile Iron Pipe

1. Manufacture in accordance with ANSI 31.50/AWWAC150 & ANSI A21.51/AWWA C151, latest revision.
2. Diameter and Class: As indicated below:

Pipe Size (in)	Pressure Class
12” and Smaller	350
14” – 24”	250
30” and Larger	150

3. Interior Coating

a. Epoxy lining: 40 mils minimum Protecto 401 or approved equal

4. Outside Coating

a. Buried: Asphaltic; 1-mil thick, minimum, in accordance with AWWA C151 / ANSO A21.51.
b. Exposed: Shop primed and painted as specified in Drawings

5. Joints:

a. Provide ductile iron pipe with push-on joints conforming to ANSI A21.11/AWWA C111, latest revision.
b. Joints shall be restrained where indicated on the drawings. Use American Fast-Grip® Gaskets, or approved equal for restrained joints. Provide a boltless, integral restraining system rated for the design pressure in accordance with the performance requirements of ANSI/AWWA C111/A21.11, unless noted otherwise on the Drawings.
c. For carrier pipes, restrained joints shall be integral to the pipe. TR-Flex or approved equal shall be used in lieu of fast-grip gaskets.
d. Gauge pipe ends (spigot end, bell, and socket) for all pipe with suitable gauges at sufficiently frequent intervals to ensure compliance to the standard dimensions of ANSI/AWWA C151/A1.5, latest addition. Manufacturer must have a recommended ovality tolerance for 18 inches and larger size pipe. Each end of each pipe 18 inches and larger shall be

measured and approved by manufacturer's quality assurance inspector to meet such out of round tolerances. Provide manufacturer's certification that ovality has been measured and controlled in accordance with manufacturer's standard.

C. PVC Pipe

1. Gravity Sewer

a. PVC pipe for gravity sewers shall be manufactured in accordance with ASTM D 3034 for 4-inch through 15-inch SDR 26 minimum and F679 for 18-inch through 36-inch 46PS/115PS sewer pipe as indicated on the drawings.
b. All PVC pipe shall be green in color and stenciled "SANITARY SEWER."
c. Joints shall be of the rubber gasket slip on type conforming to ASTM D 3212 under both pressure and vacuum. The bell shall be an integral part of the pipe with the same strength. Spigot ends shall be beveled.
d. Elastomeric gaskets shall meet the requirements of ASTM F477. Gaskets shall be locked in, NAPCO, HARCO, or approved equal.
e. PVC pipe material at different depth of burial, as defined from the final ground surface to the bottom of the pipe, shall conform to the following schedule:

1) 4-ft to 14-ft – SDR 26
2) > 14-ft – Ductile Iron Pipe

f. Transitions from PVC pipe to Ductile Iron pipe shall be made only at manholes unless noted on Drawings.
g. PVC gravity sewer shall have a minimum 3-ft separation when crossing under culverts. If separation is less than 3-ft, epoxy lined DIP should be used for the entire length of gravity sewer. A full joint of DIP should be centered on the culvert crossing.

2. Forcemains

a. PVC pipe for force mains shall conform to the requirements of AWWA C900. Pipe shall be green in color and marked with the nominal pipe size, PVC dimension ratio, AWWA pressure class, AWWA designation number (AWWA C900), manufacturer's name and labeled "Sewer Force Main".
b. The pressure rating shall be selected based upon the design requirements of the system. The minimum wall thickness shall be DR 18.
c. All gaskets shall meet ASTM F477 standards.

3. PVC joints shall be restrained where specified on the drawings.

a. Restrained joints shall be provided by a clamping ring and an additional ring designed to seat on the bell end of the pipe. The rings shall be connected with T-Head bolts.
b. Restraining devices shall provide full (360°) support around the circumference of the pipe. No point loading shall be permitted. Restraint of mechanical joint fittings shall be provided by a clamping ring installed on

the PVC pipe and connected to the mechanical joint fitting with T-Head bolts.

c. Restraining devices shall be EBAA Series 1600 or approved equal.
d. For PVC lines smaller than 4 inches, use thrust blocks or additional restraint as shown on Drawings.
e. The use of solvent weld PVC pipe and fittings in low pressure sewer mains is prohibited.

D. High Density Polyethylene Pipe

1. Pipe: Comply with AWWA C906, ASTM D2239 and ASTM D3035, DR and pressure rating as shown on the drawings.
2. Pipe shall have green stripe to designate sewer.
3. 4-inches and larger shall be DR 11 ductile iron pipe size unless indicating on Drawings.
4. Smaller than 4-inches shall be SDR 9 iron pipe size.
5. Fittings: DIP fittings
6. Joints: Butt fusion welded in accordance with ASTM 3261.
7. HDPE pipe shall be joined to ductile iron valves and fitting with a DIPS size MJ adapter kit. Pipe stiffeners shall be used to maintain roundness of the pipe. MJ adapter and stiffeners shall be installed in strict accordance with the manufacturer's recommendations.

2.2 FITTINGS

A. Mechanical Joints

1. 4-inch and Larger

a. DIP fittings to be have epoxy lining and coating.
b. Provide mechanical joint type below ground fittings manufactured of ductile iron and conforming to the requirements of ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53, latest revision. Provide fittings compatible with the pipe and designed for 150 psi working pressure, unless noted otherwise on the Drawings.
c. Provide stainless T-head bolts and nuts in sufficient quantities for each fitting or valve.
d. Restrain mechanical joint fittings using EBAA Iron, Inc., Megalug or equal. Use proper Megalug based on pipe material being used. Use twist-off nuts to insure proper actuation of mechanical joint restraining devices.
e. Where 90 degree deflections occur along the route of the force main, two (2) 45 degree bends shall be used where possible.
f. All fittings shall be of domestic origin.

2. Smaller than 4-inch

a. Fittings for pipes smaller than 4-inch shall be determined by ECU or specified on the Drawings.

B. Flanged Joints

1. DIP flange fittings to have epoxy lining and coating.
2. Provide flange fittings as required for above ground applications or exposed piping in vaults.
3. Flanges conforming to AWWA C110 can be joined with Class 125 B16.1 flanges shown in ANSI B16.1 but not with Class 250 B16.1 flanges.
4. Flange joints should be fitted so that the contact faces bear uniformly on the gasket. The joint should be made with relatively uniform bolt stress.
5. Bolts and nuts shall be type 316 stainless steel, conforming to ASTM A 193, Grade B8M, for bolts and ASTM A 194, Grade 8M, for nuts.
6. Set flange bolts beyond finger tightness with an indicating torque wrench to insure equal tension in all bolts. Tighten bolts such that those 180 degrees apart or directly opposite are torqued in sequence.
7. Provide at minimum one (1) restrained dismantling joint or flange coupling adaptor for disassembly in each linear run of flanged piping.
8. Pipe supports shall be provided for all flanged piping.
9. Piping in vaults shall be painted once tested and approved. Care should be taken to not paint over bolts and nuts to allow easy disassembly.

2.3 GATE VALVES

A. Manufacturers:

1. Mueller Co
2. East Jordan Iron Works
3. Or Approved Equal
4. Material and manufacturer shall be consistent for entire project

B. Description:

1. Comply with AWWA C509.
2. Materials:

    a. Body: Ductile iron.
    b. Lining: Epoxy coating

3. Seats: Resilient.
4. Style:

    a. Buried service: Mechanical joint ends in accordance with AWWA C111.
    b. Above ground service: Flanged ends with 125 lb. flanged ends faced and drilled per ANSI B16.1 standard for cast iron flanges.

5. Stem:

    a. Type: Non-rising.
    b. Material: Bronze.

6. Operation:

    a. 2-inch operating nut for buried applications

b. Handwheel for above ground applications
c. Opening Direction: Counterclockwise.

2.4 PLUG VALVES

A. Manufacturers:

1. Henry Pratt Company
2. DeZurick
3. Or Approved Equal
4. Material and manufacturer shall be consistent for entire project

B. Description:

1. Type:

a. Non-lubricated
b. Eccentric
c. 90 Degree Turn
d. Resilient faced Plug

C. Working Pressure: 175 psig for valves through 12-inch and 150 psig for valves for 14-inch and larger.

D. Ports:

1. Configuration: Rectangular.
2. Minimum Port Area: 100 percent of nominal pipe area for valves.

E. Stem Bearings: Self-lubricating.

F. Stem Seals:

1. Type: V-ring.
2. Material: Neoprene.

G. Packing and Gland: Accessible and externally adjustable.

H. Materials:

1. Body:

a. Cast iron, ASTM A126 Class B.
b. Lining: Epoxy coating

2. Plug:

a. Ductile iron, ASTM A126 Class B.
b. Lining: Synthetic viton compound of a minimum of 70 durometer hardness.

3. Seats: 1/8”, welded, 90% pure Nickel.

4. Style:

    a. Buried service: Mechanical joint ends in accordance with AWWA C111.
    b. Above ground service: Flanged ends with 125 lb. flanged ends faced and drilled per ANSI B16.1 standard for cast iron flanges.

5. Stem: Type 316 stainless steel.
6. Stem Bearings: Type 316L stainless steel.
7. Seals: Buna-N.
8. Operation:

    a. 2-inch operating nut for buried applications.
    b. Handwheel for above ground applications.
    c. Opening Direction: Counterclockwise.

9. Connecting Hardware: Type 316 stainless steel.
10. Plugs shall be on top when open and on pressure side when closed.

2.5 CHECK VALVES

A. Manufacturers:

1. Mueller
2. Henry Pratt Company
3. Or Approved Equal
4. Material and manufacturer shall be consistent for entire project

B. Description:

1. Comply with AWWA C508.
2. Minimum Working Pressure: 200 psig for 2” - 12” and 150 psig for 14” - 30”.
3. Check valves 6 inches and larger: Furnish with adjustable air cushion chambers.
4. Type: Swing, resilient seated with outside lever and adjustable weight.
5. Mounting: Horizontal or vertical.
6. End Connections: Integral flange ends shall be ANSI B16.1 Class 125, suitable for horizontal or vertical installation.

C. Materials:

1. Body and Cover:

    a. Ductile iron, ASTM A536.
    b. Epoxy coating

2. Disc, Disc Arm: Ductile iron, ASTM A536
3. Body Seat: Replaceable, Type 316 ASTM A276 with Buna-N renewable seat ring
4. Shaft: Type 303 Stainless Steel ASTM A582
5. Disc Seat: Buna-N
6. Lever and Counterweight: Ductile Iron, ASTM A536
7. Hinge Pin and Key: Type 316 Stainless Steel

8. Rubber Components: Buna-N
9. Connecting Hardware: Type 304 stainless steel.

2.6 AIR VACUUM VALVES

A. Manufacturers:
   1. ARI Flow Control Accessories
   2. Or Approved Equal

B. Unless otherwise specified or required by manufacturer, all air vacuum valves shall be model D-025 with 2-inch threaded connection.

C. Wastewater air and vacuum valves shall permit unrestricted passage of air during filling of the distribution piping. The valve body shall be stainless steel with stainless steel screws, unless indicated in the plan set. The float and all internal metal parts shall be stainless steel with polypropylene, and the valve shall be designed so that the venting mechanism does not come into contact with sewage.

D. Taps should be made using Romac, Smith-Blair, or approved equal tapping saddle.

E. Nipples shall be stainless steel, no galvanized nipples shall be used.

F. All air valves shall be provided with a stainless steel isolation ball valve.

2.7 ACCESSORIES

A. Polyethylene Encasement

   1. Where indicated on the drawings ductile iron pipe shall be wrapped in 6 mil polyethylene encasement in accordance with AWWA C105. All fittings shall be wrapped in 6 mil polyethylene encasement extending 6” beyond the connection.
   2. If steel gas lines are encountered during excavation, polyethylene encasement shall be used for all construction where DIP is parallel to steel gas line. If crossing a steel gas line, polyethylene encasement shall be used for a distance of 10-ft each side of gas line.

B. Zinc Coating:

   1. Where indicated on the drawings, ductile iron pipe for buried service shall be coated with a layer of arc-sprayed zinc. The mass of the zinc applied shall be 200 g/m^2 of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils.

      a. The zinc coating system shall conform to ISO 8179 standard.
      b. All pipe shall be manufactured and zinc coated in the United States at the pipe manufacturer’s facility.

C. Trench Plugs

1. Provide trench plugs where shown on drawings and at all creek crossings.
2. Trench plug consists of an impervious clay or concrete ditch check installed on the downstream side of all stream crossings. Ditch check shall be constructed for a length of 3 feet as measured along the centerline of the pipe and the full width of the trench excavation.
3. Backfill shall exhibit the characteristics of a “GC” soil rating as classified by the unified soil classification system (ASTM D2487) and shall have a coefficient of permeability no greater than .001 cm/sec.
4. The material utilized may vary from the above requirements if approved by Engineer; however, in any case the contractor shall furnish an approved independent testing facility utilizing the above methods.
5. The minimum percentage of compaction for the backfill shall be 95% proctor density (ASTM D1557).

D. Tracer Wire

1. Tracer wire to be Baron #545020502
2. Provide tracer wire on all underground pressurized pipe.
3. All wire connections and splices shall be connected with underground wire nuts, tied, and tightly taped with insulated electrical tape.
4. The marker wire shall be brought up the outside of the riser and then inside the valve box on all in-line valves and at 500’ increments along the forcemain alignment to be readily available to system operators.

E. Detection Tape

1. Green metallic detection tape shall be provided for all PVC pipes.
2. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tape shall be marked “CAUTION SEWER MAIN BURIED BELOW.”
3. Tape shall be permanently printed with no surface printing allowed. Tape width shall be a minimum of 3-inches and have a minimum thickness of 5 mil.
4. Tape to be installed 1-ft below final grade and located along the centerline of the pipe.

F. Valve Boxes

1. Manufacturers

    a. Star Pipe Products
    b. Or approved equal

2. Description

    a. Material: Cast iron
    b. Type: One Piece
    c. Lid Inscription: SEWER.
    d. Provide 6-inch Class 200 PVC riser
    e. Installation: Support valve box and PVC riser each on minimum of 2 cement bricks. Install tracer wire on outside of riser pipe and loop inside of valve box.

f. Provide concrete collar and valve marker as required. In asphalt, valve box shall be flush with final asphalt surface.

G. Pressure Gauges

1. Gauges shall be furnished as shown on the drawings. Gauges shall be bourdon tube type, with bronze movement, plexiglass covers and shall be 4½ inches in diameter with not less than 90 percent glycerin filled cast phenolic cases. Each gauge shall have a range such that the normal operating pressure shall be approximately at half the range. The gauges shall be provided with diaphragm protectors and ¼ inch NPT liquid flushing connection with brass lever handle blow-off pet cock. The diaphragm and surfaces exposed to the liquid shall be of stainless steel. Gauges shall be calibrated in pounds per square inch. Gauges should have air pocket to prevent wastewater from coming in contact with the gauge.

2.8 MATERIALS

A. Trench Types

1. Type 2 – Flat bottom trench (undisturbed earth) with backfill lightly consolidated to centerline of pipe.
2. Type 3 – Pipe bedded in minimum of 4-inches loose soil (native soil excavated from trench, free of rocks, foreign material, or frozen earth) with backfill lightly consolidated to top of pipe.

B. Bedding and Cover:

1. Gravity Sewer Bedding:

a. A continuous and uniform bedding shall be provided in the trench for all buried pipe.
b. Ductile Iron Pipe – minimum 4-in #57 stone. #57 stone to spring line
c. PVC/HDPE – minimum 4-in #57 stone. #57 stone to 12-in above pipe

2. Forcemain Bedding:

a. A continuous and uniform bedding shall be provided in the trench for all buried pipe.
b. Ductile Iron Pipe – Type 2 or Type 3 Trench as required based on depth.
c. PVC/HDPE – Type 2 Trench
   1) No rocks or gravel are permitted to be within 1-ft of PVC pressure pipe.

3. Cover: Provide a minimum of 4 feet of cover unless shown otherwise on Drawings.
4. Soil Backfill from Above Pipe to Finish Grade:

a. Ductile Iron Pipe - Subsoil with no rocks greater than 6 inches in diameter, frozen earth, or foreign matter.

b. PVC/HDPE – Subsoil free of all rocks, earth, or foreign matter within 2 feet of pipe.
c. Backfill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe.

5. Compaction:

a. Level fill materials in one continuous layer not exceeding 6 inches of compacted depth.
b. Open areas - 90% Standard Proctor
c. Paved areas – 95% Standard Proctor
d. Roadways – 100% Standard Proctor
e. Contractor is required to have a 3rd party complete compaction test a minimum of every 1,000 feet and a minimum of two under all roadways and areas designated to be paved.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that water main sizes, material, locations, and elevations are as indicated on Drawings.

3.2 INSTALLATION

A. Gravity sewer pipes, structures and manholes shall be installed and tested as specified to the grades, elevations, alignments, and orientations shown on the drawings within the following tolerances:

1. Pipe center line horizontal position at any point:	±0.50 feet
2. Pipe center line horizontal position difference between any two joints (maximum):	0.10 feet
3. Elevations of bases, openings, appurtenances, and tops of any structure or manhole (except pipe invert elevations):	±0.10 feet
4. Horizontal orientation (rotation) of any structure or manhole or any pipe penetration face:	±2.0 degrees

B. Under no circumstances should installation of sewer pipes, structures, and manholes to the tolerances specified herein results in a reverse grade. Any pipe, structures, and manholes outside of these tolerances or at an inverse grade shall be removed and replaced with correct work. Materials may be reinstalled only as approved in writing by ECU. Otherwise, removed pipe and manholes shall be removed from the site and replaced at no additional cost to ECU.

C. All PVC gravity sewer pipe shall be laid in strict accordance with ASTM 2321, and only crushed stone bedding as described elsewhere in these specifications shall be used

D. All HDPE Force mains shall be installed in accordance with the requirements of ASTM D2321. Class IV and Class V materials shall not be used in the pipe zone.

E. PVC forcemains shall be installed in conformance with, at a minimum: ASTM-2321 or ASTM-D2774.

F. All ductile iron pipe and fittings shall be installed in conformance with AWWA C600.

G. A laser beam device shall be used to ensure correct horizontal and vertical alignment for all gravity sewer pipe.

H. Forcemains connecting to manholes shall enter the manhole at the base of the manhole and in no case more than 2-ft above the invert. A trough shall be provided to direct flow to downstream pipe.

I. Before the pipe is placed in position, the bottom of the trench shall be uniformly graded and bedding stone placed so that the pipe will have a bearing for its full length. As each section of pipe is set in place a small excavation shall be made to provide a place for the bell.

J. All sewer pipe shall be laid upgrade with the spigots pointing downgrade. The pipe and specials shall be so laid in the trench that after the sewer is completed the interior surface shall conform on the bottom accurately to the grades and alignment.

K. All pipe shall be carefully examined for cracks or other defects, and no pipe shall be laid which is found defective. If any pipe is found to be defective after being laid, it shall be removed and replaced with sound pipe without further charge.

L. The interior of the pipe shall be carefully freed of all dirt and superfluous material of every description as the work proceeds.

M. After each joint is installed, the gasket shall be checked for proper position prior to installation of the succeeding length of pipe.

N. Where pipe laying is suspended at the lunch hour, at night, during inclement weather or at any other time, the open end of the pipe line shall be provided with a tight-fitting plug-in order to prevent the entrance of dirt, mud and animals.

3.3 MISCELLANEOUS INSTALLATION CONDITIONS

A. Sewer and Water Main Crossing

1. Wherever possible, install sanitary sewer mains at least 10 feet horizontally from any existing or proposed water mains. Measure the distance from edge to edge.
2. Where sanitary sewer mains are laid within 10 feet horizontally of a water main, install the sanitary sewer main in a separate trench or on an undisturbed earth shelf located on one side of the sewer at an elevation such that the bottom of the water main is at least 18 inches above the top of the sewer.
3. Install sanitary sewer mains crossing water mains, either above or below, to provide a minimum vertical separation of 18 inches between the outside of the

water main and the outside of the sewer. Whenever possible, install the sanitary sewer below the water main.

4. Special Conditions: When it is impossible to obtain the distances specified above, SCDES may allow an alternative design. Include the following guidelines in any alternative design or conditions.

    a. Maximize the distances between the water main and sewer line and the joints of each.
    b. Use materials for the sewer line which meet the requirements specified in SCDES Regulation 61-58.4(D0(1).
    c. Allow enough distance to make repairs to one of the lines without damaging the other.

5. No potable water pipe shall pass through or come into contact with any part of a sewer manhole.

6. Manhole top elevations shall be greater than or equal to the fifty(50) year flood elevation, unless watertight covers are provided.

7. Thrust blocking or restrained joints shall be provided at all changes in alignment of forcemains greater than or equal to 30 degrees.

8. An automatic air relief valve shall be placed at high points in the forcemain to prevent air locking.

9. Above-water crossings: The pipe shall be adequately supported and anchored, protected from damage and freezing, accessible for repair or replacement. All pipe and fittings shall be ductile iron.

10. Underwater crossings: A minimum of 2 feet of cover shall be provided over the pipe. When crossing water courses that are greater than 15 feet in width, the following shall be provided:

    a. The pipe material and joints shall be designed appropriately.
    b. Valves shall be located so the section can be isolated for testing or repair, the valves (on both sides of crossing) shall be easily accessible and not subject to flooding.
    c. A blow-off shall be provided on the side opposite of the supply service sized in accordance with Section R.61-58.4.(D)(7). Direct away from streams, over ground.
    d. Use DIP with mechanical joints for underwater crossings.

3.4 CONNECTIONS TO EXISTING SANITARY SEWERS OR MANHOLES

A. Connections to gravity sewers shall be made by core drilling a hole (no sledge hammer) in the wall of the existing structure of the proper size to insert the required rubber boot, and a length of sewer pipe into the hole, filling around pipe and boot with non-shrink vinyl-based grout or water plug, and troweling the inside and outside surfaces of the joint to a smooth finish. The bottom of the manhole shall be rebuilt and formed as necessary to fit the invert of the sewer as shown on the drawings for new

manholes. High-early strength cement mortar mixed with an approved non-shrink epoxy grout shall be used to minimize interruptions in sewer service. The Contractor shall perform any work needed to temporarily block or divert waste flows to complete the connection without spillage of the waste.

B. All existing connections to shall be tightly plugged and blocked to prevent the entrance of construction debris (cement, rocks, mud, silt, flushing water, etc.). The discharge of these materials to the Sanitary Sewer System during construction is prohibited. It is the Contractor's responsibility to secure and plug the system during the construction period to prevent entrance of unexpected rainwater, mud, and silt.

C. No doghouse manholes are permitted. If connecting to an existing gravity sewer line, a new manhole must be installed.

3.5 FIELD QUALITY CONTROL

A. Testing:
   1. Complete final cleaning.
   2. Complete pressure/vacuum test following ECU standard.
   3. Check all valves for operability and access.
   4. Test tracer wire for continuity along length of pipeline.
   5. Complete Post Construction CCTV

END OF SECTION 06

SECTION 07 - PRECAST CONCRETE UTILITY STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Precast manholes
2. Precast vaults
3. Precast wet wells
4. Frames and covers.
5. Access hatches.

1.2 SYSTEM DESCRIPTION

A. Design Requirements:

1. Design and installation of circular precast structures shall be in accordance with ASTM C-478.

2. Design precast components to resist all loadings required by the building code and the Contract Documents for the project application, including, but not limited to, soil, surcharge, hydrostatic, traffic, vertical live load, wind, and seismic forces as applicable.

3. Uplift:

a. Design integral precast base sections to resist flotation, as required.
b. Use groundwater elevation shown on the Contract Drawings for flotation calculations.

1) If groundwater elevations are not shown on the Drawings, use either the 100-year flood elevation or top of manhole/vault structure as basis for flotation calculations.
2) Provide factor of safety against flotation of 1.1 (minimum).

4. Precast Tops:

a. Design concrete structures to support AASHTO HS-20 loadings unless noted otherwise.

1.3 SUBMITTALS

A. Product Data

1. Covers

2. Frames
3. Component construction
4. Configuration
5. Dimensions

B. Shop Drawings

1. Indicate structure locations, elevations, sections, sizes and elevations of penetrations, and dimensions
2. Indicate design, construction and installation details, typical reinforcement and additional reinforcement at openings.

C. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for custom fabrications.

1.4 QUALITY ASSURANCE

A. Obtain precast concrete utility structures from single source.

B. Perform Work according to NPCA Quality Control Manual for Precast and Prestressed Concrete Plants.

C. Design precast concrete members under direct supervision of a Professional Structural Engineer experienced in design of precast concrete. Drawings shall bear the stamp of the P.E in South Carolina.

D. Products are subject to inspection and approval by ECU. Any imperfections or damage identified will result in rejection of materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver products until shop drawings are approved by ECU.

B. Properly handle and store all materials so that no damage or deterioration will occur during shipment or prolonged delay from the time of shipment until installation is completed and ready for operation.

C. Any damage to ECU property or private property during storing of material must be restored to equal or better condition.

D. Material damaged during shipping, storage, or installation will not be accepted.

PART 2 - PRODUCTS

2.1 PRECAST MANUFACTURERS

A. Knights Precast
B. Tindall Corporation

C. Or Approved Equal

2.2 PRECAST STRUCTURES

A. Integral Base:

1. 6-inch minimum thickness.
2. Thicker base or wings may be required to prevent floatation.
3. Diameter as shown on the Drawings.

B. Wall Sections:

1. Provide wall sections to elevations as shown on the drawings.
2. Minimum wall thickness is 5-inches.
3. Joints: Tongue and groove.
4. Joint Sealer:

    a. Meet or exceed requirements of ASTM C990.
    b. Preformed butyl rubber material in flexible rope form.
    c. 6-inch wrap butyl rubber on exterior.
    d. Manufacturers:

        1) EZ-Stik by Press Sael Gasket Company
        2) Or approved equal

5. Grout interior of all joints with non-shrink grout.

C. Top Section:

1. Provide eccentric cone for all manhole 2-ft above grade or less.
2. For manholes greater than 2-ft above grade or manholes designated for Right-of-ways, provide flat-top.

D. Doghouse Manholes:

1. Doghouse manholes are not permitted. New manholes must be installed where connecting to existing sewer mains.

E. Pipe Connections:

1. Manholes: Use a flexible synthetic rubber boot, ASTM C923

    a. Synthetic rubber resistant to sanitary sewage manufactured by Fernco or approved equal.
    b. Cast-in or pressed-on types permitted.
    c. Install cast-in type boot during pouring of manhole section

2. Wet wells and vaults: Use link-seal, or approved equal

    a. Grout inside of structure around link seal after installation and tightening.

3. All pipe penetrations must be cored. No saw cutting of penetrations is allowed.

2.3 FRAMES AND COVERS

A. Manufacturers

1. East Jordan Iron Works
2. US Foundry
3. Or Approved Equal

B. Description

1. Standard ring and cover to be EJ Iron Works V-1384 AS or US Foundry USF 669 Ring & KL Cover (2 x NPPB).
2. Ring and cover shall be free of bitumastic coating.
3. Cover shall be cast with “Property of Easley Combined Utilities.”
4. For sewer applications, cover should be cast with “Sanitary Sewer.”
5. For water applications, cover should be cast with “Water.”
6. Grout frame to concrete manhole top. Provide ½-inch of grout under frame.

2.4 ACCESS HATCHES

A. Manufacturers

1. The Bilco Company.
2. Halliday Products.
3. Or Approved Equal.

B. Description

1. All access hatches shall be double or single leaf as shown on the drawings. Automatic doors shall be equipped with a minimum of two stainless steel hinges with stainless steel pins. Each door leaf shall also have spring operators with a positive hold open arm that engages automatically in full open position, and a non-corrosive release handle. When closed, doors shall not protrude above the operating surface in which they are installed. Include slam lock feature with removable key.
2. Door leaves shall be 1/4-inch aluminum checkered plate reinforced with structural aluminum channels, capable of withstanding 300 pounds per square foot uniform load with minimal deflection for non-vehicular loading service. When subject to vehicular traffic, cover shall be reinforced to support an AASHTO H-20 wheel load with a maximum deflection of 1/150th of the span.
3. The gutter frame provided shall be of 1/4-inch aluminum with an anchor flange around the perimeter. Frame shall incorporate a 1 ½” threaded drain fitting and neoprene gasket.
4. The drain coupling shall be located in an appropriate corner of each channel frame away from the access steps. Contractor shall attach and route Sch 80 PVC pipe from drain port to daylight away from structure. If daylight is not readily accessible the drain shall be routed to the sump within the vault or into ½ cubic

yard of #57 stone wrapped with filter fabric. Piping shall project through walls with sleeve and Link-Seal in a water-tight (leak-proof) installation.
5. Hardware shall be stainless steel.
6. Any surface or portion of the frame contacting concrete shall receive a bituminous coating.
7. Fall protection shall be provided for all access hatches.

2.5 INVERT

A. Description

1. All invert channels shall be smooth and “U” shaped in cross-section, conforming to the inside of the adjacent sewer section.
2. Invert channels shall be formed directly in the concrete of the manhole base; or inverts shall be constructed of Class B concrete or approved grouted polystyrene filler pieces. Brick and mortar inverts are not acceptable.
3. Pipe openings shall provide clearance for pipe projecting a minimum of 2 inches inside the manhole.
4. Invert troughs shall be formed and finished to provide a consistent slope through the manhole from the outlet to the inlets with a minimum 0.1 foot drop across the manhole unless shown or called out otherwise on the plan drawings.
5. Invert troughs shall be height of 80% of largest pipe diameter. Benches shall have a float finish with a uniform slope toward the channel between 1 inch per foot and 2 inches per foot.
6. Changes in direction of flow shall be made with a smooth curve of as large radius as the size of the manhole will permit.

2.6 STEPS

A. Description

1. Polypropylene plastic encased Grade 60 ½-inch steel rods.
2. Provide steps conforming to ASTM C478 and OSHA standards.
3. Deform embedded portion of steps. Embed a minimum of 3/38-inches and anchor integrally into structure wall.
4. Provide maximum distance from surface to first rung not grater than 16-inches and maximum spacing on remaining rungs to be 16-inches on center.
5. Provide minimum step width of 12-inches.
6. Grout in steps shall withstand 300 pounds live loading applied vertically and 200 pounds pull-out.

2.7 RISER RINGS

A. Description

1. Thickness: 4-inches to 6-inches
   a. Material: Precast concrete.
   b. Comply with ASTM C478

2. Thickness: Less than 4-inches
   a. Material: Cast iron
   b. Comply with AASHTO M306

3. Install butyl rubber rope between sections. Grout interior for concrete risers.

4. Risers shall only be used for adjustments less than 11-inches including ring and cover. For adjustments over 11 inches, a manhole riser section shall be used.

2.8 DROP CONNECTION

A. Description

1. Utilize external drop manhole when vertical distance of invert connection is greater than 24-inches. External drops shall utilize DIP piping and fittings with epoxy lining.
2. Use internal drop for drops greater than 8-ft. Internal drops shall have a minimum manhole diameter of 5-ft. Internal drops shall be Schedule 40 PVC with Reliner Drop Bowl, or approved equal. All hardware shall be stainless steel.

2.9 MANHOLE VENT PIPES

A. Description

1. Vent pipes shall be fabricated from 4-inch Schedule 40 steep pipe. The upper end shall comprise two mitered pieces, butt welded.
2. Vent pipes shall be provided on sealed manholes or as shown on plans.
3. Vent pipes shall extend 2-ft above the 100-year flood plain or 2-ft above structure, whichever is greater.
4. For flat tops, vent shall be cast in top. For eccentric tops, vent shall penetrate riser section with link seal and grout.

2.10 INFLOW DISH

A. Description

1. For manholes in roadways, manholes shall be fitted with manhole inserts.
2. Manhole inserts are to be manufactured of high density hexane-1 coploymer meeting ASTM D1248, Class A, Category 5.

2.11 INTERIOR COATING

A. Manufacturer:

1. OBIC.
2. Or Approved Equal.

B. Description

1. Field apply interior coating for structures designated on plans as being at risk for biogenic hydrogen sulfide corrosion as shown on the Drawings.
2. Thickness as shown on the drawings.
3. Apply be means of a low pressure, wet spray.
4. Trowel finish. Perform high-voltage holiday detection tests. Repair detected holidays in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that items provided by other sections of Work are properly sized and located.

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

C. Verify that subgrade and bedding are properly prepared, compacted, and ready to receive Work of this Section.

3.2 INSTALLATION

A. Install underground precast utility structures according to ASTM C891 .

B. Lift precast concrete structures at lifting points designated by manufacturer.

C. Construction

1. After piping is installed to approximate location, excavate for precast structure.
2. Install No. 57 stone to a depth as indicated over the entire area occupied by the precast structure.
3. Install bottom section to elevations shown on the Drawings.
4. Install additional anti-floatation concrete as required.
5. Install preformed butyle rubber sealant between sections.
6. Install succeeding sections as shown on the Drawings.
7. Ensure that pipe penetrations are in alignment with pipelines. Make piping connections as shown on the Drawings. Seal space around pipe penetrations.
8. Place preformed butyl rubber sealant between precast sections.
9. Install appropriate top section to elevations shown on the Drawings.
10. Complete all grouting required for interior of structure.
11. Install corrosion protective coatings as specified and shown on the drawings.
12. Backfill and compact structure.

3.3 FIELD QUALITY CONTROL

A. Individual sections of bases, risers, and tops may be rejected for the following:
1. Fractures or cracks passing through bell.
2. Excessive patching.
3. Grouted pipe openings.

4. Defects indicating imperfect proportioning, mixing, and molding.
5. Surface defects indicating honeycombed or open texture.
6. Damaged ends, where such damage prevents making satisfactory joint.
7. Steps out of line, not properly spaced or damaged.
8. Continuous cracks.

B. Installation may be rejected for the following:

1. Use of individual components subject to rejection.
2. Failure to conform to installation requirements.
3. Visible signs of infiltration.
4. Variation from true vertical alignment by more than 2 percent of depth.
5. Failure to easily pass vacuum test or exfiltration test.

END OF SECTION 07

SECTION 08 – WASTEWATER LIFT STATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Submersible pumps.

1.2 SYSTEM DESCRIPTION

A. Design Requirements:

1. Pump Type: Wet-put mounted submersible.
2. Application: Municipal wastewater
3. Provide pumps and motors meeting the characteristics specified in Schedule 1.

B. Performance Requirements:

1. Design equipment so parts are readily accessible for inspection and repair, easily duplicated and replaced, and suitable for service required.
2. Design equipment free from shock, vibration (within the limits set forth by the Hydraulic Institute), and noise under load conditions.
3. Provide bearings and similar parts having temperature rise within the normal limits of safety and good practice for such parts.

1.3 SUBMITTALS

A. Section 01 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Catalog cuts and product specifications for each product specified showing all details of construction, dimensions, and installation.
2. Standard wiring diagrams unless wiring diagrams are specially prepared and submitted with Shop Drawings.
3. Catalog cuts and product specifications for control equipment.
4. Proposed coating system.
5. The weight of each component, motor, and pump.
6. Complete bill of materials.
7. Spare parts list.

C. Shop Drawings:

1. Installation drawings and specifically prepared technical data for each pump.

2. Certified pump manufacturer foundation, pump support and anchor bolt plans and details.
3. Certified Pump Performance Curves and Data:

    a. Show head, capacity, horsepower demand, NPSH required, and pump efficiency curves over entire operating range of pump from zero to maximum capacity.
    b. Show head, capacity, horsepower demand, and pump efficiency for point(s) specified on pump performance curves.
    c. Prepare this information for each type of pump proposed.

4. Specially prepared wiring diagrams unless standard wiring diagrams are submitted with Product Data.
5. Control Drawing and Data.

D. Quality Control Submittals:

1. Submit factory test data and certified performance curves to ECU. Do not ship pumps to site until factory test results are approved.
2. Manufacturer's equipment storage recommendations.
3. Manufacturer's standard recommended start-up report form.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Ensure that no shipment is made until equipment Shop Drawings are approved by ECU in writing.

B. Do not disassemble factory-assembled parts and components for shipment unless permission is received in writing from ECU.

C. Property protect unpainted finished iron and steel surface to prevent rust and corrosion.

D. Properly handle and store all equipment parts so that no damage or deterioration will occur during shipment or prolonged delay from the time of shipment until installation is completed and the equipment is ready for operations.

E. Do not accept equipment damaged during shipping, storage, or installation.

F. If prolonged storage is required, maintain pump as recommended by manufacturer.

1.5 WARRANTY

A. Provide warranties for all equipment supplied under this Section for a period of one (1) year by the Contractor and the manufacturer.

B. Warrant the equipment to be free from defects in workmanship, design, and materials. Replace and restore any part of the equipment that should fail during the warranty period at no expense to the Owner.

C. Provide the manufacturer's warranty period runs concurrently with the Contractor's warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ABS (Sulzer pumps)
B. Xylem (Flygt)
C. Or approved equal

2.2 GENERAL

A. Provide each pumping unit with a stainless steel nameplate, containing the following minimum information:

1. Manufacturer's name, address, and telephone number.
2. Model number.
3. Serial number.
4. Head, capacity and rpm at the rated condition.
5. Motor horsepower, rpm, and frame size.

B. Provide pumping units within each type of service which are identical in every respect with all parts being interchangeable.

C. Balance pump impellers in accordance with the requirements of ANSI S2.19, G6.3

D. Ensure that vibration, when measured at the upper motor bearing, does not exceed the limitations set forth by the Hydraulic Institute Standards.

2.3 PUMPING EQUIPMENT

A. Pump Design:

1. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by guide bars extending from the top of the station to the wetwell-mounted discharge connection.
2. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact, O-ring, or profile gasket.
3. The entire weight of the pump/motor unit shall bear on the sump floor directly or on a sump floor mounted stand.

4. Power and pilot cable supports shall be provided and consist of a wire braid sleeve with attachment loops or tails to connection to the underside of the access frame.

B. Pump Construction:

1. Major pump components shall be of gray cast iron, ASTM A-48, Class 35B or Class 40, with smooth surfaces devoid of blow holes or other casting irregularities.
2. All exposed nuts or bolts shall be AISI type 304 or type 316 stainless steel.
3. All metal surfaces coming into contact with the pumped media, other than stainless steel, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
4. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Pump/motor unit mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings.
5. Joint sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific bolt torque limit.
6. Rectangular cross-sectioned rubber, paper or synthetic gaskets that require specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

C. Cooling System:

1. Provide pump with motor water jacket encircling the stator housing of steel, ASTM A-570, Grade D. The water jacket shall provide heat dissipation for the motor regardless of whether the motor unit is submerged in the pumped media or surrounded by air.
2. The factory installed cooling system shall be adequately designed to allow the motor to run continuously under full load while in an un-submerged condition. A cooling jacket shall surround the stator housing, and a non-toxic propylene glycol solution shall be circulated through the jacket by a circulating impeller attached to the main motor shaft. The coolant shall be pumped through an integrated heat exchanger in the base of the motor, where excess heat is transferred to the process liquid. Cooling systems that cool by circulating oil within the motor chamber, or those that use a toxic cooling liquid, or those that require an external connection shall not be acceptable. The use of external heat exchangers, fans, or the supply of supplemental cooling liquid shall not be acceptable or required.
3. The internals to the cooling system shall be non-clogging by the virtue of their dimensions.

D. Cable Entry Seal:

1. The cable entry seal design shall preclude specific torque requirements to ensure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the cable entry inside diameter. The

grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones or other secondary sealing systems shall not be considered acceptable.

E. Motor:

1. Wherever possible motors should be 4 pole and rotate at approximately 1,800 rpm. 2 pole motors may be evaluated and approved by ECU on a case by case basis.
2. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber.
3. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180 degrees C (356 degrees F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95 percent.
4. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.
5. The motor shall be specifically designed for submersible pump usage and designed for continuous duty pumping media of up to 40 degrees C (104 degrees F) with an 80 degree C temperature rise and capable of at least 15 evenly spaced starts per hour.
6. The rotor bars and short circuit rings shall be made of cast aluminum.
7. Thermal switches shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable.
8. The motor and the pump shall be produced by the same manufacturer.
9. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10 percent. The motor shall be designed for operation up to 40 degrees C (104 degrees F) ambient and with a temperature rise not to exceed 80 degrees C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.
10. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of at least 65 feet.
11. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

F. Pilot Cable:

1. The pilot cable shall be designed specifically for use with submersible pumps. The cable shall be shielded, multi-conductor type with a chloroprene outer jacket and the tinned copper conductors insulated with ethylene-propylene rubber. The conductors shall be arranged in twisted pairs. The cable shall be rated for 600 Volts and 90 degrees C (194 degrees F) with a 40 degree C (104 degrees F) ambient temperature and shall be approved by Factory Mutual (FM). The cable length shall be adequate to reach the junction box without the need for splices.

G. Bearings:

1. The pump shaft shall rotate on at least three grease-lubricated bearings. The upper bearing, provided for radial forces, shall be a single roller bearing. The lower bearings shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust.
2. The minimum L_{10} bearing life shall be 50,000 hours at any point along the usable portion of the pump curve at maximum product speed.

H. Mechanical Seal:

1. For each pump, provide a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The lower seal shall be independent of the impeller hub. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating corrosion resistant silicon-carbide or tungsten carbide seal ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating corrosion resistant silicon carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counterclockwise direction of rotation without damage or loss of seal.
2. Provide seal failure sensing devices in the electrical connection chamber, the motor housing, and the oil chamber. Upon sensing seal failure, the device will shut down the pump and activate an alarm.
3. The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to affect sealing shall be used.
4. Provide each pump with a lubricant chamber for the shaft sealing system. Design lubricant chamber to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal, shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate continuously while non-submerged without damage while pumping under load.
5. Seal lubricant shall be FDA Approved, nontoxic.

I. Pump Shaft:

1. Pump and motor shaft shall be a solid continuous shaft. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be of 420 stainless-steel and shall be completely isolated from the pumped liquid.

J. Impeller:

1. The impeller(s) shall be of gray cast iron, Class 35B, or Class 40, dynamically balanced, multiple vaned, double shrouded non-clogging design having long throughlets without acute turns. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. Impeller(s) shall be keyed to the shaft, retained with an expansion ring and shall be capable of passing a minimum 3-inch diameter solid. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.

K. Wear Rings:

1. Provide a wear ring system to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a cast iron or stainless-steel ring insert that is drive fitted to the volute inlet.
2. This pump shall also have a stainless steel impeller wear ring heat-shrink fitted onto the suction inlet of the impeller.

L. Volute:

1. Pump volute(s) shall be single-piece cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. The volute shall be of a modified double-volute design for use in the pumping of liquids containing solids and stringy materials. The internal volute guide vane shall be split so as to prevent clogging but still allow for symmetrical internal volute pressure distribution. Pumps utilizing a conventional full vane, double-volute design are not acceptable. Minimum inlet and discharge size shall be as specified.

M. Protection:

1. Provide stators with thermal switches in series to monitor the temperature of each phase winding. Should high temperature occur, the thermal switches shall open, stop the motor, and activate an alarm.
2. Provide a water-in-oil sensor installed in the mechanical seal lubrication chamber to alarm when water is detected in the chamber.
3. Provide seal failure sensing devices in the electrical connection chamber, the motor housing, and the oil chamber. Upon sensing seal failure, the device will shut down the pump and activate an alarm.
4. The thermal switches, seal failure sensors, and the lower bearing temperature monitor shall be connected to a monitoring unit.

5. Remote indication of pump unit status shall be possible with connection to customer PLC or via LAN.

N. Weld Joints:

1. Provide full penetration butt welds on welded joints.
2. Provide slip on flanges with double weld joints.
3. Provide all blind flanges with fully sealed weld joint of plate to pipe.

2.4 ASSEMBLY

A. Unless otherwise specified, each piece of the pump shall be assembled in the pump manufacturer's facility to ensure the correctness of the fabrication and matching of the component parts.

B. Ship pumps fully assembled ready for installation.

2.5 ELECTRICAL CONTROL COMPONENTS

A. Panel Enclosure:

1. Rack mounted NEMA 4X stainless steel.
2. Include removable inner swing panel fabricated of aluminum having a minimum thickness of 0.080 inches mounted on a continuous stainless steel piano type hinge.
   a. Adequately size panel to completely cover all wiring and components mounted on the back panel and make provisions for the mounting of all basic and optional controls and instruments.
   b. Panel is to have a minimum horizontal swing of 90 degrees and be held in the closed position with straight slot screws.
3. Provide removable back panel of 12-gauge steel, attached to enclosure on collar studs, and of adequate size to accommodate all basic and optional components.
   a. Mount components to back panel securely utilizing screws and lock washers.
   b. Tap panel to accept mounting screws.
   c. Do not use any self-tapping screws.
   d. When applicable use DIN Rails
4. Back panel to be painted with two coats of white epoxy enamel.
5. Provide engraved nameplates on door-mounted hardware.
6. For enclosures containing variable speed drives or electronic soft starts, provide
7. proper ventilation, fan(s) and filters.

B. Motor Starters:

1. Across the line starters should only be used for pumps 25 horsepower or less. Pumps greater than 25 horsepower should be supplied with variable frequency drives (VFD's).
2. Provide for each motor a NEMA rated electronic motor starter as manufactured by Square D or equal.
    a. Equip with under voltage release and overload protection on all three phases.
    b. Provide motor starter contacts, which can be easily replaced without removing the motor's starter from its mounted position.
    c. Use manual reset overload relays and do not provide means for converting to automatic reset.

C. Controls

1. Process monitoring and controls as shown on the Process and Instrumentation Diagrams (P&ID) and as specified herein.
2. Please note that available power feed voltage will vary depending on pump station requirements.
3. Provide a duplex pump control panel (10-LCP-1) meeting the requirements of this Section.
    a. Power Requirements: 230 volt, 3 phase, 60 hertz.
    b. Non-fused disconnect switch.
    c. Control power transformer.
    d. Fuses for short circuit protection on each motor circuit and control power transformer.
    e. Motor starters with thermal overloads.
    f. GFI 20A duplex receptacle with stainless steel cover.
    g. Fluorescent light.
    h. Control relays.
    i. Terminal strip for internal and external connections.
    j. Provide UL rated, heavy duty, 600 VAC, oil-tight switches.
    k. "Hand" position not to override motor overload protection/shutdown.
    l. Phenolic name plate, black background with white lettering.
    m. Lockable enclosure.
    n. Condensation heater.
    o. Phase protection.
    p. Remote alarm terminals.
    q. Horn, 80 dB minimum.
    r. Flashing alarm light (red).
    s. Stainless Sun shield.
    t. Control Panel Door Mounted Devices:
        1) Pump run indication light (2).
        2) "Seal failure" indicator lamp (2).
        3) "High temperature" indicator lamp (2).
        4) H-O-A Switch (2).
        5) High level alarm indication light.
        6) Alarm horn silence.
        7) Elapsed run-time meter (2).

D. Pump Alternator Relay:

1. Provide relay of electronic design with three-position toggle switch to override automatic alternator and provide manual selection of either Pump No. 1 or No. 2 as the "LEAD" pump.

E. High Temperature Shutdown:

1. Provide high temperature shutdown for each motor utilizing the temperature switches embedded in the motor windings.
2. Under high temperature conditions switch opens, de-energizing the motor starter and stopping the pump motor.

F. Moisture Detector Control:

1. Provide for each pump a moisture sensor, which will detect moisture in the stator chamber.
2. Detection of moisture by the sensor disrupts the motor starting circuit of the pump involved.
3. Motor remains inoperative until problem is corrected and the control circuit is manually rest.

G. Provide the following components and mount on the back plate:

1. Provide a 115V control circuit transformer (open core and coil type) with primary fuses and secondary circuit break for:

   a. Control.

2. Provide lightning arrester
3. Provide power terminals and control terminals.

H. Design control sequence so that panel is functioning automatically again after a power failure and manual reset is not necessary.

I. Provide a terminal board for connection of line, pump leads and level sensors.

J. Provide elapsed time meter wired to each motor starter, six digit, non-resettable, to indicate total running time in hours and tenths.

K. Provide high water alarm activated by float switch.

1. Include front panel mounted silence switch.
2. Provide 115 volt AC, 40 watt, vapor tight, alarm light with red globe, guard and mounting hardware.

   a. Mount on side of panel.

3. Provide 115 volt AC, single projection, vibrating type horn with weatherproof housing, including mounting lugs and conduit tap.
4. Horn and light to operate simultaneously under alarm conditions.
5. Horn and light to be on at high level.

L. Relays:

1. Provide plug in type.
2. Provide Idec, Allen Bradley, Potter and Brunefield, Diversified Electronics, or Square D relays and sockets.
3. Provide silver cadmium oxide contacts.

M. Electrical Schematic:

1. Provide a laminated electrical schematic diagram of the pump controls including terminal board connections.
2. Permanently mount on the inside of the enclosure door.

N. All attachment screws are to be stainless steel.

O. Manufacturer:

1. To the greatest extent practical, all control components, starters, relays, contacts, etc. are to be manufactured in the United States. All components to be approved by ECU prior to use.

P. Wiring:

1. Unit to be completely factory wired except for power supply, motor connections and float switches.

    a. Company with applicable standards of National Electric Code.
    b. Color code and number as indicated on factory wiring diagram.
    c. Control wire to be MTW 90 degrees C #14 AWG.

2. Electrically ground all components to a common ground screw mounted on the removable back panel.
3. Neatly group all wiring in plastic wire troughs except wiring from the backplate must be done in separate bundled harnesses for control circuits.
4. The panel must bear a UL508 label.

Q. Level control and motor power cable:

1. Provide cable of adequate length to terminate in junction box without splicing.

R. General:

1. Pump supplier is to provide control panel.
2. Provide a termination strip for control and signal wiring installed to the SCADA Mission system. Terminations to be dry contacts.

2.6 LIQUID LEVEL CONTROL

A. Provide level control system that starts and stops the pump motors in response to changes in wetwell liquid level, as set forth herein.

B. Provide level control system capable of operating as an ultrasonic device control system with lag pump and high level alarm float switch.

C. The level control system utilizes the alternator relay to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation occurs at the end of a pumping cycle.

D. The duplex control panel operates on the “Lead/Lag” plus alarm principal utilizing four level sensors.

E. “Lead Pump On” Level Sensor:

1. Upon operator selection of automatic operation, lead level sensor switch starts the motor for one pump when the liquid level in the wetwell rises to the “lead pump on” level.

F. Low Water Level “Pumps Off” Sensor:

1. When the liquid is lowered to the low water level, the “pumps off” sensor switch stops this pump. One pumping cycle is defined as one pump operating from “lead pump on” level to low water “pumps off” level. This low water level sensor also controls the alternation of lead pump for the next cycle.

G. “Lag Pump On” Level Sensor:

1. Should the wetwell water level continue to rise, lag pump sensor switch will start the second pump or lag pump when the wetwell liquid reaches the “lag pump on” level so that both pumps are operating. Both pumps will continue to run until the water level reaches the “pumps off” sensor elevation. Design the circuitry so that the lag pump starts (when the lag level sensor elevation is reached) even if the lead pump has failed to start. Circuit design in which application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit is not acceptable.

H. “High Water Level Alarm on” Sensor:

1. Should the water level continue to rise, the “high water level alarm on” sensor will signal a high water alarm condition and energize the appropriate alarm contacts within the control panel, i.e., local alarm light and horn as well as any remote contacts for the SCADA Mission system.

I. Level sensor and float switch elevations are as shown in the Project Drawings.

2.7 WETWELL AND VALVE VAULT

A. Provide separate concrete wetwell and concrete valve vault as shown on the Drawings.

B. Provide aluminum access hatches with fall protection in accordance with specifications.

C. All pipe penetrations will include a link-seal.

2.8 ACCESSORIES

A. Access Frame and Guides:

1. Provide all access frames with integrated fall protection as specified in details and precast structures specifications.

2. All access frames shall be of sufficient size to permit removal or replacement of the pumping equipment
3. Cover guide bar holders shall be as required by the pump manufacturer
4. 304 stainless steel rail system with top, bottom, and intermediate guide bars (for triplex pump station)
5. 304 stainless steel electrical cable holders

B. Pressure Gauge Kit

1. A pressure gauge shall be provided for each pump discharge pipe.
2. Pressure gauges to be glycerin-filled and shall be a minimum of 4-inches in diameter.
3. Use ½-inch Romac stainless steel tapping saddle or approved equal.
4. Install stainless steel piping and ball valves, including ½-inch air release below diaphragm isolator.
5. Install diaphragm isolator prior to pressure gauges. Fill pipe between pressure gauge and diaphragm with distilled water to prevent wastewater from clogging gauge.

C. Dismantling Joints

1. One (1) dismantling joint shall be provided for each run of piping within the valve vault.

D. Valves and Piping

1. Check Valve: Each pump shall be equipped with a full flow type check valve capable of passing a 3" spherical solid. Valve shall be constructed with flanged ends and fitted with an external lever and torsional spring. Check valves shall be in conformance with ECU standards.
2. Isolation Valve: Each discharge line shall be equipped with a 2-way plug valve to permit isolation of the pumps from the forcemain. Plug valves shall be in conformance with ECU standards.

3. Bypass Port: Each valve vault will include a bypass port with a 4-inch cam lock and cap.

4. Piping

   a. All piping within wet well shall be ductile iron pipe with protective epoxy coating on inside and outside.
   b. All piping within the valve vault shall be flanged ductile iron pipe.
   c. All hardware shall be stainless steel.

E. Concrete Lining

1. The wet well and discharge manhole, at a minimum, shall be lined with a protective epoxy lining.
2. ECU to approve all linings prior to application.

F. Electrical Canopy

1. Provide electrical canopy for all lift station panel and controls
2. Canopy shall be designed to withstand 100 MPH wind load.
3. All structural and roofing elements to be stainless steel or aluminum.
4. See detail for additional information.

G. Emergency Generator

1. Provide emergency stand-by generator as required by ECU.
2. Generator to be diesel unless natural gas is readily available.
3. In permanent generator is required, station shall still have receptacle for portable generator (Crouse-Hinds AR2041 S22) or approved equal.

2.9 CONTROL PANEL & CONTROLS

A. Control Panel:

1. Comply with requirements of Division 26 and Section 33 32 13.19.
2. Furnish one automatic pump control center for 460volt, 3 phase-service for the pumping station. Panel shall have exterior door(s) weather protection and inner door(s) for mounting control lights and switches.
3. Pumps shall be controlled by a Programmable Logic Controller (PLC) and the level monitor system specified below as a standard
4. For each pump there shall be included individual motor circuit breakers, reduced voltage soft starters (RVSS), three phase overload protectors, manual reset, hand off automatic selector switches, running lights, ammeters and elapsed time meters.
5. Panel shall be UL listed.
6. AIC rating for all 480V breakers shall be 42,000
7. Panel shall include an integral air conditioner and other cooling equipment as required to maintain a minimum interior temperature of 85° F
8. Control panel shall include a sun shield

9. Provide phase failure / undervoltage relay to de-energize motors and include auxiliary contacts for remote indication.
10. Modicon PLC with integral programming for pump alternation and ethernet output.
11. Provide a communication module compliant with Mission SCADA system.
12. Allen Bradley panelview display to adjust pump station operating setpoints (panel inner door)
13. HOA Switch for each pump mounted on the control panel inner door Provide alarm system consisting of an alarm light and horn, with silencing reset button
14. Elapsed Time Meter for each pump (panel inner door)
15. Pump run light for each pump (panel inner door)
16. Pump fault light for each pump (panel inner door)
17. High-high Level Alarm: horn, red strobe light, and reset button, etc.
18. Three phase power monitors
19. Lighting arrestor
20. Control power transformers
21. Strip heater and thermostat
22. Motor high temperature and pump moisture sensor LED (panel inner door)
23. Intrinsic safe barrier for level sensor
24. Provide 24 volt control circuit transformer with disconnect and overload protection
25. Provide one 15A, 120V, GFCI, duplex weather proof convenience outlet
26. Provide terminal strips for interface wiring between control panel and pumping station
27. Controls shall automatically alternate the operation of the pumps
28. Provide two 20 amp, one pole breakers in the control panel as spares with four required for service.
29. Provide time delay to prevent the simultaneous starts of the pumps, field adjustable at Operator Interface Terminal (OIT). For power restoration following a power outage, at time = 0 upon restoration of power, the initial time delay setpoints are:

    a. Pump No. 1 – 15 seconds
    b. Pump No. 2 – 45 seconds

30. The control panel shall include a display readout for instantaneous and totalized flow from the force main electromagnetic flow meter.
31. A 24-hour backup battery shall be supplied for the PLC

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine all pumps for compliance with requirements for installation tolerances and other conditions which may affect performance.

3.2 PREPARATION

A. Coordinate with other trades, equipment, and systems to the fullest extent possible.

B. Take all necessary field measurements to determine the exact dimensions for all work and the required sizes of all equipment under this Contract. Verify all pertinent data and dimensions.

3.3 INSTALLATION

A. Installation in accordance with manufacturer's written instructions and recommendations and any applicable code or standard requirement. Installation shall include furnishing the required lubricants and other consumable materials for initial operation in accordance with manufacturer's recommendations.

B. If there are difficulties in operation of the equipment due to the Manufacturer's fabrication or Contractor's installation, provide additional service at no additional cost to the Owner. Install pumps and accessories where indicated on Drawings and according to manufacturer's instructions.

3.4 FIELD QUALITY CONTROL

A. Manufacturers Field Services:

1. Supplier's or manufacturer's technician for equipment specified present at jobsite for minimum man-days indicated, travel time excluded, for assistance during construction, startup, and training of personnel for plant operation. For each project, include minimum of:

a. One (1) trips:

1) One (1) man-day(s) for Installation Services.

b. Two (2) trips:

1) One (1) man-day(s) for Start-Up and Instructional Services.
2) One (1) man-day(s) for Post Start-up Service.

END OF SECTION 08

SECTION 09 - DISINFECTING OF WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section include disinfection of potable water distribution piping as well as testing and reporting requirements.

PART 2 - PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals

1. Hypochlorite: Comply with AWWA B300.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping system has been flushed clean, inspected, and pressure tested.

3.2 INSTALLATION

A. Chlorine solution shall be slowly fed through a suitable device within 10 feet of the point of filling the new main. Care should be taken in filling the mains so that all air pockets are eliminated so as to permit complete contact of the disinfection agent with the entire inside diameter of the pipe.

B. The water and chlorine solution should be slowly fed until 25 mg/l (25ppm) free chlorine is throughout the main.

C. Maintain disinfectant in the system for at least 24 hours.

D. At the end of the 24-hour period, all portions of the main shall show a chlorine residual of not less than 10 mg/l.

E. Disinfection of the new mains and the disposal of the heavily chlorinated water, following the disinfection, shall be accomplished in accordance with the latest edition of AWWA Standard C651. The heavily chlorinated water shall be neutralized prior to discharging to a swale or sanitary sewer manhole as approved by ECU.

F. An air gap must be provided between testing equipment and the distribution system. There shall be no physical connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water and other contaminating materials may be discharged or drawn into the system.

G. Following chlorination all water shall be flushed from the lines until the replacement water has a chlorine content not more than 0.1 ppm. in excess of the residual in the water from the supplying main. Water samples shall be taken by the Contractor and sent to an approved certified laboratory for bacteriological examination.

H. A minimum of two (2) samples from each sampling site, taken twenty-four (24) hours apart, will be analyzed for total coliform analysis. All samples must be absent of total coliform bacteria. Reporting must also include chlorine residual. The number of sites depends on the amount of new construction but must include all dead-end lines, be representative of the water in the newly construction. The lines shall not be placed into service until a satisfactory bacteriological report is received and approval by ECU and SCDES.

I. If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must also be reported. If non-coliform growth is greater than eighty (80) colonies per on hundred (100) milliliters, the sample result is invalid and must be repeated.

J. Replace permanent system devices that were removed for disinfection.

K. The “tablet method” of disinfection which consists of placing calcium hypochlorite granules or tablets in the water main as it is being installed and then filling the main with potable water is allowed as an additional measure but does not eliminate the need to utilize a chlorine solution for final disinfection.

END OF SECTION 09

SECTION 10 - TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Deflection testing of plastic sewer piping
2. Low pressure air testing
3. Vacuum testing of manholes
4. Exfiltration testing for water retaining structures
5. Testing of pressure piping
6. Testing of tracer wire
7. CCTV

B. Test and Evaluation Reports: Indicate results of manhole and piping tests on a form approved by ECU. Use the attached forms for:

1. Deflection test
2. Low pressure air test
3. Vacuum test
4. Exfiltration test
5. Pipe Pressure / Leakage Test

C. ECU and the engineer of record shall witness all pipe and manhole testing in order to confirm the passage or failure of all tests. The Contractor shall be responsible to confirm all parties availability to witness all testing.

PART 2 - EXECUTION

2.1 EXAMINATION

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

B. Verify that trenches are backfilled.

C. Verify that pressure piping thrust restraint system is installed.

2.2 PREPARATION

A. Safety is the responsibility of the Contractor. Care should be taken to ensure all safety equipment, barricades, and warning signs are utilized to ensure a safe working environment.

B. Preliminary testing shall be completed by Contractor prior to official testing to ensure a seamless and efficient testing process.

C. Under no circumstances shall a Contractor operate any valves or equipment within the ECU system.

D. Lamping of Gravity Pipe:

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

    a. All additional cleaning and lamping water will be supplied by the Contractor at no additional cost to ECU.

E. Plugs:

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

2.3 SCHEDULING

A. Provide a minimum of 48 hours notice to ECU prior to testing.

2.4 TESTING

A. Deflection Testing of Plastic Sewer Piping:

1. Conduct deflection test prior to low pressure air test.
2. Perform vertical ring deflection testing on non-rigid piping (thermoplastic, FRP, and acrylonitrile butadiene styrene) after backfilling has been in place for at least 30 days but not longer than 12 months.
3. Allowable maximum deflection for installed plastic sewer pipe is no greater than five percent of original vertical internal diameter.
4. Perform deflection testing using properly sized rigid ball or "go, no go" mandrel.
5. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe, as determined by ASTM standard to which pipe is manufactured; measure pipe diameter in compliance with ASTM D2122.
6. The critical dimensions of the rigid ball or mandrel shall have a +/- 0.01 inch tolerance.
7. Perform testing without mechanical pulling devices.
8. Locate, excavate, replace, and retest piping that exceeds allowable deflection at no additional cost to ECU.

B. Low-Pressure Air Testing:

1. Test each reach of gravity sewer piping between manholes in accordance with ASTM F1417.
2. Introduce air pressure slowly to approximately 5 psig.

3. Determine ground water elevation above spring line of piping.
4. For every foot of ground water above spring line of piping, increase starting air test pressure by 0.43 psi.
5. Do not increase pressure above 10 psig.
6. Allow pressure to stabilize for at least five minutes.
7. Adjust pressure to 5 psig or to increased test pressure as determined above when ground water is present.
8. Do not make allowance for laterals.
9. The time elapsed for a 0.5 psi drop in air pressure shall be not less than 10 minutes or as specified in ASTM F1417. Table attached for reference.
10. Record drop in pressure during testing period.
11. If air pressure drops more than 1.0 psi during testing period, piping has failed.
12. If 1.0 psi air pressure drop has not occurred during testing period, piping is acceptable; discontinue testing.
13. If piping fails, test reach of piping in incremental stages until leaks are isolated, repair leaks, and retest entire reach between manholes.

C. Vacuum Testing of Manholes:

1. Perform vacuum testing of all manholes using plate type test to ensure frame is vacuum tested. Whenever possible prior to backfilling in order to more easily locate leaks.
2. Test manholes with manhole frame set in place.
3. Vacuum Testing:

    a. Comply with ASTM C1244.
    b. Plug pipe openings; securely brace plugs and pipe.
    c. Inflate compression band to create seal between vacuum base and structure.
    d. Connect vacuum pump to outlet port with valve open, then draw vacuum to 10 in. Hg.
    e. Close valve.
    f. Manhole Test Duration in Seconds shall be a minimum of 60 or according to ASTM C1244 Table 1a whichever is longer.
    g. Record vacuum drop during test period.
    h. If vacuum drop is greater than 1 in. Hg during testing period, repair and retest manhole.
    i. If vacuum drop of 1 in. Hg does not occur during test period, manhole is acceptable; discontinue testing.
    j. If vacuum test fails to meet 1 in. Hg drop in specified time after repair, repair and retest manhole at no additional cost to ECU.

        1) Repair both outside and inside of joint to ensure permanent seal.

D. Water Retaining Structure Testing

1. Exfiltration Testing:

    a. Exfiltration testing shall be performed prior to any specified backfill placement at the footing or wall.
    b. Plug pipes in manhole or structure excluding overflow.

c. Remove water from manhole or structure.
d. Observe plugs over period of not less than two hours to ensure that there is no leakage into manhole or structure.
e. Fill manhole or structure with water within 4 inches of top of cover frame or overflow.
f. Prior to testing, allow manhole to soak for minimum of four hours for manholes and 24 hours for other structures to maximum of 72 hours.
g. Inspect the exterior of the wall and footing for damp spots. Damp spots shall be defined as spots where moisture can be picked up on a dry hand, the source of which is from inside the manhole or structure.
h. After soak period, adjust water level inside the structure to within 4 inches of top of cover frame or overflow.
i. Measure water level from top of manhole frame or access point.
j. At end of the 24 hour testing period, again measure water level from the same point; compute drop in water level during testing period.
k. The exfiltration test is considered satisfactory when drop in water level is less than 0.00947 gallons per foot diameter per foot of depth.

2. If unsatisfactory testing results are achieved, repair structure and retest until result meets criteria.
3. Repair visible leaks regardless of quantity of leakage.

E. Testing of Pressure Piping:

1. PE and HDPE pipe will be tested in accordance with ASTM F2164.

2. Test all other pipe material systems according to AWWA C600 (DIP) or AWWA C605 (PVC) and following:

a. Open vents at high points to purge air pockets while piping system is filling.
b. Complete walkthrough and operate valves in presence of ECU personnel.
c. Thoroughly flush line to be tested before testing to remove soil and other foreign material and to expel air from the line.
d. Hydrostatically test each portion of pressure piping, including valved sections, at 1.5 times working pressure of piping, or 200 psi, whichever is greater, (unless alternative pressure is determined by ECU) based on elevation of lowest point in piping corrected to elevation of test gage.
e. Raise pressure to specified test pressure.
f. Observe joints, fittings, and valves undergoing testing.
g. Maintain pressure within 5.0 psi of test pressure for a period of not less than 2 hours.
h. If pressure drops more than 5.0 psi during the test period, the test will be considered a failed test, and that section of line will not be accepted.

3. Determining Leakage:

a. Pump make-up water into the test section in order to maintain the test pressure within 5.0 psi. Measure the amount of make up water added during the test period by using a metering system, approved by ECU, to determine actual leakage in that section of line. Metering system shall measure in gallons.

b. At the end of the test period, if no make-up water has been added because the pressure has been maintained within 5.0 psi of the test pressure, add make-up water to return the system to the test pressure. The amount of make-up water added is considered actual league for that section of line.

4. Testing Allowance:
   a. Maximum allowable leakage for buried piping with mechanical or push-on joints shall be determined by one of the following two methods:

   b. Maximum allowable leakage for buried piping shall be determined using the following method:

$$L = SD \times \sqrt{P}/148{,}0000$$

L = testing allowance, gph.
S = length of pipe tested, feet.
D = nominal diameter of pipe, inches.
P = average test pressure during hydrostatic testing, psig.

   c. If pipe undergoing testing contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each pipe size.

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

F. Tracer wire

1. Complete tracer wire testing in conjunction with ECU representative.
2. Inspect all access points and valve boxes to ensure that wire is located outside of PVC riser and adequate wire is available to connect locating device.
3. Connect to tracer wire and follow signal to ensure that continuous signal is available.
4. If signal is lost, excavate area and splice tracer wire using underground wire nuts.

G. CCTV

1. CCTV Inspection

   a. All new gravity sewer pipes shall be inspected and the footage provided to ECU prior to low pressure air testing.
   b. Gravity sewer shall be flushed and free of debris prior to inspection.
   c. During CCTV inspection, water shall be introduced into the collection system to provide a 2-inch wide flow of clean water through the pipe for the entirety of the inspection.
   d. Inspection should provide clear views of all services and manhole entrances and exits.
   e. Inspection should be completed at a speed that allows adequate resolution to observe pipe conditions.

f. Any deficiencies identified must be repaired and the line re-inspected as outlined above until satisfactory inspection is provided.

2.5 ATTACHMENTS

A. Gravity sewer low pressure air test data sheet

B. Manhole vacuum test data sheet

C. Pressure Piping / Leakage Test

D. Mandrel Test

END OF SECTION 100

MANDREL TEST

EASLEY COMBINED UTILITIES

Project Name:_____ Contractor/Foreman:_____

Material: _____

Maximum Allowed Deflection:_____

DATE	UP STRM MH	DN STRM MH	PIPE DIA. (IN)	MATERIAL TYPE	LENGTH (FT)	MAXIMUM ALLOWED DEFLECTION	PASS/ FAIL

Signature of Inspector: _____

Signature of Engineers Representative: _____

Signature of Contractor: _____

GRAVITY SEWER LOW PRESSURE AIR TEST DATA SHEET

EASLEY COMBINED UTILITIES

Minimum Test Times for a 1 psig Pressure Drop for Size & Length of Pipe Indicated
(Adapted from ASTM F-1417-92)

Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	5:42
8	7:34	298	01.52 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:54	11:52	13:50	15:48	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:16	17:06	19:56	22:48	25:40
15	14:10	159	5.342 L	14:10	14:10	17:48	22:16	26:42	31:10	25:36	40:04
18	17:00	133	7.692 L	17:00	19:14	25:38	32:02	38:28	44:52	51:18	57:42
21	19:50	114	10.47 L	19:50	26:10	34:54	43:38	52:22	61:04	69:48	78:32
24	22:40	99	13.674 L	22:48	35:54	45:36	57:00	68:22	79:43	91:10	102:34

Test No. _____

Identification of Pipe Installation (Job name, location, etc.) _____

_____

Field Test Data:

Date: _____ Specified Maximum Pressure Drop _____psig

Identification of Pipe Material Installed_____

Pipe Under Test				Spec. Time	Field Test Operations Data					
Upstream MH sta #	Down-stream MH sta #	Dia. D (in.)	Length L (ft.)	Refer to ASTM F1417 (min:sec)	Pressure Initially Raised to (psig)	Time Al-lowed for Pressure to Stabi-lize (min)	Start Test Pres-sure (psig)	Stop Test Pres-sure (psig)	Elapsed Time (min:sec)	Pass or Fail (P or F)

Signature of Inspector: _____

Signature of Engineers Representative: _____

Signature of Contractor: _____

MANHOLE VACUUM TEST DATA SHEET

EASLEY COMBINED UTILITIES

Project Name: _____ Contractor/Foreman: _____

Minimum Test Times for Various Manhole Diameters
(Adapted from ASTM C-1244)

Depth (ft)	Manhole Diameter in Inches											
	30	33	36	42	48	54	60	66	72	84	96	120
	Test Time in Seconds											
<10	Minimum Test Time 60 Seconds											60
10											60	71
12										60	66	85
14									60	67	77	99
16								60	65	76	89	113
18							60	65	73	86	100	127
20						60	65	72	81	95	111	141
22						64	72	79	89	105	122	155
24					60	69	78	87	97	114	133	170
26					64	75	85	94	105	124	144	184
28				60	69	81	91	101	113	133	155	198
30				63	74	87	98	108	121	143	166	212
32				67	79	92	104	115	129	152	177	226
34			60	71	84	98	110	122	137	162	188	240
36			63	76	89	104	117	130	145	172	199	254
38		60	66	80	93	109	123	137	153	181	210	269
40	60	61	70	84	98	115	130	144	161	191	221	283

Manhole Vacuum Test Data (Adapted from ASTM C-1244)

Date	Manhole Number	Manhole Dia. (In)	Manhole Depth (FT)	Manhole Test Time (SEC)	Starting Test (In. HG)	Ending Test (In. HG)	Pressure Drop (In. HG)	Pass or Fail (P or F)	Comments

Signature of Inspector: _____

Signature of Engineers Representative: _____

Signature of Contractor: _____

TESTING

SECTION 10 - C

EASLEY COMBINED UTILITIES

PRESSURE PIPING / LEAKAGE TEST

EASLEY COMBINED UTILITIES

Project Name: _____ Project Number: _____

Contractor / Foreman: _____ Owner: _____

AWWAC600 Table 4.A Hydrostatic Testing Allowance per 1,000 ft of pipeline* - 2 hour test

Avg. Test Pressure (psig)	Nominal Pipe Diameter (inches)																	
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54	60	64
350	0.76	1.02	1.52	2.02	2.52	3.04	3.54	4.04	4.56	5.06	6.06	7.58	9.10	10.62	12.14	13.66	15.16	16.18
300	0.70	0.94	1.40	1.88	2.34	2.80	3.28	3.74	4.22	4.68	5.62	7.02	8.42	9.84	11.24	12.64	14.04	14.98
275	0.68	0.90	1.34	1.80	2.24	2.68	3.14	3.58	4.04	4.48	5.38	6.72	8.06	9.42	10.76	12.10	13.44	14.34
250	0.64	0.86	1.28	1.70	2.14	2.56	3.00	3.42	3.84	4.28	5.12	6.42	7.70	8.98	10.26	11.54	12.82	13.68
225	0.60	0.82	1.22	1.62	2.02	2.44	2.84	3.24	3.64	4.06	4.86	6.08	7.30	8.52	9.72	10.94	12.16	12.98
200	0.58	0.76	1.14	1.52	1.92	2.30	2.68	3.06	3.44	3.82	4.58	5.74	6.88	8.02	9.18	10.32	11.46	12.24
175	0.54	0.72	1.08	1.44	1.78	2.14	2.50	2.86	3.22	3.58	4.30	5.36	6.44	7.50	8.58	9.66	10.72	11.44
150	0.50	0.66	1.00	1.32	1.66	1.98	2.32	2.64	2.98	3.32	3.98	4.96	5.96	6.96	7.94	8.94	9.94	10.60
125	0.46	0.60	0.90	1.20	1.52	1.82	2.12	2.42	2.72	3.02	3.62	4.54	5.44	6.34	7.26	8.16	9.06	9.66
100	0.40	0.54	0.82	1.08	1.36	1.62	1.90	2.16	2.44	2.70	3.24	4.06	4.86	5.68	6.48	7.30	8.10	8.64

*If the pipeline under test contains sections of various diameters, the testing allowance will be the sum of the testing allowance for each size.

Date/Time of Test: ___

Start Time:_____ **End Time:** _____

Test Pressure: _____ psi. **Test Length**: ___ feet

Diameter (nominal): _____ inches

Allowable Leakage: _____ gal. **Actual Leakage:** __ gal.

Result (Pass or Fail): _____

Comments:_____

_____

Signature of Inspector: _____

Signature of Engineers Representative: _____

Signature of Contractor: _____

TESTING

SECTION 10 - D

EASLEY COMBINED UTILITIES

TRACER WIRE TESTING

EASLEY COMBINED UTILITIES

Project Name:_____ Contractor/Foreman:_____

DATE	FROM (Sta Number, address, hyd no. etc.)	TO (Sta Number, address, hyd no. etc.)	PASS / FAIL	COMMENTS

Signature of Inspector: _____

Signature of Engineers Representative: _____

Signature of Contractor: _____

CCTV LOG

EASLEY COMBINED UTILITIES

Project Name:_____ Contractor/Foreman:_____

DATE	UP STRM MH	DN STRM MH	PIPE MATERIAL	DIAMETER	PASS / FAIL	COMMENTS

Signature of Inspector: _____

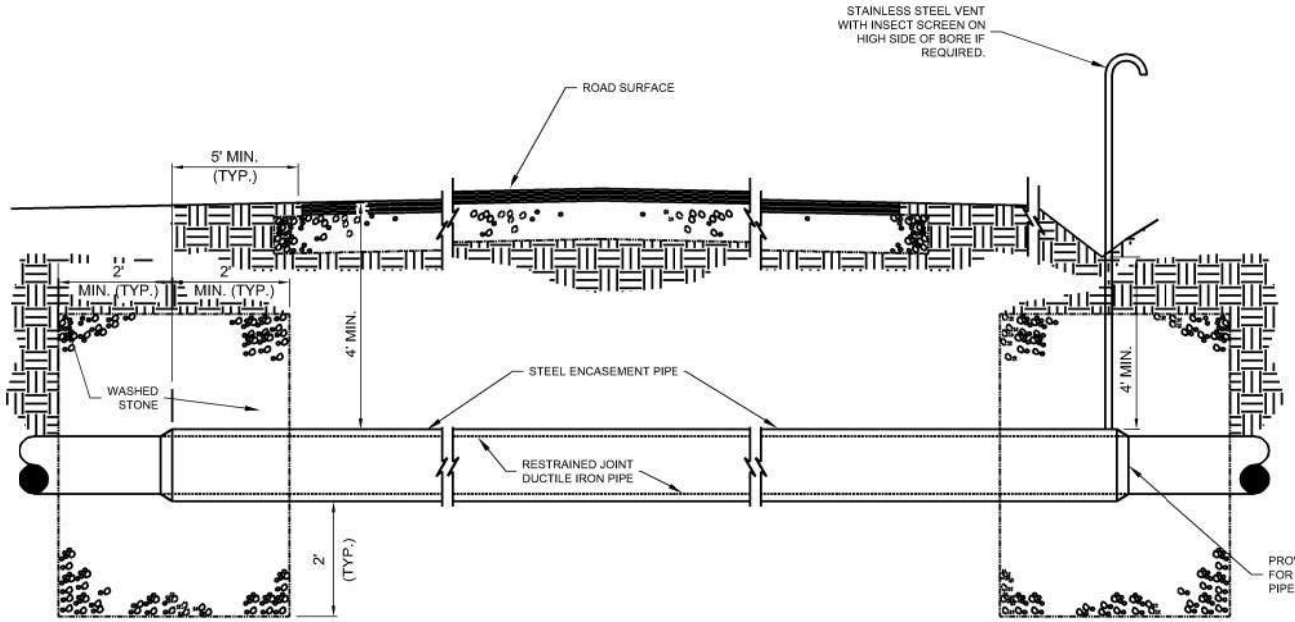
Signature of Engineers Representative: _____

Signature of Contractor: _____

EASLEY COMBINED UTILITIES

DETAILS

EASLEY COMBINED UTILITIES

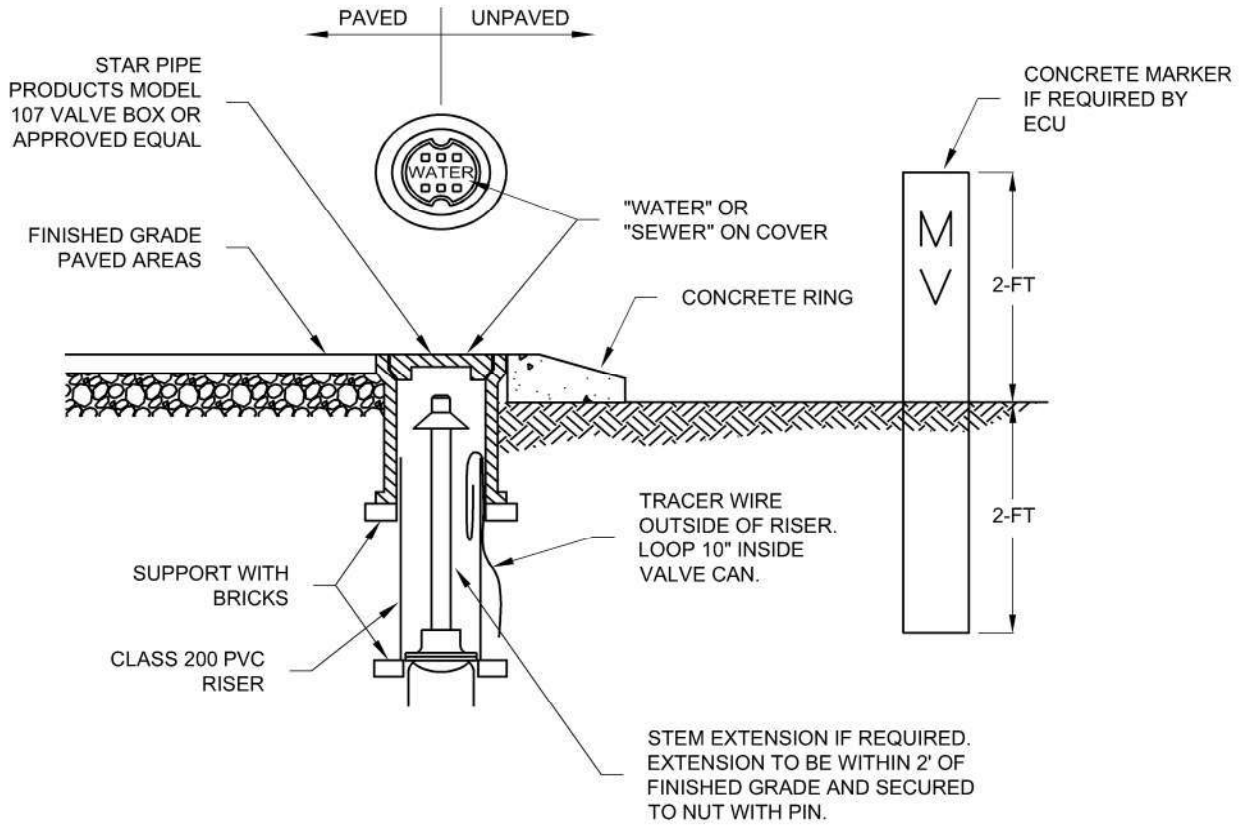


DUCTILE IRON CARRIER PIPE DIAMETER	STEEL CASING PIPE DIAMETER	STEEL CASING PIPE WALL THICKNESS
2"	8"	0.188"
3"	8"	0.188"
4"	10"	0.188"
6"	12"	0.188"
8"	16"	0.281"
10"	18"	0.312"
12"	20"	0.344"
14"	24"	0.375"
16"	24"	0.375"
18"	30"	0.469"
20"	30"	0.469"
24"	36"	0.531"
30"	42"	0.625"
36"	48"	0.688"
42"	60"	0.844"
48"	66"	0.938"

NOTES:

1) RESTRAINED JOINTS TO BE TR-FLEX OR APPROVED EQUAL. NO GRIPPER GASKETS ARE PERMITTED IN CASINGS.
2) PROVIDE "SPIDER" TYPE CASING SPACERS FOR POSITIONING CARRIER PIPE WITHIN THE CASING PIPE. USE MODEL SSI AS MANUFACTURED BY ADVANCE PRODUCTS & SYSTEMS INC. OR APPROVED EQUAL. INSTALL IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS WITH A MINIMUM OF TWO SPACERS PER PIPE SECTION.
3) PROVIDE PULL-ON TYPE SYNTHETIC RUBBER END SEALS FOR CASING PIPE, MODEL AC, AS MANUFACTURED BY ADVANCE PRODUCTS & SYSTEMS INC. OR APPROVED EQUAL. INSTALL IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
4) CASING PIPE TO BE COATED ON INSIDE AND OUTSIDE WITH BITUMASTIC COATING.

GENERAL SPECIFICATIONS	TYPICAL ROAD BORE EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. G-01		
DATE: 01/17/2025		



NOTES:

1) INSTALL MONUMENT IN GROUND BEHIND THE VALVE BOX.

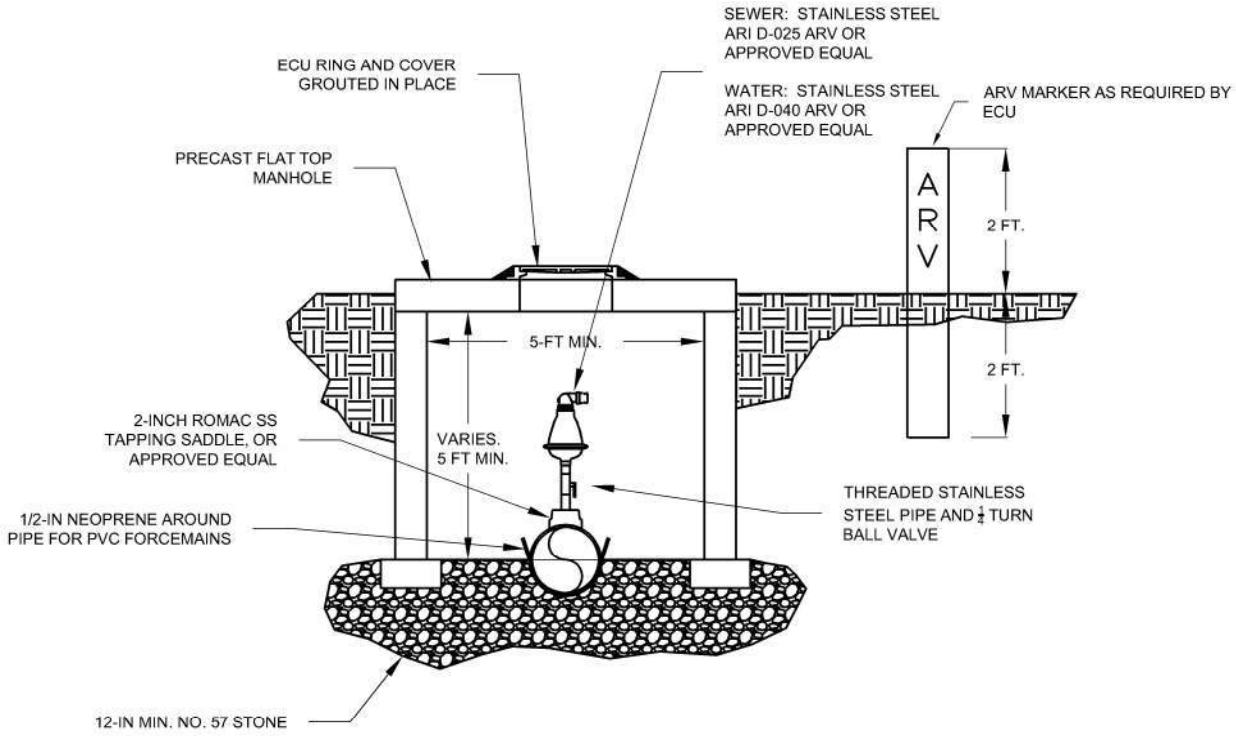
2) WHERE TWO OR MORE VALVES ARE IN THE SAME AREA, VALVE MONUMENT SHOULD INDICATE "2MV", "3MV", ETC.

3) FOR AIR RELEASE VALVES AND BLOW OFF VALVES, MONUMENT SHOULD READ "ARV" OR "BO" AS REQUIRED.

4) VALVE SHOULD BE SUPPORTED BY BRICKS.

5) TRACER WIRE SHALL BE BARON #545020502

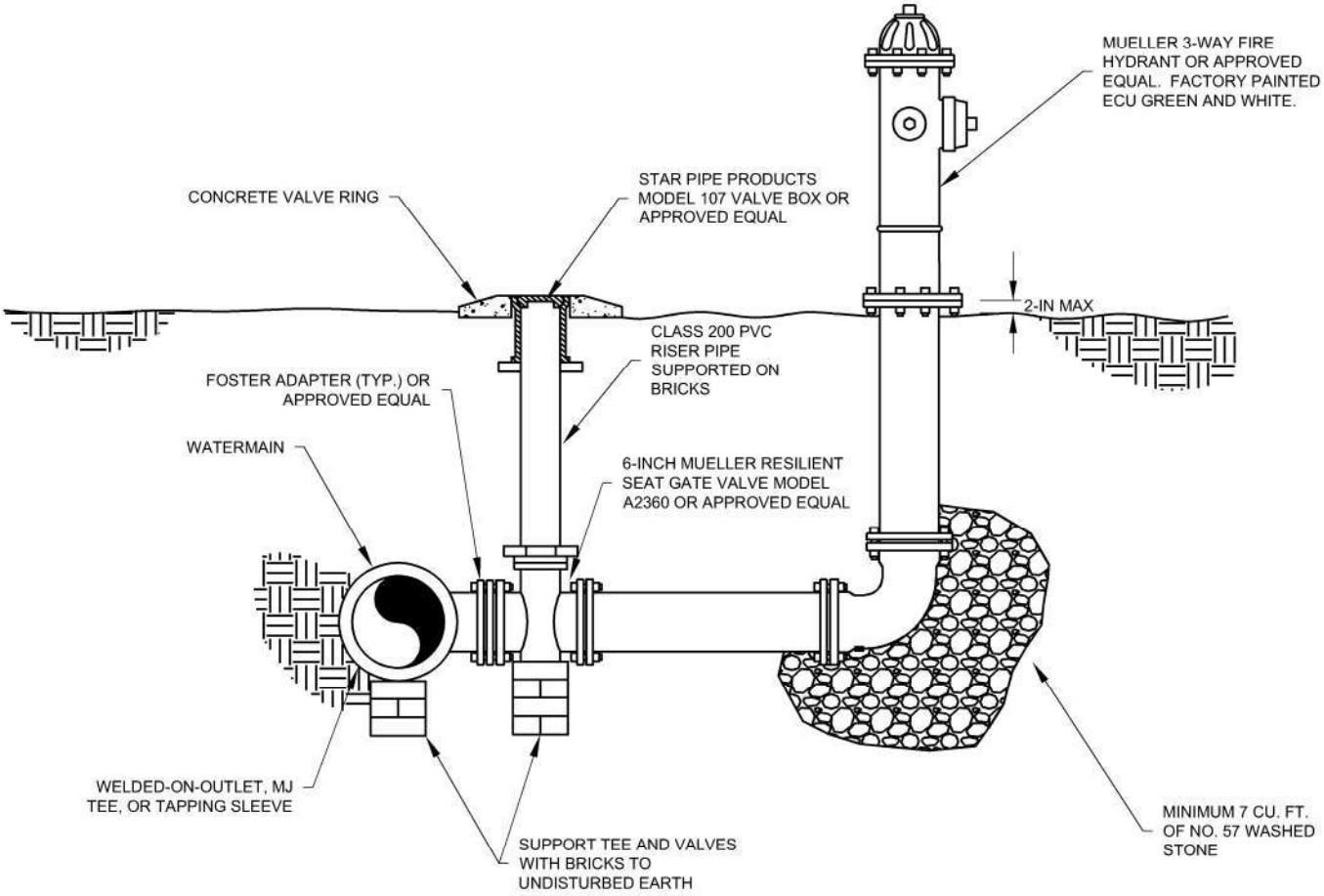
GENERAL SPECIFICATIONS	TYPICAL VALVE INSTALLATION EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. G-02		
DATE: 1/17/2025		



NOTES:

1) PRECAST STRUCTURE TO BE MANUFACTURED BY KNIGHT'S PRECAST OR TINDALL CORPORATION.
2) STRUCTURE SHALL BE ELEVATED SO THAT NO RUNOFF CAN ENTER ARV VAULT.
3) RING AND COVER TO BE MODEL V-1384 AS MANUFACTURED BY EAST JORDAN IRON WORKS PART # 41384104A01 OR EQUIVALENT US FOUNDRY - PART #8020190 - USF 669 RING & KL COVER -2XNPPB.
4) STEPS TO BE COPOLYMER POLYPROPYLENE ENCAPSULATED 1/2" STEEL ROT MEETING ASTM C-478.
5) ARV SHALL NOT BE LOCATED IN FLOOD PLAIN.
6) NO STONE SHALL COME IN CONTACT WITH PLASTIC PIPE.

GENERAL SPECIFICATIONS	AIR RELEASE VALVE EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. G-03		
DATE: 1/17/2025		

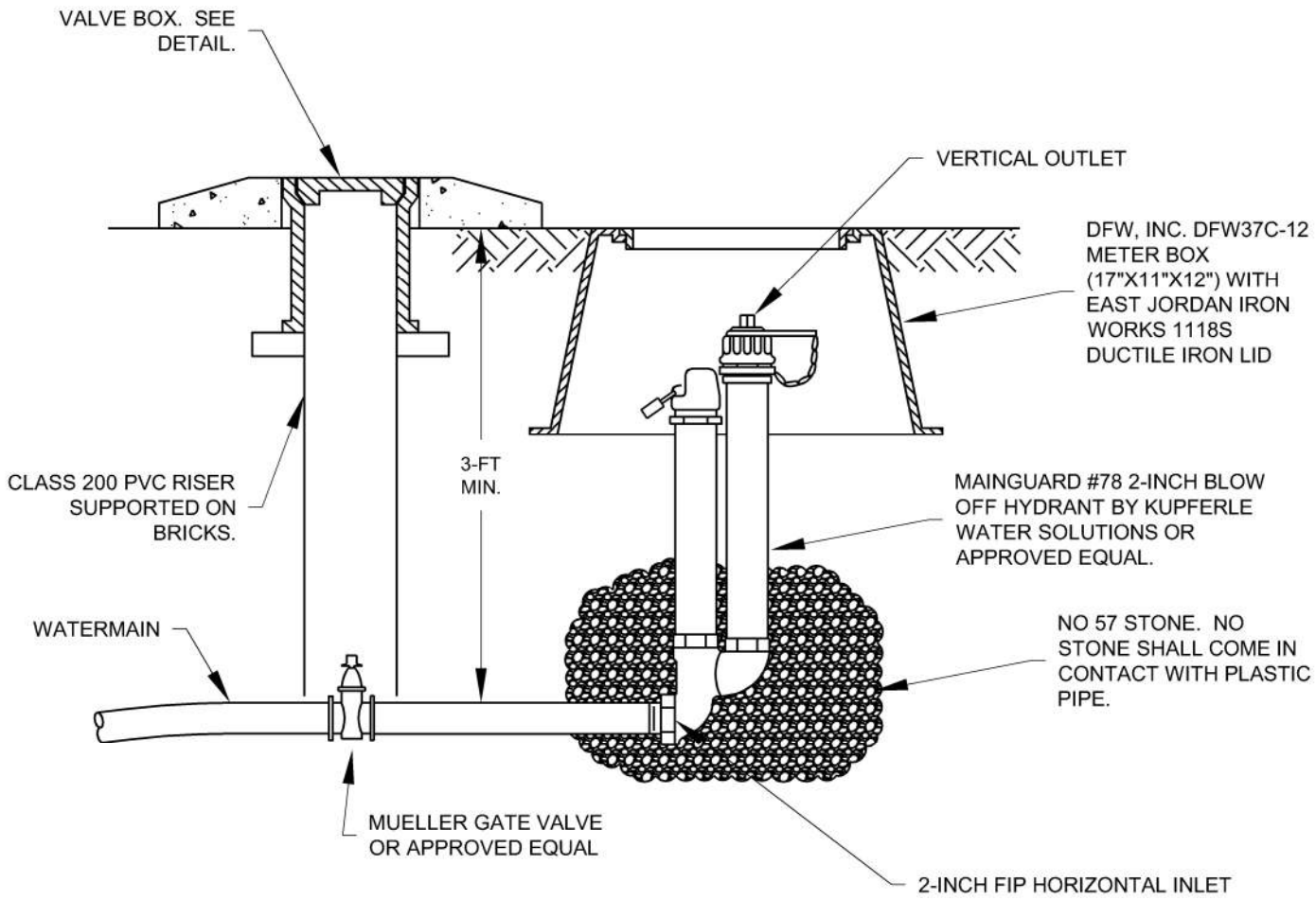


NOTE: 1) ALL VALVES AND FITTINGS SHALL BE MECHANICAL JOINT WITH MEGALUGS MANUFACTURED BY EBAA, INC. OR APPROVED EQUAL.

2) ALL PIPE SHALL BE DUCTILE IRON.

3) FIRE HYDRANT SHALL FACE ROAD UNLESS DETERMINED BY ECU.

WATER SPECIFICATIONS	TYPICAL FIRE HYDRANT ASSEMBLY EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. W-01		
DATE: 1/17/2025		

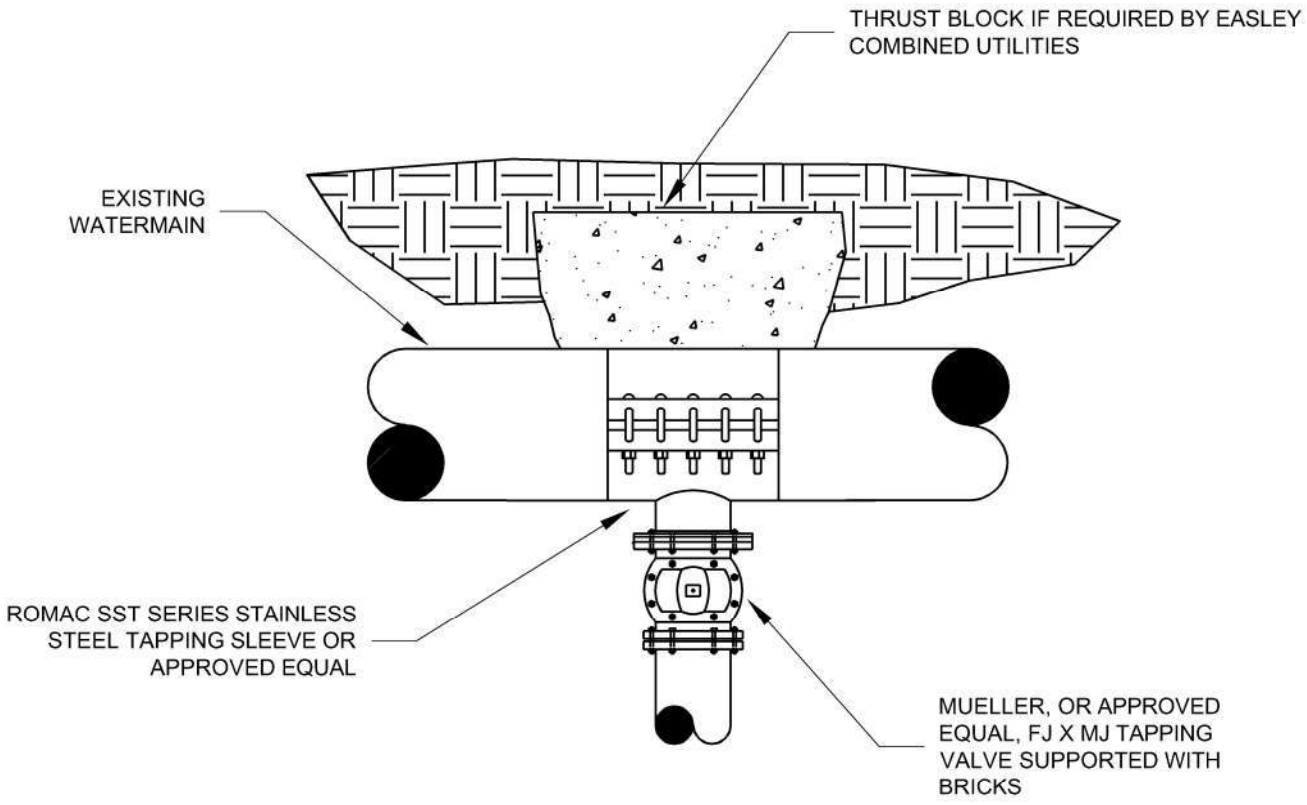


NOTES:

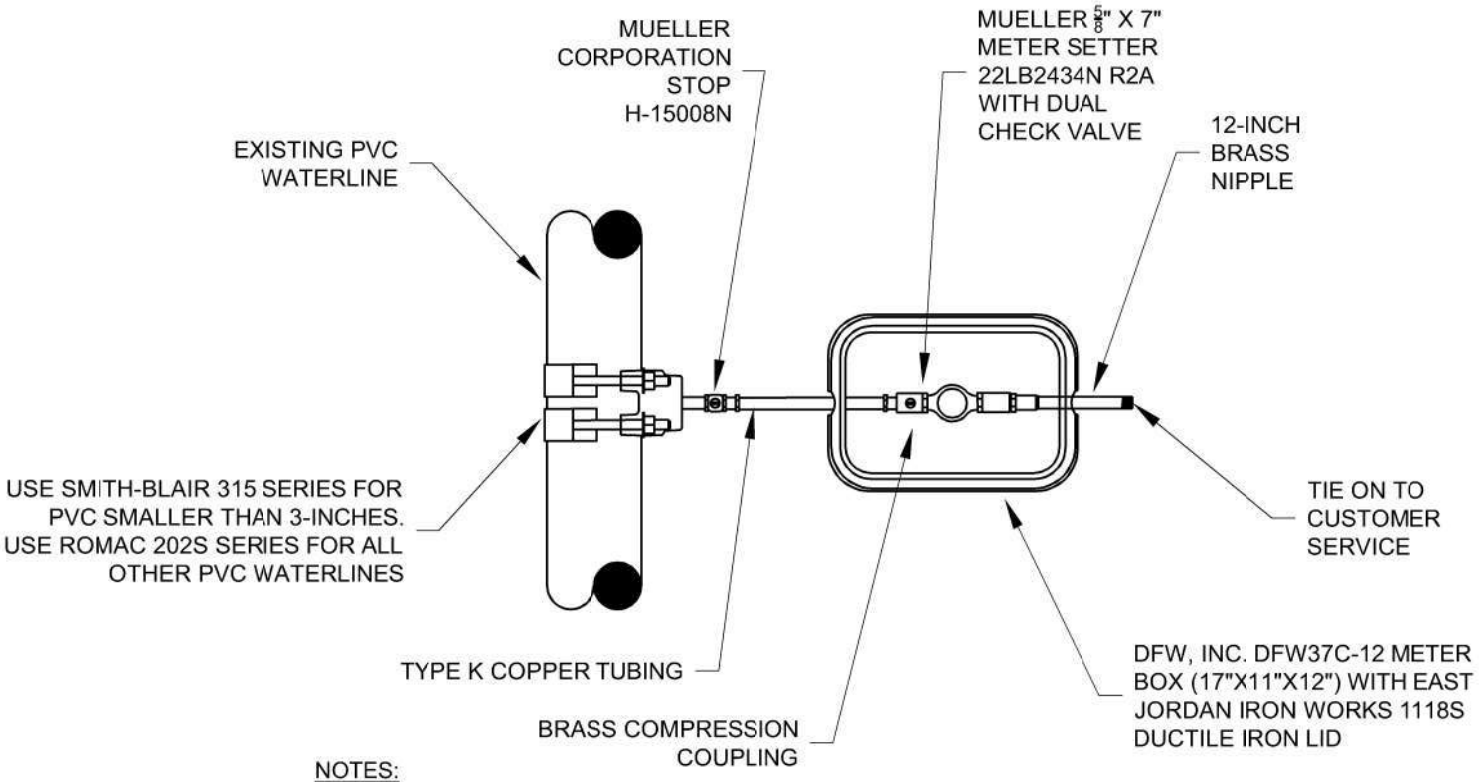
1) BLOW-OFF SHOULD NOT BE DIRECTED TOWARDS ROADS OR SO THAT THE WATER WILL FLOW INTO CREEKS, ETC. AT STREAM CROSSINGS DIRECT AWAY FROM STREAMS, OVER GROUND.

2) BLOW-OFFS SHALL BE SIZED TO PROVIDE A MINIMUM VELOCITY OF 2.5 FEET PER SECOND IN THE WATER MAIN AND MAINTAIN A RESIDUAL PRESSURE OF TWENTY-FIVE (25) PSI.

WATER SPECIFICATIONS	BLOW OFF DETAIL EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. W-02		
DATE: 1/17/2025		



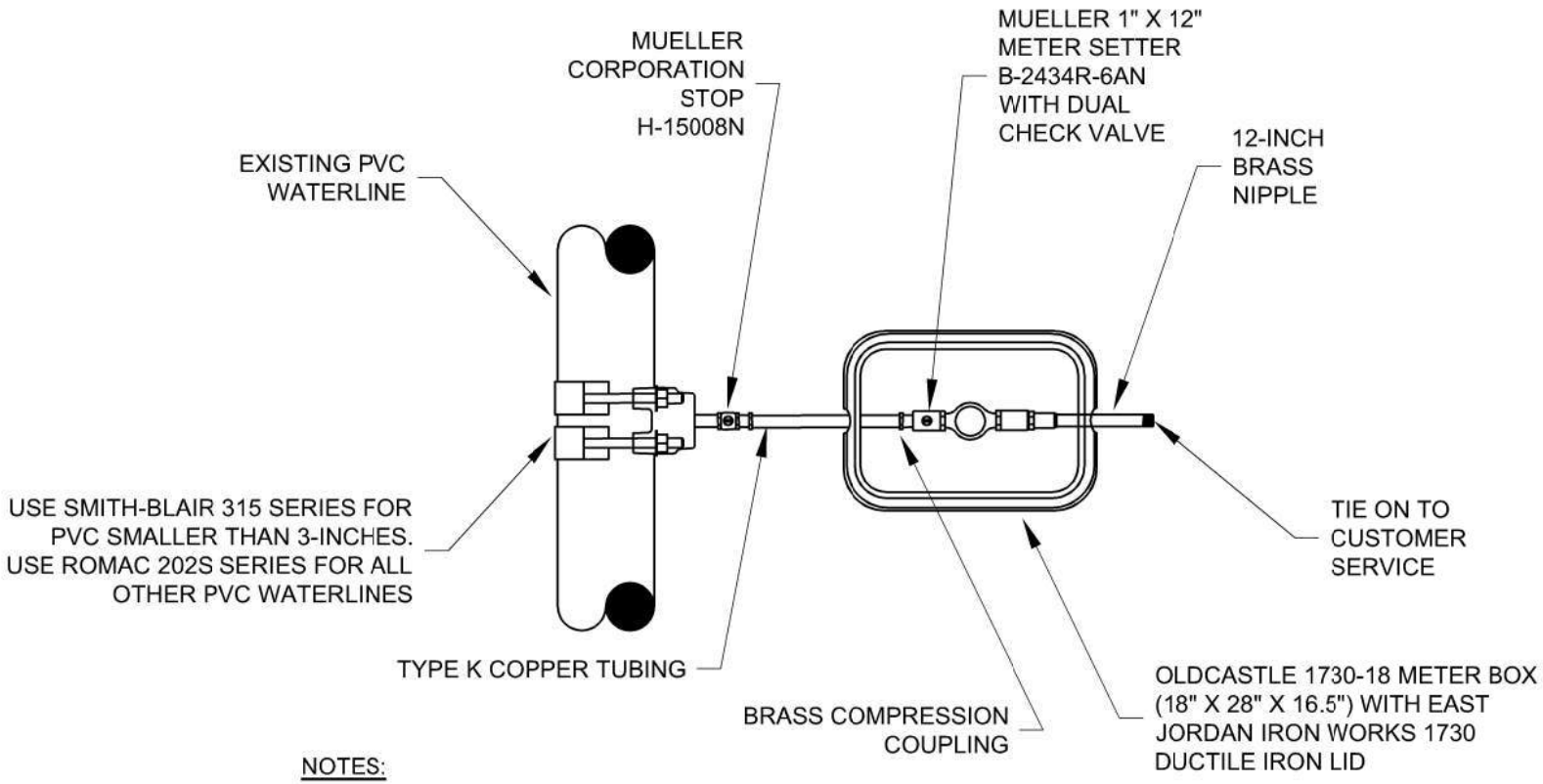
WATER SPECIFICATIONS	TAPPING SLEEVE AND VALVE EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. W-03		
DATE: 1/17/2025		



NOTES:

1) IF TAPPING DUCTILE IRON PIPE, DO NOT USE A SADDLE. TAP CORPORATION DIRECTLY INTO PIPE.
2) MATCH EXISTING MATERIAL WHEN CONNECTING CUSTOMER SERVICE TO BRASS NIPPLE.
3) METER BOXES TO BE INSTALLED ON MINIMUM OF FOUR CONCRETE BRICKS.
4) INSTALL METER BOX ON PROPERTY LINE.
5) ALL BRASS TO BE OF DOMESTIC ORIGIN.
6) METER SETTER SHALL HAVE A DUAL CHECK VALVE.
7) TAPS SHALL BE DIRECTLY IN FRONT OF METER BOX. TAPS SHALL NOT BE LOCATED WHERE METER BOX WILL BE IN DRIVEWAY.

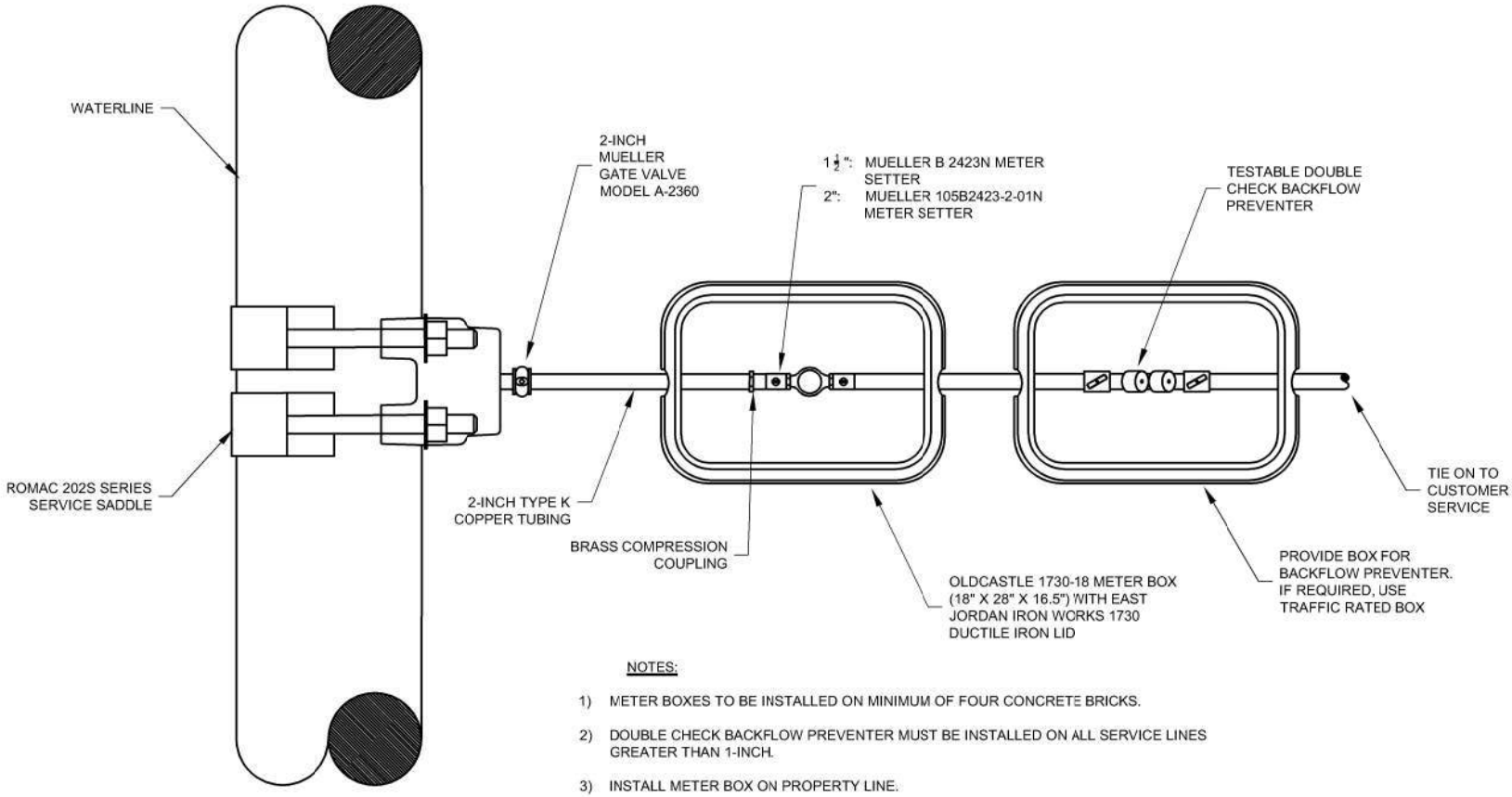
WATER SPECIFICATIONS	5/8-INCH WATER METER EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. W-04		
DATE: 1/17/2025		



NOTES:

1) IF TAPPING DUCTILE IRON PIPE, DO NOT USE A SADDLE. TAP CORPORATION DIRECTLY INTO PIPE.
2) MATCH EXISTING MATERIAL WHEN CONNECTING CUSTOMER SERVICE TO BRASS NIPPLE.
3) METER BOXES TO BE INSTALLED ON MINIMUM OF FOUR CONCRETE BRICKS.
4) INSTALL METER BOX ON PROPERTY LINE.
5) ALL BRASS TO BE OF DOMESTIC ORIGIN.
6) METER SETTER SHALL HAVE A DUAL CHECK VALVE.
7) TAPS SHALL BE DIRECTLY IN FRONT OF METER BOX. TAPS SHALL NOT BE LOCATED WHERE METER BOX WILL BE IN DRIVEWAY.

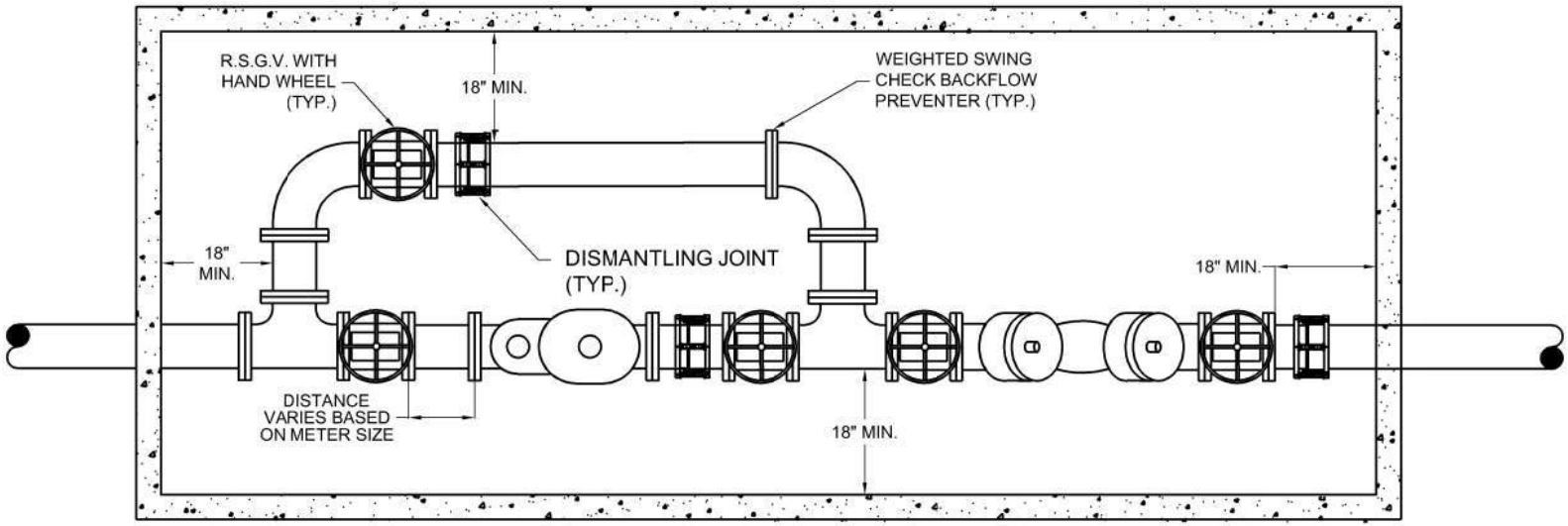
WATER SPECIFICATIONS	1-INCH WATER METER EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. W-05		
DATE: 1/17/2025		



NOTES:

1) METER BOXES TO BE INSTALLED ON MINIMUM OF FOUR CONCRETE BRICKS.
2) DOUBLE CHECK BACKFLOW PREVENTER MUST BE INSTALLED ON ALL SERVICE LINES GREATER THAN 1-INCH.
3) INSTALL METER BOX ON PROPERTY LINE.
4) ALL BRASS TO BE OF DOMESTIC ORIGIN.
5) METER BOXES TO BE INSTALLED ON MINIMUM OF FOUR CONCRETE BRICKS.
6) TAPS SHALL BE DIRECTLY IN FRONT OF METER BOX. TAPS SHALL NOT BE LOCATED WHERE METER BOX WLL BE IN DRIVEWAY.

WATER SPECIFICATIONS DETAIL NO. W-06 DATE: 1/17/2025	1.5-INCH AND 2-INCH WATER METER EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES



NOTES:

1) REINFORCED HATCH SHALL BE 30" X 3)" HALLIDAY HATCH OR APPROVED EQUAL. HATCH SHALL BE PROVIDED FOR METER AND BACKFLOW DEVICE.

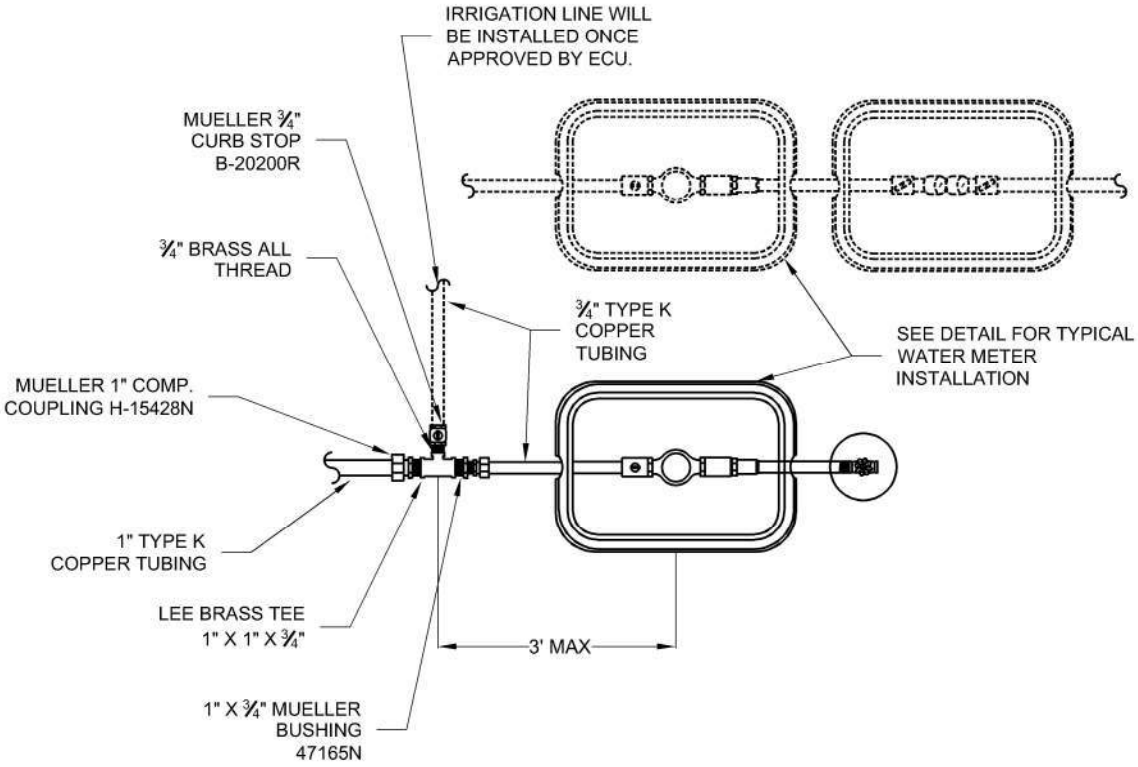
2) ALL FITTINGS MUST BE OF DOMESTIC ORIGIN.

3) EASLEY COMBINED UTILITIES WILL SELECT A WATER METER ONCE DEMAND IS DETERMINED.

4) PROVIDE SUPPORTS FOR ALL PIPING.

5) DOUBLE CHECK BACKFLOW DEVICE CAN BE IN SEPARATE VAULT IMMEDIATELY AFTER METER VAULT IF NEEDED.

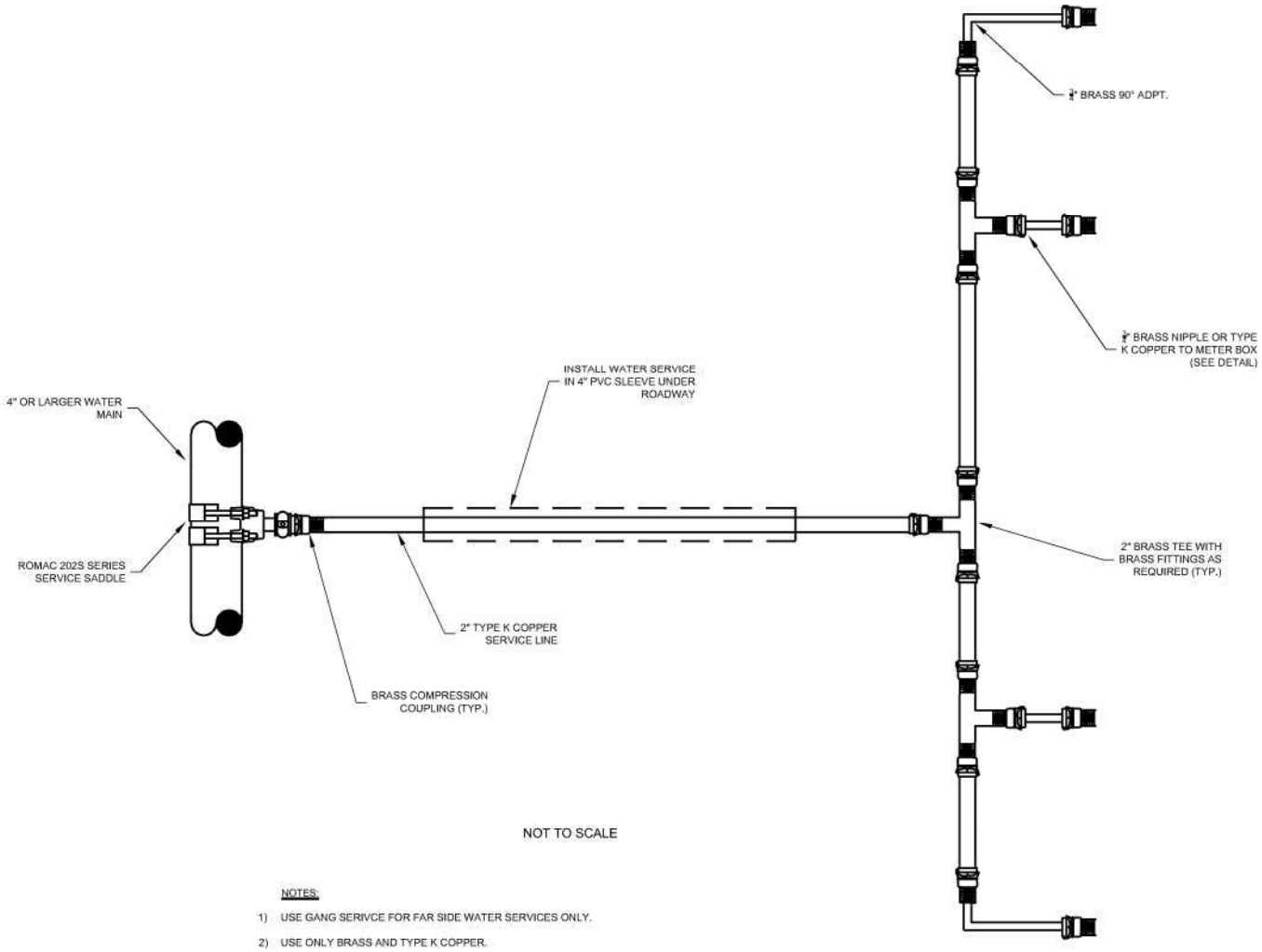
WATER SPECIFICATIONS DETAIL NO. W-07 DATE: 1/17/2025	3-INCH AND LARGER METER VAULT EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES



NOTES:

1) IRRIGATION TAPS ON DOMESTIC LINE ARE TO BE USED ON FAR SIDE TAPS ONLY.
2) CONSULT EASLEY COMBINED UTILITIES BEFORE TAPPING WATER LINE.
3) METER BOXES TO BE INSTALLED ON MINIMUM OF FOUR CONCRETE BRICKS.
4) INSTALL METER BOX(ES) ON PROPERTY LINE.
5) ALL BRASS TO BE OF DOMESTIC ORIGIN.

WATER SPECIFICATIONS	DOMESTIC SERVICE WITH IRRIGATION EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. W-08		
DATE: 1/17/2025		

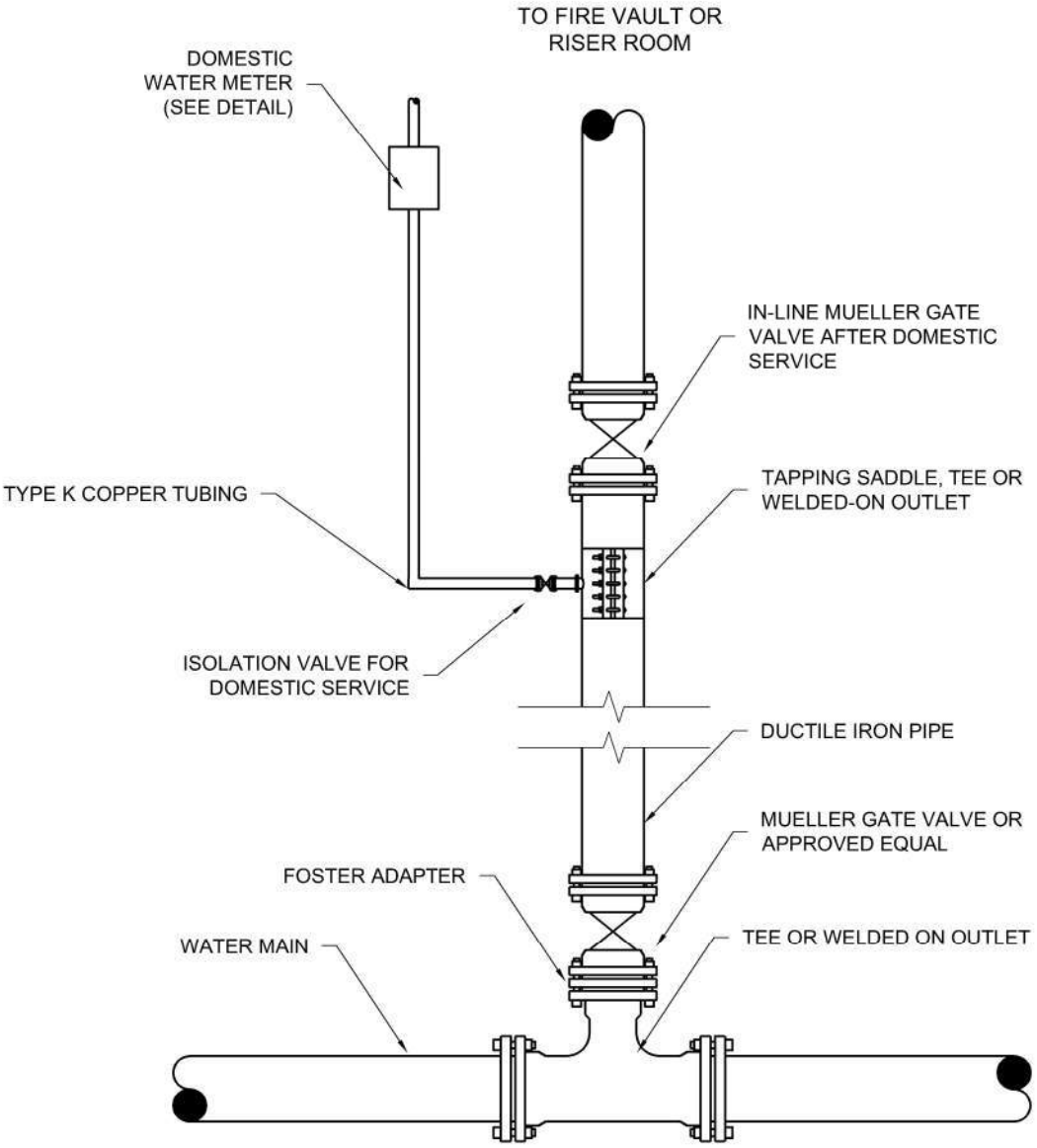


NOT TO SCALE

NOTES:

1) USE GANG SERIVCE FOR FAR SIDE WATER SERVICES ONLY.
2) USE ONLY BRASS AND TYPE K COPPER.
3) BRASS SHOULD BE OF DOMESTIC ORIGIN.
4) INSTALL METER BOX ON PROPERTY LINE OR AT SIDEWALK.

WATER SPECIFICATIONS	TYPICAL GANG DOMESTIC SERVICES EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. W-09		
DATE: 1/17/2025		



NOTE:

1) THE DOUBLE CHECK BACKFLOW ASSEMBLY FOR THE FIRE MAIN MUST BE LOCATED INSIDE A VAULT UNLESS THE BUILDING IS WITHIN 50 FEET OF THE WATERMAIN.

2) DOMESTIC LINES CAN STILL BE TAPPED OFF OF THE FIRE LINE EVEN IF THE BACKFLOW ASSEMBLY IS LOCATED IN THE BUILDING.

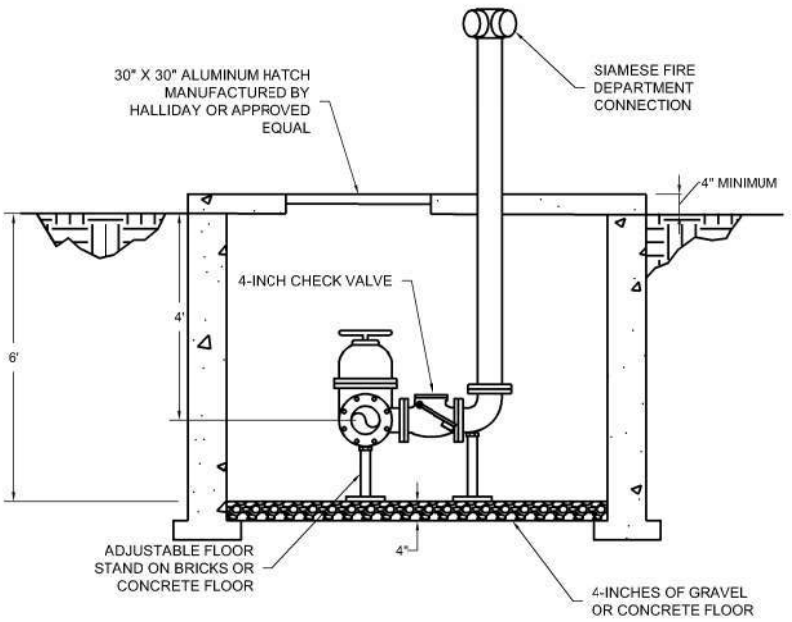
3) THE DOMESTIC WATER METER MUST BE INSTALLED ADJACENT TO THE FIRE MAIN VAULT IF USING THE ABOVE LAYOUT.

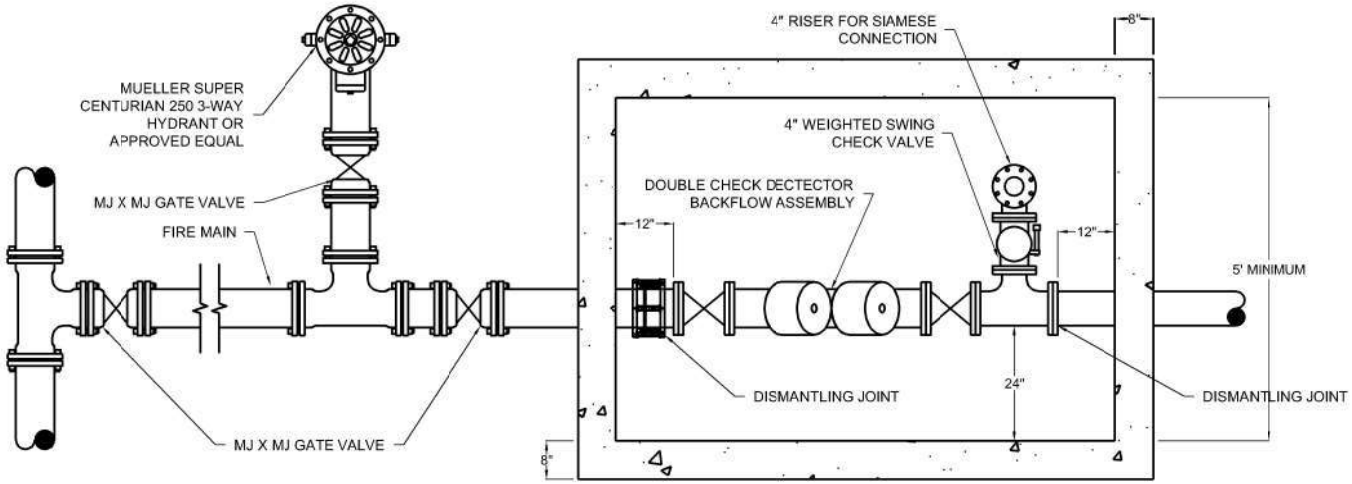
4) WATER METERS MUST BE INSTALLED AT THE PROPERTY LINE OR SIDEWALK.

WATER SPECIFICATIONS	COMBINATION DOMESTIC AND FIRE LINE EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. W-10		
DATE: 1/17/2025		

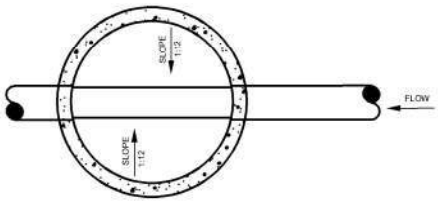
NOTES:

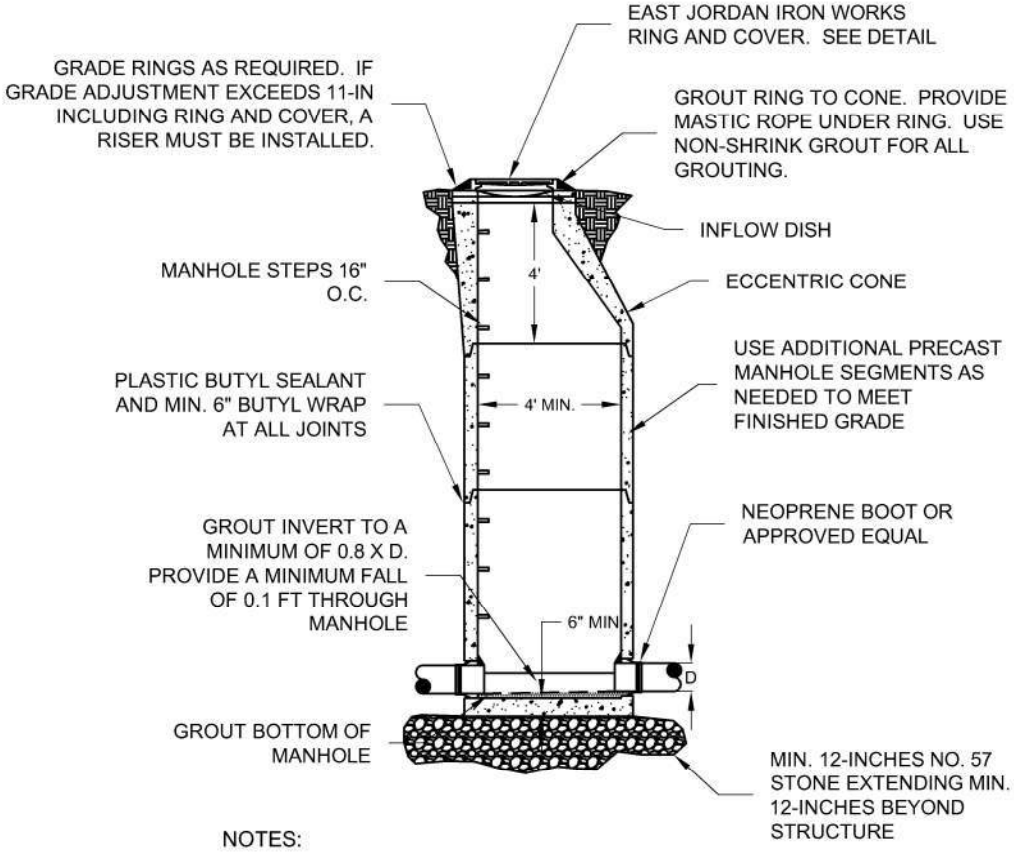
1) REINFORCED LID WILL HAVE 30" X 30" HALLIDAY HATCH OR APPROVED EQUAL.
2) ALL FITTINGS MUST BE OF DOMESTIC ORIGIN.
3) FIRE HYDRANT MUST BE INSTALLED WITHIN 100 FEET OF SIAMESE CONNECTION.
4) PROVIDE PIPE SUPPORTS FOR ALL PIPING.
5) THE DOUBLE CHECK BACKFLOW ASSEMBLY MUST BE INSTALLED WITHIN 50 FEET OF THE WATER MAIN.





WATER SPECIFICATIONS	TYPICAL FIRE VAULT EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. W-11		
DATE: 1/17/2025		





NOTES:

1) MANHOLES TO BE MANUFACTURED BY KNIGHT'S PRECAST, TINDALL CORPORATION, OR APPROVED EQUAL.

2) DROP MANHOLE TO BE USED WHEN VERTICAL DISTANCE IS GREATER THAN 24 INCHES.

3) STEPS TO BE COPOLYMER POLYPROPYLENE ENCAPSULATED 1/2" STEEL ROD MEETING ASTM C-478

4) MANHOLES IN PAVED AREAS AND YARDS SHOULD BE AT FINISHED GRADE. MANHOLES THAT ARE FLUSH SHALL HAVE AN INFLOW DISH. MANHOLES IN RIGHT-OF-WAYS SHALL BE 2-FT ABOVE FINISHED GRADE.

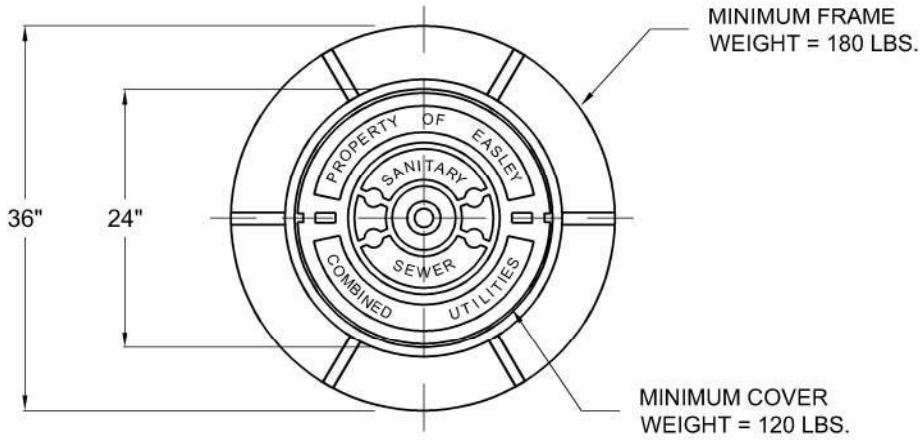
5) MANHOLES IN FLOOD PLAINS SHALL BE A MINIMUM OF 2-FT ABOVE THE 100 YEAR FLOODPLAIN OR BE SEALED WITH VENT PIPE EXTENDING 2-FT ABOVE THE 100 YEAR FLOODPLAIN.

6) MANHOLES OVER 15-FT IN DEPTH TO BE A MIN. OF 5-FT IN DIAMETER

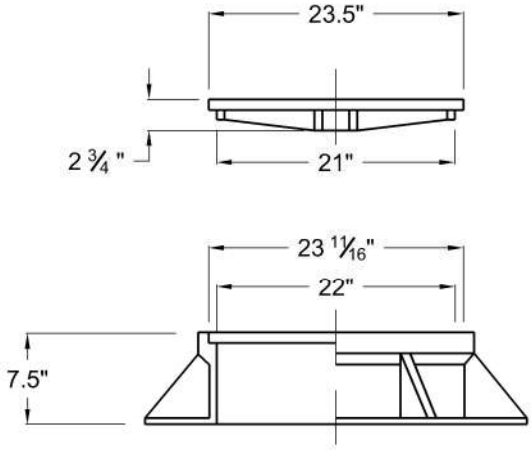
7) DOGHOUSE MANHOLES ARE PROHIBITED.

8) ON RIGHT-OF-WAYS, OR WHERE DIRECTED, INSTALL FLAT TOP MANHOLE WITHOUT INSET RING AND COVER.

SEWER SPECIFICATIONS	TYPICAL MANHOLE EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. WW-01		
DATE: 1/17/2025		



PLAN



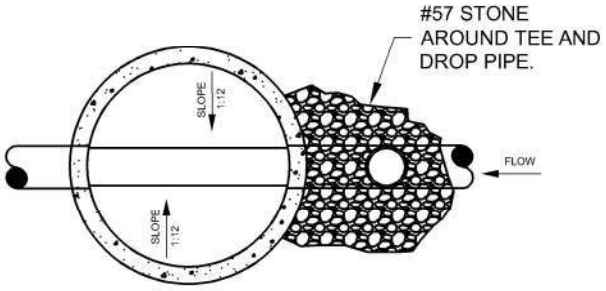
SECTION

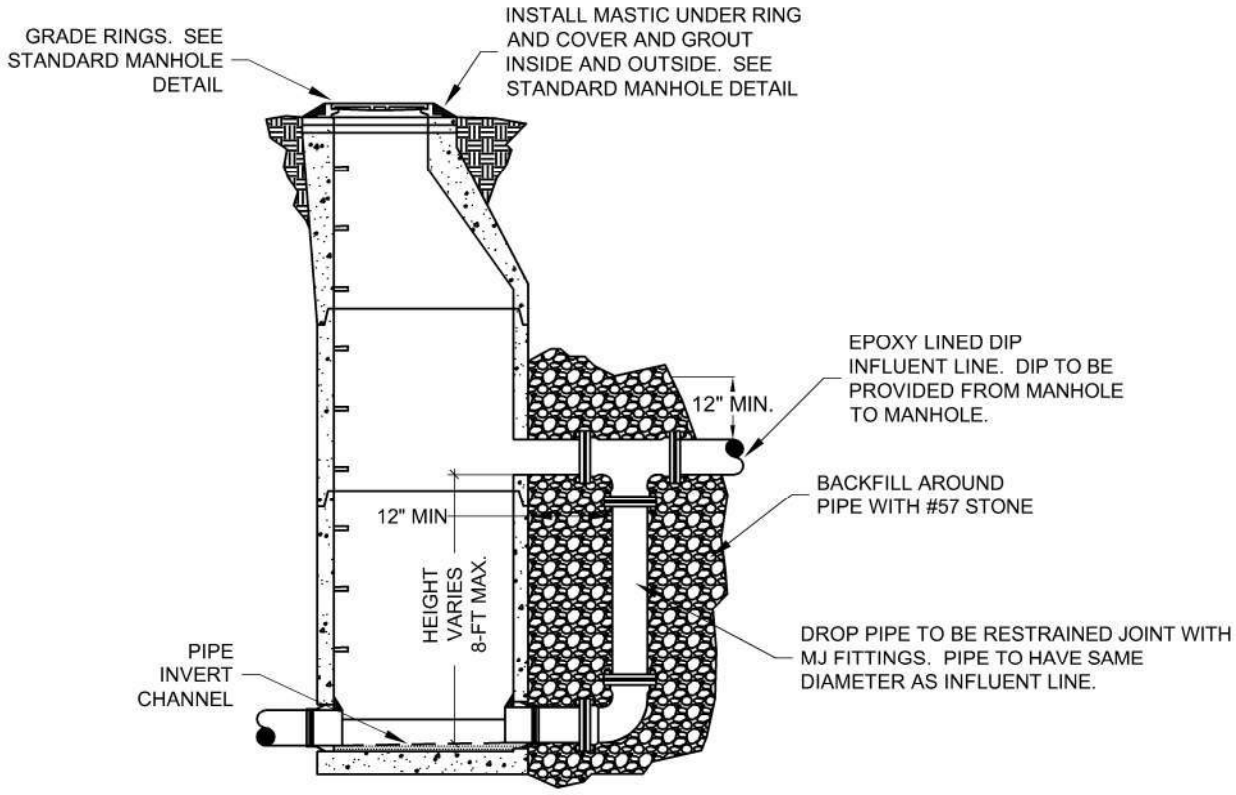
NOTES:

1) RING AND COVER TO BE MODEL V-1384 AS MANUFACTURED BY EAST JORDAN IRON WORKS PART # 41384104A01 OR EQUIVALENT US FOUNDRY - PART #8020190 - USF 669 RING & KL COVER -2XNPPB

2) RING AND COVER SHALL BE FREE OF BITUMASTIC COATING.

SEWER SPECIFICATIONS	MANHOLE RING AND COVER EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. WW-02		
DATE: 1/17/2025		





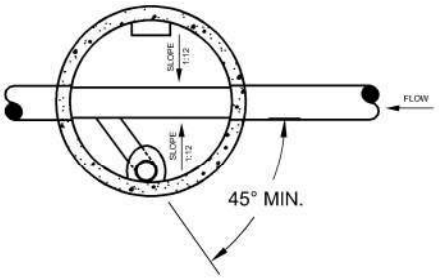
NOTES:

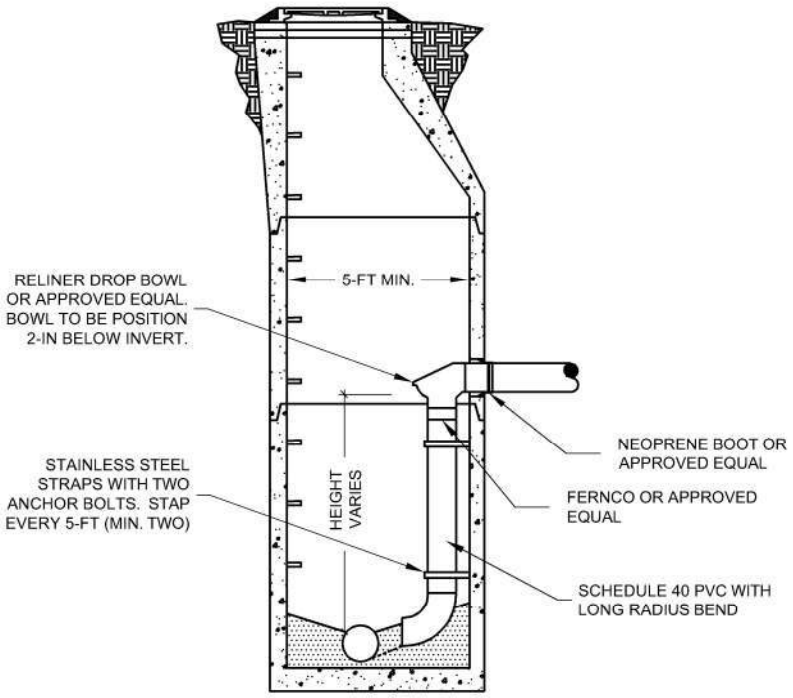
1) ALL DROP PIPE AND FITTINGS TO BE LINED WITH PROTECTO 401 EPOXY COATING.

2) DROPS OVER 8-FT IN DEPTH ARE REQUIRED TO BE INSIDE DROP.

3) MAX SLOPE ENTERING DROP MANHOLE IS 5%

SEWER SPECIFICATIONS	OUTSIDE DROP MANHOLE EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. WW-03		
DATE: 1/17/2025		





NOTES:

1) INTERNAL DROP MANHOLES TO BE USED ON ALL DROPS GREATER THAN 8 FT.

2) ALL HARDWARE TO BE STAINLESS STEEL.

3) MINIMUM MANHOLE DIAMETER IS 5-FT. LARGER MANHOLES MAY BE REQUIRED DEPENDING ON DEPTH.

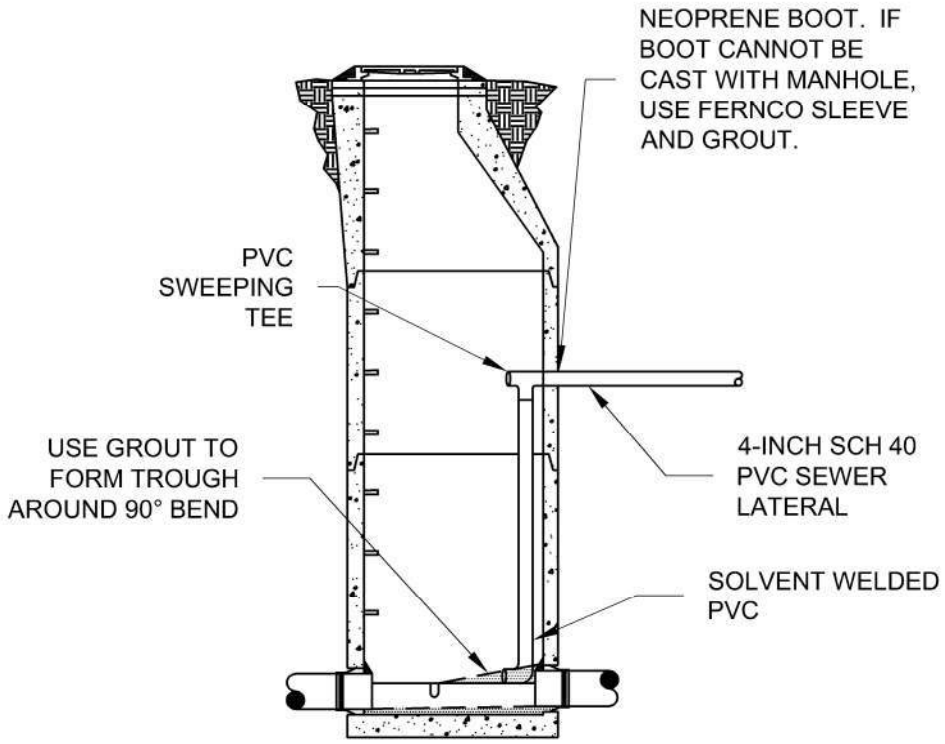
4) BOWL SHALL BE INSTALLED AS CLOSE AS POSSIBLE TO WALL WHILE STILL ALLOWING ACCESS TO ALL BOLTS AND HARDWARE.

5) NEW MANHOLES SHALL HAVE TROUGH CAST IN. EXISTING MANHOLE BENCH SHALL BE REWORKED TO CREATE TROUGH THAT ALLOWS PIPE CROWNS TO MATCH.

6) HOODS ARE REQUIRED FOR INFLUENT LINES GREATER THAN 5% SLOPE.

2) DROPS OVER 8-FT IN DEPTH ARE REQUIRED TO BE INSIDE DROP.

SEWER SPECIFICATIONS DETAIL NO. WW-04 DATE: 1/17/2025	INSIDE DROP MANHOLE EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES



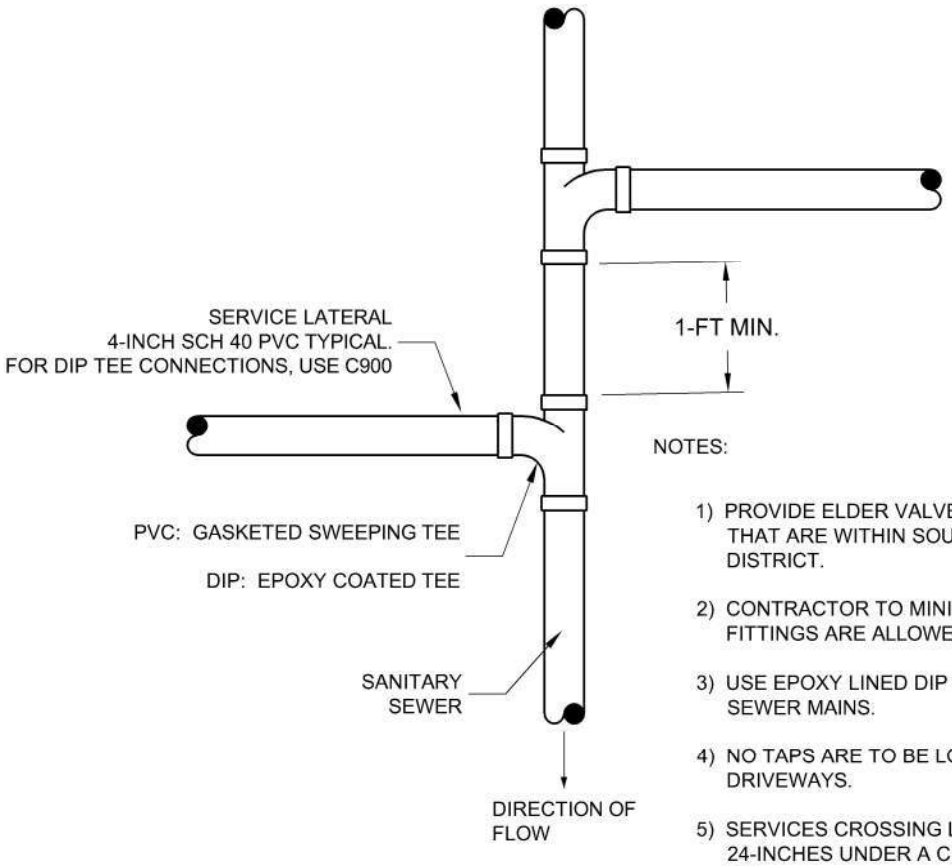
NOTES:

1) IF NEW MANHOLE IS BEING INSTALLED, SERVICE ENTRANCES SHOULD BE CAST INTO BASE AND RISER SECTIONS.

2) IF DEPTH ALLOWS, SEWER SERVICE CAN ENTER DIRECTLY INTO BOTTOM OF MANHOLE.

SEWER SPECIFICATIONS	SERVICE CONNECTION AT MANHOLE EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. WW-05		
DATE: 1/17/2025		

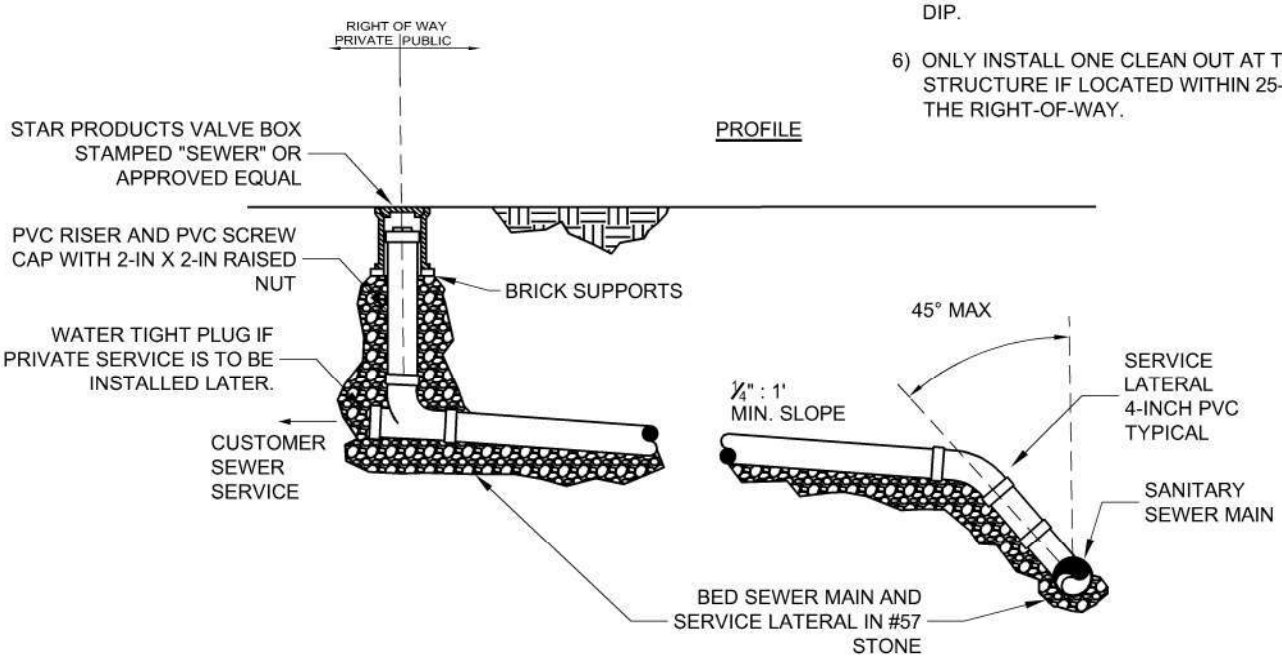
PLAN



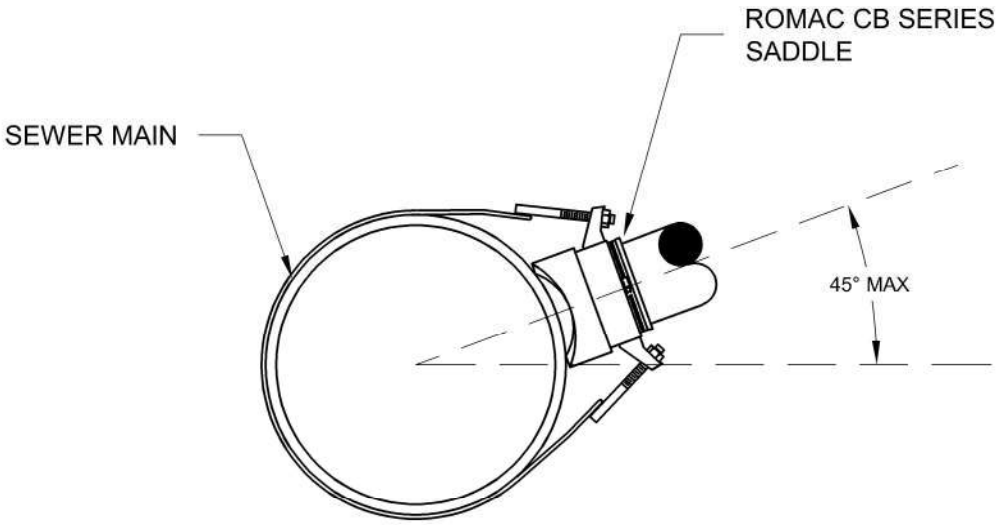
NOTES:

1) PROVIDE ELDER VALVE ON SEWER TAPS THAT ARE WITHIN SOUTHSIDE WATER DISTRICT.
2) CONTRACTOR TO MINIMIZE BENDS. NO 90° FITTINGS ARE ALLOWED.
3) USE EPOXY LINED DIP TEE FOR DIP SEWER MAINS.
4) NO TAPS ARE TO BE LOCATED UNDER DRIVEWAYS.
5) SERVICES CROSSING LESS THAN 24-INCHES UNDER A CULVERT SHALL BE DIP.
6) ONLY INSTALL ONE CLEAN OUT AT THE STRUCTURE IF LOCATED WITHIN 25-FT OF THE RIGHT-OF-WAY.

PROFILE



SEWER SPECIFICATIONS	TYPICAL SERVICE LINE EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. WW-06		
DATE: 1/17/2025		



NOTES:

1) MATCH EXISTING MATERIALS WHEN CONNECTING TO EXISTING RESIDENTIAL SEWER.

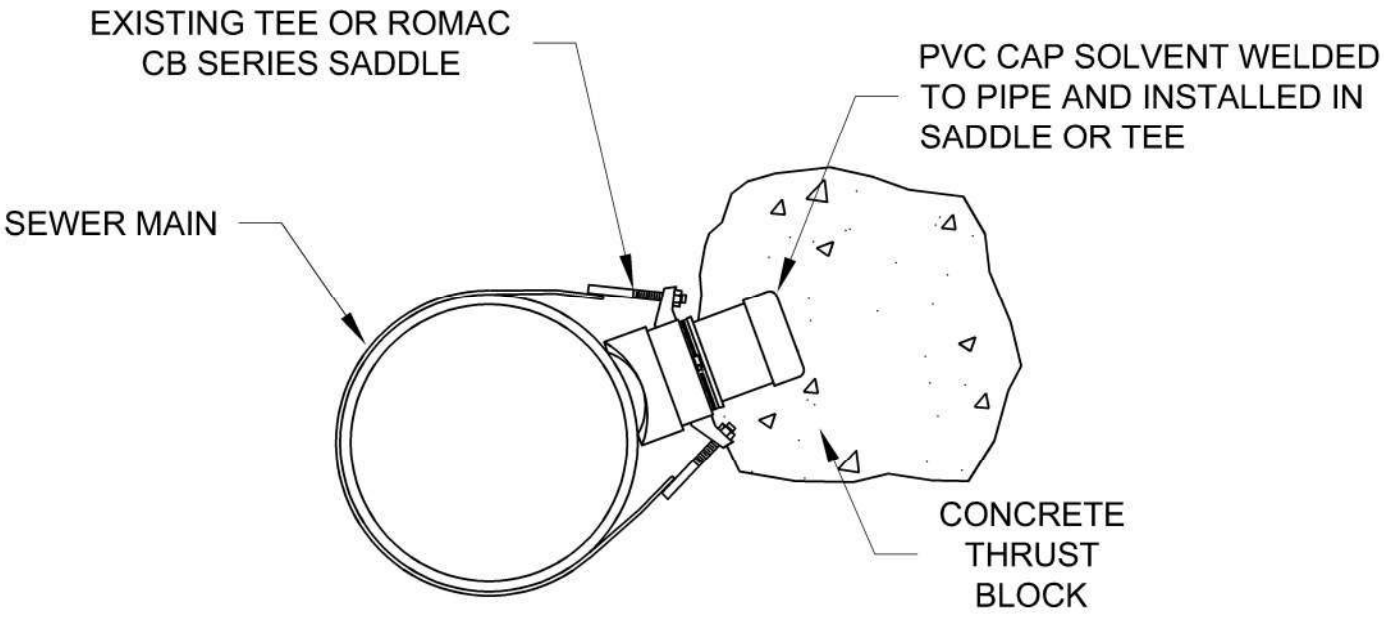
2) PROVIDE ELDER VALVE ON SEWER TAPS THAT ARE WITHIN SOUTHSIDE WATER DISTRICT.

3) SEWER TAPS ARE TO BE USED FOR TAPS ON EXISTING LINES ONLY. NEW TAPS SHALL BE INSTALLED USING SWEEPING TEES.

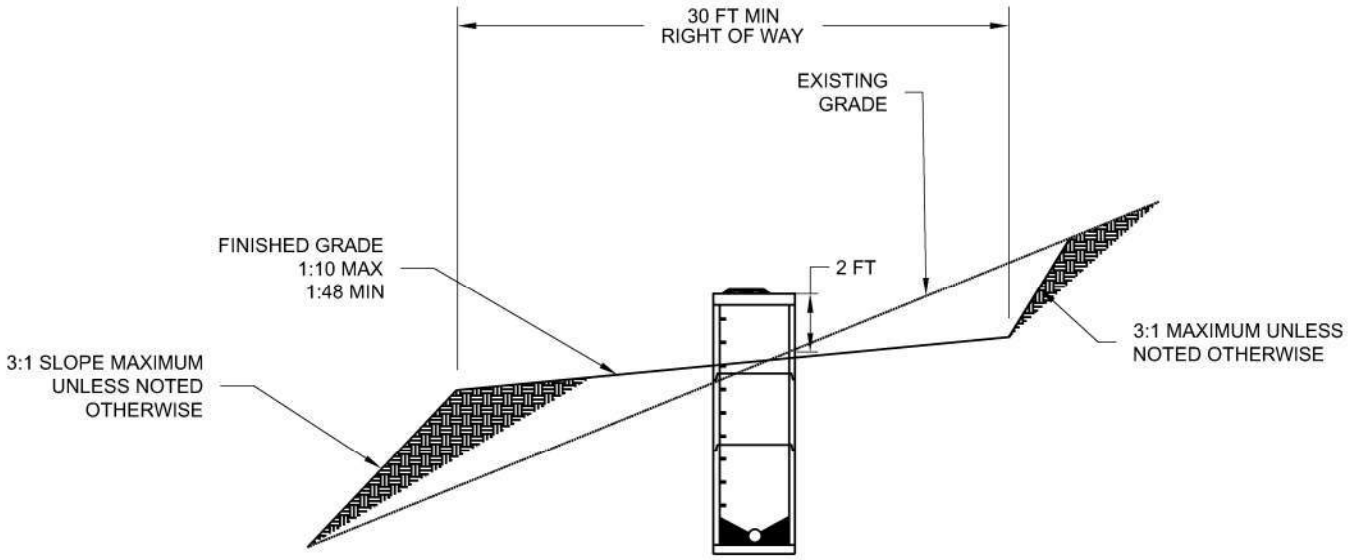
4) SEWER SERVICE TO BE SCHEDULE 40 PVC.

5) NO SEWER TAPS ARE PERMITTED WHERE SEWER SERVICE WILL BE UNDER A DRIVEWAY.

SEWER SPECIFICATIONS	SEWER TAP EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. WW-07		
DATE: 1/17/2025		



SEWER SPECIFICATIONS DETAIL NO. WW-08 DATE: 1/17/2025	TYPICAL PLUG OF SEWER TAP EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES



NOTES:

1) NO OBSTRUCTIONS SHALL BE INSTALLED PREVENTING ECU ACCESS ACROSS THE R.O.W. WRITTEN CONSENT FROM ECU IS REQUIRED FOR ANY FENCE OR GATE CROSSING THE R.O.W.

2) WHERE R.O.W CROSSES ROADS, ACCESS MUST BE PROVIDED TO ALLOW MAINTENANCE VEHICLES TO ENTER R.O.W.

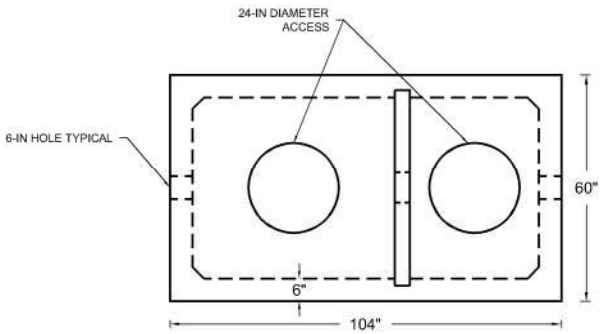
3) NO EXVCAVATING OR STOCKPILING MATERIALS MAY TAKE PLACE WITHIN ECU RIGHT-OF-WAY WITHOUT WRITTEN PERMISSION FROM ECU.

4) MINIMUM DISTANCE FROM PIPE TO EITHER EDGE OF R.O.W. IS 15-FT.

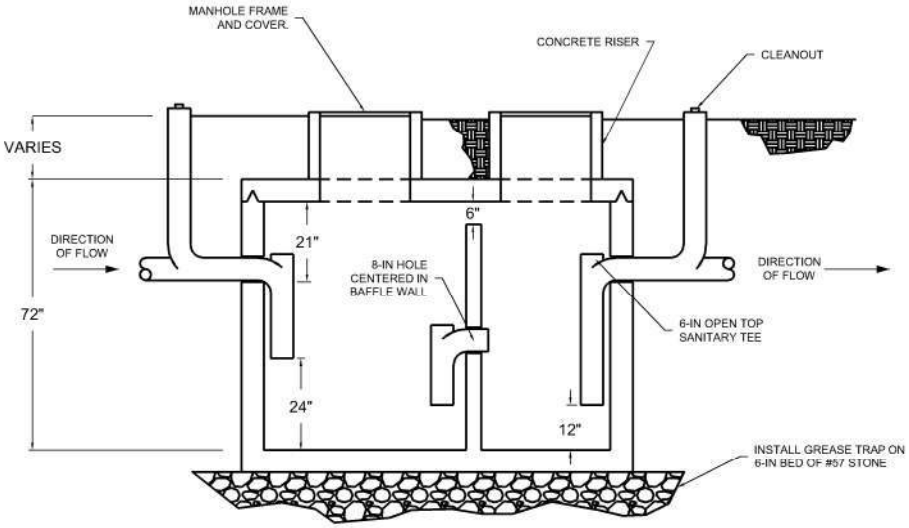
5) MANHOLES ON RIGHTS-OF-WAY TO BE FLAT TOP.

SEWER SPECIFICATIONS	TYPICAL RIGHT-OF-WAY EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. WW-09		
DATE: 1/17/2025		

PLAN



PROFILE

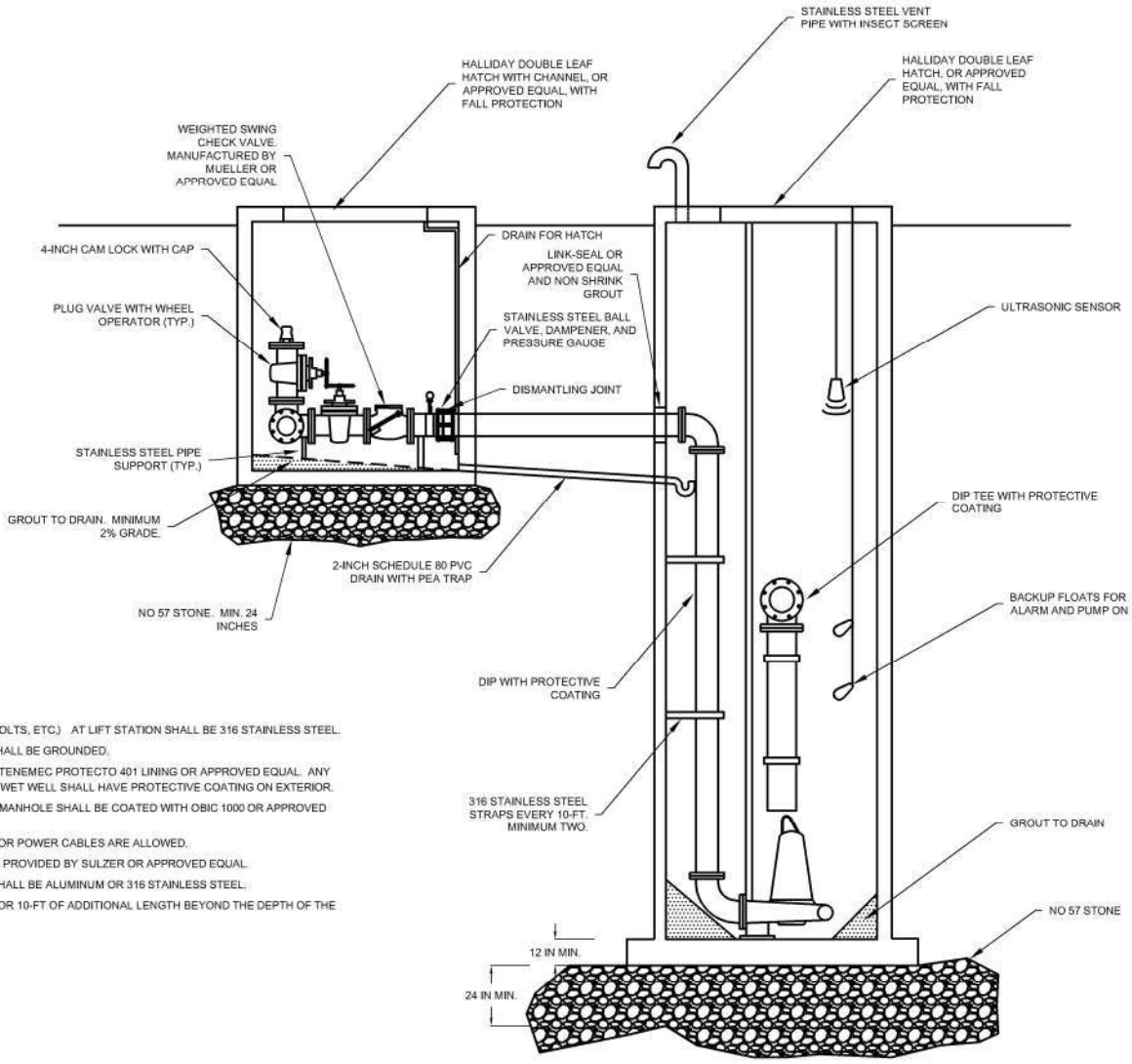


NOTES:

1) IF THE GREASE TRAP IS TO BE LOCATED IN PAVED AREAS, THE GREASE TRAP AND MANHOLE COVER SHALL BE DESIGNED FOR H-20 LOADINGS.

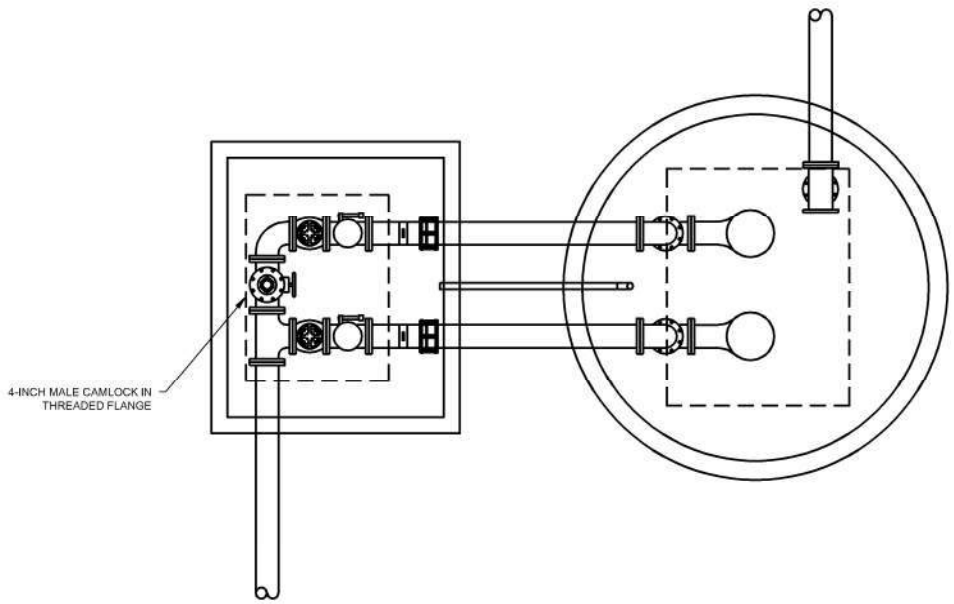
2) MINIMUM SIZE OF GREASE TRAP SHALL BE 1,500 GALLONS. EASLEY COMBINED UTILITIES MAY REQUIRE A LARGER GREASE TRAP OR MULTIPLE 1,500 GALLON GREASE TRAPS BASED ON USE OF FACILITY.

SEWER SPECIFICATIONS	GREASE TRAP EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. WW-10		
DATE: 1/17/2025		

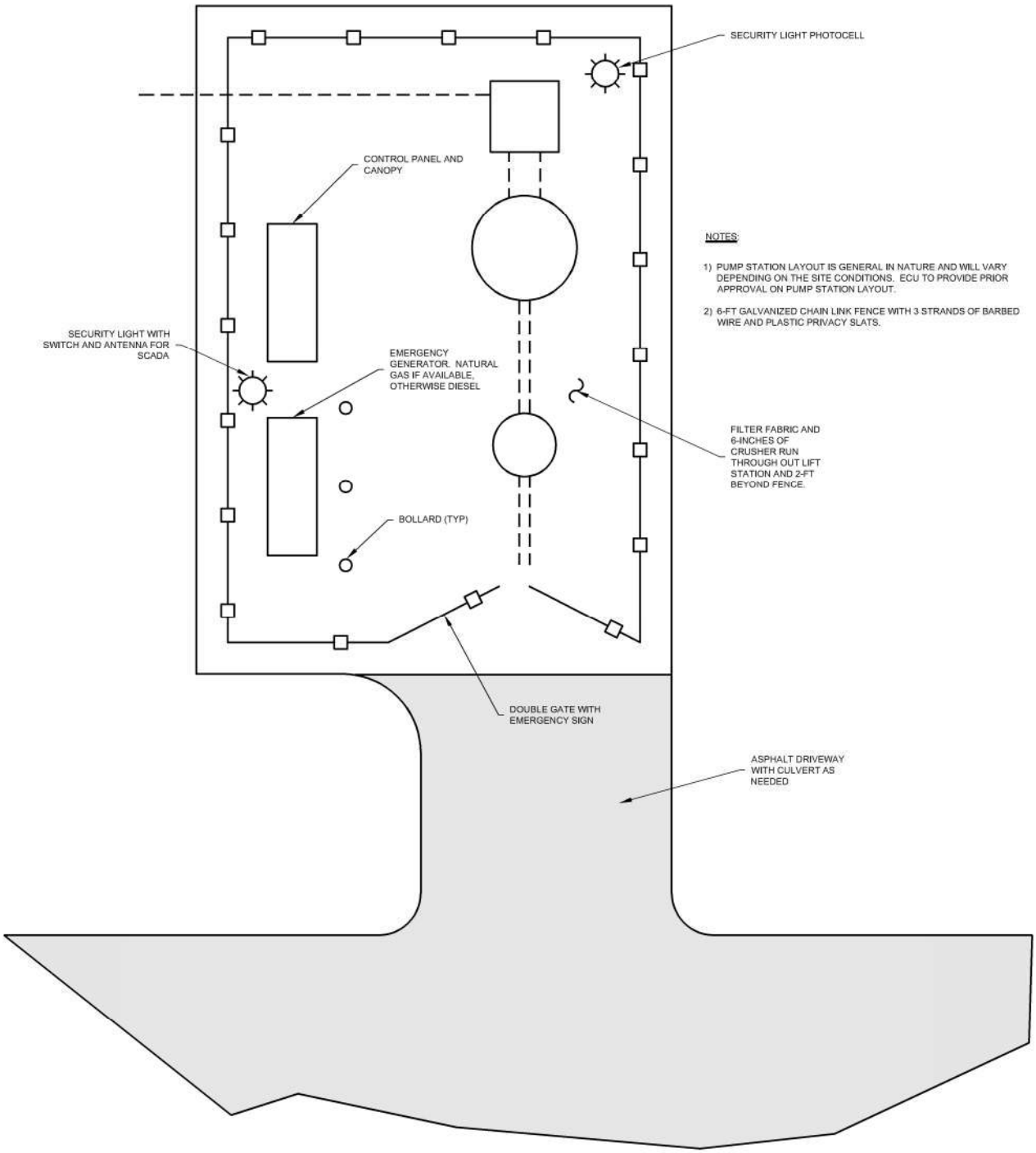


NOTES:

1) ALL HARDWARE (CHAINS, BOLTS, ETC.) AT LIFT STATION SHALL BE 316 STAINLESS STEEL.
2) ALL METAL COMPONENTS SHALL BE GROUNDED.
3) ALL DIP PIPING SHALL HAVE TENEMEC PROTECTO 401 LINING OR APPROVED EQUAL. ANY DIP FITTINGS INSIDE OF THE WET WELL SHALL HAVE PROTECTIVE COATING ON EXTERIOR.
4) WET WELL AND DISCHARGE MANHOLE SHALL BE COATED WITH OBIC 1000 OR APPROVED EQUAL.
5) NO SPLICES FOR PUMP MOTOR POWER CABLES ARE ALLOWED.
6) SUBMERSIBLE PUMPS TO BE PROVIDED BY SULZER OR APPROVED EQUAL.
7) ABOVE GROUND CONDUIT SHALL BE ALUMINUM OR 316 STAINLESS STEEL.
8) PUMP CHAIN MUST ALLOW FOR 10-FT OF ADDITIONAL LENGTH BEYOND THE DEPTH OF THE WET WELL.



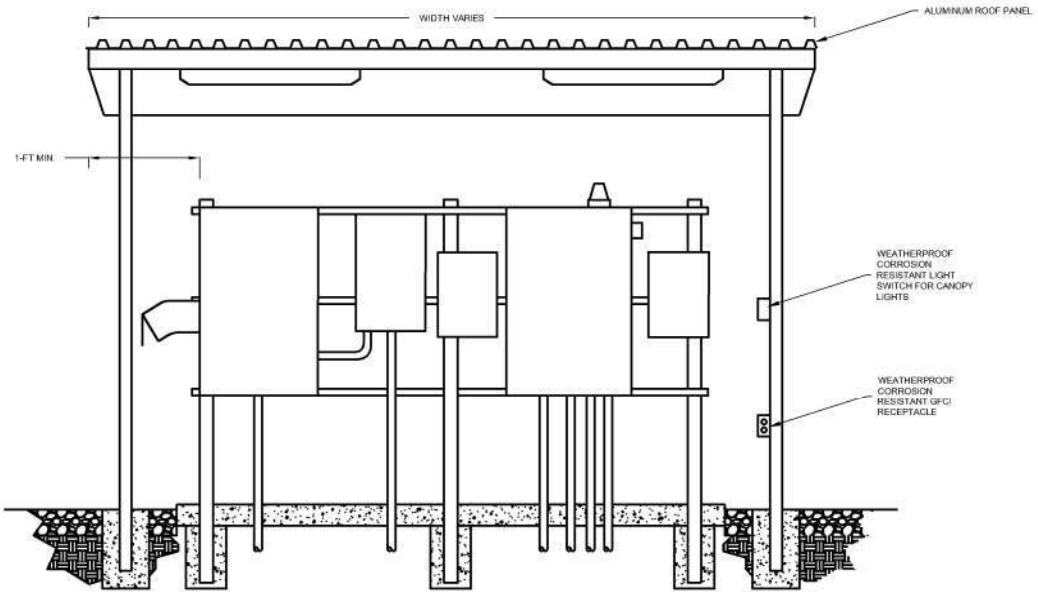
SEWER SPECIFICATIONS	TYPICAL SEWER LIFT STATION EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. WW-11		
DATE: 1/17/2025		

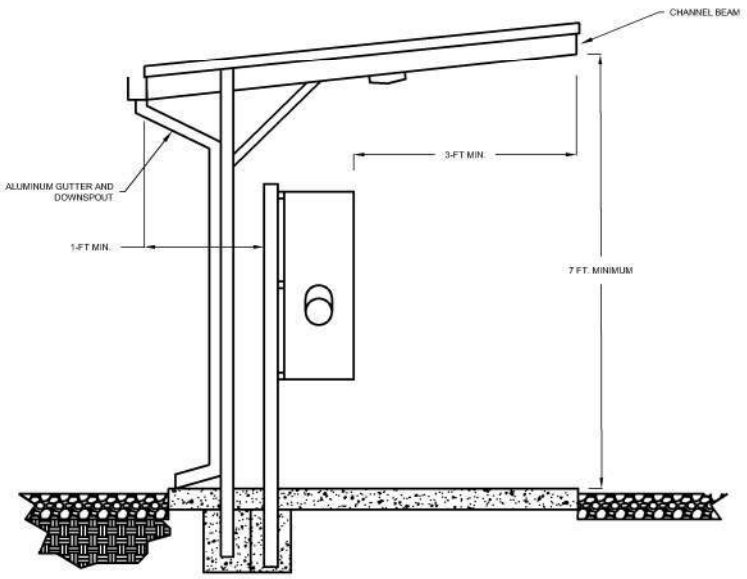


NOTES:

1) PUMP STATION LAYOUT IS GENERAL IN NATURE AND WILL VARY DEPENDING ON THE SITE CONDITIONS. ECU TO PROVIDE PRIOR APPROVAL ON PUMP STATION LAYOUT.
2) 6-FT GALVANIZED CHAIN LINK FENCE WITH 3 STRANDS OF BARBED WIRE AND PLASTIC PRIVACY SLATS.

SEWER SPECIFICATIONS	TYPICAL SEWER LIFT STATION SITE EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. WW-12		
DATE: 1/17/2025		

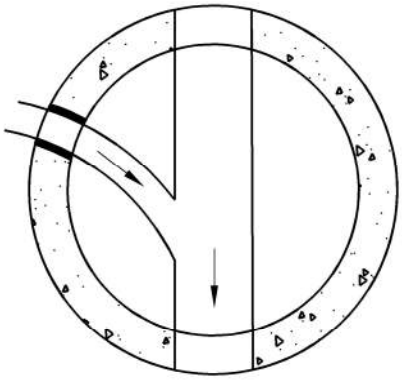




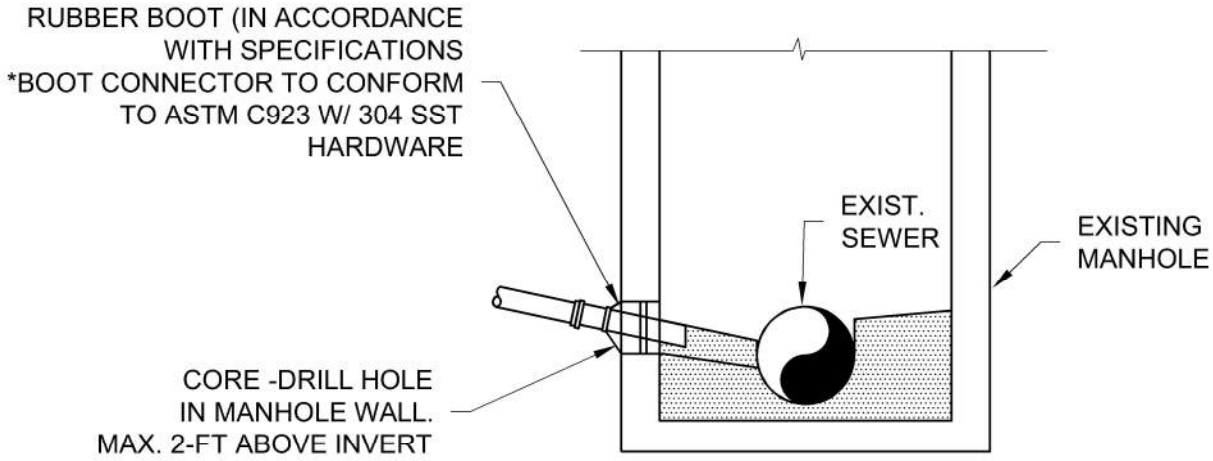
NOTES:

1) STRUCTURE AND FOOTINGS SHALL BE DESIGNED TO WITHSTAND 100 MPH WIND LOAD. DETAILED DESIGN OF STRUCTURE TO BE PROVIDED BY OTHERS.
2) ALL STRUCTURAL AND ROOFING ELEMENTS TO BE ALUMINUM OR STAINLESS STEEL. IF ALUMINUM IS IN CONTACT WITH CONCRETE, ALUMINUM MEMBERS SHALL BE COATED WITH TWO COATS OF BITUMASTIC.
3) EQUIPMENT RACK TO BE ALUMINUM UNISTRUT AND 4-INCH ALUMINUM POSTS IN CONCRETE. END CAPS TO BE PROVIDED WITH POSTS. ALUMINUM IN CONTACT WITH CONCRETE TO BE COATED WITH TWO COATS OF BITUMASTIC.
4) CONDUIT FROM WET WELL TO HAVE DUCT SEAL.
5) ALL ELECTRICAL ENCLOSURES SHALL BE 316 STAINLESS STEEL.
6) SCADA TO BE MISSION MYDRO OR APPROVED EQUAL.
7) PORTABLE GENERATOR RECEPTACLE TO BE CROUSE-HINDS AR2041 S22, OR APPROVED EQUAL.
8) WATERPROOF LED LIGHT (UP TO TWO BASED ON CANOPY SIZE) TO BE PROVIDED.
9) ALUMINUM TUBING OR CONDUIT SHALL NOT BE IN CONTACT WITH CONCRETE. COAT WITH TWO COATS OF BITUMINOUS PAINT TO 6-INCHES ABOVE FINISHED FLOOR.
10) ALL METAL COMPONENTS SHALL BE GROUNDED.

SEWER SPECIFICATIONS DETAIL NO. WW-13 DATE: 1/17/2025	TYPICAL SEWER LIFT STATION SITE EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES



PLAN



SECTION

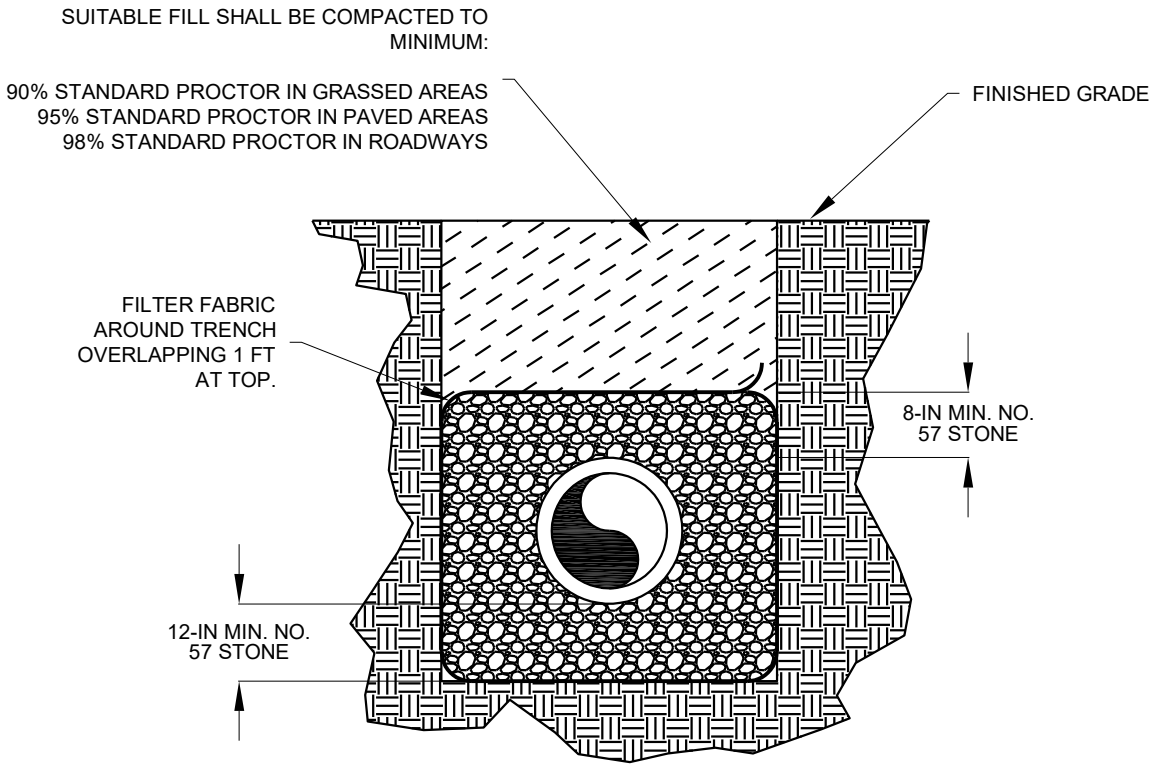
NOTES:

1. MANHOLES SHALL BE COATED WITH A CORROSION RESISTANT PROTECTIVE COATING.

2. CORE DRILL HOLE THROUGH WALL OF MANHOLE AND EXISTING BENCH AS REQUIRED. PROVIDE A WATERTIGHT SEAL AT THE PIPE CONNECTION USING A FLEXIBLE RUBBER BOOT.

3. FORCEMAIN MUST ENTER MANHOLE AT AN ANGLE TO DIRECT FLOW DOWNSTREAM. IF BENCH IS NOT CORED, A TROUGH SHALL BE CONSTRUCTED.

SEWER SPECIFICATIONS DETAIL NO. WW-14 DATE: 1/17/2025	FORCEMAIN DISCHARGE IN MANHOLE EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES



SEWER SPECIFICATIONS	SEWER EMBEDMENT IN FILL AREAS EASLEY COMBINED UTILITIES EASLEY, SOUTH CAROLINA	EASLEY COMBINED UTILITIES
DETAIL NO. WW-15		
DATE: 1/17/2025		