

STANDARD SPECIFICATIONS

FOR

WATER SYSTEM CONSTRUCTION



DW 2021-0358

APPROVED FOR CONSTRUCTION

THE DOCUMENT BEARING THIS STAMP HAS BEEN RECEIVED AND REVIEWED BY THE
TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION
DIVISION OF WATER RESOURCES
AND IS HEREBY APPROVED FOR CONSTRUCTION BY THE COMMISSIONER

R. William Houch

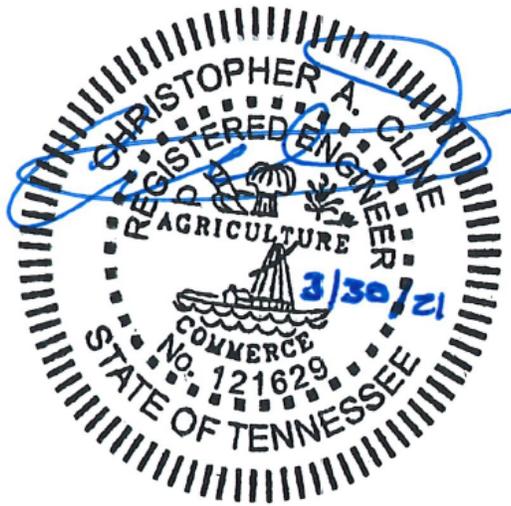
March 30, 2021

THIS APPROVAL SHALL NOT BE CONSTRUED AS CREATING A
PRESUMPTION OF CORRECT OPERATION OR AS WARRANTING BY THE
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DESIGNED GOALS.

APPROVAL EXPIRES 5 YEARS FROM ABOVE DATE

MARCH 2021
(Revised January 2022)

STANDARD SPECIFICATIONS
FOR
WATER SYSTEM CONSTRUCTION



CITY OF SEVIERVILLE, TENNESSEE

PREFACE

The Standard Specifications have been prepared to complement the Standard Detail Drawings and to provide the qualitative requirements for products, materials, and workmanship for construction of additions to and replacements of the water distribution system which is to be operated by the City of Sevierville Water and Sewer Department. These Standard Specifications are only to be used for projects with Drawings which have been approved by the Tennessee Department of Environment and Conservation, Division of Water Supply, as prepared by the City of Sevierville Water and Sewer Department, by its Design Consultant, or by a Developer's Engineer, whose Drawings must first be approved by the Sevierville Water and Sewer Department. All references in these Standard Specifications to "Engineer" and "Owner" shall mean the City of Sevierville Water and Sewer Department. These Standard Specifications are subject to revision for a specific project, with such revisions identified in the Bidding Requirements and Special Conditions document prepared by the Sevierville Water and Sewer Department or its Design Consultant, or with such revisions noted on the Drawings approved by the Sevierville Water and Sewer Department.

All work requirements described in the Standard Specifications are the responsibility of the Contractor, unless specifically designated otherwise.

| Revision Date | Section | Summary |
|----------------------|--|---|
| 01-20-2022 | 33 10 00 – Water Mains and Accessories | 3.6, D, 3 – added hydrostatic test pressure |
| | | |

SPECIFICATIONS

Section Title

Division 01 – General Requirements

01 33 23 Shop Drawings, Product Data, and Samples
01 57 13 Erosion and Sedimentation Control
01 78 23 Operations and Maintenance Data
01 78 39 Record Documents

Division 31 – Earthwork

31 11 00 Clearing and Grubbing
31 23 33 Trench Excavation and Backfill

Division 32 – Exterior Improvements

32 10 13 Removing and Replacing Pavement

Division 33 – Utilities

33 05 23.16 Bore and Jack Casings
33 10 00 Water Mains and Accessories
33 12 13 Water Service Connections

STANDARD DETAIL DRAWINGS

STD-G-01 Silt Fence Detail
STD-G-02 Concrete Encasement Detail
STD-G-03 Concrete Replacement Detail
STD-G-04 Asphalt Replacement Detail
STD-G-05 Creek Crossing Detail
STD-G-06 Typical Road Boring Detail
STD-G-07 Trench Terminology Detail
STD-G-08 Pressure Pipe Bedding and Haunching Detail

STD-W-01 Typical Blocking Detail
STD-W-02 Gate Valve Installation Detail
STD-W-03 Butterfly Valve Installation Detail
STD-W-04 Fire Hydrant Detail
STD-W-05 Typical Air Release Valve Assembly Detail
STD-W-06 Manual Termination Water Main Blow-off Detail
STD-W-07 Automatic Termination Flushing Hydrant Detail
STD-W-08 Water Service and Meter Connection Details
STD-W-09 Water Line Termination Detail

PART 1 GENERAL

1.1 SCOPE

- A. The work under this section includes submittal to the Engineer of Shop Drawings, product data, and samples required by the various sections of these Specifications.
- B. Submittal Contents: The submittal contents required are specified in each section.
- C. Definitions: Submittals are categorized as follows:
 - 1. Shop Drawings:
 - a. Shop Drawings shall include technical data, drawings, diagrams, procedure and methodology, performance curves, schedules, templates, patterns, test reports, calculations, instructions, measurements, and similar information as applicable to the specific item for which the Shop Drawing is prepared.
 - b. Provide newly-prepared information, on bond sheets, with graphic information at accurate scale (except as otherwise indicated) or appropriate number of prints hereof, with name of preparer (firm name) indicated. The Contract Drawings shall not be traced or reproduced by any method for use as or in lieu of detail Shop Drawings. Show dimensions and note dimensions that are based on field measurement. Identify materials and products in the work shown. Indicate compliance with standards and special coordination requirements. Do not allow Shop Drawings to be used in connection with the work without appropriate final "Action" markings by the Engineer.
 - c. Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, Specification Document, schedule or room numbers shown on the Contract Drawings.
 - d. Minimum assembly drawings sheet size shall be 22 x 34 inches.
 - e. Minimum detail sheet size shall be 8-1/2 x 11 inches.
 - f. Minimum Scale:
 - i. Assembly Drawings Sheet, Scale: 1-inch = 30 feet.
 - ii. Detail Sheet, Scale: 1/4-inch = 1 foot.
 - 2. Product Data:
 - a. Product data includes standard printed information on materials, products and systems, not specially prepared for this project, other than the designation of selections from among available choices printed therein.

- b. Collect required data into one submittal for each unit of work or system and mark each copy to show which choices and options are applicable to the project. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked and special coordination requirements.
- 3. Samples:
 - a. Samples include both fabricated and unfabricated physical examples of materials, products, and units of work, both as complete units and as smaller portions of units of work, either for limited visual inspection or, where indicated, for more detailed testing and analysis.
 - b. Provide units identical with final condition of proposed materials or products for the work. Include "range" samples, not less than 3 units, where unavoidable variations must be expected, and describe or identify variations between units of each set. Provide full set of optional samples where the Engineer's selection is required. Prepare samples to match the Engineer's sample where indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture, and "kind" by the Engineer. Engineer will note "test" samples, except as otherwise indicated, for other requirements, which are the exclusive responsibility of the Contractor.
- 4. Miscellaneous submittals related directly to the work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, statements of applicability, quality testing and certifying reports, copies of industry standards, Record Drawings, field measurement data, operating and maintenance materials, overrun stock, security/protection/safety keys and similar information, devices and materials applicable to the work but not processed as Shop Drawings, product data or samples.

1.2 SPECIFIC CATEGORY REQUIREMENTS

- A. General: Except as otherwise indicated in the individual work sections, comply with general requirements specified herein for each indicated category of submittal. Submittals shall contain:
 - 1. The date of submittal and the dates of any previous submittals.
 - 2. The project title.
 - 3. Numerical submittal numbers, starting with 1.0, 2.0, etc. Revisions to be numbered 1.1, 1.2, etc.
 - 4. The Names of:
 - a. Contractor.

- b. Supplier.
 - c. Manufacturer.
5. Identification of the product, with the Specification Document number, permanent equipment tag numbers, and applicable Drawing No.
 6. Field dimensions clearly identified as such.
 7. Relation to adjacent or critical features of the work or materials.
 8. Applicable standards, such as ASTM or Federal Specification numbers.
 9. Notification to the Engineer in writing, at time of submissions, of any deviations on the submittals from requirements of the Contract Documents.
 10. Identification of revisions on resubmittals.
 11. An 8 x 3-inch blank space for Contractor and Engineer stamps.
 12. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
 13. Submittal sheets or Drawings showing more than the particular item under consideration shall have all but the pertinent description of the item for which review is requested crossed out.

1.3 ROUTING OF SUBMITTALS

- A. Submittals and routine correspondence shall be routed as follows:
 1. Supplier to Contractor (through representative, if applicable).
 2. Contractor to Engineer.
 3. Engineer to Contractor and Owner.
 4. Contractor to Supplier.

PART 2 PRODUCTS

2.1 SHOP DRAWINGS

- A. Unless otherwise specifically directed by the Engineer, make all Shop Drawings accurately to a scale sufficiently large enough to show all pertinent features of the item and its method of connection to the work.
- B. Submit all shop assembly drawings, larger than 11 x 17 inches, in PDF format.

- C. Submit all Shop Drawings, 11 x 17 inches and smaller, in PDF format.

2.2 MANUFACTURER'S LITERATURE

- A. Where content of submitted literature from manufacturers includes data not pertinent to this submittal, clearly indicate which portion of the contents is being submitted for the Engineer's review.
- B. Submit the number of copies which are required to be returned (not to exceed 3) plus 3 copies which will be retained by the Engineer.

2.3 SAMPLES

- A. Samples shall illustrate materials, equipment or workmanship, and established standards by which completed work is judged.
- B. Unless otherwise specifically directed by the Engineer, all samples shall be of the precise article proposed to be furnished.
- C. Submit all samples in the quantity which is required to be returned plus one sample which will be retained by the Engineer.

2.4 COLORS

- A. Unless the precise color and pattern is specifically described in the Contract Documents, wherever a choice of color or pattern is available in a specified product, submit accurate color charts and pattern charts to the Engineer for review and selection.
- B. Unless all available colors and patterns have identical costs and identical wearing capabilities, and are identically suited to the installation, completely describe the relative costs and capabilities of each.

PART 3 EXECUTION

3.1 CONTRACTOR'S COORDINATION OF SUBMITTALS

- A. Prior to submittal for the Engineer's review, the Contractor shall use all means necessary to fully coordinate all material, including the following procedures:
 - 1. Determine and verify all field dimensions and conditions, catalog numbers, and similar data.
 - 2. Coordinate as required with all trades and all public agencies involved.
 - 3. Submit a written statement of review and compliance with the requirements of all applicable technical Specifications as well as the requirements of this section.
 - 4. Clearly indicate in a letter or memorandum on the manufacturer's or fabricator's letterhead, all deviations from the Contract Documents.

- B. Each and every copy of the Shop Drawings and data shall bear the Contractor's stamp showing that they have been so checked. Shop Drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement.
- C. The Owner may backcharge the Contractor for costs associated with having to review a particular Shop Drawing, product data or sample more than two times to receive a "No Exceptions Taken" mark.
- D. Grouping of Submittals:
 - 1. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items.
 - 2. No review will be given to partial submittals of Shop Drawings for items which interconnect and/or are interdependent. It is the Contractor's responsibility to assemble the Shop Drawings for all such interconnecting and/or interdependent items, check them and then make one submittal to the Engineer along with Contractor's comments as to compliance, non-compliance or features requiring special attention.
- E. Schedule of Submittals: Within 30 days of contract award and prior to any Shop Drawing submittal, the Contractor shall submit a schedule showing the estimated date of submittal and the desired approval date for each Shop Drawing anticipated. A reasonable period shall be scheduled for review and comments. Time lost due to unacceptable submittals shall be the Contractor's responsibility and some time allowance for resubmittal shall be provided. The schedule shall provide for submittal of items which relate to one another to be submitted concurrently.

3.2 TIMING OF SUBMITTALS

- A. Make all submittals far enough in advance of scheduled dates for installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.
- B. In scheduling, allow sufficient time for the Engineer's review following the receipt of the submittal.

3.3 REVIEW OF SHOP DRAWINGS

- A. Engineer Review:
 - 1. Allow a minimum of 30 days for the Engineer's initial processing of each submittal requiring review and response, except allow longer periods where processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination. Allow a minimum of 2 weeks for reprocessing each submittal. Advise the Engineer on each submittal as to whether processing time is critical to the progress of the work, and therefore the work would be expedited, if processing time could be foreshortened.
 - 2. Acceptable submittals will be marked "No Exceptions Taken".

3. Submittals requiring minor corrections before the product is acceptable will be marked “Make Corrections Noted”. The Contractor may order, fabricate, and ship the items included in the submittals, provided the indicated corrections are made. Drawings must be resubmitted for review and marked “No Exceptions Taken” prior to installation or use of products.
 4. Submittals marked “Amend and Resubmit” must be revised to reflect required changes and the initial review procedure repeated.
 5. The “Rejected – See Remarks” notation is used to indicate products which are not acceptable. Upon return of a submittal so marked, the Contractor shall repeat the initial review procedure utilizing acceptable products.
- B. No work or products shall be installed without a drawing or submittal bearing the “No Exceptions Taken” notation. The Contractor shall maintain at the jobsite a complete set of Shop Drawings bearing the Engineer’s stamp.
- C. Substitutions: In the event the Contractor obtains the Engineer’s approval for the use of products other than those which are listed first in the Contract Documents, the Contractor shall, at the Contractor’s own expense and using methods approved by the Engineer, make any changes to structures, piping, and electrical work that may be necessary to accommodate these products.
- D. Use of the “No Exceptions Taken” notation on Shop Drawings or other submittals is general and shall not relieve the Contractor of the responsibility of furnishing products of the proper dimension, size, quality, quantity, materials and all performance characteristics, to efficiently perform the requirements and intent of the Contract Documents. The Engineer’s review shall not relieve the Contractor of responsibility for errors of any kind on the Shop Drawings. Review is intended only to assure conformance with the design concept of the project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the jobsite. The Contractor is also responsible for information that pertains solely to the fabrication processes or to the technique of construction and for the coordination of the work of all trades.

3.4 RESUBMISSION REQUIREMENTS

- A. Shop Drawings:
1. Revise initial Drawings as required and resubmit as specified for initial submittal with the resubmittal number shown.
 2. Indicate on Drawings all changes which have been made other than those requested by the Engineer.
- B. Project Data and Samples: Resubmit new data and samples as specified for initial submittal with the resubmittal number shown.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE

A. Submittals and Permits:

1. It is the responsibility of the Owner/Developer and Contractor to obtain all permits associated with construction, specifically the Tennessee General Permit (TNR10-0000) for Storm Water.
2. Discharges for Construction Activities: If the disturbed area is greater than 1 acre, the Owner/Developer and Contractor shall provide a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the Tennessee General Permit TNR10-0000. The Owner/Developer and Contractor is responsible for obtaining an individual permit in the event a General Permit is not sufficient. Owner/Developer and Contractor shall prepare and execute a Construction Activity-Storm Water Discharge Notice of Intent (NOI) with the Tennessee Department of Environment and Conservation (TDEC) Field Office.
3. Land disturbance activity shall not commence until the Land Disturbance Permit is issued.
4. Description and working drawings shall indicate controls which will ensure that storm water and drainage from the disturbed jobsite areas, which will be denuded, stripped or modified of its naturally existing or artificially established stabilization or protection against erosion, shall pass through some type of filter system before being discharged. These areas shall be kept sufficiently moist to control dust.
5. Submit a written plan for both temporary and permanent grassing. The plan shall include selection of species, dates, and rates of application for seeding, fertilizer, and mulching.

B. Basic Principles:

1. The Contractor is responsible for inspecting and maintaining all existing erosion and sedimentation control measures.
2. Conduct the earthwork and excavation activities in such a manner to fit the topography, soil type, and condition.
3. Minimize the disturbed area and the duration of exposure to erosion elements.
4. Stabilize disturbed areas immediately.
5. Safely convey run-off from the site to an outlet such that erosion will not be increased off-site.
6. Retain sediment on-site that was generated on-site.

7. Minimize encroachment upon watercourses.

C. Implementation:

1. The erosion and sedimentation control measures shown on the Drawings are minimal requirements. The Contractor's methods of operation may dictate additional erosion and sedimentation control measures not shown on the Drawings which shall be the Contractor's responsibility to determine and install said measures. The Contractor's failure to stabilize disturbed areas immediately following intermediate or final grading may dictate additional erosion and sedimentation control measures not shown on the Drawings which shall be the Contractor's responsibility to determine and install said measures.
2. The Contractor shall notify the Engineer of any changes and/or additions to the erosion and sedimentation control plan necessary to accommodate the Contractor's methods of operation. No additional payment shall be made for erosion and sedimentation control measures made necessary by the Contractor's methods of operation.
3. The Contractor shall be solely responsible for control of erosion within the project site and prevention of sedimentation of any adjacent waterways.
4. The Contractor shall install controls which will ensure that storm water and drainage from the disturbed area of the project site shall pass through some type of filter system before being discharged. The filter system must meet the requirements of TDEC.

D. Temporary Erosion and Sedimentation Control: In general, temporary erosion and sedimentation control procedures shall be directed toward:

1. Preventing soil erosion at the source.
2. Preventing silt and sediment from entering any waterway if soil erosion cannot be prevented.
3. Preventing silt and sediment from migrating downstream in the event it cannot be prevented from entering the waterway.

E. Permanent Erosion Control: Permanent erosion control measures shall be implemented to prevent sedimentation of the waterways and to prevent erosion of the project site.

F. All Specifications are only the minimum requirements; actual requirements may be greater depending upon the situation. These Specifications may be adjusted by the sole discretion of the City of Sevierville Water and Sewer Department to fit a particular situation not routinely encountered, or as public safety issues become apparent.

1.2 QUALITY ASSURANCE

A. General: Perform all work under this section in accordance with all pertinent rules and regulations including, but not necessarily limited to, those stated herein and these Specifications.

- B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

PART 2 PRODUCTS

2.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL MATERIALS

- A. Silt fence shall meet the requirements of Tennessee Department of Transportation (TDOT) Specification, Section 918.27, Geotextile Material, latest edition. Silt fence fabric must be on the TDOT qualified product list for Geotextile (Type III) used for Erosion Control.
- B. Hay bales shall be clean, seed-free cereal, hay type.
- C. Netting shall be 1/2-inch, galvanized steel, chicken wire mesh.
- D. Filter stone shall be crushed stone conforming to TDOT Specification for mineral aggregate, size 57.
- E. Concrete block shall be hollow, non-load bearing type.
- F. Plywood shall be 3/4-inch thick exterior type.
- G. Erosion Control Matting shall be North American Green S-75.

2.2 RIP RAP

- A. Use only one method throughout the project.
- B. Stone Rip Rap: Use sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Specific gravity shall be 2.0 or greater. Rip rap shall have less than 66 percent wear when tested in accordance with AASHTO T-96. Unless shown or specified otherwise, stone rip rap shall be Type 1, rip rap.
 - 1. Type A-1, Machined Rip Rap: The pieces shall vary in size from 2 inches to 1-1/4 feet with no more than 20 percent by weight being less than 4 inches. The thickness of the stone layer shall be 1-1/2 feet with a tolerance of 3 inches. Rip rap size shall conform to TDOT Specification, Section 709.03, Machined Rip Rap, Type A-1.
 - 2. Type A-2, Machined Rip Rap: Shall be identical to Class A-1 except that hand placed rubble stone rip rap placed 1-foot thick in accordance with TDOT Specification, Section 709, Roadway Design, may be substituted for 1-1/2 feet of machined rip rap.
 - 3. Type A-3, Machined Rip Rap: Shall vary in size from 2 inches to 6 inches with no more than 20 percent by weight being less than 4 inches.

C. Sand-Cement Bag Rip Rap:

1. The bags shall be of cotton, burlap or fiber reinforced paper capable of containing the sand-cement mixture without leakage during handling and placing. Bags previously used for sugar or any other material which will adversely affect the sand-cement mixture shall not be used. Capacity shall be not less than 3/4-cubic foot, nor more than 2 cubic feet.
2. Sand and Portland cement shall be mixed at the maximum ratio of 5:1 by weight and shall obtain a minimum compressive strength of 500 psi in 7 days. For sand-cement bag rip rap, the amount of water used shall be just enough to make up the optimum moisture content of the aggregate and cement, as determined by AASHTO T134. When sand-cement rip rap is to be prebagged, the sand-cement shall be mixed dry, and after placing each course, the bags shall be wet until sufficient moisture is present for proper cement hydration.

2.3 FILTER FABRIC

- A. Silt fence shall meet the requirements of TDOT Specification, Section 918.27, Geotextile Material, latest edition. Silt fence fabric must be on the TDOT qualified product list for Geotextile (Type III) used for Erosion Control.

2.4 CONCRETE

- A. Concrete shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 to 5 inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C94. Reinforcing steel shall conform to the requirements of ASTM A615, Grade 60.
- B. Provide a concrete mix design for job mixed concrete for the Engineer's approval.

2.5 SILT CURTAIN

- A. Barriers shall be a bright color (yellow or "international" orange are recommended) that will attract the attention of nearby boaters.
- B. Seams in the fabric shall be either vulcanized, welded or sewn, and shall develop the full strength of the fabric.
- C. Flotation devices shall be flexible, buoyant units, contained in an individual flotation sleeve or collar attached to the curtain. Buoyancy provided by the flotation units shall be sufficient to support the weight of the curtain and maintain a freeboard of at least 3 inches above the water surface.
- D. Load lines shall be fabricated into the bottom of all floating turbidity curtains. The top load line shall consist of woven webbing or vinyl-sheathed steel cable and shall have a break strength in excess of 10,000 pounds. The supplemental (bottom) load line shall consist of a chain incorporated into the bottom hem of the curtain, with sufficient weight to serve as ballast to hold the curtain in a vertical position. Additional anchorage shall be provided as necessary. The load lines shall have suitable connecting devices which develop the full breaking strength for connecting to load lines in adjacent sections.

- E. External anchors may consist of wooden or metal stakes (2- x 4-inch or 2-1/2-inch minimum diameter wood or 1.33 pounds/linear foot steel).
- F. Bottom anchors shall be used and shall be sufficient to hold the curtain in the same position relative to the bottom of the watercourse, without interfering with the action of the curtain. The anchor may dig into the bottom (grappling hook, plow or fluke-type) or may be weighted (mushroom type) and shall be attached to a floating anchor buoy via an anchor line. The anchor line would then run from the buoy to the top load line of the curtain. These lines must contain enough slack to allow the buoy and curtain to float freely with water surface changes without pulling the buoy or curtain down and shall be checked regularly to make sure they do not become entangled with debris. Anchor spacing will vary with current velocity and potential wind and wave action; manufacturer's recommendations shall be followed.

2.6 POLYMER ADDITIVES

- A. Polyacrylamide (PAM) additives are permissible as a supplement to existing Best Management Practices and are not to be relied on as the only method for erosion control.
- B. If the Contractor intends to use PAM additives, they shall provide adequate documentation and testing to show the polymer type and dosing has been matched to the soil type found in the work area. Testing and documentation shall be prepared by the manufacturer of the polymer or other licensed soil professional.
- C. PAM products include but are not limited to additives to the soil, hydroseeder, treated mat or treated check dams. Due to the different nature of products, manufacturer's directions shall be provided to the Engineer prior to their use. Toxicology reports shall be supplied with all submittal data prior to use.

PART 3 EXECUTION

3.1 GENERAL

- A. Standards: Provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with TDEC, local enforcing agency guidelines, and these Specifications.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt and sediment from entering the creeks. The preferred method is to provide an undisturbed natural buffer, extending a minimal 25 feet from the top of the bank, to filter the run-off. Should this buffer prove infeasible due to construction activities being too close to the creek, or if the amount of sediment overwhelms the buffer, the Contractor shall place silt fences to filter the run-off and, if necessary, place permanent rip rap to stabilize the creek banks.
- B. Silt dams, silt fences, traps, barriers, check dams, appurtenances, and other temporary measures and devices shall be installed as indicated on the approved plans and permits, shall be maintained until no longer needed, and shall then be removed. Deteriorated hay bales and

dislodged filter stone shall be replaced with new materials. Detention ponds, if constructed, shall be maintained in a condition ensuring that unfiltered water will not leave the pond.

- C. Where permanent grassing is not appropriate, and where the Contractor's temporary erosion and sedimentation control practices are inadequate, the Engineer may direct the Contractor to provide temporary vegetative cover with fast growing seedings. Such temporary vegetative cover shall be provided by the Contractor in compliance with TDEC, specifically in the selection of species, planting dates, and application rates for seedings, fertilizer, and mulching, with the exception that kudzu shall not be permitted.
- D. All erosion and sedimentation control devices, including check dams, shall be inspected by the Contractor at least weekly and after each rainfall occurrence and cleaned out and repaired by the Contractor as necessary.
- E. Temporary erosion and sedimentation control devices shall be installed and maintained from the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

3.3 PERMANENT EROSION CONTROL

- A. Permanent erosion control shall include:
 - 1. Restoring the work site to its original contours, unless shown otherwise on the Drawings or directed by the Engineer.
 - 2. Permanent vegetative cover shall be performed in accordance with Article 3.4, below.
 - 3. Permanent stabilization of steep slopes and creeks shall be performed in accordance with Article 3.5, below.
- B. Permanent erosion control measures shall be implemented as soon as practical after the completion of pipe installation or land disturbance for each segment of the project. In no event shall implementation be postponed when no further construction activities will impact that portion or segment of the project. Partial payment requests may be withheld for those portions of the project not complying with this requirement.

3.4 GRASSING

- A. General:
 - 1. All references to grassing, unless noted otherwise, shall relate to establishing permanent vegetative cover as specified herein for seeding, fertilizing, mulching, etc.
 - 2. When final grade has been established, all bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized, and mulched in an effort to restore to a protected condition. Critical areas shall be sodded as directed by the Engineer.
 - 3. Specified permanent grassing shall be performed at the first appropriate season following establishment of final grading in each section of the site.

4. Permanent grassing shall be of a perennial species.
 5. The Owner shall inspect seeding and grassing within 60 days after planting to determine if it is acceptable. If an acceptable growth is not obtained on the first planting, reseeding, and remulching will be required.
- B. Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Where sod is removed or damaged, replant such areas using sod of the same species of grass at the first appropriate season. Outside of residential or landscaped areas, grass the entire area disturbed by the work on completion of work in any area. In all areas, promptly establish successful stands of grass.
- C. Grassing activities shall comply with TDEC Specifications, specifically for the selection of species, with the exception that kudzu shall not be permitted, planting dates, and application rates for seeding, fertilizer, and mulching. Where permanent vegetative cover (grassing) cannot be immediately established (due to season or other circumstances) the Contractor shall provide temporary vegetative cover. The Contractor must return to the site (at the appropriate season) to install permanent vegetation in areas that have received temporary vegetative cover.

3.5 RIP RAP

- A. Unless shown otherwise on the Drawings, rip rap shall be placed where ordered by the Engineer, at all points where banks of streams or drainage ditches are disturbed by excavation, or at all points where natural vegetation is removed from banks of the streams or drainage ditches. Carefully compact backfill and place rip rap to prevent subsequent settlement and erosion. This requirement applies equally to construction alongside a stream or drainage ditch as well as crossing a stream or drainage ditch.
- B. When trenching across a creek, place rip rap a distance of 10 feet upstream and 10 feet downstream from the top of the trench excavation. Place rip rap across creek bottom, across creek banks, and extend rip rap placement 5 feet beyond the top of each creek bank.
- C. Preparation of Foundations: The ground surface upon which the rip rap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before placement is commenced. Where filling of depressions is required, the new material shall be compacted with hand or mechanical tampers. Unless at creek banks or otherwise shown or specified, rip rap shall begin in a toe ditch constructed in original ground around the toe of the fill or the cut slope. The toe ditch shall be 2 feet deep in original ground, and the side next to the fill or cut shall have that same slope. After the rip rap is placed, the toe ditch shall be backfilled, and the excess dirt spread neatly within the construction easement.
- D. Placement of Filter Fabric: The surface to receive fabric shall be prepared to a relatively smooth condition free from obstructions, depressions, and debris. The fabric shall be placed with the long dimension running up the slope and shall be placed to provide a minimum number of overlaps. The strips shall be placed to provide a minimum width of 1 foot of overlap for each joint. The filter fabric shall be anchored in place with securing pins of the type recommended by the fabric manufacturer. Pins shall be placed on or within 3 inches of the centerline of the overlap. The fabric shall be placed so that the upstream strip overlaps the downstream strip. The fabric shall be placed loosely so as to give and therefore avoid stretching and tearing during placement of the stones. The stones shall be dropped no more

than 3 feet during construction. The fabric shall be protected at all times during construction from clogging due to clay, silts, chemicals or other contaminants. Any contaminated fabric or any fabric damaged during its installation or during placement of rip rap shall be removed and replaced with uncontaminated and undamaged fabric at no expense to the Owner.

- E. Placement of Rip Rap: The rip rap shall be placed on a 6-inch layer of soil, crushed stone or sand overlaying the filter fabric. This 6-inch layer shall be placed to maximize the contact between the soil beneath the filter fabric and the filter fabric. Rip rap shall be placed with its top elevation conforming with the finished grade or the natural slope of the stream bank and stream bottom.
1. Stone Rip Rap: Stone rip rap shall be dumped into place to form a uniform surface and to the thickness specified on the Drawings. The thickness tolerance for the course shall be -6 inches and +12 inches. If the Drawings or the Bid do not specify a thickness, the course shall be placed to a thickness of not less than 18 inches.
 2. Sand-Cement Bag Rip Rap: The bags shall be uniformly filled to the maximum capacity which will permit satisfactory tying. The bagged rip rap shall be placed by hand with the tied ends facing the same direction, with close, broken joints. When directed by the Engineer or required by the Drawings, header courses shall be placed. After placing, the bags shall be rammed or packed against one another to produce the required thickness and form a consolidated mass. The top of each bag shall not vary more than 3 inches above or below the required plane.

END OF SECTION

PART 1 GENERAL**1.1 SCOPE**

- A. The Contractor shall provide a complete and comprehensive reference manual (Operating and Maintenance (O&M) Manual) containing operating and maintenance data to enable operators and plant engineers to correctly operate, service, and maintain all equipment and accessories covered by these Specifications and Drawings. The data contained in the manual shall explain and illustrate clearly and simply all principles and theory of operation, operating instructions, maintenance procedures, calibration procedures, and safety precautions and procedures for the equipment involved.
- B. No separate payment will be made for the O&M Manual and the cost of said manual shall be included in the Contract Price.

1.2 SUBMITTAL SCHEDULE

- A. The Contractor shall submit, for the Engineer's approval, 2 preliminary hard copies of the O&M Manual with all specified material before the work covered by these Contract Documents is 80 percent complete. The Engineer will notify the Contractor, in writing, of any deficiencies in the manual and will return one copy of the manual for completion and/or correction.
- B. Before the operating test period or final acceptance, the Contractor shall submit 2 hard copies and 1 electronic copy of the revised O&M Manual, complete in detail as specified below.

1.3 SUBMITTAL FORMAT

- A. Each copy of the manual shall be assembled in one or more loose leaf binders, each with title page, typed table of contents, typed list of tables, typed list of figures, and heavy section dividers with reinforced holes and numbered plastic index tabs. Binders shall be 3-ring, hardback type, with transparent vinyl pocket front cover suitable for inserting identifying cover and with a transparent vinyl pocket on the spine for label. All data shall be punched for binding. Composition and printing shall be arranged so that punching does not obliterate any data. The cover and binding edge of each manual shall have the project title, Specification Document number and title, and manual title printed thereon, all as approved by the Engineer.
- B. All copies of Shop Drawings, figures, and diagrams shall be reduced to either 8-1/2 x 11 inches or to 11 inches in the vertical dimension and as near as practical to 17 inches in the horizontal dimensions. Such sheets shall be folded to 8-1/2 x 11 inches. The manual and other data shall be printed on first quality paper, 8-1/2 x 11-inch size with standard 3-hole punching. Binders shall be labeled Vol. 1, Vol. 2, etc., where more than one is required. The table of contents for the entire set, identified by volume number, shall appear in each binder. Text, figures, and drawings shall be clearly legible and suitable for dry process reproductions.

- C. Each submittal shall have a cover sheet that includes the following information:
1. The date of submittal and the dates of any previous submittals.
 2. The project title.
 3. Numerical submittal numbers, starting with 1.90, 2.90, etc. Revisions to be numbered 1.91, 1.92, etc.
 4. The names of the:
 - a. Contractor.
 - b. Supplier.
 - c. Manufacturer.
 5. Identification of the product, with the Specification Section number, permanent equipment tag numbers, and applicable drawing number.
- D. The Engineer will not recommend final acceptance of the work until the O&M Manual is complete and satisfactory to Engineer.

1.4 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

- A. Each O&M Manual shall include a title page which includes all information specified in Article 1.3, Paragraph C., above. In addition, the title page shall include the manufacturer's address, phone number, facsimile number, and contact; manufacturer's equipment name and model number; supplier's address, phone number, facsimile number, and contact.
- B. Each O&M Manual shall include a table of contents identifying the location of each item listed below, for each component supplied. For items not applicable to a component, the table of contents shall list N/A for the page number.
- C. For all equipment, the Contractor shall furnish a complete, detailed listing of all equipment, components, and accessories showing component name, manufacturer, model number, and quantity information shall be furnished for each component as outlined below:
1. Equipment function, normal operating characteristics, performance data, and limiting conditions.
 2. Detailed disassembly, overhaul and reassembly, installation, alignment, adjustment, and checking instructions.
 3. Detailed operating instructions for start-up, calibration, routine and normal operation, regulation and control, safety, shut-down and emergency conditions. Detailed list of settings for relays, pressure switches, temperature switches, level switches, thermostats, alarms, relief valves, rupture discs, etc.

4. Detailed preventative maintenance procedures and schedules, including detailed lubrication instructions and schedules, identification of required lubricants and operating fluids (description, specification, and trade name of at least 2 manufacturers), and diagrams illustrating lubrication points.
5. Detailed guide to “troubleshooting”.
6. Detailed parts lists identified by title, materials of construction, manufacturer’s part number, list of recommended spare parts identified as specified above, predicted life of parts subject to wear, and an exploded or concise cut-away view of each equipment assembly.
7. Electrical and instrumentation schematics, including motor control centers, control panels, instrument panels, and analyzer panels.
8. List of all special tools supplied and description of their use. Special tools include any tool not normally available in an industrial hardware or mill supply house.
9. List of names and addresses of nearest service centers for parts, overhaul, and service.
10. Procedures for storing, handling, and disposing of any chemicals or products used with the equipment or system.
11. The supplier’s operation and maintenance information will address the particular equipment furnished, with specific details on operation and maintenance practices. General data is not acceptable. Information contained in the manual which is not acceptable to the project shall be marked out and noted as “N/A”.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

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PART 1 GENERAL

1.1 SCOPE

- A. The Owner's requirements for all Record Drawings and As-Builts shall be as follows:
1. AutoCad format (minimum 2000 version)
 2. NAD83TN State Plane coordinates
 3. Include rim elevations for manholes
 4. Include invert elevations for all pipes entering/exiting manholes
 5. Include size and material for all pipes
 6. Include make/model of hydrants and valves

1.2 "BUY AMERICA" PROVISION

The City of Sevierville Water and Sewer Department has adopted the Federal Government's BUY AMERICA requirements. All manufacturing processes for steel and iron materials furnished for permanent incorporation into the work shall occur in the United States of America (U.S.A.). The only exception to this requirement is the production of pig iron and the processing, pelletizing, and reduction of iron ore, which may occur in another country. Other than these exceptions, all melting, rolling, extruding, machining, bending, grinding, coating, etc. must occur in the U.S.A.

Products of steel include, but are not limited to, such products as structural steel, piles, reinforcing steel, structural plate, steel culverts, guardrail and steel supports for signs, signals, and luminaires. Products of iron include, but are not limited to, such products as cast iron frames and grates. Coatings include, but are not limited to, the applications of epoxy, galvanizing, and paint. The coating material is not subject to this clause, only the application process.

A Certificate of Compliance shall be furnished for steel and iron materials. Records to be maintained by the Contractor for this certification shall include a signed mill test report and a signed certification by each supplier, distributor, fabricator, and manufacturer that has handled the steel or iron product affirming that every process, including the application of a coating, performed on the steel or iron product has been carried out in the U.S.A., except as allowed by this provision. The lack of these certificates will be justification for rejection of the steel or iron product.

The requirements of said law and regulations do not prevent a minimal use of foreign steel and iron materials if the cost of such materials used does not exceed one-tenth of one percent (0.1%) of the total contract price or \$2,500.00, whichever is greater. Upon completion of the project, the Contractor shall certify in writing as to compliance with this provision and also provide the total project delivered cost of all foreign steel and/or iron permanently incorporated into the project. The form for this certification is entitled "Buy America Certificate of Compliance".

1.3 SEWER MAIN TAPPING

- A. No tapping of sewer mains is allowed.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

PART 1 GENERAL

1.1 SCOPE

- A. Clearing and grubbing includes, but is not limited to, removing from the project site, trees, stumps, roots, brush, structures, abandoned utilities, trash, debris, and all other materials found on or near the surface of the ground in the construction area and understood by generally accepted engineering practice not to be suitable for construction of the type contemplated. Precautionary measures that prevent damage to existing features to remain are part of the work.
- B. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion and sedimentation control procedures.
- C. These Specifications are only the minimum requirements; actual requirements may be greater depending upon the situation. These Specifications may be adjusted by the sole discretion of the City of Sevierville Water and Sewer Department to fit a particular situation not routinely encountered, or as public safety issues become apparent.

1.2 QUALITY ASSURANCE

- A. The Contractor shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, state or federal authorities having jurisdiction over the project. All required permits of a temporary nature shall be obtained for construction operations by the Contractor.

1.3 JOB CONDITIONS

- A. Location of the Work: The area to be cleared and grubbed is shown schematically on the Drawings or specified below. It includes all areas designated for construction.

PART 2 PRODUCTS

2.1 EQUIPMENT

- A. The Contractor shall furnish equipment of the type normally used in clearing and grubbing operations including, but not limited to, tractors, trucks, and loaders.

PART 3 EXECUTION

3.1 SCHEDULING OF CLEARING

- A. The Contractor shall clear at each construction site only that length of the right-of-way, permanent or construction easement which would be the equivalent of one month's pipe laying. This length shall be determined from the Contractor's Progress Schedule.

- B. The Engineer may permit clearing for additional lengths of the pipeline provided that temporary erosion and sedimentation controls are in place and a satisfactory stand of temporary grass is established. Should a satisfactory stand of grass not be possible, no additional clearing shall be permitted beyond that specified above.
- C. A satisfactory stand of grass shall have no bare spots larger than 1 square yard. Bare spots shall be scattered, and the bare area shall not comprise more than 1 percent of any given area.

3.2 CLEARING AND GRUBBING

- A. Clear and grub, as required, on each side of the pipeline before excavating. Remove all trees, growth, debris, stumps, and other objectionable matter. Clear the construction easement or road right-of-way only if necessary.
- B. Materials to be cleared, grubbed, and removed from the project site include, but are not limited to, all trees, stumps, roots, brush, trash, organic matter, paving, miscellaneous structures, houses, debris, and abandoned utilities.
- C. Grubbing shall consist of completely removing roots, stumps, trash, and other debris from all graded areas so that topsoil is free of roots and debris. Topsoil is to be left sufficiently clean so that further picking and raking will not be required.
- D. All stumps, roots, foundations, and planking embedded in the ground shall be removed and disposed of. Piling and butts of utility poles shall be removed to a minimum depth of 2 feet below the limits of excavation for structures, trenches, and roadways or 2 feet below finish grade, whichever is lower.
- E. Landscaping features shall include, but are not necessarily limited to, fences, mailboxes, cultivated trees, cultivated shrubbery, property corners, man-made improvements, subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly reestablishing these features.
- F. Surface rocks and boulders shall be grubbed from the soil and removed from the site if not suitable as riprap.
- G. Where the tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility.
- H. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.
- I. All fences adjoining any excavation or embankment that, in the Contractor's opinion, may be damaged or buried, shall be carefully removed, stored, and replaced. Any fencing that, in the Engineer's opinion, is significantly damaged shall be replaced with new fence material.
- J. The Contractor shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, etc. situated within the limits of the construction area but not directly within excavation and/or fill limits. The Contractor shall be held liable for any damage the Contractor's operations have inflicted on such property.

- K. The Contractor shall be responsible for all damages to existing improvements resulting from Contractor's operations.

3.3 DISPOSAL OF DEBRIS

- A. The debris resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Contractor and shall be disposed of in accordance with all requirements of federal, state, county, and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any private property except with written consent of the property owner. In no case shall any material or debris be left on the project, shoved onto abutting private properties or buried on the project.

END OF SECTION

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PART 1 GENERAL

1.1 SCOPE

- A. The work under this section consists of furnishing all labor, equipment, and materials and performing all operations in connection with the trench excavation and backfill required to install the pipelines shown on the Drawings and as specified.
- B. Excavation shall include the removal of any trees, stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.
- C. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.
- D. The trench is divided into five specific areas:
 - 1. Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.
 - 2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.
 - 3. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
 - 4. Initial Backfill: The area above the haunching material and below a plane 12 inches above the top of the barrel of the pipe.
 - 5. Final Backfill: The area above a plane 12 inches above the top of the barrel of the pipe.
- E. The choice of method, means, techniques, and equipment rests with the Contractor. The Contractor shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material, proximity of man-made improvements to be protected, available easement or right-of-way, and prevailing practice in the area.
- F. All Specifications are only the minimum requirements; actual requirements may be greater depending upon the situation. These Specifications may be adjusted by the sole discretion of the City of Sevierville Water and Sewer Department to fit a particular situation not routinely encountered, or as public safety issues become apparent.

1.2 QUALITY ASSURANCE

- A. Density: All references to “maximum dry density” shall mean the maximum dry density defined by ASTM D698, “Maximum Density-Optimum Moisture Test”. Determination of the density of foundation, bedding, haunching or backfill materials in place shall meet with the requirements of ASTM D1556, “Density of Soil In Place by the Sand Cone Method”; ASTM D2937, “Density of Soil In Place by the Drive-Cylinder Method” or ASTM D2922, “Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)”.
- B. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specifications shall be performed by an independent testing laboratory at no cost to the Owner. The Contractor’s testing laboratory shall perform tests, at no cost to the Owner, upon change of source and at sufficient intervals during the work to certify conformance of all select material furnished for use on this project.

1.3 SAFETY

- A. Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act (OSHA) of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P, “Excavation, Trenching & Shoring” as described in OSHA Publication 2226. All trench safety is the responsibility of the Contractor.

PART 2 PRODUCTS

2.1 TRENCH FOUNDATION MATERIALS

- A. Crushed stone or surge stone shall be utilized for trench foundation (trench stabilization).
- B. Crushed stone shall be crushed limestone and shall meet the requirements of the Tennessee Department of Transportation (TDOT), Specification 903.11. Stone size shall be between No. 57 and No. 4, inclusive, as determined by TDOT Specification 903.22.
- C. Surge stone shall be crushed limestone and shall meet the requirements of TDOT Specification 903.11. Stone size shall be No. 1, inclusive, as determined by TDOT Specification 903.22.

2.2 BEDDING AND HAUNCHING MATERIALS

- A. Unless specified otherwise, bedding and haunching materials shall be crushed stone or earth materials as specified below.
- B. Crushed stone utilized for bedding and haunching shall meet the requirements of TDOT Specification 903.11. Stone size shall be No. 57, as determined by TDOT Specification 903.22.
- C. Earth materials utilized for bedding and haunching shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2 inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes, and other unsuitable materials. Should the material excavated from the

trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as bedding or haunching material, provide select material conforming to the requirements of this section at no additional cost to the Owner.

2.3 INITIAL BACKFILL

- A. Unless shown on Drawings or specified otherwise, initial backfill material shall be crushed stone or earth materials as specified for bedding and haunching materials.
- B. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2 inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes, and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as initial backfill material, provide select material conforming to the requirements of this section.

2.4 FINAL BACKFILL

- A. Final backfill material shall be general excavated earth materials, shall not contain rock larger than 3 inches at its greatest diameter, cinders, stumps, limbs, man-made wastes, and other unsuitable materials. If materials excavated from the trench are not suitable for use as final backfill material, provide select material conforming to the requirements of this section.

2.5 SELECT BACKFILL

- A. Select backfill shall be materials which meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.

2.6 CONCRETE

- A. Concrete for bedding, haunching, initial backfill or encasement shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 to 5 inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C94. Reinforcing steel shall conform to the requirements of ASTM A615, Grade 60.

2.7 FLOWABLE FILL

- A. Flowable fill for final backfill shall not have a compressive strength exceeding 150 psi, with not less than 100 pounds of cement per cubic yard, and a minimum of 250 pounds of Class C or F, Fly Ash, per cubic yard. Flowable fill shall be mixed and transported in accordance with ASTM C94.

PART 3 EXECUTION

3.1 TRENCH EXCAVATION

- A. Topsoil and grass shall be stripped a minimum of 6 inches over the trench excavation site and stockpiled separately for replacement over the finished grading areas.
- B. Trenches shall be excavated to the lines and grades shown on the Drawings with the centerlines of the trenches on the centerlines of the pipes and to the dimensions which provide the proper support and protection of the pipe and other structures and accessories.
- C. Trench Width for Pipelines:
 - 1. The sides of all trenches shall be vertical to a minimum of 1 foot above the top of the pipe. Unless otherwise indicated on the Drawings, the minimum trench width shall be equal to the sum of the outside diameter of the pipe plus 2 feet.
 - 2. Excavate the top portion of the trench to any width within the construction easement or right-of-way which will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.
 - 3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 12 inches clearance between the rock and the side of the pipe barrel or manhole.
 - 4. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher Class or Type of bedding and haunching as shown on the Drawings for the full trench width as actually cut. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the Engineer or Owner.
- D. Depth:
 - 1. The trenches shall be excavated to the required depth or elevation which allow for the placement of the pipe and bedding to the dimensions shown on the Drawings.
 - 2. Water Mains:
 - a. Depth of Trenches: Excavate trenches to provide depths as shown on the Drawings. The depth of cover shall not exceed that as shown on the Drawings by more than 1 foot, without approval of the Engineer.
 - b. Excavate trenches to provide a minimum cover not less than 3 feet. Within the right-of-way of highways, streets or roadways, excavate to place the top of the pipe a minimum of 40 inches below the nearest pavement edge or drainage ditch.

- c. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.
 - d. Depth of cover shall not exceed 5 feet unless indicated on the Drawings.
 - 3. Where rock is encountered in trenches for pipelines, provide a minimum of 6 inches clearance between the bottom of the trench and the bottom of the pipe or accessory for pipe 21 inches in diameter and smaller and 12 inches for larger pipe, valves, and manholes.
- E. Excavated Materials:
 - 1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Topsoil shall be carefully separated and lastly placed in its original location.
 - 2. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

3.2 SHEETING, BRACING, AND SHORING

- A. Sheeting, bracing, and shoring shall be performed in the following instances:
 - 1. Where sloping of the trench wall does not adequately protect persons within the trench from slides or cave-ins.
 - 2. In caving ground.
 - 3. In wet, saturated, flowing or otherwise unstable materials. The sides of all trenches and excavations shall be adequately sheeted, braced, and shored.
 - 4. Where necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees or private properties which are required to remain.
 - 5. Where necessary to maintain the top of the trench within the available construction easement or right-of-way.
- B. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970, as amended.
- C. Timber: Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.
- D. Steel Sheeting and Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth, and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth

that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities.

- E. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care shall be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield shall be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be “dragged” with the bottom of the shield extending below the top of the pipe or utility.
- F. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the Engineer it cannot be safely removed or is within 3 feet of an existing structure, utility or pipeline. Cut off any sheeting left in place at least 2 feet below the surface.

3.3 ROCK EXCAVATION

- A. Definition of Rock: Any material which cannot be excavated with conventional excavating equipment, and is removed by drilling and blasting, and occupies an original volume of at least one-half cubic yard.
- B. Blasting: Provide licensed, experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all buildings and structures from the effects of the blast. Repair any resulting damage. If the Contractor repeatedly uses excessive blasting charges or blasts in an unsafe or improper manner, the Engineer may direct the Contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.
- C. Removal of Rock: Dispose of rock off-site that is surplus or not suitable for use as rip rap or backfill.
- D. The Contractor shall notify the Engineer prior to any blasting. Additionally, the Contractor shall notify the Engineer before any charge is set.
- E. Following review by the Engineer regarding the proximity of permanent buildings and structures to the blasting site, the Engineer may direct the Contractor to employ an independent, qualified specialty subcontractor, approved by the Engineer, to monitor the blasting by use of seismograph, identify the areas where light charges must be used, conduct pre-blast and post-blast inspections of structures, including photographs or videos, and maintain a detailed written log.

3.4 DEWATERING EXCAVATIONS

- A. The Contractor, at his own expense, shall provide adequate facilities for promptly removing water from all excavations. Dewater the excavation continuously to maintain a water level 2 feet below the bottom of the trench.

- B. Control drainage in the vicinity of excavation so the ground surface is properly sloped to prevent water running into the excavation.
- C. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations. Where the utility crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property.
- D. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.
- E. Where dewatering is performed by pumping the water from a sump, crushed stone shall be used as the medium for conducting the water to the sump. Sump depth shall be at least 2 feet below the bottom of the trench. Pumping equipment shall be of sufficient quantity and/or capacity to maintain the water level in the sump 2 feet below the bottom of the trench. Pumps shall be a type such that intermittent flows can be discharged. A standby pump shall be required in the event the operating pump or pumps clog or otherwise stop operation.
- F. Dewater by use of a well point system when pumping from sumps does not lower the water level 2 feet below the trench bottom. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10 inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand, and withdrawing the casing.

3.5 TRENCH FOUNDATION AND STABILIZATION

- A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.
- B. Should the undisturbed material encountered at the trench bottom constitute, in the opinion of the Engineer, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed stone or 3,000 psi concrete as directed by the Engineer.
- C. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

3.6 BEDDING AND HAUNCHING

- A. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders or large dirt clods.
- B. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings. All bedding shall extend the full width of the trench bottom. The pipe shall be placed and brought to grade by tamping the bedding material or by removal of the excess amount of the bedding material under the pipe. Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying

pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint.

- C. At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.
- D. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders or dirt clods.
- E. Water Mains:
 - 1. Ductile Iron Pipe:
 - a. Unless otherwise shown on the Drawings or specified, bedding and haunching shall utilize earth materials and meet the requirements for Type 2, Pipe Bedding, where rock is not encountered.
 - b. In areas where rock is encountered, bedding and haunching material shall be crushed stone. Crushed stone bedding shall extend a minimum of 6 inches below the pipe.
 - c. Where the depth of cover over the piping exceeds 15 feet, the pipe bedding shall meet the requirements of Type 4, Pipe Bedding. Where the depth of cover over the piping exceeds 18 feet, the pipe bedding shall meet the requirements of Type 5, Pipe Bedding.
 - d. Type 4 or Type 5, Pipe Bedding, called for on the Drawings, specified or ordered by the Engineer, shall meet requirements for Type 4 or Type 5, Pipe Bedding, utilizing crushed stone bedding and haunching material.
 - 2. Polyvinyl Chloride (PVC) Pipe:
 - a. Unless otherwise shown on the Drawings or specified, bedding and haunching shall utilize earth materials and meet the requirements for Type 2, Pipe Bedding, where rock is not encountered.
 - b. In areas where rock is encountered, bedding and haunching material shall be crushed stone. Crushed stone bedding shall extend a minimum of 6 inches below the pipe.
- F. Excessive Width and Depth:
 - 1. Water Mains: If the trench is excavated to excess width, provide the next higher type or class of pipe bedding, but a minimum of Type 4, as detailed on the Drawings.
 - 2. If the trench is excavated to excessive depth, provide crushed stone to place the bedding at the proper elevation or grade.

3. Depth of cover will not exceed 5 feet unless indicated on the plans.

G. Compaction: Bedding and haunching materials under pipe, manholes, and accessories shall be compacted to a minimum of 90 percent of the maximum dry density, unless shown or specified otherwise.

3.7 INITIAL BACKFILL

A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill, and ensure the uniform distribution of the loads over the top of the pipe.

B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 12 inches above the pipe barrel. Layer depths shall be a maximum of 6 inches for pipe 18 inches in diameter and smaller and a maximum of 12 inches for pipe larger than 18 inches in diameter.

C. Backfill on both sides of the pipe simultaneously to prevent side pressures.

D. Compact each layer thoroughly with suitable hand tools or tamping equipment.

E. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless shown or specified otherwise.

F. In areas where the trench is cut into rock or where suitable backfill is unavailable, crushed stone shall be used for initial backfill up to 12 inches above the pipe barrel.

G. Crushed stone shall be used for initial backfill up to 12 inches above the pipe barrel for all pipe material for gravity sewers.

3.8 CONCRETE ENCASEMENT FOR PIPELINES

A. Where concrete encasement is shown on the Drawings for pipelines, excavate the trench to provide a minimum of 6 inches clearance from the bell of the pipe. Lay the pipe to line and grade on sandbags. In lieu of bedding, haunching, and initial backfill, place concrete to the full width of the trench and to a height of not less than 6 inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.

3.9 FINAL BACKFILL

A. Backfill carefully to restore the ground surface to its original condition.

B. The top 6 inches shall be topsoil obtained as specified in Article 3.1, Trench Excavation, above.

C. Excavated material, which is unsuitable for backfilling and excess material, shall be disposed of, at no additional cost to the Owner, in a manner approved by the Engineer. Surplus soil may be distributed and spread over the site if approved by the Engineer. If such spreading is allowed, the site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.

- D. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this section.
- E. After initial backfill material has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:
 - 1. In 6-inch layers, if using light power tamping equipment, such as a “jumping jack”.
 - 2. In 12-inch layers, if using heavy tamping equipment, such as hammer with tamping feet.
 - 3. In 24-inch layers, if using a hydra-hammer.
- F. Settlement: If trench settles, refill and grade the surface to conform to the adjacent surfaces.
- G. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise.

3.10 BACKFILL UNDER ROADS

- A. Crushed stone shall be used as bedding, haunching, and initial backfill for all pipe materials. Flowable Fill shall be used as final backfill up to the top of the asphalt or concrete pavement. Steel plate shall cover the patch until the fill has cured. Once the Flowable Fill has cured, the required thickness can be removed, and appropriate materials can be used to repair the road.
- B. When required by the Owner, one-half of the road crossing shall be excavated, then temporary bridges consisting of steel plate shall be placed over the excavation for use by the traveling public; then the remainder of the excavation can be carried out.

3.11 BACKFILL WITHIN TDOT RIGHT-OF-WAY

- A. Backfill within the TDOT right-of-way shall meet all requirements, standards, and specifications stipulated by TDOT.

3.12 BACKFILL ALONG RESTRAINED JOINT PIPE

- A. Backfill along restrained joint pipe shall be compacted to a minimum 90 percent of the maximum dry density.

3.13 DETECTION WIRE

- A. Provide detection wire as specified in Section 33 10 00, Water Mains and Accessories, Article 2.20, Paragraph A., of these Specifications.

3.14 TESTING AND INSPECTION

- A. The soils testing laboratory is responsible for the following:
 - 1. Compaction tests in accordance with Article 1.2, above.

2. Field density tests for each 2 feet of lift, one test for each 2,000 feet of pipe installed or more frequently if ordered by the Engineer.
 3. Inspecting and testing stripped site, subgrades, and proposed fill materials.
- B. The Contractor's duties relative to testing include:
1. Notifying laboratory of conditions requiring testing.
 2. Coordinating with laboratory for field testing.
 3. Paying costs for additional testing performed beyond the scope of that required and for retesting where initial tests reveal non-conformance with specified requirements.
 4. Providing excavation as necessary for laboratory personnel to conduct tests.
- C. Inspection:
1. Earthwork operations, acceptability of excavated materials for bedding or backfill, and placing and compaction of bedding and backfill is subject to inspection by the Engineer.
 2. Foundations and shallow spread footing foundations are required to be inspected by a geotechnical engineer, who shall verify suitable bearing and construction.
- D. Comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, state or federal authorities having jurisdiction.

END OF SECTION

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PART 1 GENERAL

1.1 SCOPE

- A. The work to be performed under this section shall consist of removing and replacing existing pavement, sidewalks, and curbs in paved areas where such have been removed for construction of water mains, fire hydrants, sewers, manholes, and all other water and sewer appurtenances and structures.
- B. All Specifications are only the minimum requirements; actual requirements may be greater depending upon the situation. These Specifications may be adjusted by the sole discretion of the City of Sevierville Water and Sewer Department to fit a particular situation not routinely encountered, or as public safety issues become apparent.

1.2 SUBMITTALS

- A. Certificates: Provide certificates stating that materials supplied comply with Specifications. Certificates shall be signed by the asphalt producer and the Contractor.

1.3 CONDITIONS

- A. Weather Limitations:
 - 1. Do not conduct paving operations when surface is wet or contains excess of moisture which would prevent uniform distribution and required penetration.
 - 2. Construct prime and tack coats, and asphaltic courses only when atmospheric temperature in the shade is above 50° F, when the underlying base is dry and when weather is not rainy.
 - 3. Place base course when air temperature is above 35° F and rising.
- B. Grade Control: Establish and maintain the required lines and grades for each course during construction operations.
- C. Sevier County and City of Sevierville Streets: All work within Sevier County or the City of Sevierville road rights-of-way shall be performed in accordance with the requirements and specifications of the applicable agency.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Mineral Aggregate Base Course: Mineral aggregate base course shall conform to the requirements of the Tennessee Department of Transportation (TDOT) Bureau of Highways (BH), Standard Specification Section 303, Road and Bridge Construction, Type A base.

- B. Bituminous Plant Mix Base (Hot Mix): The base of all paved roadways shall conform to the requirements of TDOT BH, Standard Specification Section 307, Road and Bridge Construction.
- C. Bituminous Sand-Gravel Binder Course: The binder course of all paved roadways shall conform to the requirements of TDOT BH, Standard Specification Section 409, Road and Bridge Construction.
- D. Asphaltic Concrete Surface (Hot Mix): The surface course for all pavement shall conform to the requirements of TDOT BH, Standard Specification Section 411, Road and Bridge Construction, Grading "E".
- E. Double Bituminous Surface Treatment: The surface for all pavements shall conform to the requirements of TDOT BH, Standard Specification Section 404, Road and Bridge Construction.
- F. Concrete: Provide concrete and reinforcing for concrete pavement or base courses in accordance with the requirements of TDOT BH, Standard Specification Section 501, Road and Bridge Construction.
- G. Special Surfaces: Where driveways or roadways are disturbed or damaged which are constructed of specialty type surfaces, e.g. brick or stone, these driveways and roadways shall be restored utilizing similar, if not original, materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed. Where a construction joint is within 12 inches of the broken surface, the surface shall be removed and replaced to the point along the construction joint.

2.2 TYPES OF PAVEMENTS

- A. General: All existing pavement removed, destroyed or damaged by construction shall be replaced with the same type and thickness of pavement as that existing prior to construction, unless otherwise directed by the Engineer. Materials, equipment, and construction methods used for paving work shall conform to TDOT Specifications applicable to the particular type required for replacement, repair or new pavements.
- B. Aggregate Base: Aggregate base shall be constructed in accordance with the requirements of TDOT BH, Standard Specification Section 303, Road and Bridge Construction, Type A base. Material shall be mixed and placed by the stationary plant method. If the finished compacted base course depth is 6 inches or more, the course shall be constructed in 2 or more layers of approximately equal thickness.
- C. Concrete Pavement: Concrete pavement or base courses shall be replaced with concrete. The surface finish of the replaced concrete pavement shall conform to that of the existing pavement. The surface of the replaced concrete base course shall be left rough. The slab depth shall be equivalent to the existing concrete pavement or base course, but in no case less than 6 inches thick. Transverse and longitudinal joints removed from concrete pavement shall be replaced at the same locations and to the same types and dimensions as those removed. Concrete pavements or concrete base courses shall be reinforced and shall conform to TDOT BH, Standard Specification Section 501.

- D. Asphalt Concrete Base, Binder, and Surface Course: Asphalt concrete base, binder, and surface course construction shall conform to the following TDOT BH, Standard Specifications: Section 307, bituminous plant mix base course; Section 409, bituminous sand-gravel binder course; and Section 411, Grading “E”, asphalt concrete surface course. The pavement mixture shall not be spread until the designated surface has been previously cleaned and prepared, is intact, compacted as specified herein, properly cured, dry, and the prime and/or tack coat has been applied. Apply and compact the asphalt concrete in maximum layer thickness by asphalt spreader equipment of design and operation approved by the Engineer. After compaction, the asphalt concrete shall be smooth and true to established profiles and sections. Immediately correct any high, low or defective areas by cutting out the course, replacing with fresh hot mix, and immediately compacting to conform and thoroughly bond to the surrounding area.
- E. Double Bituminous Surface Treatment: Double bituminous surface treatment shall be replaced with a minimum thickness of 1-inch conforming to the requirements of TDOT BH, Standard Specification Section 404. No bituminous surface shall be installed between October 15 and April 15, and only when the air and pavement temperatures in the shade are above 60° F.
- F. Gravel Surfaces: Existing gravel road, drive, and parking area replacement shall meet the requirements of aggregate base course. This surfacing may be authorized by the Engineer as a temporary surface for paved streets until replacement of hard surfaced pavement is authorized.
- G. Temporary Measures: During the time period between pavement removal and complete replacement of permanent pavement, maintain highways, streets, and roadways by the use of steel running plates anchored to prevent movement. The backfill above the pipe shall be compacted, as specified elsewhere, up to the existing pavement surface to provide support for the steel running plates. All pavement shall be replaced within 7 calendar days of its removal.

PART 3 EXECUTION

3.1 REMOVING PAVEMENT

- A. General: Remove existing pavement as necessary for installing the pipeline and appurtenances.
- B. Marking: Before removing any pavement, mark the pavement neatly paralleling pipelines and existing streetlines. Space the marks the width of the trench.
- C. Breaking: Break asphalt pavement along the marks using pavement shearing equipment, jack hammers or other suitable tools. Break concrete pavement along the marks by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.
- D. Machine Pulling: Do not pull pavement with machines until the pavement is completely broken and separated from pavement to remain.
- E. Damage to Adjacent Pavement: Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.

- F. Damage to Traffic Signal Loops: Any pavement removal which will include removal of traffic signal loops embedded in the pavement shall be coordinated with the City of Sevierville, Traffic Engineering Department, having jurisdiction over the traffic signal 5 days prior to pavement removal.
- G. Sidewalk: Remove and replace any sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.
- H. Curbs: Tunnel under or remove and replace any curb disturbed by construction to the nearest undisturbed joint.

3.2 REPLACING PAVEMENT

- A. Preparation of Subgrade: During backfilling and compaction of the backfill, arrange to have the compaction tested by an independent testing laboratory. After compaction testing has been satisfactorily completed, replace all pavements, sidewalks, and curbs removed.
 - 1. The existing street pavement or surface shall be removed along the lines of the work for the allowable width specified for the trench or structure. After the installation of the sewerage or water works facilities and after the backfill has been compacted suitably, the additional width of pavement to be removed, as shown on the Drawings, shall be done immediately prior to replacing the pavement.
 - 2. Trench backfill shall utilize flowable fill for the full depth of the trench as specified in Section 31 23 33, Trench Excavation and Backfill, of these Specifications.
 - 3. Temporary trench backfill along streets and driveways shall include 6 inches of crushed stone or cherty clay as a temporary surfacing of the trenches. This temporary surface shall be maintained carefully at grade and dust-free by the Contractor until the backfill of the trench has thoroughly compacted in the opinion of the Engineer and permission is granted to replace the street pavement.
 - 4. When temporary crushed stone or chert surface is considered by the Engineer to be sufficient surface for gravel pavement, the surface shall be graded smooth and to an elevation that will make the final permanent surfacing level with the adjacent surfacing that was undisturbed.
- B. Pavement Replacement:
 - 1. Prior to replacing pavement, make a final cut in concrete pavement 12 inches back from the edge of the damaged pavement with a concrete saw. Remove asphalt pavement 12 inches back from the edge of the damaged pavement using pavement shearing equipment, jack hammers or other suitable tools.
 - 2. Replace all street and roadway pavement as shown on the Drawings. Replace driveways, sidewalks, and curbs with the same material, to nearest existing undisturbed construction joint and to the same dimensions as those existing.
 - 3. If the temporary crushed stone or chert surface is to be replaced, the top 6 inches shall be removed and the crushed stone surfacing for unpaved streets or the base for the bituminous surface shall be placed.

4. Following this preparation, the chert or crushed stone base shall be primed with a suitable bituminous material and surfaced with the proper type of bituminous surface treatment.
5. Where the paved surface is to be replaced with asphaltic concrete pavement, concrete pavement or with a concrete base and a surface course, the temporary chert or crushed stone surface and any necessary backfill material, additional existing paving and new excavation shall be removed to the depth and width shown on the Drawings. All edges of the existing pavement shall be cut to a straight, vertical edge. Care shall be used to get a smooth joint between the old and new pavement and to produce an even surface on the completed street. Expansion joints, where applicable, shall be replaced in a manner equal to the original joint.
6. Where driveways or roadways, constructed of specialty type surfaces, e.g. brick or stone are disturbed or damaged, these driveways and roadways shall be restored utilizing similar materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed. Where a construction joint is within 12 inches of the broken surface, the surface shall be removed and replaced to the nearest undisturbed construction joint.

C. Pavement Resurfacing:

1. Certain areas to be resurfaced are specified or noted on the Drawings. Where pavement to be resurfaced has been damaged with potholes, the Contractor shall remove all existing loose pavement material and fill the hole with Bituminous Plant Mix Base, as specified, to the level of the existing pavement. After all pipeline installations are complete and existing pavement has been removed and replaced along the trench route, apply tack coat and surface course as specified.
2. Resurfacing limits shall be perpendicular to the road centerline. The limits of resurfacing shall be 10 feet beyond the edge of the pavement replacement on the main road being resurfaced, and to the point of tangency of the pavement on the side streets.

D. Pavement Striping: Pavement striping removed or paved over shall be replaced with the same type, dimension, and material as original unless directed otherwise by the Engineer.

E. Traffic Signal Loops: The replacement or repair of all traffic signal loops removed or damaged during the removal and replacement of pavement shall be coordinated by the Contractor with the City of Sevierville, Traffic Engineering Department, having jurisdiction over each traffic signal. The Contractor shall be responsible for payment of all fees associated with replacement or repair of traffic signal loops.

3.3 SIDEWALK AND CURB REPLACEMENT

A. Construction:

1. Whenever sidewalks are removed or disturbed in connection with construction work, they shall be replaced to the original lines and grades in fully as good or better condition than which existed prior to the Contractor's operations. All concrete

sidewalks and curbs shall be replaced with class “A” concrete. Other types of sidewalks, such as brick, stone, etc., shall be replaced with material removed during the progress of the work, in equally as good or better condition as the original.

2. Pre-formed joints shall be 1/2-inch thick, conforming to the latest edition of AASHTO M59 for sidewalks and AASHTO M123 for curbs.
 3. Forms for sidewalks shall be of wood or metal, shall be straight and free from warp, and shall be of sufficient strength, when in place, to hold the concrete true to line and grade without springing or distorting.
 4. Forms for curbs shall be metal and of an approved section. They shall be straight and free from distortions, showing no vertical variation greater than 1/8-inch in 10 feet and no lateral variation greater than 1/4-inch in 10 feet from the true plain surface on the vertical face of the form. Forms shall be of the full depth of the structure and constructed such to permit the inside forms to be securely fastened to the outside forms.
 5. Securely hold forms in place true to the lines and grades indicated on the Drawings.
 6. Wood forms may be used on sharp turns and for special sections, as approved by the Engineer. Where wooden forms are used, they shall be free from warp and shall be the nominal depth of the structure.
 7. All mortar and dirt shall be removed from forms and all forms shall be thoroughly oiled or wetted before any concrete is deposited.
- B. When a section is removed, the existing sidewalk or curb shall be cut to a neat line, perpendicular to both the centerline and the surface of the concrete slab. Existing concrete shall be cut along the nearest existing construction joints; if such joints do not exist, the cut shall be made at minimum distances shown on the Drawings.
- C. Existing concrete sidewalks and curbs that have been cut and removed for construction purposes shall be replaced with the same width and surface as the portion removed. Sidewalks shall have a minimum uniform thickness of 4 inches. The new work shall be neatly jointed to the existing concrete so that the surface of the new work shall form an even, unbroken plane with the existing surfaces.
- D. The subgrade shall be formed by excavating to a depth equal to the thickness of the concrete, plus 2 inches. Subgrade shall be of such width as to permit the proper installation and bracing of the forms. Subgrades shall be compacted by hand tamping or rolling. Soft, yielding or unstable material shall be removed and backfilled with satisfactory material. Place 2 inches of porous crushed stone under all sidewalks and curbs and compact thoroughly, then finish to a smooth, unyielding surface at proper line, grade, and cross section. Immediately prior to pouring concrete, the stone shall be thoroughly wetted, or the concrete shall be poured on a layer of heavy building paper.

E. Joint for Curbs:

1. Joints shall be constructed as indicated on the Drawings and as specified. Construct joints true to line with their faces perpendicular to the surface of the structure and within 1/4-inch of their designated position.
2. Thoroughly spade and compact the concrete at the faces of all joints filling all voids.
3. Install expansion joint materials at the point of curve at all street returns. Install expansion joint material behind the curb at abutment to sidewalks and adjacent structures.
4. Place contraction joints every 10 feet along the length of the curbs and gutters. Form contraction joints using steel templates or division plates which conform to the cross section of the structure. Leave the templates in place until the concrete has set sufficiently to hold its shape but remove them while the forms are still in place. Contraction joint templates or plates shall not extend below the top of the steel reinforcement or they shall be notched to permit the reinforcement to be continuous through the joint. Contraction joints shall be a minimum of 1-1/2 inches deep.

F. Expansion joints shall be required to replace any removed expansion joints or in new construction wherever shown on the Drawings. Expansion joints shall be true and even, shall present a satisfactory appearance, and shall extend to within 1/2-inch of the top of finished concrete surface.

G. Finishing:

1. Strike off the surface with a template and finish the surface with a wood float using heavy pressure, after which, contraction joints shall be made, and the surface finished with a wood float or steel trowel.
2. Finish the face of the curbs at the top and bottom with an approved finishing tool of the radius indicated on the Drawings.
3. Finish edges with an approved finishing tool having a 1/4-inch radius.
4. Provide a final broom finish by lightly combing with a stiff broom after troweling is complete.
5. The finished surface shall not vary more than 1/8-inch in 10 feet from the established grade.

H. Driveway and Sidewalk Ramp Openings:

1. Provide driveway openings of the widths and at the locations indicated on the Drawings and as directed by the Engineer.
2. Provide sidewalk ramp openings as indicated on the Drawings, in conformance with the applicable regulations and as directed by the Engineer.

- I. Concrete shall be suitably protected from freezing and excessive heat. It shall be kept covered with burlap or other suitable material and kept wet until cured. Provide necessary barricades to protect the work. All damage caused by people, vehicles, animals, rain, the Contractor's operations, and the like shall be repaired by the Contractor, at no additional expense to the Owner.

3.4 MAINTENANCE

- A. The Contractor shall maintain the surfaces of roadways built and pavements replaced until the acceptance of the project. Maintenance shall include replacement, scraping, reshaping, wetting, and rerolling as necessary to prevent raveling of the road material, the preservation of reasonably smooth surfaces, and the repair of damaged or unsatisfactory surfaces, to the satisfaction of the Engineer. Maintenance shall include sprinkling as may be necessary to abate dust from the gravel surfaces.

3.5 SUPERVISION AND APPROVAL

- A. Pavement restoration shall meet the requirements of the City of Sevierville, Sevier County Highway Department or other agency as required. All permits shall be obtained prior to cutting or working around any pavement. Obtain agency approval of pavement restorations before requesting final approval.
- B. Obtain the Engineer's approval of restoration of pavement, such as private roads and drives that are not the responsibility of a regulatory agency.
- C. Complete pavement restoration as soon as possible after backfilling.
- D. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the life of the Contract, including the warranty period, promptly restore or repair defects.

3.6 CLEANING

- A. The Contractor shall remove all surplus excavation materials and debris from the street surfaces and rights-of-way and shall restore street, roadway or sidewalk surfacing to its original condition.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE

- A. The work covered by this section includes furnishing all labor, materials, and equipment required to bore and jack casings and to properly complete pipeline construction as described herein and/or shown on the Drawings.
- B. Supply all materials and perform all work in accordance with applicable American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI) or other recognized standards. Latest revisions of all standards are applicable. If requested by the Engineer, submit evidence that manufacturer has consistently produced products of satisfactory quality and performance over a period of at least 2 years.
- C. All Specifications are only the minimum requirements; actual requirements may be greater depending upon the situation. These Specifications may be adjusted by the sole discretion of the City of Sevierville Water and Sewer Department to fit a particular situation not routinely encountered, or as public safety issues become apparent.

1.2 SUBMITTALS

- A. Submit Shop Drawings, product data, and experience in accordance with the requirements set forth by the Owner.
- B. Material Submittals: The Contractor shall provide Shop Drawings and other pertinent specifications and product data as follows:
 - 1. Shop Drawings for casing pipe showing sizes and connection details.
 - 2. Design mixes for concrete and grout.
 - 3. Casing Spacers.
- C. Experience Submittals: Boring and jacking casings is deemed to be specialty contractor work. A minimum of 5 continuous years of experience in steel casing construction is required of the casing installer. Evidence of this experience must be provided with the Shop Drawings for review by the Engineer.

1.3 STORAGE AND PROTECTION

- A. All materials shall be stored and protected in accordance with the manufacturer's recommendations and as approved by the Engineer.

PART 2 PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

A. Casing:

1. The casing shall be new and unused pipe. The casing shall be made from steel plate having a minimum yield strength of 35,000 psi. The steel plate shall also meet the chemical requirements of one of the following: ASTM A36; ASTM A139, Grade B, C, D or E; ASTM A53, Type S or Type E, Grade A or B.
2. The thicknesses of casing shown in Paragraph B., below, are minimum thicknesses. Actual thicknesses shall be determined by the casing installer, based on an evaluation of the required forces to be exerted on the casing when jacking. Any buckling of the casing due to jacking forces shall be repaired at no additional cost to the Owner.
3. The diameters of casing shown in Paragraph B., below, and shown on the Drawings are minimum. Larger casings, with the Engineer's approval, may be provided at no additional cost to the Owner, for whatever reasons the Contractor may decide, whether casing size availability, line and grade tolerances, soil conditions, etc.

B. Casing Sizes:

| UNDER RAILROADS | | |
|------------------------------|--------------------------------|--|
| Pipe Diameter, inches | Casing Diameter, inches | Wall Thickness, Inches - Coated |
| 6 | 14 | 0.250 |
| 8 | 18 | 0.250 |
| 10 | 20 | 0.281 |
| 12 | 24 | 0.344 |
| 14 | 24 | 0.344 |
| 16 | 32 | 0.438 |
| 18 | 36 | 0.469 |
| 20 | 42 | 0.500 |
| 24 | 48 | 0.625 |

| UNDER HIGHWAYS | | |
|------------------------------|--------------------------------|-------------------------------|
| Pipe Diameter, inches | Casing Diameter, inches | Wall Thickness, inches |
| 6 | 12 | 0.250 |
| 8 | 16 | 0.250 |
| 10 | 20 | 0.250 |
| 12 | 24 | 0.250 |
| 14 | 30 | 0.312 |
| 16 | 32 | 0.312 |
| 18 | 36 | 0.375 |
| 20 | 42 | 0.375 |
| 24 | 48 | 0.500 |

C. Casing Spacers: Casing spacers shall meet one of the following requirements:

1. Casing spacers shall be flanged, bolt-on style with a two-section stainless steel shell lined with a PVC liner, minimum 0.09-inch thick also having a hardness of 85-90 durometer. Runners shall be attached to stainless steel risers which shall be properly welded to the shell. The height of the runners and risers shall be manufactured such that the pipe does not float within the casing.
2. Casing spacers shall be a two-section, flanged, bolt on style constructed of heat fused PVC coated steel, minimum 14-gauge band and 10-gauge risers, with 2-inch wide

glass reinforced polyester insulating skids, heavy duty PVC inner liner, minimum 0.09-inch thick having a hardness of 85-90 durometer, and all stainless steel or cadmium plated hardware.

3. Casing spacers shall be equal to Cascade Waterworks Manufacturing Company, Pipeline Seal and Insulator, Inc. or Advance Products and Systems, Inc.
 4. Three casing spacers shall be installed per joint of pipe installed in the casing or per manufacturer's recommendation whichever is greater.
- D. Carrier Pipe: Carrier pipes shall meet requirements as specified in Section 33 10 00, Water Mains and Accessories, of these Specifications, for restrained joint pipe.
- E. End seals will be used to seal the carrier and casing pipe ends. Seal material shall be 1/8-inch thick synthetic rubber secured with T-304 stainless steel banding straps. Seals shall be by Advance Products & Systems, Inc., Model AC.
- F. Surface Settlement Markers: Surface settlement markers within pavement areas shall be P.K. nails. Surface settlement markers within non-paved areas shall be wooden hubs.

2.2 EQUIPMENT

- A. A cutting head shall be attached to a continuous auger mounted inside the casing pipe.
- B. On casing pipe for gravity sewer over 60 feet in length, the installation equipment shall include a steering head and a grade indicator.
- C. The steering head shall be controlled manually from the bore pit. The grade indicator shall consist of a water level attached to the casing which would indicate the elevation of the front end of the casing or some other means for grade indication approved by the Engineer.

PART 3 EXECUTION

3.1 GENERAL

- A. Interpretation of soil investigation reports and data, investigating the site and determination of the site soil conditions prior to bidding is the sole responsibility of the Contractor. Any subsurface investigation by the Bidder or Contractor must be approved by the appropriate authority having jurisdiction over the site. Rock and/or water, if encountered, shall not entitle the Contractor to additional compensation.
- B. Casing construction shall be performed so as not to interfere with, interrupt or endanger roadway surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the casing. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the casing, passages, and shafts stable. The Contractor shall be responsible for all settlement resulting from casing operations and shall repair and restore damaged property to its original or better condition at no cost to the Owner.

- C. Face Protection: The face of the excavation shall be protected from the collapse of the soil into the casing.
- D. Casing Design: Design of the bore pit and required bearing to resist jacking forces are the responsibility of the Contractor. The excavation method selected shall be compatible with expected ground conditions. The lengths of the casing shown on the Drawings are the minimum lengths required. The length of the casing may be extended for the convenience of the Contractor, at no additional cost to the Owner. Due to restrictive right-of-way and construction easements, boring and jacking casing lengths less than the nominal 20-foot length may be necessary.
- E. Highway Crossings:
 - 1. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the highway right-of-way.
 - 2. Work along or across the highway department rights-of-way shall be subject to inspection by such highway department.
 - 3. All installations shall be performed to leave free flows in drainage ditches, pipes, culverts or other surface drainage facilities of the highway, street or its connections.
 - 4. No excavated material or equipment shall be placed on the pavement or shoulders of the roadway without the express approval of the highway department.
 - 5. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed, which are placed on the right-of-way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the roadway.
 - 6. The Contractor shall be responsible for providing the Owner sufficient information to obtain a blasting permit in a timely manner.
- F. Railroad Crossings:
 - 1. The Contractor shall secure permission from the Railroad to schedule work so as not to interfere with the operation of the Railroad.
 - 2. Additional insurance is required for each railroad crossing. The Contractor shall furnish the Railroad with such additional insurance as may be needed, cost of the same shall be borne by the Contractor.
 - 3. All work on the Railroad right-of-way, including necessary support of tracks, safety of operations, and other standard and incidental operation procedures may be under the supervision of the appropriate authorized representative of the Railroad affected and any decisions of this representative pertaining to construction and/or operations shall be final and construction must be governed by such decisions.
 - 4. If, in the opinion of the Railroad, it becomes necessary to provide flagging protection, watchmen or the performance of any other work in order to keep the tracks safe for traffic, the Contractor shall coordinate such work and shall reimburse

the Railroad, in cash, for such services, in accordance with accounting procedures agreed on by the Contractor and affected Railroad before construction is started.

5. No blasting shall be permitted within the Railroad right-of-way.

3.2 GROUND WATER CONTROL

- A. The Contractor shall control the ground water throughout the construction of the casing.
- B. Methods of dewatering shall be at the option and responsibility of the Contractor. Maintain close observation to detect settlement or displacement of surface facilities due to dewatering. Should settlement or displacement be detected, notify the Engineer immediately and take such action as necessary to maintain safe conditions and prevent damage.
- C. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24-hour basis keeping excavations free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum. Dewater into a sediment trap and comply with requirements specified in Section 01 57 13, Erosion and Sedimentation Control, of these Specifications.

3.3 SAFETY

- A. Provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic, persons, and property at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.
- B. Observe all applicable requirements of the regulations of the authorities having jurisdiction over this site. Conduct the operations in such a manner that all work will be performed below the level of the roadbed.
- C. Perform all activities in accordance with the Occupational Safety and Health Act of 1970 (PL-596), as amended, applicable regulations of the Federal Government, OSHA 29 CFR 1926 and applicable criteria of ANSI A10.16-81, "Safety Requirements for Construction of Tunnel Shafts and Caissons".

3.4 SURFACE SETTLEMENT MONITORING

- A. Provide surface settlement markers, placed as specified and as directed by the Engineer. The Contractor shall place settlement markers outside of pavement area, along the centerline of the casing at 20-foot intervals and offset 10 feet each way from the centerline of the tunnel. Markers shall also be placed at each shoulder of the roadway, at each edge of pavement, at the centerline of the pavement, and at 10 and 25 feet in each direction from the centerline of the casing. Tie settlement markers to benchmarks and indices sufficiently removed as not to be affected by the casing operations.
- B. Make observations of surface settlement markers, placed as required herein, at regular time intervals acceptable to the Engineer. In the event settlement or heave on any marker exceeds 1-inch, the Contractor shall immediately cease work and using a method approved by the Engineer and the authority having jurisdiction over the project site, take immediate action to restore surface elevations to that existing prior to start of casing operations.

- C. Take readings and permanently record surface elevations prior to start of dewatering operations and/or shaft excavation. The following schedule shall be used for obtaining and recording elevation readings: all settlement markers, once a week; all settlement markers within 50 feet of the casing heading, at the beginning of each day; more frequently at the Engineer's direction if settlement is identified. Make all elevation measurements to the nearest 0.01 foot.
- D. The Contractor shall cooperate fully with jurisdictional personnel. Any settlement shall be corrected by, and at the expense of, the Contractor.
- E. Promptly report any settlement and horizontal movement immediately to the Engineer and take immediate remedial action.

3.5 BORING AND JACKING

- A. Shaft:
 - 1. Conduct boring and jacking operations from a shaft excavated at one end of the section to be bored. Where conditions and accessibility are suitable, place the shaft on the downstream end of the bore.
 - 2. The shaft shall be rectangular and excavated to a width and length required for ample working space. If necessary, sheet and shore shaft properly on all sides. Shaft sheeting shall be timber or steel piling of ample strength to safely withstand all structural loadings of whatever nature due to site and soil conditions. Keep preparations dry during all operations. Perform pumping operations as necessary.
 - 3. The bottom of the shaft shall be firm and unyielding to form an adequate foundation upon which to work. In the event the shaft bottom is not stable, excavate to such additional depth as required and place a gravel subbase or a concrete subbase, if directed by the Engineer due to soil conditions.
- B. Jacking Rails and Frame:
 - 1. Set jacking rails to proper line and grade within the shaft. Secure rails in place to prevent settlement or movement during operations. The jacking rails shall cradle and hold the casing pipe on true line and grade during the progress of installing the casing.
 - 2. Place backing between the heels of jacking rails and the rear of the shaft. The backing shall be adequate to withstand all jacking forces and loads.
 - 3. The jacking frame shall be of adequate design for the magnitude of the job. Apply thrust to the end of the pipe in such a manner to impart a uniformly balanced load to the pipe barrel without damaging the joint ends of the pipe.
- C. Boring and jacking of casing pipes shall be accomplished by the dry auger boring method without jetting, sluicing or wet-boring.
- D. Auger the hole and jack the casing through the soil simultaneously.

- E. Bored installations shall have a bored-hole diameter essentially the same as the outside diameter of the casing pipe to be installed.
- F. Execute boring ahead of the casing pipe with extreme care, commensurate with the rate of casing pipe penetration. Boring may proceed slightly in advance of the penetrating pipe and shall be made in such a manner to prevent any voids in the earth around the outside perimeter of the pipe. Make all investigations and determine if the soil conditions are such as to require the use of a shield.
- G. As the casing is installed, check the horizontal and vertical alignment frequently. Make corrections prior to continuing operation. For casing pipe installations over 100 feet in length, the auger shall be removed, and the alignment and grade checked at minimum intervals of 60 feet.
- H. Any casing pipe damaged in jacking operations shall be repaired, if approved by the Engineer, or removed and replaced at Contractor's own expense.
- I. Lengths of casing pipe, as long as practical, shall be used except as restricted otherwise. Joints between casing pipe sections shall be butt joints with complete joint penetration, single groove welds, for the entire joint circumference, in accordance with AWS recommended procedures. Prior to welding the joints, the Contractor shall ensure that both ends of the casing sections being welded are square.
- J. The Contractor shall prepare a contingency plan which will allow the use of a casing lubricant, such as bentonite, in the event excessive frictional forces jeopardize the successful completion of the casing installation.
- K. Once the jacking procedure has begun, it should be continued without stopping until completed, subject to weather and conditions beyond the control of the Contractor.
- L. Care shall be taken to ensure that casing pipe installed by boring and jacking method will be at the proper alignment and grade.
- M. The Contractor shall maintain and operate pumps and other necessary drainage system equipment to keep work dewatered at all times.
- N. Adequate sheeting, shoring, and bracing for embankments, operating pits, and other appurtenances shall be placed and maintained to ensure that work proceeds safely and expeditiously. Upon completion of the required work, the sheeting, shoring, and bracing shall be left in place, cut off or removed, as designated by the Engineer.
- O. Trench excavation, all classes and type of excavation, the removal of rock, muck, debris, the excavation of all working pits, and backfill requirements of Section 31 23 33, Trench Excavation and Backfill, of these Specifications.
- P. All surplus material shall be removed from the right-of-way and the excavation finished flush with the surrounding ground.
- Q. Grout backfill shall be used for unused holes or abandoned pipes.

- R. Any replacement of carrier pipe in an existing casing shall be considered a new installation, subject to the applicable requirements of these Specifications.

3.6 VENTILATION AND AIR QUALITY

- A. Provide, operate, and maintain for the duration of casing project a ventilation system to meet safety and OSHA requirements.

3.7 INSTALLATION OF PIPE

- A. After construction of the casing is complete, and has been accepted by the Engineer, install the pipeline in accordance with the Drawings and Specifications.
- B. Check the alignment and grade of the casing and prepare a plan to set the pipe at proper alignment, grade, and elevation, without any sags or high spots.
- C. The pipe shall be supported within the casing by use of casing spacers sized to limit radial movement to a maximum of 1-inch. Provide a minimum of 3 casing spacers per nominal length of pipe.
- D. Close the ends of the casing with end seals.

3.8 SHEETING REMOVAL

- A. Remove sheeting used for shoring from the shaft and off the jobsite. The removal of sheeting, shoring, and bracing shall be done in such a manner as not to endanger or damage either new or existing structures, private or public properties, and also to avoid cave-ins or sliding in the banks.

3.9 INTERSTATE RESTORATION

- A. When boring and jacking operations encroach upon the rights-of-way of the federal interstate system, the Contractor shall restore all screening trees with seedlings of like species.

END OF SECTION

PART 1 GENERAL**1.1 SCOPE**

- A. This section describes products to be incorporated into the water mains and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.
- C. These Specifications are only the minimum requirements; actual requirements may be greater depending upon the situation. These Specifications may be adjusted by the sole discretion of City of Sevierville Water and Sewer Department to fit a particular situation not routinely encountered, or as public safety issues become apparent.

1.2 QUALIFICATIONS

- A. If requested by the Engineer, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least 2 years.

1.3 SUBMITTALS

- A. Complete Shop Drawings and engineering data for all products shall be submitted to the Engineer a minimum of 5 working days prior to the Pre-Construction Conference.
 - 1. Complete Shop Drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples, of these Specifications.
- B. Operating and maintenance data for all equipment shall be furnished in accordance with Section 01 78 23, Operating and Maintenance Data, of these Specifications.

1.4 TRANSPORTATION AND HANDLING

- A. Unloading: Furnish equipment and facilities for unloading, handling, distributing, and storing pipe, fittings, valves, and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification. Pipe handled on skids shall not be rolled or skidded against the pipe on the ground.

- B. Handling: Handle pipe, fittings, valves, and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift or front end loader. Do not use material damaged in handling. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior coatings or internal lining of the pipe.

1.5 STORAGE AND PROTECTION

- A. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.
- B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.
- C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least 2 rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.
- D. Stored mechanical and push-on joint gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.
- E. Mechanical-joint bolts shall be handled and stored in such a manner that will ensure proper use with respect to types and sizes.

1.6 QUALITY ASSURANCE

- A. The manufacturer shall provide written certification to the Engineer that all products furnished comply with all applicable requirements of these Specifications.

PART 2 PRODUCTS

2.1 DUCTILE IRON PIPE (DIP)

- A. DIP shall be used in the following cases:
 - 1. Where water mains 6 inches or larger are required.
 - 2. Any point where the water main crosses a public road.
 - 3. Where pipe is to be installed in a casing pipe (i.e., Bore and Jack).

- B. DIP shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

| Pipe Sizes (inches) | Pressure Class (psi) |
|---------------------|----------------------|
| 4 - 18 | 350 |
| 20 | 300 |
| > 24 | 250 |

- C. Pipe shall be cement lined in accordance with AWWA C104. Pipe shall be furnished with a bituminous outside coating.

D. Fittings and Accessories:

1. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum rated working pressure of 350 psi.
2. Fittings shall be cement lined in accordance with AWWA C104 and shall be furnished with a bituminous outside coating.
3. Thrust collars shall be welded-on ductile iron body type capable of withstanding a thrust due to 250 psi internal pressure on a dead end from either direction on that pipe size. Weld-on collars shall be continuously welded to the pipe by the pipe manufacturer. Retainer glands may be used for thrust collars where shown on Drawings and as specified in this section.
4. Solid Sleeves shall permit the connection of plain end DIP and plain end PVC pipe. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for long pattern and have a minimum pressure rating of 250 psi. Solid sleeves shall have a mechanical or restrained joint as specified in this section and as shown on the Drawings. Solid sleeve shall be provided with gaskets suitable for the type of pipe to be connected. Solid sleeves shall be used only in locations shown on the Drawings or at the direction of the Engineer. Solid sleeves shall be manufactured by AIPICO, U.S. Pipe or McWane Ductile.

E. Joints for DIP and Fittings:

1. General:
 - a. Joints for DIP and fittings shall be mechanical joint, flanged joint, restrained joint or push-on joint as shown on the Drawings or specified herein.
 - b. Unless otherwise shown on the Drawings, specified or directed, all DIP laid underground shall be joined using mechanical joints or push-on type joints.

- c. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported nor by the environment in which the pipe is installed.
 - d. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.
2. Mechanical Joints:
- a. Joints shall conform to AWWA C111/ANSI A21.11.
 - b. Bolts and nuts shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A242 to the dimensions shown in AWWA C111/ANSI A21.11.
 - c. Gaskets shall be in accordance with AWWA C111/ANSI A21.11 and shall be constructed of Neoprene.
 - d. Mechanical joint glands shall be ductile or cast iron.
3. Push-On Joints: Push-on joints and gaskets shall conform to AWWA C111/ANSI A21.11. Details of the joint design shall be in accordance with the manufacturer's standard practice such as ACIPCO "Fastite", McWane "Tyton/Fastite", or U.S. Pipe or Griffin "Tyton" joints.
4. Restrained joints shall be manufactured restrained joint or restraining gasket joint as specified below:
- a. Manufactured restrained joints shall be American, FLEX-RING or LOK-RING, U.S. Pipe TR FLEX or HP LOK or McWane Ductile TR FLEX.
 - b. Restraining gasket joints shall be assembled with American FAST-GRIP, McWane Ductile SURE STOP 350 or U.S. Pipe FIELD LOK 350 gaskets.
 - c. Bolts and nuts shall be in accordance with the manufacturer's recommendations.
 - d. Gaskets shall be in accordance with the manufacturer's recommendations.
 - e. Joints for restrained joint pipe on supports shall be equal to McWane/Clow "LONG SPAN".
 - f. Mechanical joints with retainer glands are not acceptable substitutes for restrained joints.
 - g. Where pipe is to be installed suspended from or supported by a bridge a minimum of three supports are required for each joint of pipe. One is to be placed behind each bell, one at the center, and one near the spigot end.

- h. Restrained joint pipe lengths to be installed on either side of a fitting shall be designed by an Engineer licensed in the State of Tennessee and shall be approved by the City of Sevierville Water and Sewer Department.
- 5. All DIP, fittings, and accessories shall be manufactured by ACIPCO, U.S. Pipe, Griffin Pipe or McWane.
- 6. All DIP, fittings, and accessories shall be supplied by a single manufacturer and are subject to “BUY AMERICA” provisions in accordance with the General Requirements.
- F. Detection wire shall be provided over all DIP water mains.
- G. Polyethylene Encasement “POLYWRAP” shall be used on DIP water mains to prevent corrosion. This includes but not limited to areas of corrosive soils, near or crossing gas mains, near high power transmission, or as indicated by the Engineer or Owner. Pipe shall be clean and free of any soil. POLYWRAP shall be installed as recommended by manufacture.
- H. Acceptance will be on the basis of the Engineer’s inspection and the manufacturer’s written certification that the pipe was manufactured and tested in accordance with the applicable standards.

2.2 POLYVINYL CHLORIDE (PVC) PIPE – AWWA C900

- A. PVC pipe shall only be used on 4-inch diameter pipe and smaller.
- B. All PVC pipe shall have belled ends for push-on type jointing and shall conform to AWWA C900, DIP equivalent outside diameters. The pipe shall have a Dimension Ratio of 14 and shall be capable of withstanding a working pressure of 200 psi. Pipe shall be supplied in minimum lengths of 20 feet.
- C. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum rated working pressure of 250 psi. Fittings shall be cement lined in accordance with AWWA C104 and shall be furnished with a bituminous outside coating. In lieu of cement lining and bituminous coating, fittings may be provided with a fusion bonded coating and lining meeting the requirements of AWWA C116. Special adapters shall be provided, as recommended by the manufacturer, to adapt the PVC pipe to mechanical jointing with cast or DIP, fittings or valves.
- D. Detection wire shall be provided over all PVC water mains.
- E. Acceptance will be on the basis of the Engineer’s inspection and the manufacturer’s written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation (NSF). Additionally, each piece of pipe shall be stamped “NSF Approved”.

2.3 COPPER PIPE

- A. Pipe shall be hard drawn copper tubing, ASTM B88, Type K.
- B. Where required, sweat to screw adapters shall be cast bronze ANSI B16.18, wrought solder joint ANSI B16.22. Unions shall be cast bronze or bronze with solder connections. Joints shall be made with 95/5 solder for Type K pipe.

2.4 VALVES

- A. Gate Valves 2 Inches and Larger in Diameter: Gate valves shall be resilient wedge type conforming to the requirements of AWWA C509 or AWWA C515 rated for 250 psi working pressure. Valves shall open left unless noted otherwise.
 - 1. Valves shall be provided with two O-ring stem seals with one O-ring located above and one O-ring below the stem collar. The area between the O-rings shall be filled with lubricant to provide lubrication to the thrust collar bearing surfaces each time the valve is operated. At least one anti-friction washer shall be utilized to further minimize operating torque. All seals between valve parts, such as body and bonnet, bonnet, and bonnet cover, shall be flat gaskets or O-rings.
 - 2. The valve gate shall be made of cast or ductile iron having a vulcanized, synthetic rubber coating, or a seat ring attached to the disc with retaining screws. Sliding of the rubber on the seating surfaces to compress the rubber will not be allowed. The design shall be such that compression-set of the rubber shall not affect the ability of the valve to seal when pressure is applied to either side of the gate. The sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.
 - 3. All internal ferrous surfaces shall be coated with epoxy to a minimum thickness of 4 mils. The epoxy shall be non-toxic, impart no taste to the water and shall conform to AWWA C550.
 - 4. Gate valves shall be manufactured by Mueller or M&H Valve.
- B. Butterfly Valves on Larger than 12-Inch Mains:
 - 1. Butterfly valves shall be resilient seated, short body design, and shall be designed, manufactured, and tested in accordance with all requirements of AWWA C504, and as modified below. Valves shall be designed for a rated working pressure of 250 psi, Class B, AWWA C504, Section 5.2, testing requirements are modified as follows:
 - a. The leakage test shall be performed at a pressure equal to rated working pressure;
 - b. The hydrostatic test shall be performed at a pressure 2 times the rated working pressure; and

- c. Proof of design tests shall be performed and certification of such proof of design test shall be provided to the Engineer.
2. Valve bodies shall be ductile iron conforming to ASTM A536, Grade 65-45-12 or ASTM A126, Grade B, cast iron. Shafts and shaft hardware shall be ASTM A564, Type 630, stainless steel, machined and polished. Valve discs shall be ductile iron, ASTM A536, Grade 65-45-12. The resilient valve seat shall be located either on the valve disc or in the valve body and shall be fully field adjustable and field replaceable.
3. Valves shall be installed with the valve shafts horizontal. Valves and actuators shall have seals on all shafts and gaskets on valve actuator covers to prevent the entry of water. Actuator mounting brackets shall be totally enclosed and shall have gasket seals.
4. Actuators:
 - a. Valves shall be equipped with traveling nut, self-locking type actuators designed, manufactured, and tested in accordance with AWWA C504. Actuators shall be capable of holding the disc in any position between full open and full closed without any movement or fluttering of the disc.
 - b. Actuators shall be furnished with fully adjustable mechanical stop-limiting devices. Actuators that utilize the sides of the actuator housing to limit disc travel are unacceptable.
 - c. Valve actuators shall be capable of withstanding a minimum of 450-foot pounds of input torque in either the open or closed position without damage.
5. Operators: Valves for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension, as required.
6. Valve ends shall be mechanical joint type, except where flanged or restrained joint ends are shown.
7. Butterfly valves shall be manufactured by Mueller.

2.5 FIRE HYDRANTS (FH)

- A. All fire hydrants shall conform to the requirements of AWWA C502 for 250 psi working pressure. Hydrants shall be the compression type, closing with line pressure. The valve opening shall not be less than 5-1/4 inches.
- B. In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade utilizing a “breakable flange” above the groundline which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.

- C. The means for attaching the barrel to the standpipe shall permit facing the hydrant a minimum of 8 different directions.
- D. Hydrants shall be fully bronze mounted with all working parts of bronze. Valve seat ring shall be bronze and shall screw into a bronze retainer.
- E. All working parts, including the seat ring shall be removable through the top without disturbing the barrel of the hydrant.
- F. The operating nut shall match those on the existing hydrants. The operating threads shall be totally enclosed in an operating chamber, separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or an oil reservoir.
- G. Hydrant shall be a non-freezing design and be provided with a simple, positive, and automatic drain which shall be fully closed whenever the main valve is opened.
- H. Hose and pumper connections shall be breech-locked, pinned or threaded and pinned to seal them into the hydrant barrel. Each hydrant shall have two 2-1/2-inch hose connections and one 4-1/2-inch pumper connection, all with NSF threads and each equipped with cap and non-kinking chain.
- I. Hydrants shall be furnished with a mechanical joint connection to the spigot of the 6-inch hydrant lead.
- J. Minimum depth of bury shall be 40 inches. Provide extension section where necessary for proper vertical installation and in accordance with manufacturer's recommendations.
- K. All outside surfaces of the barrel above grade shall be painted with enamel equal to Koppers Glamortex 501 in yellow. Exposed surfaces shall be shop painted with one coat of alkyd primer and two coats of alkyd enamel.
- L. The Contractor shall provide one carton of collision breakage repair parts for each hydrant and one valve wrench.
- M. Hydrants shall be traffic model and shall be M&H Valve 129T or Mueller Super Centurion

2.6 AUTOMATIC FLUSHING HYDRANT

- A. The automatic water distribution flushing system is comprised of the self-contained automatic flushing unit with dechlorination capabilities, and hand-held programmer with a 9-volt power source offering up 1 year of life under normal use
- B. The components shall be contained within a maintenance free and non-corrosive enclosure. The self-contained unit shall be supplied with a bottom-vented base designed to direct the flow of water from the hydrant onto an exterior splash pad leading away from the unit. The unit shall contain the following major components.
 - 1. The internal control valve shall be capable of being activated by a 3.6-volt lithium power source offering up to 7 years of service under normal operating conditions.

2. The control valve shall be a globe valve type design capable of passing debris up to 5/8-inch in diameter without obstructing the valve's throat.
 3. Internal piping shall be schedule 80 PVC and shall have a static pressure rating of 150 psi with an operating pressure of 100 psi.
 4. A meter shall be supplied on the supply side of the flushing station to monitor water usage
- C. Automatic water distribution flushing equipment to be supplied shall be Hydro-Guard® Standard Unit HG-4 LongNeck as manufactured by Environmental Enhancement & Technologies.

2.7 VALVE BOXES (VB) AND EXTENSION STEMS

- A. All valves shall be equipped with valve boxes. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5-1/4-inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6 inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have "WATER VALVE" or "WATER" cast into them. Valve boxes shall be manufactured in the U.S.A.
- B. All valves shall be furnished with extension stems, as necessary, to bring the operating nut to within 30 inches of the top of the valve box. Connection to the valve shall be with a wrench nut coupling and a set screw to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller A-26441 or M&H Valve Style 3801.

2.8 RETAINER GLANDS

- A. Retainer glands for DIP shall be Megalug Series 1100, as manufactured by EBAA Iron.

2.9 RETAINER RINGS

- A. Retaining rings for PVC or DIP shall be GripRing as manufactured by Romac.

2.10 VALVE MARKERS (VM)

- A. The Contractor shall provide a concrete valve marker as detailed on the Drawings for each valve installed. Valve markers shall be stamped "WATER".

2.11 TAPPING SLEEVES AND VALVES (TS&V)

- A. Tapping sleeves shall be ductile iron of the split-sleeve, mechanical joint type. The Contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve. Valves shall be gate valves furnished in accordance with the specifications shown above, with flanged connection to the tapping

sleeve and mechanical joint connection to the branch pipe. The tapping sleeve and valve shall be supplied by the valve manufacturer. All sleeves and valves shall be rated for 200 psi. Tapping sleeves shall be equal to Mueller.

2.12 MISCELLANEOUS ACCESSORIES

- A. Tapping saddles for air release valves shall be nylon coated ductile iron construction. Saddle shall utilize 2 stainless steel straps to fasten around the pipe. Body shall meet ASTM A395. Stainless steel shall be 304L. Tapping saddles shall be manufactured by Mueller. Tapping saddle shall meet all parts of AWWA C800 and be NSF 61 Certified.

2.13 CORPORATION COCKS AND CURB STOPS

- A. Corporation cocks and curb stops shall be suitable for flared tube compression type joint and shall conform to AWWA C800 rated to 300 psi. Corporation cocks shall be Mueller B25008.

2.14 AIR VALVES FOR WATER SERVICE

- A. Air Release Valves shall be one of the following types:
 - 1. The air release valve shall automatically release air accumulations from the pipeline due to the action of the float. When the air valve body fills with air, the float falls freely from the orifice to allow the air to escape to the atmosphere. When all the air has been exhausted from the valve body, the float will be buoyed up to seat against the orifice and prevent water from being exhausted from the valve. The float shall be free floating within the valve body. Valve orifice size shall be as shown on the Drawings.
 - 2. The air release valve shall automatically release air accumulations from the pipeline due to the action of the float and lever mechanism. When the air valve body fills with air, the float falls. Through the leverage mechanism, this causes the resilient seat to open the orifice and allow the air to escape to the atmosphere. When all the air has been exhausted from the valve body, the float will be buoyed up. Through the leverage mechanism, this will cause the resilient seat to close the orifice, preventing water from being exhausted from the valve. Valve orifice size shall be as shown on the Drawings.
- B. Air/Vacuum Valves shall discharge large amounts of air as the pipeline fills and allow air to enter the pipeline as it drains or in the event of vacuum conditions. As air enters the valve the float shall drop from the orifice and allow the air to escape. As water rises in the valve, the float will again seal the orifice. The valve will be of such design that the float cannot blow shut at any air velocity. Valve inlet size shall be as shown on the Drawings.
- C. Combination Air Valves shall combine the features of an air release valve and an air/vacuum valve and shall be of one of the following types:

1. Valve shall consist of an air/vacuum valve described in Paragraph B., above, with an air release valve described in Paragraph A., above, tapped into its body. The valve shall be of two-piece body design with an isolation gate valve separating the two valves.
 2. Valve shall be single body, double orifice, allowing large volumes of air to escape out the larger diameter air and vacuum orifice when filling a pipeline and closes watertight when the liquid enters the valve. During large orifice closure, the smaller diameter air release orifice will open to allow small pockets of air to escape automatically and independently of the large orifice. The large air/vacuum orifice shall also allow large volumes of air to enter through the orifice during pipeline drainage to break the vacuum. Valve sizes shall be as shown on the Drawings.
- D. Surge Check Valves where shown on the Drawings or specified, provide a surge check valve on the inlet of the air/vacuum valve. The surge check valve shall be normally open, spring loaded valve consisting of a body, seat, and plug bolted to the inlet of the air/vacuum valve. The surge check shall operate on the interphase between the kinetic energy and relative velocity flows of air and water, allowing air to pass through but water shall close the surge check, reducing the rate of water flow by means of throttling orifices in the plug to prevent shock closure of the air/vacuum valve. The surge check orifices must be an adjustable type to suit operating conditions in the field.
- E. All air valves and accessories shall be supplied by a single manufacturer and shall be A.R.I. Flow Control only.

2.15 MANHOLES AND PRECAST CONCRETE PRODUCTS

- A. Provide precast concrete products in accordance with the following:
1. Precast Concrete Sections:
 - a. Precast concrete sections shall meet the requirements of ASTM C478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi. The minimum wall thickness shall be one-twelfth of the inside diameter of the base, riser or the largest cone diameter.
 - b. Transition slabs which convert bases larger than 4 feet in diameter to 4-foot diameter risers shall be designed by the precast concrete manufacturer to carry the live and dead loads exerted on the slab.
 - c. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch.
 - d. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS 202.

2. Iron Castings:
 - a. Cast iron manhole frames, covers, and steps shall meet the requirements of ASTM A48, Class 30, gray iron, and all applicable local standards. All castings shall be tough, close grained, smooth, and free from blow holes, blisters, shrinkage, strains, cracks, cold shots, and other imperfections. No casting will be accepted which weighs less than 95 percent of the design weight. Shop Drawings must indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins.
 - b. Manhole frames and covers shall say "City of Sevierville Water" and have a 24-inch diameter clear opening and be equal to East Jordan Ironworks 1040.
 - c. All frames and covers shall have machined horizontal bearing surfaces.
3. Plastic Steps: Manhole steps of polypropylene, molded around a steel rod, equal to products of M.A. Industries may be used.
4. Anchor Bolts: Concrete anchor bolts shall be used to anchor the frame to the manhole riser. Bolts shall be 5/8-inch diameter by 4-1/2-inch long.
5. Floor Door:
 - a. Door shall be single or double leaf type as shown on the Drawings.
 - b. The frame shall be 1/4-inch extruded aluminum alloy 6063-T6, with built-in neoprene cushion and with strap anchors bolted to the exterior. Door leaf shall be 1/4-inch aluminum diamond plate, alloy 6061-T6, reinforced with aluminum stiffeners as required. Stainless steel hinges shall be bolted to the underside and pivot on torsion bars that counterbalance the door for easy operation. The door shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release the cover for closing. The door shall be built to withstand a live load of 300 pounds per square foot and shall be equipped with a snap lock and removable handle. Bituminous coating shall be applied to exterior of frame by the manufacturer. The door shall also be provided with a hasp and padlock in addition to the built-in locking mechanism. Padlocks for all doors shall be keyed alike.
 - c. The floor door shall be manufactured by The Bilco Company or Washington Aluminum Company.
6. Where vent pipes are shown on the Drawings, vents shall be of one-piece, welded steel construction. Vent pipes shall equal air valve size, but no less than 4 inches. The vent pipe shall be grouted into a precast hole in the vault. The discharge of the vent pipe shall be provided with a 3/16-inch PVC coated mesh screen.

2.16 HYDRANT TEES

- A. Hydrant tees shall be equal to ACIPCO A10180 or U.S. Pipe U-592.

2.17 VALVE KEYS

- A. The Contractor shall provide to the Owner one valve key for every 5 valves provided, but no more than 3 and not less than one valve key. Valve keys shall be 72 inches long with a tee handle and a 2-inch square wrench nut. Valve keys shall be furnished by the valve manufacturer. Valve keys shall be equal to Mueller A-24610 or ACIPCO No. 1303.

2.18 CONCRETE

- A. Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 to 5 inches. For job mixed concrete, submit the concrete mix design for approval by the Engineer. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C94. Reinforcing steel shall conform to the requirements of ASTM A615, Grade 60.

2.19 METER BOXES

- A. Meter boxes for 1-inch meters shall be constructed of high-density Polyethylene of one-piece molded construction. The meter box shall be model number MSBCF1324- 18XL and the lid shall be model number 13244299 as manufactured by Oldcastle products.

2.20 DETECTION WIRE

- A. Detection Wire: Magnetically detectable wire shall be installed to locate all underground pipe (PVC, DIP, and Copper). Detectable wire shall be 10-gauge Thermo High Heat in a blue polyethylene insulated jacket (10 ga. THHN). Wire shall be manufactured for and be labeled "For Direct Bury".

PART 3 EXECUTION

3.1 EXISTING UTILITIES AND OBSTRUCTIONS

- A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner. The Contractor shall call the Tennessee One Call System, Inc. (811) as required by the Tennessee Law "Underground Utility Damage Prevention Act" (Code Section 65-31-106) and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site at least 72 hours (3 business days) prior to construction to verify the location of the existing utilities.
- B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.

1. Provide the required notice to the utility owners and allow them to locate their facilities according to Tennessee law. Field utility locations are valid for only 10 days after original notice. The Contractor shall ensure, at the time of any excavation that a valid utility location exists at the point of excavation.
2. Expose the facility, for a distance of at least 200 feet in advance of pipeline construction, to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.
3. Avoid utility damage and interruption by protection with means or methods recommended by the utility owner.
4. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested, and work order number issued, if any. The Contractor shall provide the Engineer an updated copy of the log bi-weekly, or more frequently, if required.
5. Where the installation of water mains within subdivisions or developments coincides with the installation of other utilities it is the responsibility of the contractor to identify potential conflicts other utilities being installed.

C. Conflict with Existing Utilities:

1. Horizontal Conflict: Horizontal distance shall be defined as the actual horizontal separation between the edge of a utility, main or service and closest edge of the proposed water main. The horizontal distance shall be at least 3 feet between the new water main and other existing utilities (except sewer, which is 10 feet). Where utilities are installed concurrently, the horizontal distance shall be 2 feet between the outside of each trench. The Contractor must change the proposed alignment of the water main to avoid horizontal conflicts.
2. Vertical Conflict: Vertical distance shall be defined as the actual vertical separation between the edge of a utility, main or service and the closest edge of the proposed water main. The vertical distance shall be at least 18 inches between the water main and other utilities. The contractor must change the proposed alignment of the water main to avoid vertical conflicts.

D. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipelines or other obstructions.

E. Water and Sewer Separation:

1. Water mains should maintain a minimum 10-foot edge-to-edge separation from sewer lines, whether gravity or pressure. If the main cannot be installed in the prescribed easement or right-of-way and provide the 10-foot separation, the separation may be reduced, provided the bottom of the water main is a minimum of 18 inches above the top of the sewer.

2. The water main, when installed below the sewer, shall be encased in concrete with a minimum 6-inch concrete depth to the first joint in each direction. Where water mains cross the sewer, the pipe joint adjacent to the pipe crossing the sewer shall be cut to provide maximum separation of the pipe joints from the sewer.
 3. No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.
- F. Stream Crossings and Wet Weather Conveyances: All water mains crossing streams and wet weather conveyances shall be DIP.

3.2 CONSTRUCTION ALONG HIGHWAYS, STREETS, AND ROADWAYS

- A. Install pipelines and appurtenances along highways, streets, and roadways in accordance with the applicable regulations of, and permits issued by, the Tennessee Department of Transportation (TDOT) and the County with reference to construction operations, safety, traffic control, road maintenance, and repair.
- B. All water mains under roads shall be DIP.
- C. Traffic Control:
 1. The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient lights, and other traffic control devices; provide qualified flagmen where necessary to direct traffic; take all necessary precautions for the protection of the work and the safety of the public.
 2. Construction traffic control devices and their installation shall be in accordance with the current Manual on Uniform Traffic Control Devices for Streets and Highways.
 3. Placement and removal of construction traffic control devices shall be coordinated with TDOT or with the Department with jurisdictional authority a minimum of 48 hours in advance of the activity.
 4. Placement of construction traffic control devices shall be scheduled ahead of associated construction activities. Construction time in street right-of-way shall be conducted to minimize the length of time traffic is disrupted. Construction traffic control devices shall be removed immediately following their useful purpose. Traffic control devices used intermittently, such as "Flagmen Ahead", shall be removed and replaced when needed.
 5. Existing traffic control devices within the construction work zone shall be protected from damage. Traffic control devices requiring temporary relocation shall be located as near as possible to their original vertical and horizontal locations. Original locations shall be measured from reference points and recorded in a log prior to relocation. Temporary locations shall provide the same visibility to affected traffic as the original location. Relocated traffic control devices shall be reinstalled in their original locations as soon as practical following construction.

6. Construction traffic control devices shall be maintained in good repair and shall be clean and visible to affected traffic for daytime and nighttime operation. Traffic control devices affected by the construction work zone shall be inspected daily.
7. Construction warning signs shall be black legend on an orange background. Regulatory signs shall be black legend on a white background. Construction sign panels shall meet the minimum reflective requirements of TDOT. Sign panels shall be of durable materials capable of maintaining their color, reflective character, and legibility during the period of construction.
8. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the current Manual on Uniform Traffic Control Devices for Streets and Highways, as appropriate for the speed limit at that location. Channelization devices shall be patrolled to ensure that they are maintained in the proper position throughout their period of use.

D. Construction Operations:

1. Perform all work along highways, streets, and roadways to minimize interference with traffic.
2. Stripping: Where the pipeline is laid along road right-of-way, strip and stockpile all sod, topsoil, and other material suitable for right-of-way restoration.
3. Trenching, Laying, and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.
4. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod, and any other materials removed from shoulders.
5. Construction operations shall be limited to 400 feet along areas, including clean-up and utility exploration.

E. Excavated Materials: Do not place excavated material along highways, streets, and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off of the pavement in a timely manner.

F. Drainage Structures: Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

G. Landscaping features shall include, but are not necessarily limited to fences, property corners, cultivated trees and shrubbery, manmade improvements, subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly reestablishing these features.

H. Maintaining Highways, Streets, Roadways, and Driveways:

1. Maintain streets, highways, roadways, and driveways in suitable condition for movement of traffic until completion and final acceptance of the work.
2. During the time period between pavement removal and completing permanent pavement replacement, maintain highways, streets, and roadways by the use of steel running plates. Running plate edges shall have asphalt placed around their periphery to minimize vehicular impact. The backfill above the pipe shall be compacted as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.
3. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways. The grader or front-end loader shall be available at all times.
4. Immediately repair all driveways that are cut or damaged. Maintain them in a suitable condition for use until completion and final acceptance of the work.

3.3 PIPE DISTRIBUTION

- A. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.
- B. No pipe shall be strung further along the route than 500 feet beyond the area in which the Contractor is actually working without written permission from the Owner. The Owner reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.
- C. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets, and roadways upon which pipe is distributed.
- D. No distributed pipe shall be placed inside drainage ditches.
- E. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than 5 feet from the roadway pavement, as measured edge-to-edge.

3.4 LOCATION AND GRADE

- A. The Drawings show the alignment of the water main and the location of valves, hydrants, and other appurtenances.
- B. Prior to clearing and grubbing, the Engineer will provide a temporary benchmark along the water main route and at all other locations where the alignment of the water main changes significantly.

C. Construction Staking:

1. The baselines for locating the principal components of the work and a benchmark adjacent to the work are shown on the Drawings. Baselines shall be defined as the line to which the location of the water main is referenced, i.e., edge of pavement, road centerline, property line, right-of-way or survey line. The Contractor shall be responsible for performing all survey work required for constructing the water main, including the establishment of baselines and any detail surveys needed for construction. This work shall include the staking out of permanent and temporary easements to ensure that the Contractor is not deviating from the designated easements.
2. The level of detail of survey required shall be that which the correct location of the water main can be established for construction and verified by the Engineer. Where the location of components of the water main, e.g., tunnels and fittings, are not dimensioned, the establishment on the location of these components shall be based upon scaling these locations from the Drawings with relation to readily identifiable landmarks, e.g., survey reference points, power poles, manholes, etc.

D. Reference Points:

1. The Contractor shall take all precautions necessary, which includes, but is not necessarily limited to, installing reference points, in order to protect and preserve the centerline or baseline established by the Engineer.
2. Reference points shall be placed, at or no more than 3 feet, from the outside of the construction easement or right-of-way. The location of the reference points shall be recorded in a log with a copy provided to the Engineer for use, prior to verifying reference point locations. Distances between reference points and the manhole centerlines shall be accurately measured to 0.01 foot.
3. The Contractor shall give the Engineer reasonable notice that reference points are set. The reference point locations must be verified by the Engineer prior to commencing clearing and grubbing operations.

E. After the Contractor locates and marks the water main centerline or baseline, the Contractor shall perform clearing and grubbing.

F. Construction shall begin at a connection location and proceed without interruption. Multiple construction sites shall not be permitted without written authorization from the Engineer for each site.

G. The Contractor shall be responsible for any damage done to reference points, baselines, centerlines, and temporary benchmarks, and shall be responsible for the cost of reestablishment of reference points, baselines, centerlines, and temporary benchmarks as a result of the operations.

3.5 LAYING AND JOINTING PIPE AND ACCESSORIES

- A. Lay all pipe and fittings to accurately conform to the lines and grades established by the Engineer.
- B. Pipe Installation:
 - 1. Proper implements, tools, and facilities shall be provided for the safe performance of the work. All pipe, fittings, valves, and hydrants shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.
 - 2. All pipe, fittings, valves, hydrants, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.
 - 3. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe containing dirt shall be laid.
 - 4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.
 - 5. As each length of pipe is placed in the trench, the joint shall be assembled, and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
 - 6. It is not mandatory to lay pipe with the bells facing the direction in which work is progressing.
 - 7. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade, shall not be permitted.
 - 8. Provide detection wire for all water mains (including PVC, DIP, and Copper). Detection wire shall be connected together with a brass curney, then taped each direction an additional 3 inches. Wires in valve boxes shall be protected inside a 3/4-inch PVC pipe, leaving at least 12 inches of wire hanging out of the top of the pipe as shown in the Details. All wire must be tested for location prior to acceptance.

C. Alignment and Gradient:

1. Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.
2. Maintain a transit, level, and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary, to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the Engineer. Clean-up shall be maintained no more than 500 feet behind pipe installation and shall be brought up to the construction area at the end of each day.

E. Joint Assembly:

1. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.
2. The Contractor shall inspect each pipe joint within 1,000 feet on either side of main line valves to ensure 100 percent seating of the pipe spigot, except as noted otherwise.
3. Each restrained joint shall be inspected by the Contractor to ensure that it has been "homed" 100 percent.
4. The Contractor shall internally inspect each pipe joint to ensure proper assembly for pipe 24 inches in diameter and larger after the pipe has been brought to final alignment.
5. DIP installed in roadways and as a carrier pipe inside a casing pipe shall utilize manufactured restrained joint gaskets. Restraining gasket joints shall be assembled with American Fast-Grip gaskets, U.S. Pipe FIELD LOK gasket or McWane Ductile SURE STOP 350.

F. Cutting Pipe: Cut DIP using an abrasive wheel saw. Cut PVC pipe using a suitable saw; remove all burrs and smooth the end before jointing. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories, and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.

G. Bridge Piping and Supports: Design for the installation of piping installed on a bridge structure shall be performed by a professional engineer licensed in the State of Tennessee and approved by the City of Sevierville prior to installation. The pipe and all hangers and appurtenances shall be designed to support all anticipated loads.

H. Valve and Fitting Installation:

1. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage, and cracks. Defective valves shall be corrected or held for inspection by the Engineer. Valves shall be closed before being installed.
2. Valves, fittings, plugs, and caps shall be set and joined to the pipe in the manner specified in this section for cleaning, laying, and joining pipe, except that 12-inch and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. Valves shall be installed in the closed position.
3. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut, and truly plumbed. The valve box shall not transmit shock or stress to the valve and shall accommodate the tracer wire and protective tubing as shown on the Details. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 30 inches beneath finished grade so as to set the top of the operating nut 30 inches below finished grade. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the Engineer.
4. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.
5. A valve marker shall be provided for each underground valve. Unless otherwise detailed on the Drawings or directed by the Engineer, valve markers shall be installed 6 inches inside the right-of-way or easement.
6. Gate and butterfly valves installed as a part of a branch or "Tee" shall be installed within 24 inches of the fitting and thrust restraints shall be used.

I. Hydrant Installation:

1. Prior to installation, inspect all hydrants for direction of opening, nozzle threading, operating nut and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, handling damage, and cracks. Defective hydrants shall be corrected or held for inspection by the Engineer.
2. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the roadway, with pumper nozzle facing the roadway, except that hydrants having 2-hose nozzles 90 degrees apart shall be set with each nozzle facing the roadway at an angle of 45 degrees.

3. Hydrants shall be set to the established grade, with the centerline of the lowest nozzle at least 12 inches above the ground or as directed by the Engineer.
4. Each hydrant shall be connected to the main with a 6-inch branch controlled by an independent 6-inch valve. When a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least 6 inches above the drain port opening in the hydrant to a distance of 12 inches around the elbow.
5. When a hydrant is set in clay or other impervious soil, a drainage pit 2- x 2- x 2-feet shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand under and around the elbow of the hydrant and to a level of 6 inches above the drain port.
6. Hydrants shall be located as shown on the Drawings or as directed by the Engineer. In the case of hydrants that are intended to fail at the groundline joint upon vehicle impact, specific care must be taken to provide adequate soil resistance to avoid transmitting shock moment to the lower barrel and inlet connection. In loose or poor load bearing soil, this may be accomplished by pouring a concrete collar approximately 6 inches thick to a diameter of 24 inches at or near the groundline around the hydrant barrel.
7. Hydrants shall be installed with restrained joint tees using either American “Lock-Ring” or McWane Ductile “Super-Lock” with anchor couplings for all other fittings and valve connections. Hydrant fittings other than the tee may also be installed using retainer glands, Megalug Series 1100 as manufactured by EBBA Iron. See standard detail drawing “STD-W-04”.

J. Air Valve Vaults:

1. Construct the vault or manhole as detailed on the Drawings.
2. Air release valves and manholes shall be installed on water lines at all high points as shown on the Drawings.
3. Manholes shall be constructed such that their walls are plumb.
4. The frame shall be attached to the manhole barrel by means of four 5/8-inch x 4-1/2-inch anchor bolts and shall be set in a bed of mastic so as to constitute a watertight seal between the barrel and the frame.

K. Automatic Flushing Hydrants:

1. Construct the Flushing Hydrants as detailed on the Drawings.
2. Bedding shall consist of a 4-inch lift of non-compacted sand or similar bedding material before installation of the unit.

3. Backfill the area around the automatic flushing hydrant with select materials in 6-inch lifts, keeping the flushing unit level during the filling process.

3.6 CONNECTIONS TO WATER MAINS

- A. Make connections to existing pipelines with tapping sleeves and valves, unless specifically shown otherwise on the Drawings.
- B. Location: Before laying pipe, locate the points of connection to existing water mains and uncover as necessary for the Engineer to confirm the nature of the connection to be made.
- C. Interruption of Services: Make connections to existing water mains only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the Owner.
- D. Tapping Saddles and Tapping Sleeves:
 1. Holes in the new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be permitted.
 2. Prior to attaching the saddle or sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.
 3. Before performing field machine cut, the watertightness of the saddle or sleeve assembly shall be tested. The interior of the assembly shall be filled with water and hydrostatically pressure tested to 1-1/2 times line pressure or a maximum of 250 psi. No leakage shall be permitted for a period of 5 minutes.
 4. After attaching the saddle or sleeve to an existing main, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to potable water shall be swabbed or sprayed with a one percent hypochlorite solution.
- E. Connections Using Solid Sleeves: Where connections are shown on the Drawings using solid sleeves, the Contractor shall furnish materials and labor necessary to make the connection to the existing pipeline.
- F. Connections Using Couplings: Where connections are shown on the Drawings using couplings, the Contractor shall furnish materials and labor necessary to make the connection to the existing pipeline, including all necessary cutting, plugging, and backfill.

3.7 THRUST RESTRAINT

- A. Provide restraint at all points where hydraulic thrust may develop.
- B. Water Mains: All water mains 12-inch diameter and greater, installed in fill or in areas where the soil is disturbed shall be restrained joint pipe. See Article 2.1, Paragraph D, above.

- C. Retainer Glands: Provide retainer glands where shown on the Drawings and on all fittings and valves 12 inches and larger. Retainer glands shall be installed in accordance with the manufacturer's recommendations, particularly, the required torque of the set screws. The Contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.
- D. Harnessing:
1. Provide harness rods only where specifically shown on the Drawings or directed by the Engineer.
 2. Harness rods ("All-Thread") shall be manufactured in accordance with ASTM A36 and shall have an allowable tensile stress of no less than 22,000 psi. Harness rods shall be hot-dip galvanized or field coated with bitumastic before backfilling.
 3. Where possible, harness rods shall be installed through the mechanical joint bolt holes. Where it is not possible, provide 90 degree bend eye bolts.
 4. Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe size. The eye shall be welded closed. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod. Eye bolts shall be of the same material and coating as the harness rods.
- E. Concrete Blocking:
1. Provide concrete blocking for all bends, tees, valves, and other points where thrust may develop, except where other exclusive means of thrust restraint are specifically shown on the Drawings.
 2. Concrete shall be as specified in this section.
 3. Form and pour concrete blocking at fittings as shown on the Drawings and as directed by the Engineer. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation.

3.8 INSPECTION AND TESTING

- A. Pressure and Leakage Test: Testing will not be allowed to begin without the expressed approval of the Engineer. All other utility or site construction must be complete prior to testing.
1. All sections of the water main and servicelines subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of main will be considered ready for testing after completion of all thrust restraint and backfilling.
 2. Each segment of water main between main valves shall be tested individually.

3. Test Preparation:
 - a. For water mains less than 24 inches in diameter, flush sections thoroughly at flow velocities, greater than 2-1/2 feet per second, adequate to remove debris from pipe and valve seats. For water mains 24 inches in diameter and larger, the main shall be carefully swept clean, and mopped if directed by the Engineer. Partially open valves to allow the water to flush the valve seat.
 - b. Partially operate valves and hydrants to clean-out seats.
 - c. Provide temporary blocking, bulkheads, flanges, and plugs as necessary, to assure all new pipe, valves, and appurtenances will be pressure tested.
 - d. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Insert corporation cocks at highpoints to expel air as main is filled with water as necessary to supplement automatic air valves. Corporation stops shall be constructed as detailed on the Drawings with a meter box.
 - e. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure.
 - f. The differential pressure across a valve or hydrant shall equal the maximum possible, but not exceed the rated working pressure. Where necessary, provide temporary backpressure to meet the differential pressure restrictions.
 - g. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure.
4. Test Pressure: Test the pipeline at 200 psi measured at the lowest point for at least 2 hours. Maintain the test pressure within 5 psi of the specified test pressure for the test duration. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. The source of the pressure drop shall be identified and repaired. Provide an accurate pressure gauge with graduation not greater than 2 psi. Pressure testing must be performed in the presence of the Inspector.
5. Leakage:
 - a. Leakage shall be defined as the sum of the quantity of water that must be pumped into the test section, to maintain pressure within 5 psi of the specified test pressure for the test duration plus water required to return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter.
 - b. The Owner assumes no responsibility for leakage occurring through existing valves.

6. Test Results: No test section shall be accepted if the leakage exceeds the limits determined by the following formula:

$$L = \frac{SD (P)^{1/2}}{148,000}$$

Where: L = allowable leakage, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of the pipe, in inches
P = average test pressure during the leakage test, in pounds per square inch (gauge)

As determined under Section 5 of AWWA C600.

If the water main section being tested contains lengths of various pipe diameters, the allowable leakage shall be the sum of the computed leakage for each diameter. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.

7. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size, and location of all outlets on Record Drawings.

- B. Inspection: Inspection of construction shall be performed by the Resident Inspector or the Owner's Inspector. All mains and appurtenances will be inspected prior to backfilling. If any joints, pipe or other workmanship materials are found to be defective, they shall be removed and replaced by the Contractor. The Contractor shall schedule work around the Inspector's 40-hour workweek. Any required overtime for the Inspector shall be paid by the Contractor.

3.9 DISINFECTING PIPELINE

- A. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method and these Specifications.
- B. Specialty Contractor: Disinfection shall be performed by an approved specialty contractor. Before disinfection is performed, the Contractor shall submit a written procedure for approval before being permitted to proceed with the disinfection. This plan shall also include the steps to be taken for the neutralization of the chlorinated water.
- C. Chlorination:
1. Apply chlorine solution to achieve a concentration of at least 25 milligrams per liter free chlorine in new line. Retain chlorinated water for 24 hours.
 2. Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the 24-hour period.
 3. After 24 hours, all samples of water shall contain at least 10 milligrams per liter free chlorine. Rechlorinate if required results are not obtained on all samples.

- D. Disposal of Chlorinated Water: Reduce chlorine residual of disinfection water to less than 1 milligram per liter if discharged directly to a body of water or to less than 2 milligrams per liter if discharged onto the ground prior to disposal. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. Flush all lines until residual is equal to existing system.
- E. Bacteriological Testing: After final flushing and before the water main is placed in service, the Owner will collect samples from the line and have tested for bacteriological quality in accordance with the rules of the Tennessee Department of Environment and Conservation (TDEC). The bacteriological samples shall be analyzed for both coliform and non-coliform growth. Two or more successive sets of samples, taken at 24-hour intervals, shall indicate bacteriologically satisfactory water and the results shall be submitted to TDEC. Rechlorinate lines until required results are obtained.

3.10 PROTECTION AND RESTORATION OF WORK AREA

- A. General: Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.
 - 1. The Contractor shall plan, coordinate, and prosecute the work such that disruption to personal property and business is held to a practical minimum.
 - 2. All construction areas abutting lawns and yards of residential or commercial property shall be restored promptly. Backfilling of underground facilities, ditches, and disturbed areas shall be accomplished on a daily basis as work is completed. Finishing, dressing, and grassing shall be accomplished immediately thereafter, as a continuous operation within each area being constructed and with emphasis placed on completing each individual yard or business frontage. Care shall be taken to provide positive drainage to avoid ponding or concentration of run-off.
 - 3. Handwork, including raking and smoothing, shall be required to ensure that the removal of roots, sticks, rocks, and other debris is removed in order to provide a neat and pleasing appearance.
 - 4. TDOT's Engineer shall be authorized to stop all work by the Contractor when restoration and clean-up are unsatisfactory and to require appropriate remedial measures.
- B. Man-Made Improvements: Protect, or remove and replace with the Engineer's approval, all fences, walkways, mailboxes, pipelines, drain culverts, power and telephone lines, cables, property pins, and other improvements that may be encountered in the work.
- C. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by the Engineer. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.

- D. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3 inches in diameter, not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, wood piles or trash piles will be permitted on the work site.
- E. Disposal of Rubbish: Dispose of all materials cleared and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate county, state, and federal regulatory agencies.
- F. Swamps and Other Wetlands:
 - 1. The Contractor shall not construct permanent roadbeds, berms, drainage structures or any other structures which alter the original topographic features within the easement.
 - 2. All temporary construction or alterations to the original topography will incorporate measures to prevent erosion into the surrounding swamp or wetland. All areas within the easement shall be returned to their original topographic condition as soon as possible after work is completed in the area. All materials of construction and other non-native materials shall be disposed by the Contractor.
 - 3. The Contractor shall provide temporary culverts or other drainage structures, as necessary, to permit the free migration of water between portions of a swamp, wetland or stream which may be temporarily divided by construction.
 - 4. The Contractor shall not spread, discharge or dump any fuel oil, gasoline, pesticide or any other pollutant to adjacent swamps or wetlands.
 - 5. The conditions of the individual Aquatic Resource Alteration Permit (ARAP) or Storm Water Pollution Prevention Plan (SWPPP) shall govern if there are any conflicts between these Specifications and project specific permits.

3.11 ABANDONING EXISTING WATER MAINS

- A. General: Abandon in place all existing water main segments indicated on the Drawings to be abandoned or retired. Perform abandonment after the new water main has been placed in service and all water main services have been changed over to the new main. Salvage for the Owner any and all existing fire hydrants, valve boxes, valve markers, and other materials indicated on the Drawings or located on water mains abandoned.
- B. Capping and Plugging: Disconnect by sawing or cutting and removing a segment of existing pipe where cutting and capping or plugging is shown on the Drawings or directed by the Engineer. Provide a watertight pipe cap or plug and concrete blocking for restraint to seal off existing mains indicated to remain in service. Seal ends of existing mains to be abandoned with a pipe cap or plug or with a masonry plug and minimum 6-inch cover of

concrete on all sides around the end of the pipe. The Contractor shall be responsible for uncovering and verifying the size and material of the existing main to be capped or plugged.

- C. Salvaging Materials: Salvage existing fire hydrants, valve boxes, valve markers, and other materials as indicated on the Drawings and deliver salvaged items in good condition to the Owner's storage yard; coordinate delivery and placement of salvaged materials in advance.
- D. Blow-Off Piping: Remove existing blow-off piping, located on segments of water mains to be abandoned, to a minimum of 2 feet below finished grade. Seal the end of remaining piping as specified in Paragraph B., above. Blow-off piping removed becomes the property of the Contractor.
- E. Pavement Removal and Replacement: Perform any necessary pavement removal and replacement in accordance with the details on the Drawings and the specifications of the Highway Department.

END OF SECTION

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PART 1 GENERAL

1.1 SCOPE

- A. The work covered by this section includes furnishing all materials and equipment, providing all required labor, installing water service connections, and all appurtenant work according to these Specifications and/or to the Water Connection Details as shown schematically on the Drawings.
- B. Water meters are not to be furnished nor installed. However, the water meter connection must be compatible with the water meters currently used by the City of Sevierville Water and Sewer Department.
- C. All Specifications are only the minimum requirements; actual requirements may be greater depending upon the situation. These Specifications may be adjusted by the sole discretion of the Owner to fit a particular situation not routinely encountered, or as public safety issues become apparent.

1.2 LOCATIONS

- A. Locations shall be directed by the Engineer along the route of the water mains.

1.3 SERVICE COMPATIBILITY

- A. It is the intent of these Specifications that the water service connections shall duplicate those presently being provided by the Owner in order to be compatible with their service maintenance procedures.

1.4 QUALITY CONTROL

- A. All materials installed under this section shall have the approval of the National Sanitation Foundation (NSF) for water services.
- B. All wetted materials installed under this section shall be "Lead-Free". Materials shall bear certification and comply with NSF/ANSI 61 Annex G, NSF/ANSI 372

1.5 SUBMITTALS

- A. Complete Shop Drawings and engineering data shall be submitted to the Engineer for review in accordance with the requirements of Section 01 33 23, Shop Drawings, Product Data, and Samples, of these Specifications.
- B. Operating and maintenance data for all equipment shall be furnished in accordance with Section 01 78 23, Operating and Maintenance Data, of these Specifications.

PART 2 PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

A. Service Line:

1. **Copper Tubing:** Tubing shall be ASTM B88, Type K. Fittings shall be brass with compression connection inlets and outlets, ANSI B16.26. Where required, adapters shall be brass ANSI B16.18. Unions shall be cast bronze. Joints shall be compression type. All fittings shall be of bronze construction with compression type connection.
2. **Cross-linked Polyethylene Pipe (PEX):** Tubing shall be SDR9 copper tube size manufactured in accordance with AWWA C904. PEX shall connect to standard AWWA C800 compression joint valves and fittings and ASTM F2080, Brass Compression-Sleeve Fittings. When using AWWA C800 fittings, a manufacturer's insert shall be provided to stiffen the pipe. PEX shall be equal to MUNICIPEX by Rehau Construction, LLC.
3. **Detection wire** shall be provided over all service lines.
4. **Polyvinyl Chloride (PVC) Casing Pipe:** Casing pipe for long side services shall be minimum 3 inches, Schedule 80 PVC (HDPE acceptable).

B. Meter Box:

1. Plastic meter boxes shall be model MB-2 made by Southeastern Distributors.
2. Meter box shall be fitted with cast iron cover and reader lid, with "water meter" cast in the top.
3. Minimum dimensions shall be 25 inches length, 14 inches width, and 14-1/2 inches deep.

C. Services and Accessories:

1. **Corporation Cocks and Curb Stops** shall be suitable for flared tube compression type joint and shall conform to AWWA C800 rated to 300 psi. Corporation cocks shall be Mueller B25008.
2. **Service Clamps:**
 - a. Clamp body shall be of epoxy coated ductile iron and meet all requirements of AWWA C800.
 - b. The strap shall be made of 304L stainless steel.
 - c. Service clamps shall be Mueller DR2S Series.

3. Compression Connectors shall be Mueller H14227 or H14222
 4. Meter Yolk shall be of copper and shall be Mueller H2418-R-2.
- D. Connections to Water Mains:
1. Connections to all water mains shall be made using a full body service clamp.
 2. Pressure ratings shall be 200 psi.
- E. Pressure Regulators where required shall be furnished and maintained by the Owner or the Developer. The regulator shall be installed on the discharge side of the water meter in a separate box or inside the building it serves.
- F. Detection Wire: See Section 33 10 00, Water Mains and Accessories.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Water Service Connections:
1. Water service connections shall be installed to the properties adjacent to the water transmission mains both to the same side of the roadway (Short Side Service) and to the opposite side of the roadway (Long Side Service) as directed by the Engineer.
 2. Water service connections installed under roadway shall be pulled through a minimum 3-inch casing pipe. Casings shall be installed in an open trench or through a bored hole approximately equal in diameter to the external diameter of the casing. Minimum cover under roadway shall be 40 inches and shall extend 3 feet beyond the edge of pavement or curb. At other locations, minimum cover shall be 2 feet.
 3. Installation shall conform to the Details for water service connections appearing schematically on the Drawings. Contractor shall provide any and all appurtenant work required to provide the intended water service connections.
 4. Double service lines shall be 1-inch service line on both long and short side connections. Single service lines shall be 3/4-inch service line on both long and short side connections. Exceptions may be authorized by the Owner on a case-by-case basis. Service line material shall be at the discretion of the Owner.
- B. Permanent Water Services:
1. Each new service line shall be tapped into the main through a corporation stop, utilizing a service clamp, as detailed on the Drawings. A new service line shall be provided to the meter as shown on the Drawings.
 2. A corporation cock shall be provided in the water main for each service line.

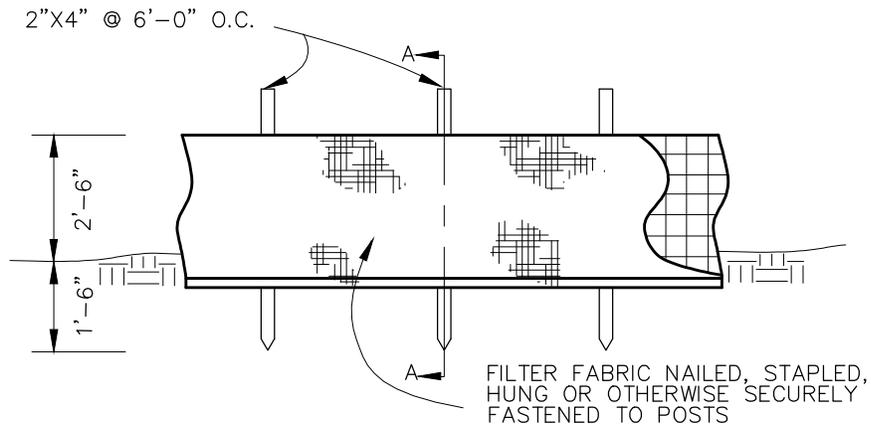
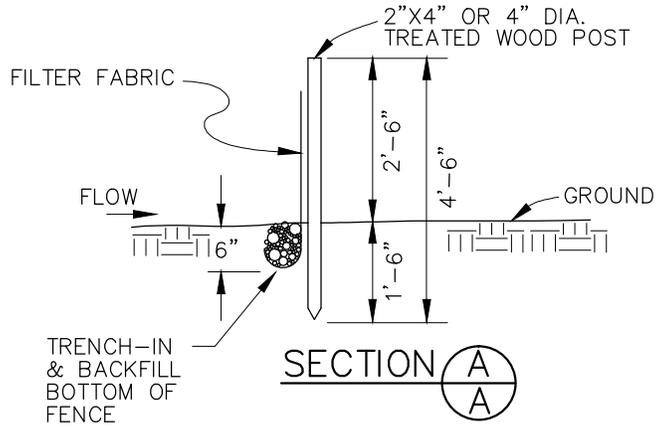
3. A curb stop shall be provided at each existing or future water meter location.
 4. A service line, sized to match the existing line unless directed otherwise by the Engineer, shall be provided between the corporation cock and curb stop.
 5. Permanent water service meters shall be located at the right-of-way or permanent utility easement limits.
- C. Temporary Water Services: Temporary services shall consist of relocating an existing water meter to just outside the construction limits to clear proposed grading by the Contractor. Temporary services shall include connecting the relocated meter to the existing or new water main as appropriate by means of a new service line and any additional depth service line installation required to clear proposed grading work.
- D. Relocation of Service Lines:
1. Relocate the existing meter to the new right-of-way or permanent utility easement limits and reconnect to the house service. Existing meters already located at the new right-of-way limits will not need relocating.
 2. Before disconnecting the existing meter, the existing corporation in the main shall be closed. All existing meters and meter boxes shall be removed, if not already located at the right-of-way, reinstalled, and reconnected as indicated on the Drawings.
 3. Existing service lines shall be field-located by the Contractor. The Contractor shall be responsible for locating existing water meters, relocating the meters and meter boxes as necessary, and determining the existing size service line to reconnect the meters to the new water mains. All service lines installed under existing pavement, including streets, driveways, and sidewalks, shall be installed by boring.
 4. The Contractor shall be prepared to make emergency repairs to the water system, if necessary, due to damage by others working in the area. In conjunction with this requirement, the Contractor shall furnish and have available at all times, a tapping machine, for the purpose of making temporary water service taps or emergency repairs to damaged water services.
- E. Transfer of Service: Immediately before connecting to the relocated or existing meter, all service lines shall be flushed to remove any foreign matter. Any special fittings required to reconnect the existing meter to the new copper service line, or the existing private service line, shall be provided by the Contractor. To minimize out of service time, the Contractor shall determine the connections to be made and have all the required pipe and fittings on hand before shutting off the existing service. After completing the connection, the new corporation stop shall be opened, and all visible leaks shall be repaired.
- F. Magnetically detectable wire shall be installed to locate all underground pipe (PVC, DIP, and Copper). See Section 33 10 00.

END OF SECTION

Standard Detail Drawings

| | |
|----------|--|
| STD-G-01 | Silt Fence Detail |
| STD-G-02 | Concrete Encasement Detail |
| STD-G-03 | Concrete Replacement Detail |
| STD-G-04 | Asphalt Replacement Detail |
| STD-G-05 | Creek Crossing Detail |
| STD-G-06 | Typical Road Boring Detail |
| STD-G-07 | Trench Terminology Detail |
| STD-G-08 | Pressure Pipe Bedding and Haunching Detail |

| | |
|----------|---|
| STD-W-01 | Typical Blocking Detail |
| STD-W-02 | Gate Valve Installation Detail |
| STD-W-03 | Butterfly Valve Installation Detail |
| STD-W-04 | Fire Hydrant Detail |
| STD-W-05 | Typical Air Release Valve Assembly Detail |
| STD-W-06 | Manual Termination Water Main Blow-off Detail |
| STD-W-07 | Automatic Termination Flushing Hydrant Detail |
| STD-W-08 | Water Service and Meter Connection Details |
| STD-W-09 | Water Line Termination Detail |



SILT FENCE DETAIL
NTS



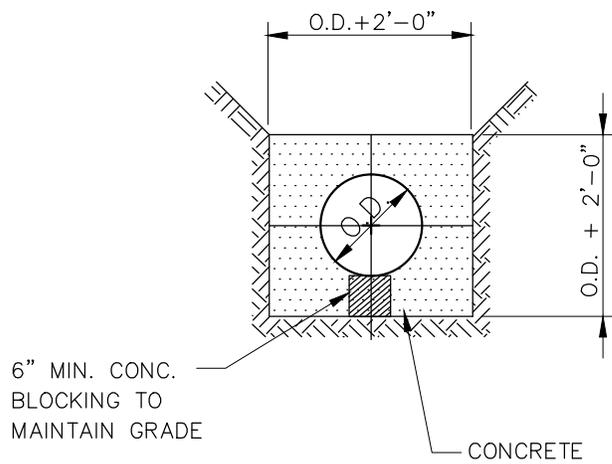
SEVIERVILLE WATER & SEWER DEPT.

DATE : DEC 2016

STANDARD DETAILS
TYPICAL CONSTRUCTION

SCALE : N.T.S

STD-G-01



CONCRETE ENCASEMENT DETAIL
N.T.S.



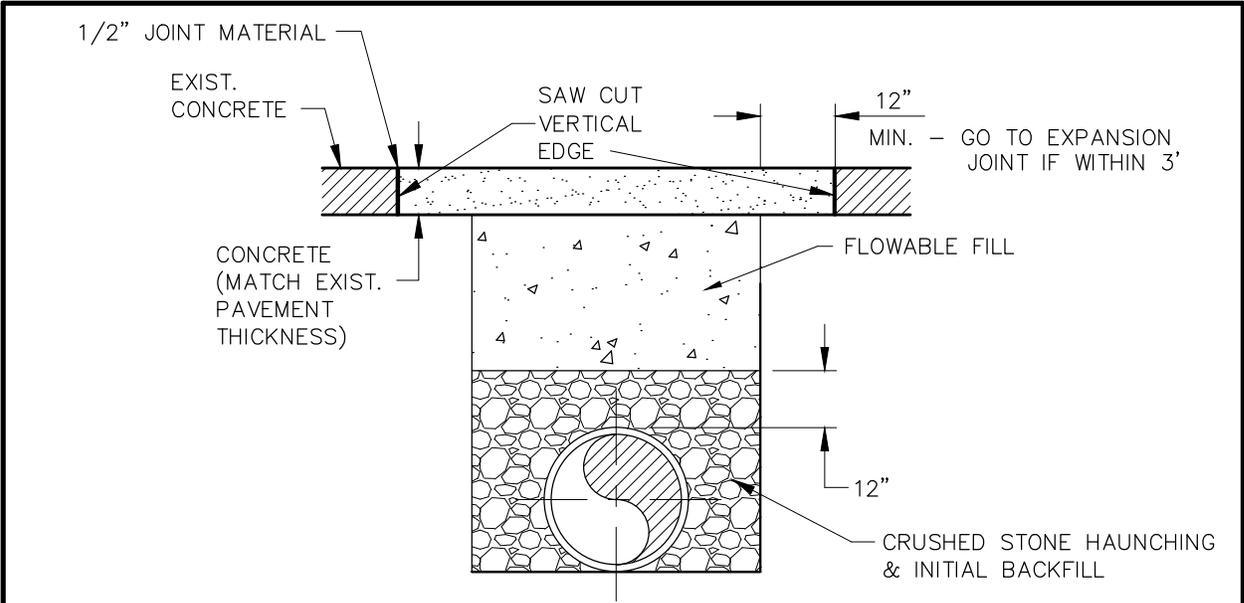
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STANDARD DETAILS
TYPICAL CONSTRUCTION

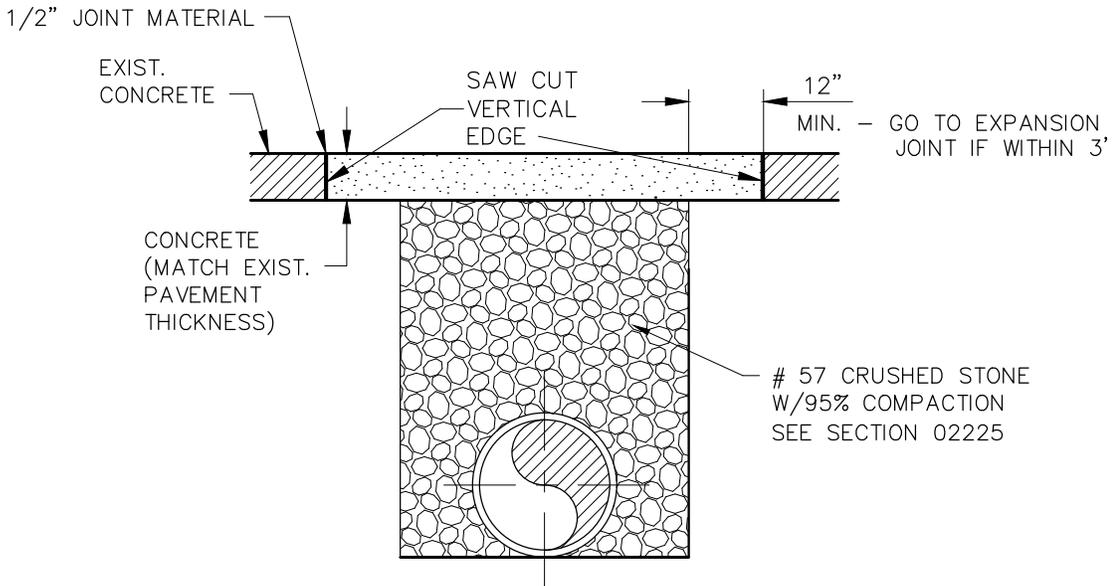
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SCALE : N.T.S

STD-G-02



CITY & COUNTY STREETS



ALL OTHERS

CONCRETE REPLACEMENT DETAIL

NTS



SEVIERVILLE WATER & SEWER DEPT.

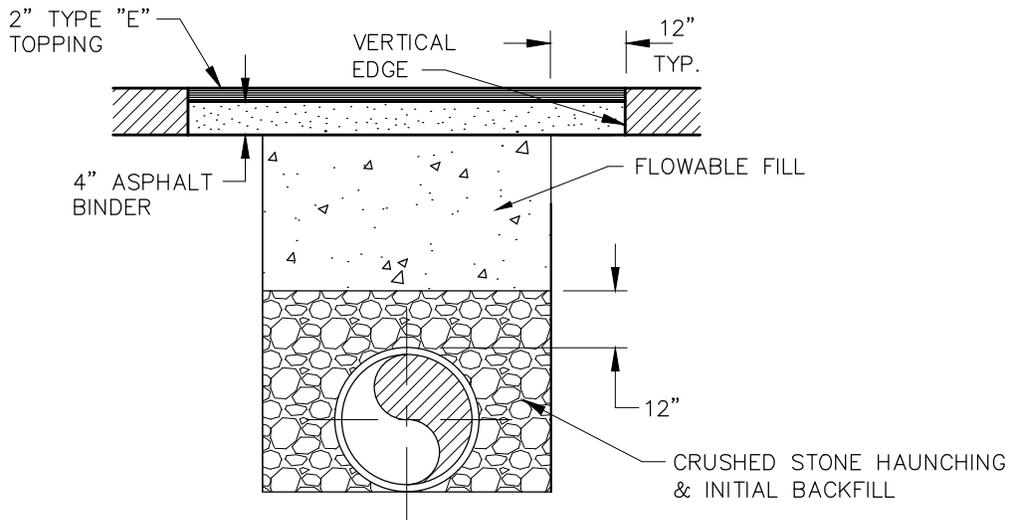
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STANDARD DETAILS

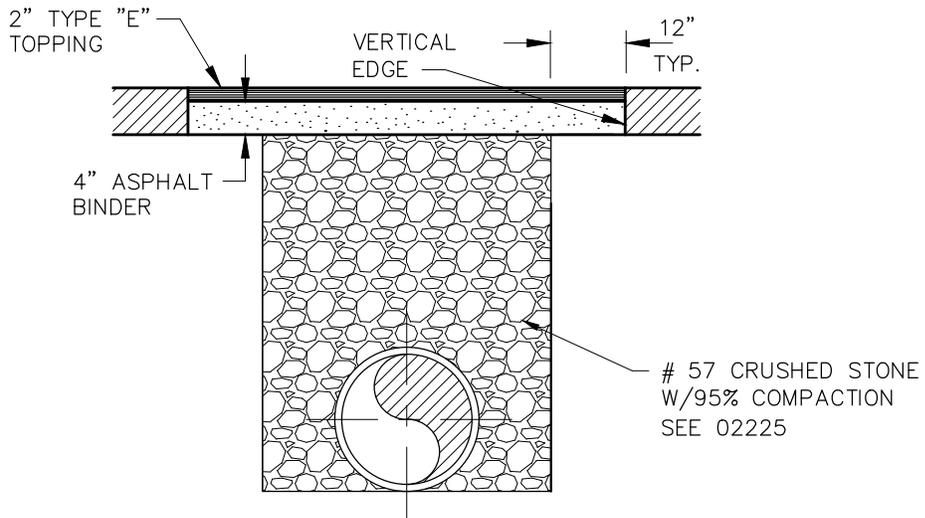
SCALE : N.T.S

TYPICAL CONSTRUCTION

STD-G-03



CITY & COUNTY STREETS



ALL OTHERS

ASPHALT REPLACEMENT DETAIL

NTS



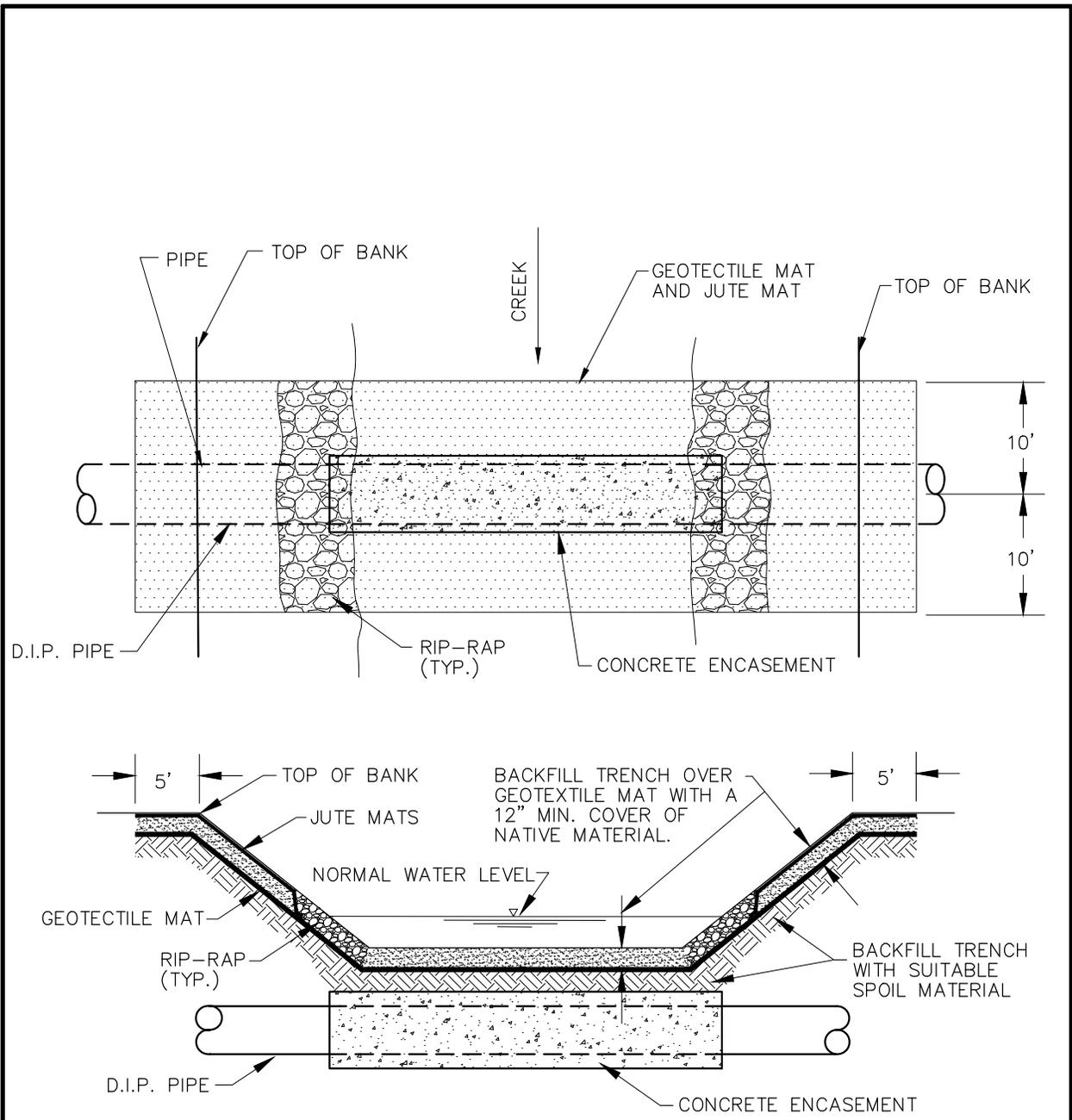
SEVIERVILLE WATER & SEWER DEPT.

DATE : DEC. 2016

SCALE : N.T.S

STANDARD DETAILS
TYPICAL CONSTRUCTION

STD-G-04



CREEK CROSSING DETAIL

NTS



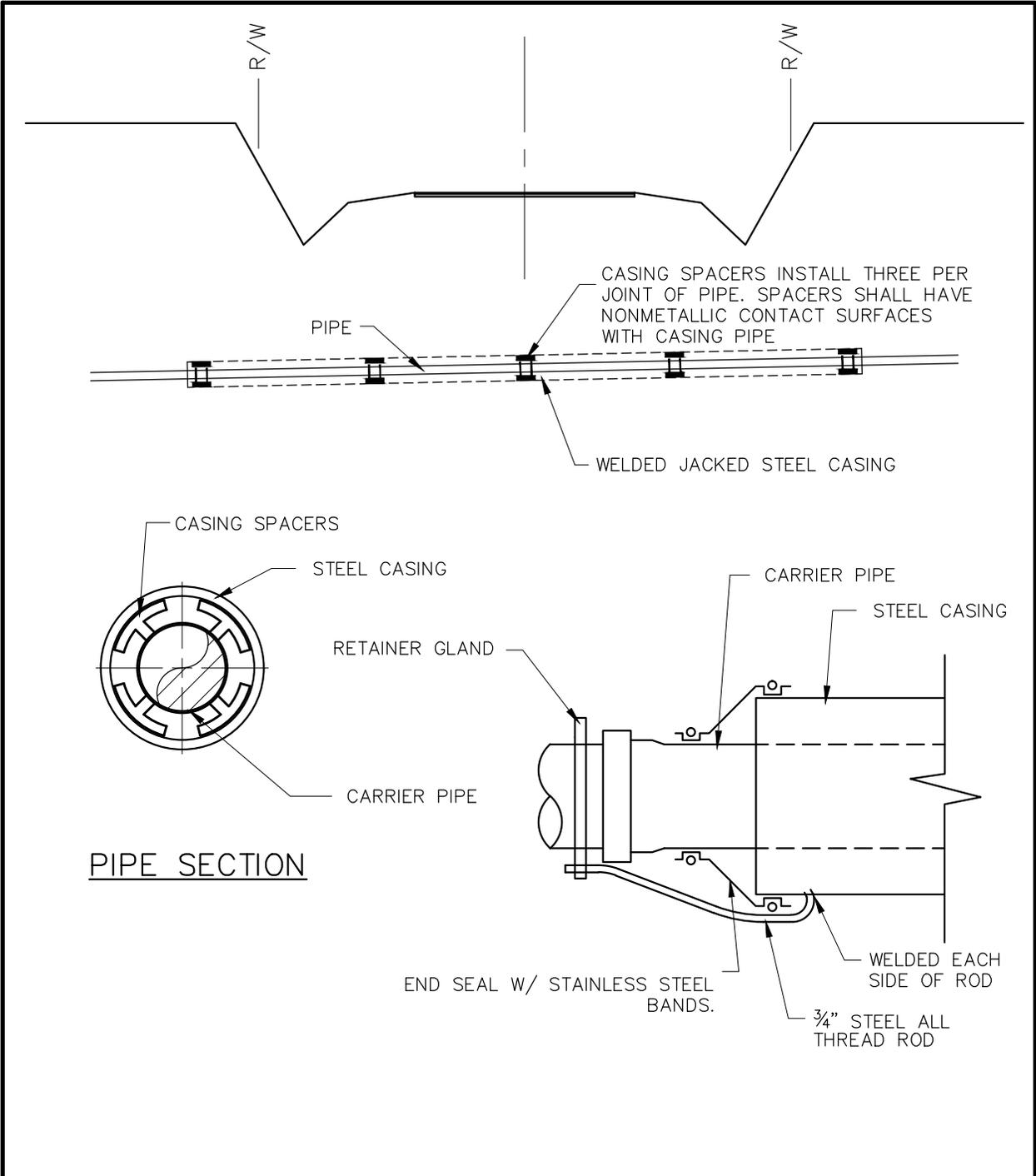
SEVIERVILLE WATER & SEWER DEPT.

DATE : DEC. 2016

STANDARD DETAILS
TYPICAL CONSTRUCTION

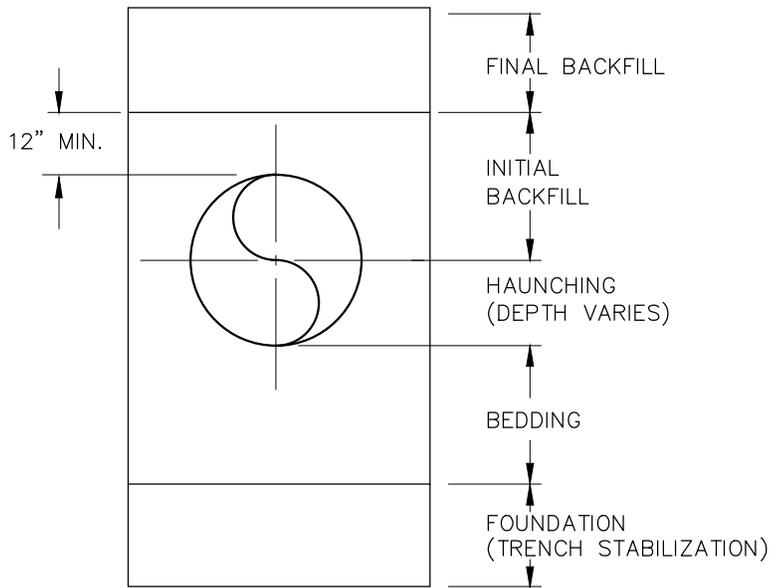
SCALE : N.T.S

STD-G-05



TYPICAL ROAD BORING DETAIL
 N.T.S.

| | | |
|---|--|------------------|
|  | SEVIERVILLE WATER & SEWER DEPT. | DATE : DEC. 2016 |
| | STANDARD DETAILS TYPICAL CONSTRUCTION | SCALE : N.T.S |
| | | STD-G-06 |



NOTE: SEE SPECIFICATIONS AND PIPE
 BEDDING AND HAUNCHING DETAILS
 FOR DIMENSIONS AND MATERIALS

TRENCH TERMINOLOGY DETAIL

N.T.S.



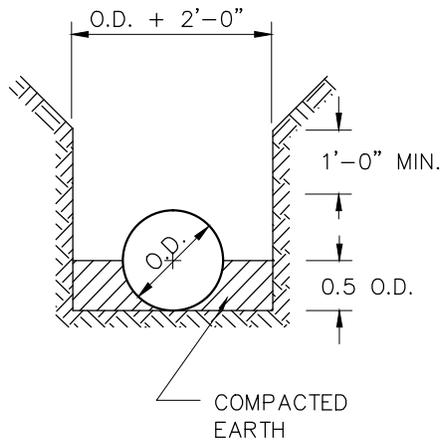
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STANDARD DETAILS
 TYPICAL CONSTRUCTION

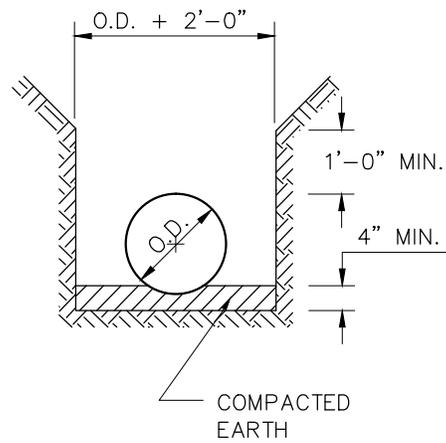
DATE : DEC. 2016

SCALE : N.T.S

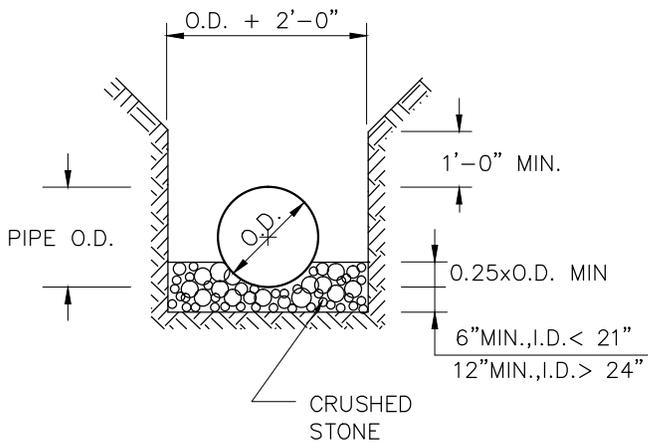
STD-G-07



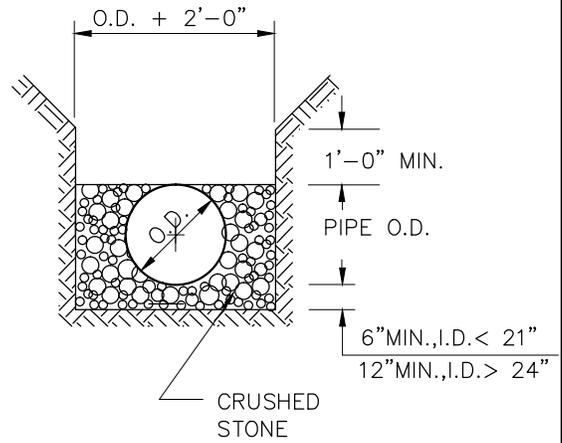
TYPE 2



TYPE 3



TYPE 4



TYPE 5

PRESSURE PIPE BEDDING AND
HAUNCHING DETAILS
N.T.S.



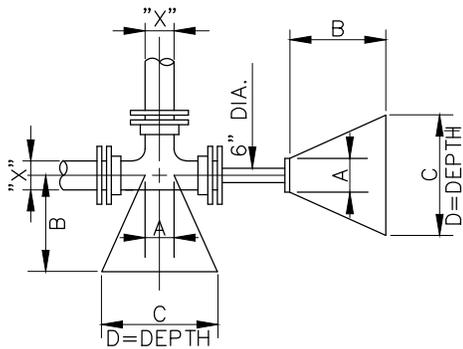
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STANDARD DETAILS
TYPICAL CONSTRUCTION

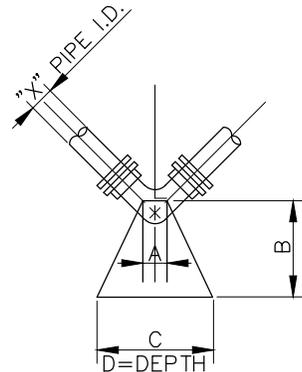
DATE : DEC. 2016

SCALE : N.T.S

STD-G-08



200 PSI TEST PRESSURE
2000 PSF SOIL BEARING



| BLOCKING DIMENSIONS | | | | | | | |
|---------------------|---------|--------|--------|-------|-------|-------|-------|
| DEAD END & TEES | X* | A | B | C | D | | |
| | BENDS | 12" | 1'-0" | 2'-1" | 4'-6" | 3'-0" | |
| 10" | | 1'-0" | 2'-6" | 4'-0" | 2'-6" | | |
| 8" | | 0'-10" | 2'-3" | 3'-3" | 2'-0" | | |
| 6" | | 0'-8" | 1'-6" | 2'-6" | 1'-6" | | |
| 90° | | 12" | 1'-0" | 4'-9" | 6'-6" | 3'-0" | |
| | | 10" | 1'-0" | 3'-6" | 5'-0" | 2'-9" | |
| | | 8" | 0'-10" | 2'-9" | 4'-0" | 2'-3" | |
| | | 6" | 0'-8" | 2'-0" | 3'-0" | 1'-9" | |
| | | 45° | 12" | 1'-0" | 2'-2" | 3'-6" | 3'-0" |
| | | | 10" | 1'-0" | 1'-9" | 3'-0" | 2'-6" |
| 8" | | | 0'-10" | 1'-6" | 2'-6" | 2'-0" | |
| 6" | | | 0'-8" | 1'-3" | 2'-0" | 1'-6" | |
| 22 1/2° | 12" | 1'-0" | 2'-0" | 2'-0" | 3'-0" | | |
| | 10" | 1'-0" | 1'-4" | 2'-6" | 1'-6" | | |
| | 8" | 0'-10" | 1'-0" | 2'-0" | 1'-3" | | |
| | 6" | 0'-8" | 0'-9" | 1'-6" | 1'-0" | | |
| | 11 1/4° | 12" | 1'-0" | 2'-0" | 2'-0" | 3'-0" | |
| | | 10" | 1'-0" | 0'-6" | 1'-6" | 1'-3" | |
| 8" | | 0'-10" | 0'-6" | 1'-4" | 1'-0" | | |
| 6" | | 0'-8" | 0'-6" | 1'-0" | 0'-9" | | |

X* = DIAMETER OF PIPE TO BE BLOCKED

| BLOCKING DIMENSIONS | | | | | | | |
|---------------------|---------|-------|--------|--------|--------|--------|-------|
| DEAD END & TEES | X* | A | B | C | D | | |
| | BENDS | 30" | 2'-0" | 6'-10" | 12'-4" | 6'-6" | |
| 24" | | 2'-0" | 5'-10" | 8'-8" | 6'-0" | | |
| 20" | | 1'-6" | 5'-6" | 7'-10" | 4'-8" | | |
| 16" | | 1'-6" | 3'-3" | 9'-6" | 4'-8" | | |
| 90° | | 30" | 2'-0" | 10'-0" | 17'-6" | 6'-6" | |
| | | 24" | 2'-0" | 9'-0" | 12'-4" | 6'-0" | |
| | | 20" | 1'-6" | 8'-3" | 11'-1" | 4'-8" | |
| | | 16" | 1'-6" | 4'-0" | 11'-2" | 5'-7" | |
| | | 45° | 30" | 2'-0" | 10'-0" | 17'-6" | 6'-6" |
| | | | 24" | 2'-0" | 9'-0" | 12'-4" | 6'-0" |
| 20" | | | 1'-6" | 8'-3" | 11'-1" | 4'-8" | |
| 16" | | | 1'-6" | 2'-9" | 8'-2" | 4'-1" | |
| 22 1/2° | 30" | 2'-0" | 2'-6" | 4'-10" | 6'-6" | | |
| | 24" | 2'-0" | 2'-0" | 3'-6" | 6'-0" | | |
| | 20" | 1'-6" | 2'-0" | 3'-1" | 4'-8" | | |
| | 16" | 1'-6" | 1'-9" | 0'-7" | 2'-11" | | |
| | 11 1/4° | 30" | 2'-0" | 2'-0" | 2'-6" | 6'-6" | |
| | | 24" | 2'-0" | 2'-0" | 2'-0" | 6'-0" | |
| 20" | | 1'-6" | 2'-0" | 2'-0" | 4'-8" | | |
| 16" | | 1'-6" | 1'-0" | 4'-2" | 2'-1" | | |

X* = DIAMETER OF PIPE TO BE BLOCKED

TYPICAL BLOCKING DETAIL

N.T.S.



SEVIERVILLE WATER & SEWER DEPT.

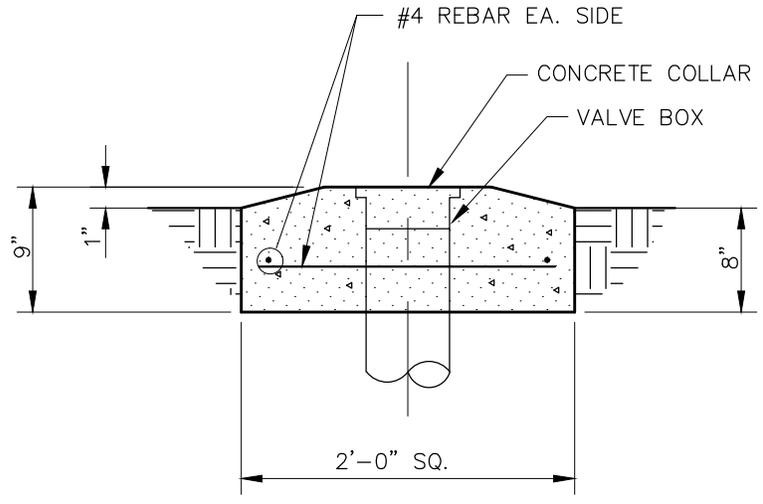
STANDARD DETAILS

WATER

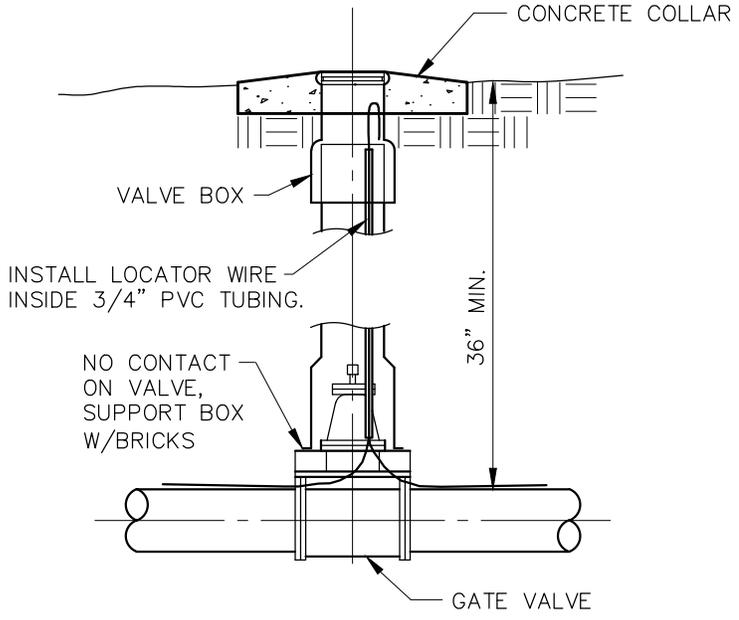
DATE : DEC. 2016

SCALE : N.T.S

STD-W-01



CONCRETE COLLAR FOR
VALVE BOX
N.T.S.



GATE VALVE
INSTALLATION DETAIL
N.T.S.



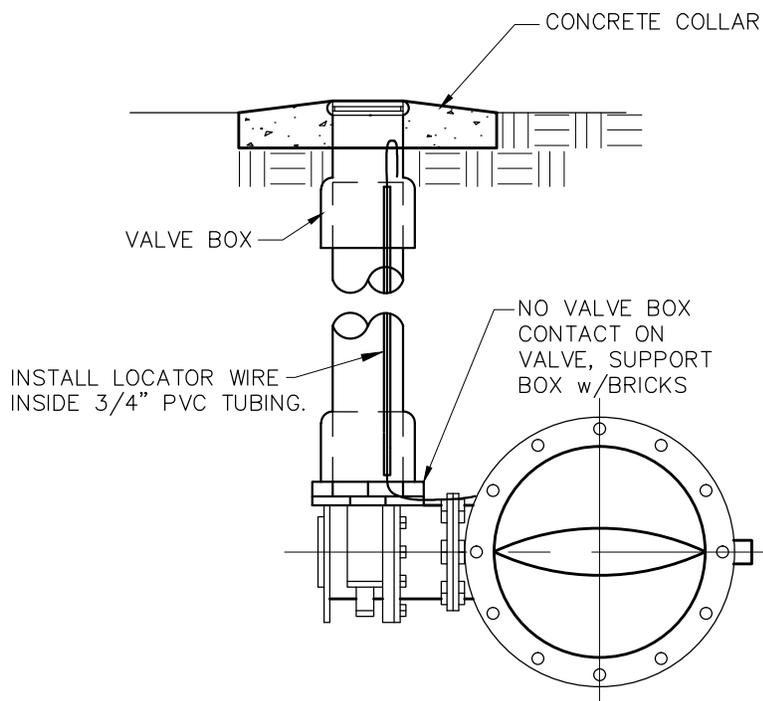
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STANDARD DETAILS

WATER

DATE : DEC. 2016
SCALE : N.T.S.

STD-W-02



BUTTERFLY VALVE INSTALLATION DETAIL

N.T.S.



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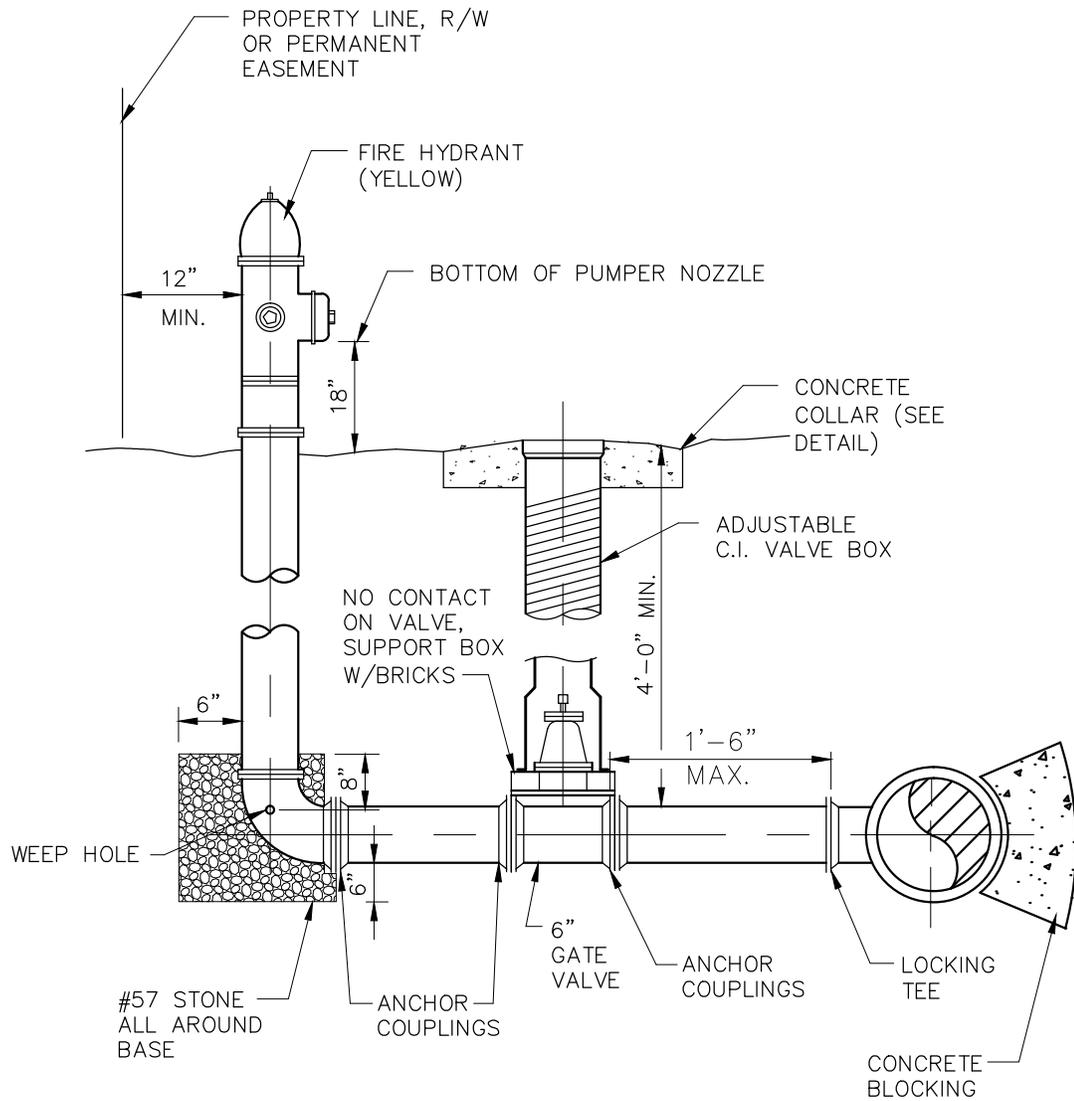
STANDARD DETAILS

WATER

DATE : DEC. 2016

SCALE : N.T.S

STD-W-03



FIRE HYDRANT
N.T.S.



SEVIERVILLE WATER & SEWER DEPT.

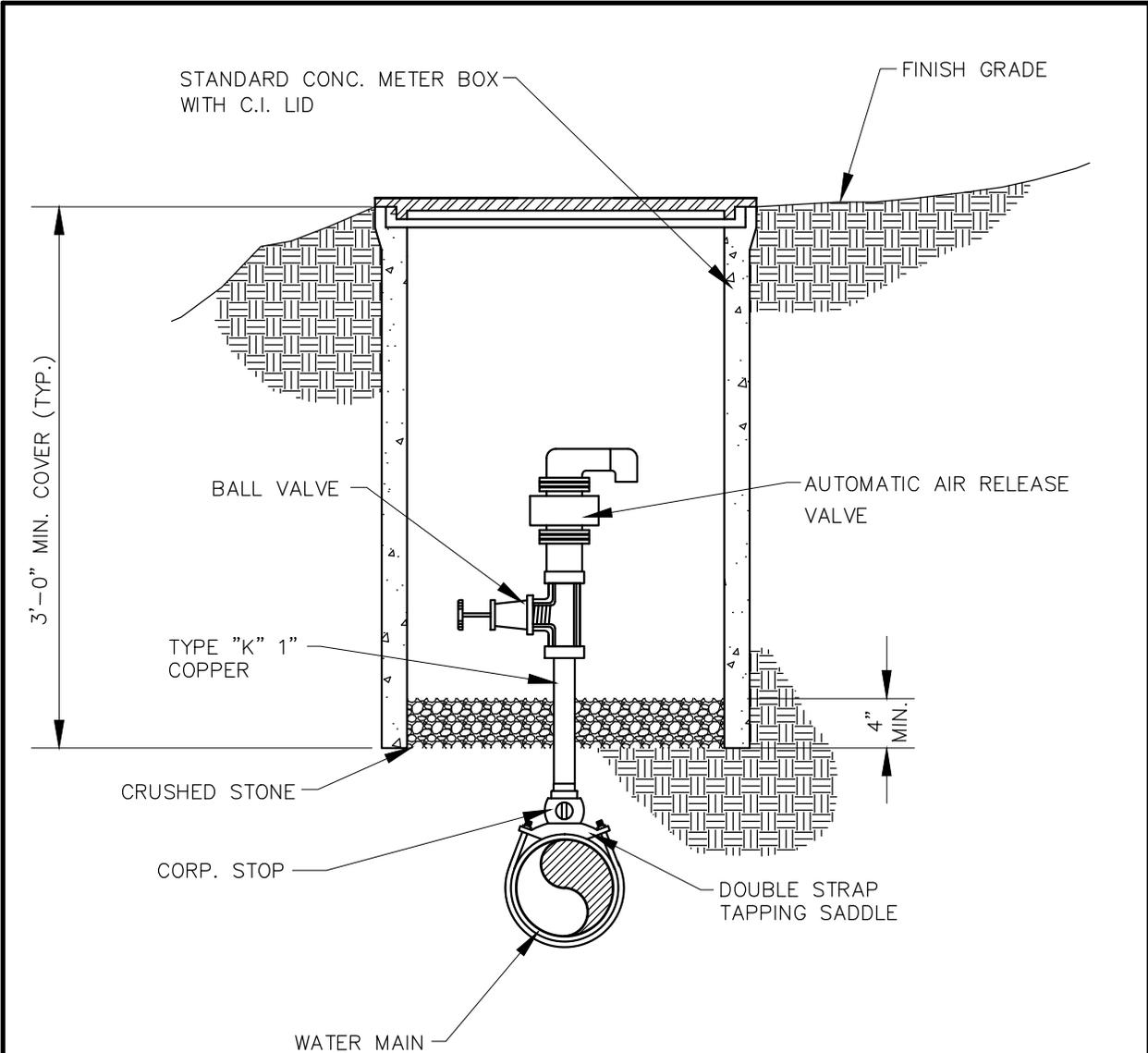
DATE : DEC. 2016

SCALE : N.T.S

STANDARD DETAILS

WATER

STD-W-04



NOTE:

1. AIR RELEASE VALVES TO BE INSTALLED ON HIGH POINTS OF WATER MAINS AS SHOWN
2. USE FOR 1" AND 2" A.R.V. INSTALLATIONS

TYPICAL AUTOMATIC AIR RELEASE VALVE ASSEMBLY

NTS



SEVIERVILLE WATER & SEWER DEPT.

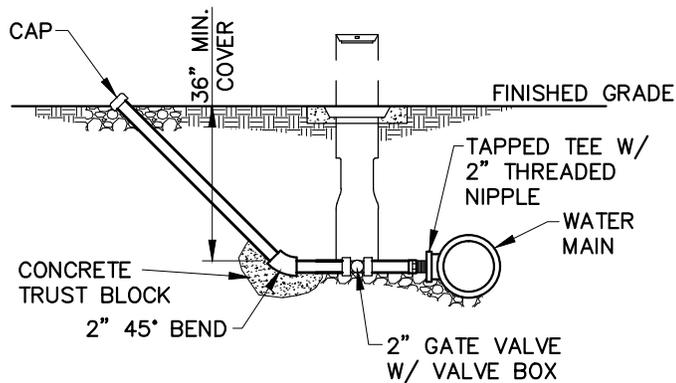
DATE : DEC. 2016

SCALE : N.T.S

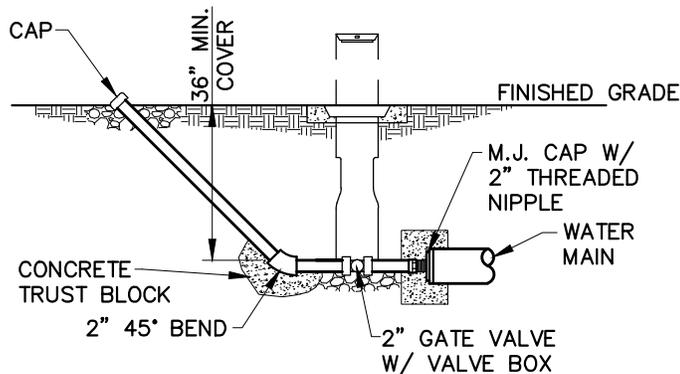
STANDARD DETAILS

WATER

STD-W-05



MANUAL IN-LINE BLOW-OFF DETAIL



MANUAL END OF LINE BLOW-OFF DETAIL

NOTES:

1. CONCRETE BLOCKING AT WATER MAIN PLUG SHALL BE A MINIMUM OF 1'-6" THICK AND BE OUT A MINIMUM OF 1'-0" INTO UNDISTURBED SOIL ON EACH SIDE AND BELOW TRENCH
2. ALL THREADED PIPE SHALL BE JOINED WITH HEAVY DUTY TEFLON TAPE OR APPROPRIATE THREAD SEALANT

WATER MAIN BLOW-OFF DETAIL

N.T.S.



SEVIERVILLE WATER & SEWER DEPT.

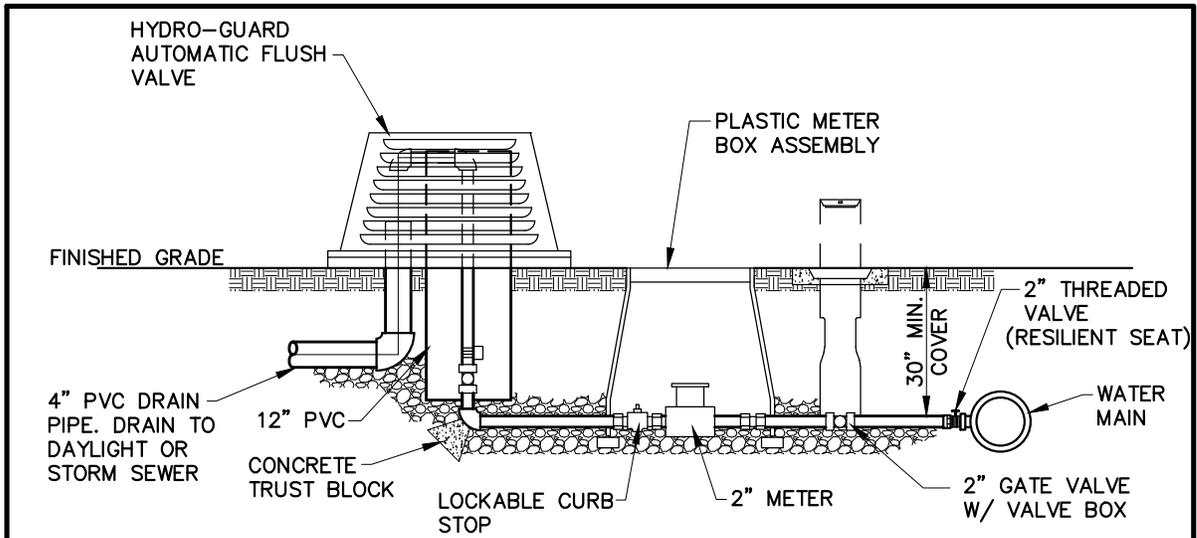
STANDARD DETAILS

WATER

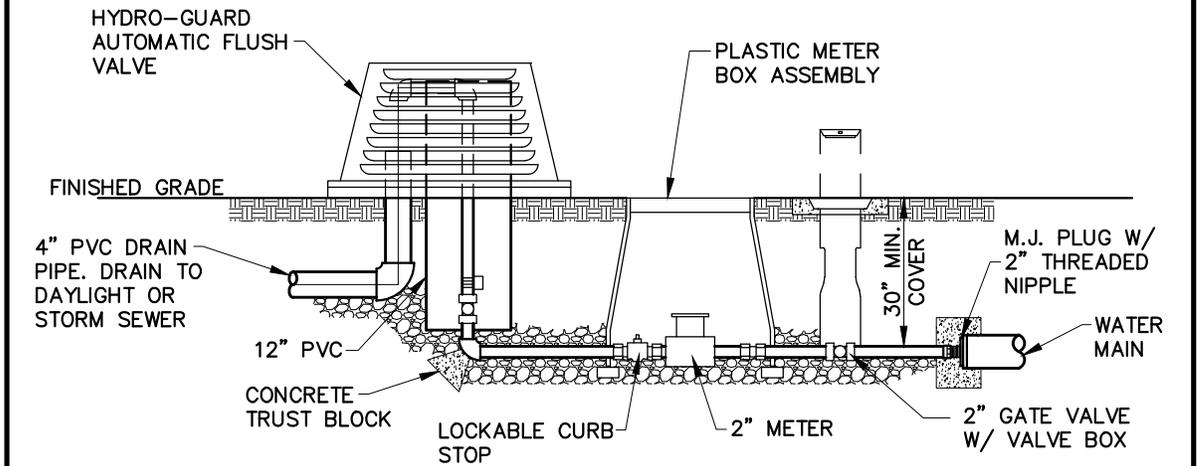
DATE : DEC. 2016

SCALE : N.T.S

STD-W-06



IN-LINE DETAIL



END OF LINE DETAIL

NOTES:

1. CONCRETE BLOCKING AT WATER MAIN PLUG SHALL BE A MINIMUM OF 1'-6" THICK AND BE OUT A MINIMUM OF 1'-0" INTO UNDISTURBED SOIL ON EACH SIDE AND BELOW TRENCH
2. ALL THREADED PIPE SHALL BE JOINED WITH HEAVY DUTY TEFLON TAPE OR APPROPRIATE THREAD SEALANT

AUTOMATIC FLUSHING HYDRANT DETAIL

N.T.S.



SEVIERVILLE WATER & SEWER DEPT.

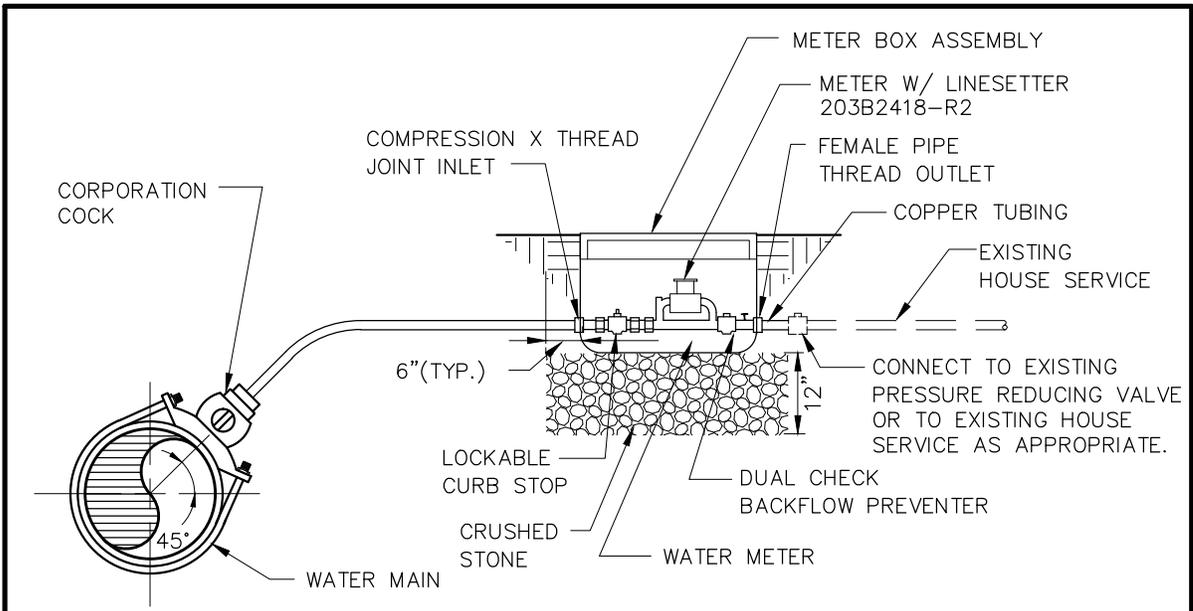
DATE : DEC. 2016

STANDARD DETAILS

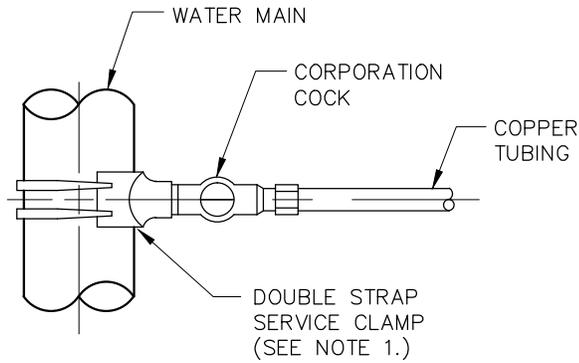
SCALE : N.T.S.

WATER

STD-W-07



ELEVATION



PLAN

NOTES:

1. SERVICE CLAMP REQUIRED ON ALL CONNECTIONS.
2. USE 3/4" COPPER FOR SINGLE SERVICE CONNECTION AND 1" COPPER FOR DOUBLE SERVICE CONNECTION. ALL COPPER IS TO BE TYPE "K".

WATER SERVICE & METER
CONNECTION DETAILS

N.T.S.



SEVIERVILLE WATER & SEWER DEPT.

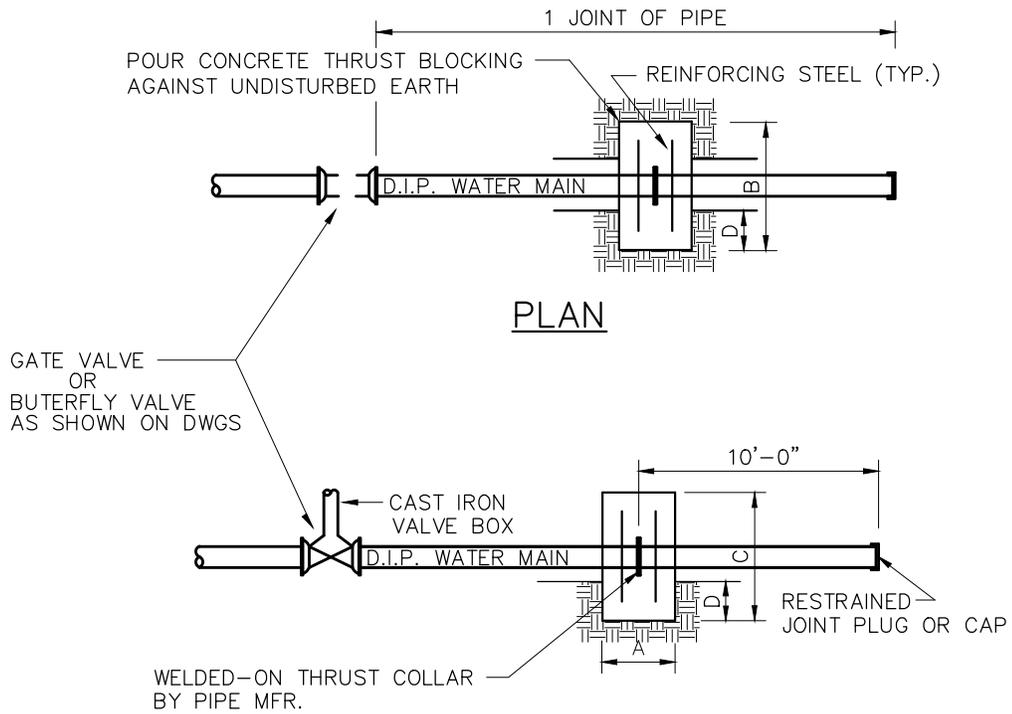
STANDARD DETAILS

WATER

DATE : DEC. 2016

SCALE : N.T.S.

STD-W-08



SECTION

| MAIN DIA | CONCRETE COLLAR DIM. | | | | STEEL REINFORCING |
|-------------|----------------------|-------|-------|-------|------------------------|
| | A | B | C | D* | |
| 12" | 1'-2" | 5'-3" | 5'-3" | 1'-0" | #7 @ 12" O.C. E.W.E.F. |
| 4",6" or 8" | 1'-0" | 4'-0" | 4'-0" | 0'-8" | #6 @ 12" O.C. E.W.E.F. |

TEST PRESSURE: 250 PSI
 SOIL BEARING PRESSURE: 3000 PSF
 *D = MINIMUM DISTANCE INTO UNDISTURBED EARTH, BOTTOM AND SIDES.

WATER LINE TERMINATION DETAILS
 NTS



SEVIERVILLE WATER & SEWER DEPT.

STANDARD DETAILS
 WATER

DATE : DEC 2016
 SCALE : N.T.S

STD-W-09



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