STANDARD WATER LINE SPECIFICATIONS

For:

SOUTH BLOUNT COUNTY UTILITY DISTRICT
320 PARTNERSHIP PARKWAY
MARYVILLE, TN 37801

April 2020

DW 2020-0504
Standard Water Line Specs
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 Hauk

May 1, 2020

THIS APPROVAL SHALL NOT BE CONSTRUED AS CREATING A PRESUMPTION OF CORRECT OPERATION OR AS WARRANTING BY THE COMMISSIONER THAT THE APPROVED FACILITIES WILL REACH THE DESIGNED GOALS.

APPROVAL EXPIRES 5 YEARS FROM ABOVE DATE

Prepared By:

CANNON & CANNON INC
CONSULTING ENGINEERS · FIELD SURVEYORS
TEL 865.670.8555
WWW.CANNON-CANNON.COM
8550 Kingston Pike
Knoxville, TN 37919

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These Standard Specifications follows the CSI Master Format Document Identifying System and Cost Accounting Numbers.

Non applicable division and section references have been omitted.

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SECTION 01031
SPECIAL PROJECT PROCEDURES

1. GENERAL

1.1 ACCESS TO PROJECT

A. The project shall be accessible at all times to representatives of the Tennessee Department of Environment and Conservation, Tennessee Department of Transportation, South Blount County Utility District, and any other state, local, or federal regulatory agencies.

1.2 SMOKING AND FIRE PRECAUTIONS

A. No smoking, fire, or use of any fire- or explosion-producing tools or equipment will be permitted on the properties of oil companies or other concerns prohibiting same on their premises or at any locations where such may endanger said premises or the current operations thereon.

1.3 MANUFACTURERS' QUALIFICATIONS

A. The manufacturers of all materials and equipment used must be reputable and regularly engaged in the manufacture of the particular material or equipment for the use and service to which it will be subjected.

1.4 CONTRACTOR SHALL PAY FOR ALL LABORATORY INSPECTION SERVICE

A. All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Contractor and approved by the Owner. Pay for all laboratory inspection services as a part of the Contract. Submit all material test reports to the Owner in triplicate.

1.5 COMPLIANCE WITH STATE AND LOCAL LAWS

A. Comply with all applicable requirements of state and local laws and ordinances to the extent that such requirements do not conflict with federal laws or regulations.

B. The Contractor will secure any and all permits. The Owner will provide bond as required by the Tennessee Department of Transportation for the installation of permanent facilities on the highway rights-of-way.

1.6 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

A. Take special care in working areas to protect public and private property. The Contractor shall replace or repair at his own expense any damaged water pipes, power and communication lines, or other public utilities, roads, curbs, gutters, sidewalks, drain pipes, sewer drainage ditches, and all plantings, including grass or sod on the site of the work. Leave the site in original or better condition after all cleanup work has been done.

1.7 MARKERS

A. Preserve all USGS, TVA, State of Tennessee, and private markers; do not remove or disturb any such markers without prior approval from the Owner. Any removal and replacement of such markers shall be at the expense of the Contractor.

1.8 PAVEMENT REPAIR AND/OR REPLACEMENT

A. Repair and/or replace asphalt and concrete driveways, walks, parking areas, shoulders, crushed stone or gravel streets and roads, etc. damaged and/or disturbed during construction.

B. Whenever pipe trenches are cut across or along existing pavement or shoulders, backfill same and restore traffic over the cuts as quickly as possible by constructing a temporary six-inch (6") surface of crushed stone. Add material and otherwise maintain such surface until the permanent pavement is restored or until the entire project is accepted.

1.9 APPROVED CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. The use of all such chemicals and the disposal of residues shall be in strict conformance with instructions.

1.10 DRAWINGS OF RECORD

A. Provide and keep up-to-date a complete record set of record drawing prints, which shall be corrected daily to show every change, and the approved shop drawings. Keep this set of prints at the job site, and use only as a record set. This shall not be construed as authorization for the Contractor to make changes in the approved layout without definite instructions in each case. Turn the set over to the Owner upon completion of the project.

1.11 PRESERVATION OF EXISTING VEGETATION

A. Take reasonable care during construction to avoid damage to vegetation. Where the area to be excavated is occupied by trees, brush, or other uncultivated vegetable growth, clear such growth from the area, and dispose of it in a satisfactory manner. Leave undisturbed any trees, cultivated shrubs, flowers, etc., situated within public rights-of-way and/or easements through private property but not located directly within excavation limits. Transplant small ornamental trees, cultivated shrubs, flowers, etc., located directly within excavation limits so they may be replaced during property restoration operations. Do not remove or disturb any tree larger than 6 inches in diameter without the permission of the Design Engineer. Take special precautions (including the provision of barricades and the temporary tying back of shrubbery and tree branches) for the protection and preservation of such objects throughout all stages of construction; the Contractor will be held liable for any damage that may result to said objects from excavation or construction operations. Trim any limbs or branches of trees broken during construction operations with a clean cut, and paint with an approved tree

pruning compound. Treat tree trunks receiving damage from equipment with a tree dressing.

1.12 UTILITIES

A. The Contractor is to contact the Owner of all underground utilities before beginning construction in the area. Carefully protect from damage all utilities in the vicinity of the work at all times. If it is necessary to repair, remove, and/or replace any such utility in order to complete the work properly, do so in compliance with the rules and regulations of the particular utility involved. Any such work shall be considered incidental to the construction or repairs of utility lines, and no additional payment will be allowed.

1.13 CATALOG DATA FOR OWNERS

A. Provide duplicate complete, bound sets of a compilation of catalog data of each manufactured item of mechanical and electrical equipment used in the work, and present this compilation to the Design Engineer for transmittal to the Owner before payment of more than ninety-five percent (95%) is made. Include descriptive data and printed installation, operating, and maintenance instructions (including a parts list for each item of equipment). Provide a complete double index as follows.

B. Listing the products alphabetically by name.

C. Listing alphabetically the names of manufacturers whose products have been incorporated in the work, together with their addresses and the names and addresses of the local sales representative.

1.14 PRECONSTRUCTION SURVEY

A. The Contractor shall video tape existing site prior to construction. Document existing damage to structures and slopes located along project route. Preconstruction survey shall be considered incidental to the project, and no additional payment will be allowed.

1.15 PROTECTION OF LIVES AND HEALTH

A. In accordance with generally accepted construction practices, the Contractor will be solely and completely responsible for conditions at the job site, including the safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours.

B. The Contractor shall comply with the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54). The duty of the Design Engineer to conduct construction review of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the construction site, nor to relieve the Contractor of his obligation to conduct comprehensive inspection of the work sufficient to ensure conformance with the intent of the contract documents.

1.16 SAFETY AND CONVENIENCE

A. The Contractor shall do all work necessary to protect the general public from hazards, including but not limited to surface irregularities or un-ramped grade changes in pedestrian sidewalks and trenches or excavations in roadway. Barricades with warning lights, lanterns, and proper signs shall be furnished in sufficient amount to safeguard the public and the Work. All barricades and signs shall be clean and serviceable.

B. During construction, the Contractor shall construct, and at all times maintain satisfactory and substantial temporary safety fencing, chain link fencing, solid fencing, railing barricades and/or steel plates as applicable at all excavations, obstructions or other hazards in streets, sidewalks, and walkways. All such barricades shall have adequate painted or flagged markings and warning lights as necessary or required for safety.

C. The Contractor shall provide flagmen or other personnel who shall be responsible for supporting safety and local resident convenience issues.

2. PRODUCTS

NOT USED

3. EXECUTION

NOT USED

End of Section

SECTION 01050
FIELD ENGINEERING

1. GENERAL

1.1 REQUIREMENTS INCLUDED

A. Contractor shall provide field engineering services and establish grades, lines, and levels, by use of recognized engineering survey practices.

B. Control datum for survey is established by Owner-provided survey.

2. PRODUCTS

NOT USED

3. EXECUTION

3.1 INSPECTION

A. Verify locations of survey control points prior to starting work. Promptly notify Owner of any discrepancies discovered.

3.2 SURVEY REFERENCE POINTS

A. Protect survey control points prior to starting site work; preserve permanent reference points during construction. Make no changes without prior written notice to Owner.

B. Promptly report to Owner the loss or destruction of any reference point or relocation required because of changes in grades or other reasons. Replace dislocated survey control points based on original survey control.

C. The Contractor shall preserve all USGS, TVA, State of Tennessee, and private markers; do not remove or disturb any such markers without prior approval from the Owner. Any removal and replacement of such markers shall be at the expense of the Contractor. The re-establishment of these markers shall be performed by a surveyor licensed by the State of Tennessee, with a letter indicating the completion of work.

3.3 STAKING

A. The Contractor shall be responsible for staking the project and preparing cut sheets as needed.

End of Section

SECTION 01090
STANDARDS

1. GENERAL

1.1 Meet the requirements and recommendations of all Standards, Institutes, Associations, etc., referred to throughout these documents and specifications as if they were fully reproduced herein. Unless otherwise noted, the latest editions shall apply.

1.2 ABBREVIATIONS

AAMA	Architectural Aluminum Manufacturers' Association
AASHTO	American Association of State Highway and Transportation Officials
ABMA	American Boiler Manufacturers' Association
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturers' Association
AGA	American Gas Association
AGC	Association of General Contractors
AGMA	American Gear Manufacturers' Association
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ASA	American Standards Association
ASAE	American Society of Automotive Engineers
ASC	Association of Specialty Contractors
ASCII	American Standard Code for Information Interchange
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPB	American Wood Preservers Bureau
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BIA	Brick Institute of America
CMAA	Crane Manufacturer's Association of America
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards
CSI	Construction Specifications Institute
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration

FGMA	Flat Glass Marketing Association
FM	Associated Factory Mutual Laboratories
FS	Federal Specifications
IEEE	Institute of Electrical and Electronic Engineers
IRI	Industrial Risk Insurers
ISA	Instrument Society of America
JIC	Joint Industrial Council
MBMA	Metal Building Manufacturers' Association
MMA	Monorail Manufacturers' Association
NAAMM	National Association of Architectural Metal Manufacturers
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturers' Association
NFPA	National Fire Protection Association or National Forest Products Association
NKCA	National Kitchen Cabinet Association
NPT	National Pipe Thread
NRCA	National Roofing Contractors' Association
NSF	National Sanitation Foundation
NSWMA	National Solid Waste Manufacturers' Association
NWMA	National Woodwork Manufacturing Association
OSHA	Occupational Safety and Health Administration
PPI	Plastics Pipe Institute
RIS	Redwood Inspection Service
SAE	Society of Automotive Engineers
SBCC	Standard Building Code Congress
SDI	Steel Deck Institute
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPII	Southern Pine Inspection Institute
SSBC	Southern Standard Building Code
SSPC	Steel Structures Painting Council
TCA	Tile Council of America
TDOT	Tennessee Department of Transportation
TIMA	Thermal Insulation Manufacturers' Association
UL	Underwriters' Laboratories
USG	United States Gypsum
WCLIB	West Coast Lumber Inspection Bureau
WWPA	Western Wood Products Association

2. PRODUCTS

NOT USED

3. EXECUTION

NOT USED

End of Section

SECTION 01302
SUBMITTALS AND SUBSTITUTIONS

1. GENERAL

1.1 SUMMARY

A. Work Included

1. Wherever possible throughout the contract documents, the minimum acceptable quality of workmanship and materials has been defined by a manufacturer's name and catalogue number, reference to recognized industry and government standards, or description of required attributes and performance.
2. To ensure that the specified products are furnished and installed in accordance with the design intent, procedures have been established for advance submittal of design data and for their review by the Owner.
3. Make all submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements.

B. Related Work Described Elsewhere

1. Individual requirements for submittals are described in other pertinent sections of these specifications.

1.2 SUBMITTALS

A. Identification of Submittals

1. General: Consecutively number all submittals.
2. Internal Identification: On at least the first page of each copy of each submittal, clearly indicate the submittal number in which the item was included.
3. Resubmittals: When material is resubmitted for any reason, transmit under a new letter of transmittal utilizing the original submittal number followed by an A, B, C, etc., depending on the number of resubmittals of the original submittal required.

B. Shop Drawings and Coordination of Drawings

1. Deliver or mail all submittals to:

South Blount County Utility District
320 Partnership Parkway
Maryville, TN 37801

Attention: A.L. Scott, District Manager
Telephone: (865) 982-3560

3. Make submittals in strict accordance with the provisions of this section.

1.1 QUALITY ASSURANCE

A. Coordination of Submittals

1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted, and verify that each item and the submittal for it conforms in all respects with the requirements of the bidding instruments.
2. Shop drawings and submittals shall bear the stamp of approval of the Contractor as evidence that this coordination has been performed.

1.4 SUBMITTAL SCHEDULE

A. Timing Of Submittals

1. General:
   A. Make all submittals far enough in advance of scheduled dates for installation to provide all time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.
   B. Submit shop drawings in accordance with the approved schedule of shop drawing submittals.
2. Owner's Review Time: In scheduling, allow at least 20 calendar days for review by the Owner following his receipt of the submittal.
3. Delays: Delays caused by tardiness in receipt of submittals will not be an acceptable basis for extension of the contract completion date.

1.5 SUBSTITUTIONS

A. Approval Required

1. The contract is based on the standards of quality established in the contract documents.
2. All products proposed for use, including those specified by required attributes and performance shall require approval by the Owner before being incorporated into the work.
3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by the Owner.

B. "Or Equal"

1. Where the phrase "or equal" or "or approved equal" occurs in the contract documents do not assume that materials, equipment, or methods will be approved as equal unless the item has been specifically approved for this work by the Owner.
2. The decision of the Owner shall be final.
3. See pertinent portions of the contract documents for additional information relating to substitutions.

2. PRODUCTS

NOT USED

3. EXECUTION

NOT USED

End of Section

SECTION 01400
QUALITY CONTROL

1. GENERAL

1.1 REQUIREMENTS INCLUDED

A. General Quality Control.

1. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship; to produce work of specified quality.

B. Workmanship.

1. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
2. Perform work by persons qualified to produce workmanship of specified quality.
3. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

C. Manufacturers' Instructions.

1. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with contract documents, request clarification from Owner before proceeding.

D. Manufacturers' Certificates.

1. When required by individual specifications section, submit manufacturers' certificate, in duplicate, that products meet or exceed specified requirements.

E. Manufacturers' Field Services.

1. When specified in respective specification sections, require supplier or manufacturer to provide qualified personnel to observe field conditions; conditions of surfaces and installation; quality of workmanship; start-up of equipment; test, adjust, and balance of equipment; and as applicable, to make appropriate recommendations.
2. A representative shall submit a written report to Owner listing observations and recommendations.

F. Testing Laboratory Services.

1. Contractor shall employ and pay for services of an Independent Testing Laboratory to perform inspections, tests, and other services required by individual specification sections.
2. Services will be performed in accordance with requirements of governing authorities and with specified standards.

3. Reports will be submitted to Owner in duplicate giving observations and results of tests, indicating compliance or non-compliance with specified standards and with contract documents.
4. Contractor shall cooperate with testing laboratory personnel, furnish tools, samples of materials, design mix, equipment, storage, and assistance as requested.

    a. Notify Owner and testing laboratory 24 hours prior to expected time for operations requiring testing services.
    b. Make arrangements with testing laboratory and pay for additional samples and tests for Contractors' convenience.

2. PRODUCTS

NOT USED

3. EXECUTION

NOT USED

End of Section

SECTION 01568
EROSION CONTROL

1. GENERAL

1.1 DESCRIPTION

A. This work shall consist of erosion control on all cut and fill operations, excavation, backfill, or other construction activities within the limits of the construction site, within any temporary or permanent easements, and within any borrow site used during the period of construction. The protection of these sites shall continue throughout the construction period. During flood seasons, protect the sites by sandbagging, pumping water, and any other means appropriate to restrain flooding of neighboring streets and properties. During dry weather, sprinkle the sites with water and/or other means as necessary to provide dust control.

B. The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control features, to ensure economical, effective, and continuous erosion control throughout the construction and post-construction period.

C. It is the intent of this section to provide a written plan to ensure that PL 100-4, Section 319, TCA 69-3-101, et. Seg., Subsection 69-3-108 and Subsection 69-3-114, and Division of Construction Grants and Loans General Permit for Utility Line Crossings, Chapter 1200-4-7.09 are met. Since the Contractor is responsible for the construction means and methods which in turn are responsible for ensuring that construction does not harm the Waters of Tennessee, the Contractor is solely responsible for ensuring that the above-mentioned laws and regulations are met. **It shall be the CONTRACTOR'S sole responsibility for payment of any fines or penalties South Blount County Utility District may receive as a result of Tennessee Department of Environment and Conservation (TDEC) enforcement due to a notice of noncompliance.**

D. Blount County Grading Permit, issued by the Blount County Stormwater Department, is required. If the land activity is equal to or greater than one tenth (1/10) of one acre in size, an engineer designed erosion control plan must be submitted with the application. Grading permit must be issued prior to any land disturbing activity. Also note, a permit will be required from the Tennessee Department of Environment and Conservation (TDEC) prior to release of the Blount County Grading Permit for land activity equal or greater than one (1.0) acre in size.

2. PRODUCTS

2.1 TEMPORARY BERMS

A. These berms are used temporarily at the top or base of newly constructed slopes to prevent excessive erosion until permanent controls are installed or slopes stabilized.

2.2 TEMPORARY SLOPE DRAINS

A. A temporary slope drain is a facility consisting of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half round pipe, metal pipe, plastic pipe, sod, or other material that may be used to carry water down slopes to reduce erosion.

2.3 SEDIMENT STRUCTURES

A. Sediment basins, ponds, and traps are prepared storage areas constructed to trap and store sediment from erodible areas in order to protect properties and stream channels below the construction areas from excessive siltation.

2.4 CHECK DAMS

A. Check dams are barriers composed of large stones, sand bags, or other noncorrodible materials placed across or partially crossing a natural or constructed drainway.

2.5 CHECK DAM (ALTERNATE): ENVIROBERM SYNTHETIC POROUS SEDIMENT CONTROL STRUCURES

A. EnviroBerm Synthetic Porous Sediment Control Structures are barriers composed of synthetic porous material placed across or partially crossing a natural or constructed drainway.

2.6 TEMPORARY SEEDING AND MULCHING

A. Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce siltation and erosion. All cut and fill slopes including waste sites and borrow pits shall be seeded when and where necessary to eliminate erosion.

2.7 BALED HAY

A. Baled hay is a temporary measure to control erosion and prevent siltation. Bales shall be either hay or straw containing 5 cubic feet or more of material. Bales shall be staked.

2.8 TEMPORARY SILT FENCES

A. Silt fences are temporary sediment barriers consisting of a filter fabric stretched across and attached to supporting posts and entrenched. The silt fence is constructed of synthetic filter fabric, posts, and depending upon the strength of the fabric used, wire fence for support. The filter barrier is constructed of stakes and burlap or synthetic filter fabric.

2.9 TEMPORARY CONSTRUCTION ENTRANCE

A. A temporary construction entrance consisting of crushed stone with a geotextile filter fabric underlining is utilized to reduce or eliminate tracking of material by construction vehicles onto public streets.

2.10 TEMPORARY INLET PROTECTION

A. Temporary inlet protection consisting of washed stone, filter fabric, wire mesh, and concrete blocks is utilized to prevent sediment from entering the storm drainage system, prior to temporary or permanent stabilization of the construction area.

2.11 RIP-RAP APRON

A. A rip-rap apron consisting of large, loose, angular stone with a geotextile filter fabric underlining is utilized to reduce stormwater velocity and dissipate the energy of flow leaving a storm drain before it empties into receiving channels, and to armor erodible materials.

2.12 PERMANENT SEEDING AND MULCHING

A. Permanent seeding and mulching are measures consisting of seeding, mulching, fertilizing, hydroseeding, and matting utilized to reduce siltation and erosion. All disturbed areas shall be stabilized upon completion of construction operations.

3. EXECUTION

3.1 PROJECT REVIEW

A. It is the responsibility of the Contractor to prepare an approved Stormwater Pollution Prevention Plan (SWPPP) and to develop additional erosion controls as necessary that are acceptable to the Owner and to applicable regulatory agencies. If at any time the Owner deems it necessary, the Contractor shall provide additional erosion devices. The site shall be provided with maximum protection from erosion at all times.

B. If the Contractor desires to stockpile construction materials, stone, earth, etc., the location of same and the protection thereof shall be defined and incorporated into the SWPPP and Blount County Grading Permit application.

3.2 CONSTRUCTION REQUIREMENTS

A. In the event of conflict between these requirements and pollution control laws, rules or regulations, or other Federal, State, or Local agencies, the more restrictive laws, rules, or regulations shall apply.

B. In streets and other paved areas, remove excavated material from the site as construction progresses to prevent any erosion of this material.

C. In other areas, place the excavated material so as not to block any drainage areas. Replace excavated material in the trench immediately after work has been completed and approved by the Owner.

D. Retain natural vegetation whenever feasible.

E. Restore and cover exposed areas subject to erosion as quickly as possible by means of seeding and mulching. Use diversion ditches or other methods as appropriate to prevent storm water from running over the exposed area until seeding is established as specified. Erosion control matting may be necessary as required by the Owner.

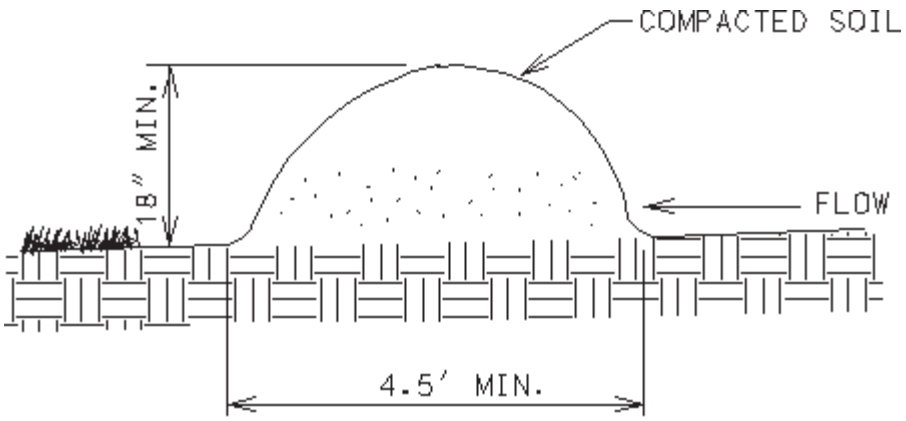
F. Take particular care along drainage ditches so that fallen trees, debris, and excavated material will not adversely affect the stream flow. Exercise care to minimize the destruction of drainage ditches. Wherever the drainage ditches are affected by construction, the contractor must repair the drainage ditches to provide a suitable condition for vegetative protection. Minimize land exposure in terms of area and time.

G. Take care during the placing of pavement, hauling of materials, etc., to keep vehicles from creating a severe erosion problem. Proper scheduling of operations and prompt repair of ruts created during this operation is necessary from this source.

3.3 CONSTRUCTION OF STRUCTURES

A. Temporary Berm (See Figure 1)

1. The maximum allowable drainage area is 5 acres.
2. The minimum allowable height measured from the upslope side of the berm is 18 inches.
3. Side slopes should be 1.5:1 or flatter. (Minimum base width of 4.5 feet).
4. The channel behind the berm shall have a positive grade to a stabilized outlet. If the channel slope is less than or equal to 2 percent, the channel shall be stabilized.



NOTE:

1. SIDE SLOPES SHALL BE 1.5:1 OR FLATTER.

Figure 1 (Temporary Berm)

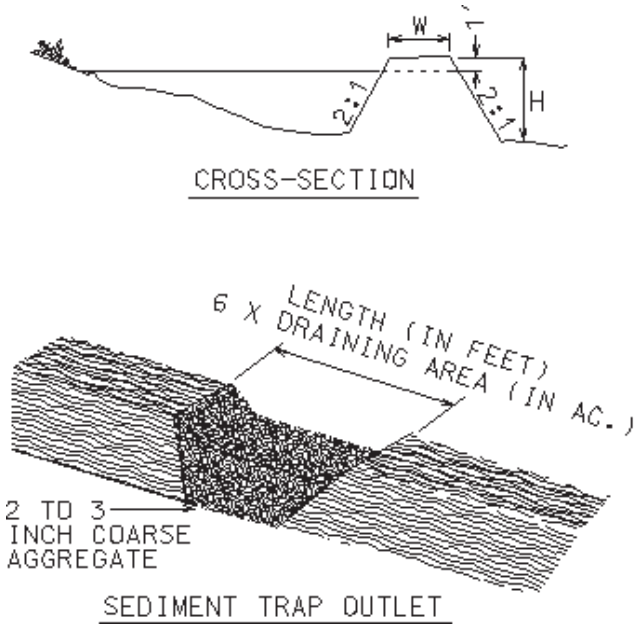
B. Temporary Slope Drains

1. Temporary slope drains shall consist of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half round pipe, metal pipe, plastic pipe, flexible rubber, or other materials which can be used as temporary measures to carry water accumulating in the cuts and on the fills down the slopes prior to installation of permanent facilities or growth of adequate ground cover on the slopes.
2. Plastic sheeting shall not be used on slopes steeper than 4:1 except for short distances of 20 feet or less.
3. All temporary slope drains shall be adequately anchored to the slope to prevent disruption by the force of the water flowing in the drains. The base for temporary slope drains shall be compacted and concavely formed to channel the water or hold the slope drain in place. The inlet end shall be properly constructed to channel water into the temporary slope drain. Energy dissipaters, sediment basins, or other approved devices shall be constructed at the outlet end of the slope drains to reduce erosion downstream. An ideal dissipater would be dumped rock or a small sediment basin which would slow the water as well as pick up some sediment. All temporary slope drains shall be removed when no longer necessary.

C. Sediment Structures (See Figure 2)

1. The area under the embankment shall be cleared, grubbed, and stripped of any vegetation and root mat. To facilitate cleanout the pool area should be cleared.

2. Fill material for the embankment shall be free of roots or other woody vegetation, organic material, large stones, and other objectionable material. The embankment should be compacted in 8-inch layers by traversing with construction equipment.
3. Construction operations shall be carried out in such a manner that erosion and water pollution are minimized.
4. The structure shall be removed and the area stabilized when the upslope drainage has been stabilized.
5. All cut and fill slopes shall be 2:1 or flatter.



EMBANKMENT DIMENSIONS

H (FT)	W (FT)
1.5	2.0
2.0	2.0
2.5	2.5
3.0	2.5
3.5	3.0
4.0	3.0
4.5	4.0
5.0	4.5

NOTES:

1. MAXIMUM HEIGHT. "H", IS 5 FEET.
2. POOL VOLUME MUST NOT EXCEED 67 CUBIC YARDS/ACRE.

Figure 2 (Sediment Structure)

D. Check Dams

1. Check dams shall be utilized to retard stream flow or restrict stream flow within the channel. Check dams can be constructed of stone.
   A. All check dams shall be keyed into the sides and bottom of the channel. The contractor shall see the design plans for further information regarding installation and placement.

E. Check Dam (Alternate): EnviroBerm Synthetic Porous Sediment Control Structures

1. All materials to be used in the construction of synthetic porous sediment control structures shall meet the following specifications:

Synthetic Porous Sediment Control Structures:

Polymer:	UV Resistant High Density Polyethylene
Size:	10 in high x 43 in long with a 2 in lip
Single Rib Thickness:	Top: 5/32 in Bottom: 5/32 in
Distance Between Ribs:	Top: 1/2 in Bottom: 1/2 in
Apparent Opening Size (AOS):	US Sieve No.4 (Average Value)
Percent Open Area:	30% (Average Value)
Weight:	3.70 lb/yd^2
Tensile Strength:	MD = 1800 lb/ft TD = 500lb/ft

Tensile Strength Method:	ASTM D4595
Velocity Reductions: *	10% to 74%
Kinetic Energy Reduction: *	40% to 85%

* Based on test results with various velocities and volumes:
T. Blench Hydraulics Laboratory, University of Alberta, Department of Civil and Environmental Owning

"M" Pins:	Regular:	Heavy Duty:
Size:	3 in x 27 in	3 in x 21 in
Product:	Deformed D 3.5 Rod	Deformed D 4.5 Rod
Diameter:	.211 in	.240 in
Tensile Strength:	80000 psi	80000 psi
Grade:	C1008	C1008

Erosion Matting:

(AS SPECIFIED ON PLANS)

1. The Contractor shall construct synthetic porous sediment control structures at the locations and spacings as shown on the Plans. When required, additional structures shall be constructed as directed by the Owner.

2. Synthetic Porous Sediment Control Structures shall be of the type specified, constructed to the specifications shown on the drawings and as directed by the Owner. The Control Structures shall be placed perpendicular to the direction of water flow.

3. Porous Sediment Control Structures shall be constructed of two panels of high density, extruded UV resistant polyethylene pinned down with "M" pins in a single row complete with a biodegradable or permanent erosion control matting on the underside.

4. Each synthetic porous sediment control structure shall comprise a central portion forming a horizontal porous weir and two inclined portions which extend from the weir up the embankment and the backslope as shown on the drawing. The structures shall have the capability to shape to the contour of the channel bottom and side slopes to ensure firm contact between the

entire bottoms of the structures and the soil. No breach shall occur along the integrity of the structure.

5. The anchoring system shall be able to endure minimum flow rates as set by the Owner. To validate specified flow rates; the Contractor shall supply a certificate from the supplier of actual field test results. The performance of the Porous Sediment Control Structures integrity shall endure freeze thaw cycles without failure; as per specified geographical areas.

6. Installation (See Figure 3)
   A. Panel Spacing: As specified on plans
   B. Starting at the top of the channel, mark each sediment control structure site with a stake.
   C. Seed the soil area were structures are to be placed. Lay an erosion mat strip across ditch at each sediment structure site. The mat should extend up the sideslope and backslope the length of the panel.
   D. Trench in the upstream edge of the mat about 4 inches deep. Staple the mat in the trench with 8-inch staples, placed about 12 inches apart. Manually backfill and compact the trench.
   E. Staple the other edge of the mat to the ground with 8-inch staples, approx. 12 inches apart.
   F. Starting at either the toe of the backslope or sideslope, place the porous panel strips on the bottom of the ditch along the center of the erosion mat. Place the spacing guide along the ground between the panels. The bottom panel lips should face outward.
   G. Put an M pin in the installation tool, place the pin over the panels about half way down the strips, (in the middle), so a pin leg is against the outside of each panel, and drive the pin through the panel lips into the ground. The panels should be wedged into the M pins at the top and ensure firm contact between the entire bottoms of the Porous Sediment Control Structure and the soil. Pull the installation tool off the installed pin.
   H. From the installed panel, extend a second pair of panels, overlapping the first panels at the toe a minimum of 2 inches up the side or backslope. Place the next 'M' pin over both sets of panels at the toe, and drive the pin into the ground with the installation tool and ensure firm contact between the entire bottoms of the Porous Sediment Control Structure and the soil.
   I. Install the next pins in the middle and at the upper end of the second set of panels, again using both the spacing strip and the driving tool. Third panel set is placed, extending across the ditch from the first installed panels, overlapped a minimum of 2 inches and the next pin placed at the overlap.
   J. This sequence is continued until the sediment structure is installed and firm contact between the entire bottoms of the Porous Sediment Control Structure and the soil are established. The last panel installed is the one extending up the opposite slope from the starting panels. No breach shall occur along the integrity of the structure.

K. This sequence is continued until the sediment structure is installed and firm contact between the entire bottoms of the Porous Sediment Control Structure and the soil are established. The last panel installed is the one extending up the opposite slope from the starting panels. No breach shall occur along the integrity of the structure.

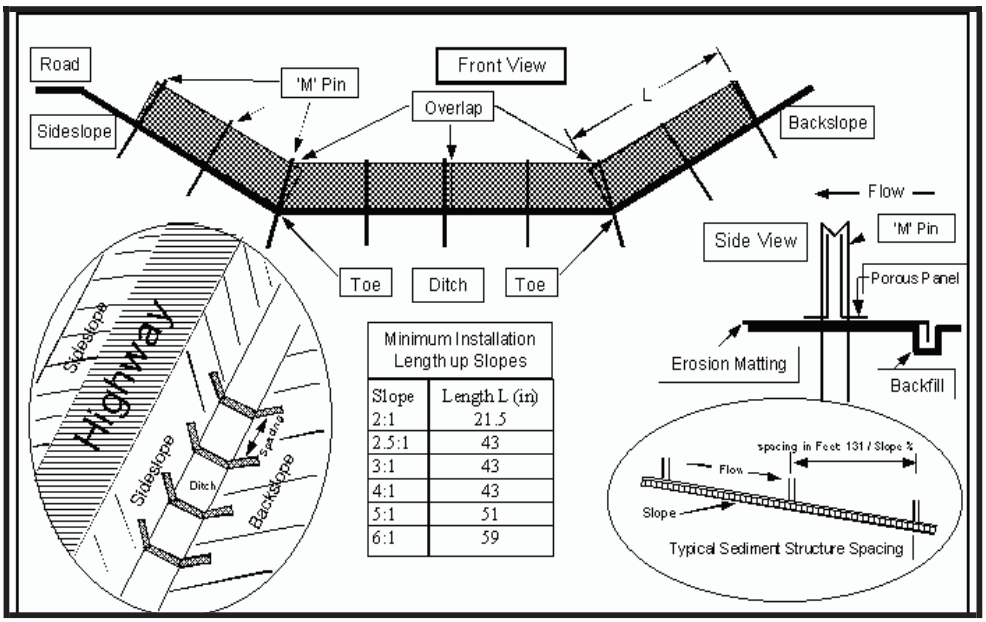


Figure 3 (EnviroBerm Porous Sediment Control Structure)

7. Maintenance

A. Silt deposited in front of the sediment control structures shall be removed regularly and at no time shall it be allowed to build up to a height exceeding half the height of the structure.

F. Temporary Seeding and Mulching: Seeding and mulching shall be performed in accordance with section 02485, Seeding.

G. Baled Hay: Hay or straw bales shall be embedded in the ground 4 to 6 inches to prevent water flowing under them. The bales shall also be anchored securely to the ground by at least two wooden stakes driven through each bale into the ground. Bales can remain in place until they rot, or be removed after they have served their purpose, as determined by the Owner. The Contractor shall keep the bales in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris cleanout will be considered maintenance.

H. Temporary Silt Fences

1. Temporary silt fences shall be placed on the natural ground, at the bottom of fill slopes, in ditches, or other areas where siltation is a problem.
2. Synthetic filter fabric shall be a pervious sheet of propylene, nylon, and polyester or ethylene yarn and shall be certified by the manufacturer or supplier.
3. Burlap shall be 10-ounce per square yard fabric.
4. Posts for silt fences shall be either 2-inch by 2-inch diameter wood or 1.33 pounds per linear foot steel with a minimum length of 4 feet. Steel posts shall have projections for fastening wire to them.
5. Stakes for filter barriers shall be 1" x 2" wood (preferred) or equivalent metal with minimum length of 3 feet.
6. Wire fence reinforcement for silt fences using standard strength filter cloth shall be a minimum of 42 inches in height, a minimum of 14 gauge and shall have a maximum mesh spacing of 6 inches.
7. The height of a filter barrier shall be a minimum of 24 inches and shall not exceed 26 inches.
8. The stakes shall be spaced a maximum of 3 feet apart at the barrier location and driven securely into the ground (minimum of 8 inches).
9. A trench shall be excavated approximately 4 inches wide and 4 inches deep along the line of stakes and upslope from the barrier.
10. The filter material shall be stapled to the wooden stakes, and 8 inches of the fabric shall be extended into the trench. Heavy duty wire staples at least ½ inch long shall be used. Filter material shall not be stapled to existing trees.
11. The trench shall be backfilled and the soil compacted over the filter material.
12. The Contractor shall be required to maintain the silt fence in a satisfactory condition for the duration of the project or until its removal is requested by the Owner. The silt accumulation at the fence may be left in place and seeded, removed, etc., as directed by the Owner. The silt fence becomes the property of the Contractor whenever the fence is removed.

I. Temporary Construction Entrance

1. Crushed stone shall be 2" to 3" (TDOT #1 or #2) with a minimum pad thickness of 6".
2. The width of the temporary construction entrance shall be 20 ft. for one-way traffic and 30 ft. for two-way traffic.
3. The geotextile filter fabric underlining must be placed the full length and width of the crushed stone pad.
4. If the action of the vehicle traveling over the crushed stone pad does not sufficiently remove the material, the tires shall be washed before entering onto public streets. A wash rack shall be incorporated into the crushed stone pad and be in compliance with all TDEC standards.

J. Temporary Inlet Protection

1. Crushed stone shall be ¾" to 3" (TDOT #3, #357, or #5) up to 2" below top of concrete block.
2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward.

K. Rip-Rap Apron: Rip-rap aprons shall be utilized to reduce stormwater velocity and dissipate the energy of flow leaving a storm drain before it empties into receiving channels, and to armor erodible materials

a. The contractor shall see the design plans for further information regarding installation and placement.

L. Permanent Seeding and Mulching: Seeding and mulching shall be performed in accordance with section 02485, Seeding.

3.4 MAINTENANCE

A. The temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. The temporary erosion control materials shall be moved and become the property of the Contractor.

B. As described in the SWPPP, the Contractor shall inspect the erosion control measures weekly and as required due to upcoming rain events and after recent rain events. The Contractor shall maintain all records of inspections and improvements as required.

3.5 EROSION CONTROL OUTSIDE PROJECT AREA

A. Temporary pollution control shall include construction work outside the project area where such work is necessary as a result of construction such as borrow pit operations, haul roads, and equipment storage sites.

End of Section

SECTION 01570
WORK ZONE TRAFFIC CONTROL

1. GENERAL

1.1 The Work to be performed shall consist of providing, installing, maintaining, relocating, and removing temporary traffic control devices and services as ordered by the traffic control plan (TCP) and as required for the control and protection of public traffic through the Project work zone.

1.2 Notification of the Work commence date and application for permission from the governing body having jurisdiction over the right-of-way is the responsibility of the Contractor.

1.3 The Work to be performed under this Section will conform to Part VI of the Manual on Uniform Traffic Control Devices (MUTCD) and shall be subject to local codes, policies, and regulations of the agency having jurisdiction over the area where the Work is performed.

1.4 If the Work is contained within a Tennessee Department of Transportation (TDOT) right of way, a traffic control plan shall be submitted for approval by TDOT.

2. PRODUCTS

2.1 All signage, channeling devices, arrow displays, lighting devices, and other traffic control devices shall conform to the design requirements contained in the MUTCD which specifically govern such features as size, contrast, colors, shape, composition, use of symbols, etc. Use of "homemade" or contractor-fabricated devices are prohibited.

3. EXECUTION

3.1 TRAFFIC CONTROL PLAN (TCP)

A. The Contractor shall submit the TCP along with a request for approval noting the date of proposed construction and the duration to the agency having jurisdiction.

B. The Contractor shall obtain any and all necessary permits required for performance and execution of the TCP in coordination with the appropriate agencies.

C. The Contractor shall install and maintain temporary traffic control devices adjacent to and within the Project work zone in accordance with the approved TCP and the MUTCD. Installation of the traffic control devices shall proceed in accordance with MUTCD phasing and shall be performed prior to the start of construction operations.

3.2 TRAFFIC CONTROL DEVICES (TCD)

A. Furnish and place Traffic Control Devices before the start of construction operations.

B. Install only those Traffic Control Devices needed for each stage or phase of construction as required by the TCP and the MUTCD.

C. Relocate temporary or permanent Traffic Control Devices as required by the phasing of the Work. Remove devices that no longer apply to the Work in progress. Temporarily cover signs when they are not applicable to current conditions.

D. Immediately clean, service, or replace any Traffic Control Device that is defaced, damaged, or when its retro reflectivity is reduced by 50% due to fading, dirt, etc. Keep all temporary Traffic Control Devices clean and serviceable.

E. If required by the work in progress, maintain Traffic Control Devices 24 hours a day with adequate barricades, lights, arrows, etc. to protect the public from traffic hazards and accidents.

F. Use flares and/or lights during times of low visibility to delineate traffic lanes and to guide traffic.

G. Remove all temporary Traffic Control Devices upon completion of the Work and repair all damage caused by their installation.

3.3 CONSTRUCTION PARKING CONTROL

A. Control parking of construction personnel's vehicles and construction equipment to prevent interference with public traffic and public access to private drives, parking areas, sidewalks, residences, etc.

B. Prevent parking on or adjacent to side streets or in non-designated areas. The Contractor at his expense will repair vehicle damage caused by the Contractor or his personnel to residential or private property.

C. Schedule and coordinate delivery and off-loading of materials so as to not interfere with traffic outside of the Contractor's designated work zone or storage yard.

3.4 FLAGMEN

A. When the TCP requires, provide flagmen or traffic control officers who are trained and equipped in accordance with the requirements of Part VI of the MUTCD.

B. Flaggers shall use Type III or Type IV retro reflective Stop/Slow paddles. Use of flags is prohibited unless it is an emergency situation in low-speed, low-volume locations which can best be controlled by a single flagger.

C. The flagger or traffic control officer shall wear a retro reflective vest at all times during traffic control operations.

D. Flaggers shall maintain sight visibility of each other at all times during traffic control operations or shall communicate utilizing radio devices.

End of Section

SECTION 01600
MATERIAL AND EQUIPMENT

1. GENERAL

1.1 REQUIREMENTS INCLUDED

A. Products.

B. Transportation and Handling.

C. Storage and Protection.

D. Product Options.

E. Products List.

F. Substitutions.

G. Systems Demonstration.

1.2 QUALITY ASSURANCE

A. Approval Required

1. The contract is based on the standards of quality established in the contract documents.
2. All products proposed for use, including those specified by required attributes and performance, shall require approval by the Owner before being incorporated into the work.
3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by the Owner.

B. "Or Equal"

1. Where the phrase "or equal" or "or approved equal" occurs in the contract documents do not assume that materials, equipment, or methods will be approved as equal unless the item has been specifically approved for this work by the Owner.
2. The decision of the Owner shall be final.
3. See pertinent portions of the contract documents for additional information relating to substitutions.

1.3 PRODUCTS

A. Products include material, equipment, and systems.

B. Comply with specifications and referenced standards as minimum requirements.

C. Components required to be supplied in quantity within a specification section shall be the same, and shall be interchangeable.

1.4 TRANSPORTATION AND HANDLING

A. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.

C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

1.5 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.

B. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

C. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

D. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

1.6 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards.

B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not specifically named.

C. Products Specified by Naming Several Manufacturers: Products of named manufacturers meeting specifications: No options, no substitutions allowed.

D. Products Specified by Naming Only One Manufacturer: No options, no substitutions allowed.

1.7 PRODUCTS LIST

A. Submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1.8 SUBSTITUTIONS

A. Concurrent with submission of product list, the Owner will consider requests from Contractor for substitutions. Subsequently, substitutions will be considered only when a product becomes unavailable due to no fault of Contractor. Confirmation of unavailable products must be in writing and certified by the manufacturer that the product is no longer available.

B. Submit separate request for each substitution. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

C. Request for substitution constitutes a representation that Contractor:

1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
2. Will provide the same warranty for substitution as for specified product.
3. Will coordinate installation and make other changes which may be required for work to be complete in all respects.
4. Waives claims for additional costs which may subsequently become apparent.

D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals. Separate written request must be submitted for any proposed substitutions or deviation from the contract documents.

E. Owner will determine acceptability of proposed substitution, and will notify Contractor of acceptance or rejection in writing within a reasonable time.

F. Substitute products shall not be ordered or installed without written acceptance.

G. Only one request for substitution will be considered for each product. When substitution is not accepted, provide specified product.

H. Owner will determine acceptability of substitutions.

1.9 SUBMITTAL PROCEDURES

A. Owner will review Contractor's requests for substitutions with reasonable promptness.

B. Upon proper submission, Owner will notify Contractor, in writing, of decision to accept or reject requested substitution within 15 days.

C. For accepted products, submit shop drawings, product data, and samples under provisions of Section 01302 - Submittals and Substitutions.

2. PRODUCTS

NOT USED

3. EXECUTION

NOT USED

End of Section

SECTION 01710
CLEANING

1. GENERAL

1.1 DESCRIPTION

A. Work Included: Throughout the construction period, maintain the site in a standard of cleanliness as described in this section.

B. Related Work Described Elsewhere: In addition to standards described in this section, comply with all requirements for cleaning up as described in various other sections of these specifications.

1.2 QUALITY ASSURANCE

A. Inspection: Conduct inspection daily, and more often if necessary, to verify that requirements for cleanliness are being met.

B. Codes and Standards: In addition to the standards described in this section, comply with all pertinent requirements of government agencies having jurisdiction.

2. PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT

A. Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

3. EXECUTION

3.1 PROGRESS CLEANING

A. General:
   1. Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
   2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for the construction of this work.
   3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
   4. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
2. Weekly, and more often if necessary, inspect all arrangements of materials stored on the site. Restack, tidy, or otherwise service all arrangements to meet the requirements of paragraph 3.1.A.1, above.
3. Maintain the site in a neat and orderly condition at all times.

3.2 FINAL CLEANING

A. Definition: Except as otherwise specifically provided, "clean" (for the purpose of all paragraphs under paragraph 3.2 shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

B. General: Prior to the completion of the work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described under paragraph 3.1, above.

C. Site: Unless otherwise specifically directed by the Owner, broom clean all paved areas on the site and all public paved areas directly adjacent to the site. Completely remove all resultant debris.

D. Timing: Schedule final cleaning as approved by the Owner to accept a completely clean project.

End of Section

SECTION 01720
PROJECT RECORD DOCUMENTS

1. GENERAL

1.1 REQUIREMENTS INCLUDED

A. Maintenance of Record Documents and Samples.

B. Submittal of Record Documents and Samples.

1.2 RELATED REQUIREMENTS

A. Section 01302 - Submittals and Substitutions: Shop drawings, product data, and samples.

B. Individual Specifications Sections: Manufacturer's certificates and certificates of inspection.

1.3 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Maintain at the site for Owner one record copy of:
   1. Contract Drawings.
   2. Specifications.
   3. Reviewed shop drawings, product data, and samples.
   4. Field test records.
   5. Inspection certificates.
   6. Manufacturer's certificates.

B. Maintain Record Documents in a clean, dry, and legible condition. Do not use Record Documents for construction purposes.

C. Keep Record Documents and samples available for inspection by Owner.

1.4 RECORDING

A. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

B. Contract Drawings and Shop Drawings: Legibly mark each item to record actual construction, including:
   1. The contractor shall submit to the Utility District Manager for review five copies of shop drawings on all products to be supplied for the project.
   2. Two reviewed copies shall be retained by the Owner, and three shall be returned to the Contractor.
   3. Resubmittals of shop drawings shall be required until the drawings are approved by the utility.
   4. Submittals shall include, but are not limited to, pipe, valves, fittings, meters, boxes, and hydrants.
   5. Any purchasing of materials prior to receiving approved shop drawings shall be at the Contractor’s own risk.

6. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
7. Field changes of dimension and detail.
8. Changes made by modifications.
9. Details not on original contract drawings.
10. References to related shop drawings and modifications.

C. Specifications: Legibly mark each item to record actual construction, including:
1. Manufacturer, trade name, and catalog number of each product actually installed, particularly optional items and substitute items.
2. Changes made by addenda and modifications.

1.5 SUBMITTALS

A. At Contract closeout, deliver Record Documents and samples to Owner.

B. Transmit with cover letter in duplicate, listing:
1. Date.
2. Project title and number.
3. Contractor's name, address, and telephone number.
4. Number and title of each Record Document.
5. Signature of Contractor or authorized representative.

2. PRODUCTS

NOT USED

3. EXECUTION

NOT USED

End of Section

SECTION 02110
CLEARING AND GRUBBING

1. GENERAL

1.1 This work consists of clearing, grubbing, removing, and disposing of all debris and of all vegetation, buildings, and foundations not removed by others that are within the designated construction areas. The work shall also include preserving and protecting from injury or defacement all vegetation and objects designated to remain.

1.2 The contractor shall work only in the areas designated on the plans. No vegetation shall be destroyed outside the limits of the work.

2. PRODUCTS

NOT USED

3. EXECUTION

3.1 The Contractor is solely responsible for the removal, hauling, and disposal of waste material. Completely dispose of all materials resulting from clearing and grubbing off the site, all at the Contractor's expense. The Owner shall not be liable for the improper disposal of waste material.

3.2 Secure in writing any approval from a property Owner desiring disposal of debris on their private property.

End of Section

SECTION 02221
UNCLASSIFIED EXCAVATION FOR UTILITIES

1. GENERAL

1.1 The work called for by this section shall consist of clearing and grubbing, loosening, loading, removing, and disposing of, in the specified manner, all wet and dry materials (including rock) encountered that must be removed for construction purposes; furnishing, placing, and maintaining all sheeting, shoring, bracing, and timbering necessary for the proper protection and safety of the work, the workmen, the public, and adjacent property and improvements; the dewatering of trenches and other excavations; the preparation of satisfactory pipe beds; the backfilling and tamping of trenches, foundations, and other structures; the preparation of fills and embankments; the removal of unsuitable material from outside the normal limits of excavation and, where ordered by the Owner, their replacement with suitable materials; and all other grading or excavation work incidental to or necessary for the work. This work shall be performed as specified below.

2. PRODUCTS

NOT USED

3. EXECUTION

3.1 PREPARATION OF THE SITE

A. Before starting construction, remove from the work site all vegetable growth (except as hereinafter excluded), debris, and/or other objectionable matter as well as any buildings and/or other structures that the drawings and/or the Owner specifically indicate are to be removed. Dispose of this refuse material in a manner acceptable to the Owner.

B. In certain areas it may be desirable for existing trees, shrubs, or other vegetation on the site to be preserved for the permanent landscape. Such vegetation may be shown on the drawings, specifically listed in the specifications, marked on the site, or identified by the Owner. In no case damage or remove such growth without written permission from the Owner.

C. If the area to be excavated is occupied by trees, brush, or other vegetable growth, clear such growth and grub the excavated area, and remove all large roots to a depth of not less than 2 feet below the bottom of the proposed construction. Dispose of the growth removed in a manner satisfactory to the Owner. Fill all holes or cavities created during this work that extend below the subgrade elevation with suitable material and compact to the same density as the surrounding material.

D. Trees, cultivated shrubs, etc., that are situated within public rights-of-way and/or construction easements through private property but not directly within the excavation area shall remain undisturbed unless it is necessary to remove them so that the work can be performed safely and unless their removal is specifically ordered by the Owner. Take special precautions to protect and preserve such growth throughout all stages of the construction.

E. Preparation of the site shall be considered an integral part of the excavation and one for which no separate payment shall be allowed.

3.2 UNSUITABLE MATERIALS

A. Wherever muck, quicksand, soft clay, swampy ground, or other material unsuitable for foundations, subgrade, or backfilling is encountered, remove it and continue excavation until suitable material is encountered. The material removed shall be disposed of in the manner described below. Then refill the areas excavated for this reason with 1- to 2-inches crushed stone up to the level of the lines, grades, and/or cross sections shown on the drawings. The top 6 inches of this refill shall be Class A, Grade D aggregate crushed stone for bedding.

3.3 ROCKS AND BOULDERS

A. Should rock be encountered in the excavation, remove it by blasting or otherwise. Where blasts are made, cover the excavation with enough excavation material and/or timber or steel matting to prevent danger to life and property. The Contractor shall secure, at his own expense, all permits required by law for blasting operations and the additional hazard insurance required. Observe all applicable laws and ordinances pertaining to blasting operations.

B. Excavate rock over the horizontal limits of excavation and to a depth of not less than 6 inches below the outside bottom of pipe up to 30 inches in diameter and not less than 12 inches below the outside bottom of larger pipes if rock extends to such depth. Then backfill the space below grade with Class A, Grade D aggregate or other approved material, tamp to the proper grade, and make ready for construction. For monolithic concrete sewers or culverts and for structures, excavate rock to the outside bottom of the structure or sewer.

3.4 DISPOSAL OF MATERIALS

A. Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the drawings or directed by the Owner shall be used for these purposes. Any materials not so used shall be considered waste materials and disposed of at the Contractor's expense.

B. Waste materials may be deposited in spoil areas at locations approved by the Owner. Do not leave in unsightly piles but instead spread in uniform layers, neatly level, and shape to drain. Seed as specified in Section 02485 - Seeding.

C. Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of that work. Leave the surface of the work in a neat, workmanlike condition, as described below.

D. The disposal of waste materials shall be considered an integral part of the excavation work and one for which no separate payment shall be allowed.

3.5 EXCAVATION FOR TRENCHES, MANHOLES, AND STRUCTURES

A. Unclassified excavation for pipelines shall consist of the excavation necessary for the construction of water, sewer, and other pipes and their appurtenances (including manholes, inlets, outlets, headwalls, collars, concrete saddles, and pipe protection) that are called for by the drawings. It shall include clearing and grubbing where necessary, backfilling and tamping pipe trenches and around structures, and disposing of waste materials; all of which shall conform to the applicable provisions set forth elsewhere in these specifications.

B. The Contractor may, if he chooses, use a motor powered trenching machine. If he does; however, he shall be fully responsible for the preservation or repair of existing utilities.

C. Unless the construction of lines by tunneling, jacking, or boring is called for by the drawings or specifically authorized by the Owner, make excavation for pipelines in open cut and true to the lines and grades shown on the drawings or established by the Owner on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed, but shall not be more than the distance determined by the following formula: 4/3d + 15 inches, where "d" represents the internal diameter of the pipe in inches. When approved in writing by the Owner, the banks of trenches from the ground surface down to a depth not closer than 1 foot above the top of the pipe may be excavated to nonvertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula 4/3d + 15 inches shall be at the expense of the Contractor and may be cause for the Owner to require that stronger pipe and/or a higher class of bedding be used at no cost to the Owner.

D. Shape the bottom of all trenches to provide uniform bearing for the bottom of the pipe barrel.

E. Excavate bell holes for bell and spigot pipe at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper jointing of the pipe. Do not excavate bell holes more than two joints ahead of pipe laying.

F. Excavation for manholes, inlets, and other incidental structures shall not be greater in horizontal area than that required to allow a 2-foot clearance between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings. No earth backfilling will be permitted under manholes, inlets, headwalls, or similar structures. Should the Contractor excavate below the elevations shown or specified, he shall, at his own expense, fill the void with either concrete or granular material approved by the Owner.

G. Do not excavate pipe trenches more than 200 feet ahead of the pipe laying. Perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where the Owner deems necessary to maintain vehicular or pedestrian traffic.

H. In all cases where materials are deposited along open trenches, place them so that in the event of rain or surcharge loading from such deposits no damage will result to the work and/or to adjacent property.

I. Excavation for manholes and other structures may be performed with nonvertical banks except beneath pavements or adjoining existing improvements. Do not permit the horizontal area of the excavation to exceed that required to allow a 2-foot clearance between the outer surface of the structure and the banks of the excavation or the sheeting used to protect the embankments. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings.

J. The Contractor shall be responsible for all safety issues relating to the trenching operations including those concerning the public and passerby. All excavation shall be performed in accordance with any and all applicable safety laws and regulations. The Developer, Utility, and Owner assume NO responsibility of any sort for acts of the Contractor.

K. The requirements of the local governing body and the Tennessee State Highway Department shall apply regarding the length of open trench of water line that may be left open overnight along streets and roads.

3.6 DEWATERING OF EXCAVATION

A. Provide and keep in operation enough suitable pumping equipment whenever necessary or whenever directed to do so by the Owner. Give special attention to excavations for those structures that, prior to proper backfilling, are subject to flotation from hydrostatic uplift.

B. All water pumped or drained from the work shall be disposed of in a manner satisfactory to the Owner without damage to adjacent property or other areas.

C. If necessary, due to the volume of water containing sediment, or due to the location of pumping activities, construct a sediment trap (structure) to pump ground water into until sediment is no longer being removed with the water. Sediment shall not be discharged to the waters of the State. The pump shall remain on the job site at all times during construction.

3.7 BORROW EXCAVATION

A. Whenever the backfill of excavated areas or the placement of embankments requires more material than is available from authorized excavations or whenever the backfill material from such excavations is unsuitable, then obtain additional material from other sources. This may require the opening of borrow pits at points accessible to the work. In such cases, make suitable arrangements with the property owner and pay all incidental costs, including any royalties, for the use of the borrowed material. Before a borrow pit is opened, the quality and suitability of its material shall be approved by the Owner. All state and local regulation concerning borrow pits, drainage, and erosion control shall be strictly followed.

B. Excavate borrow pits in such a way that the remaining surfaces and slopes are reasonably smooth and that adequate drainage is provided over the entire area. Construct drainage ditches wherever necessary to provide outlets for water to the nearest natural channel, thus preventing the formation of pools in the pit area. Leave the sides of borrow pit cuts at a maximum slope of 2:1 unless otherwise directed by the Owner.

C. Properly clear and grub borrow pits. Remove all objectionable matter from the borrow pit material before placing it in the backfill.

D. The taking of materials from borrow pits for use in the construction of backfill, fills, or embankments shall be considered an incidental part of the work. No separate payment shall be made for this.

3.8 BACKFILLING

A. Begin backfilling after the line construction is completed and then inspected and approved by the Owner. On each side of the line, from the bottom of barrel to 1 foot above the top of the pipe, the backfill material shall consist either of fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone, and/or other objectionable materials and that has a size of no more than 2 inches. Place this backfill simultaneously on either side of the pipe in even layers that before compaction are no more than 6-inches deep. Thoroughly and completely tamp each layer into place before placing additional layers. When shown on the drawings, this backfill shall, at locations beneath concrete and asphalt driveways, roadways, sidewalks, parking areas, etc. or closely adjacent to pavement, consist of Class A, Grade D aggregate. Use of aggregate backfill shall be at the direction of the Owner.

B. From 1 foot above the pipe upward, the backfill material may contain broken stones that make up approximately 1/2 of the backfill's total volume. However, if this type of backfill is used, there must be enough spalls and earth materials to fill all voids completely. The maximum dimension of individual stones in such backfill shall not exceed 6 inches, and the backfill material shall be placed and spread in even layers not more than 12 inches deep. At locations beneath or closely adjacent to pavement or at locations of improvements subject to damage by displacement, tamp and thoroughly compact the backfill in layers that, before compaction, are 6 inches deep. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.

C. If earth material for backfill is, in the opinion of the Owner, too dry to allow thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material that the Owner considers too wet or otherwise unsuitable.

D. Wherever excavation has been made within easements across private property, the top 1 foot of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stone, and/or other objectionable materials. Top soil shall be placed a minimum of 6 inches on top of this backfill material to final contours.

E. Wherever trenches have been cut across or along existing pavement, temporarily pave the backfill of such trenches by placing Class A, Grade D crushed stone as the top 12 inches of the backfill. Maintain this temporary pavement either until the permanent

pavement is restored or until the project is accepted by the Owner. On heavy-traveled roadways or as directed by the Owner, cold mix or leveling course binder 3 inches thick shall be installed and maintained until permanent pavement is installed.

F. Conduct backfilling around manholes, inlets, outfalls, and/or structures in the same manner as specified above for pipelines except that even greater care is necessary to prevent damage to the utility structure.

G. Wherever pipes have diameters of 12 inches or less, do not use power-operated tampers to tamp that portion of the backfill around the pipe within 1 foot above the pipe.

H. Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfill is being placed. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary, whenever directed to do so by the Owner.

I. Backfilling and clean-up operations shall closely follow pipe laying. Failure to comply with this provision will result in the Owner's requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.

J. Compaction Requirements: Under buildings and two times the depth of pipe beyond, and under roads and two times the depth beyond the shoulder, compact to 95-percent maximum density in accordance with ASTM D698. In all other locations, compact to 90-percent maximum density.

K. Before final acceptance, the Contractor shall be required to level off all trenches where backfill material has been piled up, or to bring the trench up to the level of the surrounding street, roadway, or terrain. The Contractor will be required to remove from the streets, roadways, and private property all excess earth or other materials.

3.9 MAINTENANCE

A. Seed and maintain in good condition all excavated areas, trenches, fills, embankments, and channels until final acceptance by the Owner.

B. Maintain trench backfill at the approximate level of the original ground surface by periodically adding backfill material wherever necessary and whenever directed to do so by the Owner. Continue such maintenance until final acceptance of the project or until the Owner issues a written release.

3.10 SLOPES

A. Neatly trim all open cut slopes and finish to conform either with the slope lines shown on the drawings or the directions of the Owner. Leave the finished surfaces of bottom and sides in reasonably smooth and uniform planes like those normally obtainable with hand tools, though the Contractor will not be required to use hand methods if he is able to obtain the required degree of evenness with mechanical equipment. Conduct grading operations so that material is not removed or loosened beyond the required slope.

3.11 SHORING, SHEETING, AND BRACING OF EXCAVATION

A. Where unstable materials are encountered or as required by law or Government regulations, such as OSHA, the sides of the trench or excavation shall be supported by substantial sheeting, bracing, and shoring, or the sides sloped to the angle of repose. Adequate and proper shoring of all excavation shall be the entire responsibility of the Contractor.

B. Foundations, adjacent to where the excavation is to be made below the depth of the foundation, shall be supported by shoring, bracing, or underpinning of a temporary or a permanent nature as may be required to assure the integrity of the structure. The Contractor will be held strictly responsible for any damage to adjoining foundations or structures.

C. No timber sheeting less than two inches in thickness and timber bracing cross bracing of struts less than six inches in thickness will be acceptable.

D. Solid sheeting will be required for wet or unstable material. It shall consist of continuous vertical sheet piling of timber two inches thick or of steel with suitable shores and braces. All sheeting to be left in place shall be two inch thick timber.

E. Care shall be taken to avoid excessive backfill loads on the completed pipelines and the requirements that the width of the ditch at the level of the crown of the pipe not exceed that specified herein.

F. Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

G. All sheeting, planking, timbering, bracing, and bridging shall be placed, renewed, and maintained as long as necessary.

End of Section

SECTION 02223
ROCK EXCAVATION FOR UTILITIES

1. GENERAL

1.1 This work covered by this section shall consist of the removal of all rock materials (as defined herein) that must be removed from their original beds so that construction can be performed as indicated by the drawings or by these specifications. It shall include the drilling and blasting incidental to excavation and the disposal of the excavated materials as specified below.

1.2 Refer to other sections for work related to that discussed in this section.

1.3 DESCRIPTION OF ROCK EXCAVATION

A. Rock excavation shall consist of the removal of all sound, solid rock which is in its original position in ledges, bedded deposits, or unstratified masses and which is of such hardness and texture that, in the opinion of the Owner, it cannot be loosed or broken down and removed without drilling and blasting.

B. In addition, if any boulders, stones, or pieces of masonry with a volume of ½ cubic yard or more are encountered within the limits of excavation, their removal shall be considered as rock excavation.

C. The removal of all other materials, however, shall be classified as common excavation and subject to the provisions set forth in Section 02221, Unclassified Excavation for Utilities. For instance, hard pan, small boulders with a volume of less than ½ cubic yard, chert, clay, soft shale, soft and disintegrated rock, and similar material shall not be considered as rock, although the Contractor may elect to excavate them by drilling and blasting.

2. PRODUCTS

NOT USED

3. EXECUTION

3.1 Excavate rock in trenches over the horizontal limits of excavation and to a depth of not less than 6 inches below where the bottom of pipelines will be. Where pipelines are to be constructed on concrete cradles, excavate rock to the bottom of the cradles, then backfill the space below grade for pipelines with fine earth or other approved material, and tamp to the proper grade and make ready for construction. For structures, excavate rock to the outside bottom of the structure.

3.2 Conduct drilling and blasting with due respect for the safety of persons and property in the vicinity and in strict conformance with all ordinances and regulations governing blasting and use of explosives. Conduct rock excavation near existing pipe or other structures with the utmost care so as to avoid damage. Damage to other structures and properties shall be promptly repaired by the Contractor at his own expense. Rock excavation shall be subject to all applicable provisions specified in Section 02221, Unclassified Excavation for Utilities, including those concerning site preparation; the disposal of materials; slopes; compacting and tamping; sheeting, shoring, and bracing; and pipeline excavation.

3.3 At the location of tees or laterals, blast a minimum of 6 linear feet of ditch line beyond the end of the lateral and in the direction and to the appropriate grade of the future lateral as indicated by the Owner, but do not excavate the material.

3.4 DISPOSAL OF MATERIALS

A. Whenever practicable, use all suitable material removed by excavation to backfill pipe trenches (i.e., material whose maximum size meets the requirements for backfilling specified in Section 02221, Unclassified Excavation for Utilities), or use it for other purposes shown on the drawings or as directed by the Owner. Any material not used shall be considered waste material and disposed of by the Contractor as specified below.

B. Waste material may be deposited in spoil areas at locations approved by the Owner or removed from the site when no suitable areas are available. Do not leave waste materials in unsightly piles, but instead spread in reasonably uniform layers.

C. Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of the work. Leave the surface of the work in a neat and workmanlike condition.

End of Section

SECTION
02271 RIP-RAP

1. GENERAL

1.1 This item consists of furnishing and placing riprap slope/ditch protection.

2. PRODUCTS

2.1 Riprap

The riprap material shall be durable and of hard natural stone, free from cracks, seams, or other defects that would tend to cause increased deterioration because of freezing and thawing or other natural causes. Riprap material shall be reasonably well graded from the minimum size stone. At least 90% of the riprap stone shall be not less than 8 inches wide by 12 inches long by 12 inches deep and shall be approximately rectangular in shape. Fragments or spalls shall be used to fill the voids between the larger rocks. The inclusion of appreciable quantities of dirt, sand, clay, or rock fines will not be accepted. All materials considered for use as riprap shall be approved by the Owner.

3. EXECUTION

3.1 Earth surface on which riprap is to be placed shall be trimmed and graded so as to provide for the thickness of riprap shown on the drawings. Surfaces that are below grade shall be brought to grade by fillings with well compacted materials similar to the adjacent materials. Prior to placement of riprap, the prepared earth foundation will be inspected and no materials shall be placed thereon until approved by the Owner.

3.2 Place riprap to the full course thickness at one operation and in such a manner as to avoid serious displacement of the underlying materials. Deliver and spread the material so that the mass of pieces in place shall be reasonably well graded, with the larger pieces uniformly distributed and the smaller pieces and spalls filling the voids between the larger pieces. The finished riprap shall be free from objectionable concentration of large or small pieces.

3.3 A tolerance of +12 inches or -6 inches from slope lines and grades shown on the drawings will be permitted on the finished surface of the riprap, except that the extreme negative tolerance shall not be continuous over an area exceeding 200 square feet.

End of Section

SECTION 02311
CONTROL BLASTING

1. GENERAL

1.1 This section covers the method, responsibilities, and required protection techniques for blasting.

1.2 At Contractor's option, blasting may be used as an alternative to nonexplosive methods of excavation. Blasting shall be performed in accordance with the Tennessee Blasting Standards Act of 1975 TCA Section 68-105, local ordinances, regulations, and as specified herein.

1.3 The Contractor shall employ blasting techniques at this own discretion given the limits and conditions stated herein.

1.4 Blasting shall be performed by a qualified, licensed blaster, who has specific experience on similar sized projects, and is knowledgeable of the Tennessee Blasting Standards Act of 1975, including additions and amendments.

2. PRODUCTS

NOT USED

3. EXECUTION

3.1 PREBLAST SURVEY AND BLAST MONITORING

A. The Contractor shall conduct a preblast survey of the surrounding structures within a minimum of 300 feet of any blasting operation and document their condition before any blasting begins. The documentation will include written descriptions, photographs of the structures, and measures of obvious signs of structural distress such as cracks.

B. Gauge marks will be located over existing cracks at selected locations to be measured before and after blasting to determine if widening or displacement has taken place.

C. Before carrying out the inspection, the Contractor shall notify the owners of the buildings or structures to be inspected and request permission to carry out the inspection. Should any building owner refuse permission to carry out this inspection, the Contractor shall notify the Owner in writing, giving the building owner's reason for refusal.

D. The Owner shall require the Contractor to monitor all blasts by an approved method and/or by a Subcontractor at the Contractor's expense. Vibration monitoring will be required on all blasts.

E. The Contractor must obtain all necessary blasting permits prior to blasting. Notification must be given to the Owner prior to blasting. Such notification shall be given no less than 24 hours prior to the scheduled blast.

3.2 SAFETY

A. Blasting shall be conducted in the conformance with all local and state safety codes. The Contractor shall secure at his own expense all required blasting permits and additional hazard insurance.

B. The Contractor shall cover the blasting area with enough excavation material and/or matting to prevent danger to lives and property.

C. It is the sole responsibility of the Contractor to properly handle, use, and store explosives. Any damages to persons or property, as a result of blasting operations, is the responsibility of the Contractor.

3.3 RECORD KEEPING

A. The Owner's representative must be present during all blasting operations.

B. The Contractor shall provide an itemized blasting log to the Owner on a daily basis.

3.4 BLASTING LIMITS

A. The Contractor shall avoid shattering rock beyond the required limits of the trench or excavation.

B. Charge holes shall be properly located and drilled to the correct depth for the charges used.

C. Charges shall be limited in size to permit reasonable removal of material by excavating equipment. Overbreak effects shall be corrected by removing the broken rock and replacing it with approved material.

End of Section

SECTION 02485
SEEDING

1. GENERAL

1.1 This work shall be performed in all disturbed areas not receiving such site improvements as buildings, roads, walks, sod, planting, etc., and shall include, but not necessarily be limited to, all seed bed preparation; the supplying and placing of soil additives, seed, and mulch wherever required by the drawings or directed by the Owner; and maintenance.

1.2 Unless otherwise approved in writing by the Owner, seeding operations shall be limited to the following planting periods:

A. Spring - March 1 through May 30

B. Fall - August 15 through October 31

1.3 Temporary seeding/strawing to support erosion minimization (and as required by the Stormwater Pollution Prevention Plan) shall be done with the project regardless of the season. Re-seeding for final stabilization shall occur during the specified planting period.

1.4 Refer to other sections for items affecting seeding. Coordinate this work with that specified by other sections for timely execution.

2. PRODUCTS

2.1 GRASS SEED

A. Kentucky 31 Fescue (Festuca Elatior) and/or annual rye meeting the requirements of the State Department of Agriculture and furnished in new bags or bags that are sound and not mended. No "below standard" seed accepted. Where lawns and fields have special grass, replace in kind.

2.2 FERTILIZER

A. Commercially manufactured; Grade 10-10-10; furnished in standard containers that are clearly marked with the name, weight, and guaranteed analysis of the contents and that ensure proper protection in transportation and handling; and in compliance with all local, state, and federal fertilizer laws.

2.3 AGRICULTURAL LIMESTONE

A. Containing a minimum of 85-percent calcium carbonate and magnesium carbonate combined, 85 percent of which passes a No. 10 mesh sieve.

2.4 MULCH

A. Stalks of rye, oats, wheat, or other approved grain crops properly cured prior to baling, air dried, and reasonably free of noxious weeds and weed seeds or other material detrimental to plant growth.

2.5 Sod shall comply with all TDOT requirements.

3. EXECUTION

3.1 Perform all seeding and related work as a continuous operation. Sow seed as soon as the seed bed has been prepared and perform subsequent work in a continuous manner.

3.2 Before beginning seeding operations in any area, complete the placing of topsoil and final grading, and have the work approved by the Owner.

3.3 Scarify, disk, harrow, rake, or otherwise work each area to be seeded until the soil has been loosened and pulverized to a depth of not less than 2 inches. Perform this work only when the soil is in a tillable and workable condition.

3.4 Apply fertilizer and agricultural limestone uniformly over the seed bed and lightly harrow, rake, or otherwise incorporate them into the soil for a depth of approximately 1 inch at the following rates:

Fertilizer: 15 pounds/1,000 square feet
Agricultural Limestone: 40 pounds/1,000 square feet

3.5 Sow seed uniformly with a rotary seeder, wheelbarrow seeder, or hydraulic equipment or by other satisfactory means.

3.6 The seeding rate shall be 5 pounds/1,000 square feet for Kentucky 31 Fescue (Festuca Elatior).

3.7 When seeding during March 1 through April 1 and October 1 through November 20, add an additional 3 pounds/1,000 square feet of annual rye grass.

3.8 Perform no seeding during windy weather or when the ground surface is frozen, wet, or otherwise untillable.

3.9 When seeding with mulch is specified, spread the mulch material evenly over the seeded areas immediately following the seeding operation.

Mulch Rate: 2 bales (100-pound minimum)/1,000 square feet

3.10 The mulch rate may be varied by the Owner, depending on the texture and condition of the mulch material and the characteristics of the area seeded. Cover all portions of the seeded areas with a uniform layer of mulch so that approximately 25 percent of the ground is visible.

3.11 No equipment, material storage, construction traffic, etc., will be permitted on newly seeded ground.

3.12 Dispose of all surplus materials as directed by the Owner.

3.13 INSPECTIONS

A. The Owner shall inspect the seeding within 60 days after planting and determine if it is acceptable.

3.14 GUARANTEE

A. Secure an acceptable growth of grass in all areas designated for seeding.

B. An area is considered acceptable if it is represented by a minimum of 100 seedlings/ square foot of the permanent species of grass representative of the seed mixture. If an acceptable growth is not obtained on the first planting, reseeding and remulching will be required.

C. If the planting is less than 50 percent successful, rework the ground, refertilize, reseed, and remulch.

D. The Contractor shall be responsible for guaranteeing and maintaining all seeding for a twelve month period from the date of initial acceptance of the seeding as stated above.

End of Section

SECTION 02545
BORING AND CASING FOR WATER LINES

1. GENERAL

1.1 The work to be performed hereunder shall consist of the installation of a casing pipe for the purpose of installing a water line as shown on the Drawings or as called for in these specifications. It shall include the excavation of a boring pit, auger boring between the points specified on the Drawings, furnishing and installing of the carrier pipe, and disposing of the excavated materials in the manner herein provided.

1.2 The Owner will provide the necessary control points required by the Contractor for this construction. The Contractor will provide the detailed layout required to keep the tunnel or bore on grade.

2. PRODUCTS

2.1 CASING PIPE

A. The casing pipe shall be of steel meeting the latest approved American Railway Engineering Association "Specifications for Pipelines for Carrying Flammable and Nonflammable Substances." The steel casing pipe shall have a minimum yield strength of 35,000 psi and shall have the minimum wall thickness shown in the following table:

	(For Highway H20 Loading)		**(For Railroad E72 Loading)**	
Carrier Pipe (inches)	Casing Pipe (inches)	Nominal Thickness (inches)	Casing Pipe (inches)	Nominal Thickness (inches)
2	6	0.250	8	0.250
4	8	0.250	10	0.250
6	12	0.250	14	0.250
8	16	0.250	18	0.281
12	20	0.281	24	0.375
16	24	0.375	30	0.500
20	30	0.500	30	0.500
24	36	0.500	36	0.625
30	42	0.500	42	0.625
36	48	0.625	48	0.750
42	54	0.625	54	0.875
48	60	0.750	60	0.875

2.2 PIPE: The carrier pipe shall meet the standards specified in Section 02713.

3. EXECUTION

3.1 BORING

A. The boring shall be accomplished by means of auguring to the size, line, and grade shown on the Drawings.

3.2 INSTALLATION OF CASING PIPE

A. Jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide watertight joints.

B. Do not remove unacceptable casing without prior approval from the Owner. If the removal of casing pipe is permitted, make proper provisions to prevent caving in of the earth surrounding the casing.

3.3 INSTALLATION OF CARRIER PIPE

A. The carrier pipe(s) shall be furnished by the Contractor. Upon acceptance of the casing, install the carrier pipe in the casing by jacking it through the casing. Spacers shall be used within the casing pipe. Casing Spacers shall be bolt style with a shell made in two sections of heavy ductile iron. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner .090" minimum thickness with 85-90 durometer. All nuts and bolts are to be 18-8 stainless steel. Runners shall be made of ultra-high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction. Runners shall be supported by risers made of heavy 304 Stainless Steel. The supports shall be mig welded to the shell and all welds shall be passivated. The height of the supports and runners combined shall be sufficient to keep the carrier pipe at least 0.75" from the casing pipe wall at all times. A minimum of three spacers shall be placed on each joint of pipe. Casing spacers shall be made by Cascade Waterworks Mgf. Co. or Pipeline Seal and Insulator, Inc., Model S 12G-2. Each end of the casing pipe shall be sealed with a wrap-around end seal. (See Standard Drawing 1024). Carrier pipe shall be ductile iron pipe with restrained joints. Refer to specification section 02713 for pipe and restrained joint material requirements.

3.4 TUNNELING ALTERNATIVE

A. In the event boring and jacking is impossible because of pipe size, rock, or other factors and the highway department or railroad will not permit open cutting, make crossings by tunneling using liner plates. Conduct tunneling operations as approved by the railroad or highway department. If voids are caused by the tunneling operations, fill by pressure grouting or by other approved methods that will provide proper support.

B. Galvanized Plates

1. After the plates are formed to shape, the plates shall be galvanized on both sides by the hot dip process. A coating of prime western spelter, or equal, shall be applied at the rate of not less than 2 ounces per square foot of double exposed surface. If the average spelter coating as determined from the required samples is less than the amount specified above, or if any 1 specimen shows a deficiency of 0.2 ounce, the lot shall be rejected. Spelter coating shall be of first-class commercial quality free from injurious defects such as blister, flux, and uncoated spots.

2. The outside of the plates shall be given a bituminous coating meeting the AASHO M-190 specifications for bituminous protected corrugated metal pipe.

C. Design and Construction

1. Construct the tunnel by the tunnel method, and completely line on the inside with structural steel liner plates meeting all requirements specified hereinafter. The dimensions of the tunnel shall be as shown on the Drawings.

2. The tunneling operation is to commence from a pit that is a minimum of 12 feet long and 4 feet wider than the diameter of the tunnel, bottom to grade, and sheeted and shored, if necessary. Furnish line and grade stakes.

3. All excavation for the entire length of the tunnel shall be done by tunneling, and the work may be done from either or both ends of the conduit. Trim the periphery of the tunnel smooth to fit the outside of the steel liner plate as nearly as is practical, and fill all space outside of the steel liner plate with a sand cement grout mixture.

4. Install the steel liner plates immediately after the excavated material has been removed. Do not remove material more than 24 inches ahead of the installed liner plates.

5. Provide all necessary bracing, bulkheads, and/or shields to ensure complete safety to all traffic at all times during the progress of the work, and perform the work in such a manner as to not interfere with normal traffic over the work.

6. The steel lining shall consist of plates 16 inches wide, and each circumferential ring shall be composed of the number and length plates necessary to complete the required diameter.

7. The inside diameter of the completed ring shall be of a minimum size as called for as a casing pipe in Paragraph 2.1A, and no part of the plate or reinforcing ribs will be allowed to extend inside this net diameter.

8. The strength of the tunnel lining will be determined by its section modulus. In no case shall it be less than 0.0590 inch cubed per inch of plate width based on the average for 1 ring of plates. Thickness of the metal for these steel plates shall be not less than 10 gauge, allowing for standard mill tolerances. The tunnel strength shall be equal to AASHO railroad E80 loading at the depth of cover obtaining.

9. All plates shall be punched for bolting on both longitudinal and circumferential seams and shall be fabricated so as to permit complete erection from the inside of the tunnel. The longitudinal seam shall be of the lap type with offset equal to gauge of metal for the full width of the plate, including flanges, and shall have staggered bolt construction fabricated so as to allow the cross section of the plate to be continuous through the seam. All plates shall be of uniform fabrication, and those intended for 1 size tunnel shall be interchangeable.

10. The material used for the construction of these plates shall be new and unused and suitable for the purpose intended. Workmanship shall be first class in every respect.

11. Install the carrier pipe to the line and grade shown on the Drawings. The carrier pipe shall be adequately blocked inside the tunnel so that no part of the carrier pipe touches the tunnel liner. The blocking shall be such that the carrier pipe cannot move horizontally or vertically. The blocking shall be installed within one foot on each side of the bell of the carrier pipe and at the center of each joint. The main portion of the support shall be stainless steel with a PVC liner between the support and the carrier pipe. Detailed plans and specifications shall be submitted showing the proposed bracing and support of the carrier pipe inside the tunnel. Each end of the tunnel liner shall be plugged with brick and mortar.

12. All tunnel liners shall have one 2-inch grout coupling in every ring. Grout back of the rings as required.

4. GUARANTEE OF WORK

4.1 Guarantee a usable completed casing or tunnel between the points specified and to the line and grade specified. The allowable tolerance at the downstream end point of the bore shall be such that the invert of the carrier pipe may be positioned within a vertical area limited on the top by an elevation no higher than the elevation shown on the Drawings and on the bottom by an elevation no lower than the existing inlet pipe invert.

4.2 The allowable tolerance at the upstream end point of the bore shall be such that the invert of the carrier pipe may be positioned at the elevation shown on the Drawings.

End of Section

SECTION 02575
PAVEMENT REPAIR

1. GENERAL

1.1 The work specified by this section shall consist of repairing or replacing all damaged pavement, whether public or private. Dirt shoulders, roads, streets, drives, and walks are to be restored to their original condition as an incidental part of the installation of utilities. Repair damaged base on either side of a trench wherever necessary. Trim the oxidation surface to neat lines outside of the trench wall and repave the entire area as specified below.

1.2 Both these specifications and the drawings make reference to the current edition of the standard specifications of the Tennessee Department of Transportation (TDOT) and the Blount County Highway Department. Even though the weather limitations, construction methods, and materials specifications contained in the TDOT specifications may not be explicitly repeated in these specifications, they shall, wherever applicable to the work called for by this section, be considered as implied and therefore adhered to. Refer to other sections for work related to that covered by this section.

2. PRODUCTS

A. Mineral Aggregate Base: Type A Base, Grading D crushed stone (TDOT Specification Section 303);

B. Bituminous Prime Coats: cutback asphalt, Grade RC-250, or material emulsified asphalt, Grade AE-P (TDOT Specification Section 402);

C. Aggregate For Cover Material: Size 7, 8 or 78 (TDOT Specification Section 402) ;

D. Tack Coat: Grade AE-3 (TDOT Specification Section 403);

E. Bituminous Plant Mix Base (Hot Mix): Grading A, B, B (modified), or C, AS or CW, as directed by the Engineer (TDOT Specification Section 307);

F. Asphaltic Concrete Surface: Grading B or C as specified (TDOT Specification Section 411);

G. Pavement Marking Paint: White and Yellow (TDOT Specification Section 716);

3. EXECUTION

3.1 SUBGRADE

A. Before any base material is installed, compact the subgrade of the area to be paved to 95 percent of optimum density as determined by ASTM D698 (Standard Proctor).

B. The backfill material shall contain no topsoil or organic matter. For all areas where subgrade has been prepared, test for uniformity of support by driving a loaded dump truck at a speed of 2 to 3 mph over the entire surface. Make further improvements on all areas that show a deflection of 1 inch or more. When completed, the finished subgrade

shall be hard, smooth, stable, and constructed in reasonably close conformance with the lines and grades that existed prior to beginning construction.

C. When a base course is compacted, cut back the surface course of the existing pavement a minimum of 1 foot beyond the limit of the joint between the old and new base course or as shown on the standard drawings. Take special care to ensure good compaction of the new base course at the joint. Apply and compact the surface to conform to the existing pavement so that it will have no surface irregularity.

3.2 BASE

A. Install a mineral aggregate base of the type specified above in accordance with TDOT specifications. The maximum compacted thickness of any one layer shall be 6 inches and the total thickness of the base shall be that indicated by the standard drawings or as shown on the plans.

3.3 SEAL COAT SURFACE

A. Uniformly apply a bituminous prime coat of either emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, over the entire width of the area to be surfaced at a rate of 0.3 gallons/square yard. Immediately after application, uniformly cover the entire area with Size 7 crushed stone chips at a rate of 12 pounds/square yard.

3.4 DOUBLE BITUMINOUS SURFACE

A. Apply the first course at a rate of 0.38 to 0.42 gallons/square yard with either emulsified asphalt, Grade RS-2, or cutback asphalt, Grade RC-800 or RC-3000, and then immediately cover with Size 6 crushed stone chips at a rate of 33 to 37 pounds/square yard. After this is rolled, apply the second course at a rate of 0.30 to 0.35 gallons/square yard, and at once uniformly cover with Size 7 chips at a rate of 20 to 25 pounds/square yard. Then roll the entire area.

B. After the application of the cover aggregate, lightly broom or otherwise maintain the surface for a period of 4 days, or as directed by the Owner. Maintenance of the surface shall include the distribution of cover aggregate over the surface to absorb any free bitumen and cover any areas deficient in aggregate. Sweep excess material from the entire surface with rotary brooms. Sweep the surface at the time determined by the Owner.

3.5 ASPHALTIC CONCRETE BINDER

A. Apply a bituminous prime coat of emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, at a rate of 0.38 to 0.42 gallons/square yard. Take care to prevent the bituminous material's splashing on exposed faces of curbs and gutters, walls, walks, trees, etc. If such splashing does occur, remove it immediately. After the prime coat has been properly cured, apply an asphaltic concrete binder to the thickness shown on the standard drawings or the plans.

B. Carefully place the material to avoid segregation of the mix. Broadcasting of the material will not be permitted. Remove any lumps that do not readily break down.

3.6 ASPHALTIC CONCRETE SURFACE

A. If the asphaltic concrete surface course is to be placed directly on the mineral aggregate base, place a bituminous prime coat as described above. If, however, the surface course is to be placed on a binder course, then apply a bituminous tack coat of the sort specified above under PRODUCTS at a rate of 0.05 to 0.10 gallons/square yard. Take care to prevent the bituminous material's splashing on exposed faces of curbs, gutters, walls, walks, trees, etc. If such splashing does occur, remove it immediately. After the prime or tack coat has been properly cured, apply the asphaltic concrete to the thickness shown on the drawings or standard drawings. Apply the surface course as described above for the binder course.

3.7 SMOOTHNESS

A. The finished surfaces shall conform to the lines and grades that existed prior to construction. No deviations, variations, or irregularities exceeding 1/4 inch in any direction when tested with a 12-foot straightedge will be permitted in the finished work, nor will any depressions that will not drain. Correct all such defects.

3.8 SAMPLING AND TESTING

A. Submit to the Owner test reports made by an independent testing laboratory on the crushed stone aggregate, bituminous materials, and asphaltic concrete design mixes, and obtain his approval of these reports before starting paving operations.

B. Tests shall be made on the completed elements of the pavement to ascertain the compacted thickness of the base and surface courses. If sections with deficient thicknesses are found, the full section for a reasonable distance on each side of the deficiency shall be refused. Remove and reinstall all such sections. Patch all test holes in connection with thickness tests.

C. When making surface tests, furnish one man to mark all surface defects for corrections.

End of Section

SECTION 02640
VALVES, HYDRANTS, AND BLOWOFFS

1. GENERAL

1.1 Refer to other specification sections for work related to valves, hydrants and blow-offs.

1.2 Submit product data for all items in this section per the provisions of Section 01302 – Submittals and Substitutions.

1.3 All valves of a single type shall be provided by a single manufacturer and shall be AWWA approved.

2. PRODUCTS

2.1 Lead content in all brass products shall comply with the *Reduction of Lead in Drinking Water Act*, effective January 4, 2014.

2.2 GATE VALVES

A. Gate valves shall be used on water lines 8-inches and smaller. Gate valves shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509/C515 of the latest revision and in accordance with the following specifications and shall be manufactured by M&H, Clow, U.S. Pipe, or Mueller.

B. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

C. The valves shall be non-rising stem with the stem made of bronze described in AWWA C509/C515. Provide 2 stem seals of the O-ring type.

D. The stem nut, also made of bronze, shall be independent of the gate.

E. The sealing mechanism shall consist of a cast or ductile iron wedge gate fully encapsulated in synthetic rubber or urethane. The resilient sealing mechanism shall provide zero leakage at 200 psi working pressure when installed with flow in either direction.

F. The valve body, bonnet, and bonnet cover shall be ductile iron or cast iron, ASTM A126, Class B, fully coated with fusion bonded epoxy, both interior and exterior.

G. All valves shall be tested and approved in strict accordance with AWWA C509/515.

H. Buried valves shall be mechanical joint and equipped with a 2-inch square operating nut and shall be completed with a valve box specified herein. Buried valves with wrench nut over 10 feet deep shall have an extension stem projecting within 2 feet of the ground surface and the stem extension shall be centered in the valve box and anchored to prevent horizontal movement and pinned to the valve nut below.

I. Above grade or partially below grade installation shall have flanged ends, 125-lb. template.

J. The valve manufacturer shall provide all glands, gaskets, and all accessories necessary to install the valve.

K. Valves in structures shall be flanged and equipped with removable hand wheel operators.

L. Valves shall open to the left (counterclockwise).

M. Gate valves smaller than 3-inches in diameter shall be iron body, bronze-mounted, with solid wedge gates. Small gate valves shall be installed with all pipe connection and fittings necessary to serve the purpose intended. Valves smaller than 3-inches shall have threaded ends and shall be equipped with standard operating nuts. Small valves shall be IBBM gate valves or pre-approved equal.

N. The use of Swivel-X or ductile iron mega-lugs is required on all fittings and valves.

O. Complete shop drawings and catalog information showing dimension, weight, specifications, and operating data for all valves that are proposed for use in the project shall be submitted to the Owner for approval prior to construction.

2.3 BUTTERFLY VALVES

A. Valves 12-inches and larger on water lines shall be butterfly valves, designed for direct burial service, which meet or exceed the requirements of AWWA C504 of latest revision and in accordance with the following specifications.

B. The valve body shall be constructed of ASTM A536, Grade 64-45-12, ductile iron with integrally cast mechanical joint ends in accordance with AWWA C111. Mechanical joint accessories shall be supplied by the valve manufacturer.

C. Valve discs shall be constructed of ductile iron.

D. Shafts of all valves shall be turned, ground, and polished. Valve shafts shall be constructed of 18-8 Type 304 or Type 316 stainless steel. Shaft diameters must meet the minimum requirements established by AWWA C504 for Class 150B.

E. The resilient seating shall be obtained by either of the following two designs:

1. Resilient Seat in the Valve Body: Valve seats shall be of a synthetic rubber compound vulcanized or bonded to the valve body. The seat bond must withstand 75 pounds per inch of pull under test procedure ASTM D429, Method B.
2. Resilient Seat Attached to the Valve Disc: The valve disc shall be fitted with a resilient seat of synthetic rubber fixed in place with a retaining ring and cap screws passing through the rubber seat. The seat retaining ring and cap screws shall be of 18-8 stainless steel. The rubber seat shall be replaceable in the field.

F. Valves shall be fitted with sleeve type bearings contained in the hubs of the valve body. Bearings shall be corrosion resistant and self lubricating. Bearing loads shall not exceed 1/5 of the compressive strength of the bearing shaft material.

1. Packing shall be of the O-ring or self adjusting Chevron type.
2. Valve operators shall conform to AWWA C504.
3. Valve operators shall be of the traveling nut, self locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Operators shall be equipped with mechanical stop limiting devices to prevent overtravel of the disc in the open and closed positions. Valve operators shall be designed to withstand a minimum input torque at the fully open or fully closed position of 300 foot-pounds without damage to the valve or operator. Valve operators shall be fully enclosed and designed to withstand continuous submergence in water to a head pressure of 25 feet.
4. The direction of opening shall be counterclockwise as viewed from the top.

G. Marking shall be cast on the body or shall be on cast plates with raised letters attached to the body to identify the size, class, year of manufacture, and manufacturer of the valve.

H. Valves shall be as manufactured by Dezurik, Henry Pratt, or approved equal.

2.4 AIR RELEASE VALVES

A. Automatic air release valves shall be installed at all high points as noted on drawings. Air valves shall be 1-inch on pipelines below 12 inches in diameter. For pipelines 12 inches in diameter and larger, the air valves shall be 2-inch size.

B. Automatic air release valves shall be plastic bodied and manufactured by Bermad or Owner approved equal.

C. Automatic air release valves shall be installed in accordance with the manufacturer's standard drawing.

2.5 TAPPING VALVES – RESILIENT SEATED GATE VALVE

A. Tapping valves shall conform to AWWA C509/C515 or latest revision covering gate valves except as modified for passage and clearance of tapping machine cutters. Valves shall be M&H, Clow, U.S. Pipe, or Mueller.

B. Tapping valves shall meet all requirements for Gate Valves (Paragraph 2.1 above) as well as having mechanical joints on one end and a tapping flange on the other end. The valve waterway shall be a full opening to admit a full size shell cutter.

C. Valves shall be furnished with tapping sleeve sized to ANSI B16.1 standards for flanges with male pilots for centering and the outlet side mechanical joint, conforming to AWWA C111. Flange and mechanical joint assemblies shall be supplied by the valve manufacturer.

2.6 TAPPING SLEEVES FOR DUCTILE IRON PIPE

A. Tapping sleeves shall be full sleeve, mechanical joint type manufactured from ductile iron meeting ASTM A536, Grade 65-45-12. Tapping sleeves 12 inch and larger may be Smith-Blair 622 epoxy coated with stainless bolts and nuts.

B. Sleeves shall be rated for a minimum of 250 psi water working pressure.

C. Side flange seals shall be of the O ring type of either round or rectangular cross-sectional shape and shall butt against the split end gaskets to produce a totally watertight seal.

D. The flange throat section of mechanical joint sleeves 12 inches and smaller shall be counterbored in accordance with MSS-SP60 for true alignment of the tapping valve and tapping machine.

E. The inside and outside of all tapping sleeves shall be coated in accordance with AWWA Standards and Federal Specifications TT-V-51.

F. The sleeve manufacturer shall furnish all the accessories necessary to assemble the sleeve to the pipe.

G. Tapping sleeves shall be subjected to a pressure test while in place on the existing water line, prior to the existing line being tapped. The tapping sleeve and valve shall be subjected to a pressure of 200 psi for a period of 15 minutes. The connection being tested shall maintain 100 percent of the test pressure throughout the test period. The Contractor shall supply all necessary equipment for testing tapping sleeves and valves.

2.7 VALVE BOXES

A. All gate valves installed below grade shall be provided with a valve box to provide access to the operating nut.

B. Valve boxes shall be 2-piece or 3-piece screw type with round or oval bases and 5-1/4-inch shafts. Valve boxes shall be cast iron. Valve box covers shall be marked "WATER" unless noted otherwise.

C. Valve boxes shall be designed to accept extension section or repair extension as needed.

D. Valves boxes shall be installed on all buried valves in accordance with the details shown on the standard drawings sheet.

E. Valve box covers shall be cast iron and suitable for heavy traffic conditions. Covers shall have the word "WATER" cast on the exposed surface and shall be lockable.

F. In unpaved areas, valve boxes shall be installed with a 24" square concrete collar, 6" thick. The collar shall be constructed level with both the finished grade and the valve box lid. The collar shall be pre-formed unless approved otherwise by the Owner.

G. Install valve box alignment device on all valves prior to installation of valve box. Provide BoxLok by Trumbull Industries, Inc. or Owner approved equal.

2.8 FIRE HYDRANTS

A. Fire hydrants shall comply in all respects with AWWA C502 and shall be the compression type, with the main valve opening against the pressure and closing with the pressure. The main valve opening shall be 5-1/4 inch in diameter. Hydrants shall be connected to the main by a 6-inch mechanical joint shoe, unless otherwise shown on the drawings, and fitted with strapping lugs. Two 2-½ inch hose nipples and one 4-½ inch steamer nipple shall be threaded and screwed into the nozzle section and then pinned to prevent turning.

B. Hydrants shall be furnished with 1-inch square operating nuts. Operating nut shall be provided with convenient means to afford lubrication to ensure ease of operation and the prevention of wear and corrosion.

C. Hydrants shall be the dry barrel type, and the ductile iron hydrant shoe shall have two positive acting noncorrodible drain valves that drain the hydrant completely by opening as soon as the main valve is closed and by closing tightly when the main valve is open. Drain valves operated by springs or gravity will not be acceptable.

D. The packing gland located in the bonnet shall be solid bronze, and gland bolts shall be steel with bronze nuts. A double O ring seal may be used in lieu of conventional stuffing box.

E. The hydrant shall open by being turned to the left and so marked on the bonnet in cast letters and arrow.

F. Threads on hose and steamer nipples, operating nut, and cap nuts shall conform to the Owner's standards.

G. Bury shall be a nominal 36-inch with the depth being measured from grade line to bottom of trench or connecting pipe. Hydrant risers shall be provided to the Owner for connection.

H. Hydrants shall be FM and UL listed and rated for 200 psi working pressure.

I. Hydrant manufacturer shall be approved by Owner.

J. Blow-off hydrants shall be 2-inch Ford Blow-off Ball Valve with T-head adapter (Product No. BLA18-777-TA-NL) or approved equal, and shall only have 2-inch hose nipples.

2.9 CORPORATION AND CURB STOPS

A. Corporation stops shall be brass, threaded to conform to AWWA C-800. The outlet shall be appropriate to the size and type of service line specified. For copper service line connections to PVC main, a combined service clamp and corporation stop shall be used for connections.

B. Curb stops shall be brass, conform to AWWA C-800, and shall be compression to compression connection type. The size of valve shall be as specified by the Owner with inlet and outlet connection appropriate to the size and type of service line specified.

Unless otherwise indicated, the curb stops shall be placed in the meter box ahead of the water meter. Where two meters are served by a single service line a "U" or "Y" connector, as approved by the Owner shall be placed ahead of the water meters.

C. When only the service lines are extended across the roadway, a compression by compression curb stop is to be installed and marking of the location is to be maintained by way of color-coated PVC pipe in a visual matter extending at least (3) feet above the finished grade.

D. Service taps must be installed on approximately 45° angles as per the plans and/or detail sheet. All fitting shall be copper or brass.

2.10 WATER METER, METER YOKES, AND METER BOX

A. Service saddles shall be Ford, Size 2"-12" Saddle, Stainless Band or Owner approved equal.

B. Corp Stop shall be Ford F-1000-3-Q, CC Thread Compression Outlet, Copper – K Type ¾" or 1", or Owner approved equal.

C. Yoke shall be Ford LSV BH41-233W-Q-NL, CTS Inlet (Quick Joint) By Double Purpose Outlet or Owner approved equal.

D. Meter Box shall be ABS 18" Deep X 24" Long Plastic Meter Box and Cast-Iron Lid or Owner approved equal.

3. EXECUTION

3.1 SETTING VALVES AND FITTINGS

A. Valves, fittings, plugs, and caps shall be set and jointed to pipe in the manner heretofore specified for cleaning, laying, and jointing pipe.

3.2 LOCATION OF VALVES

A. Valves in water mains shall be located within road right-of-way unless otherwise shown on the Owner approved drawings.

3.3 VALVE BOXES AND VALVE PITS

A. Provide a valve box for every valve with the lettering on the valve box cover being placed 90° to the line.

B. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished pavement or such other level as may be directed by the Owner.

C. Pour a 2-foot square by 6-inch thick concrete pad around the top of all valve boxes that are not located in paved areas. Precast concrete rings are not acceptable.

D. Long side services shall be installed inside conduit or pipe. Casing pipe shall be approved by Owner.

END OF SECTION

SECTION 02713
WATER LINES

1. GENERAL

1.1 Furnish all material, equipment, tools, and labor in connection with the water line, complete and in accordance with these specifications.

1.2 It shall be the Contractor's responsibility to ensure that all necessary materials are furnished to him and that those found to be defective in manufacture are replaced at no extra cost to the Owner. Materials damaged in handling after being delivered by the manufacturer shall be replaced at the Contractor's own expense. If installed material is found to be defective before the final acceptance of the work, the cost of both the material and labor needed to replace it shall not be passed on to the Owner.

1.3 The Contractor shall be responsible for safely storing materials needed for the work that have been accepted by him until they have been incorporated into the completed project. Keep the interiors of all pipes, fittings, and other accessories free from dirt and foreign matter at all times.

1.4 Refer to other sections for work related to that specified by this section. Coordinate this work with that required by other sections for timely execution.

1.5 Reaction blocking (thrust blocks) shall be installed as shown on the Standard Drawings. Wherever reaction blocking is necessary, it shall be considered an integral part of the water line work.

1.6 Materials will be visually inspected by the OWNER at the site for conformance to the specifications. At the OWNER's discretion, the CONTRACTOR may be required to supply certified mill tests, samples, or other suitable form of verification that the material meets the required specifications.

2. PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

A. Ductile iron pipe shall conform to the requirements of the latest revision of ANSI/AWWA A21.51/C-151 for ductile iron pipe centrifugally cast in metal or sand-lined molds. It shall be made and tested in accordance with ASTM A536 and be subjected to and able to withstand a hydrostatic pressure of 500 psi.

B. The pipe shall be plain end ductile iron pipe with push-on joint, single gasket joints. The design thickness shall be that specified in ANSI A21.50/AWWA C150 and a pressure class of 350. Pipe shall be manufactured by American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, Clow Corporation, McWane or Griffin. All pipe shall be of the same manufacturer.

C. A bituminous coating approximately 1 mil thick shall be applied to the outside surfaces of all ductile iron pipe fittings. The finished coating shall be continuous, smooth, and its

properties shall not vary with changes in temperatures. The coating shall be strongly adherent to the metal.

D. The length of each individual piece of ductile iron pipe shipped must be plainly marked on that piece of pipe. Ductile iron pipe is required under all road crossings and in casing. Joint restraint shall be utilized for ductile iron pipe.

E. The push-on single gasket joints shall be UL approved and shall be either “Fastite” by American Cast Iron Pipe Company, or “Tyton” by U.S. Pipe and Foundry Company.

F. The bell of each pipe shall have a tapered annular opening and a cast or machined retaining groove for the gasket. The gasket groove shall have a flared design so that maximum deflection will be provided. The plain spigot end of the pipe shall be beveled in order to simplify its entry into and centering within the bell and the compression of the gasket.

G. The gasket shall be of high quality vulcanized rubber made in the form of a solid ring to exact dimensions. The design of the gasket groove in the bell of the pipe and the design, hardness, and other properties of the gasket itself shall be such that the joint is liquid tight for all pressures from a vacuum to the maximum internal liquid pressure of 350 psi.

H. Enough lubricant shall be furnished with each order to provide a thin coat on the spigot end of each pipe. This lubricant shall be shall be nontoxic, impart no taste or smell, and have no harmful effect on the rubber gasket. It shall have a consistency that will allow it to be easily applied to the pipe in either hot or cold weather and that will enable it to adhere to either wet or dry pipe.

I. Standard and special fittings shall be ductile iron. Use standard mechanical joint fittings or anchoring tees at hydrant locations. All fittings shall conform to ANSI A21.10/AWWA C110.

J. Pipe and pipe fittings shall have cement linings as specified in ANSI A21.4/AWWA C104. In addition, an asphalt emulsion spray coat approximately 1 mil thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices. A petroleum asphaltic coating approximately 1 mil thick shall be applied to the outside of the pipe.

K. All fittings shall be mechanical joint unless otherwise shown on the drawings. Where flanged is shown, no substitution of a Uni-Flange type joint will be used. Fitting laying lengths shall conform to ANSI A21.10/AWWA C110, short body or ANSI A21.53/AWWA C153, compact.

L. Fittings shall be in accordance with the standard mechanical joint fittings manufactured by the U.S. Pipe and Foundry Company, American Ductile Iron Pipe Company, Griffin, Union Foundry, Tyler, Star, Sigma, or Pipeline Components, Inc.

M. Mechanical joint restraint, Meg-a-lug or approved equal, shall be required for a minimum of 40 feet in all directions from each and every fitting. Slip joint restraint shall be gripper gaskets.

N. Flanged fittings and other specials shall be of ductile iron and shall be manufactured to ANSI A21.10/AWWA C110 or ANSI B16.1 specifications for a minimum working pressure of 250 psi. The flanges of pipe, fittings, and specials shall be drilled to standard 125-pound template. Flanged pipe and all fittings shall be supplied with gaskets and bolts.

O. The pipe manufacturer is to furnish the Owner a certificate of inspection, sworn to by the factory inspector in the presences of a notary public, stating that the pieces of pipe in the shipment were made and tested in accordance with ANSI A21.51 and that they were subjected to and withstood a hydrostatic pressure of 500 psi. Each statement is to give the number of pieces of pipe in the shipment, the length of each piece of pipe, and the serial number of each piece of pipe making up the shipment. In addition, the weight of each individual piece of pipe making up the shipment is to be listed opposite the serial number of each pipe length and attached to the certificate of inspection.

N. Restraint devices for nominal pipe sizes 3-inch through 48-inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10. The devices shall have a working pressure rating of 350 psi for 3-16inch and 250 psi for 18-48 inch. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes. Gland body, wedges, and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536. Restraint device shall be MEG-A-LUG® or Owner approved equal.

O. Restrained Joint gaskets available for nominal pipe sizes 6-inches through 48-inches shall conform to standard dimensions and weights per ANSI/AWWA C151. The restrained joint gasket assembly shall provide a positive locking system that prevents joint separation. The design of the restrained joint gasket shall allow deflection after assembly while maintaining uniform load distribution. The joint shall be a push-on joint and shall be completely boltless.

2.2 PVC PIPE

A. All plastic pipe shall be made from Class 12454-B polyvinyl chloride plastic (PVC 1120) as defined by ASTM D1784. The pipe diameters shall conform to dimensions of cast iron pipe. All pipe shall be SDR-17 Class 250 PSI.

B. Pipe shall be of the bell and spigot type with a rubber ring suitable to meet all the test requirements of these specifications.

C. All pipes shall comply with TDEC criteria for pressure class applications, shall have NSF approval, and be manufactured in accordance with ASTM D2241. The following tests shall be run for each machine on each size and type of pipe being produced, as specified below:

1. Flattening Test: once per shift in accordance with ASTM D2412. Upon completion of the test, the specimen shall not be split, cracked, or broken.
2. Acetone Test (Extrusion Quality Test): once per shift in accordance with ASTM D2152. There shall be no flaking, peeling, cracking, or visible deterioration on the inside or outside surface after completion of the tests.
3. Quick Burst Test: Once per 24 hours in accordance with ASTM 5199.

SDR	PRESSURE RATING	MINIMUM BURSTING PRESSURE, psi
13.5	315	1,200
17	250	1,000

4. Impact Tests: for 6 inches and larger, once per shift in accordance with ASTM D2444; for 4 inches and smaller, once each 2 hours in accordance with ASTM D2444.
5. Wall Thickness and Outside Dimensions Tests: once per hour in accordance with ASTM D2122.
6. Bell Dimensions Test: once per hour in accordance with ASTM D3139.

D. If any specimen fails to meet any of the abovementioned tests, all pipe of that size and type manufactured between the test periods must be scrapped and a full set of tests rerun.

E. Furnish a certificate from the pipe manufacturer stating that he is fully competent to manufacture PVC pipe of uniform texture and strength and in full compliance with these specifications and further stating that he has manufactured such pipe and done so in sufficient quantities to be certain that it will meet all normal field conditions. In addition, the manufacturer's equipment and quality control facilities must be adequate to ensure that each extrusion of pipe is uniform in texture, dimensions, and strength. Also furnish a certificate from the manufacturer certifying that the pipe furnished for this project meets the requirements of these specifications.

F. All pipe shall be manufactured in the United States of America. All pipe for any one project shall be made by the same manufacturer.

G. All pipe may be furnished in the manufacturer's standard laying lengths of 20 feet. The Contractor's methods of storing and handling the pipe shall be approved by the OWNER. All pipe shall be supported within 5 feet of each end; in between the end supports, there shall be additional supports at least every 15 feet. The pipe shall be stored away from heat or direct sunlight. The practice of stringing pipes out along the proposed water line routes will not be allowed.

H. Certain information shall be applied to each piece of pipe. At the least, this shall consist of:

1. Nominal size
2. Type of material
3. SDR or class

4. Manufacturer
5. NSF Seal of Approval

I. Pipe that fails to comply with the requirements set forth in these specifications shall be rejected.

J. The pipe shall have push-on joints designed with grooves in which continuous molded rubber ring gaskets can be placed. Gaskets shall be made of vulcanized natural or synthetic rubber; no reclaimed rubber will be allowed. The gaskets shall be of the manufacturer's standard design dimensions and of such size and shape as to provide a positive seal under all combinations of joint and gasket tolerance. The gasket and annular groove shall be designed and shaped so that when the joint is assembled, the gasket will be radially compressed to the pipe and locked in place against displacement, thus forming a positive seal.

K. The spigot end of each pipe shall be beveled so that it can be easily inserted into the gasket joint, which in turn shall be designed so that the spigot end may move in the socket as the pipe expands or contracts. The spigot end shall be striped to indicate the distance into which it is to be inserted into the socket. Each joint shall be able to accommodate the thermal expansions and contractions experienced with a temperature shift of at least 75 degrees F.

L. Enough lubricant shall be furnished with each order to provide a coat on the spigot end of each pipe. This lubricant shall be nontoxic, impart no taste or smell to the water, have no harmful effect on the gasket or pipe material, and support no bacterial growth. The lubricant containers shall be labeled with the manufacturer's name.

M. Joints shall be manufactured in accordance with ASTM D3139 except that the thickness of the bell shall be, as a minimum, equal to that of the barrel. Joints shall be either integral bell and ring joints with rubber compression gaskets as manufactured by the Clow Corporation, Johns-Manville, or Vulcan Plastic Corporation; twin gasket couplings as manufactured by the Certain-Teed Products Corporation; or equal. However, the pipe and bell must be made by the same manufacturer.

N. Standard and special fittings shall be gray iron or ductile iron. Use standard mechanical joint fittings. All fittings shall conform to the specifications of ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153. The gaskets shall be ducked tipped transition fittings for use with PVC pipe.

O. Fittings shall be lined with enameline or a thin cement lining as specified in ANSI A21.4/AWWA C104; this lining is to be furnished at no extra cost. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately 1 mil thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices.

P. Fitting laying lengths shall conform to ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153.

Q. Fittings shall be in accordance with the standard mechanical joint fittings manufactured by the U.S. Pipe and Foundry Company, American Cast Iron Pipe Company, Clow Corporation, or equal.

R. No. 12 copper wire shall be laid in full length of all non-metallic lines. The wire shall be looped through valve boxes to be accessible for pipe locating. Wire splices shall be taped with waterproof tape.

2.3 HDPE PIPE

A. High Density Polyethylene Pipe (HDPE) shall be HDPE 3408 and have a heat indented print line containing the information required in ASTM D3035. HDPE pipe must be designated for potable water use by having a minimum of three blue stripes extruded along the entire length of the pipe and also being equally spaced around the outside diameter of the pipe. Color print lines are not an acceptable method for color marking of the pipe.

B. All HDPE pipe shall be in compliance with NSF International Standard 61. Pipe manufacturer must be approved by the Owner prior to pipe installation.

C. Pipes larger than 2-inch shall be Ductile Iron Pipe Size (DIPS) in compliance with AWWA C906 and ASTM F 714. Pipes 2 inch and less shall be Iron Pipe Size (IPS) in compliance with AWWA C901 and ASTM D3035. HDPE pipe 2 inch and larger shall be SDR 11 and pipe smaller than 2 inches shall be SDR 9.

D. Mechanical couplings designed for use in HDPE piping systems shall be installed using the qualified installation procedures developed by the manufacturers. All field mechanical joints will be visually inspected to determine if they have the same appearance as a joint properly made under the qualified procedure. All mechanical couplings used in plastic piping systems shall be designed to resist pullout. Aqua-grip or other Owner approve fittings shall be used for wet tie-ins.

E. HDPE shall be joined using thermal butt fusion, unless otherwise approved by owner. All mains and services shall be joined using thermal butt fusion. Butt fusion shall take place in weather conditions acceptable to the Owner.

F. Procedure Qualification - all joining methods for polyethylene pipe shall be qualified. The polyethylene pipe manufacturers have developed qualified procedures for electrofusion of HDPE pipe. All heat fusion joints will be visually inspected to determine if they have the same appearance as a joint properly made under the qualified procedure.

G. Joiner Qualification - persons making either thermal butt fusion or mechanical joints shall be qualified using applicable joining procedures mentioned above. Each person will be required to qualify for each of the joints they are expected to make. The qualifying procedure for polyethylene pipe joiners will consist of:

1. Training and experience with the qualified procedure.
2. Making a specimen joint according to the qualified procedure.
3. Visual inspection of the specimen joint to determine if it has the same appearance

as a joint properly made under the qualified procedure.

H. Qualification of persons making joints for each procedure will remain effective for 1 year from the date of testing, unless the Owner requires more frequent retraining due to quality of joints completed.

I. Contractor butt fusion training shall be completed by a manufacturer or manufacturer representative acceptable to the Owner. Contractor shall provide proof of training acceptable to the Owner. All personnel performing plastic pipe fusion shall at all times while performing the fusion have readily available on the job site proof of qualification from the manufacturer or other acceptable training company.

J. HDPE pipe shall be handled using canvas or nylon slings. If a forklift is to come in direct contact with HDPE pipe, the forks shall be padded. HDPE pipe shall be stored in a manner, which minimizes crushing or bending. HDPE pipe should lay flat and be stacked no higher than 84 inches. HDPE pipe coils shall not be stored in a vertical position. HDPE pipe shall be transported and stored so that it does not come in contact with debris or materials that could cause damage to the pipe.

H. No. 12 copper wire shall be laid in full length of all non-metallic lines. The wire shall be looped through valve boxes to be accessible for pipe locating. Wire splices shall be taped with waterproof tape.

2.4 SERVICE LINE TUBING

A. Service line tubing shall be REHAU® crosslinked polyethylene (PEX) conforming to ASTM F877, NSF/ANSI 14/61 and CSA B137.6. Tubing shall be of the size designated on the plans or a minimum of 1" diameter.

3. EXECUTION

3.1 INSTALLATION OF WATER LINES

A. Lay the water line to and keep it at the lines and grades required by the Drawings. All fittings, valves, and hydrants shall be at the required locations, and spigots well centered in the bells and all valve and hydrant stems plumb.

B. The pipe shall be uniformly and continuously supported throughout the entire length on a firm stable material. Where required, Size 67 crushed stone used for bedding shall meet the requirement of the Tennessee Department of Transportation.

C. Unless otherwise indicated by the Drawings, all water lines shall have at least 30-inches of cover. Any line installed within the traveled shoulder or pavement of a state highway shall have a minimum depth of cover of at least 48-inches. The pipe shall slope continuously between high and low. No departure from this policy shall be made except at the order of the Owner.

D. Install water line so there is no more than five degrees of deflection per 20 foot length of regular push-on pipe. Pipe shall be laid in straight lines and grade without kinks or sags and shall be laid in a workmanlike manner.

E. Provide and use tools and facilities that are satisfactory to the Owner and that will allow the work to be done in a safe and convenient manner. All pipe, fittings, valves, and hydrants are to be unloaded from the trucks using suitable tools and equipment. Use a derrick, ropes, or other suitable equipment to lower all pipe and fittings into the trench one piece at a time. Carefully lower each piece so that neither it nor any protective coating or lining it may have will be damaged. Under no circumstances, drop or dump water line materials into the trench.

F. If any defective item is discovered after the pipe is laid, the item shall be removed and replaced with a satisfactory item. In case a length of pipe is cut to fit a line, it shall be cut so as to leave a smooth end at right angles to the longitudinal axis of the pipe as per the latest revision of AWWA C600.

G. Lower no pipes and fittings into the trench until they have been swabbed to remove any mud, debris, etc., that may have accumulated within them. After the pipe has been lowered, remove all unnecessary materials from it. Before any pipe is laid, brush and wipe clean the outside of its spigot end and the inside of its bell and ensure that the pipe is dry and oil-free.

H. Take every precaution to keep foreign material from getting into the pipe while it is being placed in the line. If the crew laying the pipe cannot put it into the trench and in place without allowing earth to get inside it, then place a heavy, tightly woven canvas bag of suitable size over each end of the pipe and leave it there until it is time to connect that pipe to the one adjacent to it.

I. Place no debris, tools, clothing, or other materials in the pipe during laying operations.

J. After a length of pipe has been placed in the trench, center the spigot end in the bell of the adjacent pipe, and then insert to the depth specified by the manufacturer and bring to the correct line and grade. Secure the pipe in place by tamping an approved backfill material around it.

K. Bell holes shall be big enough so that there is ample room for the pipe joints to be properly made. Between bell holes, carefully grade the bottom of the trench so that each pipe barrel will rest on a solid foundation for its entire length.

L. Whenever pipe laying is not in progress, close the open ends of pipe in the trench with a watertight plug or by other means approved by the Owner. This shall be done not only at the end of each working day but also before work is stopped for lunch periods, bad weather, or any other reason. If there is water in a trench, leave this seal in place until the trench has been pumped completely dry.

K. The cutting of pipe so that fittings or closure pieces can be inserted shall be done in a neat and workmanlike manner and without any damage to the pipe. Follow the manufacturer's recommendations concerning how to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipe's axis.

L. The flame cutting of pipe by means of an oxyacetylene torch will not be allowed.

M. Unless otherwise directed by the Owner, lay pipe with the bell ends facing in the direction of laying.

N. Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions or plumb stems, or wherever long radius curves are permitted, the amount of deflection shall not exceed that necessary for the joint to be satisfactorily made, nor that recommended by the pipe manufacturer, and shall be approved by the Owner.

O. Lay no pipe in water or when it is the Owner's opinion that trench conditions are unsuitable. If crushed stone is used to improve trench conditions or as backfill for bedding the pipe, this shall be considered incidental to the project, and no separate payment will be made for its use.

P. Where a water line crosses over a sanitary sewer, use a full joint of pipe and center over the sewer. Where a water line is to be parallel to a sanitary sewer, lay it at least 10 feet from the sewer. If it is not practical for the water line and sewer line to be separated as described, then lay the water line at least 18 inches above the top of the sewer. When using ductile iron pipe, the top of 4" concrete should be below bottom of water level and 6" of concrete on top of pipe.

Q. Install thrust blocks wherever the force main changes direction (e.g., at tees and bends), at dead ends, or at any other point where the manufacturer recommends and/or in accordance with Figure 1. Thrust blocks shall be considered an integral part of the force main work.

R. Make all joints, whether standard mechanical or push-on joints, in conformance with the recommendations of the joint manufacturer as approved by the Owner.

S. Air valves shall be located at all high points on the water line as shown on the drawings.

T. When the water line crosses a ditch, creek, or stream, or as shown on the Drawings, a 6"concrete cap shall be placed above and below the pipe at the bottom of the ditch or stream bed to minimize potential erosion over the pipe. See Figure 2 in this section. All pipe shall be ductile iron pipe.

U. Any and all pipe installed in an existing or future roadway shall be Ductile Iron Pipe restrained the entire length of the crossing, including shoulders on each side of the roadway.

3.2 INSTALLATION OF FLANGED PIPE

A. Install flanged ductile iron pipe in the manner specified above except that the faces of the flanges shall be carefully centered and the sections adjusted to proper line and grade before the flange bolts are tightened. Place gaskets in position without damage. Discard and replace any gasket damaged in the process. Attach gaskets to the flange with rubber gum before the joint is made up in a manner that will prevent displacement. After the pipes have been properly centered and adjusted to true line and grade, firmly bolt them together, taking care to tighten all nuts around the flange to the same degree of pressure.

B. Unless otherwise shown on the Plans, all flanged pipe shall extend 5 feet from all structures.

3.3 DISINFECTION

A. If dirt of other foreign material that has gotten into a pipe will not, in the opinion of the Owner, be removed by flushing, the interior of the pipe shall be cleaned and swabbed with a disinfection solution of 5% hypochlorite.

B. Water shall be diverted into the pipe from the existing distribution system or some other source approved by the Owner into the newly laid pipe. Chlorine additives shall be so proportioned that the chlorine concentration is kept at a minimum of 50 mg/l available chlorine. To ensure that this concentration is maintained, measure the chlorine residual at regular intervals.

C. Table I shows the chlorine amount needed for each 100 feet of water line for various diameters. A 1 percent chlorine solution may be prepared either with 1 pound of calcium hypochlorite for each 8.5 gallons of water or with sodium hypochlorite.

Table I
Chlorine Required to Produce a 50 mg/l Concentration in 100 Feet of Pipe, by Diameter

Pipe Size (Inches)	100% Chlorine (pounds)	0.8% Chlorine Solutions (gallons)
6	0.061	0.73
8	0.108	1.30
12	0.240	2.88
16	0.428	5.20
18	0.540	6.58
20	0.680	8.12
24	0.980	11.70
30	1.526	18.28
36	2.197	26.32
42	2.991	35.83
48	3.906	46.80

D. While chlorine is being applied, the Contractor shall manipulate valves so that the treatment dosage will not flow back into the line that is supplying the water. The Contractor shall continue the application of chlorine until the entire line being treated is filled with chlorine solution. Then the Contractor shall retain the chlorinated water in the line for at least 24 hours, during which time all valves and hydrants in the line being treated shall be operated so that appurtenances can also be disinfected. After 24 hours, the treated water shall have a chlorine concentration of at least 25 mg/l throughout the line.

E. After the applicable retention period, the Contractor shall dechlorinate and flush the heavily chlorinated water from the line until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 mg/l. The Contractor shall perform flushing only at sites where there is adequate drainage and as approved by the Owner.

F. The velocity of the water used to flush a line shall be at least 2.5 feet per second. The flow rates required to produce this velocity in various sizes of pipe are shown in Table II.

G. Once a line has been flushed, the Owner shall test to make certain that the residual chlorine in the water is within acceptable limits.

H. Note that flushing is no substitute for taking preventative measures before and during the laying of water lines. Certain contaminants, especially those in caked deposits, are difficult or even impossible to remove by flushing no matter how high the velocity. Furthermore, in pipes with diameters of 16 inches or more, it can be difficult to achieve even the minimum recommended flushing velocity of 2.5 feet per second.

Table II
Required Openings to Flush Pipelines
(40 psi Residual Pressure)

Pipe Size (Inches)	Flow Required to Produce 2.5 fps Velocity (gpm)	Orifice Size (Inches)	Number of Hydrant Outlets	Hydrant Nozzle Size (Inches)
6	220	1 - 3/8	1	2 – ½
8	390	1 - 7/8	1	2 – ½
12	880	2 - 13/16	1	2 – ½
16	1,565	3 - 5/8	2	2 – ½
18	1,980	4 - 3/16	2	2 – ½
20	2,440	----------	1	4 – ½
24	3,470	----------	2	4 – ½
30	5,560	----------	2	4 – ½
36	7,920	----------	2	4 – ½
			3	2 – ½
42	10,800	----------	2	4 – ½
			4	2 – ½
48	14,100	----------	3	4 – ½
			6	2 – ½

3.4 BACTERIOLOGICAL TESTS

A. Forty-eight hours after a water line has undergone final flushing but before it is placed into service, the Owner shall collect a set of 2 samples for bacteriological testing from each 2,500 feet of line and at the end of that line.

B. Samples shall be collected in sterile bottles treated with sodium thiosulphate. Do not use a hose or fire hydrant to collect samples. A standard corporation cock in the line may be installed in the main with a copper tube gooseneck assembly. After the samples are collected, the gooseneck assembly may be removed and retained for future use.

C. The collected samples shall be taken to the Owner's laboratory to be tested for bacteriological quality in order to determine if they contain any coliform organisms. If the initial disinfection fails to produce satisfactory samples, disinfection will be repeated by the Contractor, at no additional cost to the Owner, until satisfactory samples are obtained.

D. When samples are found to be satisfactory, the water line should be hydrostatically tested.

3.5 HYDROSTATIC TESTS

A. All newly laid and backfilled pipe shall be subjected to both a pressure test and a leakage test as described in the paragraphs below. The Contractor shall provide a connection on his test apparatus for the Owner's pressure recorder during both tests. These tests shall be completed prior to the bacteriological tests.

3.6 PRESSURE TEST – DUCTILE IRON OR PVC

A. After pipe has been laid and backfilled as specified above, subject all newly laid pipe or any valved section thereof to a pressure of 200 psi. All services are to be laid prior to testing the main and tested as part of the test of the main.

B. The duration of the pressure test shall be at least two hours. The specified pressure shall be maintained within 200 psi during this test or 1-½ times working pressure, which ever is greater.

C. Slowly fill each valved section of pipe with water. Generally newly laid line is to be filled using a 1 inch line between an existing water line and the new line. A 1 inch corporation cock is to be installed on each line and a 1 inch meter and 1 inch check valve installed in the 1 inch line. Insert plugs in these taps after all tests are completed.

D. Flush with this 1 inch line until the chlorine residual is below 5 parts per million. Apply the specified pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) with a pump connected to the pipe in a manner satisfactory to the Owner. The Contractor shall furnish the pump, the pipe, connection, gauges, and all necessary apparatus.

E. The pipe shall be filled at least 24 hours prior to testing. After the Contractor's test indicates there is no leakage notify the Owner to witness the test.

F. Before applying the specified test pressure, expel all air from the pipe. If hydrants or blow-offs are not available at high places, make the necessary taps at the points of highest elevation before testing and insert plugs after the tests have been completed.

G. Carefully examine all exposed pipes, fittings, valves, and hydrants during the test. Remove any cracked or defective pipes, fittings, valves, or hydrants discovered in consequence of the pressure test.

3.7 PRESSURE TEST – HDPE

A. All requirements of Paragraph 3.6 also apply to HDPE Pressure Testing. Pressure test shall be conducted following manufacturer and accepted industry recommendations.

B. Monitored make-up water test shall consist of an initial expansion and test phase. During the initial expansion phase, the test section is pressurized to the test pressure and sufficient make-up water is added each hour for three hours to return to the test pressure.

C. After the initial expansion phase, about four hours after pressurization, the test phase begins. The test phase lasts two hours, after which a measured amount of make-up water is added to return to the test pressure. The amount of make-up water added shall not exceed the following allowable make-up water allowances in gallons per 100 feet of pipe or regulations by the State Fire Marshall's Office, whichever is less:

Allowable Make-up Water

Pipe Sizes (Inches)	Gallons per 100 Feet of Pipe
2	0.1
6	0.6
8	1.0
12	2.3

D. The total test time including initial pressurization, initial expansion and time at test pressure shall not exceed eight hours. If the pressure test is not completed within 8 hours, the test section shall be depressurized, and allowed to relax for at least 8 hours before reapplying the test pressure.

3.8 LEAKAGE TEST

A. All newly installed and backfilled pipe shall be subjected to a leakage test, conducted in the presence of the Owner immediately after the pressure test. The Contractor shall furnish the pump, pipe, connections, gauges, meter, and all necessary apparatus as well as all necessary assistance to conduct the test.

B. The leakage test shall be conducted by measuring, through a calibrated meter, the amount of water which enters the test section under 160 psi or normal working

pressures, whichever is greater, for a period of at least 2 hours. No installation will be accepted until the leakage is less than the number of gallons per 2-hour period as shown in the table below.

C. Should any test of pipe laid disclose leakage greater than that specified, the Contractor shall at his own expense locate and repair the defective joints until the leakage is within the specified allowance.

Leakage Test Allowance

Pipe Sizes (Inches)	Gallons per 1,000 Feet of Pipe
6	0.6
8	0.8
12	1.1
16	1.5
18	1.7
20	1.9
24	2.2
30	2.8
36	3.3
42	3.9
48	4.4

3.9 DISINFECTION PROCEDURE AFTER CUTTING INTO OR REPAIRING EXISTING LINES

A. The procedures outlined above apply primarily to cases in which the lines are wholly or partially dewatered. However, leaks or breaks that are repaired with clamping devices while the lines remain full of water under pressure present little danger of contamination and require no disinfection.

B. When an existing line is opened, whether by accident or design, the excavated area could be wet and contaminated because of the presence of sewers and/or groundwater nearby. The danger of contamination from such pollution can be lessened if liberal quantities of hypochlorite are applied to the open trenches. It is best to use tablets for disinfection in these cases because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation site.

C. Treat the lines by the slug method in accordance with AWWA C651, when applicable.

D. The following disinfection procedure is considered the minimum that may be used when existing lines are repaired:

1. Swab the interior of all pipes and fittings (particularly couplings and tapping sleeves) that are to be used in repairing an existing line with a solution of 5 percent hypochlorite before installation.

2. The most practical means of removing the contamination introduced into a line during repairs is to give the line a thorough flushing. If the locations of valves and hydrants make it possible, flushing in both directions is recommended. Start flushing as soon as repairs are completed, and continue until all discolored water is eliminated.

3.10 CLEANUP

M. After completing each section of water line, all debris and construction materials shall be removed from the work site. Then the surface shall be graded and smoothed on both sides of the line. The entire area shall be left clean and in a condition satisfactory to the Owner. The Contractor shall keep cleanup operations as close to active pipe laying activities as practical, generally following by less than 300 feet, or as approved by the Owner.

End of Section

SECTION 02723
FUSIBLE POLYVINYLCHLORIDE (PVC) PIPE

PART 1 GENERAL

1.1 The proposed pipe for all water line to be installed in the directional bore holes shall be fusible polyvinylchloride (PVC) pipe. Submit complete specifications and shop drawings for approval.

1.2 All pipe material to be installed in this project must be approved prior to installation.

1.3 The material manufacturer must provide written certification to the OWNER that the proposed material is adequate for the application proposed in this project. Provide information regarding similar installations.

1.4 The pipe and fusions shall be warranted for one year per the pipe supplier's standard terms.

1.5 Fusion Technician shall be qualified by the pipe supplier to install fusible PVC pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of the fusion performance on the project.

PART 2 PRODUCTS

2.1 FUSIBLE PVC PIPE

Pipe Type	Sizes (nominal)	Series	Dimension Ratio (DR)
Fusible C-900®	4" – 12"	DIPS	DR 18

A. All piping shall be made from a PVC compound conforming to cell classification 12454 per ASTM D1784.

B. Fusible PVC pipe for potable water shall conform to AWWA C900, AWWA C905, ASTM D2241 or ASTM D1785, as applicable. Testing shall be in accordance with the referenced AWWA standards for all pipe types. Pipe shall be marked verifying suitability for potable water service per NSF-61.

C. Fusible PVC pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

D. Fusible PVC pipe shall be manufactured in a standard 40' nominal length or custom lengths as specified.

E. Fusible PVC pipe shall be blue in color for potable water use.

F. Pipe shall be marked as follows:

1. Nominal Pipe Size
2. PVC
3. Dimension Ratio, Standard Dimension Ratio or Schedule
4. AWWA pressure class
5. AWWA standard designation number
6. Extrusion production record code
7. Trademark or trade name
8. Cell classification 12454 and/or PVC material code 1120 may also be included.

G. Pipe shall be homogenous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

2.2 FUSION JOINTS

A. Unless otherwise specified, fusible PVC lengths shall be assembled in the field with butt-fused joints. The fusion technician shall follow the pipe supplier's guidelines for this procedure. All fusion joints shall be completed as described in this specification.

2.3 FUSIBLE POLYVINYL CHLORIDE SWEEPS OR BENDS

A. Fusible PVC sweeps or bends shall conform to the same sizing convention, diameter dimensional tolerances and pressure class of the piping being joined by the sweep or bend.

B. Fusible PVC sweeps or bends shall be manufactured from the same fusible PVC pipe being used for the installation, and shall have at least 2 feet of straight section on either end of the sweep or bend to allow for fusion of the sweep to the pipe installation. There shall be no gasketed connections utilized with a fusible PVC sweep.

C. Standard fusible PVC sweep or bend angles shall not be greater than 22.5 degrees and shall be used in nominal diameters ranging from 4" through 16".

D. All run-of-the-pipe fittings shall be fusion welded into the pipe line. All fittings shall be factory made.

E. Fittings shall be capable of withstanding the same pressure and loading conditions specified for the pipe.

2.4 PIPE JOINING

A. Pipe to be joined by leak proof, thermal, butt fusion joints. All fusion must be done by personnel trained by the pipe supplier using tools approved by the pipe supplier. All heat fusion joints must meet the qualification procedures established by the pipe manufacturer.

B. The fusion machine shall have hydraulic pressure control for fusing 2 pipe ends together; it shall include pressure fusion indicating gauges to correctly monitor fusion

pressures. The machines shall be equipped with an electric or gasoline powered facing unit to trim irregularities from the pipe ends. The heating plate on the fusion machine shall be electrically heated and thermostatically controlled and shall contain a temperature gauge for monitoring temperature.

C. Joint strength must be equal to that of adjacent pipe as demonstrated by tensile test. In addition, results of tensile impact testing of joint should indicate a ductile rather than a brittle fracture.

D. Threaded or solvent cement joints and connections are not permitted.

2.5 TOOLS AND PROCEDURES

A. Fusion jointing and other procedures necessary for correct assembly of the Fusible PVC pipe and fitting will be done only by personnel trained in those skills by the pipe supplier.

B. Only those tools designed for aforementioned procedures and approved by the pipe supplier shall be used for assembly of pipe and fittings to ensure proper installation.

PART 3 EXECUTION

3.1 HANDLING AND STORAGE

A. Pipe shall be off-loaded, loaded, installed, handled, stored and stacked per the pipe supplier's guidelines. These guidelines include compliance with the minimum recommended bend radius and maximum safe pull force for the specific pipe being used.

B. The general best practices of the industry per AWWA M23 shall also be observed.

3.2 FUSION PROCESS

A. Fusible PVC pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.

B. Fusible PVC pipe will be fused by qualified fusion techniques holding current qualification credentials for the pipe size being used, as documented by the pipe supplier.

C. Pipe supplier's procedures shall be followed at all times during fusion operations.

D. Each fusion joint shall be recorded and logged by an approved electronic monitoring device (data logger) connected to the fusion machine, which utilizes a current version of the pipe supplier's recommended and compatible software.

E. Only approximately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. This includes requirements for safety, maintenance, and operation and modifications made for PVC.

3.3 GENERAL INSTALLATION

A. Installation guidelines from the pipe supplier shall be followed for all installations.

B. The fusible PVC pipe will be installed in a manner so as not to exceed the recommended bending radius guidelines.

C. Where fusible PVC pipe is installed by pulling in tension, the recommended maximum sage pulling force, established by the pipe supplier, shall not be exceeded.

D. Install pipe with detector wire, 9 gauge.

END OF SECTION

SECTION 03303
CONCRETE FOR UTILITIES

1. GENERAL

1.1 This item shall include furnishing and installing concrete blocking, cradles, anchors, caps, pipe protection, and/or encasement at the locations shown on the drawings and/or as directed by the Owner.

1.2 Submit concrete mix design, including all add mixtures with past strength data for review per the requirements of Section 01302 – Submittals and Substitutions.

2. PRODUCTS

NOT USED

3. EXECUTION

3.1 Concrete work shall conform to ACI 301-72 (as revised), as modified by the supplemental requirements listed below.

A. Strength: The strength of concrete shall be 4,000 psi unless otherwise shown on the drawings.

B. Durability: All concrete exposed to weather shall be air entrained.

C. Slump: Concrete shall be proportional and produced to have a slump of 3-inches with a 1-inch tolerance.

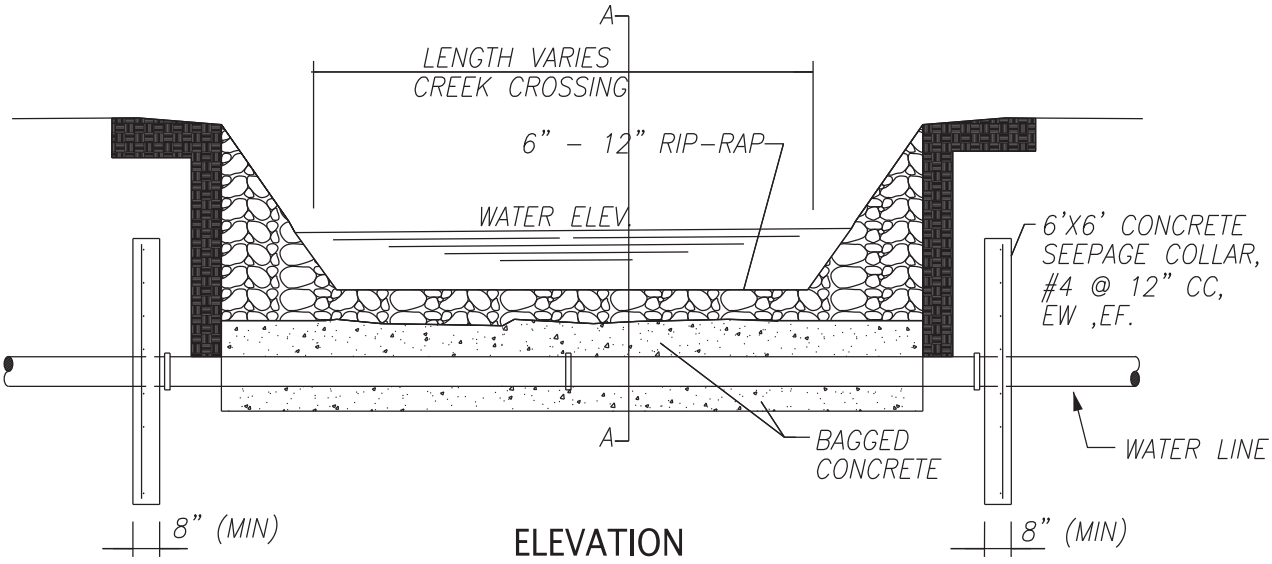
D. Admixtures: Air entrainment, mandatory for concrete exposed to weather, may be used. A water reducing admixture [retarding (normal or accelerating) depending on placing temperature] may be used if approved by the Owner.

E. Reinforcing Steel: Yield strength of reinforcing steel shall be 60,000 psi.

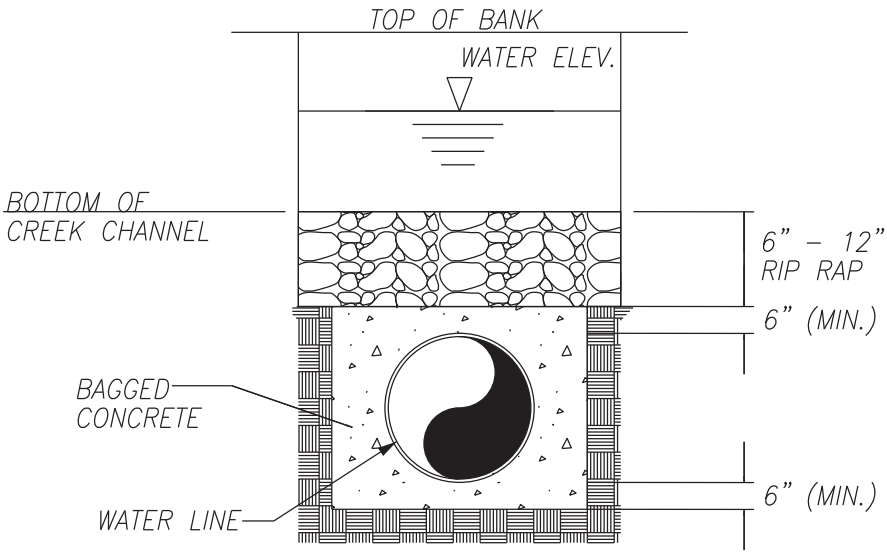
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APPENDIX A

STANDARD DETAILS



ELEVATION



SECTION A–A

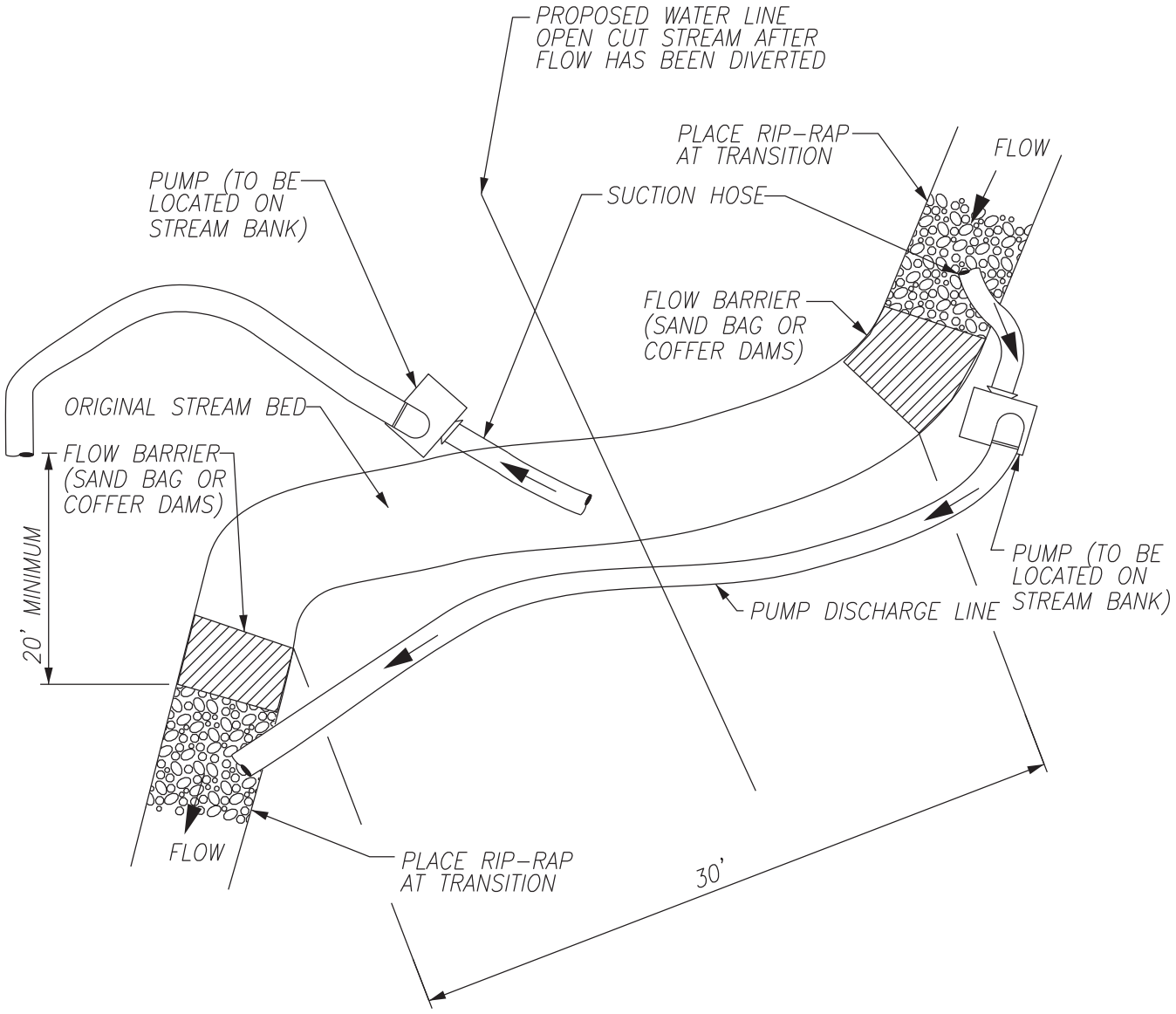
NOTES:

1. SEEPAGE COLLARS SHALL BE INSTALLED ON BOTH SIDES OF CREEK CROSSING.
2. THE SEEPAGE COLLAR SHALL NOT ENCASE A PIPE JOINT.

1 / – CREEK CROSSING DETAIL

N.T.S.

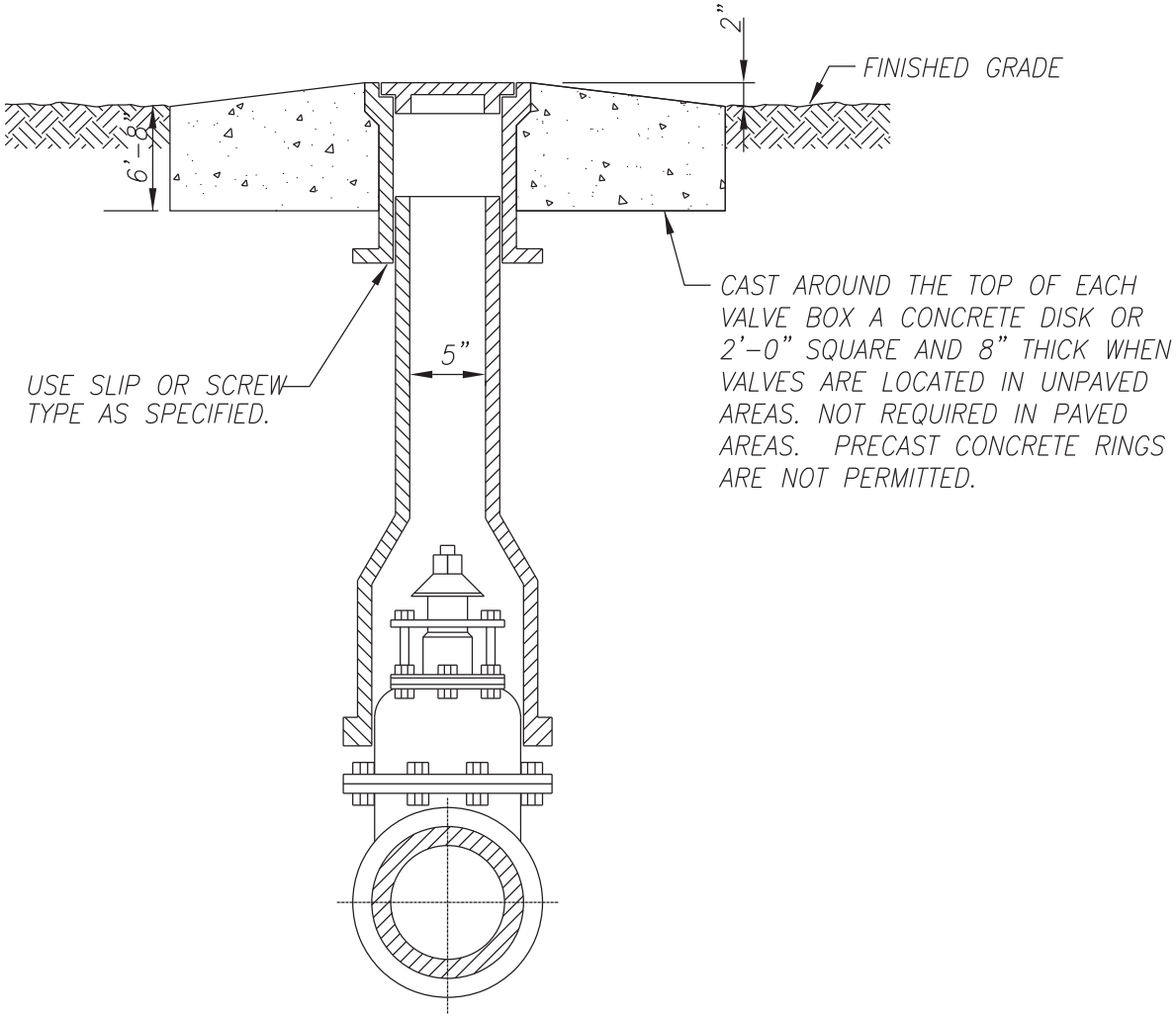
SOUTH BLOUNT COUNTY UTILITY DISTRICT
320 PARTNERSHIP PARKWAY
MARYVILLE, TENNESSEE 37801



2 / – **CREEK CROSSING – OPEN CUT**

N.T.S.

SOUTH BLOUNT COUNTY UTILITY DISTRICT
320 PARTNERSHIP PARKWAY
MARYVILLE, TENNESSEE 37801

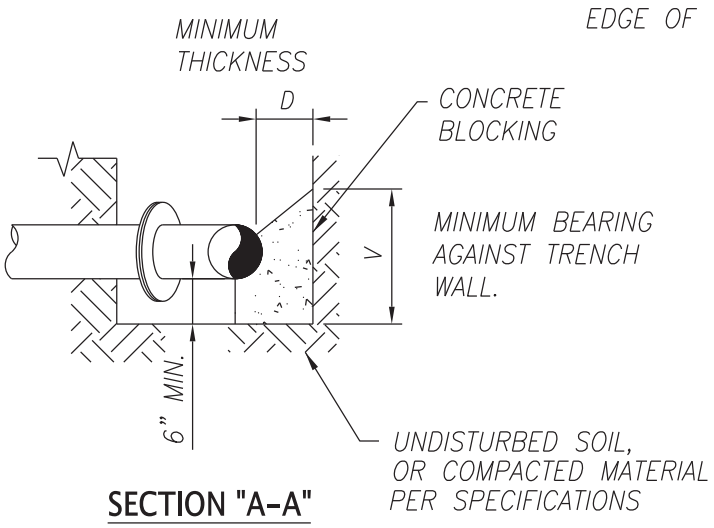


3 / –

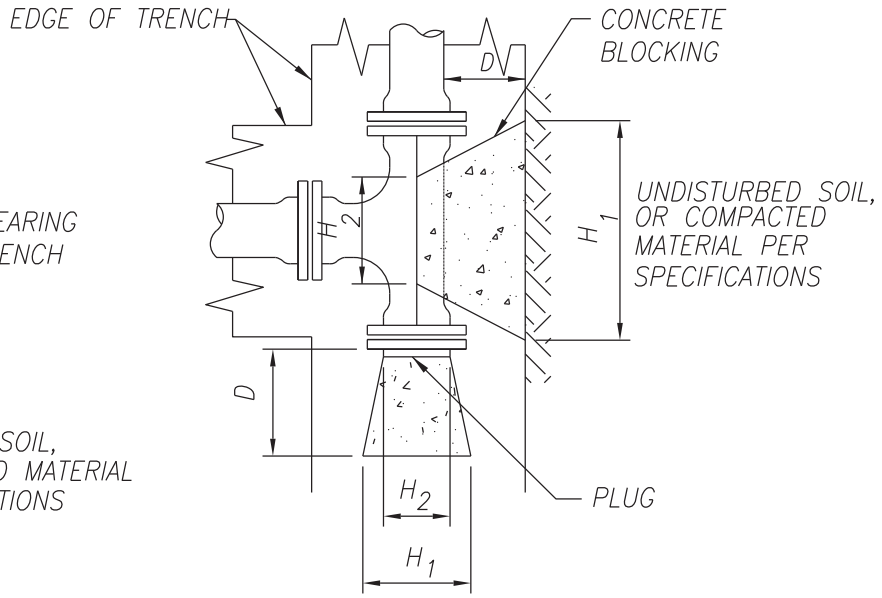
TYPICAL VALVE BOX

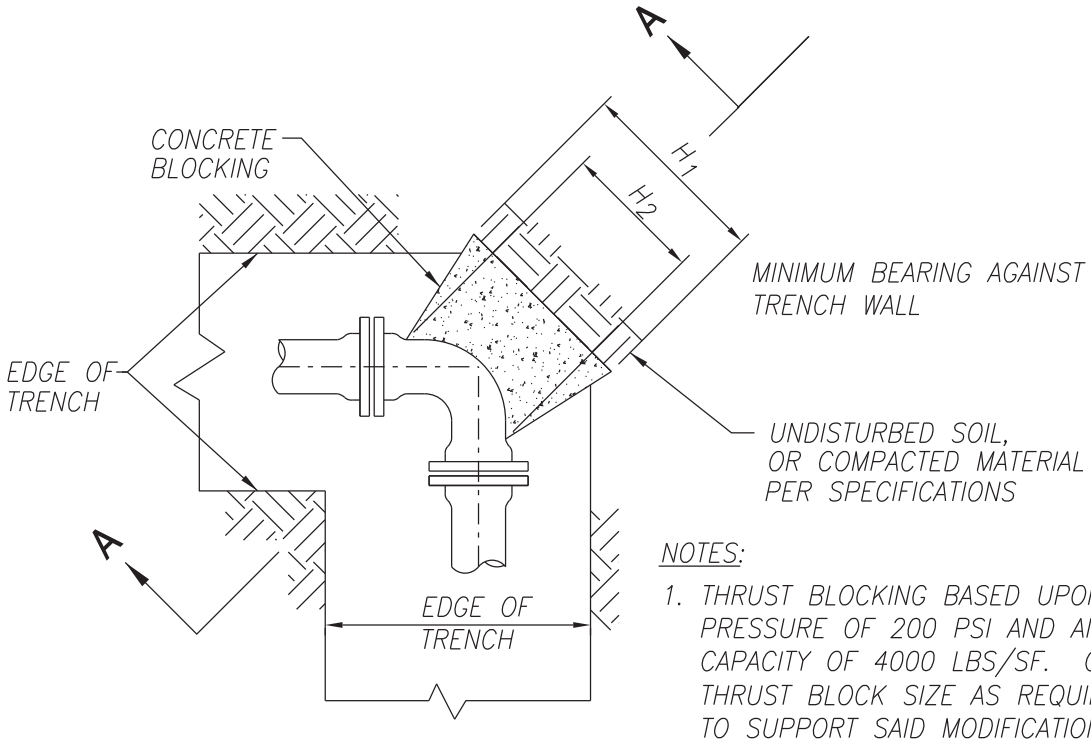
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320 PARTNERSHIP PARKWAY
MARYVILLE, TENNESSEE 37801



SECTION "A-A"





HORIZONTAL BENDS

NOTES:

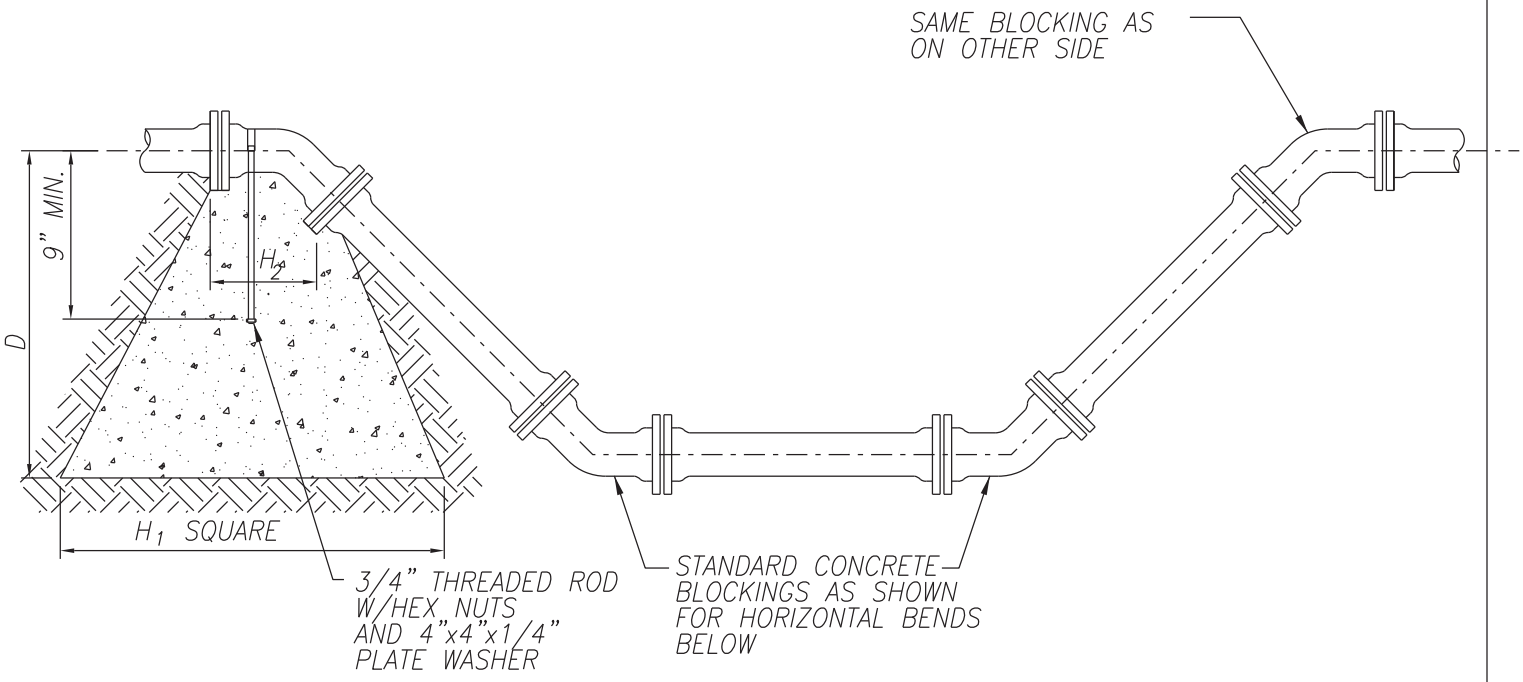
1. THRUST BLOCKING BASED UPON AN INTERVAL HYDROSTATIC PRESSURE OF 200 PSI AND AN ALLOWABLE SOIL BEARING CAPACITY OF 4000 LBS/SF. CONTRACTOR SHALL INCREASE THRUST BLOCK SIZE AS REQUIRED AND PROVIDE CALCULATIONS TO SUPPORT SAID MODIFICATION SHOULD PRESSURE BE GREATER AND/OR SOIL BEARING CAPACITY SHOULD BE LESS THAN THAT NOTED ABOVE.
2. S.B.C.U.D. SHALL APPROVE ALL THRUST BLOCKS.
3. WRAP ALL FITTINGS & PIPE IN PLASTIC PRIOR TO PLACING CONCRETE.

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THRUST BLOCK DETAIL - A

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VERTICAL BENDS

TABLE OF DIMENSIONS FOR CONCRETE BLOCKING

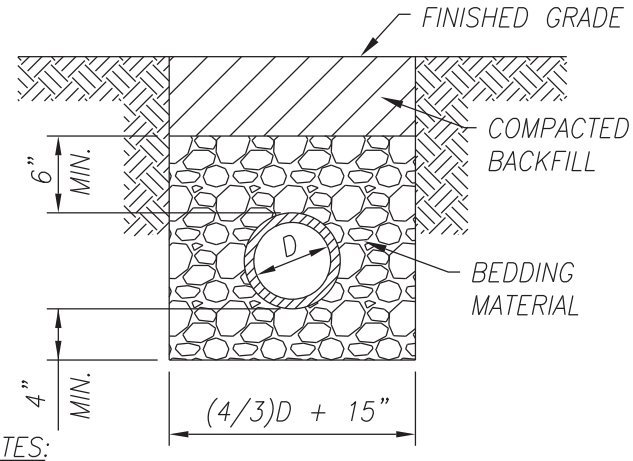
SIZE	TEES, PLUGS CROSSES					90° BENDS					45° BENDS					22 1/2° BENDS					11 1/4° BENDS					SIZE
PIPE (INCHES)	H_1	H_2	V	D	CU FT.	H_1	H_2	V	D	CU FT.	H_1	H_2	V	D	CU FT.	H_1	H_2	V	D	CU FT.	H_1	H_2	V	D	CU FT.	PIPE
2&2-1/4	18	10	12	18	1.9	18	10	12	18	1.9	18	6	12	18	1.5	18	6	12	18	1.5	18	6	12	18	1.5	2&2-1/4
3 & 4	24	12	12	18	2.3	24	12	12	18	2.3	18	8	12	18	1.6	18	8	12	18	1.6	18	8	12	18	1.6	3 & 4
6	24	16	18	18	3.5	30	16	18	18	4.1	24	10	16	18	3.2	24	10	16	18	3.2	24	10	16	18	3.2	6
8	36	18	18	18	5.1	39	18	24	18	7.3	30	11	18	18	4.0	24	11	18	18	3.5	24	11	16	18	3.4	8
10	48	24	18	24	7.2	54	32	24	18	10.3	24	18	21	18	4.6	24	18	21	18	4.6	24	18	21	18	4.6	10
12	54	30	24	24	13.4	54	32	36	24	18.2	42	18	24	24	9.6	24	18	24	24	6.6	24	18	21	24	6.1	12

5 / –

THRUST BLOCK DETAIL – B

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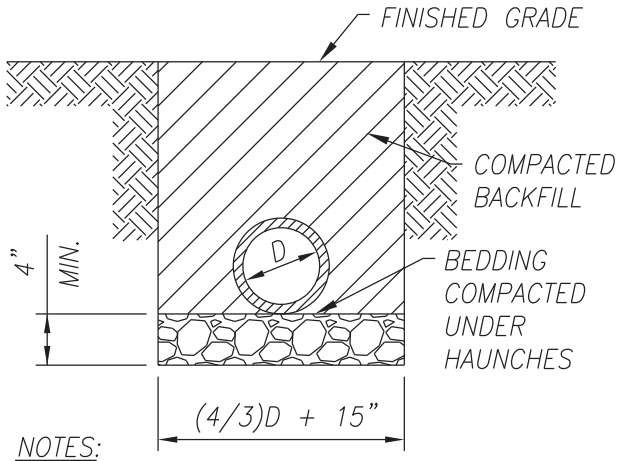
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NOTES:

1. TYPICAL BACKFILL & PIPE BEDDING FOR FLEXIBLE PIPE OUTSIDE (5' OR GREATER) OF PAVED AREAS.

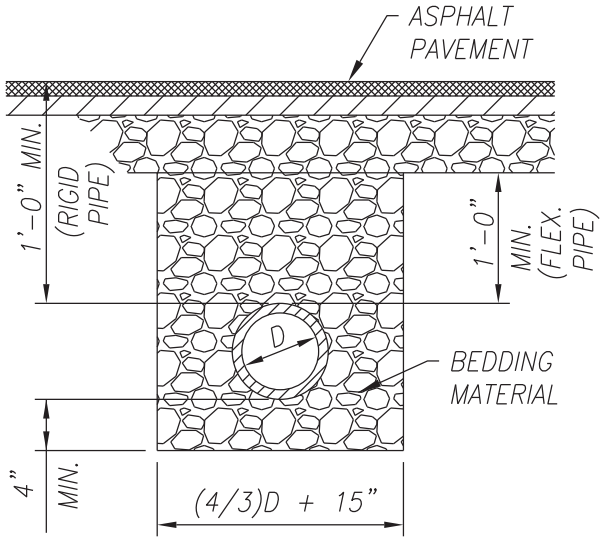
TYPE 1



NOTES:

1. TYPICAL BACKFILL & PIPE BEDDING FOR RIGID PIPE OUTSIDE (5' OR GREATER) OF PAVED AREAS.

TYPE 2



TYPE 3 (PAVED AREAS)

NOTES:

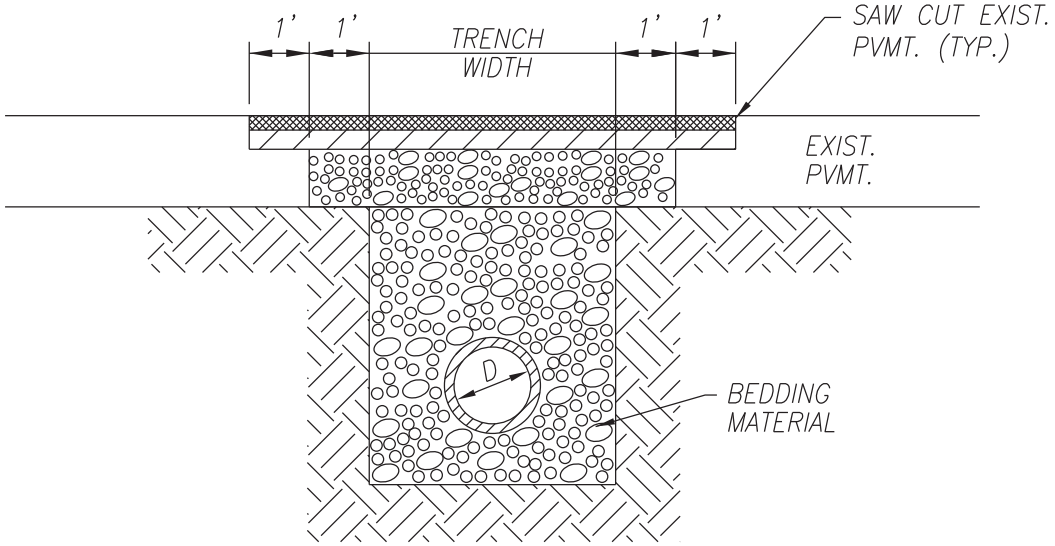
1. BEDDING MATERIAL SHALL HAVE A MINIMUM THICKNESS OF 4 IN. ACTUAL THICKNESS VARIES WITH THE PIPE MATERIAL. INSTALLATION OF BEDDING & BACKFILL SHALL BE IN STRICT COMPLIANCE WITH THE PIPE MANUFACTURER'S SPECIFICATIONS.
2. BEDDING MATERIAL TO BE #57 OR #67 CRUSHED STONE.
3. TRENCH DESIGN AND SAFETY FOR PIPELINE CONSTRUCTION IS SOLELY THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL CONFORM WITH ALL APPLICABLE LOCAL, STATE, AND OSHA REGULATIONS.

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PIPE BEDDING & BACKFILL

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NOTES:

1. REFERENCE ASPHALT PAVEMENT SECTION DETAIL FOR THICKNESS OF PAVEMENT TO BE REPLACED.

2. WHEN A TEMPORARY ASPHALT PATCH IS USED, IT SHALL BE PLACED IMMEDIATELY AFTER CRUSHED STONE BACKFILL. ALL TEMPORARY REPAIRS MUST BE PLACED PERMANENTLY WITHIN 90 DAYS.

3. WHEN "PATCHMASTER" EQUIPMENT IS USED, PAVEMENT MAY BE CUT AT THE EDGE OF TRENCH.

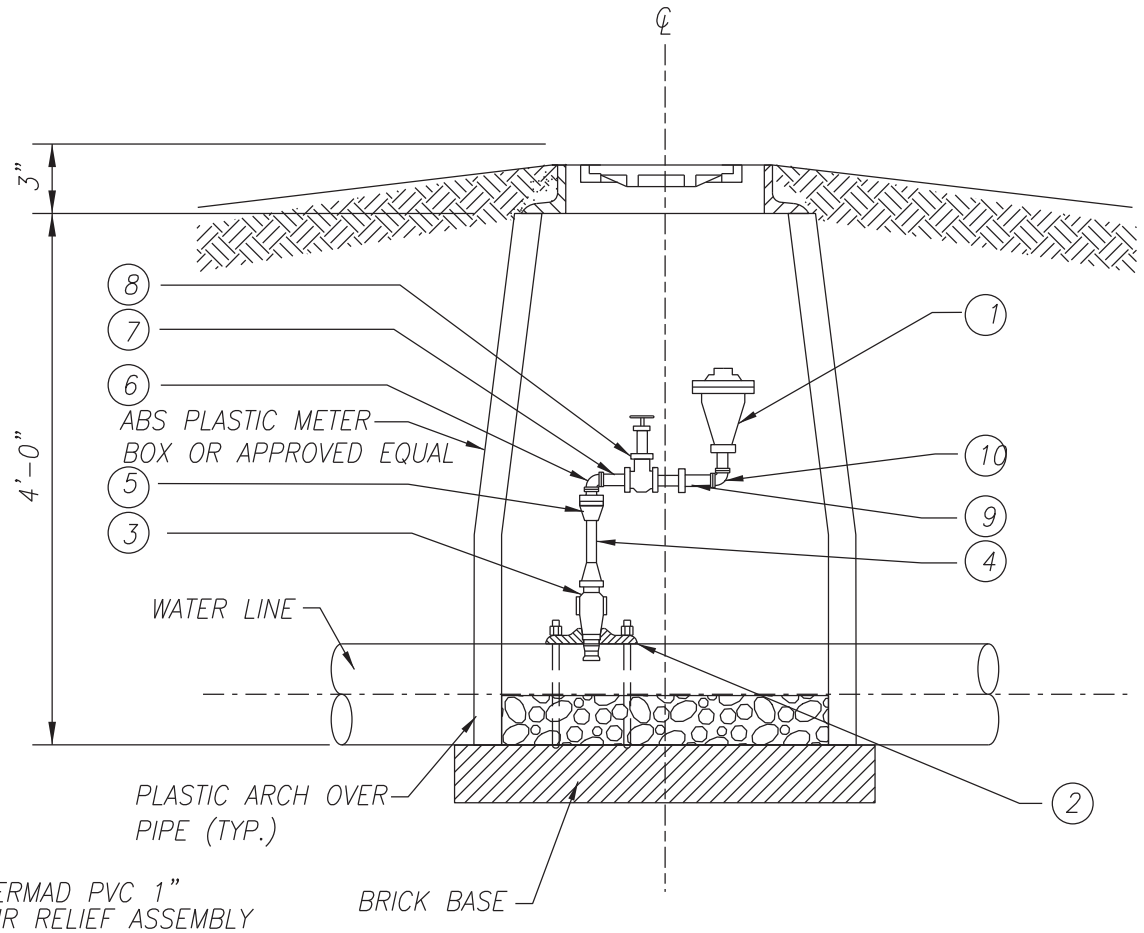
4. PAVEMENT REPAIR SHALL MEET THE REQUIREMENTS OF THE SOUTH BLOUNT UTILITY DISTRICT AND THE BLOUNT COUNTY HIGHWAY DEPARTMENT.

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PAVEMENT REPAIR

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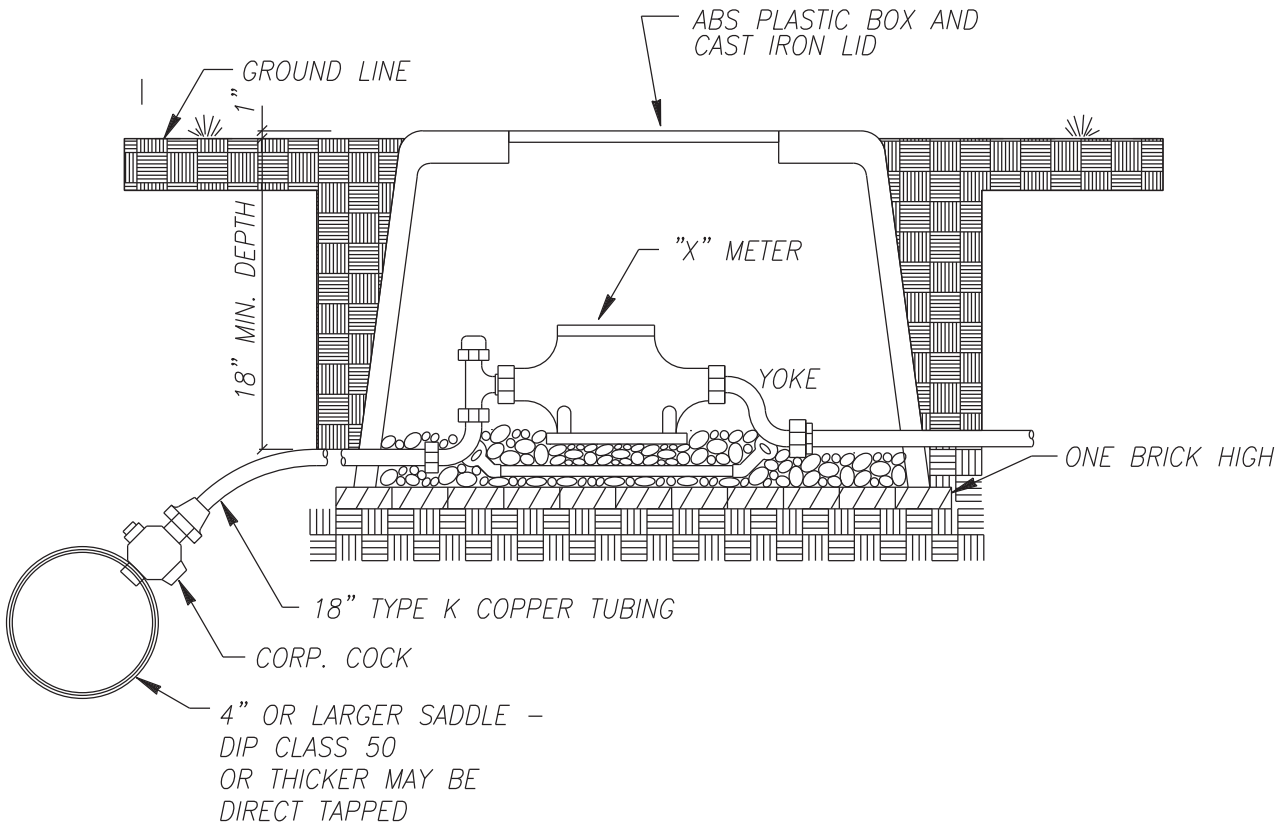


1. BERMAD PVC 1" AIR RELIEF ASSEMBLY
2. TAPPING SADDLE _ X 1" (DIP MAY BE DIRECT TAPPED)
3. CORP STOP
4. COPPER
5. MALE ADAPTOR (BRASS)
6. 90° (BRASS) FITTING
7. SHORT NIPPLE (BRASS)
8. 1/4 TURN BRASS BALL VALVE
9. SHORT NIPPLE
10. 90° FITTING

8 / – **AIR RELEASE VALVE ASSEMBLY**

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NOTES

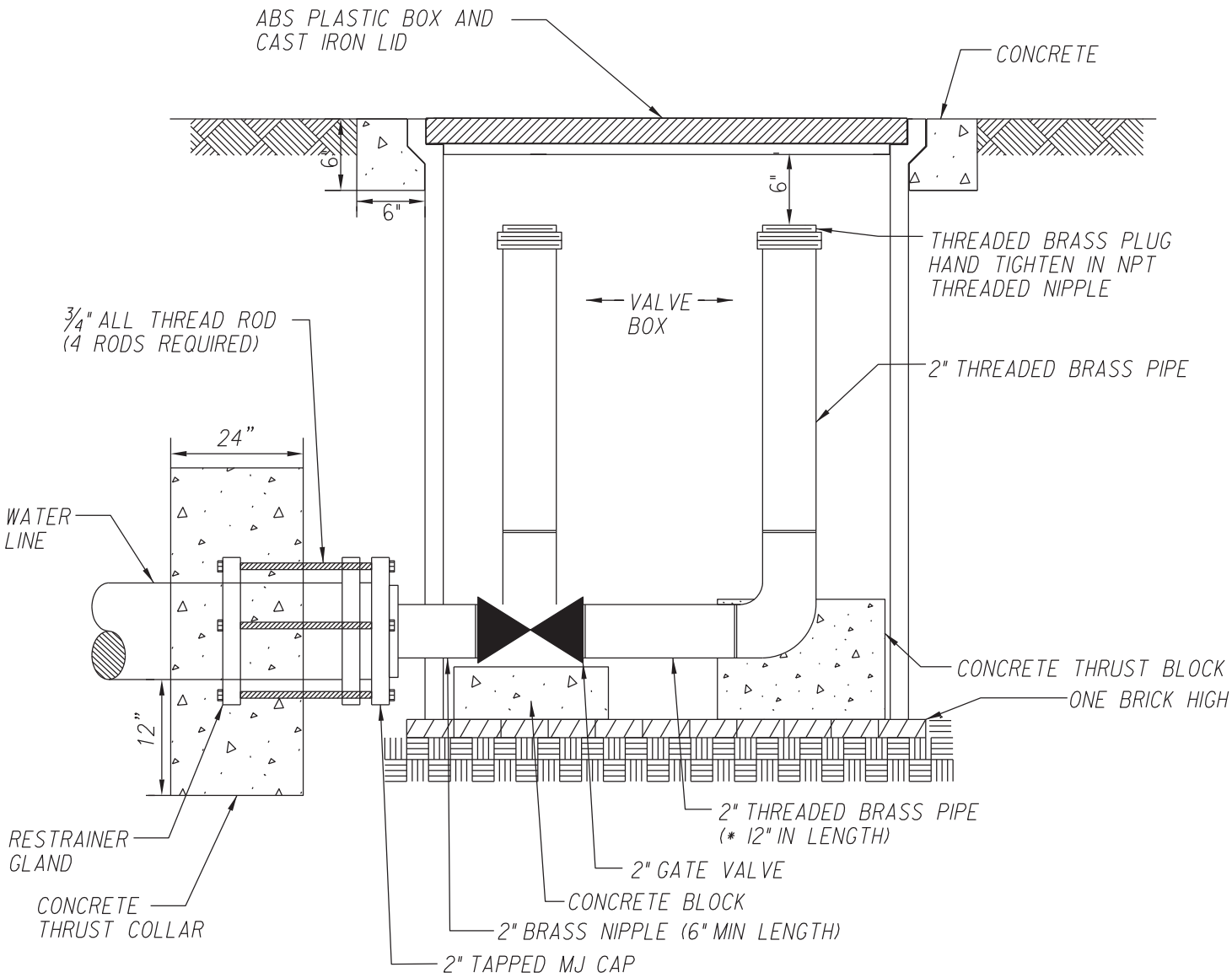
1. USE SADDLE FOR TAPS IN METAL PIPE LESS THAN 4" IN DIAMETER.
2. USE SADDLE FOR TAPS IN PVC PIPE.
3. PLACE CLEAN CRUSHED STONE 3" DEEP IN BOTTOM OF METER BOX.

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SERVICE ASSEMBLY

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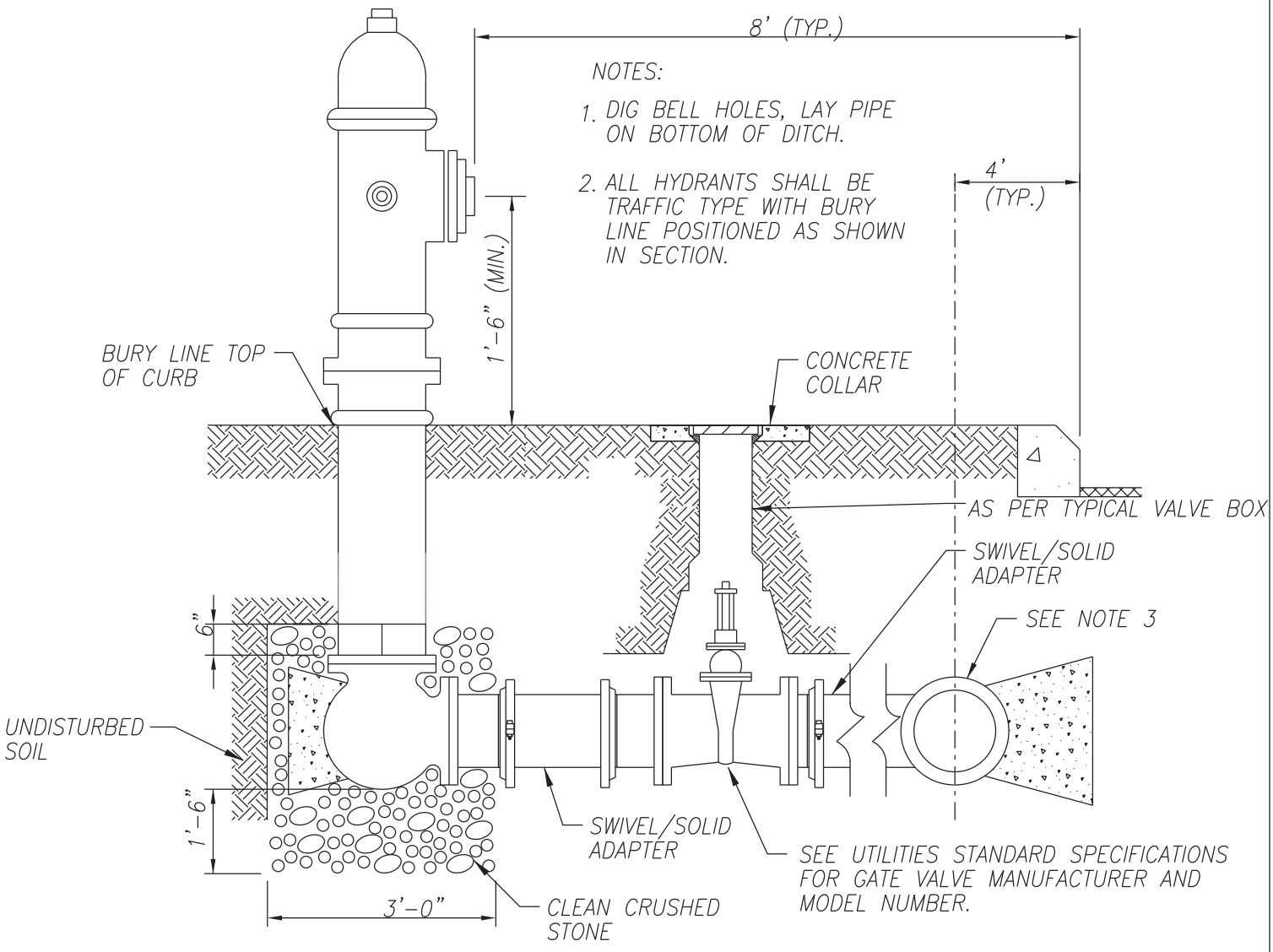
NOTE:

1. BLOW OFF HYDRANT TF500
   AS MANUFACTURED BY KUPFERLE FOUNDARY
   OR APPROVED EQUAL.

10 / – **TYPICAL BLOW-OFF ASSEMBLY**

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11 / – **FIRE HYDRANT ASSEMBLY**

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