

STANDARD WATER LINE SPECIFICATIONS

For:

**TELLICO AREA SERVICES SYSTEM (TASS)
505 CLEARVIEW ROAD MARYVILLE, TN 37801**

FEBRUARY 2026



DW20251283

APPROVED WATER SPECIFICATIONS

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 USE IN CONSTRUCTION BY THE COMMISSIONER

Kaylee Salo
02/12/2026

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 FIVE YEARS FROM ABOVE DATE

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**SECTION 01031
SPECIAL PROJECT PROCEDURES**

PART 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, Tellico Areas Services System, 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 Owner. 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 tree dressing.

1.12 UTILITIES

- A. The Contractor shall contact the Owner of all underground utilities before beginning construction in the area and comply with all location requirements as stipulated under Tennessee One-Call (811) regulations. 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 OWNER

- A. Provide two 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. Delivery of these documents is required before any retainage will be paid. Include descriptive data and printed installation, operating, and maintenance instructions (including a parts list for each item of equipment). Provide a complete index.
- B. List 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 working hours.
- B. The Contractor shall comply with 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 conformance with construction requirements does not include review of the adequacy of the Contractor's safety measures in, on, or near the construction site, nor relieve the Contractor of their 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 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 and in conformance with MUTCD standards. All such barricades shall have adequate painted or flagged markings and warning lights as necessary or required for safety. Flaggers shall be provided as required for lane closures.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

**SECTION 01050
FIELD ENGINEERING**

PART 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 will be established by Owner-provided survey.

PART 2 PRODUCTS

NOT USED

PART 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**

PART 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

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CSI	Construction Specifications Institute
EPA	Environmental Protection Agency
FM	Associated Factory Mutual Laboratories
MUTCD	Manual on Uniform Traffic Control Devices
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturers' Association
NPT	National Pipe Thread
NRCA	National Roofing Contractors' Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
PPI	Plastics Pipe Institute
SSPC	Steel Structures Painting Council
TDEC	Tennessee Department of Environment and Conservation
TDOT	Tennessee Department of Transportation
TIMA	Thermal Insulation Manufacturers' Association
UL	Underwriters' Laboratories

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01302
SUBMITTALS AND SUBSTITUTIONS

PART 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:

Tellico Area Services System (TASS)
505 Clearview Road
Maryville, TN 37801
Attention: Mark Clinton, Superintendent
Telephone: (865) 856-3530 (423) 884-6400

2. The Contractor shall provide a minimum of three (3) copies of all submittals with one copy being returned after review.
3. Electronic submittals may be accepted with Owner approval.

1.3 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.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

**SECTION 01400
QUALITY CONTROL****PART 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 the 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. The Contractor shall obtain Owner approval of the testing entity proposed for this work.
 - 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.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

**SECTION 01570
WORK ZONE TRAFFIC CONTROL**

PART 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 the Tennessee Department of Transportation (TDOT) right of way, a traffic control plan shall be submitted for approval by TDOT.

PART 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.

PART 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**

PART 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.
- C. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
- D. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
- E. 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.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

**SECTION 01710
CLEANING****PART 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.

PART 2 PRODUCTS**2.1 CLEANING MATERIALS AND EQUIPMENT**

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

PART 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 weekly, 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 requirement 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. 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.
- B. 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.
- C. Timing: Schedule final cleaning as approved by the Owner to accept a completely clean project.

END OF SECTION

**SECTION 01720
PROJECT RECORD DOCUMENTS**

PART 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 Superintendent 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. Record documents shall be in accordance with the requirements presented in the Developers Agreement.
- 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.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

**SECTION 02110
CLEARING AND GRUBBING**

PART 1 GENERAL

1.1 SCOPE

- A. The Work under this Section includes furnishing all labor, equipment and materials, and performing all operations in connection with Clearing and Grubbing. Clearing and grubbing includes, but is not limited to, removing from the Project site, trees, stumps, roots, brush, structures, abandoned utilities, trash, debris and all other materials found on or near the surface of the ground in the construction area and understood by generally accepted engineering practice not to be suitable for construction of the type contemplated. Precautionary measures that prevent damage to existing features to remain is part of the Work.
- B. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion and sedimentation control procedures.

1.2 QUALITY ASSURANCE

- A. The Contractor shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction over the Project. All required permits of a temporary nature shall be obtained for construction operations by the Contractor.
- B. Open burning, if allowed, shall first be permitted by the local authority having jurisdiction. The Contractor shall notify the local fire department and abide by fire department restrictions.

1.3 JOB CONDITIONS

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

PART 2 PRODUCTS

2.1 EQUIPMENT

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

PART 3 EXECUTION

3.1 SCHEDULING OF CLEARING

- A. The Contractor shall clear at each construction site only that length of the right-of-way, permanent or construction easement which would be the equivalent of one month's pipe laying. This length shall be determined from the Contractor's Progress Schedule.
- B. The Engineer may permit clearing for additional lengths of the pipe line provided that temporary erosion and sedimentation controls are in place and a satisfactory stand of temporary grass is established. Should a satisfactory stand of grass not be possible, no additional clearing shall be permitted beyond that specified above.

- C. A satisfactory stand of grass shall have no bare spots larger than one square yard. Bare spots shall be scattered and the bare area shall not comprise more than one percent of any given area.

3.2 CLEARING AND GRUBBING

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

3.3 DISPOSAL OF DEBRIS

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

- B. When approved in writing by the Owner and when authorized by the proper authorities, the Contractor may dispose of such debris by burning on the Project site provided all requirements set forth by the governing authorities are met. The authorization to burn shall not relieve the Contractor in any way from damages which may result from Contractor's operations. On easements through private property, the Contractor shall not burn on the site unless written permission is also secured from the property owner, in addition to authorization from the proper authorities.

END OF SECTION

**SECTION 02125
EROSION AND SEDIMENTATION CONTROL**

PART 1 GENERAL

1.1 SCOPE

- A. The work specified in this Section consists of providing, maintaining and removing temporary erosion and sedimentation controls.
- B. Temporary erosion controls, include, but are not limited to, grassing, mulching, watering and reseeding on-site surfaces and spoil and borrow area surfaces, and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the Federal Clean Water Act of 1987, as amended. The Contractor should follow the Tennessee Erosion and Sedimentation Control Handbook.
- C. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, filter stone and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the Federal Clean Water Act of 1987, as amended.
- D. Basic Principles
 - 1. Conduct the earthwork and excavation activities in such a manner to fit the topography, soil type and condition.
 - 2. Minimize the disturbed area and the duration of exposure to erosion elements.
 - 3. Stabilize disturbed areas immediately.
 - 4. Safely convey run-off from the site to an outlet such that erosion will not be increased off site.
 - 5. Retain sediment on site that was generated on site.
 - 6. Minimize encroachment upon watercourses.
- E. Temporary Erosion and Sedimentation Control: In general, temporary erosion and sedimentation control procedures shall be directed toward:
 - 1. Preventing soil erosion at the source.
 - 2. Preventing silt and sediment from entering any waterway if soil erosion cannot be prevented.
 - 3. Preventing silt and sediment from migrating downstream in the event it cannot be prevented from entering the waterway.
- F. Permanent Erosion Control: Permanent erosion control measures shall be implemented to prevent sedimentation of the waterways and to prevent erosion of the Project site.
- G. 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.
- H. 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 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 shall be 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 Tellico Area Services System may receive as a result of Tennessee Department of Environment and Conservation (TDEC) enforcement due to a notice of noncompliance.**

1.2 QUALITY ASSURANCE

- A. General: Perform all work under this Section in accordance with all pertinent rules and regulations including, but not necessarily limited to, those stated above and these Specifications.
- B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

1.3 PERMITS

- A. When the area of disturbance for the entire project is greater than 1 acre, a Storm Water Pollution Prevention Plan (SWPPP) shall be prepared and submitted to TDEC for approval unless the work involved is covered by an existing SWPPP and the inclusion is approved by TASS.

PART 2 PRODUCTS

2.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Silt Fence
 - 1. Silt fence shall be polymer type netting with a built-in cord running throughout the top edge of the fabric. Posts shall be either steel or pressure treated fir, southern pine or hemlock and shall be spaced not more than six feet on center. Silt fence shall be provided with netting to provide reinforcing when necessary. Silt fence shall have an Equivalent Opening Size (EOS) of 40 to 100. Silt fence fabric shall have a maximum permeability of 40 gallons per minute per square foot.
 - 2. Silt fence fabric shall be Mirafi 100X, Amoco 1380 or Exxon GTF-100 Series.
- B. Hay bales shall be clean, seed free cereal hay type.
- C. Netting shall be 1/2-inch, galvanized steel, chicken wire mesh.

2.2 STONE RIP-RAP

- A. Use sound, tough, durable stones resistant to the action of air and water. Slatey or shaley pieces will not be acceptable. Specific gravity shall be 2.0 or greater. Rip rap shall have less than 66 percent wear when tested in accordance with AASHTO T-96. Rip rap shall be in accordance with Section 709 of the Tennessee Department of Transportation Standard Specifications.

2.3 FILTER FABRIC

- A. The filter fabric for use under rip rap shall be a monofilament, polypropylene woven fabric meeting the specifications as established by Task Force 25 for the Federal Highway Administration. The filter fabric shall have an equivalent opening size (EOS) of 70.
- B. Filter fabric under rip rap shall be Mirafi, Amoco or Exxon.

PART 3 EXECUTION

3.1 GENERAL

- A. Standards: Provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with the Federal Clean Water Act of 1987, as amended, local enforcing agency guidelines and these Specifications.
- B. Implementation: The Contractor shall have the responsibility to actively take all steps necessary to control soil erosion and sedimentation.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt and sediment from entering the waterways. The preferred method is to provide an undisturbed natural buffer, extending a minimal five feet from the water, to filter the run-off. Should this buffer prove infeasible due to construction activities being too close to the water, or if the amount of sediment overwhelms the buffer, the Contractor shall place silt fences to filter the run-off and, if necessary, place permanent rip rap to stabilize the bank.
- B. Silt dams, silt fences, traps, barriers, check dams, appurtenances and other temporary measures and devices shall be installed as indicated on the approved plans and working drawings, shall be maintained until no longer needed, and shall then be removed. Deteriorated hay bales and dislodged filter stone shall be replaced with new materials.
- C. Where permanent grassing is not appropriate, and where the Contractor's temporary erosion and sedimentation control practices are inadequate, the Engineer may direct the Contractor to provide temporary vegetative cover with fast growing seedings.
- D. All erosion and sedimentation control devices, including check dams, shall be inspected by the Contractor at least weekly and after each rainfall occurrence and cleaned out and repaired by the Contractor as necessary.
- E. Temporary erosion and sedimentation control devices shall be installed and maintained from the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

3.3 PERMANENT EROSION CONTROL

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

3.4 SEEDING AND GRASSING

A. General

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

Times of Sowing and Seed Mixtures Required

February 1 - October 1	Group A Only
October 1 - December 1	Group B Only
December 1 - February 1	Do Not Sow Any Seeds

B. Materials

1. Topsoil: Natural, fertile, agricultural soil typical of the locality, capable of sustaining vigorous plant growth, from a well drained site free of flooding, not in frozen or muddy condition, not less than six percent organic matter, and pH value of 5.9 to 7.0. Free from subsoil, slag, clay, stones, lumps, live plants, roots, sticks, crabgrass, couch grass, noxious weeds, and foreign matter.
2. Peatmoss: Horticultural grade Class A decomposed plant material, elastic and homogeneous. Free of decomposed colloidal residue, wood, sulphur, and iron. Peatmoss shall have a pH value of 5.9 to 7.0, 60 percent organic matter by weight, moisture content not exceeding 15 percent and water absorption capacity of not less than 300 percent by weight on oven dry basis.
3. Sand: Hard, granular, natural, beach sand, washed, free of impurities, chemical, or organic matter.
4. Fertilizer: 6-12-12 grade Commercial type with six percent nitrogen, 12 percent P2O5, and 12 percent K2O.
5. Lime: Standard agricultural type containing at least 85 percent total carbonates applied at a rate of 4,000 pounds per acre (92 pounds per 1,000 square feet), or as required by the test results and recommendations as specified above. Before seeding, apply lime and fertilizer and incorporate them into the soil at least 3- inches deep by discing and harrowing, at the rates recommended above or required by the above test results.
6. Seed: Seed shall be uniform mixtures of the following kinds and properties:

Seed	Group A		Group B	
	% by Weight	Pounds/Acre	% by Weight	Pounds/Acre
Kentucky Bluegrass	25	50	25	50
Hulled Bermuda	-	-	20	40
Kentucky 31 Fescue	75	150	35	70
English Rye	-	-	20	40
Total	100	200	100	200

- C. Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Where sod is removed or damaged, replant such areas using sod of the same species of grass at the first appropriate season. Outside of residential or landscaped areas, grass the entire area disturbed by the work on completion of work in any area. In all areas, promptly establish successful stands of grass.

3.5 RIP-RAP

- A. Unless shown otherwise on the Drawings, rip-rap shall be placed where indicated by the Engineer. Carefully compact backfill and place rip rap to prevent subsequent settlement and erosion.
- B. Preparation of Foundations: The ground surface upon which the rip rap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before placement is commenced. Where filling of depressions is required, the new material shall be compacted with hand or mechanical tampers.
- C. Placement of Rip Rap: The rip-rap shall be placed on a 6-inch layer of soil, crushed stone or sand overlaying the filter fabric. This 6-inch layer shall be placed to maximize the contact between the soil beneath the filter fabric and the filter fabric. Rip rap shall be placed with its top elevation conforming with the natural slope of the stream bank and stream bottom. Stone rip rap shall be dumped into place to form a uniform surface and to the thickness specified on the Drawings. The thickness tolerance for the course shall be -6-inches and +12-inches. If the Drawings or Bid do not specify a thickness, the course shall be placed to a thickness of not less than 18-inches.
- D. Repair of Existing Rip-Rap Ditches: The Drawings show locations where existing rip rap ditches will be disturbed in order to construct the new water main. The Contractor shall limit the amount of ditch disturbed to that which is necessary to construct the water main. Immediately after placement of the water main, the rip rap ditch shall be repaired. The Contractor, at its option may reuse the existing rip-rap providing it is free of all mud or any other deleterious matter and has not been made unusable by the action of the Contractor. The Engineer will determine as to the suitability of the material for reuse. Any shortage of materials to replace the ditch shall be replaced with new material by the Contractor. If the Contractor chooses not to use the existing stone, the unused material shall be removed from the site. All new rip rap used to repair/replace the existing ditches shall meet the requirements as specified in Article 2.2 Rip-Rap of this Section.

3.6 CONSTRUCTION OF STRUCTURES

- A. Check Dams: Check dams shall be utilized to retard stream flow or restrict stream flow within the channel. 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.
- B. 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.
- C. 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.
- D. 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.
- E. 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.
- F. 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
1. The contractor shall see the design plans for further information regarding installation and placement.
- G. Permanent Seeding and Mulching: Seeding and mulching shall be performed in accordance with Article 3.4 of this section.
- 3.7 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.
- 3.8 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 02225
TRENCH EXCAVATION AND BACKFILL**

PART 1 GENERAL

1.1 SCOPE

- A. The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with the trench excavation and backfill required to install the pipelines shown on the Drawings and as specified.
- B. Excavation shall include the removal of any trees, stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.
- C. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.
- D. The trench is divided into five specific areas:
 - 1. Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.
 - 2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.
 - 3. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
 - 4. Initial Backfill: The area above the haunching material and below a plane 18 inches above the top of the barrel of the pipe or the top of duct bank.
 - 5. Final Backfill: The area above a plane 18 inches above the top of the barrel of the pipe.
- E. The choice of method, means, techniques and equipment rests with the Contractor. The Contractor shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material proximity of man-made improvements to be protected, available easement or right-of-way and prevailing practice in the area.

1.2 QUALITY ASSURANCE

- A. Density: All references to "maximum dry density" shall mean the maximum dry density defined by the "Maximum Density-Optimum Moisture Test", ASTM D 698, except that for non-cohesive materials "maximum dry density" shall mean the maximum index density as determined by the "Maximum Index Density of Soils Using a Vibratory Table", ASTM D 4253. Determination of the density of foundation, bedding, haunching, or backfill materials in place shall meet with the requirements of ASTM D 1556, "Density of Soil In Place by the Sand Cone Method", ASTM D 2937, "Density of Soil In Place by the Drive-Cylinder Method" or ASTM D 2922, "Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)".
- B. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specifications shall be performed by an independent testing laboratory. All imported fill materials shall meet the requirements of on-site fill materials.

1.3 SAFETY

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

PART 2 PRODUCTS

2.1 TRENCH FOUNDATION MATERIALS

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

2.2 BEDDING AND HAUNCHING MATERIALS

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

2.3 INITIAL BACKFILL

- A. Unless shown on the Drawings or specified otherwise, initial backfill material shall be crushed stone or earth materials as specified for bedding and haunching materials.
- B. Initial backfill material under all pavement areas or where the trench is within three feet of the pavement edge of County roads shall be crushed stone.
- C. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2 inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, initial backfill materials shall be moistened to facilitate compaction by

tamping. If materials excavated from the trench are not suitable for use as initial backfill material, provide select material conforming to the requirements of this Section.

2.4 FINAL BACKFILL

- A. Unless shown on the Drawings or specified otherwise, final backfill material shall be general excavated earth materials, shall not contain more than one-third broken rock, of which no stone or rock shall weigh more than 40 pounds, cinders, stumps, limbs, man-made wastes and other unsuitable materials. If materials excavated from the trench are not suitable for use as final backfill material, provide select material conforming to the requirements of this Section.
- B. Final backfill material, up to 6-inches of grade, under all pavement areas or where the trench is within three feet of the pavement edge shall be crushed stone.

2.5 SELECT BACKFILL

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

2.6 CONCRETE

- A. Concrete for bedding, haunching, initial backfill or encasement shall have a compressive strength of not less than 4,000 psi and a slump between 3 and 5 inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

PART 3 EXECUTION

3.1 TRENCH EXCAVATION

- A. Topsoil and grass shall be stripped a minimum of 6 inches over the trench excavation site and stockpiled separately for replacement over the non-paved, finished grading areas.
- B. Trenches shall be excavated to the lines and grades shown on the Drawings with the centerlines of the trenches on the centerlines of the pipes and to the dimensions which provide the proper support and protection of the pipe and other structures and accessories.
- C. Trench Width for Pipelines
 1. The sides of all trenches shall be as vertical as is practical to a minimum of one foot above the top of the pipe. Unless otherwise indicated on the Drawings, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.
 2. Excavate the top portion of the trench to any width within the construction easement or right-of-way which will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.
 3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 6 inches clearance between the rock and any part of the pipe or appurtenance.
 4. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher Class or Type of bedding and haunching as shown on the Drawings for the full trench width as actually cut. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-

excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the Engineer or Owner.

D. Depth

1. The trenches shall be excavated to the required depth or elevation which allow for the placement of the pipe and bedding to the dimensions shown on the Drawings or specified.
2. Excavate trenches to provide a minimum cover of 30 inches. Within the right-of-way of highways, streets or roadways, also excavate to place the top of the pipe a minimum of 30 inches below the nearest pavement edge or drainage ditch.
3. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.
4. Where rock is encountered in trenches for pipelines, excavate to the minimum depth which will provide clearance below the pipe barrel of 8 inches for pipe 21 inches in diameter and smaller and 12 inches for larger pipe, valves and manholes. Remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe, manhole or accessory.

E. Excavated Materials

1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Top soil shall be carefully separated and lastly placed in its original location.
2. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

3.2 SHEETING, BRACING AND SHORING

A. Sheeting, bracing and shoring shall be performed in the following instances:

1. Where sloping of the trench walls does not adequately protect persons within the trench from slides or cave-ins.
2. In caving ground.
3. In wet, saturated, flowing or otherwise unstable materials. The sides of all trenches and excavations shall be adequately sheeted, braced and shored.
4. Where necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees or private properties which are required to remain.
5. Where necessary to maintain the top of the trench within the available construction easement or right-of-way.

B. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970, as amended.

C. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.

D. Steel Sheeting and Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities.

E. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of

the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be "dragged" with the bottom of the shield extending below the top of the pipe or utility.

- F. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the Engineer it cannot be safely removed or is within three feet of an existing structure, utility, or pipeline. Cut off any sheeting left in place at least two feet below the surface.
- G. Sheet piling within three feet of an existing structure or pipeline shall remain in place, unless otherwise directed by the Engineer.

3.3 ROCK EXCAVATION

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

3.4 DEWATERING EXCAVATIONS

- A. Dewater excavation continuously to maintain a water level two feet below the bottom of the trench.
- B. Control drainage in the vicinity of excavation so the ground surface is properly pitched to prevent water running into the excavation.
- C. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations. Where the utility crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property.
- D. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.
- E. Where dewatering is performed by pumping the water from a sump, crushed stone shall be used as the medium for conducting the water to the sump. Sump depth shall be at least two feet below the bottom of the trench, Pumping equipment shall be of sufficient quantity and/or capacity to maintain the water level in the sump two feet below the bottom of the trench. Pumps shall be a type such that intermittent flows

can be discharged. A standby pump shall be required in the event the operating pump or pumps clog or otherwise stop operation.

- F. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet below the trench bottom. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10-inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing.

3.5 TRENCH FOUNDATION AND STABILIZATION

- A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.
- B. If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the pipe, the trench will be determined to be unsuitable and the Engineer shall then authorize payment for trench stabilization.
- C. Should the undisturbed material encountered at the trench bottom constitute, in the opinion of the Engineer, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed stone or surge stone as directed by the Engineer.
- D. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

3.6 BEDDING AND HAUNCHING

- A. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders or large dirt clods.
- B. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings. All bedding shall extend the full width of the trench bottom. The pipe shall be placed and brought to grade by tamping the bedding material or by removal of the excess amount of the bedding material under the pipe. Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint.
- C. At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.
- D. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders or dirt clods.
- E. Ductile Iron Pipe
 - 1. Unless otherwise shown on the Drawings or specified, utilize earth materials for bedding and haunching. Type 2, 3, 4 and 5 bedding shall be as detailed on the Drawings.

2. Unless specified or shown otherwise, bedding shall meet the requirements for Type 2 Pipe Bedding. Unless specified or shown otherwise for restrained joint pipe and fittings, bedding shall meet the requirements for Type 3 Pipe Bedding.
 3. Where the depth of cover over the piping exceeds 15 feet, the pipe bedding shall meet the requirements of Type 4 Pipe Bedding. Where the depth of cover over the piping exceeds 28 feet, the pipe bedding shall meet the requirements of Type 5 Pipe Bedding.
 4. Type 4 or Type 5 Pipe Bedding called for on the Drawings, specified or ordered by the Engineer, shall meet requirements for Type 4 or Type 5 Pipe Bedding, utilizing crushed stone bedding and haunching material.
- F. Polyvinyl Chloride Pipe
1. Unless shown otherwise on the Drawings, utilize earth materials for bedding and haunching.
 2. Unless shown otherwise on the Drawings, bedding and haunching shall meet the requirements for Type 2 Pipe Bedding, as detailed on the Drawings.
- G. Excessive Width and Depth
1. Water Mains: If the trench is excavated to excess width, provide the next higher type or class of pipe bedding, but a minimum of Type 4, as detailed on the Drawings.
 2. If the trench is excavated to excessive depth, provide crushed stone to place the bedding at the proper elevation or grade.
- H. Compaction: Bedding and haunching materials under pipe, manholes and accessories shall be compacted to a minimum of 90 percent of the maximum dry density, unless shown or specified otherwise.
- 3.7 INITIAL BACKFILL
- A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.
 - B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 18 inches above the pipe barrel. Layer depths shall be a maximum of 6 inches.
 - C. Backfill on both sides of the pipe simultaneously to prevent side pressures.
 - D. Compact each layer thoroughly with suitable hand tools or tamping equipment.
 - E. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless shown or specified otherwise.
 - F. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.
- 3.8 CONCRETE ENCASEMENT FOR PIPELINES
- A. Where concrete encasement is shown on the Drawings for pipelines, excavate the trench to provide a minimum of 6-inches clearance from the bell of the pipe. Lay the pipe to line and grade on concrete blocks. In lieu of bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than 6 inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.
- 3.9 3.09 FINAL BACKFILL
- A. Backfill carefully to restore the ground surface to its original condition.

- B. The top 6 inches shall be topsoil obtained as specified in "Trench Excavation" of this Section.
- C. Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of, at no additional cost to the Owner, in a manner approved by the Engineer. Surplus soil may be neatly distributed and spread over the site, if approved by the Engineer. If such spreading is allowed, the site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.
- D. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.
- E. After initial backfill material has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:
 - 1. In 6 inch layers, if using light power tamping equipment, such as a "jumping jack"
 - 2. In 12 inch layers, if using heavy tamping equipment, such as hammer with tamping feet
- F. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.
- G. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise.

3.10 ADDITIONAL MATERIAL

- A. Where final grades above the pre-construction grades are required to maintain minimum cover, additional fill material will be as shown on the Drawings. Utilize excess material excavated from the trench, if the material is suitable. If excess excavated materials are not suitable, or if the quantity available is not sufficient, provide additional suitable fill material.

3.11 BACKFILL UNDER ROADS

- A. Compact backfill underlying pavement and sidewalks, and backfill under dirt and gravel roads to a minimum 95 percent of the maximum dry density. The top 12 inches shall be compacted to a minimum of 98 percent of the maximum dry density.
- B. County Roads
 - 1. All bedding, haunching and backfill beneath the pavement, as well as within three feet from the edge of pavement, of all County roadways shall be crushed stone meeting the requirements of the appropriate County Department of Highways.
 - 2. If a pipeline is constructed beneath the shoulder of the road but is beyond three feet from the edge of pavement, final backfill shall be earth materials placed to a minimum of 95 percent of the maximum dry density. The top 6 inches shall be size No. 57 crushed stone compacted to a minimum 95 percent of the maximum dry density.
- C. State Highways (if permitted)
 - 1. All bedding, haunching and backfill beneath the pavement, as well as within paved and maintained shoulders of all state highways shall meet all TDOT requirements as outlined in the project's approved TDOT joint utility construction permit.

3.12 BACKFILL ALONG RESTRAINED JOINT PIPE

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

3.13 Testing and Inspection

- A. The soils testing laboratory is responsible for the following:
 - 1. Compaction tests in accordance with Article 1.02 of this Section.
 - 2. Field density tests as ordered by the Engineer.
 - 3. Inspecting and testing stripped site, subgrades and proposed fill materials.

- B. The Contractor's duties relative to testing include:
 - 1. Notifying laboratory of conditions requiring testing.
 - 2. Coordinating with laboratory for field testing.
 - 3. Paying costs for additional testing performed beyond the scope of that required and for re-testing where initial tests reveal non-conformance with specified requirements.
 - 4. Providing excavation as necessary for laboratory personnel to conduct tests.

- C. Inspection
 - 1. Earthwork operations, acceptability of excavated materials for bedding or backfill, and placing and compaction of bedding and backfill is subject to inspection by the Engineer.
 - 2. Foundations and shallow spread footing foundations are required to be inspected by a geotechnical engineer, who shall verify suitable bearing and construction.

- D. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.

END OF SECTION

**SECTION 02311
CONTROL BLASTING****PART 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.

PART 2 PRODUCTS

NOT USED

PART 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.

- B. The Contractor shall secure at his own expense all required blasting permits and additional hazard insurance.
- C. The Contractor shall cover the blasting area with enough excavation material and/or matting to prevent danger to lives and property.
- D. 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 02545
BORING AND CASING FOR WATER LINES**

PART 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.

PART 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 all 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 CARRIER PIPE

- A. The carrier pipe shall meet the standards specified in Section 02713.

PART 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. 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 runner 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 as provided by Cascade Waterworks Mfg. Co. or Pipeline Seal and Insulator, Inc. Each end of the casing pipe shall be sealed with a wrap-around end seal. 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 AASHTO 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 AASHTO 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.

PART 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**

PART 1 GENERAL

1.1 SCOPE

- A. The work to be performed under this Section shall consist of removing and replacing existing pavement, sidewalks and curbs in paved areas where such have been removed for construction of water mains, fire hydrants, sewers, manholes and all other water, sewer and utility appurtenances and structures.

1.2 SUBMITTALS

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

1.3 CONDITIONS

- A. Weather Limitations
 1. Do not conduct paving operations when surface is wet or contains excess of moisture which would prevent uniform distribution and required penetration.
 2. Construct prime and tack coats, and asphaltic courses only when atmospheric temperature in the shade is above 50 degrees F, when the underlying base is dry and when weather is not rainy.
 3. Place base course when air temperature is above 35 degrees F and rising.
- B. Grade Control: Establish and maintain the required lines and grades for each course during construction operations.
- C. County Roads: All work within county road rights-of-way shall be performed in accordance with the requirements and specification of the Monroe or Loudon County Highways Standards as applicable. The respective County Highway Utility Inspector shall be notified at least 24 hours prior to starting work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Mineral Aggregate Base Course: Mineral aggregate base course shall conform to the requirements of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 303, Type A base or Section 303, Class B, Grading D base.
- B. Binder (Hot Mix): The base of all paved roadways shall conform to the requirements of Section 307 of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction.
- C. Asphaltic Concrete Surface (Hot Mix): The surface course for all pavement shall conform to the requirements of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 411, Grading D or E to match existing.
- D. Double Bituminous Surface Treatment: The surface for all pavements shall conform to the requirements of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 404.

- E. Concrete: Provide concrete and reinforcing for concrete pavement or base courses in accordance with the requirements of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 501.
- F. Special Surfaces: Where driveways or roadways are disturbed or damaged which are constructed of specialty type surfaces, e.g. brick or stone, these driveways and roadways shall be restored utilizing similar, if not original, materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed.

2.2 TYPES OF PAVEMENTS

- A. General: All existing pavement removed, destroyed or damaged by construction shall be replaced with the same type and thickness of pavement as that existing prior to construction, unless otherwise directed by the Engineer. Materials, equipment and construction methods used for paving work shall conform to the Tennessee Department of Transportation specifications applicable to the particular type required for replacement, repair or new pavements.
- B. Aggregate Base: Aggregate base shall be constructed in accordance with the requirements of TDOT Section 303, Class B, Grading D. Material shall be mixed and placed by the stationary plant method. If the finished compacted base course depth is 6-inches or more, the course shall be constructed in two or more layers of approximately equal thickness.
- C. Concrete Pavement: Concrete pavement or base courses shall be replaced with concrete. The surface finish of the replaced concrete pavement shall conform to that of the existing pavement. The surface of the replaced concrete base course shall be left rough. The slab depth shall be equivalent to the existing concrete pavement or base course, but in no case less than 4-inches thick. Transverse and longitudinal joints removed from concrete pavement shall be replaced at the same locations and to the same types and dimensions as those removed. Concrete pavements or concrete base courses shall be reinforced and shall conform to the Tennessee Department of Transportation Standard Specifications, Section 501. If edge of trench is within three feet of an expansion joint, concrete shall be removed and replaced to the edge of the joint.
- D. Asphalt Concrete Base, Binder and Surface Course: Asphalt concrete base, binder and surface course construction shall conform to the Tennessee Department of Transportation Standard Specifications, Section 307 for bituminous plant mix base course and Section 411, Grading "E" for asphalt concrete surface course. The pavement mixture shall not be spread until the designated surface has been previously cleaned and prepared, is intact, compacted as specified herein, properly cured, dry and the prime and/or tack coat has been applied. Apply and compact the asphalt concrete in maximum layer thickness by asphalt spreader equipment of design and operation approved by the Engineer. After compaction, the asphalt concrete shall be smooth and true to established profiles and sections. Immediately correct any high, low or defective areas by cutting out the course, replacing with fresh hot mix, and immediately compacting to conform and thoroughly bond to the surrounding area.
- E. Gravel Surfaces: Existing gravel road, drive and parking area replacement shall meet the requirements of aggregate base course. This surfacing may be authorized by the Engineer as a temporary surface for paved streets until replacement of hard surfaced pavement is authorized.
- F. Temporary Measures: During the time period between pavement removal and complete replacement of permanent pavement, maintain highways, streets and roadways by the use of steel running plates anchored to prevent movement. The backfill above the pipe shall be compacted, as specified elsewhere, up to the existing pavement surface to provide support for the steel running plates.

PART 3 EXECUTION

3.1 REMOVING PAVEMENT

- A. General: Remove existing pavement as necessary for installing the pipe line and appurtenances.
- B. Marking: Before removing any pavement, mark the pavement neatly paralleling pipe lines and existing street lines. Space the marks the width of the trench.
- C. Breaking: Break asphalt pavement along the marks using pavement shearing equipment, jack hammers or other suitable tools. Break concrete pavement along the marks by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.
- D. Machine Pulling: Do not pull pavement with machines until the pavement is completely broken and separated from pavement to remain.
- E. Damage to Adjacent Pavement: Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.
- F. Damage to Traffic Signal Loops: Any pavement removal which will include removal of traffic signal loops embedded in the pavement shall be coordinated with the Traffic Engineering Department having jurisdiction over the traffic signal five days prior to pavement removal.
- G. Sidewalk: Remove and replace any sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.
- H. Curbs: Tunnel under or remove and replace any curb disturbed by construction to the nearest undisturbed joint.

3.2 REPLACING PAVEMENT

- A. Pavement shall be replaced no later than seven days after the original surface was cut.
- B. Preparation of Subgrade: During backfilling and compaction of the backfill, arrange to have the compaction tested by an independent testing laboratory. After compaction testing has been satisfactorily completed, replace all pavements, sidewalks and curbs removed.
 - 1. The existing street pavement or surface shall be removed along the lines of the work for the allowable width specified for the trench or structure. After the installation of the sewerage or water works facilities and after the backfill has been compacted suitably, the additional width of pavement to be removed, as shown on the Standard Detail Drawings, shall be done immediately prior to replacing the pavement.
 - 2. Trench backfill shall be compacted for the full depth of the trench as specified in Section 02225 of these Specifications.
 - 3. Temporary trench backfill along streets and driveways shall include 6-inches of crushed stone or cherty clay as a temporary surfacing of the trenches or asphalt as directed by the Engineer. This temporary surface shall be maintained carefully at grade and dust-free by the Contractor until the backfill of the trench has thoroughly compacted in the opinion of the Engineer and permission is granted to replace the street pavement.
 - 4. When temporary crushed stone or chert surface is considered by the Engineer to be sufficient surface for gravel pavement, the surface shall be graded smooth and to an elevation that will make the final permanent surfacing level with the adjacent surfacing that was undisturbed.

C. Pavement Replacement

1. Prior to replacing pavement, make a final cut in concrete pavement 12-inches back from the edge of the damaged pavement with a concrete saw. Remove asphalt pavement 12-inches back from the edge of the damaged pavement using pavement shearing equipment, jackhammers or other suitable tools.
2. Replace all street and roadway pavement as shown on the Drawings. Replace driveways, sidewalks and curbs with the same material, to nearest existing undisturbed construction joint and to the same dimensions as those existing.
3. If the temporary crushed stone or chert surface is to be replaced, the top 6-inches shall be removed and the crushed stone surfacing for unpaved streets or the base for the bituminous surface shall be placed.
4. Following this preparation, the chert or crushed stone base shall be primed with a suitable bituminous material and surfaced with the proper type of bituminous surface treatment.
5. Where the paved surface is to be replaced with asphaltic concrete pavement, concrete pavement or with a concrete base and a surface course, the temporary chert or crushed stone surface and any necessary backfill material, additional existing paving and new excavation shall be removed to the depth and width shown on the Standard Detail Drawings. All edges of the existing pavement shall be cut to a straight, vertical edge. Care shall be used to get a smooth joint between the old and new pavement and to produce an even surface on the completed street. Concrete base slabs and crushed stone bases, if required, shall be placed and allowed to cure for three days before bituminous concrete surface courses are applied. Expansion joints, where applicable, shall be replaced in a manner equal to the original joint.
6. Where driveways or roadways, constructed of specialty type surfaces, e.g. brick or stone are disturbed or damaged, these driveways and roadways shall be restored utilizing similar materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed.

D. Pavement Resurfacing

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

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

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

3.3 SIDEWALK AND CURB REPLACEMENT

A. Construction

1. All concrete sidewalks and curbs shall be replaced with concrete.
2. Prefomed joints shall be 1/2-inch thick, conforming to the latest edition of AASHTO M 59 for sidewalks and AASHTO M 123 for curbs.

3. Forms for sidewalks shall be of wood or metal, shall be straight and free from warp, and shall be of sufficient strength, when in place, to hold the concrete true to line and grade without springing or distorting.
 4. Forms for curbs shall be metal and of an approved section. They shall be straight and free from distortions, showing no vertical variation greater than 1/8-inch in 10 feet and no lateral variation greater than 1/4-inch in 10 feet from the true plain surface on the vertical face of the form. Forms shall be of the full depth of the structure and constructed such to permit the inside forms to be securely fastened to the outside forms.
 5. Securely hold forms in place true to the lines and grades to match existing.
 6. Wood forms may be used on sharp turns and for special sections, as approved by the Engineer. Where wooden forms are used, they shall be free from warp and shall be the nominal depth of the structure.
 7. All mortar and dirt shall be removed from forms and all forms shall be thoroughly oiled or wetted before any concrete is deposited.
- B. When a section is removed, the existing sidewalk or curb shall be cut to a neat line, perpendicular to both the centerline and the surface of the concrete slab. Existing concrete shall be cut along the nearest existing construction joints; if such joints do not exist, the cut shall be made at minimum distances to match existing.
- C. Existing concrete sidewalks and curbs that have been cut and removed for construction purposes shall be replaced with the same width and surface as the portion removed. Sidewalks shall have a minimum uniform thickness of 4-inches. The new work shall be neatly jointed to the existing concrete so that the surface of the new work shall form an even, unbroken plane with the existing surfaces.
- D. The subgrade shall be formed by excavating to a depth equal to the thickness of the concrete, plus 2-inches. Subgrade shall be of such width as to permit the proper installation and bracing of the forms. Subgrades shall be compacted by hand tamping or rolling. Soft, yielding or unstable material shall be removed and backfilled with satisfactory material. Place 2-inches of porous crushed stone under all sidewalks and curbs and compact thoroughly, then finish to a smooth, unyielding surface at proper line, grade and cross section.
- E. Joint for Curbs
1. Joints shall be constructed to match existing and as specified. Construct joints true to line with their faces perpendicular to the surface of the structure and within 1/4-inch of their designated position.
 2. Thoroughly spade and compact the concrete at the faces of all joints filling all voids.
 3. Install expansion joint materials at the point of curve at all street returns. Install expansion joint material behind the curb at abutment to sidewalks and adjacent structures.
 4. Place contraction joints every 10 feet along the length of the curbs and gutters. Form contraction joints using steel templates or division plates which conform to the cross section of the structure. Leave the templates in place until the concrete has set sufficiently to hold its shape, but remove them while the forms are still in place. Contraction joint templates or plates shall not extend below the top of the steel reinforcement or they shall be notched to permit the reinforcement to be continuous through the joint. Contraction joints shall be a minimum of 1-1/2-inches deep.
- F. Expansion joints shall be required to replace any removed expansion joints. Expansion joints shall be true and even, shall present a satisfactory appearance, and shall extend to within 1/2-inch of the top of finished concrete surface.
- G. Finishing
1. Strike off the surface with a template and finish the surface with a wood float using heavy pressure, after which, contraction joints shall be made and the surface finished with a wood float or steel trowel.
 2. Finish the face of the curbs at the top and bottom with an approved finishing tool of the radius to match existing.
 3. Finish edges with an approved finishing tool having a 1/4-inch radius.

4. Provide a final broom finish by lightly combing with a stiff broom after troweling is complete.
5. The finished surface shall not vary more than 1/8-inch in 10 feet from the established grade.

H. Driveway and Sidewalk Ramp Openings

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

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

3.4 MAINTENANCE

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

3.5 SUPERVISION AND APPROVAL

- A. Pavement restoration shall meet the requirements of the regulatory agency responsible for the pavement. Obtain agency approval of pavement restorations before requesting final payment.
- B. Obtain the Engineer's approval of restoration of pavement, such as private roads and drives that are not the responsibility of a regulatory agency.
- C. Complete pavement restoration as soon as possible after backfilling.
- D. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the life of the Contract, including the bonded period, promptly restore or repair defects.

3.6 CLEANING

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

END OF SECTION

SECTION 02640
VALVES, HYDRANTS, SERVICES AND BLOWOFFS

PART 1 GENERAL

- 1.1 Refer to other specification sections for work related to valves, hydrants and blowoffs.
- 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.
- 1.4 All materials which will be in direct contact with potable water supplies shall be NSF 61 compliant.

PART 2 PRODUCTS**2.1 GATE VALVES**

- A. Gate valves shall be used on water lines 10-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 M&H model 7571 or approved equal.
- 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 approved equal.
- N. The use of Swivel-X or ductile iron mega-lug type restraint 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.

2.2 BUTTERFLY VALVES

- A. Valves on water lines 12-inches and larger shall be butterfly valves, designed for direct burial service, which meet or exceed the requirements of AWWA C504, 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 Owner approved equal.

2.3 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 as manufactured by Aquestia USA (A.R.I.) or Owner approved equal. Valve type shall be appropriate for the intended use or as approved by the Owner/Engineer.
- C. Automatic air release valves shall be installed in accordance with the manufacturer's standard instructions.

2.4 TAPPING VALVES – RESILIENT SEATED GATE VALVE

- A. Tapping valves shall conform to AWWA C509/C515, latest revision. Valves shall be American Darling, M&H, U.S. Pipe, or Mueller.
- B. Tapping valves shall meet all requirements for Gate Valves (Paragraph 2.1 above) with mechanical joint/tapping flange ends. The valve waterway shall be a full port.
- 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.

2.5 TAPPING SLEEVES

- A. Tapping sleeves for Ductile Iron Pipe shall be full sleeve, mechanical joint type manufactured from ductile iron meeting ASTM A536, Grade 65-45-12 and conform with AWWA C223. Sleeves shall be epoxy coated with stainless bolts and nuts. Tapping sleeves shall be Smith-Blair 622 or approved equal.
- B. Tapping Sleeves for PVC pipe shall be in conformance with AWWA C223 and shall be Romac SST stainless steel or approved equal and sized for the O.D. of the pipe being tapped.
- C. Sleeves shall be rated for a minimum of 250 psi water working pressure.
- D. 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.
- E. 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.
- F. The inside and outside of all tapping sleeves shall be coated in accordance with AWWA Standards and Federal Specifications TT-V-51.
- G. The sleeve manufacturer shall furnish all the accessories necessary to assemble the sleeve to the pipe.
- H. 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 hydrostatic 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.

2.6 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.

2.7 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 2-1/2 inch hose nipples and one 4-1/2 inch pumper nozzle shall be NST threads and screwed into the nozzle section and pinned to prevent turning. Foster adapters are acceptable to secure the valve to the hydrant.
- B. Hydrants shall be furnished with 1-inch pentagon shaped 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. Hydrants shall be counterclockwise opening and be so marked on the bonnet in cast letters and directional 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.
- H. Hydrants shall be FM listed and rated for 200 psi working pressure.

- I. Hydrants shall be M&H, Mueller or Owner approved equal.
- 2.8 BLOW-OFF HYDRANTS
- A. Blow-off hydrants shall be GIL Industries post flushing hydrants with 2-inch hose connection, except where automatic blow-offs are indicated.
 - B. Automatic blow-off hydrants shall be Mueller Hydroguard Series 100 or approved equal and shall have 2-inch hose connection.
- 2.9 CORPORATION AND CURB STOPS
- A. Corporation stops shall be brass ball valves, threaded to conform to AWWA C-800. The outlet shall be appropriate to the size and type of service line specified. All service taps shall be a minimum of 1-inch diameter. Key corporation stops will not be accepted.
 - B. Curb stops shall be brass ball valves, threaded to conform to AWWA C-800 and shall be compression to compression 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 "Y" connector, as approved by the Owner shall be placed ahead of the water meters.
 - C. Service taps shall be installed on approximately 45-degree angles as per the plans and/or detail sheet. All fittings shall be brass.
- 2.10 WATER METER, METER YOKES, AND METER BOX
- A. Single Meter Yoke shall be Ford Linesetter 5/8" x 3/4" VBHC72-12W-44-33-NL or approved equal with ball valve inlet and dual outlet check valve.
 - B. Service Saddles for 2 to 4-inch mains shall be Ford single strap S70 series and sized specifically to the pipe outside diameter with 200 psi minimum pressure rated or approved equal.
 - C. Service Saddles for 6" and larger mains shall be double strap Ford S70 series sized specifically to the pipe outside diameter with 200 psi minimum pressure rated or approved equal.
 - D. Corporation Stops shall be 1-inch Ford FB-1001-4-Q-NL, 300 psi ball valve. Keyed corporation stops will not be accepted.
 - E. Service Pipe shall be PEX tubing conforming to ASTM F876 and F877 SDR 9.
 - F. Compression fittings shall be Ford Catalog #C-44-33Q - 3/4" and C-44-44Q - 1".
 - G. Meter Stops shall be Ford BA-43232W or BA-43444W-NL.
 - H. Meter Boxes shall be plastic/rectangular w/18" bury.
 - 1. Single meter boxes shall be Rhino MB17.5 with AMR recessed plastic lid or approved equal.
 - 2. Double meter boxes shall be Rhino MB18 with single AMR recessed plastic lid or approved equal.
 - I. Double meter yoke assemblies shall be installed with 1-inch to 3/4-inch Y to separate meter yokes in the double meter box.

2.11 BACKFLOW PREVENTERS

- A. Backflow Devices shall be per the Tennessee State approved list.

PART 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.

END OF SECTION

**SECTION 02713
WATER LINES****PART 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.
- 1.7 All materials which will be in direct contact with potable water supplies shall be NSF 61 compliant.
- 1.8 All chemicals used in the disinfection of potable water lines shall be NSF 60 compliant.

PART 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 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.

- P. 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 3-16 inch 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.
- Q. 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. All PVC pipe shall be C-900, DR-14 or 18; or ASTM 2241 SDR-17 IPS Class 250 psi. Pipe material shall be at the Owners' discretion or as indicated on the drawings.
- 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 have NSF approval and be manufactured in accordance with AWWA C-900 or ASTM D2241 as applicable. 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.
 - 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. 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.

- G. The following information shall be applied to each piece of pipe:
 - 1. Nominal size
 - 2. Type of material
 - 3. SDR or class
 - 4. Manufacturer
 - 5. NSF Seal of Approval
- H. Pipe that fails to comply with the requirements set forth in these specifications shall be rejected.
- I. 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.
- J. 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.
- K. 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.
- L. 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.
- M. Standard and special fittings for PVC pipe shall be gray iron or ductile iron with 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.
- N. 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.
- O. Fitting laying lengths shall conform to ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153.
- P. 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.
- Q. No. 14 copper wire and marking tape shall be laid along the full length of all PVC lines. All services shall have tracer wire nutted and scaled with silicone to water main tracer wire. The wire shall come up to

outside of valve boxes. Wire shall be duct taped directly to the top of water line. Locating tape shall be installed directly above pipe and buried 18-inches above the pipe.

2.3 SERVICE LINE TUBING

- A. Service line tubing shall be PEX tubing conforming to ASTM F876 and F877 SDR 9. Size shall be as designated on the plans or a minimum of 1" diameter.

2.4 MARKING TAPE

- A. Marking tape shall be blue with black or white lettering, minimum 2.5" width, 5 mil polyethylene, marked "Water Line Buried Below" or as approved.

PART 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. All water pipe installation shall conform with the requirements of AWWA C-600, latest edition.
- B. The pipe shall be uniformly and continuously supported throughout the entire length on a firm stable material. Where required size 57 stone meeting the requirements of the Tennessee Department of Transportation shall be used for pipe bedding.
- C. Unless otherwise indicated by the Drawings, all water lines shall have at least 36- 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 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. If a pipe is cut to fit, 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.
- M. 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.
- N. The flame cutting of pipe by means of an oxyacetylene torch will not be allowed.
- O. Unless otherwise directed by the Owner, lay pipe with the bell ends facing in the direction of laying.
- P. 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.
- Q. Where a water line crosses over a sanitary sewer, use a full joint of pipe (18 or 20 foot lengths) centered over the sewer. Where a water line is installed parallel to a sanitary sewer, it shall be installed at least 10 feet horizontal distance from the sewer. If it is not practical for the water line and sewer line to be separated as described, the water line shall be installed a minimum of 18-inches above the top of the sewer pipe. If conditions require that the water main be installed below the sanitary sewer, the water line shall be concrete encased to and including the first joint in each direction. 6-inch minimum encasement required.
- R. Make all joints, whether standard mechanical or push-on joints, in conformance with the recommendations of the pipe manufacturer.
- S. Air release valves shall be located at all high points on the water line and/or as indicated 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 under the ditch or stream bed to minimize potential erosion over the pipe. DIP only shall be used at all crossings.

- U. Any and all pipe installed under 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. Backfill trench in accordance with specification section 02225.

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, flanged pipe shall extend 5 feet from all structures.

3.3 MARKING OF PIPELINES

- A. All pipe shall be installed with marking tape. All PVC pipe and PEX services shall also be installed with #14 copper tracer wire.
- B. The #14 wire shall be installed immediately on the crown of the pipe prior to placing any backfill.
- C. The marking tape shall be installed 18" above the crown of the pipe.

3.4 HYDROSTATIC AND LEAKAGE TESTS

- A. All newly laid and backfilled pipe shall be subjected to both hydrostatic and leakage testing in conformance with AWWA C600 or C605 as applicable. These tests shall be completed prior to disinfection. The Contractor shall obtain and maintain onsite a current copy of the applicable AWWA standard.
- B. Prior to hydrostatic testing all water lines shall be flushed as required to remove all debris in conformance with AWWA C600 or C605 as applicable.
- C. Regardless of the results of the leakage test, every visible leak shall be repaired.

3.5 DISINFECTION

- A. All water lines and services shall be disinfected in conformance with AWWA C651, latest edition. The Contractor shall obtain and have onsite a current copy of AWWA C651. The Contractor shall obtain Owner approval of the specific method to be used prior to beginning the work.
- B. All highly chlorinated water flushed from pipelines after disinfection shall be de-chlorinated as required by state and EPA regulations. The Contractor shall obtain Owner approval of the specific method to be used.

3.6 BACTERIOLOGICAL TESTING

- A. After a water line has undergone final flushing but before it is placed into service, in coordination with the Contractor, the Owner shall collect samples for bacteriological testing as described below from Rules of Tennessee Department and Conservation Division of Water Resources 0400-45-01-.17(8)(b):

1. Bacteriological Sampling of New Facilities-Bacteriological samples will be collected and analyzed to verify the effectiveness of the disinfection practices prior to placing new facilities in service. Bacteriological samples for finished water storage facilities, water treatment facilities, and wells shall be collected as specified by AWWA standards C- 652, C-653, and C-654.

Adequacy of disinfection of new lines shall be demonstrated by collecting two sets of microbiological samples 24 hours apart or collecting a single set of microbiological samples 48 hours or longer after flushing the highly chlorinated water from the lines. In either case microbiological samples in each set will be collected at approximately 2,500-foot intervals with samples near the beginning point, the end point, and at the end of each branch line, unless written approval of alternate sampling frequency and distance between sampling points has been obtained from the Department. If the newly constructed facility yields positive bacterial samples, the line shall be flushed, and resampled. If subsequent samples are positive, the line shall be re-disinfected, flushed and sampled again.

- B. When samples results are found to be satisfactory, the water line may be placed into service with Owner approval.

3.7 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.

3.8 CLEANUP

- A. 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 11700
TELEMETRY**

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. The Contractor shall furnish and install at each water booster pump station and/or water storage tank a MISSION Communication telemetry system. The system shall be a Model 100 RTU or Model 800 RTU. Selected Model will be determined by the Owner.

1.2 SUBMITTALS

- A. Shop drawings shall be submitted in accordance with Section 01302.
- B. Operation and maintenance manuals shall be submitted in accordance with Section 01302 of these specifications.

PART 2 PRODUCTS

2.1 FIELD HARDWARE REQUIREMENTS

- A. All field hardware shall come enclosed in a durable steel or similar enclosure capable of housing all electronics and backup batteries. An optional NEMA 4X enclosure shall be offered.
- B. The field hardware shall have at least 8 digital (dry contact) inputs.
- C. The field hardware trip inputs must have end of line resistor supervision, or similar supervision, that can detect normal alarm trip inputs and detect input wiring disconnection as a distinctly different signal and report.
- D. The field unit shall be capable of reporting for each input alarm, return to normal and fault condition.
- E. The field unit shall be made available with either a radio which transmits alarms only and daily status events or continuously transmits all digital, analog and pulse inputs on an as occurs basis or at least once every two minutes and the customer may choose to utilize either type of field unit at any proposed site. The submitting Company shall detail the cost difference between field units which transmit alarms only and daily status events and field hardware which continuously transmits all digital, analog or pulse counting input changes.
- F. The field unit shall have on board diagnostic enunciator lights for each digital input, which indicate real time the state of the dry contact inputs.
- G. The field unit shall have at least two analog inputs (0-5 Vdc or 4-20 ma) of at least 10 bit resolution. Each analog input shall have at least 4 threshold alarm set points.
- H. The field unit shall be capable of reporting analog threshold alarms, daily high/low analog values and/or current analog values.
- I. The field hardware trip inputs must operate normally when either side of the trip inputs circuitry is shorted to ground and send a trouble signal upon detection of such short to ground.

- J. The field hardware trip inputs must have a programmable trip input detection delay between 0 and 90 seconds.
- K. The field unit shall have on board diagnostics that indicate received signal strength of the wireless carrier's signal, wiring faults and message transmission progress and status.
- L. The field unit hardware shall have some methodology that enables a single input to be temporarily disabled that does not conflict with the disabled inputs end of line resistor or wiring supervision method.
- M. At least three of the field hardware trip inputs must be capable of being programmed to record and report pump run times as indicated by a relay opening and closing for up to three pumps.
- N. If only two pumps are monitored, then the unit shall also record and report simultaneous pump run times.
- O. The unit shall record and report individual pump starts on a one day or seven day basis. The unit shall also have the ability to report within one hour any individual pump starting in excess of a preprogrammed amount. These excess pump start messages shall be automatically forwarded to customer users via pager, email or fax.
- P. The field unit shall be optionally capable of counting voltage pulses or contact closures from two different sources and reporting those pulse counts daily or as they occur. This shall be in addition to the other inputs described above.
- Q. The field unit shall have a means of being put in local shutdown without powering the unit down. This shall effectively stop any alarms from being either transmitted from the unit or sent from the central computer facility. The action of putting a field unit in local shut down mode must be authorized and documented via an electronic access control key or card reader. The act of the local shutdown shall be recorded, along with the name or identity of the person performing the local shutdown at the central computer facility.
- R. The field hardware shall monitor its primary AC power supply input and shall be capable of sending an AC failure alarm. The unit shall delay the AC failure report for 300 seconds. The unit shall report AC restoral.
- S. The field hardware shall have a built in supervised battery back up power supply. This power supply shall be tested and operate the equipment for at least 15 seconds every day. The unit shall detect and report any backup battery power supply test failure.
- T. The field unit shall have a built in electronic key or card reader which will, when activated, cause the central monitoring/alarm notification facility to cancel any in- progress alarm notifications for that field unit. Additionally, the key use will prevent any subsequent alarms from being processed for a period of one hour, and record at a central facility the time and name of the electronic key used for the activation. Alarm notifications will resume when the electronic key is used again or automatically resume 1 hour after the last alarm message sent from the monitored site.
- U. The field unit shall have the capability of being shut down from transmitting any alarms by use of a push button switch. The push button switch shall be activated by use of an electronic key or card. The unit shut down switch will not allow unit shut down until said electronic key or card has been used within the preceding one minute. The electronic key or card use and the subsequent unit shut down shall be transmitted immediately and the event be logged at the central computer. The field unit shall

be capable of re-enabling itself for alarm use by a subsequent electronic key or card use or subsequent push button activation or shall automatically re-enable at midnight. Such re-enabling shall be transmitted to the central computer for logging.

- V. The field hardware shall utilize a transmission scheme that detects and subsequently reports individual transmission failures.
- W. The field hardware shall utilize, in the case of a continuously transmitting field unit, a transmission scheme that encrypts the transmitted data utilizing an 128 bit encryption method that meets or exceeds the advanced encryption standard (AES). Additionally, the continually transmitting field units will have an effective, continuous, transfer rate of at least 19,200 baud.
- X. The field hardware shall utilize a transmission scheme that individually identifies each transmitted message by sequence number.
- Y. The field hardware shall optionally be capable of sending test transmissions at least every seven days and have the capability for daily and on demand test transmissions or transmitting a signal at least once a minute.
- Z. The field hardware test transmissions shall indicate current and historical radio signal reception quality and shall report any radio signal outages and the duration of the outage.
- AA. The field hardware must be capable of reporting, on demand or on schedule, operational status, accumulated pulse input values, pump run time duration's and current operational status of normal alarm trip inputs (trouble, alarm, normal states).
- BB. The field unit shall be capable of being put into a service mode at the remote site and such service mode operations shall be logged and accessible to the customer at a monitoring central facility
- CC. The field unit shall be capable of optionally providing a method to monitor the wet well float circuit directly while providing auxiliary wet well alarm relay contact closures without the addition of a separate high wet well float. This optional circuitry shall detect high wet well conditions in the event of pump station AC failures.
- DD. The field unit shall not present any electric shock hazard.
- EE. The field unit shall be capable of being listed as complying with Underwriter's Laboratory requirements for remote signaling devices.
- FF. The system shall have a primary central monitoring and control center and a fully redundant, physically separate, backup-computer monitoring center. Either center shall have the capability of operating all the remote monitoring and control field RTU's.

2.2 MONITORING AND CONTROL CENTER SOFTWARE/HARDWARE REQUIREMENTS

- A. The monitoring center (if used) functionality and customer alarm and supervisory information must be made available to customer via secure Internet connection or other access manor acceptable to customer.
- B. The monitoring center or equivalent customer operated central monitoring software must be capable of interfacing and transferring, on a continuous basis, all RTU data to an OPC compliant database for access by other OPC compliant HMI software packages. Such transfer method will have 128 bit, or better encryption, and meet or exceed the advanced encryption standard (AES). Client side OPC

software will run as an executable or NT service. Client side OPC software will, on a user definable interval, establish a socket connection to static IP address(s) at cellular RTU service provider's central computers. OPC software shall retrieve all changed OPC tag values and close the socket. OPC software shall be set up so as customers OPC computers firewalls may be programmed to only allow Internet traffic to/from the designated service providers IP addresses and port numbers. Customer's firewalls will not be programmed to accept socket connections. Cellular RTU service provider's central computers will offer a VPN option at customers request. Cellular RTU service providers OPC software will allow for multiple customer OPC software packages to establish, concurrently OPC connections so as to provide for redundant HMI database operation at customers locations. Cellular RTU service providers OPC software shall provide HMI tags for the OPC link status, which shall include a toggling health pulse tag and the vendor's server's time to be used as a method to assure the link quality. Cellular RTU service providers OPC software shall provide HMI tags for:

1. All digital inputs (to include real time pump run status)
 2. Any wiring faults at the RTU
 3. All analog inputs (with field RTU values updating every two minutes if desired)
 4. Two pulse totalizing inputs
 5. AC power status and voltages at corresponding RTU
 6. Battery Status and voltages at corresponding RTU
 7. 24 hour, since midnight and last hour totalized values from pulse totalizing inputs
 8. 24 hour, since midnight and last hour pump runtime values
 9. Electronic key reader data
 10. RTU online status with last transmission time
 11. Write to tags to operate all RTU relays with sub tags to indicate the success of the write to operation (relay command verification)
 12. Hourly RF signal strength at the RTU
- C. The monitoring center or equivalent customer operated central monitoring software must be housed in a secured, access-controlled facility/enclosure.
- D. The monitoring center or equivalent customer operated central monitoring software critical equipment must be supplied power from an uninterruptable power source capable of stand-alone operation for at least 12 hours.
- E. The monitoring center customer Internet Web site or equivalent customer operated central monitoring software, shall provide the customer with on demand capability of shutting down/waking up individual units, remotely status testing individual units, remotely controlling individual units on-board relay, individually polling units for current trip inputs or accumulator input status and values, and be capable of remotely reprogramming other critical field unit operating parameters.
- F. The monitoring center or equivalent customer operated central monitoring software shall provide individual log on access and operational security levels as well as require logged, individual acceptance/acknowledgement off all presented alarms or supervisory messages.
- G. The monitoring center or equivalent customer operated central monitoring software shall provide an easy to use/understand general system overview graphic representation of the current state of all remote points being monitored by the system.
- H. The monitoring center or equivalent customer operated central monitoring software shall provide screens that can display the current status or value from field units that provide continuously transmitted digital, analog or pulse counting data. The graphic display tools shall display the associated data on an as occurred, 1-hour or one-day time interval basis.

- I. The monitoring center or equivalent customer operated central monitoring software shall provide screens that can display historical data trends in a graphic format from field units that provide continuously transmitted digital, analog or pulse counting data.
- J. The monitoring center or equivalent customer operated central monitoring software shall provide the ability to manually control field unit relays from field units that provide continuously transmitted digital, analog or pulse counting data. All such control functions shall be password protected and logged in a secure database.
- K. The monitoring center or equivalent customer operated central monitoring software shall provide for the remote command and control of the customers monitored field hardware in a manner consistent with the field unit's capabilities. The access to this remote command and control functionality shall be security level controlled and all events of use logged in a secure database.
- L. The monitoring center or equivalent customer operated central monitoring software shall provide functions for the customer to add/delete/change a field units alarm notification delivery methodologies and destinations.
- M. The monitoring center or equivalent customer operated central monitoring software shall provide easy to understand and use screens for the customer to securely access, globally or individually, alarms, testing and notification results for the customers field monitoring units.
- N. The monitoring center or equivalent customer operated central monitoring software shall provide a methodology to enable/disable an entire unit from reporting, or any of the units individual inputs from reporting with such enabling/disabling to be time scheduled by the customer.
- O. The monitoring center or equivalent customer operated central monitoring software must have a methodology to track the results of all alarm notifications as to successful or failed. If alarm notifications fail a log of said failures and their cause shall be provided.
- P. The monitoring center or equivalent customer operated central monitoring software must have the ability to analyze and display, graphically or tabular, all pump runtimes on a daily basis. The pump runtime analysis shall use regression analysis over the preceding thirty days. The analysis shall have preset variance limits, which when exceeded, automatically cause emails, pages or faxes to be generated to a customizable list of recipients.

2.3 NOTIFICATION CAPABILITY REQUIREMENTS

- A. The monitoring center or equivalent customer operated central monitoring software shall be equipped with adequate communications links to provide reasonable assurance that alarms will be delivered via any chosen delivery methodology to selected recipients within 30 seconds of the monitoring center receiving such alarms from field equipment.
- B. The monitoring center or equivalent customer operated central monitoring software shall be capable of automatically delivering alarm or other selected messages to numeric pagers, alphanumeric pagers, email addresses, facsimile machines or voice telephones (hardwired or wireless, local or long distance).
- C. Such delivered messages will include a cancellation/acceptance code (or other such methodology) that is used by the recipient to indicate to the monitoring system that the recipient has received/accepted the sent message. All message notification attempts; failures and delivery/acceptance confirmations will be logged.

- D. The monitoring center or equivalent customer operated central monitoring software shall digitally record all phone based voice notifications (alarms) from off hook to on hook. The monitoring center or equivalent customer operated central monitoring software shall store these recordings for at least 60 days and shall provide a web based means to play back or transfer these alarm recordings in a .wav or .mpeg file format.
- E. The monitoring center or equivalent customer operated central monitoring software shall be capable of scheduling alarm notifications to recipients by time of day, day of week, holiday and input type.
- F. The monitoring center or equivalent customer operated central monitoring software shall be capable of delivering to the alarm notification recipient the pump running status of all monitored pumps at the monitored site in the same alarm notification message as the initiating alarm message.
- G. The monitoring center or equivalent customer operated central monitoring software must have the ability to suppress erroneous digital alarms that occur in conjunction with AC power failures.
- H. The monitoring center or equivalent customer operated central monitoring software must have the ability to selectively suppress repeat or duplicate alarms from a particular field unit and a particular input.
- I. The monitoring center or equivalent customer operated central monitoring software shall be capable of buffering AC power failure messages for a customer defined amount of time and then issuing a single group alarm notification message that embodies a list of all of the monitored sites that have an AC power failure. The same group alarm notification function shall apply to monitored sites that have AC power restoring to normal.
- J. The monitoring center or equivalent customer operated central monitoring software shall store all system messaging transactions, operator commands, notification attempts and message delivery confirmations in a secure, nonalterable database.
- K. The monitoring center or equivalent customer operated central monitoring software shall automatically report and notify customer designated recipients of RTU telemetry link loss within five minutes of link loss for continuous telemetry RTUs or twenty five hours of link loss for daily reporting RTUs.

2.4 ADMINISTRATIVE REPORTS REQUIREMENTS

- A. The monitoring center or equivalent customer operated central monitoring software shall provide the customer with automatically generated weekly reports of all alarms, notifications, delivery confirmations/acceptances and unit test failures. Such weekly reports shall be automatically faxed or e-mailed to up to 4 customer designated recipients.
- B. The monitoring center or equivalent customer operated central monitoring software shall be capable of generating historical reports of any/all field monitoring units alarms, notifications, delivery confirmations/acceptances and test failures.
- C. The monitoring center or equivalent customer operated central monitoring software shall automatically archive all logged system activity on a daily basis to a physically separate database and computer.
- D. The monitoring center or equivalent customer operated central monitoring software shall analyze (buy percent variance or regression analysis) all pump runtimes on a daily basis and automatically generate and send via email or fax out of bounds reports to up to 4 recipients.

- E. The monitoring center or equivalent customer operated central monitoring software must have the ability to display, by site or by electronic keyholder, all uses of the electronic key use for at least a months period of time. Such electronic key use records will be accessible in a report form for hard copy storage.
- F. The monitoring center or equivalent customer operated central monitoring software must have the ability to transfer alarm, electronic key use, analog values, pulse count values and pump run time values to other computers via a coma delineated text string file transfer so as the data can be imported into other generally accepted spread sheet computer programs.

PART 3 EXECUTION

3.1 GENERAL

- A. The telemetry system shall be manufactured and tested in accordance with the best applicable trade practices and in compliance with state, OSHA, and other governing code requirements.

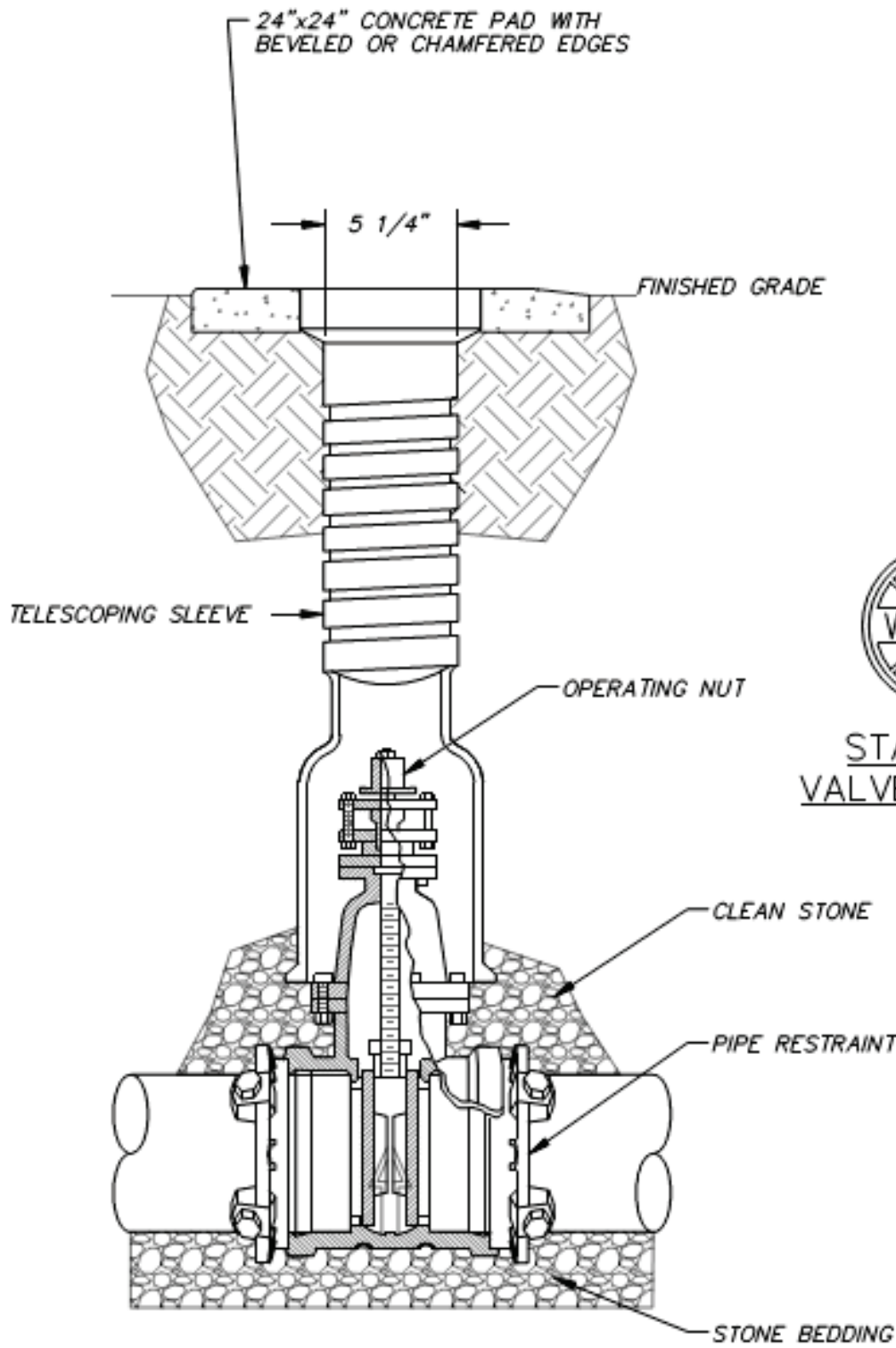
3.2 INSTALLATION

- A. Installation shall be in accordance with manufacturer's written instructions.

END OF SECTION

APPENDIX A

STANDARD DETAILS



GATE VALVE SECTION

SCALE: NONE (CLOSED POSITION)

NOTE TO CONTRACTOR: PROVIDE MATERIAL SUBMITTALS TO TASS FOR APPROVAL.

**TELICO AREA
SERVICES SYSTEM**
505 CLEARVIEW ROAD
MARYVILLE, TN 37801

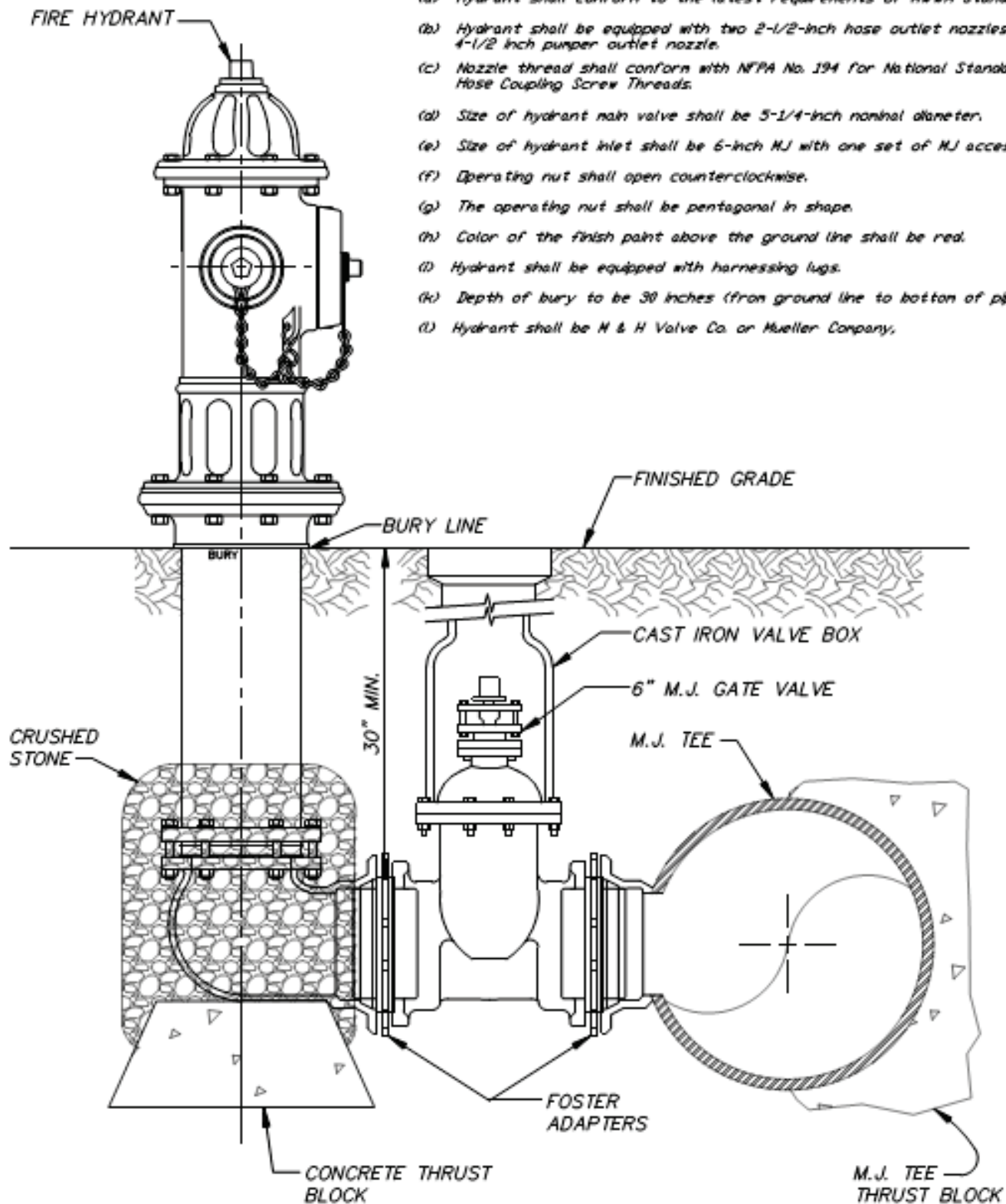
TELICO AREA SERVICES SYSTEM (TASS)
STANDARD DETAILS

GATE VALVE AND VALVE BOX – DETAIL
REFERENCE TASS SPEC. SECTION 02640

SD-1
REV. DEC. 2025

NOTES:

- (a) Hydrant shall conform to the latest requirements of AWVA Standard C-502.
- (b) Hydrant shall be equipped with two 2-1/2-inch hose outlet nozzles and one 4-1/2 inch pumper outlet nozzle.
- (c) Nozzle thread shall conform with NFPA No. 194 for National Standard Fire Hose Coupling Screw Threads.
- (d) Size of hydrant main valve shall be 5-1/4-inch nominal diameter.
- (e) Size of hydrant inlet shall be 6-inch MJ with one set of MJ accessories.
- (f) Operating nut shall open counterclockwise.
- (g) The operating nut shall be pentagonal in shape.
- (h) Color of the finish paint above the ground line shall be red.
- (i) Hydrant shall be equipped with harnessing lugs.
- (k) Depth of bury to be 30 inches (from ground line to bottom of pipe).
- (l) Hydrant shall be M & H Valve Co. or Mueller Company.



NOTE TO CONTRACTOR: PROVIDE MATERIAL SUBMITTALS TO TASS FOR APPROVAL



TELICO AREA
SERVICES SYSTEM

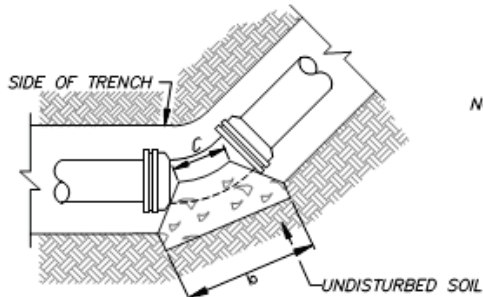
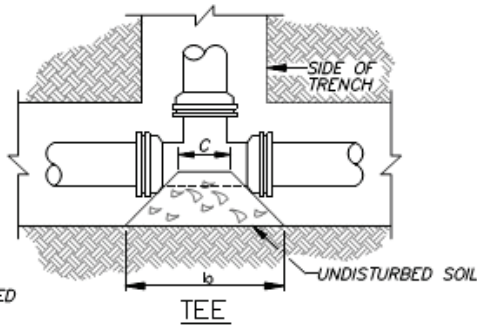
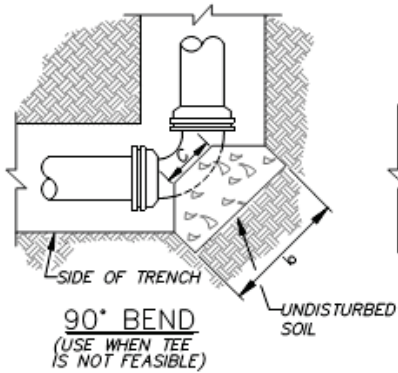
505 CLEARVIEW ROAD
MARYVILLE, TN 37801

TELICO AREA SERVICES SYSTEM (TASS)
STANDARD DETAILS

FIRE HYDRANT ASSEMBLY
REFERENCE TASS SPEC. SECTION 02640

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NOTE: THRUST BLOCK TO BE POURED AGAINST UNDISTURBED EARTH.

$b \times h$ - Required Bearing Block Area
 b must be $>h$ and $<2h$
 h must be $>dia.$ of pipe and $<h$

45° - Minimum Angle from Bearing Block Area.

45° - 22 1/2° - 11 1/4° - BENDS

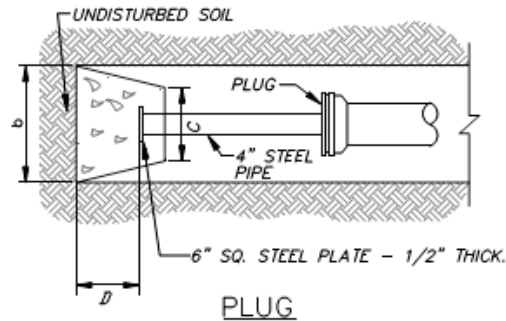
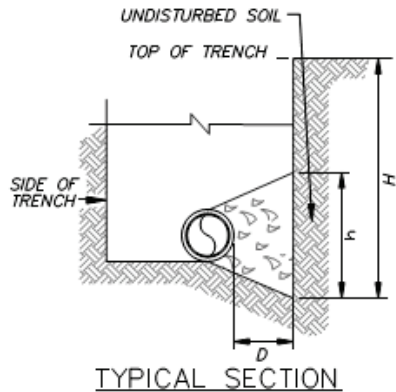


TABLE CONDITIONS:

DESIGN PRESSURE: 100 PSI,
 SOIL BEARING: 1,000 PSF (SDFT CLAY)
 SAFETY FACTOR: 1

ALL OTHER CONDITIONS MUST BE CALCULATED AS PROVIDED IN DIPRA 'THRUST RESTRAINT FOR D.I. PIPE' AND DIMENSIONS PROVIDED.

NOTES:

1. TASS INSPECTOR SHALL INSPECT ALL THRUST BLOCK

2. WRAP ALL FITTINGS IN HEAVY PLASTIC BEFORE PLACING CONCRETE.

3. THERE MUST BE ADEQUATE HORIZONTAL CLEARANCE BEHIND THRUST BLOCK(S) OF UNDISTURBED EARTH BEHIND THRUST BLOCK BASE TO SUPPORT DESIGN LOAD - (b DIMENSION)

11-1/4° BEND							
SIZE	4'	6'	8'	10'	12'	16'	24'
b	9'	12'	15'	23'	24'	29'	50'
h	6'	9'	12'	12'	16'	18'	30'
C	8'	10'	12'	14'	16'	18'	18'
D	6'	6'	6'	18'	24'	24'	24'

22-1/2° BEND							
SIZE	4'	6'	8'	10'	12'	16'	24'
b	12'	18'	23'	27'	32'	37'	61'
h	9'	12'	16'	20'	24'	28'	48'
C	8'	10'	12'	14'	16'	15'	15'
D	4'	6'	9'	18'	24'	24'	24'

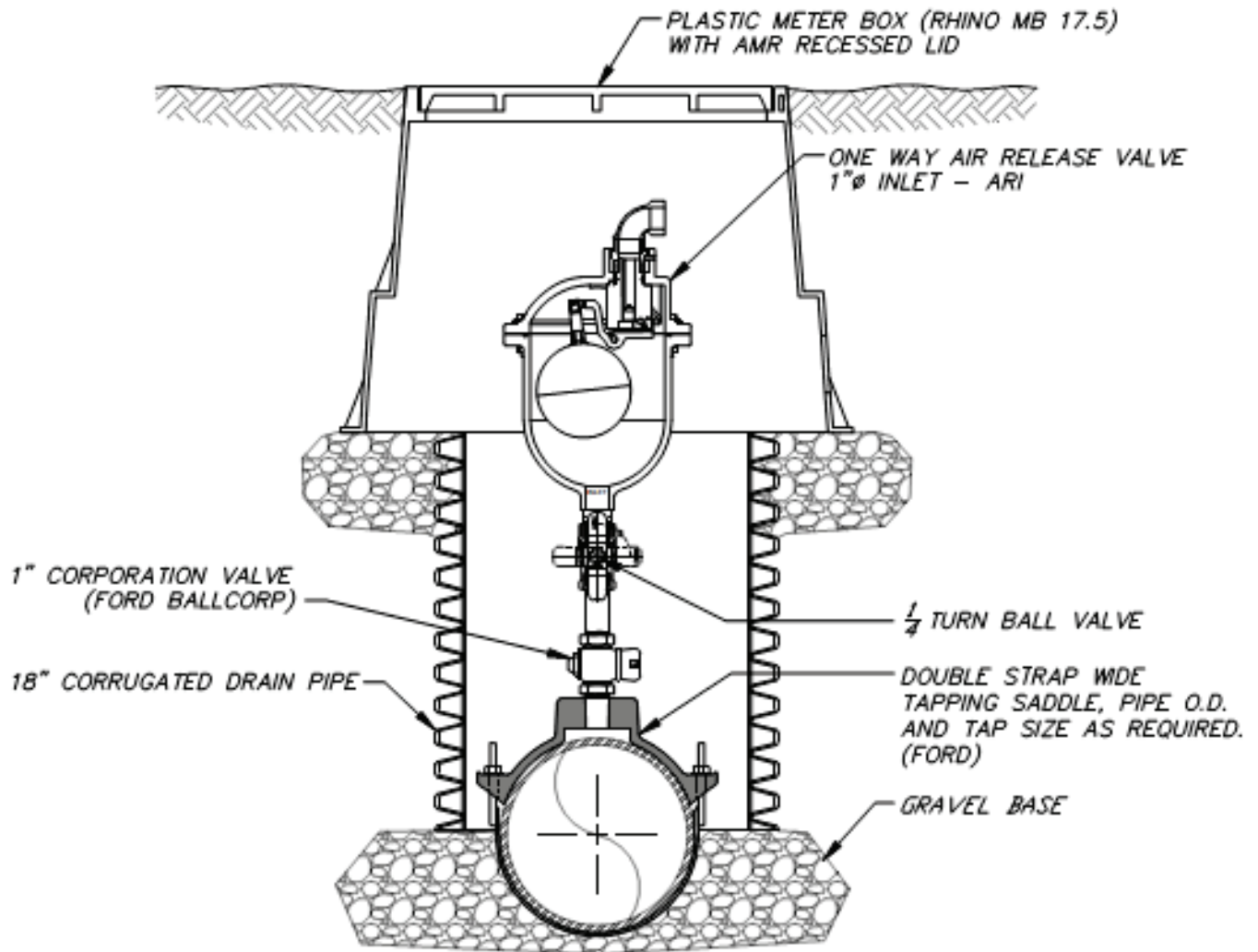
45° BEND							
SIZE	4'	6'	8'	10'	12'	16'	24'
b	18'	23'	30'	36'	42'	56'	107'
h	12'	18'	24'	30'	36'	36'	54'
C	8'	10'	12'	14'	16'	26'	59'
D	6'	9'	12'	18'	24'	24'	24'

90° BEND							
SIZE	4'	6'	8'	10'	12'	16'	24'
b	23'	32'	44'	55'	66'	78'	137'
h	16'	24'	30'	36'	42'	48'	78'
C	9'	12'	12'	15'	16'	42'	88'
D	8'	12'	16'	18'	24'	24'	24'

TEE							
SIZE	4'	6'	8'	10'	12'	16'	24'
Main	4'-6"	8'-12"	8'-10"	12'	12'	12'	18'
Branch	4'-6"	2'-6"	8'-10"	2'-6"	8'-10"	12'	16'-18"
b		26'	43'	26'	43'	52'	70'
h		26'	43'	26'	43'	52'	70'
C		12'	12'	12'	12'	12'	30'
D		13'	21'	13'	21'	26'	24'

PLUG							
SIZE	4'	6'	8'	10'	12'	16'	24'
b	26'	36'	52'	70'	82'	98'	108'
h	20'	30'	36'	40'	48'	54'	96'
C	12'	12'	12'	12'	18'	30'	36'
D	18'	18'	18'	24'	24'	36'	36'

NOTE TO CONTRACTOR: PROVIDE MATERIAL SUBMITTALS TO TASS FOR APPROVAL.



DETAIL ~ AIR RELIEF VALVE

SCALE: NONE

NOTE TO CONTRACTOR: PROVIDE MATERIAL SUBMITTALS TO TASS FOR APPROVAL.



TELICO AREA
SERVICES SYSTEM

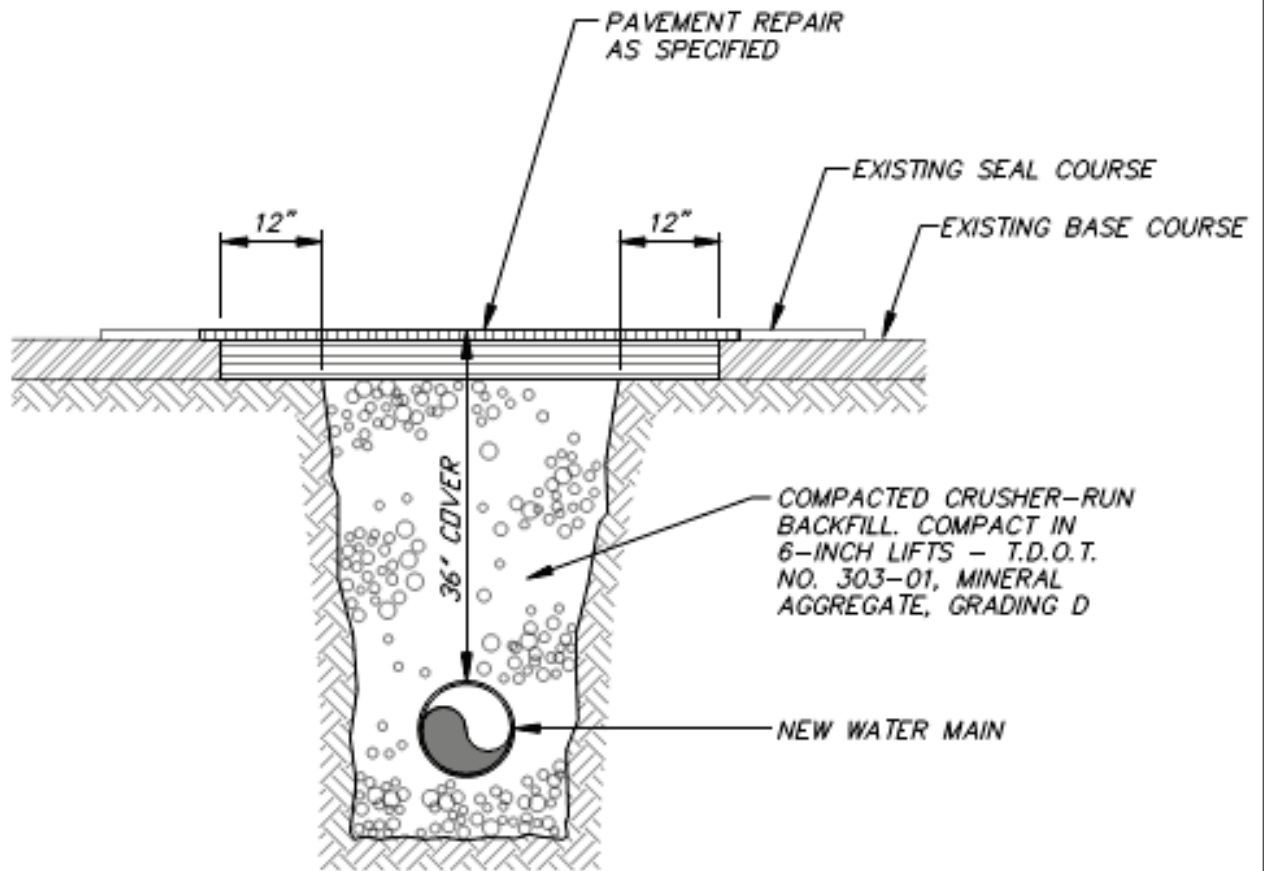
505 CLEARVIEW ROAD
MARYVILLE, TN 37801

TELICO AREA SERVICES SYSTEM (TASS)
STANDARD DETAILS

AIR RELIEF VALVE - DETAIL
REFERENCE TASS SPEC. SECTION 02640

SD-4

REV. DEC. 2025



NOTE ~ THE TRENCH BOTTOM SHALL BE SMOOTH AND FREE OF STONES GREATER THAN 1/2" DIA. LARGE DIRT CLODS, AND ANY FROZEN MATTER. CONTRACTOR SHALL EXCAVATE FOR PIPE BELLS TO PROVIDE SUPPORT FOR THE PIPE THROUGHOUT IT'S LENGTH.

DETAIL ~ ASPHALT PAVEMENT REPAIR TRENCHED CONSTRUCTION

SCALE: NONE

NOTE TO CONTRACTOR: PROVIDE MATERIAL SUBMITTALS TO TASS FOR APPROVAL.



TELICO AREA
SERVICES SYSTEM

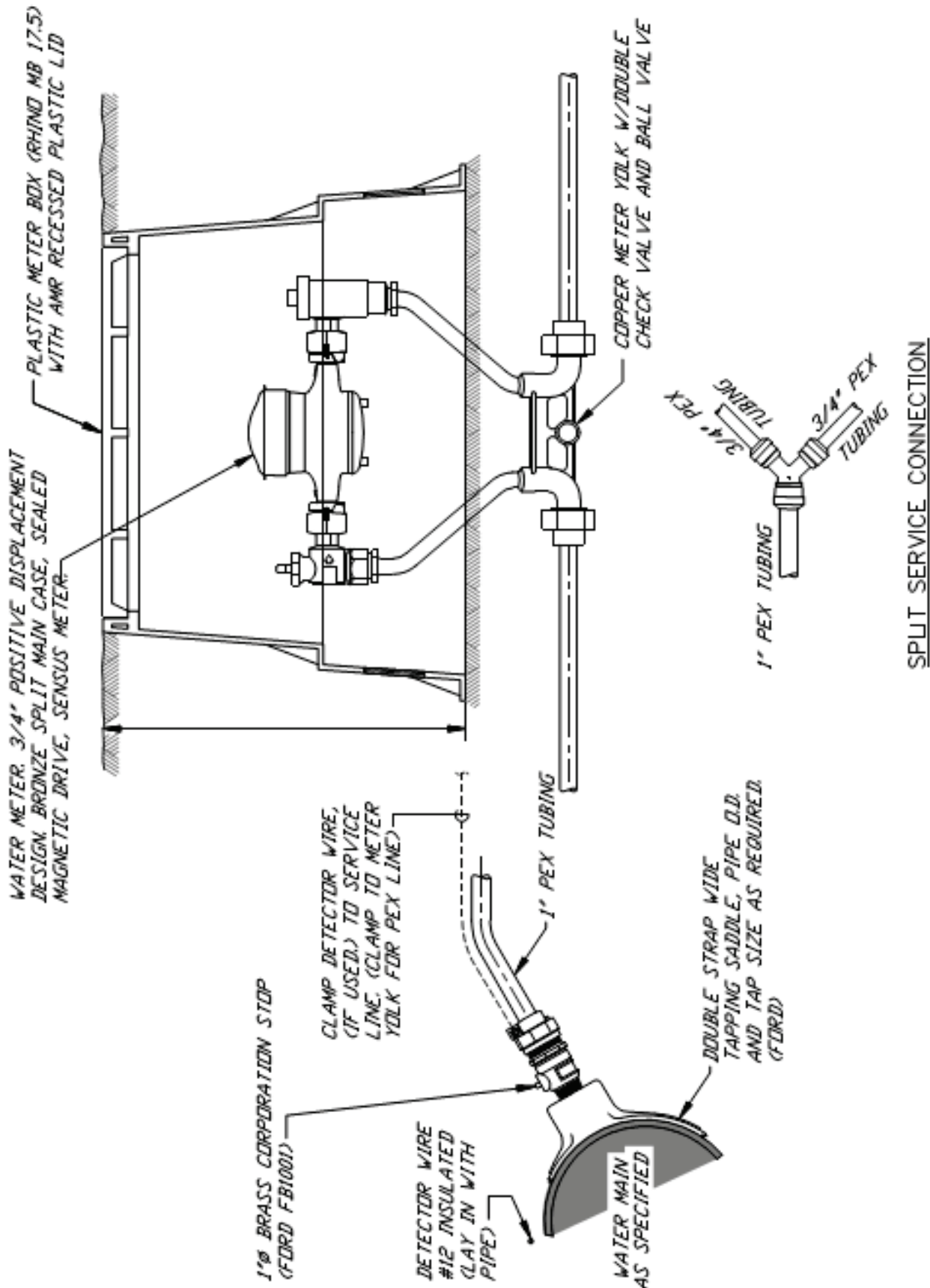
505 CLEARVIEW ROAD
MARYVILLE, TN 37801

TELICO AREA SERVICES SYSTEM (TASS)
STANDARD DETAILS

ASPHALT PAVEMENT REPAIR - DETAIL
REFERENCE TASS SPEC. SECTION 02575

SD-5

REV. DEC. 2025



SPLIT SERVICE CONNECTION

DETAIL ~ TYPICAL SERVICE CONNECTION & METER SETTING

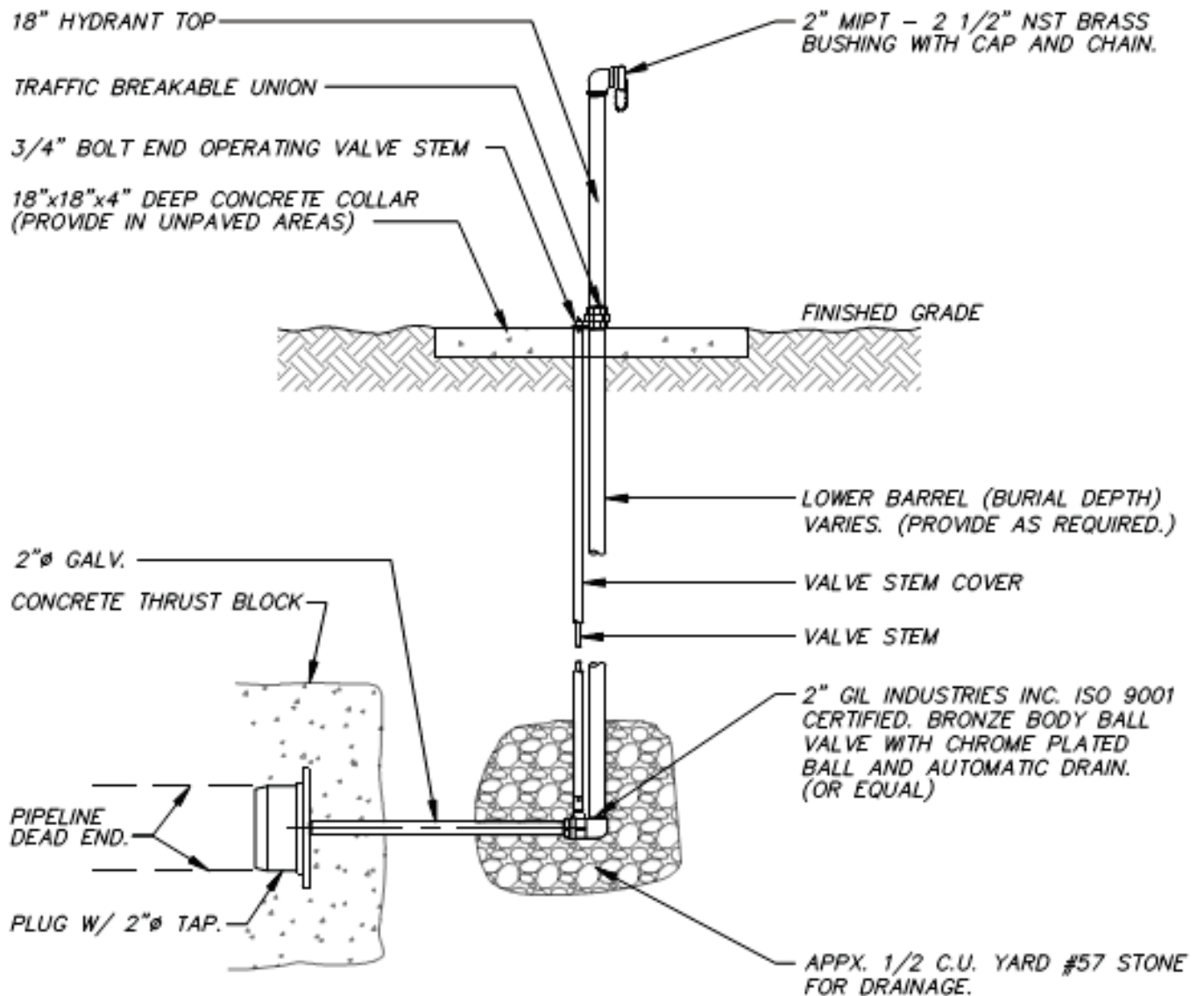
SCALE: NONE

NOTE TO CONTRACTOR: PROVIDE MATERIAL SUBMITTALS TO TASS FOR APPROVAL.

TELICO AREA SERVICES SYSTEM
505 CLEARVIEW ROAD
MARYVILLE, TN 37801

TELICO AREA SERVICES SYSTEM (TASS)
TYPICAL SERVICE CONNECTION & METER SETTING - DETAIL
REFERENCE TASS SPEC. SECTION 02640

SD-6
REV. 3 2025



NOTE: TO BE INSTALLED AND TESTED WITH MAIN LINE.

DETAIL ~ DEAD-END FLUSHING HYDRANT

SCALE: NONE

NOTE TO CONTRACTOR: PROVIDE MATERIAL SUBMITTALS TO TASS FOR APPROVAL.



TELICO AREA
SERVICES SYSTEM

505 CLEARMEW ROAD
MARYVILLE, TN 37801

TELICO AREA SERVICES SYSTEM (TASS)
STANDARD DETAILS

DEAD END FLUSHING HYDRANT - DETAIL
REFERENCE TASS SPEC. SECTION 02640

SD-7

REV. DEC. 2025

MUELLER Hydro-Guard 100 SERIES
AUTOMATIC FLUSHING SYSTEM

36" Dia. x 4" DEEP CONCRETE COLLAR
CHAMFER OUTSIDE EDGE.
(PROVIDE IN UNPAVED AREAS)

FINISHED GRADE

CLEAN #57 STONE

GEOTEXTILE FABRIC

2"Ø GALV.

CONCRETE THRUST BLOCK

PIPELINE
DEAD END.

PLUG W/ 2"Ø TAP.

COMPACT SUB-GRADE

NOTE: TO BE INSTALLED AND TESTED WITH MAIN LINE.

DETAIL ~ DEAD-END AUTOMATIC FLUSHING HYDRANT

SCALE: NONE

NOTE TO CONTRACTOR: PROVIDE MATERIAL SUBMITTALS TO TASS FOR APPROVAL.

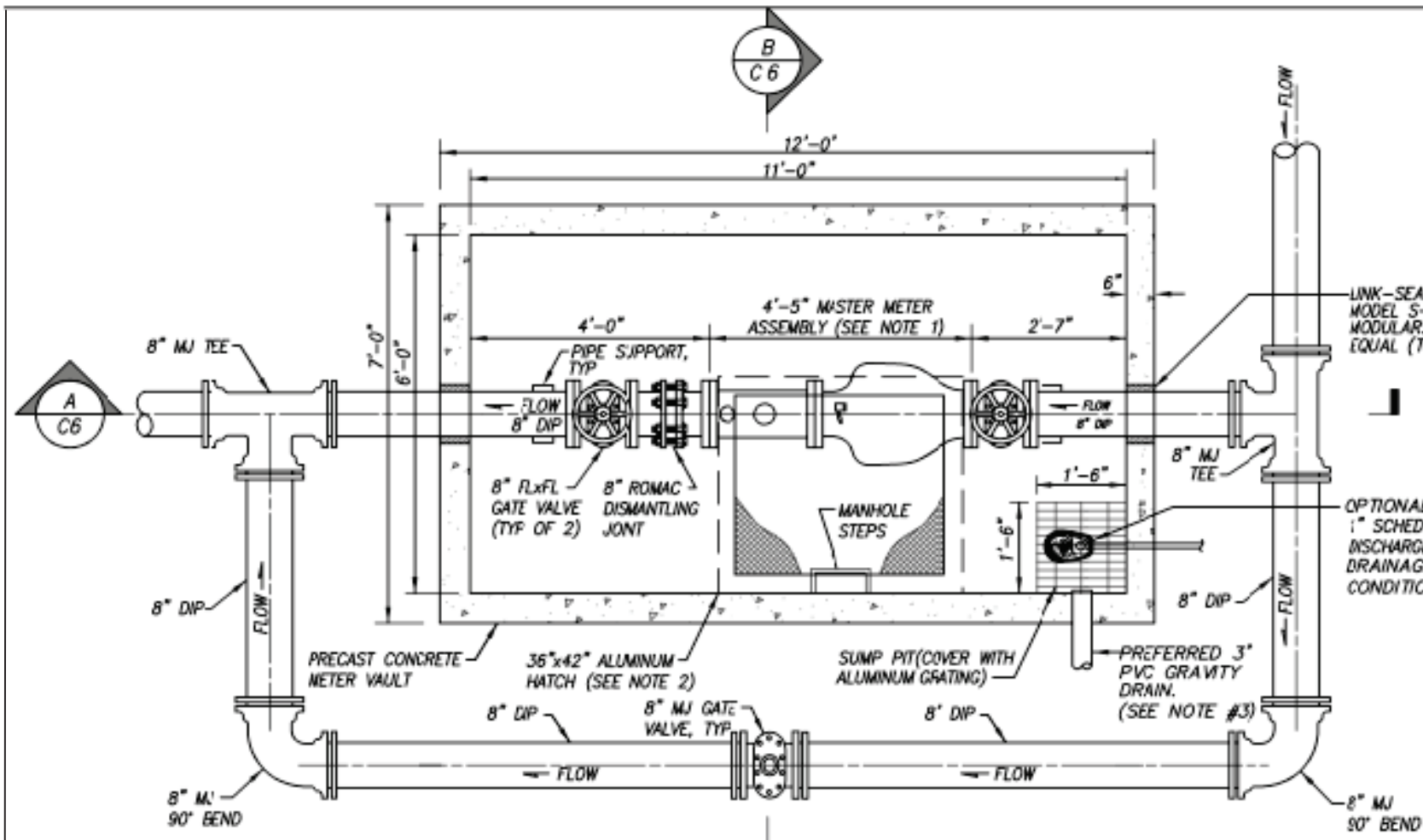


TELICO AREA SERVICES SYSTEM (TASS)
STANDARD DETAILS

AUTOMATIC FLUSHING HYDRANT - DETAIL
REFERENCE TASS SPEC. SECTION 02640

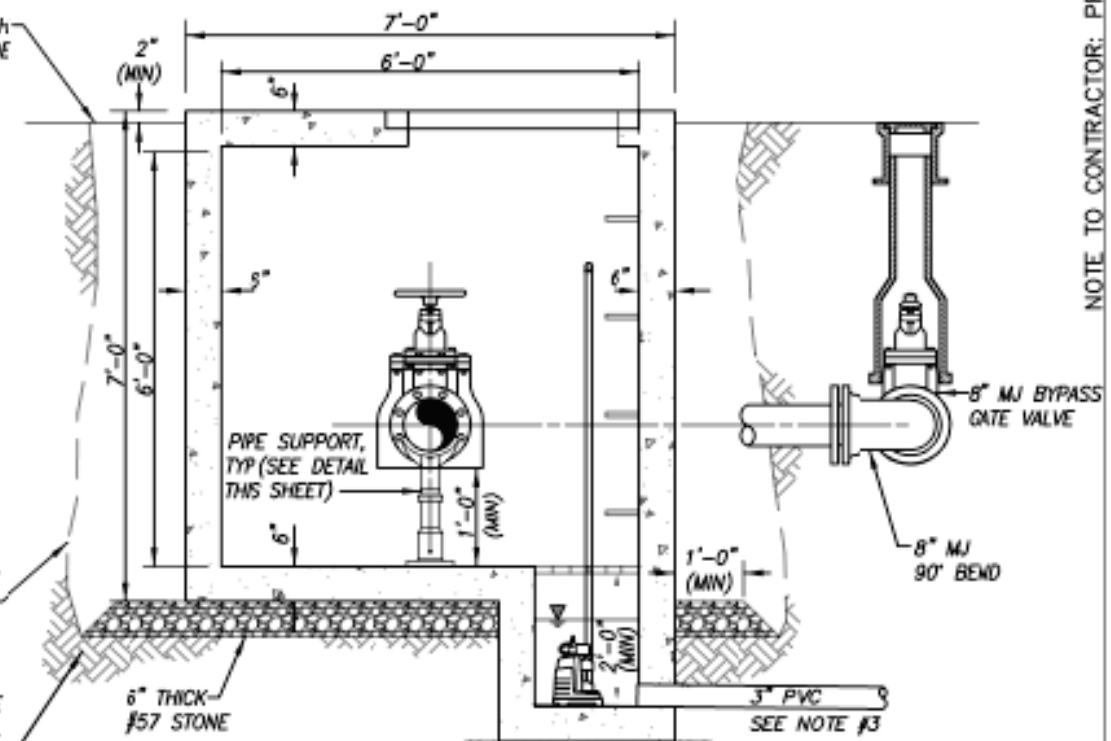
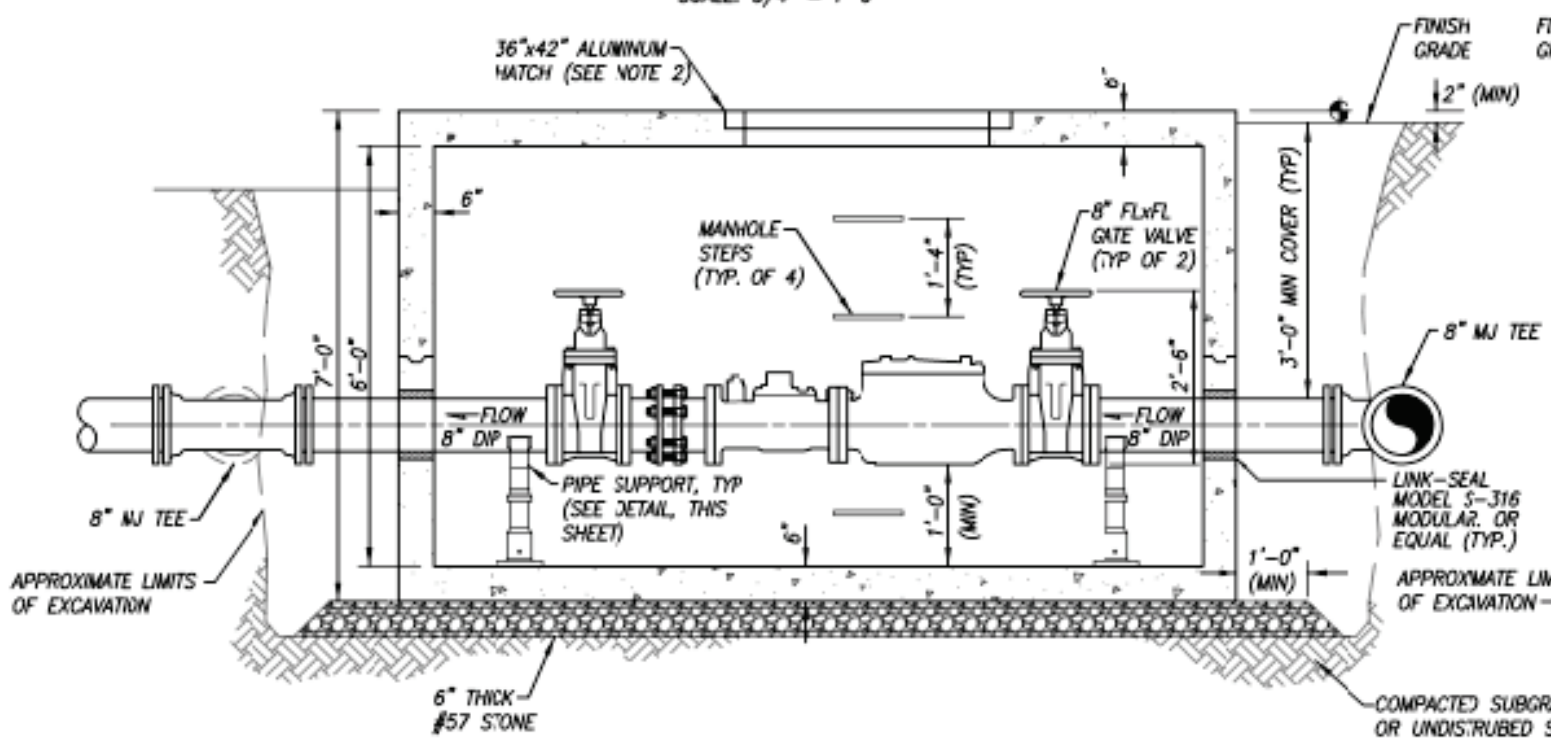
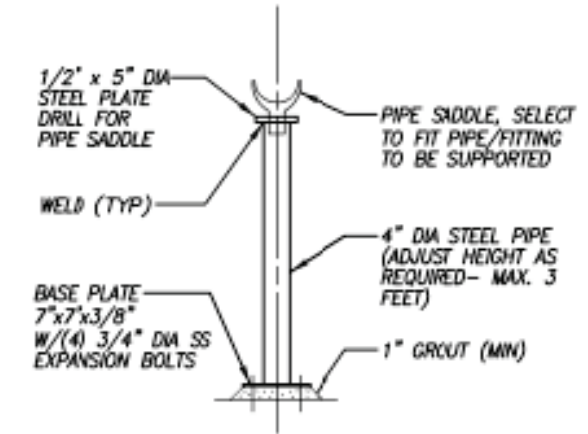
SD-7a

REV. DEC. 2025



MASTER METER NOTES:

1. METER SHALL BE AS SELECTED BY AND COORDINATED WITH TASS.
2. ALUMINUM HATCH SHALL BE DOUBLE-LEAF (WHEN AVAILABLE) ACCESS DOOR AS MANUFACTURED BY "HALLIDAY" OR APPROVED EQUAL, AND SHALL INCLUDE 1/4" ALUMINUM DIAMOND PATTERN COVER, 1/4" ALUMINUM CHANNEL WITH RECESSED ANCHORS, STAINLESS STEEL HARDWARE, STAINLESS STEEL LIFTING SPRING MECHANISM, AND REMOVABLE SQUARE KEY WRENCH. WETWELL HATCH SHALL INCLUDE PROTECTIVE FALL/SAFETY GRATING (PETRO-GRATE SERIES X OR APPROVED EQUAL).
3. PROVIDE A 3" PVC GRAVITY DRAIN TO DAYLIGHT, OR STORM STRUCTURE (WHERE CONDITIONS ALLOW), SLOPE MIN 1/8":1'. WHERE EXISTING CONDITIONS PROHIBIT A GRAVITY DRAIN, THE CONTRACTOR SHALL PROVIDE AND INSTALL A SUMP PUMP. PUMP SHALL BE MODEL M98 CAST IRON SERIES "FLOW-MATE" SUBMERSIBLE EFFLUENT PUMP WITH 1-1/2" DISCHARGE AS MANUFACTURED BY "ZOELLER" OR APPROVED EQUAL PUMP PROVIDED WITH 1-1/2" DISCHARGE CHECK VALVE AND SINGLE PIGGYBACK VARIABLE LEVEL FLOAT SWITCH. (SUMP PIT FLOOR TO BE FLAT WITH SUMP PUMP, OR SLOPE 2% TO DRAIN WITH GRAVITY DRAIN OPTION.)



0 1" 2" 3"
GRAPHIC SCALE: 3/4" = 1'-0"
(PLOTTED 50% SCALE)
(TEXT INCREASED 50% FOR CLARITY AT 50% SCALE)

NOTE TO CONTRACTOR: PROVIDE MATERIAL SUBMITTALS TO TASS FOR APPROVAL.