

**NORTH WEST UTILITY DISTRICT, TENNESSEE  
STANDARD SPECIFICATIONS  
FOR WATER PROJECTS**

**LAST REVISION: DECEMBER 2022**



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## Part 1 General

### 1.01 Scope

- A. These specifications shall apply to all water utility construction which is, or which will become a part of North West Utility District's water system. These specifications shall also apply to private water systems that are under Owner's jurisdictions for inspection. Any failure to comply with these specifications shall be cause for the Owner to refuse acceptance of such distribution lines for operation and maintenance
- B. The project consists of providing all material, labor, tools, equipment, and incidentals needed to complete construction, testing, and placing into service all water mains or other appurtenances shown and listed on the plans and contract documents.

### 1.02 Definitions

- A. Owner: North West Utility District
- B. Contractor: Person, firm or corporation with whom the Owner has entered into the Agreement.
- C. Resident Project Representative (RPR): Authorized representative of the Owner who is assigned to the site or any part thereof.

### 1.03 Contractor's Responsibilities

- A. Protection of Lives and Health
  - a. In accordance with generally accepted construction practices, the Contractor will be solely and completely responsible for conditions at the job site, including the safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. The Contractor shall follow all applicable OSHA Standards and provide documentation of OSHA compliance upon request of the Owner, RPR, or TOSHA.
  - b. Pipe and materials shall be stored in a safe location, away from roadways, and properly barricaded for the safety of vehicular and pedestrian traffic. 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 of the current operations thereon.
  - c. Contractor shall comply with all applicable laws, regulations, and requirements which may or may not be included in these technical specifications, including, but

not limited to, Contractor Licensing Act of 1994, as amended, and the Tennessee State Safety, Health, and Labor Standards.

- d. Contractor shall provide proof he holds a valid Contractor's license in the state of Tennessee with a Municipal and Utility Construction (MU) classification of sufficient monetary limit to bid on and/or perform water distribution system installation and construction for North West Utility District. The license number shall be provided to Owner prior to construction.
- e. Contractor shall obtain all licenses and permits prior to the start of work. Copies of each permit shall be submitted to the North West Utility District. Contractor shall be responsible for obtaining permission to work in the right-of-way from the following agencies, including, but not limited to the City or County Engineering or Highway Department having jurisdiction and the Tennessee Department of Transportation.

#### 1.04 Rights-of-Way and Easements

- A. All work on water and wastewater mains to be dedicated to the Owner shall be on public rights-of-way and/or on easements secured by the Owner or by Contractor/developer and transferred to the Owner. Easement areas shall be restored to as near original condition as possible, and to the satisfaction of Owner.

#### 1.05 Protection of Public and Private Property

- A. Take special care in working areas to protect public and private property. The Contractor shall immediately notify the Owner and/or RPR, and the property owner when damage property occurs. At Owner's discretion, Contractor shall replace or repair in a timely manner at his own expense any damaged water or sewer mains, power and communication lines, or other public utilities, roads, curbs, gutters, sidewalks, fences, drain pipes, and drainage ditches. It shall be the responsibility of Contractor to replace damaged vegetation or to compensate the property owner for replacement value for those areas located outside the easement limits. Leave the site in a condition satisfactory to Owner.
- B. Take reasonable care during construction to avoid damage to vegetation. 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 vegetation throughout all stages of construction. 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 lawful and satisfactory manner. Trim any limbs or branches of trees broken during construction operations with a clean cut, and paint with an approved tree pruning compound. Treat damaged tree trunks with appropriate tree dressing.
- C. Contractor shall examine the site and become familiar with any construction requirements, such as work related to drainage ways, erosion control, and easements. Any such work shall be considered incidental to the Work, and no additional payment will be allowed. Sodding, fabric mats, or other methods of re-establishing vegetation may be required by Owner if difficulty persists in reestablishing vegetation, and shall be considered incidental to construction.

## 1.06 Obstructions Encountered During Construction

- A. The locations of existing utilities, public or private, are approximate only. Contractor is to contact owners of all underground utilities through Tennessee One-Call, Underground Utility Damage Prevention Act, Protection of Utilities.
- B. 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 repairs of utility lines, and no additional payment will be allowed.
- C. Contractor shall report damages to the Owner at 423.332.2427 and proceed as directed and report to other utility owners as required.

## 1.07 Substitutions

- A. The contract is based on the standards of quality established in the contract documents.
- B. All products proposed for use, including those specified by required attributes and performance shall require approval by Owner before being incorporated into the work.
- C. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by Owner. Where the phrase "or equal" or "or approved equal" occurs in the plans or specifications, do not assume that materials, equipment, or methods will be approved as equal unless the item has been specifically approved for this work by Owner. The decision of Owner shall be final.

## 1.08 Construction Clearing

- A. 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. Dispose of all materials in accordance with all applicable laws and regulations and, when applicable.
- B. Maintain the site in a neat and orderly condition at all times.

## 1.09 One Year Warranty

- A. Contractor shall warranty all materials, equipment, and workmanship for a period of one year from the date of Substantial Completion of the Work as determined by the Certificate of Substantial completion issued by the Owner. If during this time period any material, equipment, or item of construction proves defective, Contractor must guarantee the workmanship, including parts, for one year after the project ends. If Owner must perform emergency repairs during the guarantee period, Contractor shall be liable for the costs incurred by Owner, including labor, equipment and materials. This includes, but not limited to, anything that was put in the ground. All

meter boxes and valve boxes must remain flush with the ground and allow easy access. Guarantees shall be covered by Contractor's performance bond where applicable. Neither the final acceptance, final payment, nor other provision relieves Contractor of the responsibility for faulty material, equipment or workmanship.

### 1.010 Owner's Representation During Construction

- A. The Resident Project Representative (RPR), who is the Owner's agent at the site, will act as directed by and under the supervision of Owner and will confer with Owner regarding RPR's actions. The RPR's dealings in matters pertaining to the on-site work shall, in general, be with Owner and Contractor, keeping Owner advised as necessary. The RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor.

## Part 2 Products

### 2.01 General

- A. All products and materials utilized in the execution of the work described herein shall meet or exceed the specified characteristics provided herein.

## Part 3 Execution

(NOT USED)

END OF SECTION

## Part 1 General

### 1.1 Section Includes

- A. Clearing and grubbing.
- B. Excavation and disposal of all wet and dry materials (including rock) encountered that must be removed for construction purposes.
- C. Sheeting, shoring, bracing, and timbering.
- D. Dewatering of trenches and other excavations.
- E. Pipe bedding.
- F. Backfilling and tamping of trenches, foundations, and other structures.

### 1.2 Definitions

- A. Degree of Compaction: Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D698, for general soil types, abbreviated as percent laboratory maximum density.
- B. Hard Materials: Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.
- C. Rock: Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement.

### 1.3 Submittals

- A. The following shall be submitted to Owner before construction of work:
  - 1. Flowable Fill: Certified mix design and test results; including types and weight per cubic yard for each component of mix.
  - 2. Should the Contractor excavate twenty feet or greater in depth, a protective system designed by a registered professional engineer shall be submitted prior to the start of work. The Contractor shall provide a drawing which identifies the type of location and protective system to be used with supporting data as necessary.
  - 3. Dewatering work plan.

4. Blasting work plan as prior approved by the Owner.
- B. Test Reports – Submit copies of all laboratory and field test reports within 24 hours of the completion of the test.
  1. Borrow Site Testing: Fill and backfill test.
  2. Select material test.
  3. Porous fill test for capillary water barrier.
  4. Density test.

#### 1.4 Delivery, Storage, and Handling

- A. Perform in a manner to prevent contamination or segregation of materials.

#### 1.5 Requirements for Off Site Soil

- A. Soils brought in from off site for use as backfill shall be tested for petroleum hydrocarbons, BTEX, PCBs and HW characteristics (including toxicity, ignitability, corrosivity, and reactivity). Backfill shall not contain concentrations of these analytes above the appropriate State and/or EPA criteria, and shall pass the tests for HW characteristics. Determine petroleum hydrocarbon concentrations by using appropriate State protocols. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5035/8260B. Perform complete TCLP in accordance with EPA SW-846.3-3 Method 1311. Perform HW characteristic tests for ignitability, corrosivity, and reactivity in accordance with accepted standard methods. Perform PCB testing in accordance with accepted standard methods for sampling and analysis of bulk solid samples. Provide borrow site testing for petroleum hydrocarbons and BTEX from a grab sample of material from the area most likely to be contaminated at the borrow site (as indicated by visual or olfactory evidence), with at least one test from each borrow site. For each borrow site, provide borrow site testing for HW characteristics from a composite sample of material, collected in accordance with standard soil sampling techniques. Do not bring material onsite until tests results have been received and approved by the Owner.

#### 1.6 Field Measurements

- A. Verify that survey bench mark and intended elevations for the Work are as shown on the drawings.

#### 1.7 Coordination

- A. Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.



## 1.8 Quality Assurance

- A. Shoring and Sheeting Plan: Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Drawings shall include material sizes and types, arrangement of members, and the sequence and method of installation and removal. Calculations shall include data and references used.
  - 1. The Contractor is required to hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer shall be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer shall update the excavation, sheeting and dewatering plans as construction progresses to reflect changing conditions and shall submit an updated plan if necessary. A written report shall be submitted, at least monthly, informing the Contractor and Owner of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems.
- B. Dewatering Work Plan: Submit procedures for accomplishing dewatering work.
- C. Utilities: Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Report damage to utility lines or subsurface construction immediately to the Engineer.

## Part 2 Products

### 2.1 Trench Stabilization Material

- A. Base Rock: TDOT Mineral Aggregate Base Class A, Aggregate Grading D as specified in Section 903.05 of the TDOT Standard Specifications for Road and Bridge Construction.
- B. Granular Backfill: TDOT #57 stone as specified in Section 903.22 of the TDOT Standard Specifications for Road and Bridge Construction.

### 2.2 Pipe Zone Material

- A. Crushed stone, TDOT #7 as specified in Section 903.22 –Sizes of Coarse Aggregate AASHTO M 43, of the TDOT Standard Specifications for Road and Bridge Construction; Class B aggregate.
- B. Excavated materials suitable for use shall consist of sand, clay, or soil free from large rocks, silt, roots, organic matter, or trash. Excavated materials shall be approved by the OWNER (see Part 3, Execution, Section 3.10, Pipe Zone).

### 2.3 Earth Backfill

- A. Soil, clay, or other excavated material suitable for use as backfill.

- B. Free from roots or organic matter, refuse, boulders and material larger than 6 inches in diameter, or other deleterious materials.

## 2.4 Flowable Fill

- A. Select and proportion ingredients to obtain compressive strength between 50 psi and 150 psi at 28 days in accordance with ASTM D4832.
- B. Materials:
  - 1. Cement: ASTM C150, Type I or Type II.
  - 2. Aggregate: ASTM C33, Size 7.
  - 3. Fly Ash (if used): ASTM C618, Class C.
  - 4. Water: Clean, potable, containing less than 500 ppm of chlorides.

## 2.5 Source Quality Control

- A. Perform gradation analysis in accordance with ASTM C136 for:
  - 1. Imported earth backfill, including specified class.
  - 2. Trench stabilization material.
  - 3. Pipe zone material.
- B. Certify Laboratory Performance of Mix Designs: Flowable fill.

# Part 3 Execution

## 3.1 Protection

- A. Shoring and Sheeting
  - 1. Take special care to avoid damage wherever excavation is being done. Sufficiently sheet, shore, and brace the sides of all excavations to prevent slides, cave-ins, settlement, or movement of the banks and to maintain the specified trench widths. Use solid sheets in wet, saturated, or flowing ground. All sheeting, shoring, and bracing shall have enough strength and rigidity to withstand the pressures exerted, to keep the walls of the excavation properly in place, and to protect all persons and property from injury or damage. Separate payment will not be made for sheeting, shoring, and bracing, which are considered an incidental part of the excavation work.
  - 2. Wherever employees may be exposed to moving ground or cave-ins, shore and lay back exposed earth excavation surfaces more than 5 feet high to a stable slope, or else provide some equivalent means of protection. Effectively protect trenches less than 5 feet deep when examination of the ground indicates

hazardous ground movement may be expected. Guard the walls and faces of all excavations in which employees are exposed to danger from moving ground by a shoring system, sloping of the ground, or some equivalent protection.

3. Trench excavation safety protection shall be accomplished as required by the most recent provisions of Part 1926, Subpart P - Excavations, Trenching, and Shoring of the Occupational Safety and Health Administration (OSHA) Standards and Interpretations, as may be amended. Comply with all OSHA standards in determining where and in what manner sheeting, shoring, and bracing are to be done. The sheeting, shoring, and bracing system shall be designed by a professional engineer licensed in the State of Tennessee and shall be subject to approval by the Engineer. However, such approval does not relieve the Contractor of the sole responsibility for the safety of all employees, the effectiveness of the system, and any damages or injuries resulting from the lack or inadequacy of sheeting, shoring, and bracing.
4. Where excavations are made adjacent to existing buildings or structures or in paved streets or alleys, take particular care to sheet, shore, and brace the sides of the excavation so as to prevent any undermining of or settlement beneath such structures or pavement. Underpin adjacent structures wherever necessary, with the approval of the Engineer.
5. Do not leave sheeting, shoring, or bracing materials in place unless this is called for by the Drawings, ordered by the Engineer, or deemed necessary or advisable for the safety or protection of the new or existing work or features. Remove these materials in such a manner that the new structure or any existing structures or property, whether public or private, will not be endangered or damaged and that cave-ins and slides are avoided.
6. Fill and compact all holes and voids left in the work by the removal of sheeting, shoring, or bracing as specified herein.
7. The Contractor may use a trench box, which is a prefabricated movable trench shield composed of steel plates welded to a heavy steel frame. The trench box shall be designed to provide protection equal to or greater than that of an appropriate shoring system.
8. A "Qualified Person", as defined by OSHA regulations, shall be on-site at all times during activities requiring trench safety provisions.

B. Drainage and Dewatering

1. Provide for the collection and disposal of surface and subsurface water encountered during construction.
2. Drainage: So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. Where applicable, the Contractor shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary

ditches, dikes, swales, and other drainage features and equipment as required to maintain dry soils, prevent erosion and undermining of foundations. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

3. Dewatering:

- a. Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 2 feet below the working level.
- b. Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly.

C. Underground Utilities

1. Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of all existing utilities prior to starting construction. The Contractor shall scan the construction site with electromagnetic and sonic equipment and mark the surface of the ground where existing underground utilities are discovered.

- D. Machinery and Equipment: Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

### 3.2 Surface Preparation

- A. Clear and grub project area in accordance with Section 31 11 00 - Clearing and Grubbing.
- B. Identify required lines, levels, contours, and datum.
- C. Protect plant life, lawns, and other features remaining as part of final landscaping.

- D. Maintain and protect above and below grade utilities which are to remain.

### 3.3 Excavation

- A. Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Excavations below indicated depths will not be permitted except to remove unsatisfactory material.
  - 1. **Blasting:** Where permitted and allowed by the Owner and Engineer as an acceptable trenching option, blasting shall be performed in accordance with appropriate criteria established by the National Fire Protection Association and all Local, County, State, and Federal codes and ordinances. The Contractor shall be responsible for obtaining all permits at no cost to the Owner. Blasting for utility excavation must be done in such a manner as to minimize the fracturing of rock beyond the required excavation. The Contractor shall consider the elevation of utilities in relation to the blasting charge and the relative alignment of existing and proposed trenches. Blasting within such areas shall be accomplished only by qualified Contractors who hold blasting licenses from a qualified agency. Any damage to existing utilities resulting from blasting shall be repaired at the Contractor's expense. Sand shall not be used for bedding for backfill in trenches that have been blasted.
- B. Wherever muck, quicksand, soft clay, swampy ground, or other material unsuitable for foundations, subgrade, or backfilling is encountered, remove it and continue excavation until suitable material is encountered. The material removed shall be disposed of in the manner described below. Then refill the areas excavated for this reason with 1 inch to 2 inch sized crushed stone up to the level of the lines, grades, and/or cross sections shown on the Drawings. The top 6 inches of this refill shall be No. 67 TDOT crushed stone for bedding
- C. Unless specified otherwise, refill excavations cut below indicated depth with bedding material and compact to 95 percent of ASTM D698 maximum density. Satisfactory material removed below the depths indicated, without specific direction of the Engineer, shall be replaced with satisfactory materials to the indicated excavation grade. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Engineer.
- D. **Pipe Trenches:**
  - 1. Unless the construction of lines by tunneling, jacking, or boring is called for by the Drawings or specifically authorized by the Engineer, make excavation for pipelines in open cut and true to the lines and grades shown on the Drawings or established by the Engineer on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed, but shall not be more than the distance determined by the following

formula:  $4/3d + 15$  inches, where "d" represents the internal diameter of the pipe in inches. When approved in writing by the Engineer, the banks of trenches from the ground surface down to a depth not closer than 1 foot above the top of the pipe may be excavated to nonvertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula  $4/3d + 15$  inches shall be at the expense of the Contractor and may be cause for the Engineer to require that stronger pipe and/or a higher class of bedding be used at no cost to the Owner.

2. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement. Tamp if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 6 inches below the bottom of the pipe.
  3. Excavate bell holes for bell and spigot pipe at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper jointing of the pipe. Do not excavate bell holes more than 2 joints ahead of pipe laying.
  4. Provide minimum depths of "Bedding Material" as defined in Tables 1, 2, and 3.
  5. Do not excavate pipe trenches more than 200 feet ahead of the pipe laying, and perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where the Engineer deems necessary to maintain vehicular or pedestrian traffic.
  6. In all cases where materials are deposited along open trenches, place them so that in the event of rain no damage will result to the work and/or to adjacent property.
- E. Hard Material and Rock
1. Any material that is encountered within the limits of the required excavation that cannot be removed except by drilling and/or blasting, including rock, boulders, masonry, hard pan, chert, shale, street and sidewalk pavements, and/or similar materials, shall be considered as unclassified excavation, and no separate payment will be made therefor.
  2. Should rock be encountered in the excavation, remove it by blasting or other methods. Where blasts are made, cover the excavation with enough excavation material and/or timber or steel matting to prevent danger to life and property. The Contractor shall secure, at his own expense, all permits required by law for blasting operations and the additional hazard insurance required. Observe all applicable laws and ordinances pertaining to blasting operations.

3. Excavate rock over the horizontal limits of excavation and to a depth of not less than 6 inches below the bottom of pipe up to 30 inches in diameter and not less than 12 inches below the bottom of larger pipes if rock extends to such depth. Then backfill the space below grade with No. 67 (TDOT) crushed stone or other approved material, tamp to the proper grade, and make ready for construction.

F. Excavated Materials

1. Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Paragraph "DISPOSITION OF SURPLUS MATERIAL."

### 3.4 Filling and Backfilling

- A. Fill and backfill to contours, elevations, and dimensions indicated. Compact each lift before placing overlaying lift.

B. Backfill and Fill Material Placement For Utilities

1. Begin backfilling after the line construction is completed and then inspected and approved by the Engineer. Place this backfill simultaneously on either side of the pipe in even layers that before compaction are no more than 4 inches deep. Thoroughly and completely tamp each layer into place before placing additional layers.

- C. At locations of improvements subject to damage by displacement, tamp and thoroughly compact the backfill in layers that, before compaction, are 6 inches deep. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.

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

- E. Wherever excavation has been made within easements across private property, the top 1 foot of backfill material shall consist of topsoil, as defined in Section 32 92 19 - Seeding.

- F. Wherever trenches have been cut across or along existing pavement and driveways, including gravel or dirt drives, temporarily pave the backfill of such trenches by placing mineral aggregate (TDOT) crushed stone as the top 12 inches of the backfill. Maintain this temporary pavement either until the permanent pavement is restored or until the project is accepted by the Owner.

- G. Conduct backfilling around manholes, inlets, outfalls, and/or structures in the same manner as specified above for pipelines except that even greater care is necessary

to prevent damage to the utility structure.

- H. Do not use power operated tampers to tamp that portion of the backfill around the pipe within 1 foot above the pipe.
- I. Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfill is being placed. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary, whenever directed to do so by the Engineer.
- J. Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the Engineer's requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.
- K. Compaction Requirements: Under buildings and 2 times the depth of pipe beyond, and under roads and 2 times the depth beyond the shoulder, compact to 100 percent maximum density in accordance with ASTM D698. In all other locations, compact to 95 percent maximum density.

### 3.5 Borrow

- A. Whenever the backfill of excavated areas or the placement of embankments requires more material than is available from authorized excavations, or whenever the backfill material from such excavations is unsuitable, then obtain additional material from other sources. This may require the opening of borrow pits at points accessible to the work. In such cases, make suitable arrangements with the property owner and pay all incidental costs, including any royalties, for the use of the borrowed material. Before a borrow pit is opened, the quality and suitability of its material shall be approved by the Engineer.
- B. Excavate borrow pits in such a way that the remaining surfaces and slopes are reasonably smooth and that adequate drainage is provided over the entire area. Construct drainage ditches wherever necessary to provide outlets for water to the nearest natural channel, thus preventing the formation of pools in the pit area. Leave the sides of borrow pit cuts at a maximum slope of 2:1 unless otherwise directed by the Engineer.
- C. Properly clear and grub borrow pits and remove all objectionable matter from the borrow pit material before placing it in the backfill.
- D. The taking of materials from borrow pits for use in the construction of backfill, fills, or embankments shall be considered an incidental part of the work; no separate payment shall be made for this.

### 3.6 Finish Operations

- A. Grading: Finish grades as indicated within one-tenth of one foot. Grade areas to drain water away from structures. Maintain areas free of trash and debris. For existing grades that will remain but which were disturbed by Contractor's operations, grade as directed.



- B. Protection of Surfaces: Protect newly backfilled, graded, and topsoiled areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

### 3.7 Disposition of Surplus Material

- A. Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the Drawings or directed by the Engineer shall be used for these purposes. Any materials not so used shall be considered waste materials and disposed of by the Contractor as specified below.
- B. Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of that work. The Contractor shall dispose of these surplus and waste materials off-site in an appropriate manner in conformity with pertinent codes and ordinances. Leave the surface of the work in a neat and workmanlike condition, as described below.
- C. The disposal of waste materials shall be considered an integral part of the excavation work and one for which no separate payment shall be allowed.

### 3.8 Field Quality Control

- A. Sampling: Take the number and size of samples required to perform the following tests.
- B. Testing: Perform one of each of the following tests for each material used. Provide additional tests for each source change.
  - 1. Bedding Material and Fill and Backfill Material Testing: Test fill and backfill material in accordance with ASTM C136 for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D4318 for liquid limit and for plastic limit; ASTM D698 or ASTM D1557 for moisture density relations, as applicable.
  - 2. Density Tests: Test density in accordance with ASTM D1556, or ASTM D6938. When ASTM D6938 density tests are used, verify density test results by performing an ASTM D1556 density test at a location already ASTM D6938 tested as specified herein. Perform an ASTM D1556 density test at the start of the job, and for every 10 ASTM D6938 density tests thereafter. Test each lift at randomly selected locations with one test per 200 linear feet in each lift.

Table 1: Backfilling and Compaction of Trenches for Pressure Pipes in Unimproved Areas

Layer*	Depth			Material**			
	≤15"Ø	18"-38"Ø	>38"Ø	DIP	PVC	HDPE	Conc
<b>A</b>	4" min	6" min	12" min	I B	II	II	I B
<b>B1</b>	½ OD			III	II	II	III
<b>B2</b>	½ OD			III	II	II	III
<b>C</b>	6"			III	II	II	III
<b>D</b>	6"			IV A	II	II	IV A
<b>E</b>	Varies			IV A	IV A	IV A	IV A

\*See Figure 1.

\*\*Bedding material to be used in wet conditions for all layers.

Table 2: Backfilling and Compaction of Trenches for Gravity Lines in Unimproved Areas

Layer*	Depth			Material**			
	≤15"Ø	18"-38"Ø	>38"Ø	DIP	PVC	HDPE	Conc
<b>A</b>	4" min	6" min	12" min	I B	II	II	I B
<b>B1</b>	½ OD			I B	II	II	I B
<b>B2</b>	½ OD			III	II	II	III
<b>C</b>	6"			III	II	II	III
<b>D</b>	6"			IV A	II	II	IV A
<b>E</b>	Varies			IV A	IV A	IV A	IV A

\*See Figure 1.

\*\*Bedding material to be used in wet conditions for all layers.

Table 3: Backfilling and Compaction of Trenches in Paved Areas

Layer*	Depth			Material			
	≤15"Ø	18"-38"Ø	>38"Ø	DIP	PVC	HDPE	Conc
<b>A</b>	4" min	6" min	12" min	I B	II	II	I B
<b>B1</b>	½ OD			I B	II	II	I B
<b>B2</b>	½ OD			I B	II	II	I B
<b>C</b>	6"			I B	II	II	I B
<b>D</b>	6"			I B	II	II	I B
<b>E</b>	Varies			I B	II	II	I B

\*See Figure 1.

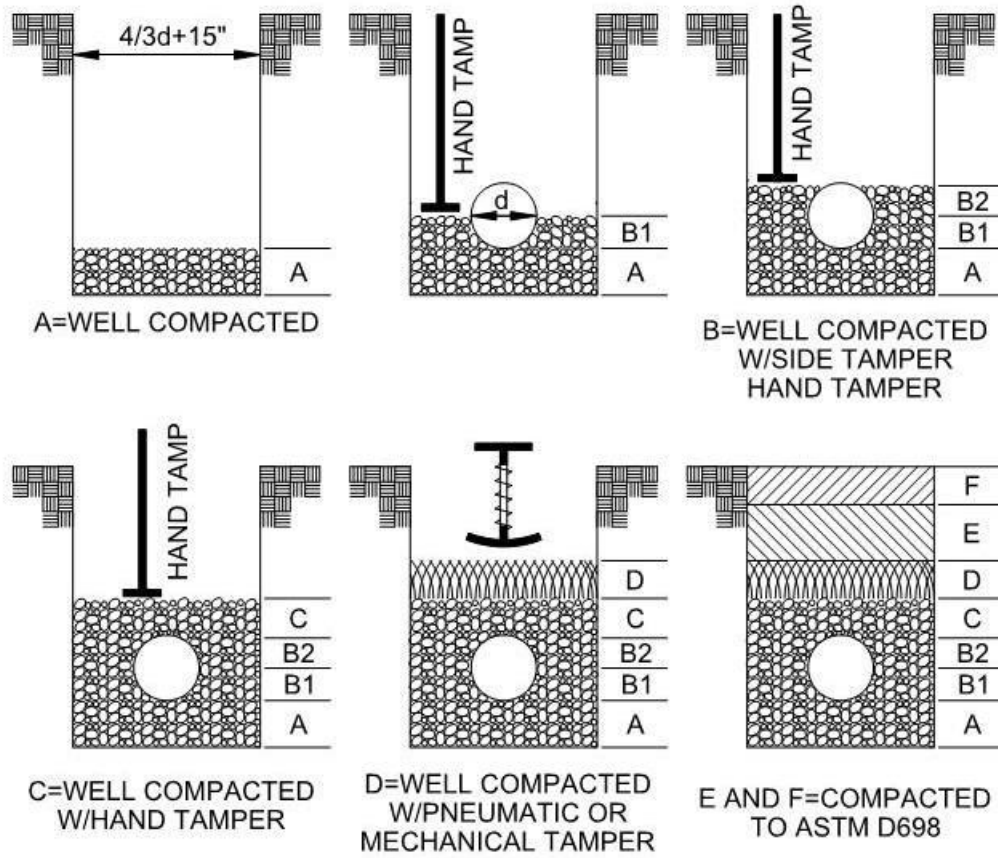


Figure 1: Backfilling and Compaction of Trenches

END OF SECTION

## Part 1 General

### 1.01 Scope of Work

- A. The Contractor shall furnish all equipment, labor, and materials (unless otherwise agreed upon in writing) necessary to construct water mains and appurtenances and perform all work specified or indicated on the Standard Details. The work shall include all necessary trenching, backfilling, soil erosion and sedimentation control, and testing. These specifications cover water and mains and service connections complete.
- B. The Contractor shall arrange his work so as to minimize interference with pedestrian and vehicular traffic, and to avoid interruption of service of any existing utilities. The Contractor shall furnish and maintain suitable bridges, footways, or other means of access to or across intercepted streets, alleys, driveways and walkways, where necessary.
- C. The Contractor shall be responsible for removing all water from excavations and trenches whether from surface or ground sources.
- D. The Contractor shall guarantee all material and workmanship on year from the date of final acceptance of the work. If during this period any material or workmanship, etc., proves defective, the Contractor shall repair same at his own cost and expense and to the satisfaction of the Owner.
- E. In addition to the responsibility of the Contractor for remedying observed defects in his work during the guarantee period, the Contractor shall also reimburse the Owner for all expenses incurred in investigations to assure the Owner that the completed work is in accordance with these specifications.

### 1.02 Inspection

- A. All materials to be installed shall be inspected by the Owner for compliance with these Specifications.

### 1.03 Connection to Work By Others or Existing Lines

- A. For existing lines or lines installed to which piping must connect, the Contractor shall expose buried lines to confirm or determine pipe material and diameter, furnish and install appropriate piping, and make proper connections. Such investigation is subject to the prior notification and coordination requirements specified elsewhere herein.

## 1.04 Applicable Specifications and Standards

- A. The latest editions of the following specifications, standards and publications setting the minimum requirements for quality, safety and performance of work and materials form a part of these Regulations as though fully repeated herein:
  - 1. ASTM American Society of Testing Materials
  - 2. ANSI American National Standards Institute
  - 3. AWWA American Water Works Association
  - 4. OSHA Occupational Safety and Health Administration

## Part 2 Materials

### 2.01 General

- A. Materials to be incorporated into the work shall be new and unused and shall conform to all applicable requirements of these specifications. Submittal and approval of all materials, shop Standard Details, or samples shall be in conformance with these specifications. Any materials installed prior to approval by the Department will be subject to rejection, and will be removed at the Contractor's expense.
- B. Acceptance will be on the basis of inspection and the manufacturer's written certification that the pipe, fittings and appurtenances were manufactured and tested in accordance with the applicable standards.
- C. Any pipe, fittings and appurtenances used in the installation or repair of water mains or services shall be lead-free pipe and fittings by an all-American manufacturer. Alternate vendor only by providing documentation demonstrating similar specifications.

### 2.02 Ductile Iron Pipe (DIP)

- A. Ductile iron pipe from an approved manufacturer such as U.S. Pipe or Alternate vendor only by providing documentation demonstrating similar specifications to ANSI/AWWA C151/A21.51-96 and shall be a minimum of pressure Class 350 or thickness Class 52 unless otherwise specified or shown on the Standard Details. Pipe sizes will be as shown on all plans and details. All pipes shall be furnished in minimum lengths of 18 feet.
- B. Fittings
  - a. Fittings shall be compact ductile iron and conform to ANSI/AWWA C153/A21.53.06 with rated working pressure of 350 psi or ANSI/AWWA C110/A21.10.03 with rated working pressure of 250 psi. Fittings shall be mechanical joint ductile iron and conform to ANSI/AWWA C111/A21.11-07. Pipe

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and fittings shall be furnished cement lined in accordance with ANSI/AWWA C104/A21.4-03, seal coated inside and bituminous coated outside.

- C. Tyton joints shall be push-on type for pipe and standard mechanical joints for fittings with the exception of hydrant fittings and completed with necessary gaskets and lubricant to be in accordance with ANSI/AWWA C151/A21.51-96 and ANSI/AWWA C111/A21.11-07 specifications. Fittings for bends shall be mechanical joint with retainer glands. Provide and install the appropriate gaskets, nuts and bolts for mechanical joints. Nuts shall be steel with American Standard Regular hexagonal dimensions, all as specified in ANSI B17.2.
1. All bolts and all nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A and 2B fit.
  2. When flanged joints are indicated provide gaskets for flange joints made of 1/8 inch thick cloth reinforced rubber. Gaskets may be ring type or full-face type.
  3. Provide bolts for flange connections. Bolts shall be steel with American Regular unfinished square or hexagon heads. Nuts shall be steel with American Standard Regular hexagonal dimensions, all as specified in ANSI B17.2. All bolts and all nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A and 2B fit.
- D. Field lock gaskets are required on two pipe joints up and downstream from any fitting, in addition to megalugs on each fitting.
- E. The following sizes and classes of pipe are allowable:
1. 4" Class 350
  2. 6" Class 350
  3. 8" Class 350
  4. 12" Class 350
  5. 16" Class 250
  6. 24" Class 250

## 2.03 Plastic Pipe (PVC)

- A. Materials:
1. Pipe, polyvinyl chloride (PVC) C900, DR21 or greater. Shall conform to ASTM D2241. Lay lengths shall be minimum of 20 feet. PVC pipe may only be used for installations of 3" and smaller. Installation shall conform to standard ASTM D2774 Pipe joints shall conform to ASTM D3139.
  2. Fittings. Socket type, DR21 polyvinyl chloride (PVC).
  3. Unions. Socket type, DR21 polyvinyl chloride (PVC).
  4. Flanges. Flat face, socket type, DR21 polyvinyl chloride (PVC).

5. Gaskets. 1/8 inch thick, EPDM low torque, full face gaskets with concentric, convex rings between center hole and bolt hole circle. Shall conform to Standard ASTM F477.
6. Bolts and Nuts. Stainless Steel, hex head bolts (Grade B) with heavy, buff finish, cold punched nuts
7. Pipe color must be White NSF 14 and 61.
8. Detailed specifications may be provided upon request or found at [https://napcopipe.com/sites/default/files/media/MU-PS-003-US-EN-0119.3\\_D2241-IB.pdf](https://napcopipe.com/sites/default/files/media/MU-PS-003-US-EN-0119.3_D2241-IB.pdf)

## 2.04 Service Tubing

- A. Service lines shall be copper tubing conforming to ASTM Designation B88, latest revision for the Type "K" soft Temper and AWWA 7S-CR Type "K" and may be used in 20 foot straight length or 60/100 foot coils.
- B. Where required, adapters shall be brass ANSI B 16.18. Unions shall be cast bronzes. Joints shall be compression type.

## 2.05 Gate Valves

- A. Gate valves size 3 inches and larger shall be resilient seat wedge type and shall conform with the specifications of the American Water Works Association, Designation C509-01, latest edition rated for 200 psi minimum working pressure. Gate valves shall be equipped with "O" ring stem seals above and below stem thrust collar. Gate valves for use on mechanical joint ductile iron pipe and slip joint ductile iron pipe shall have manufacturer's standardized mechanical joint ends, in accordance with ANSI/AWWA C111/A21.11-07 and ANSI/AWWA 550-05. Gate valve body and bonnet shall be ductile or cast iron and shall be fusion bonded, interior and exterior, with epoxy coating which conforms to ANSI/AWWA C509-01, latest edition.
- B. Water mains in which the valves are installed shall be tested as specified and the valve must remain water tight under this pressure in each direction.
- C. Valves shall open counter clockwise (no exceptions will be allowed); shall be designed for vertical installation; and shall be the non-rising stem type.
- D. Valves shall be equipped with valve boxes. Provide extension stem where required to bring the operating nut to within 36 inches of ground surface and shall have a 24" x 24" x 10" concrete collar poured in place. Trowel level with ground surface.
- E. Primary valve shall be Mueller resilient wedge gate valve. Alternate vendors only by providing documentation demonstrating similar specifications
- F. Gate valves 2-1/2 inches in diameter and smaller shall be bronze, heavy duty, rising stem (2-1/2 inches and smaller only), rated for 200 psi WSP. Valves shall conform to Federal Specification WW-V-54, Class A, Type II.



- G. Gate valves shall be installed on all fire lines and distribution lines smaller than 16-inches.
- H. The size and location of valves shall be shown on the accepted plans.
- I. Detailed specifications may be provided or found online at <https://www.muellercompany.com/sites/muellercompany.com/files/uploads/media/1403-muellerco-prod-specs-2362-resilient-wedge-gate-valves.pdf>

## 2.06 Valve Operators

- A. All valve operators shall be suitable for buried service.
- B. Where indicated buried service valves shall be equipped with a standard two-inch square opening nut (OPEN LEFT), valve box and concrete collar place flush with the finished ground surface.
- C. No butterfly valves shall be used.
- D. Above ground operators shall have:
  - 1. Riser stem and operator mechanism;
  - 2. Min. of 2 foot by 2 foot by six inch thick concrete pad at the finished ground surface;
  - 3. Standard pattern non-rising stem support stand for the above ground operator, either hand-wheel or electrical valve operator. The support stand shall be such design as to support a multi-turn hand-wheel operator or an electrical valve operator with hand-wheel.

## 2.07 Valve Boxes

- A. Valve Boxes: Acceptable valve boxes are the round, two-piece, screw-type, and either an 18" x 24" or 24" x 36" size. If neither size will work, a piece of 6" ductile iron pipe can be used in conjunction with a valve box collar and lid. Valve boxes shall have a 5.25 inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Lids shall have "WATER" cast into them and fit in the top of the valve box or valve box collar.
  - 1. Only after the valve has been completely installed, test before backfilling the excavation. Following the installation of the valve box, carefully backfill the ground, and tamp so that the top surface, after completion, will be no more than 2 inches above the ground surface or exactly even with paved surfaces. In its final position, the box shall not touch the valve or stem at any point.

## 2.08 Tapping Valves and Sleeves

- A. Tapping valves 12-inches and smaller shall meet the 200psi working pressure and 400psi test pressure to conform to AWWA C509 latest revision or AWWA C515. Tapping valves manufacturer shall be Mueller, US Pipe, or M&H. Tapping sleeves shall be cast or ductile iron of the split-sleeve, mechanical joint type. Valves shall be resilient seat gate valves sizes 6" - 10".
- B. Tapping valves shall be Mueller Model H-687 sizes 4" - 10", H-667 sizes 12" - 20", M&H Style 3751-NRS sizes 4" - 10" or Style 751 sizes 12" - 20". Sleeves shall be Mueller Model H-615 or US Pipe MJ T-9.
- C. Connections to water mains may use Tapping Sleeve and Valve as permitted according to the table below. Where not specifically permitted for Tapping Sleeve and Valves, connections are to be made by cut-in to the existing line. No taps are permitted to 6 inch and smaller lines.

Tapping Schedule

Existing Pipe Size	Largest Tap Permitted*
6 inch	not permitted
8 inch	6 inch
10 inch	8 inch
12 inch	10 inch

\*Next smallest pipe size is largest tap permitted.

## 2.09 Fire Hydrants

- A. Primary fire hydrants shall be Mueller Modern Centurion, or equal and shall conform to ANSI/AWWA C502-05. Alternate vendors only by providing documentation demonstrating similar specifications. Fire hydrants shall be dry barrel type with a 6-inch mechanical joint shoe and minimum of 3-foot bury.
- B. Hydrants shall have two 2.5 inch nozzles and one 4.5 inch pumper nozzle all on the same elevation. The nozzle threads shall be National Standard Fire Hose Coupling Screw Thread as described in Appendix A of ANSI/AWWA C502-05.
- C. Hydrants shall be painted yellow. Bonnet and top shall be painted per below requirements:
  - a. Light Blue top = 1500 gpm or higher
  - b. Green top = 1000-1499 gpm
  - c. Orange top = 500-999 gpm
  - d. Red top = LESS than 500 gpm,
  - e. Violet BARREL = Non-potable water
  - f. Black BARREL = OUT OF SERVICE

- D. Operating nut shall be 1.5 inch point to flat and Open Left. Breakaway type flange is required.
- E. Location of hydrants shall be drawn on plans approved by State, any local governing bodies and the District.
- F. Detailed specifications may be provided or found online at [https://www.muellercompany.com/sites/muellercompany.com/files/uploads/media/mueller\\_modern\\_centurion\\_fire\\_hydrant\\_specification\\_form\\_10641.pdf](https://www.muellercompany.com/sites/muellercompany.com/files/uploads/media/mueller_modern_centurion_fire_hydrant_specification_form_10641.pdf)

## 2.10 Air Valves

- A. Air valves shall be Air valves for water lines shall be used to release the air trapped in the water main during its installation. The size of the air release is dictated by the size of pipe being installed. Installation shall be in accordance with the Materials specifications and as shown on the Standard Drawings.
- B. Air valves shall be 1-inch size on pipelines 12 inches in diameter and smaller. For larger pipes, the air valves shall be 2-inch size.
- C. Air valves shall be located at all high points on the pipeline or as directed by the Owner.
- D. Air valves shall be installed in precast concrete or brick manhole as shown on drawings.
- E. A tapping saddle shall be used on all air valve installations.
- F. Air valves shall be Crispin AR Series, APCO 50 or 200A Series, or approved equal. They shall be installed in a standard round meter box (plastic 18" tall with a black exterior and black interior with a cast iron lid) with a ¾" curb stop, either a Ford B44-333- Q or a Mueller B-25146, below it.

## 2.11 Blow Off

- A. They will consist of the plug (Trim Tyton with set screws and tapped 2"), two 2" x 6" and two 2" x 8" epoxy coated, ductile iron nipples, two 2" brass 90° bends, a 2" threaded valve (open left) with 2" operating nut, and a Gil Industries Post Flushing Hydrant. These shall be constructed as shown (<http://www.gilindustries.com/postflushing.htm>).
- B. Brass nipples shall be used if the ductile nipples are unavailable. Galvanized shall not be used. All connections made using a pipe joint compound.

## 2.12 Double Check Backflow Preventers.

- A. Double check backflow preventers shall conform to the following standards: A.S.S.E. No. 1015, A.W.W.A., C506, C.S.A. B64.5, FCCCHR of USC Manual - Section 10, U.L. Classified File No. EX3185, and be accepted by IAPMO (UPC), SBCCI (Basic Plumbing Code).

- B. Shut-off valves for backflow preventers in sizes 2 inch and smaller shall be full-port ball-type, with threaded connections and bronze bodies with copper content not less than 80 percent. Shut-off valves for backflow preventers in sizes 2-1/2 inches and larger shall be full-port ball-type, or resilient-wedge gate-type, with flanged connections, and iron bodies with FDA-approved fusion bonded epoxy coating inside and out.
- C. Double check backflow preventers shall be Ford or approved equal.

## 2.13 Double Detector Check Valve Assembly.

- A. Double detector check valve assemblies shall conform to the following standards:
  - 1. A.S.S.E. Standard No. 1015, AWWA Standard C 506; FCCCHR of USC Manual Section 10., U.L. Classified File No. EX 3185, and be listed under CSA B.64 Standard.
  - 2. All assemblies shall be standard equipped with epoxy coated UL/FM listed OS&Y resilient seat gate valves. Check valve bodies shall be epoxy-coated cast iron. The bypass line unit shall consist of an approved double check backflow preventer and water meter that reads in gallons.
- B. Double detector check assemblies shall be Watts 709DDC or approved equal.

## 2.14 Valve Markers.

- A. Valve markers shall be 4 feet long concrete posts. They shall have "WATER" imprinted on one side. A brass disc shall be cast into the marker immediately below the imprint indicating the distance to the valve. The upper 12 inches of marker shall be painted blue to indicate water. Valve locations shall be clearly marked by an arrow painted on the nearest curb or pavement using blue paint.

## 2.15 Corporation Cocks and Curb Stops.

- A. All 3/4 inch and 1 inch corporation cocks shall be Mueller or approved equal. All 1-1/2 inches and 2 inches corporation cocks shall be Mueller or Ford or approved equal.
- B. Curb stops for 2 inch blow-off assemblies shall have inside I.P.T. on both ends. They shall be Mueller or approved equal.

## 2.16 Retainer Glands

- A. Retainer Glands shall be ductile iron and shall be manufactured in the United States.
- B. Retainer glands shall be provided at all mechanical joints, including fittings, valves, and other locations as shown on the standard details or as directed by the Department.

- C. Retainer glands shall be the following types: Set Screw Type- Set screw type retainer glands shall be ACIPCO, EBAA Iron, Union Foundry, or Tyler. Compact/lightweight retainer glands shall not be allowed. The minimum working pressure and minimum weight, excluding set screws and gasket material, shall be as follows:

<b>Retainer Gland Size (Inches)</b>	<b>Minimum Working Pressure (PSI)</b>	<b>Minimum Weight (Pounds)</b>
4	350	6.0
6	350	11.8
8	250	16.0
12	250	24.8
16	200	50.0
20	200	72.5
24	150	85.0

- D. Wedge Type: Wedge type retainer glands shall be MEGALUG, Series 1100 as manufactured by EBAA Iron, Inc.

## 2.17 Locator Wire

Locator wire shall be Number 14 AWG solid THHN plastic coated copper wire with purple insulation. Locator wire shall be extended above ground 3 to 4 feet in a valve box as directed by the Owner. Locator wire shall be laid 6 inches above the pipe and should not come in direct contact with the pipe. Locator wire shall be used on all installations of non-metallic pipe (AWWA C9).

## 2.18 Casing Pipe

- A. Steel casing pipe shall be manufactured from steel conforming to ASTM A 139, Grade B and shall be new and unused. Minimum size and thickness shall be as follows:

### Casing Pipe Under Roadways

<b>Pipe Diameter (inches)</b>	<b>Casing Diameter (inches)</b>	<b>Wall Thickness (inches)</b>
6	12	0.250
8	16	0.250
10	16	0.250
12	18	0.250
14	22	0.375
16	24	0.375
18	30	0.375
20	30	0.375
24	36	0.375
30	42	0.375

The materials for casings under State Highways shall be in accordance with the Tennessee Department of Transportation Standard Specifications for the Construction of Roads and Bridges, latest edition. It shall be the Contractor's responsibility to determine

the exact requirements of the Tennessee Department of Transportation. If there is a conflict between these Regulations and the Tennessee Department of Transportation Specifications, the latter shall take precedent.

Pipe Diameter (inches)	Casing Diameter (inches)	Wall Thickness (inches)
6	14	0.250
8	18	0.250
10	20	0.281
12	22	0.375
14	24	0.375
16	30	0.406
18	30	0.406
20	32	0.469
24	32	0.469
30	42	0.500

## 2.19 Concrete Thrust Block/ Thrust Restraint

- A. Thrust blocks shall be installed on ductile iron pipe wherever the water main changes direction (at tees and bends), at dead ends, or at any other point recommended by the manufacturer or required by the Owner. Thrust blocks shall be considered an integral part of the water line work. Where thrust blocking is inadequate or inappropriate, tie rods shall be installed.
  - a. All pipe and fittings in contact with concrete thrust restraint blocks should be wrapped in plastic sheeting, minimum 6-mil thickness.
- B. A Field Lok 350 Gasket, used for pipe restraint and inserted into the bell of the pipe. MJ Field Lok is a pipe restraint similar to a mega lug. Both with an Owner approved manufacturer design may be used in place of, or in addition to concrete thrust restraints with prior approval of the Owner.
- C. For Field Lok 350 Gasket information, please visit: <http://uspipe.com/products/joint-restraint/field-lok-350-gaskets>
- D. For MJ Field Lok information, please visit: <http://www.uspipe.com/products/joint-restraint/mj-field-lok-gaskets>

## 2.20 Foster Adapters

- A. Foster Adapters, a compact restraint device, shall be used to connect two mechanical joint pieces. They are typically used between a mechanical joint fitting and a mechanical joint valve but do not have other applications. For more information, please visit: <http://www.infactcorp.com/wp-content/uploads/2013/10/Infact-Foster-Specs.-rev-2013-Aug9.pdf>

## 2.21 Meter Boxes

- A. Meter boxes and covers shall be constructed of cast iron for paved areas or plastic for outside of roadways. Construction of box and cover shall match in any installation. In the case of subdivision installation, all meter boxes for a single development shall be of the same type unless otherwise specifically approved by the Owner.
- B. Meter boxes for 2-inch meter assemblies shall be polymer concrete meter well with lid.
- C. Meter boxes and covers shall be colored to indicate water service. Plastic boxes shall be impregnated such that the color is consistent throughout the structure of the box. Cast Iron boxes shall be shop-painted interior and exterior prior to delivery using an approved two part epoxy paint.
- D. If plastic boxes are provided, they shall be high-density polyethylene.
- E. Meter boxes and covers shall be manufactured in the USA only.

## 2.22 Meter Settings

- A. Typically a one inch copper line is used to set two  $\frac{3}{4}$ " meter settings. The following starts at the water main and goes through to the tail piece where the customer connects their service line. The connection to the main water shall be made using a 1" corporation stop, either a Ford F1000-4-Q or Mueller H-15008. Type K copper tubing shall be used throughout. Next is a 1" x  $\frac{3}{4}$ " Y; either a Ford Y44-243-Q or a Mueller H-15343. Typically one leg from the Y goes to a yoke while the other is stubbed out with a  $\frac{3}{4}$ " curb stop, either a Ford B44- 333-Q or a Mueller B-25146. The copper setter, or yoke, shall be either a Ford VBH71- 7W-44-33-Q or a Mueller  $\frac{5}{8}$ " x 7" 221B2470-R2. The meter box is a square (18" tall) plastic one with a black exterior and black interior. The meter lid shall be cast iron. A  $\frac{3}{4}$ " x 12" brass nipple will be left coming from the outlet side of the yoke and extending one foot past the customer's side of the box. The yoke shall be centered in the meter box. No part of the yoke, especially the cutoff and check valve, shall be touching the meter box.

## Part 3 Execution

### 3.01 Pipeline Installation

- A. All items are to be installed per the manufacturer's specifications, AWWA standards, and in accordance with the plans approved by the state, North West Utility District and the local governing body.
- B. Proper and suitable tools and appliances for safe and convenient handling and laying of pipe and fittings shall be used. Great care shall be taken to prevent the pipe coating from being damaged particularly cement linings on the inside of the pipes and fittings. Any damage shall be remedied as directed.

- C. All pipe and fittings shall be carefully examined by the Contractor for defects just before laying and no pipe or fitting shall be laid which is defective. If any defective pipe or fitting is discovered after having been laid, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the Contractor at his own expense.
- D. No pipe shall be laid in water. The Contractor will be required to operate pumps, if necessary, to remove water (whether from ground or surface sources) from the trench while pipe is being laid and joints are being made. When work is not in progress the ends of the pipe shall be closed to prevent water or other foreign material from entering the pipe. Valves installed on existing mains shall be kept closed until after the line is tested, disinfected, and accepted for service.
- E. Pipe laid in trenches shall be laid true to line and grade on a firm and even bearing for its full length at depths and grades as indicated. Adequate precautions shall be taken to prevent floatation of pipelines prior to backfilling. Installation of ductile iron pipe in underground pressure piping systems shall conform to the requirements of ANSI/AWWA C600-05. Excavation of trenches and backfilling around pipes shall conform to the requirements of the section entitled "Excavation, Trenching and Backfilling" of these Specifications.
- F. Unless otherwise indicated on the drawings, all water lines shall have at least 30 inches of clean (no rocks, asphalt, etc.) dirt from the top of the pipe. If rock is encountered, the pipe shall be bedded in at least 6" of gravel and the ditch backfilled with gravel to a minimum depth of 12" above the top of the pipe. PVC pipe must adhere to ASTM D2774. The Owner shall approve all exceptions.
- G. When an existing or proposed road is crossed via an open cut, it shall be back-filled in accordance with the local governing body. The maximum trench width for water line installations shall be 24 inches for 6- and 8-inch lines and 30 inches for 10- and 12-inch lines. Trench widths for larger sizes shall be approved by the Owner. Minimum trench widths must be achieved to ensure proper backfilling around pipe. It is the contractor's responsibility to verify what the regulations are. Existing pavement shall be cut in neat, straight lines with either a pavement breaker or pavement saw and returned to its previous state.
- H. Contractor shall determine where the pipe is to be installed according to the centerline of the right of way. Consideration must be taken of sidewalks and other utilities.
- I. If the use of steel casing (continuous weld construction and installed with welded joints) is necessary or dictated by the local authority, Field Lock gaskets shall be used inside. The appropriate spacers are to be used also. The company doing the bore must be approved by North West Utility District.

The casing shall have minimum yield strength of 35,000 psi and minimum thickness:

<u>Pipe Diameter (inches)</u>	<u>Minimum Thickness (inches)</u>
≤12	0.188



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16	0.219
24	0.344
30	0.406

- J. Whenever pipe laying is not in progress, the open ends of the pipe shall be closed either with a watertight plug or by other means approved by the Owner.
- K. Wherever pipe must be deflected from a straight line, (in either the vertical or horizontal plane) in order to avoid obstructions or plumb stems, or wherever along radius curves are permitted, the amount of deflection shall neither exceed that necessary for the joint to be satisfactorily made, nor exceed that recommended by the pipe manufacturer and shall be approved by the Owner. Bend fittings shall be used when the pipe deflections are inadequate, according to manufacturer's recommendations, or as directed by the Owner.
- L. Horizontal Separation
- 1) Under normal conditions - Water mains and service lines shall maintain a minimum of 10 feet edge-to-edge horizontal separation from sanitary sewer, storm sewer, sanitary manhole, or sanitary force mains.
  - 2) Under unusual conditions – When local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer to a storm or sanitary sewer provided that:
    - a) The bottom of the water main is at least 18 inches above the top of the sewer
    - b) Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water-tightness prior to backfilling.
  - 3) No water pipe shall pass through or come in contact with any part of a sewer manhole.
- M. Vertical Separation. If the water main or service line cannot be installed with the above-described horizontal separation, the following vertical separation shall apply.:
- 1) Normal Conditions - Water mains crossing house sewers, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer, whenever possible, where water mains are within 3 feet horizontally or cross sanitary sewers or sanitary force mains.
  - 2) Unusual Conditions - Water mains passing under sewers, shall, in addition, be protected by providing:
    - a) A vertical separation of at least 18 inches between the bottom of the

- sewer and the top of the water main;
  - b) Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water mains;
  - c) That the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer;
  - d) Both the sewer and the water main shall be constructed of water pipe.
- N. Field Lock gaskets shall be used throughout a water main crossing, when crossing a body of water (creek, stream, lake, etc.). Valves shall be provided at both ends of the crossing so that the section can be isolated for test or repair; the valves shall be easily accessible and not subject to flooding.
- O. All elbows, tees, branches, crosses, and reducers in pressure piping systems shall be adequately restrained against thrust. Underground pressure piping containing un-harnessed push-on or mechanical joints or expansion joints shall be restrained by thrust blocks. The Contractor may use forms or earth walls to mold the thrust blocks. When earth walls are used, they shall be cut true to shape and all excess earth removed. The work shall be conducted so that no loose earth will become mixed with the concrete. At the end of 24 hours, damp earth may be placed over the concrete to retain moisture.
- P. All lumps, blisters, excess coating, dirt and other objectionable substances shall be removed from the bells and spigots. Bells and spigots shall be wiped clean and dry. Bells shall be centered in the trench and spigots driven home.
- Q. The Contractor shall keep a transit and appurtenances on the job to be used for laying out the angles required for making bends and other works of this nature. shall be removed before backfilling. All stress points and ends of mains shall be inspected before backfilling.
- R. Provide casing pipe where water lines cross roads. Casings are required at all roads, unless ductile iron pipe is used and the Owner grants a waiver. Such waiver shall be approved during the plan review process and recorded on the construction plans.
- S. All water distribution mains shall be flushed prior to inspection as specified below to assure complete removal of all debris and foreign material.
- T. Bends, valves and other points where deemed necessary shall be blocked and harnessed to resist thrust. This shall be accomplished by methods and means approved by the Department. All forms used to form concrete for blocking. Bends of 90°'s, are not permitted. 45°'s, 22.5°'s and 11.25°'s are permitted as long as Mechanical joints are used. When alignment requires deflection greater than 5 degrees between full lengths of pipe, bends will be required. Short lengths of pipe in place of bends will not be permitted.

- U. Blow-off valves shall be installed at terminus of all dead end mains that have no provision to ever be extended. A minimum of five Field Lock gaskets are to be used prior to termination. Method of installation shall be approved by North West Utility District. Refer to Standard Details for 2 inch blow-off details. If it is a valve (stub out for future growth), a minimum of five full pieces of pipe will be installed past the termination point with a 4x4 installed vertically in the ground to mark the end unless otherwise noted on the plat. The end of the pipe must be securely sealed to keep it free of dirt, groundwater, and animals. Approved plans will show locations.
- V. Mechanical joints and restrained joints shall be made in strict accordance with the pipe manufacturer's instructions. The gaskets and follower rings shall be kept clean and carefully centered in the bell with the bolts and bolt holes always parallel with the centerline of the pipe. The coating and lining of the pipe shall not be damaged. The nuts on all bolts shall be started and tightened evenly around the entire circumference of the pipe. No one nut shall be tightened more than ½ turn tighter than the remainder of the nuts of the joint. When the joint is complete, the follower ring shall be equal distance from (parallel with) the face of the bell. Bolts shall not be over-stressed and shall be tightened just enough to compress the gasket sufficient to prevent leakage. Just prior to assembly, the gasket shall be cleaned of all foreign material and shall be brushed with soapy water just before slipping the gasket over the spigot and into the bell of the pipes. The joint shall be in straight alignment during assembly. Any deflection required shall be made after assembly but before tightening bolts. Bolts shall be tightened with torque wrenches with the following torque loads applied:

Range of Torque

<b>Bolt Size(inches)</b>	<b>Foot Pounds</b>
5/8	45 – 60
3/4	75 – 90
1	100 – 120
1-1/4	120 - 150

- W. Push-on type joints shall be made in strict accordance with the pipe manufacturer's instructions. All joints shall be completely "belled-up" and all spigots shall be "home". The gasket seat in the socket, the gasket and the plain end of the pipe to be entered shall be wiped clean before assembly. After the gasket has been inserted into the gasket recess, a thin film of lubricant shall be applied to the inside surface of the gasket and to the outside surface of the spigot end of the pipe to be jointed. After lubricating, the end of the pipe shall not be allowed to touch the bottom or side of the trench causing dirt to adhere to the joint surface. When pipe is cut in the field, the cut end of the pipe shall be beveled with a file or grinder. The joint shall be in straight alignment while pushing the pipe to make assembly. Any deflection required shall be made after the joint is assembled.
- X. Set screw type retainer glands shall be installed in strict accordance with the fitting manufacturer's instructions. After making up the mechanical joint as previously specified, the set screws shall be run down until they are in firm contact with the pipe. The set screws shall then be tightened once completely around the joint to approximately 40 foot-pounds torque. Finally, the set screws shall be tightened twice completely around the joint to the following torques, unless a "break-away"

torque is used: 3" through 12" glands - 80 foot – pounds 14" through 24" glands - 65 foot – pounds

- Y. Wedge type retainer glands shall be installed in strict accordance with the manufacturer's instructions. Impact wrenches shall be prohibited for used with "break-away" nuts for final tightening.
- Z. Retainer gland joints shall be made in straight alignment and any deflection required shall be made before tightening the joint bolts or set screws.

### 3.02 Ductile Iron and PVC Mains

- A. After a length of ductile iron or PVC pipe has been placed in the trench, the spigot end shall be centered in the bell of the adjacent pipe and then inserted to the depth specified by the manufacturer.
- B. Bell holes, when required, shall be big enough so that there is ample room for the pipe joints to be properly made. The trench shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length. Pipe shall be laid and continuously supported on undisturbed or well-compacted soil. Pipe shall not be supported by blocks or allowed to rest on rocks or any other material that could cause shearing stresses on the pipe during backfill. All backfilling shall be in accordance with specification herein.
- C. Pipe shall be cut so that valves, fittings, or closure pieces can be inserted in a neat and workman-like manner and without any damage to the pipe. The manufacturer's recommendations shall be followed to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipes axis. For cast iron pipe, hydraulic cutters or a carborundum saw shall be used. A carborundum saw shall be used for ductile iron pipe. The Owner may consider other methods for 12-inch diameter and larger pipe.
- D. Pipe shall be installed with the bell ends facing in the direction of laying unless otherwise directed by the Owner.

### 3.03 Tapping Sleeves

- A. Prior to attaching the sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.
- B. Before performing field machine cut, the water tightness of the sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with water. An air compressor shall be attached, which will induce a test pressure as specified in this Article. No leakage shall be permitted for a period of five minutes.
- C. After attaching the sleeve to an existing main, but prior to making the tap, the interior of the assembly shall be disinfected.

### 3.04 Connecting to Existing Side Street Mains

- A. Before taking existing side street mains out of service, taps for air removal shall be made at each high point along the section of existing main to be temporarily taken out of service. With the Department's approval at each location, existing service lines may be used to expel air.
- B. Close service line curb stops along the section or sections that will be dewatered and close all connecting main valves.
- C. Take existing main out of service, cut and complete connection as detailed on the Standard Details.
- D. Open appropriate valve and after expelling all air, return existing main to Service and re-open all service line curb stops.
- E. At all taps to remove air, install brass cap on corporation stop, backfill, and replace pavement where required.

### 3.05 Valve and Fitting Installation

- A. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves shall be corrected or held for inspection by the Department. Valves shall be closed before being installed.
- B. Gate valves, both mechanical joint and tapping, are to be installed per the requirements of ANSI/AWWA C509-01. Valves are to be installed, along with a valve box, such that a valve key can easily operate it after back-filling. The top of the valve box shall be flush with the finished grade. The locations, sizes, and types of the valves are dictated by the approved plans.
- C. Valves, fittings, plugs and caps shall be set and joined to the pipe except that 12 inch and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. Valves shall be installed in the closed position.
- D. Fittings are to be installed as shown on the plans. Any deviations must be approved beforehand by either the North West Utility District General Manager or Inspector. Any time a thrust block is used, 5 Field Lock gaskets and either Mega Lugs or MJ Field Locks are to be installed as well. For a 90° bend, 5 Field Lock gaskets shall be installed on both sides of the fitting as well as either Mega Lugs or MJ Field Locks. Approved mechanical joint accessories (bolts, gaskets, and glands) are to be used.

- E. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 30 inches beneath finished grade so as to set the top of the operating nut 30 inches below finished grade. The valve box be flush with the surface of the finished area or such other level as directed by the Department.
- F. If valve boxes are installed concurrently with valves, the Contractor shall be responsible for maintaining valve boxes until the warranty period expires. All lost or damaged valve boxes shall be replaced by the Contractor, at the Contractor's own expense.
- G. A concrete pad shall be required around each valve box, the top flush with the cover as detailed on the Standard Details. Pre-cast valve pads will only be allowed where approved by the Department and specifically noted on the construction plans. Pre-cast pads shall not be used on slopes or in ditches.
- H. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.
- I. Where main valves are shown on the Standard Details adjacent to intersection tees, install the valves no more than four feet from the tee unless shown or specified otherwise.
- J. Non-restrained and push-on joints shall not be installed within 15-feet of restrained joints at valves or fittings, unless shown otherwise on the Standard Details or approved by the Department.

### 3.06 Fire Hydrant

- A. Each fire hydrant shall be installed in accordance with ANSI/AWWA C502-05. The assembly shall consist of a fire hydrant, a connector piece (MJ gland on one end and DI rotating MJ gland on the other end), a 6" MJ (isolation) valve, and MJ Fire Hydrant Tee. Erect the fire hydrant to stand plumb with the pumper nozzle facing the road. The weep holes are to be unobstructed. The location is dictated by the approved plans. The hydrant should be installed such that the lowest nozzle is at least 12 inches above finished grade. If extensions are needed, it will be the sole responsibility of the contractor to both purchase and install them.

### 3.07 Taps

- A. All taps and materials are to be provided by North West Utility District at the contractor's expense. A tap application and fee must be completed prior to commencing work. An estimate of the tap materials may be provided prior to North

West Utility District completing the work but the contractor will be responsible for the actual costs incurred by North West Utility District for materials and any additional required testing.

### 3.08 Foster Adapters

- A. Foster adapters are to be used in connecting two mechanical joint fittings. They are typically used between a tee and a valve but do have other uses.

### 3.09 Jack and Bore

- A. The Contractor shall provide to the Department, for approval, a detailed plan for the methods proposed for the construction of the casing. These plans shall include the methods proposed for groundwater control and face protection.
- B. In general, jack and bore operations shall conform to the requirements of the Tennessee Department of Transportation as presented in their *Standard Specifications for the Construction of Roads and Bridges*, latest edition. If a conflict between these Regulations and the Tennessee Department of Transportation Specifications exists, the more stringent Specifications shall govern.
- C. Install the steel casing pipe by the dry boring method. Bore the hole and install the casing through the soil simultaneously by a cutting head on a continuous auger mounted inside the casing pipe. Fully weld lengths of casing pipe to the preceding section in accordance with AWS recommended procedures. After the boring and installation of the casing is complete, install a cleaning plug on the rig and clean the casing.
- D. After construction of the casing is complete, and has been accepted, install the pipeline in accordance with the detailed Standard Details and/or these Regulations.
- E. Check the alignment and grade of the casing and prepare plan for approval to set the carrier pipe at proper alignment, grade and elevation. The carrier pipe shall be supported by stainless steel casing spacers to preclude movement within the casing. One spacer shall be placed not more than two feet from each end of the casing. Subsequent spacers shall be placed at 6 feet - 10 feet intervals within the casing.
- F. Provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.
- G. Begin the boring operation in a pit, sheeted and shored as necessary and begin at and proceed from one end. Observe all applicable requirements of Tennessee Department of Transportation regulations or City/County Transportation Department, as applicable.

- H. Conduct the operations in such a manner that all work will be performed below the level of the roadbed. Coordinate and schedule all of the work with Tennessee Department of Transportation or City/County Transportation Department, as applicable.
- I. Complete all boring work at one particular location before boring work is started at another location.
- J. If the casing installation work is being conducted in an unsafe manner or in a manner detrimental to the overpassing roadway or to the safety of the traveling public, all operations of boring shall cease until the necessary corrections have been made. In the event that distress occurs to the roadway due to the boring, the Contractor shall be required to submit a plan to repair the roadway. The plan must be acceptable to the Tennessee Department of Transportation or City/County Transportation Department, as applicable.

### 3.10 Free Boring

- A. The Contractor may construct a driveway crossing by the free bore method, in lieu of making a pavement cut, where indicated on the Standard Details and approved by the Department. The free bore method shall be accomplished by the dry auger boring method without jetting, sluicing, or wet boring.
- B. The diameter of the free bore shall not exceed the pipe bell outside diameter or the pipe barrel outside diameter plus 1 inch, whichever is greater.
- C. Free boring is allowable only under residential driveways. Free boring is not allowed under commercial driveways or any roadway.
- D. The Contractor shall be responsible for any settlement of the driveway caused by the free bore construction activities.
- E. If the Contractor elects to free bore and an acceptable installation does not result for any reason, the Contractor shall install a casing pipe by the bore and jack method.

### 3.11 Double Check Backflow Preventers

- A. Double check backflow preventer may be required at specific locations as directed by the Department. When required, the backflow preventer shall be housed in a meter box or vault as per the detail.
- B. One and one-half inch and smaller backflow preventers require a minimum of 6 - inches below, 8 inches behind, 8 inches in front of, and 3 inches above the highest point on the device or its valves.
- C. Two inch and larger backflow preventers require a minimum of 12 inches below, 12 inches behind, 24 inches in front of and 3 inches above the highest point on the device or its shut off valves.



- D. A minimum of 6 inches between the pit walls and the large device's valves and 3 inches between the pit walls and the valves on the small devices is required.
- E. The dimensions given above assume a standard "shallow" installation. If the depth exceeds 12 inches to the top of the device the other dimensions will need to be increased accordingly and be approved by the Department.

### 3.12 Locator Wire

- A. A continuous or properly spliced Number 14 AWG THHN solid plastic coated copper wire shall be placed along all PVC pipeline installations (ASTM D2774).
- B. Care shall be taken during backfilling to prevent damaging or cutting of the locator wire.
- C. All splices shall be made by using copper wire "U" bolt assemblies and then wrapping with electrical tape.
- D. Wire shall be wrapped around pipe such that at least four (4) "wraps" are produced per length of pipe.
- E. In lieu of "wrapping", the tracer wire may be strung along the top of pipe provided it is taped to the pipe every five (5) feet to ensure proper positioning during backfilling.
- F. Locator wire shall be brought up to ground surface at all valve boxes and service connections. At service connections, a length of at least 12 inches of locator wire shall be coiled inside the meter vault. At valve boxes, a length of at least 12 inches of locator wire shall be coiled in a sealed opening at each valve pad. Locator wire from each side of valve shall terminate in the valve pad. Locator wires from each side of valve shall be bridged underground at the valve level to form a continuous conductor.

### 3.13 Valve Markers

- A. Markers shall be installed with the top of the marker protruding 36 inches above the ground surface. Valve markers shall be located in a suitable location approved by the Department's Inspector during construction.
- B. A marker shall be located within 20 feet or less from all in-line valves and/or tapping valves. One marker may be used to reference the location of more than one valve provided the valves are within 20 feet of the marker. No marker is to be installed within three feet of direct line of operation of a fire hydrant. Valve marker shall be installed in ditch line being in direct line with water main.
- C. The brass disc shall be stamped with the distance between the valve(s) and marker. The marker shall be installed such that the disc faces the valve.

### 3.14 Field Pressure Testing

- A. After the pipe has been installed, the complete pipeline shall be subjected to a hydrostatic pressure test.
- B. All testing shall be scheduled with the Owner.
- C. Mains and services shall be pressure tested as a complete system or as directed by the Owner.
- D. All pressure and leakage testing of water mains and appurtenances shall be in conformance with the latest revision of AWWA Standard C600 for DIP and AWWA C605 for PVC.
- E. All newly installed and backfilled pipe or any valved section thereof shall be subjected to a hydrostatic pressure test, conducted in the presence of the OWNER. If testing against a previously existing valve and the valve leaks, the CONTRACTOR shall be responsible for the valve. However, the OWNER shall not be liable for costs or lost time incurred by the CONTRACTOR when attempting to test a line against a faulty valve.
- F. Water used to conduct the hydrostatic testing shall be of the same quality required for KUB tap water.
- G. Hydrostatic Pressure Test – DIP
  - a. Each valved section of pipe shall be slowly filled with water, and a test pressure equal to the 1.5 times the normal working pressure (but not less than 200 psi) shall be applied for a minimum of 2 hours. Test pressure shall be based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge. A pump shall be connected to the pipe in a manner satisfactory to the OWNER. The CONTRACTOR shall furnish the labor and equipment, including the pump pipe, connections, gauges, and all necessary apparatus.
  - b. The hydrostatic pressure test shall be conducted by measuring, through a calibrated meter, the amount of water, which enters the test section under 200 psi or normal working pressures (whichever is greater) for a period of at least 2 hours. No installation will be accepted until the hydrostatic testing allowance is less than the number of gallons per hour as determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148,000}$$

L = allowable leakage gallons/hour

S = length of pipeline tested, in feet

D = nominal diameter at the pipe, inches

P = average test pressure during the leakage test, psig

- c. The following table has been developed for the commonly used sizes of ductile iron pipe with the nominal laying length of 20 feet, under a test pressure of 200 psi. The hydrostatic testing allowance formula above may be used when conditions differ from those stated parameters.

<b>Pipe Diameter (inches)</b>	<b>Allowable Leakage per 1000 feet (gallons/hr)</b>
8	0.66
12	0.99
16	1.32
20	1.66
24	1.99
30	2.48
36	2.98

- d. Cracked or defective pipes, fittings, valves, or hydrants discovered in consequence of this hydrostatic pressure test shall be replaced with sound material in the manner specified at no cost to the OWNER. The test shall be repeated until the results are satisfactory to the OWNER. A recording chart shall be used to document the results of the test if requested by the OWNER.

#### H. Hydrostatic Pressure Test – PVC

- Submit detailed test procedures and methods for Engineer's review. Testing shall be conducted in accordance with AWWA C605.
- The specified pressure test shall not exceed pipe or thrust restraint design pressures.
- Water lines installed using PVC pipe shall pass a pressure test equal to 1.5 times the normal working pressure (but not less than 200 psi) for a period of 2 hours minimum and 4 hours maximum.
- Hydrostatic testing allowances shall not exceed those indicated in AWWA C605. Provide suitable restrained bulkheads as required to complete the hydrostatic testing specified.

- e. Leakage shall be defined as the quantity of water that must be supplied into the pipe section being tested to maintain a pressure within 5 psi of the specified leakage-test pressure after the pipe has been filled with water and the air in the pipeline has been expelled. No installation will be accepted if the leakage is greater than that determined values in AWWA C605.

### 3.15 Final Cleaning

- A. Interim Cleaning: Prevent the accumulation of weld rod, weld spatter, pipe cuttings and filings, gravel, cleaning rags, and other foreign material within piping sections during fabrication. The piping shall be examined to assure removal of these and other foreign objects prior to assembly and installation.
- B. Flushing: Following assembly and testing, and prior to pressure testing, piping systems shall be flushed with water to remove accumulated construction debris, air pockets and other foreign matter. The piping shall be flushed until all foreign matter is removed from the pipeline. Flushing shall not substitute for preventive measures during construction. Certain contaminates, such as caked deposits, resist flushing at any feasible velocity and pigging of the main may be required. The flushing shall be done in accordance with ANSI/AWWA C651-05. Provide all hoses, temporary pipes, ditches, and other items as required to properly dispose of flushing water without damage to adjacent properties. The minimum flushing velocity shall be 2.5 fps. For large diameter pipe where it is impractical to flush the pipe at the minimum flushing velocity, the pipeline shall be cleaned in-place from the inside by brushing and sweeping, then flushing the pipeline at a lower velocity. Cone strainers shall be installed in the flushing connections of attached equipment and left in place until cleaning is completed. Accumulated debris shall be removed through drains, or by removing spools or valves. When flushing, the contractor is do use Best Management Practice's that will allow the water to sheet flow over a vegetated area if possible, and not to cause erosion which in turn will cause fugitive sediment to be suspended. Please contact the Hamilton County Water Quality Program at 423-209-7851 or the Chattanooga office at 423-668-2530 if there is any uncertainty on handling the discharge.
- C. Disinfection: Disinfect all pipelines which will carry potable water, non-potable water, or hot water. Before acceptance of piping system operation, each section of completed pipeline shall be disinfected in accordance with ANSI/AWWA C651. Section 4.4 includes acceptable methods. After pressure tests have been made, the piping section to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall be liquid chlorine, calcium hypochlorite, or sodium hypochlorite. The chlorinating material shall provide a dosage of not less than 50 ppm and shall be introduced into the piping in an approved manner. PVC pipe lines shall be chlorinated using only the above specified chlorinating material in solution. In no case shall the agent be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all non-spore-forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 25 ppm of free chlorine residual throughout the line at the

end of the retention period. All valves on the lines being disinfected shall be opened and closed several times during the contact period. The main should be flushed as soon as possible with clean water until the residual chlorine is reduced to less than 1.0 ppm (within 24hr), because prolonged exposure to high concentrations of chlorine might damage the asphaltic seal coating. North West Utility District will furnish the disinfectant for the contractor. During the flushing period, each outlet on the line shall be opened and closed several times. From several points in the pipeline section, Contractor personnel, approved by the Engineer, shall take samples in sterilized containers and have a bacterial examination performed by a commercial laboratory in accordance with state approved methods. The commercial laboratory must be certified by the state's approving authority for examination of potable water. The disinfection shall be repeated until the piping system passes the bacterial examination for 2 consecutive days. The piping system will not be accepted until satisfactory bacteriological results have been obtained.

- D. Bacteriological Test: The contractor is responsible for obtaining a clean bacteriological test from an approved laboratory. The report must be sent to North West Utility District.

### 3.16 Waste Water Disposal

- A. The water used for testing, cleaning, flushing and/or disinfection shall be disposed of in accordance with all applicable regulations. Disposal is solely the responsibility of the Contractor. The method proposed for disposal of waste water shall be provided to, and approved by, the Engineer prior to performing any testing, cleaning, flushing and disinfection activities.

### 3.17 Fire Sprinkler

- A. The fire sprinkler system and the acceptance thereof by North West Utility District is subject to the prior approval of the fire department having jurisdiction of the premises to be served. Also, the **Application for Special Connection** must be completed before North West Utility District will approve the plans.
- B. That the entire private protection system on the premises shall be subject to the inspection, test and approval of North West Utility District. Its representatives shall have the right to enter the premises at reasonable time for the purpose of making such reasonable inspections as it may deem necessary, and to insure compliance with the terms and conditions of its **Application for Special Connection**.
- C. That all pipes and appurtenances shall be constructed and maintained in good condition by and at the expense of the Owner. All pipes and fittings shall be constructed of ductile iron from the North West Utility District water main to the interior of the building and either ductile iron, copper, and/or steel from there.

- D. That an AWWA approved backflow preventer (DCCA) and, if necessary, an AWWA approved fire line meter approved by both North West Utility District and the fire underwriters, will be required on the service at a location approved by North West Utility District. Such meter or device shall be installed and maintained by and at the cost and expense of the Owner, but subject to the inspection and approval of North West Utility District. The by-pass meter only, used with the detector device, shall be Badger M-25 or M-70, and must be purchased at North West Utility District office.
- E. That a gate valve with post indicator controlling the entire supply shall be placed at the curb or property line of the street in which the main is located or at such other point as may be approved by North West Utility District, and shall be furnished, installed and maintained by and at the expense of the Owner, and unless otherwise approved by North West Utility District, said valve shall be installed in a valve pit or vault which shall be furnished, installed and maintained by and at the expense of the Owner.
- F. That all hydrants and other fixtures connected to the private fire protection system shall be kept closed and sealed, and not opened or used except during times of fire or testing. Upon extinguishment of each fire or following each test, the Owner shall immediately close such fixtures and notify North West Utility District so that they may be sealed. Whenever a private fire protection system is to be tested, the Owner shall notify North West Utility District at least two business days in advance of such proposed test, requesting approval of the method, day, and hour on which it is to be made.
- G. That no anti-freeze or any other substance, not specifically approved by the Environmental Protection Agency as non-detrimental to the public water supply, shall be introduced into sprinkling systems or into any pipe, fixture, appurtenance or other portion of the Owner's private fire protection service system.
- H. That the Owner understands and agrees that the extent of the rights of the Owner under the ***Application for Special Connection*** is to receive, but only at times of fire on said premises, such supply of water as shall then be available and no other greater quantity.
- I. The Owner further acknowledges and agrees North West Utility District shall not be considered in any way or manner an insurer of property or persons, or to have undertaken to extinguish fire or to protect any persons of property against loss or damage by fire, or otherwise, and North West Utility District shall be free and exempt from any and all claims for damages on account of any injury to property or persons by reason of fire, water, failure to supply water or pressure, or any other cause whatsoever.
- J. Any waste of water or use of water through this connection for purposes other than testing or the extinguishment of fire shall be deemed a violation of the

rules, regulations and conditions of service of North West Utility District.

- K. That if private fire hydrants are included as part of this fire sprinkler system, they shall be painted any color other than that adopted by North West Utility District for public fire hydrants.
- L. That the Owner shall furnish, attach and make a part hereof, three (3) complete sets of drawings showing the pipes, pumps, valves, hydrants, sprinkler systems, hose outlets and connections, standpipes, tanks and other openings and appurtenances contemplated in this application. Such drawings, which shall be stamped "Approved" by the Insurance Services Office or other comparable agency approved by North West Utility District, must also show all other water supply water systems and pipelines and appurtenances which are proposed of which may exist on the premises to be served.
- M. That no pipe, fixtures or appurtenances connected with the Owner's private fire protection service system shall be connected with any pipe, fixtures or appurtenances supplied with water from any other source, unless specifically approved in writing by North West Utility District.
- N. That the Owner agrees to obtain in advance the approval of North West Utility District for any change, alteration, addition or deduction contemplated in the pipes, fixtures, openings and appurtenances and uses herein specified. Notwithstanding the approval of North West Utility District, the Owner agrees that, except for those facilities which North West Utility District has specifically agreed to provide and maintain, the Owner is and will be solely responsible for the design, adequacy, function and maintenance of its private fire protection system referred to in this application.
- O. That North West Utility District has the right to discontinue or disconnect the service pipe herein applied for, and to terminate service, after due written notice to the Owner, for failure to pay any bill when due, for leakage within the Owner's system, for violation of any other terms and conditions of the ***Application for Special Connection***, or for any violation of its rules, regulations and conditions of service; and North West Utility District also has the right to shut off all or any part of its facilities and discontinue the service without notice when deemed necessary by North West Utility District (1) if a condition dangerous or hazardous to life, physical safety or property exists, (2) upon order by any court, the Department of Conservation and Environment or other duly authorized public authority, (3) if fraudulent or unauthorized use of water by the Owner is detected, or if North West Utility District's regulating or measuring equipment has been tampered with by the Applicant.
- P. That upon acceptance of the ***Application for Special Connection*** by North West Utility District and the completion of the installation of the service pipe applied for, this application shall be in full force and effect as a contract and shall continue as such until cancelled by written notice given thirty (30) days in advance by the Owner to the North West Utility District, except as otherwise provided in numbered paragraph (14) above.

- Q. The acceptance of the ***Application for Special Connection*** by North West Utility District must be executed by its Manager or Inspector before same becomes effective.

END OF SECTION