

STANDARD  
WATER SPECIFICATIONS  
WATER LINES AND APPURTENANCES

SHELBYVILLE, TENNESSEE

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**APPROVED WATER SPECIFICATIONS**

THE DOCUMENT BEARING THIS STAMP HAS BEEN RECEIVED AND REVIEWED BY THE  
TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION

DIVISION OF WATER RESOURCES

AND IS HEREBY APPROVED FOR USE IN CONSTRUCTION BY THE COMMISSIONER



03/11/2022

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

APPROVAL EXPIRES FIVE YEARS FROM ABOVE DATE



City of Shelbyville  
Shelbyville Power, Water, and Sewerage System  
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WATER LINES AND APPURTENANCES

1. Scope of the Work

The water line work to be accomplished under this Detailed Specification consists of the furnishing of all labor, materials, equipment, and services necessary for the construction of water lines and appurtenances for the Shelbyville Power, Water and Sewerage System of the City of Shelbyville, Tennessee.

2. Location of Water Lines

The approximate location of the water line in relation to the Limits of Rights-of-Way, pavement, *etc.*, shall be shown on Plans submitted and approved by the Manager of the Shelbyville Power, Water and Sewerage System and the Tennessee Department of Environment and Conservation. The final location of the water line shall be constructed by the Contractor as close to that shown on the Plans. The final location may be varied by the Contractor with the approval of the Manager of the Water System provided (1) the proposed location is within the construction easement shown on the approved Plans, and (2) the proposed location is approved by the City of Shelbyville, the Shelbyville Power, Water and Sewerage System and the Bedford County Highway Department, or other agency or legal entity having jurisdiction. The final location in any event may be varied by necessity due to construction conditions at the direction of the Manager of the Water System due to the requirements of the Tennessee Department of Transportation (TDOT), the City of Shelbyville, the Shelbyville Power, Water and Sewerage System and the Bedford county Highway Department, or other agency or legal entity having jurisdiction.

3. Pipeline Materials for Water Lines

a. General

In order to conform with the materials in the existing water system, all water lines shall be ductile iron pipe. PVC PIPE WILL NOT BE PERMITTED UNLESS APPROVED BY THE MANAGER OF THE WATER SYSTEM.

b. Ductile Iron Pipe

Ductile iron pipe shall be centrifugally cast, manufactured and tested in accordance with the ANSI/AWWA C150/A21.50-91 for Ductile Iron, Grade 60-42-10. The nominal wall thickness for each pipe size of Pressure Class 350 pipe shall be as follows:

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<u>Size</u>	<u>Wall Thickness</u>
4-inch	0.25-inch
6-inch	0.25-inch
8-inch	0.25-inch
10-inch	0.26-inch
12-inch	0.28-inch

For pipe 14-inch and larger, a working pressure of 250 psi plus a surge allowance of 100 psi will be required. The nominal wall thickness for each pipe size of Pressure Class 250 pipe shall be as follows:

<u>Size</u>	<u>Wall Thickness</u>
14-inch	0.28-inch
16-inch	0.30-inch
20-inch	0.33-inch

The pipe shall be manufactured and tested in accordance with the requirements of ANSI Specification A21.51.

Pipe shall be push-on type joint incorporating a single molded rubber ring gasket unless otherwise indicated and shall be furnished tar coated outside and the manufacturer's standard cement lined inside to comply with ANSI Specification A21.4.

c. Ductile Iron Fittings

All fittings for ductile iron pipe shall be Class 350 single gasket seal joint ductile iron conforming to ANSI/AWWA C111/A21.11 and ductile iron conforming to ANSI/AWWA C153/A21.53, and shall meet the current requirements for the manufacturer's standards. Fittings shown on the Standard Detail Sheet are intended to convey the general configuration but the Contractor shall furnish all fittings required.

Each fitting shall be certified by the manufacturer to have been tested and to have met the requirements of the governing standard specifications.

All fittings shall be furnished tar coated outside and the manufacturer's standard cement lined inside.

d. Restrained Joints

Ductile iron pipe with restrained joints shall be either Pressure Class 350 for 4-through 12-inch or Pressure Class 250 for 14-inch and larger and conform to the latest revisions of ANSI Specification A21.10, A21.11 and A21.51. The pipe

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shall be installed at stream and creek crossings or where directed by the Manager of the Water System and shall be American Flex-Ring or equal.

### 4. Lines and Grades

Unless otherwise directed by the Manager of the Water System, lines and grades shall be set to conform to those shown on the approved Plans where required to insure that our release valves have sufficient depth and function properly. PLAN AND PROFILE INFORMATION SHALL BE PROVIDED FOR ALL WATER LINES OVER 8 INCHES IN SIZE.

The Contractor shall lay the new finished water transmission lines to maintain a minimum vertical separation of 18 inches between the finished water transmission lines and the existing sanitary sewer line where they cross and a minimum horizontal separation of 10 feet between the finished water transmission lines and the existing sanitary sewer line where they parallel.

**When local conditions prevent a horizontal separation of 10 feet, a water main maybe laid closer to a storm or sanitary sewer provided that the bottom of the water main is at least 18 inches above the top of the sewer; or the sewer shall be constructed of material and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water tightness prior to backfilling.**

### 5. Excavation of Pipeline Trenches (Water Lines)

#### a. General

The excavation shall be carried to the depths indicated on the approved Plans and/or directed by the Manager of the Water System to permit proper bedding of the pipe. Trenches shall be opened to a depth where the top of the pipe shall not be less than thirty-six (36) inches below the surface of the ground when laid through wooded areas, fields, and other such areas outside the pavement or traveled surface of highways and roadways. Where a greater depth of cover is not indicated on the approved Plans, the minimum depth of cover shall not be less than forty-two (42) inches for pipelines laid in the shoulder or traveled surface of any highway and/or roadway. Any line laid within the right-of-way of a State Highway shall have a minimum depth of cover of four (4) feet. ALL DEPTHS OF COVER ARE MEASURED TO THE TOP OF THE PIPE.

Trenches shall be of sufficient width to provide free working space on each side of the pipe and permit proper backfilling around the pipe, but unless specifically authorized by the Manager of the Water System, trenches shall in no case be excavated or permitted to become **narrower** than 1 foot 6 inches plus the nominal diameter of the pipe **nine inches clear at bells and the pipe are required future work space.**

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Unless specifically directed otherwise by the Manager of the Water System or where required to uncover or determine the presence of underground obstructions, not more than three hundred feet of trench shall be opened ahead of the pipe laying, and not more than two hundred feet of open ditch shall be left behind the pipe laying. Before laying the pipe, the Contractor shall open the trench far enough ahead to reveal obstructions that may necessitate changing the line or grade of the pipeline. It will be the responsibility of the Contractor to contact and coordinate the location of all existing utilities. **NO WORK SHALL BEGIN UNTIL ALL EXISTING UNDERGROUND UTILITIES HAVE BEEN LOCATED AND MARKED. (and depth verified)**

All barricades, watchmen, and other such signs and signals as may be necessary to warn the public of the dangers in connection with open trenches, excavations and other obstructions shall be provided by and at the expense of the Contractor.

The trench shall be straight and uniform to permit laying pipe to the proper lines and grades.

When so required by the Shelbyville Power, Water and Sewerage System, one-half of the street crossings and road crossings shall be excavated, then temporary bridges consisting of ½-inch steel plate shall be placed over the side excavated for the convenience of the traveling public; then the remainder of the excavation shall be carried out. All backfilled ditches shall be maintained in such a manner that they offer minimal hazard to the passage of traffic. The convenience of the traveling public and the property owners abutting the improvements shall be taken into consideration. All public or private drives shall be promptly backfilled or bridged. **ALL PERMIT FEES AND DEPOSITORS ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND SHALL HAVE BEEN APPROVED BY THE CITY OF SHELBYVILLE PRIOR TO ANY CONSTRUCTION.**

All excavated material not needed for backfilling purposes shall be disposed of in a manner satisfactory to the Owner.

**WHERE UNDERCUTTING OF THE TRENCH IS REQUIRED,** the quantity of same will be determined by an inspection by the Manager of the Water System. The quantity of undercutting of trench will be determined by the area of unsuitable native material encountered. The Contractor will be required to remove all unsuitable material and fill the ditch with crushed stone to 6-inches below the elevation of the invert of the pipe. If native materials obtained from prior trench excavation are determined by the Manager of the Water System to be suitable for replacing the materials excavated by undercutting, no imported materials will be required.

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All excavation shall be accomplished in accordance with applicable OSHA safety laws and regulations; the Shelbyville Power, Water and Sewerage System, as previously stated, does not assume responsibility of any degree or sort for acts of the Contractor.

In all areas along State Highways where the pipeline is being laid in the pavement or in the right-of-way of the road, TDOT requires that excavation during each day be limited to the footage of pipe that can be laid and the trench be backfilled so that not ditch is left open overnight in such areas. No gravel trenches shall be open to traffic at any time along State Highways. The rules and regulations of TDOT shall apply to State Highways; the requirements of the City of Shelbyville and the Bedford County Highway Department shall apply to all other roads.

b. Excavation on Easements

Excavation of pipeline trenches on easements shall be performed in such a manner that the private property owner's facilities and grounds shall be restored to as near their original condition as possible considering the work performed. The grass cover of the ditches or excavations shall be the same type as the original undisturbed cover. Work to be performed shall be done in the area of the construction limits shown on the approved Plans. The Contractor shall denote the limits of construction in any area if this is not a part of the proposed development.

Before any excavation is begun or before drilling and blasting, a minimum of nine (9) inches of the topsoil or original cover shall be removed and stockpiled in a manner not to contaminate the topsoil with other fill or excavated material. Should the depth of excavation require a trench wider than specified in Subparagraph a. above, a minimum of nine (9) inches of topsoil or original cover shall be removed from the additional area and stockpiled as described hereinbefore.

Excavated materials suitable for backfill shall be placed at a distance far enough from the ditch to allow excavated rock to be placed next to the open trench; however, stockpiling OUTSIDE THE EASEMENT SHALL BE DONE ONLY WITH THE PROPERTY OWNER'S WRITTEN PERMISSION. A COPY OF THE PROPERTY OWNER'S WRITTEN PERMISSION SHALL BE FORWARDED TO THE MANAGER OF THE WATER SYSTEM.

6. Pipe Laying and Bedding – Water Lines

a. General

The trench shall be excavated to the required depth and width, bell holes and/or jointing holes shall be dug in advance of pipe laying.

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The bed of each pipe shall be carefully prepared to that each individual piece of pipe shall have a uniform bearing. Pipes shall be laid in a straight line and grade without kinks or sags, and shall be laid in a workmanlike manner. Bell holes and/or jointing holes shall be large enough so that the bell or hub will clear the ground and leave ample room for making joints and inspection of joints.

Before each piece of pipe is lowered into the trench, it shall be thoroughly swabbed out to insure its being clean. Each piece of pipe shall be lowered separately.

Care shall be taken to prevent injury to the pipe coating both inside and out. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines.

If any defective pipe or fitting shall be discovered after the pipeline is laid, they shall be removed and replaced with a satisfactory pipe or fitting without additional charge. In case a length of pipe is cut to fit a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe as per AWWA standard C600, latest revision.

All angles or bends in the pipelines, either vertical or horizontal, shall be satisfactorily braced or anchored against the tendency of movement with joint harness, concrete or equal anchors to the satisfaction of the Manager of the Water System and as shown on the Detail Sheet.

Open ends of unfinished pipelines shall be securely plugged or closed at the end of each day's work or when the line is left temporarily at any other time. The maximum horizontal or vertical deflection for laying pipe shall be 3° per pipe section (18 inches for 18 feet length of pipe) unless the manufacturer's printed instructions permit a greater deflection.

When rock is encountered, the trench shall be excavated to a depth at least 6 inches below the bottom of the pipe and refilled with the bedding material to a sufficient depth to provide a firm bed for the bottom quadrant of the pipe. Bedding material shall be crushed stone conforming to TDOT Size No. 67 gradation.

If wet, mucky and/or unstable or unsuitable material is encountered in the trench bottom, the Manager of the Water System may require additional excavation to insure a firm foundation for the pipe. In such cases, the trench bottom shall be brought back up to the proper grade with bedding material as provided herein.

The Manager of the Water System shall determine when it is necessary to use such material and the Contractor shall be responsible for calling such unstable trench bottom conditions to the attention of the Manager of the Water System.

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### b. Ductile Iron Pipe

Outside of roadways ductile iron pipe shall be laid on a **6” bedding of compacted crushed stone meeting the requirements of TDOT Size No. 67 gradation. The compacted crushed stone shall be back filled to 6” above the pipe in a dirt ditch line and 12” above the pipe in a rock ditch line.** Inside of roadways ductile iron pipe shall be laid as specified in Paragraph 11. Pipeline Trenches Within Existing Roadways hereinafter. Bell holes shall be provided to insure that the pipe is uniformly supported over its entire length. Any unyielding material such as rock within the pipe foundation shall be removed and the foundation shall be brought up to grade as specified in Subparagraph a. of this Paragraph. No rock larger than 1 inch shall be permitted within 12 inches of the pipe.

### 7. Crushed Stone for Pipe Bedding

When rock **or dirt** is encountered, the trench shall be excavated to a depth at least 6 inches below the bottom of the pipe and refilled with the bedding material to a sufficient depth to provide a firm bed for the bottom quadrant of the pipe. Crushed stone shall be utilized to a depth of 12 inches above the top of the pipe **in rock and 6” in dirt.**

Bedding shall be crushed stone meeting the requirements of the TDOT Size No. 67 gradation.

### 8. Undercutting of Pipeline Trench

If unsuitable material is encountered in a trench bottom, the Manager of the Water System may require additional excavation to insure a firm foundation for the pipe. In such cases, the trench bottom shall be brought back up to proper grade with bedding material as provided herein. Crushed stone or chert refill will be required below a plane 6 inches beneath the bottom of the pipe.

### 9. Class “C” Concrete Work

Concrete used for anchors, kickers, and encasement shall be Class “C” concrete as shown on the Detail sheet.

### 10. Backfilling Pipeline Trenches

#### a. General

**In the backfilling of the trench above the pipe or pipe envelope, material shall be crushed stone to a depth of 12 inches above the top of pipe in a rock trench, 6 inches above the top of pipe in a dirt ditch, material above the crushed stone shall be reasonably free from rock and be acceptable to the Manager of the Water System.** The backfill material shall be carefully and solidly tamped around the pipe up to the point where the pipe is thoroughly covered with at least

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one foot material. Walking or working on the completed pipeline, except as may be necessary in tamping or backfilling, shall not be permitted until the trench has been backfilled to a height of at least one foot above the top of the pipe. The filling of the trench shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur.

In filling the remainder of the trench, the backfill material may be shoveled into the trench without compacting, and heaped over whenever, in the opinion of the Manager of the Water System, this method of backfilling may be used without inconvenience to the public. Where street paving or shoulders are to be replaced, the Contractor will be required to tamp or puddle all backfill as described hereinafter.

In areas where the line is laid in the right-of-way of a State Highway or when required by the Manager of the Water System, backfill shall be of select material of the same type as the existing natural material or fill in which the trench is dug.

When so required by the Manager of the Water System, the backfilling shall all be placed in layers not exceeding six (6) inches and firmly tamped into place by tampers or rammers.

Mechanical tamping will be required on lines where street pavement is to be replaced immediately. BACKFILL MATERIAL WILL BE FLOWABLE FILL OR CRUSHED STONE IN PAVED STREETS OR ROADWAYS AS SPECIFIED IN PARAGRAPH 11. PIPELINE TRENCHES WITHIN EXISTING ROADWAYS HEREINAFTER.

Whenever, in the opinion of the Manager of the Water System, it is necessary, he may require the Contractor to use a combination of any or all of the above outlined methods for proper compaction of the backfill in the trenches.

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

### b. Backfill in Paved Areas

#### (1) State Highways

Where water lines are to be installed within the paved surface of the shoulders of State Highways, the backfill shall be flowable fill meeting the requirements of Section 204.06 above the pipe envelope as shown on the Detail Sheet.

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A 10-inch layer of TDOT Class "A", Grading "D" compacted in 5-inch lifts shall be installed prior to any pavement preparation.

WORK IN THIS ARE SHALL ONLY BE DONE WITH PRIOR WRITTEN APPROVAL OF THE TENNESSEE DEPARTMENT OF TRANSPORTATION.

### (2) City Streets

Where water lines are to be installed within the paved surface or shoulders of City of Shelbyville streets, the backfill material shall be TDOT Size No. 67 crushed stone above the pipe envelope as shown on the Detail Sheet.

### c. Backfilling Operations Conducted on Easements

Backfilling of trenches or excavations on easements shall be performed in such a manner that the private property owner's facilities and grounds shall be restored to as near as possible their original condition immediately after pipe laying.

After the pipe bedding, pipe, and backfill along the sides of the pipe and over the pipe (if required) as specified hereinbefore has been placed, the excavated rock next to the ditch shall be placed in the ditch. Excavated rock shall not be placed any closer than eighteen (18) inches from the finished grade and any excess rock shall be removed by the Contractor and disposed of as directed.

The residue of the stockpiled bedding material shall be cleaned up and placed into the trench, leaving no bedding stone scattered over the area. The previously excavated materials suitable for backfill shall be placed into the ditch only upon clean-up and backfill of the bedding material. The top portion of the trench or excavation shall be filled using the stockpiled topsoil. The ditch shall be left high to allow for settling unless in the opinion of the Manager of the Water System this method of backfilling will cause inconvenience to the private property owner. SEEDING OR SODDING SHALL PROCEED IMMEDIATELY FOLLOWING BACKFILL.

If the backfilling operation is performed during extremely dry weather the contractor should leave some stockpiled topsoil to use later as additional fill after settlement has occurred.

THE CONTRACTOR WILL BE HELD REPOSIBLE FOR THE CONDITION OF GRASS COVER AND THE CONDITION OF THE GROUND SURFACE AT THE TIME OF FINAL INSPECTION UNLESS THE PRIVATE OWNER HAS PLOWED OR EXCAVATED THE GROUND.

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d. Disposal of Excess Material

The Contractor shall be responsible for the off-site disposal of any and all excess or unsuitable material excavated in the construction of the project. The Contractor shall be responsible for obtaining any and all permits, license fee, *etc.*, associated with the disposal of excess material.

11. Pipeline Trenches Within Existing Roadways

Where excavation is within the traveled portion of State highways or City of Shelbyville streets, all native earth and rock shall be removed and hauled away and disposed of by the Contractor at his own expense. The resulting backfill material shall be flowable fill under State highways and compacted crushed stone meeting the requirement of TDOT Size No. 67 gradation under city streets.

12. Inspection of Lines – During Construction

The Contractor shall notify the Manager of the Water System when pipe will be received on the job where proper arrangements may be made for inspecting the unloading and stringing, as well as inspecting the pipe proper and examining for the stamp for the independent laboratory.

BEFORE THE CONTRACTOR BACKFILLS ANY OF THE LINES, THEY SHALL BE FIRST INSPECTED BY THE MANAGER OF THE WATER SYSTEM; AND THE MANAGER OF THE WATER SYSTEM SHALL GIVE THE CONTRACTOR PERMISSION TO PROCEED WITH THE BACKFILLING. If any joints, pipes, or other workmanship or materials are found to be defective, they shall be removed and replaced by the Contractor.

13. Testing of Lines

**Pipelines will be tested at 200 PSI for the first two hours and 50 PSI in excess of normal working pressure of the pipe measured at the lowest elevation of the pipe for the remaining 6 hours.**

**The allowable leakage table below (as prescribed by the latest revision of AWWA Standard C600, latest revision) can only be used at the discretion of the General Manager; if he feels all leaks have been found or fixed.**

Allowable Leakage/1000 ft.

<u>Pipe Size</u>	<u>200 psi</u>	<u>175 psi</u>
4-inch	0.43 gal/hour	0.40 gal/hour
6-inch	0.64 gal/hour	0.59 gal/hour
8-inch	0.85 gal/hour	0.80 gal/hour
10-inch	1.06 gal/hour	0.99 gal/hour
12-inch	1.28 gal/hour	1.19 gal/hour

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14-inch	1.48 gal/hour	1.39 gal/hour
16-inch	1.70 gal/hour	1.59 gal/hour
20-inch	2.12 gal/hour	1.98 gal/hour

The Contractor shall furnish all gauges, meters, pumps, and other equipment required and shall maintain said equipment in condition for accurate testing as determined by the Manager of the Water System. Where practicable, pipelines shall be tested in lengths between line valves or plugs of no more than 3000 feet. Where leaks are visible at exposed joints and/or evident on the surface when joints are covered the pipe shall be rejoined and leakage minimized regardless of total leakage as shown by test.

Duration of test shall be not less than 2 hours where joints are exposed and not less than 8 hours where joints are covered. Lines which fail to meet the leakage requirements shall be repaired and retested until test requirements are met. All pipe, fittings, and other material found to be defective under test shall be removed and replaced at the Contractor's expense.

Pipelines shall be held under normal operating pressures for at least three (3) days before testing.

### 14. Disinfection of Lines

The new water lines shall not be placed in service – either temporarily or permanently – until they have been thoroughly disinfected in accordance with the following requirements and to the satisfaction of the Manager of the Water System.

**Disinfection of New Facilities - Bacteriological samples will be collected and analyzed to verify the effectiveness of the disinfection practices prior to placing new facilities in service. Bacteriological samples shall be collected to determine the effectiveness of the installation process including protecting the pipe material during storage, installation, and disinfection. This can be demonstrated by collecting two sets of microbiological samples 24 hours apart or collecting a single set of microbiological samples 48 hours or longer after flushing the highly chlorinated water from the lines. In either case microbiological samples in each set will be collected at approximately 2,500-foot intervals with samples near the beginning point and at the end point unless alternate sampling frequency and distance between sampling point approval has been obtained from the state. Where sanitary conditions were not maintained before, during or after construction, an additional bacteriological sample shall be collected from a location representing the water from the contaminated area. Unsanitary conditions include failure to document the sanitary handling of materials, to conduct construction inspections and to maintain records, and to document sanitary practices during construction and other hazards such trench flooding during construction. If the constructed facility yields positive bacterial samples, additional flushing, disinfection and bacteriological sampling**

shall be repeated until the water is coliform free. Disinfection of water lines shall comply with AWWA Standard C651.

The interiors of pipes, fittings, and valves shall be protected from contamination. Pipe delivered for construction shall be stung to minimize the entrance of foreign material. All openings in the pipeline shall be closed with water tight plugs when pipe laying is stopped at the close of the day’s work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used when watertight plugs are not practicable and when thorough cleaning will be performed by flushing or other means.

The tablet method consists of placing calcium hypochlorite granules or tablets in the water main as it is being installed and then filling the main with potable water when installation is completed. This method may be used if the pipes and appurtenances are kept clean and dry during construction. During construction, calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-ft intervals. The quantity of granules shall be shown in the table below.

Ounces of calcium hypochlorite granules to be placed at beginning of main and at each 500-foot interval.

Pipe Diameter (d)		Calcium Hypochlorite Granules	
Inches	(mm)	Oz.	(g)
4	100	1.7	57
6	150	3.8	113
8	200	6.7	200
10	250	10.5	300
12	300	15.1	430
14 and larger	(350 and larger)	$D^2 \times 15.1$	$D^2 \times 427.9$

Where D is the inside pipe diameter in feet  $D = d/12$

**Filling and contact** - When installation has been completed, the main shall be filled with water at a rate to ensure that the water within the main will flow at a velocity no greater than 1 ft/s (0.3 m/s). Precautions shall be taken to ensure that air pockets are eliminated. This water shall remain in the pipe for at least 24 hours. If the water temperature is less than 41 degrees Fahrenheit (5 degrees Celsius), the water shall remain in the pipe for at least 48 hours. As an optional procedure (if specified by the purchaser), water used to fill the new main shall be supplied through a temporary connection that shall include an appropriate cross-connection control device, consistent with the degree of hazard, for backflow protection of the active distribution system. A detectable chlorine residual should be found at each sampling point after the 24 hour period. The results must be reported.

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### 15. Highways Crossings

#### a. Bored State Highway Crossings

All board crossings of U.S. and State of Tennessee Highways, shall be made by boring with a steel casing pipe as specified in Paragraph 17 hereinafter. The pipe shall be jacked through a bored hole. Where boring is required, the holes shall be bored under the highway at least four (4) feet below the surface with no disturbance to the surface. THE CONTRACTOR SHALL OBTAIN ALL APPROVALS AND POST ALL BONDS AS REQUIRED BY THE GOVERNMENT ENTITIES AFFECTED.

#### b. Open-Cut State Highway Crossings

If approval of TDOT can be obtained by the Contractor, special open-cut highway crossings of U.S. and State of Tennessee Highways can be made as shown on the Detail Sheet. The following TDOT requirements shall apply: "Where open-cutting is allowed, the following conditions shall be met: (a) All backfill material shall be compacted crushed stone, and (b) One-half of the times." The Contractor shall keep the pipeline trench to a minimum to prevent excessive disturbance of the existing pavement. The proposed water line shall be at least four (4) feet below the highway. The Contractor shall be fully responsible for the successful operation, without interruption, of traffic and shall be held responsible for returning the highway to its original condition. The Contractor shall be responsible for any settlement which occurs as a result of his work. The Contractor shall also post signs warning approaching motorists of the work underway. During construction, flagmen will be required. Any open trenches shall be bridged with temporary bridges consisting of 1-inch steel plate for the convenience of the traveling public.

#### c. Open-Cut County and City Highway Crossings

Whenever possible, crossings under highways will be open-cut. There the following TDOT requirements apply: "Where open-cutting is allowed, the following conditions shall be met: (a) All backfill material shall be compacted crushed stone, and (b) One-half of the traveled portion of the paving must be open at all times." Crossings of city streets and county roads will be open-cut with the permission of the City of Shelbyville and the Bedford County Highway Department.

### 16. Railroad Crossings

#### a. Jacked or Bored

The Contractor should familiarize himself with the requirements of the railroad within whose rights-of-way the Contractor is working. THE CONTRACTOR

## Detailed Specifications

WILL OBTAIN AND PAY FOR ANY PERMIT THAT IS REQUIRED IN ORDER TO WORK WITHIN THAT RIGHT-OF-WAY AND SHALL PAY FOR ANY SPECIAL INSURANCE TO THE AMOUNT AND EXTENT REQUIRED BY THE RAILROAD INVOLVED.

Generally, pipeline crossings of railroads shall be made by boring or jacking a smooth wall steel casing pipe under the roadbed and inserting the carrier therein. Casing pipe shall be so constructed as to prevent leakage of any substance from the casing through its length except at ends. Casing shall be so installed to prevent the formation of a waterway under the roadway, with an even bearing through its length, and shall slope to one end (except for longitudinal occupancy).

Bored or jacked installations shall have a bored hole diameter essentially the same as the outside diameter of the pipe. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe by more than approximately 1 inch, remedial measures as approved by the Railway Company shall be taken. Boring operations shall not be stopped if such stoppage would be detrimental to the railroad.

### 17. Steel Casing Pipe for Highway and Railroad Crossings

#### a. General

Where required, highway and/or railroad crossings shall be bored or tunneled so as to prevent interruption to traffic and to prevent later settlement of the roadway or roadbed. The Contractor must be fully equipped and experienced in the installation of large diameter structures by boring or tunneling methods. The Contractor shall be fully responsible for the successful operation without interruption of traffic and shall be held responsible for any settlement which occurs as a result of his work.

#### b. Steel Casing Pipe

Black steel casing pipe shall be manufactured and tested in accordance with ASTM Specification A 139 or A-53, Grade B, 35,000 psi yield strength, meeting the American Railway Engineering Association (AREA) Specification for Coated Corrugated Metal Pipe and Arches, Chapter 1, Part 5. Steel casing pipe where shown shall be as follows:

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<u>Diameter Carrier in Inches</u>	<u>Diameter Casing in Inches</u>	<u>Minimum Wall Thickness Of Casing in Inches</u>
4	12	0.250
6	14	0.250
8	16	0.281
10	20	0.344
12	24	0.407
14	24	0.407
16	36	0.532
18	36	0.532
20	40	0.563
24	40	0.563

### 18. Stream or River Crossings

Where required by the Manager of the Water System, the Contractor shall install Pressure Class restrained joint ductile iron pipe as specified in Paragraph 3, Subparagraph d. of this Detailed Specification.

If a crossing of the Duck River is required, the Contractor shall contact the Manager of the Water System for the required pipeline specifications to be utilized.

THE CONTRACTOR SHALL BE REQUIRED TO MEET ALL APPLICABLE TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION WATER POLLUTION CONTROL REQUIREMENTS AS IT RELATES TO SOIL EROSION.

### 19. Gate Valves

Gate valves shall conform to AWWA Standards C509, latest revision, as modified herein. All gate valves shall be of the resilient seat type iron body, non-rising stem, suitable for water working pressure of the 200 psi. Valves shall be of a standard manufacture and of the highest quality both as to materials and workmanship. An affidavit of compliance is required. Bolting materials shall be cadmium plated. The stem sealing shall be by an O-ring.

All gate valves shall be furnished with mechanical joint end-connections, unless otherwise shown on the Detail Sheet or specified herein. The end-connections furnished shall be suitable for connection to the pipe furnished.

All gate valves shall have the name or monogram of the manufacturer, the year the valve casting was made, the size of the valve, and the working water pressure cast on the body of the valve. They shall be coated with black asphalt varnish and touched up in the field as required.

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All gate valves shall be provided with a 2-inch square operating nut and shall open by turning to the left (counter-clockwise). All gate valves shall be M & H, Clow, Mueller or an approved equal.

### 20. Butterfly Valves

Butterfly valves for pipeline service shall be suitable for 150 psi working pressure, shall be designed for underground service and shall meet the requirements of AWWA Standard C504, latest revision, as modified hereinafter. Butterfly valves shall be Dresser Style 450, Model 655 BIF a Division of Leeds and Northrup, American Flow Control or other manufacturer approved by the Manager of the Water System in writing. Valves may be either of the “short” or “long” laying length type where this meets service conditions.

Butterfly valves shall be furnished with mechanical joint end connections unless flanged connections are requested by the Contractor. The end connections shall be suitable for the connections to cast or ductile iron pipe, or concrete pressure pipe. “Slip-on” joints will not be allowed.

Valve operators shall consist of a geared 2-inch square nut and shall conform to the latest revision of AWWA Standard C504, latest revision, and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. The gear box shall be fully sealed and grease packed. Stops shall be provided to stop the valve in the fully open or fully closed positions. Valve operators shall take at least 32 turns to open and shall be capable of resisting without damage an input of at least 300 foot pounds. Valves shall open by turning counter-clockwise.

### 21. Valve Boxes

Valve boxes shall be cast iron, THREE (3) PIECE, screw type with drop cover marked “Water”. They shall be set vertically and properly adjusted so that the cover shall be in the same plane as the finished surface of the ground or street. For ease of location and identification a 2’-0” square by 6-inch thick concrete pad with a cast aluminum plaque imbedded therein shall be furnished as shown on the Detail Sheet.

### 22. Tapping Sleeves and Valves

Tapping sleeves with mechanical joint ends and flanged connection for valve together with a gate valve conforming to the specifications for Gate Valves in Paragraph 19 of this Detailed Specification shall be provided where required. Tapping sleeves and valves shall have a pressure rating corresponding to the pressure zone in which they are located. The Contractor shall verify in the field the type of existing pipe that the tapping sleeve will be used in connection with. The valve shall be supplied with a three-piece valve box and operating nut. Tapping sleeves and valves shall be as manufactured by M & H Valve and Fitting Company, Eddy Valve Company, or approved equal.

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### 23. Air Release Valves and Boxes

Air release valves and boxes shall be installed on the mains at all high points in the lines as shown on the approved Plans. The exact location of air release valves will be determined in the field by the Manager of the Water System.

The air release valves shall be Model 200 for 8-inch through 12-inch pipe and Model 200A for 6-inch and smaller pipe as manufactured by the Valve and Primer Corporation, or Crispin equivalent. For pipelines larger than 12-inch, the Contractor shall contact the Manager of the Water System for the required air release valve specifications to be utilized. The valves shall be 2-inch inlet diameter for 6-inch through 12-inch pipe and shall be fitted with the proper size orifice. The body and cover shall be of cast iron, the trim shall be brass and the float shall be of stainless steel. The valves shall be suitable for use in lines having a maximum water pressure of 150 psi. The assembly of the air release valve and box is shown on the Detail Sheet.

### 24. Blow-Offs

Blow-offs shall be installed as shown on the Detail Sheet and directed by the Manager of the Water System.

### 25. Fire Hydrants

#### Fire Hydrant Specification (4 1/2" Main Valve) with Integral Restraint Joint System Shoe

- a. Fire hydrants shall meet or exceed all applicable requirements of the latest revisions of ANSI/AWWA Standard C502 and shall be FM 1510 Approved.
- b. Fire hydrants shall be rated for a working pressure of 250 psig. (1725 kPa). Fire hydrants shall be pressure tested in the fully closed and fully open positions to 500 psig (3450 kPa).
- c. Fire hydrants shall be of the compression type, opening against the pressure and closing with the pressure.
- d. Fire hydrants shall have a minimum 4 1/2" main valve opening and a nominal inside lower/upper barrel diameter (I.D.) of 5.98" to assure maximum flow performance.
- e. Fire hydrants shall be three-way in design, having one 4 1/2" pumper nozzle GA 4-610 and two 2 1/2" hose nozzle GA NS. Nozzle caps shall be secured to the hydrant by galvanized chain that meets ASTM A-467 Class MT. Thread pattern for nozzle is as follows: major diameter 6:2624, pitch diameter 6:100, minor diameter J:9125. Thread pattern for cap is as follows: major diameter 6:2824, pitch diameter 6:120, minor diameter 5:9576. Nozzles must be bronze to bronze seat.

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- f. The bonnet assembly shall provide an oil reservoir and lubrication system that automatically circulates lubricant to all stem threads and bearing surfaces each time the hydrant is operated from open to close. The bonnet shall have a service plug to facilitate oil replacement when the hydrant is serviced. This lubrication system shall be sealed from the waterway and any external contaminants by use of o-ring seals. An anti-friction washer shall be in place above the thrust collar to further minimize operating torque. The oil reservoir shall be factory filled with a low viscosity FDA approved non-toxic oil lubricant which will remain fluid through a temperature range of -60 degrees F. to +150 degrees F.
- g. The operating nut shall be a one piece design, manufactured of ASTM B62 or B584 bronze hold down nut. The hold down nut shall be threaded into the bonnet in such a manner as to prevent accidental disengagement during the opening cycle of the hydrant. The use of set screws as a means of retention is unacceptable. A resilient weather seal shall be incorporated into the hold down nut, for the purpose of protecting the operating mechanism from the elements.
- h. The direction of the opening shall be as specified by the end user. An arrow shall be cast on the bonnet flange to indicate the specified opening direction.
- i. The hydrant bonnet shall be attached to the upper barrel by not less than eight bolts and nuts and sealed by an "O" ring.
- j. Hydrants shall be a "traffic-model" having upper and lower barrels joined at the ground line by a separate and breakable "swivel" flange providing 360 degree rotation of upper barrel for proper nozzle facing. This flange shall employ not less than eight bolts. The safety flange segments shall be located under the upper barrel flange to prevent the segments from falling into the lower barrel when the hydrant is struck. The pressure seal between the barrels shall be not less than 18" of clearance from the centerline of the lowest nozzle to the ground.
- k. The operating stem shall consist of two pieces, not less than 1-1/4" diameter (excluding threaded or machined areas) and shall be connected by a stainless steel safety coupling. The safety coupling shall have an integral internal stop to prevent the coupling from sliding down into the lower barrel. The stem coupling shall be designed to break on traffic impact and so that impacted pieces shall not fall into the hydrant main valve. Proof of design impact testing to be performed at a certified independent test facility.
- l. Screws, pins, bolts, or fasteners used in conjunction with the stem couplings shall also be stainless steel. The top of the lower stem shall be recessed 2" below the top of the lower barrel to prevent water hammers in the event of a "drive over" where a vehicle tire might accidentally depress the main valve.
- m. The lower barrel shall be an integrally cast unit composed of ASTM A126 Class B grey iron. The use of threaded on or mechanically attached flanges is deemed

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- unacceptable. The hydrant bury depth shall be clearly marked on the hydrant lower barrel.
- n. Composition of the main valve shall be molded rubber having a Shore A Durometer hardness of 95 +/- 5 and shall be reversible in design to provide a spare in place. Plastic (polyurethane) main valves are unacceptable. The main valve shall have a cross section not less than 1”.
  - o. Hydrant shall be equipped with (2) two drain valves which drain the barrel when the hydrant is closed and seal shut when the hydrant is opened. These drain valves shall be an integral part of the one piece bronze upper valve plate. They shall operate without the use of springs, toggles, tubes, levers or other intricate synchronizing mechanisms.
  - p. The upper valve plate, seat ring and drain ring (shoe bushing) must be ASTM B62 or B584 bronze and work in conjunction to form an all bronze drain way. A minimum of two (2) internal and two (2) external drain openings are required. Drains ported through and iron shoe are not permitted.
  - q. The bronze seat ring shall thread into a bronze drain ring (or shoe bushing) providing a bronze to bronze threaded connection. Seat rings shall be o-ring pressure sealed.
  - r. The shoe inlet size and connection type shall be the integral restrain joint system. The hydrant shoe shall be composed of ASTM A536 65-45-12 ductile iron. A minimum of size bolts and nuts is required to fasten the shoe to the lower barrel.
  - s. The shoe, lower valve plate, stem cap, upper and lower barrels, bonnet, pumper and hose caps shall be primer coated inside and out with a 2-part epoxy that is NSF 61 compliant and meets the requirement of AWWA C-550. Top coat of the upper barrel, bonnet and cap shall be polyurethane enamel Sherwin Williams Polane SP polyurethane enamel.
  - t. If a stem cap nut is utilized, it must be locked in place by a stainless steel lock washer or similar non-corrosive device that will prevent the cap nut from backing-off during normal use.
  - u. Hydrants shall be warranted by the manufacturer against defects in materials or workmanship for a period of ten years (10) from the date of manufacture. The manufacturing facility for the hydrant must have current ISO certification.
  - v. Hydrant shall be Mueller Super Centurion 250 A-421 or approved equal.

Failure to comply with any of these above requirements is sufficient cause for rejection of proposed hydrants.

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The System reserves the right accept only those materials which are in full compliance with these specifications and deemed most advantageous to its interests.

The hydrants shall have 4-inch mechanical joint inlets, 4 ½-inch valve opening, 6 ½-Inch inside diameter riser barrel, 36 inches of bury, standard operating nuts opening left (counter-clockwise) and safety “breakable flanges” located above the ground line.

Exterior surfaces of hydrants shall be painted after installation with one (1) coat of red lead and two (2) coats of Sonneborn’s Hydrant Enamel. Color shall be red.

Fire hydrants shall be Clow Corporation, Model F-2500; Mueller Improved AWWA type, Model A-24010; Matthews Modernized type as manufactured by Kennedy Valve Mfg. Co., Inc. of Elmire, NY; equivalent M & H model; or approved equal.

### 26. Service Connection Piping for Water Meter Reconnection

#### a. Water Meters

Water meters will be furnished by the Shelbyville Power, Water and Sewerage System.

#### b. Meter Fittings

The necessary corporation stops, curb cocks, and all other fittings and accessories shall be furnished as indicated on the Detail Sheet.

#### c. Meter Boxes

All meter boxes shall be constructed as shown on the Detail Sheet. Shop drawings of the meter boxes and covers shall be subject to the approval of the Manager of the Water System prior to installation.

#### d. Service Connection Piping

Service connection piping shall be ¾-inch Type K copper meeting ASTM Designation B 8-83a. Copper fittings shall meet all applicable ANSI requirements. Special care shall be taken to protect the service piping with earthen material, from sharp and hard objects. Cover is to be at least 30 inches at all points. The Contractor will be responsible for providing and installing all service connections to the meter box and shall provide the corporation cock at the water line (which shall be left in the open position) and where the meter box is to be placed (This cock shall be left in the closed position). The location of the meter box curb cock shall be marked by means of a wire attached at one end to the curb cock and at the other end to stake where so directed by the Manger of the Water System.

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e. Casing Pipe for Highway Crossing

Service lines which cross highways shall be installed as specified in Paragraph 17 of this Detailed Specification using the materials and methods specified in this Paragraph for the carrier pipe.

27. Removing and Replacing Concrete Driveways, Sidewalks and Paved Ditches

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

After the sub-base has been brought to a satisfactory grade, a 3-inch layer of cinders or crushed stone shall be spread over it and thoroughly tamped. Immediately prior to pouring the concrete, the cinders or stone shall be thoroughly wetted, or the concrete shall be poured on a layer of heavy building paper.

The driveways shall consist of 6 inches of Class "A" concrete, struck off to accurately placed screeds and worked with a wooded float until the mortar appears on top. After the surface has been thoroughly floated, it shall be brushed to leave marking of a uniform type similar to the existing driveway. All joints and edges shall be finished with an edging tool. The allowable joint variation shall be 1/8 inch to 10 feet transversely and longitudinally.

Other type of driveways, such as brick, stone asphaltic concrete, *etc.*, shall be replaced with material removed during the progress of the work, in equally as good condition as that found before the work began.

28. Removing and Replacing Concrete Curb and Gutter

Where a concrete curb and gutter are damaged or disturbed during the construction work, it shall be replaced, using Class "A" concrete, in fully good or better condition than which existed prior to the Contractor's operation.

29. Replacing Existing Streets and Roadways

a. General

The Contractor shall replace all existing streets, alleys, and roadways which may be removed, disturbed, or damaged in connection with his operation. The Contractor shall reconstruct same to the original lines and grades in such manner as to leave all such surfaces in fully as good or better condition than that which existed prior to his operations. The reuse of materials removed in making excavations will be permitted in the manner described, provided said materials are in good condition.

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Gravel, crushed limestone, bituminous materials, or other materials used in the resurfacing of streets, shall meet the current requirements of the Standard Specifications of TDOT.

The maximum allowable width will be 5.0 feet. Any disturbance beyond said 5.0 feet will be considered as due to the Contractor's negligence **without permission from the General Manager**. Where State Highways are crossed the typical sections shown on the Detail Sheet shall be utilized to repair the highway.

b. Backfill of Trenches Under Roadways (Must be approved by Public Works)

Replacement of streets and roadways after trenching shall be handled in the following manner:

When crushed stone or flowable fill is used to backfill the trench, it shall be brought to subgrade.

The Contractor shall maintain the trench by adding crushed stone to finished grade to keep the trench in a safe and passable condition until such time that sufficient settlement has taken place and the trenches are ready for final resurfacing.

Backfill material under pavement on the right-of-way of City streets shall be TDOT Size No. 67 gradation crushed stone with a 6 inch cap of Class "A", Grading "D" crushed stone.

c. Traffic-Bound Base Course

After the backfill has been compacted to within about 6 inches of finish grade as specified hereinbefore, the Contractor shall then place approximately 6 inches of crushed stone as a traffic-bound base course, at the proper elevation to allow for settlement, but not in such a way as to prevent traffic from using the street or roadway. Crushed stone shall be TDOT Class "A", Grading "D".

The Contractor shall maintain the traffic-bound base course by adding crushed stone – as specified above – in a safe and passable condition for a period of sixty (60) days, or until such time as in the opinion of the Manager of the Water System sufficient settlement has taken place; and trenches are ready for final resurfacing. Crushed stone will be paid for at the unit price specified in the Contract.

d. Subgrade for Final Resurfacing

The traffic-bound course described above shall comprise the base course for all types of resurfacing.

When in the opinion of the Manager of the Water System, the trench has reached a condition of settlement satisfactory for final resurfacing, the Contractor shall

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first strip the base course or backfill with crushed stone—size as specified above—to obtain the proper subgrade elevation. The subgrade shall then be rolled with an approved type roller, or tamped until thoroughly compact and 6 inches thick.

Any depressions shall be filled with crushed stone – as specified – and the process of rolling or tamping continued until the subgrade has a smooth and uniform surface.

e. Removing and Replacing Concrete Street Pavement

Where Portland cement concrete pavement must be removed and/or replaced, it shall be replaced to a thickness equivalent to the existing pavement but in no case less than six inches. It shall be accomplished with Class “A” concrete.

f. Portland Cement Concrete Subslab

Where Portland cement concrete pavement subslab is required under bituminous pavement replacement, it shall conform to the existing pavement and/or the Detail Sheet and shall be accomplished with Class “A” concrete. The subgrade shall be prepared as above specified.

g. Asphaltic Concrete Pavement

Where asphaltic concrete pavement is to be replaced, the subgrade shall be prepared as above specified, and this subgrade shall comprise the base course upon which the bituminous pavement shall be laid. The existing pavement shall be neatly cut back approximately one (1) foot outside the trench and the new pavement tied into the existing. The subgrade or base shall be thoroughly cleaned and broomed and a prime coat of medium tar shall be uniformly applied at a rate of 0.20 to 0.25 gallons per square yard.

Where Portland cement concrete subslab is required, the prime shall be applied to the concrete at a rate of 0.05 gallons per square yard. The prime shall be applied by a pressure distributor or other approved pressure spray method.

When the prime coat has become tacky but not dry and hard, a bituminous surfacing consisting of asphaltic concrete shall be placed, spread, finished and compacted in accordance with the current standard specifications of TDOT, Section 411, Grading D, with 85-100 penetration grade asphalt. Compacted thickness of asphaltic concrete pavement replacement shall be as directed.

h. Bituminous Surfacing (Surface Treatment)

Where bituminous surfacing is to be replaced, as shown on the Detail Sheet, or as directed by the Manager of the Water System, the traffic-bound base shall comprise the subgrade upon which the bituminous surfacing shall be constructed.

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After the subgrade or base has been prepared, thoroughly cleaned and broomed, a prime coat of medium tar shall be applied at the rate of 0.30 to 0.35 gallon per square yard.

When the prime coat has become tacky but not hard, bituminous material (asphalt of the grade directed by the Manager of the Water System) shall be applied in two applications at the rate of 0.35 to 0.45 gallon per square yard for each application. The Contractor shall apply approximately 50 pounds per square yard of crushed stone chips between the two applications of bituminous material and 35-40 pounds of chips after the final application of bituminous material.

i. Untreated Surface

Where the existing surface is untreated crushed stone, the Contractor shall replace the surfacing that is disturbed or removed with crushed stone as above specified to at least the thickness of the existing surface.

30. Seeding of Disturbed Areas

The areas disturbed by construction which are not a part of pavements shall be seeded in accordance with the requirement below. Roadway shoulders which were crushed stone or receive crushed stone are considered as pavements. Special attention shall be directed to the work performed on private easements.

All disturbed areas other than lawns, which shall be reseeded in approximately their preconstruction condition, shall be left smooth and thickly sown with a mixture of Blue Grass, Italian Rye Grass, Kentucky Fescue #31 and/or such other grasses as are specified by the Manager of the Water System (in pastures, *etc.*, the property owner's preference of grasses shall be used). When the final grading has been completed, the entire area to be seeded shall be hand raked and fertilized with ammonium nitrate at the rate of 5 pounds per 1,000 square feet and an approved commercial fertilizer at the rate of 10 pounds per 1,000 square feet. The analysis of the commercial fertilizer shall be determined by soil tests.

After the fertilizer has been distributed, the Contractor shall rake or harrow the ground to thoroughly work the fertilizer into the soil. The seed shall then be sowed in two (2) operations, broadcast either by hand or by approved sowing equipment. The application shall be 30 pounds per acre for each operation. If the Manager of the Water System determines to use "hulled" or "unhulled" Bermuda, the application rate shall be 7 pounds per acre. After the seed has been distributed, the Contractor shall then lightly cover the seed by use of a drag or their approved device. All seed shall be certified not more than three percent weed. The seeded area shall then be covered with straw at the rate of 1 ½ tons per acre.

Any necessary reseeded or repairing shall be accomplished by the Contractor prior to final acceptance. If the construction work is brought to completion when, in the opinion

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of the Manager of the Water System, the season is not favorable for the seeding of the grounds, then the Contractor shall delay this item of work until the proper season for such seeding as directed by the Manager of the Water System.

All planting and seeding shall be watered thoroughly as soon as completed and shall be watered twice daily or more often, if necessary until all growth is thoroughly established.

### 31. Rip-Rap

Rip-rap where directed by the Manager of the Water System shall be of the “rubble stone” type complying with the requirements set forth by TDOT Standard Specifications for Road and Bridge Construction Section 709, Subsections: 09.01, 709.02(a) 709.04, 709.08, and 709.09.

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