

**MURFREESBORO WATER RESOURCES DEPARTMENT**

MURFREESBORO, TENNESSEE

**STANDARD  
TECHNICAL SPECIFICATIONS  
AND  
DETAIL DRAWINGS  
FOR THE INSTALLATION OF**

**REPURIFIED WATER MAINS & APPURTENANCES**

**January 2019**

PREPARED BY:

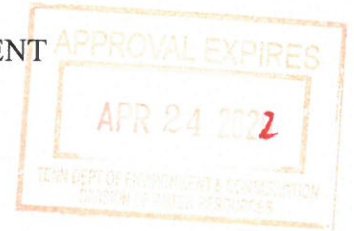
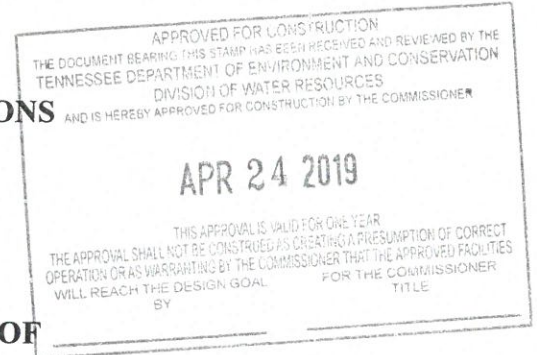
**DW 19 0478**

MURFREESBORO WATER RESOURCES DEPARTMENT



APPROVED BY:

TENNESSEE DEPARTMENT OF ENVIRONMENT & CONSERVATION



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## SECTION 02221W

### TRENCHING, BEDDING AND BACKFILLING

For

### WATER LINES, SEWER FORCEMAINS & REPURIFIED WATER LINES

#### PART 1 – GENERAL

##### 1.1 SCOPE OF WORK

The work covered by this Section consists of loosening, loading, removing, and disposing of, in the specified manner, all wet and dry materials (including rock) encountered that must be removed for construction of waterlines and sewage force mains; furnishing, placing, and maintaining all sheeting, shoring, bracing, and timbering necessary for the proper protection and safety of the work, the workforce, the public, and adjacent property and improvements; the dewatering of trenches and other excavations; the preparation of satisfactory pipe beds; the backfilling and compaction of trenches, foundations, and other structures; the removal of unsuitable material from outside the normal limits of excavation, and where ordered by the Engineering, their replacement with suitable materials; and all other grading or excavation work incidental to or necessary for the work.

##### 1.2 PERMITS AND NOTIFICATIONS

The Contractor shall be responsible for obtaining all the local permits, to include street cut permits, required and for notifying Tennessee One Call to locate all the existing utilities.

#### PART 2 – PRODUCTS

##### 2.1 NOT APPLICABLE

#### PART 3 – EXECUTION

##### 3.1 TRENCH EXCAVATION

Trenches shall be neatly excavated to the alignment and depth required for the proper installation of pipe, bedding material, and appurtenances.

The trench shall be excavated to sufficient depth to permit a normal minimum cover of forty-two (42”) inches to be maintained over the top of waterlines and sewage force mains. Normal trench depths will be such as to provide for at least this depth of cover and must be even deeper where the existing or adjacent road grade is such that excavation or grading is likely at the trench location. In exceptional cases, with the Engineer’s approval, the minimum cover of forty-two (42”) inches for waterlines and sewage force mains may be reduced to thirty-six (36”) inches. The Contractor’s attention is called to

the fact that the thirty-six (36") inch depth of cover for waterlines and for sewage force mains are absolute minimums and may be used only with the Engineer's approval in instances where obstructions or other unusual conditions are encountered in trenching operations. The Contractor will be permitted to lay the pipe above the obstruction only if the minimum cover required can be obtained while providing a separation of at least eighteen (18") inches between the bottom of the pipe and the top of the obstruction. Where this minimum cover and the required clearance cannot be obtained, the Contractor will be required to lay the pipe under the obstruction and will receive no additional compensation for the additional depth of trench required for constructing the line in this manner. The Contractor will also be required to gradually increase the depth of trench when approaching cuts, creek banks, or other changes in grade in order to avoid the use of fittings wherever it is practical to do so and at no additional cost to the Owner.

Trench widths, except in rock when a trenching machine is used, from a point one (1) foot above the top of the pipe down to the bottom of the trench shall be held to a minimum consistent with the provision of necessary space for proper assembly of the pipe. Unless approved otherwise by the Engineer, the trench width, except in rock when a trenching machine is used, must provide a clearance of not less than nine (9") inches in any horizontal direction from all parts of pipe or fittings in the area from the trench bottom to a point one (1) foot above the top of the pipe.

Trench walls shall be kept as nearly vertical as possible with due consideration to soil conditions encountered and in accordance with all OSHA and TOSHA standards. When necessary, sheeting or bracing shall be provided to protect life and property.

The Contractor shall excavate by hand wherever necessary to protect existing structures or utilities from damage or to prevent over-depth excavation in the trench subgrade. The bottom of the trenches, whether in dirt or crushed stone bedding, must be shaped by hand, and bell holes must be dug so that the full length of pipe is resting on trench bottom. Blocking shall not be used, and neither shall the pipe be laid on a trench bottom that has not been leveled to provide support throughout the full length of the pipe.

Should the Contractor excavate below the required depth, the Contractor shall, at no expense to the Owner, bring the excavation to proper grade by filling the void with clean crushed stone size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction.

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 in paragraph 3.4 Disposal of Materials. Refill the areas excavated for this reason with one to two (1" to 2") inch crushed stone up to the level of the lines, grades, and/or cross sections shown on the Plans. The top six (6") inches of this refill shall be crushed stone size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction.

Trenches shall be opened up far enough ahead of pipe laying to reveal obstructions, but in general shall not include more than two hundred (200') feet of continuous open trench at

any time. The Contractor will be required to follow up trenching operations promptly with pipe laying, backfill if an inspector is present, and rough cleanup, and in the event of failure to do so, may be prohibited from opening additional trench until such work is completed. This requirement is particularly applicable to work being done in developed areas.

Where trenches cross streets, walks, driveways, and other points as may be directed by the Engineer, the trenches shall be bridged in an open and secure manner, so as to prevent any serious interruption of travel upon the roadway or sidewalks, and also to afford necessary access to public or private premises. No driveways shall be cut or blocked without giving twenty-four (24) hour notice to the occupant of the property. Effort shall be made to schedule the blocking of drives to suit the occupant's convenience, and except in case of emergency, drives shall not be blocked without an alternate access being provided. The material used, and the mode of construction of said bridges and the approaches thereto, must be satisfactory to the Engineer.

### 3.2 EXCAVATION FOR PIERS, MANHOLES, AND OTHER STRUCTURES

Excavation for piers, manholes, and other incidental structures shall not be greater in horizontal area than that required to allow a two (2') foot clearance between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevation shown on the Plans. No earth backfilling will be permitted under piers, manholes, or similar structures. Should the Contractor excavate below the elevations shown or specified, the Contractor shall, at no cost to the Owner, fill the void with either concrete or clean crushed stone size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction. Excavation for piers, manholes, and other structures may be performed with nonvertical banks except beneath pavements or adjoining existing improvements.

### 3.3 EXCAVATION IN SOLID ROCK

Solid rock shall consist of such materials in the original bed or well defined ledges which, in the opinion of the Engineer, cannot be removed with pick and shovel, trenching machine, backhoe, or other similar devices, and which requires drilling and blasting, or the use of jackhammers or bullpoints. Concrete and masonry structures that require drilling and blasting for removal shall be considered as rock unless otherwise provided for herein. Boulders or detached pieces of rock having volumes of more than nine (9) cubic feet shall also be considered as rock. All rock shall be removed to provide a clearance of not less than nine (9") inches, (eighteen (18") inches when a trenching machine is used), in any horizontal direction from all parts of pipe, fittings, piers, manholes, and other appurtenances.

Excavate rock over the horizontal limits of excavation and to a depth of not less than six (6") inches below the bottom of the structure or pipe. Then backfill the space below grade with crushed stone size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, or other approved material, tamp to the proper grade, and make ready for construction.

Where waterlines or sewage force mains are constructed across cultivated fields and pastures, or in streets, excavated rock shall not be mixed with backfill material used to complete the final eight (8") inch layer of backfill at the original ground surface. Surplus rock shall be removed and wasted at points designated by the Owner.

Blasting operations shall be conducted in strict accordance with all existing ordinances and regulations, and shall be done only after a pre-blast survey is done at no cost to the Owner by a firm approved by the Engineer. All exposed structures shall be carefully protected from the effects of the blast, and all blasts shall be covered with heavy timbers or other suitable material. The blasting shall be done only by experienced personnel certified by the State of Tennessee Fire Marshal's Office. Any damage done shall be promptly repaired at the Contractor's expense.

Rock excavation in proximity to other pipes or structures shall be conducted with the utmost care to prevent damage to the existing pipes or structures, and any such damage caused shall be promptly repaired at the Contractor's expense. Blasting operations shall not be conducted within ten (10') feet of finished sewer or water pipe.

Extreme care shall be exercised in blasting, with signals of danger given before the firing of any charge. The Contractor shall, in all acts, conform to and obey all rules and regulations for the protection of life and property that may be imposed by any public authorities or that may be made from time to time by the Engineer, relative to the storing and handling of explosives and the blasting operations.

Where rock is encountered in the immediate vicinity of gas mains, telephone cables, building footings, gasoline tanks, or other hazardous areas, the Contractor shall remove the rock by means other than blasting. Care shall be taken in blasting operations to see that pipe or other structures previously installed are not damaged by blasting.

### 3.4 DISPOSAL OF MATERIALS

Excavated material shall be stored safely away from the edge of the trench and in such a way as to avoid encroachment on private property, danger to workers, utilities, or traffic, and to cause minimum inconvenience through blocking of drives, sidewalks, natural drains, etc.

Any surplus excavated material remaining after the trench backfill has been completed shall be removed from the site by the Contractor. The material may be stockpiled in a suitable location for use in correcting any future trench settlement if it meets the requirements of acceptable backfill. Surplus excavated material may be disposed of in other locations only after the Owner and the property owner have given permission, and have indicated that the material is not required on site.

Excavated material which is unsuitable for use in backfill, or surplus excavated material which is not desired by the Owner or the property owner, shall be hauled away and disposed of in an acceptable manner by the Contractor.

There shall be no disposal of materials allowed in the flood way or flood plain. Contractor is responsible for obtaining approval from all applicable agencies and/or property owners for any disposal sites. Copies of all approvals and agreements are to be submitted to the Owner.

### 3.5 DEWATERING TRENCHES

The Contractor shall be responsible for handling storm water runoff and ground water in such a way as to maintain trenches and excavations in a dry condition until the work is completed. Pumps, piping, well points, labor, fuel, and other facilities necessary to control, intercept, remove and/or dispose of water shall be provided at the Contractor's expense.

Water shall be kept out of trenches and other excavations to the extent necessary to protect the supporting strength of the foundation material, permit efficient and satisfactory assembly or replacement of facilities, and to prevent floating or misalignment.

All water pumped or drained from the work shall be disposed of in a manner satisfactory to the Engineer without damage to adjacent property or to other work under construction. The Contractor shall not dispose of storm or surface water through new or existing sanitary sewerage facilities.

No pipe shall be laid in water, and water shall not be allowed to run over masonry until concrete or mortar has set at least forty-eight (48) hours.

The dewatering of the excavation shall be considered an integral part of the excavation work, and no separate payment will be allowed therefore. Where the Contractor fails, refuses, or neglects to control water in trenches or other excavations, and corrective work is deemed by the Engineer to be necessary as a consequence thereof, such work shall be at the Contractor's expense.

### 3.6 BRACING, SHEETING, SHORING, AND TRENCH BOXES

A. The Contractor shall provide such bracing, sheeting, shoring, or trench boxes as may be necessary for the protection of life and property. The Contractor shall be solely responsible for determining when and where to use bracing, sheeting, shoring, or trench boxes in order to protect all employees during the pipe laying operation. The Contractor shall comply with all OSHA and TOSHA standards in determining where and in what manner bracing, sheeting, shoring, or trench boxes are to be used. The Contractor has 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. Where excavations are made adjacent to existing buildings or structures or in paved streets or alleys, the Contractor shall 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. The Contractor shall decide when it is necessary to

underpin adjacent structures wherever necessary, with the approval of the Engineer.

- B. Bracing, sheeting, or shoring shall conform to applicable safety codes, and shall be left in place until the pipe is laid, checked, and backfilled to a safe level at or above the top of the pipe. The bracing or sheeting and shoring may then be removed in an approved manner unless the Engineer specifically directs that the sheeting be left in place. Where the sheeting is left in place, either at the direction of the Engineer or option of the Contractor, the sheeting shall be cut off at least eighteen (18") inches below the finished ground level.
- C. 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 and shall comply with all OSHA and TOSHA standards.

### 3.7 FOUNDATION STABILIZATION

After the trench is opened and grade established, it will be examined by the Engineer who will determine whether or not it is satisfactory foundation for pipes and/or appurtenances, or if it is necessary to stabilize the base. The Engineer may order the Contractor to undercut the trench and refill the areas excavated for this reason with one to two (1" to 2") inch crushed stone up to the level of the lines, grades, and/or cross sections shown on the Plans. The top six (6") inches of this refill shall be crushed stone size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction. The stone so placed shall be brought to the subgrade required by the bedding for the particular location or pipe material and compacted.

### 3.8 BEDDING

Bedding for the installation of waterlines and sewage force mains in a trench condition are shown on the Standard Detail Drawings and described as follows:

For all PVC waterlines and sewage force mains, and all ductile iron waterlines and sewage force mains excavated in solid rock, Class "C-1" bedding as shown on the Standard Detail Drawing shall be used. For Class "C-1" bedding, a minimum of six (6") inches of crushed stone shall be placed in the bottom of the trench to maintain the required grade and to provide continuous support of the bottom of the pipe. The Contractor shall bring the crushed stone bedding up to the required level and shall then shape the bedding to receive the pipe. Bell holes shall be dug so that the bottom of the bells will not support the pipe. Once the pipe is in place, the crushed stone shall be brought up to a minimum of six (6") inches above the top of the pipe, thus completing the bedding of the pipe.



Ductile iron pipe may be installed on shaped trench bottoms with shaped bell holes when the trench is excavated in dry, stable earth and is approved by the Engineer. This is Class “C-2” bedding as shown on the Standard Detail Drawings.

The crushed stone material to be used for pipe bedding shall be washed stone provided by a quarry and equal to size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction.

### 3.9 BACKFILLING

All trenches shall be backfilled immediately after pipes are laid therein, and joints inspected by the Engineer, unless other protection of the pipeline is directed.

Three classes of acceptable backfill material and placement procedures are described as follows:

#### A. SELECTED BACKFILL

Selected backfill material shall consist of finely divided earth, or other approved material carefully placed about the pipe and up to a height above the top of the pipe barrel as shown on the Standard Detail Drawings for pipe bedding. Material shall be placed in uniform layers not exceeding nine (9”) inches in thickness, each layer thoroughly compacted with proper hand tools in such manner as not to disturb or injure the pipe. Backfilling shall be carried on simultaneously on both sides of the pipe in such manner that injurious side pressures do not occur. If suitable select materials are not available from trench excavation, the Contractor will be required to obtain them elsewhere.

#### B. GENERAL BACKFILL

After bedding has been placed and tamped, the remainder of the trench may be backfilled with general excavated material, provided no rock which is of dimension no greater than six (6”) inches along any axis, shall be used for backfill. Backfill material shall be placed in uniform layers not exceeding nine (9”) inches in thickness with each layer thoroughly compacted with heavy duty power tamping equipment of the “Wacker” type, to the full satisfaction of the Engineer. The use of power “Jumping Jack” tampers will not be permitted. At locations outside roads, streets, walks, or other traveled ways open to vehicular or pedestrian travel, the Engineer may waive the requirement of power compaction of backfill upon written request of the Contractor; in which case, after placing the remainder of the backfill up to a level slightly below the natural ground surface, surplus excavation shall be windrowed and maintained in a suitable manner to concentrate and pond surface runoff from rains over the trench; after sufficient settlement has been obtained in the opinion of the Engineer, the Contractor shall complete the dressing, removal of surplus material, and surface cleanup in accordance with the Specifications.

#### C. CRUSHED STONE

Crushed stone backfill is required for sanitary sewers installed in or across streets, except streets being constructed in new subdivisions, in or across state highways, across drives and other paved or traveled areas. The crushed stone shall be washed stone provided by a quarry and No. 57 or 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction. However, the Tennessee Department of Transportation may require or permit special backfill treatment. Backfill shall be placed in layers or lifts not exceeding twelve (12") inches in thickness. After placing in layers, the stone shall be carefully compacted to maximum density or minimum volume with a vibratory type compactor.

Backfilling around manholes and other structures in streets, state highways, and other paved areas shall also consist of No. 57 or 67's. Backfill around manholes, piers, or other structures in locations not subject to traffic may consist of excavated material subject to the following restrictions:

1. No rock larger than six (6") inches in any dimension shall be placed within six (6") inches of the manhole, structure or pipes entering or leaving the manhole.
2. No rock larger than six (6") inches in any dimension shall be placed in the vertical prism above and extending nine (9") inches outside of the pipelines.
3. Crushed stone shall be used under, around, and over the tops of any pipes entering or leaving the manholes as required by the class of bedding for the pipe of a particular material or at a particular location.
4. Excavated material used for backfill shall be carefully placed in layers and compacted in such manner as to fill all voids and prevent excessive settlement.

#### D. FINAL GRADING AND TOPSOILING

This shall include the separation and redepositing of topsoil, final grading and raking of all areas disturbed by construction operations across public and/or private property.

Topsoil may be the topsoil originally excavated from the area and separated from the common excavation for redepositing under this item if suitable soils are encountered, or topsoil obtained off the site of the work from other sources by the Contractor and satisfactory to the Engineer. All arrangements and expenses for securing, loading, hauling and spreading topsoil shall be by the Contractor.

The topsoil shall be deposited and spread so that the top 8 inches of the disturbed area is rock free.

The Contractor shall be responsible for and shall protect all sewers, storm sewers and electric, telephone, water, or other pipes or conduits against danger or damage while excavated areas are being backfilled and from future settlement of the backfill. In all instances, sufficient care must be exercised to avoid leaving any holes or voids in trench walls which may later be filled by leaching or settlement of surrounding material thereby causing future trench settlement. Where damage should occur as a result of the Contractor's backfilling operations or from settlement, such damage shall promptly be repaired.

Whenever the trenches have not been properly filled, or if settlement occurs, they shall be refilled, smoothed off, and finally made to conform to the surface of the ground. Backfilling shall be carefully performed, and the original surface restored to the full satisfaction of the Engineer. Surplus material shall be disposed of as directed by the Engineer.

Where excavated material is not suitable for use as backfill material, CONTRACTOR shall provide acceptable backfill material from other sources at no extra cost.

END OF SECTION 02221W

## SECTION 02642

### VALVES, BLOW-OFF HYDRANTS AND WATER METERS FOR REPURIFIED WATER LINES

#### PART 1 – GENERAL

##### 1.1 SCOPE OF WORK

The work covered by this Section relates to valves, blow-off hydrants, water meters and other appurtenances for repurified waterlines including type required, installation, and testing.

##### 1.2 TYPE VALVES REQUIRED

Unless shown otherwise on the Plans or approved by the Engineer, valves on repurified waterlines twelve (12”) inches and smaller shall be gate valves; and valves on waterlines sixteen (16”) inches and larger shall be butterfly valves.

##### 1.3 STORAGE OF MATERIALS

The Contractor shall be responsible for safely storing, in accordance with manufacturer’s recommendations, materials that have been accepted on the job until they have been incorporated into the completed project. Keep the interiors of all valves, hydrants, blow-offs, water meters and other accessories free from dirt and foreign matter at all times.

##### 1.4 DEFECTIVE MATERIALS

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

##### 1.5 RELATED WORK SPECIFIED ELSEWHERE

Refer to following Sections of these Specifications for work related to this Section:

- A. Section 02221W – Trenching, Bedding and Backfilling for Water Lines, Sewer Forcemains and Repurified Water Lines.

##### 1.6 STANDARDS

Where materials and methods are indicated in the following specifications as being in conformance with a standard specification, it shall refer in all cases to the latest edition of the specifications and shall include all interim revisions. Listing of a standard

specification without further reference indicates that the particular material or method shall conform with such listed specification.

All materials to be incorporated in this project shall be first quality, new, and undamaged material conforming to all applicable portions of these specifications. Where deviation from the specifications is necessary because of changes in manufacturing procedures, inability to obtain the specified product, or other extenuating circumstances, a request for the proposed substitution shall be submitted to the Engineer in writing for consideration. Materials failing to conform to these specifications shall not be delivered to the job site unless the Contractor has written approval from the Engineer covering the substitute materials.

## PART 2 – PRODUCTS

### 2.1 GATE VALVES

Gate valves shall be resilient seated, solid wedge, conforming to meet or exceed the latest revisions of AWWA Standard C509 or C515 in accordance with the following specifications. Each valve shall have the manufactures name, pressure rating, and year in which it was manufactured cast in the body. The body, bonnet and the o-ring plate shall be fusion bonded epoxy coated inside and out in accordance with AWWA C550 and shall be NSF 61 Certified. Valve shall be furnished by the following manufactures: American Flow Control, Mueller, U.S. Pipe Company, M & H, or approved equal.

Valve waterways shall be smooth, have an unobstructed waterway and shall be free of all pockets, cavities and depressions in the seat area, equal to or greater than the full nominal diameter of the valve.

Valve stems shall be with the stem made of cast, rolled bronze, copper alloy or stainless steel in full compliance with AWWA C509 or C515. Two stem seal o-rings shall be located above the thrust collar and one o-ring below. The stems shall also have a low torque thrust washer located above and below the stem collar to reduce friction during operation.

The stem nut, also made of bronze, or copper alloy may be independent of the gate or cast integrally with the gate. If the stem nut is cast integrally, the threads shall be straight and true with the axis of the stem to avoid binding during the opening or closing cycle.

The valve seat shall consist of cast or ductile iron, having a vulcanized synthetic rubber coating or EPDM rubber seat permanently bonded to the seat wedge per ASTM D-429. The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

The valve body, bonnet, and bonnet cover shall be cast iron ASTM A126, Class “B” or ductile iron ASTM A536.

Valves shall be hydrostatically tested at five hundred (500) psig equal to the requirements of ANSI/AWWA C509 or C515, and shall be guaranteed for not less than two hundred fifty (250) pounds maximum working pressure unless otherwise shown on plans.

Buried valves shall be mechanical joint and equipped with a two (2”) inch square operating nut. Valves in structures shall be flanged and equipped with removable hand wheel operators. Valves for all repurified water lines shall open to the right.

The Contractor shall furnish the Engineer with certificates of inspection, sworn to by the factory inspector, in the presence of a Notary Public, stating that the valves were made and satisfactorily tested in full compliance with AWWA C509 or C515.

## 2.2 BUTTERFLY VALVES

Butterfly valves shall be of heavy cast iron or ductile iron construction with mechanical joint ends and shall be designed for underground installation. Valves shall be the GROUNDHOG type as manufactured by Henry Pratt Company, American Flow Control, or approved equal. Valves shall be equipped with suitable gearing and an enclosed gear case. Valves shall have permanent packing, self-lubricating bearings, and one-piece stainless-steel shafts with ductile iron or Ni-resist disc keyed to shaft. Seating surface shall be resilient synthetic Buna-N rubber, securely fastened to prevent separation or distortion. The operating nuts shall be standard two (2") inch square nuts, opening **right**.

All butterfly valves shall be furnished for installation in a horizontal line with the operating nut in a vertical position. Each shall be furnished for buried service with a valve box as specified and as detailed on the Drawings.

All butterfly valves shall be of the tight closing, rubber seated type. Valves shall be bubble tight (in both directions) at rated pressures and shall be satisfactory for applications involving throttling service and/or frequent operations and for applications involving valve operation after long periods of inactivity. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. Valves shall conform to Class 150-B of AWWA Specifications C-504, latest revision. The manufacturer shall have manufactured tight closing rubber seated butterfly valves for a period of at least five years. All valves shall be designed for the most severe operating conditions such as free discharge of "line break" conditions.

Valve bodies shall be constructed of cast iron ASTM A-126 Class B. Body thicknesses shall meet or exceed the requirements given in AWWA Specification C-504 of latest revision, for Class 150-B Valves.

Valve discs shall be constructed of ductile iron conforming to ASTM A-536 or cast iron conforming to ASTM A48, Class 40 or alloy cast iron conforming to ASTM A-436, Type 1. Shafts shall be constructed of either 18-8, Type 304 stainless steel, turned, ground and polished, mechanically secured to the valve disc by the use of 18.8, Type 304, stainless steel taper pins, or high-tensile carbon steel, furnished with permanent rubber static shaft seals and Type 304 stainless steel shaft journals to completely isolate the shaft from line fluid. Non-circular hex shafts will be acceptable.

Valve seats shall be of either new natural rubber or of synthetic rubber, Buna N compound. Rubber seats may be applied to either the body or the disc. Seats applied to the body shall be simultaneously molded and vulcanized into the body, and seat bond must withstand 75 lbs. pull under test procedure ASTM D-429, Method B. Rubber seats applied to the disc edge shall be vulcanized to an 18-8 stainless steel locking screw fasteners. Valves with the rubber seat integral with the body and machined to provide a

permanent corrosion resistant seating area. Valves employing a complete rubber liner will not be acceptable in any size.

Valves shall be fitted with sleeve type bearings. Bearings shall be corrosion resistant and self-lubricating.

Both valve ends shall be mechanical-joint as per AWWA Specification C-111/A21.11.

All surfaces of the valves shall be clean, dry and free from grease before painting. The valve interior surfaces, except seating surfaces, and the exterior surface shall be evenly coated with black asphalt varnish in accordance with Federal Specification TT-V-51c and AWWA C-504. In addition, butterfly valves shall be coated on the outside with an epoxy coating. Coating shall be colored purple, Pantone 522, to denote use in the Repurified Water System.

Valve operators shall be designed to hold the valve in any intermediate position between full open or fully closed without creeping fluttering. Valve operators shall be manual and shall be of the traveling nut type. Units shall be designed for buried service and shall be fully gasketed and grease packed. Adjustable mechanical stops shall be provided to stop valve in the fully opened and fully closed positions. The 2" square operating nut shall have cast on it an arrow indicating the direction of turning for opening the valve. Valves for use Repurified Water Lines shall open to the right. Manual operators shall require at least 30 turns of the operating nut to rotate the disc 90 degrees.

Hydrostatic and leakage tests shall be conducted in compliance with AWWA Specification C-504, and copies of the certified reports shall be submitted to the Engineer.

The Contractor shall submit specifications and blueprints of manufacturer showing detail dimensions and giving the kind of material used, also tensile strength and elastic limit of metal, and shall give weight of valves and diameter of stem at bottom of thread.

Valves shall be rated for minimum one hundred fifty (150) psi service and shall be tested to one hundred fifty (150) psi with drop tight shutoff unless otherwise shown on plans. Valves shall equal or exceed AWWA Specification C504, latest revision. The Contractor shall furnish the Engineer with certificates of inspection, sworn to by the factory inspector, in the presence of a Notary Public, stating that the valves were made and satisfactorily tested in full compliance with AWWA C504.

### 2.3 TAPPING SLEEVES AND VALVES

Tapping sleeves shall consist of a mechanical joint tapping sleeve and a valve with a mechanical joint outlet. The valve shall conform to all applicable specifications for gate valves. The Department will make all taps under pressure, using a tapping sleeve and valve. The Contract will not make taps, unless otherwise approved.

### 2.4 VALVE BOXES

Valve boxes shall consist of precast concrete sections with cast iron frames and covers. The precast concrete sections are each approximately six (6") inches high with a minimum inside opening of eleven by thirteen (11" x 13") inches. Manufacturer shall be Hula Concrete Products of Hickman, TN, or Thomas Holton of Christiana, TN or approved equal.

The cast iron frames and covers shall be roadway type, John Bouchard No. 8006, **East Jordan (EJ) 8041** or equal, having inside dimensions of eleven by thirteen and one-fourth (11" x 13¼") inches and a height of six and one-half (6½") inches **marked "Repurified or Reclaimed Water"**. The combined weight of frame and cover shall be one hundred ninety-five (195) pounds.

## 2.5 BLOW-OFF HYDRANT ASSEMBLIES

Blow-off valve assemblies shall be a two and one-quarter (2¼") inch M & H (Style 33) Post Type Hydrant, John C. Kupferle Foundry (Eclipse No. 2), or approved equal, and shall be constructed in accordance with the Standard Detail Drawing W-22 or W-22A. Where shown on the plans for an automatic flushing hydrant to be installed the Kupferle Foundry 9600TS model must be used in accordance with Standard Detail Drawing R-1.

## 2.6 HOSE BIBB CONNECTIONS

Hose bibb connections are allowed for hand watering and other limited outdoor activities provided the hose bibb is located in a locked box below ground level.

The lock box shall bear a permanent and clear label, "REPURIFIED WATER" "DO NOT DRINK"

## 2.7 WATER METERS

The Department will install all water meters two (2) inch and less. This work will include the tap on the mainline, the water service line to the meter, the meter and the box. The Contractor will be responsible for purchasing and installing all water meters three (3) inch and larger. This work will include the service line to the meter, the meter and the box. If a mainline tap is required, the Department will install the tapping sleeve and valve for the Contractor.

For all meters three (3) inch and larger, the meter shall be Sensus Omni C2 with an Itron connection, ERT, antenna and test port with a nipple and valve. Two (2) gate valves with hand wheels will be required, one on each side of the meter, unless a valve is already being provided with the tap for the service, in which just the valve on the building side of the meter would be required.

The vault for the water meter shall be precast concrete with an aluminum hatch for access. Shop drawings for the vault and hatch should be supplied to the Department for review and approval prior to purchase.



## PART 3 – EXECUTION

### 3.1 GENERAL

Installation of valves shall conform to provisions of these specifications and recommendations of the manufacturer.

### 3.2 VALVES AND VALVE BOXES

Valves shall be installed in the repurified waterline at the locations shown on the Plans or as directed by the Engineer, and in accordance with the Standard Detail Drawing and these specifications. Valves shall be installed in a horizontal run of pipe with valve stems in a vertical position. Buried valves shall have a two (2") inch square operating nut.

Provide a valve box for every valve. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut of the valve, with the box cover flush with the surface of the finished pavement or such other level as may be directed by the Engineer.

Where valves are deeper than 36 inches an extension is required to bring the operating nut to within 24 inches of the finished grade.

Repurified water lines shall be equipped with blow-off hydrants at appropriate locations, as determined by the Department.

All valves shall be left exposed until visually inspected and approved by a Department inspector.

### 3.3 TAPPING SLEEVES AND VALVES FOR MAIN EXTENSIONS

All repurified water line taps, for mainline extensions, will be installed by the Department. This will include the tapping sleeve, the valve, the valve box, the tapping machine and all labor to make a complete tap. The Department also will backfill the trench with stone, but will not install any pavement replacement. At the discretion of the Department, the Contractor may be responsible for this work.

### 3.4 TAPS FOR REPURIFIED WATER SERVICE

All repurified water line taps, for repurified water service, will be installed by the Department. This will include the corporation stop, the polyethylene tubing over to the property line, the curb stop, the meter setter, the meter and box and all labor to provide a complete service. The Department also will backfill the trench with stone, but will not install any pavement replacement. At the discretion of the Department, the Contractor may be required to perform this work up to the curb stop, along major thoroughfares and with road improvement projects.

### 3.5 BLOW-OFF HYDRANT ASSEMBLIES

Blow-offs shall be installed at the locations shown on the Plans, or as directed by the Engineer, and in accordance with the Standard Detail Drawing and these specifications.

Unless otherwise indicated on the Plans, all blow-offs, **except for the automatic flushing devices**, shall have a two and one-quarter (2 $\frac{1}{4}$ " ) inches main valve opening consisting of two (2) feet minimum of three (3" ) inch ductile iron pipe or C900 **PVC** from water main, connecting to a M & H (Style 33), John C. Kupferle Foundry Eclipse No. 2 Post Type Blow-off Hydrant, or approved equal. **Automatic flushing devices shall be installed per Detail R-1.**

Concrete blocking shall be as shown on the Standard Detail Drawing.

END OF SECTION 02642

## SECTION 02734

### REPURIFIED WATER LINES

#### PART 1 – GENERAL

##### 1.1 SCOPE OF WORK

The work covered by this Section relates to repurified water lines and appurtenances including pipe material permitted, installation, testing, and cleanup.

##### 1.2 PIPE MATERIAL PERMITTED

Pipe for repurified water lines shall be PVC pipe C900, C905, or ductile iron, as specified herein and shown on the contract drawings.

##### 1.3 STORAGE OF MATERIALS

The Contractor shall be responsible for safely storing, in accordance with manufacturer's recommendations, materials that have been accepted until they have been incorporated into the completed project. Keep the interiors of all pipes, fittings, and other accessories free from dirt and foreign matter at all times.

##### 1.4 DEFECTIVE MATERIALS

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

##### 1.5 RELATED WORK SPECIFIED ELSEWHERE

Refer to following Sections of these Specifications for work related to this Section:

- A. Section 02221W – Trenching, Bedding and Backfilling for Water Lines and Sewer Force mains and Repurified Water Lines
- B. Section 02642 – Valves, Blow-Off Hydrants and Water Meters for Repurified Water Lines
- C. Section 02735 - Polyethylene Encasement for Ductile iron Pipes

D. Section 03303 - Concrete for Water Lines, Sanitary Sewer Main, Repurified Water Lines, Sewer Force mains and Appurtenances

1.6 STANDARDS

Where materials and methods are indicated in the following specifications as being in conformance with a standard specification, it shall refer in all cases to the latest edition of the specifications and shall include all interim revisions. Listing of a standard specification without further reference indicates that the particular material or method shall conform with such listed specification.

All materials to be incorporated in this project shall be first quality, new, and undamaged material conforming to all applicable portions of these specifications. Where deviation from the specifications is necessary because of changes in manufacturing procedures, inability to obtain the specified product, or other extenuating circumstances, a request for the proposed substitution shall be submitted to the Engineer in writing for consideration. Materials failing to conform to these specifications shall not be delivered to the job site unless the Contractor has written approval from the Engineer covering the substitute materials.

The supplier must provide and deliver pipe manufactured by one company per project/job only. The mixing of different pipe manufacturers will no longer be accepted. Jobs can be broken into separate sections and/or phases as approved by the Murfreesboro Water & Sewer Department.

PART 2 – PRODUCTS

2.01 GENERAL PIPE REQUIREMENTS

A. QUALITY AND INSPECTION

Latitudes in workmanship and finish allowed by ASTM Specifications notwithstanding, all pipe shall be first quality, of smooth exterior and interior surfaces, free from cracks, blisters, and other imperfections, and true to theoretical shapes and forms throughout each length. All pipe, independent of laboratory tests, shall be subject to the inspection of the Engineer at the pipe plant, trench, or other point of delivery for the purpose of culling and rejecting pipe which does not conform to the requirements of these Specifications. Pipe which does not conform shall be marked as such by the Engineer and shall not be delivered or used in the work. Repairing of rejected pipe will not be permitted.

B. EXPERIENCE OF MANUFACTURER

The manufacturer of the pipe shall submit evidence, if requested by the Engineer, of having consistently produced both pipe and joints of specified quality and satisfactory performance results in service over a period of at least two years. The manufacturing process shall be subject to the approval of the Engineer.

## 2.02 POLYVINYL CHLORIDE (PVC) PIPE

### A. MATERIAL

PVC pipe shall conform to the requirements of AWWA C900/905 and shall be furnished in cast iron pipe equivalent outside diameters. For pipe (4") inches through (12") inches in diameter, pipe shall be minimum pressure class **150** psi (**DR18**) with integral wall thickness bell ends. For pipe 14" in diameter and larger, minimum pressure class shall be 200 psi (DR 21) with integral wall thickness bell ends and furnished in cast iron pipe equivalent outside diameters.

### B. JOINTS

Provision must be made for contraction and expansion of each joint with flexible ring gaskets from rubber or other suitable material. Gasket materials shall meet the requirements established in ASTM F477. Joints shall be manufactured in accordance with ASTM D3139. Lubricant shall be nontoxic and shall not promote biological growth. Solvent cemented joints in the field are not permitted. Where restrained joints are called for on the plans, the pipe joints and fittings shall be as follows:

1. For C900 PVC pipe and fittings shall be EBAA Iron, Inc. Series 1600.
2. For C905 PVC pipe and fittings shall be EBAA Iron, Inc. Series 2800.

The restraining glands shall have a pressure rating equal to that of the pipe on which it is used.

### C. TESTING

The following tests shall be run for each machine on each size and type of pipe being produced as specified:

1. FLATTENING TEST

Once per shift in accordance with ASTM D2412. Upon completion of the test, the specimen shall not be split, cracked, or broken.

2. ACETONE TEST (Extrusion Quality Test)

Once per shift in accordance with ASTM D2152. There shall be no flaking, peeling, cracking, or visible deterioration on the inside or outside surface after completion of the tests.

3. QUICK BURST TEST

Once per twenty-four (24) hours in accordance with ASTM 1599.

4. WALL THICKNESS AND OUTSIDE DIMENSIONS TEST

Once per hour in accordance with ASTM D2122.

5. BELL DIMENSIONS TEST

Once per hour in accordance with ASTM D3139.

If any specimen fails to meet any of the above-mentioned tests, all pipe of that size and type measured between the test periods must be scrapped and a full set of tests rerun.

D. MARKING

1. All new buried pipe, including service lines, valves and other appurtenances shall be colored purple, Pantone 522 or equivalent. Pipe shall be marked in accordance with AWWA C900/905 and shall also be marked with two lines in opposite sides of the pipe reading "CAUTION REPURIFIED WATER - DO NOT DRINK" in intervals not to exceed five (5) feet.

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

- a. Nominal size
- b. Type of material
- c. DR or class
- d. Manufacturer
- e. NSF Seal of Approval

E. CERTIFICATIONS

The manufacturer shall furnish certifications as follows:

1. That the pipe and joints have been manufactured in accordance with AWWA C900/905 "Standard for Polyvinyl Chloride (PVC) Pressure Pipe, four (4") inches through twelve (12") inches, for Water Distribution".
2. That the pipe and joints have been tested in accordance with the ASTM designations for the respective tests designated in C.

F. LENGTHS

Pipe shall be furnished in minimum lengths of twenty (20') feet, except for special construction conditions.

G. DETECTABLE TAPE

Detectable tape is required for repurified water system pipe line. It shall be 2" wide and shall be an inert, bonded layer plastic with a metallic foil core and shall be highly resistant to alkalis, acids or other destructive chemical components likely to be encountered in soils. The tape shall be colored bright purple to denote location of repurified water line and shall bear the imprint: "CAUTION REPURIFIED WATER - DO NOT DRINK".

H. DETECTION WIRE

Pipe shall have a fourteen (14) TW solid copper wire with a white coating installed in such manner that detection with electronic equipment is possible. The detection wire shall be continuous and shall be installed/taped on top of the pipe.

I. MANUFACTURER

Pipe shall be as manufactured by JM-Eagle Manufacturing, National, North American Pipe, , Diamond Plastics and Royal Building Products, Pipelife Jet Stream, Sanderson Pipe or an approved equal.

2.03 DUCTILE IRON PIPE

- A. Where directed by the Owner or Engineer or shown on the Contract drawings for use in special locations, ductile iron pipe shall be used in the repurified water system.

B. MATERIAL

Ductile iron pipe for repurified water lines shall be designed in accordance with the latest revisions of ANSI/AWWA C150/A21.50 for a minimum 200 psi rated working pressure plus a 100 psi minimum surge allowance; a 2 to 1 factor of safety on the sum of working pressure plus surge pressure. Also required is special thickness Class 52 for pipe sizes 12" and smaller.

Ductile iron pipe for repurified water lines shall be manufactured in the U.S.A. in accordance with ANSI/AWWA/C151/A21.51, latest revision, for centrifugally cast ductile iron pipe. Each pipe shall be subjected to a hydrostatic pressure test of at least 500 psi at the point of manufacture.

Pipe shall be furnished with **asphaltic** seal coat and an **asphaltic** coating on the outside per ANSI/AWWA C151/A21.51. Pipe shall have an interior cement lining. Cement lining shall conform to ANSI/AWWA/C104/A21.4, latest revision. All pipe shall have a pressure class of 200 psi unless noted otherwise on the Plans.

All Ductile Iron Pipe (DIP) installed for use as repurified water main shall be wrapped in a polyethylene encasement as specified in Section 02735.

#### C. JOINTS

Joints shall be compression type slip joints equal to the "Fastite" joint as manufactured by American Cast Iron Pipe Company, "Tyton" as manufactured by U.S. Pipe and Foundry or "Bell-Tite" as manufactured by James B. Clow and Son. Gaskets and lubricants shall be furnished with the pipe. Where restrained joints are called for on the Plans, the pipe joints and fittings shall be American **"Fastite" with fast-grip gasket, Flex Ring, or Lok Ring** joint pipe and fittings or equal.

#### D. TESTING

Testing of ductile iron pipe and joints shall be performed in accordance with ANSI/AWWA/C151/A21.51 and ANSI/AWWA/C111/A21.11, latest revisions.

#### E. MARKING

The exterior of the pipe shall be clearly marked to indicate the class or nominal thickness, manufacturer, date of manufacture, the pipe class, and weight. Exterior markings shall also positively identify the pipe as being ductile iron. Pipe shall also be marked with two lines on opposite sides of the pipe reading "CAUTION REPURIFIED WATER - DO NOT DRINK" in intervals not to exceed five (5) feet. (Letters shall be minimum 2" in height).



F. CERTIFICATIONS

Pipe manufacturers shall furnish written certification that the pipe and joints have been manufactured and tested in accordance with the latest revision of ANSI/AWWA/C151/A21.51 and ANSI/AWWA/C111/A21.11 for ductile iron pipe centrifugally cast in metal or sand lined molds.

G. LENGTHS

Pipe shall be furnished in lengths of eighteen to twenty (18' to 20') feet, except for special construction conditions.

H. MANUFACTURER

Ductile iron pipe shall be as manufactured by U.S./Griffin Pipe and Foundry Company, American Cast Iron Pipe Company, McWane/James B. Clow and Sons, or an approved equal.

2.04 FITTINGS

Fittings furnished for use with PVC or ductile iron pipe shall be fittings conforming to ANSI/AWWA/C110/A21.10, latest revisions. Unless otherwise indicated, ends shall be mechanical joint. Fittings shall have interior lining and exterior coating as specified for ductile iron pipe. Fittings shall be of ductile iron. Ductile iron compact fittings shall conform to ANSI/AWWA/C153/A21.53. Fittings shall have a pressure rating of 350 psi.

Fittings shall be in accordance with standard mechanical joint fittings as manufactured by the U.S./Griffin Pipe and Foundry Company, American Cast Iron Pipe Company, McWane/James B. Clow and Sons, **Tyler/Union, Sigma, Star, SIP Industries** or an approved equal.

2.05 CASING PIPE

The minimum material requirements for casing pipe used in highway and railroad crossings shall be steel conforming to ASTM A139, Grade B. Minimum yield strength shall be 35,000 psi. All casing pipe used must meet the approval of the permitting authority. If the casing pipe is being used in a bore situation within the City's rights-of-way, the bore must extend to 10 feet on either side of the toe of the slope and/or the back of the ditch and at minimum from right-of-way to right-of-way. Nominal casing diameter shall be as indicated on the plans as determined by the Department, but in no case shall be smaller than 2 sizes larger than the carrier pipe size. Joints shall be continuously welded. Casing pipe and joints shall be leak proof and capable of withstanding Cooper E-80 loading. Casing pipe shall be coated as specified herein.

The minimum wall thickness of casing pipe shall be as shown in the table below:

<u>Nominal Diameter (Inches)</u>	<u>Minimum Wall Thickness (Inches)</u>	
	<u>With Coating</u>	<u>Without Coating</u>
Under 14	0.188	0.251
14 and 16	0.219	0.282
18	0.250	0.313
20	0.281	0.344
22	0.312	0.375
24	0.344	0.407
26	0.375	0.438
28 and 30	0.406	0.469
32	0.438	0.501
34 and 36	0.469	0.532
38, 40, 42	0.500	0.563

Where specified, coating for steel casing pipe shall be a two component, self-priming, chemically cured coal tar epoxy-polyamide protective coating. Minimum dry film thickness of completed coating shall be sixteen (16) mils. Material shall be Kopcoat 300 M, Tnemec 46H-413 Hi Build Tnemec – Tar or equal. Preparation shall be SP6 commercial blast.

## 2.06 CONCRETE

### A. CLASS “A” CONCRETE

Class “A” concrete shall have a minimum compressive strength of four thousand (4,000) pounds per square inch in twenty-eight (28) days and shall contain not less than six hundred (600) pounds of cement per cubic yard.

### B. CLASS “B” CONCRETE

Class “B” concrete shall have a minimum compressive strength of three thousand (3,000) pounds per square inch in twenty-eight (28) days and shall contain not less than five hundred fifty (550) pounds of cement per cubic yard.

## 2.07 RUBBLE STONE RIPRAP

Where riprap is called for on the drawings, coarse stone from the excavation may be conserved and used, except for stream bank stabilization. Riprap for bank stabilization shall be sound, dense, and durable, free from excessive cracks, pyrite intrusions, and other structural defects. At least ninety (90%) percent of the stone shall be not less than eight (8”) inches wide by twelve (12”) inches long by twelve

(12") inches deep and shall be approximately rectangular in shape. Maximum size shall not be larger than eighteen (18") inches is diameter.

## 2.08 POLYETHYLENE TUBING FOR SERVICES/IRRIGATION

Polyethylene Tubing will be acceptable for usage for repurified water in size 1" to 2" in diameter. This tubing shall be manufactured in accordance with the requirements of ASTM D2737 & AWWA C901 and have a pressure rating of two hundred (200) pounds per square inch. The tubing must have an exterior color of Lavender. An acceptable manufacturer is Endot Industries or approved equal.

## 2.09 TAPPING SADDLES

Tapping saddles for 1" and 2" services shall be manufactured by Ford Meter Box Company, Inc. (FS 101 or FS 202) or approved equal. They must be ductile iron per ASTM A536 with stainless steel bands and CC threads per AWWA C800.

## 2.10 CORPORATION STOPS

Key/Plug Corporation Stops for 1" services and Ballcorp Corporation Stops for 2" services shall be manufactured by Ford Meter Box Company, Inc. or approved equal. The inlet side of the 1" corp stop shall be CC taper threads by quick joint outlet for copper or plastic tubing (F-1000-4-Q) and withstand a working pressure of 100 PSI. The inlet side of the 2" ballcorp stop shall be CC taper threads by quick joint outlet for copper or plastic tubing (FBRW-1000-7-Q) and withstand a working pressure up to 300 PSI.

## 2.11 CURB STOPS

Ball Valve Curb Stops for 1" (B11- or B41) and 2" (BRW11 or BRW41) services shall be manufactured by Ford Meter Box Company, Inc. or approved equal. Both sizes shall have padlock wings and where possible they must be stamped "repurified water". Compression /Quick Joint ends are acceptable where needed.

## 2.12 COPPERSETTERS

Coppersettters for 1" (VBRWHH74-10W-81-44) and 2" (VBRWHH77-12B-11-77) meters shall be Ford 70 Series manufactured by Ford Meter Box Company, Inc. or approved equal. The inlet for the 1" setter shall have a ball valve and have a male iron pipe union swivel connection and the outlet shall be a dual check with a double purpose union swivel connection. The inlet for the 2" setter shall have a ball valve and a female iron pipe connection and the outlet shall be an angle dual check valve with female iron pipe connection. The 2" setter shall also have a bypass connection.

## PART 3 – EXECUTION

### 3.1 GENERAL

Prior to construction, the Contractor is responsible for obtaining coverage under the State's Construction General Permit and City Land Disturbance, in cases where the disturbed area covers more than an acre; and for implementing erosion and sediment controls as required.

The Contractor will be held completely responsible for any damage to pavement, sidewalks, curbs, gutters, meter or valve boxes, street inlets, or other structure or appurtenances as a result of construction operations. It should be specifically noted that the Contractor shall be responsible for damage even though the character or nature of the original pavement or structure was such that it was not capable of carrying the load of the construction equipment regardless of the construction methods used.

The Contractor shall take precautions as may be necessary to avoid endangering personnel, pavement, adjacent utilities, or structures through cave-ins, slides, settlement, or other soil disturbance resulting from construction operations. The Contractor shall furnish and maintain barricades, signs, flashing lights, and other warning devices as necessary for public safety and as required by the Manual on Uniform Traffic Control Devices, Part 6.

The Contractor shall plan construction operations so as to cause a minimum of inconvenience to property owners and to traffic. Flaggers shall be provided as required on heavily traveled streets to avoid traffic jams or accidents. No road, street, or alley may be closed unless absolutely necessary, and then only if the following conditions are met:

1. Permit is secured from appropriate State, County, or Municipal authorities having jurisdiction.
2. All emergency agencies are notified before road is closed.
3. Suitable detours are provided and are clearly marked.

No driveways shall be cut or blocked without first giving twenty-four (24) hour notice to the occupant of the property. Every effort shall be made to schedule the blocking of drives to suit the occupant's convenience, and except in case of emergency, drives shall not be blocked without an alternative access being provided.

Whenever pipe laying operations are to be discontinued for an extended period of time, the end of the pipe shall be carefully secured to avoid displacement or misalignment, and a tight fitting plug or stopper shall be placed in the line. Upon

resumption of laying operations, the plug or stopper shall not be removed from the line until any water, mud, or other debris has been removed to avoid entry into the completed section of the waterline.

Installation of repurified water lines shall conform to provisions of these specifications and recommendations of the pipe manufacturer. Installation instructions provided by the pipe manufacturer shall be available at all times at the location of the work.

The proper gaskets and lubricants shall be furnished by the pipe manufacturer, and lubricants shall be delivered to the job site in properly labeled, unopened containers.

When repurified water lines are to be constructed near sewer lines or water lines, horizontal and vertical separation shall be maintained as described below:

A. Separation of Repurified Water Lines and Sanitary Sewer Lines

1. Wherever practical for parallel installations, line separation is to be at least 10 feet edge to edge. If this cannot be obtained, the bottom of the repurified waterline shall be at least 18 inches above the top of the sewer. If this condition is also unobtainable, the sewer line is to be constructed of materials and have a joint design equivalent to repurified water main standards and shall be pressure tested to 50 psi to assure water tightness.
2. Where the repurified water line crosses house sewers, storm sewers, or sanitary sewers, a separation of at least 18 inches shall be provided between the bottom of the repurified water line and the top of the sewer. If this separation cannot be obtained, sewers within 10 feet of the repurified waterline shall be constructed of materials and have a joint design equivalent to repurified water main standards. Such sewer lines shall be pressure tested to 50 psi to assure water tightness. Repurified water mains passing under sewers shall be protected (in addition to the above sewer line construction) by providing: at least 18 inches between the bottom of the sewer and the top of the repurified water line; adequate structural support of the sewer to prevent excessive joint deflection or damage to the repurified waterline; centering of the repurified water line section to result in the repurified waterline joints being removed from the sewer line to the maximum possible extent.
3. No repurified water line shall pass through or come into contact with any part of a sewer or sewer manhole.

B. Separation of Repurified Water Lines and Potable Water Lines

1. Horizontal Separation – Wherever practical, a minimum horizontal separation of ten feet between parallel buried, repurified water and potable water lines shall be maintained. If construction conditions dictate that the parallel repurified water line must be installed within 10 feet of a potable water line, then the top of the repurified water line shall be 18 inches below the bottom of the potable water line or shall be restrained joint or installed in a sleeve. At no time shall the separation be less than four feet.
2. Vertical Separation of Crossings - Where a repurified water line crosses a buried potable water line, the repurified water line must be located a minimum of 18 inches below the potable water line. Repurified water lines may pass over a potable water line with a minimum of 18 inches vertical separation is maintained if a full standard pipe length is centered over the crossing or the repurified water line is installed in a pipe sleeve, which extends a minimum of 10 feet on either side of the potable water line. There will be no additional compensation for installation of the pipe sleeve. Cost shall be included in other unit prices.

### 3.2 EXCAVATION AND BEDDING

The trench excavation for repurified water lines and other structures, including excavation in solid rock, and any necessary foundation stabilization, dewatering, sheeting or shoring, and the disposal of materials shall be done in accordance with Section 02221W, Trenching, Bedding and Backfilling for Water lines, Sewage Force Mains and Repurified Water Lines.

In wet or mucky areas where the subgrade of the trench walls have insufficient stability to support the installed repurified water line, the Contractor will be directed to remove such unstable material and replace same with crushed stone size No. 67 as given in Section 903 of the latest Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction. Where the wet or mucky condition is caused by the Contractor's failure or neglect to properly handle ground water or protect against the entrance of storm water, the Contractor will be required to remove and replace the unstable material at no expense to the Owner.

Unless otherwise indicated on the Plans or Standard Detail Drawings, all repurified water lines shall have a minimum of forty-two (42") inches of cover. No departure from this policy shall be made except with the approval of the Engineer.

### 3.3 PIPE INSTALLATION

Repurified water lines shall be installed in accordance with details shown on the Plans. The work shall be done by experienced personnel; and pipe, fittings, valves, and accessories shall be installed in strict accordance with these specifications and the recommendations of the manufacturer. Gaskets, bolts, lubricant, and other accessories shall be furnished by, or as recommended by, the manufacturer.

Pipe line alignment and gradients shall be straight or shall follow true curves as nearly as is practicable. Curves or changes in grade will be made by making deflections at the pipe joints where feasible, but the maximum permissible deflections shall be as recommended by the pipe manufacturer. The Contractor shall have on hand at the site of the work a table showing the permissible deflections whenever the pipe laying is in progress. All fittings, valves, and hydrants shall be at the required locations, the spigots centered in the bells, and all valve and hydrant stems plumb.

After the pipe has been swabbed and inspected, it shall be lowered into the trench. The Contractor shall exercise care in the handling of pipe. Suitable clamps, slings, or other lifting devices shall be provided for handling pipe and fittings. Pipe and fittings shall be carefully loaded into the trench piece by piece. AT NO TIME SHALL A SECTION OF PIPE BE ROLLED OR DROPPED INTO THE TRENCH. Bell holes of ample depth and width shall be excavated in pipe trenches at the location of each joint to permit the joint to be properly made and to insure uniform bearing of the pipe barrel on the bottom of the trench. The spigot end of the pipe and the bell or socket of the previously laid pipe shall be wiped clean. The gasket shall be inserted, lubricant shall be applied, and the joint shall be made up by shoving the pipe home. Care shall be taken to insure that the gasket is not twisted or dislodged and that the pipe spigot is inserted the proper distance into the socket. Secure the pipe in place by tamping an approved backfill material around it.

Mechanical joints shall be made only by experienced workmen. Sockets and spigots shall be washed with soapy water before slipping the gland and gasket over the spigot end of the pipe. The spigot shall be inserted into the socket full depth, after which the gasket shall be pushed into position making sure that it is evenly seated in the socket. The gland shall then be moved into position for compressing the gasket. Bolts and nuts shall be tightened "finger-tight", after which they shall be tightened to a uniform permanent tightness, using a torque wrench for tightening. Bolts shall be tightened alternately one hundred eighty (180°) degrees apart.

Lay pipe with the bell ends facing in the direction of laying unless otherwise directed by the Engineer.

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

Whenever pipe laying is not in progress, close the open ends of pipe either with a watertight plug or by other means approved by the Engineer. If the joints of any pipe in the trench cannot be completed until a later time, caulk them with packing in order to make them as watertight as possible; this shall be done not only at the end of each working day but also before work is stopped for lunch periods, bad weather, or any other reason. If there is water in a trench, leave this seal in place until the trench has been pumped completely dry.

### 3.4 THRUST BLOCKS OR RESTRAINTS

#### A. THRUST BLOCKS

Poured-in-place concrete thrust blocks must be provided at all points of unbalanced pressure where the pipe line could pull apart. Thrust blocks shall conform to details and minimum bearing areas as shown on the Standard Detail Drawings, and they shall bear against the undisturbed trench face. Care shall be taken to avoid pouring concrete over or around pipe joints and to protect bolts, glands, or other component parts of the joint while the thrust block is being poured.

Where over bends (downward bends) cannot be avoided, the fitting must be held in place by one of the following methods:

1. Steel rods anchored for at least eighteen (18") inches in solid rock.
2. Concrete, of sufficient volume as directed by the Engineer, placed under pipe to counteract unbalanced force, with steel clamp and anchor bolts to hold fitting to concrete as shown on Standard Detail Drawing.
3. Approved type of locked flexible joint extending a minimum of two (2) pipe joints on each side of the bend. (Number of lengths to be reviewed by Engineer.)

Rods and bolts shall have a minimum diameter of three-quarter (3/4") inch and clamps or straps shall be of steel having at least one-fourth (1/4") inch thickness. Steel rods, bolts, clamps, etc. shall be coated with coal tar epoxy. Concrete used in thrust blocks shall be Class "B".

#### B. RESTRAINTS



All dead end mains shall be adequately restrained to prevent separation when operating under pressure or during pressure surges. Unless otherwise directed the dead ends shall consist of a mechanical joint plug and a one (1') foot length of pipe bracing between the plug and a concrete thrust block. The length of the thrust block shall be such as to bear against the undisturbed trench face. The brace pipe shall be steel pipe, and shall be sized as indicated on the Standard Detail Drawing. Pipe ends shall be cut square, and a one-fourth (1/4") inch steel plate of the dimensions shown on the Standard Detail Drawing shall be tack welded over each end of the brace pipe.

The pipe brace shall be in contact with the dead end main and be 6" into the concrete brace to eliminate any movement.

### 3.5 CONNECTIONS TO EXISTING REPURIFIED WATER MAINS

#### 1. MAIN LINE CONNECTIONS FOR MAIN EXTENSIONS

##### A. PRESSURE CONNECTIONS

Where pressure connections are called for on the Plans, the Department will furnish the materials and labor to install the tapping sleeve and valve and make a complete tap. **At the discretion of the Department the Contractor will be required to** perform all excavation, blocking, and backfill and make a temporary pavement patch. Pavement saw cutting, milling, binder application and pavement overlay may also be required by the contractor to satisfy the requirements of the City Engineering Department and any street cut permits.

##### B. DEAD END CONNECTIONS

Connections which are to be made at dead end lines where the main is to be extended will require removing a plug and blocking, valving off the line and continuing with the installation of the new line. This work will be **by the Contractor**. The location of the nearest existing valves have been shown on the Plans, and it is assumed that the valves are in operating condition, but the Owner/Department makes no claim as to the effectiveness of the valves. In the event any valve fails to operate, or does not provide drop tight shut-off, the Owner will assist the Contractor in locating other valves which may be used, but the Contractor will not be entitled to additional compensation for any delay or extra cost resulting there from.

Arrangements for shut-down of any line for the purpose of making a connection thereto shall be made through the Engineering Department of

the Water Resources Department. Where the line to be shut off is an integral part of the feeder system or serves more than five (5) services, the Owner may stipulate that the connection be made at night or on weekends.

The Contractor shall request the Owner to valve off the desired area at the agreed upon time. The Contractor's forces are not to operate valves on the existing system unless specifically authorized to do so by the Owner.

## 2. MAIN LINE CONNECTIONS FOR SERVICE/IRRIGATION

### A. PRESSURE CONNECTIONS

In most cases the service connections to the existing repurified water mains will be made by the **Department** and be made under pressure. No **service** connections to an existing repurified water line shall be made until all lines have been tested and approved for service.

- a. For services 2" and less, the Department will furnish all the materials and labor to make the tap, extend the service to the property line, or meter location, and install the meter and meter box. The Contractor will be required to acquire the street cut permit if the tap is within the right of way, perform all excavation, blocking, and backfill and make a permanent pavement repair patch.
- b. For services greater than 2", the Department will furnish the tapping machine and the crew to make the tap and furnish and install the tapping sleeve and valve. The Contractor will be required to acquire the street cut permit if the tap is within the right of way, perform all excavation, blocking, and backfill and make a permanent pavement repair patch. The Contractor will connect to the valve in the street and install the size line as shown on the plans, **install the water meter and box per Section 2642.**

**At the discretion of the Department, the Contractor may be required to provide the materials, make the service connections and extend service stubs to the property lines or meter locations. Should this be the case a list of materials to be used is given in Sections 2.08 through 2.12.**

Pavement saw cutting, milling, binder application and pavement overlay may also be required by the contractor to satisfy the requirements of the City Engineering Department and any street cut permits.

## 3.6 BACKFILLING

The backfilling for repurified water lines and other appurtenances shall be done in accordance with Section 02221W, Trenching, Bedding and Backfilling Water Lines, Sewer Force mains and Repurified Water Lines.

### 3.7 TESTING AND DISINFECTION

#### A. GENERAL

Upon completion of the construction work under this Contract, the Contractor shall conduct the necessary pressure and leakage tests. The Murfreesboro Water Resources Department shall disinfect the completed repurified water main and appurtenances and conduct required bacteriological tests. The Contractor shall furnish all labor, tools, equipment, and materials for making the pressure and leakage tests, except for water which will be furnished by the Owner at no cost to the Contractor. In the event that the pressure or leakage test is unsatisfactory, the Contractor shall take corrective measures and shall repeat the tests until satisfactory results are obtained.

#### B. TESTING

Wherever, in the opinion of the Engineer, conditions will permit, the pipe line shall be tested before the trench is backfilled. All joints shall be examined during the open trench test and all visible leaks entirely stopped. Joints which leak shall be remade and retested until the lines pass the required test. Any cracked or broken pipe, fittings, valves, hydrants, or other work shall be removed and replaced, at the expense of the Contractor, with sound pieces or units as may be required.

The Contractor shall furnish, install, and remove all necessary temporary flanges, plugs, or bulkheads required for conducting the pressure tests, as well as all material, labor, and equipment required to carry out the tests and to replace defective material.

The Owner shall furnish and install corporation stops at high points on the lines for blowing the lines free from air. One corporation stop shall be furnished and installed for each test pump location.

Each section of the completed repurified water main extensions shall be subjected to a pressure test. The section to be tested shall be valved off by gate valves, after having been filled with water, and a positive displacement test pump shall be used to pump clean water into the section to build up a test pressure equal to one hundred fifty (150) psi or one and one-half (1½) times the working pressure, whichever is greater. The test pump shall then be valved off from the system, and the pressure shall be

observed over a period of one hour. A drop in pressure of five (5) psi or more during the one-hour test period shall be taken as an indication of leakage. After leaks are found and corrected, the Contractor shall repeat the pressure test using the same procedure described above. Should the Contractor be unable to obtain a satisfactory pressure test over a duration of one hour, he shall then be required to perform a leakage test conforming to AWWA Standard C600-93, and the leakage allowed must be calculated according to the formula required therein.

### 3.8 CLEANUP PROCEDURES AND REQUIREMENTS

The Contractor shall not, without the permission of the Engineer, remove from the line of work any earth excavated there from which may be suitable for backfilling or surfacing until the excavation has been refilled and surfaced.

As soon as the backfilling of an excavation is completed, and when in areas of existing development, the Contractor must at once begin the removal of all surplus dirt except that which is actually necessary to provide for the settlement of the fill. The Contractor shall also remove all the pipe and other material placed or left on the street except material needed for the replacement of paving, and the street shall be opened up and made passable for traffic. Following the above work, the repairing and complete restoration of the street surfaces, bridges, crossings, and all places affected by the work shall be done as promptly as possible.

All excavated material shall be cleared from adjacent street surfaces, gutters, sidewalks, parkways, railroads, grass plots, yards, etc., and the whole work shall be left in a tidy and acceptable condition.

Unless indicated on the Plans or instructed otherwise by the Engineer, the Contractor will be required to regrass lawn areas, road right-of-way areas, fields, pastures, woods, or other areas where any type of ground cover was originally present. Also, trees, shrubs, or other ornamental plants damaged by the Contractor's operation shall be replaced to the satisfaction of the Owner and in accordance with the City's Tree Management Ordinance.

The Engineer shall be the sole authority in determining time in which rough and final cleanup shall be accomplished. Rough cleanup shall consist of removal of rocks larger than six (6") inches in any dimension, grading of excess backfill material over pipe line or removal of said material, opening of any drainage ways, restoration of any street or roadway to condition so that traffic may safely and conveniently use street or roadway, restoration of pedestrian ways to condition where pedestrians may safely and conveniently use same. Rough cleanup shall, in general, be prosecuted no later than one (1) day after pipe laying and backfilling

or no farther behind pipe laying operations than one thousand (1,000') feet; whichever time limit is shortest shall govern. Final cleanup consisting of pavement replacement, sidewalk replacement, removal of rocks, hand raking with seeding, strawing, etc., of lawns and neutral grounds, adjusting grade of ground over pipe line, property repairs, and other items shall, in general, be accomplished no later than three (3) weeks after completion of backfilling.

### 3.9 SPECIAL WORK AREAS

#### A. GENERAL

The Contractor's attention is called to special conditions that exist in certain special areas that are commonly encountered in the installation of repurified water lines, namely:

1. In easements
2. On state highway and railroad and gas right-of-way
3. Stream Crossings

The special conditions for these areas are discussed herein in Sections B, C, and D. All, some, or none of these areas may be encountered in the project for which these specifications apply.

#### B. EASEMENTS

The Contractor shall take care in working on private property where easements have been obtained in order to install the repurified water line. The Contractor shall make inquiry as to whether the property owner wishes to retain the material from the excavation occurring on the property owner's property. If the property owner desires to keep excess material on the property, Contractor shall receive written permission from property owner to stockpile excess material in an area designated by property owner. At no time shall the Contractor remove any excavated material from the property without first inquiring as to property owner's desire of whether to retain material generated on their property. Any excess material, if not desired by the property owner, shall be disposed of in accordance with Section 3.80.

#### C. STATE HIGHWAY/ RAILROAD CROSSINGS/ GAS CROSSINGS

The installation of repurified water lines along and across state highways shall be made in accordance with the details shown on the Plans, as specified herein, and with all requirements of the Tennessee Department of Transportation (TDOT) with reference to construction operations,

safety, traffic control, road maintenance and repair, etc. **Permits for TDOT work will be obtained by Murfreesboro Water Resources Department.**

The installation of repurified water lines along and across railroads and/or gas mains shall be made in accordance with the details shown on the Plans, as specified herein, and with all requirements of the Railroad and/or Gas Company with reference to construction operations, safety, maintenance of service, etc.

**Permits for Railroad or Gas Crossings work will be completed and applied for by the Owner/Developer.** All costs for labor, materials, and supervisory personnel furnished by the TDOT, Railroad Company and/or Gas Company in connection with the work, if any, shall be at the expense of **the Owner/Developer.** The Contractor shall fully inform himself/herself of the conditions and insurance requirements of the permit and fully comply with those conditions and requirements.

The Contractor shall be responsible for fully informing himself/herself with regard to all TDOT, Railroad Company and/or Gas Company regulations and conditions relating to pipe line crossings.

The Contractor shall be responsible for notifying TDOT, the Railroad Company and/or Gas Company when work is about to begin on the crossing.

#### D. STREAM CROSSINGS

Where indicated on the Plans, special construction shall be used at stream crossings. Details shall be as shown on the Plans. **In these areas, the Contractor shall drill a line of perimeter holes spaced no more than 2 times the diameter of the drilled holes. The perimeter holes shall be a maximum of 3" in diameter and shall not be charged with explosives. Also, the perimeter holes shall be drilled vertically and to a minimum of three (3) feet below the proposed invert of the sewer line. Inside the creek crossing zone, the Contractor shall drill holes inside the perimeter holes in a pattern suitable to rubbleize the trench rock. The Contractor shall not use more than five (5) pounds of explosives per delay for the drilled holes inside the perimeter holes in the designated creek crossing zone**

When required, the Owner/Developer will submit the appropriate permit applications and details to TDEC and the U.S. Army Corps of Engineers so that appropriate permits can be obtained for the stream crossings. The Contractor shall be required to adhere to the permit requirements from each agency for the repurified water line crossing of the stream.

#### 4.0 ACCEPTANCE OF WORK

Water lines and appurtenances will not be considered ready for acceptance until all provisions of these Specifications have been complied with, until all tests have been satisfactorily completed, and until final inspection of the work has been made.

END OF SECTION

## SECTION 02735

### POLYETHYLENE ENCASUREMENT FOR DUCTILE IRON PIPE

#### PART 1 - GENERAL

##### 1.01 SCOPE OF WORK

- A. Provide all labor, materials, equipment and services required for installing polyethylene encasement of ductile iron pipe and associated appurtenances, where shown on the Plans or otherwise required by the ENGINEER.

#### PART 2 – PRODUCTS

##### 2.01 POLYETHYLENE TUBES AND SHEETS

- A. Polyethylene tubes and sheets used for encasement shall conform to AWWA C105 standard in underground installations of ductile iron piping for water and other liquids (e.g., repurified water mains).
- B. Polyethylene wrap in tube or sheet form for piping encasement shall be manufactured of virgin polyethylene material conforming to the requirements of ANSI/ASTM Standard Specification D1248. The specified nominal thickness for low-density polyethylene film is 0.008 in. (8 mils). The specified nominal thickness for high-density cross-laminated polyethylene film is 0.004 in. (4 mils). The minus thickness tolerance shall not exceed 10 percent of the nominal thickness on both material types.
- C. The polyethylene tubes and sheets for use in encasing repurified water mains shall be color Pantone 522, or approved equal.

#### PART 3 - EXECUTION

##### 3.01 INSTALLATION OF POLYETHYLENE ENCASUREMENT:

- A. The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material but is not intended to be a completely air and watertight enclosure. Overlaps shall be secured by the use of polyethylene adhesive tape, plastic string or other nondegradable material approved by the ENGINEER and capable of holding the encasement in place until backfilling operations are completed. Pipe and fittings shall be wrapped with polyethylene prior to pouring concrete thrust blocks.



1. Method A - For use with Polyethylene Tubes:
  - a. Cut polyethylene tube to a length approximately two feet (2') longer than the pipe section.
  - b. Slip the tube around the pipe, centering it to provide a one foot (1') overlap on each adjacent pipe section, and bunching it accordion-fashion lengthwise until it clears the pipe ends.
  - c. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation of the polyethylene tube.
  - d. After assembling the pipe joint, make the overlap of the polyethylene tube. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe, and secure it in place. Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width at the top of the pipe to make a snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points.
  - e. Any cuts, tears, punctures, or other damage to the polyethylene shall be repaired in accordance with Paragraph 4.
2. Method B - For use with Polyethylene Tubes:
  - a. Cut polyethylene tube to a length approximately one foot (1') shorter than that of the pipe section. Slip the tube around the pipe, centering it to provide six inches (6") of bare pipe at each end. Take up the slack at the top of the pipe to make a snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points; secure the ends as described herein under Method A.
  - b. Before making a joint, slip a three foot (3') length of polyethylene tube over the end of the preceding pipe section, bunching it accordion-fashion lengthwise. After completing the joint, pull the three foot length of polyethylene over the joint, overlapping the polyethylene

previously installed on each adjacent section of pipe by at least one foot (1').

- c. Any cuts, tears, punctures, or other damage to the polyethylene shall be repaired in accordance with Paragraph 4.

3. Method C - For use with Polyethylene Sheets:

- a. Cut polyethylene sheet to a length approximately two feet (2') longer than that of the pipe section. Center the cut length to provide a one foot (1') overlap on each adjacent pipe section, bunching it until it clears the pipe ends. Wrap the polyethylene around the pipe so that it circumferentially overlaps the top quadrant of the pipe. Secure the cut edge of polyethylene sheet at intervals of approximately three feet (3').
- b. Lower the wrapped pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation of the polyethylene. After completing the joint, make the overlap and secure the ends as described herein under Method A.
- c. Any cuts, tears, punctures, or other damage to the polyethylene shall be repaired in accordance with Paragraph 4.

3. Appurtenances:

Pipe-Shaped Appurtenances:

- a. Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in the same manner as the pipe.

Odd-Shaped Appurtenances:

- a. When it is not practical to wrap valves, tees, crosses and other odd-shaped pieces in a tube, wrap with a flat sheet or split length of polyethylene tube by passing the sheet under the appurtenance and bringing it up around the body. Make seams by bringing the edges together, folding over twice, and taping down.

- b. Tape polyethylene securely in place at valve stem and other penetrations.
4. Repair any cuts, tears, punctures, or damage to polyethylene with polyethylene adhesive tape or with a short length of polyethylene sheet or a tube cut open, wrapped around the pipe to cover the damaged area, and secured in place.
5. Openings in the encasement shall provide for branches, blowoffs, air valves, and similar appurtenances by making an X-shaped cut in the polyethylene and temporarily folding back the film. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut with tape. Service taps and other taps without tapping sleeves should be made directly through the polyethylene after wrapping the pipe with 2-3 layers of polyethylene tape, with any resulting damaged areas being repaired as described herein.
6. Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, extend the polyethylene wrap to cover the adjacent pipe for a distance of at least three feet (3'). Secure the end with circumferential turns of tape. Service lines and other attached lines of dissimilar metals shall be wrapped with polyethylene or a suitable dielectric tape for a minimum clear distance of three feet (3') away from the ductile-iron pipe.
7. Backfilling for Polyethylene-Wrapped Pipe
  - a. Use the same backfill material as specified for pipe without polyethylene wrap, exercising care to prevent damage to the polyethylene wrapping when placing backfill material.
  - b. Backfill material shall be free from cinders, refuse, boulders, rocks, stones, or other material that could damage the polyethylene. Backfill shall be as specified for the pipe without polyethylene encasement.

END OF SECTION

## SECTION 03303

### CONCRETE FOR WATER LINES, SANITARY SEWER MAINS, REPURIFIED WATER LINES, SEWER FORCEMAINS AND APPURTENANCES

#### PART 1 – GENERAL

##### 1.1 SCOPE OF WORK

The work covered by this Section relates to concrete blocking, cradles, anchors, caps, protection, and/or encasement for water and sanitary sewer line appurtenances at the locations shown on the Plans or as directed by the Engineer, and in accordance with the Standard Detail Drawings.

##### 1.2 STANDARD

The standard for this work shall be ACI 301-72 Specifications for Structural Concrete for Buildings (as revised) and as modified by the following supplemental requirements:

###### A. SECTION 3.2 STRENGTH

The minimum compressive strength for Class “B” concrete shall be three thousand (3,000) pounds per square inch in twenty-eight (28) days.

###### B. SECTION 3.4.1 DURABILITY

All concrete exposed to weather shall be air entrained. All concrete that will be underground need not be air entrained.

###### C. SECTION 3.5 SLUMP

Concrete shall be proportional and produced to have a slump of three (3”) inches with a one (1”) inch tolerance.

###### D. SECTION 3.7 ADMIXTURES

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

###### E. SECTION 5.2.1 REINFORCING STEEL

Yield strength of reinforcing steel shall be sixty thousand (60,000) psi.

##### 1.3 RELATED WORK SPECIFIED ELSEWHERE

Refer to other Sections of these Specifications for work related to this Section.

## PART 2 – PRODUCTS

### 2.1 CONCRETE

Class “B” concrete for the water and sanitary sewer line appurtenances listed herein shall conform to the following:

#### A. CEMENT

Cement shall be Portland cement of a brand approved by the Engineers, and shall conform to “Standard Specifications for Portland Cement”, Type 1, ASTM Designation C150, latest revision.

#### B. FINE AGGREGATE

Fine aggregate shall be clean, hard, uncoated sand conforming to ASTM Designation C33, latest revision, “Standard Specifications for Concrete Aggregate”.

#### C. COARSE AGGREGATE

Coarse aggregate shall consist of clean, hard, dense particles of stone or gravel conforming to ASTM Designation C33, latest revision, “Standard Specifications for Concrete Aggregate”. Aggregate shall be well graded between one and one-half (1½”) inches and number four (4) sieve sizes.

#### D. WATER

Water used in mixing concrete shall be clean and free from organic matter, pollutants, and other foreign materials.

#### E. READY-MIX CONCRETE

Ready-mix concrete shall be secured only from a source approved by the Engineers, and shall conform to ASTM Designation C94, latest revision, “Specifications for Ready-Mix Concrete”. Before any concrete is delivered to the job site, the supplier must furnish a statement of the proportions of cement, fine aggregate, and coarse aggregate to be used for each mix ordered, and must receive the Engineer’s approval of such proportions.

### 2.2 STEEL REINFORCING

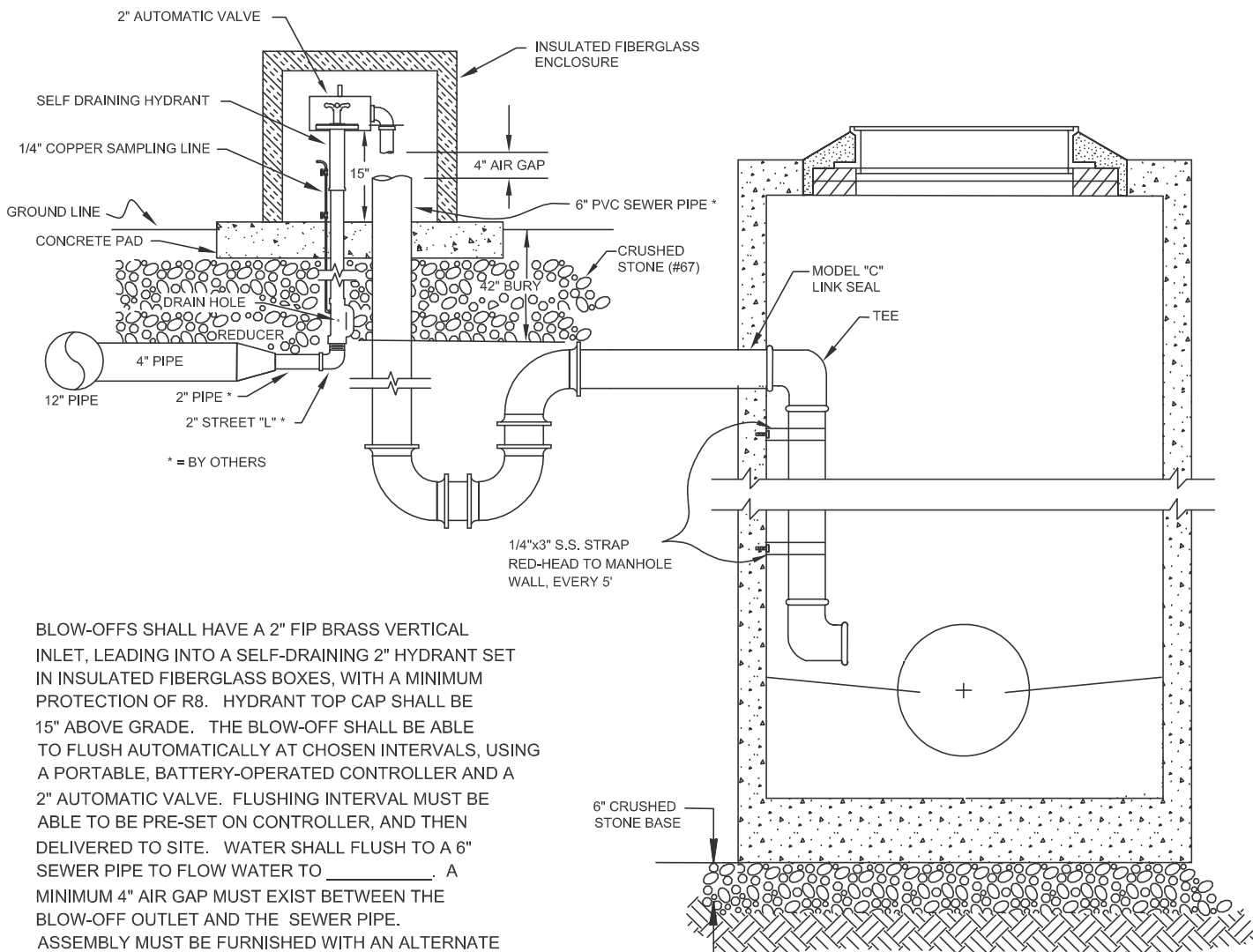
Reinforcing bars shall be intermediate grade steel conforming to ASTM Designation A15, latest revision, “Standard Specifications for Billet Steel Bars for Concrete Reinforcement”. Bars shall be deformed with a cross sectional area at all points equal to that of plain bars of equal nominal size.

## PART 3 – EXECUTION

### 3.1 GENERAL

Place concrete appurtenances at locations shown on the Plans and in accordance with Standard Detail Drawings.

END OF SECTION 03303



BLOW-OFFS SHALL HAVE A 2" FIP BRASS VERTICAL INLET, LEADING INTO A SELF-DRAINING 2" HYDRANT SET IN INSULATED FIBERGLASS BOXES, WITH A MINIMUM PROTECTION OF R8. HYDRANT TOP CAP SHALL BE 15" ABOVE GRADE. THE BLOW-OFF SHALL BE ABLE TO FLUSH AUTOMATICALLY AT CHOSEN INTERVALS, USING A PORTABLE, BATTERY-OPERATED CONTROLLER AND A 2" AUTOMATIC VALVE. FLUSHING INTERVAL MUST BE ABLE TO BE PRE-SET ON CONTROLLER, AND THEN DELIVERED TO SITE. WATER SHALL FLUSH TO A 6" SEWER PIPE TO FLOW WATER TO \_\_\_\_\_. A MINIMUM 4" AIR GAP MUST EXIST BETWEEN THE BLOW-OFF OUTLET AND THE SEWER PIPE. ASSEMBLY MUST BE FURNISHED WITH AN ALTERNATE FLUSHING PIPE FOR MANUAL OPERATION. BLOW-OFF SHALL BE MANUFACTURED BY KUPFERLE FOUNDRY, ST. LOUIS, MO MODEL #9600TS ,OR APPROVED EQUAL.

DRAWING NOT TO SCALE

APRIL 30, 2006  
 DRAWN BY: DWG  
 APPROVED BY: DWG  
 DATE REVISED:

REPURIFIED WATER MAIN  
 BLOW-OFF ASSEMBLY

STANDARD  
 DRAWING NO.  
 R - 1