

CITY OF BONNER SPRINGS, KANSAS

**DIVISION II
CONSTRUCTION AND MATERIAL SPECIFICATIONS**

SECTION 2900 WATERLINES

APPROVED AND ADOPTED THIS 11th DAY OF JULY, 2005
Revised January 28, 2013

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CITY OF BONNER SPRINGS, KANSAS

SECTION 2900 WATERLINES

The purpose of this specification is to govern the furnishing of all materials, labor, equipment, tools, superintendence, and other services necessary to construct water mains, complete with appurtenances including extensions and relocations at the locations shown on the plans, in accordance with the requirements of applicable Sections of the General Provisions and Covenants, and as provided for in the Special Provisions.

SECTION 2901 MATERIALS

2901.1 Scope: This section governs materials for water mains having a diameter of four (4) inches and larger and service lines. All piping shall be restrained

2901.2 Pipe and Fittings:

- A. Ductile-Iron Pipe (DIP):** Unless indicated otherwise on the construction plans, all ductile iron pipes shall be constructed in accordance with all requirements of the latest revision of ANSI A21.51/AWWA C151. All ductile iron pipes shall meet the requirements of pressure Class 350 pipe for sizes twelve (12) inches and smaller, and pressure Class 250 for all pipes larger than twelve (12) inches, unless otherwise indicated by the plans. Pipe shall be manufactured in the USA.

Joints, unless otherwise specified, shall be restrained. Thrust blocks shall not be used to prevent pipe separation. Where push-on type joints are utilized, they shall be of a type that is conforming to ANSI A21.11/AWWA C111, except gaskets shall be synthetic rubber. Natural rubber will not be acceptable. The pipe shall be cement mortar lined, conforming to ANSI A21.4/AWWA C104 and shall be coated inside and out with a bituminous coating.

- B. Ductile-Iron Fittings:** Ductile-iron fittings shall be complete with all accessories and shall be ASTM A536, Grade 80-60-03 or 70-50-05, conforming to ANSI A21.10, AWWA C 110 or ductile iron compact fittings per ANSI A21.53, AWWA C153. Joints shall be mechanical or flanged. Mechanical joints shall conform to ANSI A21.11/AWWA C111 and shall be fully restrained. All fittings shall be cement mortar lined conforming to ANSI A21.4/AWWA C104 and shall be coated inside and out with a bituminous coating. Flanged joints shall conform to ANSI B16.1, 125 pound or U.S. Pipe "Flange-Type." Bolts shall be ASTM A307, chamfered or rounded ends projecting one-fourth (1/4) to one-half (1/2) inch beyond the outer face of the nut which shall be ASTM A307, hexagonal, ANSI B18.2, heavy semi-finished pattern. Gaskets shall conform to ASTM D1330, Grade 1, red rubber, ring type, one-eighth (1/8) inch thick or U.S. Pipe "Flange-Type", one-eighth (1/8) inch thick. Fittings shall have distinctly cast upon them the pressure rating and letters "DI" or "DUCTILE."

- C. Cast-iron Fittings:** Cast-iron fittings shall conform to ANSI A21.10. Joints shall be of the standard mechanical joint type conforming to ANSI A21.10/AWWA C110. All fittings shall be cement mortar lined conforming to ANSI A21.4/AWWA C104, and shall be coated inside and out with a bituminous coating. Flanged joints shall conform to ANSI B16.1, 125 pound or U.S. Pipe "Flange-Type." Bolts shall be ASTM A307, chamfered or rounded ends projecting one-fourth (1/4) to one-half (1/2) inch beyond the outer face of the nut which shall be ASTM A307, hexagonal, ANSI B18.2, heavy semi-finished pattern. Gaskets shall

conform to ASTM D1330, Grade 1, red rubber, ring type, one-eighth (1/8) inch thick or U.S. Pipe "Flange-Type", one-eighth (1/8) inch thick.

- D. Poly(vinyl chloride) Pipe (PVC):** PVC pipes shall meet the requirements of ASTM D1784, Cell Classification 12454-B, for PVC compounds. PVC pipes twelve (12) inches or smaller shall meet the latest revisions of ANSI/AWWA C900, and ANSI/AWWA C905 for pipes larger than twelve (12) inches. All PVC pipes shall meet cast iron O.D. sizes. Materials from which the pipe is manufactured shall have been tested and approved for conveying potable water by the National Sanitation Foundation and so listed by Underwriters Laboratories, and shall be marked with the UL logo. Where fittings are required, cast or ductile-iron fittings shall be used.

Pipe wall thickness shall be as required to provide a minimum wall thickness with a Dimension Ratio (DR) of 18 for a maximum working pressure of 150 psi and a DR of 14 for a maximum working pressure of 200 psi as defined in ANSI/AWWA C900 and C905.

Joints, unless otherwise specified, shall be restrained (Eagle Loc 900, Fusible PVC, or approved equal). Thrust blocks shall not be used to prevent pipe separation. Where slip-on type joints are utilized, they shall be of a type that is conforming to slip-on type with integral bell and spigot pipe, meeting the requirements of ASTM D3139. Flexible elastomeric gaskets shall meet the requirements of ASTM F477 except they shall be synthetic rubber. Natural rubber will not be acceptable. Solvent weld joints are not allowed.

- E. Prestressed Concrete Steel Cylinder Pipe (PCCP):** Prestressed concrete steel cylinder pipe shall be as set forth by AWWA C301 or the latest revision thereof, for prestressed concrete pressure pipe, steel cylinder type. Joints shall be gasketed.

PCCP shall be designed for 150 psi working pressure unless otherwise indicated in the Special Provisions or drawings. PCCP shall be properly prestressed to accommodate the trench backfill loads at the depths shown on the drawings.

All specials and fittings shall conform to requirements of AWWA C301 and shall be designed and fabricated to accommodate pressure and backfill load stresses equal to or greater than the connecting piping.

Each length of pipe and all specials and fittings shall be marked to show the proper location in the line. Schedules and drawings shall be submitted to the Engineer for approval prior to manufacture or shipment as required in Section 1.5 of AWWA C301.

Installation of PCCP, shall conform to both the requirements of the project specifications and the recommendations by the manufacturer as approved by the Engineer. Joint grouting of gasketed joints will be required as recommended by the manufacturer and as approved by the Engineer.

- F. High-Density Poly Ethylene (HDPE) Pipe and Fittings:** Materials used for the manufacture of polyethylene pipe and fittings shall be PE 3408 high density polyethylene meeting cell classification 345464C for black or 345464E for color and stripes per ASTM D 3350; and shall be listed in the name of the pipe and fitting Manufacturer in PPI (Plastics Pipe Institute) TR-4 with a standard grade HDB rating of 1600 psi at 73°F. The Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements. The fitting material may be gray or black. Polyethylene pipe and fittings shall be supplied by the same

qualified and approved manufacturer. Materials from which the pipe is manufactured shall have been tested and approved for conveying potable water by the National Sanitation Foundation and so listed by Underwriters Laboratories, and shall be marked with the UL logo. Joints shall be restrained and thrust blocks shall not be required to prevent pipe separation.

1. **Polyethylene Pipe:** Pipe shall be manufactured in accordance with ASTM F 714 and shall be so marked. Each production lot of material or pipe shall be tested for melt index, density and for black pipe, % carbon. Each production lot of pipe shall be tested for dimensions and ring tensile strength.
2. **Polyethylene Fittings:** Polyethylene fittings shall be molded or fabricated by the approved pipe manufacturer. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe. Molded polyethylene fittings shall be manufactured in accordance with ASTM D 3261 and shall be so marked.
3. **Polyethylene Flange Adapters:** Flange adapters with manufacturer recommended back-up ring shall be made with sufficient through-bore length to be clamped in a butt fusion-joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves (serrations) to promote gasketless sealing, or restrain the gasket against blowout.
4. **MJ Adapters:** MJ Adapters shall have a stainless steel stiffener that is mechanically locked into the adapter.

2901.3 Valves and Valve Boxes:

- A. **Gate Valves:** The type, size, and location of all valves shall be as shown on the Plans. Except as modified or provided herein, valves shall be rated at 250 psi working pressure and 500 psi test pressure with a cast iron or ductile iron body and non-rising stems. Valves shall meet the requirements of NSF-61. Gate valves shall be resilient-seated conforming with all applicable requirements of ANSI/AWWA C509 or ANSI/AWWA C515 and shall be American Flow Control Series 2500, Mueller A2360, or Mueller A2361.
- B. **Valve Ends:** Valve ends shall be of the mechanical joint type, conforming to ANSI A21.11/AWWA C111 except where flanged ends are required by the drawings and specifications.
- C. **Bonnet Thrust Plates:** The bonnet shall have a removable thrust plate to permit the removal and replacement of the valve stem and "O" ring seal while the valve is in service.
- D. **Stem Seals and Coatings:**
 1. All valves shall be provided with stem seals of the "O" ring type. Two "O" rings shall be used with at least one "O" ring inserted above the thrust collar. The packing plate shall be attached to the valve bonnet by not less than three (3) bolts with one "O" ring below the thrust collar.
 2. All exterior surfaces of each valve shall be cleaned and painted in the shop with two (2) coats of asphalt varnish conforming to Federal Specifications TT-V-51-E or be epoxy coated. The interior surfaces of resilient-seated gate valves shall have a protective

coating of fusion bonded, nontoxic epoxy, which is safe for potable water.

E. Valve Operation: All valves shall be equipped with a two (2) inch square wrench nut and the direction of rotation to open the valve shall be to the left (counterclockwise) unless otherwise noted in the Special Provisions.

F. Extension Stems: When the distance from the top of the valve cover to the valve operating nut exceeds 3 feet, each buried valve shall be provided with in extension stem and operating nut to conform with Standard Drawings.

G. Valve Boxes, Bases, Lids and Covers:

1. Two-piece Valve Box and Base:

a. Valve Boxes: Boxes shall be six (6) inch C900 with the same DR as any six (6) inch waterline present (minimum of DR 18) or ASTM D-3034 DR 23.5 minimum.

b. Lids and Covers: Valve lids and covers for use in grass, sidewalks, and pavement less than five (5) inches thick shall be Clay & Bailey No. 2194 or approved equal. In thicker pavement, valve lids and covers shall be Clay & Bailey No. 2196 or an approved equal. Valve lids shall have "Water" cast into the lid.

2901.4 Fire Hydrants:

A. General: Fire hydrants shall be Mueller Super Centurion 250 or American Flow Control American Darling B-84-B and shall be installed with a six (6) inch auxiliary gate valve. The fire hydrants shall be rated at 250 psi working pressure and 500 psi test pressure. Hydrants shall be traffic model with breakaway flange or coupling. Fire hydrants shall conform to AWWA C502 and the following:

Type of Shutoff	Compression
Size of Hydrants	5 ¼ inches
Inlet Connection	6 inches
Outlet Nozzles	2 – 2 ½ inch hose and 1 – 4 ½ inch pumper
Outlet Nozzle Threads	ANSI B-26
Direction to Open	Counterclockwise
Stem Seals	O-ring
Outlet Nozzle Cap Chains	Required
Drain Outlet	Required
Finish Paint	<u>Factory painted</u> above the ground line with yellow enameled paint
Weather Cap on Operating Nut	Required
Oil Reservoir or Grease Chamber	Required

Hydrants shall be supplied by the Contractor with all joint glands, gaskets, bolts, and nuts required for installation. Hydrants shall be set in accordance with Section 2902.7.

2901.5 Specials:

A. General: Air release, meter, and pressure-reducing valve vaults shall be precast concrete conforming to ASTM C478. Access lid castings shall be as noted in the Special Provisions or

as shown on the plans.

Vaults which, by their special nature must be cast in-place, shall conform to the plans and concrete specifications in Section 2901.8.

- B. Pressure-Reducing Valves:** Pressure-reducing valves shall be designed to provide tight shutoff under conditions of no flow and shall not "hunt" under ordinary flow conditions. Pressure-reducing valves shall be as noted in the Special Provisions, and selected and sized as recommended by the valve manufacturer. Pressure-reducing valves shall be suitable for operation under the pressure and flow conditions as shown on the plans.
- C. Combination Air Valves:** Combination air-release and vacuum-relief valves shall be installed at high points in water mains where air can accumulate and a fire hydrant is not required. Automatic air release valves shall not be installed in areas where flooding of the manhole chamber may occur. Each valve assembly shall be installed complete with appropriate piping and valves as shown in the standard drawings. All piping and isolation valves shall be brass except for the air outlet from the valve, which shall be brass or copper tubing. The open end of an automatic air relief valve shall extend at least one foot above grade and provided with a screen and be downward facing.

Combination air release and vacuum relief valves shall be of the integral type with a valve assembly which functions as both an air and vacuum valve and an air release valve and shall meet or exceed ANSI/AWWA 512 standards. Valves shall have stainless steel floats and all working parts shall be brass, stainless steel, or other non-corroding materials. Valves shall have a minimum two (2) inch inlet connection.

Shutoff valves shall be provided to isolate the piping to each combination air release and vacuum relief valve assembly. Shutoff valves shall be a minimum two (2) inch solid wedge gate valves.

- D. Tapping Sleeves and Valves:** Tapping sleeves and valves of the type and size indicated shall be furnished and installed where shown on the Plans. Except as modified or provided herein, valves shall meet the same requirements as gate valves previously listed except that the outlet end shall be standard mechanical joint end conforming to ANSI A21.11/AWWA C111 and the inlet end shall have an inlet flange conforming to ANSI B16.1 for mating to the tapping sleeve unless explicitly provided for otherwise in the plans and Special Provisions.

2901.6 Bedding Material:

- A. Pipe Embedment:** Embedment for pipe shall be in accordance with these specifications, the City of Bonner Springs standard drawings, and details of the laying condition as specified.
- B. Granular Bedding:** Granular bedding shall be crushed rock with not less than 95 percent passing a one-half (½) inch screen and not less than 95 percent retained on a No.4 screen. Place in not more than six (6) inch layers, and compact by slicing with a shovel or vibrating.
- C. Buckshot:** Buckshot aggregate material shall be used as granular materials for embedment of PVC and HPDE pipe and for backfilling pavement excavations. Place in not more than six (6) inch layers and compact by slicing with a shovel or vibrating. The gradation for the material shall be as follows:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
3/8-inch	100
No. 4	60-80
No. 10	0-15

D. Hand-Placed Embedment: Hand-placed embedment shall be finely divided, job-excavated material free from debris, organic material, frozen materials, and stones placed by machine or hand in uniform layers not more than 8 inches thick and tamped around the water main. Granular embedment material may be substituted for all or part of this embedment type.

2901.7 Polyethylene Encasement: Metal pipe and fittings shall be installed with a polyethylene tube encasement having a minimum thickness of 0.008" (8 mils) and conforming to ANSI/AWWA C105/A21.5.

2901.8 Location Wire and Tape:

A. Location Wire: Location wire shall be minimum 14 gauge, insulated with blue polyethylene, be steel core with copper cladding, and marketed by the manufacturer for direct bury applications. THHN insulated wire shall not be used. Split bolt connectors, gel encapsulated splice kits (3M DBR-6 Direct Bury Splice Kits or approved equal) or approved equal service connectors shall be used at splice points to maintain electric continuity.

B. Marking Tape: Marking tape shall be constructed of chemically inert material, 4.0 mils thick minimum, 6 inches wide, and marked in chemically inert ink. Neither tape nor ink shall degrade when exposed to acids, alkalies and other destructive substances commonly found in soil. The marking tape shall be blue in color and have "Water Line" printed on the tape at 20 to 30 inch intervals. Tape shall be a tape such as Tara Tape® marking tape from Reef Industries or engineer approved equal.

2901.9 Concrete:

A. Scope: This specification is intended primarily for concrete thrust blocks, encasements and vaults (refer to Standard Drawings). Concrete for all driveway, sidewalk, roadway pavement and/or curb and gutter replacement shall conform to the requirements of other sections.

B. General: The concrete shall be MCIB A618-1-4 as designated by the Mid-West Concrete Industry Board, Inc., Kansas City, Missouri.

1. The cement shall be Portland Cement Type I unless high early strength is required in which instance Type III shall be used. All cement shall conform to the "Standard Specification for Portland Cement," ASTM C150.
2. All aggregates shall conform to the appropriate bulletins and specifications of the Mid-West Concrete Industry Board, Inc.
3. Water for mixing and curing concrete shall be clean and free from injurious amounts of sewage, oil, acid, alkali, salt or organic matter. Only potable water will be acceptable without testing. Total water content of concrete shall not exceed 6.5 gallons of water per 100 pounds of cement in the mix.
4. Ready-mixed concrete shall be used unless otherwise permitted by the Engineer. Ready-

mixed concrete shall be mixed and delivered in accordance with the requirements set forth in the "Standard Specifications for Ready-Mixed Concrete," ASTM C94.

5. All concrete shall cure for twenty-four (24) hours prior to backfill.

2901.10 Casing Pipe: Casing pipe shall be used where required at railroad or highway crossings. The casing pipe shall be in accordance with the Special Provisions and meet the requirements of the railroad or highway authority with regard to type of material, wall thickness and coating of casing pipe. No casing will be installed without the approval of the involved highway or railroad authority. In lieu of casing pipe, tunneling may be allowed for large waterline projects if provided in the Special Provisions.

For pipe installed inside a casing pipe or tunnel liner, corrosion resistant factory made casing spacers shall be utilized. The ends of each casing pipe or tunnel liner shall be closed with corrosion resistant factory made end seals such as neoprene with stainless steel bands or as shown on the plans. The closures for each casing pipe or tunnel liner shall not be constructed until all testing of the line has been completed and accepted.

SECTION 2902 CONSTRUCTION DETAILS

2902.1 Grading and Excavation:

- A. Scope:** Excavation and trenching work shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching as required; the handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of subgrades; pumping and dewatering as necessary or required; protection of adjacent property; and other appurtenant work.
- B. General:** Excavation and trenching work shall be performed in a safe and proper manner with suitable precautions being taken against all hazards.

The Contractor shall explore and expose any and all obstructions in advance of excavation so that minor changes in grade and alignment may be made.

In paralleling present water and gas mains, the Contractor shall protect all service connections and shall arrange to furnish service to the consumers with minimum interruption.

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street drainage.

- C. Classification of Excavated Material:** No classification of excavated materials will be made unless specifically stated in the proposal and contract. When specifically indicated in the proposal and contract, classification of excavated materials will be made as follows:
 1. **Rock:** Rock excavation will be so classified where sandstone, limestone, blue shale or other similar material is encountered and, in the Engineer's opinion, requires drilling or blasting to remove the material.

2. Earth: All material not classified as rock.

Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work regardless of the type, character, composition, or condition thereof.

D. Blasting: The Contractor shall comply with all laws, ordinances, applicable safety code requirements, and regulations relative to the handling, storage, and use of explosives and the protection of life and property. The Contractor shall be responsible for all damage caused by their blasting operations and shall be responsible for responding to all complaints. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation of the trench.

The Contractor shall not blast any rock or other materials or allow the same to be done in prosecution of the work unless he secures proper insurance coverage and a blasting permit from City Hall, as required by the Bonner Springs Municipal Code.

Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials, except as the Engineer specifies or directs. All unusable or excess rock materials shall be removed from the site and disposed of in an approved location.

When the Engineer requires, the Contractor shall provide a pre-blast survey of all structures located within 1,000 feet of his blast sites. The survey shall be of such nature as to accurately establish the structural condition of all houses, buildings, bridges, overpasses, etc., within the specified area. No blasting shall be allowed until the pre-blast survey has been completed and has been reviewed and accepted by the Engineer. The Contractor must submit to the Engineer pre-blast survey reports for all structures within the specified area. The pre-blast survey shall be performed by qualified personnel regularly engaged in blast operations.

Before blasting is started, the Contractor shall inform all residents within a radius of 1,000 feet of the blasting location by means of printed information sheets, news releases or other acceptable methods.

The Contractor shall provide suitable warning by siren or whistle prior to all blasts.

When blasting is to occur within 500 feet of any structure adjacent to the blast site, the Contractor shall obtain ground vibration monitoring and interpretation for each blast by qualified personnel regularly engaged in blast operation monitoring and control. One copy of the recorded data from each blast, including the computed interpretations, shall be furnished to the Engineer. Maximum particle velocity allowed shall be two (2) inches per second. To reduce annoyance to local residents, vibration should be kept as much below the two (2) inch per second level as possible and still permit efficient performance of the required demolition work.

The requirements presented herein shall not relieve the Contractor from the responsibility to avoid disturbing earth or rock beyond indicated and specified lines and levels.

E. Unauthorized Excavation: Any part of the trench excavated below grade shall be corrected with material approved by the Engineer placed and compacted by the Contractor.

- F. Removal of Water:** The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

All excavations for concrete structures or trenches which extend down to or below static groundwater elevations shall be dewatered by lowering and maintaining the groundwater surface beneath such excavations a distance of not less than 12 inches below the bottom of the excavation.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property. Contractor shall be responsible for obtaining all applicable water discharge permits.

The Contractor will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

- G. Sheeting and Shoring:** Except where banks are cut back on a stable slope, excavation for structures and trenches shall be properly and substantially sheeted, braced, or shored as necessary to prevent caving or sliding, to provide protection for workmen and the work, and to provide protection for existing structures and facilities. Sheeting, bracing, and shoring shall be designed and built to withstand all loads that might be caused by earth movement or pressure and shall be rigid, maintaining shape and position under all circumstances.

Trench sheeting shall not be pulled unless pipe strength is sufficient to carry trench loads based on trench width to the back of sheeting. Sheeting shall not be pulled after backfilling. When ordered by the Engineer, wood sheeting shall be left permanently in the trench.

Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

- H. Stabilization:** Trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen.

Trench bottoms which are otherwise solid but which become mucky on top due to construction operations shall be reinforced with one or more layers of crushed stone or gravel. Not more than one-half ($\frac{1}{2}$) inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon.

- I. Trench Excavation:** The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. One block or 300 feet, whichever is the shorter, shall be the maximum length of open trench ahead of pipe laying unless the Engineer provides written permission stating otherwise.

Except where tunneling or boring and jacking is specified and shown on the plan by the Engineer, all trench excavations shall be open cut.

The alignment, depth, and grade of all trenches shall be maintained as shown on the drawings by overhead grade lines parallel to the pipe invert.

All open trenches shall be provided with adequate protective devices.

- J. Alignment and Grade:** The alignment and grade or elevation of the pipeline shall be maintained as shown on the contract drawings by overhead grade lines parallel to the pipe invert. When a minimum distance note between the pipe and the finished ground line or existing ground line are indicated on the drawings the Contractor shall install the pipe with the minimum cover indicated. Depths greater than the minimum cover maybe required in order to provide vertical deflection without installing fittings and still maintain maximum deflection angles as required by the manufacturer.

The Contractor must maintain a constant check of the pipe alignment and trench depth and will be held responsible for any deviations there from.

Unless otherwise set forth by the Engineer, the horizontal alignment and vertical elevations of the water main shall be maintained to within three inches as shown on the plans. Pipe deflection angles at the joint shall not exceed the pipe manufacturer's requirements and in no circumstances shall ductile iron pipe exceed those requirements indicated in AWWA C600.

Where profiles for vertical elevations are not provided on the drawings, the pipe shall be installed at such a depth as to meet minimum cover requirements. Vertical deflection angle requirements indicated above shall apply. The contractor shall install the water main in such a manner as to avoid or minimize the number of unnecessary high points in the line. If in the opinion of the Engineer, the Contractor has created such an unnecessary high point, the Contractor shall re-install that portion of the water main as to correct the high point at no cost to the City.

The maximum depth of cover over the water main shall not exceed five (5) feet unless otherwise indicated on the drawings.

- K. Minimum Cover:** Except where otherwise shown, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe as indicated below:

1. 48" of cover for up to 16" pipes
2. 60" of cover for pipes larger than 16"

Greater pipe cover depths may be necessary where existing pipe, conduits, drains, drainage structures, or other obstructions are encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside pipe top to finish grade or pavement surface elevations.

- L. Limiting Trench Width:** Trenches shall be excavated to a width, which will provide adequate working space and pipe clearances for proper pipe installation, jointing, and embedment. However, the limiting trench widths below an elevation six (6) inches above the

top of the installed pipe shall be as follows:

Trench Width

<u>Pipe Size</u>	<u>Minimum Trench Width In Earth</u>	<u>Maximum Trench Width In Earth</u>	<u>Minimum Clearance In Rock</u>
4"	16"	28"	6"
6"	18"	30"	6"
8"	20"	32"	6"
10"	22"	34"	6"
12"	24"	36"	6"
16"	28"	40"	6"
20"	36"	44"	9"
24"	40"	48"	9"
30"	48"	54"	9"
36"	54"	60"	9"

Where necessary to reduce earth load on trench banks to prevent sliding and caving, banks may be cut back on slopes which shall not extend lower than one (1) foot above the pipe top.

M. Unauthorized Trench Widths: When, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in the foregoing tables, either pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required by loading conditions and as determined by the Engineer, shall be furnished and installed by and at the Contractor's expense.

N. Trench Bottom in Earth: The trench in earth shall have a flat bottom the full width of the trench and shall be over-excavated and bedded to the grade to which the pipe is to be laid. The bedding shall be graded to provide a uniform bearing and continuous support for each pipe at every point along its entire length.

The bedding material shall be as specified in Section 2901.6 and also as shown on the Standard Drawings.

O. Bell Holes: Bell holes for the pipe shall be dug after the trench has been cut to proper grade and immediately prior to the laying of the pipe length. No part of the bell shall be in contact with the trench bottom.

P. Removed.

Q. Rock Exploration: Unless shown otherwise on the plans or noted in the Special Provisions, no rock exploration has been made. On those projects where rock exploration has been made, test holes have been drilled at locations and intervals as shown on the plans or subsurface information report to determine the approximate location and rock depth. Resistance to penetration was assumed to be "solid rock". This information is furnished for general reference purposes only.

The Contractor must form his own opinion as to the character of materials which will be encountered from an inspection in the ground, from his own investigation of the test hole information, or from such other investigations as he may desire.

R. Trench Bottoms in Rock: All rock excavation shall be carried to a minimum of six (6) inches below the pipe bottom. For PVC and HDPE pipe, trench excavation shall be carried to a minimum of 12" below the bottom of the pipe. Granular pipe embedment material shall be used to restore the trench bottom to the desired elevation and grade and to provide a uniform bearing and continuous support for the pipe along its entire length. Care shall be exercised to prevent any portion of the pipe from coming to bear on solid rock or boulders.

S. Mechanical Excavation: The use of mechanical equipment will not be permitted in locations where its operations would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand-excavating methods shall be used.

Mechanical equipment used for trench excavation shall be of the type, design, and construction and shall be so operated that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from the bottom of the trench, and that trench alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

If desired, the Contractor may undercut the trench bottom and bring it to grade with five-eighths (5/8) inch crushed rock, provided that the depth of the undercut and backfill with crushed rock shall not exceed six (6) inches. Where crushed rock is used, it shall be placed in the trench, spread uniformly, and graded prior to placing the pipe in the trench.

All mechanical trenching equipment, its operating conditions, and the manner of its operations shall be subject at all times to the approval of the Engineer.

T. Stream Crossings: Pipe throughout the crossing shall be restrained to prevent separation through the use of restrained joint pipe or set screw retainer glands.

The trench width shall be as required for proper pipe installation and the trench depth shall be as required to give five (5) feet minimum cover unless navigable. See standard detail 29-16. Navigable streams require a seven (7) foot minimum depth from bottom of streambed to top of pipe. The trench shall be excavated a sufficient distance from the stream or drainage way to prevent excess bending of pipe. Concrete pipe encasement shall be required from bank to bank of the stream or drainage way and shall be placed as indicated on the plans.

The construction of riprap for erosion prevention will be required at all stream or drainage way bottoms and slopes.

U. Highway and Railroad Crossings: The Contractor shall make highway and railroad crossing in accordance with these specifications, the Special Provisions and as shown on the plans.

All construction or work performed and all operations of the Contractor, his employees, or his subcontractors within the limits of highway or railroad right-of-ways shall be in conformity with all the requirements, regulations and be under the control (through the Engineer) of the City.

The Contractor shall pay all fees and obtain all necessary permits to make the crossings

unless otherwise directed.

2902.2 Installation:

A. General: Laying of ductile-iron pipe, poly(vinyl chloride) pipe, prestressed concrete steel cylinder pipe, and High-Density Poly Ethylene (HDPE) Pipe; installation of valves, and hydrants; and embedment and backfill shall conform to the following specifications and the details as shown on the plans. Installation shall conform to AWWA C600 (Standard for Installation of Ductile-Iron Mains and Their Appurtenances), AWWA 605 (Standard for Underground Installation of PVC and PVC Pressure Pipe and Fittings) or AWWA C906 (Standard for Polyethylene (PE) Pressure Pipe and Fittings) as applicable.

1. Unless otherwise specified or shown on the plans, the water mains shall have a minimum depth of cover as indicated in Section 2902.1.K.
2. Whenever pipe laying is stopped, the open end of the line shall be sealed with a watertight plug which will prevent trench water from entering the pipe.
3. Pipe is to be installed inside a casing pipe or tunnel liner, tested, and then sealed. Sand fill shall be used when shown on the plans or required by the Special Provisions. The closures for each casing pipe or tunnel liner shall not be constructed until all testing of the line has been completed and accepted.

B. Poly(vinyl chloride) Pipe:

1. Handling: Pipe, fittings, and other accessories shall at all times be handled with care to avoid damage. Under no circumstances shall they be dropped. Pipe fittings shall be handled as specified for ductile-iron pipe. Any damaged pipe shall be rejected.
2. Cutting Pipe: All pipe shall be cut with a saw or special cutting tool. Cutting shall be done in a neat manner without damage to the pipe. Cuts shall be smooth, straight and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed and beveled. Beveling shall be done with a specifically designed beveling tool. Hand beveling will not be allowed. When cutting pipe with couplings, mark the field cut pipe end the same distance in as the mark appeared on the original full-length pipe section.
3. Cleaning: The interior of all pipes shall be thoroughly cleaned of foreign matter before being installed and shall be kept clean until the work has been accepted.
4. Inspection: Pipes shall be carefully examined for cracks and other defects immediately before installation. All defective, damaged, or unsound pipe shall be rejected and marked as such and removed from the site of the work.
5. Alignment: Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the pipe manufacturers requirements.
6. Pipe Laying: PVC pipe shall be installed in strict accordance with the requirements and instructions of the pipe manufacturer. The pipe shall be protected from lateral displacement and deflection by pipe embedment material installed as specified for pipe embedment and as shown on the Standard Drawings. No pipe shall be laid under unsuitable trench conditions. Whenever pipe laying is stopped, the open end of the line

shall be sealed with a watertight plug which will prevent trench water from entering the pipe.

C. Ductile Iron Pipe:

1. Handling: Pipe, fittings and accessories shall be handled in a manner that will ensure installation in a sound, undamaged condition. Equipment, tools, and methods used in unloading, reloading, hauling, and laying pipe and fittings shall be such that the pipe, pipe coating, and fittings are not damaged. Hooks shall not be used. Under no circumstances shall pipe or accessories be dropped or dumped. Pipe and fittings on which the cement lining has been broken or loosened shall be replaced by the Contractor. Where the damaged areas are small and readily accessible, the Contractor may be permitted to repair the lining.

All pipe coating which has been damaged shall be repaired by the Contractor before installing the pipe.

2. Cutting Pipe: Ductile-iron pipe shall be cut with either a saw or an abrasive wheel. Cutting of existing cast-iron pipe shall be done with either a saw or abrasive wheel, or when there is a free end, with mechanical pipe cutters. The cutting of pipe with a torch will not be permitted.

Cutting shall be done in a neat manner without damage to the pipe, or the cement lining. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed with a file to remove all roughness and sharp corners.

3. Cleaning: The interior of all pipe and fittings shall be thoroughly cleaned of foreign matter before being installed and shall be kept clean until the work has been accepted. Such surfaces shall be wire brushed, if necessary, wiped clean, and kept clean until jointing is completed.
4. Inspection: Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. Spigot ends shall be examined with particular care since they are vulnerable to damage from handling. All defective, damaged, or unsound pipe and fittings shall be rejected and marked as such and removed from the site of the work.
5. Alignment of Bell-and-Spigot Pipe: Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the quantities stipulated in Tables 3 and 4 of ANSI/AWWA C600.
6. Pipe Laying: The pipe shall be installed in strict accordance with the requirements and instructions of the pipe manufacturer. The pipe shall be protected from lateral displacement and deflection by pipe embedment material installed as specified for pipe embedment and as shown on the Standard Drawings. No pipe shall be laid under unsuitable trench conditions. Whenever pipe laying is stopped, the open end of the line shall be sealed with a watertight plug which will prevent trench water from entering the pipe

D. Prestressed Concrete Steel Cylinder Pipe:

1. Handling: Pipe, fittings, and other accessories shall at all times be handled with care to

avoid damage. Under no circumstances shall they be dropped. Pipe and project specific fittings shall be handled per manufacturer's recommendations. Any damaged pipe shall be rejected.

2. Cutting Pipe: The pipe manufacturer shall produce all project specific pipe lengths and fittings. Field cutting of PCCP is not allowed unless otherwise approved by the pipe manufacturer for specific situations.
3. Cleaning: The interior of all pipe and fittings shall be thoroughly cleaned of foreign matter before being installed and shall be kept clean until the work has been accepted.
4. Inspection: Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. All defective, damaged, or unsound pipe and fittings shall be rejected and marked as such and removed from the site of the work.
5. Alignment: Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the pipe manufacturer's requirements.
6. Pipe Laying: The pipe shall be installed in strict accordance with the requirements and instructions of the pipe manufacturer. The pipe shall be protected from lateral displacement and deflection by pipe embedment material installed as specified for pipe embedment and as shown on the Standard Drawings. No pipe shall be laid under unsuitable trench conditions. Whenever pipe installation is stopped, the open end of the line shall be sealed with a watertight plug, which will prevent trench water from entering the pipe.

E. High-Density Poly Ethylene (HDPE) Pipe and Fittings:

1. Handling: When lifting with slings, only wide fabric choker slings capable of safely carrying the load shall be used to lift, move, or lower pipe and fittings. Wire rope and chain are prohibited. Slings shall be of sufficient capacity for the load, and shall be inspected before use. Worn or damaged equipment shall not be used. Any damaged pipe shall be rejected.
2. Cutting Pipe: All pipe shall be cut with a saw or special cutting tool. Cutting shall be done in a neat manner without damage to the pipe. Cuts shall be smooth, straight and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed as required for joining process.
3. Cleaning: The interior of all pipe and fittings shall be thoroughly cleaned of foreign matter before being installed and shall be kept clean until the work has been accepted.
4. Inspection: Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. All defective, damaged, or unsound pipe and fittings shall be rejected and marked as such and removed from the site of the work.
5. Alignment: Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the pipe manufacturer's requirements.
6. Pipe Laying: The pipe shall be installed in strict accordance with the requirements and instructions of the pipe manufacturer. The pipe shall be protected from lateral

displacement and deflection by pipe embedment material installed as specified for pipe embedment and as shown on the Standard Drawings. Embedment material soil type and particle size shall be in accordance with ASTM D 2774. Embedment shall be placed and compacted to at least 90% Standard Proctor Density in 6" lifts to at least 12" above the pipe crown. During embedment placement and compaction, care shall be taken to ensure that the haunch areas below the pipe springline are completely filled and free of voids. Pipe shall not be installed out of round. No pipe shall be laid under unsuitable trench conditions. Whenever pipe installation is stopped, the open end of the line shall be sealed with a watertight plug, which will prevent trench water from entering the pipe.

2902.3 Jointing:

- A. Push-on Joints:** Push-on joints shall conform to ANSI A21.1, except the gaskets shall be neoprene or other synthetic rubber. Natural rubber will not be acceptable.

In the case of the push-on joint, the gasket seat in the bell shall be wiped clean with a cloth, after which the gasket should be sprung into place. Thereafter, a thick film of lubricant should be applied to all of the inner surface of the gasket which will come into contact with the entering pipe.

The lubricant and the gaskets shall be as recommended and supplied by the manufacturer of the pipe being used. The lubricant shall be odorless, tasteless and non-toxic.

The pipe's plain end shall be wiped clean and a thin lubricant film shall be applied to the pipe's outside and beveled edge. The pipe's plain end should then be placed in approximate alignment with the bell of the pipe to which it is to be joined. The joint can be made up with the entering pipe deflected at an angle, but this angle should not exceed the manufacturer's recommended maximum. The pipe's plain end should then be lifted and started into the socket so that it is in contact with the gasket.

The joint is made up by exerting sufficient force on the entering pipe so that its plain end is moved past the gasket (which is thereby compressed) until the pipe reaches the reference line on the male end of the pipe. This force can be applied by means of a jack-type tool or backhoe.

Field cut pipe, in the case of the push-on joint, shall be bevel to remove any sharp or rough edges which otherwise might damage the gasket.

- B. Mechanical Joints:** Gray iron mechanical joint fittings shall conform to ANSI A21.10, 250 psi pressure rating. Ductile iron mechanical joint fittings shall conform to ANSI A21.10, 350 psi pressure rating, ASTM A536, Grade 80-60-03 or 70-50-05. Pipe sockets, socket flanges, packing glands, gaskets, and bolts shall conform to ANSI 21.11.

The mechanical joint shall be used only where shown on drawings or called for in the specifications. The rubber gasket and packing gland shall, after proper joint cleaning, be in position on the spigot before shoving the pipe to its final position. It is important that the entering spigot is centered in, and that the gland or follower ring is parallel to the face of the connection bell. At joints where angular deflections are required, the gasket should be shoved home and the gland properly positioned with respect to the connecting bell with the connection pipes being in as nearly perfect alignment as practicable. The bolts shall be slightly and uniformly tightened as specified hereinafter.

Immediately prior to connecting any two mechanical joint piping units, the gasket shall be coated with soapy water and all surfaces of the bell, spigot and gland which will come in contact with the gasket at any time during assembly shall be wire brushed, wiped clean, coated with soapy water and the gland and gasket slipped over the pipe's spigot end. The spigot shall then be inserted to the full depth of the socket and then retracted (a) one-eighth (1/8) inch in straight runs or (b) one-half (1/2) of the amount of the calculated joint opening in the plane of deflection (assuming that the pipe is shoved home and the retraction amount is assured with the two connecting pipes in alignment).

The gasket shall then be carefully pushed into position and evenly seated in the bell. The gland shall be shoved into place against the gasket, the bolts inserted, and the nuts tightened with the fingers until snug. Final bolt tightening shall be done with a ratchet torque wrench.

It is essential that the gland be brought toward the pipe flange (bell face) evenly, maintaining approximately the same distance between the gland and the bell face at all points around its circumference. This may be done by partially tightening the bottom bolt, then the top bolt, next the bolts on either side, and finally the remaining bolts, alternately tightening bolts 180 degrees apart. This cycle is to be repeated until all bolts are tightened to a torque value of:

5/8" bolts	40 to 60 foot pounds
3/4" bolts	60 to 90 foot pounds

If effective sealing is not obtained at the maximum torque specified for the bolt size used, the joint shall be disassembled, thoroughly cleaned and reassembled. Overstressing of bolts to compensate for poor installation practice will not be permitted.

- C. Flanged Joints:** Flanges shall conform to ANSI B16.1, 125 pound or U.S. Pipe "Flange-Type". Bolts shall be ASTM A307, chamfered or rounded ends projecting one-fourth (1/4) to one-half (1/2) inch beyond the outer face of the nut, which shall be ASTM A307, hexagonal, ANSI B18.2, heavy semi-finished pattern. Gaskets shall conform to ASTM D1330, Grade 1, red rubber, ring type, one-eighth (1/8) inch thick or U.S. Pipe "Flange-Type", one-eighth (1/8) inch thick.

The pipe end and flange face shall be machine finished in a single operation. Flange faces shall be flat and perpendicular to the pipe centerline.

When bolting flanged joints, care shall be taken to insure that there is no restraint on the opposite pipe end or fitting which would prevent uniform gasket compression or cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bell and spigot joints shall not be packed or assembled until all flanged joints affected thereby have been tightened. Bolts shall be tightened gradually and at a uniform rate, so that gasket compression is uniform.

- D. Restrained Joints:** Restrained joints for pipe larger than twelve (12) inches shall be American "Lockfast", U.S. Pipe "Lok-Type", or Clow "Super-Lock". Restrained joints for pipe twelve (12) inches and smaller shall be American "Lock-Fastite" (ductile iron pipe), U.S. Pipe "Loc-Tyton", or Clow "Super-Lok".

Restrained joint pipe shall be used where shown on the drawings and shall be installed in accordance with the recommendations of the pipe manufacturer. Each restrained joint shall

be capable of resisting the thrust of the pressures to be applied.

- E. Butt Fusion Joints:** Joints between plain end pipes and fittings shall be made by butt fusion using procedures that are recommended by the pipe and fitting Manufacturer. The Contractor shall ensure that persons making heat fusion joints have received training in the Manufacturer's recommended procedure. The Contractor shall maintain records of trained personnel, and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall not be removed unless specifically indicated.

Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR, for example, SDR 13.5 to SDR 17, or SDR 11 to SDR 13.5. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall). Standard DR's for polyethylene pipe are 9, 11, 13.5, 17, 21, 26, 32.5 and 41.

- F. HDPE Joining by Other Means:** Polyethylene pipe and fittings may be joined together or to other materials by means of (a) flanged connections (flange adapters and back-up rings), (b) mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, (c) MJ Adapters or (d) electrofusion. When joining by other means, the installation instructions of the joining device manufacturer shall be observed.

2902.4 Connection to Existing Mains:

- A. General:** The Contractor shall furnish and install all of the fittings necessary for connections between new water mains and existing water mains. The fittings shall be as indicated on the plans unless otherwise authorized by the Engineer.
1. When the fittings consist of tapping sleeves and valves, the Contractor shall perform the actual tapping operation of the mains under the direction of Bonner Springs Utility (BSU) Department. BSU will not perform any water main tapping operations unless specified otherwise in the construction drawings.
 2. No connections to existing mains shall be started without prior approval of the BSU, and each connection with an existing main shall be made at a time and under conditions which will least interfere with service to customers affected thereby. Only BSU Personnel are authorized to operate water valves.
 3. In all cases where it is necessary to take an existing main or service line out of service in order to accomplish the work to be performed, the Contractor shall notify BSU at least 48 hours in advance as to the approximate length of time the main or service line will be out of service.
 4. When the closing of a valve to make the connections affects a customer who cannot be without service, the Contractor shall arrange to supply a temporary service and schedule the time that is most convenient to the customer for making the connection to the existing mains.
 5. Facilities shall be provided for proper dewatering and for disposal of all water removed from the dewatered lines and excavations without damage to adjacent property.

6. Special care shall be taken to prevent contamination when dewatering, cutting into, and making connections with existing pipe. No trench water, mud, or other contaminating substances shall be permitted to get into the lines.
7. It shall be the responsibility of the Contractor to make any and all excavations, backfill as required, and furnish all labor, equipment and material necessary to complete the connection as detailed on the plans.

2902.5 Polyethylene Encasements:

- A. General:** Polyethylene encasement shall be installed on ductile-iron pipe and fittings.
- B. Installation:** The polyethylene encasement shall be installed as specified in "Method A" or "Method B" below.
 1. Method A: Polyethylene tubing shall be approximately two (2) feet longer than the length of the pipe section to provide a one (1) foot overlap on each adjacent pipe section. Tube ends shall be taped and sealed in place.
 2. Method B: Polyethylene tubing shall be one (1) foot shorter than the pipe length section with a three (3) foot length of polyethylene tube centered over pipe joint and lapped over pipe section and its tubing. Tube ends shall be taped and sealed in place.
 3. Repairs: Any rips, punctures, or other damages to the polyethylene shall be repaired with adhesive, tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured with adhesive tape.

2902.6 Location Wire and Tape:

- A. General:** Location wire shall be installed with all water mains. Marking tape shall be installed above all water mains installed by open trench excavation.
- B. Installation:** Location wire shall be secured above water mains and connected to valve boxes as shown on Standard Drawings. Splicing shall be held to a minimum and will not be allowed between valve risers.

Before project acceptance the contractor in the presence of BSU personnel will test the electric continuity of all installations. Contractor shall be responsible for the cost of repair and any retesting required.

The marking tape shall be installed directly above the centerline of the pipe and 18 to 24 inches below finish grade.

2902.7 Setting Valves, Fittings and Hydrants:

- A. Valves and Fittings:** All valves, Fittings, plugs and caps shall be set and joined to the pipe in the manner heretofore specified for cleaning, laying and joining pipe, except that large valves may require special support so that the pipe will not be required to support the valve weight.

Each valve shall be inspected before installation to ensure that all foreign substances have been removed from within the valve body, and shall be opened and closed to see that all parts are in first-class working condition. Gate valves shall be set vertical in the horizontal pipeline. Valves and pipe shall be supported in such a manner as to prevent stress in either with no deflection in the valve/pipe joint.

Valve boxes and lids shall be installed at each valve and shall be supported and maintained centered and plumb over the valve's operating nut. The valve box shaft shall not transmit shock or stress to the valve. Install valve box covers flush with the surface of the finished area or as directed by the Engineer.

All bends and tees shall be provided with thrust blocks of plain concrete, as specified. All dead ends on new mains shall be closed with plugs or caps suitably restrained to prevent blowing off under test pressure.

- B. Hydrants:** All new hydrant installations shall be as shown on the plans or Standard Drawings and shall include all necessary excavation and backfill to make the installation complete.

Hydrants shall be set so that at least the minimum pipe cover is provided for the branch supply line. Hydrant drainage shall be provided by installing around the hydrant, and below the hydrant supply pipe top, at least one-half ($\frac{1}{2}$) cubic yard of clean three-fourths ($\frac{3}{4}$) inch rock.

All hydrants shall stand plumb and be set on flat rock or a concrete foundation, with the weep holes being kept clear and free to drain. If fire hydrant extensions are required, the necessary fittings will be provided by the Contractor and properly installed by the Contractor at the exact direction and location determined by the Engineer.

Hydrants shall be set to a grade that allows their proper operation. Traffic hydrants with breakaway joint must be set with the joint above the ground line. The exact elevation of the break away flange shall be determined by the Engineer. Hydrants behind curbs shall be placed with the hydrant centerline at least 24 inches from the back of curb. Hydrants shall be rotated so as to have the pumper nozzle facing the street or rotated as required by the Engineer.

Defective hydrants shall be corrected or replaced.

Immediately before installation of a hydrant, the following operations shall be performed:

1. The hydrant shall be thoroughly inspected.
2. The hydrant interior shall be thoroughly cleaned.
3. The hydrant shall be opened and closed as many times as may be necessary to determine if all parts are in proper working order, with valves seating properly and the drain valve operating freely.
4. The packing gland shall be checked to determine if the packing is in place and the gland nut is properly tightened.

5. After installation, each new fire hydrant shall receive a fresh coat of paint prior to Substantial Completion.

2902.8 Thrust Restraint:

- A. Hydrants:** The back of the base elbow of each hydrant shall be braced against a sufficient area of unexcavated earth or rock with a concrete thrust block or be restrained by suitable restrained joints as shown on the plans or the Standard Drawings.
- B. Fittings:** All plugs, caps, tees, bends and other fittings, unless otherwise specified, shall be provided with reaction blocking or suitably restrained joints as shown on the plans or Standard Drawings.
- C. Thrust Blocks:** Vertical and horizontal reaction blocking shall be concrete as specified herein. Thrust blocks shall be installed between solid ground and the fitting to be restrained. Concrete shall be located to contain the resultant thrust force and permit access to pipe and fitting joints for repairs.
- D. Restrained Joints:** Restrained push-on or mechanical joints, mechanical joint anchoring fittings, and mechanical joints utilizing set screw ductile-iron retainer glands may be used in lieu of concrete thrust blocking if so indicated on the plans or approved by the Engineer.

2902.9 Embedment and Backfilling: Embedment and backfill shall be accomplished in accordance with the laying condition as specified and as shown on the plans or the Standard Drawings.

- A. Pipe Embedment:** All pipe embedment shall conform to Class B Modified unless otherwise specified. Installation shall be in strict conformance with instructions for the appropriate Class being utilized.

All Class A concrete embedments for rigid conduits shall begin and end at a pipe joint.

- B. Trench Backfill:** All trench backfill above pipe embedment shall conform to the following requirements:

1. Backfill Materials:

- a. Backfill shall not be placed when material contains frost, is frozen, wet, or a blanket of snow prevents proper compaction. Backfill shall not contain waste material, organic material, or debris of any kind.
- b. Job-excavated material may be used for compacted backfill when the job-excavated material is finely divided and free from debris, organic material, cinders, ore, other corrosive material, and stones larger than three (3) inches in greatest dimension. Large masses of moist, stiff clay shall not be used.
- c. At the option of the Contractor, compacted backfill may be job-excavated material or graded gravel, except that all street crossings shall be backfilled with flowable backfill from four (4) feet back of curb to four (4) feet back of curb.

Gravel for compacted backfill, other than for street crossings, shall conform to the following gradation:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
1 inch	100
¾ inch	85-100
⅜ inch	50-80
No. 4	35-60
No. 40	15-30
No. 200	5-10

The gravel mixture shall contain no clay lumps or organic matter. The fraction passing the No. 4 sieve shall have a liquid limit not greater than 25, and a plasticity index not greater than five (5).

- d. The top portion of the backfill beneath established lawn areas shall be finished with at least 12 inches of topsoil corresponding to, or better than, that underlying adjoining lawn area.

2. Compacted Backfill:

- a. Compacted backfill shall be required for the full depth of the trench above the embedment located beneath structures, street, road, or highway right-of-way, driveways, walks, parking areas, and at all locations shown on the plans or as directed by the Engineer during the progress of the work.
- b. Job-excavated materials shall be placed in uniform layers not exceeding eight (8) inches in uncompacted thickness. Increased layer thickness may be permitted for non-cohesive material if the Contractor demonstrates to the satisfaction of the Engineer that the specified compacted density will be obtained.
- c. Granular bedding and buckshot aggregate used for backfill shall be placed in uniform layers not exceeding 6 inches and compacted by slicing with a shovel or vibrating equipment.
- d. Backfill under all pavements and shoulders, driveways, and sidewalks shall utilize Controlled Low Strength Material (CLSM) or flowable fill. Flowable fill shall be composed of Portland cement, fly ash (optional), fine aggregate, coarse aggregate (optional), water, and a shrinkage compensator, proportioned as required to create a mix as approved by the Engineer. Design strength shall not exceed 100 psi.
- e. Compaction under street or highway back slopes, berms, median strips, and developed yards shall be 90 percent of maximum density for the entire depth.
- f. The method of compaction and the equipment used shall be appropriate for the material to be compacted, and shall not transmit damaging shocks to the pipe. The compaction method used shall be at the discretion of the Contractor subject to obtaining the densities as specified above.
- g. Backfill failing to meet required densities shall be removed or scarified and recompacted as necessary to achieve specified results.

3. Uncompacted Backfill:

- a. Uncompacted backfill in undeveloped areas and non-established lawn areas shall be adequate to prevent significant future settlement. Finish grade shall be slightly mounded.
- b. Uncompacted backfill material above pipe embedment may be placed by any method acceptable to the Engineer which will not impose excessive concentrated or unbalanced loads, shock, impact on, or displacement of installed pipe
- c. Uncompacted earth backfill material to be placed above embedments shall be free of brush, roots more than two (2) inches in diameter, debris, cinders, other corrosive materials, and junk. However, it may contain rubble and detritus from rock excavation, stones, and boulders in certain portions of the trench depth.
- d. Compact masses of stiff clay or other consolidated material more than one (1) cubic foot in volume shall not be permitted to fall more than five (5) feet into the trench unless cushioned by at least two (2) feet of loose backfill above the pipe embedment.
- e. No uncompacted trench backfill material containing rocks, or rock excavation detritus, shall be placed in the upper 18 inches of the trench except with specific permission of the Engineer. Nor shall any stone larger than eight (8) inches in its greatest dimension be placed within three (3) feet of the pipe top. Large stones may be placed in the remainder of the trench backfill only if well separated and arranged so that no interference with backfill settlement will result.

2902.10 Disinfection and Testing:

- A. Disinfection Requirements:** After installation, the entire main shall be flushed and disinfected by chlorination. Materials, methods, and procedures for disinfection work shall conform to the requirements of AWWA C651, "Standard for Disinfecting Water Mains," except as modified herein. Mains shall be disinfected and tested in lengths between line valves or plugs of no more than 1,500 feet in length. All disinfection procedures must be observed by Bonner Springs Utilities (BSU) personnel.

All disinfection work shall be acceptable to the Kansas Department of Health and Environment (KDHE). The Contractor shall perform disinfection in accordance with KDHE's Minimum Design Standards, Appendix D.

Water in reasonable amounts for proper completion of flushing or disinfection work will be furnished at existing fire hydrants by the Owner without charge to the Contractor. The Contractor shall furnish all necessary pipe, hose, nozzles, and tools and shall perform all necessary labor. Contractor shall make arrangements with BSU and the Engineer (who will fix the time, rate, and duration of each withdrawal from the distribution system) as to the amount of water required and the time when the water will be needed. Unnecessary water waste will not be tolerated. Special hydrant wrenches shall be used for opening and closing fire hydrants. In no case shall pipe wrenches be used for this purpose.

The main shall be flushed at the maximum velocity which can be developed, and no less than two and one-half (2.5) feet per second. Flushing shall be carried out until a turbidity-free water is obtained from all points along the main. All flushing work shall be done in the presence of the Engineer. The Contractor shall notify the Engineer at least 24 hours in

advance of the times and places at which flushing work is to be done.

Unless otherwise noted in the Special Provisions, the Contractor shall disinfect the main. When noted in the Special Provisions, the Contractor may be only required to prepare the main for disinfection by the City.

1. Chlorination by the Contractor shall conform to AWWA C651 and be performed as to provide a minimum concentration of 50 parts per million of available chlorine. Water entering the new main shall receive a dose of the chlorine solution fed at a constant rate such that the water will have not less than 50 mg/l free chlorine.

Chlorine Required to Produce 50 mg/l
Concentration in 100 feet of Pipe

<u>Pipe Diameter (inches)</u>	<u>Pipe Volume (gal)</u>	<u>10% Solution (ounces-uk)</u>	<u>70% Compound (ounces-uk)</u>
4	65.2	4.35	0.62
6	147	9.78	1.40
8	261	17.38	2.48
10	408	27.16	3.88
12	587	39.11	5.59
16	1044	69.54	9.93
20	1631	108.65	15.52
24	2349	156.46	22.35
30	3670	244.47	34.92
36	5285	352.03	50.29

Admission of disinfectant solution into, or the flushing thereof, through existing mains shall be held to a minimum possible, and then only after proper and adequate measures have been taken to effectively prevent any such solution or wastewater from entering branch service connections to water customers.

2. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances.
3. At the end of the 24-hour period, the treated water in all portions of the main shall have a residual chlorine content of not less than 10 parts per million.
4. Mains shall be flushed and samples shall be taken for bacteriological testing prior to placing in service. The highly chlorinated water shall be flushed from the main until chlorine residual measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system. The flushing water shall be disposed of without damage to public or private property. Chlorine is toxic to fish and other aquatic life. Neutralization of highly concentrated chlorinated water must be provided if the residual chlorine can enter surface water sources such as streams or rivers.
5. After chlorine solution has been flushed out of the line, samples will be taken by BSU personnel after a 24-hour period. The Contractor will coordinate with BSU to obtain the

samples and the samples will be tested at a BSU facility. A minimum of two samples shall be taken, one from each end of the line. Samples should be obtained from flush points that were used for the chlorine flushing or from a saddle tap that was installed during the disinfection process.

6. If initial disinfection fails to produce satisfactory bacteriological samples, disinfection and testing shall be repeated at the expense of the Contractor, until satisfactory bacteriological samples have been obtained.

B. Disinfection Procedures:

1. Use a large tank filled with water, containing at least 50 mg/l of chlorine and fill the entire pipe with this solution.
2. Potable water is fed into the new line from the existing system, and close to this source a strong solution of chlorine is added at a rate related to the flow and strength of the strong solution. This is found by the following formulas:

$$\text{ppm(mix)} = \frac{\text{GPM(pipe)} \times \text{ppm(wanted in waterline)}}{\text{GPM(mix pump)}}$$

$$\# \text{Chlorine} = \frac{\text{ppm(mix)} \times \text{gals.(in barrel)} \times 8.3 \times 10^{-6}}{\% \text{Active agent} \times 10^{-2}}$$

Where:

ppm(mix) = Strength of chlorine solution in barrel

GPM(pipe) = Flow rate of water from existing system (must be measured) by meter or other device at pipe's discharge end

ppm(wanted in waterline) = 50

GPM(mix pump) = Flow rate of strong solution being pumped into waterline (must be measured)

#Chlorine = Amount of dry chlorine added to barrel of water to make strong solution

Gals.(in barrel) = Gallons of water in barrel for mixing the strong solution, must be measured (i.e. 55 Gals. drum).

% Active agent = Printed on container of HTH or other brand of granular chlorine.

C. Permissible Disinfection Variation: Only those variations approved by KDHE are permissible.

D. Hydrostatic Testing: Unless otherwise indicated in the Special Provisions, a test pressure of less than 150 psi at the highest point of the main will not be accepted. Where practicable, mains shall be tested in lengths between line valves or plugs of no more than 1,500 feet in length. Leakage test shall be conducted concurrently with the pressure test.

1. For DIP and PVC, the Contractor shall perform hydrostatic pressure and leakage tests in accordance with KDHE's Minimum Design Standards, Appendix C.
2. For HDPE, duration of the test shall be not less than two (2) hours. It is recommended that pressure be stabilized for one (1) hour prior to leakage test. Test pressure shall be at least 1.5 times design pressure. Maintain pressure throughout test ± 5 psi of test pressure.

Line leakage shall be the total water amount introduced into the line, as measured by a meter during the leakage test. The pipe is acceptable when leakage does not exceed that determined by the following formula:

$$Q = 0.0075 DLN$$

Where: Q = Allowable leakage (gallons/hour)
 D = Pipe nominal diameter (inches)
 L = Length of section tested (thousand feet)
 N = Square root of average test pressure (psi)

For reference, the allowable leakage for 1000 feet of pipe at 150 psi in gallons per hour is as follows:

<u>Pipe Diameter (inches)</u>	<u>GPH/1000' of Pipe</u>
4	0.37
6	0.55
8	0.74
10	0.92
12	1.10
16	1.47
20	1.84
24	2.21
30	2.76
36	3.31

When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in of nominal valve size shall be allowed. When hydrants are in the test section, the test shall be made against the closed hydrant.

In the event that the line under test contains pipe of more than one size, the allowable leakage shall be calculated separately for each size and corresponding length of line, and then added to obtain the total allowable leakage for the entire line.

3. All visible leaks at exposed joints and all leaks evident on the surface where joints are covered shall be repaired regardless of total leakage as shown by test. All pipe, fittings, valves and other materials found to be defective under test shall be removed and replaced at the Contractor's expense.
4. Lines, which fail to meet test requirements, shall be repaired and retested as necessary until the test requirements are met.
5. Defects: It is the intent of these specifications and the contract based thereon that:

- a. All joints in piping shall be watertight and free from visible leaks during the prescribed leakage test.
- b. Each and every leak which may be discovered at any time prior to the expiration of two (2) years from and after the date of final acceptance of the work by the Owner shall be located and repaired by and at the expense of the Contractor, regardless of any amount that the total line leakage rate during the specified leakage test may be below the specified maximum rate.
- c. If the specified leakage test is made after the pipeline has been backfilled and the joints covered, and such test shows a leakage rate in excess of the permissible maximum, the Contractor shall make all necessary surveys in connection with the location and repair of leaking joints to the extent required to reduce the total leakage to an acceptable amount. Where evidence of leaking joints does not appear on the ground surface above or near the leaks, the Contractor shall prospect the line by sinking a hole, with an auger or otherwise, at the location of each joint and determine any undue saturation of the soil which would indicate a leak at such joint; such prospecting shall be done after pressure has been maintained in the line a sufficient time to provide adequate soil saturation for locating leaks by this method.
- d. Leaks in mechanical joints shall be repaired by dismantling, cleaning, realigning gland and gasket, and rebolting. Under no circumstances shall gland bolts be tightened beyond the specified and allowable torque limits in an attempt to reduce or stop leakage from a defective joint or for any other purpose.

2902.11 Surface Restoration:

- A. Seeding and Sodding:** All unpaved areas cut by the line of trench or excavation or damaged during the work shall be seeded or sodded when specifically indicated on the plans.
- B. Sidewalks and Driveways:** All paved sidewalk and driveway areas cut by the line of trench or excavation or damaged during the work shall be replaced.
- C. Streets and Curbing:** All paved street, shoulder and curbing areas cut by the line of trench or excavation or damaged during the work shall be replaced to conform to the lines and grades of the original pavement and shall be of equal quality, thickness and appearance to that removed.
- D. Valve Boxes:** All valve boxes in sodded areas shall be installed at finish grade unless otherwise instructed by City. Valve boxes not installed both at finish grade and in developed areas shall have a 6-foot blue painted t-post installed to mark the valve box and shall be three (3) inches minimum above finish grade.

SECTION 2903 WATERLINES NEAR SEWERS

2903.1 Horizontal Separation: Whenever possible, a water main shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer, or manhole. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the Engineer and KDHE shall be consulted as to the precautions to be taken to protect the public water supply.

2903.2 Vertical Separation: Whenever water mains must cross sanitary sewers, house sewers, or storm drains, the water main shall be laid at such an elevation that the bottom of the water main is 24 inches above the sewer or drain top. A full length of water main pipe shall be centered over the sewer line to be crossed so that the joints will be equally distant from the sewer and as remote there from as possible. This vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally, or any sewer or drain it crosses.

Sanitary sewer force mains have the additional requirement of being located at least 2-foot clear and below waterlines. Sanitary sewer force mains shall not cross above water lines.

2903.3 Unusual Conditions: Where conditions prevent the minimum vertical separation set forth above from being maintained, or when it is necessary for the water main to pass under a sewer or drain, the water main shall be laid with slip-on or mechanical joint ductile iron pipe (DIP) which must extend on each side of the crossing to a distance from the sewer of at least 10 feet. In making such a crossing, a full length of water main pipe must be centered over or under the sewer or drain to be crossed, so that the joints will be equidistant from the sewer or drain and as remote there from as possible. The sewer or drain line must also be replaced until the normal distance from the sewer or drain line to the water main is at least 10 feet, with DIP with push-on or mechanical joints or pre-stressed concrete cylinder pipe (PCCP) (both with polyethylene protection), or push-on gasket poly-vinyl-chloride (PVC) pipe. When using DIP and PCCP, the joints shall be encased with reinforced concrete. Where a water main must cross under a sewer or drain, a vertical separation of 24 inches between the bottom of the sewer or drain and the water main top shall be maintained, with adequate support, especially for the larger sized sewer or drain lines to prevent them from settling on and breaking the water main.

Where it is not practical to maintain the required horizontal or vertical separation distance between a water line and a sanitary sewer force main, KDHE will consider proposals providing equivalent protection by other methods on a case-by-case basis, if supported by data from the design engineer.

2903.4 Sewer Manholes: No water pipe shall pass through, or come in contact with, any part of a sewer or a sewer manhole.

SECTION 2904 MISCELANEOUS ITEMS

2904.1 New Water Service Connections:

- A. General:** This section covers all new water service connection sizes. The Contractor shall furnish all material, labor, and equipment required for the installation of the new water service except for specific materials and labor which shall be provided by City and listed below. Contractor supplied material, labor, and equipment shall include boring of road crossings, sleeves, casings, compaction and re-sodding of the established lawns.

The Contractor shall make all meter taps greater than two (2) inch. However, the Contractor must coordinate with BSU and only make the tap in the presence of BSU personnel. The City shall perform all taps two (2) inch and smaller. Contractor must follow conditions set forth by City Policy "Residential Water Service Connection / Meter Installations" concerning tapping of water main (e.g. scheduling taps) regardless of tap size.

All other applicable sections of these specifications shall also apply to new water service connections.

B. Approved Materials:

1. **Service Saddles (City):** For connection to water mains less than 12", use epoxy coated saddle with a stainless steel strap. For connection to water mains 12" and larger, use epoxy coated saddle with dual stainless steel straps.
2. **Corporation Stop (City):** McDonald #4701-22 or approved equal for DIP & PVC. For HDPE, use fused tapping saddles.
3. **Meter Tile (City):**
 - a. For 5/8" x 3/4" meters: 18" x 36" PVC.
 - b. For 5/8" x 1" meters: 24" x 36" PVC.
4. **Meter Tile Ring and Lid (City):** GCI MBX 1157 or approved equal.
5. **Meter Setter (City):**
 - a. For 5/8" x 3/4" meters: Yoke bar, cut-off valve, and angle check.
 - b. For 5/8" x 1" meters: Yoke bar, cut-off valve, and angle check.
6. **Service Line (Contractor):** Soft "K" copper or HDPE, 3/4" and larger.

C. Meter Installation:

1. All meter setter installations shall be inspected by BSU personnel.
2. Water meter pits shall typically be placed within private property at the property/right-of-way line of the service address. Alternate locations must have prior approval of BSU. Meter pits shall be placed approximately 12-feet from the back of curve or edge of road in residential areas (not less than 10 feet and note more than 15 feet).
3. All meter setters shall be set in the meter tile so that the face of the meter is at least sixteen (16) inches, but not more than twenty-two (22) inches below the finished grade.
4. Meter pits shall not be located in driveways, walkways, or cast-in-place concrete without prior approval. Traffic model rings and lids shall be installed when required for these instances.
5. All meter tiles shall be set plumb, backfilled and compacted with earth. Each meter tile shall be centered directly over the meter that it serves. The top of the tile cover shall be flush with the finished grade in sided areas and two (2) inches above grade in unfinished areas.

D. Service Lines:

1. Service lines shall be composed of no more than one (1) separate length between the corporation stop and the meter pit.
2. All connections to the tubing shall be made with compression fittings. No field or shop solder connection will be permitted.
3. All service lines from the main to meter must be the same diameter as the meter (3/4" minimum).
4. All service lines are to be installed with 48" cover (42" minimum).

E. Street and Drive Crossings:

1. All street and/or drive crossings shall be made by means of boring, jacking, or tunneling. Unless otherwise approved by the Engineer, all street borings shall be forty-eight (48) inches below the finished grade. Casing pipe must be utilized on all street crossings.
2. No fitting shall be installed under pavement.
3. All street crossings serving two residential units shall be a minimum of one (1) inch.
4. Contractor shall encase one (1) inch service or smaller lines in two (2) inch PVC Class 200 pipe. Contractor shall encase two (2) inch service lines in four (4) inch PVC Class 200 pipe. Casing pipe shall extend two (2) feet beyond the paved surface or back of curb, whichever is greater. The end of the casing pipe shall be sealed with cement grout.
5. All street crossing shall be marked / stamped on curb.

F. Tapping:

1. The Contractor shall make all taps on the water main larger than two (2) inches in the presence of BSU personnel. BSU personnel shall make all taps two (2) inches and smaller.
2. The Contractor shall expose the water main immediately prior to tapping. Tap must be 24 inches distance from any joint.
3. Excavation and backfilling of the main must be done in the same eight-hour day between 7 A.M. and 3 P.M. It must be filled immediately after the tap is made and inspected.
4. All barricades and warning devices shall be provided and maintained by the Contractor.

G. Salvage Materials:

1. All usable salvaged items including fittings, valves, meters, etc. shall be field cleaned and transported by the Contractor to the City's designated storage yard and shall remain the property of the City.

H. Excavation:

1. Service Lines:

- a. Mechanical equipment used for trench excavation shall be of a type, design, and construction, and shall be so operated that the rough trench widths of approximately 12 inches maximum width and vertical sidewalls can be obtained at least from an elevation of one foot above the top of the bottom of the trench.
- b. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts or other existing property, utilities or structures above or below ground. In all such locations, hand excavating methods shall be used.
- c. Cutting trench banks on slopes to reduce earth load to prevent sliding and caving will be permitted only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits. Slopes shall not extend lower than one foot above the top of the pipe.
- d. Where pipe grades or elevations are not definitely fixed by the contract drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe of 42 inches. Greater pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades, but shall be limited to no more than sixty (60) inches of cover unless approved by the Engineer. Measurement of pipe cover depth shall be made vertically from the outside top of the pipe to finished ground or pavement surface elevation.

I. Embedment: Embedment for pipe shall be pipe embedment as defined in 2902.9.A.

J. Backfill, Compaction and Sodding: Compaction of backfill shall be done immediately after placement of backfill. Under no circumstance shall there be more than eight uncompacted meter locations at one time. Compacted backfill will be required for the full depth of the trench. Earth backfill shall be free of rock or debris. All sections of this specification concerning backfill, compaction and sodding shall apply to the new service line connections and replacements.

K. Backfill Under Pavements, Driveways, Sidewalks, and Other Paved Areas: Under areas to be paved, the backfill materials from the top of the pipe embedment to bottom of pavement shall be placed as per standard drawing 29-4B.

L. Water Service Connection Sizes 3” and Larger: Meter pit, valves, and fittings arrangements shall conform to the general layout indicated in the Standard Drawings. The Engineer shall determine the size of meter pit, pipe, meter and fittings required, subject to City’s approval.

2904.2 Fire Sprinkler System:

A. General:

- 1. The fire sprinkler system shall be as approved by the Building Official of the City of Bonner Springs and in accordance with NFPA Standards. The Contractor shall furnish

calculations and five (5) sets of plans to the City Staff for review and approval. It shall be noted that each sprinkler system shall be equipped with an alarm system connected to an authorized Central Station for dispatching.

B. Detector Check Valves

1. At every building where fire sprinklers are deemed necessary, a detector check valve assembly shall be installed at an approved point on the fire-line main to prevent back-siphonage and back pressure backflow of non-potable water into the potable water supply system.
2. The detector check valve assembly can be either installed outside or inside the building as shown in the Standard Drawings, as approved by BSU, the City Engineer and the City Fire Chief. If the assembly is installed inside the building then it shall be in a designated sprinkler room. If the assembly is installed outside the building then it shall be in a concrete pit as shown in the Standard Drawings.
3. Isolation valves shall be installed at both sides of the detector check valve. The valve on the potable water supply side shall be an OS&Y resilient seat gate valve. The valve on the sprinkler side of the assembly shall be a resilient seat gate valve with an indicator either wall type (American-Darling No. 1P17W or approved equal) or post type (American-Darling No. 1P17) depending on the type of arrangement.
4. An approved fire department connection (2-1/2" x 2-1/2" x 4") shall be installed past the indicator valve with a check valve (APCO double-door series 9000 or approved equal).
5. The detector check valve shall be one of the following types:

Ames, 300 Series
Watts 709 or 757
Febco 506 or 856
Or
Approved equal

The valve body shall be either a cast bronze body or fabricated steel with silicone discs, Buna-N seals, and stainless steel springs and linkage parts. The detector check valves shall be either hot dip galvanized (ASTM 123) or fusion-bonded epoxy coated in accordance with AWWA C550. The rated working pressure for the detector check valves shall be 175 psi for sizes 4" thru 10". The flange dimensions and holes shall be in accordance with ASNI B16.5 Class 125. Each valve shall bear a nameplate, which provides nominal size, direction of flow, psi rating and year of manufacture. In addition, the check valve assembly shall be equipped with a by-pass assembly consisting of an approved check valve assembly and water meter furnished by the City and paid for and installed by the Contractor.

C. Testing of Fire Line and Sprinklers:

1. Fire systems must be tested using procedures listed in 2902.10 from the water main to the first valve, including pressure test, leakage test, chlorination, flush, and bacteriological test.
2. Sprinkler testing and inspection of material inside the building shall be administered by the City Fire Chief or an officer appointed on his behalf in accordance with NFPA Standards.
3. Backflow device must be tested after installation, prior to water service start-up.

2904.3 Disinfection and Testing of Water Tanks and Reservoirs:

A. General:

1. New or repaired potable water storage facilities shall be thoroughly flushed and disinfected before being put in use for water supply purposes. Disinfection and testing shall conform to the latest revisions of AWWA C652.

B. Procedures: Three approved procedures for disinfection following initial flushing are as follows:

1. The water storage facility shall be filled to the overflow level with potable water to which enough chlorine is added to provide a free chlorine residual in the full facility of not less than 10 mg/L at the end of the appropriate 6 hour or 24 hour retention period. A 6 hour retention period is required when the water entering the storage facility has been chlorinated uniformly by gas-feed or chemical pump equipment. A 24 hour retention period is required when the initial chlorination concentration is not uniform when the water enters the storage facility such as when sodium hypochlorite is poured into the storage facility as indicated in AWWA C652 4.3.1.2.2 or the use of Calcium hypochlorite granules or tablets are used as indicated in AWWA C652 4.3.1. When directed by BSU, excess highly chlorinated water shall be purged from the drain piping.
2. A solution of 200 mg/L available chlorine shall be applied directly to the surfaces of all parts of the storage facility that will be in contact with water when the storage facility is full to the overflow elevation. The chlorine solution may be applied with suitable brushes or spray equipment. The solution shall coat all surfaces to be treated, including the inlet and outlet piping, and shall be applied to any separate drain piping such that it will have available chlorine of no less than 10 mg/L when filled with water. The disinfected surfaces shall remain in contact with the strong chlorine solution for at least 30 minutes, after which the solution should be rinsed off by washing the walls and floor with a stream of potable water and this water wasted. The storage facility should then be filled with water containing 2 mg/L of chlorine. The storage facility shall remain full for a period of not less eight (8) hours contact. A free-chlorine residual of not less than 1 mg/L shall remain after the retention time has expired. When directed by the City, excess highly chlorinated water shall then be purged from the storage facility.

3. Chlorine is toxic to fish and other aquatic life. Neutralization of highly concentrated chlorinated water must be provided if the residual chlorine can enter surface water sources such as streams or rivers.

C. Bacteriological Tests:

1. After chlorine solution has been flushed out of the water storage facility, and before placed in service, the Contractor shall coordinate with BSU personnel to obtain 2 sets of samples, 24 hours apart, for bacteriologic quality in accordance to AWWA C652. The samples shall be delivered to an acceptable independent testing laboratory confirming the absence of coliform organisms. Tests shall be made at the expense of the Contractor.
2. If initial disinfection fails to produce satisfactory bacteriological samples, disinfection and testing shall be repeated at the expense of the Contractor until satisfactory bacteriological samples have been obtained.

2904.4 Backflow Prevention and Cross Connection Control:

A. General:

1. The potable water system must be protected from introduction of contaminants by backflow or cross connection. A backflow prevention system approved by the BSU shall be installed on any connection of the potable water system where backflow into the system creates a potential health hazard and or degrades the quality of the water. No customer shall cause or allow the construction or maintenance of an unprotected cross-connection.
2. At a minimum, guidelines presented in the latest edition of the American Water Works Association Manual M14, Backflow Prevention and Cross Connection Control shall be followed. BSU shall have the authority to review and approve or reject any backflow prevention system.
3. Any customer who installs a backflow prevention system must maintain and inspect the system annually and maintain records that such testing was performed and present the inspection reports when requested by BSU. Any backflow system found to not be working as intended shall be repaired by the system owner within 30 days or the BSU may shut off service.

B. Control of Backflow or Cross Connection Hazards: The following backflow prevention systems shall be used if a potential backflow or cross connection hazard exists as determined by BSU:

1. Air Gap Separation: The discharge pipe of an approved air-gap assembly shall terminate a minimum of one-inch or two pipe diameters above the flood level rim of the receiving vessel, whichever is greater.
2. Lawn sprinkler systems: Sprinkler systems using potable water can use a PVB device unless a higher degree of hazard exists. The injection of fertilizers, pesticides, or other contaminants through the irrigation system represents a higher degree of hazard and requires the use of a device such as a reduced pressure principle backflow assembly (RP device) to ensure safety.

3. Double check valve assemblies: Double check valve assemblies may be used for piping systems connected to potable water storage tanks without air-gap separation, normally wet fire suppression systems that do not use additives or chemicals, or systems that in the determination of BSU do not pose a public health threat or degrade the quality of the water may use BSU approved double check valve assemblies.
4. Reduced pressure principle double check backflow prevention assemblies shall be required on all piping systems not discussed above that in the determination of BSU have the potential to cause health hazards or degrade the quality of water if backflow occurs. Restricted or classified facilities closed to BSU shall require reduced pressure principal double check valve assemblies be installed in locations accessible to BSU.

C. Approved Backflow Prevention Assembly Installations:

1. All backflow prevention assemblies shall be accessible for inspection, testing, and easy replacement.
2. The backflow prevention assemblies shall not be subjected to freezing, excessive heat or flooding.
3. No bypass piping around a backflow prevention assembly will be allowed.
4. Backflow prevention assemblies shall be installed on the customer water system as close to the potential hazard as possible so as to provide additional piping length before the first potable use facility.
5. Reduced pressure principle double check backflow prevention assemblies shall be installed with no plug or additional piping affixed to the pressure relief valve port. The pressure relief valve port shall be installed a minimum of one foot above the floor. The pressure differential relief valve shall operate to maintain the zone between the two check valves at least two pounds per square inch (2.0 psi) less than the supply pressure. The number two (2) check valve shall seal leak tight against reverse flow under all pressure differentials. The static pressure drop across the number one (1) check valve shall be at least three pounds per square inch (3 psi) greater than the pressure differential between the supply pressure and the pressure zone required to open the pressure relief valve.
6. All check valves shall be imprinted with the direction of flow for proper operation.

D. Testing of Backflow Prevention Assemblies:

1. All backflow prevention devices shall be tested and inspected upon installation and annually by certified inspectors. Test reports must be sent via fax, mail, or email to BSU.
2. Certified testers will inspect the check valves to ensure they maintain at least one pound per square inch (1 psi.) differential in the direction of flow and are leak tight against reverse flow. The tester shall prepare a report of the test and sign the report and deliver one copy to BSU within 30 days of the test. The report shall list the tests performed and the results of the tests.
3. Certified testers shall have satisfactorily completed written and performance

examinations administered by the American Backflow Prevention Association (ABPA) Tester Certification Program or the American Society of Sanitary Engineering (ASSE). Testers shall maintain their certification status and proof of status for BSU review.

4. Backflow assemblies failing to meet the criteria listed herein shall be replaced or repaired and retested within 30 days.

SECTION 2905 MEASUREMENT AND PAYMENT

2905.1 Scope: This section covers the methods of measurement, and the basis of payment, for the furnishing of all labor, equipment, tools and materials and for the performance of all related work necessary to complete any construction covered in Section 2900.

2905.2 General: Unless specifically altered by the Contract Special Provisions, the methods of measurement and payment will be as specified herein, and as listed in the Proposal.

2905.3 Items Not Listed in the Proposal: There will be no measurement or separate payment for any item of work not specifically identified and listed in the Proposal and all costs pertaining thereto will be included in the Lump Sum Proposal or Contract Unit Prices for other items listed in the Proposal.

2905.4 Methods of Measurement: The quantities of accepted work will be measured and determined as follows:

A. Water Main - Pipe:

1. Open Trenched: Measurement of various size and types of water mains including fittings, bends, and valves will be in linear feet as called for in the Proposal and/or as shown on the plans, based on field-measured lengths of acceptably installed pipe, as measured along the centerline thereof. Excavation, bedding, retainer glands, thrust blocks, encasement, location wire and tape, backfill and other subsidiary items to the pipe will not be measured separately.
2. Tunneled, Bored or Jacked: Measurement will be made in linear feet for the applicable size, and type of water main, tunneled, bored or jacked as called for in the Proposal and/or as shown on the plans, based on actual field-measured lengths of acceptably installed pipe within casing or tunnel liner, including bore pits, dewatering, shoring, sand fill, end seals and other subsidiary items.

B. Valves and Valve Boxes: Measurement will be made for the applicable size and type of valve, including valve boxes, bases, lids and covers, as determined by the quantity of valves installed.

C. Fire Hydrant Assemblies: Measurement will be made based on the actual number of hydrant assemblies installed as called for on the plans or as directed by the Engineer. No measurement for payment will be made for branch piping, fittings, couplings, thrust blocks or other appurtenant items including valves and valve boxes.

D. Specials (Meter Vaults, Air Valves, Pressure-Relief Valves, etc.): Measurement for these type items will be made based on the actual number of units installed, as called for on the

plans or as directed by the Engineer.

2905.5 Basis of Payment: Payment for the completed and accepted work shall be made by one of the following methods:

- A. Lump Sum:** Payment will be made at the contract lump sum bid price
- B. Unit Price:** Payment will be made, based on measurement quantities, as shown in the contract unit prices.
- C. Items Not Listed in the Proposal:** There will be no measurement or separate payment for any other items of work not identified nor listed in the Proposal and all costs pertaining thereto shall be included in the lump sum or contract unit price, depending on which form is used, for other items listed in the statement of work in the Proposal.

END OF SECTION