Technical Manual

Requirements and Specifications
For
Potable Water Facilities

Henderson Water Utility
Henderson, Kentucky

June 2016
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1. WATER TECHNICAL MANUAL

1.1 INTRODUCTION

This document contains technical guidance for the construction of potable water facilities to serve existing and new development. It establishes uniform policies and procedures for the construction and acceptance of potable water facilities to provide for efficient, reliable service.

HWU staff responsible for working with developers and others subject to the procedures and specifications contained herein may be contacted by telephone at (270) 826-2824, or may be visited at the System Operations Center, 230 N. Alvasia Street, Henderson, KY 42420.

1.2 PURPOSE

The purpose of this manual is to provide standards to assure consistent quality in the design and construction of potable water infrastructure that becomes a part of the HWU system. The manual establishes uniformity in design assumptions and general methods of design, and sets policy regarding design standards and specifications. Finally, the manual outlines the required calculations and design applicable to all potable water infrastructure.

Provision of Potable Water Facilities

HWU reserves the right to design and construct all improvements to the potable water system for existing and new developments. In certain instances, HWU may allow others to design and construct potable water facilities that are to become part of HWU’s system. Construction by outside agents requires signing of an agreement; negotiation of possible future reimbursement of costs; and all required licenses, permits, easements and rights of way must be obtained and provided to HWU. In addition, HWU must inspect all elements of the construction, and witness and approve all testing prior to acceptance.

Water System Extensions

The procedures in this manual will apply to extensions to furnish water service to a prospective customer or customers, including new developments. The customer(s) being served are expected to pay the cost of the extension unless prior arrangements have been made to share the cost. HWU may require developers or others requesting line extensions to pay the full cost of off-site improvements necessary to serve a development.

Any additions to the public potable water system made as a result of an agreement with HWU shall become the property of HWU, which reserves the right to further extend the lines or provide other facilities deemed necessary without reimbursement to another party, unless specifically covered by a reimbursement agreement.

If a line extension is to be built on road frontage or vacant land, the extension will normally stop at the last point of service. To insure that right of way will be available for future use, HWU may require the granting of an easement across the entire frontage, or to the furthest property line.
1.3 GENERAL REQUIREMENTS

The following is a list of requirements to be followed by a developer or others who wish to design, finance, and construct potable water system facilities that will become a part of the HWU system. These requirements must be followed in order for the proposed potable water system facilities to be considered for acceptance and connection to the HWU system.

Where an industry or national standard (AWWA, ANSI, etc.) is referenced, the latest revision shall apply, unless noted otherwise.

The Great Lakes - Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers’ “Recommended Standards for Water Works” (10-States Standards) shall control for any item of design or specification not covered by this Manual.

Design Criteria

The following is a list of minimum design criteria required for any water facility to be approved to connect to the HWU system. For all these requirements, deviation requires prior written approval.

1. Pipe size and material shall be as determined by HWU. PVC pipe C-900, C-905 or cement lined ductile iron pipe, Pressure Class 350, shall be a minimum and shall be manufactured and installed in accordance with the specifications contained herein. Higher-class pipe may be required. All water mains shall be a minimum of 8-inch diameter, unless otherwise approved in writing. Where a dead-end water main only serves one hydrant and is not likely to be extended in the future, the water main may be reduced to a 6-inch diameter. Where a water main dead ends at the end of a cul-de-sac and is deemed by HWU to not likely be extended in the future, the water main may be reduced to a 2-inch HDPE pipe around the head of the cul-de-sac, with a below-ground flush hydrant.

2. The pipeline shall be installed with holes for the bells cut at each joint and bedded with select material. Mechanical restraint retainer glands shall be used on all fittings.

3. Fire hydrants shall be installed not more than 600 feet apart. Fire hydrants shall be installed on all dead-end lines 6-inches or greater. In other situations, HWU may allow the installation of flush hydrants (minimum 2½ inch outlet with 3-inch D.I. barrel). Where an arterial street has four or more traffic lanes, hydrant spacing shall be 500 feet on each side of the street on an alternating basis (every 250 feet along the centerline dimension of the road, alternating sides).

4. Gate valves for lines smaller than 16” or butterfly valves for lines 16” and larger shall be spaced at a maximum of 600 feet. Gate or butterfly valves shall also be provided at all branch lines and at the tie-in to any existing line. At line tee connections, 3 valves shall be installed. A valve shall be installed at the end of every line followed by a full section of pipe and end cap. Hydrant valves shall be installed with a 6” tee installation and no other taps or services. The hydrant valve shall isolate the hydrant only.
5. Dead-end lines will not be allowed if HWU determines that connections should be made to loop the system.

6. The maximum working pressure shall not be more than two thirds of the pressure rating of the pipe.

7. Air release valves shall be located only where necessary as determined by HWU.

8. Casing pipes shall be sized to accommodate future growth as determined by HWU. The casing pipe shall be extended a minimum of five (5) feet past the ditch or toe-of-slope or as required by the owner of the right-of-way being crossed.

9. Water mains shall be laid at least 10 feet horizontally from any existing or proposed gravity sanitary or storm sewer, septic tank or subsoil treatment system. The distance shall be measured from the outside of each pipe wall. Water lines crossing sewer mains shall have a vertical distance of 18 inches between the outside of the water main and the outside of the sewer. If a water line is to be laid beneath a sewer main, the sewer main shall be constructed of ductile iron pipe or in a steel casing, with one full length of pipe centered on the water main. At all crossings, one full length of the water main pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.

10. Ductile iron pipe shall be required within 200-feet of oil or gasoline lines, underground storage tanks, petroleum storage tanks, or property known to be contaminated by petroleum products, and shall be constructed using pipe joint materials which are resistant to permeation of petroleum products.

11. Any over-excavation required for boring operations or any other reason shall be backfilled with #9M stone or other approved material up to and including bedding for pipe.

12. The results of water sample analyses from disinfection shall be distributed to Kentucky Division of Water and HWU.

13. The construction drawings shall include a profile of the water line.

14. Where facilities are being constructed to serve residential lots, a double meter box and hanger setting, placed on the property line between the two lots, shall be installed where possible. One-inch soft copper service line shall be installed for double meter settings and ¾” soft copper service line shall be installed for single meter settings.

15. For ditch or waterway crossings 15 feet or greater in width (top of bank to top of bank), the following shall be provided as a minimum (each crossing shall be evaluated on a case by case basis):

   a. The pipe shall be of special construction, having flexible, watertight joints, with restraint as required;

   b. Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible, and not subject to
flooding; and the valve closest to the supply source shall be supplied with a test point.

16. Water mains shall be designed and built so that they generally run adjacent to, but outside of road rights-of-way in dedicated utility easements. Easements for water lines shall be a minimum of 12 feet in width. Easements for water and sewer lines running parallel shall be of sufficient width to maintain a minimum of 10 feet of separation between the adjacent edges of the water and sewer lines. The outer edge of the easement for single and parallel lines shall be a distance from the outside edge of the pipe(s) based on the formula (invert depth in feet/2) or 5 feet minimum.

17. Easements wider than those described herein may be required at HWU’s discretion.

18. Water lines shall be designed so that an individual meter can be installed to serve each building, except for accessory structures.

19. Water lines installed at a slope greater than 20 percent (5:1) shall be approved on a case by case basis by HWU.

Other

1. In no case shall any existing valve be operated by other than HWU personnel.

2. Any new section of water line must be ready for use before disinfection.
### MATERIALS CHECKLIST

<table>
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<th>Category</th>
<th>Description</th>
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| **DI PIPE**     | DI (DUCTILE IRON)  
Pressure Class 350; AWWA/ANSI C151/A21.51  
Cement Mortar Lined with Bituminous Seal Coat  
Clow, Griffen, US Pipe or approved equal |
| **PVC PIPE**    | AWWA C900 and C905  
Pipe 4” thru 12” diameter 150psi Pressure Class; Dimension ratio DR 18  
Pipe larger than 12” diameter 165psi Pressure Class; Dimension ratio DR 25  
J-M Manufacturing Co. or approved equal |
| **HDPE PIPE**   | ASTM D-3350  
Pipe small than 4” diameter 165psi Pressure Class; Dimension ratio DR 9 |
| **FITTING**     | DI (DUCTILE IRON)  
Class 350; Mechanical Joint  
AWWA/ANSI C153/A21.53  
Cement Mortar Lined with Bituminous Seal Coat  
Tyler, Clow, Griffen or approved equal |
| **GATE VALVE**  | Resilient Seat  
Rated Working Pressure – 200 psi  
Mechanical Joint; AWWA C509; NSF/ANSI 61-G  
Kennedy, Mueller or approved equal |
| **AIR RELEASE VALVE** | ANSI/AWWA C512  
Made from Non-Corrodible Materials  
Stainless Steel Saddle, Corp Stop, and Globe Valve Required  
ARI Model S-014 or approved equal |
| **TAPPING VALVE** | Resilient Seat  
AWWA C509; NSF/ANSI 61-G  
Rate Working Pressure – 200 psi  
Tapping Flange x Mechanical Joint  
AWWA C550 Fusion Bonded Epoxy Coating  
Kennedy, Mueller or approved equal |
| **TAPPING SLEEVE** | Stainless Steel Body  
SS Flanged  
Rated Working Pressure – 200 psi  
ASTM A126  
Kennedy, Ford or approved equal |
| **CASING**      | Steel, Plain end, 35,000 psi yield point strength  
ASTM A252 Grade 2 or ASTM A139 Grade B  
Minimum Wall Thickness – Schedule 20; 0.375 for 24” and larger  
Un-Coated and Un-Wrapped |
| **VALVE BOXES** | Adjustable Cast Iron  
Covers Marked “Water”  
4 ½” Inside Diameter  
Screw Type  
Tyler/Union or approved equal |
| **FIRE HYDRANTS** | AWWA C502  
Kennedy Model K81D, AVK Model 2780-5” Storz, or approved equal |
| **RETAINER GLANDS** | Ductile Iron PVC  
Meg-a-lug (Ebaa Iron), Uniflange Wedge Action Retainer (Ford) or approved equal |
1.4 GENERAL INFORMATION - PLAN AND PROFILE SHEETS

**Title Sheet, General Notes, Legend, and Map Index**

1. Name of development; name, address, and telephone number of developer in lower right-hand corner of plans.
2. Names of existing utilities, contact person, and telephone numbers.
3. Vicinity map (highlighting proposed extension).
4. Sheet index.
5. A legend that includes all items of work in the plan set.
6. General notes shall include the following as applicable:
   a) The contractor is prohibited from excavating until existing underground utilities have been located through Kentucky 811. Utility locations are approximate. Phone numbers for known utilities in the area are shown on this sheet, however other utility companies may also have facilities in the project area. Contractor shall identify and contact all utilities, including those who do not subscribe to KY 811 (including Henderson Municipal Power and Light – HMP&L).
   b) Main line tie-ins and meter reconnections shall be coordinated with HWU.
   c) Contractor shall perform required reconnection work on the customer’s side of the meter under supervision of a licensed plumber. Obtaining plumbing permits shall be the responsibility of the contractor, and this work shall be coordinated with the property owner.
   d) Contractor shall be responsible for maintenance of traffic in accordance with requirements of the Manual of Uniform Traffic Control Devices (MUTCD).
   e) Driveways shall be bored without casing.
   f) All meter locations registering over 85 psi shall have an individual pressure-reducing valve installed with tandem setter at the meter.
   g) Contractor shall comply with all local, state, and federal regulations pertaining to existing asbestos cement pipe.
   h) Water lines shall be pressure tested and disinfected in accordance with HWU specifications.

**Content of Water Line Plan Sheets**

1. Minimum 24” x 36” sheet size.
2. Title block
3. Name, address, and telephone number of developer
4. Name, address and telephone number of engineer
5. Professional engineer seal and signature
6. Sheet number
7. North arrow  
8. Scale (minimum 1” = 100’)  
9. Date  
10. Right of way  
11. Show waterline easements  
12. Property owners, PVA parcel number  
13. Show all available information for existing and proposed utilities in project area, including:  
   a) Details of tie in to existing lines  
   b) Size of lines and class of pipe  
   c) Meter locations  
   d) Valves  
   e) Fire hydrants or flush hydrants  
   f) Length and size of steel casing pipe for road bores or open cut  
   g) Reference distances to waterline from centerline of road or other visible permanent topography  
   h) Detail information for all road, creek, and railroad crossings  
14. Show match lines with station number reference  
15. Cross-reference the plan sheets at road intersections

**STANDARD DETAIL DRAWINGS**

Standard details must be included in the drawings if any of the items listed below are used:

1. Fire Hydrant Assembly (profile view) HWU001.DWG  
2. Flush Hydrant Assembly (profile view) HWU002.DWG  
3. Air Release Valve HWU003.DWG  
4. Gate Valve and Box (in street) HWU004.DWG  
5. Valve placement at tees (plan view) HWU005.DWG  
6. Service tap HWU006.DWG  
7. 3/4” & 1” Single Meter Setting HWU007.DWG  
8. 3/4” Dual Meter Setting HWU008.DWG  
9. Not use HWU009.DWG  
10. Thrust blocking HWU010.DWG  
    Water Main: Open cut Installation – Method B HWU011B.DWG  
    Water Main: Open cut Installation – Method C HWU011C.DWG  
12. Water main: ditch or Stream crossing HWU012.DWG  
13. Proposed water line under Proposed sewer line HWU0013.DWG  
14. Cased water line crossing Under roadway HWU0014.DWG  
15. Casing detail HWU0015.DWG  
16. Joint Restraint Length Detail HWU0016.DWG
POTABLE WATER SYSTEM SPECIFICATIONS

1.5 General

The work to be accomplished under these specifications is the furnishing of all labor, materials and equipment required for the construction of potable water mains and appurtenances as shown on the drawings and more fully described herein.

1.5.1 DEFINITIONS

Henderson Water Utility means the utility having jurisdiction and supplying water and/or sewer service and abbreviated herein as HWU.

Contractor means the party who has been retained by HWU or others to perform the construction work.

Engineer means the HWU General Manager, an Engineer in responsible charge working under contract to HWU or in the employ of HWU, or an Engineer in responsible charge working in the employ of a developer under an Infrastructure Development Agreement.

Owner means HWU or a developer working under an Infrastructure Development Agreement.

1.5.2 SAFETY

All work shall be carried out in accordance with all applicable rules and regulations of the Kentucky Labor Cabinet, Division of Occupational Safety and Health, and HWU Safety Policies.

1.5.3 PRODUCT DELIVERY, STORAGE AND HANDLING

Care shall be exercised in transporting and handling to avoid damage to pipe and fittings, and all appurtenances. Materials shall be stored in an enclosure or under protective coverings if required to prevent damage. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris.

Contractor shall inspect materials furnished by HWU at delivery. Contractor shall report to HWU immediately upon finding defects in any material supplied by HWU. Contractor shall furnish all materials and labor required for replacement of installed materials found to be defective or damaged after delivery.

HWU reserves the right to reject any materials that do not comply with these standards.

1.5.4 NOTIFICATION

The Contractor shall give the Owner or Owner’s representative a minimum of 48 hours notice before starting construction. Where a public roadway must be closed, notify all safety agencies and the general public in accordance with local and state regulations. Where a private driveway
must be closed, provide the resident a minimum 48 hours advance notice. Maintain continuous access to non-residential private driveway crossings to the maximum extent possible.

1.5.5 INSPECTION

The Owner’s Engineer shall make periodic observations during construction to provide final certification that the improvements were installed in conformance with HWU standards and the approved construction drawings. In addition to observation by the Engineer, a final inspection will be made prior to putting the facilities in service. Final inspection will be made prior to acceptance of any facilities and only after all construction is complete. The Contractor shall provide labor and materials as required to complete the punch list developed during final inspection. Access to the construction site and construction records shall be provided at all times to inspectors.

During construction, the Contractor shall notify the Owner upon installation of any fitting, valve, hydrant or other appurtenance, and shall not cover up such items until GPS coordinates are established for such items, either by Owner’s personnel or by a Kentucky Registered Licensed Surveyor employed by the Contractor. Coordinates must be referenced to the Kentucky State Plane Coordinate System NAD 83. If items are covered before GPS coordinates are obtained, the Contractor may be required to excavate to allow coordinates to be obtained.

In lieu of GPS coordinates, the Contractor may choose to provide a complete set of “As-Built” plans including two copies of full-size (24” x 36”) bound drawings for the entire completed facilities. Both plan and profile of the sewer lines and facilities shall be included on the as-built drawings. In addition, one copy of the final as-built drawings including, plan and profile, in digital *.DWG or *.DXF format shall be provided. These digital files must be readable and the coordinates of the file shall be referenced to the Kentucky State Plane Coordinate System NAD83.

1.5.6 MATERIALS OR EQUIPMENT TO BE FURNISHED (“OR-EQUAL” CLAUSES)

Where material or equipment is specified by a trade or brand name, it is not the intention of the Owner to discriminate against an equal product of another manufacturer, but rather to set a definite standard of quality or performance, and to establish an equal basis for the evaluation of products. Where the words “equivalent” or “equal to” are used, they shall be understood to mean that the article referred to shall be the equivalent of, or equal to some other things, in the opinion or judgment of the Engineer. The Engineer will consider other products on the basis of materials of construction, weight, function, size (it must fit the space provided), service history and electrical and mechanical characteristics.

Where these specifications state one or more model numbers and manufacturers followed by the words "or approved equal" the meaning is that the product(s) specified is acceptable and that while there may be other products that are acceptable the only way to be assured is to submit the desired substitution and receive an affirmative answer. The Engineer will consider the factors previously described in making the determination.

Unless otherwise specified, all materials shall be the best of their respective kinds and shall be in all cases fully equal to approved samples. The Engineer shall have the right to require the use of
such specifically designated material, article, or process. The Engineer, where practical, may require submission of actual samples of materials or products. If for lack of data only one name is shown, it shall be deemed as only establishing a standard of quality and/or performance.

1.5.7 SHOP DRAWINGS AND SUBMITTALS

Whenever materials are to be incorporated into the work, and are subsequently to be accepted by HWU, copies of information describing and depicting the details of all equipment, controls, materials and/or services to be provided, hereinafter referred to as “shop drawings”, shall be submitted and approved as required in the applicable procurement documents, agreement or bid specifications.

Shop drawings for all equipment and materials must show the following information at a minimum:

   a) Manufacturer’s cut sheets or other detailed product information.
   b) Detailed dimensional drawings of each valve and fitting.
   c) Detailed description of materials of construction and applicable standards.

1.5.8 PERMITS, EASEMENTS, AND RIGHTS-OF-WAY

Unless stated otherwise, the Owner shall make application for, obtain and pay fees for all licenses, permits, easements, and rights-of-way, including railroad permits (where applicable). The Owner shall be required to comply with all State and municipal ordinances, laws, and/or codes, which may apply to same.

1.5.9 CONTRACTOR’S CERTIFICATION

The Contractor shall certify, upon completion of project construction, that all work was completed in accordance with drawings and specification bearing Owner’s approval. The certification must be signed, and dated by the Contractor.
2. MATERIALS

2.1 PIPE

2.1.1 PVC PIPE

PVC pipe 4” thru 12” diameter for potable water main shall conform to AWWA C900, 150 psi pressure class, DR 18.

Pipe larger than 12” diameter shall conform to AWWA C905, 165 psi pressure class, DR 25. Joints shall be of the push-on type as specified.

PVC pipe with rubber gaskets shall conform to dimensions and tolerances: ASTM D-2241, ASTM D-2122, and NSF International F-14

Materials: ASTM D-1784 and NSF International for potable water use. Pipe and couplings shall be made of virgin PVC compounds with a cell classification of 12454-A or 12454-B. The hydrostatic design basis rating shall be 4,000 psi for water at 73.4 degrees F (23 degrees C).


Lubricants: Compatible with PVC materials and approved for use in potable water line pipe.

Each piece of pipe shall bear the manufacturer’s name or trademark, and NSF International (NSF) mark of approval.

2.1.2 DUCTILE IRON PIPE

Ductile iron pipe shall be designed and manufactured in accordance with the latest revision of ANSI/AWWA C150/A21.50 for a minimum 150 psi (or project requirements, whichever is greater) rated working pressure plus a 100 psi surge allowance (if anticipated surge pressures are other than 100 psi, the actual anticipated pressure should be used); and a 2 to 1 factor of safety on the sum of working pressure plus surge pressure.

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

Ductile iron pipe shall have standard asphaltic coating on the exterior. Pipe shall also have a cement-mortar lining on the interior in accordance with ANSI/AWWA C104/A21.4.

The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. The manufacturer’s mark, country where cast, year in which the pipe was produced, and the letters “DI” or “DUCTILE” shall be cast or stamped on the pipe.

Ductile iron pipe shall be furnished with Tyton® or Fastite® Push-on Type Joints, or approved equal. Joints shall be in accordance with ANSI/AWWA C111/A21.11, and be furnished complete with all necessary accessories.

Fittings shall be manufactured in the U.S.A. and be ductile iron. Fittings shall conform to ANSI/AWWA C153/A21.53. Fittings shall have a standard asphaltic coating on the exterior.
Fittings shall also have a cement-mortar lining on the interior in accordance with ANSI/AWWA C104/A21.4.

Fittings and accessories shall be furnished with Mechanical Type Joints in accordance with ANSI/AWWA C111/A21.11.

All pipe, fittings and accessories shall be installed and tested in accordance with ANSI/AWWA C600.

Polyethylene protection wrapping will be required for all ductile iron installations. Polyethylene shall be either 4 mil HDCL (high density cross laminated) or 8 mil LLD (linear low density) installed in accordance with AWWA C105.

Ductile iron pipe shall be manufactured by Clow Water Systems, US Pipe, or approved equal.

2.1.3 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

High Density Polyethylene Pipe (HDPE) shall be 160 psi working pressure, dimensional ratio DR9, for 4” and smaller, and shall conform to ASTM D-3350.

Molded fittings shall be made from material meeting the same requirements as the pipe, shall be manufactured in accordance with ASTM D3261 and shall be so marked. Fittings shall meet the appropriate AWWA standard (C901 or C906) and shall be Pressure Class 160.

Mechanical connections, when used, shall be specifically designed for use with HDPE pipe.

Pipe and molded fittings shall be manufactured by JM Eagle, or approved equal.

2.2 FITTINGS & GASKETS

Fittings for water lines shall be ductile iron fittings in accordance with ANSI/AWWA C153/A21.53) and shall conform to the details and dimensions shown therein. Fittings shall have mechanical joints meeting the requirements of ANSI/AWWA C111/A21.11). Fittings shall have interior cement-mortar lining as specified for the pipe.

Mechanical joints shall be bolted and of the stuffing box type and shall consist of a bell, with exterior flange and interior recess for the sealing gasket, a pipe or fitting plain end, a sealing gasket, a follower gland, tee-head bolts and hexagon nuts.

All mechanical joint connections shall be made using restraining joint glands.

Use Meg-A-Lug type fittings specific to the pipe material. Other mechanical restraining system may be used if approved in writing by HWU.

All restraining joint glands to be installed according to manufacturer specifications concerning torque.

Ductile iron fittings shall be manufactured by Tyler Union or approved equal.

Field Lok gasket shall be a boltless, integral restraining system and shall have a pressure rating based on the performance requirements of ANSI/AWWA C111/A21.11, and shall be constructed
with stainless steel locking segments vulcanized into the gasket to grip the pipe to prevent joint separation.

Field Lok gasket shall be manufactured by US Pipe (Field Lok 350®).

Ductile iron pipe restraints three (3) through sixteen (16) inch shall have a working pressure rating of 350 psi. Ductile iron pipe restraints eighteen (18) inch and up shall have a working pressure rating of 250 psi. Ductile iron pipe restraints shall be manufactured in the USA, and shall be a wedge action restraining type with breakaway bolt design to ensure proper torque for installation. Ductile iron pipe restraints shall be for mechanical joint type, and shall have T-bolts, nuts, and gaskets that conform to AWWA C111, and a black e-coating to prevent corrosion. Ductile iron pipe restraints shall be Ebba Iron Sales, Inc. (1100 Megalug Series) or The FORD Meterbox Co., Inc. (UFR1400 Series) or approved equal.

2.3 VALVES


2.3.1 GATE VALVES

All gate valves shall conform to the latest revision of “AWWA C-509 Standard for Gate Valves - 3 inch through 48 inch - For Water and Other Liquid”.

All gate valves shall be of the resilient seat type, ductile iron body, non-rising stem, fully bronze mounted and suitable for water working pressures of 150 psi, unless otherwise indicated in the drawings. Valves shall be of standard manufacturer and of the highest quality both as to materials and workmanship.

All gate valves shall be furnished with mechanical joint end connections, unless otherwise shown on the Drawings or specified hereinafter.

All gate valves shall have the name or monogram of the manufacturer, the year the valve casting was made, the size of the valve, and the working water pressure cast on the body of the valve.

Each gate valve installed in the ground shall be installed in a vertical position with a valve box. Gate valves set with valve boxes shall be provided with a 2-inch square operating nut and shall be opened by turning to the left (counterclockwise).

Gate valves shall be sized and installed at locations shown on the drawings.

2.3.2 BUTTERFLY VALVES

All butterfly valves shall be of the tight closing, with rubber seats which are recess mounted and securely fastened to the valve body or to the valve disc. Valves shall be rated for 150 psi pressure. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. Valves
shall meet the full structural requirements of the application classes of AWWA C504, latest revision.

Valve bodies shall be constructed of ductile iron and shall have integrally cast mechanical joint ends. Two (2) trunnions for shaft bearings shall be integral with each valve body. Body thickness shall be in accordance with AWWA C504. Valves shafts shall be constructed of stainless steel or of other approved construction.

The disc may be constructed of any material described in AWWA C504, Section 3.4. All disc seating edges shall be smooth and polished. Valve shafts shall be a one-piece unit extending full size through the valve disc and bearings. Valve seats shall be a natural rubber to a synthetic compound and shall be mounted in body or on the disc. Disc mounted seats shall be mechanically retained; body mounted seats shall be bonded to the valve body. Bonded-in seats must be simultaneously molded in, vulcanized and bonded to the body and the seat bond must withstand 75 pounds pull under test procedure ASTM D429, Method B. Valves shall be fitted with sleeve type bearings. Bearing load shall not exceed 2,500 psi. Valves shall be as manufactured by Henry Pratt Company; Dresser; or American-Darling.

The operators shall be the traveling nut type, AWWA C504, Class 150B. All operators shall be fully gasketed and grease packed and designed to withstand submersion in water to 10 psi. The number of turns to move from fully open to fully closed shall closely resemble conventional distribution valve practice to minimize water hammer. The operator shall be equipped for buried service.

All surfaces of the valve shall be clean, dry, and free from grease before painting. The valve interior surfaces except seating surfaces shall be evenly coated with black asphalt varnish in accordance with Federal Specifications TT-C-494 B and AWWA C504.

Hydrostatic and leakage tests shall be conducted in accordance with AWWA C504, Section 5.

Butterfly valves installed in the ground shall have the operator nut in a vertical position for use in the valve box.

Butterfly valves shall be sized and installed at locations shown on the Drawings.

2.3.3 AIR RELEASE VALVES

Air release valves shall be installed at the high points in the lines as shown on the Drawings. Air valve stems shall be connected to the main by a corporation stop. Valves shall be suitable for average working water pressure of 300 psi, have a 2-inch large orifice and a 3/32-inch small orifice. Valves shall be equipped with cast iron body and cover, stainless steel float, Buna-N seat and bronze linkage. Bronze parts that meet potable water shall conform to NSF/ANSI 61-G. Air release valves shall be ARI Model S-014 or approved equal.

Air release valves shall be connected to the main by a corporation stop with inside I.P.S. threaded outlet. The inlet pipe to the valve shall be 304 stainless steel pipe with I.P.S. male threaded ends.

The air valve shall be contained in a straight section of 36” RCP with standard manhole frame and lid as per the standard drawings, and shall be set on a crushed stone or gravel base.
2.3.4 TAPPING SLEEVES AND VALVES

Tapping sleeves shall be suitable for working pressures of 150 psi.

Tapping sleeves for connections to existing water lines shall be two-piece fabricated saddles of all stainless steel construction with stainless steel flanges. Saddle bolts are to be stainless steel.

Tapping valves shall be of the mechanical joint type suitable for working pressures of 150 psi and shall be Mueller No. H-667, American Valve and Hydrant No. 565, M&H No. 751, Kennedy Figure 8950SS or approved equal.

Line tapping materials shall be supplied and installation performed by HWU personnel.

2.3.5 VALVE BOXES

Valve boxes shall be of 5-1/4 inch, standard cast iron, two or three piece, screw type valve box with drop cover marked “WATER”. Valve boxes and covers shall be as manufactured by Tyler Corporation, Opelika Foundry, Bingham & Taylor, or approved equal.

2.4 FIRE HYDRANTS AND FLUSH HYDRANTS

2.4.1 FIRE HYDRANTS

Fire hydrants shall conform in all respects to the requirements of AWWA C502, latest revision. The hydrant barrel shall have a safety breakage feature above the ground line. All hydrants shall have 6-inch mechanical joint shoe connection; two 2-1/2-inch hose discharge nozzles and one 4-1/2-inch pumper nozzle. The nozzle connection threads shall be National Standard Hose Coupling Thread (N.S.T.). The pumper nozzle shall be furnished with a 5” quick connect nozzle, Storz or approved equal. The main valve shall have 5-1/4-inch full opening and be of the compression type, opening against water pressure so that the main valve remains closed should the barrel be broken off. Each nozzle is to be protected by nozzle caps. The caps shall be furnished with a 1-1/2-inch open-left pentagonal opening nut, gaskets and attachment chains.

Hydrants shall be furnished for a minimum 3’-6” bury depth. The Contractor is responsible to provide adequate hydrant barrel length for proper installation in accordance with the standard drawings and the manufacturer’s recommendations.

The hydrants shall be fully bronze mounted. The main valves shall have a threaded bronze seat ring assembly of such design that is easily removable by unscrewing from a threaded bronze drain ring. Drainage waterways shall be completely bronze to prevent rust and corrosion. Bronze parts that meet potable water shall conform to NSF/ANSI 61-G.

The operating stem shall be equipped with anti-friction thrust bearing to reduce operating torque and assure easy opening. A stop shall be provided to limit stem travel. Stem threads shall be enclosed in a permanently sealed lubricant reservoir protected from weather and the waterway with O-ring seals.
Fire hydrants are to be painted red or yellow on the upper barrel and bonnet. Hydrants shall be Kennedy K81D, AVK Model 2780-5” Storz, or approved equal.

Quick-connect nozzles shall be “Storz” by Kochek Co., Inc., or approved equal, and shall have a 5” metal face, a 4 1/2” NH female face for connection to the hydrant, (3) set screws, hi-visibility reflective tape, low profile hydrant nut cap, and 3/32-inch stainless steel aircraft cable retainer. Color shall be dark grey.

2.4.2 FLUSH HYDRANTS

Flush Hydrants shall be Kupferle Eclipse 2 Post Hydrant (in pedestrian or vehicular traffic areas, M & H Flush Type Style 333 furnished with cast iron box and cover) or approved equal.

Flush hydrants shall be installed with a reducer, valve, and with the top flush with the ground or sidewalk. They shall not be installed on a tap off the water main. A thrust block is required for flush hydrants the same as for a fire hydrant. The flush hydrant shall be located on the easement with good access for use.

Bronze parts that meet potable water shall conform to NSF/ANSI 61-G.

2.5 CASING PIPE FOR BORE OR DITCH CROSSING

Casing pipe for water lines installed by road boring or in ditch crossings where required on the drawings or bid documents shall be steel, plain end, uncoated and unwrapped, have a minimum yield point strength of 35,000 psi and conform to ASTM A252 Grade 2 or ASTM A139 Grade B without hydrostatic tests. The steel pipe shall have welded joints and be in at least 18-foot lengths. Pipe shall be straight along the centerline axis within 1/50 of the outside diameter. Pipe shall also be free from dents or humps due to damage or variations in wall thickness.

For street and ditch crossings, casing pipe shall be a minimum of Schedule 20, with wall thickness of 0.375 for 24 inch and larger casings. For railroad crossings, casings shall have a minimum wall thickness as specified by the railroad company. For State or Federal highway crossings, Kentucky Transportation Cabinet standards will apply.

All encasement pipe and one pipe length outside the casing on both ends shall be restrained.

Pipes in casings shall be supported with stainless steel liner skids, as manufactured by Cascade Waterworks Manufacturing, CSS series, or approved equal. A minimum of two spacers shall be provided with each length of pipe. For PVC pipe, spacers shall be provided at six foot (6’) intervals. For DI pipe, spacers shall be provided at ten foot (10’) intervals.

Provide casing end seals model “AM”, as manufactured by Advance Products and Systems, Inc., (www.apsonline.com), or approved equal.
2.6 WATER SERVICE LINE & METER ACCESSORIES

2.6.1 PRODUCTS
All ¾” and 1” service pipe shall be type K soft copper. All brass, copper and bronze fittings and accessories shall comply with NFS/ANSI 61 and NFS/ANSI 372 ("lead free" rules). Service pipe greater than 1” shall be PE Pipe, SDR 11.

2.6.2 METER SETTER KIT
¾ dual setter kit shall be CITCO #DH1434-2-COMP or ¾ WWSI Fab Meter Box or approved equal.
1” dual setter kit shall be CITCO CMU 1.0 or 1” WWSI Fab Meter Box or approved equal.
1 ½” dual setter kit shall be CITCO CMU 1.5 or 1 ½” WWSI Fab Meter Box or equal.
2” dual setter kit shall be CITCO CMU 2.0 or 2” WWSI Fab Meter Box or approved equal.

2.6.3 METER BOX TOPS AND LIDS
Dual meter box top and lid shall be Ford Model A53H-T or Vestal RMC-21L with small nut non-recessed CI meter box locking ring and cover 32-094 or approved equal.
Single meter box top and lid shall be Ford Model A52H-TT or Vestal RMC-18L meter box cover, 32-023 or approved equal.
Corporation stop shall be Ford Model F-600-3, F-600-4, FB400-6, FB400-7 or approved equal.
All soft copper connections shall be flare type connections.
Service saddles shall be Ford Model FS303 or approved equal.
Service saddles are required for PVC mains.
3. INSTALLATION

3.1 TRENCH EXCAVATION

Trenching shall be accomplished as described hereinafter. All excavation shall be “unclassified” and no additional payment will be made for rock excavation unless a separate bid item is provided for rock excavation. Rock is defined herein as hardpan or bedrock of such consistency as to not be breakable with standard excavating equipment, and excludes any rubble or boulders.

Unless otherwise directed by the Engineer, trenches in which pipes are to be laid shall be excavated in open cut to the depths shown on the plans. Excavation in earth shall undercut the pipe to a depth below the required invert elevation that will permit laying the pipe in a bed of granular material to provide continuous support for the bottom quadrant of the pipe. The bedding shall be as set out in hereinafter.

Trenches shall be of sufficient width to provide free working space on each side of the pipe and to permit backfilling around the pipe, but unless specifically authorized by the Engineer, trenches shall in no case be excavated or permitted to become wider than 2 feet 6 inches plus the nominal diameter of the pipe at the level of or below the top of the pipe. If the trench does become wider than 2 feet 6 inches at the level of or below the top of the pipe, special precautions may be necessary, such as providing compacted, granular fill up to top of the pipe or providing the pipe with additional crushing strength as determined by the Engineer after taking into account the actual trench loads that may result and the strength of the pipe being used. The Contractor shall bear the cost of such special precautions as are necessary.

Prior to excavating the trench, Contractor shall pothole far enough ahead to reveal obstructions that may necessitate changing the line or grade of the pipeline, in order to avoid delays or the addition of avoidable fittings. Before laying the pipe, the trench shall be opened far enough ahead to reveal obstructions that may necessitate changing the line or grade of the pipeline.

Unless specifically directed otherwise by the Engineer, not more than 100 feet of trench shall be opened ahead of pipe laying work of any one crew, and not more than 100 feet of open ditch shall be left behind the pipe laying work of any one crew. Watchman or barricades, lanterns and other such signs and signals as may be necessary to warn the public of the dangers in connection with open trenches, excavation and other obstructions, shall be provided by and at the expense of the Contractor. Conformance to all state highway requirements shall be the responsibility of the Contractor when encroachment on state right-of-way is necessary.

When directed by the Engineer, only one-half of street crossings and road crossing shall be excavated before placing temporary bridges over the side excavated for the convenience of the traveling public. All backfilled ditches shall be maintained in such a manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and property owners abutting shall be taken into consideration. All public or private drives shall be taken into consideration and shall be promptly backfilled or bridged at the direction of the Engineer. Disposal of excavated materials shall cause as little interference with the work as possible, and in every case the disposition of materials shall be satisfactory to the Engineer. Trenches in which pipes are to be
laid shall be excavated in open cut to the depths shown on the approved plans, cut sheets or as specified by the Engineer.

Where conditions exist that may be conductive to slides or cave-ins, proper and adequate sheeting, shoring and bracing shall be installed to provide safe working conditions and to prevent damage to work. Trenches shall be kept free of water during the laying of the pipe and until the pipeline has been backfilled. All excavation shall be in accordance with OSHA and/or KOSHA regulations. Where a trench box is used, the excavation shall be made such that the box rests on undisturbed soil fully above the top of the installed pipe to a maximum of two (2) feet or the maximum allowed by other regulation, whichever is less; to avoid disturbing the pipe bedding when the box is pulled forward. Where sheeting or shoring is used, it shall be fully removed with the completion of backfilling unless otherwise approved in writing by HWU.

Water line trenches shall be excavated to the depths shown on the plans or as directed by the Engineer. If depths are not shown on the plans, all water lines shall have 3’-6” to 4’-0” cover unless otherwise approved by the Engineer.

Dewatering of trenches shall be considered a part of trenching, at no extra cost to the Owner. Dewatering of trenches shall include ground water and storm or sanitary sewage. Suitable pumping and other dewatering equipment are to be provided by the Contractor, to insure the installation of the pipeline structure in a dewatered trench and under the proper conditions. Dewatering shall include all practical means available for prevention of surface runoff into trenches and scouring against newly laid pipe.

Wherever pipelines are in, or cross, driveways and streets, the Contractor shall be responsible for any trench settlement which occurs within these rights-of-way within one (1) year from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be removed and/or replaced by the Contractor at no extra cost to the Owner. Repair of settlement damage shall meet the approval of the Engineer, and the agency having jurisdiction over the roadway.

**3.2 LAYING OF PIPE**

**3.2.1 Laying Requirements**

Pressure pipe shall be installed in accordance with AWWA C600, latest revision, and laid to lines, cover or grades shown on the drawings. Water lines installed on a slope greater than 20 percent shall be approved on a case by case basis by HWU.

Each segment of pipe must be swabbed out before lowering into trench. All pipe shall be visually inspected for cleanliness and proper jointing.

All pipe shall be laid with: proper alignment; evenness of width and depth of joints; perfection in jointing; and care of the pipe in handling. Joint deflections shall not exceed one-half of the manufacturer’s recommended maximum allowable.
Precautions must be taken to prevent flotation of the pipe should water enter the trench prior to putting the pipeline into operation.

In wet, yielding or mucky locations where pipe is in danger of sinking below grade or floating out of grade or alignment, or where the backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. If crushed rock fill beneath the pipe is necessary for stability, it will be paid for at the unit price bid per ton of such material in place except in cases where instability is caused by neglect of the Contractor.

Whenever pipe laying is stopped, the end of the pipe shall be securely plugged with a watertight plug.

Elbows, plugs, dead end valves, and tees shall be firmly blocked, as shown on the Drawings, to prevent internal pressure from springing the pipe from the intended alignment, with permanent materials solidly placed without covering pipe joints.

No pipe shall be laid resting on solid rock, blocking or other unyielding objects. Pipe shall not be belled prior to being lowered into the trench except as otherwise stated herein or pre-approved by HWU.

When locating near sewer lines, the horizontal separation between water and sewer lines should be at least 10 feet measured to the pipe wall exterior. Should conditions prevent a horizontal separation of 10 feet, HWU may allow a deviation on a case by case basis. Such deviation may be allowed if the sewer is laid in a separate trench or if it is laid in the same trench with the water main located at one side on a bench of undisturbed earth. In either case, the elevation of the crown of the sewer must be at least 18 inches below the invert of the water main.

Water mains crossing above sewer lines shall be waterworks grade ductile iron pipe. The crossing shall be at the midpoint of the section of sewer pipe. The ductile iron water pipe shall be laid with a 20-foot section of pipe centered at the sewer line to insure that joints are as far as possible from the crossing.

Water mains crossing sewers shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer. Should conditions prevent the water main from being buried to meet the above requirements and maintain minimum cover, HWU may allow a deviation on a case by case basis, if supported by data from the Engineer. Such deviation may be allowed if the sanitary sewer line is constructed with ductile iron pipe with protective internal coating of “Protecto-401” or equivalent epoxy coating (RCP or cement lined DIP for storm sewer) for a distance of 10 feet on each side of the water line and one full length of water main is centered over the sewer so that both joints will be as far from the sewer as possible. As an alternative for existing sewers, the sewer line may be encased in a steel casing pipe with end seals for 10 feet on each side of the water line.

3.2.2 PIPE BEDDING

All water main pipe shall be bedded with select material. Where suitable soil conditions are encountered, the trench bottom may be shaped to cradle the bottom 60 degrees of the pipe.
All water main pipe shall be supported on a smoothly graded trench bottom. Holes in the trench bottom or bedding for pipe bells must be provided at each joint and should be no larger than necessary for proper joint assembly and assurance that pipe barrel will lie flat on trench bottom. The trench must supply true and even support for pipe.

In no case shall the pipe be supported directly on solid rock. When rock is encountered in the trench bottom, bedding shall consist of fine gravel or size #9 crushed stone only.

3.2.3 SPECIAL BACKFILL

Crushed stone for “Special Backfill” where required as set out in these specifications, shall be Kentucky Transportation Cabinet crushed stone, size #9. In locations that require “SPECIAL BACKFILL” the entire trench shall be filled with No. 9 crushed stone to a point 4” below the final subgrade. In most cases this will occur under road crossings. The top 6” of the trench shall be filled with DGA followed by the appropriate layer of surface material (asphalt, concrete, gravel, etc.) to bring the trench to final grade.

All bore pits and any over digging related to such will be stabilized with #3 stone and backfilled with #9 stone to sub-grade.

3.2.4 INSTALLATION AND JOINTING

Jointing of push-on type Ductile Iron Pipe with rubber gasket couplings shall be accomplished in accordance with the manufacturer’s specifications.

Pipe shall not be laid in water or upon frozen sub grade at any time or condition when, in the opinion of the Engineer, conditions are unsuitable.

HDPE shall be installed either by Open Trench construction or Directional Bore method. HDPE pipe shall be joined by thermal butt fusion. HDPE joints shall be made in strict compliance with the manufacturer’s recommendations.

Mechanical connections of HDPE pipe to valves, meters, etc. shall be through flanged connections which shall consist of the following: A polyethylene flange shall be thermally butt-fused to the stub end of the pipe; a 316 stainless steel back up ring shall mate with a 316 stainless steel flange; 316 stainless steel bolts and nuts shall be used.

3.2.5 BACKFILLING

Backfilling of pipeline trenches shall be accomplished in accordance with the details set forth hereinafter.

In all cases walking or working on the completed pipelines, except as may be necessary in tamping or backfilling, will not be permitted until the trench has been backfilled to a point one foot (1’) above the top of the pipe. The filling of the trench and compaction of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur. The methods of backfilling shall be as follows:
**Method “A” - Backfilling in Open Terrain:**

The lower portion of the trench, from the pipe bedding to a point six (6) inches above the top outside surface of the pipe, shall be backfilled with previously excavated soil material which is free from rock and/or acceptable to the Engineer. This soil material shall be placed in a manner approved by the Engineer and shall be lightly compacted by walking in or hand tamping to avoid displacement of the pipe. Crushed stone or fine gravel may be used as backfill in lieu of the compacted soil materials. Tamping or compaction, or materials used in lieu of backfill, is not a separate pay item.

The upper portion of the trench above the compacted portion shall be backfilled with material which is free from large rock. Incorporation of rock with any individual piece having a volume exceeding eight (8) cubic inches is prohibited. Backfilling this portion of the trench may be accomplished by any means approved by the Engineer. The trench backfill shall be heaped over the top of the trench or leveled as directed by the Engineer. Material for backfilling the upper portion of the trench is not a separate pay item.

**Method “B” - Backfilling Under Sidewalks and Unpaved Driveways:**

The trench from the bottom of the trench to grade shall be backfilled with No. 9 crushed stone.

**Method “C” - Backfilling Under Streets, Roads and Paved Driveways:**

The lower portion of the trench to a point six inches (6”) below the bottom of the pavement or concrete sub-slab shall be backfilled with No. 9 crushed stone or fine gravel. Backfill for the lower portion of the trench is not a separate pay item.

The upper portion of the trench, from the top of the #9 stone to grade, shall be backfilled with a base course of dense graded aggregate. At such time that pavement replacement is accomplished, the excess base course shall be removed as required. Material for backfilling the upper portion of the trench is not a separate pay item.

Before final acceptance, the Contractor will be required to level off all trenches or to bring the trench up to grade. The Contractor shall, at his expense, also remove and legally dispose of all excess earth or other materials from roadways, right-of-ways and/or private property. Hazardous materials shall be handled and disposed of in accordance with all local, State and Federal requirements.

In the event that pavement is not placed immediately following trench backfilling in streets and highways, the Contractor shall be responsible for maintaining the trench surface in a smooth and level condition at proper pavement grade at all times. The Contractor shall be liable for any damage to persons or property resulting from the Contractor’s failure to maintain the trench surface.

Flowable fill shall be allowed as an alternate method for backfilling of utility cuts and trenches, with approval of the Engineer.
3.2.6 CONCRETE CRADLE, ANCHORS, THRUST BLOCKS OR ENCASEMENTS

Concrete anchors and thrust blocking of water mains and fittings shall be placed where shown on the Drawings, required by the Specifications, or as directed by the Engineer. Concrete shall be 2,500 psi and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints.

All valves shall be anchored in accordance with the details on the project drawings.

No fitting shall be totally encased in concrete so as to prohibit future excavation or repairs.

Concrete cradles and/or encasement shall not be allowed except with express written permission by HWU. If concrete trench stabilization is necessary, excavate the trench and place the concrete to allow a minimum of four (4) inches of granular material between the concrete and the installed pipeline or structure. If concrete protection is required over the top of the pipeline, place a minimum of four (4) inches of granular material between the pipeline and the concrete. If flowable fill concrete is used to backfill the trench, bed the pipeline as indicated on the drawings to a point at least 6 inches above the top of the pipe prior to placement of the flowable fill.

3.2.7 DITCH OR WATERWAY CROSSINGS

For ditch or waterway crossings 15 feet or greater in width, unless the design plans indicate otherwise, the pipe shall be of special construction, having flexible watertight joints, and valves shall be provided at both ends of the crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible, and not subject to flooding. The valve closest to the supply source shall be supplied with a test point.

For ditch or waterway crossings less than 15 feet in width, restrained joint gaskets shall be used on the ductile iron pipe.

The Contractor shall include allowance in his bid to divert water during creek crossing installation, dewatering and/or other steps necessary to accomplish the work. No extras will be allowed for this work unless clearly outside the scope of what normally should be expected and the Contractor immediately notifies the Owner if such a situation is encountered.

3.2.8 FIRE HYDRANT INSTALLATION

Hydrants shall be located as shown on the plans or as directed by the Engineer. The location shall provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians. When placed behind the curb or sidewalk, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than 4'-0" from the gutter face of the curb, the edge of sidewalk, or a driveway. All hydrants shall stand plumb with the pumper nozzle facing the curb. Hydrants shall be set to the established grade, with nozzles at 18 inches above finished grade as shown on the drawings or as directed by the Engineer. Unless otherwise shown, each hydrant on the drawings shall be connected to the main with a 6-inch branch connection controlled by an independent 6-inch gate valve. Fine grade river gravel to be placed 6” from surface to 6” below waterline in a 2’-0” radius around hydrant barrel, for dissipation of weep hole
drainage. No drainage sump shall be connected to a sanitary sewer. No hydrant shall be set over any other utility.

All hydrants shall be provided with a thrust block, minimum of two (2), 4” x 8” x 16” precast concrete blocks, set against undisturbed ground and the fitting to be anchored. The backing shall be placed between undisturbed ground and the fitting to be anchored. The backing shall be so placed that the pipe and fitting joints will be accessible for repair. If shown on the drawings or directed by the Engineer any movement shall be prevented by attaching suitable metal rods, clamps, or restrained fittings.

3.2.9 FITTING INSTALLATION

M.J. Fittings shall be installed with a restraining gland (Meg-a-Lug by Ebara Iron, Uni-Flange Series 1400 by Ford Meter Box, or approved equal) or other mechanical restraining system approved in writing by HWU and torqued at the specified foot-pounds of the manufacturer. Additionally, joining restraint is required along the length of pipe as specified in the table below for the various type and size of fitting.

### Ductile Iron Pipe - Joint Restraint Length (ft.)

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Horizontal Bend</th>
<th>Vertical Bend - Upper</th>
<th>Vertical Bend - Lower</th>
<th>Tee</th>
<th>Reducer</th>
<th>Dead End</th>
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<td>45° 14 7 4 6 3 2 4</td>
<td>45° 18 9 5 7 4 2 4</td>
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<td>18 18</td>
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<tr>
<td>18”</td>
<td>55 23 11 6</td>
<td>35 17 9 15 7 4 55 22</td>
<td>60 31 17 9 6 3 55 22</td>
<td>72</td>
<td>90 84</td>
<td></td>
</tr>
</tbody>
</table>

### PVC Pipe - Joint Restraint Length (ft.)

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Horizontal Bend</th>
<th>Vertical Bend - Upper</th>
<th>Vertical Bend - Lower</th>
<th>Tee</th>
<th>Reducer</th>
<th>Dead End</th>
</tr>
</thead>
<tbody>
<tr>
<td>6”</td>
<td>28 12 6 3</td>
<td>21 10 5 7 4 2 6 1</td>
<td>28 14 7 9 5 3 22 1</td>
<td>28</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>8”</td>
<td>36 15 8 4</td>
<td>28 14 7 9 5 3 22 1</td>
<td>33 16 8 11 6 3 34 10 1</td>
<td>27</td>
<td>49 79</td>
<td></td>
</tr>
<tr>
<td>10”</td>
<td>43 18 9 5</td>
<td>33 16 8 11 6 3 34 10 1</td>
<td>51 21 11 5 39 19 10 13 7 4 48 25 1</td>
<td>28</td>
<td>50 93</td>
<td></td>
</tr>
<tr>
<td>12”</td>
<td>51 21 11 5</td>
<td>39 19 10 13 7 4 48 25 1</td>
<td>71 30 15 7 55 27 14 19 9 5 86 22 1</td>
<td>72</td>
<td>90 133</td>
<td></td>
</tr>
</tbody>
</table>

**Parameters**

- **Soil Type:** MH (silt/clay with granular backfill)
- **Safety Factor:** 1.5 to 1
- **Trench Type:** 3
- **Depth of Bury:** 3.5 ft.
- **Test Pressure:** 150 psi

**Assumptions**

1.) For Vertical Bend, the Low Side Depth is 6 ft.
2.) For Tee, Length Along Run is 18 inches.

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All rubber gaskets in M.J. fittings shall be soaped as per manufacturer recommendations.

Mechanical joints shall be made in accordance with the recommendations of the manufacturer. Joint bolts shall be drawn up equally around the entire periphery maintaining equal spacing from the gland to the face of the flange at all points around the joint. All bolts shall be tightened to within the following torque range. Bolts may be snugged with an air wrench.

Final tightening shall be by hand-operated torque wrench with bolts torqued to the following specifications:

<table>
<thead>
<tr>
<th>PIPE SIZE (in.)</th>
<th>BOLT SIZE (in.)</th>
<th>RANGE OF TORQUE (ft.-lb.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>5/8</td>
<td>45-60</td>
</tr>
<tr>
<td>4-24</td>
<td>¾</td>
<td>75-90</td>
</tr>
<tr>
<td>30-36</td>
<td>1</td>
<td>100-120</td>
</tr>
<tr>
<td>42-48</td>
<td>1-1/4</td>
<td>120-150</td>
</tr>
</tbody>
</table>

3.2.10 TERMINATION OF LINE

Lines shall be terminated for future use as shown on the drawings. If not shown on the drawings, termination shall be with a flushing hydrant.

3.2.11 LINE VALVES

Line valves shall be installed not more than 600 feet apart and where a main tees off to another line. A line valve shall be installed at each leg of a tee, for a total of 3 valves. Tees for hydrants shall include 2 line valves and one hydrant valve. A line valve shall be installed at the end of every line with full section of pipe and end cap. Line valves shall be placed outside roadways.

3.2.12 HYDRANT VALVES

Hydrant valves shall be installed on a single 6” tee line with no other taps or services. Hydrant valve must isolate the hydrant only.

Valve boxes for gate valves shall be two or three piece type. Valve boxes shall be accurately centered over valve operating nut, with backfill thoroughly tamped about them. Valve box bases shall not rest on the valves but shall be supported on crushed stone fill. They shall be set vertically and properly cut and/or adjusted so that the tops of boxes will be at grade in any paving, walk or road surface, and 2 to 3 inches above ground in grass plots, fields, woods, or other open terrain.

3.2.13 CASING PIPE FOR BORE OR DITCH CROSSING

Steel casing pipe for bore or ditch crossings shall be placed at the elevations shown on the Drawings. All joints between lengths shall be solidly welded with a smooth non-obstructing joint inside. The casing pipe shall be installed without bends. The pipelines shall be installed after the casing pipe is in place.

Provide and install stainless steel casing spacers and end seals.
3.3 LOCATOR WIRE AND TAPE

Tracer wire and locator tape shall be furnished and installed with all water mains. The tracer wire shall be taped or suitably held over the top center of the pipe and shall be #12 single strand copper wire with THW insulation or approved equal. All splices shall be made with the aid of DBR Direct Bury Splice Connectors as manufactured by 3M Electrical Products Division to insure continuity and insulation of the copper wire from the soil. Tracer wire shall be securely connected at flange bolts to all valves, fittings and hydrants to provide a suitable electrical connection. The electrical continuity of tracer wire between valves and fire hydrants shall be verified and defects found shall be corrected prior to acceptance by the Engineer. A metallic locator tape shall be buried in the trench a minimum of 12” over the top of the pipe and a minimum of 12” below the finished grade. The words “Caution Water Line Below” shall be repetitively printed along the length of the tape.

3.4 FIELD QUALITY CONTROL

3.4.1 TESTING PIPE

The Contractor will be required to test all pipelines and appurtenances with water. The maximum test pressure, measured at the lowest elevation of the pipeline being tested, shall be the pressure class of the pipe unless a specific test pressure is shown on the Drawings. The minimum test pressure shall be 1.5 times the design static pressure or 150 psi, whichever is greater.

When the line or section being tested is pumped up to the required pressure, it shall be valved off from the pump and a pressure gauge placed in the line. The pressure drop in the line, if any, shall be noted. If no pressure drop is noted in 4 hours, the HWU, at its discretion, may accept the line or section as being tested, or HWU may require the test run the full 24 hours.

At the end of the 24-hour test period, the pressure shall be recorded. If there is a drop in pressure, the Contractor shall be required to find and repair any leaks, and retest until there is no pressure drop over the test period.

Regardless of the testing, all leaks that are evident, in the opinion of the Engineer, due to water at the surface of the ground, or by listening, the leak can be heard underground with the geophone, or any other means of determining a leak, the Contractor shall be required to repair those leaks.

The Contractor shall furnish the meter or suction tank, pipe test plugs, and bypass piping, and make all connections for conducting the above tests. The pumping equipment used shall be centrifugal pump, or other pumping equipment, which will not place shock pressures on the pipeline. Power plunger or positive displacement pumps will not be permitted for use on closed pipe system for any purpose.

Inspection of pipe laying shall in no way relieve the Contractor of the responsibility for passing tests or correcting poor workmanship.

All testing will be observed by HWU or HWU’s representative.
Test sections of water main shall not exceed 2500 feet in length. Valves are to be suitably located along the water main to accommodate this requirement.

3.4.2 DISINFECTION

The new section must be ready for use before disinfection is done and the new line placed into service.

Before any new section is put into service and prior to final acceptance, the Contractor shall disinfect all constructed water lines carrying treated water in accordance with AWWA C651-14, and local and state regulations.

Prior to starting disinfection, all water mains shall be filled with water, removing air pockets, then thoroughly flushed to remove debris. Flushing velocity in the main shall be not less than three feet per second (3.0 ft/second). For larger main, pigging is an option in place of high velocity flushing.

Disinfection will then be accomplished by the adding of the chlorine solution while filling the main to obtain the initial 50 ppm of chlorine. The Contractor shall supply all equipment, labor, etc. necessary for flushing and disinfecting the mains. The Contractor shall submit, in writing, to the Engineer, the method he proposes to use for adding the chlorine, including backflow/cross connection control, and dechlorination of highly chlorinated water used in disinfection (see section 3.4.3 below).

Disinfection shall be accomplished by filling the new and/or repaired portions of the system with water having a chlorine content of at least 50 parts per million and at the end of a 24 hour contact time a residual of at least 25 parts per million shall remain. During the 24-hour period, valves and hydrants shall be operated to insure disinfection of all appurtenances. At the end of the 24-hour contact period, all the sterilized surfaces and areas shall be thoroughly flushed from the water system.

For tie-ins to an existing system such as the use of tapping valves where keeping the main out of service would restrict service to existing customers, disinfection may consist of thoroughly cleaning the new part with a solution containing not less than 1 percent chlorine.

After initial disinfection and flushing, the Contractor will use a certified lab to collect water samples for bacteriological testing. For new water mains, sets of samples shall be collected for every 1,200 feet of the new main, plus one set from the end of the line, and at least one from each branch greater than one pipe length. A new or routine replacement main shall not be placed in service until negative laboratory results are obtained on the bacteriological analyses. Sample bottles shall be clearly identified as “special” construction tests. If any of the samples are found to be positive or contain confluent growth, the Contractor shall repeat the disinfection procedure until the required numbers of negative samples are obtained.

For new mains two options are available for bacteriological testing.

Option A: Take an initial set of samples, and then resample after a minimum of 16 hours. Both sets of samples must pass for the line to be put into service.

Option B: Before approving a main for use, let it sit for a minimum of 16 hours without any water use. Then collect two samples, without flushing the main, a minimum of 15 minutes apart while
the sampling taps are left running. Both sets of samples must pass for the line to be put into service.

Since new mains do not typically contain coliform bacteria but often contain HPC bacteria, a standard heterotrophic plate count (HPC) test may be required. If sample results show HPC greater than 500 CFU/ml, flushing should resume and another set of HPC and coliform samples collected until no coliform are present and the HPC is less than 500 CFU/ml.

Certified results shall be presented to HWU in writing before the new section is put in service. HWU personnel will then place the new section in service if usage connections are made and the section is ready for use. Under no circumstances are valves to be operated by anyone other than HWU personnel.

Water used for flushing shall be metered and charged to the Contractor.

3.4.3 DE-CHLORINATION

Chlorinated water shall be disposed of in accordance with 401 KAR 5:031 and 8:020 which state that the allowable in stream concentration of chlorine is 10 ug/l, which is equal to 0.01 mg/l. The Contractor shall submit, in writing to the Engineer, the method he proposes for dechlorinating. Recommended chemicals, per AWWA C655, are sulfur dioxide, sodium bisulfate, sodium sulfite, and sodium thiosulfate.

3.4.4 WATER FOR TESTING, FLUSHING, AND DISINFECTION

Water for filling the line, pressure testing, flushing, and disinfection will be supplied or paid for by the Contractor.

3.5 WATER SERVICE LINE & METER ACCESSORIES

3.5.1 EXECUTION

All new service lines, corporation stops and meter kits necessary for service up to and including the meter box shall be installed before water main is tested or put in service.

All new corporation stops are to be installed in the horizontal 3 o’clock or 9 o’clock positions in accordance with standard drawing.

All taps on the water main shall be made with an AWWA approved tapping machine (no manual taps will be allowed). Saddles are not required for taps of 1” or smaller on ductile iron pipe. All other taps require the use of a service saddle. Saddles are required on all PVC pipe.

A standard setter kit shall be installed at locations as shown on the construction drawings and as per standard drawings.

Backfill under sidewalk, curb and roadway shall be special backfill as per standard drawings.

Final finish elevation on meter kit assembly shall match final finish grade of lot.

For dual meter settings, the meter assembly shall be on the property line.
3.5.2 FIELD QUALITY CONTROL

All new service lines and accessories shall be tested to same standards and at the same time as the water main.
FIRE HYDRANT ASSEMBLY PROFILE

NOTES:

HYDRANTS SHALL BE KENNEDY K81A OR AVK 2780 WITH STORZ PUMPER CONNECTION.

WASHED #9 GRAVEL TO BE PLACED 6" FROM SURFACE TO 6" BELOW WATER MAIN IN A 2'-0" RADIUS AROUND HYDRANT BARREL, FOR DISSIPATION OF WEEP HOLE DRAINAGE.

MAINTAIN CONTINUITY OF TRACER WIRE AT ALL TIMES.

SEE LATEST EDITION OF THE HWU "REQUIREMENTS AND SPECIFICATIONS FOR POTABLE WATER FACILITIES" FOR SPECIFIC PART NUMBERS OF ITEMS SHOWN IN DIAGRAM.

SEE STANDARD DRAWING HWU005 FOR PLAN VIEW OF VALVE PLACEMENT AT HYDRANT.
FLUSH HYDRANT ASSEMBLY PROFILE

NOTES:

2 1/2" HYDRANT BY M&H VALVE CO. OR APPROVED EQUAL.

WASHED #9 GRAVEL TO BE PLACED 6" FROM SURFACE TO 6" BELOW WATER LINE IN A 2'-0" RADIUS AROUND HYDRANT BARREL, FOR DISSIPATION OF WEEP HOLE DRAINAGE.

COIL SUFFICIENT TRACER WIRE INSIDE FLUSH HYDRANT BOX TO REACH ABOVE FINISH GRADE.

MAINTAIN CONTINUITY OF TRACER WIRE AT ALL TIMES.

SEE LATEST EDITION OF THE HWU "REQUIREMENTS AND SPECIFICATIONS FOR POTABLE WATER FACILITIES" FOR SPECIFIC PART NUMBERS OF ITEMS SHOWN IN DIAGRAM.

PLACE BURIED METALLIC LOCATOR TAPE 18"-24" ABOVE TOP OF PIPE AS SHOWN. TAPE MUST CONTINUOUSLY READ "CAUTION: BURIED WATER LINE BELOW".
AIR RELEASE VALVE

NOTES:

WASHED #9 GRAVEL TO BE PLACED TO 6" MIN. BELOW WATER MAIN AND A MIN. 4" BEYOND OUTSIDE STRUCTURE WALL FOR DRAINAGE AND FOUNDATION SUPPORT.

INSTALL AIR RELEASE VALVE A MIN. OF 1 FOOT AWAY FROM THE NEAREST PIPE JOINT.

MAINTAIN CONTINUITY OF TRACER WIRE THROUGH THE VAULT.

SEE LATEST EDITION OF HWU "REQUIREMENTS AND SPECIFICATIONS FOR POTABLE WATER FACILITIES" FOR SPECIFIC PART NUMBERS OF ITEMS SHOWN IN DIAGRAMS.
GATE VALVE & BOX
(IN LAWN/LANDSCAPED AREAS)

NOTES:

SPLICING MADE ON TRACER WIRE WILL BE MADE WITH THE AID OF DBR DIRECT BURY SPLICE CONNECTORS AS MANUFACTURED BY SM ELECTRICAL PRODUCTS DIVISION.

MAINTAIN CONTINUITY OF TRACER WIRE AT ALL TIMES.

PLACE BURIED METALLIC LOCATOR TAPE 18"–24" ABOVE TOP OF PIPE AS SHOWN. TAPE MUST CONTINUOUSLY READ: "WARNING: BURIED WATER LINE BELOW".
**TYPICAL MAIN LINE TEE**

**HYDRANT IN CONJUNCTION WITH MAIN LINE TEE**

---

**TEE FOR HYDRANT OFF OF MAIN**

6" & 8" WATER MAIN ONLY

**VALVE PLACEMENT AT TEES**

**PLAN VIEW**

**NOTES:**

ALL FITTINGS TO BE DUCTILE IRON MECHANICAL JOINTS. GATE VALVE ON ALL BRANCHES OF THE TEE, UNLESS OTHERWISE INSTRUCTED BY HWU.

SEE LATEST EDITION OF THE HWU "REQUIREMENTS AND SPECIFICATIONS FOR POTABLE WATER FACILITIES" FOR SPECIFIC PART NUMBERS OF ITEMS SHOWN IN DIAGRAMS.

MINIMUM DISTANCE BETWEEN FITTING BELLS OF 2'-0".
NOTES:

SERVICE LINE TO METER TO BE ¾" FOR SINGLE METER OR 1" FOR DUAL METER RESIDENTIAL SETTINGS.

ALL CORPORATION STOPS ARE TO BE INSTALLED IN THE HORIZONTAL 3 O’CLOCK OR 9 O’CLOCK POSITIONS.

DIRECT TAPS ALLOWED ONLY TO DIP. TAPS TO PVC PIPE ARE TO INCLUDE TAPPING SADDLE (FORD FS 300 SERIES OR APPROVED EQUAL)
3/4" & 1" SINGLE METER SETTING

NOTES:
MINIMUM BOX DEPTH 18" FOR 3/4" METER, 20" FOR 1" METER.

METER BOX TO BE 18" DIA. x 24" TALL FOR 3/4" METER AND 21" DIA. x 24" TALL FOR 1" METER.

METER TO BE SUPPLIED AND INSTALLED BY HWU ONLY.

SEE LATEST EDITION OF THE HWU "Requirements and Specifications for Potable Water Facilities" FOR SPECIFIC PART NUMBERS OF ITEMS SHOWN IN DIAGRAM.
METER BOX TOP AND RIM SHALL BE FORD METER BOX CO. INC., MODEL A55H OR VESTAL 32-374 (DIRT), 32-437 (CONCRETE) OR APPROVED EQUAL

SET COVER FLUSH WITH GROUND

DUAL SETTER METER KIT AS PER SPECS

SET ON UNDISTURBED SOIL

1/2" TYPE "K" TUBING

30" MINIMUM

18" MIN.

WATER MAIN

TO SUPPLY

1" TYPE "K" TUBING

CORPORATION STOP

3/4" DUAL METER SETTING

NOTES:
LOCATE NEAR COMMON PROPERTY LINE.

METERS TO BE SUPPLIED AND INSTALLED BY HWU ONLY.

SEE LATEST EDITION OF THE HWU "REQUIREMENTS AND SPECIFICATIONS FOR POTABLE WATER FACILITIES" FOR SPECIFIC PART NUMBERS OF ITEMS SHOWN IN DIAGRAM.
CONCRETE THRUST BLOCK, MINIMUM OF 1-8" x 8" x 16" CONCRETE BLOCK

POURED CONCRETE THRUST BLOCKING, TO BE POURED AGAINST UNDISTURBED EARTH, WITH NO CONCRETE TOUCHING THE FITTING

UNDISTURBED EARTH

ADHESIVE TAPE (DUCT TAPE, TYP.)
MEGALUG RETAINER GLANDS

UNDISTURBED EARTH

POLYETHYLENE WRAP (TYP.)

WATER MAIN

SEE NOTE FOR WIDTH

PLAN OF 45° OR 22 1/2° BEND

POURED CONCRETE THRUST BLOCKING, TO BE POURED AGAINST UNDISTURBED EARTH, WITH NO CONCRETE TOUCHING THE FITTING

POLYETHYLENE WRAP (TYP.)

MEGALUG RETAINER GLANDS

GATE VALVE

ADHESIVE TAPE (DUCT TAPE, TYP.)

UNDISTURBED EARTH

MEGALUG RETAINER GLANDS

GATE VALVE

ADHESIVE TAPE (DUCT TAPE, TYP.)

UNDISTURBED EARTH

MEGALUG RETAINER GLANDS

GATE VALVE

MEGALUG RETAINER GLANDS

WATER MAIN

PLAN OF TEE
THRUST BLOCKING

NOTES:
ALL FITTINGS TO BE DUCTILE IRON MECHANICAL JOINTS.
GATE VALVE ON ALL BRANCHES OF THE TEE, UNLESS OTHERWISE INSTRUCTED BY HWU.

MAXIMUM WIDTH OF TRENCH TO BE 2' + PIPE DIAMETER.

SEE LATEST EDITION OF THE HWU "REQUIREMENTS AND SPECIFICATIONS FOR POTABLE WATER FACILITIES" FOR SPECIFIC PART NUMBERS OF ITEMS SHOWN IN DIAGRAMS.
TRENCH SECTION METHOD "A" OPEN TERRAIN
WATER MAIN: OPEN CUT INSTALLATION

NOTES:

HAND PLACE AND TAMPER BEDDING MATERIAL TO 6" ABOVE TOP OF PIPE SO AS NOT TO DISTURB OR DAMAGE PIPE.

UPPER PORTION OF TRENCH USE EXCAVATED MATERIAL FREE FROM OBJECTS HAVING A VOLUME EXCEEDING EIGHT CUBIC INCHES.

PLACE BURIED METALLIC LOCATOR TAPE 18"–24" ABOVE TOP OF PIPE AS SHOWN. TAPE MUST CONTINUOUSLY READ: "CAUTION: BURIED WATER LINE BELOW".

MAINTAIN CONTINUITY OF TRACER WIRE AT ALL TIMES.

HOLES IN BEDDING FOR PIPE BELLS MUST BE PROVIDED AT EACH JOINT.
TRENCH SECTION METHOD "B" SIDEWALKS & UNPAVED DRIVEWAYS
WATER MAIN: OPEN CUT INSTALLATION

NOTES:
BACKFILL TRENCH FROM BEDDING TO FINISHED GRADE WITH #9 CRUSHED STONE. HAND PLACE AND TAMP BEDDING TO 6" ABOVE TOP OF PIPE SO AS NOT TO DISTURB OR DAMAGE PIPE.

PLACE BURIED METALLIC LOCATOR TAPE 18"-24" ABOVE TOP OF PIPE AS SHOWN. TAPE MUST CONTINUOUSLY READ: "CAUTION: BURIED WATER LINE BELOW".

MAINTAIN CONTINUITY OF TRACER WIRE AT ALL TIMES.
HOLIES IN BEDDING FOR PIPE BELLS MUST BE PROVIDED AT EACH JOINT.
TRENCH SECTION METHOD "C"
STREETS, ROADS, & PAVED DRIVEWAYS
WATER MAIN: OPEN CUT INSTALLATION

NOTES:

HAND PLACE AND TAMPA BEDDING MATERIAL TO 6" ABOVE THE TOP OF PIPE SO AS NOT TO DISTURB OR DAMAGE PIPE.
LOWER PORTION OF TRENCH FROM BEDDING TO SIX INCHES BELOW BASE OF PAVEMENT USE #9 CRUSHED STONE.
UPPER PORTION OF TRENCH FROM #9 STONE TO BASE OF PAVEMENT USE A BASE COURSE OF DENSE GRADED AGGREGATE.
PLACE BURIED METALLIC LOCATOR TAPE 18"-24" ABOVE TOP OF PIPE AS SHOWN. TAPE MUST CONTINUOUSLY READ:
"CAUTION: BURIED WATER LINE BELOW".
MAINTAIN CONTINUITY OF TRACER WIRE AT ALL TIMES.
HOLES IN BEDDING FOR PIPE BELLS MUST BE PROVIDED AT EACH JOINT.
WATER MAIN: DITCH OR STREAM CROSSING

NOTES:

BAGGED CONCRETE PROTECTIVE BARRIER: PLACE BAGGED CONCRETE END TO END FROM TOP OF BANK TO TOP OF BANK, APPROX. 12" ABOVE WATER MAIN.

FOR STREAMS GREATER IN WIDTH THAN 15'-0", SEE SECTION 3.2.7.

MAINTAIN CONTINUITY OF TRACER WIRE AT ALL TIMES.

PLACE BURIED METALLIC LOCATOR TAPE 18'-24" ABOVE TOP OF PIPE AS SHOWN. TAPE MUST CONTINUOUSLY READ: "CAUTION: BURIED WATER LINE BELOW".

VALVES REQUIRED ON BOTH SIDES OF CROSSING. SEE SECTION 3.2.7 FOR SPECIFICS.

TEST POINT REQUIRED ON ONE SIDE OF CROSSING. SEE SECTION 3.2.7 FOR SPECIFICS.

SEE LATEST EDITION OF THE HWU "REQUIREMENTS AND SPECIFICATIONS FOR POTABLE WATER FACILITIES" FOR SPECIFIC PART NUMBERS OF ITEMS SHOWN IN DIAGRAM.

FOR VERTICAL DISTANCES GREATER THAN 6'-0" FROM TOP OF BANK TO DITCH BOTTOM, USE HDPE FOR CROSSING.
PROPOSED WATER LINE UNDER PROPOSED OR EXISTING SANITARY SEWER

NOTES:

JOINTS MUST BE CENTERED UNDER THE PROPOSED SEWER LINE.

THE EXACT MANNER, TYPE, LOCATION, AND LENGTH OF THE CROSSING SHALL BE DETERMINED BY THE ENGINEER IN THE FIELD.

SEWERLINE MUST BE ONE JOINT OF EPOXY COATED DUCTILE IRON SEWER PIPE CENTERED OVER WATER LINE.

PLACE BURIED METALLIC LOCATOR TAPE 18"-24" ABOVE TOP OF PIPE AS SHOWN. TAPE MUST CONTINUOUSLY READ: "CAUTION: BURIED WATER LINE BELOW".

SEE LATEST EDITION OF THE HWU "REQUIREMENTS AND SPECIFICATIONS FOR POTABLE WATER FACILITIES" FOR SPECIFIC PART NUMBERS OF ITEMS SHOWN IN DIAGRAM.
Cased Water Main Crossing Under a Roadway

Notes:
- Extend casing pipe at least 5'-0" past the edge of the shoulder or 6'-0" past the top outside edge of the ditch if present, whichever is greater.
- Install field lok gaskets within all encasement pipe and one pipe length outside of the casing on both ends.
- The sleeve used will be casing seal model "AM" by Advance Products & Systems, Inc. or approved equal. Stainless steel bands to be placed on both ends of the seal.
- Maintain continuity of tracer wire at all times. Tracer wire is to be run through casing with water main.
- Place buried metallic locator tape 18"-24" above top of pipe as shown. Tape must continuously read: "Caution: Buried water line below".
- See latest edition of HWU "Requirements and Specifications for Potable Water Facilities" for specific part numbers of items shown in diagram.
NOTES:

SEE LATEST EDITION OF THE HWU "REQUIREMENTS AND SPECIFICATIONS FOR POTABLE WATER FACILITIES" FOR SPECIFIC PART NUMBERS OF ITEMS SHOWN IN DIAGRAMS.

INSTALL FIELD LOK GASKETS WITHIN ALL ENCASEMENT PIPE AND ONE PIPE LENGTH OUTSIDE OF THE CASING ON BOTH ENDS.

THE SLEEVE USED WILL BE CASING SEAL MODEL "AM" BY ADVANCE PRODUCTS & SYSTEMS, INC., OR APPROVED EQUAL. STAINLESS STEEL BANDS WILL BE PLACED ON BOTH ENDS OF THE SEAL.

MAINTAIN CONTINUITY OF TRACER WIRE AT ALL TIMES. TRACER WIRE IS TO BE RUN THROUGH THE CASING WITH THE WATER MAIN.

IN THE CASE OF A SLOPED BORING, CASING SHALL BE INSTALLED FROM THE DOWN-HILL SIDE WHERE POSSIBLE.

ALL BORE AND CASING MATERIALS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS SPECIFICATIONS AND THE HWU "REQUIREMENTS AND SPECIFICATIONS FOR POTABLE WATER FACILITIES".
VERTICAL BEND

TEE

HORIZONTAL BEND

REDUCER

DEAD END

JOINT RESTRAINT LENGTH DETAIL

NOTE:
DISTANCE "L" MEASURED ALONG PIPE FROM END OF FITTING.