CONSTRUCTION SPECIFICATIONS FOR WATER LINE EXTENSIONS

300 General

This section describes specifications for installation of water mains and appurtenances.

301 Design Criteria

301.1 Water Line

All water mains shall be a minimum 6” diameter and sized after hydraulic analysis based on pressure requirements and flow demands as shown in Table 1.

Table 1

Type of Unit	Unit Design Flow
Residential	400 GPD per unit
Commercial	1,000 GPD per unit
Industrial	1,000 GPD per acre

301.2 Fire Lines

Minimum fire flow shall be 1,000 gpm for two hours in the following corridors:

1. Industrial Park;
2. Bypass Area;
3. Central Business District (bound by Maple Street, Ironworks Road, Highland Street, and Boone Avenue); and
4. Lexington Avenue, Maryland Avenue to Bon Haven, McCann Drive, and Floyd Clay Drive.

All other areas shall have a minimum fire flow of 750 gpm for two hours.

302 Pipe & Fittings

Ductile iron pipe shall conform to ANSI A21.50-14 (AWWA C 150). The pipe shall be designed for an internal working pressure of 350 psi and external loading produced by laying condition "A" (flat bottom trench, without blocks, untamped backfill). The pipe shall be Thickness Class 51 or greater.

Joints shall be push-on type, single rubber gasket, with cast or mechanical gasket socket recessed bell with a tapered annular opening and flared socket; plain spigot ends shall be suitably beveled to permit easy entry into the bell, centering the gasket and compression of the gasket. The push-on type joints shall be "Fastite" as manufactured by the American Cast Iron Pipe Company or "Tyton" as manufactured by U.S. Pipe or approved equal.

Fittings shall be Mechanical-Joint Fittings with body thickness and radii of curvature conforming to ANSI/AWWA C 110 and joints in accordance with ANSI/AWWA C 111/A21.11-17, Class 350 ductile iron in sizes 6" through 48". Bolts and taps shall be ductile iron.

Pipe and fittings shall be tar coated outside and shall receive a standard cement lining with bituminous seal coat on the inside in accordance with the ANSI A21.4-16 (AWWA C 104).

NOTE: High pressure areas in the water distribution system will require appropriate rated materials as approved by WMU.

303 Gate Valves

Resilient seat gate valves shall fully comply with the latest revision of AWWA C509-15, and shall also be UL listed and FM approved. The valves shall be tested and certified to ANSI/NSF 61.

All valves shall be Mueller A2361, M&H C509 (style 4067-01) or approved equal.

All valves shall have a 250 psi working pressure and be NRS (non-rising stem).

All valves shall be furnished with MJ end connections, unless otherwise shown on the plans or specified herein. The end connections shall be suitable to receive ductile iron pipe.

All valves shall open counterclockwise and have an arrow cast on the operating nut showing opening direction.

All valves shall be provided with a 2” square-operating nut. The bolt that attaches the operating nut to the stem shall be recessed into the operating nut so as not to interfere with valve wrench operation.

All 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 pressure cast on the body of the valve. Valves set in vaults or pits shall be OS & Y.

All valves shall have bolts and nuts for the stuffing box and bonnet with one of the following compositions:

a) Type 304 stainless steel.
b) Type 316 stainless steel.
c) Type 18-8 stainless steel.

The valve stem shall be made of bronze ASTM B-132 alloy C67600 bar stock material. The stem shall have at least one “anti-friction” thrust washer above and below the stem collar to reduce operating torque. The design of the NRS valve stem shall be such that

if excessive input torque is applied, stem failure shall occur above the stuffing box at such a point as to enable the operation of the valve with a pipe wrench or other readily available tool. The stem material shall provide a minimum 70,000 psi tensile strength with 15% elongation and yield strength of 30,000 psi. Valves with cast stems or two piece stem collars are not acceptable.

All valves shall have a stuffing box that is "O" ring sealed. Two "O" rings shall be placed above and one "O" ring below the stem thrust collar. The thrust collar shall be factory lubricated. The thrust collar and its lubrication shall be isolated by the "O" rings from the waterway and from outside contamination providing permanent lubrication for long term ease of operation. Valves without a stuffing box are unacceptable. Valves without at least three stem "O" rings are also unacceptable.

All cast ferrous components shall be ductile iron and shall be manufactured in compliance with the latest edition of AWWA/ANSI C515. The valve shall also be UL Listed and FM Approved in applicable configurations. The body and bonnet shall also adhere to the minimum wall thickness as set forth in Table 2, section 4.3.1 of AWWA C509. Wall thickness less than those in table 2 are not acceptable.

The valve disc and guide lugs must be fully (100%) encapsulated in SBR ASTM D2000 rubber material. The peel strength shall not be less than 75 pounds per inch. Guide caps of an acetyl bearing material shall be placed over solid guide lugs to prevent abrasion and to reduce the operating torque.

All exterior valve body bolting shall be type 304 stainless steel and shall be provided with hexagonal heads with dimensions conforming to ANSI B18.2.1. Metric size and/or socket head cap screws or bolts, are not allowed. The operating nut shall be 2" square and shall be constructed of ductile iron fitted to a square tapered stem to help ensure even valve operating input torque. All body gaskets shall be of the pressure energized O-ring style design.

All valves shall have all internal and external ferrous surfaces coated with a fusion bonded thermosetting powder epoxy coating of 10 mils nominal thickness. The coating shall conform to AWWA C550.

304 Butterfly Valves

All butterfly valves shall be equivalent to Mueller Lineseal III, or M&H 4500 with 360° seating, seat replacement without valve disassembly, low head loss, self lubricated bearings, corrosion resistant mating surfaces, stainless steel stem, AWWA lengths and shaft sizes. Valves shall be of standard manufacture and of the highest quality both as to materials and workmanship and shall conform to the latest revisions, of AWWA Specification C-504-15. The valves shall have a rated working pressure of 150 psi and be tar coated on the outside. Special circumstances may dictate a higher working pressure than 150 psi.

Butterfly valves for in ground service shall be furnished with MJ end connections, unless otherwise shown on the plans or specified herein. The end connections shall be suitable to receive ductile iron pipe.

All butterfly valves shall have the name or monogram of the manufacturer, the year the valve casting was made, the size of valve, and the working pressure cast on the body of the valve. Butterfly valves set with valve boxes shall be provided with a 2" square operating nut and shall be opened by turning counterclockwise only; butterfly valves set in vaults or pits shall be OS & Y.

305 Tapping Sleeves and Tapping Valves

Tapping sleeves shall be cast iron (Mueller H-615 or approved equal) or stainless steel, (Mueller 304, Romac SST-III or approved equal).

Tapping valves shall be Mueller T-2361, American 2500 Waterous Resilient Wedge valve or approved equal.

Assembled tapping sleeves and valve must be pressure tested at 150 psi for 30 minutes prior to the actual wet tap to the water main. A WMU representative must witness the test.

The pipe tap coupon shall be surrendered to WMU upon completion of the tap.

306 Combination Air and Vacuum Valve

The combination air and vacuum valve shall consist of a KINETIC air and vacuum valve and an air release valve contained in a single body housing. The valves shall be designed to exhaust large amounts of air during filling, to release small amounts of accumulated air during operation, and to admit large amounts of air upon impending vacuum during draining.

The inlet shall be the nominal size of the valve and the outlet shall be the same size as the inlet. Body and cover shall be of cast iron conforming to ASTM A126, Class B. The air and vacuum portion of the valve shall be designed to exhaust air at up to sonic velocity without blowing shut. There shall be no baffles, deflectors, or stems. The floats shall be spherical and shall be capable of withstanding a test pressure of 1000 psi. The air release portion shall have a type 316 stainless steel leverage mechanism and float. The small orifice shall be stainless steel and have a rubber seat.
The combination air and vacuum valve shall be provided with optional throttling device.

The combination air and vacuum valve shall be VAG-GA Model Number 905 or 922-H or approved equal.

307 Valve Boxes

Valve boxes shall be cast iron, two-piece, slip type with drop cover marked "WATER" Tyler model 6855 or approved equal. They shall be set vertically and properly adjusted

so that the cover will be in the same plane as the finished surface of the ground or street. Deep buried valves (exceeding (5) feet) shall have operating stems extensions (Trumbull Valve Extension Stems) connected to the valve operating nut and extended to within one (1) foot below the top of the valve box.

308 Fire Hydrants

Fire hydrants shall meet or exceed all applicable requirements and tests of ANSI and the latest revisions of AWWA Standard C502-14. Fire hydrants shall meet all test requirements and be listed by Underwriters Laboratories Inc. Fire hydrants shall meet all test requirements and have full approval of Factory Mutual.

Fire hydrants shall be Mueller Company Super Centurion 250 No. A-423 or M&H 129.

Fire hydrants shall be rated for a working pressure of 250 psi.

Fire hydrants shall be of the compression type, opening against the pressure and closing with the pressure.

Fire hydrants shall have a minimum 5-1/4” main valve opening and a minimum inside lower/upper barrel diameter (I.D.) of 7” to assure maximum flow performance.

Fire hydrants shall be three-way in design, having one pumper nozzle 4-1/2" and two 2-1/2” hose nozzle(s). Nozzle thread type shall be national standard threads. Nozzles shall thread counterclockwise into hydrant barrel utilizing “O” ring seals.

The bonnet assembly shall provide an oil reservoir and lubrication system that automatically circulates lubricant to all stem threads and bearing surfaces each time the hydrant is operated. This lubrication system shall be sealed from the waterway and any external contaminants by use of “O“ ring seals. An anti-friction washer shall be in place above the thrust collar to further minimize operating torque. The oil reservoir shall be factory filled with a low viscosity, FDA approved non-toxic oil lubricant which will remain fluid through a temperature range of -60^0 F. to $+150^0$ F.

The operating nut shall be a one-piece design, manufactured of ASTM B-584 bronze. It shall be pentagon in shape. The operating nut shall be affixed to the bonnet by means of an ASTM B-584 bronze hold down nut. The hold down nut shall be threaded into the bonnet in such a manner as to prevent accidental disengagement during the opening cycle of the hydrant. The use of Allen head set screws as a means of retention is unacceptable. A resilient weather seal shall be incorporated into the hold down nut, for the purpose of protecting the operating mechanism from the elements.

The direction of the opening shall be counterclockwise. An arrow shall be cast on the bonnet flange to indicate the specified opening direction.

The fire hydrant bonnet shall be attached to the upper barrel by not less than eight bolts and nuts and sealed by an “O” ring.

Fire hydrants shall be a “traffic-model” having upper and lower barrels joined at the ground line by a separate and breakable “swivel” flange providing 360^0 rotation of upper barrel for proper nozzle facing. This flange shall employ not less than eight bolts. The safety flange segments shall be located under the upper barrel flange to prevent the segments from falling into the lower barrel when the hydrant is struck. The pressure seal between the barrels shall be an “O” ring. The proper ground line shall be cast clearly on the lower barrel and shall provide not less than 18” of clearance from the centerline of the lowest nozzle to the ground.

The operating stem shall consist of two pieces, not less than 1-1/4” diameter (excluding threaded or machined areas) and shall be connected by a stainless steel safety coupling. The safety coupling shall have an integral internal stop to prevent the coupling from sliding down into the lower barrel when the hydrant is struck. Screws, pins, bolts, or fasteners used in conjunction with the stem couplings shall also be stainless steel. The top of the lower stem shall be recessed 2” below the face of the safety flange to prevent water hammer in the event of a “ drive over” where a vehicle tire might accidentally depress the main valve.

The lower barrel shall be an integrally cast unit. The use of threaded on or mechanically attached flanges is deemed unacceptable. The hydrant bury depth shall be clearly marked on the hydrant lower barrel.

Fire hydrants shall be equipped with two (2) drain valves, which drain the barrel when the hydrant is closed and seal shut when the hydrant is opened. These drain valves shall be an integral part of the one-piece bronze upper valve plate. They shall operate without the use of springs, toggles, tubes, levers or other intricate synchronizing mechanisms.

The upper valve plate, seat ring and drain ring (shoe bushing) must be ASTM B-584 bronze and work in conjunction to form an all bronze drain way. A minimum of two (2) internal and two (2) external drain openings are required. Drains ported through an iron shoe must be bronze lined.

The bronze seat ring shall thread into a bronze drain ring (or shoe bushing) providing a bronze to bronze connection. Seat rings shall be “O” ring pressure sealed.

The shoe inlet size and connection type shall be a MJ connection, having ample blocking pads for sturdy setting and the MJ connection must have an anchor coupling to secure the hydrant to piping. A minimum of six bolts and nuts is required to fasten the shoe to the lower barrel.

The interior of the shoe including the lower valve plate and stem cap nut shall have a protective coating that meets the requirements of AWWA C-550. If a stem cap nut is utilized, it must be locked in place by a stainless steel lock washer or similar non-corrosive device that will prevent the cap nut from backing-off during normal use.

Fire Hydrants are to be installed with a gate valve and connected with a mechanical joint anchoring coupling. Also, a valve box and concrete valve box pad are required for the gate valve. (See WMU standard detail drawings for installation).

Location of hydrants shall be in conformity with the requirements of the Winchester Fire Department.

309 Mechanical Joint Anchor Pipe

Mechanical Joint Anchor Pipe shall be included with a fire hydrant setting. Clow Corporation F1211 MJ or Tyler swivel by solid adapter 5-198 MJ or approved equal is acceptable. (See WMU standard detail drawing).

310 Encasement Pipe

Casing pipe shall conform to AWWA C200-86 and AWWA M11 latest revision, and shall be placed at the location shown on the plans in accordance with the noted size, length, and type of material. The steel casing pipe shall have a minimum wall thickness of 1/4" for new casing pipe or 3/8" for salvaged casing pipe.

PVC casing pipe will be approved on a case by case basis by WMU.

For existing pipe installations, split steel casing pipe shall conform to the above specifications except that it shall be in two (2) semi-circular sections joined by a continuous weld from one end to the other without any traceable voids. All casing pipes shall be sealed at each end with a rubber Fernco end seal.

The casing pipe should be 6-8 in. larger than the outside diameter of the carrier pipe bells. The carrier pipe may be pushed or pulled through the completed casing pipe in accordance with the manufactures recommendation for installation into casing pipe.

Minimum wall thickness shall be as listed below:

Nominal diameter (inches)	Wall thickness (inches)
18 or less	0.0375
24	0.500
30	0.500
36	0.532
42	0.625

All welds at the joints will be a continuous circumferential weld on the outside of the pipe.

Casing spacers shall be Cascade CCS or approved equal and shall be placed around the carrier pipe to ensure approximate centering within the casing pipe to prevent damage during installation in accordance with the manufacturer's recommendation. Casing spacers shall have a bolt on shell made in two (2) sections. All metal components shall be Type 304 (18-8) Stainless Steel. It shall have an elastomeric liner to isolate the shell

from the carrier pipe. It shall have runners attached to the shell and be designed to provide a minimum of .75 inches between the carrier pipes greatest outside diameter and the casing pipes inside diameter. The chock runners shall be beveled with high abrasion resistance and a low friction coefficient.

Care must be exercised in order to avoid contact between the carrier and casing pipes. In order to avoid the transfer of earth and live loads to the carrier pipe, the space between the carrier and casing pipes should not be filled completely.
Trace wire shall be a continuous run of 12 gauge copper clad wire affixed to the top runners of the casing spacers.

Trace wire shall be installed with the carrier pipe as a continuous run of 12 gauge copper clad wire affixed to the top runners of the casing spacers.

310.1 Casing Pipe for Water Service Lines

2" PVC, schedule 80, bell and spigot conduits shall be installed for water service lines that will extend from the water main to the property served across the street. The maximum laying length for the 2" PVC is fifty feet. Lines that will extend beyond fifty feet must be 3" PVC, schedule 80, bell and spigot pipe.

2" PVC, schedule 80, bell and spigot conduits shall be installed with a minimum cover of 36" for water service lines that will extend from the water main to the property served across the street. The conduits shall be laid in a consistent elevation from the spring line of the water main to the location indicated on the plans. Both ends of the conduit shall be capped (not taped) to prevent dirt, debris and water from accumulating within the conduit.

No. 4 rebar, painted blue, shall be placed at the both ends of the conduits on the service side to protect the pipe from trenching equipment. Rebar Caps shall be placed on the exposed ends of the rebar.

Detectable mylar tape is required 18-inches below finished grade above all conduits.

Properly grounded tracer (locating) wire shall be installed parallel to the conduit. The ground shall be on the meter side of the conduit and extend to the water main where it is to be spliced to the tracer wire installed as part of the water main line installation. All splices shall be with moisture and corrosion resistant connectors similar to the Copperhead SnakeBite connectors or 3M DBR Tracer wire connectors. Tracer wire shall be 12-gauge copper clad wire with a minimum 30-mil HDPE coating. The grounds for the tracer wire shall be drive in magnesium ground rods with an HDPE cap and installed perpendicular to the laying direction of the conduit. All ground rods shall have a minimum of 2-feet of wire (slack) looped prior to connecting to the main tracer wire.

311 Concrete

Concrete for thrust blocks, etc. shall be placed where shown on the approved plans, required by the specifications, or as directed by WMU. The concrete shall be 3500 psi and care shall be taken in placing the concrete not to disturb the pipe or injure the joints.

All concrete thrust blocks shall be formed with plywood or particleboard and poured to undisturbed earth. Thrust blocks shall be formed to allow access for removal of bolts and flanges.

311.1 Valve Box Concrete Pad

An 18" square 4" thick concrete pad shall be constructed around the top of each cast iron valve box. (See WMU standard detail drawings).

312 Plastic Wrap for Fittings

All fittings to be thrust blocked shall be wrapped with heavy plastic prior to placement of concrete (minimum 4-mill thickness).

313 Installation

313.1 Excavation for Trenches

Unless otherwise directed by WMU, trenches in which water lines are to be laid shall be open cut excavation to the depths shown on the WMU standard detail sheet.
The trench shall be prepared to provide full support for the lower quadrant of the barrel of each pipe in good firm earth. Where the bell and spigot pipe are involved, bell holes shall be excavated during this latter operation to prevent the bells from being supported on undisturbed earth. Prior to laying the pipe section the trench bottom shall be probed to determine that a minimum six (6) inch layer of earth bedding does exist.

If the foundation is rock and the excavation has been undercut as set out hereinbefore, a 6" bed of earth material shall be placed to provide continuous support for the lower quadrant of the pipe. This does not include street and road crossings.

Trenches shall be of sufficient width to provide free working space (minimum 12") on each side of the pipe and to permit proper backfilling around the pipe, but unless specifically authorized by WMU, trenches shall in no case be excavated or permitted to become wider than 2' 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' at the level of or below the top of the pipe, special precautions may be necessary such as providing compacted fill up to the top of the pipe or providing pipe with additional crushing strength as determined by WMU after taking into account the actual trench loads that may result and the strength of the pipe. Trenches cut in roads and street shall not exceed a maximum width of 2' plus the nominal diameter of the pipe at the level of the road or street surface or as prescribed in any permits issued for the road cut.

Unless specifically directed otherwise by WMU, not more than 500 feet of open ditch shall be left behind the pipe laying work of any one crew after being inspected by WMU. Watchmen 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, excavations and other obstructions, shall be provided.

When so required, or when directed by WMU only one-half of street crossings 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 manner that they will not offer a hazard to the passage of traffic. The convenience of the traveling public and the property owners abutting the improvements shall be taken into consideration. All public or private drives where open cutting is permitted shall be promptly backfilled with No. 9 stone bridged at the direction of WMU.

313.2 Laying Depths for Water Mains

Water mains shall be laid with a minimum cover of 36" and a maximum depth of 6 feet, unless written approval is obtained from WMU, except as specifically directed on the plans.

313.3 Dewatering

Adequate facilities shall be provided for promptly and continuously removing water from all excavation. No pipe shall be laid in a trench with water pooling in an open trench. (No Exceptions)

313.4 Unauthorized Excavation

Whenever the excavation is carried beyond or below the required depth, during road crossings, the space shall be filled with #9 stone or compacted DGA to the proper height.

Whenever the excavation is carried beyond or below the required depth, during non-road crossings, the space shall be filled with loosely placed compactable soil approved by WMU, to the proper height.

313.5 Pipe Bedding

The foundation for pipes laid in trenches shall be prepared so that the entire load of the backfill on top of the pipe will be carried uniformly on the barrel of the pipe. Pipe bells shall not, independently, carry the entire load of the backfill. The Contractor shall use the method of bedding the pipe as shown on the trench details in the construction plans. When the "Undercutting Method" is used in rock bottom trenches, good earth material shall be placed to a depth that the bottom of the barrel of the pipe will be at least 6" above the excavated rock bottom.

In wet, mucky and yielding locations where pipe is in danger of sinking below grade or floating out of line or grade, the pipe must be weighted or secured permanently in place by such means as will prove effective. In areas where a high water table exists, caution must be exercised in the placement of the backfill material to prevent flotation of the pipe at any time.

It should be noted that no pipe shall be laid on solid or blasted rock, and the trench bottom shall be probed to determine if there is a minimum of 6" of bedding between

bottom of pipe and rock. In the event the 6" of bedding does not exist, the rock shall be removed and replaced with 6" of good earth material.

313.6 Pipe Laying

Care should be taken to ensure the cleanliness of stored pipe on a project site. Pipe shall be stored and placed so as not to endanger the public, the workers, or the adjoining property. Pipe shall be stacked on well -drained, flat and unyielding surface. Until such time that the pipe is to be used it should be stored on chokes to prevent dirt, mud and debris from accumulating within the pipe. No dirt or mud filled piping shall be used.

All pipe shall be laid with ends abutting and true in accordance with approved plans. Pipe shall be fitted and matched so that when laid in the work, it will provide a smooth and uniform invert. Supporting of pipe shall be as set forth herein under "Pipe Bedding" and in no case shall the supporting of pipe on blocks or rocks be permitted.

Fittings and specials for the water main shall be provided and laid as and where directed by WMU or as shown on the plans.

Any piece of pipe or fitting which is known to be defective shall not be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, it shall be removed and replaced with a satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

Irregularities in subgrade in an earth trench shall be corrected by use of good earth as specified hereinbefore.

The interior of the pipe, as the work progresses, shall be cleaned of dirt, jointing materials, and superfluous materials of every description. When laying pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plug fitted into the pipe bell so as to exclude water, earth or other material from entering the pipe. Buckets, bags and/or tape shall not be used to close and exposed end of the pipe. Precautions shall be taken to prevent flotation of pipe by runoff into the trench, and in the event flotation of the pipe by runoff occurs, the pipe must be cleaned and re-laid.

No backfilling (except for securing pipe in place) over pipe will be allowed until WMU has had an opportunity to make an inspection of the joints, alignments and grade in the section laid, but such inspection shall not relieve any responsibility of further liability in case of defective joints, misalignment caused by backfilling and other such deficiencies that are noted later. The length of open ditch shall not exceed 500 feet.

313.7 Tracer / Locate Wire

All waterline installed as of the approval date of this manual shall be installed using tracer wire or locate wire. This does not negate the requirement for water line marking tape, which is installed 18-inches below the finished grade.

Tracer wire shall be 12 gauge Copper Clad Steel (CCS) with a minimum 30 mil HDPE coating. The tracer wire for water lines shall be blue in accordance with the APW uniform marking code.

The tracer wire shall be placed in the same orientation to all installed pipe. Lay the tracer wire immediately parallel to the water main at the bottom of the trench. Securing the wire to the pipe is not recommended. Lay mainline trace wire continuously, by-passing around the outside of valves and fittings on the street side of the water main.

Connectors used to splice individual legs or components of the tracer system shall be of the type to protect the connections from moisture and corrosion. Copperhead SnakeBite connectors and 3M DBR are two of the commonly used moisture displacement connectors. Twisting the wires together and wrapping with electrical tape is not an approved method for connecting tracer wire legs.

The ends of all branches (service conduits) shall be grounded with a drive in magnesium grounding rod similar to the Copper Head Industries Grounding Rod. Connect the lateral tracer line to the main line tracer wire using moisture and corrosion resistant connectors. Two feet of extra wire (slack) shall be installed below ground to reduce the possibility of grounding rods and wires being broken during future excavations. Grounding rods shall be installed perpendicular to the laying direction of the service conduit lines.

Tracer wire access boxes along with a drive in magnesium grounding rod will be installed on all fire hydrants included in the project. The access box will be securely connected to the upper barrel of the fire hydrant above the bury line. PVC conduit shall extend from the access box along the lower barrel of the fire hydrant. Straps or tape will not be allowed. Two feet of extra wire (slack) shall be installed below the conduit to reduce the possibility of grounding rods and/or access box wires being broken during future excavations.

All tracer wire installation shall be field verified by using a conductive mode locator set at 512 Hz. Continuity test will not be accepted. Any legs/lengths of tracer wire that cannot be readily traced shall be corrected

313.8 Detectable Mylar Tape

All water lines must be marked with a 2-inch printed Mylar detectable tape labeled "Water", as manufactured by Lifeguard or approved equal. The tape shall be installed 18" below finished grade and directly over the water line. See WMU standard detail drawings.

313.9 Anchorage of Bends, Tees, Plugs, Hydrants, and Valves

At all tees, plugs, caps and bends of 11-1/4 degrees and greater, and at reducers or in fittings where changes in pipe diameter occur, movement shall be prevented by using suitable thrust blocks, anchoring pipe, stainless steel strapping or ballast. Hydrants and valves shall be provided with similar protection. Thrust blocks and supports shall be as shown in the typical details, with sufficient volumes of 3500 psi concrete being provided; however, care shall be taken to leave weep holes unobstructed and allow for future

tightening of all nearby joints. Thrust blocks shall be placed so that the pipe and fitting joints will be accessible for repair.

Bridles, harness or pipe ballasting shall meet with the approval of WMU. Stainless steel rods and clamps shall be provided as shown on the WMU Typical Detail Sheet.

Ductile Iron retainer glands (Mega Lugs) shall be used on all mechanical joint fittings. (No Exceptions)

313.10 Jointing

Jointing shall be accomplished in accordance with the manufacturer's recommendations.

313.11 Backfilling Pipeline Trenches

Backfilling of pipeline trenches shall be accomplished in accordance with the methods outlined herein. In all cases, walking equipment 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 (1) foot (minimum) above the top of the pipe. The backfill shall be placed 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 - Areas Not Subject to Vehicular Traffic
The lower part of the trench up to a point one (1) foot above the top of the pipe shall be backfilled with earth, free from rock, and acceptable to WMU. In the remainder of the trench, the backfill material shall be free from rock (the sum of two area dimensions shall not exceed 1 square foot) and the backfill material may be placed into the trench without compacting but heaped over whenever, in the opinion of WMU, this method of backfilling may be used without inconvenience to the public. The backfilling of earth material or selected material, must be approved by WMU.

No open cutting of a State, City, or County road/street shall occur without written approval from the proper authorities. In the event open cutting is allowed, the following shall apply:

Method B - Streets and Roads
The lower part of the trench up to a point one (1) foot above the top of the pipe shall be backfilled with #9 crushed stone and acceptable to WMU. The remainder of the trench shall be backfilled to the height indicated in the "Pavement Replacement Details" on the WMU Standard Detail Sheet or as required by the permitting agency.

NOTE
ALL STREETS, ROADS, ENTRANCES, AND DRIVEWAYS DISTURBED DURING CONSTRUCTION SHALL BE RESTORED TO AS GOOD OR BETTER THAN ORIGINAL, CONDITION PRIOR TO ACCEPTANCE BY WMU.

313.12 Connections to Existing Mains

The Contractor shall make all connections to existing mains as shown on the approved plans. The Contractor shall notify the Winchester Municipal Utilities 48 hours in advance and schedule the time for making the connection so as to minimize possible interruptions to service and for scheduling inspections. If the connection to existing water mains is done in a manner differently than with an approved tapping sleeve and valve, connections will be made only after the new water line is substantially complete and ready for acceptance by the Winchester Municipal Utilities (WMU). Authorization for final connection must be received from WMU before connection is made. Once the connection is made the valve servicing the new water main shall remain in the closed position until such time as the water line is to be filled or flushed and will be closed immediately afterwards. The valve servicing the new water main shall only be opened by a WMU representative.

313.13 Water Mains Crossing Under State Maintained Roads or Railroads

Unless otherwise approved, all water mains crossing under state maintained roads and railroads shall be bored and jacked in place. The encasement pipe shall be steel, plain end coal tar enameled, mill coated inside and out, with a minimum yield strength of 35,000 psi. The steel pipe shall have welded joints and be a minimum of 18' lengths. The wall thickness of encasement pipe with a nominal diameter of 18 inches or less, shall be a minimum of .375 inches. The wall thickness of encasement pipe with a nominal diameter greater than 18 inches but less than 30 inches shall be a minimum of .500 inches and diameter shall be as shown on the plans. In the newest revision of KYTC Standards and Specifications there is no provision for the use of salvage pipe material. **ALL BORINGS ARE SUBJECT TO STATE AND RAILROAD SPECIFICATIONS AND REGULATIONS AS REQUIRED**.

314 Hydrostatic Testing

314.1 Restrictions

Testing shall be for all newly laid water line and appurtenances. The testing shall be conducted between valved sections of the line. The test pressure shall be 150 psi or at least 1.5 times the working pressure at the lowest point of testing or not less than 1.25 times the working pressure at the highest point along the test section. The test sections shall not lose or vary by more than 5 psi for a minimum of two hours. A liquid filled gauge measuring no more than 250 psi in 2 psi increments, shall be used for the pressure test(s).

Newly installed water lines will not be filled and tested on the same day to allow for the removal of air from the line(s). When filling, the line sections will be filled slowly. Corporation stops must be installed, by the contractor, at all high points of the line so that air can be removed. The test pressure shall not exceed pipe or thrust block design pressure.

Valves shall not be opened or closed when the test pressure is greater than the valve's rated pressure or the pressure of the existing water line.

314.2 Pressurization

The purpose of this test is to be sure the pipe and accessories will be able to withstand conditions above normal operating conditions. The below listed sequencing / actions should be followed prior to and during testing:

- Fill the line slowly.
- Flush thoroughly.
- Partially open valves and hydrants several times under normal line pressure to remove any possible foreign material.
- All air must be removed.
- Hydrants in the test section must be closed. The valve between the hydrant and main must remain open during testing.
- Pressure shall be applied by a pump that is satisfactory to WMU.
- Test pressure must be monitored by an accurate liquid filled gauge.
- The line may require pumping several times to acquire stabilization prior to starting the test.

During the pressure test, exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully for defects and leaks.
All defects must be repaired by the contractor, and the tests shall be repeated until satisfactory to WMU.

314.3 Allowable Leakage Test

- The leakage test shall be performed after the pressure test is completed.
- Leakage shall not be measured by a drop in pressure in a test section over a period of time.
- Leakage test shall be for a minimum of 4 hours and a maximum of 24 hours.
- Allowable Leakage Table- See Example 3 - 216.
- No pipe installation shall be accepted if the leakage is greater than is allowed by the following formula:

$$\frac{\text{Distance of Line x Allowable Leakage x Amount of Hours}}{\text{100 (Feet of Pipe)}}$$

Example:

$$\frac{\text{800 Ft. x 0.74 (8" pipe) x 24 Hrs.}}{\text{1000 Ft.}} = \text{14.21 Gals. Allowable Leakage}$$

- Additional leakage will be allowed when testing against closed metal-seated valves. Leakage per closed valve size is permitted.

.0078 x Amount of Hours x Nominal Size of Valve

Example:

.0078 x 24 Hrs. x 8" valve = 1.50 Gal. Allowable Leakage

- A calibrated container shall be used when measuring allowable leakage.
- All visible leaks are to be repaired, regardless of the amount of leakage.

314.4 Disinfection

All newly installed water lines and appurtenances shall be disinfected in accordance with the Kentucky Division of Water guidance and policies.

All new water distribution systems including storage distribution tanks and repaired portions of, or all extensions to existing systems shall be thoroughly disinfected before being placed in service, by the use of chlorine in such amounts as to produce an initial concentration of at least fifty (50) ppm and a residual of at least twenty five (25) ppm at the end of 24 hours and followed by thorough flushing.

A newly installed main shall be disinfected in accordance with ANSI/AWWA C601. Following chlorination, the main should be flushed as soon as possible (within 24 hours). Care must be exercised when disposing of water with a high chlorine residual (greater than 1 mg/L). Possible means of disposal include sanitary sewers, storm sewers, or on land. If sanitary sewers are used, there should be adequate dilution and travel time so there will be no chlorine residual when the water reaches the wastewater treatment plant. If a storm sewer is used, there is to be no remaining chlorine residual when the water reaches the receiving waters (creek, river, retention basin or lake). Land disposal may be acceptable if percolation rates are high and there are no nearby wells pumping groundwater.

315 Bacteriological Test

All new water distribution systems including storage distribution tanks and all extensions to existing systems shall require bacteriological tests for Total Coliforms. If laboratory results produce a positive result the line section shall be flushed and disinfected again.