

DESIGN CRITERIA
FOR
WATER MAIN EXTENSIONS
AND
APPURTENANCES

GENERAL REQUIREMENTS
MATERIAL SPECIFICATIONS
CONSTRUCTION SPECIFICATIONS

Meadville Area Water Authority

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Prepared by



AMERICAN WATER

REVISIONS

November 24, 2008 – 2000.09 Service Lines and Appurtenances for Meters, paragraph G - Added polyethylene (PE) as an option for service lines under 2-inches, page 11.

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200.00 GENERAL REQUIREMENTS

200.01 SCOPE

The design criteria for water distribution systems presented hereinafter offers basic standards for use in the design process. Each application will be reviewed on a case by case basis by the Meadville Area Water Authority, (the “Authority”) engineer. The decision of the Authority is final. Reference material contained herein, as well as additional information, may be obtained from the “Rules and Regulations Governing Water Service of the Authority, Construction Standards of Municipalities, BOCA, AWWA, ASTM and PADEP Public Water Supply Manual Part II.

200.02 FEES

The owner/developer of such parcel of land to be developed at the time of construction plans submittal shall pay to the Authority a nonrefundable deposit of five hundred (\$500) dollars. The plan review fee provides for the costs of service performed by the Authority including, but not limited to, planning, engineering review of plans, legal services, inspection of construction, and all other technical and administrative services provided relative to extensions to the existing Authority water system. Should the cost exceed \$500, the Owner will be charged the additional fees. Any monies unexpended from the deposit upon completion of the project shall be returned to the owner/developer.

Item	Fee
Plan review	\$500.00
Inspection Services performed by the Authority	\$25 per hour
Inspection Services performed by the Authority’s engineer	Actual cost billed to the Authority
Water consumption for filling and flushing main	Standard Rate Charge x five (5) times the volume of the main extension
Legal Fee	Actual cost billed to the Authority

200.03 APPLICATION PROCESS

Any person, firm, or corporation desiring to have water service made available to a particular area or subdivision and to be served by the AUTHORITY shall:

A. Make Application

At own expense submit four (4) copies of detailed plans and specifications of the distribution system signed and sealed by a Pennsylvania licensed professional engineer in conformance with the regulations of the Authority.

1. The plans for water mains and appurtenances shall show all appropriate physical features adjacent to the proposed water mains along with horizontal and vertical controls and hydrant coverage. Other utilities, such as sanitary

and storm sewers, manholes, etc., shall be shown on the plans with horizontal and vertical separation distances meeting PADEP standards – Public Water Supply Manual Part II.

2. Plans for water distribution mains must be submitted to the Authority for review and approval. The plans must be prepared on 24" x 36" plan sheets and the four (4) sets submitted must be of quality suitable for reproduction. Each sheet of a set of plans must bear a signed and dated imprint of a Pennsylvania professional engineer's seal.
3. The title sheet for a set of plans generally contains the following: Name of project, name of municipality, area to be served, municipal officials' names, index of drawings, date, address, and names of the design engineer (in addition to seal).
4. The general layout sheet shall include a large scale map of the entire distribution system showing the corporate or utility district boundaries. Existing and planned utilities shall be shown with line sizes noted and easily distinguishable between existing and planned. The layout sheet shall incorporate both a north arrow and scale and if the area to be served is obscure, a location plan shall be provided showing the municipality or utility district in relation to surrounding towns, streams, and noted landmarks.
5. All plans shall be on the state plane coordinate system NAD 1983 U.S. Survey Feet, PA Zone North. Vertical benchmark shall be a USGS benchmark (NAD 1983). Drawings are to include PA One Call number with, serial number(s) and a listing of all known utilities.
- 6.. The plan sheets shall be drawn at a scale not greater than 1 inch equals 200 feet and be complete with north arrow, scale, street and road names, existing utilities, planned utilities, and installation notes with locations shown for all valves, hydrants, and other appurtenances. The plan sheets shall also provide adequate descriptions of any features not otherwise covered by the specifications. The planned water distribution mains shall have adequate notes and stationing system to aid in the location of the water lines and appurtenances.
6. Any feature of construction which requires additional clarification to that shown on the plan sheets shall be drawn in detail on profile and/or detail sheets. Each detail shall cover thoroughly the dimensions, equipment, materials, method of construction, and any clarifying notes to aid in construction of the item.

B. Obtain Preliminary Approval From Governing Municipality

Owner/developer/contractor shall secure the approval of the plans and specifications in writing from the governing municipality. The preliminary approval shall contain the names, addresses and phone numbers of municipal contacts.

C. Water Service Agreement

Following Authority's engineer's review of plans, the Authority and the owner/developer/contractor shall enter into a Water Service Agreement outlining the responsibilities of the owner/developer/contractor, Authority, bond requirements, legal fees, inspection costs, easements and right-of-ways required, and etc.

The Authority may request a pre-construction conference prior to the start of construction of the water system extension.

D. As-Constructed Drawings

Following the end of construction of the water distribution mains, the tracing shall be revised to reflect any deviations from the plans and provide the precise field location of the water mains, valves, hydrants, services, and other appurtenances. Three copies of the As-Constructed drawings and electronic CADD (Microstation or AutoCAD, latest version) files on CD media shall be submitted to the Authority.

E. Dedication of Water Line

Upon Authority approval of all As-Constructed Drawings, easements and right of ways the water line will be dedicated to the Authority.

200.04 DEVELOPERS ENGINEERING REVIEW

An engineer's report shall be written and submitted to the Authority for review. This report shall address all applicable points as set forth by these specifications.

A. Design Factors

The source of water supply for the distribution system under design shall be thoroughly investigated to ascertain that it can supply the average and peak daily demands imposed upon it by the proposed system without loss or burden to the existing customers supplied by it. The normal working pressure in proposed extension should be approximately 40 - 80 psi.

B. Water Consumption

In addition to fire flow requirements, water mains and distribution systems shall be sized for normal and peak daily demands of required consumption.

C. Fire Flow Requirements

The proposed extension shall be investigated for the fire flow that can be provided while maintaining no less than 20 pounds per square inch residual pressure in the remainder of the distribution system. The fire flow information shall be provided to the local municipality and operating fire company for comment. The guidelines of the Insurance Services Office (ISO) and related agencies shall be used to determine the minimum flow allowable. Include contact information and phone numbers for municipalities, fire companies, etc.

D. Minimum Line Size

The minimum size of water distribution mains shall be that which is required to provide the maximum daily demand plus fire flow while maintaining adequate residual pressure. The minimum size of pipe allowable by the Authority is 8-inch diameter unless otherwise approved by the Authority.

E. Sizing Water Mains

Water mains shall be sized to provide the maximum daily demand plus anticipated fire flow plus any foreseeable future demand while maintaining a minimum of 20 pounds per square inch residual pressure at all points in the proposed extension and the existing system. The pressure losses due to friction must be calculated from the storage or pumping facilities using typical system flows as well as the flows required by the distribution mains being added.

F. Dead Ends

Dead ends shall be minimized to assure adequate water quality and maximize fire flows. Loop and grid connections shall be used whenever feasible. The Authority has the final approval for all dead ends.

G. Private Fire Connections

Private fire connections shall be constructed using ductile iron pipe and appurtenances.

The minimum back flow prevention device shall be a double check valve assembly. The Authority has the right to require additional or alternative backflow prevention devices, including reduced-pressure zone devices.

H. Services

All services shall have a separate service line, complete with all appurtenances, except meter, to the property line.

I. Determination of Maximum and Minimum Pressures Within the System

In the determination of the proper pressure class of pipe materials for use in the system, consideration must be given to the maximum and minimum pressures that will be encountered. The following factors must be considered when determining pressure within a system:

1. Highest and lowest elevations of pipelines;
2. High and low levels in the water storage reservoirs;
3. Booster pumping stations - suction and discharge pressures;
4. Fire flow requirements;
5. Special control valves, i.e., pressure reducing valves in the system;
6. Surge allowance and water hammer;
7. Customer water usage (present and future); and

8. The normal working pressure in the extension should be approximately 40 to 80 psig. If above 60 psi, provide pressure reducing valves at each service connection.

J. Location of Appurtenances

1. Control valves (gate valves), at minimum, shall be placed at all intersections of water mains. In straight runs of pipes, place valves no less than 500 feet apart.
2. The Authority reserves the right to require placement of additional valves at any location deemed necessary.
3. Safety valves (air release, pressure reducing, etc.) shall be installed in appropriately designed manholes, vaults or chambers and at such locations as deemed necessary for the safe, reliable operation of the distribution system.

K. Fire Hydrants and Blow-Offs

In general, fire hydrants for residential areas shall be spaced at 350 - 600 feet or less and/or at street intersections, whichever is less; for commercial areas, not more than 500 feet and at street intersections, whichever is less; and for public and institutional properties, a number and spacing to accommodate the needed fire flows with adequate back-up spacing. A fire hydrant shall be located at the end of each extension for both fire protection and line flushing. Blow-off hydrants shall be installed at the end of dead end lines and at each location required to provide adequate flushing of the mains. The spacing of hydrants shall be approved by the municipality and the fire chief of the municipality.

200.05 MATERIAL STANDARDS

All material used in the Meadville Area Water system shall conform to AWWA, ANSI, and ASTM standards. Approved manufacturers on some items have been specified in order to maintain consistency of the distribution system. Any materials or products not specifically addressed herein will be reviewed by the Authority on a case by case basis. All plans and material shall be reviewed by the Authority's professional engineer and manager who shall provide comments for the final approval of the Authority. All materials that come in contact with potable water shall meet NSF-61 standards.

200.06 PIPE and FITTINGS

A. Ductile Iron Pipe (DIP)

Ductile iron pipe shall be designed in accordance with AWWA C151 (ANSI A21.50). Ductile iron pipe wall thickness shall meet AWWA C150 (ANSI A21.50) latest edition. Buried ductile iron pipe shall have pressure class designation of 350. Exposed flanged joint ductile iron pipe used in vaults, chambers, etc, shall be Class 53.

The interior of the pipe shall have a cement-mortar lining in accordance with AWWA C104 ANSI A21.4, double thickness, and NSF-61 approved asphaltic seal coated in accordance Section 4-11, Seal Coat of AWWA C104.

The exterior of the buried and exposed pipe shall have asphaltic coating in accordance with Section 51-8, Coating and Linings, AWWA C151.

Buried joints shall be either push-on, mechanical, or restrained joints conforming to AWWA C111. Exposed piping used in chambers, vaults, etc. shall be flanged. Flanged joints shall conform to AWWA C115. Flanges to be Class 125, faced and drilled in accordance with ANSI B16.1. Joints furnished complete with all accessories necessary for makeup of particular joint involved (glands, bolts, nuts, gaskets, etc).

B. Ductile Iron Fittings

Gray iron or ductile iron conforming to applicable provisions of AWWA C110 or ductile iron compact fittings conforming to AWWA C153. Minimum working pressure rated at 250 psi.

Fittings are to be mechanical or restrained joint conforming with applicable provision of AWWA C111. Provide wedge action retainer glands at mechanical joints. Restrained joint fittings shall have identical joints as restrained joint pipe.

The fitting lining shall be cement mortar lined in accordance with AWWA C104, double thickness and asphaltic seal coated in accordance with Section 4-12, Seal Coat, of AWWA C104. Seal coatings NSF 61 approved.

Exterior surface of buried and exposed fittings shall have standard asphaltic coating in accordance with Section 51-8, Coating and Linings, AWWA C151.

C. Polyvinyl Chloride (PVC)

Polyvinyl chloride (PVC) pipe shall be manufactured in accordance with AWWA C-900 latest edition. AWWA C-900 PVC pipe is pressure rated for each Dimension Ratio (DR). Push on type joints, either integral bell or coupling shall include gasket and lubricants to conform to AWWA C900 latest edition.

Use of PVC is subject to Authority approval.

SIZE (inches)	DIMENSION RATIO (DR)	PRESSURE CLASS (PSI)	AVERAGE O.D. (inches)	LENGTH (feet)
4	14	200	4.80	20
6	14	200	6.90	20
8	14	200	9.05	20
10	14	200	11.10	20
12	14	200	13.20	20

D. Polyvinyl Chloride (PVC) Fittings

All fittings for PVC pipe shall be ductile iron fittings, as specified above. PVC fittings are not permitted.

200.07 VALVES AND VALVE BOXES

A. Valves – Gate (3-inch and larger)

All gate valves 3-inch through 12-inch in size shall be ductile iron body, resilient-seated nut operated, non-rising stem, inside screw gate valves suitable for buried service. Design valves for an operating pressure of 200 p.s.i., test pressures to 400 p.s.i., manufactured and tested in accordance with ANSI/AWWA C509 or C515.

Valves shall be furnished with interior and exterior epoxy coating. Epoxy coating shall meet or exceed all applicable requirements of ANSI/AWWA C550 Standard and certified to ANSI/NSF 61.

Gate valves shall have mechanical joints in accordance with AWWA C111 with wedge action mechanical joint retainer glands, except in restrained areas. Valves with mechanical joints in restrained areas to be provided with adaptor pieces with the spigot ends modified to provide a restrained joint, using a welded ring and a second follower gland by restrained bell or restrained spigot ends similar to American MJ Coupled Joint. (Pipe supplier to submit detailed sketch of proposed restraining system for the Authority's approval).

Gate valves shall, open left.

B. Valves (2-inch and under)

All valves 2" and under shall have bronze bodies and shall open or close with a one quarter turn.

C. Valve Boxes

Valve boxes shall be gray ductile or gray cast iron, hot coat inside and out with tar or asphalt compound in accordance with ANSI/AWWA C111/A21.10. Valve boxes shall be 5-1/4 inch nominal shaft diameter and of three pieces. Valve box design of adjustable two section screw type telescoping column or three section with separate base, and furnished with a cover marked "WATER". Length of valve boxes shall be determined by Contractor.

D. Tapping Sleeves and Valves

The Authority shall furnish the parts and make all taps to our water lines for future waterline extensions at our expense. The Authority will provide a cost estimate to the Contractor.

200.08 FIRE HYDRANTS

Fire hydrants shall be dry-barrel in accordance with ANSI/AWWA C502. Hydrants shall be equipped with traffic breakaway flange such that the hydrant valve will remain closed in the event of accidental damage or breaking of the hydrant above or near grade level. The main valve shall be of the compression type closing with line pressure, and

having a 5-1/4 inch nominal main valve opening. Fire hydrants shall be three-way in design, having one 4" pumper nozzle and two 2-1/2" hose nozzle(s). Nozzle thread type shall be National Standard. Nozzles shall thread counterclockwise into hydrant barrel utilizing "o" ring seals. A suitable nozzle lock shall be in place to prevent inadvertent nozzle removal.

The operating nut shall be a one piece design, manufactured of ASTM B-584 bronze. It shall be pentagon/square 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 open left. An arrow shall be cast on the bonnet flange to indicate the specified opening direction.

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

The hydrants must prevent a contaminant from entering the distribution system through the fire hydrant by either preventing the introduction of a contaminant into the hydrant or preventing a contaminant to escape through the hydrant into the distribution system in a backflow or back-siphonage condition. The device must not increase the overall fire hydrant pressure drop through the pumper nozzle at 1,000 gpm by more than 1 psig (for a 4-1/2" or larger nozzle)

The secure fire hydrant shall be the Mueller® Super Centurion 250 HS™ (high security)

The hydrant joint shall be a mechanical joint, manufactured in accordance with ANSI/AWWA C11/A21.11. The paint color of the hydrant shall be red.

200.09 SERVICE LINES

A. Tapping Saddles (Stainless Steel)

Tapping saddles conform to AWWA C800, latest revision. Saddles shall have a body made of high strength ductile iron per ASTM A535, double wide band, and a stainless steel band and a Buna-N rubber gasket, in accordance with ASTM-D2000. Bolt size shall be 5/8-inch for saddles larger than 4-inch and 1/2-inch bolts for 3-inch and smaller. The finish on the saddle body shall be fusion epoxy coating approximately 12 mils thick.

B. Corporation Stops

All brass corporation stops shall conform to AWWA Standard C800 (ASTM B-62, UNS NO C83600-85-5-5) with a working pressure of 300 PSI. Inlet threads shall be AWWA tapered and the outlet threads flared copper.

C. Quarter Bend Swivel Couplings for Corporation Stops

All quarter bend swivel nut ell couplings for corporation stops shall be brass and conform to AWWA Standard C800 (ASTM B-62, UNS NO C83600-85-5-5) with a working pressure of 300 PSI. Quarter bend swivel bends inlet shall be female copper thread swivel nut by flared copper.

D. Curb Stops

Curb stops shall be straight-through design and shall provide a drip-tight shutoff in the closed position. The stop head shall be of the tee design or flat design unless otherwise specified. Inlet shall be flare copper and the outlet maybe flared copper or copper service lines or pack joint for PE service lines.

E. Curb Boxes

Curb boxes shall be “Eclipse Boxes Complete” manufactured by Bingham & Taylor with a TYPE A lid marked “Water” and having a pentagon brass plug. The bottom shall be cast iron and belled and arched to fit curb stops.

F. Meter Pits for Non-Traffic Areas

The Authority requires meter pits in cases where the length of the service line extension exceeds 100 feet. In all cases where deemed advisable, the Authority will require the customer to construct, at his expense, a watertight brick or concrete or an approved meter pit provided with a suitable cover. The approved meter pit is to be installed at the property or curb line and is to be used for the housing of the meter required for the service of the premises.

The meter pit is to be installed at the property or curb line and used for the housing of the meter required for the service of the premises. Note: All meter pits are to have a shut off valve before and after the meter and a backflow preventer.

F. Meter Pits for Traffic Areas

Meter pits for traffic areas are to be designed by a Pennsylvania professional engineer and submitted to the Authority for approval.

G. Service Lines and Appurtenances for Meters

The Service line from main to curb stop is the Authority’s responsibility. The service line from the curb box to the Customer is the Customer’s responsibility. The minimum service size is 3/4 –inch. The service line material for under 2-inch shall be constructed with copper Type K or polyethylene (PE). Services 2-inches or over may be constructed of Ductile Iron, Polyethylene (PE) material or PVC with the Authority’s approval. Service lines over 100 feet will require the installation of a meter vault or pit at the customer expense.

1. K-Copper - Copper water tube shall conform to AWWA C800, latest revision, appendix A section A.2 and ASTM B88; 3/4" up to 2" copper water tube shall be type "K" soft. All tubing shall be delivered without kinks, dents or unrounded ends or sections.
2. K-Copper Fittings – The fittings used in service lines shall be designed for connection to the service line by thread, compression, or flaring. Small

waterways and abrupt corners causing water turbulence and pressure drop should be minimized.

3. Polyethylene (PE) water service tubing shall be NFS-61 approved and conform to AWWA C901 specifications, latest revisions, for 2-inch to 3-inch class 200-psi (SDR9). All tubing shall be of the Copper Tubing Size-OD (CTS) and shall conform to all ASTM D-2737. Polyethylene tubing shall be made from prime virgin resins exhibiting a cell classification of PE 3408 and ASTM D3350. All pipe sections shall be marked as prescribed by AWWA C901 and NSF. Provide stainless steel inserts at all connection points.
4. Polyethylene (PE) Fittings – No polyethylene (PE) fittings are allowed.

H. Backflow Prevention - Domestic Services

The minimum backflow protection for domestic services is a dual check valve and a thermal expansion tank. Each service connection shall be reviewed by the Authority before final approval. In-line dual check valves shall have accessible access for quick inspection and replacement of internal working parts without removing the valve for the service line. The dual check valve shall have a minimum of 175 PSI maximum working water pressure and rated at 180 degree Fahrenheit maximum constant temperature. All brass shall conform to AWWA Standard C800 (ASTM B-62, UNS NO C83600 - 85-5-5-5).

I. Backflow Prevention – Commercial, Industrial, and other

Backflow prevention devices for commercial, industrial and other applications will be approved based on the application in accordance with the Authority's policy for the control of cross connection and backflow prevention.

J. Pressure Reducing Valves

Pressure reducing valves are the responsibility of the customer. The Authority recommends the installation of a pressure reducing valve on any water service that exceeds 50 psi line pressure.

K. Shut-off Valves Before and After the Meter

Each meter installation shall be equipped with two shut-off valves. The shut-off valve before the meter shall not have a bleeder valve. The shut off valve at the outlet of the meter shall have a bleeder valve to make repairs to the customer's inside plumbing without removing the meter.

The shut-off valves shall be bronze or copper body.

L. Meter Installation

The contractor is responsible for ensuring the connections are ready for the meter installation provided by the Authority. The connection dimensions or a meter blank shall be provided by the Authority.

200.10 GENERAL CONSTRUCTION SPECIFICATIONS

The construction specifications outline the responsibility of the contractor to perform the work in accordance with the Authority's requirements.

A. PA ONE CALL

The contractor is responsible for PA One Call in accordance with Act 287 as amended for locating all utilities. The contractor shall notify the Authority 48 hours prior to any construction. PA One Call phone numbers, serial numbers, and a list of all known utilities must be included on the drawings.

B. Responsibility for Safe Storage and Replacement of Damaged Material

The contractor shall be responsible for the safe storage of material furnished. The interior of all pipe fittings and other accessories shall be kept free from dirt and foreign matter at all times. Any damaged material shall be replaced by the contractor at his own expense.

C. Work To Be Done

The contractor shall excavate as required both in earth and rock for placing the water line and appurtenances required to complete the work in accordance with the plans and specifications. Also he shall perform all the needed ditching, diking, pumping, bailing and draining, sheeting and shoring, fencing, lighting and watching; make all provisions necessary to maintain and protect buildings, fences, water pipes, gas pipes, conduits, sewers, culverts, railways, electric lines, and other structures; provide all bridges, fences, or other means of maintaining travel on intercepted streets and over-roads and railroads, and on streets or roads in which the trenches are excavated; and repair all damages done to such structures; construct all foundations, and all brick, concrete, stone, and timber work; to lay all pipes; set in place all iron work; refill all trenches, and fill over and alongside the sewers to lines and elevations shown on plans and sections; clear away all rubbish and all surplus material, restoring the streets, sidewalks, and roadways to good condition for public travel; and to furnish and deliver all materials of every description, whether needed permanently or temporarily, also all tools, implements, and labor, and all required machinery, and the transportation of the same and the power to operate the same. All water lines and appurtenances shall be built and put in complete working order in accordance with the water service agreement and the specifications herein set forth and the Authority's requirements.

D. Grade and Alignment

The water main shall be laid and maintained to the required lines and grades.

E. Depth of Pipe and Backfill

Trench details are shown on the attached Typical Trench Details Drawing. All pipe shall be laid to a depth, which will provide a cover of at least four feet (4') over the highest part of the pipe. Select backfill shall meet the required backfill requirements of the Authority and the municipality or PennDOT. It shall be the contractor's responsibility to dispose of excess excavated material in a legal manner. Bedding and backfill requirements must be shown on an attached detail on the Developers' drawings.

F. Handling of Water Main Material into Trench

Unload, handle and store DIP, fittings, valves and appurtenances in accordance with AWWA C600.

All pipe, fittings, valves and hydrants shall be carefully lowered into the trench piece by piece by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to water main materials and protective coatings and linings.

G. Cleaning Pipe and Fittings

All lumps, blisters, and excess coal tar coating shall be removed from the bell-and-spigot end of each pipe and the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean, dry, and free from oil and grease before the pipe is laid. Close open pipe ends with watertight plug when pipe laying is not in progress.

200.11 EXCAVATION AND PREPARATION OF TRENCH

A. Trenching

The trench shall be dug so that the pipe can be laid to the alignment and depth required, and it shall be excavated only so far in advance of pipe-laying as permitted by the Authority. The trench shall be so braced and drained that the workmen may work therein safely and efficiently. It is essential that the discharge of the trench dewatering pumps be conducted to natural drainage channels, drains, or sewers.

Owner/developer/contractor shall obtain all required permits and approvals for and discharges.

B. Traffic Control

The contractor shall set up traffic controls in accordance with PENNDOT Form 408, section 900, and any local municipality requirements before excavation.

C. Minimum Trench Widths

The maximum trench widths shall be:

Pipe Size	Trench Width
4" – 12"	30"
14" – 18"	O.D. + 18"
20" – 24"	O.D. + 24"

E. Excavation to Grade

The trench shall be excavated to the depth required to include bedding so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at every point between bell holes. Any part of the bottom of the trench excavated below the specified grade shall be corrected with approved material, thoroughly compacted, as directed by the Authority. The finished subgrade shall be prepared accurately by means of hand tools.

When unsuitable material is found below subgrade, as determined by the Authority, remove material to a depth determined by Authority, and provide approved bedding material compacted in 4 inch layers.

Remove rock below subgrade if shattered due to excessive drilling, and in opinion of Authority it is unfit for foundations. Backfill to subgrade with concrete, or other material acceptable to Authority.

F. Protection of Property and Surface Structures

Trees, shrubbery, fences, poles, and all other property and surface structures shall be protected unless their removal is shown on the drawings or authorized by the engineer. When it is necessary to cut roots and tree branches, such cutting shall be done under the supervision and direction of the Authority.

G. Bedding

Pipe bedding requirements are shown in ATTACHMENT 1 - Typical Trench Details Drawing.

H. Allowable Removal of Pavement

The contractor shall remove pavement and road surfaces as a part of the trench excavation and the amount removed shall depend upon the width of trench specified for the installation of the pipe and the width and length of the pavement area required to be removed for the installation of gate valves, specials, manholes, or other structures. The width of pavement removed along the normal trench for the installation of the pipe shall not exceed the width of the trench specified by more than six inches (6") on each side of the trench. The widths and lengths of the area of pavement removed for the installation of gate valves, specials, manholes, or other structures shall not exceed the maximum linear dimensions of such structures by more than twelve inches (12") on either side.

If the contractor removes or damages pavement or surfaces beyond the limits specified above, such pavement and surfaces shall also be replaced or repaired at the expense of the contractor.

200.12 INSTALLATION OF PIPE

A. General

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the pipe-laying crew cannot put the pipe into the trench and into place without getting earth in it, the Authority may require that before lowering the pipe into the trench a heavy, tightly-woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

Join pipe in accordance with AWWA C600. After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Pipe and fittings, which do not allow a sufficient and uniform space for joints, shall be removed and replaced with pipe and fittings of proper dimensions to insure such uniform space. Precautions shall be taken to prevent dirt from entering the joint space. Provide valves 12-inch and larger with crushed stone or concrete pad support. Set valves truly vertical.

At times when pipe-laying is not in progress, the open ends of pipe shall be closed by a water-tight plug or other means approved by the Authority. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

B. Bell Ends to Face Direction of Laying Permissible Deflection at Joints

Pipe shall be laid with bell ends facing in the direction of laying, unless directed otherwise by the Authority.

Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or plumb stems, or where long-radius curves are permitted, the amount of deflection allowed shall not exceed that amount as specified by the pipe manufacturer and shall be approved by the Authority.

C. Unsuitable Conditions for Laying Pipe

No pipe shall be laid in water or when, in the opinion of the Authority, trench conditions are unsuitable.

D. Thrust Blocking

All reducers, caps, tees, bends and such parts of the pipework that will have a tendency to draw away or separate, due to internal hydraulic forces, shall be secured firmly by concrete thrust blocks poured as detailed on the plans and designed by a professional engineer registered by the Commonwealth of Pennsylvania.

E. Identification Tape and Detection Wire

A metallic tracer tape marked "Caution Water Line Buried Below" shall be installed in the ditch above the pipe to allow location by a metal detecting device and to alert construction workers of the presence of a water line. The tape shall be color coded and labeled to identify the type of line. Tape shall be installed within one foot of finished grade and shall be at least six inches wide.

A 14 gauge insulated copper detection wire shall be installed at the trench bottom and stubbed up at each valve location and left accessible inside the valve box for all PCV and PE pipe. The wire shall form a continuing loop in the water system. All splices in the wire shall be made securely and covered thoroughly with electrical tape.

F. Blow-Offs on Dead End Lines

The contractor shall install a blow-off of sufficient size to achieve 2.5 fps on the end of each dead end line, except where fire hydrants are installed, to facilitate filling, sterilizing, and blowing-off of lines, both during construction and system operation.

G. Setting Hydrants

The installation of hydrants shall be as follows;

1. Hydrants shall be lowered into the trench, inspected, cleaned, jointed to pipe, and reaction or thrust blocks provided as specified herein for installation of water mains, laterals and fittings.
2. Each hydrant shall be connected to the main with a six-inch (6") pipe branch controlled by an independent six-inch (6") gate valve. Lengths of pipe and use of couplings between main and valve and hydrant shall be as shown on the drawings.
3. A drainage pit two feet in diameter and two feet deep shall be excavated below each hydrant. The pit shall be filled compactly with coarse gravel or broken stone mixed with coarse sand, under and around the bowl of the hydrant to a level six inches (6") above the waste opening. No hydrant drainage pit shall be connected to a sewer.
4. A reaction or thrust backing shall be provided at the bowl of each hydrant and shall be so placed as not to obstruct the drainage outlet of the hydrant, or the bowl of the hydrant. The hydrant shall be tied to the pipe main with rods. A minimum of 2 - 3/4" rods, painted with two coats of asphaltic coating shall be used.
5. Hydrants shall be thoroughly cleaned of dirt or other foreign matter before setting.

200.13 BACKFILLING TRENCHES

- A. Backfilling of trenches shall be performed in accordance with ANSI/AWWA C600 of latest revision or local municipality requirements.

200.14 PRESSURE TESTING OF WATER LINE

A. Testing Water Distribution System

1. The contractor shall provide all necessary equipment, gauges, labor, tools, and services, and shall perform all work required in connection with testing water mains, laterals, and service lines. An official of the Authority must be present to witness the tests.
2. Each valved section of water main shall be slowly filled with water with care being taken to expel all air from pipes. If hydrants or blow-offs are not available at high points in the main, the pipe shall be tapped at high points to vent the air and shall be plugged at completion of tests.
3. The contractor shall perform all pressure and leakage tests before backfilling the trenches and at least 5 days after thrust blocks are concreted in place.

a. Pressure and Leakage Test:

- i. Before the Authority shall accept any water lines, these lines or each valved section shall be tested at a hydrostatic pressure of at least 150 p.s.i. or 1.25 times, whichever is higher, than the expected highest working pressure of the line.
- ii. The duration of each pressure test shall be at least two hours. The test pressure shall not vary by more than 5 psi.
- iii. No pipe installation will be accepted until the leakage per 2-hour period is less than the number of gallons listed below.
$$L = \frac{SD(P)^{1/2}}{133,200}$$

in which L is the allowable leakage, in gallons per hour; S is the length of the pipe tested in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.

- iv. Should any test of pipe laid disclose leakage greater than that specified, the defective joints shall be located and repaired until the leakage is within the specified allowance.

200.15 DISINFECTION PROCEDURE FOR NEW WATER LINES

- A.** After being tested, as described above, all newly installed water mains and repaired portions of or extensions to existing water mains shall be thoroughly flushed, disinfected, and subjected to bacteriological tests. Disinfection shall comply with AWWA Standard C651, Disinfection of Water Mains, or latest revision.
- B.** The newly laid main shall be thoroughly flushed with water from the existing distribution system. Flushing shall be at a sufficient rate to produce a minimum velocity of 2.5 feet per second in the main. After thorough flushing has been completed, chlorine for disinfection shall be applied and maintained at a minimum of 50 mg/l available chlorine. To ensure that this concentration is maintained, the chlorine residual shall be measured at regular intervals.
- C.** Chlorine may be applied by the following ways:
 1. As chlorine gas-water mixture: The chlorine solution shall be applied by means of a solution-feed chlorinating device.
 2. As a solution of calcium hypochlorite powder in water: Calcium hypochlorite shall be the commercial product known as H.T.H., Perchlora, or Maxochlor, or approved equal. The solution consisting of five percent (5%) powder and ninety-five percent (95%) water by weight shall be prepared.

3. Table I shows how much chlorine is needed for each 100 feet of line for pipes of various diameters. A 1% chlorine solution may be prepared either with 1 pound of calcium hypochlorite for each 8.5 gallons of water or with sodium hypochlorite.

TABLE I

CHLORINE REQUIRED TO PRODUCE A 50 MG/L CONCENTRATION
IN 100 FEET OF PIPE, BY DIAMETER

Pipe Size (inches)	100% Chlorine (pounds)	1% Chlorine Solution (gallons)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88
14	0.328	3.96
16	0.434	5.20
18	0.540	6.48
20	0.680	8.00
24	0.980	11.52

4. The chlorinating agent shall be applied at the beginning of the section adjacent to the feeder connection, and shall be injected through a corporation cock or other connection insuring treatment to the entire line. The chlorinating agent shall be fed into the new line slowly.
5. While the chlorine is being applied, the valves shall be manipulated so that the treatment dosage will not flow back into the line that is supplying the water. The application of chlorine shall be continued until the entire line being treated is filled with the chlorine solution. Then the chlorinated water shall be retained in the line for at least 24 hours, during which time all valves and hydrants in the line being treated shall be operated so that appurtenances can also be disinfected. After 24 hours, the treated water shall have a chlorine concentration of at least 25 mg/l throughout the line.
6. After the application retention period, the heavily chlorinated water shall be flushed from the line until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system. Owner/developer/contractor is responsible for the legal disposal of chlorinated water, and dechlorination thereof, as required, and shall obtain all requested permits and approvals.
7. The velocity of the water used to flush a line shall be at least 2.5 fps.
8. Once the line has been flushed, tests shall be performed to make certain that the rendered chlorine in the water is within acceptable limits.

9. Flushing shall not be considered a substitute for taking preventive measures before and during the laying of water lines.

200.16 DISINFECTION PROCEDURES AFTER CUTTING INTO OR REPAIRING EXISTING LINES

1. The disinfection procedures outlined above also apply to cases in which the lines are wholly or partially de-watered.
2. However, leaks or breaks that are repaired with clamping devices while the line remains full of water under pressure present little danger of contamination and require no disinfection.
4. The following disinfection procedure is considered the minimum that may be used when existing lines are repaired.
5. Swab the interior of all pipes and fittings (particularly coupling and tapping sleeves) that are to be used in repairing an existing line with a solution of 5% hypochlorite before installing them.
6. The most practical means of removing contamination introduced into a line during repairs is to give the line a thorough flushing. If the locations of valves and hydrants make it possible, flushing in both directions is recommended. Start flushing as soon as repairs are completed, and continue until all discolored water is eliminated.

200.17 BACTERIOLOGICAL TESTS

1. After a potable water line has undergone final flushing, following the disinfection but before it is placed into service, a sample shall be collected for bacteriological testing from the end of that line. In the case of extremely long lines, additional samples shall be required by the Authority.
2. These samples shall be collected in sterile bottles treated with sodium thiosulphate. A hose or fire hydrant shall not be used to collect samples. One suggested sampling method is to install a standard corporation cock in the line with a copper tube gooseneck assembly; after the samples have been taken, the gooseneck assembly can be removed and retained for later use.
3. The samples collected shall be taken to a PADEP approved laboratory to be tested for bacteriological quality in order to determine if they contain any coliform organisms. If the initial disinfection is positive for coliform, the contractor will resample. If the test fails two times the disinfection procedures shall be repeated.
5. When the samples tested are found to be satisfactory, the water lines may be placed in service.

200.18 CLEANUP OF WORKSITE

It is the daily responsibility of the contractor to remove all excavated materials from the road area.

A. Cleaning Up

All excess excavated material, rubbish, and debris from adjacent street surfaces, gutters, sidewalks, parking areas, grass plots, etc., shall be removed and the project as a whole shall be left in a neat and acceptable condition.

B. Backfill of Roadway

All cuts made in streets shall be filled with approved backfill material, and patched with Cold-Mix for temporary use in accordance with practices required by applicable local municipality and/or PENNDOT requirements.

200.19 FINAL ROAD RESTORATION

A. Replacement of Street/Road

All cuts made in streets shall be paved with Hot-Mix after the backfill has settled in accordance with practices required by applicable local municipality and/or PENNDOT requirements.

200.20 APPROVED MANUFACTURERS OF MATERIALS

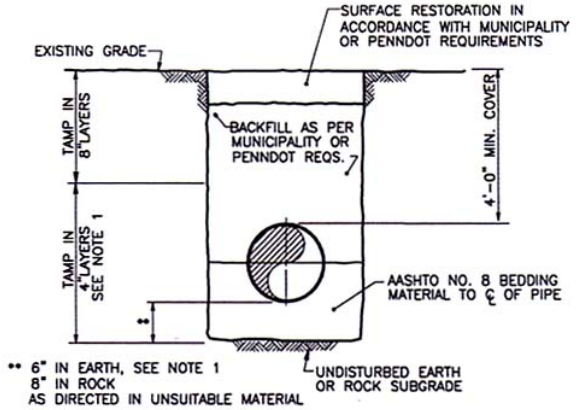
This table is designed as a guide for owners/developers/contractors of the Authority's approved manufacturers of materials. This list does not provide the specifications. The specifications are shown in the Construction Specifications. Proposed equals will be reviewed upon request and the Authority reserves the right to require an approved equal.

Item	Approved Manufacturer	Notes
<i>PIPE</i>		
Ductile Iron Pipe (DIP)	Griffin, US Pipe, American	
Polyvinyl Chloride (PVC) Pipe	North American, John's Manville, Charlotte	
<i>FITTINGS (DIP)</i>		
Valves (3-inch and larger)	Mueller, Kennedy	Open left
Valve Boxes	Bingham & Taylor	3 pc CI screw type
Megalugs	Ford, Mueller	
Bends	Griffin, US Pipe, American	
Tapping Sleeves	Mueller	Long bolt pattern
Tapping Valves	Mueller	Open left
<i>FITTINGS (PVC)</i>	No PVC Fittings are allowed	
<i>FIRE HYDRANTS</i>	Mueller Super Centurion 250 HS American Darling	
<i>SERVICES</i>		
K-Type Copper	Russell, American, Reading	
Polyethylene (PE)	North American	
Tapping Saddles (SS)	Smith Blair, Ford, Mueller	
Corporation Stops	AY McDonald, Ford, Mueller	
Quarter Bend Swivel Couplings	AY McDonald, Ford, Mueller	
Curb Boxes	Bingham & Taylor, AY McDonald	1-inch brass plug lid
Curbstops	Bingham & Taylor, AY McDonald	

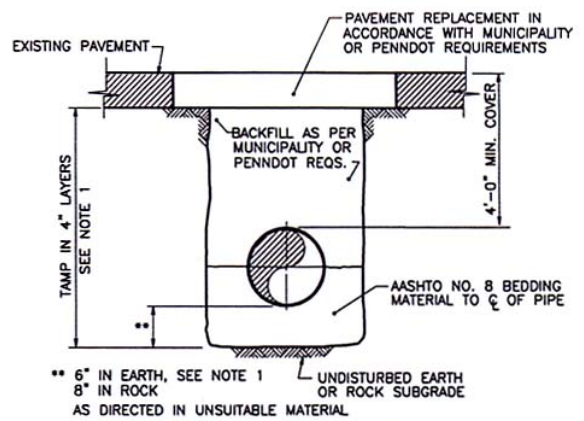
Meter Pits (non traffic areas)	Mueller, Ford	Lids for meter pits – hoe in top for remote
Meter Pits (traffic areas)	To be designed by PA Professional engineer	To be approved by MAWA
<i>BACKFLOW DEVICES WITHOUT METERS</i>		
Double Check Valve (firelines)	Watts, Wilkins	Testable backflow preventer
Hose-Bibb Vacuum Breaker	Watts, Wilkins	Not a testable device
<i>METER SETTINGS</i>		
Meter		Furnished by MAWA
Shut-off valve before meter	Nibco, Watts, Ford, Hammond	Required - No drain valve
Shut-off valve after meter	Nibco, Watts, Ford, Hammond	Required - Drain valve recommended
Pressure Reducing Valve	Watts, Wilkins	Recommended
Thermal Expansion Tank	X-Trol, Watts	Recommended
Backflow Preventers	Watts, Wilkins	
Dual check valve (residential)	Wilkins, Watts	Non testable backflow preventer
Reduce Pressure Zone valve (special applications)	Wilkins, Watts	Testable backflow preventer

ATTACHMENT 1 – Typical Trench Details

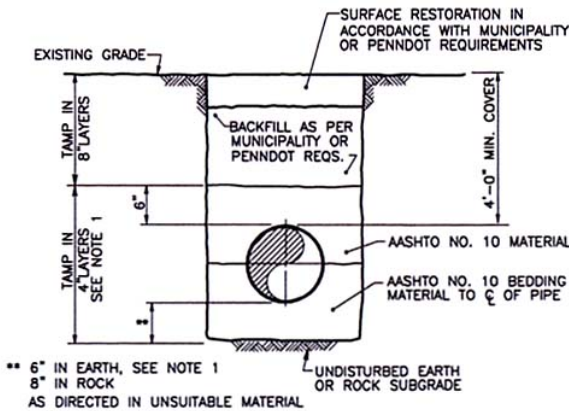
TYPICAL TRENCH DETAILS



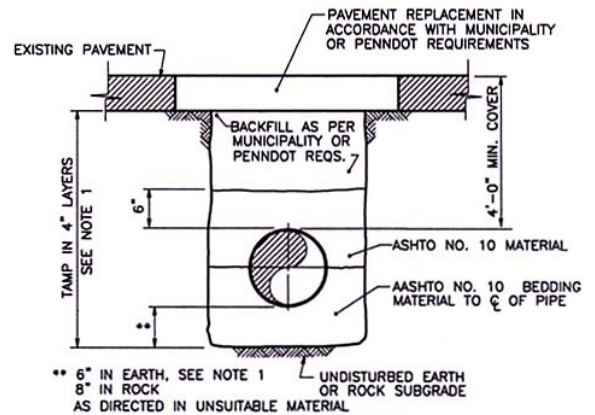
**DUCTILE IRON WATER PIPE
TYPICAL TRENCH UNPAVED AREAS**
NO SCALE



**DUCTILE IRON WATER PIPE
TYPICAL TRENCH PAVED AREAS**
NO SCALE



**PVC WATER PIPE
TYPICAL TRENCH UNPAVED AREAS**
NO SCALE



**PVC WATER PIPE
TYPICAL TRENCH PAVED AREAS**
NO SCALE

TRENCH NOTES:

1. IF VIBRATORY COMPACTION EQUIPMENT IS USED BACKFILL MAY BE IN 8" LAYERS.