

CITY OF TANEYTOWN

Carroll County, Maryland

SPECIFICATIONS FOR WATER SYSTEM CONSTRUCTION

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Carroll County, Maryland**

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Recipients of this document must keep themselves informed of any revisions which may be made to the Specifications.

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SECTION 1 - GENERAL REQUIREMENTS

A. GENERAL

1. Definitions

- a. Applicant/Owner: All references to the "Applicant or Owner" in these specifications pertain to the individual, organization, company or developer who requesting water capacity allocation from the City.
- b. City: City of Taneytown
- c. Customer: Any person or company who receives water service from the City.
- d. Extendor: The builder of the water main extension or water service facilities. Where the Extendor is acting as an agent of the Applicant, the requirements of the Extendor under these specifications shall also apply to the Applicant, and the City shall have recourse to either party. These Specifications shall not, however, be construed to dictate the legal relationship between and Applicant and his Extendor.

2. Scope

Where an Applicant for water service desires to design and construct a separate water supply system, the Applicant shall consult with the City prior to design, to obtain approval and to establish design criteria.

All water service projects shall be done in accordance with the latest edition of the *Code of the City of Taneytown* and these *Specifications for Water System Construction*.

The private portion of water service, located after the curb stop or meter pit, is not covered under these specifications and shall conform to the requirements of the International Residential Plumbing Code as amended by the Carroll County Plumbing Code.

An Applicant for an extension of water service shall submit plans providing the following information:

- a. Water Demands:
 - Number and type of housing units, with anticipated construction schedule
 - Estimated total population served
 - Average daily water demand
 - Maximum daily water demand
 - Maximum hourly water demand

Fire protection demand and duration (see Design Criteria)

Construction elevations (USGS datum)

- b. Existing and proposed streets, property and lot lines, and building locations.
- c. Existing and proposed utilities including location and sizes of water mains, valves, hydrants, blow-offs and other facilities.
- d. Legend of symbols, scale and date.
- e. A note which states: "All water main construction shall conform to the City of Taneytown's *Specifications for Water System Construction*, which shall take precedence over other notes on the Drawings."

3. Design Criteria

The following design criteria shall be used unless exceptions are approved in writing by the City. Where special design criteria are required, the Applicants should consult with the City prior to preparation and submission of plans. The design criteria for water demands are as follows:

a. Domestic Water Requirements:

Average Daily Requirement: 250 gallons per day per EDU (the City, at its own discretion, may apply a reserve factor in excess of the 250 gpd or consider a lesser requirement based on building type.)

Maximum Hourly Demand: 4.0 times average daily demand

- b. Industrial or special water demands: established for each installation.
- c. Fire demands:

(1) Residential

Type of Construction	Fire Flow (gpm)	Flow Duration (hours)
Residential (apartments, condominiums, nursing homes, etc.)	3,500	3
Residential (townhomes and duplexes)	1,500	2
Residential (single family)	1,000	2

(2) Non-Residential

For all non-residential developments, the needed fire flow (NFF) shall be calculated in accordance with the Insurance Services Office (ISO) "Guide for Determination of Needed Fire Flow", latest revision. The calculated NFF is

subject to approval by the City.

(3) Buildings with Automatic Sprinkler Systems

Calculated NFF may decrease if automatic sprinkler systems are installed in buildings. However, the fire flow provided shall not be less than 500 gpm.

4. Liability

The Extendor shall be responsible for any and all damage, loss, or injury to persons or property that may arise, or be incurred, in or during the conduct or progress of the work.

5. City's Right of Inspection

The City shall have the right to inspect any water system construction carried out by the Applicant. Should the inspected work prove to be unsatisfactory, the cost of removing and replacing, renewing and making good the unsatisfactory work shall be borne by the Applicant. No water service facility shall be placed in service until it has been successfully tested in the presence of an authorized City representative.

6. Working Conditions

No night, Saturday, Sunday or National Holiday work subject to City inspection will be permitted except in cases of emergency with written City consent. No work shall be done when, in the opinion of the City, the weather is unsuitable.

7. Standard Specifications

Standard specifications of societies, associations, institutes, etc., referred to in these Specifications, shall be the latest edition of such Specifications unless otherwise noted.

8. Work Area Traffic Control and Maintenance

- a. Traffic in work areas shall be controlled to protect the public and workmen, while minimizing the inconvenience to the public. Traffic control devices shall conform to the Maryland State Highway Administration (MDSHA) requirements. Traffic control measures shall be coordinated with the City of Taneytown.
- b. Unless authorized by the City to completely close the road, the contractor must take the necessary measures to keep the road open for traffic, at his own expense. When vehicles must be stopped for short periods, work shall be performed during other than peak traffic periods. During progress of work, sidewalks and crossings must be kept open for pedestrians, unless otherwise authorized. Access to residential and business establishments shall be maintained, except when work is actually being performed in the area. During

non-working hours the Extendor shall insure that all streets affected by construction are open and can be safely traveled by vehicles.

- c. The Extendor shall construct and maintain, without extra compensation, adequate and proper bridges over excavations for safe accommodation of pedestrians or vehicles. The Extendor shall furnish and erect approved barricades at crossings of trenches, or along the trench, to protect the public.
- d. All sidewalks, roadways and private property shall be kept clear of excessive dust, dirt, mud or other excavated material. The City shall be empowered to require the cleaning and/or dampening of any area, if in the judgment of the City's inspector such action is necessary for the safety and accommodation of traffic and the public. Trenches across driveways, side streets, alleys and entrances shall be maintained after backfilling.
- e. All stored materials and equipment which may obstruct traffic shall be protected by approved lights, lanterns, torches, or guards.

9. MISS UTILITY

The location and type of utility lines at the work site must be identified and detailed information from each user (utility owner or operator) must be requested at least 48 hours before beginning work, excluding weekends and legal holidays. In Maryland, the organization to contact is MISS UTILITY. The telephone number is 1-800-257-7777. The Extendor must provide his operators with the information and must inform any user of any damage made or discovered during construction.

Any damage to existing utilities shall be repaired at the Extendor's expense and to the satisfaction of the owner of the utility.

10. Permits

- a. The Applicant shall secure, in the name of the City, all permits that are required from the Maryland Department of Environment (MDE), Maryland State Highway Administration (MDSHA), and the Maryland Midland Railroad. The Applicant shall secure, in his own name, all other required construction permits such as a Carroll County Grading Permit. Any existing street, highway or other improvements disturbed during construction shall be restored to the satisfaction of the City before the facilities will be approved for final acceptance by the City. All costs of such permits, including any and all bonds required, shall be the sole expense of the Applicant. Prior to opening any excavation within the right of way of any railroad or state highway, the Extendor shall make certain that the necessary agreements have been executed and that all required permits have been obtained.
- b. The Applicant shall acquire all necessary permits for blasting and for special equipment. Any provisions in these permits shall supersede the above provisions. If blasting is to be performed, the Applicant shall provide written

notices to the City and all residences and businesses in the surrounding area a minimum of 48 hours in advance of the blasting.

- c. Approval by the City inspector of all or part of any work performed under a permit issued by an independent agency shall not constitute acknowledgement that the work was performed in accordance with such permit; nor shall such approval by the inspector be construed as a release of the applicant from his obligations to meet the requirements of the permit, or that such approval serves as a waiver of the City's right to seek enforcement from the permitting agency.

11. General Excavation

a. Clearing and Grubbing

Clearing includes the cutting and disposal of all trees, vegetation, and other objectionable material occurring within a width of the work area established prior to construction. Grubbing includes the removal and disposal of all stumps and root mats located within the established area. The method of disposal of waste material shall conform to all state and local laws, ordinances and regulations, including the Air Pollution Control Act of 1990, or as amended.

Trees cut down shall have their stumps removed, and all resulting debris shall be removed and disposed of by the Extensor at his expense.

b. Exploratory Test Pits

Test pits shall be dug in advance of trench excavation when necessary to determine the location and depth of existing utilities, rock, groundwater levels, or other conditions that might affect construction.

c. Protection of Property and Structures

The Extensor shall, at his own expense, sustain in their places, and protect from direct or indirect injury, all poles, pipes, conduits, tracks, roadways, curbs, walks, walls, buildings, and other structures or property in the vicinity of his work. The Extensor shall be responsible for any damages, and assume all expense for direct or indirect injury, caused by his work, to any person, property, or structure.

Pipes and underground conduits exposed as a result of the Extensor's operations shall be adequately supported by timber or planking, such that the anchorage of the supports will not be disturbed or weakened during backfilling. Approved backfill material shall be carefully tamped under and around the supports, and all supports shall be left in place.

Any removal, realignment, or change in the position of any pipe, conduit, pole, or other structure due to the construction shall be done at the Extensor's expense and with the approval of the owner of the obstruction. If fencing removed served as an enclosure for animals, the Extensor shall prevent the escape of the animals. When the water main is completed, the Extensor shall restore the temporary and permanent rights of way to their original condition at his own expense.

d. Removal of Pavement and Storage of Materials

The Extendor shall grub and clear the surface and remove all surface materials over the line of the trench; properly separate and classify the material removed; and store, guard, and preserve any materials required for backfilling or other purposes. All materials taken from the trenches shall be stored away from the street or highway, unless otherwise authorized by the City. The materials shall be placed or stored in a manner that will not obstruct any pipe, culvert, gutter, drain, ditch, hydrant, or water way. The width of the work area to be disturbed shall be established prior to construction. Pavement shall be cut to neat lines with a concrete saw or air spade in accordance with local government regulations.

Backfill material shall not be removed from the lines of work before the excavation is refilled, except with City approval. This provision shall not relieve the Extendor of his obligation to remove and dispose of the excavated material at his expense.

In business districts, state highways, streets with heavy traffic, narrow streets, or any other locations where working space is limited, the excavated material shall, when required by the City, be removed at the Extendor's own cost and expense, as soon as excavated. The Extendor shall not cast excavated material beyond the curb or right of way lines, or on sidewalks or lawns. Excess excavated material shall be removed to a location provided by the Extendor. The Extendor may, at his own cost and expense bring back this material for backfill, if it is suitable, or shall provide other suitable material. When soft or wet material must be hauled over streets, the Extendor shall prevent spillage. All topsoil within the trench limits shall be removed prior to excavation and replaced after backfilling.

12. Drainage and Dewatering

The Extendor shall keep gutters, storm sewers, drains, and ditches open at all times for surface drainage. The Extendor shall direct water across or over pavements only through approved pipes or properly constructed troughs, and he shall do so at his own cost and expense. The ground surface shall be properly ditched to prevent water from running into the pipe trenches. Use silt bags or other approved measures to prevent silt and other debris from entering the storm water system.

The Extendor shall keep all excavations free from water at his own expense.

13. Special Requirements

- a. All water lines shall be extended to the furthest property lines or corners of the development under consideration. The exception shall be where lines cannot be further extended at the sole discretion of the City. The size and location of the water mains, pumping stations, pressure boosting stations, pressure reducing stations, water storage tanks, fire hydrants, valves and other appurtenances shall be determined or approved by the City's Engineer so as to comply with the City's long-range facilities planning.

- b. The Extendor shall maintain existing water lines in service. If an existing water line is damaged or broken, the Extendor shall expeditiously restore service at his expense to the satisfaction of the owner.
 - c. All water mains to be dedicated to the City shall have a 20' right of way. The Extendor shall provide the City with a 1-year warranty on all water system components dedicated to the City. The warranty period should begin on the date the system is dedicated to the City.
 - d. Gas utility mains shall be shown on water and sewer plan and profile sheets during the design phase of the project for City approval prior to construction.
 - e. Construction of water mains and appurtenances shall conform to the requirements of the Occupational Safety and Health Act (OSHA).
 - f. Water mains, service lines, water meters and appurtenances shall be designed and constructed to prevent freezing.
 - g. All equipment used on roadways shall be equipped with rubber tires or treads. If other than rubber tires or treads are used, the pavement shall be protected by heavy rubber belting. If pavement, curb and/or sidewalk is damaged or marked by construction equipment, the areas shall be restored at no cost to the City.
 - h. The Extendor shall not obstruct fire hydrants.
 - i. Backfill material shall not be removed from the lines of work before the excavation is refilled, except with City approval. This provision shall not relieve the Extendor of his obligation to remove and dispose of the excavated material at his expense.
 - j. The work shall be protected from damage during storms.
 - k. A competent person shall be made available within 2 hours in case emergency situations arise during non-working hours.
 - l. The local Police and Fire Departments shall be informed of the work schedule and of possible street obstructions.
 - m. Blasting for excavation shall be permitted only after securing approval(s) and establishing the hours of blasting. The blasting procedure, including protection of persons and property, shall be in strict accordance with federal, state and local regulations.
14. Construction Water Usage

Connection to City of Taneytown fire hydrants and any other unmetered usage of City water for construction (and any other) purposes is prohibited. Should the contractor wish to establish a connection to the Taneytown water system to provide

water supply during construction operations, a request shall be made of the City and approved with the following conditions:

- a. The water shall be delivered through a weather-protected tap of a City water main in accordance with the provisions of the following sections.
- b. All usage shall be metered with a meter provided by the Contractor.
- c. The water supply shall be isolated by gate valves and a backflow preventer provided by the Contractor.
- d. The Contractor shall provide prior written notification to the City and to all residences and businesses in the area a minimum of 48 hours prior to tapping the water main.

END OF SECTION

SECTION 2 – WATER SERVICE

A. GENERAL

1. A water service is that section of a water line that extends from the water main to the property line, curb line or right-of-way line of the property which it serves.
2. The private portion of water service, located after the curb stop or meter pit, is not covered under these specifications and shall conform to the requirements of the International Residential Plumbing Code as amended by the Carroll County Plumbing Code.
3. All water services constructed within the service area of the City shall meet the requirements of this specification.
4. Water service pipe and fittings shall be furnished and installed in strict accordance with these specifications, and any and all practices and precautions required for the water mains specified in SECTION 3 – WATER MAINS of these specifications are equally applicable to the water services.
5. Each Improved Property shall have its own individual service. The water service shall normally consist of a corporation stop, pipe and meter pit.
6. Supervision and Inspection

The construction of services shall at all times be subject to the supervision and inspection by the City or its duly authorized representative and shall conform to the City's specifications. No owner shall permit water services to be covered or backfilled until authorized by the City to do so.

B. DESIGN CRITERIA

1. Size of Lines

The sizing of services shall be in accordance with AWWA Manual of Water Supply Practice M22 *Sizing of Water Service Lines and Meters* and is subject to City approval. The Applicant shall provide justification for service sizing for City review and approval. Single unit residential services shall normally be 1 inch in size.

2. Depth of Lines

The minimum depth of backfill over pipes shall be 3'-6" (42 inches).

3. Location of Services

- a. Services shall be installed at least 5 feet away, measured horizontally, from other utilities. Services shall also be installed above sewer utilities. If these minimum distances cannot be achieved, alternative methods for protecting the water utilities, as approved by the City, shall be used.

b. Refer to SECTION 3 – WATER MAINS for additional requirements on utility separation.

c. A service shall be provided for each lot.

4. Underground Pipe and Fittings

Services from the water main to the curb stop valve and box (beginning of service line) shall be Type K copper water tubing or ductile iron pipe.

C. MATERIALS AND EQUIPMENT

1. Pipes

a. Copper Tube and Fittings

(1) Copper tube shall conform to the requirements of ASTM B88, with Type K for underground installations.

(2) The water service copper tubing must be one continuous piece with no fittings or splices.

(3) Fittings for Copper Tubing

Fittings for copper tubing shall be the compression type conforming to AWWA C800 with a pressure class of 150 psi. All service fittings shall be compression connection manufactured by Mueller Company or Quick Joint manufactured by Ford.

b. Ductile Iron Pipe and Fittings

(1) Refer to SECTION 3 – WATER MAINS for these requirements.

2. Corporation Stops

Corporation stop compression connections shall be Mueller 110 or Ford Quick Joint. Corporation stop valves shall be Mueller H-15008 or Ford FB1000 Series.

3. Service Saddles

For water service connections up to 2 inches, service saddles may be used if necessary. Service saddles shall have double straps of zinc-plated steel. Service saddles shall be Style F202 by Ford Meter Box Company, Inc. or equal.

4. Tapping Sleeves

For water service connections that are 3 inches or larger, tapping sleeves shall be used. Tapping sleeves shall be of ductile iron construction with a ductile iron mechanical joint outlet. Tapping sleeves shall be Series 2800 by American Flow Control or equal.

5. Curb Stops and Curb Boxes

- a. Curb stop compression connections shall be Mueller 110 or Ford Quick Joint. Curb stop valves shall be Mueller H-15209, Mueller B-25209 or Ford B44 Series.
- b. Curb boxes shall be two-piece, screw type, cast iron and be operable with a 6-foot long wrench. They shall be manufactured by Tyler/Union, Series 6500 with 2½-inch shaft and shall be provided with a lid with the word "WATER" cast in. The standard box number shall be 93-E which has an extension range of 36 to 54 inches. Other box numbers shall be used as required if the burial depth is out of the 93-E extension range.
- c. For service lines 3-inches and larger the curb stop valve shall be a gate valve with box meeting the requirements of SECTION 3 – WATER MAINS.

5. Meter Pits

- a. For service line connections up to 2 inches, where other metering is not being performed, meter pits shall be installed in place of curb stops. Where a development is served by a common water meter, requirements for installation of meter pits or curb stops will be left to the discretion of the developer.
- b. Meter pits shall be installed in non-paved areas only. If this is not possible, approval will be required by the City prior to installation. In cases like this, the meter pit and ring and cover shall be H20 rated for traffic loading and located in areas not subject to heavy traffic (ie. outside cartways, in designated pedestrian walkways, etc.).
- c. Meter pits shall be constructed of HDPE with dimensions of 18" diameter with depth as needed, as produced by SIGMA Corporation or approved equal.
- d. Rings and covers shall be cast iron construction for recessed lids as produced by Vestal Manufacturing. Rings shall be model 32-042. Lids shall be model 32-460 for placement in non-paved areas and model 32-280 for placement in paved areas or approved equal. Lids shall be 11.5" diameter.
- e. Meter setters shall be 70 Series Coppersetter as produced by The Ford Meter Box Company, Inc. Setters shall be 15" in height and include both an angle ball valve on the inlet side and an angle cartridge dual check valve on the outlet side.
- f. Water meters will be provided subject to current City fee schedule and installed by the City or a certified plumber.

6. Clamping Devices

Socket clamps, anchor, straps, and tie rods, used to anchor pipe fittings, shall be as manufactured by the Grinnell Company, Inc. or approved equal.

D. INSTALLATION

1. Refer to the applicable parts of SECTION 3 – WATER MAINS for installation requirements.
2. When installing corporation stops, the main shall be tapped at a 45 degree angle with the horizontal. Service tubing shall be installed as a continuous length of pipe and shall have a minimum cover of 3'-6". Curb stops shall be vertical, with the top of the curb box at finished grade. Curb boxes shall not be located in roadways or driveways. The curb box shall be set on a precast concrete block firmly embedded in virgin soil at a minimum depth of 4 feet but shall not exceed a maximum depth of 5 feet. The curb box shall be positioned so that it is centered over the curb stop valve. Align to provide unobstructed access to the valve. Where grading may still be in progress the curb box shall be marked by a minimum 2" x 4" pressure treated lumber stake projecting 18 inches above final grade.
3. Copper tubing services shall be bedded in sand, free of limestone, or wrapped with plastic sheeting protection. Select fill (native soil with no rocks and minimal stones with no materials larger than 0.5 inches in largest dimension) may also be used as bedding material as approved by the City. A minimum of 6 inches of bedding material shall be provided around the pipe in all directions.
4. Meter Pits shall be installed on a brick foundation and be backfilled as per the service line.
5. Services crossing any roadway must either be installed by the open cut method or must be installed within a protective steel casing which is auger bored or jacked beneath the roadway. Services crossing state highways are subject to state approval and must be installed in accordance with MDSHA requirements and specifications. Services crossing County roads are subject to County approval and shall be installed in accordance with County requirements.
5. Special Conditions and Requirements
 - a. Trench excavation, in any material, shall extend for 4 feet beyond the end of the service for the full depth of the service. If the service is intended to be used at a later date, then prior to backfilling, a minimum 2" x 4" treated lumber locator marker shall be placed against the end of each service and shall extend a minimum of 12 inches above the ground.

E. TESTING AND INSPECTION

1. Notification

It is incumbent upon the Applicant to notify the City a minimum of 48 hours in advance of when the work will be ready for inspection.

2. Before backfilling the trench or covering any work, an inspection by the City from the water main to the meter pit valve must be performed.

3. Service connections which are constructed as part of new water main installations shall be inspected and tested as part of the water main extension as described in SECTION 3 – WATER MAINS.

4. Service connections to existing water mains shall be pressure tested from the meter pit valve to the corporation stop.

a. Pressure Test

- (1) Each service shall be subjected to a pressure test prior to approval by the City. The test shall be witnessed by an agent of the City and the service line shall not be deemed acceptable until said service has satisfactorily passed the test described below. All costs of testing and any subsequent test(s), including equipment, material or labor required shall be the responsibility of the Applicant.

- (2) Services 2-inches and Smaller

All newly laid pipe shall be subjected to a test pressure of 150 pounds per square inch, or 150% of the normal working pressure, whichever is greater in accordance with AWWA C600. There shall be no drop in pressure for a period of 15 minutes.

- (3) Service Lines Larger than 2-inches

Refer to SECTION 3 – WATER MAINS for the testing requirements.

5. Disinfection

Services shall be part of the testing and disinfection program specified in SECTION 3 – WATER MAINS per AWWA standards. The chlorine from the services shall be flushed and drained. If necessary, the Applicant shall request service customers to run spigots in the dwelling to remove chlorine from the lines. The City shall not be responsible for any damage to customer service lines.

F. DETAIL DRAWINGS

Relevant Detail Drawings are:

- 4 Typical Service (Up to 2") Using Corporation Stop
- 4.a Typical Service (Up to 2") Using Corporation Stop and Curb Stop
- 5 New Service Connection (Up to 2") Using Service Saddle
- 6 New Service Connection (Larger than 2") to a New Water Main
- 7 New Service Connection (Larger than 2") to an Existing Water Main

END OF SECTION

SECTION 3 - WATER MAINS

A. GENERAL

1. A water main is that portion of the public water system that conveys drinking water from the source of treatment (well house or water treatment facility) to the individual water services. Water mains are generally located within public street rights of way and are a minimum of 8 inches in diameter.

2. Supervision and Inspection

The construction of mains shall at all times be subject to the supervision and inspection by the City or its duly authorized representative and shall conform to the City's specifications. No owner shall permit water mains to be covered or backfilled until authorized by the City to do so.

3. Regulatory Agencies

- a. All designs shall conform to good engineering practice and all proposed water construction projects shall meet the requirements of the Maryland Department of the Environment (MDE), OSHA, and the Maryland Department of Labor, Licensing & Regulation, and shall conform to the requirements contained herein.
- b. The design criteria contained herein shall be used unless exceptions are approved in writing by the City. Where special design criteria are required, the Applicant must consult the City prior to the preparation and submission of plans.

B. DESIGN CRITERIA

1. Size of Mains

Adequacy of main sizes shall be determined based on a total flow requirement of fire demand in accordance with ISO methodology plus maximum daily demand plus special requirements. A maximum C value of 120 is permitted for cement-lined ductile iron pipe. Required minimum diameter is 8 inches.

Fire hydrant branches shall be not less than 6-inch diameter and no longer than necessary. The maximum permissible length is 50 feet unless a longer length is approved by the City. A gate valve shall be provided on each fire hydrant lateral at the hydrant as depicted in the detailed drawings.

2. Depth of Mains

The minimum depth of backfill over pipes shall be 3'-6" (42 inches). The maximum depth of backfill over pipes shall be 7 feet.

3. Location of Mains

- a. General

- (1) Mains shall normally be located within the right of way lines of public streets. If it is necessary to locate a main on private property, the Applicant shall provide a water main easement in the name of the City. The easement shall consist of a 20-foot wide permanent easement, normally centered on the pipeline, and an additional 20-foot wide temporary construction easement.
- (2) Distribution main networks shall be looped and dead-end mains shall be avoided. When dead-end mains cannot be avoided, hydrants shall be provided at the ends of the mains.
- (3) Distribution mains shall be located not less than 15 feet from buildings, except as approved by the City.
- (4) Design of the horizontal and vertical layout of water mains shall follow sound engineering principles. Utility crossings and localized high spots shall be minimized. Maximum horizontal separation of utilities shall be provided for ease of future maintenance and health and safety reasons.

b. Water Mains Near Sewers

- (1) Parallel Installation: Water mains shall be laid at least 10 feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain 10 feet of separation, the City may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.
- (2) Crossings: Whenever water mains must cross building drains, storm drains, or sanitary sewers, the water main shall be laid at such an elevation that the bottom of the water main is 18 inches above the top of the drain or sewer. This vertical separation shall be maintained for the portion of the water main located within 10 feet horizontally of any sewer or drain it crosses. The 10 feet is to be measured as a perpendicular distance from the drain or sewer line to the water line.
- (3) Exception: When it is impossible to obtain the proper horizontal and vertical separation as stipulated in Items (2) and (3) above, both the water main and sewer line shall be constructed of ductile iron pipe having mechanical joints. Other types of joints of equal or greater integrity may be used at the discretion of the City. Where water mains must cross under a sewer, additional protection shall be provided by:
 - (a) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line;
 - (b) Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line; and
 - (c) Centering the length of the water line at the point of the crossing so that the joints are equidistant and as far as possible from the sewer.

(4) The City shall be consulted when any of the above conditions cannot be met, to discuss the use of double casing or concrete encasement of sewer and/or water lines as possible alternatives.

(5) No water pipe shall pass through, or come into contact with, any part of a sewer manhole.

c. Water Mains Near Gas Mains and Other Utilities

(1) Parallel Installation: Water mains shall be laid at least 10 feet horizontally from any existing or proposed gas main or other utility. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10-foot separation, the City may allow deviation on a case-by-case basis, if supported by data from the design engineer.

(2) Crossings: Whenever water mains must cross gas mains or other utilities, a minimum vertical separation of 18 inches shall be provided measured edge to edge. This vertical separation shall be maintained for the portion of the water main located within 10 feet horizontally of any gas main or other utility it crosses. The 10 feet is to be measured as a perpendicular distance from the gas main or other utility to the water main. Where the water main must cross under a gas main or other utility, adequate structural support for the gas main or other utility shall be provided to prevent excessive deflection of the joints and the settling on and breaking of the water line.

(3) The City shall be consulted when any of the above conditions cannot be met, to discuss possible alternatives.

4. Water Pressures

a. General

(1) Water pressure should normally be maintained in the range from 35 pounds per square inch (psi) to 100 psi at ground elevation. The required minimum pressure at ground elevation shall be 20 psi during fire flows.

(2) In areas where the static water pressure in the distribution system is less than 35 psi, booster pumps will be required. The provision of booster pumps is the Applicant's responsibility.

b. Design Pressure

The design pressure for equipment and materials shall be at least equal to 150 psi plus a 100 psi surge allowance.

c. Fire Demands

Where only hose streams are required, fire flow requirements shall be satisfied while maintaining 20 psi residual pressure at hydrants in the immediate vicinity of the fire.

Where automatic sprinkler systems are involved, residual pressures must be adequate for their proper operation.

d. Booster Pumping Station

The necessity of, design of, and construction of main line booster pumping stations shall be subject to City approval.

5. Cross-Connections

No water source of any type, other than the City water supply, shall be connected to customer piping served from the City water system. All potential cross-connections shall be eliminated. Backflow prevention devices shall be installed on all connections.

6. Location of Valves

- a. A minimum of four valves shall be used at crosses and three valves at tees. Valves shall be placed at least every 1,000 feet on arterial mains and minor distributors, or at other selected points throughout the distribution system.
- b. All water mains shall extend at least 40 feet beyond each valve located on a dead-end main, unless restrained properly and approved otherwise by the City.
- c. A valve shall be installed on each hydrant branch pipe between the main and the hydrant and near the end of any main which may be extended.

7. Air Release and Vacuum Valves

Air release valves shall only be used as a last resort. Profile of water main shall be designed to have horizontal or rising slope to high point where a fire hydrant is located. If needed, air release and vacuum valves shall be installed at all high points on supply or transmission mains and on distribution mains as directed by the City. Air valves shall be installed in concrete manholes as depicted in the detail drawings.

8. Fire Hydrants

- a. In dead-end mains or where required by the City, a fire hydrant shall be installed for flushing the main.
- b. Fire hydrants are required and the following hydrant spacing guidelines shall apply:
 - (1) In residential areas, all parts of any existing or proposed building shall be within 500 feet of a hydrant.
 - (2) In industrial areas, hydrants should be spaced according to the latest requirements of the Insurance Services Office.
 - (3) Generally, a hydrant should be placed at each street intersection, and intermediate hydrants shall be installed if the distance between intersections exceeds 500 feet.

(4) In checking distances between hydrants and buildings, measurements should be made along public streets, except where private entrances or parking areas are available for access.

- c. As installed, breakaway flanges shall not exceed a distance of 6 inches above finished grade.

9. Cathodic Protection

Water mains installed near utilities having cathodic protection shall themselves be protected. The methods of protection, which may include insulating couplings, polyethylene encasement, electrical connectors, test stations, and other facilities, shall be subject to City approval.

10. Customer Metering

Each customer shall be metered. The Contractor's licensed plumber installs and the City maintains water meters. (See SECTION 2 – WATER SERVICE.)

11. Borings

Bored crossings shall be done in accordance with MDSA requirements.

C. MATERIALS AND EQUIPMENT

1. Ductile Iron Pipe and Fittings

(References to ASTM, AWWA and ANSI Specifications imply Latest Edition.)

a. Ductile Iron Pipe

(1) Ductile iron pipe shall be in accordance with the Standard Specification as set forth in the ASTM A746 and in accordance with the standard specification as set forth in ANSI Specification A21.50 or AWWA Specification C150.

(2) Ductile iron pipe shall be by U.S. Pipe and Foundry Company or American Ductile Iron Pipe Company.

b. Joints

(1) Joints shall be of the push-on type or mechanical joint type in full accordance with ANSI A21.11 or AWWA C111 Specifications.

(2) Mechanical joint retainer glands ("Megalug") as manufactured by EBAA Iron Inc. of Texas can be selected for restraining the mechanical joint of ductile iron pipe for field closures or as approved by the City. The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil.

(3) Sleeve type couplings shall be ductile iron mechanical joint solid sleeves.

c. Minimum Thickness

Thickness design shall be per AWWA C150, except provide minimum Class 52.

d. Ductile Iron Fittings

- (1) Ductile iron fittings shall be accepted for all ductile iron pipe. Ductile iron fittings shall have a minimum pressure rating of 250 psi, and shall conform to ANSI A21.10 (AWWA C110) and shall be cement mortar lined as specified above.
- (2) Fittings used with ductile iron pipe shall be furnished with mechanical joint ends conforming to ANSI A21.11. Mechanical joint fittings shall be furnished complete with ductile iron glands, carbon steel bolts and nuts as per ASTM A307, and plain rubber gaskets.
- (3) Flanged fittings, for exposed piping and/or when specified, shall conform to ANSI A21.10 or ANSI B16.1. All flanges shall be faced and drilled in accordance with ANSI B16.1. Machine bolts and nuts for flanged fittings shall be steel, conforming to ASTM Designation A307, Grade B. Dimensions of bolts and nuts shall conform to ANSI B18.2. Threads of bolts and nuts shall conform to ANSI B1.1, Coarse-Thread Series, Class 2A fit on bolts, and Class 2B fit on nuts. Gasket for flanged connections shall be red sheet rubber or 1/16" thick cloth insertion rubber full face type and shall be the flat ring type. Dimensions of gaskets shall conform to ANSI B16.21.
- (4) All fittings shall be cement-mortar lined, paint seal coated inside, and bituminous coated outside, conforming to AWWA C104. Certification from the manufacturer that all fittings comply with the ANSI Standards noted above, shall be submitted to the City.

e. Interior Lining

Cement mortar linings shall be in accordance with ANSI Specification A21.4 or AWWA C104, except the thickness of the linings shall not be less than the following:

<u>Pipe Diameter</u>	<u>Thickness</u>
3" through 12"	1/8"
14" through 24"	3/16"

f. Exterior Coating

- (1) Buried pipe shall be installed with a bituminous coating in accordance with AWWA C151 and C110 respectively.
- (2) Buried pipe in corrosive soils shall be installed with polyethylene encasement conforming to AWWA C105, where indicated on the Drawings or as directed by the City. The polyethylene sheet shall be 8 mils thick minimum.

2. Mechanical Joint Retainer Glands

Retainer glands, when used for restraint, shall be ductile iron with twist-off nuts to insure proper actuating of the restraining devices. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153/A21.53 of latest revision. Retainer glands shall be manufactured by Megalug or equivalent. The retainer glands shall be installed according to the manufacturer's standard recommendations. Where retainer glands are used, joint deflection shall not exceed 3 degrees. Approval from the City for the use of retainer glands must be obtained.

3. Valves and Boxes

a. General

Isolating valves shall be gate valves.

b. Gate Valves

- (1) Gate valves shall be iron body, bronze mounted, resilient seated, wedge type and shall conform to AWWA C509. Valves shall be suitable for 200 psi working pressure.
- (2) Valves shall be vertical, inside screw, non-rising stem with 2-inch operating nut. Valves shall open anti-clockwise and shall be fitted with double O-ring stem seals and be suitable for buried applications. Valves shall have mechanical joint ends and shall have fusion-bonded epoxy coating inside and outside.
- (3) Acceptable manufacturers: Mueller or American Flow Control (AFC).

c. Air Release Valves

- (1) Air release valves shall conform to AWWA C512 specifications (latest edition) and shall be combination type. Valves shall be sized according to manufacturer's recommendations based on main size, main capacity and pressure.
- (2) Acceptable manufacturers: Val-Matic.

d. Valve Boxes

- (1) Underground valves shall have extension-type, roadway-type valve boxes. Valve boxes shall be cast iron and shall be two-piece telescoping screw-type construction. Valve boxes shall have 5-1/4-inch shafts, shall have covers marked "WATER", and shall be coated inside and out with a tar or asphalt compound. Valve boxes shall be manufactured by Bingham & Taylor or Tyler Union.
- (2) Underground valves equipped with Leak Noise Loggers shall have a traffic-rated ABS composite lid.

4. Fire Hydrants

- a. Fire hydrants shall be compression type with a 5 1/4-inch hydrant seat opening and a 6-inch mechanical joint inlet. The hydrant shall have two 2 1/2-inch hose nozzles and one 4 1/2-inch pumper nozzle with National Standard Thread, complete with nozzle caps and chains. The hydrants shall be traffic type with appropriate breakaway flanges. Hydrants shall be painted yellow.
- b. Acceptable manufacturers: American Flow Control 5-1/4" American-Darling B-62-B-5.

5. Tapping Sleeves and Valves

- a. Tapping sleeves shall be ductile iron construction meeting ASTM A536 Grade 65-45-12, designated for working pressure not less than 200 psi. Armored end gaskets shall be provided for the full area of the sleeve flanges. Sleeves shall be as manufactured by Mueller or American Flow Control. Nuts and bolts shall be Type 304 stainless steel.
- b. Tapping valves shall conform to the requirements specified above for gate valves except that one end shall be flanged and one mechanical. Tapping valves shall be provided with an oversized opening to permit the use of full size cutters.

6 Steel Casing Pipe

The steel casing pipe shall have a minimum yield strength of 35,000 psi, have a thickness as required but not less than 0.375 inches, be equipped with grout holes and conform to AWWA C200 and ASTM A53. Casing interior and exterior shall be painted with two coats bitumastic enamel coating in accordance with AWWA C203. Pipe cradles or isolators shall be as shown on the detail drawings, APS casing spacers, Model SSI, or approved equal.

8. Detectable Warning Tape

Detectable warning tape shall be polyethylene film encasing a metallic core, minimum 6 inches wide and 4 mils thick, color-coded blue for water, bearing in black letters, the continuous legend - CAUTION – WATER LINE BURIED BELOW.

9. Leak Noise Loggers

- a. Leak Noise Loggers shall be deployed in the distribution system to provide continuous monitoring of leakage. Installed on pipe fittings, they are retained in place by a strong magnet and are powered by replaceable batteries. When a potential leak is detected, the unit enters an alarm state and transmits a signal to indicate a "LEAK" condition. The unit includes extended logging functionality, where noise is recorded at preset intervals over an extended period of time. The logger can store up to twenty-nine days of level and spread history and the noise trends identified can then be presented in graph format, enabling the user to distinguish clearly between leak

and non-leak noise. The logger shall have user changeable alarm threshold settings that can be accessed remotely.

- b. Loggers shall have a range of 500 feet when installed on ductile iron water mains.
- c. The final number and layout of the loggers is subject to review and approval of the City.
- d. Loggers shall be Permalog by Fluid Conservation Systems as approved by the City.

D. INSTALLATION

1. Connections to Existing System and Interruptions of Service

- a. The City shall be notified at least 10 working days before installing connections to the existing water system or shutting off a portion of the system. Under no circumstances shall the valves on the existing system be operated, except under the direct supervision of a City representative.
- b. The City reserves the right to designate the day and time when water mains may be shut off and may require that this work be done at night or on a weekend. In addition, the City reserves the right to require that, where service to customers is interrupted, work is carried out continuously and expeditiously until water service is restored. The installation schedule and procedure shall be approved by the City before the work is started, and all necessary materials, tools and equipment shall be on hand before work is started. Where required, the new water mains shall be tested, sterilized and flushed prior to the installation of the connections. Written notification of service disruption shall be provided to the City and all affected residents and businesses a minimum of 48 hours in advance of the disruption.
- c. Test pits to determine the exact location, elevation, diameter and type of the existing pipe shall be excavated under the supervision of the City.

2. Excavation

- a. The trench shall be excavated to a depth of 6 inches below the outside diameter of the pipe barrel, or deeper if so specified. The width of the trench shall be as shown on the detail drawings. The resultant subgrade shall be undisturbed or compacted as approved by the Engineer if disturbed.
- b. When the pipe is to be laid in fill, bring the fill to 2 feet above the elevation of the top of pipe to be laid before excavation commences. Compact fill to 95% of the maximum density as determined by ASTM D1557 70 or AASHTO T 180, Method D (Modified Proctor). The bottom of the trench shall be compacted to 95% of maximum density prior to installation of the pipe bedding.

3. Bedding

- a. The pipe shall be bedded on 6 inches of AASHTO No. 8 or AASHTO No. 57 stone, the full width of the trench, and shall be covered with AASHTO No. 8 or AASHTO No. 57 stone to a height of 12 inches over the top of the pipe.
- b. The bedding shall be thoroughly compacted to 90% Standard Proctor, AASHTO T-99. The bedding shall provide uniform and continuous bearing and support for the pipe at every point between the bells.
- c. Unstable Subgrade
 - (1) Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable, or other organic material, or large pieces or fragments of inorganic material, which, in the opinion of the City, should be removed, the Applicant shall excavate and remove such unsuitable material to the width and depth recommended by the City. Before pipe is laid, the subgrade shall be formed by backfilling with AASHTO No. 8 stone in 3-inch (uncompacted thickness) layers thoroughly compacted to 95% of maximum density and the bedding prepared as hereinbefore specified.
 - (2) Flowable Backfill meeting the requirements of MDSHA *Standard Specifications for Construction and Materials Section 314 – Flowable Backfill for Utility Cuts* may be used as an alternative to backfilling with stone. Material consists of a mixture of cement and water which shall have a 28-day unconfined minimum compressive strength of 100 psi based on the manufacturer's certification, and shall be placed in accordance with the manufacturer's recommendations.
- d. If potentially corrosive materials are encountered, polyethylene encasement shall be installed to protect ductile iron pipe in accordance with ANSI/AWWA C105/A21.5.
- e. Special Foundations

Where the bottom of the trench at the subgrade is found to consist of material which is unstable to such a degree that, in the opinion of the City, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, a suitable foundation for the pipe shall be designed and submitted to the City for approval.

- f. Concrete Encasement

Pipes to be encased in concrete shall have a minimum of 6 inches of concrete above and below the pipe and the concrete shall extend for the full width of the natural trench. No formwork to limit the concrete width shall be used. Flexible pipe joints shall be provided in the pipe at a distance of three times the pipe diameter from the ends of the concrete encasement, to provide pipe articulation. Pipes shall be protected against flotation during placement of concrete encasement. This may require two stage concrete placement combined with anchor straps.

4. Pipeline Installation

- a. General

This Section covers the installation of the water mains, complete with all fittings, valves, reaction backings and/or harnessing, connections and appurtenances. Installation shall be performed as specified in AWWA Standard for Installation of Ductile Iron Water Mains, C600, except where otherwise specified herein.

b. Responsibility for Material

(1) The City shall not be responsible for materials, and materials found defective in manufacture or damaged in handling, as determined by the City, and shall be replaced at no cost to the City. Any materials found defective shall be promptly removed from the site. Defective pipe shall be classified as follows:

- (a) Damage to interior or exterior paint seal coats.
- (b) Damage to interior cement-mortar lining.
- (c) Insufficient cement-mortar lining thickness.
- (d) Poor quality interior paint seal coat causing a partial obstruction in the pipe round.
- (e) Pipe out of round.
- (f) Damaged pipe barrel area causing a reduction in effective pipe thickness.
- (g) Any material that is dropped during handling, regardless of its apparent condition.

c. Handling of Material

Pipe shall be so handled that the coating and lining is not damaged. If any part of the coating or lining is damaged, the repair shall be made to the satisfaction of the City. Valves and hydrants shall be stored and kept dry before installation. Any material that is dropped during handling is subject to rejection regardless of its apparent condition.

d. Alignment and Grade

- (1) Where the proposed pipeline route is on a curve, the pipe may be deflected at the joints to published manufacturer's tolerances. Where underground conditions require a change of alignment or grade, such change shall be made only with the written consent of the City. When a change in grade is indicated which will result in the pipe having more cover than originally anticipated, the class of pipe installed at the location shall withstand the new loadings.
- (2) Except at predesignated points, no high points shall be established where air can accumulate. If field conditions necessitate a change in the pipe profile and, in the opinion of the City, the change requires the installation of an air release valve and manhole, installation of the same shall be ordered at no expense to the City.

e. Lowering Water Main Material into Trench

AWWA Specification C600, Section 3.3 shall apply.

f. Cleaning Pipe and Fittings

All lumps, blisters, and excess coating shall be removed from the end of each piece of pipe and fitting. The outside of the spigot, the inside of the bell, and the gasket shall be thoroughly wiped clean and dry before the pipe is installed.

g. Laying Pipe

(1) No pipe shall be laid when, in the opinion of the City, trench or weather conditions are unsuitable. No wedging or blocking will be permitted unless permission is obtained from the City. When pipelaying is not in progress, the open ends of installed pipe shall be closed by approved means to prevent entrance of trench water and foreign material into the line. Enough backfill shall be placed in the center sections of the pipe to prevent floating. Any pipe that has floated shall be removed from the trench and relaid.

(2) Pipe Clearance in Rock

(a) Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe and fittings for pipes 24 inches in diameter or smaller, and 9 inches for pipes larger than 24 inches in diameter.

(b) The specified minimum clearances are the minimum clear distances which will be permitted between any part of the pipe and/or fitting being laid and any part, projection or point of rock, boulder or stone.

(3) Joints

All joints shall be made in accordance with the pipe supplier's specifications and in accordance with the following instructions:

(a) Push-on Type Joints

Cleaning and assembly of push-on joints shall conform to AWWA C600, Section 3.4.1.

(b) Mechanical Joints

The cleaning, assembly, and bolting of the mechanical joint shall conform to AWWA C600, Section 3.4.2.

(c) Flanged Joints

- (1) Flanged joints shall not be used for buried service except at a tapping sleeve/valve joint.
- (2) Flanges shall be wiped clean with a solvent-soaked rag prior to installation. The gasket shall also be wiped clean.
- (3) The pipe, fittings and valves shall be properly supported during installation.
- (4) All flanges shall be properly aligned and checked with a spirit level, both horizontally along the pipe and vertically across the flange faces.
- (5) With flanges secured in position, half the bolts shall be inserted at the bottom of the flange, the gasket inserted between the flanges, and the remaining bolts inserted.
- (6) The threads of the bolts shall be given a light coating of thread lubricant, and the nuts shall be installed on the bolts and turned up by hand. The nuts shall be tightened with a wrench by the crossover method to load the bolts evenly until the joints are tight.

h. Setting Valves and Valve Boxes

All valves shall be set vertical and shall be provided with a valve box. If the valve is furnished with a bypass, a valve box shall also be furnished for the bypass valve. The tops of boxes shall be set 1/4" below finished grade, unless directed otherwise by the City. Valve and fitting installation shall be in accordance with Section 3.6 of AWWA C600.

i. Setting of Hydrants

Fire hydrants shall be installed as specified in AWWA C600, Section 3.7 at a minimum burial depth of 3.5 feet, and placement shall comply with the International Fire Code. Where there is curbing, the hydrant shall be a minimum of 2 feet from the edge of curb. Where there is no sidewalk or curb, the hydrant shall be not less than 6 feet from the edge of paved road surface. In no case will hydrants be located closer than 25 feet to a building except where building walls are blank fire walls. Hydrants shall not be located closer than 3 feet to any obstruction, or in front of entrance ways. All hydrants shall stand plumb, with the pumper nozzle facing the curb, and the hose nozzles parallel to the curb as shown on the detail drawings. The vertical variance between the manufacturer's recommended bury grade line and finish grade shall not exceed 4 inches.

j. Anchorage

- (1) All plugs, caps, tees, and bends (both horizontal and vertical) shall be provided with concrete reaction backings, or approved restrained joint system. Where the water mains must be tested before connections to existing mains can be installed, temporary reaction backings or restrained type plugs shall be installed.

- (2) The City's approval shall be obtained for the anchorage of the pipe and fittings at each connection, or at any other locations designated by the City. The City reserves the right to require mechanical joint retainer glands in addition to concrete reaction backings.
- (3) Hydrant bases shall be braced against undisturbed earth with reaction backings, or shall be restrained with restrained joints, in a manner approved by the City. Tie rods or clamps are also acceptable. The approved hydrant installation is shown on the detail drawings.

5. Backfilling

- a. The trench may be filled with excavated material above the AASHTO No. 8 or AASHTO No. 57 stone as specified above except that stones larger than 8 inches may not be placed in the trench and the fill shall not contain more than 20% stone in total volume.
- b. Where a new water main is to be installed in an existing roadway, that portion of the trench shall be backfilled with compacted CR-6 stone. Native fill may not be placed back in the trench due to potential for settlement.
- c. The trench shall be properly tamped in lifts not to exceed the maximum thickness for the type of tamping equipment being used. The first lift above the bedding material shall be two feet with subsequent lifts not to exceed one foot. All bedding and backfilling shall be compacted to 95% of maximum density as determined by ASTM D1557 70 or AASHTO T 180, Method D (Modified Proctor). Backfilling shall not be done with frozen material. No backfilling shall be done if the material already in the trench is frozen.
- d. Install detectable warning tape directly above pipeline, a minimum of 18 inches below finished grade but no less than 24 inches above the crown of the pipe.
- e. Utility excavations in areas of streets, access drives, parking areas and loading areas shall be backfilled and compacted in accordance with all applicable City/County regulations.
- f. In state highways, all backfill and compaction shall be in accordance with the requirements of MDSHA.
- g. Compacted clay dikes shall be installed along the water main alignment at an interval not to exceed 300 feet, at the downstream side of stream crossings and at the upstream and downstream limits of wetlands crossings. Dikes shall extend the full width of the trench and shall be a minimum length of 5 feet. Dikes shall extend vertically from undisturbed ground at the bottom of the trench to a distance of 2 feet below final grade. Clay shall contain no more than 15% stone by volume.

6. Surface Restoration

- a. In state highways surface restoration shall be in accordance with MDSHA requirements, or as specified in the MDSHA permit issued for the subject project.

- b. In county roads, paved areas or other traffic areas surface restoration shall be in accordance with county requirements.

7. Bored Crossings

- a. Tolerances for installation of the casing pipes shall be as follows:
 - (1) Elevation: to grade or a maximum of 9 inches below grade.
 - (2) Plan Location: plus or minus 1 foot.
- b. The carrier pipes shall be supported within the casing pipes so that the pipe bells do not rest directly on the casing. The load of the carrier pipes shall be distributed along the casing by the method of support shown on the detail drawings.
- c. All work shall be performed in conformance with the requirements of MDSHA or other regulatory agencies involved.

E. TESTING AND INSPECTION

1. General

This Section covers the testing and disinfection of the water mains. A schedule and procedure for the testing and disinfection of the different parts of the work shall be prepared and submitted to the City for approval two weeks before beginning the testing and disinfection. Testing and disinfection shall be performed promptly and efficiently without interference to the system operation. A minimum 24 hours notice shall be given before testing any main.

Testing and disinfection of the various sections of water mains shall begin promptly upon the completion of a section of work, unless the City approves otherwise. City inspection shall be done prior to backfilling the work. The City reserves the right to limit the amount of water main to be tested.

2. Notification

It is incumbent upon the Applicant to notify the City a minimum of 48 hours in advance of construction work.

3. Pressure Test

a. General

- (1) After the pipe has been laid and backfilled as specified, all newly laid pipe shall be subjected to a hydrostatic pressure of 150 pounds per square inch, or 150% of the normal working pressure, whichever is greater in accordance with AWWA C600.
- (2) Where any section of a water main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least five days have

elapsed after the concrete reaction backing was installed. If high early strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least two days have elapsed.

(3) Air release valves shall be installed but isolated during testing of the pipeline.

b. Duration of Pressure Tests

The duration of each pressure test shall be 2 hours.

c. Procedure

(1) Each section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the City. The pump, pipe connections, and all necessary apparatus, including gauges, shall be furnished by the Applicant and are subject to approval by the City. The Applicant will make all taps into the pipe, and furnish all necessary assistance for conducting the tests.

(2) Expelling Air Before Test

Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Applicant shall make the necessary taps at such points before the test is made. After the test has been completed, the Applicant shall remove and plug the taps or leave them in place at the direction of the City.

(3) Examination Under Pressure

Any cracks or defective pipes, fittings, or valves discovered in consequence of this pressure test, shall be removed and replaced by the Applicant, and the test shall be repeated.

(4) Testing Allowance

Testing allowance shall be defined as the quantity of makeup water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the testing pressure. The maximum volume of makeup water shall be calculated by the following formula:

$$L = \frac{SD\sqrt{P}}{133,200}$$

Where:

L = volume of allowable makeup water [gph]

S = length of pipe tested [ft]

D = nominal diameter of the pipe [in]

P = test pressure [psig]

During the 2-hour test period, the test shall be deemed successful if the required volume of makeup water does not exceed the allowable volume as calculated above.

4. Disinfection

a. General

Before being placed in service, all pipe installed shall be disinfected in accordance with AWWA C651.

b. Form of Chlorine for Disinfection

Either liquid chlorine, sodium hypochlorite solution or calcium hypochlorite granules or tablets shall be used for disinfection in accordance with AWWA C651, Section 2.

c. Application of Chlorine

One of the three methods of chlorination (continuous-feed method, tablet method and slug method) specified in AWWA C651 Section 5 shall be used for disinfection. The method most suitable for the given situation shall be used and shall be reviewed with the City's representative before application. The continuous-feed method is suitable for general application. The tablet method is suitable for use in pipes smaller than 24 inches in diameter and only if the pipe is kept clean and dry. The slug method is suitable for use in large diameter pipes where the volume of water involved makes the continuous-feed method impractical.

d. Point of Application

The chlorine solution shall be applied at the high end of the pipeline section through a corporation stop inserted in the top of the new pipe. If the water for the chlorine solution is supplied from the existing pipeline, there shall be a physical break between the injector supply and the injector or pump.

e. Rate of Application

The chlorine solution shall be pumped slowly into the new pipeline until the entire main is filled with the chlorine solution. If required by the City, the chlorine residual shall be measured at several points along the main.

f. Point of Discharge

(1) The sterilizing solution shall be dechlorinated prior to discharge through available outlets, or through taps in the main. Chlorinated water is extremely toxic, and the property and fish life shall be protected from any damage that would result from contact with the discharge. Where necessary, federal, state and local regulatory agencies shall be contacted to determine special provisions for the disposal of the water.

- (2) One available option is to discharge the dechlorinated water to the sanitary sewer, subject to City approval. Prior to discharge, check the downstream chlorine residual to determine if there is any chlorine present using a pocket colorimeter.

g. Flushing Water

The City will provide flushing water. Water used for flushing must either be metered or the usage must be calculated and reported to the City. No existing water system valves shall be operated without the presence of the City's representative.

h. Water for Testing

The City will furnish water for one hydrostatic test and disinfection procedures per line installed. If pipelines must be retested and disinfected, additional water will be provided at current City rates.

i. Disinfection of Water Main Connections

If it is not possible to disinfect the pipe, valves, and fittings in the manner specified above, with the City's approval, the following procedure will be used:

The interior of all pipe, fittings, and valves shall be swabbed with a 5% hypochlorite solution which can be obtained by mixing 3 pounds of granulated calcium hypochlorite with 5 gallons of water. After the pipe, fittings, and valves have been swabbed, they shall be thoroughly flushed with water.

j. Bacteriological Tests

After final flushing is completed and before the water main is put into service the Applicant shall have the replacement water tested for bacteriological quality.

Bacteriological sampling and analysis shall be performed in accordance with AWWA C651 by a MDE certified laboratory.

F. DETAIL DRAWINGS

Relevant Detail Drawings are:

- 1 Right-of-way Restoration
- 2 Concrete Encasement
- 3 Pavement Restoration
- 8 Typical Fire Hydrant Setting
- 9 Air Release Valve Manhole

10 Thrust Blocks for Horizontal Bends and Lower Vertical Bends

11 Restrained DI Pipe Length

12 Pipe Cradle in Casings

13 Clay Dike

14 Blowoff

END OF SECTION

SECTION 4 – WELL HOUSES

A. GENERAL

1. The information contained in this section is meant to serve as a general guide for well house design. All well house designs must be submitted to the City for review and approval prior to construction.

2. State Requirements

Well houses for drinking water shall be properly designed to conform to all applicable regulations of the Maryland Department of the Environment (MDE), Ten State Standards, National Fire Protection Association (NFPA), Occupational Safety and Health Administration (OSHA), and the Maryland Department of Labor, Licensing, & Regulation.

3. Permits

The Applicant shall secure, in the name of the City, all permits that are required in the name of the City such as those from MDE, Maryland Midland Railroad, and the Maryland State Highway Administration (MDSHA). The Applicant shall secure, in their own name, all required construction permits such as Grading Permits and Building Permits. Costs of all permits, including any and all bonds required, shall be the sole expense of the Applicant. Any existing street, highway, or other improvements disturbed during construction shall be restored to the satisfaction of the appropriate municipality or Owner before the facilities will be approved for final acceptance by the City.

4. Safety Requirements

All gears, chains, couplings, projecting set screws, keys, and similar rotating or reciprocating parts shall be protected in accordance with the American National Standards Institute (ANSI).

5. Drawings and Details

Prior to approval by the City, detailed construction drawings, specifications, design calculations, and pump curves must be submitted for review by the Engineer. The drawings will be reviewed for general design, general dimensions, and apparent suitability and will be approved or returned for revisions. Such approval will not relieve the Applicant of the responsibility for furnishing equipment which will satisfactorily perform under the conditions specified.

B. SITE DESIGN CRITERIA

1. Municipal Requirements

All aspects of the site design shall be in accordance with county and local municipal zoning and land development requirements.

2. Site

- a. The well house site shall be properly graded to eliminate any storm water problems and/or ponding conditions. After grading, the site shall be seeded and landscaped. Provisions shall be made to include shrubbery or trees in the landscaping to enhance the appearance of the station. The Applicant is responsible for obtaining a good stand of grass until the time of first cutting.
- b. The site shall be of sufficient size to accommodate the well head and building and to permit the turn-around of service vehicles.

3. Access Road and Turn-Around

- a. The access road and turn-around at the well house shall have a paved surface. The minimum width of the paved surface of the access road shall be 12 feet and the access road and turn-around shall be constructed to the following minimum requirements:

Formed, shaped and compacted subgrade

DGSA base course - 6" thick

Bituminous concrete binder course - 3" thick

Bituminous concrete wearing course - 1 1/2 " thick

- b. The paved area within the fenced area must be large enough and be designed so as to allow the turn-around of a single unit utility vehicle with a wheelbase of 20' and width of 8'-6".
- c. Provisions shall be made within the site to allow for access by a crane.

4. Fencing and Lighting

- a. The site shall be fenced with vinyl-coated chain link fence 6'-0" high with sliding/rolling link fence gate and personnel gate. The personnel gate must be separate from the sliding/rolling gate. Locking devices must be provided on both gates.
- b. Barbed wire, conforming to ASTM A121, shall consist of two 12 ½-gauge twisted line wires with 14-gauge round aluminum wire barbs, having 4 points and spaced 5 inches on center. Line wire shall have a vinyl coating to match the fence chain link. Barbed wire support arms shall be single arm, for 3 strands of barbed wire and be at an angle of 45 degrees, with the top strand of barbed wire being 12 inches above and 12 inches out from the fence line.

- c. The building shall be provided with exterior lighting above each entrance into the building.

5. Sewer Service

4" floor drains shall be provided inside the well house building. The floor drains shall be connected to public sanitary sewer.

6. Water Service

Furnish and install two 1" brass hose bibbs on the potable water line within the building.

A 1" brass hose bibb shall also be installed on the raw water line for water quality sampling.

7. Power Supply

The power supply for each new well house shall be a three-phase service from the electrical utility company. Services shall be 208/120 Volts or 480/277 Volts, wye-grounded. Delta-type services including open-delta are prohibited unless required by the electric utility and reviewed/approved by the Engineer on a case-by-case basis.

Additionally, all new pump motors shall operate on three-phase power. Phase converters shall not be allowed. Any exceptions to this requirement must be reviewed and approved by the Engineer on a case-by-case basis.

C. MATERIALS AND EQUIPMENT

1. Description of Equipment

The Applicant shall furnish a complete description of all equipment to be supplied including manufacturer's information and relevant pump characteristic curves based on laboratory tests of existing similar pumps. The curves shall show the capacity, head, bowl efficiency, and brake horsepower throughout the head and capacity range.

2. Well Construction

The well shall be constructed with a pitless adapter that will extend the casing pipe 24 inches above finished grade. The well shall have a weatherproof cap with screened air vent. The submersible pump shall be set at a depth to be determined by a licensed hydrogeologist. A check valve shall be installed in the discharge pipe within the well casing approximately 21 feet above the pump discharge. In addition, an air tube shall be installed for manual measurement of the water level. A transducer shall be installed in the well casing to shut the pump down should the water level drop too low.

3. Submersible Turbine Pump, Motor and Settings

- a. The pump, motor, and controls shall be designed and built for 24-hour continuous service at all points within the required range of operation without overheating, cavitation, or excessive vibration.
- b. The pump shall be furnished with a stainless steel nameplate with the manufacturer's name and model number, serial number, rated flow capacity, head, speed and any other pertinent data. The motor shall also be furnished with a nameplate with the manufacturer's name and model number, serial number, horsepower, speed, input voltage, amps, number of cycles, and power and service factors.
- c. The materials of construction for the turbine pump shall conform to AWWA E101.
- d. A minimum of four radially spaced guide vanes shall be welded onto the discharge column pipe immediately above the pump bowl assembly to assure that the submersible pump and motor assembly is properly centered within the well casing.
- e. The pump motor shall be designed to operate on either 208 Volt or 460 Volt, 3 Phase, 60 Hz power supply. The nameplate rating for the motor horsepower shall not be exceeded at any point on the pump performance curve without considering the service factor. The motor shall have a 1.15 service factor when operated on sinusoidal power and 1.0 when operated on a variable-frequency source.

4. Chlorination System

- a. A gas chlorination system shall be provided for disinfection. The system shall include a dual 150-pound cylinder scale for weighing the gas cylinders, two gas chlorinators, automatic switchover valve, gas flow controller, and ejector. In addition, a booster pump for supply of water to the ejector shall be provided. Design shall be subject to the approval of the City.
- b. The gas chlorinators shall be sized to supply a maximum dosage rate of 10 mg/L at the design flow rate for the well pump.
- c. The gas cylinders, chlorinators, scale, automatic switchover valve, flow controller, and ejector shall be housed in a separate sealed chlorine room. The room shall be provided with a shatter-resistant interior observation window to inspect the chlorine room. The room shall be provided with a ventilation system capable of 1 air exchange per minute. A suction vent shall be provided with the intake 6 inches above the floor and a fresh air inlet at the opposite end of the room. Separate switches for the ventilation system and room lighting shall be provided at the entrance of the room and at the observation window with a fan-on indicating light. A chlorine gas detector shall also be provided that will sound an alarm in the event of a gas leak.

5. Flow Meter

- a. A turbine flow meter of the magnetic drive type shall be provided for measurement of flow. No gears shall extend into the flow stream. The meter shall have an accuracy of +/- 1.5% over the entire range and shall be the OMNI T² by Sensus or approved equal.
- b. Provisions shall be made to connect the flow meter to the City's telemetry system.

6. Pipes and Fittings

- a. Discharge piping within the well casing shall be Schedule 40 galvanized steel pipe. The pipe shall be threaded and pipe lengths shall not exceed 21 feet in length.
- b. Yard piping and piping within the well house shall be Class 52 (min) cement-lined ductile iron: ANSI A21.50 and ANSI A21.51. Fittings shall be gray iron or ductile iron: ANSI A21.10, up to 12" inclusive, 250 psi rated. Flanged joints shall be used inside structures. Mechanical joints shall be used for buried pipe. All indoor piping shall have direction of flow arrows painted on them.

7. Valves

All valves of the same type shall be provided by the same manufacturer.

a. Gate Valves

- (1) Valves shall open to the left (counter-clockwise). Operating nuts or wheels shall have an arrow and the word "OPEN" indicating the direction of opening cast on the valve body.

- (2) Acceptable manufacturers: American Flow Control or equal.

b. Check Valves

- (1) Check valves for metallic lines of 2-in to 24-in diameter shall be swing type and shall meet the requirements of AWWA C508. The valves shall be iron body, bronze mounted, single disc, 150 psi working water pressure, non-shock, and hydrostatically tested at 300 psi.
- (2) Check valves 2-in and smaller for installation in copper and steel pipes shall be bronze, swing type, 125 lb with solder or screwed ends.
- (3) Wafer style check valves shall be of the dual disc type with bodies constructed of cast iron, ASTM A126, Class B. Disc shall be fabricated of ductile iron, ASTM A536 and shall be electroless nickel-plated. Body seat material shall be Buna-N. Spring material shall be Type 316 stainless steel. The ends shall be plain. The valve shall be by APCO; Val-Matic; GA; Keystone or equal.

- (4) All check valves 3-in and smaller shall be Class 125 by Nibco or equal. Check valves 4-in and larger shall be flanged and similar to Hammond 1R-1124.

c. Rate of Flow Control/Check Valves

- (1) The rate of flow control valve shall limit flow to a preset maximum rate regardless of changing line pressure. Flow ranges shall meet the criteria as approved by the City. Rate of flow control/check valves shall be factory tested.
- (2) All rate of flow control/check valves shall have flanged connections on each side of the valve.
- (3) The valve shall be hydraulically operated, single diaphragm-actuated, glove pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed, and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.
- (4) The pilot control system shall be a direct acting diaphragm valve designed to close when the controlling differential exceeds the adjustable spring setting. The pilot control is normally held open by the force of compression on the spring above the diaphragm and it closes when the pressure acting in the underside of the diaphragm exceeds the spring setting. The pilot control system shall contain a fixed orifice. No variable orifices shall be permitted. A full range of spring settings shall be available in ranges of 0-450 psi.
- (5) The valve shall be a Cla-Val Co. Model 40-01 rate of flow control valve as manufactured by Cla-Val Co. Newport Beach, CA.

d. Air Release Valves

- (1) Air release valves shall be installed to release any small accumulations of air which may collect while pipe is in operation and under pressure.
- (2) The small orifice assembly air release valve shall automatically release air accumulations from the pipe while under positive pressure. When the valve body fills with air, the float ball shall fall to open the small orifice and exhaust the air to atmosphere. When the air has been exhausted, the float ball shall be buoyed up and shall tightly close the small orifice.
- (3) The small orifice assembly shall be furnished with cast iron body and cover (ASTM A126 Class B). The float ball shall be constructed of stainless steel and

shall be attached to a stainless steel lever mechanism. A resilient, Buna-N seat shall be attached to the lever mechanism for drop-tight closure.

- (4) Separate air release valves shall be manufactured by APCO; Val-Matic; GA; Crispin or equal of the special type for use with clean water.

8. Well House Building

All electrical controls and chlorination equipment shall be mounted permanently inside the well house building. The building shall also house the pump control panel and the backflow preventer, meter, and hose bibbs. The building shall be a masonry type building with split face brick exterior, blending aesthetically with the surrounding environment. Interior walls shall be of block construction; dry wall material shall not be allowed. Construction details of the building shall be subject to approval by the City. Neither temporary structures nor fiberglass housings will be accepted.

D. STATION CONSTRUCTION

1. General

The station shall be designed and constructed in accordance with the requirements of MDE, NFPA, OSHA, and the Maryland Department of Labor, Licensing & Regulation.

2. Mechanical Ventilation

Mechanical ventilation shall be provided for the chlorination room. The equipment must be capable of providing the number of air changes per hour as dictated by the requirements of MDE and OSHA.

3. Wiring

The control panel shall be completely wired at the factory, except for the power feed lines, and shall be in accordance with NFPA 70 (National Electric Code [NEC]). All wiring in the well house shall be color-coded as indicated on the wiring diagram. All wiring outside the pump control panel shall be in rigid conduit, 3/4" minimum, except for 115 volt accessory items which are provided with a connecting insulated service cord by the manufacturer. Accessory items shall be plugged into polarized, grounded convenience outlets, located close to their installed position so that such items can be readily removed and serviced if necessary.

Conduit shall be rigid galvanized steel only in indoor dry (non-process) areas and PVC where buried (Schedule 40 if concrete encased, Schedule 80 if direct buried). Conduit in other areas including conduit outside and in process areas shall be PVC-coated rigid galvanized steel, except in the Chlorine Room (where all conduit must be PVC Schedule 80).

Outlets in wet, damp, process, or outdoor areas shall be weather-protected and GFCI-type. Daisy-chaining GFCI outlets is prohibited.

4. Heater

Electric unit heaters shall be installed in the building and sized to maintain a minimum ambient temperature of 60° F. The heaters shall be thermostatically controlled. Heaters shall not be placed within two (2) feet of control panel and electrical equipment.

5. Painting

a. Metal Surfaces: All exposed structural and miscellaneous steel, steel doors and frames, steel louver frames, tanks, mechanical and electrical equipment, pipe, fittings and valves shall be properly primed and painted with two coats of rust inhibitor paint in strict accordance with the manufacturer's recommendations.

b. Plastic Surfaces: One coat of epoxy primer followed by one coat of acrylic urethane.

All paint, painting procedures and application methods shall be as recommended by a reputable paint manufacturer and approved by the City.

E. CONTROL/ALARM SYSTEM

1. The well pump shall be controlled by means of a radio system that will activate and deactivate the well pump based on the water level in the City water storage tank. In addition, provisions shall be made to allow the pump to be controlled remotely by City personnel through the City's telemetry system. Activation of the well pump shall also activate the booster pump, which will start the flow of chlorine. A transducer shall be provided in the well so that the pump may be shut down before it can run dry.

a. The wellhouse control system shall be equipped with a RAD-900-IFS Radio by Phoenix Contact. This radio shall be configured to communicate with the City's main controller located at Well 8. This controller shall start and stop the well pump via radio communication.

b. Local controls at the wellhouse shall consist of a Hand-Off-Auto switch. Automatic controls shall run the pump based on the signal from the City's main controller. In both Hand and Auto conditions, the well pump shall shut down when the transducer indicates a low level in the well. A low level shall trigger an alarm.

c. The Applicant is responsible for furnishing and installing all necessary equipment and contracting with the City's system integrator for connection to the City's existing telemetry system.

2. Provide a chlorine gas detector inside the well house building.

3. Alarms shall be communicated via the RAD-900-IFS Radio to the City's main controller. Alarm conditions should prevent the system from operating until the alarm condition returns to normal.

F. TESTS

Field tests shall be carried out at the expense of the Applicant to ensure that turbine well pump and all other equipment meet the design criteria. The City's personnel will witness the field tests.

G. EMERGENCY POWER

1. The Applicant shall install a diesel emergency generator set and automatic transfer switch to run the pump and all equipment within the station upon loss of normal power.
2. The system components shall be new equipment of current design, not one-of-a-kind, and consist of a state-approved engine-driven, electric generator with mounted start-stop controls, an automatic load transfer control, fuel, oil and antifreeze, and necessary accessories. All components shall be completely built, tested and shipped by a manufacturer who has been regularly engaged in the production of such equipment for the past ten years and who has a local parts and service facility. The generator shall be as manufactured by Kohler, Caterpillar, Cummins, or approved equal.
3. The generator shall be provided with a weatherproof, NEMA 3R outdoor housing and shall be mounted on a welded steel skid base, which in turn shall mount on 6" high I-beams securely mounted to the frame and a concrete pad. The pad shall be sloped to prevent standing water from accumulating under the generator set. The starting batteries shall be placed on a cast iron rack inside the housing.
4. All required anchor bolts shall be furnished and installed.
5. The muffler shall be a hospital-grade silencer attached to the exhaust line by 125-lb. standard pipe flanges. The exhaust line shall contain a condensate trap with drain cock at the first point of rise in the line from the engine. Only long radius elbows shall be used in the exhaust line. A stainless steel flexible pipe shall connect the engine to the exhaust system.
6. Provide thermostatically controlled heaters for both engine jacket water and lubricating oil systems set to maintain 90 degree F temperature in both systems with an ambient temperature of zero degrees. In addition, a battery heater shall also be provided to maintain the battery temperature at a minimum of 50 degrees F and to automatically shut off at 90 degrees F. Provide manual switches to disconnect the heaters when not required.
7. Provide a circuit breaker with the generator. Breaker shall be rated to handle the generated fault currents and shall be one of those listed by the transfer switch

manufacturer. Breaker shall have the required number of poles and current rating capable of handling required load. Breaker shall be mounted within the generator enclosure.

8. Provide generator control panel with the following: voltmeter, ammeter, selector switch, start controls, voltage level adjustment rheostat or digital control, oil pressure gauge, fault indicators for safety shutdown, "Auto/Manual" switch, water temperature gauge, running time meter, panel face illumination from the battery, generator failure output contacts.
9. Provide base-mounted, double-walled diesel fuel tank of sufficient capacity to sustain a minimum of 24 hours running at full load, fuel gauge, fuel lines, threaded vent opening and a full tank of diesel fuel.
10. A current-limiting battery charger shall be furnished to automatically recharge the starting batteries. Charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, and fused AC input. AC input voltages shall be 120 Volts. Amperage output shall be no less than 5 amperes. Charger shall be LaMarche Manufacturing Company, Magnevolt, or Approved Equal.

H. TRANSFER SWITCH

1. The automatic transfer switch shall be fully rated to protect all types of loads, inductive and resistive, from loss of continuity of power. The switch shall afford complete protection. The switch shall be rated as suitable for all classes of loads without de-rating, either open or enclosed.
2. The transfer switch shall automatically transfer its load circuit to the generator after failure of its normal supply. Upon restoration of the normal supply, the transfer switch shall automatically retransfer its load circuits to the normal supply.
3. All pilot devices/relays shall be of the industrial type rated 10 amperes with self-cleaning contacts.
4. Components of the operating mechanism shall be insulated or electrically dead.
5. All electrical equipment or apparatus of any one system must be the product of one manufacturer, or equivalent products of a number of manufacturers which are suitable for use in a unified system. No circuit breaker types are acceptable, nor parts thereof.
6. For complete protection, voltage sensing relays shall be provided to monitor each phase of the normal supply. A drop in voltage in any phase below the predetermined dropout value of the relay shall initiate load transfer. The relay shall initiate retransfer of the load to normal supply as soon as the voltage is restored in all phases beyond the predetermined pickup value of the relay.

7. The transfer switch shall obtain its operating current from the sources to which the load is being transferred.
8. The automatic transfer switch shall also be furnished with the following options:
adjustable 2 to 120 second time delay on normal to emergency; adjustable 0 to 15 second time delay on engine starting; adjustable 12 second to 30 minute time delay on emergency to normal; adjustable 0 to 30 minutes, set at 5 minute time delay for engine cooloff; frequency/voltage relay for emergency source; test switch in cover of switch; normal supply pilot lights, emergency supply pilot light; engine start-stop contacts; relay auxiliary contacts on normal and emergency source, 1 N.O. and 1 N.C.; solid neutral bar assembly; plant exerciser for automatic test operation of plant with transfer of load for pre-selected intervals (adjustable 0-168 hours in multiples of 15 minutes) at least once a week.
9. All accessories and equipment shall be front accessible for ease of maintenance or removal.
10. Transfer switches and options shall be as manufactured by ASCO, Kohler, Cummins, or approved equal.

I. LIGHTING

1. The Applicant shall install lamps and accessories as required. Prior to acceptance of building by the City, all fixtures shall be cleaned, free of dust, insects and all foreign matter.
2. The light fixture schedule is as follows:
 - a. Industrial, ceiling mounted LED, 2-lamp, 4-foot linear fixtures. NEMA 4X rated, 120/277 Volts AC Input.
 - b. Outdoor wall-mounted LED, 120/277 Volts, with integral photocell control. 3000K color temperature max.

J. ELECTRICAL UNIT HEATERS

1. Horizontal forced air unit heaters shall be rated for the building size. Mounting brackets designed for either ceiling or wall swivel mounting shall be furnished for each heater. The cabinet shall be of 18 gauge die-formed furniture grade steel. Individual adjustable louvers shall be furnished to provide desired control of discharge air. All metal surfaces of the casing shall be phosphate coated to resist corrosion, with a baked enamel finish.
2. Automatic reset thermal over-heat protection shall be provided.
3. Motors shall be of the totally enclosed fan-cooled continuous duty (TEFC), sleeve bearing type, equipped with built-in thermal overload protection.

4. Fans shall be aluminum, directly connected to fan motor, dynamically balanced and designed specifically for unit heater application.
5. Heaters shall be equipped with built-in comfort control thermostats and necessary control transformers and contactors. Heaters shall be equipped with cord and twist lock plug for connection to receptacle and shall be Chromalox, Berko, or approved equal.

K. METAL LOUVERS AND DAMPERS

1. The Applicant shall furnish and install all metal louvers and dampers required for installation in the building. Separate louver and damper assemblies shall be supplied for each opening, with the louver assembly on the exterior side and the damper assembly on the interior side.
2. The metal louvers shall be of stationary, weatherproof design complete with screens, trim, and closure pieces for a complete installation. It shall be the responsibility of the Applicant to check all opening sizes and completely coordinate the installation.
3. The louver frame and blades shall be extruded aluminum section, 6063-T5 alloy. The heads, sills, and jambs shall be one-piece structural members with integral caulking strips and retaining beads. All fasteners shall be stainless steel or aluminum. All louvers shall be provided with a ½-inch mesh aluminum bird screen secured by an extruded aluminum frame.
4. Damper frames shall be 6063-T5 extruded aluminum wall thickness with mitered corners. Blades shall be formed aluminum with extruded vinyl edge seal or 6063-T5 extruded aluminum with extruded vinyl edge seals.
5. The operating blades for the motorized dampers shall be operated by an electrically-controlled motor operator that shall fail open. The motor shall be totally enclosed and suitable for operation on 120 Volt, 60 Hz, single-phase power. The unit shall be furnished with all controls and accessories for a complete working installation. The actuator motor shall be sized so that it can open the damper in sufficient time to prevent the formation of a vacuum within the generator room.
6. The motor-operated intake damper shall be wired for both manual and automatic operation. A selector switch shall be provided for manual open-close operation.
7. A thermostat shall also be provided to automatically open the intake damper on excessive heat build-up within the building. The thermostat shall have a control range of 70° to 140° F, and shall be by Honeywell, Chromalox or approved equal.
8. A limit switch shall be installed at the intake damper location, and shall be positioned so that the switch is operated by the opening of the damper blades. If the damper and switch do not open after a preset time, a relay shall signal a “damper failure” condition to

the alarm system. Limit switch shall be as manufactured by Square D or approved equal.

9. Both louver and damper assemblies shall be free of scratches and blemishes and provided in a baked enamel finish in a color to be selected by the City.
10. The louvers and dampers shall be manufactured by United Enertech, Ruskin, American Warming & Ventilating or approved equal.

L. ELECTRICAL CONSTRUCTION

1. The Applicant shall meet with the electric utility company to determine all requirements at the site for service and metering. Any excess charges by the utilities for furnishing the required service shall be the responsibility of the Applicant.
2. The Applicant shall furnish and install a service pole at each well house if the service is overhead. Service conductors and raceways shall be installed from the building underground to the service pole and up the pole terminating in an approved entrance fitting. The power company will furnish and install an overhead service drop to the pole and connect to service conductors. Poles shall be guyed if required to offset pull of power company's service drop.
3. If the service is underground, the Applicant shall furnish and install underground conduit, current transformer cabinet, and meter base. Current transformer cabinet or self-contained meter base, as necessary, shall be mounted on the building. The utility companies will furnish and install the service lateral.
4. A grounding grid shall be provided at the service location (service pole and/or building). Metal raceways, metal enclosures of electrical devices, transformer frames, neutral conductor, and other equipment shall be completely grounded in accordance with the NEC. All necessary conduit, conductors, clamps, connectors, etc. for the grounding system shall be furnished and installed by the Applicant.
5. Provide a main service-entrance approved disconnect switch with current limiting fuses as required. Heavy-duty type, NEMA 1 enclosure indoors, NEMA 4X enclosure outdoors with padlock attachment; Square D, Eaton, or approved equal.
6. Panelboards shall be rated for the voltage present, dead-front type, lockable with thermal-magnetic bolt-on circuit breakers, neutral and ground bus, typed circuit directory.
7. Surge protection shall be provided on the incoming feeders immediately on the load side of the main disconnect switch, and the grounding lead connected to the grounding system shall be as short as possible. SPDs shall be Square D, Eaton, or approved equal. Surge protection shall also be supplied for incoming telecom lines; Phoenix Contact, Rockwell, or approved equal.

8. Light switches to be 20 Amp, 120/277 Volt rated, Industrial type, Legrand Series 20AC or approved equal. if weatherproof use Legrand WP-1 lever handle weather-sealing cover with FS-type box.
9. Receptacles shall be 20 Amp rated, 120 Volt, two-pole, hard-use rated, grounding duplex, Legrand 5362 or approved equal; ground fault type to be Legrand, specification-grade; if weatherproof use FS box with wet location cover; power outlet receptacle rated as required, heavy-duty, Legrand or approved equal.
10. Underground ducts shall be encased in four inches of concrete. Where conduits pass under roadways, parking lots, or on filled ground, a mat shall be provided in concrete, consisting of two longitudinal #4 bars with #3 ties, 12" on center. Trenches shall be backfilled with clean dirt, thoroughly compacted.
11. PVC Schedule 40 conduit shall be UL listed and as manufactured by Carlon, Sedco or approved equal. All bends in duct lines of 40° and greater shall be manufactured steel elbows of the same size as the PVC ducts. Rigid galvanized conduit shall conform to Federal Specifications WW-C-581E and be UL listed and manufactured by National, Allied Tube & Conduit, or approved equal. PVC-coated conduit shall be UL listed, 40-mil min exterior PVC coating with 2-mil min interior urethane coating, by Robroy (Plastibond), ABB (Ocal), or approved equal.
12. No EMT or IMC shall be permitted.
13. Install sealing fittings, Crouse-Hinds type EYS or EZS, Appleton type EYS or ESU, or approved equal, wherever a conduit passes into a hazardous area or extends between areas having widely different temperatures.
14. Wires and cables minimum size shall be #12, medium hard drawn copper. Wire shall have Type THWN-2 or XHHW-2 insulation. Wire size of #12 or larger and shall be stranded (except #12 and #10 lighting and receptacle circuits, which shall be solid). All wiring shall be color coded in accordance with current NEC requirements.
15. For wire size #10 and smaller, a solderless type press connector similar to "Buchanan" shall be used with snap-on type nylon insulator; splices of larger sizes of wire shall be made using an indentor type coupling applied with a hydraulic pressure tool.
16. All materials and workmanship shall meet the minimum requirements of the following codes and standards where applicable:
 - a. National Fire Protection Association (NFPA) - National Electrical Code (NEC)
 - b. National Electrical Manufacturers Association (NEMA)
 - c. Institute of Electrical and Electronic Engineers (IEEE)

- d. The U.S.A. Standards Institute - Standards & Definitions of Electrical Terms (U.S.A.S.)
 - e. National Electrical Safety Code (NESC)
 - f. Underwriter's Laboratories Inc (UL)
 - g. OSHA Standards, where applicable, shall also be met, including those for temporary wiring on construction sites.
17. All necessary permits and fees for this work shall be secured and paid for by the Applicant. Inspection shall be by an approved inspection agency licensed by the State of Maryland and final certificate of approval shall be delivered to the City prior to acceptance.

M. START-UP

1. The Applicant shall provide the services of fully qualified manufacturer's representatives for services during installation, at start-up, and for instructing the City's personnel in the operation, routine maintenance, and trouble-shooting for all equipment, mechanical and electrical, furnished with the turbine well pump and the well house. Applicant shall full load test the generator for four (4) continuous hours using Applicant-furnished load bank. Notify Engineer 48 hours prior to the test. If testing stops for any reason, correct the problem and start a new four (4) hour test. Submit test results for Engineer review.
2. The Applicant shall provide five (5) bound copies of a manual fully explaining the operation, routine maintenance, and troubleshooting for equipment. The manuals shall include copies of all shop drawings with all required revisions. These manuals must be submitted to the City for approval prior to acceptance.
3. The manuals must include information relative to suppliers of spare and replacement parts.

N. DETAIL DRAWINGS

Relevant detail drawings are:

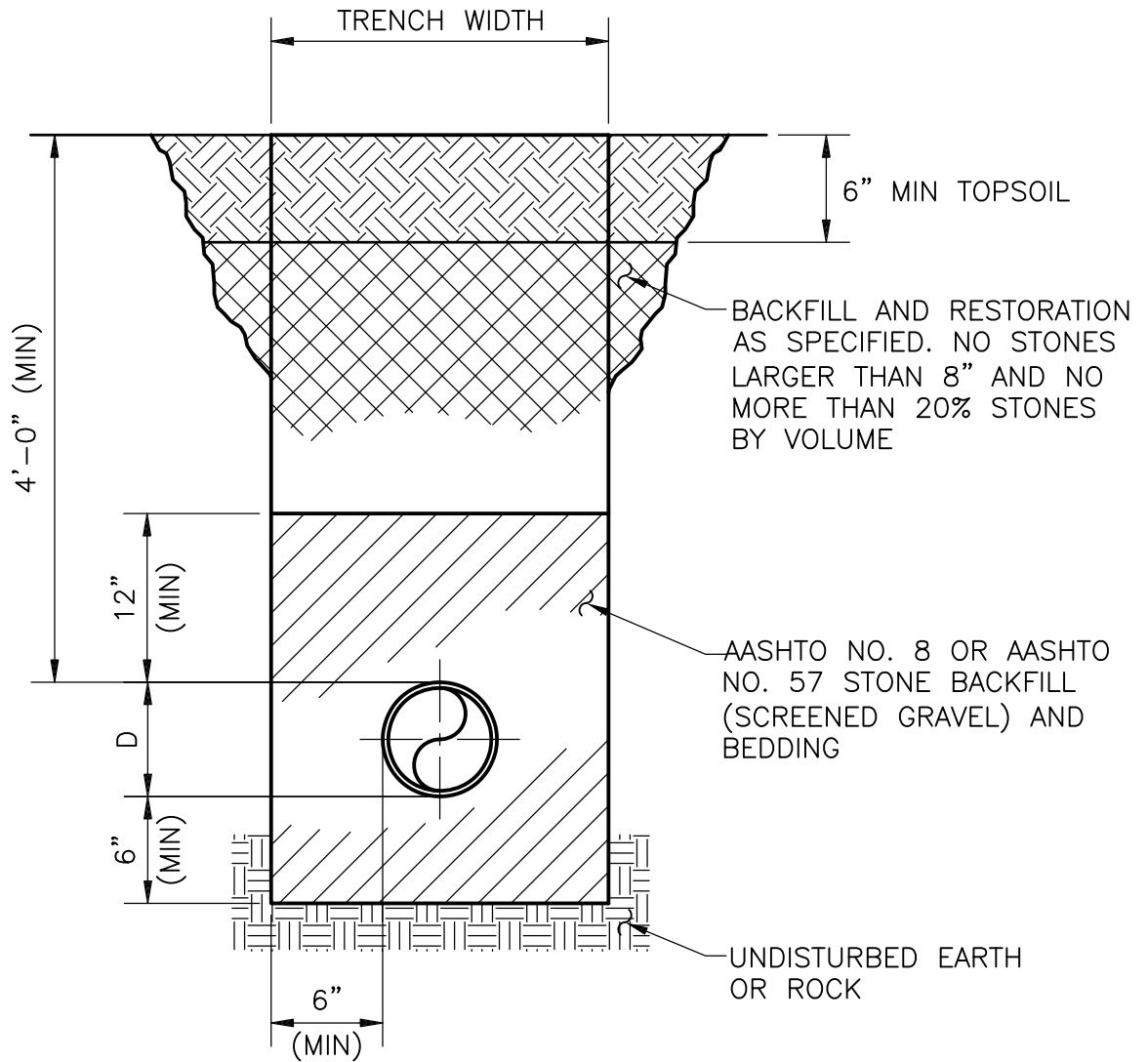
21 Typical Pumping Station Security Fence and Access Gate

END OF SECTION

APPENDIX A

DETAIL DRAWINGS INDEX

<u>No.</u>	<u>Description</u>
1	Right-of-Way Restoration
2	Concrete Encasement
3	Pavement Restoration
4	Typical Service (Up to 2") Using Corporation Stop and Meter Pit
4.a	Typical Service (Up to 2") Using Corporation Stop and Curb Stop
5	New Service Connection (Up to 2") Using Service Saddle
6	New Service Connection (Larger than 2") to a New Water Main
7	New Service Connection (Larger than 2") to an Existing Water Main
8	Typical Fire Hydrant Setting
9	Air Release Valve Manhole
10	Thrust Blocks for Horizontal Bends and Lower Vertical Bends
11	Restrained DI Pipe Length
12	Pipe Cradle in Casings
13	Clay Dike
14	Blowoff

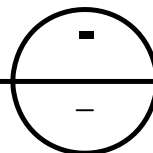


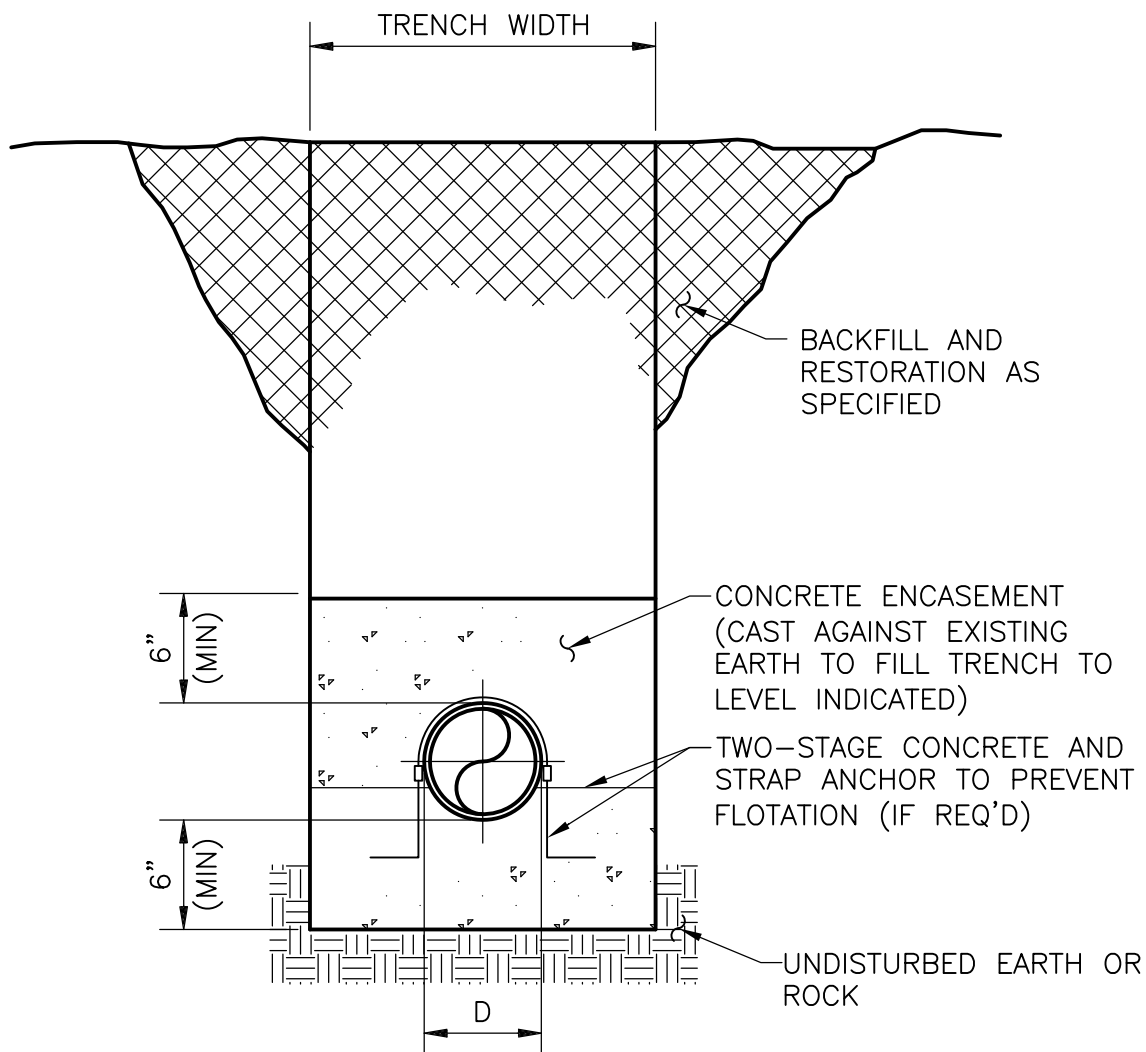
NOTE:
TRENCH SIDE SLOPES SHALL BE IN ACCORDANCE WITH OSHA REQUIREMENTS. BEGIN SIDE SLOPES, IF USED, APPROXIMATELY 18" ABOVE TOP OF PIPE (TYPICAL ALL BEDDING TYPES).

RIGHT-OF-WAY RESTORATION

DETAIL

NO SCALE



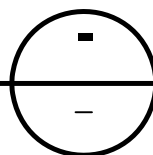


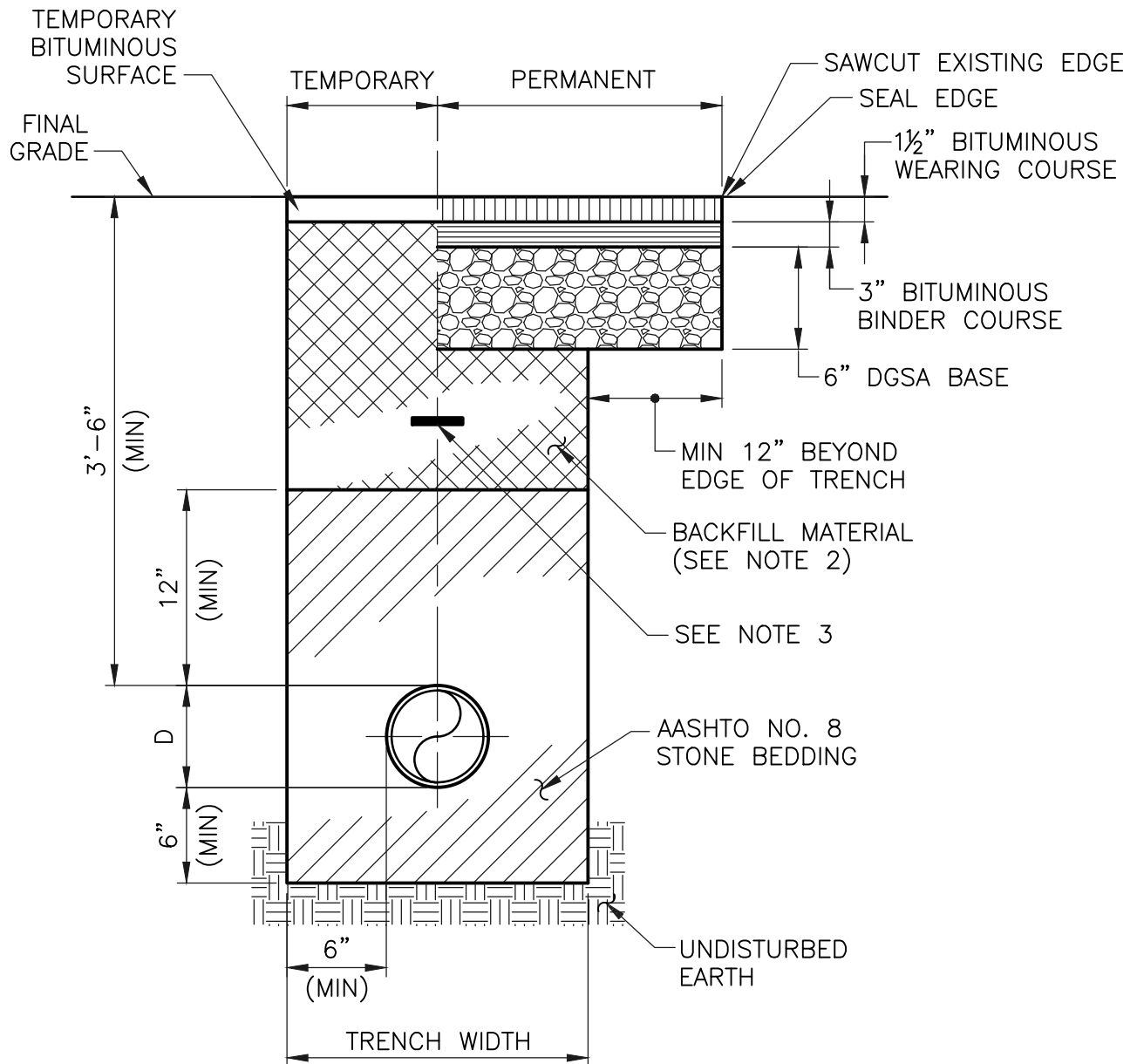
NOTE:
TRENCH SIDE SLOPES SHALL BE IN ACCORDANCE WITH OSHA REQUIREMENTS. BEGIN SIDE SLOPES, IF USED, APPROXIMATELY 18" ABOVE TOP OF PIPE (TYPICAL ALL BEDDING TYPES).

CONCRETE ENCASEMENT

DETAIL

NO SCALE





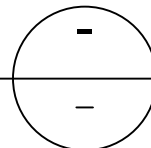
NOTES:

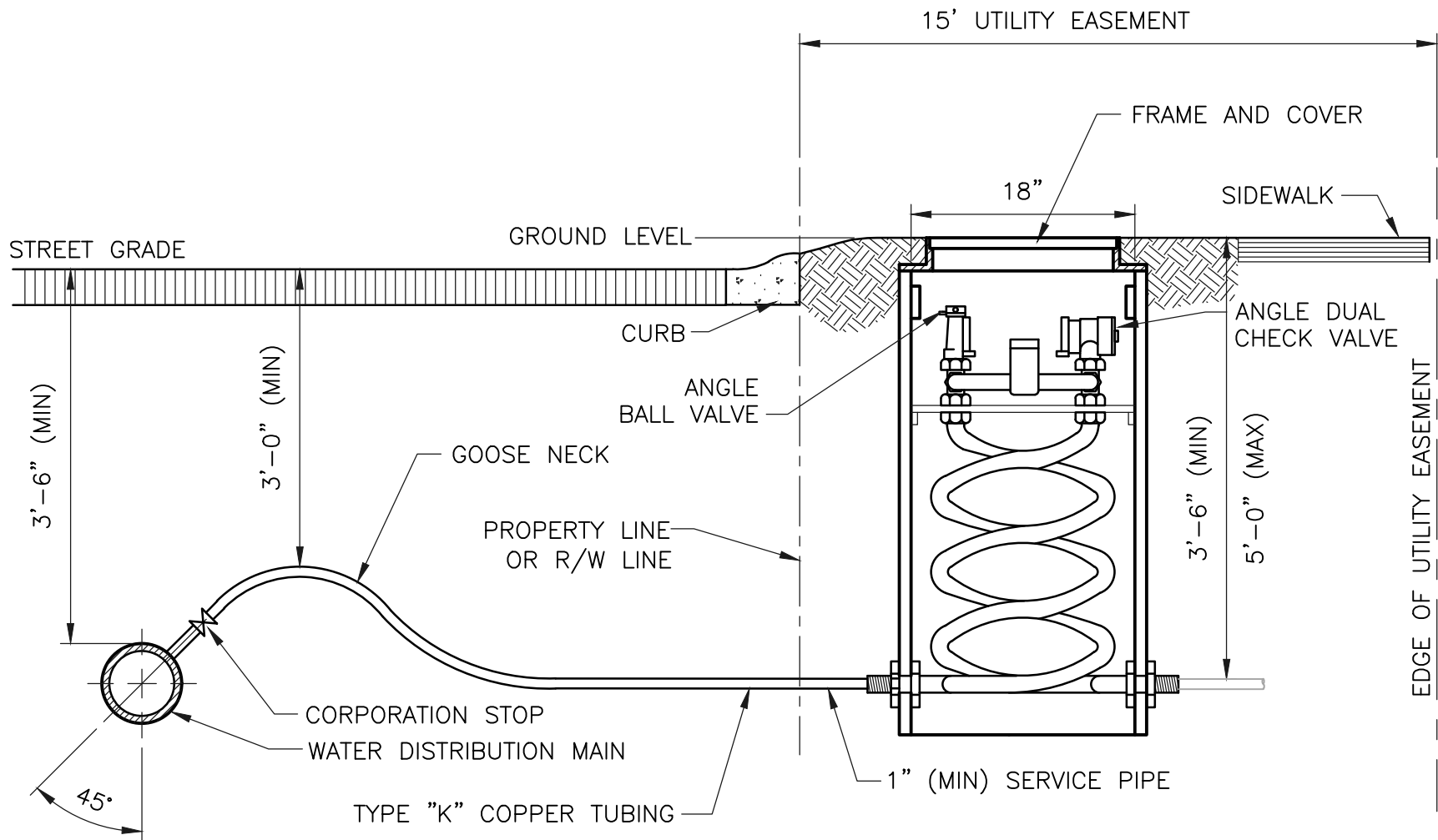
1. BACKFILL & PAVEMENT RESTORATION IN STATE OR COUNTY ROADS SHALL BE AS SPECIFIED BY MDSHA OR CARROLL COUNTY, RESPECTIVELY.
2. BACKFILL & PAVEMENT RESTORATION IN CITY ROADS, ACCESS DRIVES, PARKING AREAS AND LOADING AREAS SHALL BE AS SPECIFIED BY THE ENGINEER. BACKFILL MATERIAL IN EXISTING PAVED AREAS SHALL BE CR-6.
3. ADD MAGNETIC WARNING SAFETY TAPE ABOVE ALL WATER MAINS. TAPE SHALL BE PLACED DIRECTLY ABOVE PIPE CENTERLINE, 12-18 INCHES BELOW FINISHED GRADE.

PAVEMENT RESTORATION

DETAIL

NO SCALE



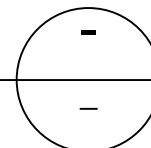


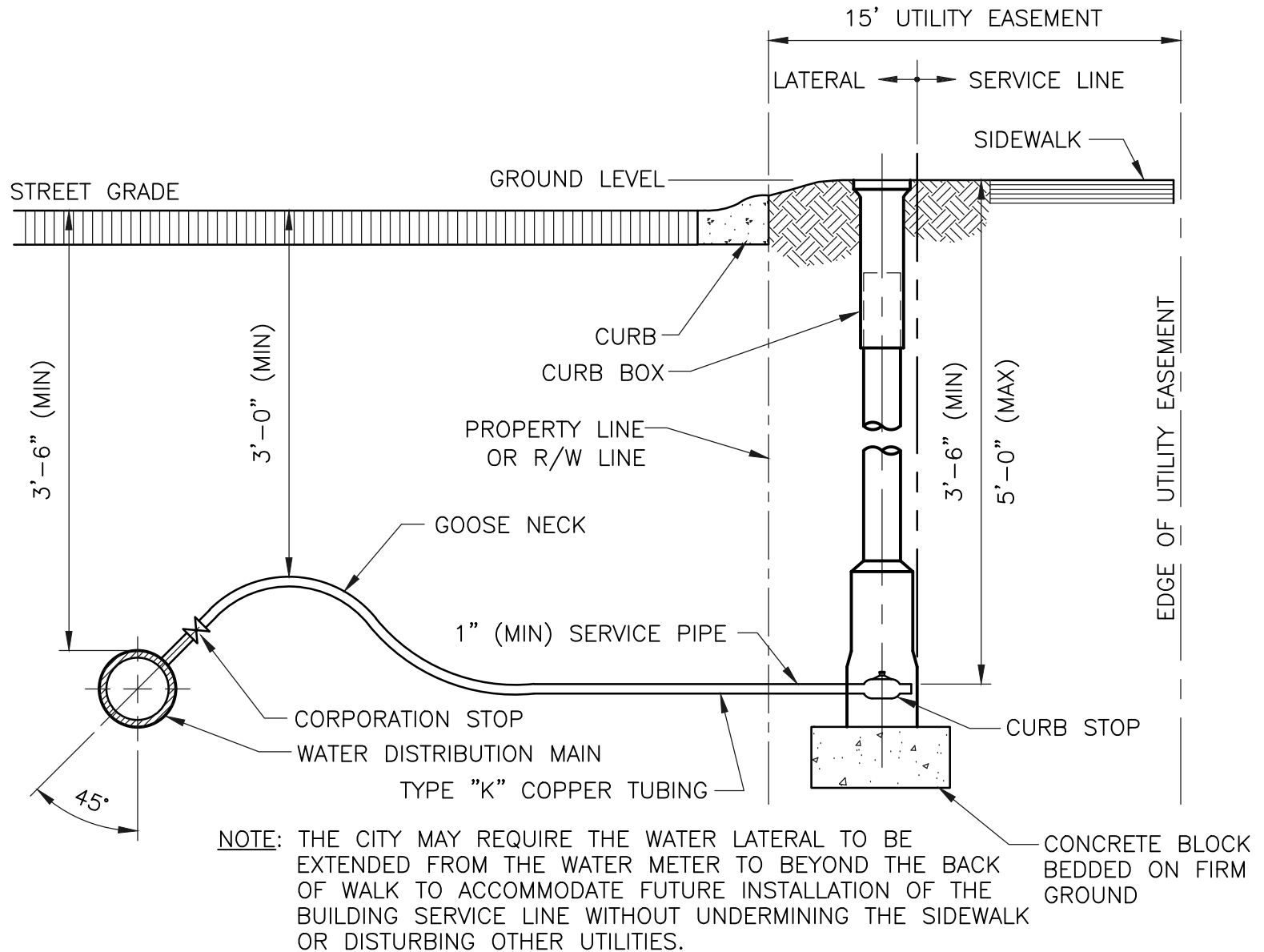
NOTE: THE CITY MAY REQUIRE THE WATER LATERAL TO BE EXTENDED FROM THE WATER METER TO BEYOND THE BACK OF WALK TO ACCOMMODATE FUTURE INSTALLATION OF THE BUILDING SERVICE LINE WITHOUT UNDERMINING THE SIDEWALK OR DISTURBING OTHER UTILITIES.

**TYPICAL SERVICE (UP TO 2")
USING CORPORATION STOP**

DETAIL

NTS

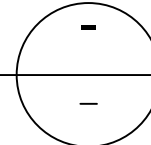


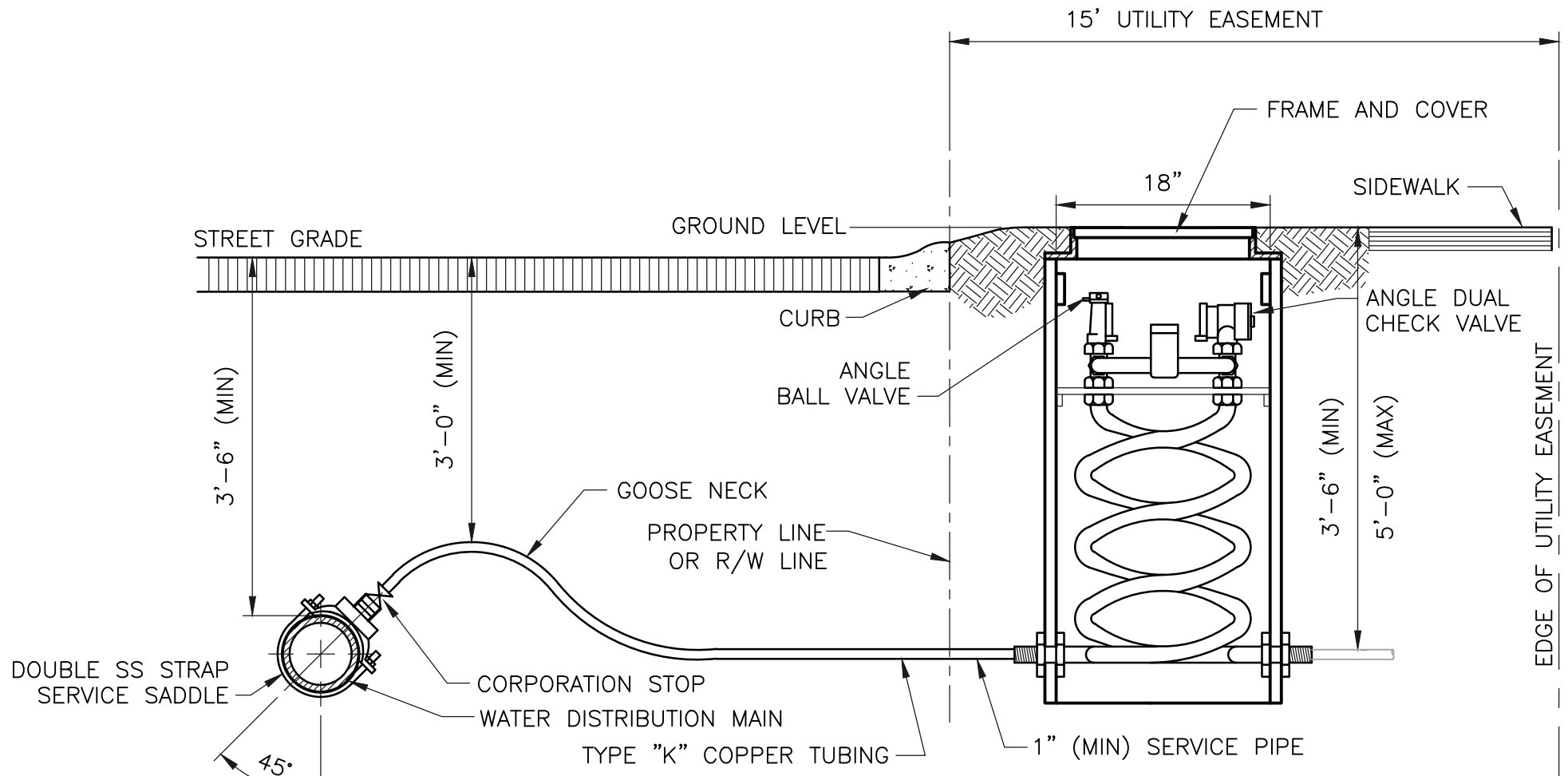


**TYPICAL SERVICE (UP TO 2")
USING CORPORATION STOP AND CURB STOP**

DETAIL

NTS



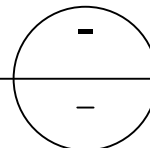


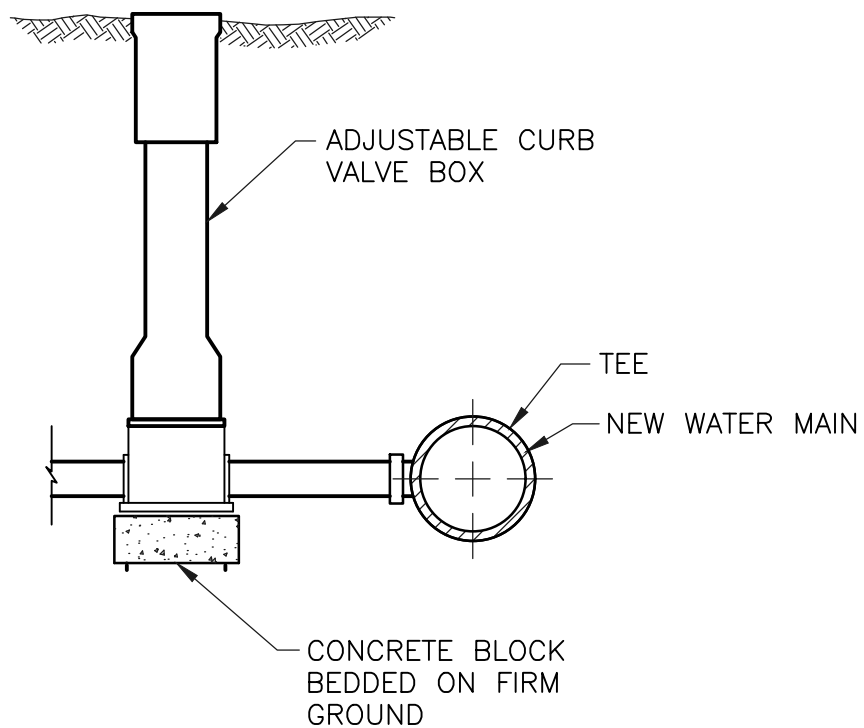
NOTE: THE CITY MAY REQUIRE THE WATER LATERAL TO BE EXTENDED FROM THE WATER METER TO BEYOND THE BACK OF SIDEWALK TO ACCOMMODATE FUTURE INSTALLATION OF THE BUILDING SERVICE LINE WITHOUT UNDERMINING THE SIDEWALK OR DISTURBING OTHER UTILITIES.

NEW SERVICE CONNECTION (UP TO 2") USING SERVICE SADDLE

DETAIL

NO SCALE

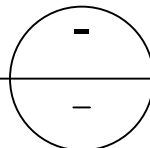


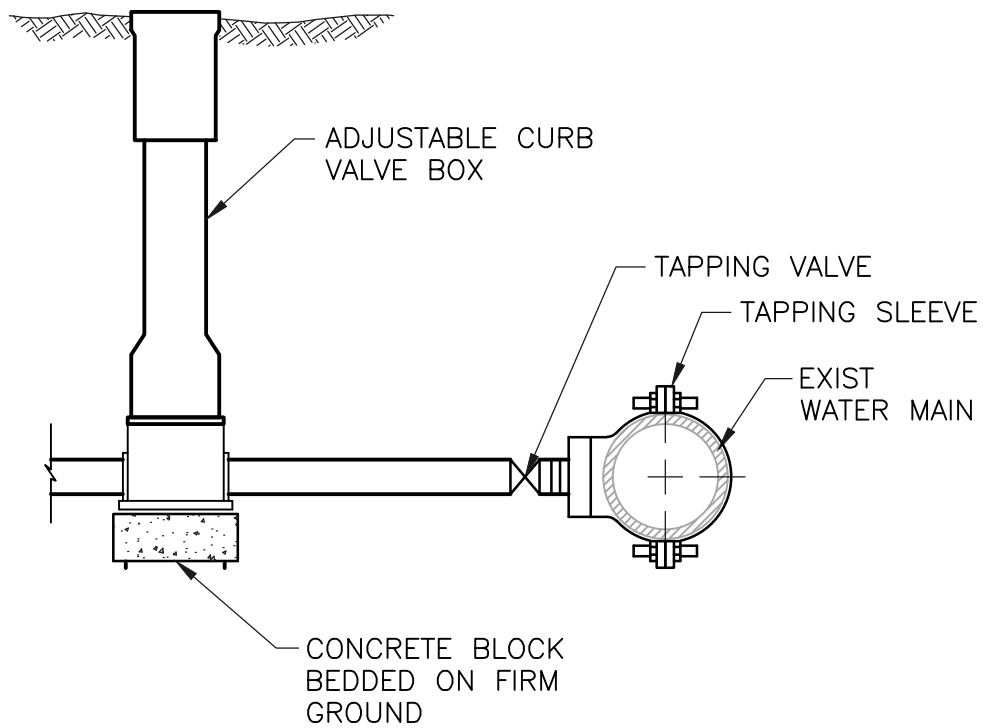


NEW SERVICE CONNECTION
(LARGER THAN 2")
TO A NEW WATER MAIN

DETAIL

NO SCALE

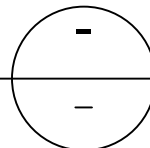


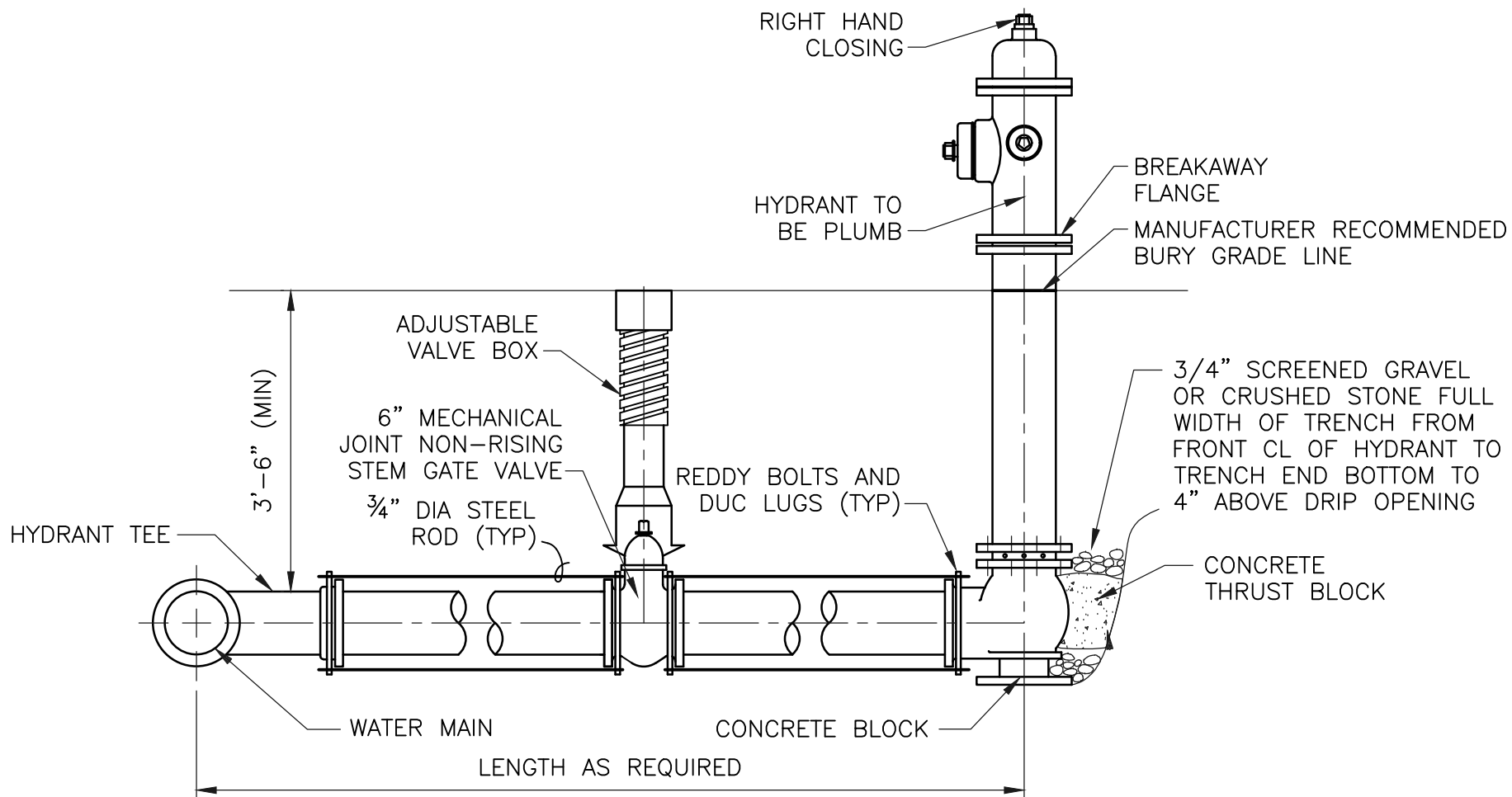


NEW SERVICE CONNECTION
(LARGER THAN 2")
TO AN EXISTING WATER MAIN

DETAIL

NO SCALE





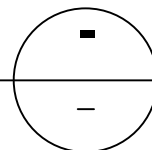
NOTES:

1. MASS CONCRETE THRUST BLOCK AND RESTRAINT RODS NOT REQUIRED BY CITY IF "MEGALUG" MECHANICAL JOINT RESTRAINTS USED.
2. MANUFACTURER'S RECOMMENDED BURY GRADE LINE SHALL BE WITHIN 4 INCHES OF FINAL GRADE.

TYPICAL FIRE HYDRANT SETTING

DETAIL

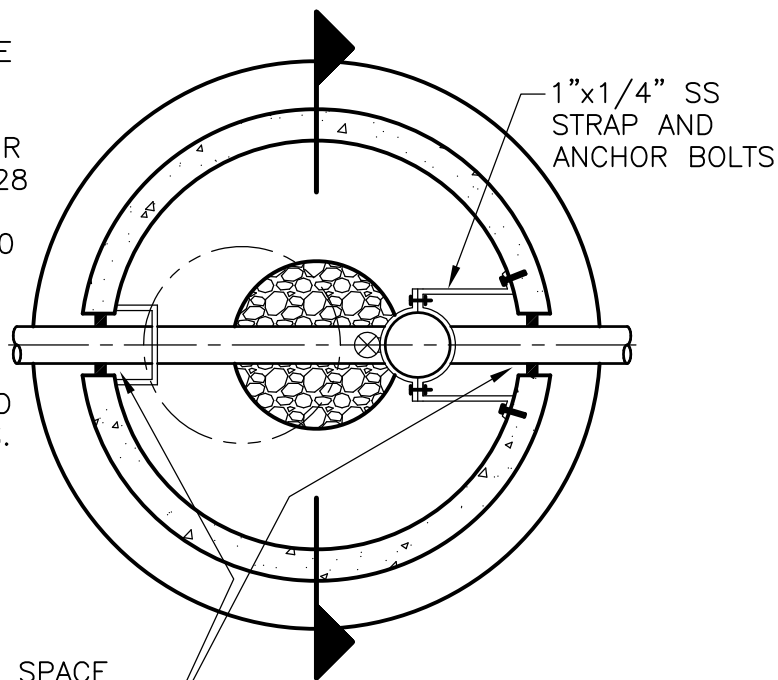
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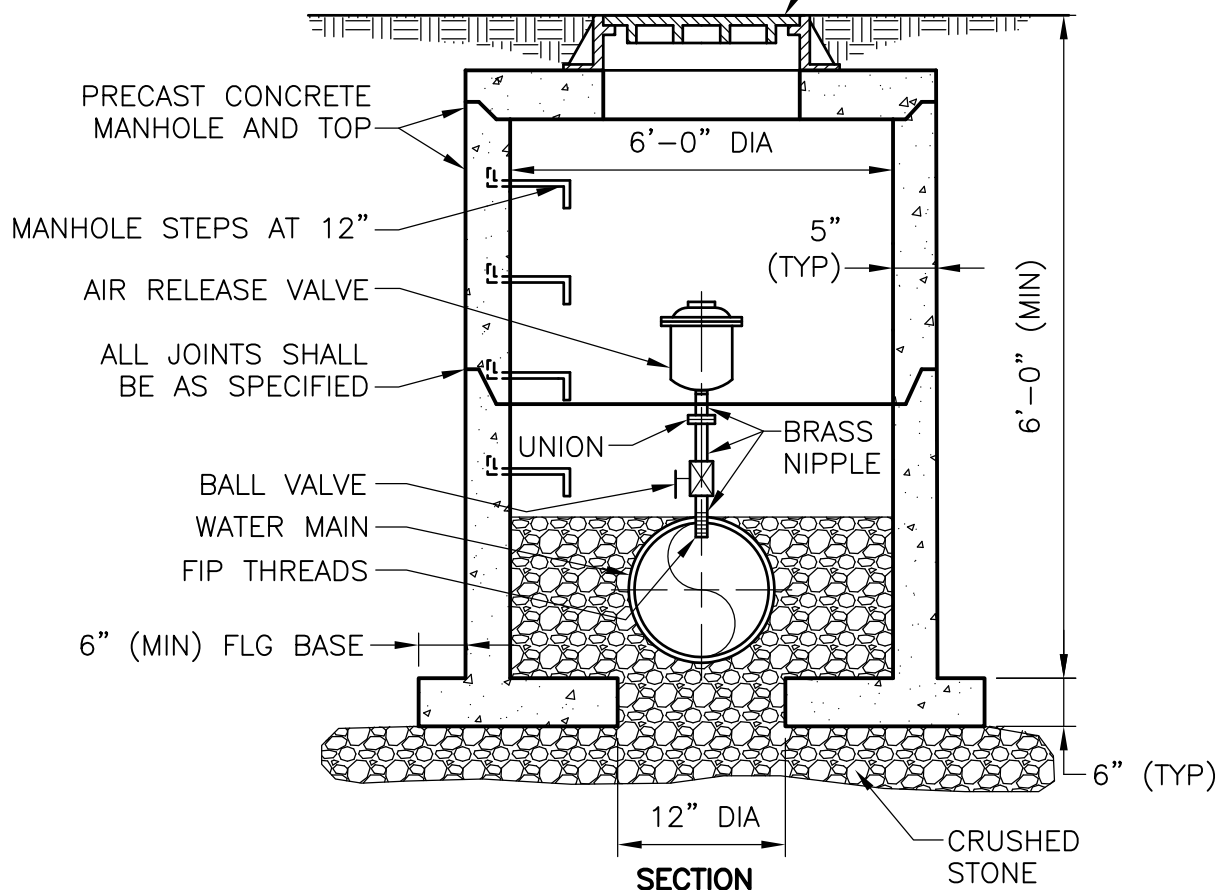
NOTES:

1. ALL PRECAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL COMPLY WITH ASTM C-478.
2. CEMENT SHALL BE TYPE II OR III, AIR ENTRAINED, WITH $f'_c=3,000$ psi AT 28 DAYS.
3. REINFORCEMENT SHALL BE GRADE 60 PER ASTM A-615.
4. 24" DIA. CAST IRON FRAME AND COVER PER ASTM A-48, CLASS 30, FOR H-20 LOADING.
5. CAST IRON FRAME TO BE BOLTED TO MANHOLE WITH $5/8"$ ANCHOR BOLTS. CASTING AND GRADE RINGS TO BE SEALED TO MANHOLE WITH PREFORMED PLASTIC SEALING COMPOUND.
6. ALL JOINTS SHALL BE SEALED WITH PREFORMED PLASTIC SEALING COMPOUND.
7. PREFORMED PLASTIC SEALING COMPOUND.

FILL ANNULAR SPACE
W/NON-SHRINK GROUT.
TROWEL SMOOTH AND FLUSH
W/INTERIOR FACE OF MANHOLE



SECTIONAL PLAN

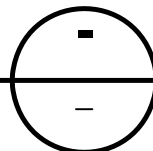


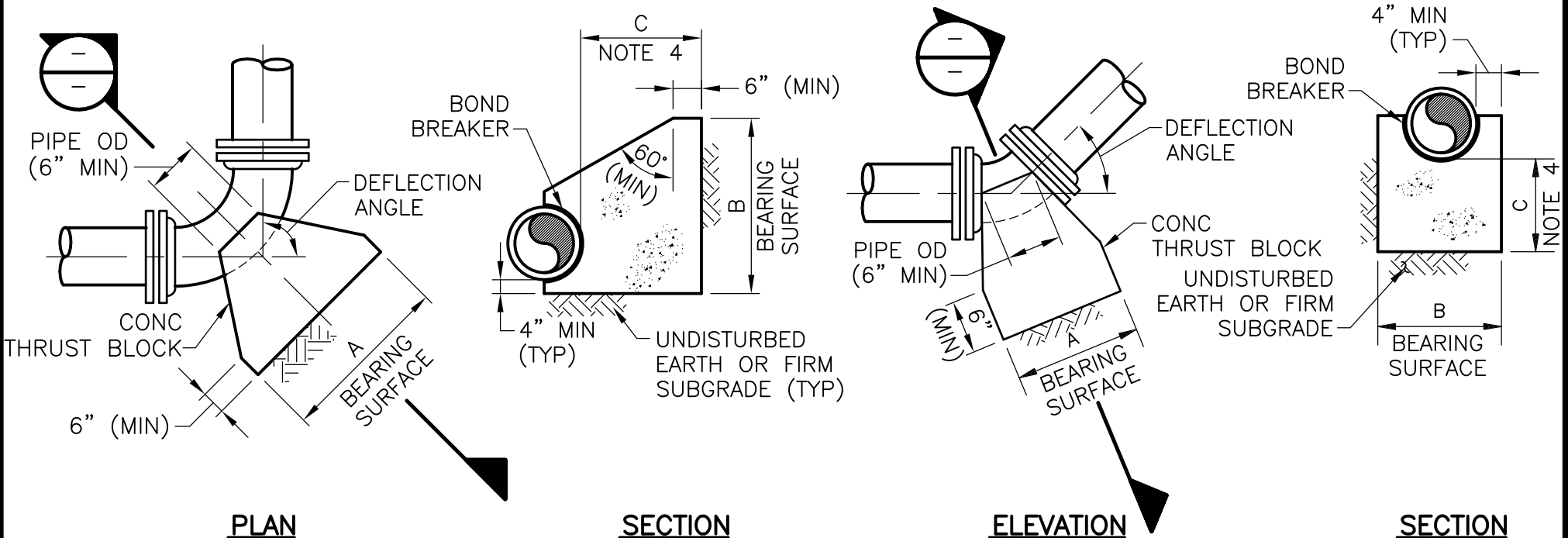
SECTION

AIR RELEASE VALVE MANHOLE

DETAIL

NO SCALE





DETAIL FOR HORIZONTAL BENDS

DETAIL FOR LOWER VERTICAL BENDS

NOMINAL PIPE SIZE (INCHES)	MAXIMUM PIPE OD (INCHES)	REQUIRED BEARING AREA (SQ FT)					
		90 DEG	60 DEG	45 DEG	30 DEG	22.50 DEG	11.25 DEG
4	4.80	2.9	2.0	1.6	1.1	0.8	0.4
8	9.05	10	7	6	4	3	1.4
12	13.20	22	15	12	8	6	3
18	19.50	48	34	26	17	13	7
20	21.60	58	41	32	21	16	8
24	25.80	83	59	45	30	23	12

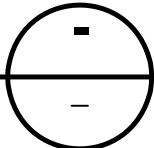
THRUST BLOCKS FOR HORIZONTAL BENDS AND LOWER VERTICAL BENDS

- NOTES:
- 1. MAXIMUM TEST PRESURE = 1.5 x 150 PSI
 - 2. MINIMUM ALLOWABLE SOIL BEARING PRESSURE = 2000 PSF
 - 3. BEARING AREA = A x B
 - 4. C SHALL BE GREATER THAN A/2 AND B/2.

THRUST BLOCKS
FOR HORIZONTAL BENDS
AND LOWER VERTICAL BENDS

DETAIL

NO SCALE



**MINIMUM RESTRAINED PIPE LENGTH (FT)
FOR VERTICAL BENDS**

(WITHOUT POLYETHYLENE ENCASEMENT)

DIAMETER (IN)	VERTICAL BEND ANGLE (DEGREES)		
	45	22½	11¼
6	20	1	5
8	26	12	6
10	32	15	8
12	37	18	9
14	43	21	10
16	48	23	12
18	54	26	13
20	59	28	14
24	70	34	17

**MINIMUM RESTRAINED PIPE LENGTH (FT) FOR
HORIZONTAL BENDS**

(WITHOUT POLYETHYLENE ENCASEMENT)

DIAMETER (IN)	HORIZONTAL BEND ANGLE (DEGREES)			
	90	45	22½	11¼
6	15	6	3	1
8	19	8	4	2
10	23	10	5	2
12	28	11	5	3
14	32	13	6	3
16	36	15	7	4
18	40	16	8	4
20	43	18	9	4
24	51	21	10	5

**MINIMUM RESTRAINED PIPE LENGTH (FT)
FOR VERTICAL BENDS**

(WITH POLYETHYLENE ENCASEMENT)

DIAMETER (IN)	VERTICAL BEND ANGLE (DEGREES)		
	45	22½	11¼
6	29	14	7
8	37	18	9
10	45	22	11
12	53	26	13
14	61	29	15
16	69	33	16
18	77	37	18
20	85	41	20
24	100	48	24

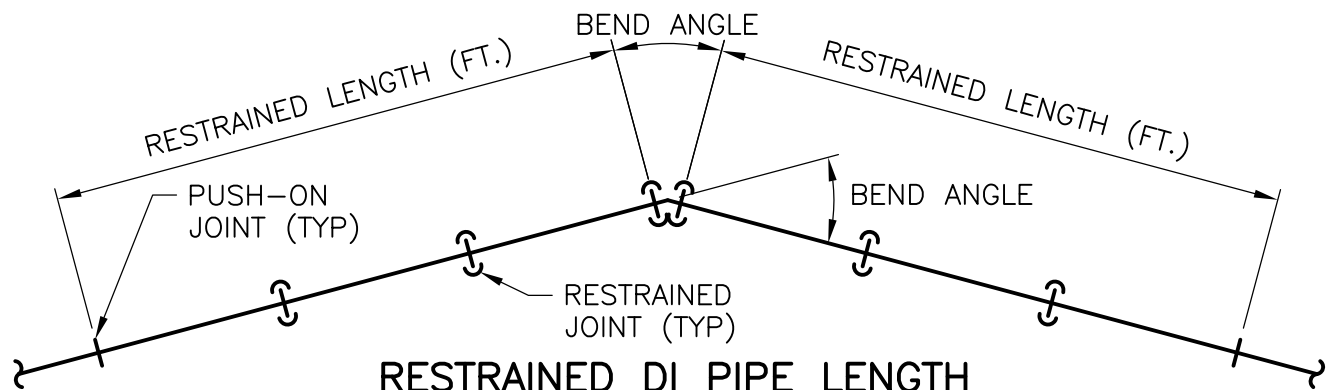
**MINIMUM RESTRAINED PIPE LENGTH (FT) FOR
HORIZONTAL BENDS**

(WITH POLYETHYLENE ENCASEMENT)

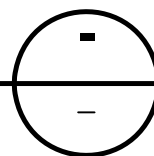
DIAMETER (IN)	HORIZONTAL BEND ANGLE (DEGREES)			
	90	45	22½	11¼
6	16	7	3	2
8	21	9	4	2
10	26	11	5	3
12	30	13	6	3
14	35	14	7	3
16	39	16	8	4
18	44	18	9	4
20	48	20	9	5
24	56	23	11	6

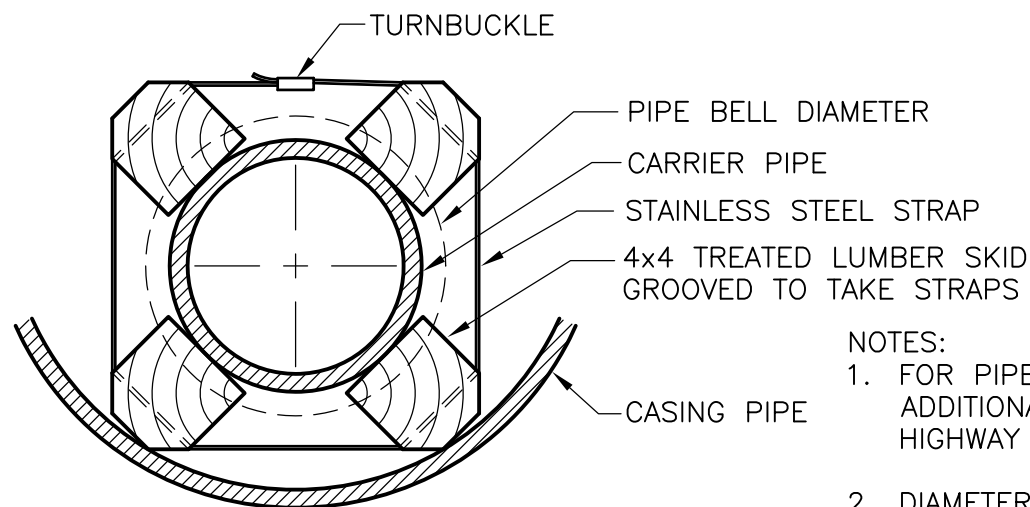
NOTES:

- | | | |
|---|------------------------------|--------------------|
| 1 | DESIGN PRESSURE | = 150 PSI |
| 2 | DEPTH OF COVER | = 4 FEET |
| 3 | SAFETY FACTOR | = 1.5 |
| 4 | SOIL TYPE | = COHESIVE ANGULAR |
| 5 | SOIL INTERNAL FRICTION ANGLE | = 20 DEGREES |
| 6 | SOIL COHESION | = 200 PSF |
| 7 | SOIL DENSITY | = 90 PCF |

**RESTRAINED DI PIPE LENGTH****DETAIL**

NO SCALE

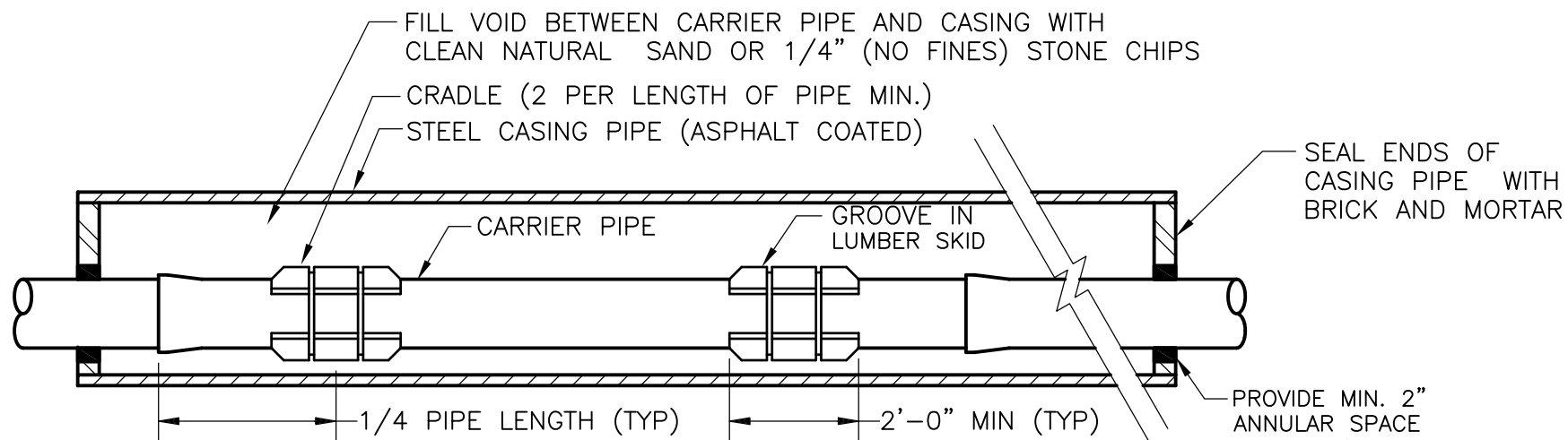




NOTES:

1. FOR PIPES CROSSING STATE ROADS OR RAILROADS ADDITIONAL REQUIREMENTS (IF ANY) IMPOSED BY HIGHWAY OR RAILROAD OWNER MUST BE MET.
2. DIAMETER OF CASING SHALL BE IN ACCORDANCE WITH HIGHWAY OR RAILROAD OWNER'S STANDARDS.

CROSS SECTION

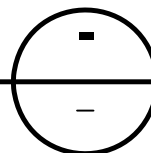


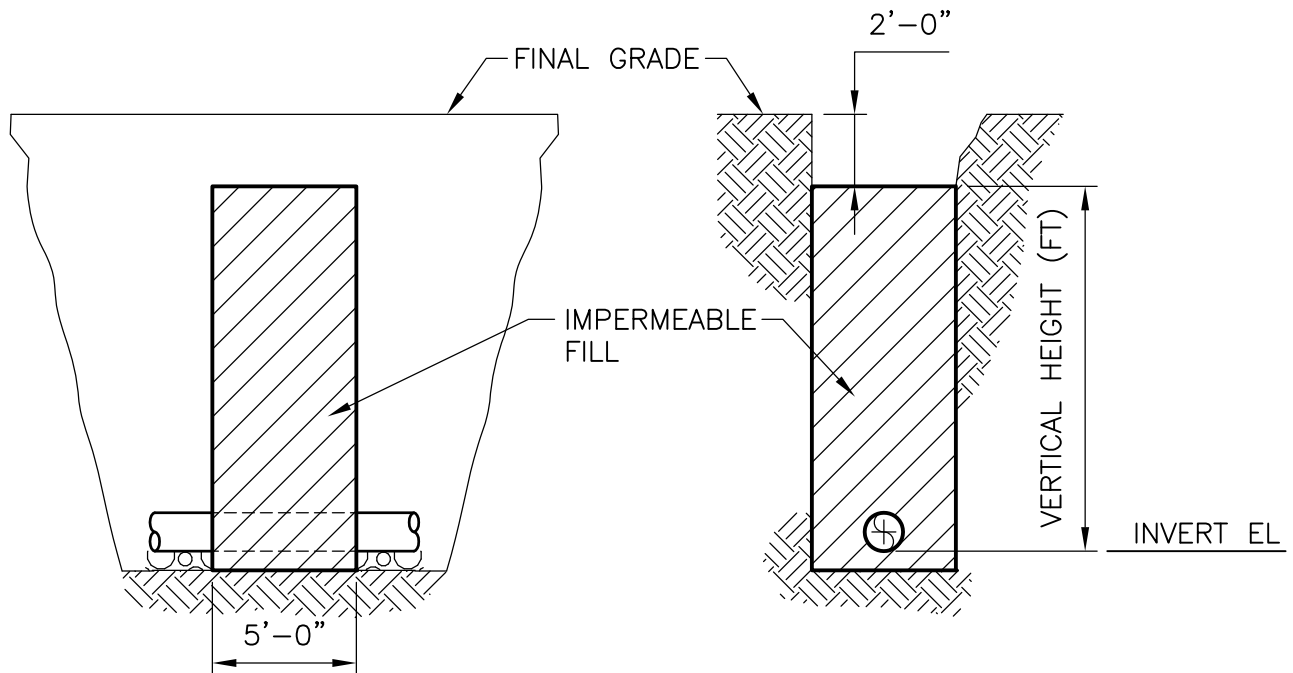
PROFILE

PIPE CRADLE IN CASINGS

DETAIL

NO SCALE





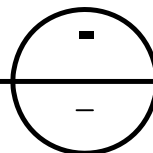
NOTES:

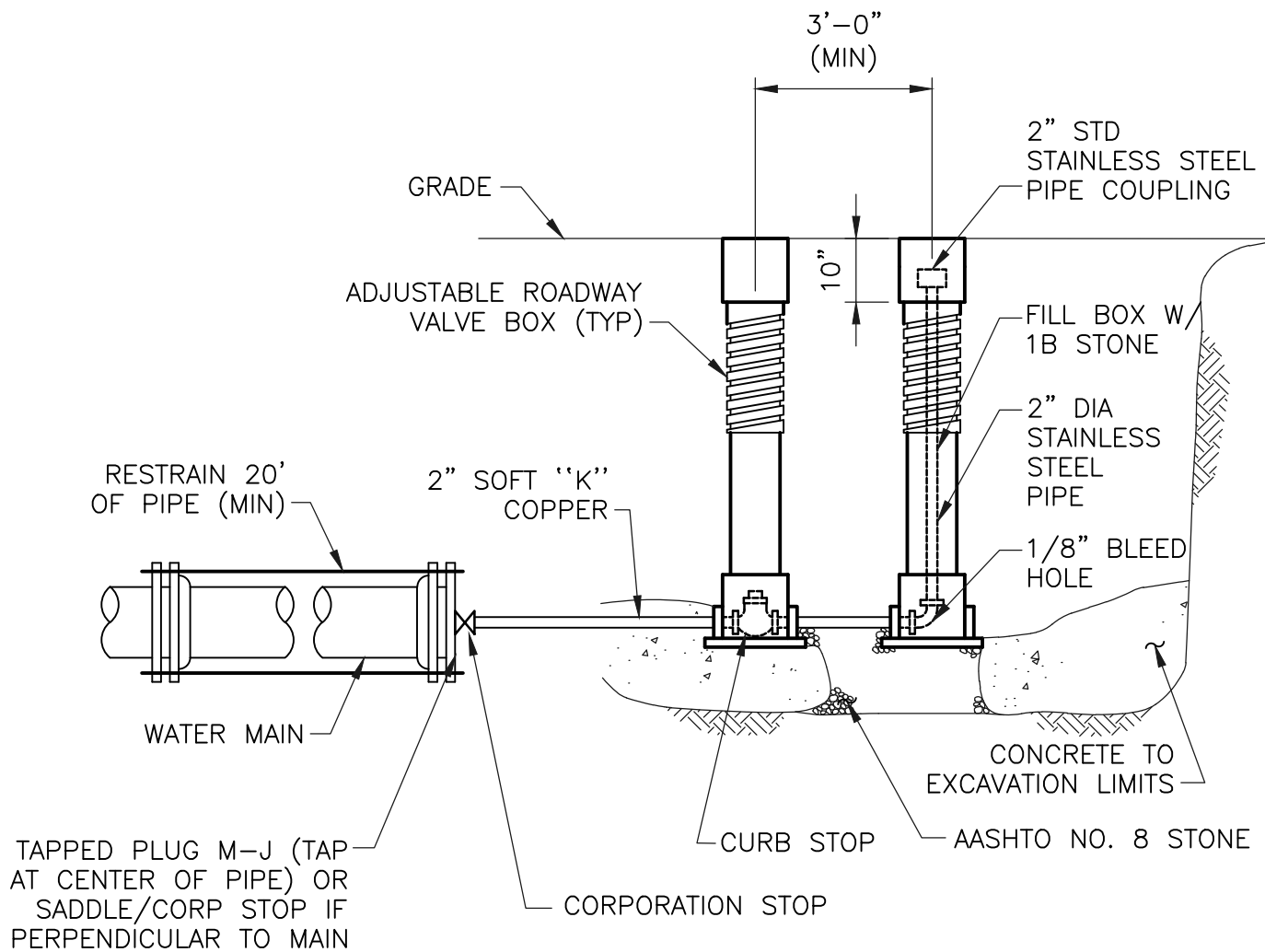
1. COMPACTED TRENCH PLUG SHALL EXTEND VERTICALLY FROM UNDISTURBED GROUND AT BOTTOM OF TRENCH TO WITHIN TWO (2') FEET OF FINAL GRADE, AND FROM UNDISTURBED GROUND ON TRENCH SIDES FOR FULL WIDTH OF TRENCH.
2. EACH TRECH PLUG SHALL CONSIST OF CLAY CONTAINING NO MORE THAN 15% (BY VOLUME) STONE NOT LARGER THAN TWO (2") INCHES IN DIAMETER. CLAY SHALL BE PLACED IN SIX (6") INCH LIFTS AND COMPACTED BY MECHANICAL TAMPER TO NOT LESS THAN 95% OF MAXIMUM DENSITY AT OPTIMUM MOISTURE CONTENT.
3. INSTALL AT LEAST ONE CLAY DIKE BETWEEN EACH PAIR OF MANHOLES OR EVERY 300 FEET WHICHEVER IS LESS, AT DOWNSTREAM SIDE OF STREAM CROSSINGS AND AT UPSTREAM AND DOWNSTREAM LIMITS OF WETLAND CROSSINGS.

CLAY DIKE

DETAIL

NTS





TYPICAL BLOWOFF INSTALLATION

DETAIL

NTS

