WATER AND SEWER SERVICES DEPARTMENT
DESIGN STANDARDS

May 1998

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INTRODUCTION

The objective of these standards is to establish a closer working relationship between the City of Johnson City and all persons or firms responsible for the design of water supply and sanitary sewer facilities connecting to the water and sewer system operated by the City.

These requirements and guidelines are intended to aid in the preparation of plans and are not intended to supersede the requirements of the Tennessee Department of Environment and Conservation (TDEC). After approval by the City, TDEC will continue to be the final authority. All plans shall be approved by TDEC.

The following design requirements shall apply to any development that proposes to connect to the water or sanitary sewer system of the City of Johnson City, Tennessee. These requirements should not be construed as being the total requirements. The City may require additions to be made where circumstances warrant including oversizing of facilities in order to adequately serve future development in the area. There has been no attempt to address every situation. Cases where criteria will not apply will be handled on an individual basis.

1. SUBMISSION OF ENGINEERING DOCUMENTS

1.1. GENERAL

All reports, final plans and specifications should be submitted at least 30 days prior to the date on which action by the Department is desired. Plans for developments inside the city limits or within the regional planning area shall be submitted to the City of Johnson City Planning Department; plans for all other developments shall be submitted directly to the Water and Sewer Department. Preliminary plans should be submitted for review prior to the preparation of final plans when the project will significantly change the distribution and collection system. No approval for construction will be issued until final, complete, detailed plans and specifications have been submitted to the Department and found to be satisfactory. Documents submitted for formal approval shall include but not be limited to:

a. summary of the basis of design,

b. hydraulic calculations and profiles,

c. general layout

d. detailed plans,

e. specifications.

Submittals should be addressed to:

City of Johnson City
Water and Sewer Department
P.O. Box 2466
Johnson City, TN 37605
Phone: (423) 461-1646
Fax: (423) 975-2653
E-Mail: h2oengin@johnsoncitytn.org

1.2. PLANS

Plans for water and sewer works improvements should, where pertinent, provide the following:

1.2.1. General layout, including

a. project name,

b. location map scaled to no less than 1” = 1000 feet,

c. area or institution to be served,

d. scale, in feet, 1” =50 feet or 1” = 100 feet horizontal scale, 1” = 5 feet vertical scale for sanitary sewer and 1” = 10 feet vertical scale for water,

e. north direction,

f. datum used,

g. date, address, name, and phone number of the designing engineer, owner, developer, and surveyor,

h. signed and dated imprint of professional engineer’s seal,

i. civil district of proposed development including map and parcel number,

j. legible prints suitable for reproduction, all sheets 24” x 36” in size,

k. location and size of existing water and sanitary sewer mains, adjacent to proposed construction,

l. location and nature of existing utilities including storm sewer lines, gas lines, cable lines, electricity lines, and telephone lines

m. location of topographic features such as rights-of-way, property lines including names of adjacent property owners, limits of easements, etc.,

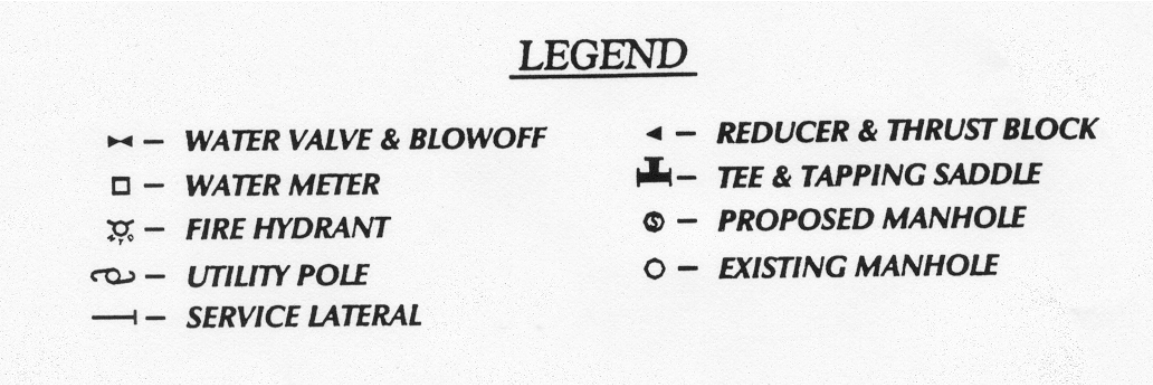
n. contour lines at suitable intervals for both existing and proposed conditions.

1.2.2. Detailed plans for distribution systems, including

a. a vicinity map showing location of project, if system map is not included,

b. key map, showing location of detailed drawings, when project is comprehensive,

c. symbol legend including the following



d. location of proposed water and sanitary sewer lines in relation to roads, bridges, and other identifiable objects,

e. location of valves, fire hydrants, tees, reducers/enlargers, and manholes including invert and surface elevations,

f. hydraulic computations showing hydraulics of proposed additions to the distribution and collection system.

g. sanitary sewer profiles corresponding to plan view with sizes of all water mains and sanitary sewer lines shown in both the plan and profile views,

h. detail sheets for construction features which require additional clarifications. Each detail shall cover the dimensions, equipment, materials, and any clarifying notes to aid in construction of the item. Details of all appurtenance for sanitary sewer and water construction shall be provided on detail sheets. Standard water and sewer details can be found in Appendix 1.

1.2.3. Notes to be written on all plans, including

a. All water and sewer construction shall be in accordance with the specifications of the City of Johnson City and TDEC.

b. The Contractor is to be responsible for informing the City of Johnson City Water and Sewer Inspection Division in writing two weeks prior to the start of construction and three weeks prior to water and sewer service connections to the City's system, conforming to the requirements of the City's inspector during construction, and requesting final inspection and approval from the City.

c. All water and sewer plans must be submitted to and approved by TDEC prior to construction. A copy of the approval letter must be submitted to the Johnson City Water and Sewer Engineering Department prior to construction.

d. The Contractor shall be responsible for locating and verifying the elevations of existing utilities prior to construction.

e. All excavation for tie-ins and taps as well as all backfilling operations will be the responsibility of the developer.

f. Backfill for water and sewer lines in the street shall be compacted crushed stone.

g. Connection to existing City facilities shall be made only under the supervision of a representative of the City.

h. As-built plans must be completed and shall be submitted on paper ***and in digital form*** *prior to acceptance of water and sewer lines by the City.*

1.2.4. Notes to be written on all sanitary sewer pump station plans, including

a. Contractor shall supply and install only the specified equipment. Shop drawings shall include only the specified electrical equipment.

b. The Facility Maintenance Division and the Engineering Division will approve all final plans, specifications, and shop drawings prior to construction.

c. At the final inspection and start up/check out of all pump stations, a qualified representative of the pump and motor manufacturer shall be present and shall perform all start up operations. That person shall be responsible for providing all the necessary instructions and training of operations personnel from the Water and Sewer Department. Four sets of operation and maintenance manuals shall be provided for all equipment.

d. Where possible the standard pump station plans provided by the Water and Sewer Department shall be used.

1.2.5. Plans of Sewage Pumping Stations

Plans must be submitted on all sewage pump stations that serve more than two residences. Any pump station of this size or larger is considered a "sewage system" by the State of Tennessee and, as such, must be designed and built in conformance with this criteria. Pump stations will not be approved unless ownership and responsibility for operation are by a public entity or other acceptable long term operation or maintenance scheme is approved in advance by TDEC and the City of Johnson City.

1.2.5.1. A general layout plan must be submitted for projects involving construction or substantial modification of pumping stations. The plan should show:

a. The location and extent of the drainage area, both present and future.

b. A contour map of the property to be used.

c. Any municipal boundaries within the tributary area.

d. The location of the pumping station and force main, and pertinent elevations.

e. A site plan showing the forms of land use (commercial, residential, and agricultural) existing or proposed for the near future within a 100-foot radius of the pumping station. Existing buildings and their types within 100 feet of the pumping station property lines should be included.

1.2.5.2. Detail plans must be submitted showing:

a. The proposed pumping station, including provisions for installation of future pumps or ejectors.

b. Elevation of known high groundwater and 50 year flood elevation at the site and maximum elevation of sewage in the collection system upon occasion of power failure.

c. Plan and elevation views of the pump suction (from the wet well), and discharge piping showing all isolation valves and gates.

d. A minimum site size of 25 feet by 25 feet is desired for the pumping station. The site shall be large enough to allow Water and Sewer Department maintenance trucks to turn around on the site.

e. A minimum of 12 feet wide access road. Depth of compacted stone shall be a minimum of 10 inches. Storm drainage ditches and culverts shall be provided. All graded areas along the access road shall be sloped with at least a minimum 2:1 side slope (horizontal:vertical). All graded areas shall be satisfactorily seeded and mulched. Vertical gradient for the access road shall not exceed 12%. For accessibility, a 25 foot wide right-of-way shall be provided.

1.3. EASEMENTS

When easements are required, they are to have a minimum width of 7.5 feet along all property lines and/or 7.5 feet along each side of water and/or sewage pipe centerline. The final plat of a subdivision or development must show the easement to be recorded prior to final acceptance of the facilities by the City. For easements not occurring along property lines, an easement document must be filed which must include where the deed is recorded, signature of the owner, and notarization. A fee simple plat shall also be submitted.

For developments which require either a water booster station or a sanitary sewer pump station, a parcel of land shall be deeded to the City of Johnson City Water and Sewer Department. Plats with descriptions and deeds shall be provided for all pumping stations and access roads to pumping stations. See the sample format for easements in Appendix 4.

1.4. REVISIONS TO APPROVED PLANS

Any significant deviations from approved plans or specifications affecting capacity, hydraulic conditions, to the quality of water to be delivered, must be approved by

the Department before such changes are made. Revised plans or specifications must be submitted in time to permit the review and approval of such plans or specifications **before any construction work** that will be affected by such changes is begun.

1.5. AS-BUILT PLANS

Following the completion of construction, as-built plans shall be submitted to the Department indicating any deviations from original plan. These plans shall include the actual field angles between lines, all actual service lines and tee locations, the distance to the end of the service lines to property corners and lines, the depth to the top of the end of the service laterals, the location of valves in relation to at least two permanent landmarks, the depth and invert elevation of all manholes, invert elevations of all lines in the manholes, the actual grade of all sewer lines, and alignment and grade changes. These plans shall be completed and submitted on paper **and in digital form** before final approval of the development will be granted.

2. WATER DISTRIBUTION SYSTEMS

2.1. SYSTEM DESIGN

2.1.1. Minimum Pipe Size

a. The minimum size of pipe for principal water mains and for water mains where fire hydrants are to be attached shall be 6-inch diameter. The minimum size of pipe on a dead end street shall meet the following standards:

Type of Dead End Street	Length of Street	Commercial/Industrial Development	Multi-Family Development	Single Family Development
Permanent	street length ≤ 300 ft	6”	6”	2”
	301 ft ≤ street length ≤ 600 ft	8”	6”	6”
	street length > 600 ft	10”	8”	8”
Non-Permanent	street length ≤ 300 ft	8”	8”	6”
	301 ft ≤ street length ≤ 600 ft	8”	8”	8”
	street length > 600 ft	10”	8”	8”

b. Size of water mains shall be justified by hydraulic analysis. Two (2) inch water mains will only be considered for short cul-de-sacs and permanent dead-ends where future growth is not feasible.

c. All water mains including those not designed to provide fire protection shall be sized after a hydraulic analysis based on flow demands and pressure requirements. The system shall be designed to maintain a minimum pressure of 20 psi at all points in the distribution system under all conditions of flow.

d. Wide variations in pressure above the minimum requirement of 20 psi may be inherent in the design of a distribution system but extreme pressures should not be delivered to the customer (unless higher pressures are requested). The extreme pressure requirement can be met by the use of pressure reducing valves on each customer’s source line, or by designing the distribution system to limit the maximum pressure.

e. All assumptions and any flow data used must be clearly documented and submitted with the hydraulic analysis. If actual flow data is not available, theoretical calculations shall be based on all storage facilities half-full and the Hazen-Williams friction factor appropriate for type of pipe being used but in no case greater than 130.

f. Water mains and distribution systems for domestic purposes should be sized for an instantaneous peak domestic demand of 2 gpm per connection or as per Appendix 2.

2.1.2. Fire Protection

a. The minimum pipe size to which a fire hydrant may be connected is 6-inch. On permanent dead-end streets exceeding 300 feet in length, the minimum pipe size to which a fire hydrant can be installed shall be 6" for single-family and multi-family developments and 8" for commercial/industrial development.

b. Fire hydrants shall not be connected to water mains which are not capable of providing a flow of 500 gpm at 20 psi pressure. The National Fire Protection Association (NFPA) states that the minimum fire protection flow of 500 gpm should be available for a 1 hour duration.

c. Fire hydrants should be located at intersections, in the middle of long blocks, near the end of long dead-end streets, or on property lines.

d. The maximum lineal distance between hydrants shall be 500 feet for single-family developments and 300 feet for multi-family and commercial/industrial developments.

e. When fire protection is to be provided, system design should consider the recommendations of the Insurance Services Organization.

f. Fire hydrants shall meet AWWA Standard C502 of latest revision.

g. For standardization purposes, fire hydrants shall be Kennedy KAD1-A Guardian as manufactured by the Kennedy Valve Company or American Darling ADV MK 73 as manufactured by American Darling.

2.1.3. Dead Ends

a. Dead ends shall be minimized in order to provide better water service through looping the system.

b. Where dead end mains occur they should be provided with a fire hydrant, when fire flows are available, or

blow-off for flushing purposes. The blow-off shall be at least 2 inches in diameter, but should provide flushing velocities of 2 feet per second or greater.

c. No flushing device shall be directly connected to any sewer nor be subject to flooding or plugging.

2.2. INSTALLATION OF MAINS

2.2.1. Adequate support shall be provided for all pipes.

2.2.2. A continuous and uniform bedding shall be provided in the trench for all buried pipe.

2.2.3. Cover- All distribution mains shall be provided with sufficient earth or other suitable cover to prevent freezing. The cover shall not be less than 30 inches measured above the top of the pipe.

2.2.4. Hydrostatic Tests

a. Pressure and leakage tests shall be performed in accordance with current AWWA Standard C600 and/or manufacturer's installation procedures.

b. The test pressure of the installed pipe shall be a minimum of 150 psi or 1.5 times the working pressure, whichever is greater.

c. Allowable leakage shall be no greater than as calculated in $L = SD \sqrt{P}/133{,}200$ where L is allowable leakage in gallons/hours, S is the length of pipe tested in feet, D is pipe diameter in inches and P is test pressure in psi. The following table shows allowable leakage per 1000 ft. of pipeline for various pipe sizes and test pressures. If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each site.

Ave. Test	(Gallons per Hour) Nominal Pipe Diameter - Inches																
PSI	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	52
450	0.32	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350	0.28	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300	.026	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275	0.25	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250	0.24	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225	0.23	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200	0.21	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175	0.20	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150	0.19	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.84	4.41	4.97
125	0.17	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100	0.15	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

d. The developer and/or contractor shall be responsible for providing all labor and necessary testing equipment required for the testing of installed water lines which connect to the City's system. These installed lines include private lines and those that are to be dedicated to the City of Johnson City. All testing must be witnessed and accepted by an appropriate official of the City of Johnson City.

2.2.5. Disinfection of New Water Mains – The specifications shall include detailed procedures for the adequate flushing, disinfection, and (Total Coliform) bacteriological testing of all new water mains. A representative of the City of Johnson City or qualified laboratory certified for testing will collect the sample for bacteriological testing. Disinfection as described in current AWWA Standard C651 will be accepted.

2.2.6. Disinfection When Cutting into or Repairing Existing Mains:

a. Shall be performed when mains are wholly or partially dewatered;

b. Shall follow current AWWA C651 procedures including trench treatment, swabbing with hypochlorite solution, flushing and/or slug chlorination as appropriate;

c. Bacteriological testing should be done after repairs are complete but the water main may be returned to service prior to completion of testing to minimize the time customers are out of water;

d. Leaks or breaks that are repaired with clamping devices while mains remain full of water under pressure require no disinfection.

2.2.7. When non-metallic pipe is installed, detection tape labeled WATER in blue lettering shall be installed.

2.3. SEPERATION OF WATER MAINS AND SEWERS

2.3.1. General – The following factors should be considered in providing adequate separation:

a. materials and type of joints for water and sewer pipes;

b. soil conditions;

c. service and branch connections into the water main and sewer line;

d. compensating variations in the horizontal and vertical separations;

e. space for repair and alterations of water and sewer pipes;

f. off-setting of pipes around manholes;

g. water mains and sanitary or storm sewers shall not be laid in the same trench.

2.3.2. Parallel Installation

a. Normal conditions – Water mains shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer or sewer manhole, whenever possible; the distance shall be measured edge-to-edge.

b. Unusual conditions – When local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer to a storm or sanitary sewer provided that:

1. the bottom of the water main is at least 18 inches above the top of the sewer;

2. where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water-tightness prior to backfilling.

2.3.3. Crossings

a. Normal conditions – Water mains crossing house sewers, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer, whenever possible.

b. Unusual conditions – when local conditions prevent a vertical separation as described in Section 2.3.3.a, the following construction shall be used:

1. Sewers passing over or under water mains should be constructed of the materials described in Section 2.3.2b2.

2. Water mains passing under sewers shall, in addition, be protected by providing:

i. a vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main;

ii. adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water mains;

iii. that the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

iv. both the sewer and the water main shall be constructed of water pipe and tested in accordance with Section 2.2.5.

2.3.4. Sewer manholes – No water pipe shall pass through or come into contact with any part of a sewer or sewer manhole.

2.4. SURFACE WATER CROSSINGS – Surface water crossings, both over and under water, present special problems which should be discussed with the Department before final plans are prepared.

2.4.1. Above-water crossings – The pipe shall be:

a. adequately supported;

b. protected from damage and freezing;

c. accessible for repair or replacement.

d. non-obstructive to flow line of surface water

2.4.2. When crossing water courses which are greater than 15 feet in width:

a. The pipe shall be of special construction, having flexible, watertight joints;

b. Valves shall be provided at both ends of water crossing so that the sections can be isolated for test or repair; the valves shall be easily accessible and not subject to flooding;

c. Sampling taps should be available at each end of the crossing;

d. Permanent taps should be made for testing and locating leaks.

2.5. CROSS CONNECTIONS

a. There shall be no physical connection between the distribution system and any pipes, pumps, hydrants, well, or tanks whereby unsafe water and other contaminating materials may be discharged or drawn into the system.

b. The approval of the Department shall be obtained for interconnections between potable water supplies.

c. Neither steam condensate nor cooling water from engine jackets or other heat exchange devices shall be returned to the potable water supply.

2.6. WATER SERVICES AND PLUMBING – Water services and plumbing shall conform to relevant local and/or state plumbing codes, or to the Standard Plumbing Code.

2.7. MATERIALS - GENERAL

a. Pipe selected shall have been manufactured in conformity with the latest standards issued by the American Water Works Association, if such standards exist, and be acceptable to the Department.

b. in the absence of such standards, pipe meeting applicable ASTM and ANSI criteria and acceptable to the Department may be selected.

c. Used water mains that meet these standards may be used again, after the pipe has been thoroughly cleaned and restored practically to its original condition.

d. Packing and jointing materials used on the joints of pipe shall meet the standards of the American Water Works Association or the Department.

e. Mechanical joints or slip-on-joints with rubber gaskets are preferred.

2.8. PIPE

2.8.1. Ductile iron pipe shall meet the latest requirements of ANSI/AWWA-C151 for ductile iron pipe. All pipe 6" in diameter or larger shall be ductile iron.

2.8.2. PVC pipe – 2 inch through 4 inch

a. PVC pipe meeting the standards set forth in AWWA C-900 (latest edition) will be accepted for those working pressures as designated by class.

b. SDR 21, Class 200 pressure rated pipe may be used where the working pressure does not exceed 135 psi. The pipe must meet all requirements set forth in ASTM Standard D 2241 for 2-inch through 4-inch designated SDR 21. The pipe must bear the National Sanitation Foundation Testing Laboratories, Inc. seal of approval for potable water, or an approval equal.

c. Provision must be made for contraction and expansion at each joint with flexible ring gaskets made from rubber or other suitable material. Gasket materials shall meet the requirements established in ASTM F477.

d. Joints for PR 200 (pressure rated) pipe (ASTM D2241) shall be manufactured in accordance with ASTM D3139.

e. Lubricants shall be non-toxic and shall not promote biological growth.

f. Solvent cemented joints in the field are not permitted.

g. Forty-foot lengths will be permitted when the engineering specifications contain special conditions for handling such pipe lengths. These conditions shall include provisions for transporting pipe from storage areas to the installation area on specially designed racks to prevent the ends of the pipe from dragging.

h. This policy does not apply to plastic service lines.

2.9. SERVICE LATERALS – Service laterals shall be provided to all lots and dwellings. Multi-unit rental structures may be provided with a single water lateral. In subdivisions, a one (1) inch lateral shall be provided at lot lines within the development. Service laterals should be sized according to the potential hydraulic demand. Engineering justifications for lateral size selection greater than one (1) inch shall be included with the engineer's hydraulic calculations. All laterals shall be copper, type "K".

2.10. VALVE, AIR RELIEF, METER AND BLOW-OFF CHAMBERS

a. Sediment accumulations may be removed through a standard fire hydrant, and compressed air and pumping may be used for dewatering mains through hydrants.

b. At high points in water mains where air can accumulate, provisions shall be made to remove the air by means of hydrants of air relief valves. Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur.

c. Chambers or pits containing valves, blow-offs, meters or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer, nor shall blow-offs or air-relief valves be connected directly to any sewer.

d. Such chambers or pits shall be drained to the surface of the ground where they are not subject to flooding by surface water, or to absorption pits underground.

e. Valves are to be placed at all intersections of water mains but at no time greater than 4000 feet apart.

f. Gate valves shall meet current AWWA C500 standards and be approved by the City.

3. WATER PUMPING FACILITIES

3.1. GENERAL – Pumping facilities shall be designed to maintain the sanitary quality of pumped water. Subsurface pits or pump rooms and inaccessible installations should be avoided. No pumping station shall be subject to flooding.

3.2. LOCATION – The pumping station shall be so located that the proposed site will meet the requirements of the sanitary protection of the water quality, hydraulics of the system and be protected against interruption of service be fire, flood or any other hazard.

3.2.1. Site Protection – The station shall be:

a. elevated to a minimum of one foot above highest recorded flood elevation, or protected to such elevation;

b. accessible at all times unless permitted to be out of service for period of inaccessibility;

c. graded around station so as to lead surface drainage away from the station;

d. protected to prevent vandalism and entrance by unauthorized persons or animals.

3.2.2. Heating – Provision shall be made for adequate heating for the safe and efficient operation of the equipment. In pump houses not occupied by personnel, only enough heat need be provided to prevent freezing of equipment or treatment process.

3.2.3. Ventilation – Adequate ventilation shall be provided for all pumping stations. Forced ventilation of at least 6 changes of air per hour shall be provided for:

a. all rooms, compartments, pits and other enclosures below grade floor;

b. any area where unsafe atmosphere may develop or where excessive heat may be built up.

3.2.4. Dehumidification – In areas where excess moisture could cause hazards to safety or damage to equipment means for dehumidification shall be provided.

3.2.5. Lighting – Pump stations shall be adequately lighted throughout. All electrical work shall conform to the requirements of the American Insurance Association and related agencies, the National Electrical Code, and relevant State and/or local codes.

3.2.6. Landscaping – Dependent upon location of pump station, landscaping may be required.

3.3. PUMPS – At least 2 pumping units shall be provided. Each pumping unit shall be capable of carrying the peak demand. If more than 2 units are installed, they shall have sufficient capacity so that any 1 pump can be taken out of service and the remaining pumps are capable of carrying the peak demand. Pump head and system head curves shall be submitted to the Department for review purposes. The pumping units shall:

a. have ample capacity to supply the peak demand without dangerous overloading;

b. be driven by a prime mover able to operate against the maximum head and air temperature which may be encountered;

c. have spare parts and tools readily available.

RPM pumps are not desirable and should be avoided if at all possible.

3.3.1. Suction Lift – Suction lift pumps will be considered on an individual basis based on justification of design engineer.

3.3.2. Booster pumps – Booster pumps shall be located or controlled so that:

a. they will not produce negative pressure anywhere in the distribution system;

b. the pressure in the suction line shall be maintained at or above 20 psi by the use of a pressure sustaining valve or low pressure cutoff device.

c. automatic or remote control devices shall have a range between the start and cutoff pressure which will prevent excessive cycling.

3.3.3. In-line Booster Pumps – In addition to the other requirements of this section, in-line booster pumps shall be accessible for servicing and repairs.

3.3.4. Fire pumps shall be designed in accordance with similar criteria.

3.4. AUTOMATIC AND REMOTE CONTROLLED STATIONS – All automatic stations should be provided with automatic signaling apparatus which will report when the station is out of service. All remote controlled stations shall be electrically operated and controlled and shall have signaling apparatus of proven performance. Installation of electrical equipment shall conform with the National Electrical Code.

3.5. APPURTENANCES

3.5.1. Valves – Pumps shall be adequately valved to permit satisfactory operation, maintenance and repair of the equipment. If foot valves are necessary they shall have a net valve area of at least 2 ½ times the area of the suction pipe and they shall be screened. Each pump shall have a positive acting valve on the discharge side between the pump and shutoff valve.

3.5.2. Piping – In general, piping shall:

a. be designed so that the friction head will be minimized;

b. not be subject to contamination;

c. have watertight joints;

d. be protected against surge or water hammer;

e. be such that each pump has an individual suction line or the lines shall be so manifolded that they will insure similar hydraulic and operation conditions.

3.5.3. Gauges and Meters – Each pump shall:

a. have a standard pressure gauge on its discharge line;

b. have a compound gauge on its suction line;

c. have recording gauges in larger stations;

d. have a means for measuring the discharge.

The larger stations should have indicating, totaling and recording metering of the total water pumped.

3.5.4. Water Seals – Water seals shall not be supplied with water of a lesser sanitary quality than that of the water being pumped.

3.5.5. Controls – Pumps, their prime movers and accessories, shall be controlled in such a manner that they will operate at rated capacity without dangerous overload. Where two or more pumps are installed, provision shall be made for proper alternation. Provision shall be made to prevent operation of the pump during the backspin cycle. Electrical controls should be located above grade.

3.5.6. Auxiliary Power Supply – When automatic pre-lubrication of pump bearings is necessary, and an auxiliary power supply is provided, the pre-lubrication line shall be provided with a valved by-pass around the automatic control.

4. SANITARY SEWER COLLECTION SYSTEM

4.1. SYSTEM DESIGN

4.1.1. Design Period

a. Collection Sewers (Laterals and Submains) – Collection sewers should be designed for the ultimate development of the tributary areas.

b. Main, Trunk and Interceptor Sewers – Selection of the design period for trunk and interceptor sewers should be based on evaluation of economical, functional, and other considerations. Some of the factors that should be considered in the evaluation are:

1. Possible solids deposition, odor, and pipe corrosion that might occur at initial flows

2. Population and economic growth projections and the accuracy of the projections.

3. Comparative costs of staged construction alternatives.

4. Effect of sewer sizing on land use and development.

4.1.2. Design Basis

New sewer systems shall be designed on the basis of per capita flows or alternative methods. Documentation of the alternative methods shall be provided.

4.1.2.1. Per Capita Flow

New sewer system designed on the basis of an average daily per capita flow may be designed for flow equal to that set forth in Appendix 3. These figures are assumed to cover normal infiltration and inflow, but an additional allowance should be made where conditions are unfavorable. If there is an existing water system in the area, water consumption figures can be used to help substantiate the selected per capita flow. Generally, the sewers should be designed to carry, when running full, not less than the following:

a. Lateral and Submains: Minimum peak design flow should be not less than 400 percent of the average design flow.

   "Lateral" is defined as a sewer that has no other common sewers discharging into it.

   "Submain" is defined as a sewer that receives flow from one or more lateral sewers.

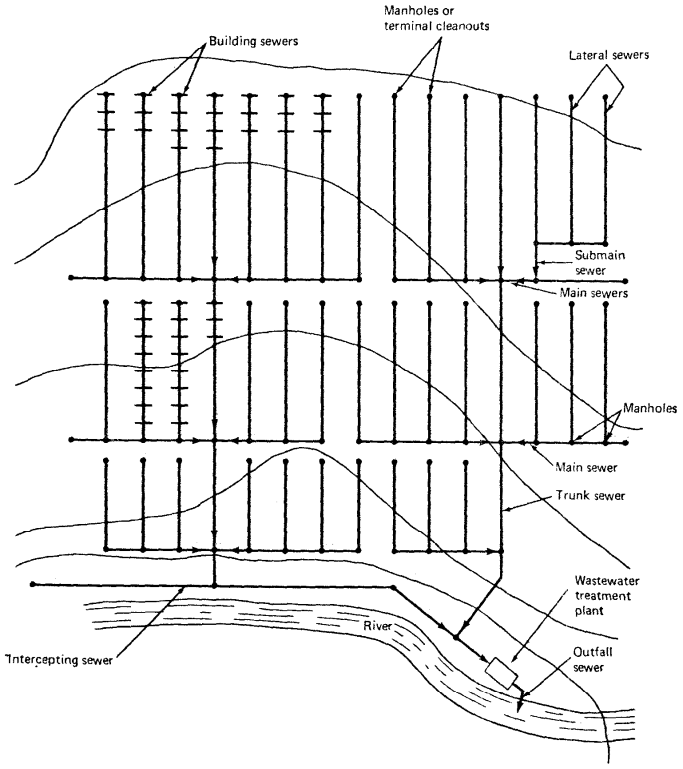
b. Main, Trunk, and Interceptor Sewers: Minimum peak design flow should be not less than 250 percent of the average design flow.

"Main" or "trunk" is defined as a sewer that receives flow from one or more submains.

"Interceptor" is defined as a sewer that receives flow from a number of main or trunk sewers, force mains, etc.

The illustration on the following page depicts the differences between a lateral, submain, main, trunk, and interceptor sewers.

Lateral, Submain, Trunk, & Interceptor Sewer Illustration



4.1.2.2.Alternative Methods

New sewer systems may be designed by alternative methods other than on the basis of per capita flow rates. Alternative methods may include the use of peaking factors of the

contributing area, allowances for future commercial and industrial areas, separation of infiltration and inflow from the normal sanitary flow, and modification of per capita flow rates (based on specific data). Documentation of the alternative method used shall be provided. When infiltration is calculated separately from the normal sanitary flow, the maximum allowable infiltration rate shall be 25 gallons per day inch diameter of the sewer per mile of sewer.

4.1.3. Design Factors

The following factors must be considered in the design of sanitary sewers:

a. Peak sewage flows from residential, commercial, institutional, and Industrial sources

b. Groundwater infiltration and exfiltration

c. Topography and depth of excavation

d. Treatment plant location

e. Soils conditions

f. Pumping requirements

g. Maintenance, including manpower and budget

h. Existing sewers

i. Existing and future surface improvements

j. Controlling service connection elevations

4.2. DESIGN AND CONSTRUCTION DETAILS

4.2.1. Gravity Sewers

4.2.1.1. Minimum Size

No public sewer shall be less than 8 inches in diameter. Service laterals shall be a minimum of 6” in diameter extending to the lot of parcel line. Ends of service lines shall be plugged with a machine made cap. A vertical 4”x 4”

wooden post shall be located from the end of the cap to the ground surface for lateral identification purposes.

4.2.1.2.Depth

All gravity sewer lines shall have a minimum of 3 feet of cover when located in roadways and 2 – ½ feet of cover when located in open spaces. The depth of cover is measured to the top of the pipe. Whenever possible, manholes should be installed outside paved areas and within 5 feet of the outside face of the curb.

4.2.1.3.Roughness Coefficient

The roughness coefficient should be documented for the type of pipe used. However, for ease of calculations, an "n" valve of 0.0115 for PVC pipe and 0.015 for ductile iron pipe may be used in Manning's formula for the design of sewer facilities.

4.2.1.4.Slope

All conventional gravity sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second. The following minimum slopes should be provided; however, slopes greater than these are desirable:

Table 4-1

Sewer Size (inches)	Minimum Slope (feet per 100 feet)
6	0.38
8	0.26
10	0.193
12	0.151
14	0.123
15	0.112
16	0.103
18	0.088
21	0.072
24	0.060
27	0.051
30	0.045
36	0.035
42	0.028
48	0.024

Under special conditions, slopes slightly less than those required for the 2.0-feet-per-second velocity when flowing full may be permitted. Such decreased slopes will only be considered where the depth of flow will be 0.3 of the diameter or greater for design average flow. Whenever such decreased slopes are proposed, the design engineer shall furnish with his report his computations of the depths of flow in such pipes at minimum, average, and daily or hourly rates of flow. The City of Johnson City Water and Sewer Department must recognize and accept in writing the problems of additional maintenance caused by decreased slopes.

Sewers shall be laid with uniform slope between manholes.

Sewers on 18 percent slope or greater shall be anchored securely with concrete anchors or equal. Suggested minimum anchorage spacing is as follows:

a. Not over 36 feet center to center on grades 18 percent and up to 25 percent.

b. Not over 24 feet center to center on grades 25 percent and up to
35 percent.

c. Not over 16 feet center to center on grades 35 percent and over.

4.2.1.5. Alignment

Generally, gravity sewers shall be designed with straight alignment between manholes. However, curved sewers may be approved where circumstances warrant, but only in large (i.e., 36" and larger) diameter segments.

4.2.1.6. Increasing Size

Where a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An approximate method for securing these results is to place the 0.8 depth point of both sewers at the same elevation.

4.2.1.7. High-Velocity Protection

Where velocities greater than 15 feet per second are expected, special provision shall be made to protect against internal erosion or displacement by shock.

4.2.2. Materials

In general, pipe 15" or smaller shall be PVC unless otherwise specified. Pipe larger than 15" shall be ductile iron or PVC. When ductile iron is specified for any part of a sewer, it must be specified from manhole to manhole and must be coated on the interior. The PVC pipe 15" or larger in diameter shall be solid wall type, no open rib or closed profile types will be allowed. Jointing two different types of pipe between manholes will not be permitted. Due to maintenance considerations, the City requires that all lateral sewer service lines at depths greater than 15 feet be constructed of ductile iron.

4.2.2.1. Semi-rigid Pipe

Shall include, but not be limited to, ductile iron pipe. For ductile iron pipe, an epoxy lining is required. The material must be a high build multi-component Amine cured Novalac Epoxy lining. The lining shall be Protecto 401 Ceramic Epoxy or approved equal. Polyethylene linings are not acceptable. All pipe should meet the appropriate ASTM and/or ANSI specifications.

4.2.2.2. Flexible Pipe

Shall include, but not be limited to, polyvinyl chloride pipe (PVC), polyethylene pipe (PE), fiberglass composite pipe, reinforced plastic mortar pipe (RPM) and reinforced thermosetting resin pipe (RTR). PVC pipe should have a maximum Standard Dimension Ratio (SDR) of 35 or conform to ASTM F-789. All other flexible pipe that is not classified by the SDR system should have the same calculated maximum deflection under identical conditions as the SDR 35 PVC pipe.

Flexible pipe deflection under earth loading may be calculated using the formula presented in the ASCE/WPCF publications, Design and Construction of Sanitary and Storm Sewers.

All pipe should meet appropriate ASTM and/or ANSI specifications. It should be noted that ASTM D-3033 and D-3034 PVC pipes differ in wall thickness and have non interchangeable fittings.

4.2.3. Pipe Bedding

All sewers shall be designed to prevent damage from superimposed loads. Proper allowance for loads on the sewer shall be made because of the width and depth of trench. Trench widths should be kept to a minimum. Backfill material up to three feet above the top of the pipe should not exceed 6 inches in diameter at its greater dimension.

As a general rule, in roadways where cover is less than 4 feet, ductile iron pipe, solid wall flexible plastic pipe, or concrete encasement shall be used. In such cases, a minimum cover of six inches (12 inches for solid wall flexible plastic pipe) is required. For structural reasons, ductile iron pipe, concrete encasement, or relocation shall be required when culverts or other conduits are laid such that the top of the sewer is less than 18 inches below the bottom of the culvert or conduit.

Uncased borings are not permitted for pipe larger than 3 inches.

Special care shall be used in placing bedding in the haunch region.

4.2.3.1. Semi-rigid Pipe

Bedding Classes, I and II (ML and CL only) as described in ASTM D-2321 shall be used for all semi-rigid pipe provided with the specified bedding to support the anticipated load. Class I material is defined as angular, ¼ to 1 inch graded stone including a number of fill materials that have regional significance such as crushed stone, cinders, slag and crushed shells. Class II material is defined as coarse sands and gravels with a maximum particle dimension of 1 – ½ inch including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry.

Underground installation of ductile iron shall be installed as per ASTM A-746.

4.2.3.2. Flexible Pipe

Bedding Class I as described in ASTM D-2321 shall be used for all flexible pipe provided that the proper strength pipe is used with the specified bedding to support the anticipated load.

Bedding, haunching, initial backfill, and backfill shall be placed in accordance to ASTM D-2321.

It is recommended that polyethylene pipe be installed with Class I bedding material for bedding, haunching, and initial backfill as described in 2.4.3.4.

4.2.3.3. Alternate Bedding Option

As an alternative to sub-sections 4.2.3.1. and 4.2.3.2. all sewers shall be bedded and backfilled with a minimum of six inched of Class I material over the top and below the invert of the pipe.

4.2.3.4. Deflection Testing

Deflection testing of all flexible pipe shall be required. The test shall be conducted after the backfill has been in place at least 24 hours.

No pipe shall exceed a deflection of 5%.

The test shall be run with a rigid ball or an engineer-approved 9-arm mandrel having a diameter equal to 95% of the inside diameter of the pipe. The test must be performed by manually pulling the test device through the line.

4.2.3.5. Check Dams

Check dams shall be installed in the bedding and backfill of all new or replaced sewer lines to limit the drainage area subject to the french drain effect of gravel bedding. Major rehabilitation projects should also include check dams in the design. Dams shall consist of compacted clay bedding and backfill at least three (3) feet thick to the top of the trench and cut into the walls of the trench two (2) feet. Alternatively, concrete may be used, keyed into the trench walls. Dams shall be placed no more than 500 feet apart.

The preferred location is upstream of each manhole. All stream crossings will include check dams on both sides of the crossing.

4.2.4. Joints

The method of making joints and the materials used should be included in the specifications. Sewer joints shall be designed to eliminate infiltration and exfiltration to prevent the entrance of roots.

Elastomeric gaskets, other types of pre-molded (factory made) joints are required. The butt fusion joining technique is acceptable for polyethylene pipe. On concrete pipe of 36" and greater diameter, the Anderson type joint shall be required. Cement mortar joints are not acceptable. Field solvent welds for PVC and PE pipe and fittings are not acceptable.

4.2.5. Leakage Testing

Leakage tests shall be specified.

4.2.5.1. Low Pressure Air Testing

Low pressure air-testing shall be performed as per ASTM C-828 on all gravity pipe. The time required for the pressure to drop from the stabilized 3.5 psig to 2.5 psig should be greater than or equal to the minimum calculated test time (the test criteria should be based on the air loss rate). The testing method should take into consideration the range in groundwater elevations projected and the situation during the test. The height of the groundwater should be measured from the top of the invert (one foot of H_2O = 0.433 psi). Table 4-2 gives the minimum test times for this pressure drop to occur for various pipe sizes per 100 ft.:

Table 4-2 Specification Time for Length Shown

Pipe Diameter	100'	150'	200'	250'	300'	350'	400'	450'
6"	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8"	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10"	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12"	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15"	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18"	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21"	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24"	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27"	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30"	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33"	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36"	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

4.2.6. Manholes

4.2.6.1. Location

Manholes shall be installed at the end of each line of 8-inch diameter or greater unless the 8-inch line is expected to be extended in the foreseeable future; in which case a cleanout shall be installed at the end of the line; at all changes in grade, size, or alignment; at all intersections; and at distances not greater than 400 feet. Cleanouts may be used in lieu of manholes at the end of lines that are 6 inches in diameter and not more than 150 feet long.

4.2.6.2. Drop Connection

An outside drop connection shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert should be filleted to prevent solids deposition.

4.2.6.3. Diameter

The minimum diameter of manholes shall be 48 inches; larger diameters are preferable. The minimum clear opening in the manhole frame shall be 24 inches to provide safe access for emergencies.

Manholes connecting significant industries to the system should be larger, to provide space for monitoring and sampling equipment.

4.2.6.4. Flow Channels

Flow channels in manholes shall be of such shape and slope to provide smooth transition between inlet and outlet sewers and to minimize turbulence. A minimum slope of 0.1 ft. drop across the bottom of the manhole must be provided to maintain cleaning and the hydraulic gradient. Channeling height shall be to the crowns of the sewers. Benches shall be sloped from the manhole wall toward the channel to prevent accumulation of solids.

4.2.6.5. Watertightness

Watertight manhole covers shall be used wherever the manhole tops may be flooded. Manholes of brick or segmented block are not acceptable.

4.2.6.6. Testing

All new or rehabilitated manholes shall be vacuum tested to assure watertightness before backfilling. The exterior surface must be painted with waterproofing material as the vacuum is being pulled to seal the pores of the concrete.

The developer and/or contractor shall be responsible for providing all labor and necessary testing equipment required for the testing of installed sewer lines and manholes which connect to the City's system. These installed lines and manholes include private lines and those that are to be dedicated to the City of Johnson City. All testing must be witnessed and accepted by an appropriate official of the City of Johnson City.

4.2.6.7. Connections

Line connections directly to the manholes or to short stubs integral with the manholes should be made with flexible joints. Flexible joints. Flexible joints are joints which permit the manholes to settle without destroying the watertight integrity of the line connections. A maximum of two service line connections will be allowed into end of line manholes, with a minimum of 45 degree alignment differential maintained between them. The angle between them and the downstream sewer main shall not be more than 90 degrees.

4.2.6.8. Ventilation

Ventilation of gravity sewer systems should be considered where continuous watertight sections greater than 1,000 feet in length are incurred. Vent height and construction must consider flood conditions.

4.2.6.9. Materials

Manholes shall be specified as precast concrete. Type II cement shall be used for increased sulfate resistance meeting AASHTO M-199SR or ASTM C-478 standards. The precast manhole base shall provide flexible joints for pipe connection. O-ring or "double mastic" joints in accordance with ASTM C-443 or ASTM C-361 shall be used at all joints between sections in sanitary sewer manholes.

4.2.6.10. Frame, Covers, and Steps

Frames, covers, and steps shall be of suitable material and designed to accommodate prevailing site conditions and to provide for a safe installation. Materials used for manhole steps should be highly corrosion-resistant meeting ASTM C-478 standards. The use of galvanized steel should be avoided and aluminum or plastic with reinforcing bar is preferred.

4.3. SPECIAL DETAILS

4.3.1. Protection of Water Supplies

4.3.1.1. Water supply Interconnections

There shall be no physical connection between a public or private potable water supply system and a sewer or appurtenance thereto.

4.3.1.2. Relation to Waterworks Structures

It is generally recognized that sewers shall be kept remote from public water supply wells or other water supply sources and structures.

4.3.1.3. Relation to Water Mains

Horizontal Separation: Whenever practical, sewers should be laid at least 10 feet horizontally from any existing or proposed water main. The distance should be measured edge to edge. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if it is laid in a separate trench and if the elevation of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.

Vertical Separation: Whenever sewers must cross under water mains, the sewer shall be laid at such elevation that the top of the sewer is at least 18 inched below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirement, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be

centered over the sewer so that both joints will be as far from the sewer as possible.

When it is impractical to obtain proper horizontal and vertical separation as stipulated above, the sewer shall be designed and constructed equal to the water main pipe and shall be pressure-tested to assure water-tightness (see drinking water criteria). Such arrangements are discouraged and adequate reason shall be provided to justify the design.

4.3.2. Backflow Preventers

State approved reduced pressure backflow prevention devices are required on all potable water mains serving a sanitary sewage lift station. A list of approved backflow preventers may be obtained from the TDEC Division of Water Supply.

Backflow preventers shall be installed as per the Design Criteria for Community Public Water Systems, Division of Water Supply. Below-ground pit installations are not acceptable.

4.3.3. Sewers in Relation to Streams

4.3.3.1. Location of Sewers in Streams

The top of all sewers entering or crossing streams shall be at a sufficient depth below the natural bottom of the stream bed to protect the sewer line. In general, the following cover requirements must be met:

a. One (1) foot of cover (poured in place concrete) is required where the sewer is located in rock.

b. Three (3) feet of cover is required in stabilized stream channels.

c. Seven (7) feet of cover or more is required in shifting stream channels.

Sewers located along streams shall be located outside of the stream bed and sufficiently removed therefrom to minimize disturbance or root damage to streamside trees and vegetation.

Sewer outfalls, headwalls, manholes, gateboxes or other structures shall be located so they do not interfere with the free discharge of flow of the stream.

Sewers crossing streams shall be designed to cross the stream as nearly perpendicular to the stream flow as possible and shall be free from change in grade. To prevent the french drain effect of the sewer crossing the stream check dams must be installed up stream in the pipe conduit trench. This must be separate from any concrete encasement.

4.3.3.2. Construction

Sewers entering or crossing streams shall be constructed of lined ductile iron pipe with mechanical joints, concrete encased, or shall be so otherwise constructed that they will remain watertight and free from changes in alignment or grade. Sewer systems shall be designed to minimize the number of stream crossings. The construction methods that will minimize siltation shall be employed. Upon completion of construction, the stream shall be returned as nearly as possible to its original condition. The stream banks shall be seeded, planted or other erosion prevention methods employed to prevent erosion. Stream banks shall be sodded, if necessary, to prevent erosion. Where tree canopy has been removed, replacement trees shall be planted of natural species. The consulting engineer shall specify the specific method or methods to be employed in the construction of the sewers in or near the stream to control siltation.

During construction of sewerage projects, the contractor shall be prohibited by clauses in the specifications from unnecessarily disturbing or uprooting trees and vegetation along the stream bank and in the vicinity of the stream, dumping of soil and debris into streams and/or on banks of streams, changing course of the stream without encroachment permit, leaving cofferdams in streams, leaving temporary stream crossings for equipment, operating equipment in the stream, or pumping silt-laden water into the stream.

Provisions shall be made in the specifications to retard the rate of runoff from the construction site and control disposal of runoff, including liberal use of entrenched silt fencing to trap sediment resulting from construction in temporary or permanent silt-holding basins, including pump discharges

resulting from dewatering operations; to deposit out of the flood plain area all material and debris removed from the stream bed.

Specifications shall require that cleanup, grading, seeding, planting or restoration of the work area shall be carried out as early as practical as the construction proceeds.

Uncased borings are not permitted unless approved by engineer.

The design engineer is encouraged to read and become familiar with the Tennessee Erosion and Sediment Control Handbook available from the Tennessee Department of Environment and Conservation.

4.3.3.3. Special Construction Requirements

Special design requirements shall be employed to prevent stream drainage from sinking at the crossing and following along the sewer pipe bedding. This can be accomplished with an in-trench impounding structure of compacted clay or other impermeable materials. Other proposals will be considered.

4.3.3.4. Aerial Crossings

Sewers laid on piers across ravines or streams shall be allowed when it can be demonstrated that no other practical alternative exists or, in the design engineer's judgement, other methods will not be as reliable. Support shall be provided for all joints. All supports shall be designed to prevent frost heave, overturning or settlement. Precautions against freezing, such as insulation or increased slope, shall be provided. Expansion jointing shall be provided between above-ground and below-ground sewers. The impact of flood waters and debris shall be considered. The bottom of the pipe should be placed no lower than the elevation of the fifty (50) year flood stage.

4.3.3.5. Permits

It shall be the developer's responsibility to obtain all necessary permits along streams or rivers; i.e., Corps of Engineers, TVA, or the Natural Resources Section of the Division of Water Pollution Control.

4.3.4. Sewers in Relation to Storm Drainage Infrastructure – No sanitary sewer shall be located in a detention basin or other drainage structure. Sanitary sewer pipe and manholes shall not be located in or underneath the dam or dike of the detention basin nor located anywhere within ten feet horizontally of the projected maximum high water line of the water in the detention basin.

5. WASTEWATER PUMPING FACILITIES

5.1. GENERAL

5.1.1. Location and Flood Protection

Sewage pump stations should be located as far as practicable from present or proposed built-up residential areas, and an all-weather road shall be provided. Noise control, odor control, and station architectural and landscaping design should be taken into consideration. Sites for stations shall be of sufficient size for future expansion or addition, if applicable. The station site for all above ground stations shall also be fenced and locked.

The station's operational components shall be located at an elevation that is not subject to the 100-year flood or shall otherwise be adequately protected against the 100-year flood damage. The top (floor) of the pumping station shall be a minimum of 6 inches above the finished grade of the site around the station.

Where the wet well is at a depth greater than the watertable elevation, special provisions shall be made to ensure water tight construction of the wet well. Any connections to the pump station should be made at an elevation higher than the maximum watertable elevation, where possible.

The site for the pump station shall be a minimum of 25 feet by 25 feet in size. Larger sites will be required dependent upon the size of the station. In remote areas where there is a good possibility of vandalism, a chain link fence shall be provided around the site. The site shall be large enough to allow Water and Sewer Department maintenance trucks to turn around on the site.

For accessibility, a 25 foot right-of-way shall be provided for all pumping stations. The width of an access road shall be 12 feet minimum. Depth of compacted stone shall be a minimum of 10 inches. Storm drainage ditches and culverts shall be provided. All graded areas along the access road shall be sloped with at least a minimum 2:1 (horizontal:vertical). All graded areas shall be satisfactorily seeded and mulched. Vertical gradient for the access road shall not exceed 12%. Provisions shall include sufficient right-of-way for overhead power and telephone service.

5.1.2. Pumping Rate and Number of Units

At least two pump units shall be provided, each capable of handling the expected maximum flow. Pump head and system head curves shall be submitted to the Department for review purposes.

Where three or more units are provided, they shall be designed to fit actual flow conditions and must be of such capacity that, with any one unit out of service, the remaining units will have capacity to handle the maximum sewage flow. The number of pump units may be controlled by the reliability classification of the adjacent receiving waters.

When the station is expected to operate at a flow rate less than one half the average design flow for an extended period of time, the design shall address measures taken to prevent septicity due to long holding times in the wet well.

For standardization purposes, the following pumping stations shall be specified:

a. a Goulds submersible sewage pump as manufactured by the Goulds Pumps, Inc., Seneca Falls, New York,

b. a Sta-Rite submersible grinder pump as manufactured by Sta-Rite Corporation of Salt Lake City, Utah,

c. a Smith and Loveless wet well mounted type as manufactured by Smith and Loveless, Inc., Lenexa, Kansas.

It is preferred that a Goulds pump be installed in a sanitary sewage lift station. However, when a Goulds is not adequate for the conditions, a Sta-Rite grinder pump or Smith and Loveless wet well mounted pump shall be used.

Plans for these standardized pump station can be obtained on disk from the Water & Sewer Department. These standard plans shall be completed and used by a registered professional engineer. The completed plans shall be reviewed and approved by the Engineering and Facility Maintenance Divisions of the Water and Sewer Department.

5.1.3. Grit and Clogging Protection

Where it may be necessary to pump sewage prior to grit removal, the design of the wet well should receive special attention, and the discharge piping should be designed to prevent grit settling in pump discharge lines of pumps not operating.

For large pump stations (generally, larger than 1 MGD) handling raw sewage, consideration should be given to installation of readily accessible bar racks with clear openings not exceeding 2 – ½ inches, unless pneumatic ejectors are used or special devices are installed to protect the pumps from clogging or damage. Where the size of the installation warrants, a mechanically cleaned bar screen with grinder or comminution device is recommended. Where screens are located below ground, convenient facilities must be provided for handling screenings. For the larger or deeper stations, duplicate protection units, each sized at full capacity, are preferred.

5.1.4. Pumping Units

5.1.4.1. Pump Openings

Pumps shall be capable of passing spheres of at least 3 inches in diameter. Pump suction openings shall be at least 4 inched in diameter. Pump discharge openings shall be at least 2" in diameter for Sta-Rite grinder pumps and 4" in diameter for Smith & Loveless and Goulds pumps.

5.1.4.2. Priming

Pumps shall be so placed that under normal operating conditions they will operate under a positive suction head (except for suction lift pumps).

5.1.4.3. Intake

Each pump shall have an individual intake. Wet well design should be such as to avoid turbulence near the intake.

5.1.4.4. Controls

Control float switches should be so located as not to be affected by the flows entering the wet well or by the suction of the pumps. Controls must be able to activate additional pumps if water in the wetwell continues to rise. Provisions should be made to automatically alternate the pumps in use. Pump stations with motors and/or controls below grade should be equipped with a secure external disconnect switch.

If float switches are used, an “intrinsically safe” power source must be considered.

5.1.5. Flow Measurement

Suitable devices for measuring sewage flow should be provided at pumping stations with flow capacity greater than 1.0 million gallons per day (mgd). Hour timers (totalizers) shall be installed on all pumps unless otherwise approved by the Department.

5.1.6. Alarm System

An alarm system shall be provided for all pumping stations. Consideration of telemetry alarm to 24-hour monitoring stations or telephone alarms to duty personnel shall be given when reliability classifications or property damage warrants it. When telemetry is not used, an audiovisual device should be installed at the station for external observation.

Alarms for high wet well and power failure shall be provided, as a minimum, for all pump stations. For larger stations, alarms signalizing pump and other component failures or malfunctions should also be provided.

A backup power supply, such as a battery pack with an automatic switchover feature, should be provided for the alarm system, such that a failure of the primary power source will not disable the alarm system. Test circuits should be provided to enable the alarm system to be tested and verified that it is in good working order.

5.1.7. Emergency Overflow Pumping

Regardless of the type of emergency power standby system provided, a riser from the force main with rapid connection capabilities and appropriate valving shall be provided for all lift stations to hook up portable pumps.

5.2. SPECIAL DETAILS

5.2.1. General

5.2.1.1.Materials

In the selection of materials, consideration should be given to the presence of hydrogen sulfide and other corrosive

gases, greases, oils, and other constituents frequently present in sewage.

5.2.1.2. Electrical Equipment

Electrical systems and components (e.g., motors, lights, cables, conduits, switchboxes, control circuits) in enclosed or partially enclosed spaces where flammable mixtures occasionally may be present (including raw sewage wet wells) shall comply with the National Electrical Code requirements for Class I Division 1 locations.

5.2.1.3. Water Supply

There shall be no physical connection between any potable water supply and a sewage pumping station which under any conditions might cause contamination of the potable water supply. If a potable water supply is brought to the station, it shall comply with conditions stipulated in section 4.3.2.

5.2.1.4. Lighting

Adequate lighting for the entire pump station shall be provided.

5.2.1.5. Pump and Motor Removal

Provisions shall be made to facilitate removing pumps, motors, and other equipment, without interruption of system service.

5.2.1.6. Access

Suitable and safe means of access should be provided to equipment requiring inspection or maintenance. Stairways and ladders shall satisfy all OSHA requirements.

5.2.1.7. Valves and Piping

Suitable shutoff valves shall be placed on suction and discharge lines of each pump for normal pump isolation. A check valve should be placed on each discharge line between the shutoff valve and the pump. Pump suction and discharge piping should not be less than 4 inches in diameter except where design of special equipment allows. The velocity in the suction line should not exceed 6 feet per second and, in

the discharge piping, 8 feet per second. A separate shutoff valve is desirable on the common line leaving the pump station.

5.2.1.8. Ventilation

Ventilation should be provided for all pump stations during all periods when the station is manned. Where the pump is below ground, mechanical ventilation is required and should be arranged so as to independently ventilate the dry well. If screens or mechanical equipment, which might require periodic maintenance and inspection, are located in the wet well, then it should also be mechanically ventilated. There should be no interconnection between the wet well and the dry well ventilation systems. In pits over 15 feet deep, multiple inlets and outlets are desirable. Dampers should not be used on exhaust or fresh air ducts, and fine screens or other obstructions in air ducts should be avoided to prevent clogging. Switches for operation of ventilation equipment should be marked and conveniently located above grade and near the pump station entrance.

Consideration should be given also to automatic controls where intermittent operation is used. The fan wheel should be fabricated from nonsparking material. In climates where excessive moisture or low temperature is a problem, consideration should be given to installation of automatic heating and/or dehumidifying equipment. Where heat buildup from pump motors may be a problem, consideration should be given to automatic ventilation to dissipate motor heat.

5.2.2. Wet Well – Dry Well Stations

5.2.2.1. Separation

Wet and dry wells, including their superstructures, should be completely separated.

Where continuity of pump station operation is necessary, consideration should be given to dividing the wet well into two sections, properly interconnected, to facilitate repairs and cleaning.

5.2.2.2. Wet Well Size

The effective capacity of the wet well should be evaluated based on pumping requirements and reliability classifications.

5.2.2.3. Floor Slope

The wet well floor should have a minimum slope of 1-to-1 in the hopper bottom. The horizontal area of the hopper bottom should be no greater than necessary for proper installation and function of the inlet.

5.2.2.4. Ventilation

Wet Well ventilation may be either continuous or intermittent. Ventilation, if continuous, should provide at least 12 complete air changes per hour; if intermittent, at least 30 complete air changes per hour. Such ventilation should be accomplished by introduction of fresh air into the wet well by mechanical means.

Dry well ventilation may be either continuous or intermittent. Ventilation, if continuous, should provide at least 6 complete air changes per hour; if intermittent, at least 30 complete air changes per hour.

Portable ventilation equipment is acceptable for small pump stations where occupancy is rare.

5.2.2.5. Dry Well Dewatering

A separate sump pump should be provided in the dry wells to remove leakage or drainage with the discharge above the high water level of the wet well. Water ejectors connected to a potable water supply will not be approved. All floor and walkway surfaces should have an adequate slope to a point of drainage.

5.2.3. Suction Lift Stations

5.2.3.1. Priming

Conventional suction-lift pumps should be of the self-priming type, as demonstrated by a reliable record of satisfactory operation. The maximum recommended lift for a suction lift pump station is 15 feet, using pumps of 200 gallons per minute (gpm) capacity or less.

5.2.3.2. Capacity

The capacity of suction lift pump stations should be limited by the net positive suction head and specific speed requirements, as stated on the manufacturer's pump curve, for the most severe operating conditions.

5.2.3.3. Air Relief

a. Air Relief Lines

All suction lift pumps must be provided with an air relief line on the pump discharge piping. This line should be located at the maximum elevation between the pump discharge flange and the discharge check valve to ensure the maximum bleed-off of entrapped air. Air relief piping shall be sized appropriately. A separate air relief line shall be provided for each pump discharge. The air relief line should terminate in the wet well or suitable sump and be open to the atmosphere.

b. Air Relief Valves

Air relief valves should be provided in air relief lines on pumps not discharging to gravity sewer collection systems. The air relief valve should be located as close as practical to the discharge side of the pump.

5.2.3.4. Pump Location

Suction lift pumps shall not be located within the wet well.

5.2.3.5. Access to Wet Well

Access to the wet well should not be through the dry well, and the dry well should have a gastight seal when mounted directly above the wet well.

5.2.4. Submersible Pumps

5.2.4.1. Pump Removal

Submersible pumps shall be readily removable and replaceable without dewatering the wet well or requiring

personnel to enter the wet well. Continuity of operation of the other units shall be maintained.

A hoist and accessories for removing the pumps from the wet well should be provided.

5.2.4.2. Controls

The control panel shall be located outside the wet well and suitably protected from weather, humidity, and vandalism.

5.2.4.3. Valves

All control valves on the discharge line for each pump should be placed in a convenient location outside the wet well in separate pits and be suitably protected from weather and vandalism. Outside valve covers should not be installed.

5.2.4.4. Submergence

Positive provision, such as backup controls, should be made to assure submergence of the pumping units.

5.3. OPERABILITY AND RELIABILITY

5.3.1. Objective

The objective of reliability is to prevent the discharge of raw or partially treated sewage to any waters and to protect public health by preventing backup of sewage and subsequent discharge to basements, streets, and other public and private property.

5.3.2. Backup Units

A minimum of two pumps shall be provided in each station in accordance with section 5.1.2.

5.3.3. Emergency Power Supply

5.3.3.1. General

Provision of an emergency power supply for pumping stations should be made, and may be accomplished by connection of the station to at least two independent public utility sources, or by provision in-place internal combustion engine equipment that will generate electrical or mechanical

energy, or by the provision of portable pumping equipment. Emergency power must be provided for all stations.

Emergency power shall be provided that, alone or combined with storage, will prevent overflows from occurring during any power outage that is equal to the maximum outage in the immediate area during the last 10 years. If available data are less than 10 years, an evaluation of a similar area served by the power utility for 10 years would be appropriate.

5.3.3.2. In-Place Equipment

Where in-place internal combustion equipment is utilized, the following guidelines are recommended:

a. Placement

The unit should be bolted in place. Facilities should be provided for unit removal for purposes of major repair or routine maintenance.

b. Controls

Provision should be made for automatic and manual startup and cut-in.

c. Size

Unit size should be adequate to provide power for lighting and ventilating systems and such further systems that affect capability and safety as well as the pumps.

d. Engine Location

The unit internal combustion engine should be located above grade, with suitable and adequate ventilation of exhaust gases.

e. Underground Fuel Storage Tank

If the fuel tank for the generator is to be placed below ground level, design and construction must conform to the applicable requirements of Federal Regulations 40 CFR 280 and 281. Contact the Tennessee Division of Superfund, Underground Storage Tank Program, for guidance.

5.3.3.3. Portable Equipment

Where portable equipment is utilized, the following guidelines are recommended:

Pumping units should have connections to operate between the wetwell and the discharge side of station, and the station should be provided with permanent fixtures that will facilitate rapid and easy connection of lines. Electrical energy generating units should be protected against burnout when normal utility services are restored, and should have sufficient capacity to provide power for lighting and ventilating systems and any other station systems affecting capability and safely, in addition to the pumping units.

5.3.4. Storage

Where storage is provided in lieu of an emergency power supply, wet well and tributary main capacity above the high-level alarm should be sufficient to hold the peak flow expected during the maximum power outage duration during the last 10 years.

5.4. FORCE MAINS

5.4.1. Size

Minimum size force mains should be not less than 4 inches on diameter, except for grinder pump, septic tank effluent or vacuum applications.

5.4.2. Velocity

At pumping capacity, a minimum self-scouring velocity of 2 feet per second (fps) should be maintained unless flushing facilities are provided. Velocity should not exceed 8 feet per second.

5.4.3. Air Relief Valve

An air relief valve shall be placed at the necessary high points in the force main where the elevation differential is greater than 5 vertical feet to relieve air locking. Air relief valves must be installed in a container approved by the City which shall be flush with the ground level.

5.4.4. Termination

The force main shall enter the receiving manhole with its centerline horizontal and with an invert elevation that will ensure a smooth flow transition to the gravity flow section; but in no case shall the force main enter the gravity sewer system at a point more than 1 foot above the flow line of the receiving manhole. The design should minimize turbulence at the point of discharge.

Consideration should be given to the use of inert materials or protective coatings for the receiving manhole to prevent deterioration as a result of hydrogen sulfide or other chemicals where such chemicals are present or suspected to be present because of industrial discharges or long force mains.

5.4.5. Materials of Construction

The pipe material should be adapted to local conditions, such as character of industrial wastes, soil characteristics, exceptionally heavy external loadings, internal erosion, corrosion, and similar problems. All pipe material shall be PVC or ductile iron.

Installation specification shall contain appropriate requirements based on the criteria, standards, and requirements established by the industry in its technical publications. Requirements shall be set forth in the specifications for the pipe and methods of bedding and backfilling thereof so as not to damage the pipe or its joints, impede cleaning operations, not create excessive side sill pressures or ovalation of the pipe, nor seriously impair flow capacity.

All pipes shall be designed to prevent damage from superimposed loads. Proper allowance for loads on the pipe shall be made because of the width and depth of trench.

Where ductile iron pipe is used in a force main, a special interior coating shall be used at all high points in the force main for a distance of at least 50 feet on either side of the high point of the force main.

5.4.6. Pressure Tests

Before backfilling, all force mains shall be tested at a minimum pressure of at least 50 percent above the design operating pressure for at least 30 minutes. Leakage shall not exceed the amount given by the following formula:

$$L = \frac{ND(P)}{7{,}400}^{0.5}$$

Where L is allowable leakage in gallons per hour,

N is the number of pipe joints (18 foot joints),

D is the pipe diameter in inches,

P is the test pressure in psi.

5.4.7. Anchorage

Force mains shall be sufficiently anchored within the pump station and throughout the line length. The number of bends shall be as few as possible. Thrust blocks, restrained joints, and/or tie rods shall be provided where restraint is needed.

5.4.8. Friction Losses

A C factor shall be used that will take into consideration the conditions of the force main at its design usage. A pipe that is coated with grease after several years will not have the same C factor as it did when it was first placed into operation.

5.4.9. Water Hammer

The force main design shall investigate the potential for the existence of water hammer.

5.4.10. Location

Force mains may be installed within the same ditch line as gravity sewer provided that the same spacing requirement regarding to water lines is maintained. Special care shall be provided to protect both the force main and the gravity sewer during construction and during the operation of the sanitary sewer system.

5.4.11. Gate or Plug Valve

Just outside the sewage lift station, a gate or plug valve shall be located in the force main.

6. EROSION CONTROL

6.1. GENERAL

Temporary control measures as shown in the plans shall be used to control erosion and water pollution through the use of berms, dikes, dams, sediment basins, fiber mats, netting, mulched, grasses, slope drains, temporary silt fences, and other control devices.

The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control features to assure economical, effective, and continuous erosion control throughout the construction and post-construction period.

6.2. MATERIALS

6.2.1. Temporary Berms

A temporary berm is constructed of compacted soil, with or without a shallow ditch, at the top of fill slopes or transverse to centerline on fills. These berms are used temporarily at the top of newly constructed slopes to prevent excessive erosion until permanent controls are installed or slopes stabilized.

6.2.2. Temporary Slope Drains

A temporary slope drain is a facility consisting of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe, sod or other material acceptable to the Water and Sewer Department. Temporary slope drains are used to carry water down slopes to reduce erosion.

6.2.3. Sediment Structures

Sediment basins, ponds, and traps are prepared storage areas constructed to trap and store sediment from erodible areas. These structures protect properties and stream channels below the construction areas from excessive siltation.

6.2.4. Check Dams

Check dams are barriers composed of logs and poles, large stones or other materials placed across a natural or constructed drainway. Stone check dams shall not be utilized where the drainage area exceeds fifty (50) acres.

Log and pole structures shall not be used where the drainage area exceeds five (5) acres.

6.2.5. Temporary Seeding and Mulching

Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes including waste sites and borrow pits shall be seeded when and where necessary to eliminate erosion.

6.2.6. Brush Barriers

Brush barriers shall consist of brush, tree trimmings, shrubs, plants, and other approved refuse from the clearing and grubbing operations. Brush barriers are placed on natural ground at the bottom of fill slopes where the most likely erodible areas are located to restrain sedimentation particles.

6.2.7. Baled hay or Straw checks

Bales hay or straw erosion checks are temporary measures to control erosion and present siltation. Bales shall be either hay or straw containing five (5) cubic feet or more of material. Baled hay or straw checks shall be used where the existing ground slopes toward or away from the embankment along the toe of slopes, in ditches, or other areas where siltation erosion or water run-off is a problem.

6.2.8. Temporary silt fences

Silt fences are temporary measures utilizing woven wire or other approved material attached to posts with filter cloth composed of burlap, plastic filter fabric, etc., attached to the upstream side of the fence to retain the suspended silt particles in the run-off water.

6.3. CONSTRUCTION REQUIREMENTS

The City of Johnson City has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, the surface earth material exposed by excavation, borrow and fill operations and to direct the contractor to provide immediate, permanent, or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses, lakes, ponds or other water impoundment. Such work may involve the

construction of temporary berms, dikes, dams, sediment basins, slope drains and use of temporary mulches, mats, seeding or other control devices or methods as necessary to control erosion.
Cut and fill slopes shall be seeded and mulched as the excavation proceeds to the extent directed by the city.

The contractor shall be required to incorporate all permanent erosion control features into the project at the earliest practicable time. Temporary pollution control measures shall be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices but are not associated with permanent control features of the project.

In the event of conflict between these requirements and pollution control laws, rules or regulations, or other Federal, State or Local agencies, the more restrictive laws, rules or regulations shall apply.

7. MATERIALS AGREEMENT

The materials agreement is a policy of the City of Johnson City which entitles a developer a reimbursement of material costs for the construction of utilities. The agreement is applicable for developments which are constructed within the City of Johnson City's corporate limits. The following criteria must be met by the developer in order to qualify for the financial commitment by the City:

a. Final construction plans and hydraulic calculations must be approved by the Director of the Water and Sewer Department.

b. A material take-off by the developer's licensed engineer must be submitted for approval by the Water and Sewer Department.

c. Ordering and manufacturing of materials shall not begin until the material agreement is approved.

d. Any changes or revisions to the approved plans shall be submitted in writing to the reviewing engineer and the Director of the Water and Sewer Department. After the revised plans are approved, revised estimated quantities shall be submitted in writing and approved.

e. At the completion of the project, a list of the final "as-built" quantities shall be submitted with the "As-Built" plans.

f. Any rejected materials for a development will be picked up by the supplier. A credit shall be issued to the City for all returned items.

g. Any materials which are not utilized in the construction of the project shall be addressed in the same manner as rejected materials.

h. Water booster stations and sanitary sewer lift stations are exempt from material reimbursement but are required to meet all specifications and inspections as required by the Water and Sewer Department.

i. Only material costs for water and wastewater lines 6" or greater in diameter and related appurtenances will be reimbursed by the City. Water meters are not included in this agreement.

8. SUBDIVISION APPROVAL PROCESS

(within corporate limits of the City of Johnson City)

The subdivision process is a cooperative effort between several departments of the City of Johnson City and developers. The major contributors to the process include the Planning Department, the Civil Engineering Department, and the Water and Sewer Department. The subdivision process is a progressive process in that certain steps or procedures must be met prior to continuing to the next step. If all requirements are satisfied as they are required this process is a smooth transition.

The subdivision approval process is generally as follows:

a. The developer approaches the Development Division of the Planning Department with a concept plan.

b. The concept plan is distributed to the Public Works Engineering Department and the Water and Sewer Department for review and comments. (Generally the concept plan does not include utilities.) The purpose for the concept plan is to evaluate the basic layout of the development. This includes lot sizes and positioning, street widths, street stub locations, and aesthetics.

c. The developer has the option to submit a request for concept plan approval to the Johnson City Regional Planning Commission. This approval addresses the issues mentioned in part b. This approval does not allow the developer to begin construction.

d. Once concept approval is granted by the Planning Commission, the developer must retain a Licensed Engineer to begin a detailed design of the development.

e. The developer submits detailed plans to the Development Office. The plans include a site plan, grading plan, utility layout, and related detail sheets. The Development Office distributes these plans to the appropriate departments.

f. The plans are reviewed by the appropriate departments. The Water and Sewer Department analyzes the plans to determine the ability to provide adequate water and sanitary sewer services to the proposed development. The evaluations include a detail analysis of the hydraulic calculations, size of proposed pipes, fire protection, and associated devices. The Water and Sewer Department's evaluation is required since it is expected to accept the utilities upon completion of the project.

g. Review comments from the associated departments are returned to the Development Office and provided to the developer/engineer.

h. Upon revisions being made, steps f. and g. are repeated until the subdivision
plans meet the requirements of the City. The City refers to the Johnson City Subdivision Regulations and applicable state codes for guidance in its review of proposed subdivisions.

i. Upon addressing all review comments, the developer submits the revised plans to the Johnson City Regional Planning Commission for preliminary subdivision approval.

j. The developer shall submit eight (8) complete sets of the construction plans to the Water and Sewer Department. The Director of the Water and Sewer Department will approve the plans for state review once all comments are completed. The hydraulic calculations should be included with the plans.

k. The developer will submit a written request to the Director of the Water and Sewer Department for material reimbursement. The current city policy is to reimburse water and sanitary sewer material costs excluding sales tax for subdivisions located within the corporate limits.

l. A developer's engineer will calculate an estimate of the materials proposed in the development in conjunction with the construction plans having preliminary subdivision approval.

m. The materials cost estimate requires approval by the Johnson City Commission. Upon its approval, the materials are ordered and stocked by the Water and Sewer Department. Ordering and/or manufacturing of materials shall not begin until the material agreement is approved. During the construction phase of the development, any additional materials not anticipated by the materials take-off shall be noted to the Water and Sewer inspector who will contact the appropriate Water and Sewer representative to have the materials released to the developer.

n. A two (2) week notification will be required once the development receives state approval for water and sewer inspection services. Any material which is installed without the consent of the inspector or representative of the City will be required to be removed at the developer's expense. Upon satisfying all the above requirements, the developer may begin construction of the proposed development.

o. During the construction process, the Water and Sewer and Public Works Engineering Departments will conduct inspections to ensure that the development meets the requirements of the City and the approved construction plans.

p. During the construction phase, any changes or revisions from the approved plans must be submitted in writing to the reviewing engineer and the Director of the Water and Sewer Department. The revised plans must be approved by the Water and Sewer Department. After revised plans are approved, revised estimated quantities must be submitted in writing and approved.

q. Upon satisfactory completion of the construction, the developer will develop "as-builts" of the subdivision. As-builts are a set of plans which illustrate the actual location of utilities, streets, and property lines.

r. Once as-builts are submitted, the developer may request final subdivision by the Planning Commission. The approval grants the developer the ability to sell parcels. If construction of the subdivision is not completed, the developer can request to bond the remaining construction work. The bond calculations are performed by engineers in the Public Works Engineering and Water and Sewer Departments.

s. Once all utility construction and testing are completed and final subdivision approval has been granted, the utilities are connected to the Johnson City system and a dedication agreement is signed by the contractor/developer. Also, the cost of utility materials are reimbursed with approval of the Johnson City Commission.

t. Upon the completion of all the above requirements, a dedication agreement is
signed and the utilities become the part of the Johnson City utility infrastructure.

9. DEVELOPMENT APPROVAL PROCESS

(outside corporate limits of the City of Johnson City)

The development process is a cooperative effort between the Water and Sewer Department of the City of Johnson City and developers. The development process is a progressive process in that certain steps or procedures must be met prior to continuing to the next step. If all requirements are satisfies as they are required this process is a smooth transition.

The development approval process is generally as follows:

a. The developer approaches the City of Johnson City Water and Sewer Department with concept plans.

b. The concept plan is reviewed and comments are made. (Generally the concept plan does not include utilities.) The purpose for the concept plan is to evaluate the basic layout of the development. This includes lot sizes and positioning, street widths, street stub locations, and aesthetics.

c. Once concept approval is granted by the Water and Sewer Department, the developer must retain a Licensed Engineer to begin a detailed design of the development.

d. The developer submits detailed plans to the Water and Sewer Department. The plans include a site plan, grading plan, utility layout, and related detail sheets.

e. The Water and Sewer Department reviews and analyzes the plans to determine the ability to provide adequate water and sanitary sewer services to the proposed development. The evaluations include a detail analysis of the hydraulic calculations, size of proposed pipes, fire protection, and associated devices. The Water and Sewer Department's evaluation is required since it is expected to accept the utilities upon completion of the project.

f. Review comments from the associated departments are returned to the developer/engineer.

g. Upon revisions being made, steps f. and g. are repeated until the subdivision plans meet the requirements of the City.

h. The developer shall submit eight (8) complete sets of the construction plans to the Water and Sewer Department. The Director of the Water and Sewer Department will approve the plans for state review once all comments are completed. The hydraulic calculations should be included with the plans.

i. A two (2) week notification will be required once the development receives state approval for water and sewer inspection services. Any material which is installed without the department's consent will be required to be removed at the developer's expense. Upon satisfying all the above requirements, the developer may begin construction of the proposed development.

j. During the construction process, the Water and Department will conduct inspections to ensure that the development meets the requirements of the City and the approved construction plans.

k. During the construction phase, any changes or revisions from the approved plans must be submitted in writing to the reviewing engineer and the Director of the Water and Sewer Department. The revised plans must be approved by the Water and Sewer Department.

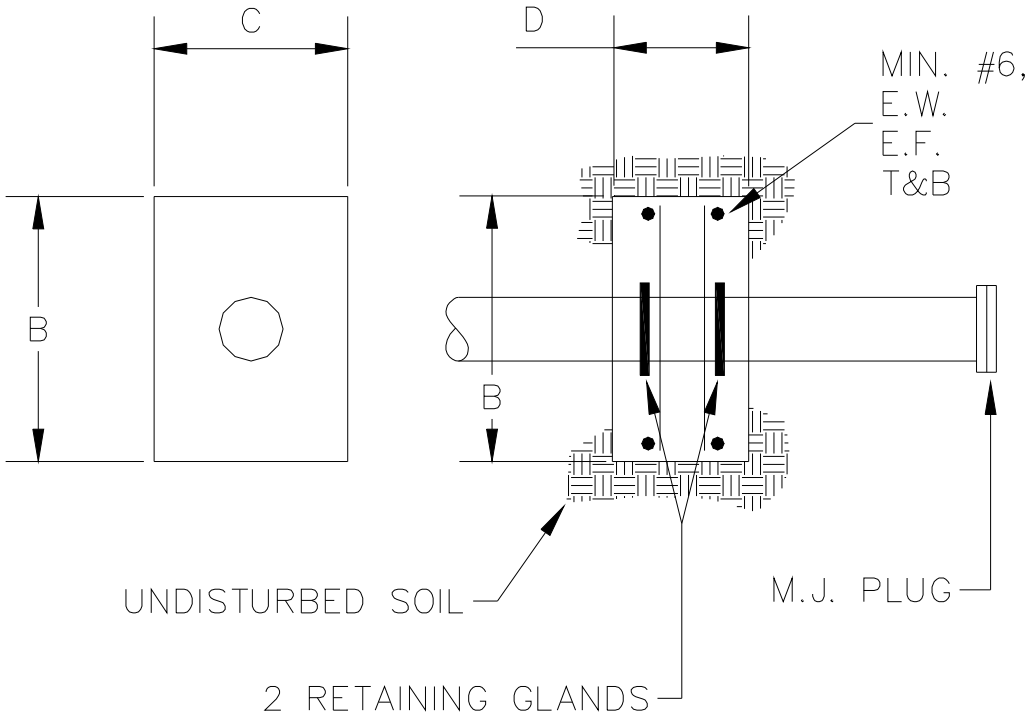
l. Upon satisfactory completion of the construction, the developer will develop "as-builts" of the subdivision. As-builts are a set of plans which illustrate the actual location of utilities, streets, and property lines.

m. Once all utility construction and testing are completed, the utilities are connected to the Johnson City system.

n. Upon the completion of all the above requirements, the utilities become the part of the Johnson City utility infrastructure.

Appendix 1

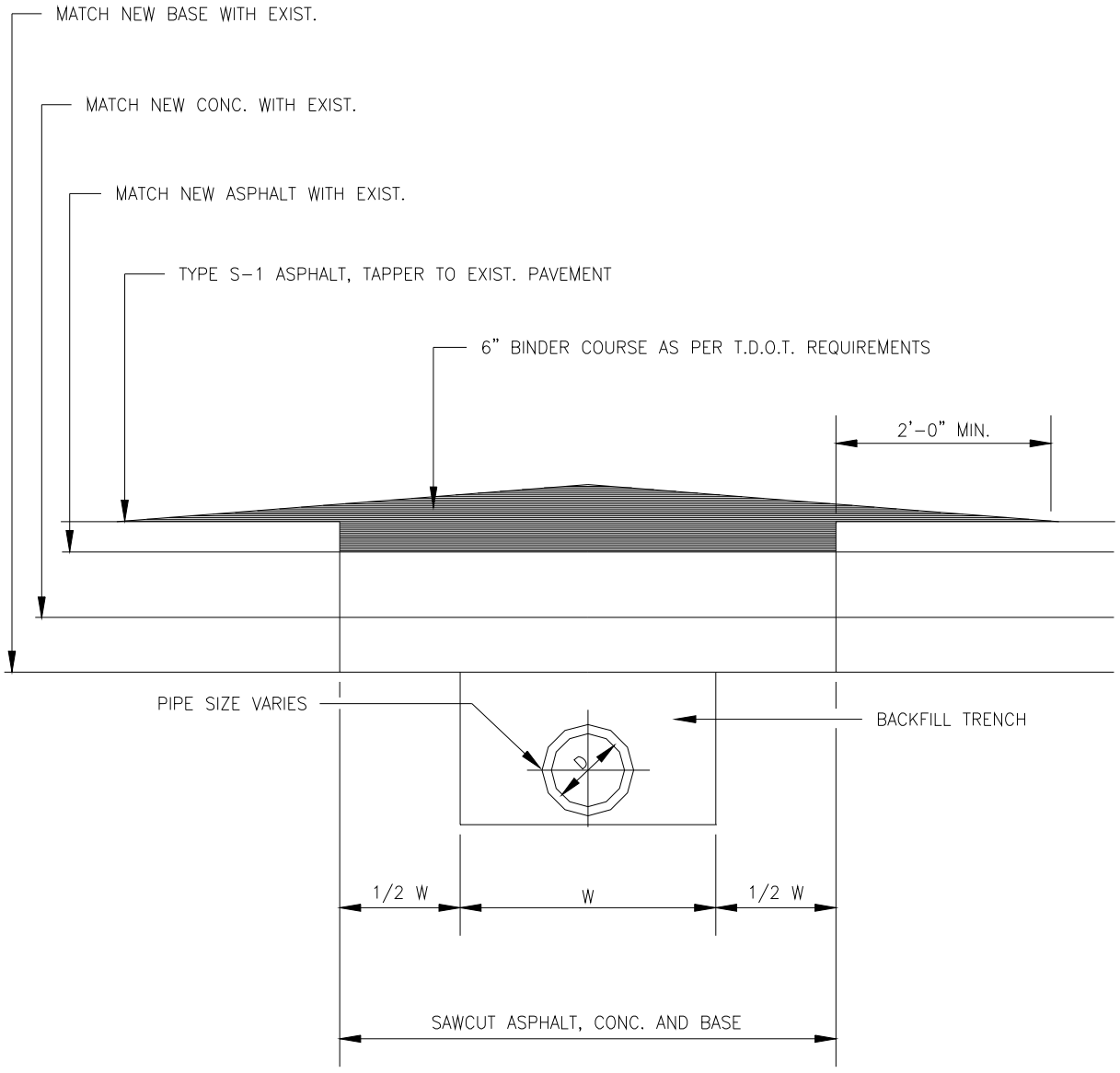
Standard Water and Sewer Details



SIZE	B	C	D
6"	24"	18"	18"
10"	48"	24"	24"

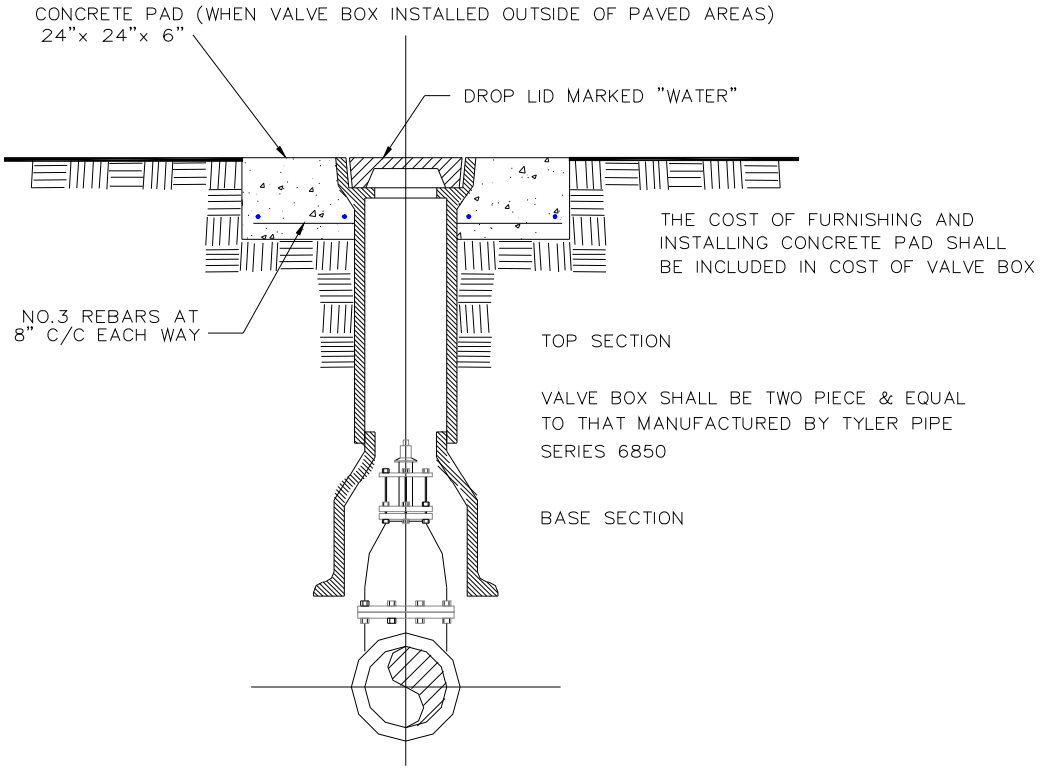
DEADMAN THRUST BLOCK

DWG NO.
DM1



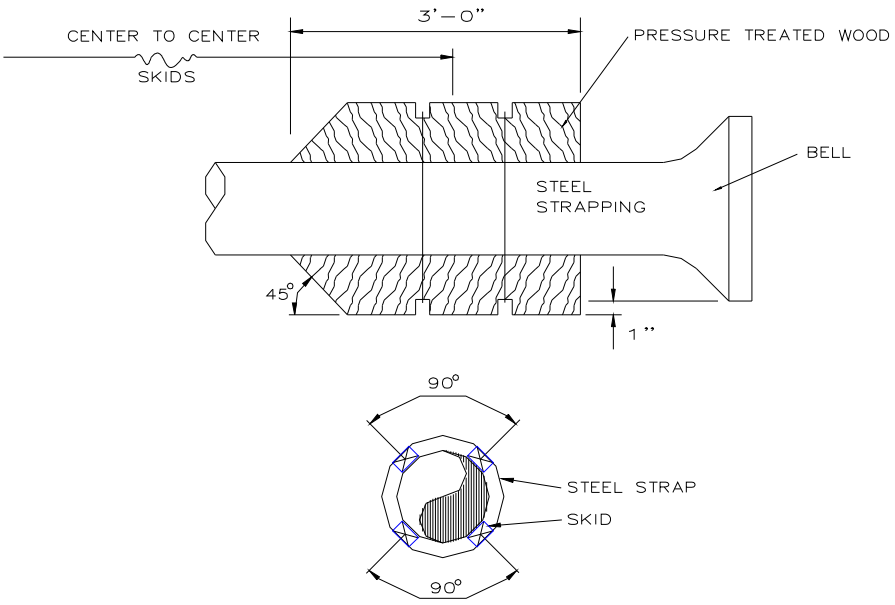
HIGHWAY REPAVING

DWG NO.
HR1



VALVE BOX (TWO PIECE)

DWG NO.
VB1



SKID SPACING TABLE

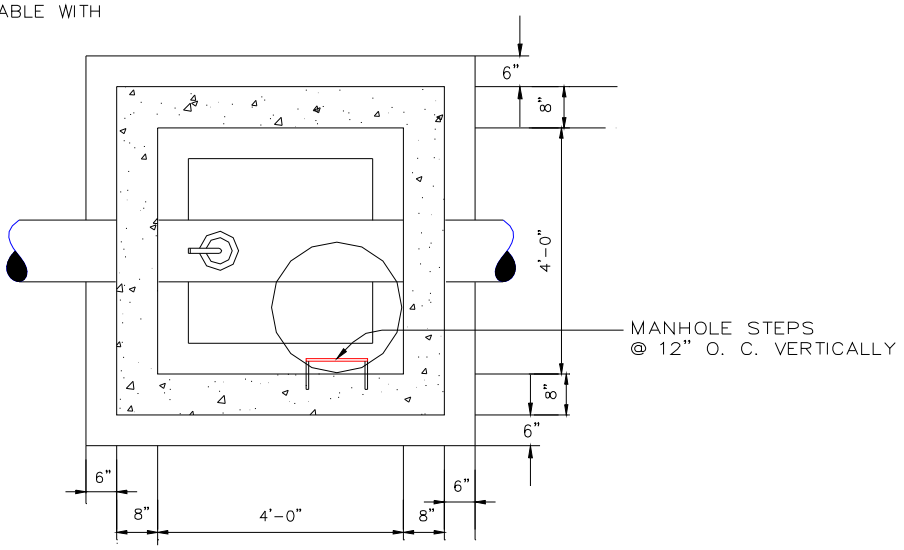
NOMINAL PIPE SIZE (DIAMETER, IN.)	CENTER TO CENTER SPACING
4	4 FT.
6	6 FT.
8	7 FT.
10	8 FT.
12	9 FT.
14	10 FT.
16	10 FT.

CASING SKIDS

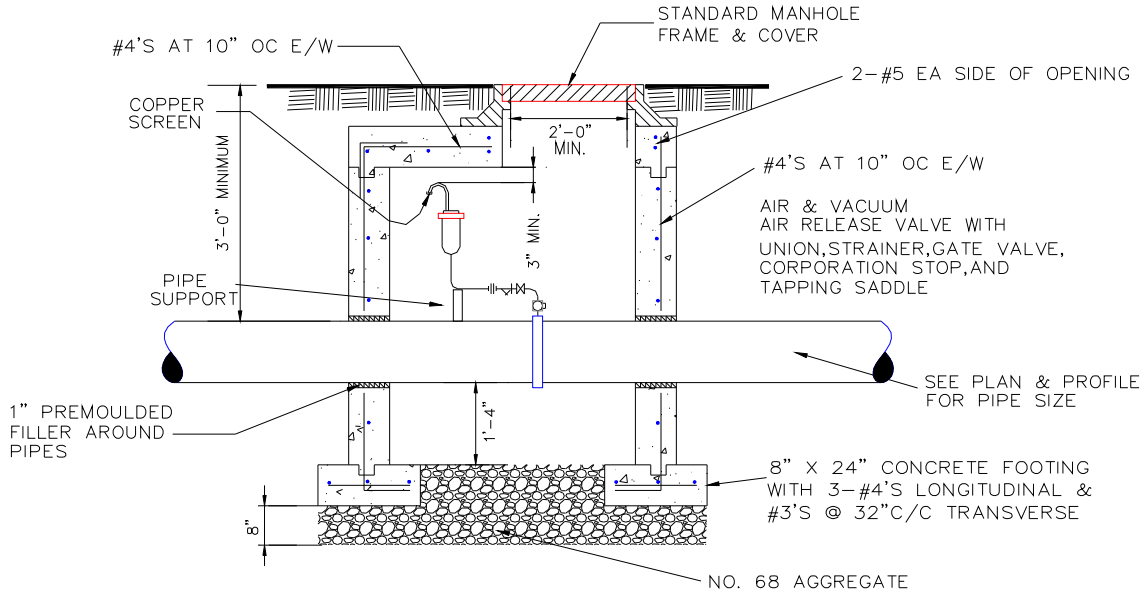
DWG NO.
CS1

NOTES!

1. AIR RELEASE VALVES SHALL BE 1" UNLESS OTHERWISE NOTED.
2. ALL PIPING AND FITTINGS FOR AIR VALVES SHALL BE THE SAME SIZE OF THE VALVE.
3. ALL PIPING FOR AIR VALVES SHALL BE SCHEDULE 80 GALV. IRON
4. VAULT SHALL BE CAST-IN-PLACE OR PRE-CAST.
5. ROUND MANHOLE IS ACCEPTABLE WITH MIN. DIAMETER OF 4'-0".



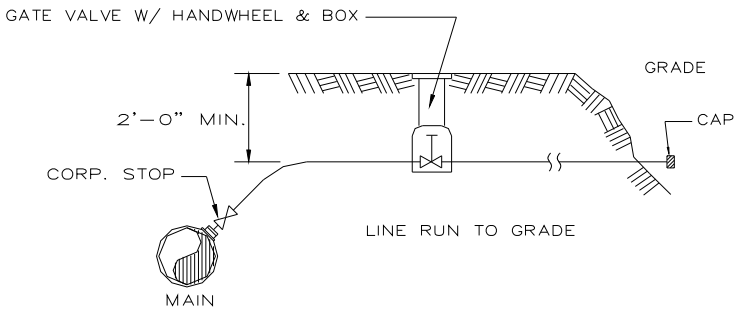
PLAN



SECTION

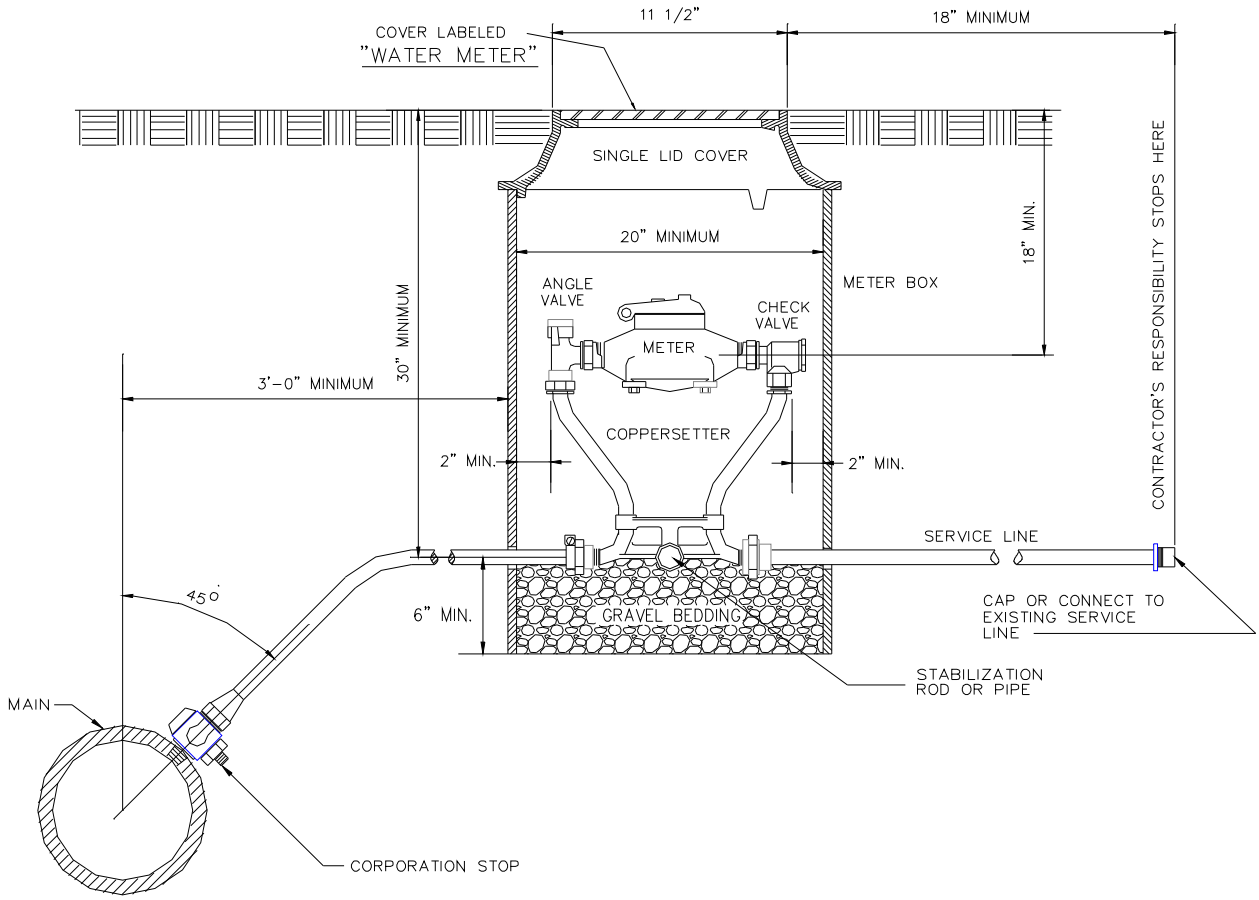
AIR RELEASE & VACUUM VALVE

DWG NO.
ARVV1



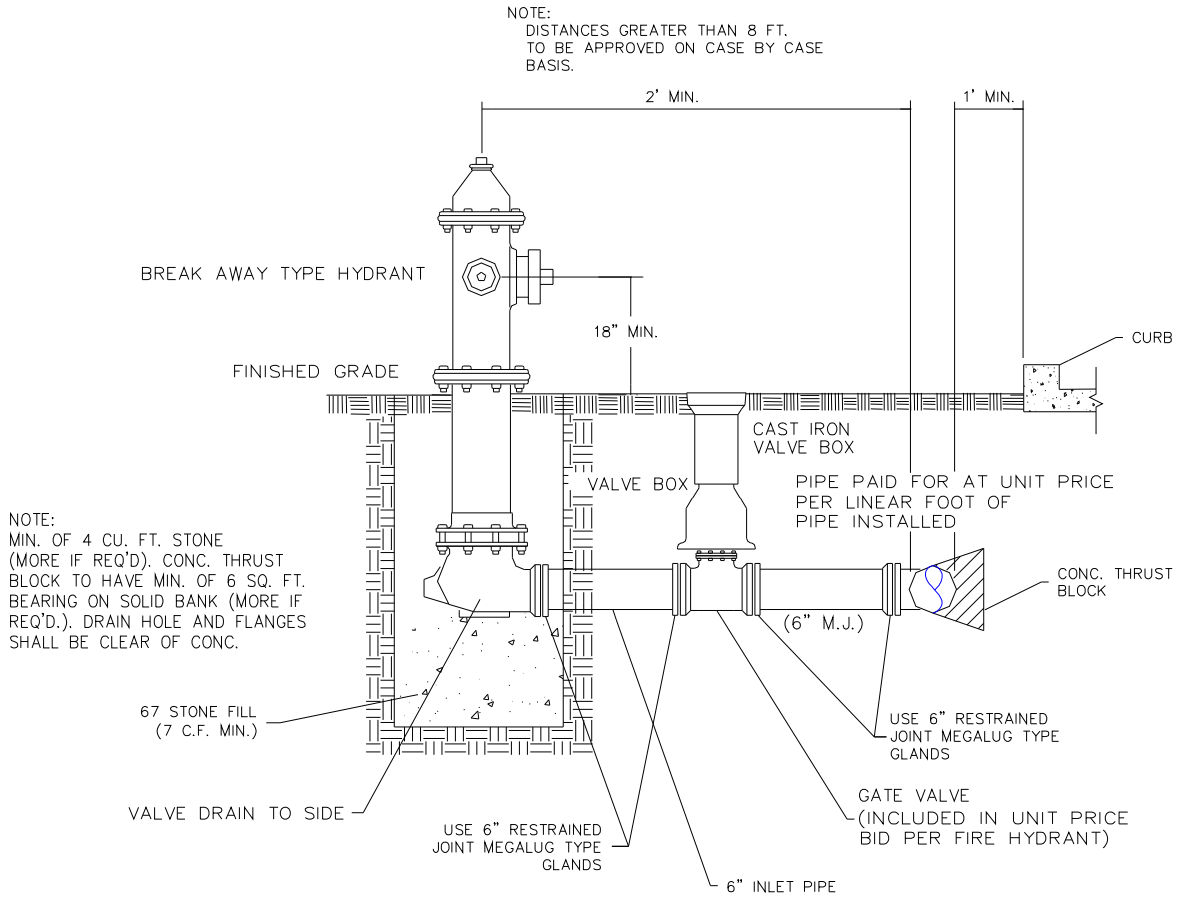
NOTE: SIZE OF LINE AND APPURTANCES DEPENDENT ON TYPE OF SERVICE.

SAMPLE TAP	DWG NO. ST1



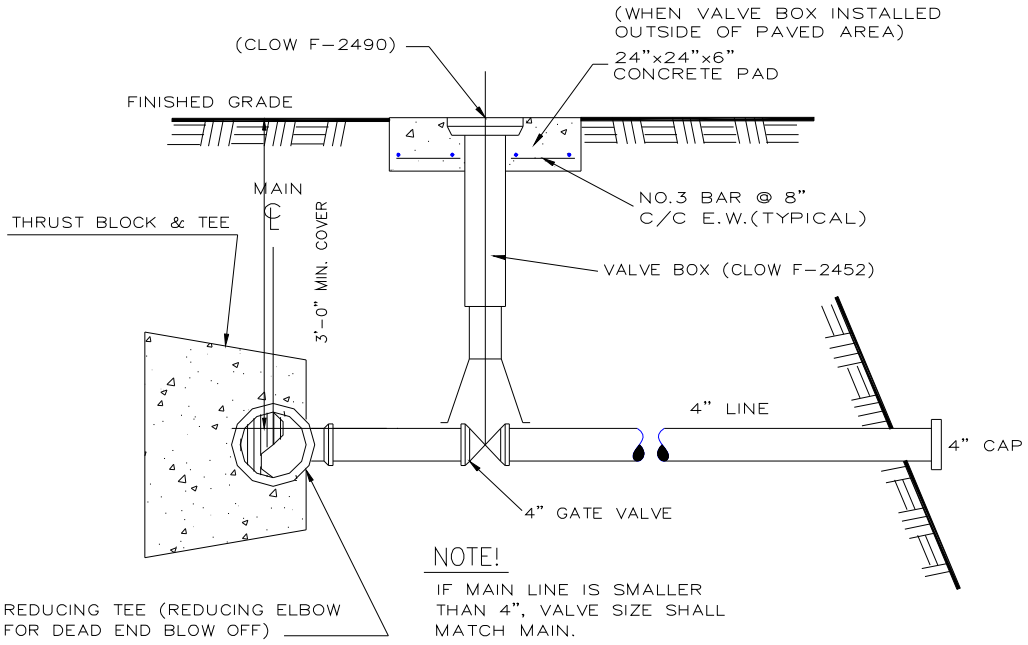
METER SETTING (3/4" & 5/8")

DWG NO.
MS1



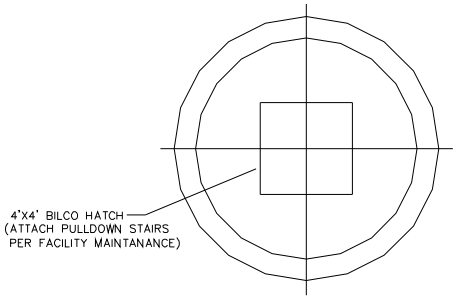
DETAIL OF FIRE HYDRANT

FIRE HYDRANT INSTALLATION	DWG NO. FH11

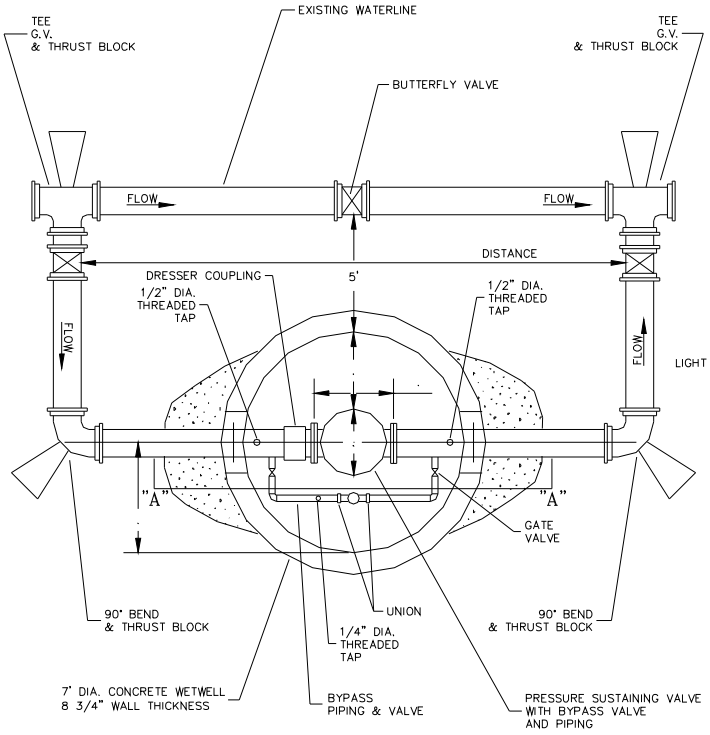


BLOW OFF

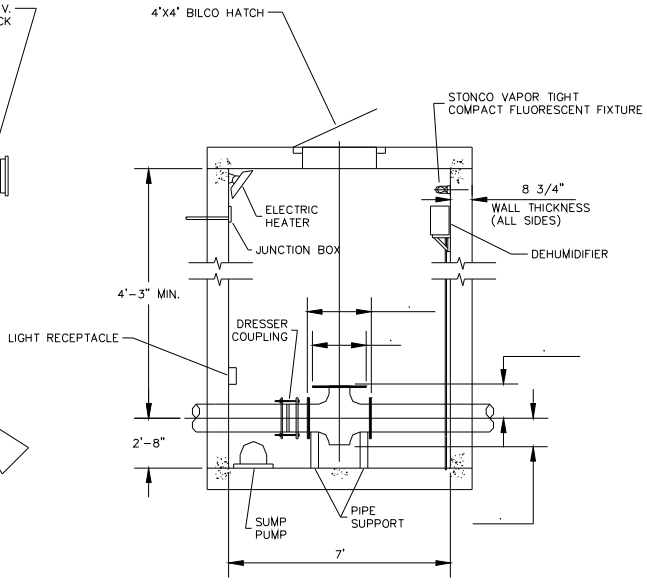
DWG NO.
B01



ROOF PLAN
N.T.S.



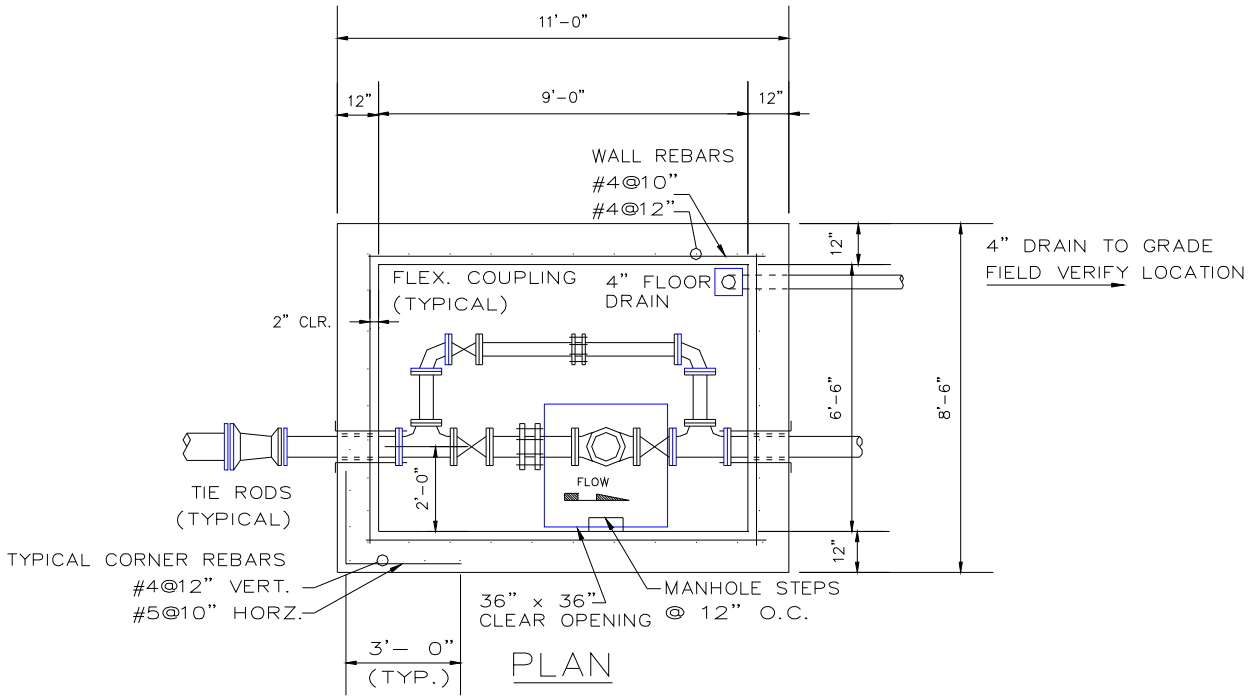
N.T.S

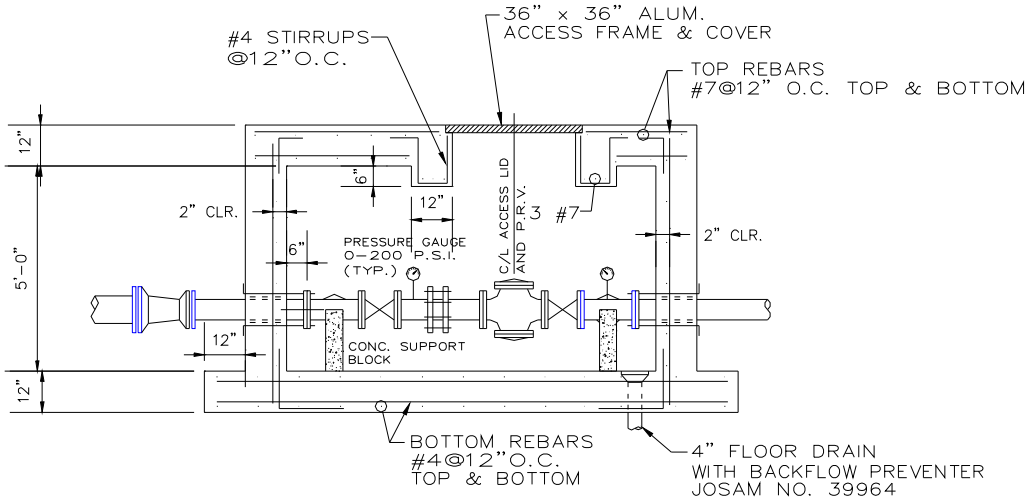


SECTION A – A
N.T.S.

PRESSURE SUSTAINING VALVE IN MANHOLE

DWG NO.
PSV

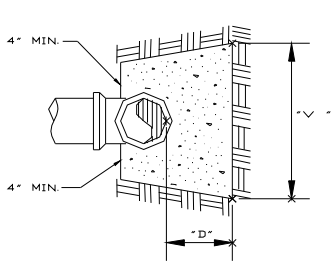


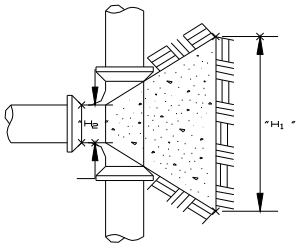


TYPICAL SECTION

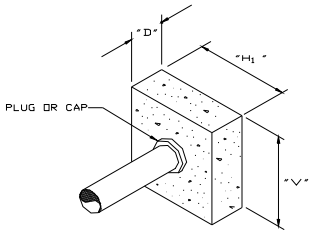
PRESSURE REDUCING VALVE VAULT

DWG NO.
PRVV1

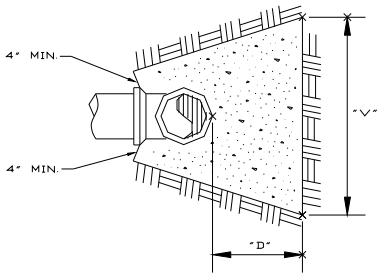


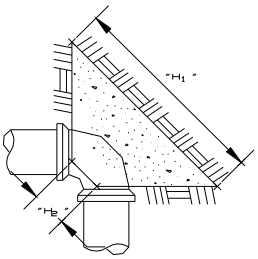


DETAIL OF HORIZONTAL & VERTICAL TEE
SEE TABLE BELOW FOR DIMENSIONS

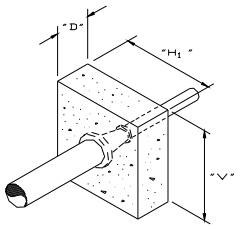


DETAIL DEAD END

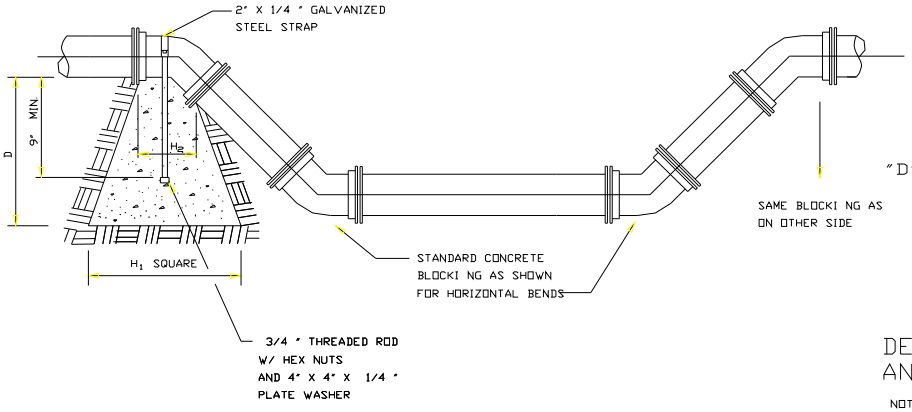


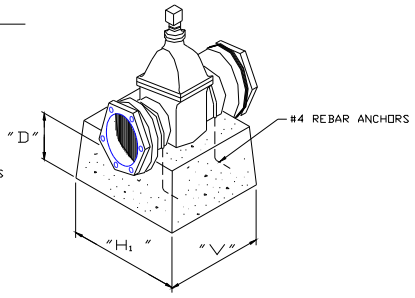


DETAIL OF HORIZONTAL BENDS
SEE TABLE BELOW FOR DIMENSIONS



DETAIL AT REDUCER





DETAIL AT GATE VALVE
AND BUTTERFLY VALVE

NOTE: SADDLE BLOCKING ON EITHER SIDE OF THE VALVE MAY BE USED AS AN ALTERNATE.

SEE FOLLOWING TABLE FOR DIMENSIONS

THRUST BLOCKS	DWG NO. TB1

THRUST BLOCK DATA

DWG NO. TB1

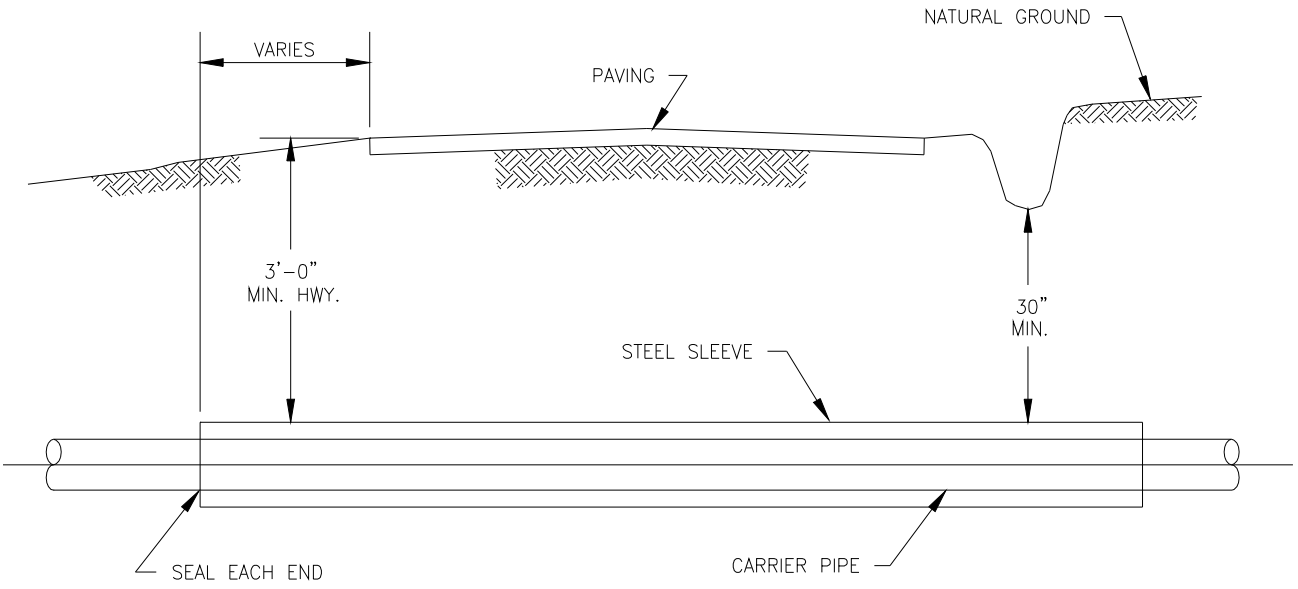
TABLE OF DIMENSIONS FOR CONCRETE BLOCKING
(INCHES)

SIZE	TEES, PLUGS CROSSES					90° BENDS					45° BENDS					22 1/2° BENDS					11 1/4° BENDS					VALVES			
PIPE	H_1	H_2	V	D	CU FT.	H_1	H_2	V	D	CU FT.	H_1	H_2	V	D	CU FT.	H_1	H_2	V	D	CU FT.	H_1	H_2	V	D	CU FT.	H_1	V	D	CU FT.
2&2 1/4	18	10	12	18	1.9	18	10	12	18	1.9	18	6	12	18	1.5	18	6	12	18	1.5	18	6	12	18	1.5	18	12	18	2.3
3&4	24	12	12	18	2.3	24	12	12	18	2.3	18	8	12	18	1.6	18	8	12	18	1.6	18	8	12	18	1.6	18	12	18	2.3
6"	24	16	18	18	3.5	30	16	18	18	4.1	24	10	16	18	3.2	24	10	16	18	3.2	24	10	16	18	3.2	24	16	18	4.0
8"	36	18	18	18	5.1	39	18	24	18	7.3	30	11	18	18	4.0	24	11	18	18	3.5	24	11	16	18	3.4	24	16	18	4.0
10"	48	24	18	24	7.2	54	32	24	18	10.3	24	18	21	18	4.6	24	18	21	18	4.6	24	18	21	18	4.6	24	21	18	5.3
12"	54	30	24	24	13.4	54	32	36	24	18.2	42	18	24	24	9.6	24	18	24	24	6.6	24	18	21	24	6.1	24	21	24	7.0
14"	60	32	30	24	17.9	60	40	42	24	25.0	44	24	30	24	13.2	30	24	24	24	9.2	27	21	24	24	7.9	27	24	24	9.0
16"	60	34	36	24	22.5	69	48	48	24	29.0	48	30	36	24	17.0	36	30	27	24	11.8	27	24	27	24	9.1	27	27	24	10.1
18"	72	36	40	24	30.0	72	48	60	24	38.0	48	30	42	24	21.0	42	30	30	24	15.0	30	30	36	24	13.0	30	36	24	15.0
20"	84	38	42	24	36.0	84	48	66	24	48.0	54	40	46	24	27.0	48	36	36	24	19.0	42	40	36	24	18.0	42	36	24	21.0

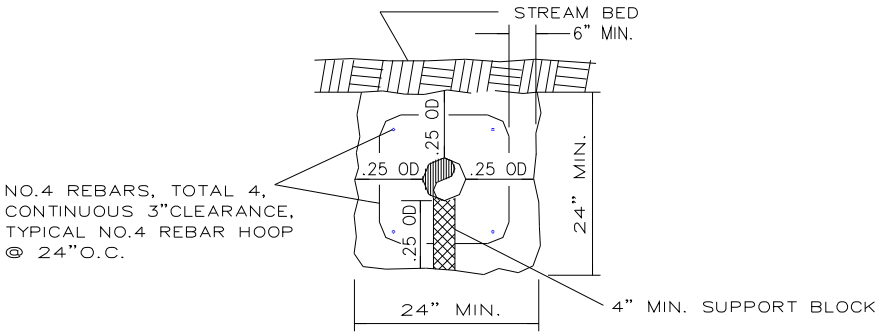
THRUST BLOCKS ARE DESIGNED FOR A WORKING PRESSURE AS SHOWN IN THE TABLES AND AN ALLOWABLE SOIL BEARING PRESSURE OF 2000 PSF. IF PRESSURES AND SOIL BEARING VALUES DO NOT FALL WITHIN THESE LIMITS, CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO INSTALLATION OF THRUST BLOCKS.

VERTICAL SUMMIT BENDS THRUST BLOCK DATA – ALL CLASSES

PIPE SIZE	11 1/4°			22 1/2°			45°			REBARS
	A	B	C	A	B	C	A	B	C	
3" & UNDER	2'6"	2'6"	1'1"	2'6"	2'6"	2'0"	3'0"	3'0"	2'6"	3 – NO. 3
4"	2'8"	2'8"	12"	2'8"	2'8"	2'6"	3'6"	3'6"	3'0"	3 – NO. 4
6"	2'10"	2'10"	2'4"	3'10"	3'10"	3'4"	4'6"	4'6"	4'0"	3 – NO. 4
8"	4'0"	4'0"	2'4"	4'8"	4'8"	4'0"	5'6"	5'6"	5'0"	3 – NO. 6



HIGHWAY CROSSING	DWG NO. HC1

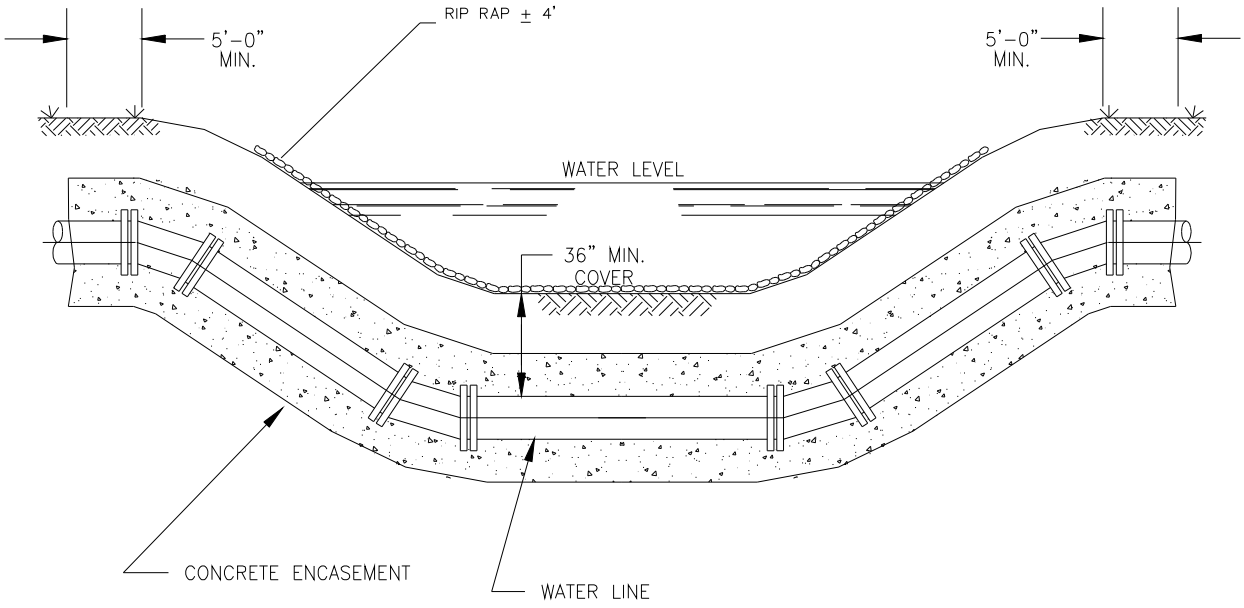


NOTES!

1. PROVIDE GATE VALVE & BOX SAME SIZE AS MAIN ON BOTH ENDS OF STREAM CROSSING AS DIRECTED BY ENGINEER.

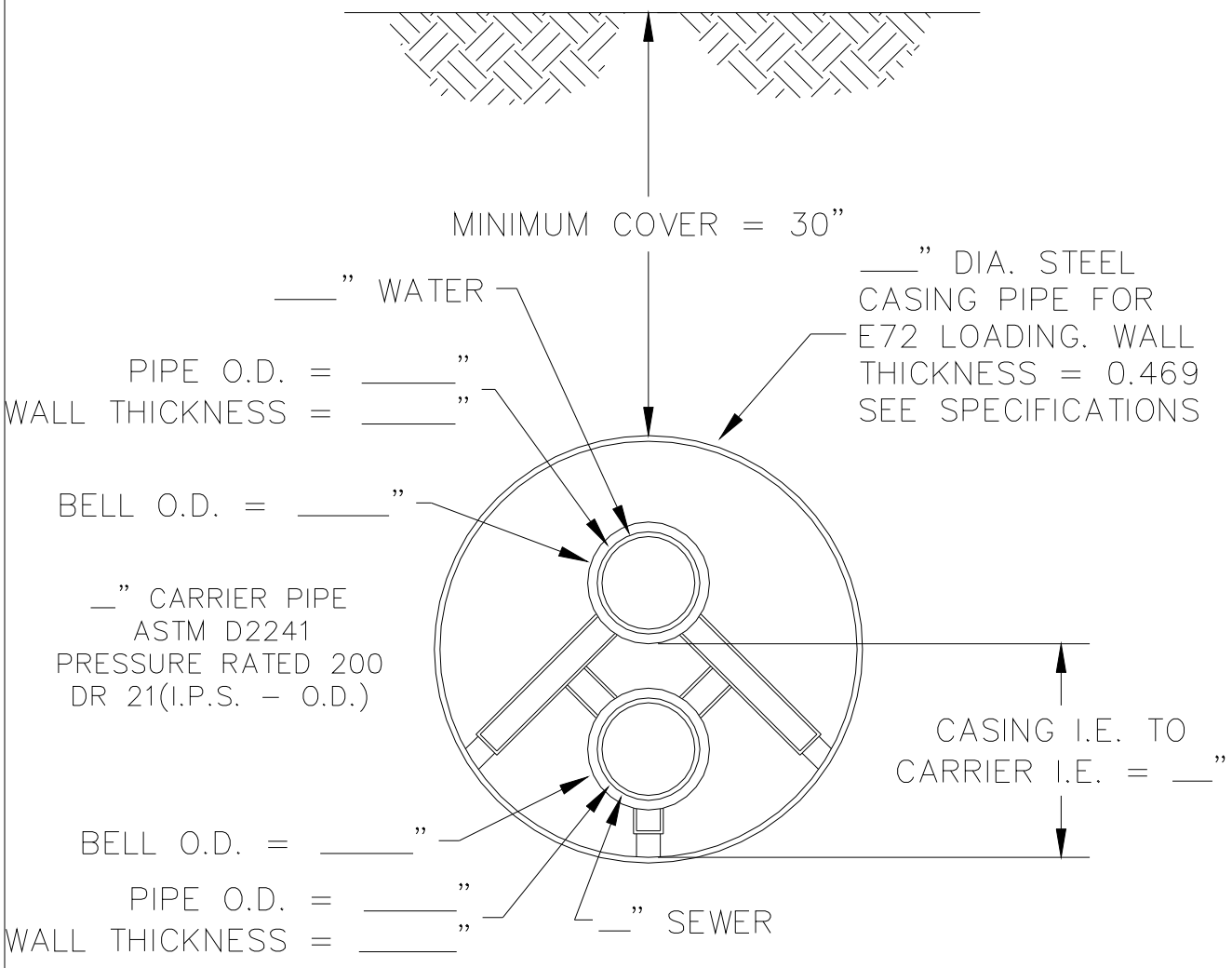
2. PROVIDE 1/2" SAMPLE TAP AND VALVE BOX, BOTH ENDS OF CROSSING, AS DIRECTED BY ENGINEER

SECTION



CREEK CROSSING

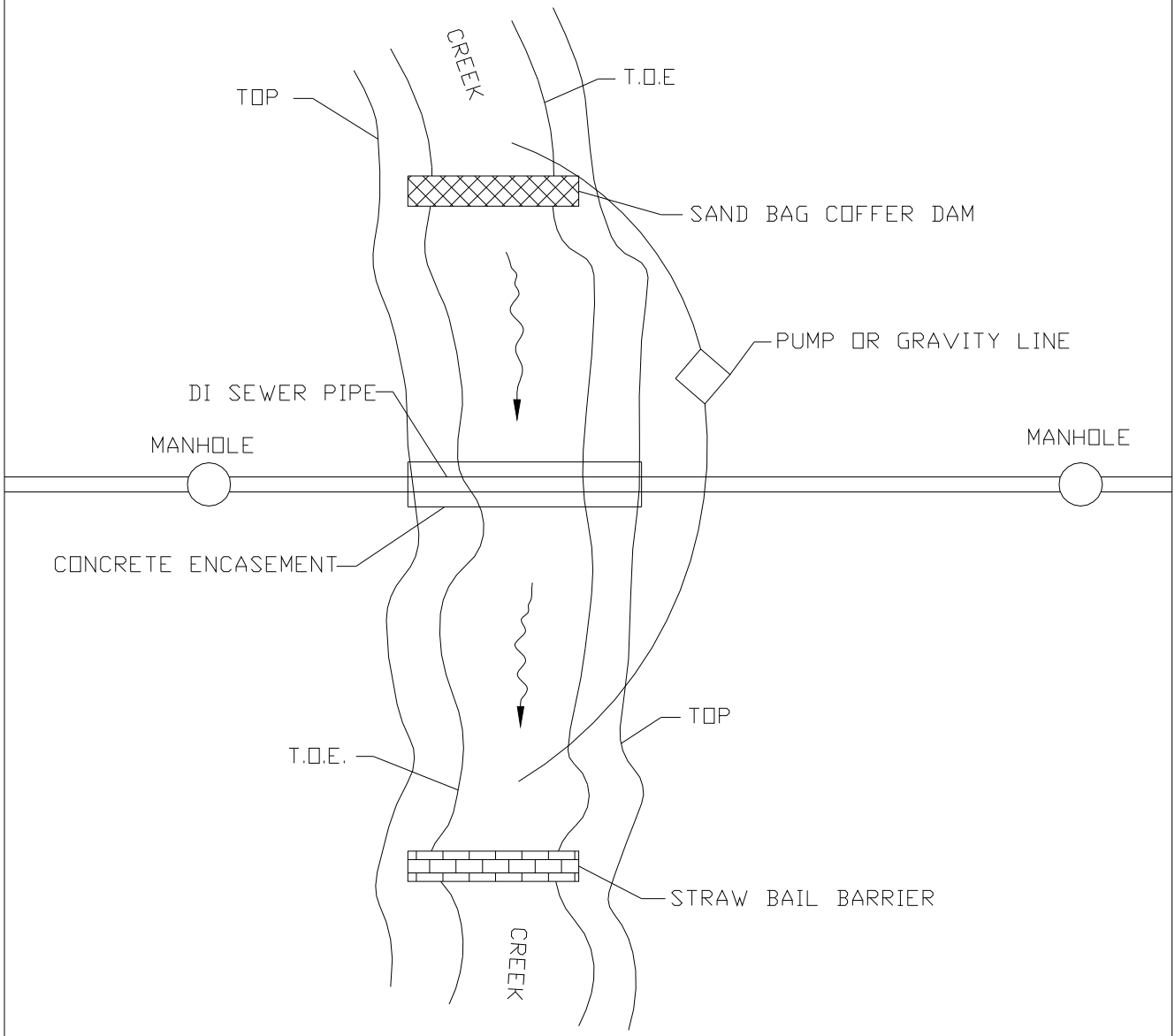
DWG NO. CC1



INSTALL CASING SPACER ASSEMBLY 7'–0" O.C.
AS MANUFACTURED BY ADVANCE PRODUCTS & SYSTEMS
OR EQUIVALENT. SUBMIT SHOP DRAWING PRIOR TO FABRICATION.

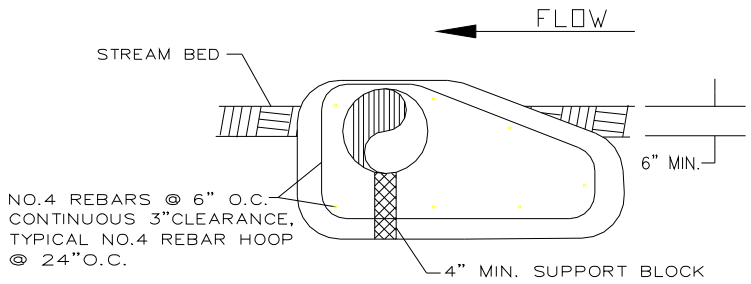
N.T.S.

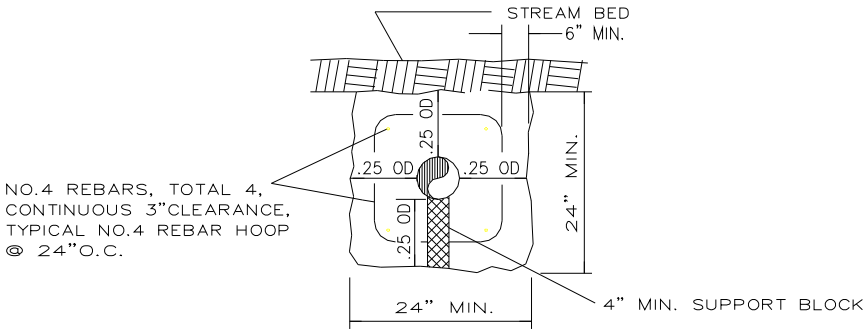
CROSSING DETAIL	DWG NO.
	NO



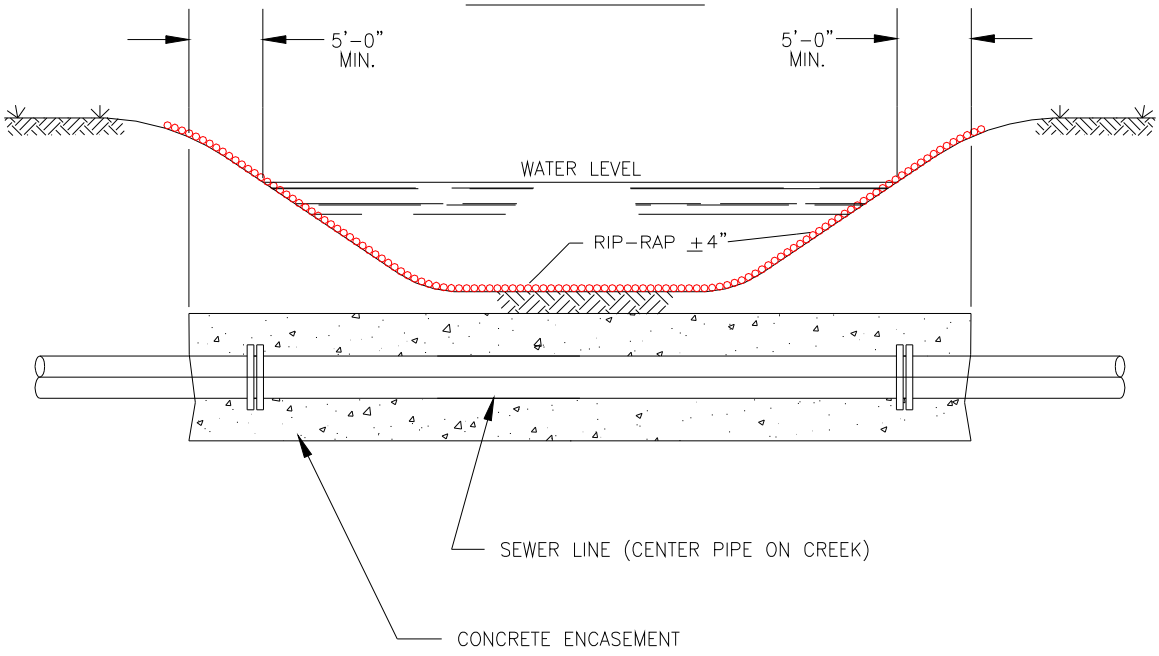
CREEK CROSSING

DWG NO.
CC2



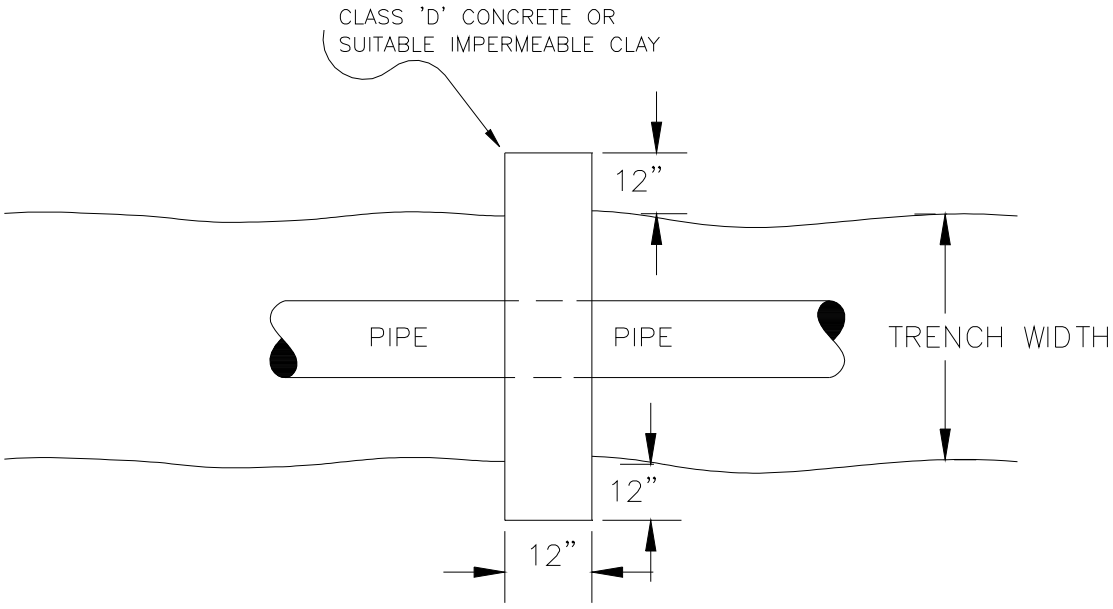


SECTION



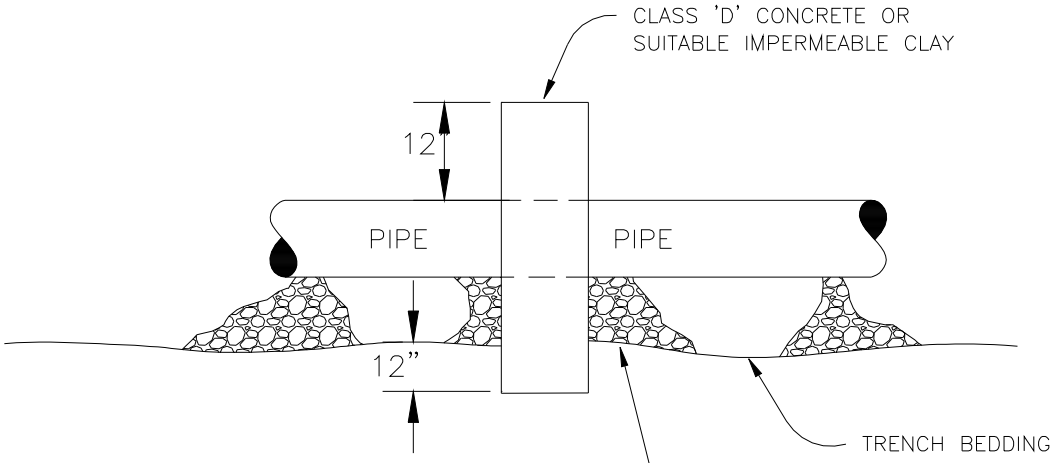
CREEK CROSSING DETAIL

DWG NO.
CC1



PLAN

N.T.S.



SECTION

N.T.S.

TYPICAL CHECK DAM

DWG NO.

CD

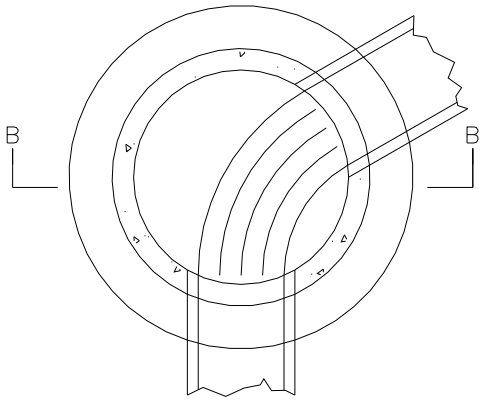
NOTES:

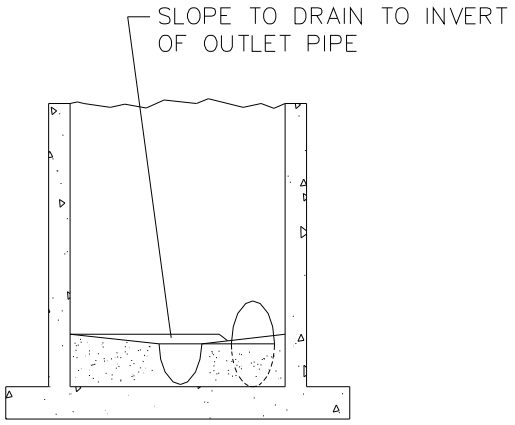
1. SHAPING OF MANHOLE AND INLET INVERTS IN ACCORDANCE WITH THIS DRAWING IS TO APPLY TO THOSE STRUCTURES SPECIFIED ON PLANS. THE COST OF FURNISHING AND PLACING ALL MATERIALS IS TO BE INCLUDED IN THE PRICE BID FOR THE PARTICULAR DROP INLET COMPLETE, AND/OR VERTICAL FEET OF MANHOLE.

2. MANHOLE OR DROP INLET IS TO BE FORMED AND CONSTRUCTED IN ACCORDANCE WITH APPLICABLE STANDARD OR SPECIAL DRAWING. THE INVERT SHAPING AS DETAILED HEREON IS TO CONSIST OF A PORTLAND CEMENT CONCRETE MIX CONFORMING TO A CLASS A OR CLASS C, EXCEPT THAT 25% OF COARSE AGGREGATE MAY BE UP TO 4" IN DIAMETER AND CONSIST OF STONE, BROKEN BRICK, BROKEN CONCRETE OR BROKEN CONCRETE BLOCK. THE SURFACE SHALL BE LEFT SMOOTH BY MEANS OF HAND TROWELLING. NONE OF THE COARSE AGGREGATE SHALL REMAIN EXPOSED.

3. DETAILS OF INVERT SHAPING AS SHOWN HEREON ARE FOR EXAMPLE PURPOSES ONLY. EACH MANHOLE OR DROP INLET IS TO BE SHAPED INDIVDUALLY TO BEST FIT THE PARTICULAR INLET AND OUTLET CONFIGURATION AND FLOW LINES.

4. A 1" GAP SHALL BE MAINTAINED BETWEEN THE GROUTED CHANNEL AND THE SEWER PIPE AT BOTH THE MANHOLE INLET AND OUTLET. GROUT SHOULD NOT COME INTO CONTACT WITH THE SEWER PIPE.

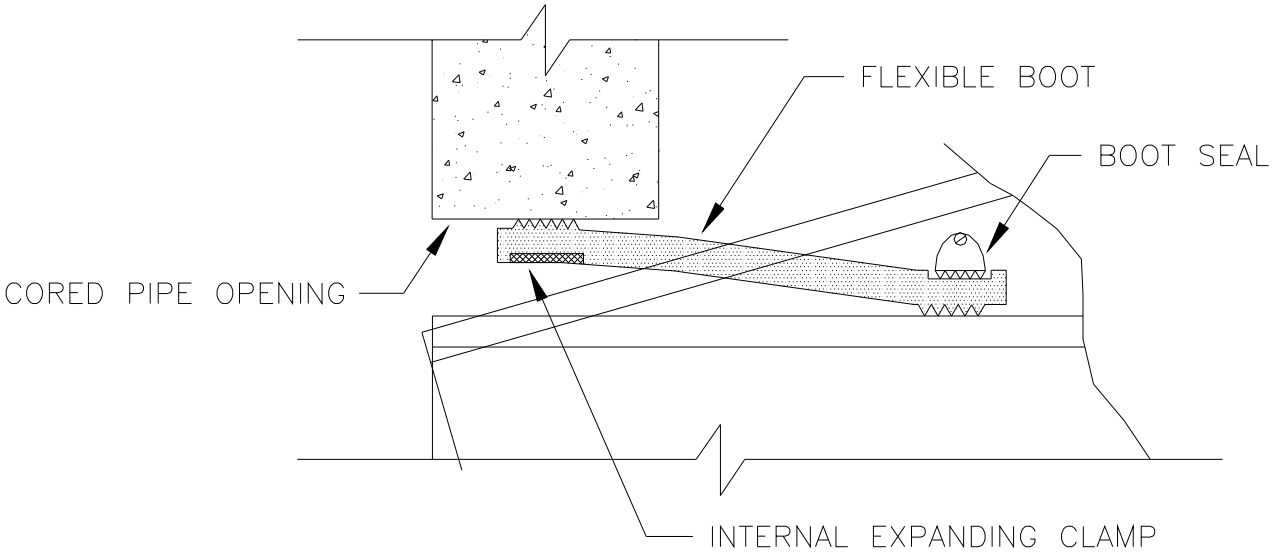




SECTION B–B

STANDARD SHAPING OF MANHOLE INVERTS

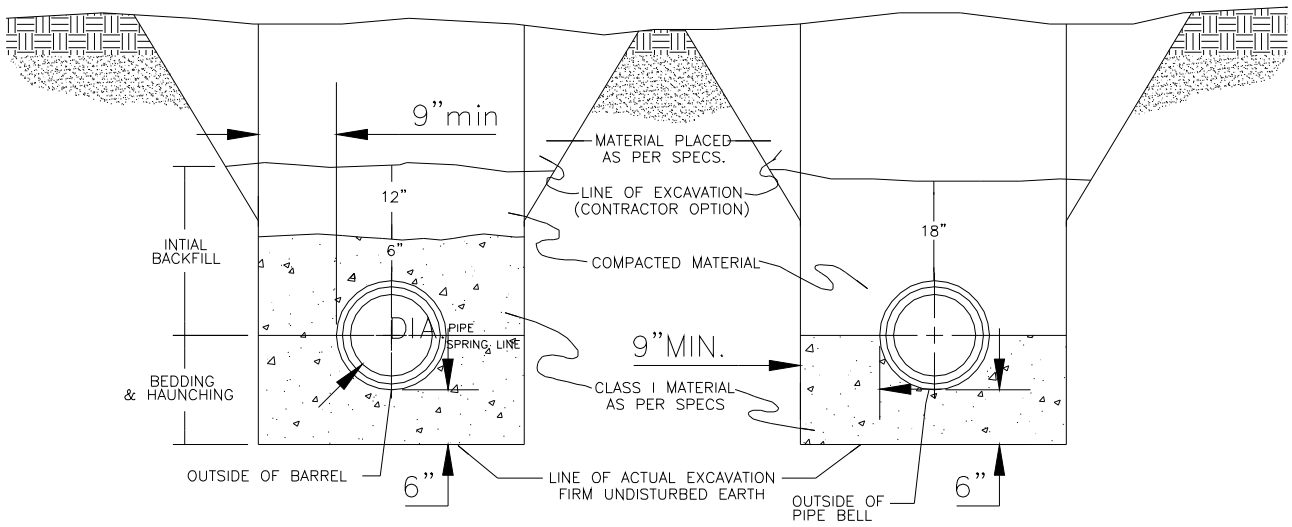
DWG NO.
MI



BOOT DETAIL

FLEXIBLE BOOT FOR MANHOLES

DWG NO.
FBMH



— PVC PIPE BEDDING DETAIL — — DUCTILE IRON PIPE BEDDING —

NOTE: ALL LINES INSTALLED IN PAVED AREAS SHALL BE BACKFILLED COMPLETELY WITH CRUSHED STONE.

BEDDING AS SHOWN FOR DUCTILE IRON PIPE SHALL ONLY BE REQUIRED WHEN UNSUITABLE SOIL OR SOLID ROCK IS ENCOUNTERED AT THE TRENCH BOTTOM.

WATER & SEWER PIPE BEDDING DETAILS	DWG NO. PBD

NOTES:

1. WASTEWATER COLLECTION SYSTEM SHALL BE INSTALLED ON UNIFORM GRADES BETWEEN MANHOLES. ALL MANHOLE JOINTS TO BE "DOUBLE MASTIC"OR"O-RING"TYPE, TIGHTLY SEALED TO EXCLUDE INFILTRATION.PIPE TO MANHOLE CONNECTIONS SHALL BE GROUTED WITH NON-SHRINK GROUT TO A WATERTIGHT CONDITION.

2. ALL MATERIAL,DESIGN,MANUFACTURE,PHYSICAL TEXT REQUIREMENT,FINISH,MARKING, INSPECTION,REJECTION,AND REPAIR TO MEET A.S.T.M.C478 PRECAST, REINFORCED CONCRETE MANHOLE RISERS AND TOPS EXCEPT AS MAYBE MODIFIED IN SPECIFICATIONS.

3. SEE STANDARD SPECIFICATIONS FOR SEWER CONSTRUCTION OF THE CITY OF JOHNSON CITY WATER AND SEWER DEPARTMENT FOR ADDITIONAL INSTRUCTIONS.

4. FLEXIBLE MANHOLE-PIPE JOINT AS MANUFACTURED BY KOR-N-SEAL,OR "PSX".

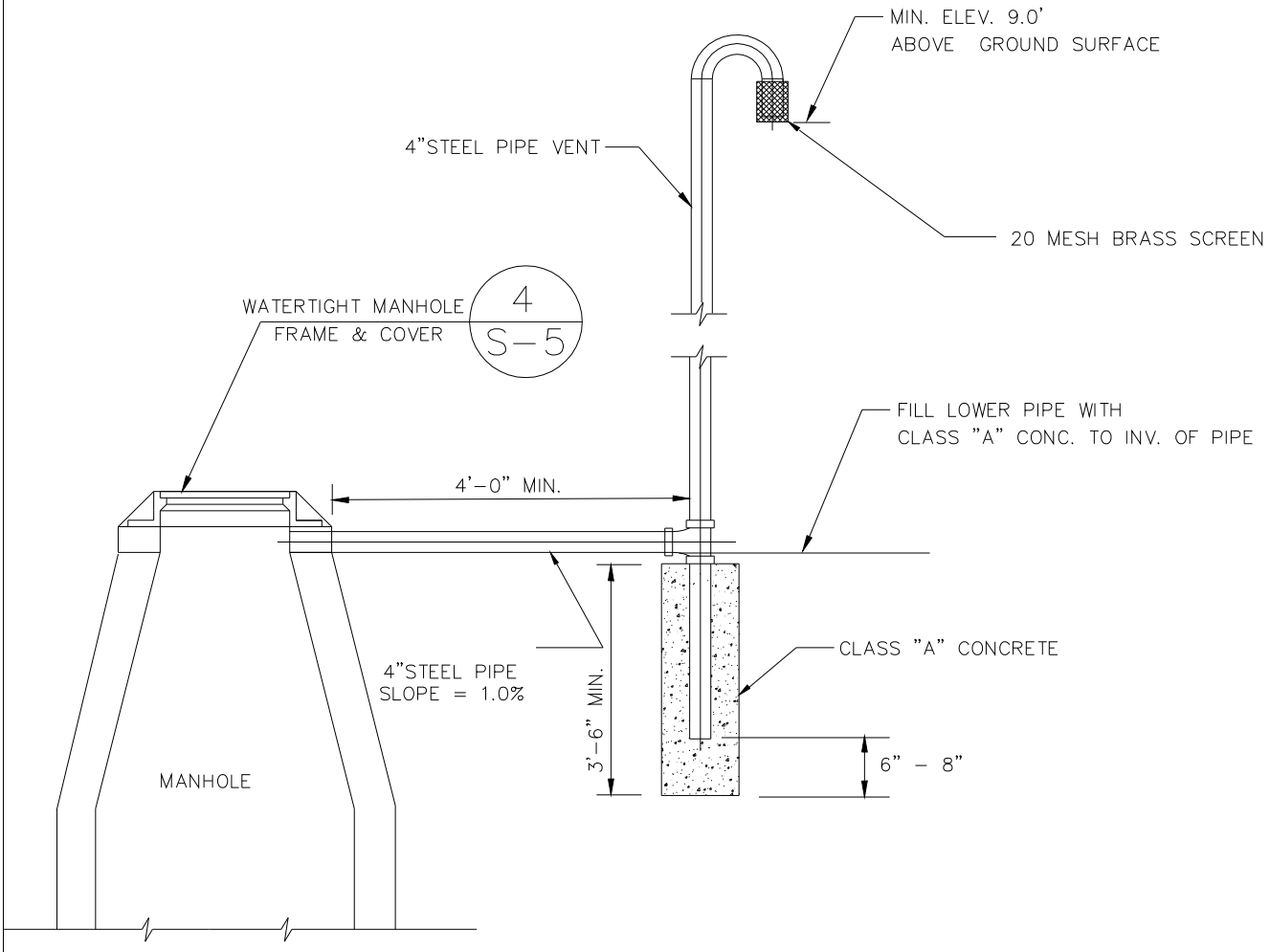
5. ALL INTERNAL SEAMS OF MANHOLES TO BE GROUTED.

* CLEAR OPENING WILL BE NO SMALLER THAN 24" DIAMETER.

6. NO THRU WALL LIFT HOLES ALLOWED ON MANHOLES.

NOTES FOR MANHOLES	DWG NO.
	MH

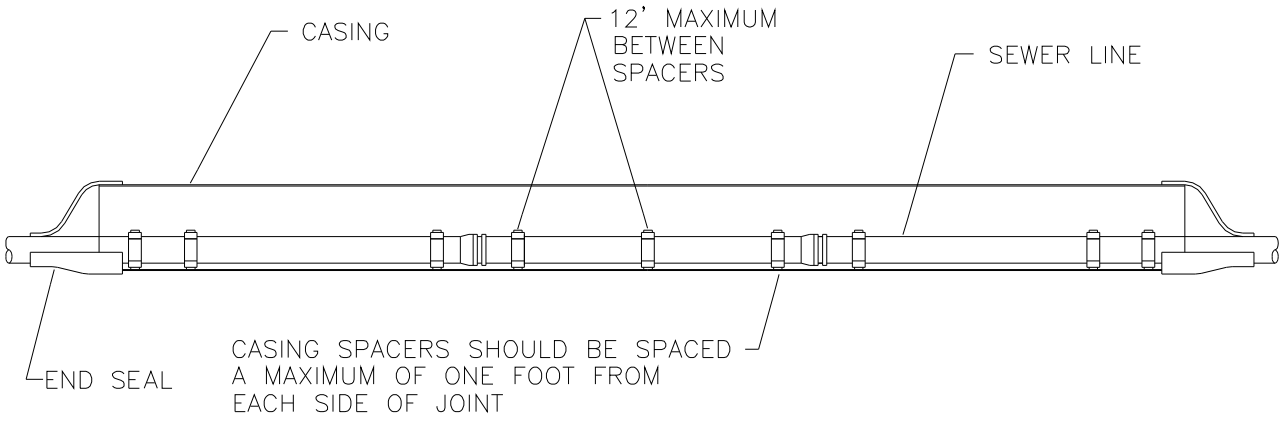
VENT PIPE SHALL BE LOCATED OUT OF A TRAVEL WAY, IN BACK OF A CURB OR SIDEWALK, OR AS CALLED FOR ON PLANS. PIPE TO BE PAINTED WITH ONE COAT RED LEAD PRIMER, PHENOLIC RESIN VARNISH BASE, INERTOL #621, AND FOLLOWED BY TWO (2) COATS OF EPOXY ESTER INERTOL PONKATE ENAMEL. PRIMER SHALL BE ALLOWED TO DRY 72 HRS. IN GOOD WEATHER AND SHALL BE THOROUGHLY DRY BEFORE RECOATING. TOP COAT OF PAINT SHALL BE DARK GREEN.



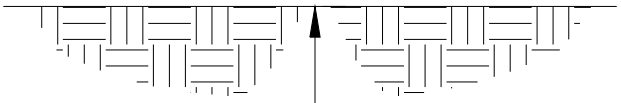
3/S-5 VENTED PIPE FOR MANHOLE
NTS

VENT DETAIL FOR WATERTIGHT MANHOLES

DWG NO. VD

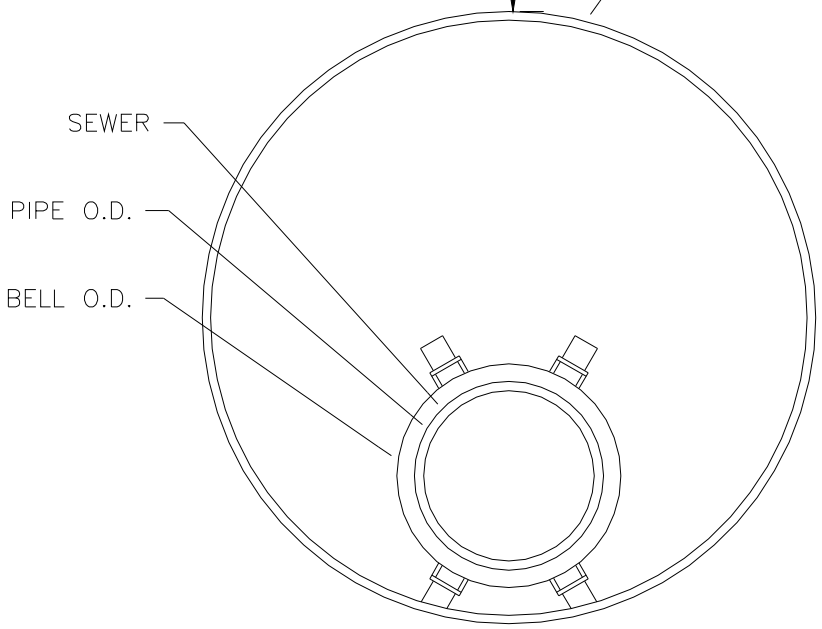


SPACER LOCATION
N.T.S.



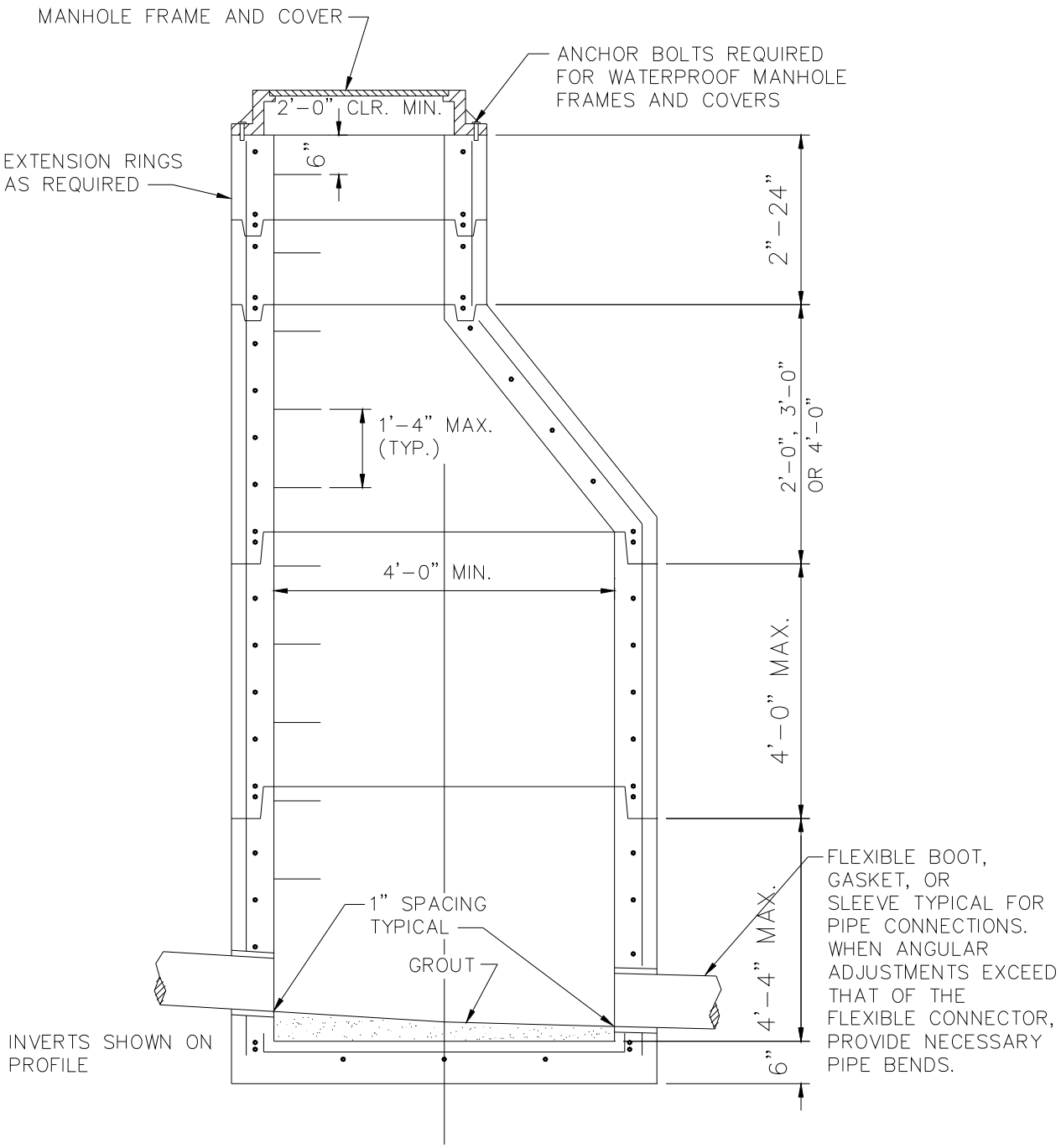
MIN. COVER = 30"

STEEL CASING PIPE FOR E72 LOADING. WALL THICKNESS = 0.469. SEE SPECIFICATIONS



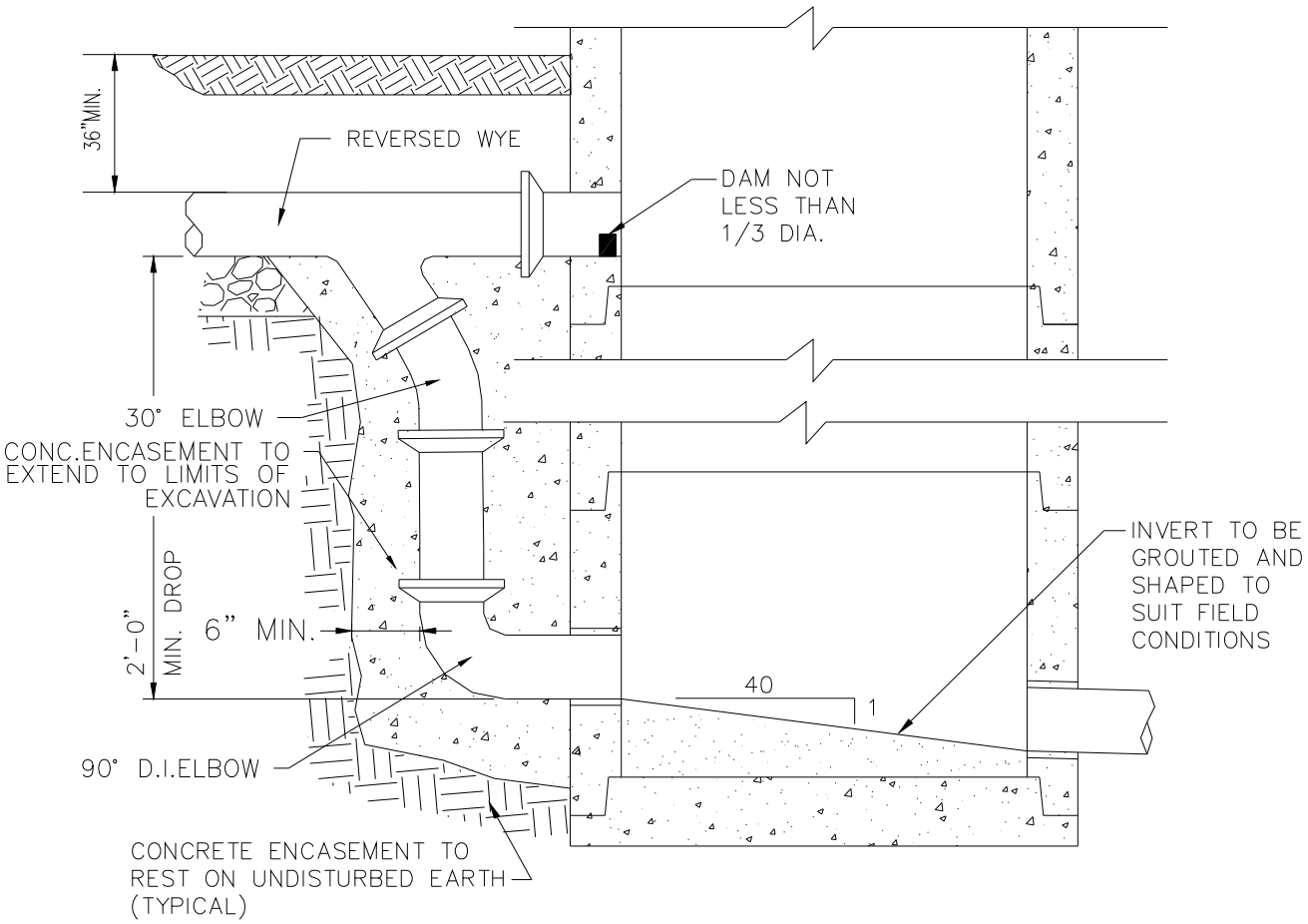
CASING DETAIL

DWG NO.
CD



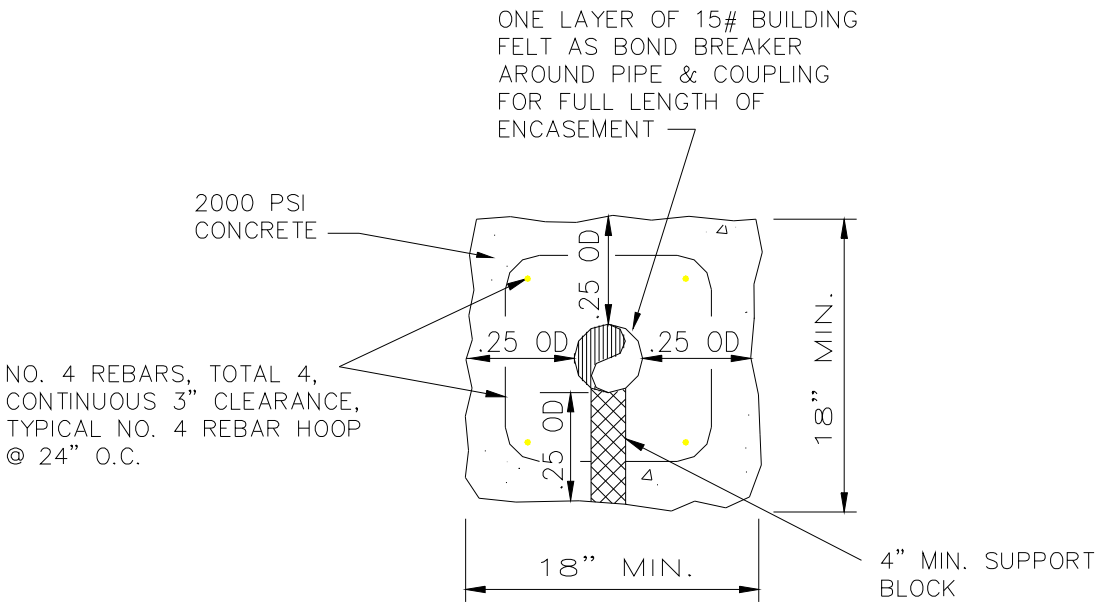
PRECAST MANHOLE WITH MONOLITHIC BASE

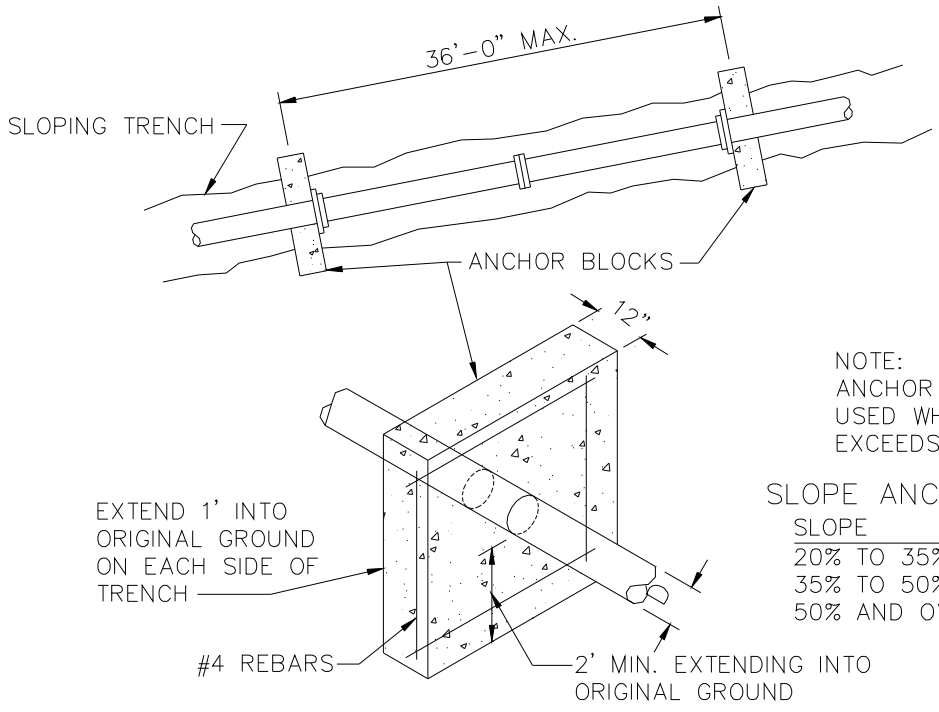
DWG NO. PM/MB



DETAIL – DROP MANHOLE

DWG NO.
DM





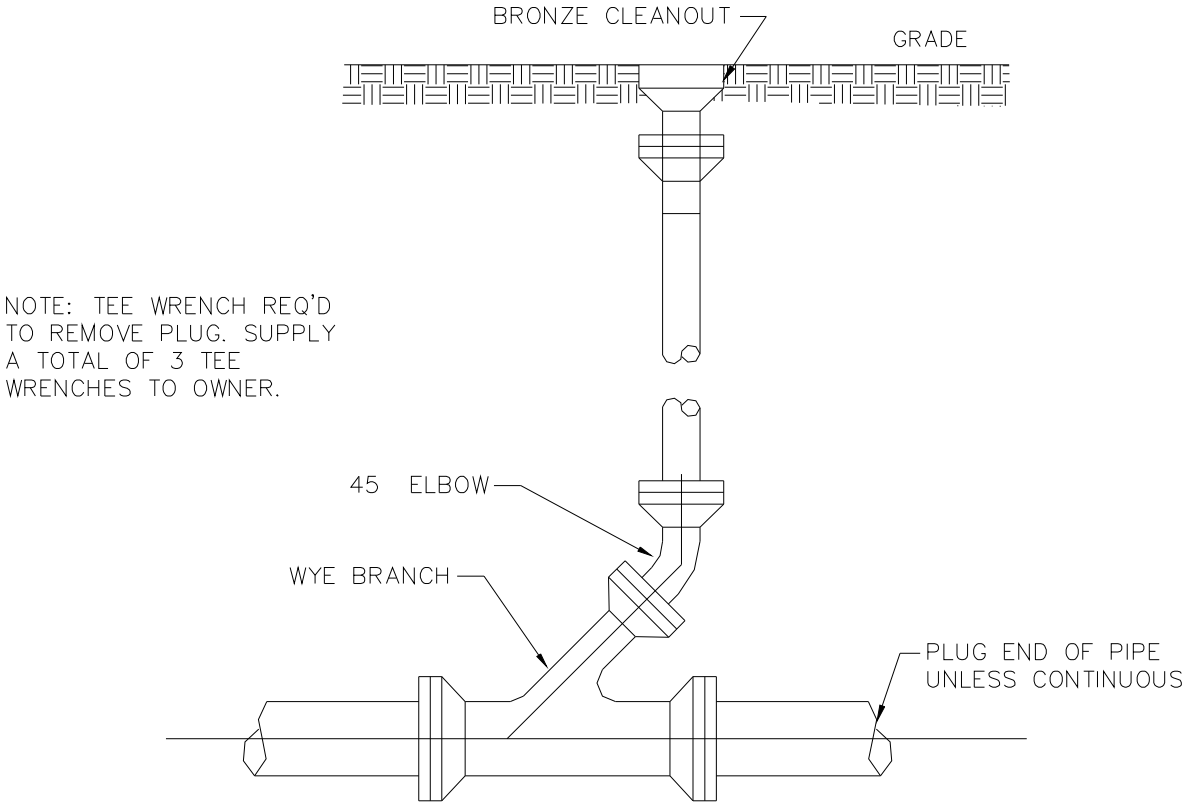
NOTE:
ANCHOR BLOCKS TO BE USED WHEN SLOPE EXCEEDS 20%

SLOPE ANCHOR SPACING

SLOPE	SPACING
20% TO 35%	36 FT.
35% TO 50%	24 FT.
50% AND OVER	16 FT.

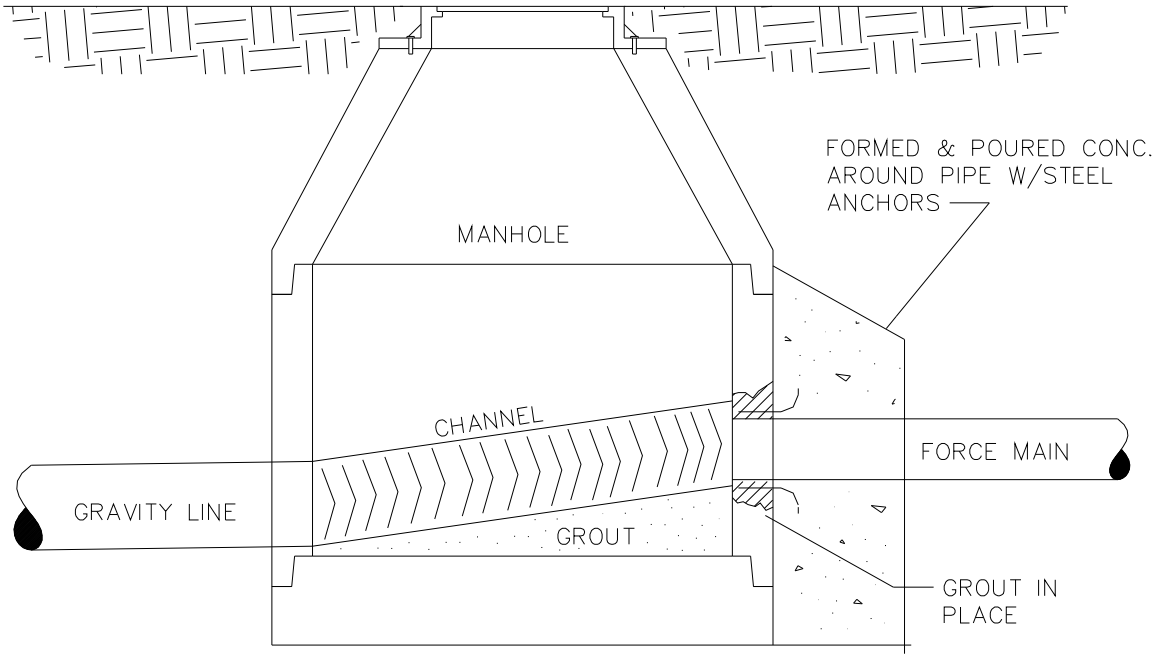
DETAIL SHOWING CONCRETE ENCASEMENT & ANCHOR BLOCK

DWG NO. CE&AB



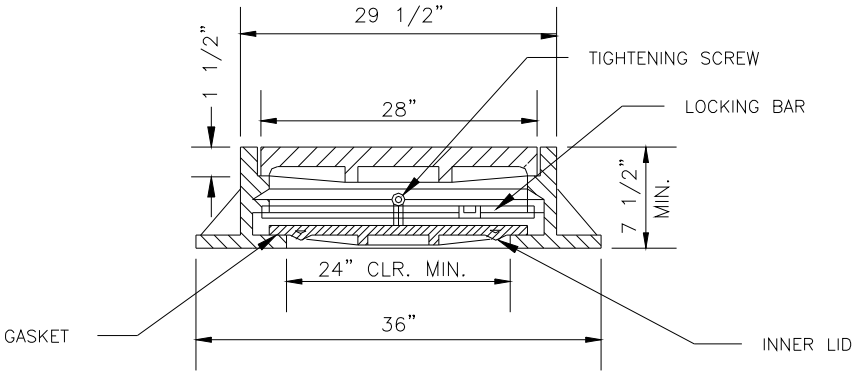
DETAIL OF CLEANOUT

DWG NO.
CD 1

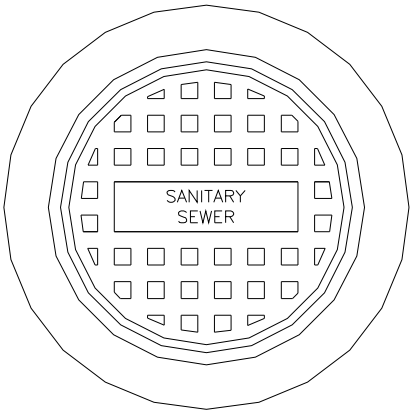


DETAIL – FORCE MAIN TERMINATION

DWG NO.
FMT
1



SECTION



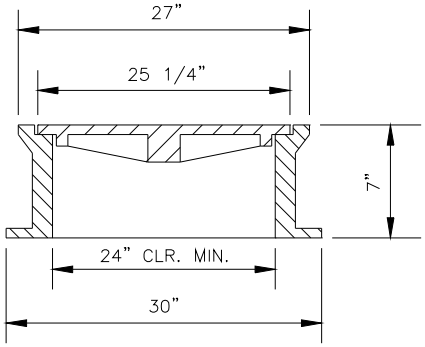
TOP VIEW

WATERTIGHT MANHOLE

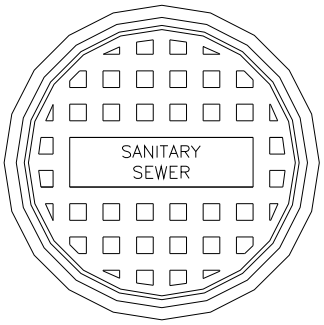
TOTAL WEIGHT 500 lbs.

WATERTIGHT MANHOLE FRAME & COVER

DWG NO. MH-FC 2



SECTION

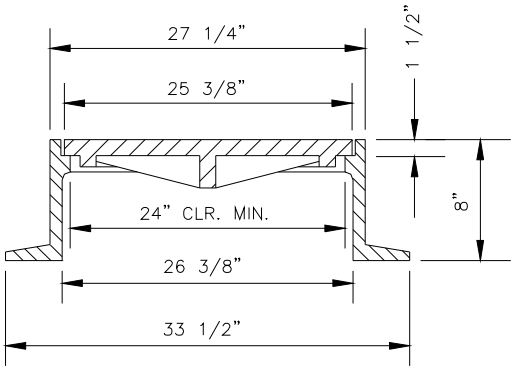


TOP VIEW

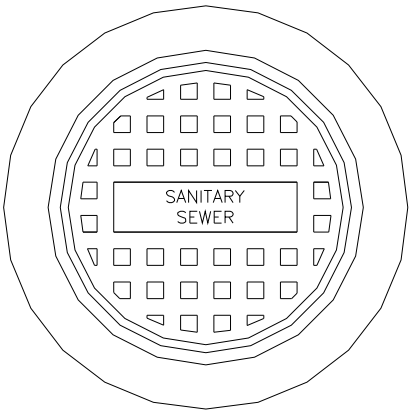
NON–TRAFFIC

RING 105 lbs.
COVER 105 lbs.

TOTAL 210 lbs.



SECTION



TOP VIEW

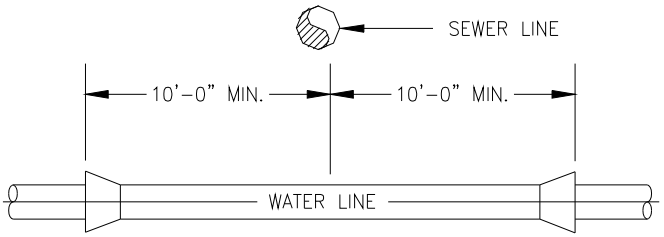
TRAFFIC

RING 190 lbs.
COVER 150 lbs.

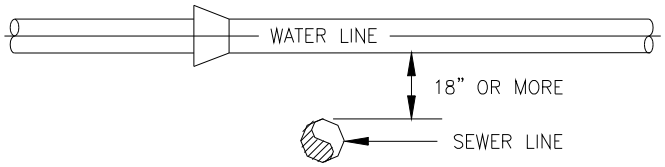
TOTAL 340 lbs.

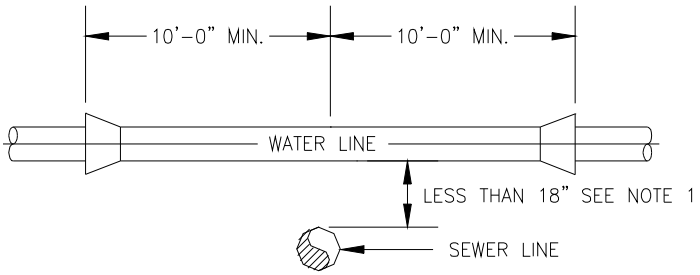
TRAFFIC & NON–TRAFFIC MANHOLE FRAME & COVER

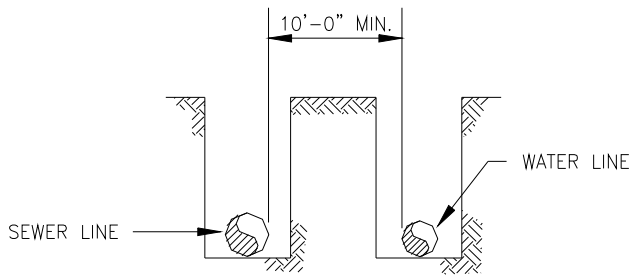
DWG NO.
MH–FC
1



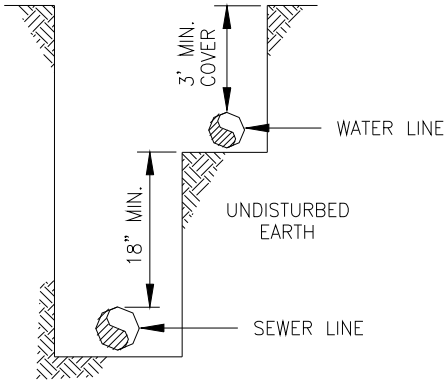
NOTE: 1. SEWER LINE TO BE CONSTRUCTED OF WATER LINE MATERIAL & PRESSURE TESTED (SEE SPEC.) AT ADDITIONAL COST.







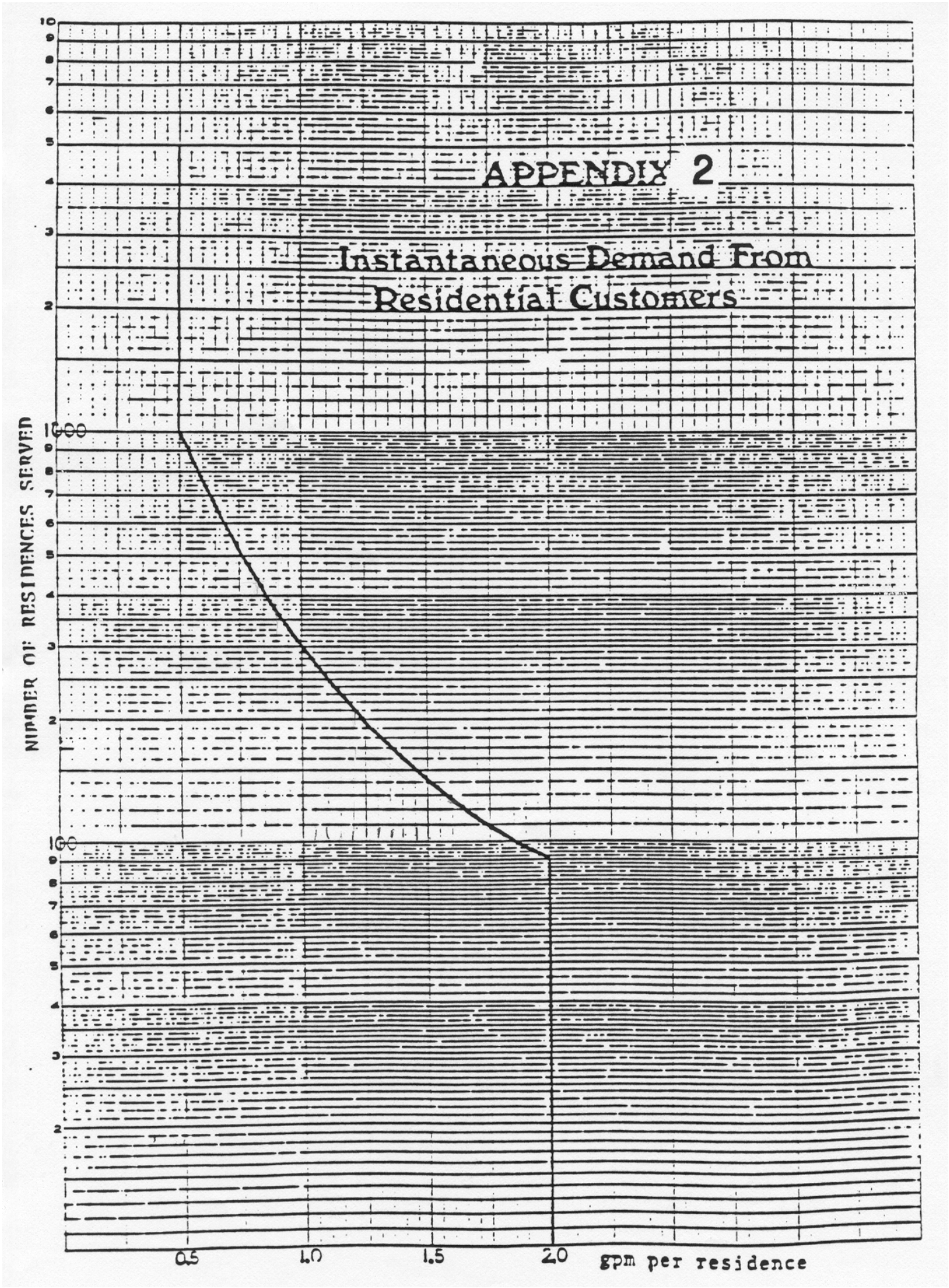
HORIZONTAL SEPARATION



VERTICAL SEPARATION

WATER & SEWER SEPARATION

DWG NO.
WSS1


APPENDIX 2
Instantaneous Demand From
Residential Customers
NUMBER OF RESIDENCES SERVED
1000
100
0.5
1.0
1.5
2.0
gpm per residence

APPENDIX 3
Design Basis for New Sewage Works

Discharge Facility	Design Units	Flow (gpd)	BOD (lb/day)	TSS (lb/day)	Flow Duration (hr)
Dwellings	per person	100	0.17	0.2	24
School with showers and cafeteria	per person	16	0.04	0.04	8
School w/o showers and with cafeteria	per person	12	0.025	0.025	8
Boarding School	per person	75	0.2	0.2	16
Motels at 65 gal/person (rooms only)	per person	130	0.26	0.26	16
Trailer courts at 3 persons/trailer	per trailer	225	0.6	0.6	24
Restaurants	per seat	40	0.2	0.2	16
Interstate or through highway restaurants	per seat	180	0.7	0.7	16
Interstate rest areas	per person	5	0.01	0.01	24
Service stations	per vehicle serviced	10	0.01	0.01	16
Factories	per person per 8 hr shift	25	0.05	0.05	Operating
Shopping Center (no food) (no food)	per 1000 sq. of ultimate floor	150	0.01	0.01	12
Hospitals	per bed	300	0.6	0.6	24
Nursing home(add 75 gals for laundry)	per bed	120	0.3	0.3	24
Homes for the Aged	per bed	60	0.2	0.2	24
Child Care Center	per child and adult	10	0.1	0.1	Operating
Laundromats, 9 to 12 machines	per machine	250	0.3	0.3	16
Swimming pools	per swimmer	10	0.001	0.001	12
Theaters, auditorium type	per seat	5	0.01	0.01	12
Picnic areas	per person	5	0.01	0.01	12
Resort camps, day & night with limited plumbing	per campsite	50	0.05	0.05	24
Luxury camps with flush toilets	per campsite	100	0.1	0.1	24
Churches (no kitchen)	per seat	3	0.005	0.005	Operating

Note: In all cases use actual data from similar facilities when possible. Note variations due to factors such as age, water conservation, etc. Submit all design data used.

Appendix 4

Standard Forms

City of Johnson City Water and Sewer Department

Notification of Construction

Date: _____

Development: _____

Location: _____

Construction Contractor: _____

Engineer: _____

Contact Person: _____

_____
(address)

_____
(address)

_____
(telephone)

Approximate footage and size of water line: _____

Approximate footage and size of sanitary sewer line: _____

Estimated time frame for construction: _____

City of Johnson City Water and Sewer Department

Notification of Connection to City's System

Date: _____

Development: _____

Location: _____

Construction Contractor: _____

Engineer: _____

Contact Person: _____

_____
(address)

_____
(address)

_____
(telephone)

Water service required: _____

Sanitary sewer service required: _____

City of Johnson City Water and Sewer Department

Request for Design Standards Amendment

To request changes to these design standards, please submit a written request on the standard form provided on Appendix 4 to the following address:

Jim Milhorn, Engineering Services Coordinator
Johnson City Water & Sewer Department
P.O. Box 2466
Johnson City, TN 37605

If the changes are approved, an addendum to the design standards will be distributed to all those received an original set of design standards. All requests must be submitted by a registered professional engineer.

Date: _____

Requester: _____

_____
(address)

_____
(address)

_____
(telephone)

Change Requested: _____

_____

_____

Reasoning for Request: _____

_____

_____

PROJECT _____ COUNTY _____

_____ MAP# _____

PLAN SHEET # _____ PARCEL # _____

DEED OF UTILITY AND DRAINAGE EASEMENT

THIS INDENTURE made and entered into on this the _____ day of _____, 20 , by and between _____ Party/Parties of the First Part, and the CITY OF JOHNSON CITY, TENNESSEE, a Municipal Corporation with principal sites in Washington County, Tennessee, Party of the Second Part;

W I T N E S S E T H:

For and in consideration of the sum of TEN DOLLARS ($10.00) cash in hand paid and other good and valuable considerations, the receipt of all of which is hereby acknowledged, the Party/Parties of the First Part have this day bargained and sold and do by these presents hereby transfer and convey into the Party of the Second Part, its successors and assigns, a perpetual easement for sanitary sewer, all other utilities and drainage, together with the full right and authority to locate, relocate, construct, reconstruct, build, lay, maintain, and operate sanitary sewer, all other utilities and drainage, together with the full right and authority to locate, relocate, construct, reconstruct, build, lay, maintain, and operate sanitary sewer, all other utilities and drainage along said easement across property located in the _____ Civil District of _____ County, Tennessee, and more particularly described as follows, to-wit:

UTILITY AND DRAINAGE EASEMENT

** PERMANENT EASEMENT DESCRIPTION AND AREA REQUIRED**

CONSTRUCTION EASEMENT

The grantor(s) hereby convey an easement for the construction of improvements which runs parallel to and outside the proposed utility and drainage easement a width of _____ ft. on (each side, one side) to be used by the City of Johnson City, Tennessee, its contractors or assigns for a period of 1 year from and after the commencement of construction.

Area required _____.

The Party/Parties of the First Part acquired title to said land by Deed of record in the Register's Office for Washington County, Tennessee in Deed Book ___, Page _____, to which reference is here made.

TO HAVE AND TO HOLD SAID PROPERTY, together with all the rights, privileges and appurtenances thereunto appertaining unto the Part of the Second Part, its successors and assigns, in fee simple, forever.

The Party/Parties of the First Part convenant with the Party of the Second Part, its successors and assigns, that they are lawfully seized and possessed of said property; that they have a good and lawful right to sell and convey the same; that the same is free and unencumbered, and the title to said property they will forever warrant and defend against the claims of all persons whomsoever.

This property is conveyed subject to all valid restrictive convenants and easements, if any, of record.

IN TESTMONY WHEREOF, the Party/Parties of the First Part have set their hands and seals, this the day and year first above written.

_____

_____

STATE OF TENNESSEE
COUNTY OF _____

Before me, a Notary Public in and for the said State and County, personally appeared _____, with whom I am personally acquainted, or whose identity was proven to me on satisfactory evidence, and who, upon oath, acknowledged that they executed the foregoing instrument for the purposes therein contained.

WITNESS my hand and official seal at office in the State and County aforesaid on this the _____ day of _____, 20 _____.

_____
Notary Public

My Commission Expires:

_____

Prepared by:
James D. Culp
City Staff Attorney
601 E. Main Street
Johnson City, TN 37601
423-434-6009

WARRANTY DEED

THIS INDENTURE made and entered into on this the ___ day of _____, 20_____ by and between _____, Parties of the First Part; and the CITY OF JOHNSON CITY, TENNESSEE, a Municipal Corporation incorporated by Chapter 189 of the 1939 Private Acts of the Tennessee General Assembly, Party of the Second Part;

W I T N E S S E T H:

For and in consideration of the sum of TEN DOLLARS ($10.00) cash in hand paid and other good and valuable considerations, the receipt of all of which is hereby acknowledged, the Parties of the First Part have this day bargained and sold and do by these presents hereby transfer and convey into the Party of the Second Part, its successors and assigns, the following described real property, situate, lying and being in the Fifteenth (15th) Civil District of Washington County, Tennessee, and more particularly described as follows, to-wit:

Tax Map _____ Group _____ Parcel _____

ACQUISITION IN FEE SIMPLE

BEGINNING at a point on _____'s line, said point being a northwesterly corner to Lot – Block – Section – of the ----------Subdivision; thence, with ------ North 47 degrees 51 minutes 35 seconds East, 50.00 feet to a point; thence, through Lot 16 two new courses: (1) South 41 degrees 26 minutes 26 seconds East, 50.61 feet to a point; (2) South 48 degrees 33 minutes 35 seconds West, 50.00 feet to a point on ------ line; thence, with ------- North 41 degrees 26 minutes 26 seconds West, 50.00 feet to the point of BEGINNING. Containing ------- square feet, more or less.

UTILITY AND DRAINAGE EASEMENT

---------- Subdivision
Lot -- Block -- Section --

BEGINNING at a point on the line common between Lot – and Lot --, said point being South 47 degrees 15 minutes 25 seconds East – 0.86 feet from the Northeast corner of Lot 16; thence, with Lot 15 South 47 degrees 15 minutes 25 seconds East, 15.02 feet to a point; thence, through Lot 16 a new course South 45 degrees 21 minutes 35 seconds West, 74.71 feet to a point on the proposed property line to be conveyed to --------; thence, with proposed line North 41 degrees 26 minutes 26 seconds West, 15.02 feet to a point; thence, a new course through Lot 16 North 45 degrees 21 minutes 35 seconds East, 73.19 feet to the point of BEGINNING.

Easement 2:
BEGINNING a point on the line common to Lot --- and Lot --, said point being North 49 degrees 51 minutes 05 seconds East, 24.91 feet from the southwest common corner of Lot --- and the Northwesterly corner to Lot ---; thence, through Lot – two new courses: (1) North 86 degrees 04 minutes 13 seconds West, 34.36 feet to a point; (2) North 43 degrees 04 minutes 21 seconds West, 351.21 feet to a point on the proposed property line to be conveyed to ----------; thence, with proposed line North 48 degrees 33 minutes 35 seconds East, 15.01 feet to a point; thence, through Lot --- two new courses: (1) South 43 degrees 04 minutes 21 seconds East, 344.88 feet to a point; (2) South 86 degrees 04 minutes 12 seconds East, 43.95 feet to a point on Lot –'s line; thence, with Lot --- South 49 degrees 51 minutes 05 seconds West, 21.56 feet to the point of BEGINNING.

Being a permanent sewer easement containing 6917.00 square feet, more or less. The Parties of the First Part also convey to the Party of the Second Part an
easement for the construction of improvements which runs parallel to and outside the proposed utility and drainage easements a width of 7.5 feet on each side to be used by the City of Johnson City, Tennessee, its contractors or assigns, which temporary easement shall expire one (1) calendar year after the commencement of construction, and shall consist of approximately 7324.00 square feet, more or less.

All of the aforesaid property being more particularly described and illustrated on a drawing prepared by ------- RLS # ----------, ------------, Johnson City, Tennessee 37605, which drawing is dated ---------, 1995 and is appended to this instrument as Exhibit A and is incorporated herein by references fully as if set forth verbatim.

Being a portion of that property conveyed to --------- and wife ------------------
by ------------ and wife ------------------ by deed of record in the Register's Office for Washington County, Tennessee, at Jonesborough, at Roll ---, Image ---, to which reference is here made.

TO HAVE AND TO HOLD SAID PROPERTY, together with all the rights, privileges and appurtenances thereunto appertaining unto the Party of the Second Part, its successors and assigns, in fee simple, forever.

The Parties of the First Part covenant with the Party of the Second Part, its successors and assigns, that they are lawfully seized and possessed of said property; that they have a good and lawful right to sell and convey the same; that the same is free and unencumbered, and the title to said property they will forever warrant and defend against the claims of all persons whomsoever.

This property is conveyed subject to all valid restrictive covenants and easements, if any, of record.

IN TESTIMONY WHEREOF, the Parties of the First Part have set their hands and seals, this the day and year first above written.

_____
XXXXXXXXXXX

_____
XXXXXXXX

STATE OF TENNESSEE
COUNTY OF WASHINGTON

Before me, a Notary Public in and for the said State and County, personally appeared XXXXXXXXXXX, with whom I am personally acquainted, or whose identity was proven to me on satisfactory evidence, and who, upon oath, acknowledged that he executed the foregoing instrument for the purposes therein contained.

WITNESS my hand official seal at office in the State and County aforesaid on this the _____ day of_____, 20__.

_____
NOTARY PUBLIC

My Commission Expires:

_____

STATE OF TENNESSEE
COUNTY OF WASHINGTON

Before me, a Notary Public in and for the said State and County, personally appeared XXXXXXXXXXXXX, with whom I am personally acquainted, or whose identity was proven to me on satisfactory evidence, and who, upon oath, acknowledged that she executed the foregoing instrument for the purposes therein contained.

WITNESS my hand and official seal at office in the State and County aforesaid on this the _____ day of _____, 20_____.

_____
NOTARY PUBLIC

My Commission Expires:

_____

PROPERTY OWNER:	PERSON OR AGENT RESPONSIBLE FOR PAYMENT OF TAXES:
_____	_____
NAME	NAME
_____	_____
_____	_____
ADDRESS	ADDRESS

_____
(MORTGAGEE)
IF NONE, PLEASE WRITE NONE

STATE OF _____

COUNTY OF _____

I, or we, hereby swear or affirm that the actual consideration for this transfer or value of the property transferred, whichever is greater, is $ _____, which amount is equal to or greater than the amount which the property transferred would command at a fair voluntary sale.

AFFIANT _____

Subscribed and sworn to before me this _____ day of _____, 20 _____

NOTARY PUBLIC _____

My Commission expires _____

Appendix 5

Clearance Requirements for Underground Power Cables

CLEARANCE REQUIREMENTS FOR UNDERGROUND POWER CABLES

Johnson City Power Board
Administrative Directive

Effective Date: Immediately
Approved by: Board of Directors 11/23/99

Water, Sewer, and Storm Drain lines are to be a minimum of 4'-0" from centerline of the nearest underground electric power cable. This clearance is preferred for new underground electric designs. See note below if this clearance can not be met.

Underground electric power cables crossing water, sewer or storm drain lines are to have a minimum of 12" vertical clearance. This is a NESC code requirement.

Underground electric power cables are to be installed below all water, sewer, and storm drains whenever possible. If the underground electric lines are to be installed above other utilities, the electric lines are to be encased in concrete and will be extended 2'-0" past the centerline on each side of the crossing. This is a NESC code requirement.

See the attached drawing for details.

Note: If these distances cannot be met by the other utilities, refer to the NESC for minimum distance required. See NESC rule 352C and 354.

Note: The preferred clearance distance of 4'-0" is intended to create a safe working area for all utilities.