WATER

AND

WASTEWATER

Rockdale Water Resources

STANDARDS

AND

SPECIFICATIONS

AUGUST 2019

ROCKDALE COUNTY

A Perfectly Positioned Community With A Rock Solid Approach Dedicated to Excellence In Customer Service, Quality of Life and Global Economic Development.

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APPENDIX B SEWER DETAILS

ARTICLE 1

ADMINISTRATIVE PROCEDURE

1.01 PURPOSE

This Article of the Specifications describes procedures, design criteria, and products to be incorporated into the water distribution and wastewater collection systems. The Developer shall furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.

The contract drawings approved by Rockdale Water Resources ("RWR") indicate the extent and general arrangement of the water distribution and sanitary sewer collection systems. If any departure from the approved construction drawings are deemed necessary by the contractor, details of such departures and the reasons therefore shall be submitted to RWR as soon as practicable for approval.

All contractors and designers should be aware of RWR construction specification requirements prior to design and construction. As such, all contractors and designers are required to possess a copy of the RWR Construction Standards Latest Edition. The contractor's copy of these specifications shall be available for consultation at the construction site. RWR reserves the right to stop the contractor's water and sewer line construction if RWR Water and Wastewater Standards and Specifications, Latest Edition, are not available for inspection and consultation at the construction site.

RWR will not be held responsible for any water distribution or sanitary sewer collection systems installation, which cannot be accepted into its system because of the contractor's lack of knowledge of the existence of the RWR Specifications. If it appears that the plans were prepared without regard to these specifications, they will be returned without comment.

1.02 PROJECT APPROVAL PROCEDURE

A. All project design and construction shall be in accordance with all federal, state and local standards and regulations, including but not limited to the latest editions of the following documents:

1. Rockdale County Utility Ordinance, latest edition.

2. Rockdale Water Resources Water and Wastewater Standards and Specifications, latest edition.

B. A project Concept Meeting should be held with RWR Engineering Division prior to the preliminary plat or construction plans submittal. The purpose of the Concept Meeting is to insure the following:

1. The Developer and Developer's Engineer are familiar with all aspects of RWR Standards and Specifications.

2. Review and discuss the general characteristics of the project.

3. The Developer and Developer's Engineer are aware of the process of submitting plans for review and approval by RWR.

4. The Developer and Developer's Engineer understand any special requirement relative to any local, state, or federal regulations which have to be included with plan submittals.

1.03 PROJECT ACCEPTANCE

A. The Engineering Department will issue an acceptance letter when the following requirements are met:

1. All quality assurance tests are conducted by the contractors, observed by RWR personnel, and are found to meet or exceed established requirements.

2. All Water and Sewer structures are successfully completed for the development.

3. The original permanent easements naming Rockdale Water Resources as the grantee for all required off-site public water and sanitary sewer structures are on file with RWR Engineering Department. Note: The owner/developer is responsible for obtaining and recording of all required off-site easements.

4. As-built drawings are reviewed and approved.

B. Twenty-one months after the letter of acceptance is issued, the project will be re-inspected to ensure system acceptability. A representative of the developer must be present for this inspection. If any corrective measures are necessary, a letter delineating the items to be corrected will be sent to the developer.

C. Two years after the project is accepted and after all final punch-list items have been resolved, the maintenance bond will be released.

1.04 "AS-BUILT" DRAWINGS

A. Two sets of paper copies shall be submitted.

B. Electronic "As-Built" files shall be compatible with RWR's version of AutoCAD.

C. All "As-Built" drawings shall be in state plane coordinate system, USA, GA, NAD 83, West Foot.

D. A registered land surveyor or Professional Engineer, licensed in the State of Georgia, is required to field verify the "As-Built" drawings (location and invert elevation of pipes, manholes elevations, lateral locations, etc.). "As-Built" drawings shall reflect actual field conditions. Unmodified construction drawings are not acceptable.

The following standard certification language shall appear on each sheet of the "As-Built" drawings, accompanied by the signature of the registered engineer or land surveyor, prior to approval of the drawings by Rockdale Water Resources:

"I certify that this project has been built as depicted on the "As-Built" drawings. I further certify that I have field verified all elevations, volumes, and locations as appropriate for the potable water, sanitary sewer and stormwater management structures depicted on these drawings."

Each certification statement as listed in this section shall be accompanied by the appropriate signature. The signatory's name shall be either type written or legibly printed below each signature. "As-Built" drawings containing illegibly printed or typed names will be considered unacceptable and the drawings will be returned unapproved.

The developer may be required at his or her cost to construct, reconstruct, remove or modify utility infrastructure to comply with the "As-Built" drawings when and if field conditions do not match the "As-Built" drawings.

1.05 MAINTENANCE REQUIREMENTS

A. The Owner shall maintain all water and sewer infrastructure accepted by RWR for a period of 24 months after acceptance. After 24 Months, accepted infrastructure belongs to RWR, and RWR shall provide all maintenance in perpetuity.

B. Private water and sewer infrastructure shall be maintained by the owner in perpetuity. Even though these structures may be regulated by RWR, RWR does not claim ownership and shall not provide maintenance.

C. Examples of private infrastructure include but are not limited to:

1. Water – service lines, fire protection lines, hydrants on private property, backflow prevention devices, etc.

2. Sewer –service lines, clean outs, manholes, grease traps, etc...

D. Maintenance of accepted infrastructure during 24 – month warranty period shall be guaranteed by a maintenance bond provided by the owner as a condition of acceptance. Maintenance bond amounts are based on the following standard construction:

1. $5,000 base amount.

2. $2.50 per linear foot of water main installed

3. $2.50 per linear foot of sewer main installed

4. $2.50 per linear foot of force main installed

a. RWR, in its sole discretion, reserves the right to consider proof of actual cost in lieu of the above-listed standard costs for construction.

b. The maintenance bond must remain in full force and effect for a minimum of 24 months from the date of issuance of an acceptance letter by RWR.

c. RWR may require, at its sole discretion, a cash bond for the price of the repair to the yards, driveways, landscaping, and other features associated with proposed utility lines that cross property owned by others. The purpose of the cash bond is to assure that prompt and satisfactory repair of the damaged property is performed.

d. All bonds as discussed in these specifications must meet the approval of RWR. RWR, in its sole discretion, may accept an irrevocable letter of credit in lieu of a bond.

e. Failures to the system while under warranty are the responsibility of the Developer, including but not limited to damage caused by the developer's contractors and other utility contractors. RWR will make a reasonable effort to contact the developer to repair failed infrastructure. Should the developer fail to respond in a timely manner (immediately in the case of emergencies) or should the repair be unsatisfactory to RWR in any way, RWR will make the repair and bill the developer.

f. RWR reserves the right to notify the developer's surety and/or financial institution(s) regarding defective and/or damaged infrastructure. Such notifications may consist of, but not necessarily be limited to, copying the surety and/or financial institution(s) on punch-list letters and other such correspondence pertaining to the construction project.

ARTICLE 2

DESIGN STANDARDS - WATER

2.01 DESIGN CRITERIA

A. Water Main Sizes: Minimum water mains shall be sized as shown in the following summary:

Residential	8-inch
Office and Institutional	12-inch
Commercial and Industrial	12-inch

This summary shall supersede all ordinances or specifications that show sizes other than the above.

Water main sizes along certain routes shall be sized according to the latest revision of the Water System Master Plan on file at the office of the Director of Water Resources.

B. Fire Protection

It is developer's responsibility to provide adequate fire protection to the new residential subdivisions. Hydraulic calculation for adequate fire protection shall be prepared by a Registered Professional Engineer in the State of Georgia and submitted to the county for approval.

C. Water Main Location

1. Subdivisions: Along subdivision streets or inside new developments, water mains shall be located 7 feet behind the back of curb. See Standard Drawings A-1 through A-3.

2. Existing City and County Right-of-Way: Water mains shall be located a minimum of 7 feet inside the right-of-way limit. A Land Disturbance Permit shall be obtained from Rockdale County or the City of Conyers prior to encroachment on right-of-way. See Standard Drawing A-4.

3. Georgia Department of Transportation Right-of-Way: Along Georgia Department of Transportation right-of-way, water mains shall be located a maximum of 5 feet inside the right-of-way limit. See standard drawing A-4.

A Utility Encroachment Permit shall be obtained from the Georgia Department of Transportation prior to construction. A permit application and required drawings shall be prepared by the Developer and sent through RWR Engineering.

4. Easements: Water mains shall be located along roadway right-of-ways unless approved otherwise. Any water mains constructed on private property shall have a recorded easement submitted before construction drawings are approved.

5. Roadway Crossings: Water mains and service lines crossing existing City, County or Department of Transportation paved streets and roadways shall be bored and cased. Permits are required from the proper authority prior to construction. Every effort shall be made to bore under roads, including moving to different boring locations. If subsurface conditions (rock) should prevent boring, then only by written permission from the proper authority shall the road be open-cut. Lines installed by open-cut without written permission shall not be accepted. Department of Transportation roadways shall not be open-cut under any circumstances. Repair of open-cut roadways shall conform to Standard Drawing A-10.

6. Railroad Crossings: When water mains are to cross right-of-ways owned by any railroad, an approved permit shall be required prior to construction. Permit shall be sent through RWR Engineering. All fees associated with the railroad crossing shall be paid by the Developer.

7. Depth: Minimum depth of cover shall be 4.5 feet on water mains and 2.5 feet on service lines.

D. Water Main and Service Line Materials

1. Ductile Iron Pipe (DIP): Water mains constructed along or crossing any existing or proposed City, County, Department of Transportation roadway, or Railroad right-of-way shall be constructed of ductile iron pipe.

2. Water Service Lines: All water service lines 2-inches in diameter and less shall be constructed of copper tubing. Water service lines 3-inches in diameter and larger shall be constructed of ductile iron pipe.

3. All service lines are to have appropriate backflow prevention ahead of tie-in to county water system.

E. Fire Hydrant Spacing: The maximum distance between fire hydrants shall be 500 feet. Fire hydrants shall be installed on the end of mains in cul-de-sacs.

F. Valve Spacing: Valves shall be located on all mains such that a minimum number of customers would be affected should maintenance become necessary.

1. On water mains 8-inches in diameter or larger, valves shall be placed at all road intersections and at 1,000 foot intervals, maximum.

2. Valves with thrust collars shall be placed on temporary or permanent dead ends of water mains so that future extension may occur without main shut-off.

3. Refer to the Standard Drawings for water main location and valve installation requirements. (Standard Drawings A-1 to A-5).

G. Location of Water Service Lines: Water service lines for all developments shall be a minimum 1-inch in diameter and connect to the main as shown on Standard Drawing A-9 in Appendix A. Depending on anticipated water usage, larger water service lines may be required in certain developments. Rockdale Water Resources shall have final authority on the sizing for the required services.

2.02 INFORMATION TO BE SHOWN ON PLANS – WATER

Information on plans should include the following:

1. Project name and valid registration stamp of the Professional Engineer registered in the State of Georgia. The stamp and signature of registered land surveyors or landscape architects are not acceptable. The registered Professional Engineer must also stamp any plan redesign.

2. (Site plans) Street, street names, lot layout (if subdivision) or building locations (if multi-family, commercial or industrial), land lots and district, north arrow, water layout only.

3. (Detailed plans) The location and the construction of water mains, valves, fire hydrants, and appurtenances.

4. Limits of the 100 year flood plain.

5. Thrust blocks at all bends and tees. Thrust blocks shall be designed by a registered Professional Engineer licensed in the State of Georgia.

6. Type of material to be used.

7. Location and size of existing water lines surrounding the project.

8. Nearest existing line valves on the main.

9. Other utilities in area of potential conflict.

10. Proposed tie-in with existing lines.

11. Pressure-flow test results, development water demand and fire flow requirements.

12. Twenty-foot permanent easements are required where the water line crosses private property. More easement area may be required as deemed necessary by RWR.

13. Plan and profile scales shall be:

Vertical:	1 inch = 5 feet or 1 inch = 10 feet
Horizontal:	1 inch = 20 feet, 1 inch = 50 feet or 1 inch = 100 feet

14. Sheet size is 24 inches x 36 inches. "Half-size" drawing sets will <u>not</u> be reviewed and will be returned to the owner/developer.

15. A general site(vicinity) location map.

16. <u>The following notes shall be required on all drawings submitted to RWR</u>:

    a. Design and construction of all water and sanitary sewer lines shall conform to Rockdale Water Resources Water and Wastewater Standards and Specifications, latest edition.

    b. Contractor will notify RWR Engineering Department at least 72 hours prior to beginning of construction on water and sewer. An inspector will be assigned and a pre-construction meeting scheduled at this time.

    c. "As-Built" drawings shall be field verified and stamped by a registered Professional Engineer or land surveyor, licensed in the State of Georgia.

    d. The contractor shall comply with all Utilities Protection Center requirements.

17. Additional items may be requested if deemed necessary by RWR.

ARTICLE 3

CONSTRUCTION STANDARDS - WATER

3.01 MATERIALS

A. Applicable Standards: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable. If requested by Rockdale Water Resources, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

B. Substitutions: Whenever a product is identified in the Specifications by reference to manufacturers' or vendors' names, trade names, catalog numbers, etc., the Developer may freely choose from those referenced products which ones he wishes to provide. Any item or product other than those designated shall be considered a substitution. The Developer must obtain prior approval from Rockdale Water Resources for all substitutions. Requests for substitutions must be received by Rockdale Water Resources with Construction Plan submittal. Provide all pipe, fittings, valves, tapping sleeves and valves, hydrants, and all other materials required for completion of the work. Provide materials in accordance with the following:

C. Ductile Iron Pipe (DIP)

1. Ductile iron pipe shall conform to AWWA C151 and shall be Class 51 unless shown otherwise. All pipe shall be furnished in minimum lengths of 18 feet. Pipe and fittings shall be cement lined in accordance with AWWA C104. Fittings shall be ductile iron including glands and shall conform to AWWA C153 with minimum rated working pressure of 250 psi. Pipe and fittings shall be furnished with a bituminous outside coating.

2. Joints shall be push-on type for pipe and standard mechanical or flanged joint for fittings. Push-on and mechanical joints shall conform to AWWA C111. Restrained joints shall be equal to American "LOK-FAST", "FLEX-RING" or "LOK-RING", Clow "SUPER-LOCK", or U.S. Pipe "TR FLEX" or "LOK-TYTE". Restrained joint pipe (RJP) on piers shall have bolted joints and shall be specifically designed for clear spans of at least 36 feet.

3. The appropriate gaskets for mechanical and flange joints must be provided. Gaskets for flange joints shall be made of 1/8-inch thick cloth reinforced rubber; gaskets may be ring type or full- face type.

4. The necessary bolts for mechanical and flange connections must be provided. Bolts for flange connections shall be steel with American Regular unfinished square or hexagon heads. Nuts shall be steel with American Standard Regular hexagonal dimensions, all as specified in ANSI B 17.2. All bolts and all nuts shall be threaded in accordance with ANSI B 1.1, Coarse Thread Series, Class 2A and 2B fit.

5. Ductile iron pipe shall be encased with polyethylene film where applicable. Polyethylene film shall have a minimum thickness of 8 mils. Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of RWR.

6. Acceptance will be on the basis of Rockdale Water Resources inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

D. Copper Tubing (CT): Tubing shall be hard drawn copper, ASTM B 88, Type K. Fittings shall be compression type or sweat type wrought copper, ANSI B 16.22. Where required, sweat to screw adapters shall be cast bronze ANSI B 16.18, wrought solder joint ANSI B 16.22. Unions shall be cast bronze or bronze with solder connections. Joints shall be made with 95/5 silver solder for Type K pipe.

E. Gate Valves (GV)

1. Gate valves with diameters 2 through 12-inches shall be designed, manufactured, and tested in accordance with the applicable requirements of AWWA C500 or AWWA C509. Gate valves shall be specified for 200 psi working pressure:

2. Valve ends shall be mechanical joint type except where flanged ends are required.

3. Valves shall open left and shall have O-ring type stem seals.

4. Each valve shall be equipped with a valve box. Extension stem must be provided where required to bring the operating nut to within 24-inches of ground surface.

5. All valves shall be non-rising stem type. Operating nut shall be 2-inch square unless shown otherwise.

6. Gate valves shall be American-Darling, M&H Valve, Mueller or CLOW.

F. Butterfly Valves (BV)

1. Butterfly valves shall be designed, manufactured, and tested in accordance with the applicable requirements of AWWA C504. Butterfly valves shall be specified with the following working pressures:

Elevation, feet (Mean Sea Level)	Working Pressure, psi
800 or greater	150
Less than 800, but greater than 600	250

2. Valves shall be the resilient-seated, short body design. End configuration shall be compatible with adjacent piping. Valve bodies shall be high-strength cast iron, ASTM A 126 Class B. Shafts shall be 18-8, type 304 stainless steel, machined and polished. Valve discs shall be ductile iron, ASTM A 536, Grade 65-45-12.

3. Valves shall be equipped with geared operators capable of withstanding 450 feet-pounds of input torque. Operators shall conform to the requirements of AWWA C504. All joint material required for the valve installation shall be furnished by the valve manufacturer.

4. Butterfly valves shall be American-Darling, M&H Valve, Mueller or CLOW.

G. Fire Hydrants (FH)

1. All fire hydrants shall conform to the applicable requirements of AWWA C502. Fire hydrants shall be specified for 200 psi working pressure.

2. Hydrants shall be the compression type, closing with line pressure. The valve opening shall not be less than 5-1/4-inches.

3. In the event of a traffic accident, the hydrant barrel shall break away from the lower barrel at a point above grade and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.

4. The means for attaching the upper barrel to the lower barrel shall permit facing the hydrant a minimum of eight different directions.

5, Hydrants shall be fully bronze mounted with all working parts of bronze.

Valve seat ring shall be bronze and shall screw into a bronze retainer.

6. All working parts, including the seat ring, shall be removable through the top of the hydrant without disturbing the barrel of the hydrant.

7. The operating nut shall be National Standard. The operating threads shall be totally enclosed in an operating chamber separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or an oil reservoir. A stop nut shall be positioned in the top operating mechanism of the hydrant so that the valve stem cannot contact the bottom of the shoe when the hydrant is fully open.

8. Hydrant shall be a non-freezing design and provided with a simple, positive, and automatic drain which shall be fully closed whenever the main valve is opened.

9. Hose and pumper connections shall be breech-locked, pinned, or threaded and pinned to seal them into the hydrant barrel. Each hydrant shall have two 2-1/2-inch hose connections and one 4-1/2-inch pumper connection, all with National Standard threads and each equipped with cap and non-kinking chain.

10. Hydrants shall be furnished with a mechanical joint connection to the spigot of an anchor coupling.

11. Minimum depth of bury shall be 4.5 feet. Provide extension section where necessary for vertical installation and in accordance with manufacturer's recommendations.

12. All outside surfaces of the barrel above grade shall be painted white with enamel equal to Koppers Glamortex 501.

13. Hydrants shall be traffic model and shall be American-Darling B-84-B, M&H Valve 129-01, Mueller Super Centurion, CLOW or East Jordan Iron Works.

H. Valve Boxes (VB): All valves shall be equipped with valve boxes. Valve boxes shall be heavy roadway type. The valve boxes shall be cast iron two-piece slip or screw type with drop covers. The valve boxes shall be adjustable 6-inches up or down from the nominal required cover over the pipe. Extensions shall be provided as necessary. The cover shall be stamped "Water Valve" or "W". A concrete collar shall be furnished for all valve boxes outside the roadway.

I. Valve Markers (VM): The Developer shall provide a concrete or reinforced fiberglass valve marker for each valve installed. Valve markers shall be stamped "Water Valve" and have the distance to the valve box stamped or engraved on them.

J. Tapping Sleeves and Valves (TS&V): Tapping sleeves shall be cast or ductile iron of the split sleeve, mechanical joint type. Valves shall be gate valves furnished in accordance with the specifications shown above, with flanged connection to the tapping sleeve and mechanical joint connection to the branch pipe. The valve shall have tapped plug on the bonnet for release of trapped air. The necessary bolts, glands, and gaskets shall be furnished by the manufacturer. The tapping sleeve and valve shall be supplied by the same manufacturer.

K. Tapping Saddles: Tapping saddles shall be ductile iron body type with O-ring gasket and alloy steel straps. Connection shall be flanged or mechanical joint as required.

L. Service Saddles: Service saddles shall be ductile iron body type with O-ring gasket and alloy steel straps. Connection shall be for AWWA or NPT threads. Service saddles shall be equal to Rockwell #313, Dresser #291, or Ford F202.

M. Corporation Stops and Curb Stops: Corporation stops and curb stops shall be ground key type or ball valve type; shall be made of bronze conforming to ASTM B 61 or B 62; and shall be suitable for the working pressure of the system. Seat and ball shall be SS. Ends shall be suitable for flared copper tube or compression type joint. Threaded ends for inlet and outlet of corporation stops shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ANSI B 16.26. Corporation stops and curb stops shall be manufactured by Mueller, Ford or Hays.

N. Retainer Glands: Retainer glands shall be equal to ACIPCO A 90857 or EBBA Iron Megalug.

O. Hydrant Tees: Hydrant tees shall be equal to ACIPCO A 10180 or U.S. Pipe U-592.

P. Anchor Couplings: Anchor couplings shall be equal to ACIPCO A 10895 or U.S. Pipe U-591.

Q. Meter Box: Meter boxes shall be NDS AMR BOX D1200-BO.
Cover with 2 1/8” DIA. Touch tone hole. Or approved equal.

R. Detection Tape: Detectable mylar encased aluminum foil marking tape shall be installed over all water mains. Tape will be Precaution Blue in color, at least 1-1/2-inches wide, and shall bear the printed identification "Caution: Water Line Buried Below" (reverse printed), so as to be readable through the mylar. Surface printing on the tape shall be equal to Lineguard Type II Detectable.

S. Air Release Valves: Valves shall be automatic air release valves designed to allow escape of air under pressure and close water-tight when water enters the valve. The valve shall have a minimum orifice diameter of 3/16-inch. The valve body shall be cast iron, designed to facilitate disassembly for cleaning and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion resistant materials. Valves shall be designed for potable water service. Valves shall be equal to Golden-Anderson, APCO, Crispin, Empire, or Val-Matic.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROLS

The Developer shall submit a description, working drawing and schedule for proposed temporary erosion and sedimentation controls to the local authority. The description and working drawings shall meet the requirements of the Manual for Erosion and Sediment Control in Georgia, latest edition and local soil erosion and sedimentation control ordinances. The Developer shall acquire land disturbance permits from the local authority and shall pay any fees for said permits. The Developer shall be responsible for submitting to the local authority sufficient documents such that the local authority can acquire approval from RWR or Soil and Water Conservation District. All fines imposed for improper erosion and sedimentation control shall be paid by the Developer.

3.03 EXISTING UNDERGROUND UTILITIES AND OBSTRUCTIONS

A. The Construction Plans shall indicate underground utilities or obstructions that are known to exist according to the best information available. The Developer, as required by Georgia Law 25-9-1, shall call the Utilities Protection Center (UPC) (404-325-5000 or 1-800-282-7411) and those utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site to verify the location of the existing utilities.

1. Electronic Pipe and Cable Locator: Furnish and have available at all times an electronic pipe locator, in good working order, to aid in locating existing pipe lines or other obstructions.

2. Water and Sewer Separation: Water mains shall maintain a minimum 10 foot edge to edge separation from sewer lines, whether gravity or pressure. Where the water main crosses a sewer line, an 18-inch vertical separation shall be maintained and a full joint of water pipe shall be centered over the sewer line. The sewer line in this area shall be D.I.P. Any deviation shall be requested in writing for approval.

3.04 CLEARING AND GRUBBING

A. Clear and grub 5 feet on each side of the pipeline before excavating. Remove all trees, growth, debris, stumps and other objectionable matter. Clear the construction easement or road right-of-way only if necessary.

B. Clearing

1. All vegetation such as trees, shrubs, brush, logs, upturned stumps and roots of down trees, and other similar items shall be removed and disposed of. Cultivated growth shall be removed and trees felled as necessary and in accordance with the requirements of paragraph PROTECTION AND RESTORATION OF WORK AREA.

2. Where the tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility.

3. All buildings, fences, lumber piles, trash, and obstructions, except utility poles, shall be removed and disposed of by the Contractor. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.

4. All fences adjoining any excavation or embankment that may be damaged or buried shall be carefully removed, stored, and replaced.

C. Grubbing: All stumps, roots, foundations and planking embedded in the ground shall be removed. Piling and butts of utility poles shall be removed to a minimum depth of 2 feet below the limits of excavation for structures, trenches, and roadways or 2 feet below finish grade, whichever is lower.

D. Disposal of Refuse

1. The refuse resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Developer and shall be disposed of in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any private property except with written consent of the property owner. In no case shall any material be left on the project, shoved onto abutting private properties, or buried on the project.

2. When approved in writing by RWR and when authorized by the proper authorities, the Developer may dispose of such refuse by burning on the project site provided all requirements set forth by the governing authorities are met. The authorization to burn shall not relieve the Developer in any way from

damages which may result from his operations. On easements through private property, the Contractor shall not burn on the site unless written permission is secured from the property owner.

E. Scheduling of Clearing

1. On existing right-of-way, The Developer shall clear at each construction site only that length of the permanent or construction easement which would be the equivalent of two week's pipe laying.

2. RWR may permit clearing for additional lengths of the pipe line provided that erosion and sedimentation controls are in place and a satisfactory stand of grass is established. Should a satisfactory stand of grass not be possible, no additional clearing shall be permitted beyond that specified above.

3. A satisfactory stand of grass shall have no bare spots larger than 1 square yard. Bare spots shall be scattered and the bare area shall not comprise more than 1 percent of any given area.

4. The Developer shall be responsible for all damages to existing improvements resulting from his operations.

3.05 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS

A. Install water lines and appurtenances along highways, streets and roadways in accordance with the applicable regulations of and permits issued by the Department of Transportation, Rockdale County and the City of Conyers with reference to construction operations, safety, traffic control, road maintenance and repair.

B. Traffic Control

1. The Developer shall provide, erect and maintain all necessary barricades, suitable and sufficient lights and other traffic control devices; shall provide qualified flagmen where necessary to direct traffic; shall take all necessary precautions for the protection of the work and the safety of the public. Flagmen shall be certified by attending a Georgia DOT approved flagman training program.

2. Construction traffic control devices and their installation shall be in accordance with the current Manual On Uniform Traffic Control Devices for Streets and Highways.

C. Construction Operations: Perform all work along highways, streets and roadways to minimize interference with traffic.

1. Stripping: Where the pipe line is laid along road right-of-way, strip and stockpile all sod, topsoil and other material suitable for right-of-way restoration.

2. Trenching, Laying and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.

3. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod and any other materials removed from shoulders.

D. Excavated Materials: Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off of the pavement in a timely manner.

E. Drainage Structures: Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material and free to drain at all times.

F. Maintaining Highways, Streets, Roadways and Driveways

1. Maintain streets, highways, roadways and driveways in suitable condition for movement of traffic until completion and final acceptance of the work.

2. During the time period between pavement removal and replacement, maintain roads by the use of steel running plates. Asphalt shall be placed around all edges of the running plate to minimize vehicular impact. The backfill above the pipe shall be compacted as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.

3. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways. Make the grader or front-end loader available at all times.

4. Repair all driveways that are cut or damaged immediately. Maintain them in a suitable condition for use until completion and final acceptance of the work.

3.06 HANDLING MATERIALS

A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or

dumped will be subject to rejection without additional justification.

B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front loader. Do not use material damaged in handling.

C. Distribution: Distribute and place pipe and materials to not interfere with traffic along roadways. Do not string pipe more than 1,000 feet beyond the area where pipe is being laid on existing roads. Do not obstruct drainage ditches.

D. Storage: Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.

3.07 CONNECTIONS TO EXISTING PIPE LINES

A. Make connections to existing lines with tapping sleeves, solid sleeves, saddles and valves as specified. Prepare lines for connection as described under Pressure and Leakage Test. Contractor must have RWR approval before any work is performed on the existing water distribution system. Notice should be provided to Dispatch office and Engineering.

B. Location: Before laying pipe, locate the points of connection to existing pipe lines and uncover as necessary for RWR inspection.

C. Interruption of Services: Make connections to existing pipe lines only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the inspector.

D. No one other than RWR personnel may operate system valves.

3.08 EXCAVATION AND BEDDING

A. Excavate trenches by open cut. Pavement removal and replacement required by the excavation of trenches shall be done in accordance with the requirements of paragraph REMOVING AND REPLACING PAVEMENT. Perform all excavation in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596) as amended. The Developer shall pay particular attention to Safety & Health Regulations Part 1926, subpart P "Excavations, Trenching & Shoring" as described in OSHA publication 2226.

B. Depth of Trenches: Excavate trenches to provide a minimum cover of 4.5 feet. Within the right-of-way of highways, streets, or roadways, excavate to place the top of

the pipe a minimum of 4 feet below the nearest pavement edge.

C. Additional Trench Depth: Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.

D. Width of Trenches: Excavate trenches wide enough to allow proper installation of pipe, fittings, and other materials, and not less than 9-inches clear of the outside barrel of the pipe on any side at any point.

E. Bell Holes: At each joint, excavate bell holes of ample depth and width to permit the joint to be made properly and to relieve pipe bell of any load.

F. Earth Excavation: Excavate and prepare the trench bottom to support the pipe uniformly throughout its length. If the trench is excavated to excessive width or depth, provide crushed stone meeting the requirements of Georgia DOT Specification 800.01 for No. 57 stone to achieve Standard Laying Condition Type 4 in accordance with AWWA C151.

G. Rock Excavation: Excavate and prepare the trench bottom to support the pipe uniformly throughout its length.

1. Definition of Rock: Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 18,300 pounds (comparable to Caterpillar Model 215), and occupying an original volume of at least one-half cubic yard.

2. Excavation: Where rock is encountered, excavate to the minimum depth and width which will provide 6-inches clearance beyond the outside diameter of the pipe bell.

3. Blasting: Provide experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all structures from the effects of the blast. Repair any resulting damage.

H. Bedding

1. Bed water mains in suitable earth materials. Bedding shall be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.

2. Bedding shall meet all requirements of Standard Laying Condition Type 2 in accordance with AWWA C151 and as shown in Standard Drawing A-15. Where Type 4 or Type 5 bedding is called for on the Construction Plans,

specified or ordered by the County, this bedding shall meet all requirements of Standard Laying Condition Type 4 or Type 5 in accordance with AWWA C151 and as detailed on the Drawings, utilizing crushed stone as specified below. If the trench is excavated to excessive width or depth, provide crushed stone to achieve Standard Laying Condition Type 4 in accordance with AWWA C151 and as detailed on the Construction Plans.

3. Crushed stone shall be quartzite granite meeting the size requirements of ASTM C 33, Coarse Aggregate, Size Number 57.

4. For restrained joint pipe, bedding shall meet all requirements of Standard Laying Condition Type 3 in accordance with AWWA C151 and as detailed on the Construction Plans.

I. Bracing and Sheeting: When required by regulations or to prevent damage to adjoining structures, roadways, pavements, utilities, trees, or private property which are specifically required to remain, provide bracing and sheeting.

1. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of RWR it cannot be safely removed. Cut off sheeting left in place at least 2 feet below the surface.

2. Steel Sheet Piling: Continuous lockjoint steel sheet piling may be substituted for timber sheeting when approved by RWR. Steel piling may be removed, without cutting, provided the rate of removal keeps pace with the tamping and backfilling operations to assure complete filling of the void created by the withdrawal of the piling. Complete withdrawal of the piling in advance of the tamping and backfilling will not be permitted. Piling, where ordered to be left in place by RWR for reasons of safety, will be cut off where directed.

3. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the bedding of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be "dragged" with the bottom of the shield extending below the top of the pipe.

J. Dewatering Trenches: Dewater excavation continuously to maintain a water level

below the bottom of the trench. Dewater running sand by well pointing. Where soil conditions do not permit use of well point, construct french drains of crushed stone or gravel to conduct water to sumps.

K. Trench Stabilization: Wherever the material at the bottom of the trench is unsuitable for the proper installation of the pipe, RWR will direct the removal and replacement of the unsuitable material. When so directed, undercut the trench and backfill with crushed stone. Place and compact this material to bring the trench to the required grade.

3.09 LAYING AND JOINTING PIPE AND FITTINGS

A. Lay all pipe and fittings to accurately conform to the lines and grades established by the Construction Plans.

B. Handling

1. Use suitable tools and equipment to handle and lay pipe. Prevent damage to the pipe and the cement lining. Examine all pipe carefully for cracks and other defects as it is laid. Do not lay pipe or other materials which are known to be defective.

2. Lower pipe, fittings, valves, and accessories into the trench by suitable means. Do not drop or dump pipe or accessories into the trench.

3. Clean pipe and fittings thoroughly before laying. Keep the pipe line clean until final acceptance.

4. If any pipe or other material is discovered to be defective or damaged after being laid, remove and replace it.

C. Alignment and Gradient

1. Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.

2. Maintain a transit and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times

when work is not in progress. If necessary to backfill over the end of an uncompleted pipe, close the end with a mechanical joint plug.

E. Laying Pipe in Trenches: Lay the pipe with solid bearing throughout its length.

1. Earth Trenches: Grade the bottom of the trench to a true line. Lay the pipe in clean bedding material, free of rock, organics, and other unsuitable materials.

2. Rock Trenches: Bed the pipe in at least 6-inches of clay or granular bedding material. Backfill with the same material to at least 2 feet above the pipe.

3. Wet Trenches: Do not lay pipe in water. Provide dewatering equipment to maintain a ground water level below the bottom of the pipe while pipe is being laid.

F. Joints: Push-on, mechanical, flanged and restrained type joints shall be made in accordance with the manufacturer's recommendations.

G. Cutting: Cut ductile iron pipe using an abrasive wheel saw. Cut PVC pipe using a suitable saw; remove all burrs and smooth the end before jointing.

3.10 FLUSHING OF WATER MAINS

The flushing of all water mains shall be accomplished through an acceptable flushing (blowoff) arrangement comprising of a gate valve and required length of pipe. Through flushing at a minimum velocity of 2.5 feet per second shall be achieved using the outlet size openings listed below (40 P.S.I. residual pressure must be maintained in the water main):

Pipe Size (In)	Required GPM @ 2.5 FPS	Flush Valve Pipe Size (In)
6	220	6
8	400	8
10	660	10
For all other pipe sizes engineer to specify flush Valve and pipe size per AWWA C651		

All dead end water mains shall have adequately sized flush assembly to facilitate periodic flushing of the water lines. The contractor shall study the plans and make provisions to comply with this requirement. Any additional cost to the contractor for complying with this requirement shall be borne by the contractor.

3.11 THRUST RESTRAINT

A. Provide restraint at all points where hydraulic thrust may develop. Harness rods and MJ fittings are preferred type of thrust restraint.

B. Harnessing: Install harness rods where specifically directed by the Construction Plans. Harness rods shall be manufactured in accordance with ASTM A 36 and shall have an allowable tensile stress no less than 22,000 psi. Harness rods shall be hot dip galvanized.

C. Hydrants: Hydrants shall be attached to the water main with hydrant tees and anchor couplings.

D. Concrete Blocking: Provide concrete blocking for all other bends, tees, valves, and other points where thrust may develop as designed by Professional Engineer licensed in the state of Georgia.

3.12 BACKFILLING

A. Backfill and compact to prevent settlement and displacement of the pipe.

B. Material: Backfill trenches with earth only. Do not use rock excavated from trenches in the backfill. If necessary, furnish suitable earth material to backfill the trench.

C. Compaction: Place backfill material in the bottom of the trench and up to 2 feet above the pipe in 6-inch layers or lifts. Compact with two- hand operated air hammers with tamping feet, one on each side of the pipe, operated simultaneously. Backfilling, shall be compacted as follows:

1. In 6-inch layers/lifts, if using light power tamping equipment such as a "jumping jack",

2. In 1- foot layers/lifts, if using heavy tamping equipment such as hammer with tamping feet.

D. Backfill Under Pavements: Backfill underlying pavement and backfill under dirt and gravel roads shall be compacted to 95 percent of the maximum dry density as determined by the Standard Proctor Compaction Test (ASTM D 698). Developer shall supply compaction test reports as required by the inspector.

E. Backfill Along Restrained Joint Pipe: The backfill around the pipe, up to the top of the pipe, shall be compacted to 80 percent of the maximum dry density as determined by the Standard Proctor Compaction Test, ASTM D 698.

F. Detection Tape: Bury detection tape 12 to 18-inches below finished ground surface directly over all pipe and services. Install according to the manufacturer's written recommendations.

3.13 REMOVING AND REPLACING PAVEMENT

A. Removing and replacement of pavement on DOT roads shall conform to Georgia DOT Manual latest edition.

B. Removing Pavement: Remove existing pavement as necessary for the installation of the pipe line and appurtenances.

1. Marking: Before removing any pavement, mark the pavement neatly, paralleling pipe lines and existing street lines. Space the marks the width of the trench.

2. Breaking: Break asphalt pavement along the marks using jack hammers or other suitable tools. Break concrete pavement along the marks by use of jack hammers or by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.

3. Machine Pulling: Do not pull pavement with machines until completely broken and separated from pavement to remain.

4. Damage to Adjacent Pavement: Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.

5. Sidewalk: Remove and replace sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.

6. Curbing: Tunnel under or remove and replace to the nearest undisturbed joint.

C. Replacing Pavement: Upon completion of backfilling and consolidation of the backfill, arrange to have the compaction tested by an independent testing laboratory approved by RWR. After compaction testing has been satisfactorily completed, replace all pavements, sidewalks and curbs removed. Gravel roads and drives shall meet the requirements for graded aggregate sub-base.

1. Materials: Place materials for pavement replacement to dimensions shown on the Drawings.

a. Graded Aggregate Sub-Base: Furnish graded aggregate sub-base in two sizes of such gradation that when combined in approximately equal quantities, the resulting mixture is well graded from coarse to fine, meeting the gradation requirements of Section 815 of the Georgia Department of Transportation Standard Specifications.

b. Black Base: The base for all paved roadways shall conform to the requirements of the Georgia Department of Transportation Specifications for the Black Base (Hot Mix). Use a Pug Mill Rotary Drum type mixer with minimum capacity of not less than 50 tons per hour for asphalt production. Apply and compact the base in two courses by asphalt spreader equipment of design and operation approved by RWR. After compaction, the black base shall be smooth and true to established profiles and sections.

c. Surface Course: The surface course for all pavement, including paint or tack coat when required by the County, shall conform to the requirements of the Georgia Department of Transportation Specifications for Asphaltic Concrete, Section 400, Type "F". Produce surface course in an asphalt plant of the same type as noted above for Black Base. Apply and compact the surface course in a manner approved by RWR. Immediately correct any high, low or defective areas by cutting out the course, replacing with fresh hot mix, and immediately compacting to conform and thoroughly bond to the surrounding area.

d. Concrete: Provide concrete and reinforcing for concrete pavement in accordance with the requirements of Georgia Department of Transportation Specifications for Portland Cement Concrete Pavement, Section 430.

2. Supervision and Approval

a. Pavement restoration shall meet the requirements of the regulatory agency responsible for the pavement. Obtain agency approval of pavement restorations before requesting final payment.

b. Complete pavement restoration as soon as possible after backfilling.

3. Replacement: Prior to replacing pavement, make a final cut in concrete pavement 12-inches back from the edge of damaged pavement. Make the cut using a rotary saw. Remove asphalt pavement 9-inches back from the edge of damaged pavement using jack hammers or other suitable tools. Replace all street and roadway pavement as shown on the Drawings. Replace driveways,

sidewalks, and curbs with the same material and to the same dimensions as existing.

4. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the work, promptly restore or repair defects.

3.14 ROADWAY CROSSINGS

A. Furnish and install tunnel liner or casing pipe and install the pipe line therein in accordance with the Drawings and the following specifications:

B. General: The Developer shall provide to RWR, for approval, a detailed plan for the methods proposed for the construction of the tunnel or casing. These plans shall include the methods proposed for groundwater control and face protection.

1. Groundwater Control: The Developer shall control the groundwater throughout the construction of the tunnel or casing. The groundwater shall be controlled by dewatering (well points or deep wells), grouting, compressed air, freezing or other method approved by RWR.

2. Face Protection: The face of the excavation shall be protected from the collapse of the soil into the tunnel or casing. This protection is to be provided by bulkheads, shields or other means approved by RWR.

C. Casing: Furnish all material and equipment and perform all labor required to install steel casing pipe. A minimum of five years of experience in steel pipe casing construction is required by the casing installer.

1. Materials: The casing shall be made from steel plate having a minimum yield strength of 35,000 psi. The steel plate shall also meet the chemical requirements of ASTM A 36. The outside of the casing pipe shall be coated with coal tar epoxy having a minimum dry film thickness of 16 mils. Surface preparation shall be SSPC-SP 10. Epoxy shall have a minimum solids content of 65 percent by volume and shall be air or airless spray applied; minimum drying time shall be seven days. Brushing shall be permitted in small areas only. All coating and recoating shall be done in strict accordance with the manufacturer's recommendations. Epoxy shall be equal to Tnemec, Indurall or Valspar.

UNDER RAILROADS

Pipe Diameter, inches	Casing Diameter, inches	Wall Thickness, inches
6	14	0.250

8	18	0.250
10	20	0.281
12	22	0.312
14	24	0.344
16	30	0.406

UNDER HIGHWAYS

Pipe Diameter, inches	Casing Diameter, inches	Wall Thickness, inches
6	12	0.250
8	16	0.250
10	16	0.250
12	18	0.250
14	22	0.250
16	24	0.250

2. Construction: Install the steel casing pipe by the dry boring method. Bore the hole and install the casing through the soil simultaneously by a cutting head on a continuous auger mounted inside the casing pipe. Fully weld lengths of casing pipe to the preceding section in accordance with AWS recommended procedures. After the boring and installation of the casing is complete, install a cleaning plug on the rig and clean the casing.

D. Tunnel

1. Install the tunnel liner in strict accordance with Department of Transportation (DOT) and/or Railroad Company requirements. Provide any special insurance coverage required by the governing body. A minimum of five years of experience in construction of tunnels of the general size is required of the tunnel installer. Submit evidence of experience with shop drawings for review by RWR.

2. Excavate tunnel by full face, heading and bench, or multiple drift procedures. Any procedure utilizing a full or partial shield, a tunneling machine or other equipment which exerts a force on the liner plates for the purpose of

propelling, steering or stabilizing the equipment will not be allowed.

3. Prior to any work involving explosives, make application to DOT for a special permit which will be in addition to any tunneling permit not involving explosives.

4. Comply with all requirements and conditions of all permits including required submittals.

5. Schedule the work so as not to interfere with or in any way endanger traffic flow on the highway or railway. Provide all required safety measures as specified in the Manual On Uniform Traffic Control Devices.

   a. Materials: Tunnel liner plates shall be manufactured from steel meeting the chemical requirements of ASTM A 569 with the following mechanical properties before cold forming:

Minimum tensile strength	=	42,000 psi
Minimum yield strength	=	28,000 psi
Elongation, 2-inches	=	30 percent

   b. Liner plates shall be 10 gage and shall be formed to provide circumferential flanged joints. Longitudinal joints may be flanged or offset lap seam type. All plates shall be punched for bolting on both longitudinal and circumferential seams or joints. Bolt spacing in circumferential flanges shall be in accordance with the manufacturer's standard spacing and shall be a multiple of the plate length so that plates having the same curvature shall be interchangeable and will permit staggering of the longitudinal seams. Bolt spacing at flanged longitudinal seams shall be in accordance with the manufacturer's standard spacing. For lapped longitudinal seams, bolt size and spacing shall be in accordance with the manufacturer's standard but not less than that required to meet the longitudinal seam strength requirements of Section 13 of AASHTO Standard Specifications for Highway Bridges.

   c. All liner plates in one tunnel shall be the same type.

   d. Liner plates shall be hot-dip galvanized in accordance with ASTM A 123 and bituminous coated.

   e. Bolts shall conform to ASTM A 307 Grade A, and shall be hot-dip galvanized in accordance with ASTM A 153.

f. Grout nipples shall be 2-inch minimum diameter tapped couplings welded into place over holes cut in the liner plate.

g. The quantity of mixing water used shall be that which will produce a workable mixture of grout capable of being pumped into the voids created by the tunneling.

h. Brick shall be whole and hardburned, conforming to ASTM C 32 Grade MS. Mortar shall be made of 1 part Portland cement and 2 parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150. Sand shall meet ASTM C 53.

6. Construction of Tunnel

a. Construct tunnel so that no settlement of the overpassing roadway or railway section will occur. In order to prevent such settlement, the use of poling plates, breast boards, shields, and soil solidification or a combination of these methods may be necessary.

b. Install steel liner plates as soon as possible, but no more than 5 feet of tunnel shall remain unlined while tunneling operations are in progress. No portion of the tunnel shall be left unlined at the end of the day's operation.

c. Liner plates shall be installed in accordance with the manufacturer's recommendations and shall be self-supporting.

d. The tunnel excavation shall have a diameter essentially the same as the outside diameter of the liner plates.

e. Locate liner plates with grout couplings at the top of the tunnel at intervals not to exceed 10 feet.

f. Install additional plates with grout couplings on each side of the tunnel between the top couplings.

g. Pressure grout all voids in the area outside the plates every 10 feet and at the end of the work shift. Pressure grout more frequently if soil conditions dictate. Before grouting any segment of tunnel liner, seal that segment sufficiently between the liner plates and the surrounding soil to retain the grouting pressure. Locate seals at the entrance of the tunnel, between grout couplings, and within 1 foot of the end of the

tunnel at the end of the work shift.

h. Provide pumping equipment for grouting operations. Pump horsepower and the resulting pressure in the grouting line shall be sufficient to completely fill the voids without buckling or shifting the liner plates or damaging the roadway.

i. Repair damaged spelter coating in accordance with Georgia DOT Specifications, Section 645. Any plates having damaged spelter or bituminous coatings which, in the opinion of the County cannot be satisfactorily repaired, shall be replaced at no additional cost.

E. Installation of Pipe

1. After construction of the casing or tunnel is complete, and has been accepted by RWR, install the pipeline in accordance with the detailed Drawings and the Specifications.

2. Check the alignment and grade of the casing or tunnel and submit a plan to RWR for approval to set the pipe at proper alignment, grade and elevation. The pipe shall be supported by wooden skids strapped to the pipe barrel, or some similar arrangement approved by RWR, to preclude movement within the casing or tunnel. Fill the void between pipe and casing or tunnel with grout. Grout shall be pumped through a pipe, gradually filling the void from the lower end to the upper end.

3. Close the ends of the casing with 4-inch brick walls, tunnel with 3 course brick walls, plastered with Portland cement mortar and waterproofed with asphaltic roofing cement.

F. Safety

1. Provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.

2. Begin the tunneling or boring operation in a pit, sheeted and shored as necessary and begin at and proceed from one end. Observe all applicable requirements of DOT and Railroad regulations. Conduct the operations in such a manner that all work will be performed below the level of the roadbed. Coordinate and schedule all of the work with DOT.

3. Complete all tunneling work at one particular location before tunneling work is started at another location.

4. A temporary bulkhead against the face of the excavation shall be provided and well braced during each cessation of tunneling work while the heading is within 20 feet of railroad tracks or highway pavement.

5. If, in the opinion of RWR, the tunnel installation work is being conducted in an unsafe manner or in a manner detrimental to the overpassing roadway or to the safety of the traveling public, all operations of tunneling and boring shall cease until the necessary corrections have been made. In the event that distress occurs to the roadway due to the tunneling, the Developer shall be required to submit a plan to repair the roadway. The plan must be acceptable to DOT, the Railroad if applicable, and RWR.

6. RWR will not be responsible and shall be saved harmless in the event of delays to the Developer's work resulting from any cause whatsoever.

3.15 STREAM AND DITCH CROSSING

A. At all points where banks of streams or drainage ditches are disturbed by excavation or where natural vegetation is removed, carefully compact backfill and place rip rap to prevent subsequent settlement and erosion.

B. This requirement applies equally to construction along side a stream or drainage ditch as well as crossing stream or drainage ditch. Place rip rap a distance of not less than 10 feet upstream and 10 feet downstream from any disturbed area. Extend rip rap from 1 foot below stream bed to top of bank. Place to conform with the natural slope of the stream bank.

C. Use sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Specific gravity shall be 2.0 or higher.

D. Minimum weight of individual stones shall be 50 pounds. The maximum allowable dimension for an individual stone is 24-inches. The minimum allowable dimension for an individual stone is 6-inches. At least 50 percent of the stones shall have a minimum dimension of 12-inches.

E. Imbed stone rip rap by hand so as to form a compact layer at least 12-inches thick. Place rip rap in such a way that the smaller stones are not segregated but evenly distributed. Place chinking stones in the crevices between the larger stones so that a dense, well graded mass is produced.

3.16 PRESSURE AND LEAKAGE TEST

A. All sections of water line subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of line will be considered ready for testing after completion of all thrust restraint. Backfilling at fitting locations is optional. Each segment of pipeline between line valves shall be tested individually.

B. Test Preparation

1. Flush pipeline section thoroughly at flow velocities adequate to remove debris from pipe and valve seats. Partially operate valves and hydrants to clean out seats. Provide correctly sized temporary outlets in number adequate to achieve flushing velocities.

2. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.

3. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Unless permanent air vents are in place, insert temporary corporation stops at highpoints to expel air as line is filled with water.

4. Before installing tapping sleeves, lines shall be cleaned with soap and water then rinsed with 5% chlorine solution. Air shall be released from tapping valve through tapped plug. Sleeve and valve shall pass pressure test with water at 200 psi for 10 minutes before cutting operation can start.

5. Fill pipeline slowly with water. Provide a motor driven test pump with an accurate water meter to pump the line to the specified pressure. Differential pressure at valves and hydrants shall not exceed manufacturer's pressure rating.

C. Test Pressure: Test the pipeline at 200 psi measured at the highest point for at least 2 hours. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. The test pressure shall not vary by more than 5 psi for the test duration. Provide an accurate pressure gage with graduations not less than 5 psi.

D. Leakage

1. Leakage shall be defined as the quantity of water that must be pumped into the test section, to maintain pressure within 5 psi of the specified test pressure for the test duration plus water required to return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter.

2. Leakage through existing valves shall not prevent the contractor from successfully testing all new work. The contractor shall be responsible for testing all new work beyond existing valves. Provide temporary plugs as required.

E. Test Results: No test section shall be accepted if the leakage exceeds the limits determined under Section 4 of AWWA C600. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.

F. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on Record Drawings.

3.17 DISINFECTION

A. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method.

B. Specialty Contractor: Disinfection shall be performed by an approved specialty contractor. Before disinfection is performed, the Contractor shall submit a written procedure for approval before being permitted to proceed with the disinfection. This plan shall also include the steps to be taken for the neutralization of the chlorinated water.

C. Chlorination: Sample ports shall be spaced every 1000'. Apply chlorine solution to achieve a concentration of at least 25 milligrams per liter free chlorine in new line. Retain chlorinated water for 24 hours (not longer than 48 hours). Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the 24 hour period. After 24 hours, all samples of water shall contain at least 10 milligrams per liter free chlorine. Re-chlorinate if required results are not obtained on all samples.

D. Disposal of Chlorinated Water: Reduce chlorine residual of disinfection water to that of existing distribution system prior to disposal. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. Flush all lines until residual is equal to existing system.

E. Bacteriological Testing: After final flushing and before the water along main is placed in service, the RWR staff shall collect samples from the line and have tested for bacteriological quality in accordance with the rules of the Georgia Department of Natural Resources, Environmental Protection Division. Testing shall be performed by a laboratory certified by the State of Georgia. Re-chlorinate lines until required results are obtained.

3.18 PROTECTION AND RESTORATION OF WORK AREA

A. General: Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.

B. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by RWR. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.

C. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3-inches in diameter, not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Developer. No stumps, wood piles, or trash piles will be permitted on the work site.

D. Erosion Control: Plan excavation work to prevent erosion and the washing of soil into adjacent streams. Limit the amount of open excavation at any one time. Place spoil in the proper place and keep natural water routes open. All owner/developer and contractor activities should comply with Georgia's NPDES General Permit No. GAR100000 for Storm Water Discharges Associated with Construction Activities.

E. Disposal of Rubbish: Dispose of all materials cleaned and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate regulatory agencies, county, state and federal.

APPENDIX A – WATER DETAILS

WATER MAIN LOCATION SUBDIVISION STREET	A-1
WATER MAIN LOCATION SUBDIVISION STREET	A-2
WATER MAIN LOCATION SUBDIVISION STREET	A-3
WATER MAIN LOCATION ROADWAYS	A-4
VALVE INSTALLATION	A-5
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FIRE HYDRANT INSTALLATION ROADS AND HIGHWAYS	A-7
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WATER SERVICE LINE	A-9
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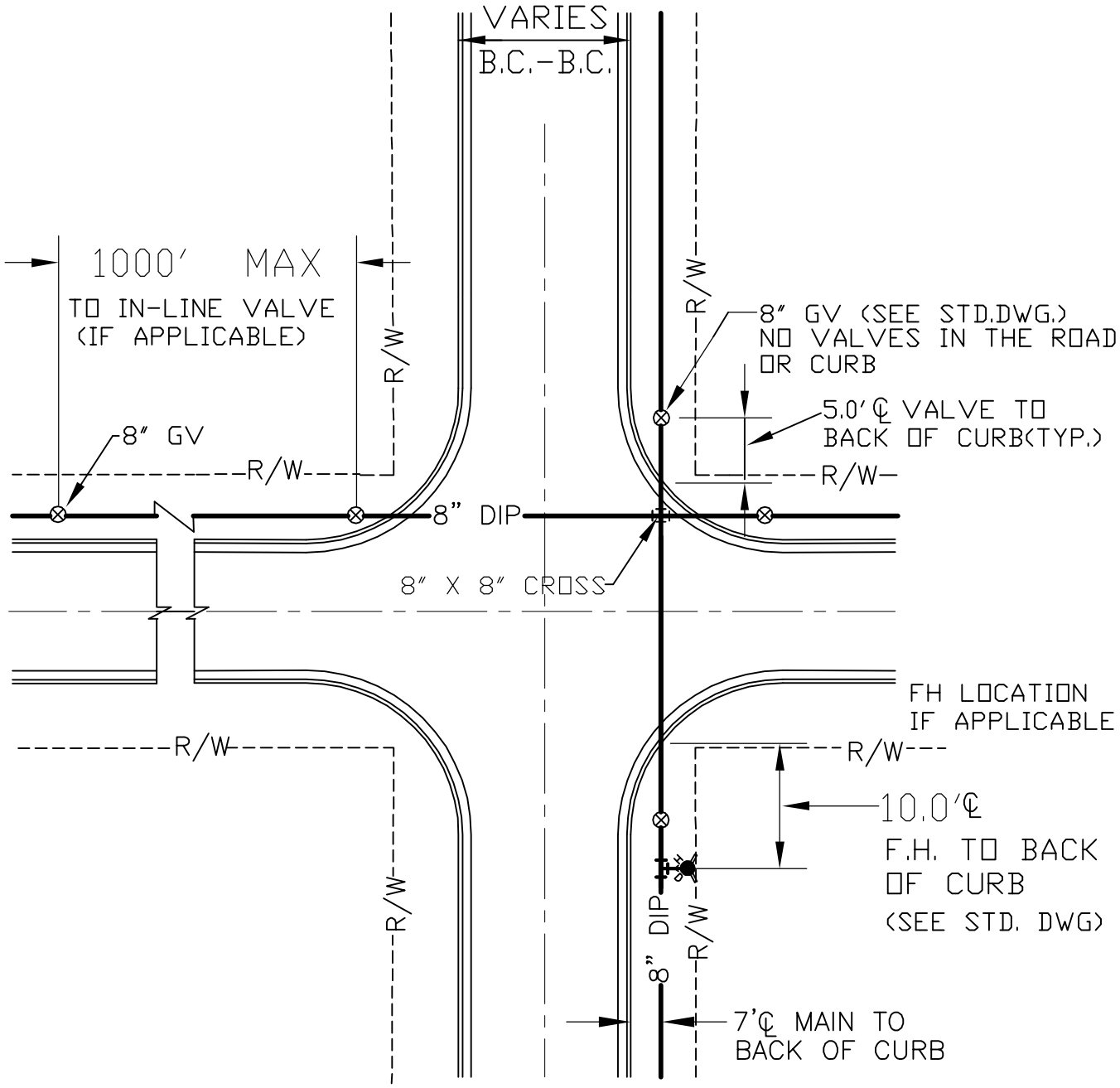


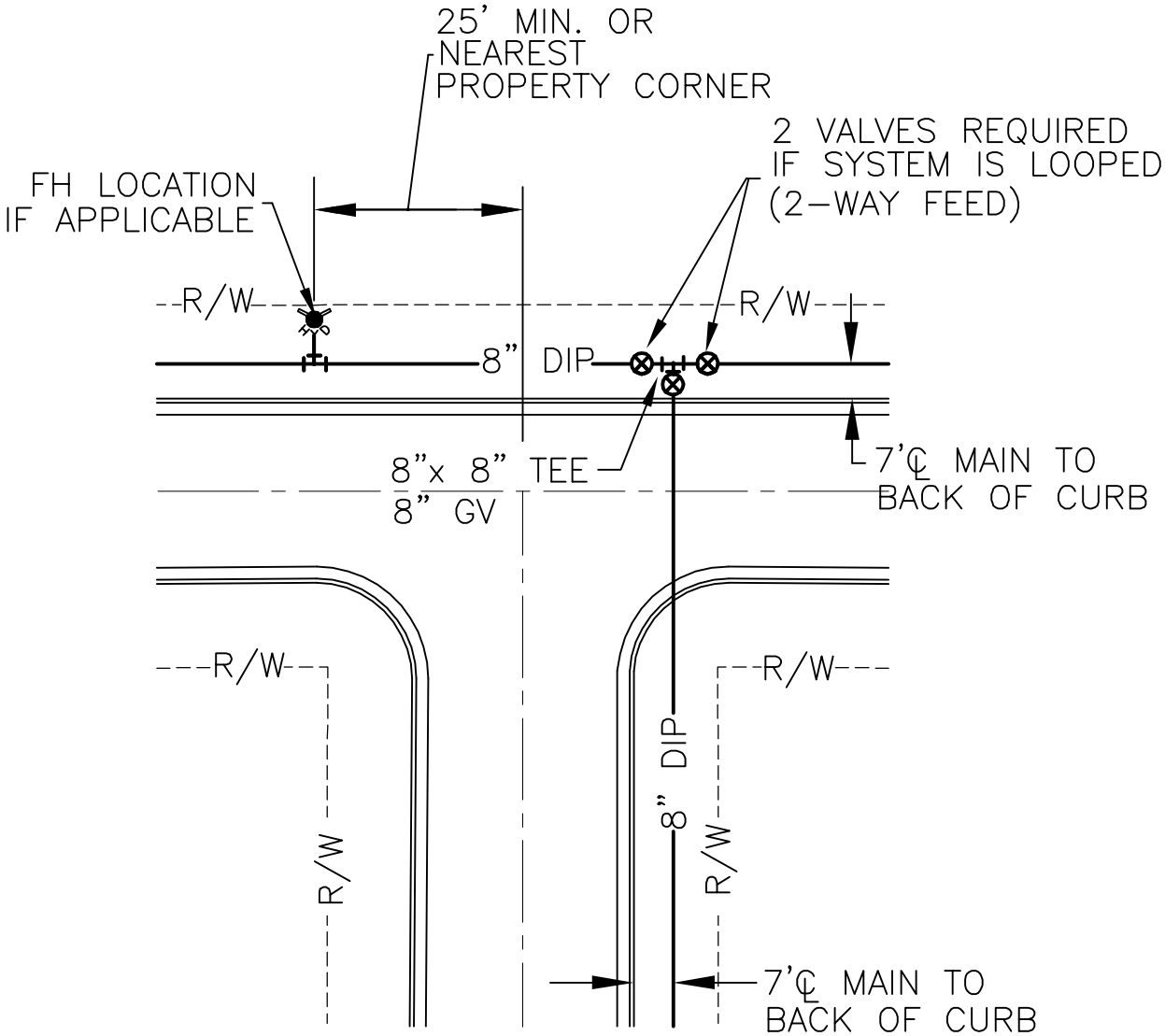
4–WAY INTERSECTION

ROCKDALE WATER RESOURCES

WATER MAIN LOCATION
SUBDIVISION STREET

NOT TO SCALE

STANDARD DRAWING No. A-1

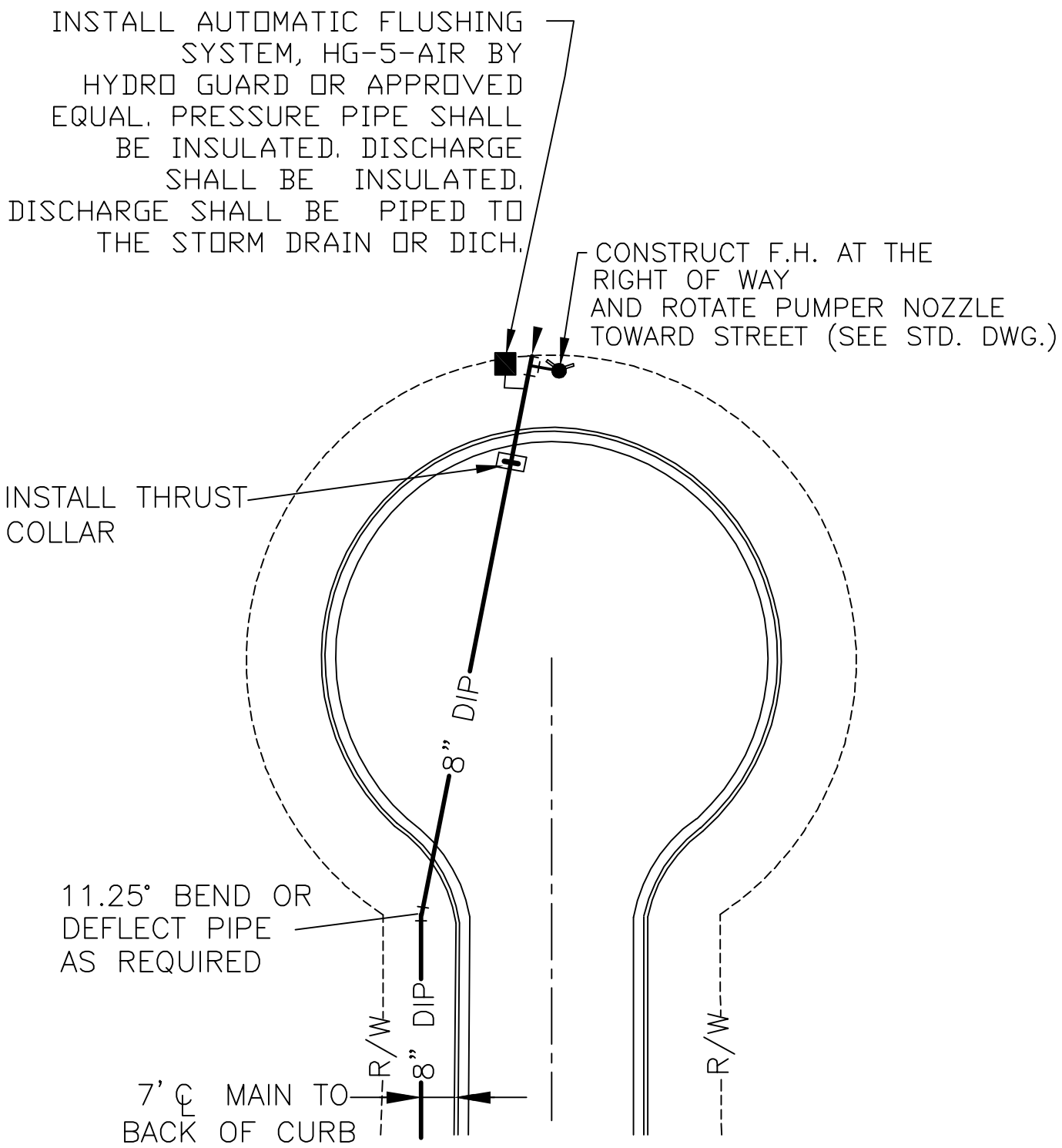


TEE INTERSECTION

ROCKDALE WATER RESOURCES

WATER MAIN LOCATION
SUBDIVISION STREET
NOT TO SCALE

STANDARD DRAWING No. A-2

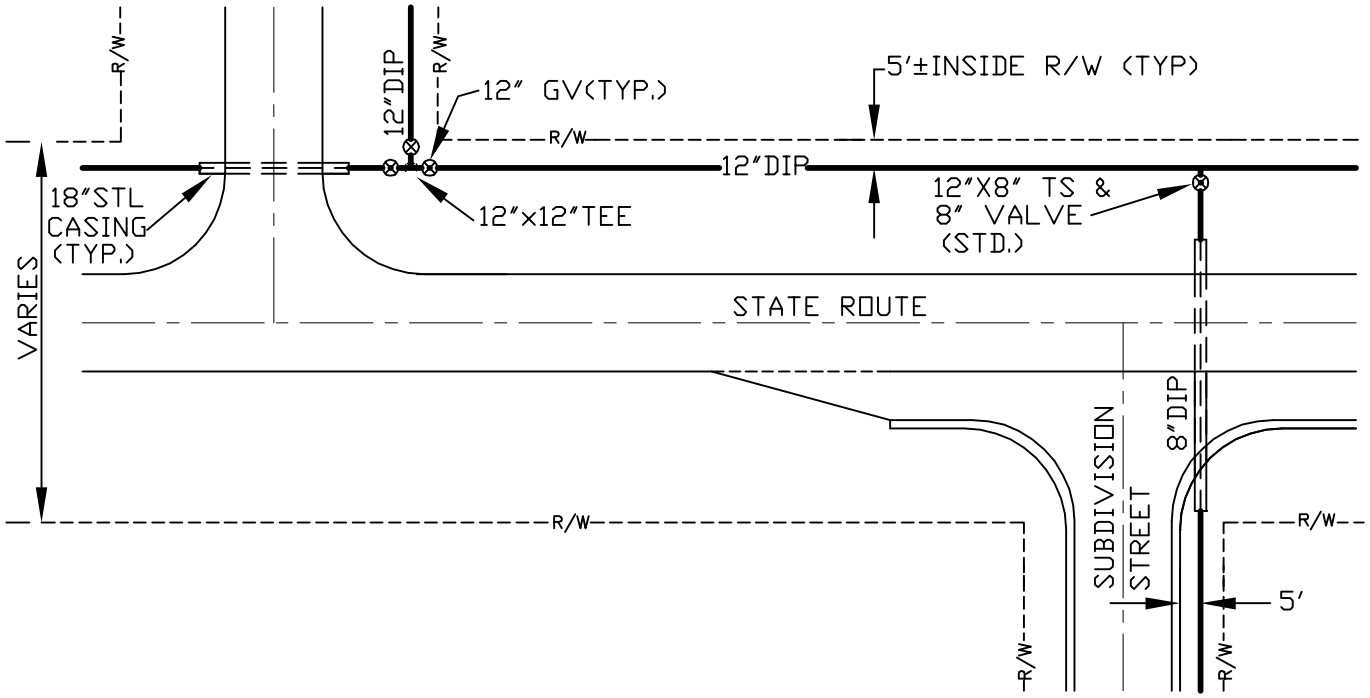


CUL–DE–SAC

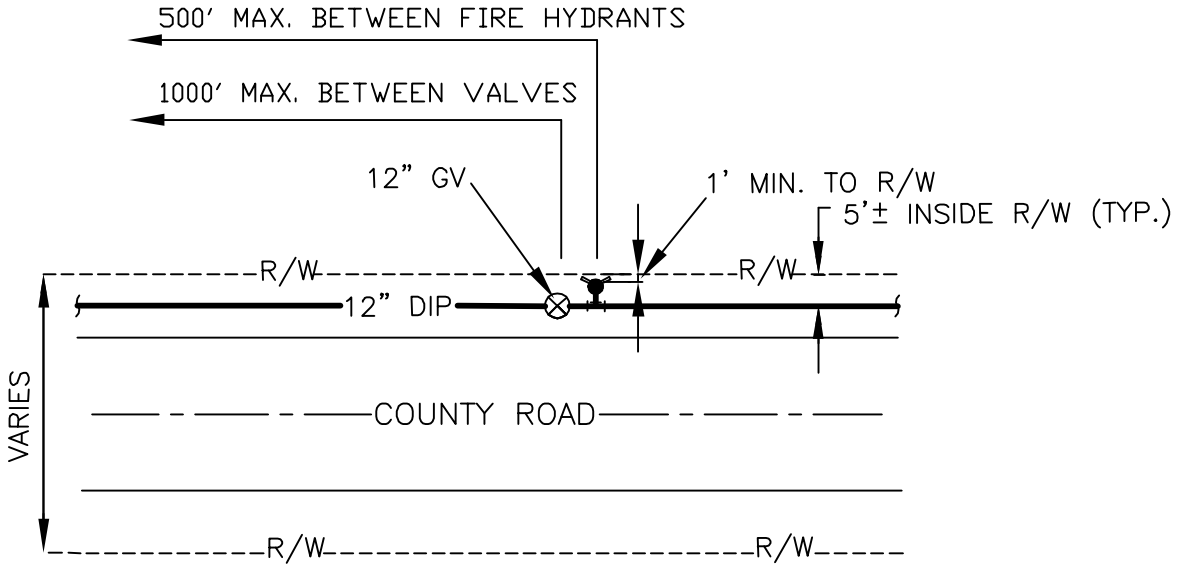
ROCKDALE WATER RESOURCES

WATER MAIN LOCATION
SUBDIVISION STREET
NOT TO SCALE

STANDARD DRAWING No. A-3



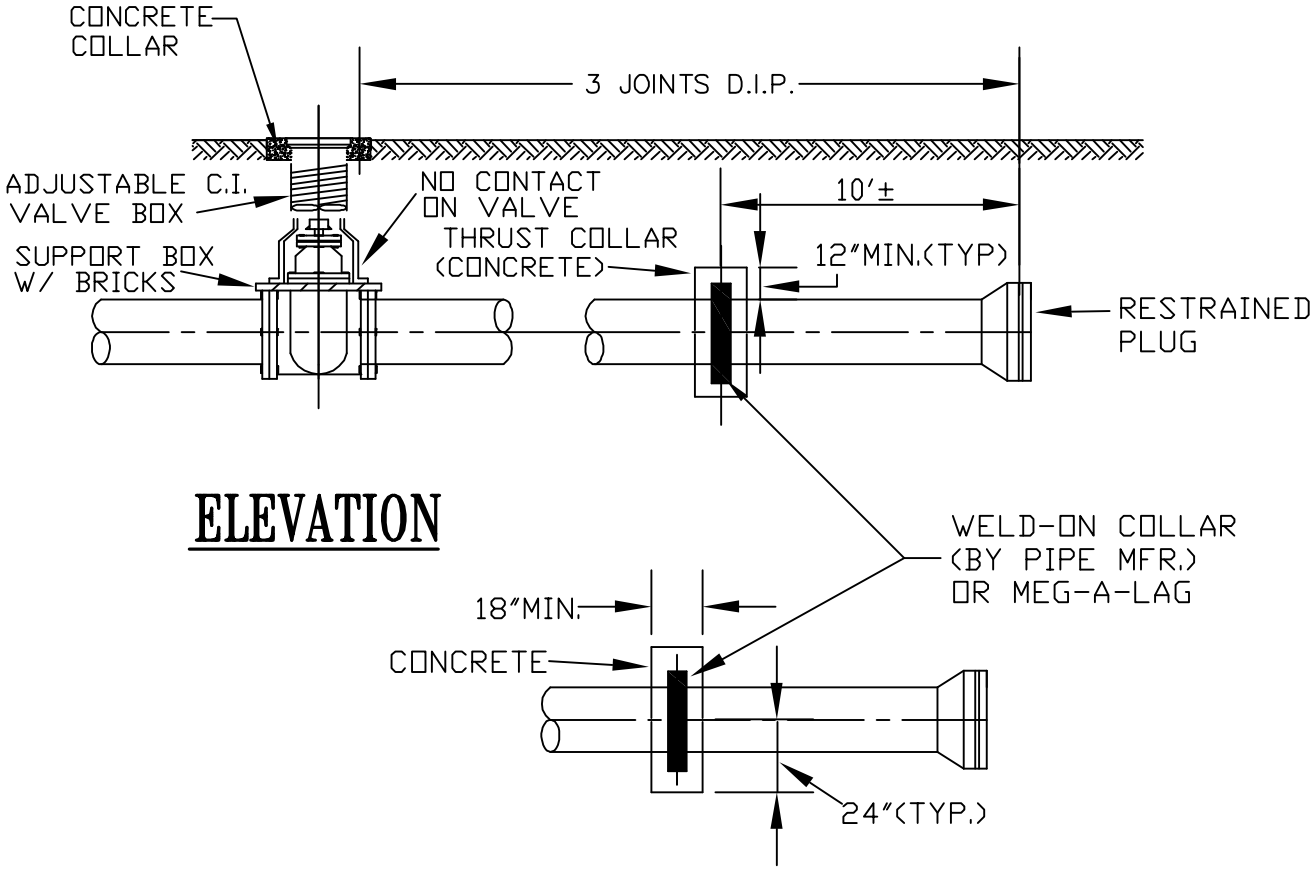
GEORGIA DOT ROADS



ROCKDALE COUNTY ROADS

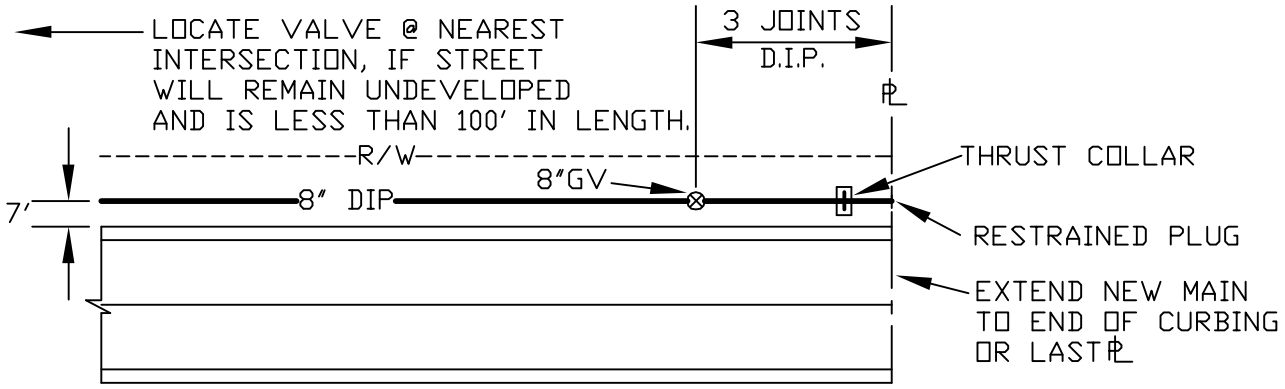
ROCKDALE WATER RESOURCES

WATER MAIN LOCATION
ROADWAYS
NOT TO SCALE
STANDARD DRAWING No. A-4



ELEVATION

PLAN

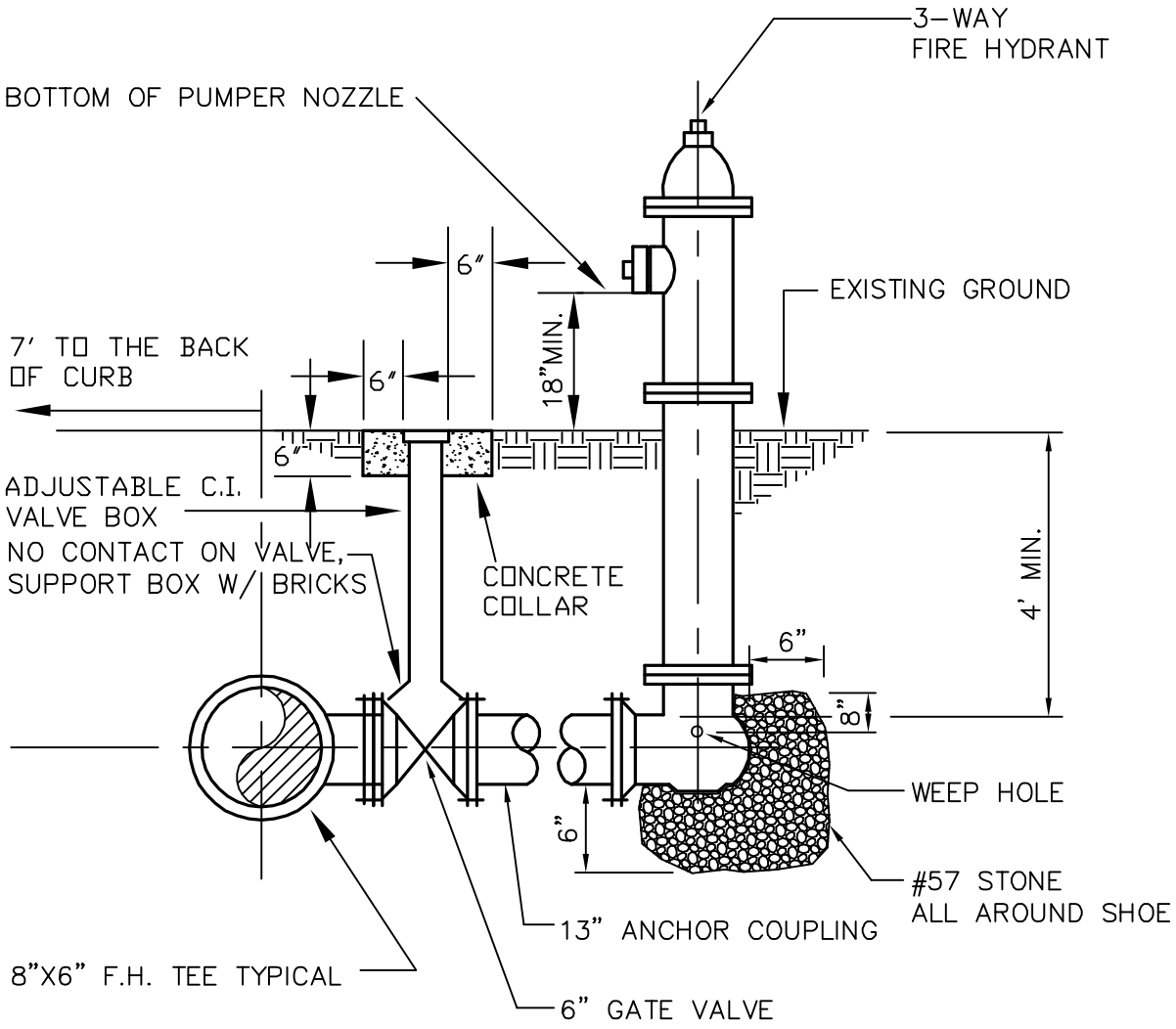


TEMPORARY DEAD END IN SUBDIVISION

ROCKDALE WATER RESOURCES

VALVE INSTALLATION
NOT TO SCALE

STANDARD DRAWING No. A-5

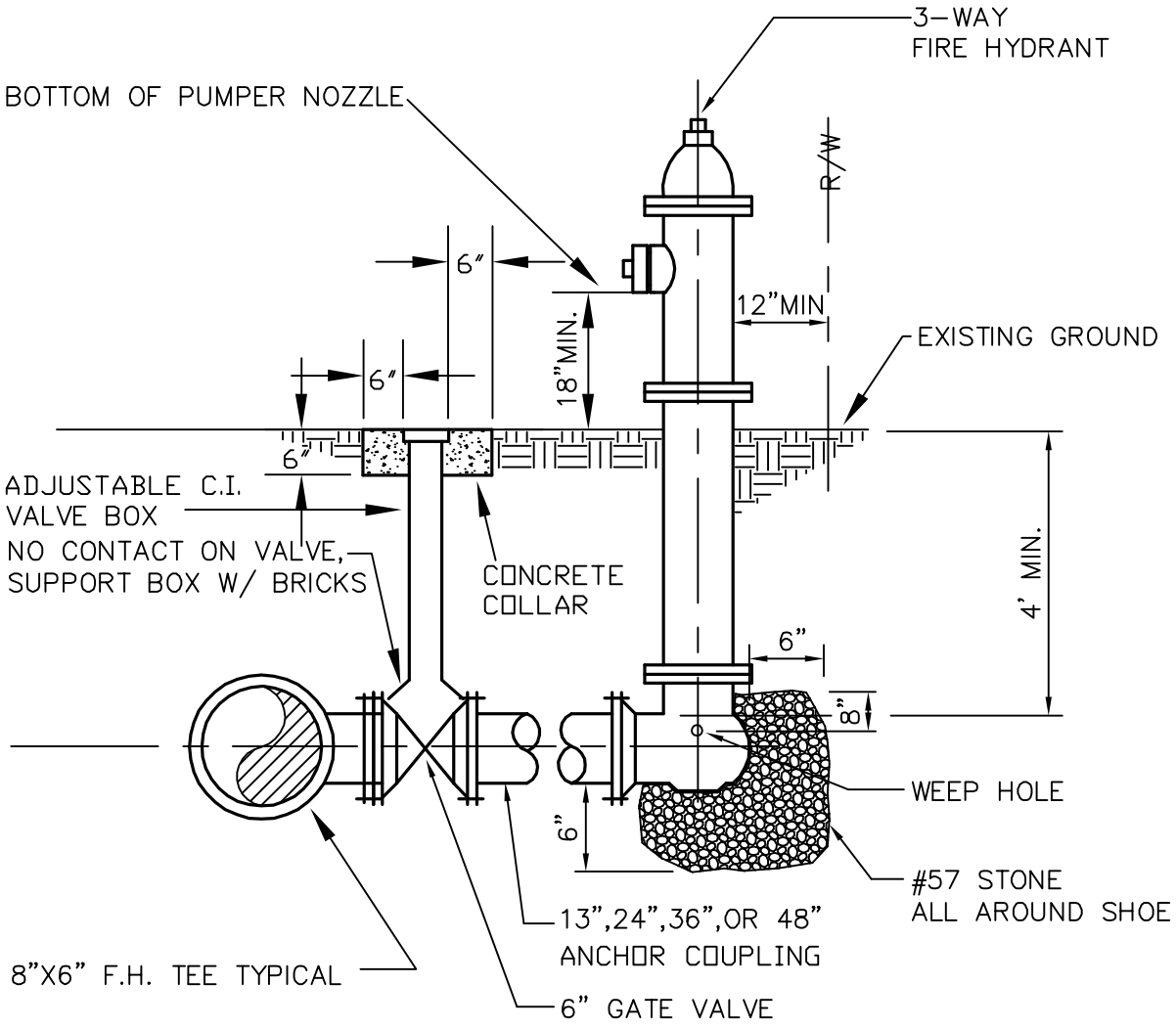


ROCKDALE WATER RESOURCES

FIRE HYDRANT INSTALLATION
SUBDIVISION STREET

NOT TO SCALE

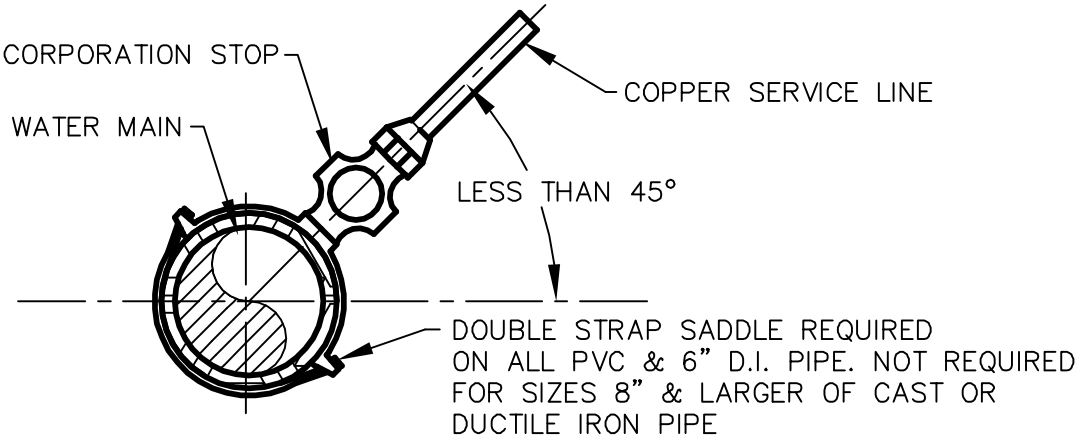
STANDARD DRAWING No. A-6



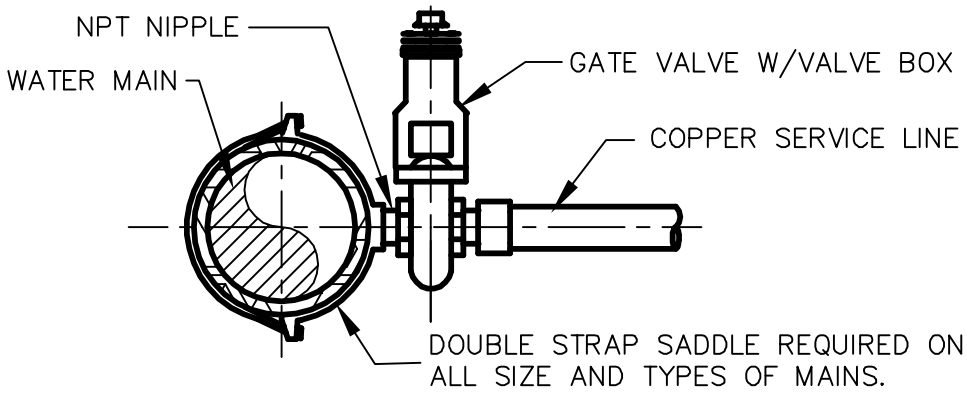
NOTES: FOR MAIN SIZES 16-INCH AND LARGER, 6-INCH GV MAY BE CONNECTED TO MAIN BY TAPPING SADDLE AND ANCHOR COUPLING IN LIEU OF HYDRANT TEE

ROCKDALE WATER RESOURCES

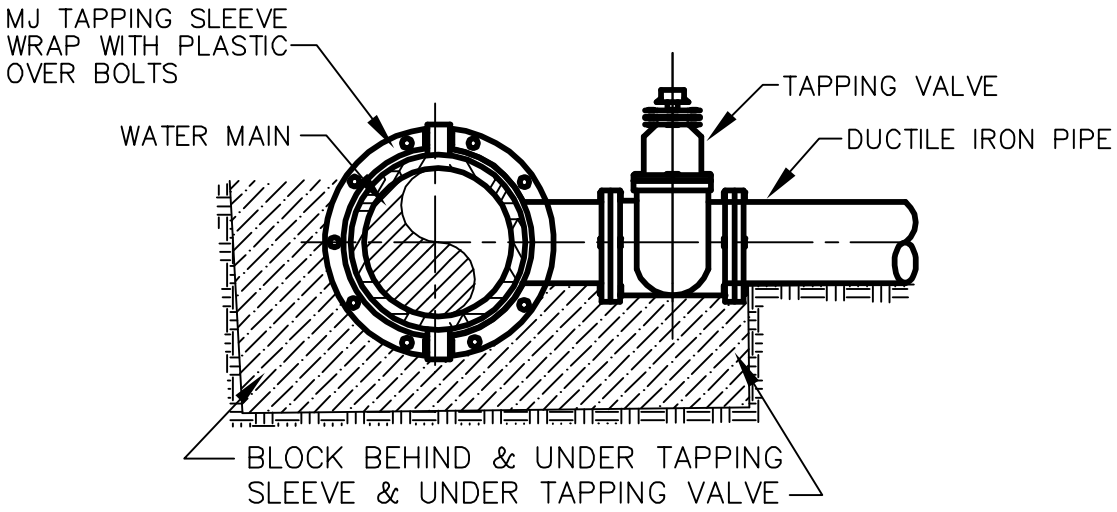
FIRE HYDRANT INSTALLATION
ROADS AND HIGHWAYS
NOT TO SCALE
STANDARD DRAWING No. A-7



1" SERVICE CONNECTONS



1 1/2" & 2" SERVICE CONNECTONS



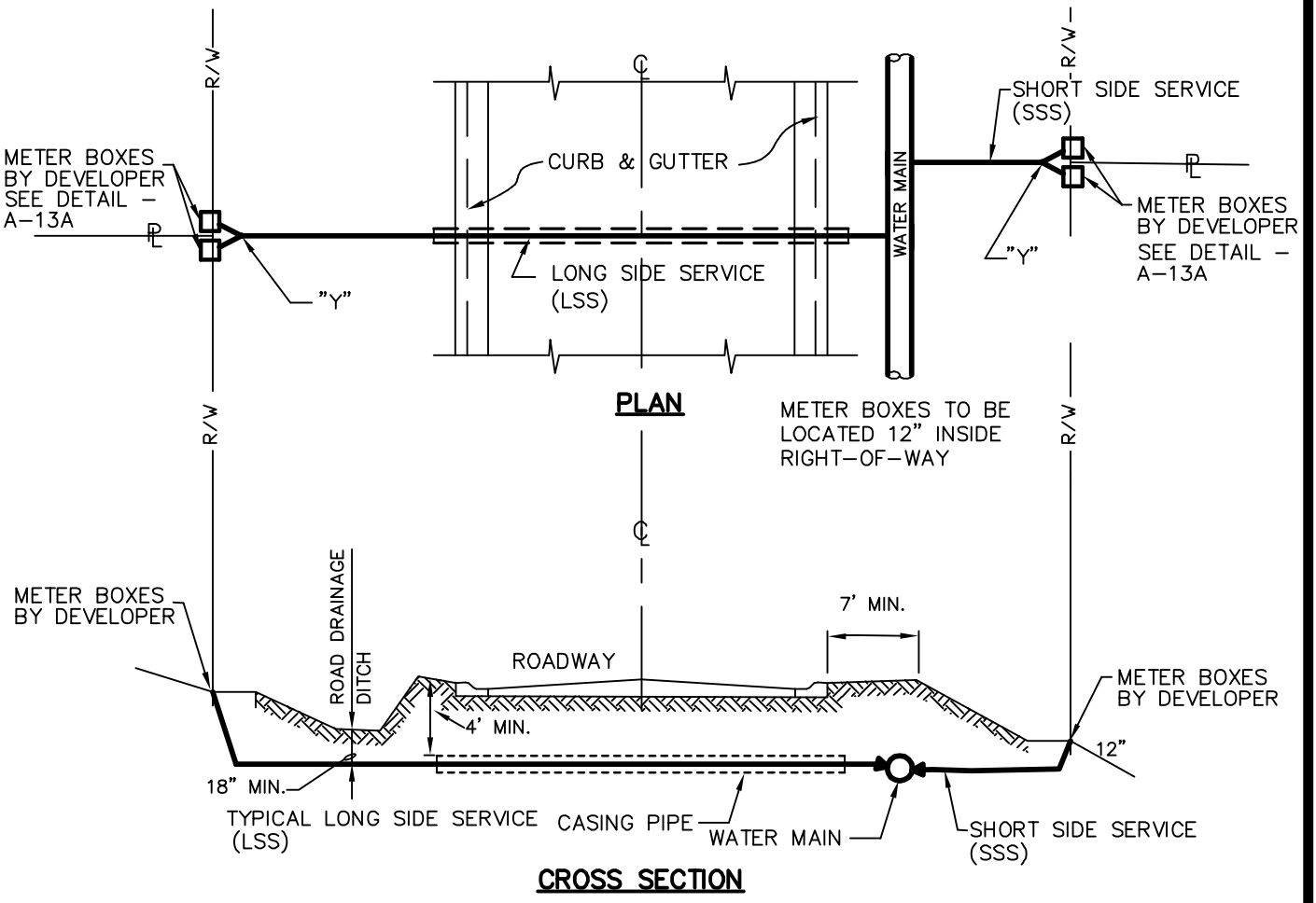
3" & LARGER SERVICE CONNECTONS

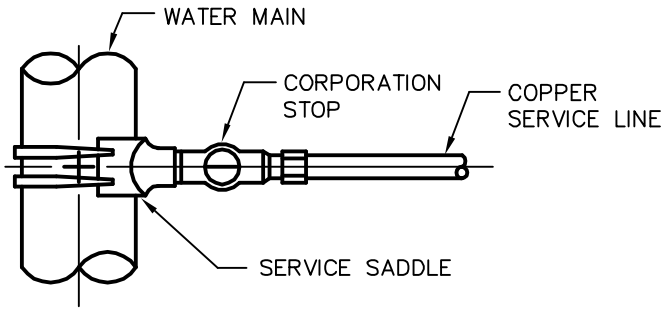
ROCKDALE WATER RESOURCES

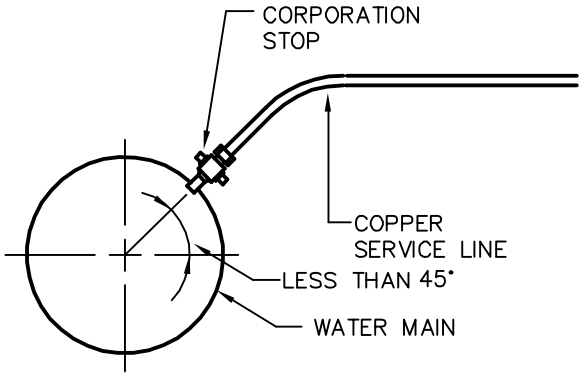
CONNECTIONS TO WATER MAINS

NOT TO SCALE

STANDARD DRAWING No. A-8





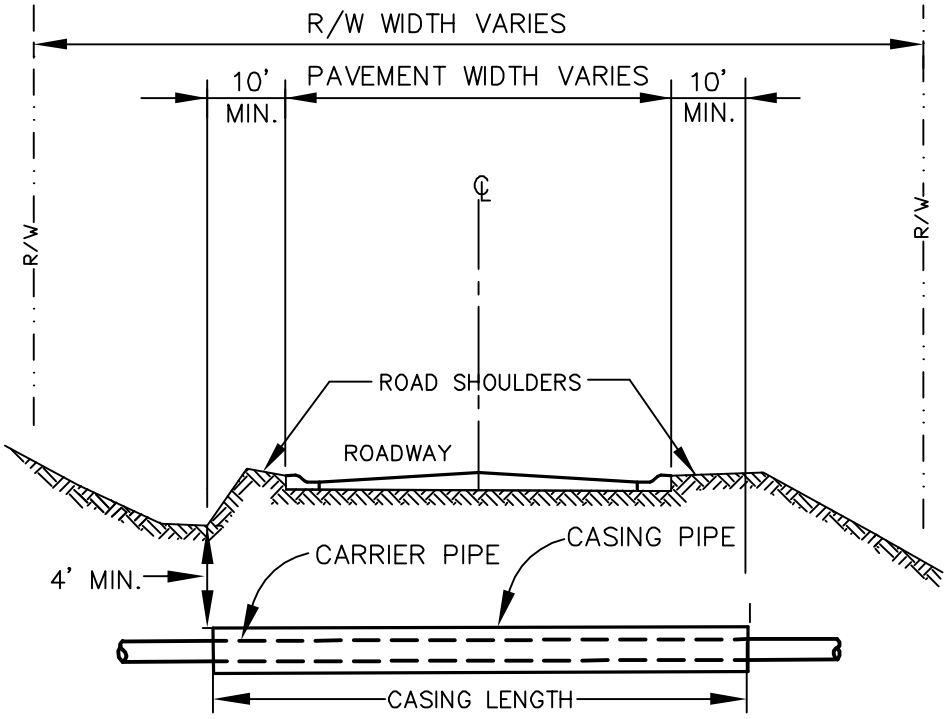


ROCKDALE WATER RESOURCES

WATER SERVICE LINE

NOT TO SCALE

STANDARD DRAWING No. A-9



CASING REQUIREMENTS @ ROADWAY CROSSINGS							
CARRIER LINE	MATL.	O.D.	MAX. O.D. @ JOINTS	MIN. CASING SIZE	MATL.	I.D.	MAX. O.D. @ JOINTS
3/4"	CT	0.88"	N/A	1 1/4"	PVC	1.36"	2.00"±
1"	CT	1.13"	N/A	1 1/2"	PVC	1.59"	2.25"±
1 1/2"	CT	1.63"	1.70"**	2"	PVC	2.05"	2.75"±
2"	CT	2.13"	2.20"**	2 1/2"	PVC	2.44"	3.50"±
3"	DI	3.96"	6.08"	8"	STL	8.00"	8.63"±
4"	DI	4.80"	7.00"	8"	STL	8.00"	8.63"±
6"	DI	6.90"	9.13"	12"	STL	12.00"	12.75"±
8"	DI	9.05"	11.50"	16"	STL	15.50"	16.00"±
10"	DI	11.10"	13.63"	16"	STL	15.50"	16.00"±
12"	DI	13.20"	15.75"	18"	STL	17.50"	18.00"±

N/A : NOT APPLICABLE
* * : SOLDER COUPLING

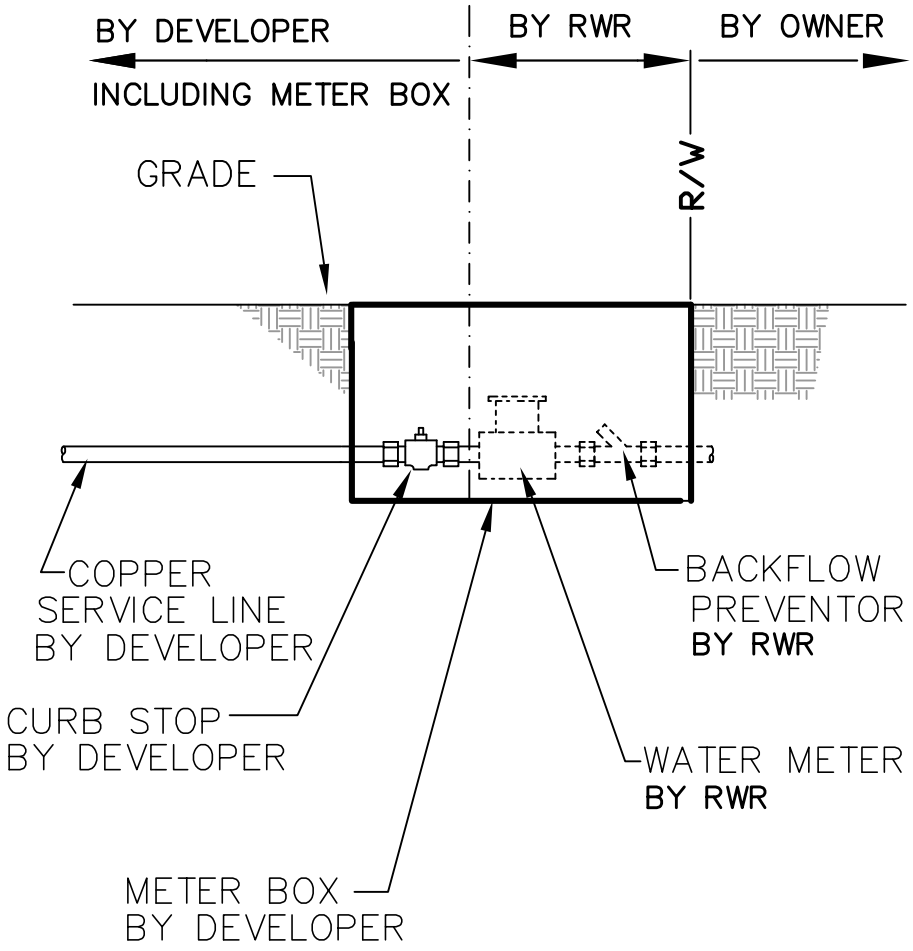
CT : COPPER TUBING
DI : DUCTILE IRON
STL : STEEL

ROCKDALE WATER RESOURCES

CASING REQUIREMENTS

NOT TO SCALE

STANDARD DRAWING No. A-10



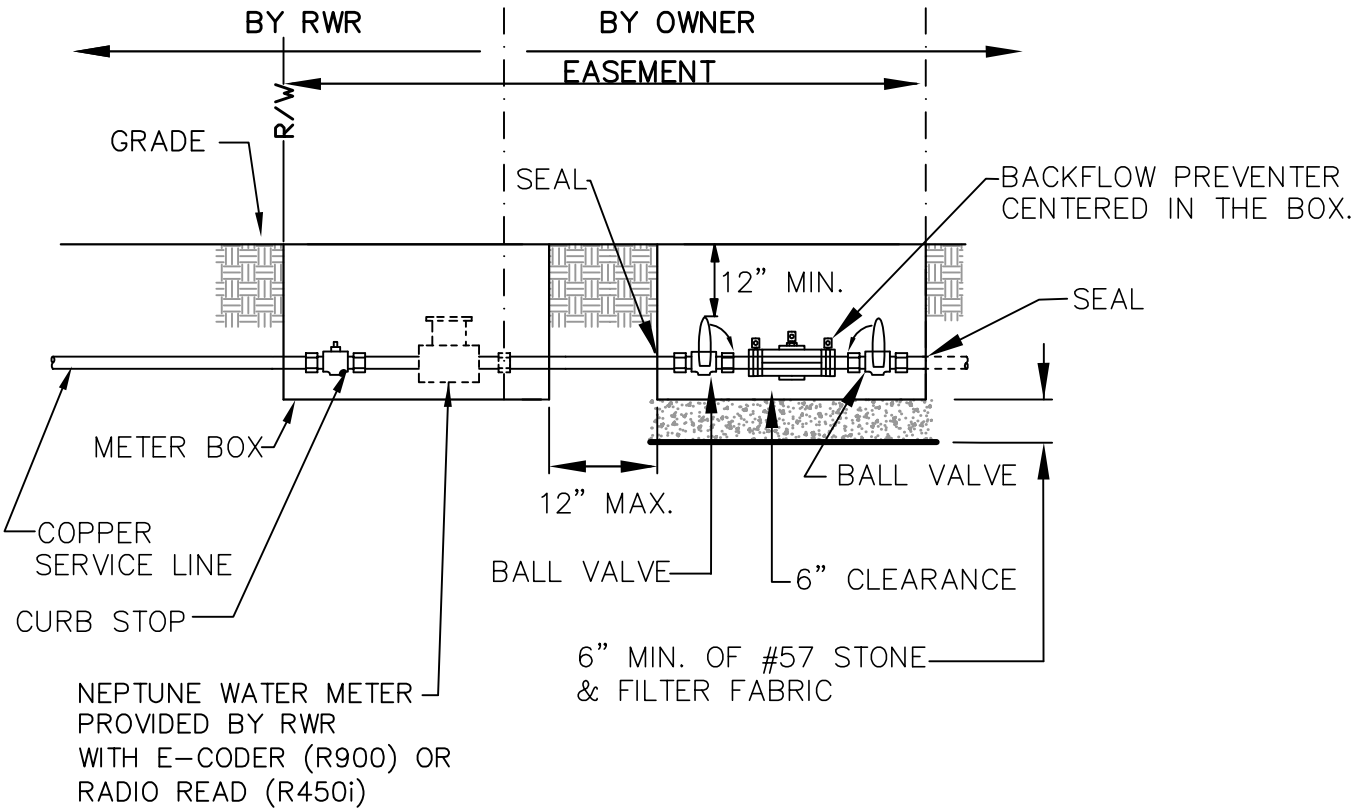
METER BOX:
NDS AMR BOX D1200
COVER WITH HOLE FOR ANTENNA.

ROCKDALE WATER RESOURCES

RESIDENTIAL
WATER METER AND BOX

NOT TO SCALE

STANDARD DRAWING No. A-11



The Customer/Owner shall provide a Double Check Valve or (DCV) Backflow Preventer in a size to match that of the required service meter.

The DCV device shall have current approval from the University of Southern California, Foundation for Cross-Connection Control (USC-FCCC). The DCV-BFP assembly is to be tested by a nationally recognized testing laboratory in accordance with ASSE Standard 1015 and bear the ASSE seal; be individually factory tested, shipped, and installed as a unit.

INSTALLATION INSTRUCTIONS: The DCV-BFP assembly shall be installed in a Utility Box adjacent to, or as close as practical to the outlet side of the meter installation. The DCV- shall be a minimum of 12" and a maximum of 16" below grade and centered in the Utility Box.

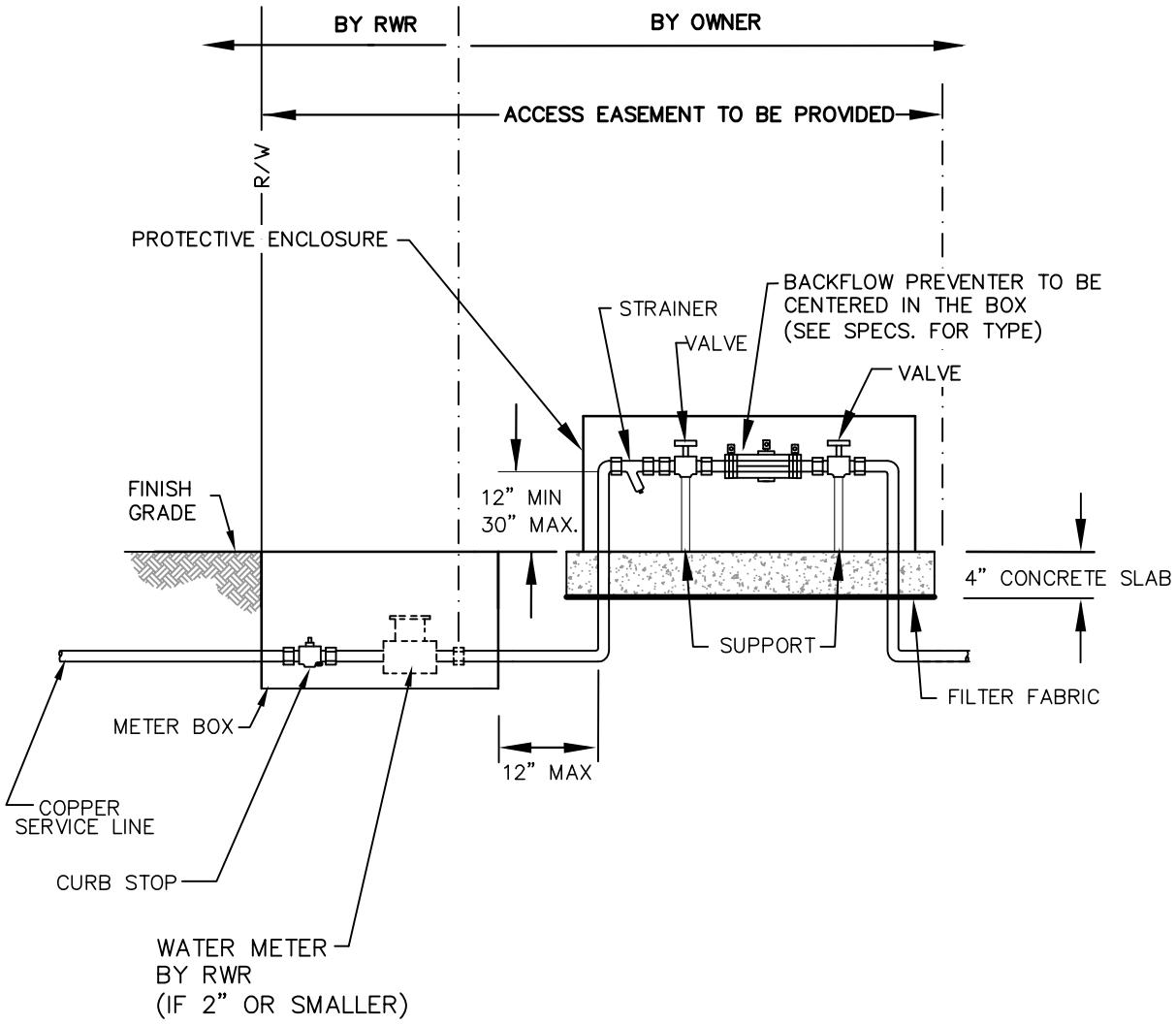
The Utility Box shall be adequately sized to match the DCV-BFP. ***All*** test ports, inlet, and outlet shut-off valves must be in the box, and ***accessible*** to maintain and test the device. Test cocks fitted with brass or plastic plugs or caps.

COMMERCIAL 5/8 - 2"
WATER METER AND
BACKFLOW PREVENTION DEVICE

NOT TO SCALE

ROCKDALE WATER RESOURCES

STANDARD DRAWING No. A-12



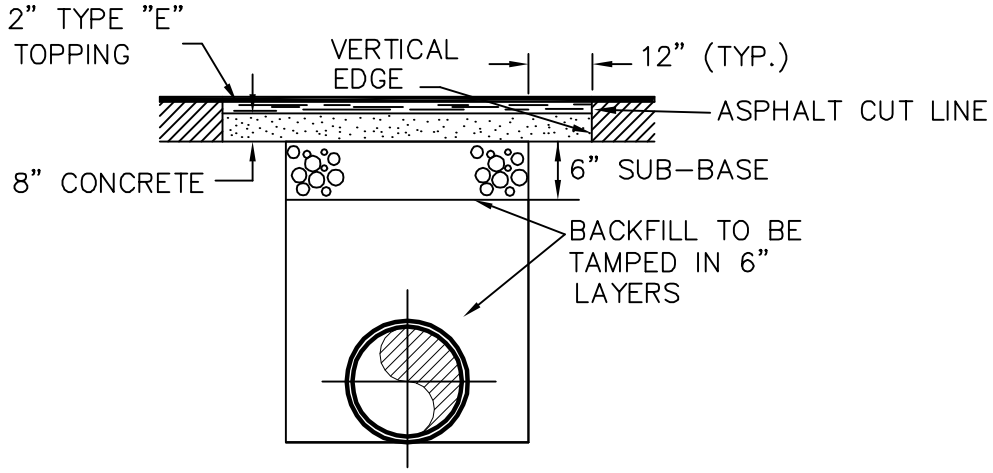
1. THE CUSTOMER/OWNER SHALL PROVIDE WATER METERS LARGER THAN 2". THE CUSTOMER/OWNER SHALL CALL DELTA MUNICIPAL AT 770–277–0211 TO PURCHASE THE METER. THE FOLLOWING INFORMATION SHALL BE PROVIDED TO DELTA:
   1.1. METER SIZE
   1.2. TYPE OF METER– RADIO READ (R450i) OR DRIVE BY (R900). RWR WILL SPECIFY WHICH TYPE.
2. HOT BOX PROTECTIVE ENCLOSURE SHOULD BE HEATED OR INSULATED TO PROTECT FROM FREEZING.
3. RPZ ENCLOSURE SHOULD BE OF FIBERGLASS CONSTRUCTION WITH GROUND ANCHOR CAPABILITES AND LOCKABLE LID.

ROCKDALE WATER RESOURCES

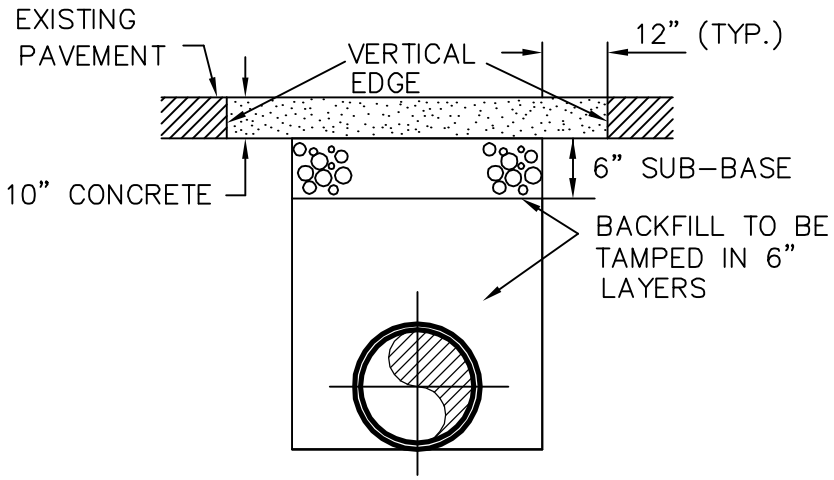
COMMERCIAL WATER METER AND RPZ BOX

NOT TO SCALE

STANDARD DRAWING No. A-13



ASPHALT



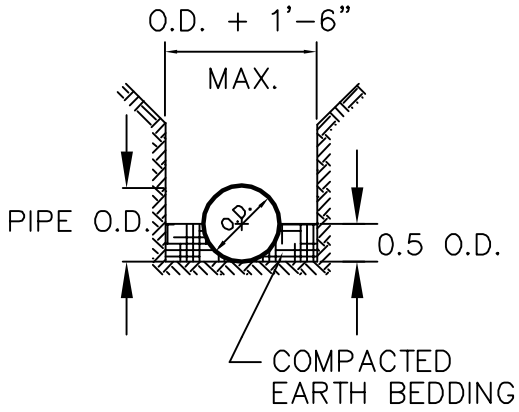
CONCRETE

ROCKDALE WATER RESOURCES

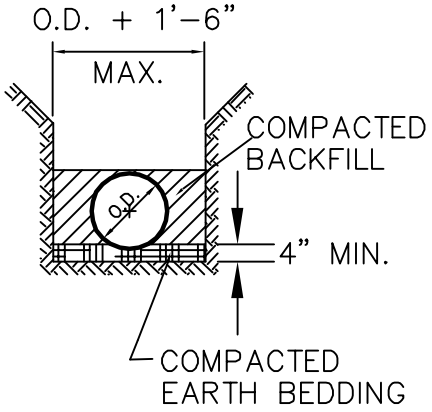
PAVEMENT REPLACEMENT

NOT TO SCALE

STANDARD DRAWING No. A-14



TYPE 2



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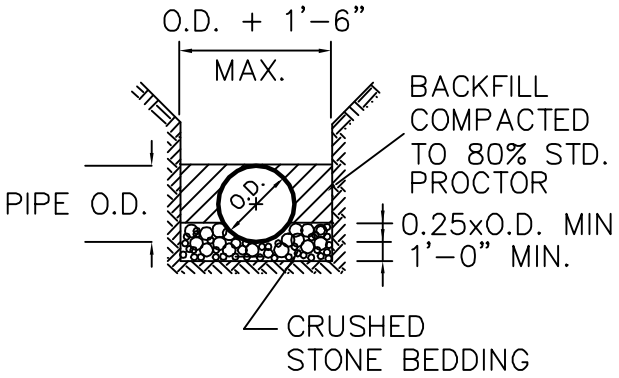

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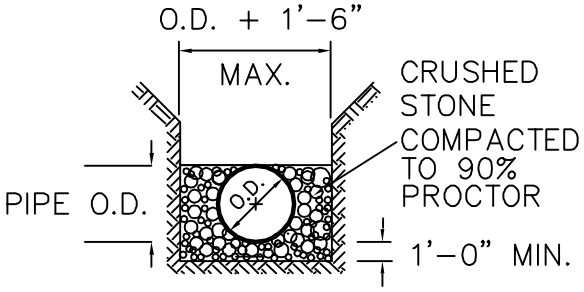


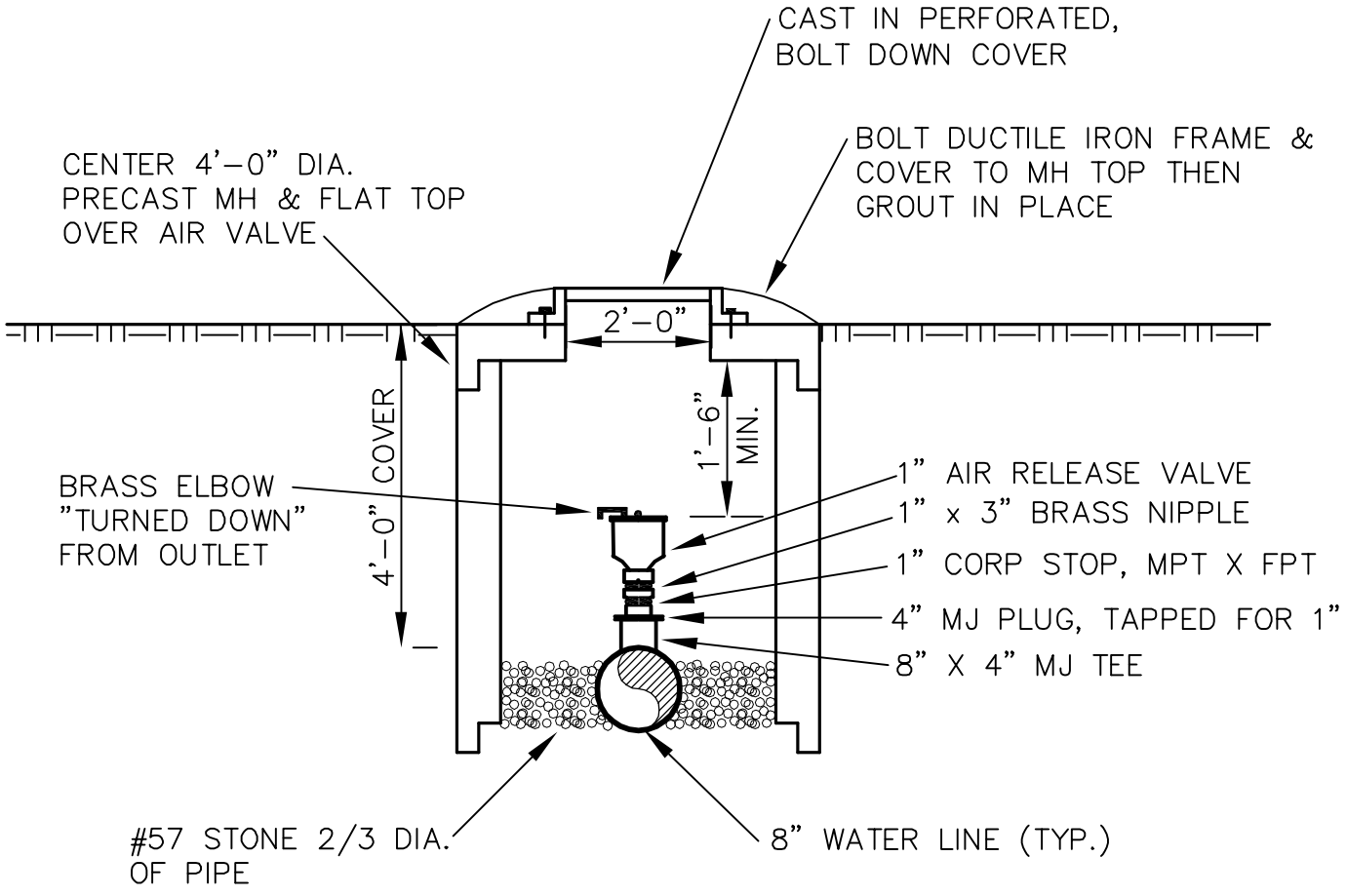
TYPE 5

TYPICAL PIPE BEDDING DETAILS

ROCKDALE WATER RESOURCES

STANDARD LAYING CONDITION FOR PIPE
NOT TO SCALE

STANDARD DRAWING No. A-15

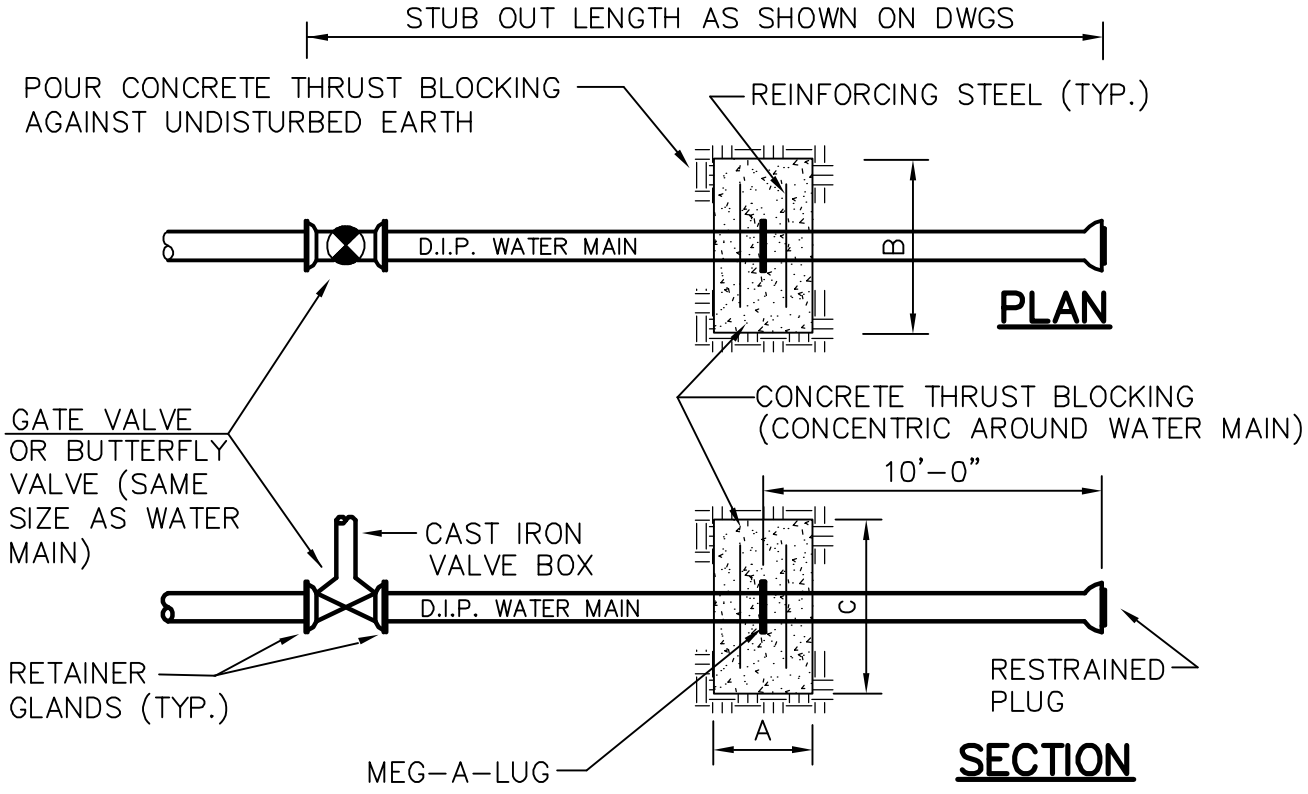


ROCKDALE WATER RESOURCES

AIR RELEASE VALVE INSTALLATION

NOT TO SCALE

STANDARD DRAWING No. A-16



WATER MAIN DIA.	CONC. COLLAR DIM.			STEEL REINFORCING
	A	B	C	
16"	2'-6"	6'-6"	6'-6"	#8 @ 12" O.C. EW EF
12"	2'-0"	5'-3"	5'-3"	#7 @ 12" O.C. EW EF
8"	1'-6"	4'-0"	4'-0"	#6 @ 12" O.C. EW EF

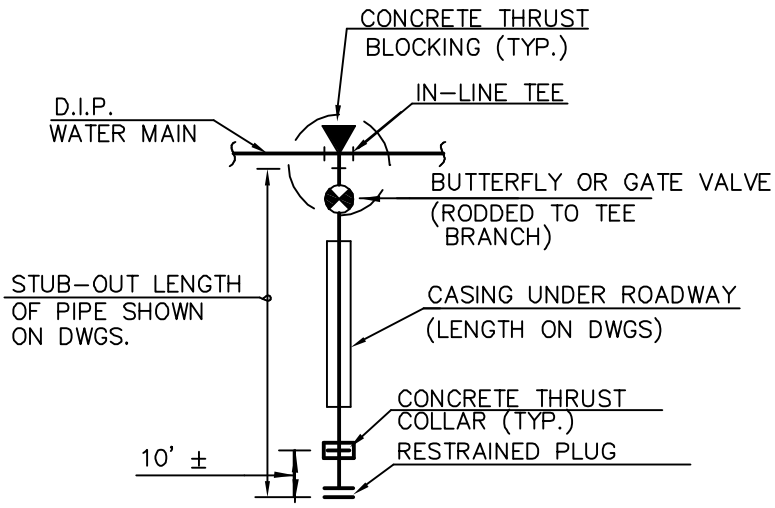
TEST PRESSURE: 250 PSI
SOIL BEARING PRESSURE: 2000 PSF

THRUST COLLARS

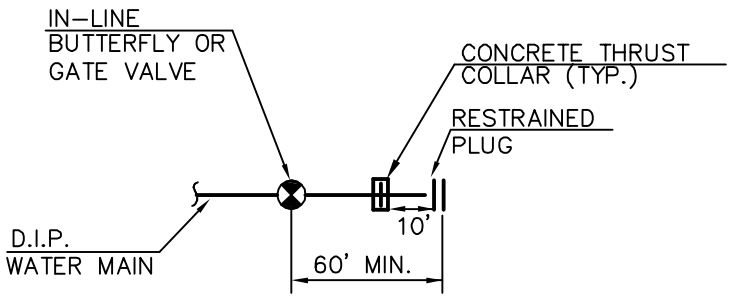
ROCKDALE WATER RESOURCES

THRUST COLLARS
NOT TO SCALE

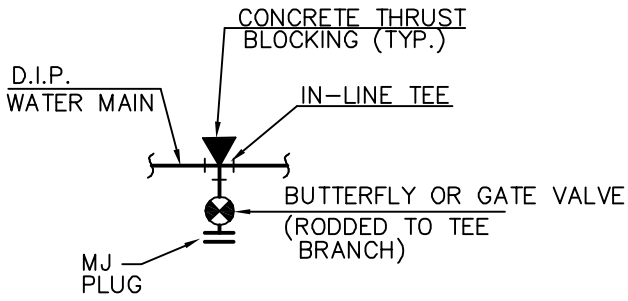
STANDARD DRAWING No. A-17



LONG SIDE (L.S.)



DEAD END (D.E.)



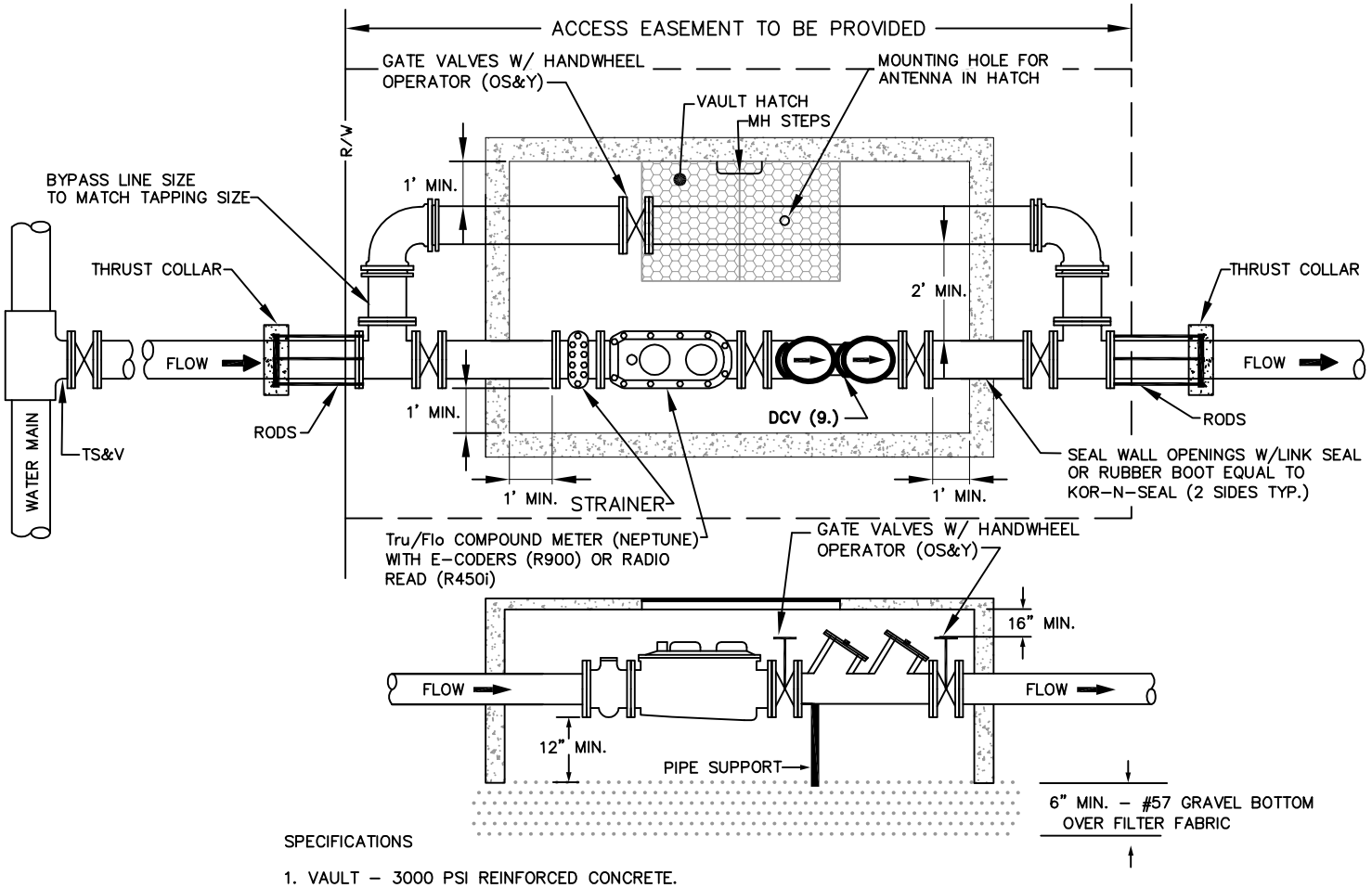
SHORT SIDE (S.S.)

ROCKDALE WATER RESOURCES

WATER MAIN STUB-OUT DETAILS

NOT TO SCALE

STANDARD DRAWING No. A-18



SPECIFICATIONS

1. VAULT – 3000 PSI REINFORCED CONCRETE.
2. TOP OF VAULT ELEVATION TO BE AT LEAST 3" – 6" ABOVE FINISH GRADE.
3. ALUMINUM HATCH EQUAL TO BILCO, 150 PSF, STAINLESS STEEL HDWR. SHALL HAVE HOLE IN HATCH FOR METER ANTENNA.
4. VAULT MFR. SHALL CAST HATCH FLUSH IN TOP SLAB.
5. PROVIDE MIN. 4' COVER OVER LINES OR PER APPROVED SITE DWGS.
6. DIP = PC 350; RESTRAIN MJ W/MEGA-LUGS FOR BURIED SERVICE, FIELD-LOK OR TR-FLEX RJ FOR PUSH-ON JTS.
7. CLASS 125 FLANGE JOINTS INSIDE VAULT: FLANGE DIP = THICKNESS CLASS 53.
8. PRESSURE TEST AND DISINFECT IN ACCORDANCE W/AWWA.
9. DCV (DOUBLE CHECK VALVE) – TESTABLE PER AWWA STANDARDS.

MINIMUM VAULT SIZES

L 12'-0"x W 8'-0" Vault with 48"x48" Hatch

SUGGESTED DEVICES:

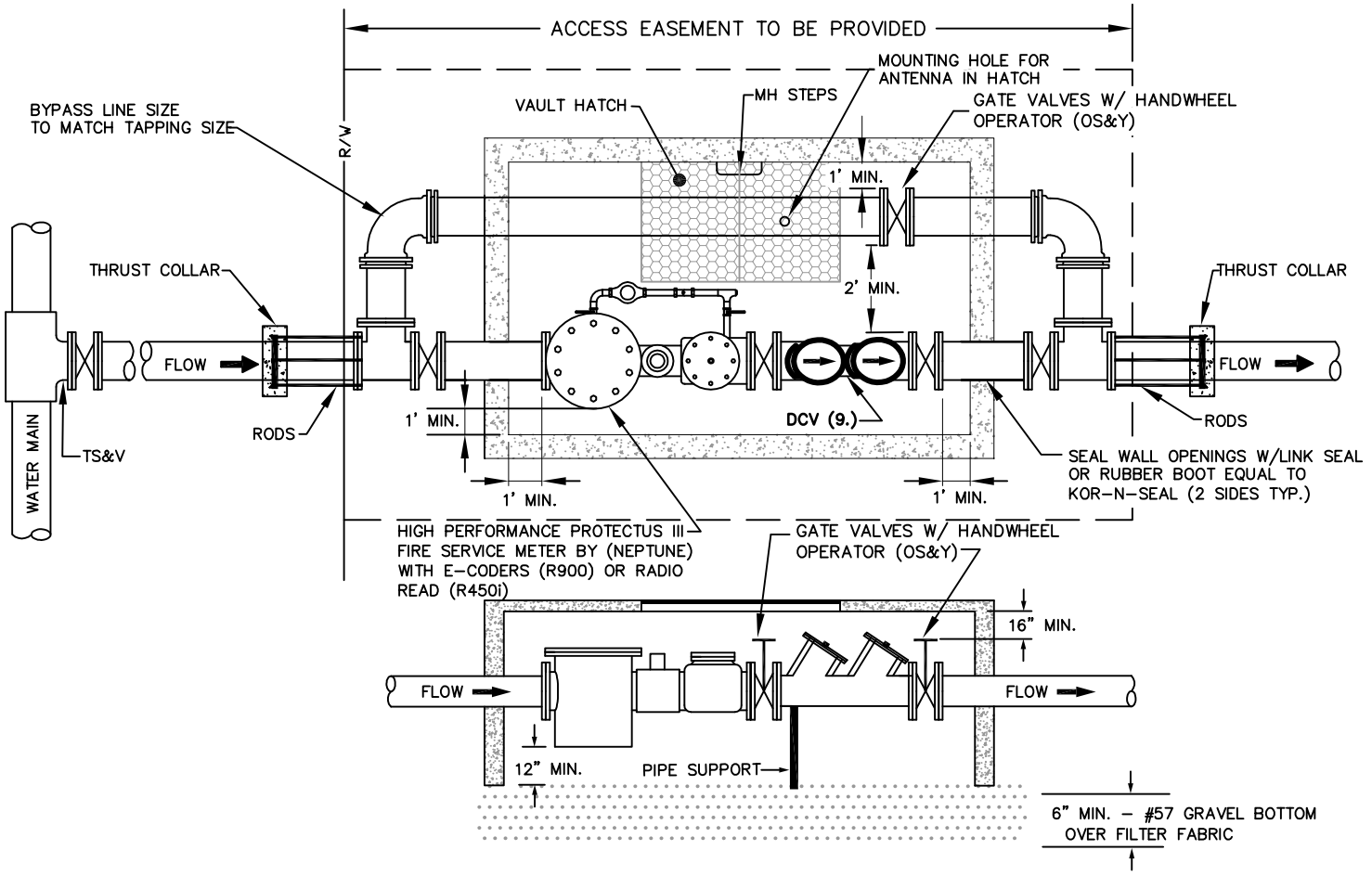
AMES– Model #DCDA
FEBCO– Model #806 Type YD
HERSEY–Model #DDCII
WILKINS–Model #950 DA
WATTS– Model #709 DDC
OR APPROVED EQUAL

LARGE WATER METER CONNECTION FROM 3" TO 6" METERS FOR COMBINED POTABLE AND FIRE FLOW

NOT TO SCALE

ROCKDALE WATER RESOURCES

STANDARD DRAWING No. A-19



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3. ALUMINUM HATCH EQUAL TO BILCO, 150 PSF, STAINLESS STEEL HDWR. SHALL HAVE HOLE IN HATCH FOR METER ANTENNA.
4. VAULT MFR. SHALL CAST HATCH FLUSH IN TOP SLAB.
5. PROVIDE MIN. 4' COVER OVER LINES OR PER APPROVED SITE DWGS.
6. DIP = PC 350; RESTRAIN MJ W/MEGA-LUGS FOR BURIED SERVICE, FIELD-LOK OR TR-FLEX RJ FOR PUSH-ON JTS.
7. CLASS 125 FLANGE JOINTS INSIDE VAULT: FLANGE DIP = THICKNESS CLASS 53.
8. PRESSURE TEST AND DISINFECT IN ACCORDANCE W/AWWA.
9. DCV (DOUBLE CHECK VALVE) – TESTABLE PER AWWA STANDARDS.

MINIMUM VAULT SIZES

L 14'–0"x W 10'–0" Vault with 48"x48" Hatch

SUGGESTED DEVICES:

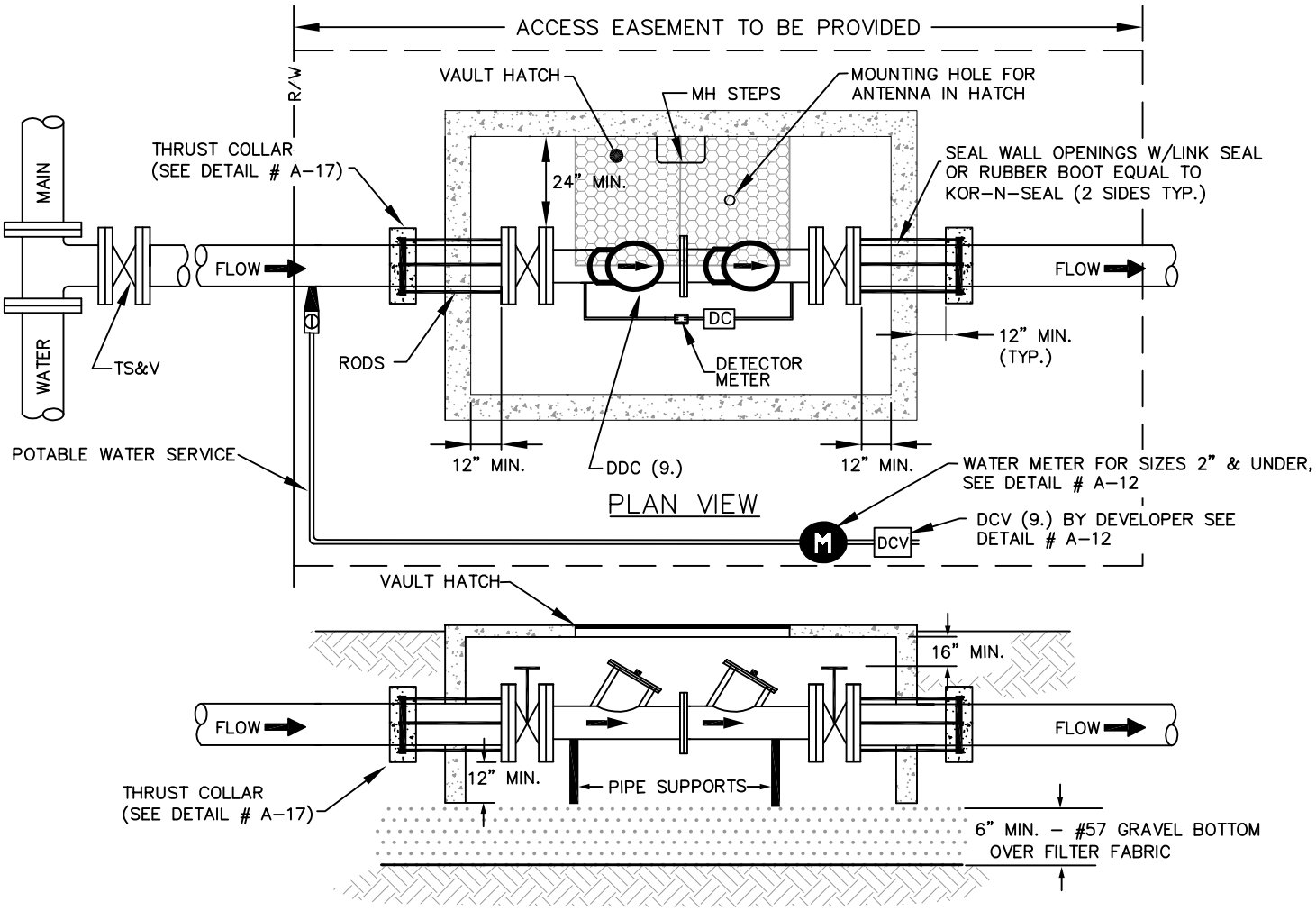
AMES– Model #DCDA
FEBCO– Model #806 Type YD
HERSEY–Model #DDCII
WILKINS–Model #950 DA
WATTS– Model #709 DDC
OR APPROVED EQUAL

LARGE WATER METER CONNECTION FOR 8" AND 10" METERS FOR COMBINED POTABLE AND FIRE FLOW

NOT TO SCALE

ROCKDALE WATER RESOURCES

STANDARD DRAWING No. A-20



MINIMUM VAULT SIZE			
FIRE CONNECTION SIZE	LENGTH	WIDTH	HATCH
10"	12'-0"	6'-0"	48"X48"
8"	10'-0"	5'-0"	36"X48"
6"	8'-6"	4'-6"	36"X36"
4"	7'-0"	4'-6"	36"X36"
3"	7'-0"	4'-6"	36"X36"

SUGGESTED DEVICES:

AMES- Model #DCDA
FEBCO- Model #806 Type YD
HERSEY-Model #DDCII
WILKINS-Model #950 DA
WATTS- Model #709 DDC
OR APPROVED EQUAL

GATE VALVES W/ HANDWHEEL OPERATOR (OS&Y)

SPECIFICATIONS

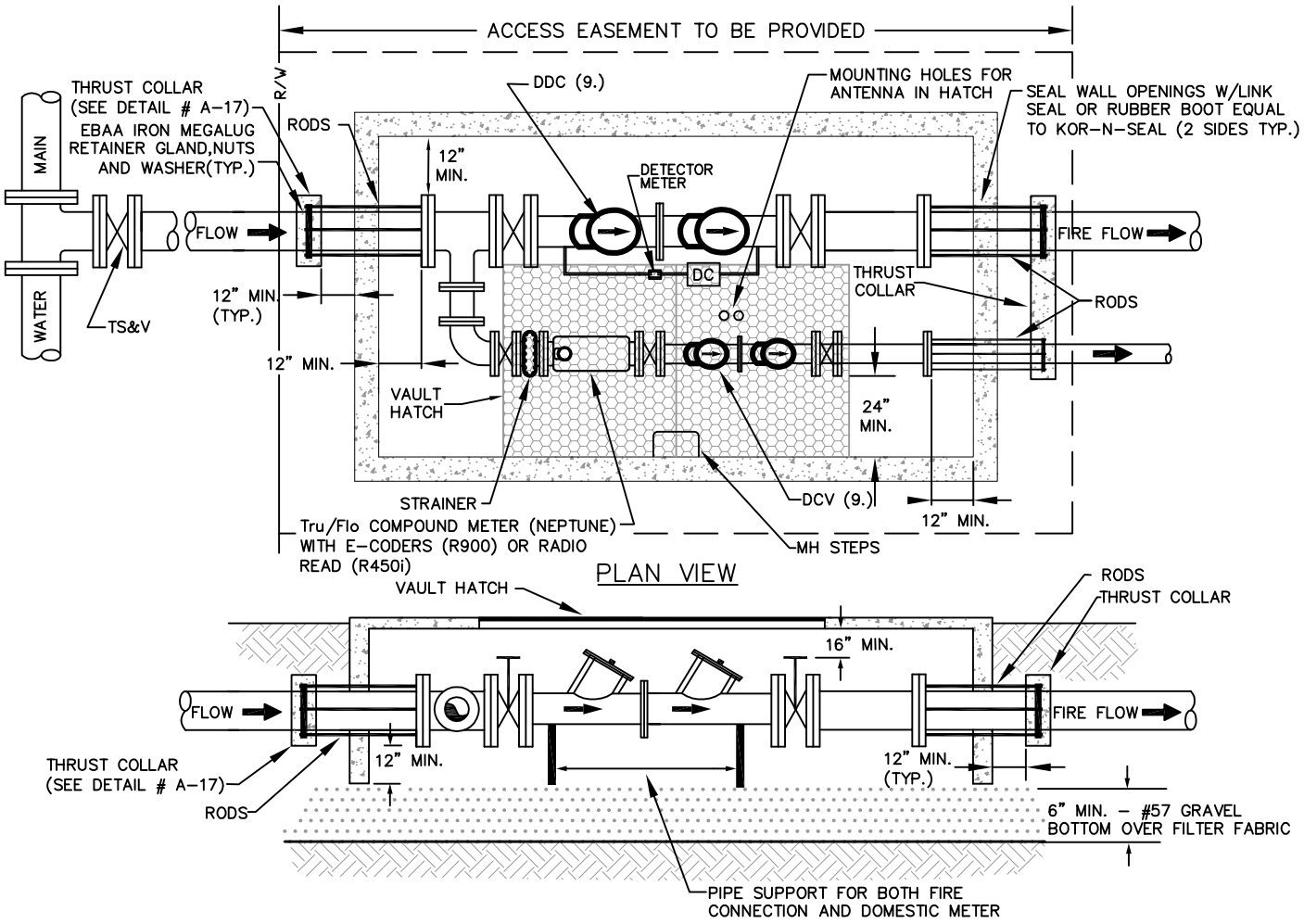
1. VAULT - 3000 PSI REINFORCED CONCRETE.
2. TOP OF VAULT ELEVATION TO BE AT LEAST 3" - 6" ABOVE FINISH GRADE.
3. ALUMINUM HATCH EQUAL TO BILCO, 150 PSF, STAINLESS STEEL HDWR.
4. VAULT MFR. SHALL CAST HATCH FLUSH IN TOP SLAB.
5. PROVIDE MIN. 4' COVER OVER LINES OR PER APPROVED SITE DWGS.
6. DIP = PC 350; RESTRAIN MJ W/MEGA-LUGS FOR BURIED SERVICE, FIELD-LOK OR TR-FLEX RJ FOR PUSH-ON JTS.
7. CLASS 125 FLANGE JOINTS INSIDE VAULT: FLANGE DIP = THICKNESS CLASS 53.
8. PRESSURE TEST AND DISINFECT IN ACCORDANCE W/AWWA.
9. TESTABLE PER AWWA STANDARDS.
10. ACCESS LADDER-SHALL BE DOWELED TO WALL AND CENTERED AT HATCH OPENING.
11. VAULT SHALL BE INSTALLED ON PRIVATE PROPERTY. CUSTOMER MUST PROVIDE 15'X30' EASEMENT.

FIRE LINE SERVICE CONNECTION AND POTABLE WATER METER 2" & UNDER

NOT TO SCALE

ROCKDALE WATER RESOURCES

STANDARD DRAWING No. A-21



MINIMUM VAULT SIZE				
FIRE CONNECTION SIZE	POTABLE WATER METER SIZE	LENGTH	WIDTH	HATCH
10"	4" OR 3"	14'-0"	8'-0"	60"X60"
8"	4" OR 3"	12'-0"	6'-0"	48"X48"
6"	4" OR 3"	12'-0"	6'-0"	48"X48"

SUGGESTED DEVICES:

AMES- Model #DCDA
FEBCO- Model #806 Type YD
HERSEY-Model #DDCII
WILKINS-Model #950 DA
WATTS- Model #709 DDC
OR APPROVED EQUAL

GATE VALVES W/ HANDWHEEL OPERATOR (OS&Y)

SPECIFICATIONS

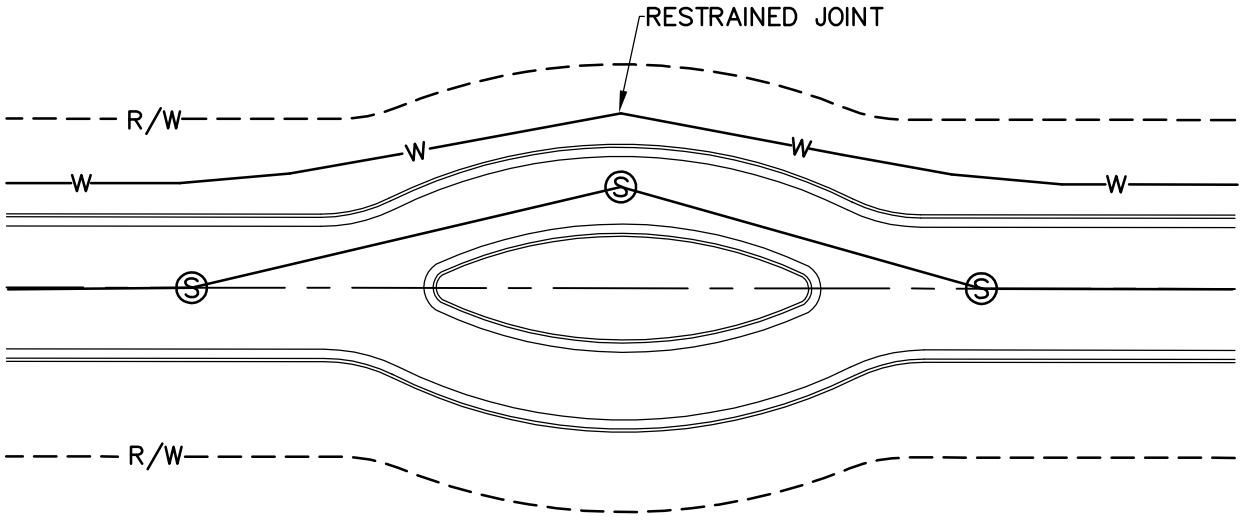
1. VAULT - 3000 PSI REINFORCED CONCRETE.
2. TOP OF VAULT ELEVATION TO BE AT LEAST 3" - 6" ABOVE FINISH GRADE.
3. ALUMINUM HATCH EQUAL TO BILCO, 150 PSF, STAINLESS STEEL HARDWARE.
4. VAULT MFR. SHALL CAST HATCH FLUSH IN TOP SLAB.
5. PROVIDE MIN. 4' COVER OVER LINES OR PER APPROVED SITE DWGS.
6. DIP = PC 350; RESTRAIN MJ W/MEGA-LUGS FOR BURIED SERVICE, FIELD-LOK OR TR-FLEX RJ FOR PUSH-ON JTS.
7. CLASS 125 FLANGE JOINTS INSIDE VAULT: FLANGE DIP = THICKNESS CLASS 53.
8. PRESSURE TEST AND DISINFECT IN ACCORDANCE W/AWWA.
9. TESTABLE PER AWWA STANDARDS.
10. FOR METERS GREATER THAN 4" SUBMIT VAULT FOR APPROVAL.
11. ACCESS LADDER-SHALL BE DOWELED TO WALL AND CENTERED AT HATCH OPENING.
12. VAULT SHALL BE INSTALLED ON PRIVATE PROPERTY. CUSTOMER MUST PROVIDE 15'X30' EASEMENT.
13. ALL CHECK VALVE AND METER ASSEMBLIES SHALL BE SUPPORTED IN TWO (2) PLACES.

ROCKDALE WATER RESOURCES

FIRE LINE SERVICE CONNECTION AND POTABLE WATER METER 3" & LARGER

NOT TO SCALE

STANDARD DRAWING No. A-22



NOT TO SCALE

ROCKDALE WATER RESOURCES

UTILITY PLACEMENT AT TRAFFIC CALMING DEVICES

STANDARD DRAWING No. A-23

ARTICLE 4

DESIGN STANDARDS - SEWER

4.01 SANITARY SEWER DESIGN CRITERIA

1.	Minimum sewer size	
	Collector	8 inches
	Service	6 inches
	Force Main	4 inches DIP
2.	Design period	50 years (per EPA)
3.	Minimum sewer line slope:	0.70%

Ductile Iron Pipe Requirements

< 10%	No special requirements.
10% - 15%	Concrete collar required at the downstream manhole.
>15%	Concrete collar at every joint

PVC Pipe Requirements (SDR 26)

< 10%	No special requirements.
10% - 15%	Concrete collar at every joint
>15%	Unacceptable

4. Flow Calculations

FLOW CALCULATIONS AND LOADING CRITERIA

The following list represents minimum loading criteria presently being accepted by RWR.

Type Installation	Sewage Flow, GPD Per Capita, unless noted	BOD_5 lbs/day
AIRPORTS[*1]:		
Passenger	5	0.02
Employee	25	0.05
APARTMENTS & CONDOMINIUMS:		
Laundry	400	1.08
1 Bedroom	175	0.45
2 Bedroom	250	0.00
3 Bedroom	325	0.00
Clubhouse	500	1.35
AUDITORIUM, CONVENTION CENTER, ASSEMBLY HALLS[*1]:		
Per Capita (Maximum Capacity)	10	0.05
BAR, TAVERN[*1]:		
Patron	4	0.015
or		
Per Seat	50	0.18
Employee	25	0.05
BOWLING ALLEY[*1]:		
Per Lane	125	0.32
Employee	25	0.05
OVERNIGHT CAMPING GROUNDS:		

Per Space	175	0.42

Type Installation	Sewage Flow, GPD Per Capita, unless noted	BOD_5 lbs/day
CHURCH[*1]:		
Per Seat	5	0.02
COIN LAUNDRIES:		
Per Load	30	0.08
Per Machine	400	1.05
COUNTRY CLUBS:		
Resident Member	100	0.20
Non-resident Member	25	0.08
HOSPITALS:		
Per Bed	200	0.30
INDUSTRIAL[*1]:		
Employee	25	0.05
Employee w/showers	35	0.06
NURSING HOMES:		
Per Bed	125	0.20
Employee	25	0.05
MOBILE HOME PARKS:		
Per Space	300	0.68
MOTEL, HOTEL:		
Per Unit	100	0.24

Type Installation	Sewage Flow, GPD Per Capita, unless noted	BOD_5 lbs/day
OFFICES[*1]:		
Per Employee	25	0.05
or		
Per 1000 square feet	175	0.35
PICNIC AREAS, PARKS:		
Per Capita	10	0.03
Per Capita w/Showers	25	0.07
POLICE, FIRE STATION[*3]:		
Resident Employee (Food Included)	75	0.15
Day Employee (No Food Service)	25	0.05
RESIDENCES[*4]: (Including those in "second Home" developments)		
Per Resident	400	0.68
REST STOPS, COMFORT STATIONS:		
Per Visitor	5	0.012
Employee	25	0.05
RESTARAUNT:		
Per Meal w/o Garbage Grinder	4	0.03
Per Meal w/Garbage Grinder	5	0.05
or		
Per Seat w/o Garbage Grinder	45	0.33

Per Seat w/Garbage Grinder	55	0.55
Employees	25	0.05

Type Installation	Sewage Flow, GPD Per Capita, unless noted	BOD_5 lbs/day
SCHOOLS[*5]:		
General	12	0.04
Cafeteria	4	0.01
Cafeteria w/Garbage Grinder	5	0.02
Gym	4	0.01
SERVICE STATION:		
Per Car	10	0.03
Employee	25	0.05
STORES, SHOPPING CENTER[*6]:		
Per 1,000 square feet	100	0.40
SWIMMING POOLS:		
Per Swimmer	20	0.04
Employee	25	0.05
THEATER (Regular)[*2]:		
Per Seat	5	0.02
THEATER (Drive-In)[*2]:		
Per Car Space	8	0.03

[*1] Food Service Not Included
[*2] Employees Included
[*3] Add 10% to 20% for Visitors
[*4] Normally 4 persons/home, Increase BOD 50% if garbage grinder installed

*5 Based on A.D.A., add 10% for peaks, employees and visitors

*6 Toilet Waste Only

Peak Factor 2.5

Note: At peak flow, pipes shall flow no more than 25% depth with respect to pipe diameter. For example, an 8-inch gravity sewer line shall be designed such that depth at peak flow conditions does not exceed 2-inches.

5. Minimum Manning's "n" Factor .013

6. A sewer flow calculation table similar to the following shall be included with the plans:

Sewer Line I.D.	Number of Lots Falling to Line	Average Daily Flow (ADF) @ 400 GPD per Lot	Peak Flow @ 2.5 x ADF	Minimum Proposed Sewer Line Slope
A	75	30,000	75,000	0.7%
B	90	36,000	90,000	1.0%
C	165	66,000	165,000	2.6%

7. Velocity Requirements

a. Force Main
   Minimum 2.0 fps
   Maximum 5.0 fps

b. Gravity Sewer
   Minimum 2.0 fps
   Maximum 15.0 fps

Where velocities in gravity sewer lines greater than 15 fps are attained, RWR, in its sole discretion, may require special provisions to protect against displacement by erosion and impact. Drop manholes and/or steel erosion plates can be constructed to reduce high flow velocities.

8. Sewers shall be designed with a capacity to handle the wastewater generated by the drainage area above the sewer for the ultimate density of that land. All sanitary sewer sizes and wastewater flow projections shall be in conformance with the Water and Sewer Master Plan, latest version, which is on file at the office of the Director of Water Resources.

9. A Wastewater Conveyance Capacity Certificate shall be provided for every project by a Licensed Professional Engineer in the State of Georgia to insure that existing sewer lines can handle the existing flow plus a peak flow from the proposed development. Certificate shall include support documentation for review by Rockdale Water Resources. The limits of the study shall be determined by the Rockdale Water Resources engineering staff.

10. Infiltration Allowance 25 gpd/in. Dia./Mile

11. Maximum distance between manholes 400 feet

12. No Sewers shall be connected to a manhole which requires a horizontal deflection angle greater than 90 degrees between an influent and effluent pipe, unless one pipe diameter drop between the pipes can be maintained.

13. If elevation difference between the inverts of influent and effluent is greater than 2', outside drop is required.

14. Sewer lines shall be located in the centerline of road rights-of-way, if possible.

15. Minimum ground cover shall not be less than 2 feet.

16. Service lines stub-outs shall be plugged or capped with leak proof plugs or caps as manufactured by ETCO, Inc. or approved equal and the locations of each service shall be identified by station on the "As-Built" drawings.

17. Construction material and installation shall be in accordance with the current RWR construction specifications.

18. A horizontal separation of at least 10 feet must be maintained between the water main and the existing or proposed sewer. When water mains cross sewers, a minimum vertical separation of 18 inches must be provided between the two pipes (measured edge to edge). At crossings, one full length of water pipe must be located so that both joints are as far from the sewer as possible. Water mains shall never be installed below a sewer.

19. All sewers shall be designed to prevent damage from superimposed live, dead and frost induced loads. Proper allowances for loads on the sewer shall be made because of soil and potential ground water conditions, as well as the width and depth of the trench. The weight of soil above the sewer and the weight and buoyancy forces associated with the water must be taken into account.

20. DIP will be used on sewer lines with less than 4 feet of cover, greater than 14 feet of cover and all exposed sewer lines.

21. DIP shall be used whenever storm water pipe overlays the sewer line.

22. DIP shall be used on sewer lines that cross streams and drainage ditches. Buried sewer lines beneath streams shall be encased in concrete a minimum of five feet beyond each stream bank.

23. Buoyancy of sewers shall be considered in sewer design. RWR, in its sole discretion, reserves the right to require additional soil cover and/or concrete anchor blocks to prevent floatation of the pipe where high ground water conditions are anticipated.

24. Force mains shall be DIP.

25. Pipe material shall be consistent between the manholes.

26. Sanitary sewer services in the right-of-way shall be DIP.

27. The developers of new subdivisions shall be required to install sewer laterals to all lots in sewered subdivisions.

28. Individual service laterals must serve only one dwelling.

29. Drainage from structures that could potentially cause infiltration or inflow (e.g., downspouts, swimming pools, garbage and trash receptacles, dumpsters, etc.) shall not connect to the sanitary sewer collection system.

30. RWR, in its sole discretion, may require the plans to include details of any and all elements of the design not covered by these specifications. A Professional Engineer registered in the State of Georgia shall certify all such details.

31. In order to facilitate future extension of the sewer collection system, RWR, in its sole discretion, may require the owner/developer to provide an easement through the property or extend the sewer line to the edge of the project property line.

4.02 WASTEWATER PUMP STATIONS AND FORCE MAINS

A. GENERAL

The construction of wastewater pumping stations will be permitted only where there is no wastewater treatment facility downstream of the proposed pumping station site. Pump stations shall be designed for the entire drainage basin. Force mains shall discharge into the nearest wastewater collection system, which has adequate capacity to handle the additional flows. Wastewater pumping stations shall be the Flygt submersible type, with a fenced site and access roads as required (See Detail).

Conceptual Design: The conceptual plan shall be presented to RWR at the pre design meeting to identify the proposed pumping station site and provide evidence that no gravity sewer service is available in the proposed area. The collection basin to which the wastewater is to be transferred shall be identified along with the projected pump station capacity and head.

B. DESIGN CRITERIA

1. Design Flows
The design average daily flow shall be computed as outlined in Section 4.01. The design pumping capability of the station shall be based upon the Peak Design Flow which shall be calculated by multiplying the design average flow by a peaking factor of 2.5.

2. Site

a.. The site shall be provided with iron pins at each property corner. The site dimensions shall be a minimum of 40 feet by 40 feet. The perimeter of the site shall be fenced with a 7 feet high chain link fence with 3 strand barbed wire on top and be provided with a double gate, minimum 14 feet wide. See pump station site layout standard drawing B-19.

b. A power pole shall be located within the fenced area with meters located in such a manner that they can be easily read from outside the fenced area. All power lines within the site shall be underground. A security light shall be mounted to the power pole.

c. The pumping station shall be provided with a 5/8-inch water service and hose bib. The water service line shall have a BFP just downstream of the meter.

d. An access road shall be provided between the pavement of the nearest public road and the pumping station site. The access road shall be minimum 12 feet in width.

e. The pump station site shall be deeded to RWR; the access road may be deeded to RWR or may be located within an easement. In either case, the minimum width of property shall be 40 feet. Provide proper drainage along and across access road, using culverts as necessary.

f. The telemetry equipment shall be provided by the Developer and shall meet all the Specifications of Section 4.03 below.

g. Buoyancy of pump station structures shall be considered and adequate provisions shall be made for protection.

C. Wet Well: Wet well shall be constructed of precast concrete manhole sections, either round or rectangular in shape.

1. Minimum allowable diameter shall be 6 feet. Wet well size shall also meet manufacturer's minimum size requirements.

2. Top of slab shall be 3 feet above the 100-year flood elevation.

3. The interior of the wet well shall be protected by epoxy coating.

4. All hatches shall be aluminum with stainless steel hasp and hinge.

5. All bolts, nuts and washers in wet well shall be 316 stainless steel.

6. The levels in the wet well shall be set in the following manner:

- pumps off; set above pump volute,

- lead/lag differential shall be a minimum of one foot,

- alarm elevation shall be a minimum of one foot above the last lag setting, and

- influent pipe shall be a minimum of one foot above the alarm setting.

D. Valve Vault: The vault shall be constructed as shown on the Standard Details. The vault shall be constructed of precast concrete. Each pump discharge shall be provided with a check valve and a plug valve. Valve vault shall have min. 6’ interior height.

E. Pumps: Pumps shall be submersible type and provided in a duplex or triplex configuration. In a duplex configuration, each pump shall be capable of handling the design flow, with the second pump as a stand-by. In a triplex configuration, all three pumps shall be the same with two pumps operating simultaneously being capable of handling the design flow, with the third pump as a stand-by.

Manufacturer: Pumps shall be manufactured by **Flygt**, unless otherwise specified or approved by RWR.

1. The design flow for the pump station shall represent the peak flow of the entire drainage basin. RWR may elect to increase the design flow in anticipation of further developments. The pump station shall be capable of pumping the peak design flow. Head capacity curves shall be prepared and submitted to RWR along with the pump station plans. Such curves shall be based upon appropriate friction losses. Head capacity curves shall verify that the pumps are operating at peak efficiency and are suitable for the design flow application. Pump and motor selection and head capacity curves shall reflect hydraulic conditions in cases where receiving force main systems are interconnected to additional pumping stations.

2. Pump motors shall be non-overloading over the entire pump range.

3. Motor rpm shall not exceed 1800 rpm.

4. Three phase power shall be required on all motors 4.7 HP and larger.

5. Pump and motor shall be furnished with adequately sized stainless steel lifting chain. The length shall reach the top of the station plus an additional 6 feet. Chain shall be 1/4-inch welded hot-dipped galvanized link chain.

6. DEVELOPER's ENGINEER shall submit signed, sealed, and dated design calculations for all wastewater pump stations. Calculations shall include head capacity curves with copies of the manufacturer's pump curves, hydraulic analysis of force main system, operating cycle calculations with wet well sizing, buoyancy calculations, and electrical calculations.

F. Force Mains: Force mains shall be designed based on a field-run survey. Air release or air/vacuum valves shall be placed at all high points. Wherever possible, lay force mains at a flat or positive grade. Installation requirements shall meet the requirements for water mains. Force mains shall be constructed of ductile iron pipe with polyethylene, polyurethane or epoxy linings. Force mains shall be sized to provide a minimum velocity of 2 feet per second and a maximum velocity of 5 feet per second. New manhole may be required at the force main connection to the existing system.

3. STANDBY SYSTEM SPECIFICATIONS

A. The standby generator shall be rated for continuous, standby service for the stations full load demand. This shall include running both pumps with staggered startups.

B. The generator shall be housed in a weatherproof enclosure. Quiet site soundproofing shall be provided to reduce noise to 68 db at a distance of 7 meters for natural gas powered generators and 70 db at a distance of 7 meters for diesel powered generators.

C. Outdoor weather-protective housing with critical grade exhaust muffler shall be installed. The housing shall have hinged side access doors and a rear control door. All doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color. Vibration isolators as recommended by the generator set manufacturer shall be provided. The generator must be mounted far enough away from obstructions to allow all doors to be opened 90°. All conduits and gas lines shall be installed underground.

D. Generator shall be supplied with all auxiliary systems necessary for operation (i.e. batteries, battery charger, block heater, etc.).

E. The standby power system shall include an automatic transfer switch. Transfer switch shall be rated for 100% of full load. Switch shall be provided with indicators for all phases of operation and be equipped with a fully programmable timer for exercising the equipment. The switch must be selectable for load or no load.

F. Generator shall be load tested at 100% full load on site for a period of four hours using resistive load banks. Developer's engineer must notify Rockdale Water Resources inspector 24 hours prior to test and provide a certification letter from the manufacturer.

G. Four complete sets of O & M manuals and keys shall be provided for generator and automatic transfer switch.

H. Generator control system must include a programmable control device to allow automatic start-up and test functions. Test functions can be programmed for daily, weekly or monthly testing. Connections to the telemetry system for remote monitoring of functional and failure must be provided.

I. Pump stations are required to have continuous standby power. Generators rated 100 KW and below are to be installed to operate on natural gas. If gas is unavailable, a letter of exception must be obtained from RWR. Generators above 100 KW shall be diesel powered with 100 gallons minimum fuel storage capacity or 24-hour operating time, which ever is greater. Fuel storage shall be accomplished by the use of corrosion–resistant double wall sub-base fuel tank only, no

underground storage will be allowed. A leak detection device shall be provided in the interstitial space for sensing fuel leakage. The device contact shall be connected to the generator control panel terminals for telemetry.
F.1-10 Allowable equipment:

1. John Deere
2. Kohler
3. Caterpillar
4. Cummins-Onan

Generator manufacturer will provide a 60-month comprehensive warranty to include parts and labor.

J. Transfer switches shall be in NEMA-4 enclosure obtained from the following manufacturers/representatives:

1. Cummins-Onan
2. ASCO

K. All pump stations shall be provided with emergency power receptacles. In addition, for pump stations to be dedicated to RWR, a stand-by emergency generator set shall be provided to RWR at no cost for each wastewater pumping station. All such generators shall be rated and designed to operate the pump station under design conditions. Determination of the pump station's critical points shall be at the discretion of the RWR.

4.03 TELEMETRY

A. RTU Equipment Requirements

Each remote site to be monitored requires a Remote Terminal Unit (RTU) to communicate by radio or other means to the master control area at Quigg Branch. Each RTU will have the capability to accept most types of inputs and outputs; standard inputs and outputs will be digital inputs, digital outputs, analog inputs, and analog outputs. Those signal statuses will be transmitted to the master station when polled. That is, the master station SCADA System will poll each site in the order designated at the periodic rates programmed. Should an emergency situation occur at a given site it breaks the normal polling sequence and notifies the master site immediately. The site status will be immediately received and handled as designated at the master station SCADA System.

B. PLC

PLC is defined as Programmable Logic Controller (PLC). The PLC for the RTU application herein consists of a rack, power supply, CPU (Central Processing Unit), inputs, outputs and a Modbus communication card or port. The standard water and wastewater telemetry PLC is to be an Allen Bradley Micrologix Model 1764-LRP. The critical sites that require redundant communication will utilize the Allen-Bradley SLC-503 series.

C. PLC Architecture

The PLC architecture for a standard RTU will consist of the Allen-Bradley Micrologix 1500 PLC with built in I/O (Inputs/Outputs). Modbus communication will be through the built-in Modbus-RTU port. Several sites have I/O expansion cards to accommodate the additional I/O functionality necessary. The addition of I/O expansion cards may be used in the future, if necessary, to accommodate future I/O requirements. Some sites may be identified as critical and a means of redundancy shall be included. The redundancy can include redundant PLC CPU's for critical site control and redundant communications such as radio and land line (phone) or, alternately a cellular phone. The standard communication line shall transmit and receive data over the Modbus interface. The PLC architecture, as a minimum, for critical RTU's that require redundant communication will consist of a seven (7) slot rack (1746-A7), 24 VDC (70W) power supply (1746-P2), SLC5/03 CPU (1747-L531), 1-16 point 110 VAC digital input card (1746-IA16), 1-16 point 110-VAC triac output card (1746-OA16), Modbus communication module as manufactured by ProSoft (Model 3150-MCM) and if required a 4 channel analog input card (1746-N14).

D. PLC Design – Allen Bradley

The manufacturer and model selected for Rockdale Water Resources is the Allen-Bradley model Micrologix 1500 and the SLC-500. Although there are a number of other manufacturers that have an equal product, such as General Electric, Modicon, and Siemens, Allen Bradley has been selected as the standard due to not only the performance but because of the amount of Allen-Bradley equipment that is presently in service throughout the County. By standardizing to one manufacturer this allows RWR personnel to become more proficient in the operation and maintenance of the hardware and software.

A Programmable Logic Controller has many uses. It has a CPU (Central Processing Unit) that performs many functions. One of the most popular functions is to automatically control equipment to meet a programmed control strategy based on commands issued by an operator and monitoring process and status feedback; This is accomplished with the use of inputs and outputs, analog and discrete. However, data (inputs, outputs and operator commands) may be transmitted and received over a

network for use at any node included on the network. The PLC CPU has the ability to perform many calculations such as addition, subtraction, multiplication, division, >, <, square root and PID Loops (proportional, integral and derivative) just to name a few. In addition to these many functions the PLC's primary use is to perform sequential function logic. Functions such as automatically controlling the starting and stopping of pumps based on an associated wet well level. This type of control is important in the automatic sequencing of plant functions. These functions can then be monitored or controlled, from a local or remote operator interface for convenience. In this system, the operator interface is the Quigg Branch Master SCADA System Operator Interface.

E. Radio

The primary communication method is accomplished through a FCC licensed 900 MHZ Radio System. The Master Station is the Quigg Branch site with repeater locations at the Prime Site Tower (FCC call sign WPQS 240) and the South Tower (FCC call sign WPQS 239). Critical sites include a redundant or back-up means of communication with the use of a phone land line. Should the radio fail to communicate an alarm shall be indicated on the SCADA System and the back-up communication means activated. Stations with out back-up communication, when the RTU is out of service will have to be monitored by trained personnel.

F. Radio System – Microwave Data Systems

The Telemetry System is to be designed with a radio system as manufactured by Microwave Data System also known as MDS. The models to be used will be model MDS 9710 for each RTU site. At each of the repeater locations will be MDS model MDS 9790; at Quigg Branch (the master control location) will be MDS model 9720. The master control and two repeater sites are set-up with redundant radios; in the event the primary radio should fail the standby radio resumes operation. The radio system as manufactured by MDS is the latest, state of the art, MAS (Multiple Address System) technology available and is a proven design.

The model MDS 9710 (and 9720-redundant) was designed to operate in a point-to-multipoint environment such as the RWR water and wastewater SCADA application. This radio can operate as either a half-duplex (i.e., two-way communication, but not at the same time) or simplex radio (i.e., broadcast communication only) and as a master or remote. When required, radio diagnostics are available from anywhere on the SCADA network.

The model MDS 9790 is a redundant master station that features the same proven digital signal processing technology as the MDS 9710 radio. The MDS 9790 can operate as either a full-duplex (i.e., simultaneous two-way communication) of half-

duplex radio and can be configured as a redundant master station or repeater.

The MDS 9790, 9720 and 9710 combination brings the radio system operation to a level of operation and maintenance consistent with the best radio-based systems. At the master site, Quigg Branch, there will be two redundant master radio systems. One will communicate with the Prime Site Tower repeater, and the second will communicate with the South Tower repeater. The remote RTU's will communicate with either of the two repeater towers. If for some reason a remote site can not receive or transmit due to the path being blocked an alternate means of communication such as a land line or cellular phone will be required. Data from each of the remote sites may pass through its MDS 9710 radio; through the repeater and on to the Quigg Branch master radio system to be displayed on the Wonderware SCADA System.

G. System Redundancy

With critical sites in the system, it is extremely beneficial to have a back-up means of communication and/or control as included here.

All sites pass information through the Quigg Branch master site with remote sites communicating through either of the two repeater sites. The master control station and the two repeater locations are considered critical points. Should either of these radio systems fail, the sites monitored by this respective group will no longer be automatically updated. An alarm will be indicated upon a radio failure. Each of these locations are equipped with a redundant radio system; should the primary radio fail, the back-up radio will resume operation and initiate an alarm.

The level of communication redundancy consists of redundant radios and in addition to the radio, a land line or cell phone line could be included as back-up to the radio.

The redundant control mode could include a redundant PLC CPU and power supplies. With a back-up CPU should the primary CPU fail, the PLC would switch over to the back-up CPU and the operation would resume and an alarm indicated at the station and on the SCADA System.

H. Enclosure

The standard RTU enclosure is designed to withstand the worst-case Georgia conditions. These conditions include temperatures ranging from –20°F-120°F, direct sun, driving rain, sleet and snow. Enclosure will be NEMA 4X, 316 stainless steel, wall mount type. Larger enclosures will be free standing. Where appropriate, the enclosures will include a sunshield and a drip shield. All panels include a heater and thermostat to avoid condensation and to maintain the enclosure temperature within the operating range of the enclosed equipment.

The enclosure shall contain the radio, PLC, an appropriately-sized UPS, terminal blocks, relays, surge suppression, power supplies and any other miscellaneous equipment required. All equipment shall be complete and mounted on the rear sub panel. Panels that require pilot devices: if the panel is located outdoors, all pilot devices shall be mounted on an inner swing outer door where the controls are out-of site. To operate, the enclosure door must be opened.

I. Testing Requirements

To add remote site(s), the necessary data shall be collected such as the site coordinates to run a path analyses or paper survey to determine the initial signal strength from either the Prime Site or the South Tower. Which ever signal strength is satisfactory shall be selected as the repeater of choice to send the required data to the master control station. If radio is not an acceptable solution, the station(s) can be added to the system by land line or cellular.

J. Remote Diagnostics

The MDS radios are equipped with the capability to test, troubleshoot, and adjust the radio parameters. These unique features allow maintenance personnel to monitor and/or test the radio system from locally or a remote location or from the master control station. The software required is Windows based and can operate on most laptop and desktop PCs. The software is supplied by MDS and is called "MDS Inside Radio System Management Software".

4.04 MATERIALS OF CONSTRUCTION

A. Fencing

1. Provide fencing as shown on the standard detail . Where the Developer finds it necessary to remove fencing to facilitate construction activities, the Developer shall completely remove all fencing including posts and wire mesh within the affected area. Fencing shall be replaced using the components that were removed, if in satisfactory condition, or new materials otherwise.

2. Overall height for new fencing shall be 7 feet with 3 strands of barbed wire on malleable iron post tops. Posts shall be set at no more than 10 foot centers, a full 3 feet deep in concrete footings, poured the full size of the holes as excavated. Corner posts shall have the necessary strut and tie bracing.

3. Where fencing crosses ditches, steep grades, and other unusual conditions,

make special provisions to insure that the security, appearance, maintainability, and permanence of the standard fencing are equaled or exceeded.

4. Materials shall conform to the following:

   a. Fence Mesh - 9 gage wire, woven to 2-inch squares, galvanized after weaving, 6 foot wide roll. Continuous tension wire shall be provided at the lower edge of the mesh.

   b. Line Post - 2-1/2-inch O.D. Galvanized Pipe (3.65 #/ft.)

   c. Corner Post - 3-inch O.D. Galvanized Pipe (5.79 #/ft.)

   d. Gate Post - 4-inch O.D. Galvanized Pipe (9.ll #/ft.)

   e. Top Rail - 1-5/8-inch O.D. Galvanized Pipe (2.27 #/ft.) with extra-long pressed steel sleeves.

   f. Gates shall be supplied with heavy duty latches, keepers, and heavy duty hardened bronze padlocks with duplicate keys.

   g. Gate frames - 2-inch O.D. galvanized pipe frame (2.72 #/ft.).

   h. Barbed wire shall consist of three strands of 12 gage wire, with 4-point pattern barbs, galvanized after weaving.

B. Ductile Iron Pipe (DIP): Furnish all pipe in lengths of at least 18 feet.

1. Pipe: Ductile iron pipe shall conform to AWWA C151. Provide Class 51 for push-on and MJ pipe and Class 53 for flanged pipe, unless otherwise specified. Pipe and fittings shall be cement lined in accordance with AWWA C104. Fittings shall be ductile iron and shall conform to AWWA C110 with a minimum rated working pressure of 150 psi. Where buried or concealed, furnish pipe and fittings with asphaltic outside coating. Where exposed, submerged, or exposed to spray, furnish primed pipe and fittings.

2. Joints: Joints shall be push-on or flanged type for pipe and standard mechanical and flanged joints for fittings. Joints shall conform to AWWA C110 or C 111. Provide fittings with ANSI 125 pound flanges. Gaskets for flanged piping shall be 1/8-inch thick ring type of red sheet rubber. Bolts for flange piping shall be hex head machine bolts with hex nuts. Bolts shall conform to ASTM A 307, Grade 2. Threads shall be ANSI B1.1 Coarse thread series, Class 2A external and Class 2B internal.

3. Acceptance: Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

C. Air Valves

1. Air Release Valves: Valves shall be automatic air release valves designed to allow escape of the air under pressure and close water-tight when liquid enters the valve. The valve shall have a maximum orifice diameter of 5/16-inch. The valve body shall be cast iron, designed to facilitate disassembly for cleaning and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion-resistant materials. Valves shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without dismantling the valve. Valves shall be recommended by the manufacturer for wastewater service. Air release valves shall be manufactured by Apco Valve Corp, Val-Matic, or G.A. Industries.

2. Automatic Air and Vacuum Valves: Valves shall be automatic air and vacuum valves designed to allow the escape of air, close watertight when liquid enters the valve, and allow air to enter in the event of a vacuum. The valve body shall be cast iron, designed to facilitate disassembly for cleaning and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion-resistant materials. Valves shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without dismantling the valve. Valves shall be recommended by the manufacturer for wastewater service. Air and vacuum valves shall be manufactured by Apco Valve Corporation, Val-Matic, or G.A. Industries.

3. Combination Air Valves: Combination air valve shall consist of an air release valve tapped into the body of an air and vacuum valve.

4. Single Body Valve: In lieu of item 3 above, a single body, double orifice, sewage combination valve may be used. Materials of construction, orifice size, venting capacity and accessories shall meet the requirements of item 1 and 2 above. Single body, double orifice valve shall be equal to APCO Valve Corporation.

D. Cushioned Swing Check Valves

1. Check valves shall be hinged disc type with cast iron body and bronze or bronze-fitted disc. Valves shall be designed for the operating head indicated and shall not slam shut on pump shutdown. Valves shall be equipped with a l/2-inch stop cock at the high point of the valve for bleeding air from the line.

2. Valves shall be outside weight and lever cushioned type. The cushion chamber shall be attached to the side of the valve body externally and constructed with a piston operating in a chamber that will effectively prevent hammering action at the pump discharge heads specified. The cushioning shall be by air, and the cushion chamber shall be so arranged that the closing speed will be adjustable to meet the service requirements.

3. Valves shall be manufactured by G-A Industries or APCO Valve Corporation.

E. Plug Valves: Valves shall be 90 degree turn non-lubricated eccentric type with resilient faced plugs. Design of the valve shall provide that contact between the seat and the plug shall only occur in the final degrees of plug movement. Valves shall be suitable for throttling service and service where valve operation is infrequent.

1. Operating Requirements: Valves shall provide drip-tight shut-off up to the full pressure rating with pressure in either direction. Pressure ratings shall be established by hydrostatic tests conducted in accordance with ANSI B 16.1. Valves shall be rated at a minimum of 150 psi. Valves 20-inches and smaller shall have a port area equal to at least 80 percent of the full pipe area; port areas of larger valves shall equal or exceed 100 percent of the full pipe area.

2. Valve Body: Bodies shall be cast-iron conforming to ASTM A 126 class B (carbon steel for 2-inch valves). All exposed nuts, bolts, springs, washers, etc. shall be zinc coated in accordance with ASTM A 153. Valves shall have flanged or mechanical joint ends as shown on the standard detail. Flanged valves shall have ANSI 125 pound standard flanges. Mechanical joint valves shall have bell ends conforming to applicable requirements of ANSI 21.11. Flanged valves with flange-to-MJ adapters shall <u>not</u> be acceptable in lieu of MJ valves.

3. Valve Seats and Seat Rings: Valve seats shall be a raised welded-in overlay machined to mate with the resilient faced plug. Valve seat rings shall be an integral casting machined to mate with the resilient seat. Valve seats and valve seat rings shall be 90 percent pure nickel and shall be a minimum thickness of 1/8-inch.

4. Valve Plug: The plug shall be of semi-steel conforming to ASTM A 126, Class B.

5. Resilient Seat: The resilient seating material shall be a synthetic rubber compound of approximately 70 durometer hardness bonded to the plug or retaining element. Facing material shall be abrasion resistant and suitable for sewage and sludge service.

6. Shaft Bearings: Valves shall be furnished with replaceable sleeve-type bearings in the upper and lower journals. Bearings shall comply with applicable requirements of AWWA C507, paragraphs 8.1, 8.3, 8.4, and 8.5. Bearing materials shall have a proven record of service of not less than five years.

7. Shaft Seal: The valve body shall be fitted with a bolted bonnet incorporating a stuffing box and pull-down packing gland. Packing shall be the split chevron type. Design of exposed valves shall allow visible inspection of the shaft seal, adjustment of the packing, and replacement of the packing, all without disturbing the bonnet or valve operator. The shaft seal shall comply with the requirements of AWWA C504.

8. Manual Operation: Valves 8-inches and smaller in diameter shall be equipped with lever operators. Provide one valve wrench for each exposed valve. Valves 10-inches and larger in diameter shall be equipped with geared operators. Geared operators shall be worm and gear type, totally enclosed, running in oil, with seals provided on all shafts to prevent entry of dirt and water into the actuator. All shaft bearings shall be permanently lubricated bronze bushings. Operator shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. Construction of operator housing shall be semi-steel. All exposed nuts, bolts and washers shall be zinc plated in accordance with ASTM A 153. Gear operators shall comply with requirements of AWWA C504. Valves 10-inches and larger shall be furnished with a hand wheel. Valves and operators shall have seals on all shafts and gaskets on valve operator covers to prevent the entry of water. Operator mounting brackets shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers shall be stainless steel.

9. Manufacturer: All plug valves shall be products of one manufacturer. Manufacturers must submit evidence of five years satisfactory service in sewage applications of valves of the same design and of the sizes required. Valves shall be manufactured by DeZurik, Kennedy, or Homestead.

F. Submersible pumps shall be totally submersible, electric motor driven, non-clog sewage pumps. Pump design shall allow for continuous, unsubmerged operation without auxiliary cooling pump. Pump design shall incorporate an automatic discharge connection, allowing each unit to be removed for inspection or service by simply lifting the pump. Reconnection shall require only lowering of the pump into position.

1. Pump Construction

a. All major parts, such as the stator casing, oil casing, volute, sliding bracket, and discharge connection shall be of gray iron. All exposed bolts and nuts shall be stainless steel. All mating surfaces of major parts shall be machined and fitted with rubber O-ring seals where watertight sealing is required. All parts shall be interchangeable and watertight sealing shall not require additional machining of replacement parts, sealing compounds, or the application of specific torques to connectors.

b. No portion of the pump unit shall bear directly on the floor of the wet well. There shall be no more than one 90 degree bend allowed between the volute discharge flange and station piping.

c. A sliding guide bracket shall be an integral part of the pump unit. The volute casing shall have a machined discharge flange to automatically and firmly connect with the cast iron discharge connection, which when bolted to the floor of the sump and discharge line, will receive the pump discharge connecting flange without the need of adjustment, fasteners, clamps or similar devices.

2. Impeller: A wear ring system shall be installed to provide efficient sealing between the volute and impeller. The impeller shall be gray cast iron, of non-clogging design, capable of handling solids, fibrous material, heavy sludge and other matter found in normal sewage applications. The impeller shall be constructed with a long throughlet without acute turns. The impeller shall be dynamically balanced. Static and dynamic balancing operations shall not deform or weaken it. The impeller shall be a slip fit to the shaft and key driven. Non-corroding fasteners shall be used.

3. Shaft Seals: Each pump shall be provided with a mechanical rotating shaft seal system running in an oil reservoir having separate, constantly hydro-dynamically lubricated lapped seal faces. The lower seal unit between the pump and oil chamber shall contain one stationary and one positively driven rotating tungsten-carbide ring. The upper seal unit between the oil sump and motor housing shall contain one stationary tungsten-carbide ring

and one positively driven rotating carbon ring. Each interface shall be held in contact by its own independent spring system supplemented by external liquid pressures. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. No seal damage shall result from operating the pumping unit out of its liquid environment. The seal system shall not rely upon the pumped media for lubrication. The oil reservoir shall have a drain and inspection plug with positive seal which shall be easily accessible from outside the pump.

4. Pump Motor

   a. The pump motor shall be designed in accordance with the standards of NEMA. The motor shall be housed in a watertight casing. The pump shaft shall be a one piece solid shaft of C1034 carbon steel and shall be completely isolated from the pumped liquid. The shaft shall be supported above and below the rotor by anti-friction bearings designed to provide long life and minimize shaft deflection. At least one bearing shall be double row type. Bearings shall have a minimum AFBMA B10 life of 20,000 hours.

   b. The design shall incorporate a positive, circulated cooling system to cool the motor. Passages for cooling media, where used, shall be adequately dimensioned to prevent clogging.

   c. Thermal sensors shall be provided to monitor stator temperature. One thermal switch shall be imbedded in the end coils of each stator winding. These thermal switches shall be used in conjunction, with and in addition to, external motor protection and shall be wired into the control panel.

5. Cable: Cable shall have P122 MSHA approval for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors. The cable entry sealing fitting shall relieve stress on conductors and provide a watertight and submersible seal without the use of sealing compounds and without the application of specific torques to connectors. The conductors shall connect to a terminal board which shall provide a moisture tight seal between the cable entry junction chamber and the motor.

6. Testing: The pump manufacturer shall perform the following inspections and tests on each pump before shipment from factory:

   a. A motor and cable test for moisture content and insulation defects.

b. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.

c. The pump shall be run for 30 minutes submerged, a minimum of 6 feet under water.

d. The motor and cable shall then be tested a second time for moisture content and insulation defects.

A written certification that these tests have been performed shall be provided with each pump at the time of shipment. After testing, the pump cable end shall be suitably protected for shipment and installation.

7. Access Frame and Door: The access frame shall be fabricated metal frame designed to be cast into a concrete structure. The door shall be 1/4-inch aluminum diamond plate hinged to the frame and equipped with a mechanism designed to assist in lifting the door. The door shall have an automatic hold-open feature, a slam latch with inside handle, outside removable key wrench and plug, and a hasp for padlocking.

8. Guide Bars: Guide bars shall be galvanized pipe or structural section attached to the automatic discharge connection at their lower end and to an upper guide bar bracket at their upper end. Intermediate guide bar supports shall be provided as required to insure a rigid installation. Guide bars shall not support any of the weight of the pump.

9. Electrical Controls

a. Furnish and install one automatic pump control center in a NEMA 12 enclosure for operation on a 460 volt, 3 phase, 60 Hertz, 3 wire service, three phase overload protection with manual reset and a magnet contactor. A 24 volt control circuit transformer with disconnect and overload protection shall be included, with an automatic, electrical alternator provided. Overload and disconnect functions shall be provided by a single magnetic-hydraulic, temperature-insensitive component.

b. Units shall be precalibrated to match motor and control characteristics and factory sealed to ensure trip setting is tamperproof. Control design shall allow for manual or automatic operation.

c. Control panel shall include an audible and visual high level alarm

with silence button. Control panel shall be provided with a 110-volt grounded outlet on the interior of the control panel. Control panel and electrical controls shall be provided with lightning arrestors. Control panel shall include a heater with thermostat for humidity control.

10. Liquid Level Sensors: Furnish and install liquid level sensors of the non-floating, displacement type. Level sensors shall be rated for operation at milliwatt levels. Floats or restrained floats shall not be acceptable. Provide sensors with adequate lengths of cable for the installation.

G. Electrical Power and Systems

1. General

a. Motor Wiring: Furnish and install power wiring to motors. Wiring into motor shall be complete with connections through associated disconnect switches, and motor starters, including "in-line" (branch circuit power line) controlling devices. Receive, store, and install individually mounted starters and controllers for motors. Wiring shall be in conduit, with final connection to rotating equipment made through a section of PVC jacketed flexible conduit. Motors shall be grounded.

b. Control Wiring: Control wiring is defined as that wiring which provides connections between control circuit elements and does not provide the power circuit into motor terminals.

2. Products

a. Disconnect Switches: Disconnect switches shall be quick-make, quick-break, UL labeled Heavy Duty safety switches. Switch ratings shall be for the applied voltage and current. Disconnects shall be non-fused type or if fused type is required by manufacturer's nameplate on equipment served (In which case fuses shall be sized as recommended by manufacturer). Where fusible safety switches are specified, they shall contain Class R fuse rejection clips. Disconnect switch enclosures shall be NEMA 3R. Manufacturers: General Electric, Westinghouse, ITE, Square D. Designate with permanent labels, the maximum allowable fusing capacity and fuse type for fusible switches. Install label on inside cover. Disconnects for 120V motors 1/2 HP or less, motor rated toggle
switches in steel outlet boxes. When a disconnect switch is used with

motors, it shall be an approved HP rated type.

b. Fuses: Motor fuses shall be sized for maximum of 125 percent of full load motor name plate rating. Provide label in each switch stating size and type of fuse. Replace all blown fuses up to final acceptance of job. Provide a spare set of fuses used in switchboard, panel boards and elsewhere on project. Quantities: 10 percent of total or minimum of 3 fuses for each size and type. Fuse manufacturers: Bussman, Hi-Cap (L), Limitron (RK1), Fusetron (RK5), or equal by Chase-Shawmut. All fuses shall be of same manufacturer.

c. Conduit: All conduit shall be hot-dipped galvanized rigid steel, UL labeled.

d. Conductors: All conductors shall be copper, single conductor, 75 degree C. Type THWN.

3. Execution

a. Metering: Metering equipment will be provided for the electrical service. Metering shall be arranged with the RWR and shall be installed in accordance with the utility company's requirements.

b. Excavation, Backfilling, and Concrete Encasement: Comply with all requirements specified in this specification for underground piping and manhole installations except when minimum depth of cover required is 18-inches.

H. Precast Concrete Wet Well: Provide materials for construction of manholes in accordance with the following:

1. Precast Concrete Sections: Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi. The minimum shell thickness shall be one twelfth of the inside diameter of the riser of the largest cone diameter. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS 202.

2. Brick and Mortar: Brick shall be whole and hardburned, conforming to ASTM C 32 Grade MS. Mortar shall be made of 1 part Portland cement and 2 parts clean sharp sand. Cement shall be Type 1 and shall conform to

ASTM C 150. Sand shall meet ASTM C 53.

3. Rubber Boots: Provide preformed rubber boots and fasteners equal to those manufactured by Kor-N-Seal or Press Seal Gasket Corporation.

4. Wet well shall have epoxy coating on interior and water proof sealant applied to exterior.

5. Ballast shall be cast in to the base of the wet well.

4.05 INFORMATION TO BE SHOWN ON PLANS AND PROFILES - SEWER

A. Information to be shown on sewer plans and profiles include the following:

1. Project name and valid registration stamp of the Professional Engineer registered in the State of Georgia competent in the treatment of water pollution. The stamp and signature of land surveyor or landscape architect is not acceptable. The registered Professional Engineer must stamp any plan redesigns.

2. Proposed service area (acres) and the population that will be served by the project.

3. Total service area (acres) and the population that could ultimately be serviced by the project (i.e., include upstream users).

4. Site plan should include streets, street names, lot layout (if subdivision) or building locations (if multi-family, commercial or industrial), land lots and district, north arrow, scale, sewer layout topography, streams, and storm drainage pipes.

5. 100 year flood plain and/or all stream buffers.

6. Pipe location, size, flow direction, and grade.

7. Manhole location, size, and identification, with elevation. Noted to include inverts.

8. Service location, size, tracer peg location, and elevation.

9. Type of material to be used for pipe, manholes, etc.

10. Location and size of existing sewer lines within 1,000 feet of the project.

11. The nearest existing sanitary sewer manhole on existing sewer line.

12. Other utilities in areas of potential conflicts.

13. Existing ground elevation relative to proposed sewer line.

14. Proposed tie-in with existing lines.

15. Wastewater Conveyance Capacity Certificate.

16. Twenty-foot permanent easements if the sewer line crosses private property. More easement area may be required as deemed necessary by RWR.

17. Plan and profile scales shall be:

Vertical:	One inch = 5 feet or 1 inch = 10 feet
Horizontal:	One inch = 20 feet or 1 inch = 50 feet

18. Sheet size is 24 inches x 36 inches. "Half-size" drawing sets will not be reviewed and will be returned to the owner/developer.

19. Effect on existing or proposed pumping station produced by the proposed development. Pump stations must be shown on the drawings indicating recorded easements for roads, fences with gates and wash down potable water/backflow preventer, and telemetry system.

20. A recorded easement for further extending sewer lines in order not to impact neighboring property owners must be shown on all drawings.

21. <u>The following notes shall be required on all drawings submitted to RWR</u>:

    a. **Design and construction of all water and sanitary sewer lines shall conform to Rockdale Water Resources Water and Wastewater Standards and Specifications, latest edition.**

    Notify RWR Engineering Department at least 72 hours prior to beginning of construction on water and sewer. An inspector will be assigned and a pre-construction meeting scheduled at this time.

    b. "As-Built" drawings shall be field verified and stamped by a registered Professional Engineer or land surveyor, licensed in the State of Georgia.

22. The contractor shall comply with all Utilities Protection Center requirements.

23. Additional items may be requested if deemed necessary by RWR.

4.06 INFORMATION TO BE INCLUDED IN PUMP STATION PLANS, REPORTS, & SPECIFICATIONS

A. DESIGN AND DEVELOPMENT REPORT(DDR) shall be submitted on 8 ½- by 11-inch paper with oversized foldout sheets as appropriate, and shall contain, at a minimum, the following components:

1. Title page, including project name and date, correlating with the design drawings

2. Location map showing:

   a. Property lines, lot lines, building locations, roads, etc.
   b. Lift station
   c. Influent sewers and manholes
   d. Force mains

3. Basin Assessment including:

   a. Identification of land area in the basin tributary to lift station
   b. Breakdown of acreage in basin according to existing land use
   c. Breakdown of acreage in basin according to the projected land use

4. Average and peak flow calculations, for immediate and future conditions

5. Force main sizing calculations

6. Individual pump and system performance head and flow curves

7. Static head and total dynamic head calculations at a range of wet well levels and pumping rates

8. Net positive suction head available (NPSHA) calculations

9. Pump cycle time and wet well sizing calculations

10. Efficiency and power calculations

11. Hydraulic transient analysis (if required)

12. Standby generator sizing calculations.

B. DESIGN DRAWINGS shall be submitted on 24- by 36-inch sheets, and shall contain, at a minimum, the following components:

1. Title page

2. Development plan showing location of:

    a. Property lines, lot lines, building locations, roads, etc.
    b. Lift station
    c. Influent sewers and manholes
    d. Force mains

3. Lift station site layout showing:

    a. Property boundary
    b. Location of structures
    c. Fence lines
    d. Roadways and drives
    e. Easements and rights-of-way
    f. Pipelines and other utilities
    g. Topographic contours
    h. 100-year flood elevation and/or all stream buffers.

4. Plan and elevation views of structures including:

    a. Wet well
    b. Valve vault
    c. Electrical building, if required

5. Mechanical design drawing(s) showing:

    a. Plan and profile views of pumps
    b. Pipe sizes
    c. Pipe supports
    d. Valves, couplings, taps, and other appurtenances
    e. Equipment size, manufacturer, and model number

6. Plan and profile views of gravity sewers and force mains leading to and from the lift station

7. Electrical design drawing(s) showing:

a. Incoming power supply
b. Control panel, lighting panel, distribution diagram
c. Telemetry
d. Auxiliary power

8. Structural, mechanical, electrical, and architectural details, including applicable RWR standard details, for all structures and equipment.

4.07 GREASE TRAPS

Design Criteria

Minimum grease trap size is 750 gallons.

Multiple grease traps shall be plumbed in parallel with equal amounts of waste water going to each grease trap.
All grease traps detention time – 30 min. minimum.

A. Automotive Facilities

All garages, car washes, and auto repair facilities shall install a grease trap or oil separator. A Professional Engineer licensed in the State of Georgia must design traps and design calculations must be submitted to Rockdale Water Resources for review.

B. Restaurants

1. Grease traps are to be located outside of the building.

2. Grease traps are to process kitchen waste only. Sanitary sewage shall not enter the grease trap.

3. Grease trap volume shall be designed so as to ensure compliance with pretreatment standards as specified in the Rockdale Water Resources Standards and Specifications, latest edition. The minimum grease trap volume is 750 gallons, provided all pretreatment standards are met. The developer shall submit all necessary calculations to justify the proposed grease trap volume. All calculations shall be certified by a Professional Engineer registered in the State of Georgia.

4. All outdoor grease traps shall fall to a dedicated manhole that will be used for testing purposes (a.k.a. a test manhole). The test manhole shall have a single invert in from the grease trap and a single invert out to the sanitary sewer lateral. Sanitary sewage shall not be plumbed through the test manhole.

C. Sandwich Shops, Delis and Carry Outs (no inside cooking)

Rockdale Water Resources, in its sole discretion, may consider approving smaller indoor grease traps provided the restaurant has no indoor cooking facilities and the indoor grease trap is at least a 40 pound unit that will be located away from the sink.

D. Miscellaneous Oil and Grease Generators

Rockdale Water Resources, in its sole discretion, may require the installation of a grease trap if the development has the potential to discharge oil or grease to the wastewater collection (e.g., industrial facilities, food distribution centers, etc.).

E. Provisions for Larger Grease Traps

In case of certain fast food restaurants or establishments that are operating 24-hours or with the potential to discharge large quantities of oils, grease, solids or wastewaters, larger grease trap capacities may be required. Rockdale Water Resources may approve pre-packaged or manufactured grease traps with proper engineering and application review.

F. SAND AND GRIT SEPARATORS

Rockdale Water Resources, in its sole discretion, may require the installation of sand and grit separators if the development provides an opportunity for sand and/or grit to enter the sanitary sewer collection system.

ARTICLE 5

CONSTRUCTION STANDARDS - SEWER

5.01 PIPE AND ACCESSORIES

A. All pipes are subject to the inspection of RWR at the pipe plant, jobsite, or other point of delivery for the purpose of rejecting pipe not conforming to these Specifications.

B. Ductile Iron Pipe (DIP): Ductile iron pipe shall be utilized as shown on the Drawings. All pipes shall be furnished in nominal lengths of at least 18 to 20 feet.

1. Pipe and Fittings: Ductile iron pipe shall conform to AWWA C151 and shall be Pressure Class 350 unless shown otherwise on the Drawings. Pipe and fittings shall be cement lined in accordance with AWWA C104. Fittings shall conform to AWWA C110 with rated working pressure of 150 psi. Pipe and fittings shall be furnished with a bituminous outside coating. Tapping saddles shall be ductile iron.

2. Joints: Unless shown or specified otherwise, joints shall be push-on type for pipe and standard mechanical joints for fittings. Joints shall conform to AWWA C111. Restrained joints shall be equal to American "LOK-FAST", "FLEX-RING" or "LOK-RING", Clow "SUPER-LOCK", or U.S. "TR FLEX" or "LOK-TYTE".

3. Acceptance: Acceptance will be on the basis of RWR's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

4. Polyethylene Encasement: Ductile iron pipe shall be encased with polyethylene film where shown on the drawings. Polyethylene film shall have a minimum thickness of 8 mils. Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired.

5. Service: Furnish the services of a competent factory representative of the pipe manufacturer for purposes of supervising and/or inspecting the installation of the pipe.

C. Polyvinyl Chloride (PVC) Gravity Sewer Pipe: PVC gravity sewer pipe shall be supplied in nominal lengths of 13 to 20 feet.

1. Pipe: PVC gravity sewer pipe and fittings 4 to 15-inches in diameter shall be manufactured in accordance with ASTM D 3034, SDR 26. PVC gravity sewer pipe and fittings 18 to 21-inches in diameter shall be manufactured in accordance with ASTM F 679, minimum wall thickness T-1. Fittings for pipe 8-inches and less in diameter shall be one piece with no solvent-welded joints. Fittings for pipe 10-inches and larger may be fabricated using solvent welding. No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings delivered ready for use.

2. Joints: Joints for pipe and fittings shall be of the integral bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage. Joints shall meet the requirements of ASTM D 3212; gaskets shall meet the requirements of ASTM F 477. The joint system shall be identical for pipe and fittings.

3. Detection Tape: Detectable mylar encased aluminum foil marking tape will be installed over all sewers. Tape will be green in color, at least 1-1/2-inches wide, and shall bear the printed identification "Caution: Buried Sewer Line Below" (reverse printed), so as to be readable through the mylar. Surface printing on the tape shall be equal to Lineguard Type II Detectable.

4. Acceptance: Acceptance will be on the basis of RWR's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

5. Service: Furnish the services of a competent factory representative of the pipe manufacturer for purposes of supervising and/or inspecting the installation of the pipe.

D. Materials for Manholes: Provide materials for construction of manholes in accordance with the following:

1. Precast Concrete Sections: Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi. The minimum wall thickness shall be one twelfth of the inside diameter of the riser of the largest cone diameter plus 1-inch or wall thickness suitable for use of rubber boot. Transition slabs which convert bases larger than 4 feet in diameter to 4 foot diameter risers shall be designed by the manhole manufacturer to carry the live and dead loads exerted on the slab.

Vertical manhole sections shall be joined with gaskets conforming to ASTM C443 or with double mastic.

Flexible external manhole chimney seals shall be installed on all manholes in the roadway. Chimney seals shall be Infi-Shield, SurSeal, Cretex or approved equal. Installation shall be in strict accordance with the manufacturer's instructions.

2. Pipe Tee Manholes: Concrete pipe tees shall meet the requirements of the pipe in which it is used. Steel reinforcement in the riser shall be securely welded to steel in the line pipe before concrete fill is begun. The remainder of the manhole shall be as specified for precast concrete sections.

3. Manhole Frame and Cover:

   All frames and covers shall be 24" ERGO or approved equal:

   (a) Covers and Frames shall be manufactured from Ductile Iron in accordance with ISO 1083.

   (b) Covers shall be one-man operable using standard tools and shall be capable of withstanding an average load of 120,000 lb.

   (c) Covers to be hinged and incorporate a 90 degree blocking system to prevent accidental closure.

   (d) Frames shall be circular with 26" minimum clear opening.

   (e) Frames shall incorporate seating gasket.

   (f) Frames shall be complete with dual wiper infiltration resistant hinge plugs.

   (g) Locking devices shall be installed in **all** manhole covers. Locking devices shall be "CAMLOCK" or approved equal. At least 3 (three) keys per project shall be supplied to the RWR inspector.

4. Manhole Steps: Manhole steps shall not be installed in the manholes. Manhole access shall be performed in accordance with OSHA "Confined Space Entry" procedures.

5. Rubber Boots: Provide preformed rubber boots and fasteners equal to those manufactured by Kor-N-Seal or Press Seal Gasket Corporation.

5.02 LOCATION AND GRADE

A. The Drawings shall show the alignment and slope of the sewer and the location of manholes to include inverts and other appurtenances. The slope shown on the drawings is the slope of the invert of the pipe.

B. After the centerline or baseline of the sewer is located, clear the easement. The Contractor shall take all precautions necessary, which shall include but not necessarily be limited to installing reference points, to protect and preserve the centerline or baseline.

C. A temporary benchmark shall be provided at intervals along the sewer route and a hub at the centerline of each manhole and at all other locations where the alignment of the sewer changes for verification of sewer grade.

D. Construction shall begin at the low end of the sewer and proceed upstream without interruption. Multiple construction sites shall not be permitted without written authorization from RWR for each site.

E. During clearing and construction, protect benchmarks and verify their location and elevation. Preserve the location of the reference points and centerline of manholes, and provide all other control required to construct the line.

The Contractor shall be responsible for any damage done to reference points, base lines, center lines, and temporary bench marks, and shall be responsible for the cost of re-establishment of same.

5.03 EXISTING UNDERGROUND UTILITIES AND OBSTRUCTIONS

The Drawings shall indicate underground utilities or obstructions that are known to exist according to the best information available. The Contractor, as required by Georgia law, shall call the Utilities Protection Center (UPC) at **811** and those utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site to verify the location of, and possible interference with, the existing utilities, arrange for necessary suspension of service and make arrangements to locate and avoid interference with said utilities. Where these or unforeseen underground utilities are encountered, the location and alignment may be changed, upon written approval of the Engineer, to avoid interference.

5.04 TEMPORARY EROSION AND SEDIMENTATION CONTROLS

The Developer shall submit a description, working drawing, and schedule for proposed temporary erosion and sedimentation controls to the local authority. The description and working drawings shall meet the requirements of the Manual for Erosion and Sediment Control in Georgia, latest edition and local soil erosion and sedimentation control ordinances. The Developer shall acquire land disturbance permits from the local authority and shall pay any fees for said permits. The Developer shall be responsible for submitting to the local authority sufficient documents such that the local authority can acquire approval from the Rockdale County or Soil and Water Conservation District. All fines imposed for improper erosion and sedimentation control shall be paid by the Developer.

5.05 CLEARING AND GRUBBING

A. Clear and grub the permanent easement 10 feet on each side of the pipeline before excavating. Remove all trees, growth, debris, stumps and other objectionable matter. Clear the construction easement or road right-of-way only if necessary.

B. Clearing

1. All growth such as trees, shrubs, brush, logs, upturned stumps and roots of down trees and other similar items shall be removed and disposed of properly. Cultivated growth shall be removed and trees felled as necessary and in accordance with the requirements Section 5-18 PROTECTION AND RESTORATION OF WORK AREA.

2. Where the tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility.

3. All buildings, fences, lumber piles, trash, and obstructions, except utility poles, shall be removed and disposed of by the Developer. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.

4. All fences adjoining any excavation or embankment that may be damaged or buried shall be carefully removed, stored, and replaced.

C. Grubbing: All stumps, roots, foundations and planking embedded in the ground shall be removed and disposed of. Piling and butts of utility poles shall be removed to a minimum depth of 2 feet below the limits of excavation for structures, trenches, and roadways or 2 feet below finish grade, whichever is lower.

D. Disposal of Refuse: The refuse resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Developer and shall be disposed of in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any private property except by written consent of the property owner. In no case shall any material be left on the project, shoved onto abutting private properties, or be buried on the project. When approved in writing by the County and when authorized by the proper authorities, the Developer may dispose of such refuse by burning on the site of the project provided all requirements set forth by the governing authorities are met. The authorization to burn shall not relieve the Developer in any way from damages which may result from his operations. On easements through private property, the Developer shall not burn on the site unless written permission is secured from the property owner.

E. Scheduling of Clearing: The Developer shall clear at each construction site only that length of the permanent or construction easement which would be the equivalent of one month's pipe laying. RWR may permit clearing for additional lengths of the sewer provided that erosion and sedimentation controls are in place and a satisfactory stand of grass is established. Should a satisfactory stand of grass not be possible, no additional clearing shall be permitted beyond that specified above. A satisfactory stand of grass shall have no bare spots larger than 1 square yard. Bare spots shall be scattered and the bare area shall not comprise more than 1 percent of any given area. The Developer shall be responsible for all damages to existing improvements resulting from his operations.

5.06 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS

A. Install sewer lines and appurtenances along highways, streets, and roadways in accordance with the applicable regulations of and permits issued by the Georgia Department of Transportation, Rockdale County, and City of Conyers with reference to construction operations, safety, traffic control, road maintenance and repair.

B. Traffic Control

1. The Developer shall provide, erect and maintain all necessary barricades, suitable and sufficient lights and other traffic control devices; shall provide qualified flagmen where necessary to direct traffic; shall take all necessary

precautions for the protection of the work and the safety of the public. Flagmen shall be certified by a DOT approved flagman training program.

2. Construction traffic control devices and their installation shall be in accordance with the current Georgia Manual On Uniform Traffic_Control Devices for Streets and Highways.

3. Placement and removal of construction traffic control devices shall be coordinated with the Department of Transportation, Rockdale County and City of Conyers a minimum of 48 hours in advance.

4. Placement of construction traffic control devices shall be scheduled ahead of associated construction activities. Construction time in street right-of-way shall be conducted to minimize the length of time traffic is disrupted. Construction traffic control devices shall be removed immediately following their useful purpose. Traffic control devices used intermittently, such as "Flagmen Ahead", shall be removed and replaced when needed.

5. Existing permanent traffic control devices within the construction work zone shall be protected from damage due to construction operations. All damaged traffic control devices requiring temporary relocation due to construction shall be located as near as possible to their original position. Their original position shall be measured from permanent reference points and recorded in a permanent log prior to relocation. Temporary locations shall provide the same visibility to affected traffic as the original position. Relocated permanent traffic control devices shall be reinstalled in their original positions as soon as practical following construction in the affected location.

6. Construction traffic control devices shall be maintained in good repair, clean and visible to affected traffic for day time and night time operation. Traffic control devices affected by the construction work zone shall be inspected daily.

7. Construction warning signs shall be black legend on an orange background. Regulatory signs shall be black legend on a white background. Construction sign panels shall meet the minimum reflective requirements of the Department of Transportation, Rockdale County, and City of Conyers. Sign panels shall be of durable materials capable of maintaining their color, reflective character, and legibility during the period of construction.

8. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the current Georgia Manual On Uniform Traffic Control Devices for Streets and Highways, appropriate for the speed limit at that

location. Channelization devices shall be patrolled to insure that they are maintained in the proper position throughout their period of use.

C. Construction Operations

1. Perform all work along highways, streets and roadways to minimize interference with traffic.

2. Stripping: Where the pipe line is laid along road right-of-way, strip and stockpile all sod, topsoil, and other material suitable for right-of-way restoration.

3. Trenching, Laying, and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.

4. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod, and any other materials removed from shoulders.

D. Excavated Materials: Do not place excavated material along highways, streets, and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off the pavement in a timely manner.

E. Drainage Structures: Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

F. Maintaining Highways, Streets, Roadways, and Driveways

1. Maintain streets, highways, roadways, and driveways in suitable condition for movement of traffic until completion and final acceptance of the work.

2. During the time period between pavement removal and completing permanent pavement replacement, maintain highways, streets, and roadways by the use of steel running plates. The edges of running plates shall have asphalt placed around their periphery to minimize vehicular impact. The backfill above the pipe shall be compacted, as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.

3. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways. Make the grader or front-end loader available at all times.

4. Immediately repair all driveways that are cut or damaged. Maintain them in a suitable condition for use until completion and final acceptance of the work.

5.07 HANDLING MATERIALS

A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.

B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift or other front loader. Do not use materials damaged in handling.

C. Distribution: Distribute and place pipe and materials to not interfere with traffic. Do not string pipe more than 1,000 feet beyond the area where pipe is being laid. Do not obstruct drainage ditches.

D. Storage: Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.

5.08 EXCAVATION OF TRENCHES

A. Excavate trenches by open cut. Pavement removal and replacement required by the excavation of trenches shall be done in accordance with the requirements of Article 3.13 of this specification. Perform all excavation in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596) as amended. The Developer shall pay particular attention to Safety & Health Regulations Part 1926, subpart P "Excavations, Trenching & Shoring" as described in OSHA Publication 2226.

B. Dimensions

1. Excavate trenches to the depths shown on the Standard Details for each class of bedding and for manholes and other structures.

2. Excavate the top portion of the trench to any width within the construction easement or right-of-way which will not cause unnecessary damage to adjoining structures, roadways, pavements, utilities, trees, or private property.

3. Excavate the lower portion of the trench to a width no greater than the outside diameter of the pipe plus 18-inches. Maintain this width up to two feet above the pipe.

4. If trenches are excavated to excessive dimensions or collapse because of inadequate or improperly placed bracing and sheeting, lay the pipe with the next better class of bedding. If excavation for manholes and other structures is made to excessive depth, backfill with compacted bedding material to the required grade.

C. Bracing and Sheeting: When required by regulations or to prevent damage to adjoining structures, roadways, pavements, utilities, trees or private property which are specifically required to remain, provide bracing and sheeting.

1. Timber: Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of RWR it cannot be safely removed. Cut off sheeting left in place at least two feet below the surface.

2. Steel Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth, and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. Sheet piling within three feet of an existing structure or pipeline shall remain in place.

3. Trench Shield: A trench shield (or box) may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the bedding of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be "dragged" with the bottom of the shield extending below the top of the pipe.

D. Dewatering Trenches: Dewater excavation continuously to maintain a water level below the bottom of the trench. Dewater running sand by well pointing. Where soil conditions do not permit use of well point, construct french drains of crushed stone or gravel to convey water to sumps.

E. Trench Stabilization: Wherever the material at the bottom of the trench is unsuitable for the proper installation of the pipe, RWR will direct the removal and replacement of the unsuitable material. When so directed, undercut the trench and backfill with bedding material. Place and compact this material to bring the trench to the required grade.

F. Rock Excavation

1. Definition of Rock: Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 18,300 pounds (comparable to Caterpillar Model 215), and occupying an original volume of at least one-half cubic yard.

2. Excavation: Where rock is encountered in trenches, excavate to the minimum depth which will provide clearance below the pipe barrel of 8-inches for pipe 21-inches in diameter and smaller and 12-inches for larger pipe and manholes. Remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe or manhole. The minimum width of trench in rock shall be 36-inches.

3. Blasting

a. Blasting shall be performed by a licensed blasting contractor only. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all structures from the effects of the blast. Repair any resulting damage.

b. If the Developer persistently uses excessive blasting charges or blasts in an unsafe or improper manner, RWR may direct the Developer to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.

c. No blasting shall be permitted within the Gas Pipeline easement. If rock is to be removed from the easement, the rock shall be broken by jack hammer or similar method approved by RWR and Pipeline Company.

4. Removal of Rock: Dispose of rock which is surplus or not suitable for use as rip rap or backfill.

5.09 BEDDING

A. Bed pipelines in accordance with the Standard Details and the following

Specifications.

1. Materials: Bedding materials shall be crushed stone. Crushed stone bedding material shall meet the requirements of Georgia Department of Transportation Specification 800.01 for No. 57 stone, Group II (quartzite granite). Earth bedding material shall be suitable materials selected from materials excavated from the trench. Materials shall be clean and free of rock, organics, and other unsuitable material.

2. General: Compact stone bedding material by tamping or slicing with a flat blade shovel. Prepare the trench bottom to support the pipe uniformly throughout its length. Provide bell holes to relieve pipe bells of all loads. If the trench is excavated to excessive width or depth, provide the next better class of bedding.

3. Gravity Sewers: Lay PVC pipe with minimum Class "B" bedding. PVC pipe installation shall conform to the requirements of ASTM D 2321. Lay all other pipe with Class "C" bedding unless shown or specified otherwise.

    a. Class "A": Excavate the trench to a depth of one-fourth the nominal diameter of the pipe below grade and lay the pipe to line and grade on concrete block. Place concrete as specified in paragraph 1.17, CONCRETE ENCASEMENT COLLARS AND BLOCKING, to the full width of the trench and to a height of one-fourth the outside diameter of the pipe above the invert.

    b. Class "B": Excavate the bottom of the trench flat at a minimum depth shown on the Standard Details below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Bedding shall then be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.

    c. Class "C": Excavate the bottom of the trench flat at a minimum depth shown on the Standard Details below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Bedding shall then be carefully placed by hand and compacted to provide full support under and up to a height of one-fourth the outside diameter of the pipe above the invert.

4. Manholes: Excavate to a minimum of 12-inches below the planned elevation of the base of the manhole. Place and compact crushed stone bedding material to the required grade before constructing the manhole.

5. Compaction: Bedding under pipe and manholes shall be compacted to a minimum of 85 percent of the maximum Standard Proctor density, unless shown or specified otherwise.

6. Bell Holes: At each joint, excavate bell holes of ample depth and width to permit the joint to be made properly and to relieve pipe bell of any load.

7. Force Mains: Unless specified or shown otherwise, bed force mains in suitable earth materials. For ductile iron pipe, bedding shall meet all requirements of Standard Laying Condition Type 2 in accordance with AWWA C151 and as detailed on the Standard Details. Where Type 4 bedding is called for on the Drawings, this bedding shall meet all requirements of Standard Laying Condition Type 4 in accordance with AWWA C151 and as detailed on the Standard Details, utilizing crushed stone as specified above. If the trench is excavated to excessive width or depth, provide crushed stone to achieve Standard Laying Condition Type 4 in accordance with AWWA C151 and as detailed on the Standard Details. For restrained joint pipe, bedding shall meet all requirements of Standard Laying Condition Type 3 in accordance with AWWA C151 and as detailed on the Standard Details.

5.10 INSTALLING PIPE

A. Install the pipe to conform accurately to the alignment and grade shown on the Standard Details.

B. Handling: Use suitable tools and equipment to handle and lay pipe. Prevent damage to the pipe. Examine all pipes for cracks and other defects as it is laid. Do not lay pipe or other materials, which are known to be defective. If any pipe or other material is discovered to be defective or damaged after being laid, remove and replace it.

C. Sequence: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe, close the end with a plug.

D. Placing and Jointing: Clean pipe and fittings thoroughly before laying. Before making the joint, clean the sealing surfaces of dust, dirt, gravel and other foreign substances. Apply joint lubricant recommended by the pipe manufacturer. Center the spigot end in the bell of the preceding pipe and shove home, following all

manufacturer's recommendations. Apply moderate force to ensure proper seating. Complete jointing no later than five minutes after application of the lubricant. Immediately after jointing, bring the pipe to final alignment and grade.

E. Pressure Piping: Comply with items A, B, and C of section 5.10 when laying pressure piping. In addition, the following requirements apply:

1. Make all joints in accordance with the manufacturer's recommendations.

2. Take special precautions to prevent damage to the cement lining of ductile iron pipe.

3. Ensure that force mains are laid on a continuous grade as shown on the Drawings. Remove and relay pipe laid at incorrect grade.

4. Minimum depth of cover for force mains shall be 4 feet below final grade. Within DOT right-of-way, install force mains at a minimum depth of 4 feet below the nearest pavement edge. Within DOT right-of-way all force mains shall be DIP, with proper internal corrosion protection.

F. House Connections: Install wyes or tees in locations designated by RWR for future connection of service lines. Plug the branch of the wye or tee. Record the location of fittings installed on a copy of the Approved Drawings to be submitted as Record Drawings.

5.11 BACKFILLING

A. Backfill carefully to restore the ground surface to its original condition. Dispose of surplus material.

B. Detection Tape: Detection tape shall be buried from 16" to 2' beneath the ground surface directly over the top of the pipe. The tape will be installed according to the manufacturer's recommendations in a manner acceptable to the County.

C. Initial: Place initial backfill material carefully around the pipe above bedding in uniform 6-inch layers to a depth of at least 18-inches above the pipe bell. Compact each layer thoroughly with suitable hand tools. Do not disturb or damage the pipe. Backfill on both sides of the pipe simultaneously to prevent side pressures. Initial backfill material is earth material excavated from the trench which is clean and free of rock, stumps, limbs, man-made waste and other unsuitable material. Should pipe installation activities encounter saturated material during excavation, the saturated material may be used as initial backfill provided it is allowed to dry properly and is capable of meeting the specified compaction requirements. If materials excavated

from the trench are not suitable for use as initial backfill material, obtain suitable materials elsewhere.

D. Final: After initial backfill material has been placed and compacted, backfill with general excavated material. Final backfill material shall not contain more than 1/3 broken rock, of which no single stone or boulder shall weigh more than 50 pounds. Place backfill material in uniform layers, compacting each layer thoroughly with heavy, power tamping tools of the "Wacker" type, a hydra-hammer or backhoe.

E. Settlement: If trenches settle, re-fill and grade the surface to conform to the adjacent surfaces.

F. Backfill Under Roads: Compact backfill underlying pavement and backfill under dirt and gravel roads to 95 percent of the maximum dry density as determined by the Standard Proctor Compaction Test (ASTM D 698). A minimum of two density tests shall be performed for each sewer lateral and at least every 100 feet when sewer is within pavement, present or proposed.

G. Additional Material: Where final grades above the pre-existing grades are required to maintain minimum cover, additional fill material will be shown on the Standard Details. Utilize excess material excavated from the trench if the material is suitable. If excess excavated materials are not suitable, or if the quantity available is not sufficient, provide suitable additional fill material.

H. Backfill Within DOT Right-of-Way: Backfill within the DOT right-of-way shall meet the requirements stipulated in the "Utility Accommodation Policy and Standards", published by the Georgia Department of Transportation.

I. Backfill Along Restrained Joint Pipe: Backfill along restrained joint pipe shall be compacted to at least 80 percent of the maximum dry density as determined by the Standard Proctor Compaction Test (ASTM D 698).

J. Select Backfill: Select backfill shall be provided if the indigenous material will not meet the compaction requirements specified elsewhere.

5.12 MANHOLES

A. Manholes shall be precast per applicable ASTM C478 standards. Manholes shall be eccentric. Manholes shall have copolymer coated plastic steps on centers between 12 and 16 inches for all manholes over two feet in depth. All manholes shall have flexible boot seals conforming to ASTM C923 where the sewer pipes enter and leave the manhole. A-Lok X-Cel Pipe to Manhole Connectors are considered a suitable alternative. All flexible rubber boot seals shall be jointed to the manhole at the

manufacturing plant. Holes for pipe entering or leaving the manhole shall be a minimum of six inches above the base floor of the manhole at the plant or in the field and a rubber gasket installed. Vertical manhole sections shall be joined with gaskets conforming to ASTM C443 or with double mastic.

Flexible external manhole chimney seals shall be installed on all manholes. Chimney seals shall be Infi-Shield, SurSeal, Cretex or approved equal. Installation shall be in strict accordance with the manufacturer's instructions.

B. Top of the manhole shall be 3 feet above the 100 years floodplain and shall be cast in flat top lid. Frame and cover shall be "24" ERGO with CAMLOCK anti-theft cover lock or approved equal. Frame shall be cast into the cast-in flat top lid. Exterior steps shall be installed.

C. Outside drop connection is required at every manhole where drop between influent and effluent pipe is greater than 2'. See Detail B-2.

D. Existing manholes shall be cored prior to making connections to new sewer lines or laterals. Once the new connection has been made, the existing manhole shall be sealed with Kor-N-Seal or a RWR approved equal. All connections shall conform to ASTM C443.

E. RWR, at its sole discretion, may require brick manholes that are encountered during construction to be replaced with new manholes that meet the standards as described in Section 5.12 of these specifications.

5.13 CONCRETE ENCASEMENT COLLARS AND BLOCKING

A. Concrete: Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by RWR. Mix and transport ready-mixed concrete in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, grade 60.

B. Encasement: Excavate the trench to provide a minimum of 6-inches clearance from the bell of the pipe. Lay the pipe to line and grade on concrete block. Pour concrete to the full width of the trench, and to a height of not less than 6-inches above the top of the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is poured.

C. Blocking: Block bends, tees, valves, and other points where hydraulic thrust may develop. Form and pour concrete blocking as shown on the Standard Details and as

directed by RWR. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation. Blocking is not required in locations where restrained joint pipe or restrained joint fittings are shown on the Drawings.

D. Collars: Construct collars as shown on the Standard Details.

5.14 REMOVING AND REPLACING PAVEMENT

A. Removing Pavement: Remove existing pavement as necessary for installing the pipe and appurtenances.

1. Marking: Before removing any pavement, mark the pavement neatly paralleling pipe lines and existing street lines. Space the marks the width of the trench.

2. Breaking: Break asphalt pavement along the marks using jack hammers or other suitable tools. Break concrete pavement along the marks by use of jack hammers or by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.

3. Machine Pulling: Do not pull pavement with machines until completely broken and separated from pavement to remain.

4. Damage to Adjacent Pavement: Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement to RWR satisfaction.

5. Sidewalk: Remove and replace sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.

6. Curbs: Remove and replace or tunnel under any curb disturbed by construction to the nearest undisturbed joint.

B. Replacing Pavement: Upon completion of backfilling and consolidation of the backfill, arrange to have the compaction tested by an independent testing laboratory approved by RWR. After compaction testing has been satisfactorily completed, replace all pavement, sidewalks, and curbs removed. Gravel roads and drives shall meet the requirements for graded aggregate sub-base.

1. Materials: Place materials for pavement replacement to dimensions shown on the Drawings.

a. Graded Aggregate Sub-Base: Furnish graded aggregate sub-base in two sizes of such gradation that when combined in approximately equal quantities, the resulting mixture is well graded from coarse to fine, meeting the gradation requirements of Section 815 of the Georgia Department of Transportation Standard Specifications.

b. Black Base: The base for all paved roadways shall conform to the requirements of the Georgia Department of Transportation Specifications for the Black Base (Hot Mix). Use a Pug Mill Rotary Drum type mixer with minimum capacity of not less than 50 tons per hour for asphalt production. Apply and compact the base in two courses by asphalt spreader equipment of design and operation approved by RWR. After compaction, the black base shall be smooth and true to established profiles and sections.

c. Surface Course: The surface course for all pavement, including paint or tack coat when required by RWR, shall conform to the requirements of the Georgia Department of Transportation Specifications for Asphaltic Concrete, Section 400, Type "F" (Modified Top). Produce surface course in an asphalt plant of the same type as noted above for Black Base. Apply and compact the surface course in a manner approved by RWR. Immediately correct any high, low or defective areas by cutting out the course, replacing with fresh hot mix, and immediately compacting to conform and thoroughly bond to the surrounding area.

d. Concrete: Provide concrete and reinforcing for concrete pavement in accordance with the requirements of Georgia Department of Transportation Specifications for Portland Cement Concrete Pavement, Section 430.

2. Supervision and Approval: Pavement restoration shall meet the requirements of the regulatory agency responsible for the pavement. Obtain agency approval of pavement restorations before requesting final payment.

3. Replacement: Prior to replacing pavement, make a final cut in concrete pavement 12-inches back from the edge of damaged pavement. Make the cut using a rotary saw. Remove asphalt pavement 9-inches back from the edge of damaged pavement using jack hammers or other suitable tools. Replace all street and roadway pavement as shown on the Standard Details. Replace driveways, sidewalks, and curbs with the same material and to the same dimensions as existing.

4. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the life of the bonded period, promptly restore or repair defects.

5.15 ROADWAY CROSSINGS

A. Furnish and install tunnel liner or casing pipe and install the pipe line therein in accordance with the Standard Details and the following specifications:

B. General: The Developer shall provide to RWR, for approval, a detailed plan for the methods proposed for the construction of the tunnel or casing. These plans shall include the methods proposed for groundwater control and face protection.

1. Groundwater Control: The Developer shall control the groundwater throughout the construction of the tunnel or casing. The groundwater shall be controlled by dewatering (well points or deep wells), grouting, compressed air, freezing or other method approved by RWR. The Developer shall prepare a written, detailed plan for controlling the groundwater, citing similar installation conditions and results. This plan is to be submitted to RWR for approval prior to any construction activity for the tunnel or casing.

2. Face Protection: The face of the tunnel excavation shall be protected from the collapse of the soil. This protection is to be provided by bulkheads, shields or other means approved by RWR.

C. Casing: Furnish all material and equipment and perform all labor required to install steel casing pipe at locations indicated on the Standard Details and as specified. A minimum of five years of experience in steel pipe casing construction is required by the casing installer. Submit evidence of experience with shop drawings for review by RWR.

1. Materials: The casing shall be made from steel plate having a minimum yield strength of 35,000 psi. The steel plate shall also meet the chemical requirements of ASTM A 36. The outside of the casing pipe shall be coated with coal tar epoxy having a minimum dry film thickness of 16 mils. Surface preparation shall be SSPC-SP 10. Epoxy shall have a minimum solids content of 65 percent by volume and shall be air or airless spray applied; minimum drying time shall be seven days. Brushing shall be permitted in small areas only. All coating and recoating shall be done in strict accordance with the manufacturer's recommendations. Epoxy shall be Tnemec, Indurall or Valspar.

UNDER RAILROADS

Pipe Diameter inches	Casing Diameter inches	Wall Thickness inches
6	14	0.250
8	18	0.250
10	20	0.281
12	22	0.312
16	30	0.406
18	30	0.406
20	32	0.469
24	36	0.469
30	42	0.500
36	48	0.625

UNDER HIGHWAYS

Pipe Diameter inches	Casing Diameter inches	Wall Thickness inches
6	12	0.250
8	16	0.250
10	16	0.250
12	18	0.250
16	24	0.250
18	30	0.312
20	30	0.312
24	36	0.375
30	42	0.375
36	48	0.500

2. Construction: Install the steel casing pipe by the dry boring method. Bore the hole and install the casing through the soil simultaneously by a cutting head on a continuous auger mounted inside the casing pipe. On casing pipe for gravity sewer over 60 feet in length, the installation equipment shall include a steering head and a grade indicator. The steering head shall be controlled manually from the bore pit. The grade indicator shall consist of a water level attached to the casing, which would

indicate the elevation of the front end of the casing, or some other means for grade indication approved by RWR. For casing pipe installations over 100 feet in length, the auger shall be removed and the alignment and grade checked at minimum intervals of 60 feet. Fully weld lengths of casing pipe to the preceding section in accordance with AWS recommended procedures. After the boring and installation of the casing is complete, install a cleaning plug on the rig and clean the casing.

D. Tunnel: Install the tunnel liner in strict accordance with Department of Transportation (DOT) and/or Railroad Company requirements. Provide any special insurance coverage required by the governing body. A minimum of five years of experience in construction of tunnels of the general size is required of the tunnel installer. Prior to any work involving explosives, the Developer shall make application to DOT for a special permit, which will be in addition to any tunneling permit not involving explosives. The Developer shall comply with all requirements and conditions of all permits including required submittals. Schedule the work so as not to interfere with or in any way endanger traffic flow on the highway or railway. Provide all required safety measures as specified in the Georgia Manual On Uniform Traffic Control Devices.

1. Materials: Tunnel liner plates shall be manufactured from steel meeting the chemical requirements of ASTM A 569 with the following mechanical properties before cold forming:

Minimum tensile strength	=	42,000 psi
Minimum yield strength	=	28,000 psi
Elongation, 2-inches	=	30 percent

Liner plates shall be minimum 10 gage, with the nominal neutral axis diameter shown on the Drawings for each crossing. All plates shall be formed to provide circumferential flanged joints. Longitudinal joints may be flanged or offset lap seam type. All plates shall be punched for bolting on both longitudinal and circumferential seams or joints. Bolt spacing in circumferential flanges shall be in accordance with the manufacturer's standard spacing and shall be a multiple of the plate length so that plates having the same curvature shall be interchangeable and will permit staggering of the longitudinal seams. Bolt spacing at flanged longitudinal seams shall be in accordance with the manufacturer's standard spacing. For lapped longitudinal seams, bolt size and spacing shall be in accordance with the manufacturer's standard but not less than that required to meet the longitudinal seam strength requirements of Section 13 of AASHTO Standard Specifications for Highway Bridges. All liner plates in one tunnel shall be the same type. Liner plates shall be hot-dip galvanized in accordance with ASTM A 123 and bituminous coated. Bolts shall conform to ASTM A 307 Grade A, and shall be hot-dip galvanized in accordance with ASTM A 153. Grout nipples shall be 2-inch minimum diameter tapped couplings welded into place over holes cut in the liner plate. Grout shall consist of 1 part Portland cement, 2 parts mortar sand. The quantity of mixing water used shall be that which will produce a workable mixture of grout capable of being pumped into the voids created by the tunneling. Brick and mortar shall meet the requirements for Manhole Materials.

2. Construction of Tunnel: Construct tunnel so that no settlement of the overpassing roadway or railway section will occur. In order to prevent such settlement, the use of poling plates, breast boards, shields, and soil solidification or a combination of these methods may be necessary. Install steel liner plates as soon as possible, but no more than 5 feet of tunnel shall remain unlined while tunneling operations are in progress. No portion of the tunnel shall be left unlined at the end of the day's operation. Liner plates shall be installed in accordance with the manufacturer's recommendations and shall be self-supporting. The tunnel excavation shall have a diameter essentially the same as the outside diameter of the liner plates. Locate liner plates with grout couplings at the top of the tunnel at intervals not to exceed 10 feet. Install additional plates with grout couplings on each side of the tunnel between the top couplings. Pressure grout all voids in the area outside the plates every 10 feet and at the end of the work shift. Pressure grout more frequently if soil conditions dictate. Before grouting any segment of tunnel liner, seal that segment sufficiently between the liner plates and the surrounding soil to retain the grouting pressure. Locate seals at the entrance of the tunnel, between grout couplings, and within 1 foot of the end of the tunnel at the end of the work shift. Provide pumping equipment for grouting

operations. Pump horsepower and the resulting pressure in the grouting line shall be sufficient to completely fill the voids without buckling or shifting the liner plates or damaging the roadway. Repair damaged spelter coating in accordance with Georgia DOT Specifications, Section 645. Any plates having damaged spelter or bituminous coatings which, in the opinion of RWR cannot be satisfactorily repaired, shall be replaced at no additional cost.

E. Installation of Pipe: After construction of the casing or tunnel is complete, and has been accepted by RWR, install the pipeline in accordance with the Standard Details and Specifications. For gravity sewers, check the alignment and grade of the casing or tunnel and submit a plan to RWR for approval to set the pipe at proper alignment, grade and elevation. The pipe shall be supported by wooden skids strapped to the pipe barrel, or similar arrangement approved by RWR, to prevent pipe movement or flotation within the casing or tunnel. Fill the void between pipe and casing or tunnel with grout. Prior to grouting, the pipe within the casing or tunnel shall be filled with water to guard against flotation. Grout shall be pumped gradually filling the void from the lower end to the upper end. For force mains, the pipe shall be supported by wooden skids strapped to the pipe barrel, or some similar arrangement approved by RWR, to preclude pipe movement within the casing or tunnel. Close the ends of the casing with 4-inch brick walls, tunnel with 3 course brick walls, plastered with Portland cement mortar.

F. Safety: Provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it. Begin the tunneling or boring operation in a pit, sheeted and shored as necessary and begin at and proceed from one end. Observe all applicable requirements of DOT and Railroad regulations. Conduct the operations in such a manner that all work will be performed below the level of the roadbed. Coordinate and schedule all of the work with DOT. A temporary bulkhead against the face of the excavation shall be provided and well braced during each cessation of tunneling work while the heading is within 20 feet of railroad tracks or highway pavement. If, in the opinion of RWR, the tunnel installation work is being conducted in an unsafe manner or in a manner detrimental to the overpassing roadway or to the safety of the traveling public, all operations of tunneling and boring shall cease until the necessary corrections have been made. In the event that distress occurs to the roadway due to the tunneling, the Developer shall be required to submit a plan to repair the roadway. The plan must be acceptable to DOT, the Railroad, and RWR. RWR will not be responsible and shall be saved harmless in the event of delays to the Developer's work resulting from any cause whatsoever.

5.16 STREAM AND DITCH CROSSING

Sewer pipe crossing streams or drainage ditches shall be ductile iron pipe. Ductile iron pipe crossing streams shall be encased in concrete a minimum of five feet beyond the edge of each stream bank. The contractor shall use either stone rip-rap or sand-cement rip-rap throughout the job. The rip-rap shall meet the same material requirements as described herein.

A. Underground Stream Crossing

At all points where banks or streams or drainage ditches are disturbed by excavation or where natural vegetation is removed, the contractor shall carefully compact backfill and place rip-rap to prevent subsequent settlement and erosion.

This requirement applies equally to construction along the sides of a stream or drainage ditch, as well as the crossing of streams or drainage ditches. The contractor shall place rip-rap a distance of not less than 10 feet upstream and 10 feet downstream from any disturbed area. The actual distance of rip-rap will be determined by the inspector. Rip-rap shall be extended from one foot below the stream bed to the top of the bank and shall be placed to conform to the natural slope of the stream bank.

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

1. One foot of cover is required where the sewer is located in rock.

2. A minimum of three feet of cover is required where the sewer is not located in rock. RWR, in its sole discretion, may require additional cover depending on the size and flow rate of the stream.

3. Buoyancy calculations for pipes located below stream channels shall be submitted with the plans for review by RWR.

4. The top of the sewer line shall be placed at least four inches below the bottom of the channel pavement for paved stream channels.

B. Aerial Stream Crossing

1. Concrete Piers

Support shall be provided for all joints in pipes utilized for aerial crossings. The support shall be designed to prevent overturning and

settlement. Expansion jointing shall be provided between above ground and below ground sewers. For aerial stream crossings, the impact of flood waters and debris shall be considered. The bottom of the pipe should be placed not lower than the elevation of the 50 year flood. Ductile iron pipe with restrained mechanical joints is required.

The design of concrete piers shall be stamped and signed by a Professional Engineer licensed in the State of Georgia. Design calculations for concrete piers shall be submitted to RWR for review and comment. RWR, in its sole discretion, may require a certified geotechnical engineering firm to inspect and approve any and all phases of pier construction.

2. Pedestrian Barriers

Pedestrian barriers shall be installed on all sewer pipe that is four (4) feet or more above the stream bed. Barriers shall be of the rod type or screen type having a finish compatible with the project architecture. The pedestrian barriers shall be Custom Fab or approved equal. The size and installation of pedestrian barriers must be approved by RWR.

5.17 INSPECTION AND TESTING

A. Clean and wash lines prior to any testing. Where any obstruction is met, clean the sewers by means of rods, swabs, or other instruments.

B. Gravity Sewers: Pipelines shall be straight and show a uniform grade between manholes. Correct any discrepancies discovered during inspection.

1. Infiltration Tests: Install suitable weirs in manholes selected by the Engineer to determine the leakage of ground water into the sewer. The maximum length of line for each infiltration test shall be 5,000 feet. Measure leakage only when all visible leaks have been repaired and the ground water is 2 feet above the top of the pipe. If leakage in any section of the sewer line exceeds 25 gpd/inch diameter/mile, locate and repair leaks. Repair methods must be approved by RWR. After repairs are completed, re-test for leakage. Furnish, install, and remove the necessary weirs, plugs, and bulkheads required to perform the leakage tests.

2. Exfiltration Tests: Choose one of the following when groundwater is not 2 feet above the top of the pipe.

a. Hydrostatic Test: Test pipe between manholes with a minimum of 10

feet hydrostatic pressure, measured at the center of the pipe at the upstream manhole. The ends of the pipe in the test section shall be closed with suitable watertight bulkheads. Inserted into each bulkhead at the top of the sewer pipe shall be a 2-inch pipe nipple with an elbow. At the upper end of the test section, a 12-inch riser pipe shall be connected to the 2-inch nipple. The test section of pipe shall be filled through the pipe connection in the lower bulkhead which shall be fitted with a tight valve, until all air is exhausted and until water overflows the riser pipe at the upper end. Water may be introduced into the pipe 24 hours prior to the test period to allow complete saturation. House service lines, if installed, shall also be fitted with suitable bulkheads having provisions for the release of air while the test section is being filled with water. During the test period, which shall extend over a period of 2 hours, water shall be introduced into the riser pipe from measured containers at such intervals as are necessary to maintain the water level at the top of the riser pipe. The total volume of water added during the test period shall not exceed that specified for infiltration.

b. Low-Pressure Air Test: Prior to air testing, the section of sewer between manholes shall be thoroughly cleaned and wetted. Immediately after cleaning or while the pipe is water soaked, the sewer shall be tested with low-pressure air. At the Developer's option, sewers may be tested in lengths between manholes or in short sections (25 feet or less) using Air-Lock balls pulled through the line from manhole to manhole. Air shall be slowly supplied to the plugged sewer section until internal air pressure reaches approximately 4.0 psi. After this pressure is reached and the pressure allowed to stabilize (approximately 2 to 5 minutes), the pressure may be reduced to 3.5 psi before starting the test. If a 1.0 psi drop does not occur within the test time, then the line has passed the test. If the pressure drops more than 1.0 psi during the test time, the line is presumed to have failed the test, and the Developer will be required to locate the failure, make necessary repairs, and retest the line. Minimum test time for various pipe sizes, in accordance with ASTM C 828, as amended to date, is as follows:

Nominal Pipe Size, inches	T (time) Min/100 Feet
8	1.2
10	1.5
12	1.8
15	2.1

Nominal Pipe Size, inches	T (time) Min/100 Feet
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0

c. Required test equipment, including Air-Lock balls, braces, air hose, air source, timer, rotometer as applicable, cut-off valves, pressure reducing valve, 0-15 psi pressure gauge, 0-5 psi pressure gauge with gradations in 0.1 psi and accuracy of plus or minus 2 percent, shall be provided by the Developer.

d. The Developer shall keep records of all tests made. Copy of such records will be given to RWR. Such records shall show date, line number and stations, operator, and such other pertinent information as required by RWR.

e. The Developer is cautioned to observe proper safety precautions in performance of the air testing. It is imperative that plugs be properly secured and that care be exercised in their removal.

f. Every precaution shall be taken to avoid the possibility of over-pressurizing the sewer line.

C. Vacuum Testing Manhole Structures:

The contractor shall make arrangements to have each manhole tested under negative pressure (vacuum) in accordance with ASTM C1244 prior to acceptance by Rockdale Water Resources. For manholes located beneath pavement, vacuum tests shall be conducted after the base coat of asphalt has been laid. Cement based products such

as grout and other brittle materials shall not be used to repair manholes that have failed a vacuum test. Acceptable repair products include Rubber Neck by K.T. Snyder or approved equal, applied to the **clean exterior** of the manhole.

Rockdale Water Resources, in its sole discretion, may require manholes that fail vacuum tests to be replaced in their entirety and retested.

Minimum Test Times for Various Manhole Diameters

	Diameter (in)		
Depth [1] (ft)	48	60	72
		Time (s)	
<4	10	13	16
6	15	20	25
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

[1] Round actual depth of manhole to next depth up (ex. 11 foot deep manhole, use depth of 12 feet).

5.18 PROTECTION AND RESTORATION OF WORK AREA

A. General: Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.

B. Man-Made Improvements: Protect, or remove and replace with RWR's approval, all fences, piers, docks, walkways, mail boxes, pipe lines, drain culverts, power and telephone lines and cables, and other improvements that may be encountered in the work.

C. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by RWR. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.

D. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3-inches in diameter, not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work site and disposed of by the Developer. No stumps, wood piles, or trash piles will be permitted on the work site.

E. Grassing: Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Outside of residential areas, plant the entire area disturbed by the work in rye, fescue, bermuda, clover or other suitable ground cover on completion of work in any area. In all areas, promptly establish successful stands of grass. Grassing activities shall comply with the Manual for Erosion and Sediment Control in Georgia, specifically, selection of species, planting dates, and application rates for seeding, fertilizer and mulching. Where permanent vegetative cover (grassing) cannot be immediately established (due to season or other circumstances), the Contractor shall provide temporary vegetative cover. The Contractor shall submit a written plan for grassing to the Engineer for approval. This plan shall include selection of species, dates, and rate of application.

F. Erosion Control: Plan excavation work to prevent erosion and the washing of soil into adjacent streams. Limit the amount of open excavation at any one time. Place spoil in the proper place and keep natural water routes open. All owner/developer and contractor activities should comply with Georgia's NPDES permits: No. GAR100001 (stand-alone); No. GAR100002 (infrastructure); and No. GAR100003 (common development) for Storm Water Discharges Associate with construction activities.

G. Disposal of Rubbish: Dispose of all materials cleaned and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate regulatory agencies, county, state and federal.

H. Swamps and Other Wetlands: The Developer shall not construct permanent roadbeds, berms, drainage structures or any other structures which alter the original topographic features within the easement. Temporary construction of roadbeds, berms, drainage structures, or stockpiling of excavated material and bedding will be permitted as necessary. All temporary construction or alterations to the original

topography will incorporate measures to prevent erosion into the surrounding swamp or wetland. All areas within the easement shall be returned to their original topographic condition as soon as possible after work is completed in the area. All materials of construction and other non-native materials shall be disposed of by the Developer. The Developer shall provide temporary culverts or other drainage structures as necessary to permit the free migration of water between portions of a swamp, wetland, or stream which may be temporarily divided by construction. The Developer shall not spread, discharge, or dump any fuel oil, gasoline, pesticide, or any other pollutant to adjacent swamps or wetlands.

APPENDIX B – SEWER DETAILS

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PRECAST MANHOLE	B-4
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UTILITY PLACEMENT DETAIL AT TRAFFIC CALMING DEVICES	B-20
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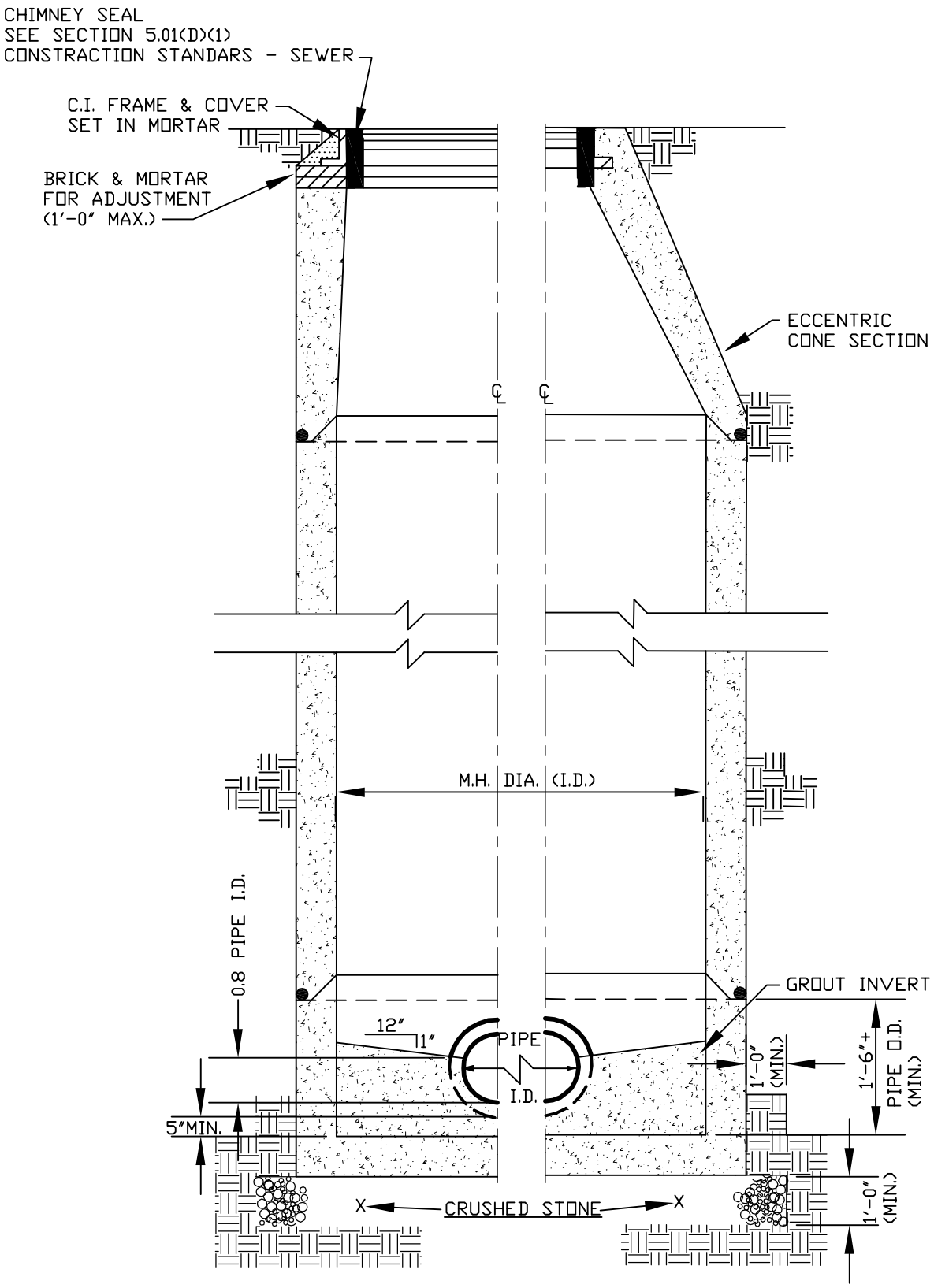
TOP ABOVE GRADE

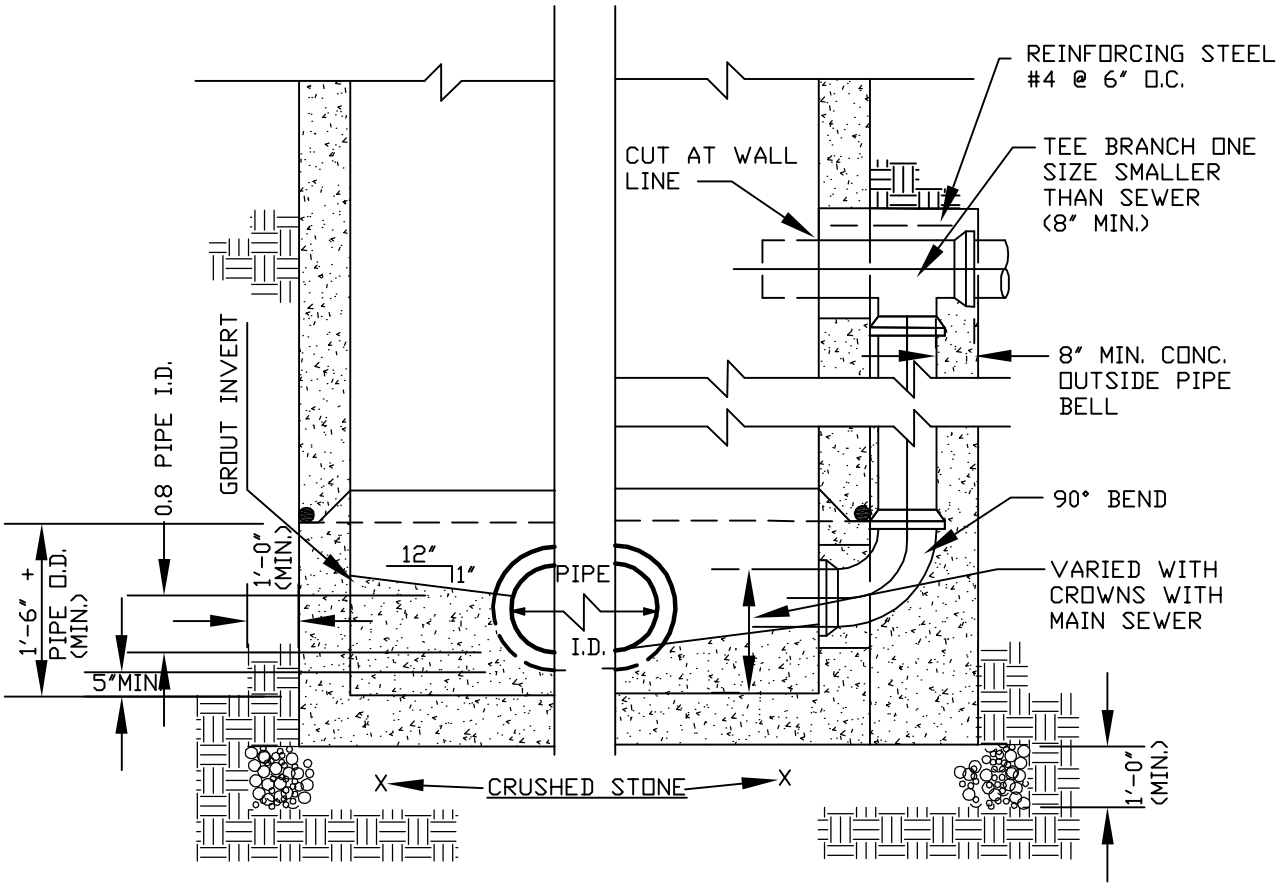


PRECAST CONCRETE MANHOLE DETAIL

NOT TO SCALE

STANDARD DRAWING No. B-1

ROCKDALE WATER RESOURCES

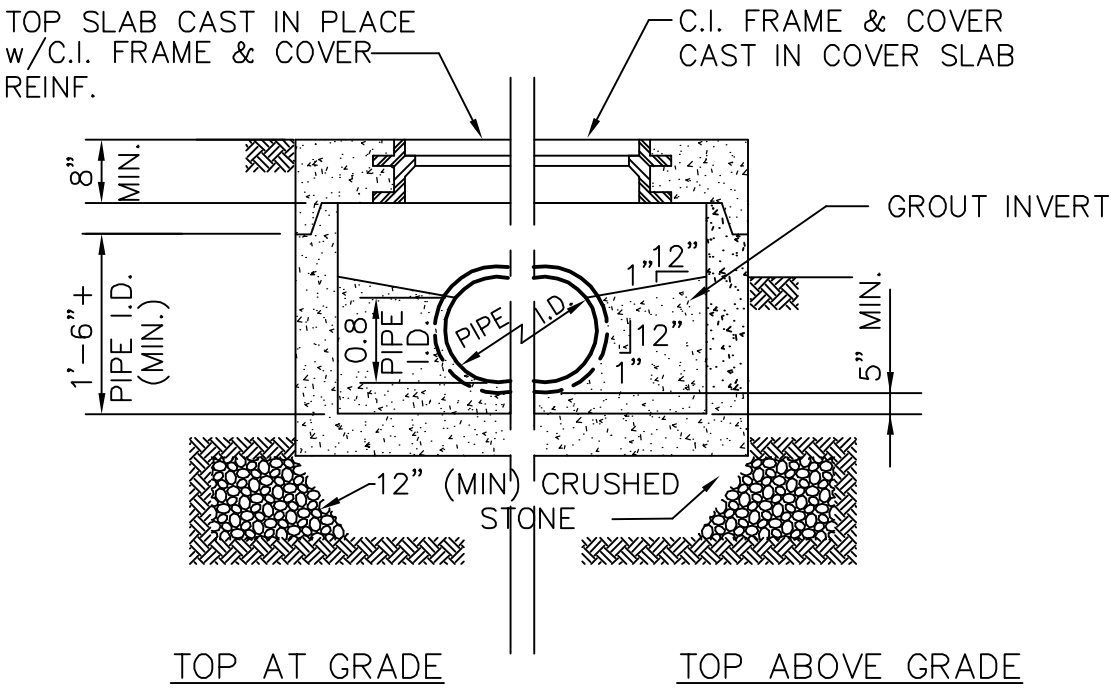


ROCKDALE WATER RESOURCES

OUTSIDE DROP DETAIL

NOT TO SCALE

STANDARD DRAWING No. B-2

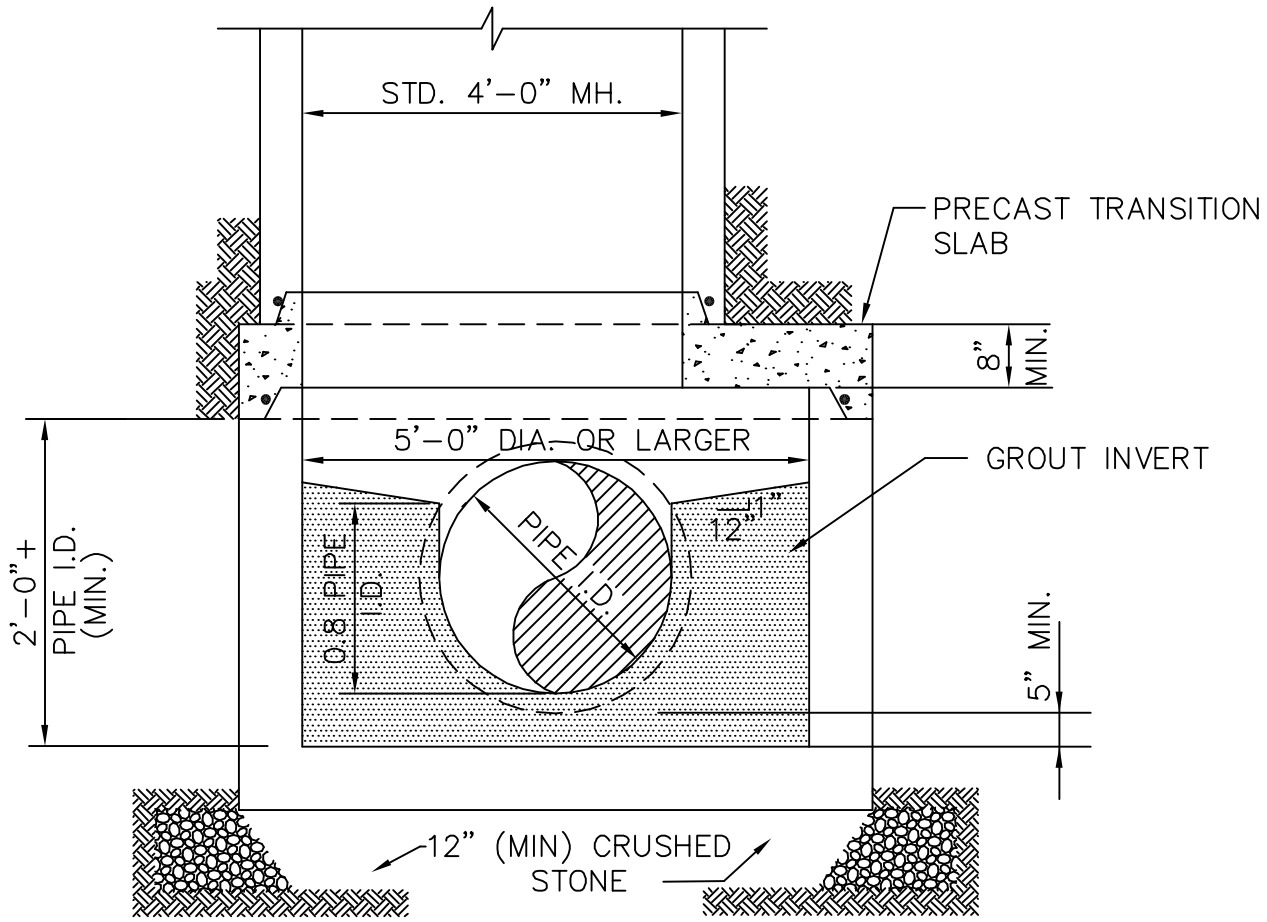


ROCKDALE WATER RESOURCES

SHALLOW MANHOLE

NOT TO SCALE

STANDARD DRAWING No. B-3



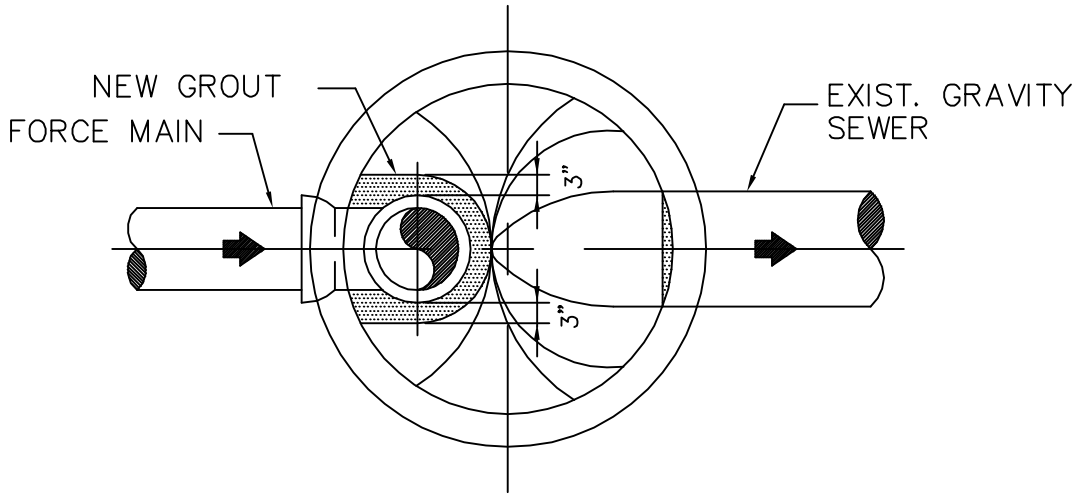
LOWER SECTION
5'–0" DIA. OR LARGER

ROCKDALE WATER RESOURCES

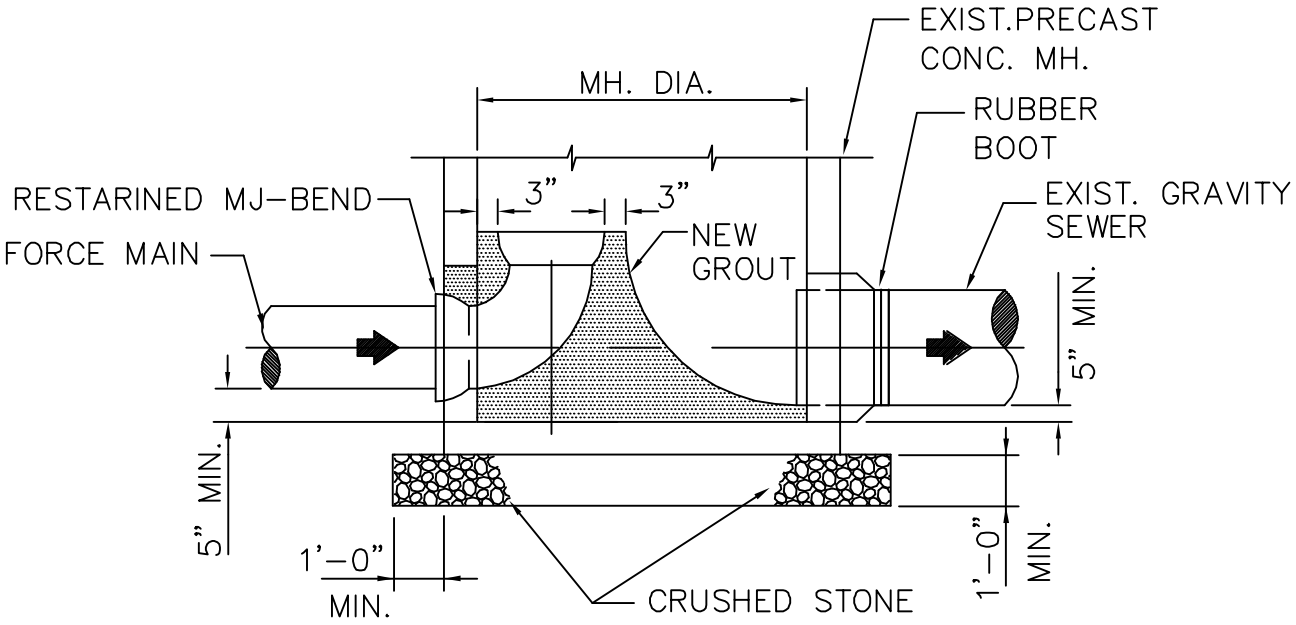
PRECAST MANHOLE

NOT TO SCALE

STANDARD DRAWING No. B-4



PLAN



SECTION

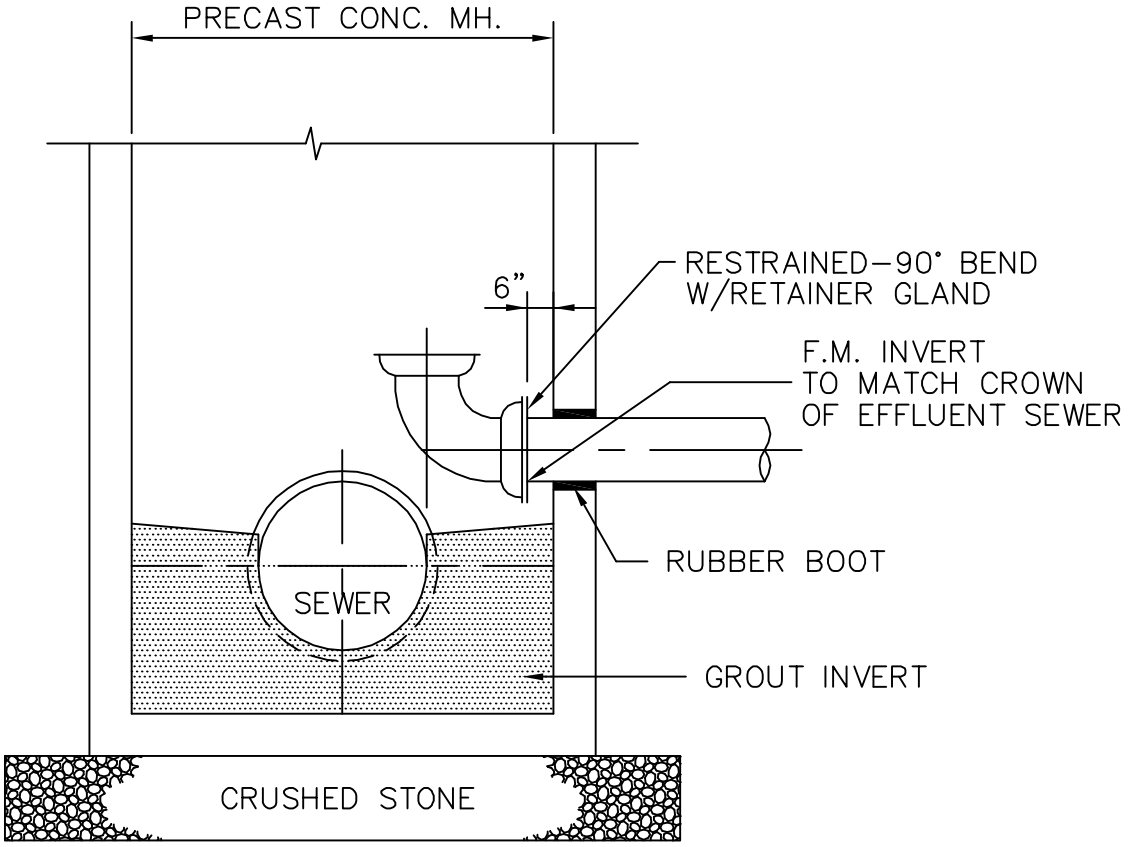
PROTECTIVE EPOXY GROUT TO BE APPLIED TO ALL MANHOLES THAT RECEIVE FORCE MAIN DISCHARGE AND SHALL BE 1/8" THICK MINIMUM.
EPOXY GROUT – PG-2035 (PERMAGILE INDUSTRIES INC.) OR APPROVED EQUAL.

ROCKDALE WATER RESOURCES

FORCE MAIN CONNECTION DETAIL NEW INSTALLATION

NOT TO SCALE

STANDARD DRAWING No. B-5



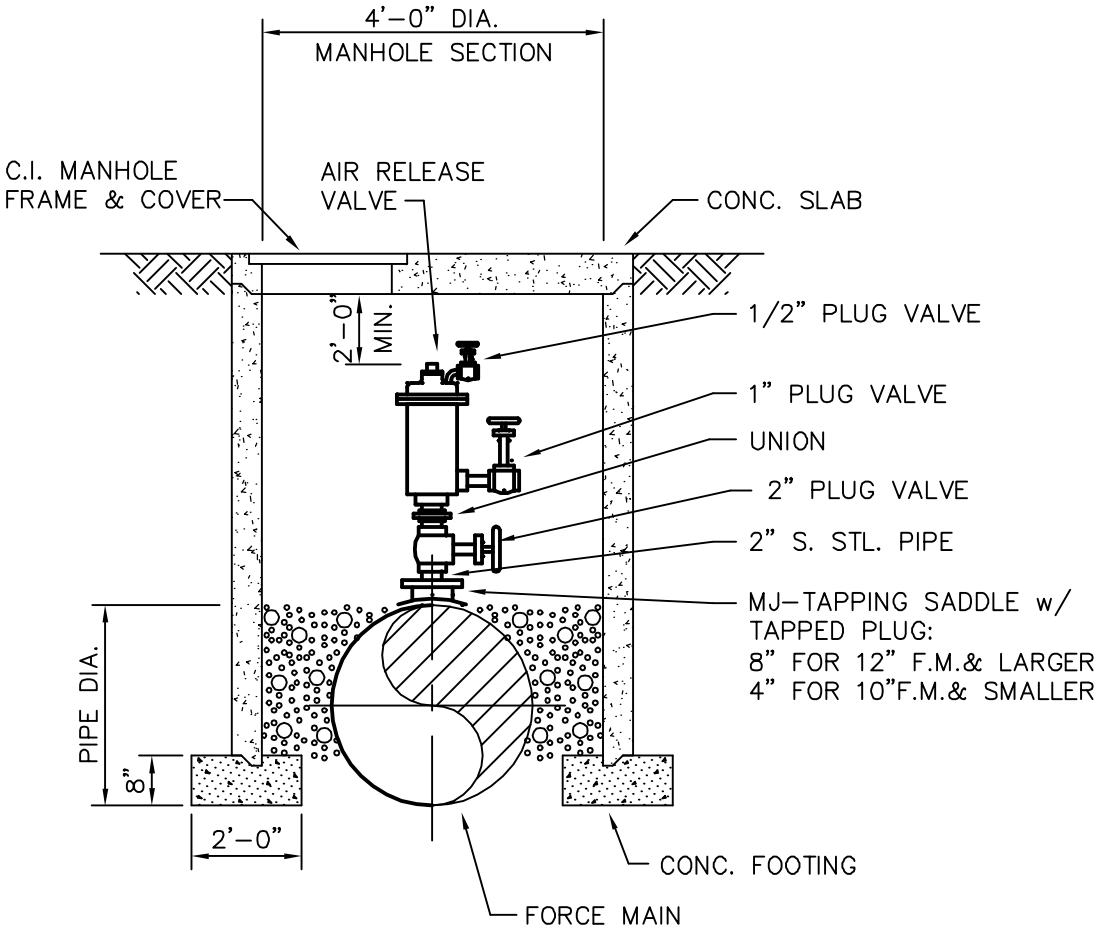
PROTECTIVE EPOXY GROUT TO BE APPLIED TO ALL MANHOLES THAT RECEIVE FORCE MAIN DISCHARGE AND SHALL BE 1/8" THICK MINIMUM.
EPOXY GROUT – PG–2035 (PERMAGILE INDUSTRIES INC.) OR APPROVED EQUAL.

ROCKDALE WATER RESOURCES

FORCE MAIN CONNECTION DETAIL EXISTING MANHOLE

NOT TO SCALE

STANDARD DRAWING No. B-6

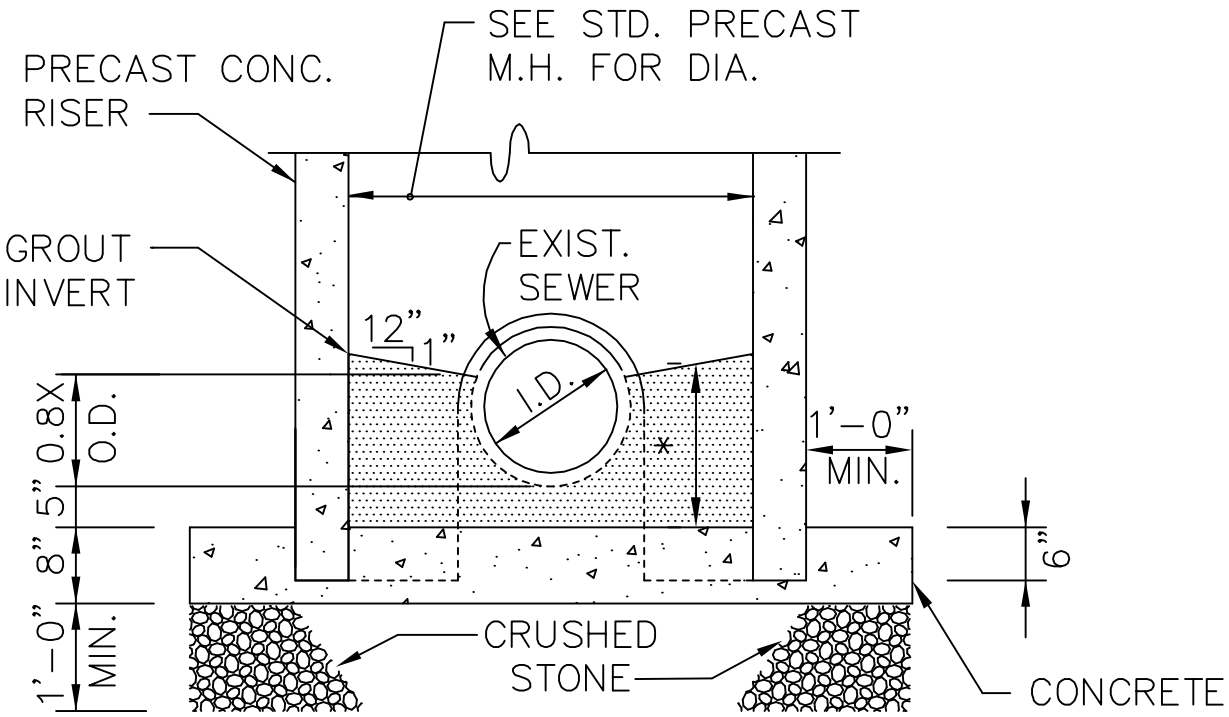


AIR RELEASE VALVE MANHOLE

NOT TO SCALE

ROCKDALE WATER RESOURCES

STANDARD DRAWING No. B-7

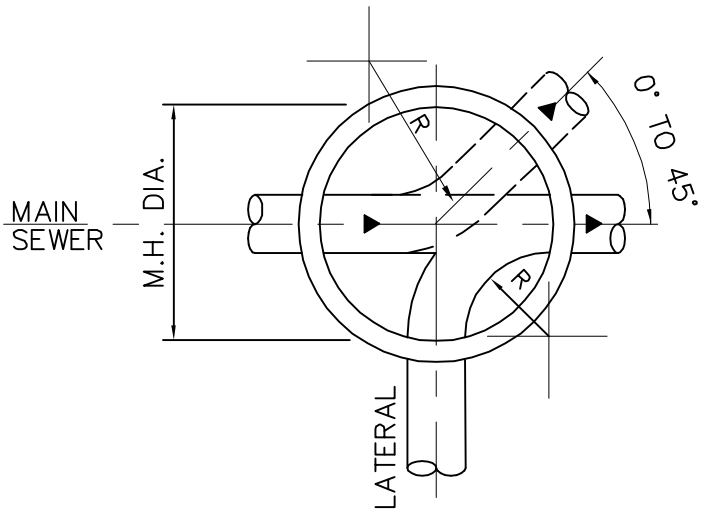


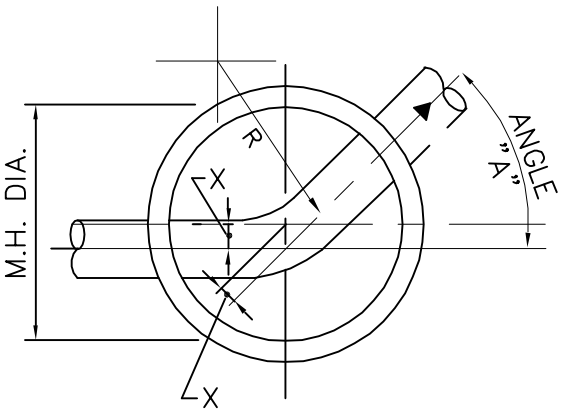
PRECAST MANHOLE OVER EXIST. SEWER

NOT TO SCALE

ROCKDALE WATER RESOURCES

STANDARD DRAWING No. B-8





STANDARD MANHOLE SCHEDULE OF GOVERNING DIMENSIONS				
PIPE SIZE	ANGLE "A"	MH. DIA.		"X"
8" TO 15"	0° TO 90°	4'–0"		0"
18" TO 24"	0° TO 60°	4'–0"		0"
18" TO 24"	60° TO 90°	5'–0"		6"
27" TO 30"	0° TO 30°	5'–0"		0"
27" TO 30"	30° TO 60°	5'–0"		6"
27" TO 30"	60° TO 90°	6'–0"		8"
36"	0° TO 90°	6'–0"		0"
42"	0° TO 60°	7'–0"		8"
42"	60° TO 90°	8'–0"		6"
48"	0° TO 45°	8'–0"		6"

NOTE:
MINIMUM ℄ RADIUS OF M.H. INVERT
= 1.5 x PIPE DIAMETER

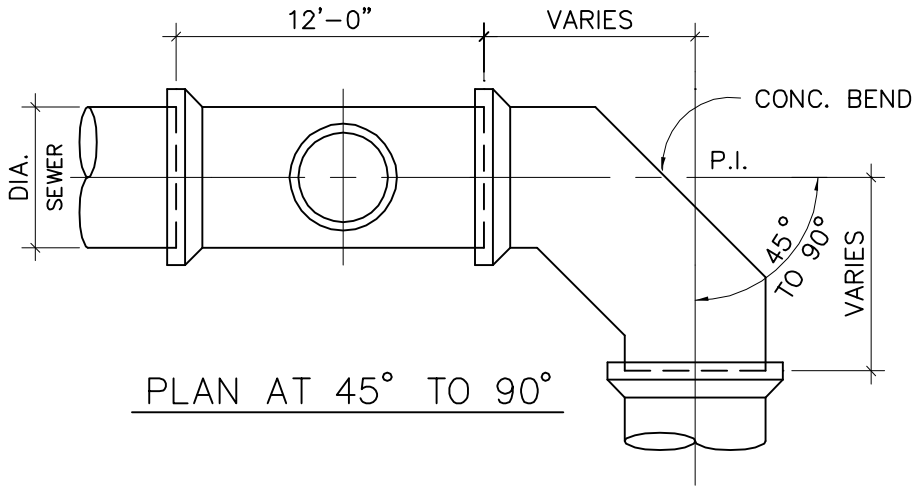
TYPICAL PLANS

ROCKDALE WATER RESOURCES

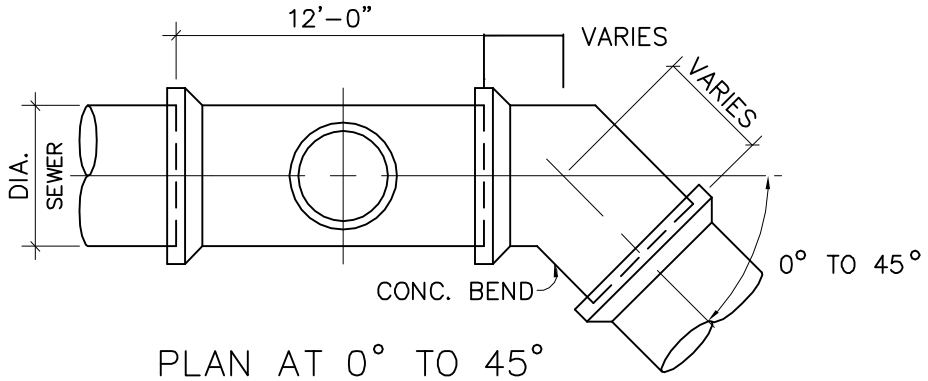
STANDARD MANHOLE DETAIL

NOT TO SCALE

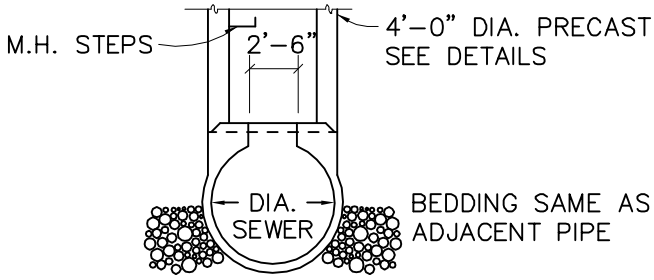
STANDARD DRAWING No. B-9



PLAN AT 45° TO 90°



PLAN AT 0° TO 45°



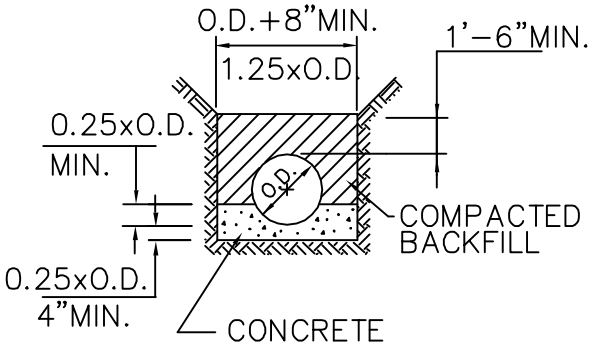
SECTION AT MANHOLE

ROCKDALE WATER RESOURCES

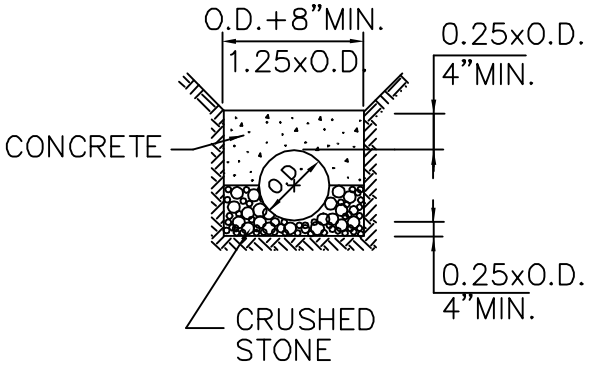
TYPICAL PIPE-TEE MANHOLE DETAIL

NOT TO SCALE

STANDARD DRAWING No. B-10

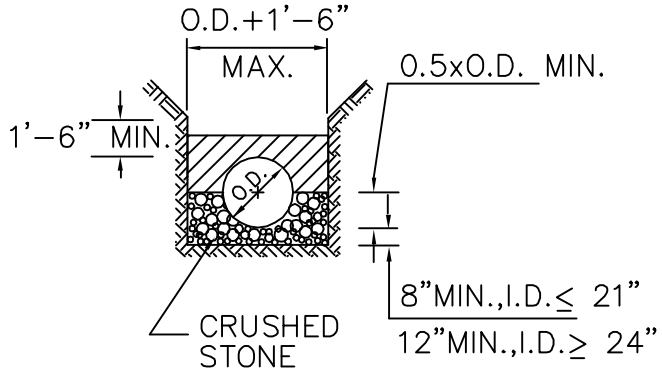


CONCRETE CRADLE

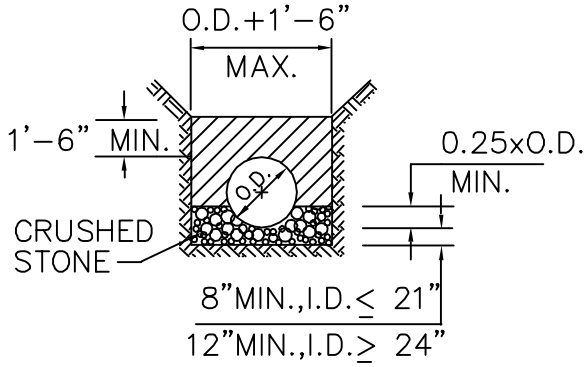


CONCRETE ARCH.

CLASS "A"



CLASS "B"



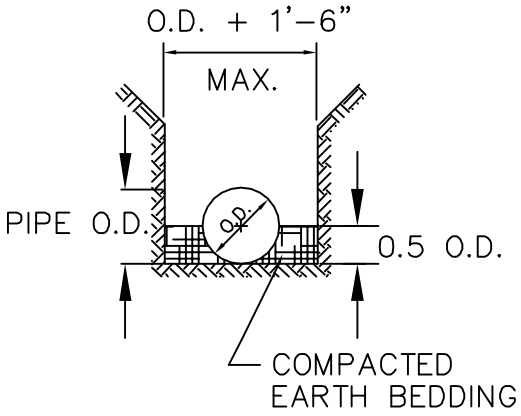
CLASS "C"

TYPICAL PIPE BEDDING DETAILS

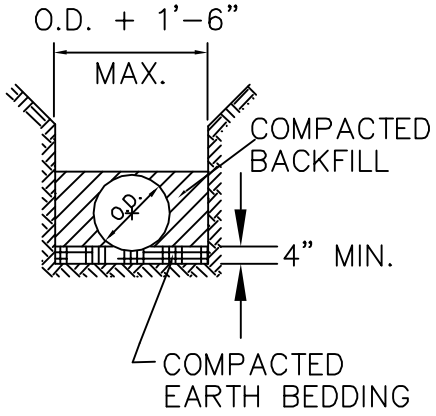
ROCKDALE WATER RESOURCES

TYPICAL PIPE BEDDING DETAILS
NOT TO SCALE

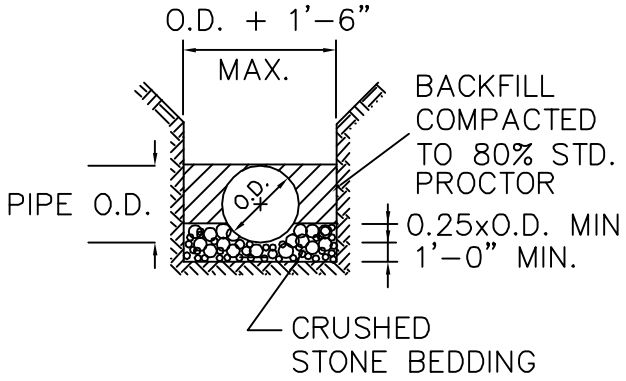
STANDARD DRAWING No. B-11



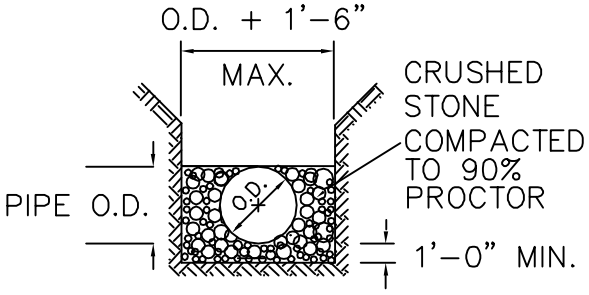
TYPE 2



TYPE 3



TYPE 4



TYPE 5

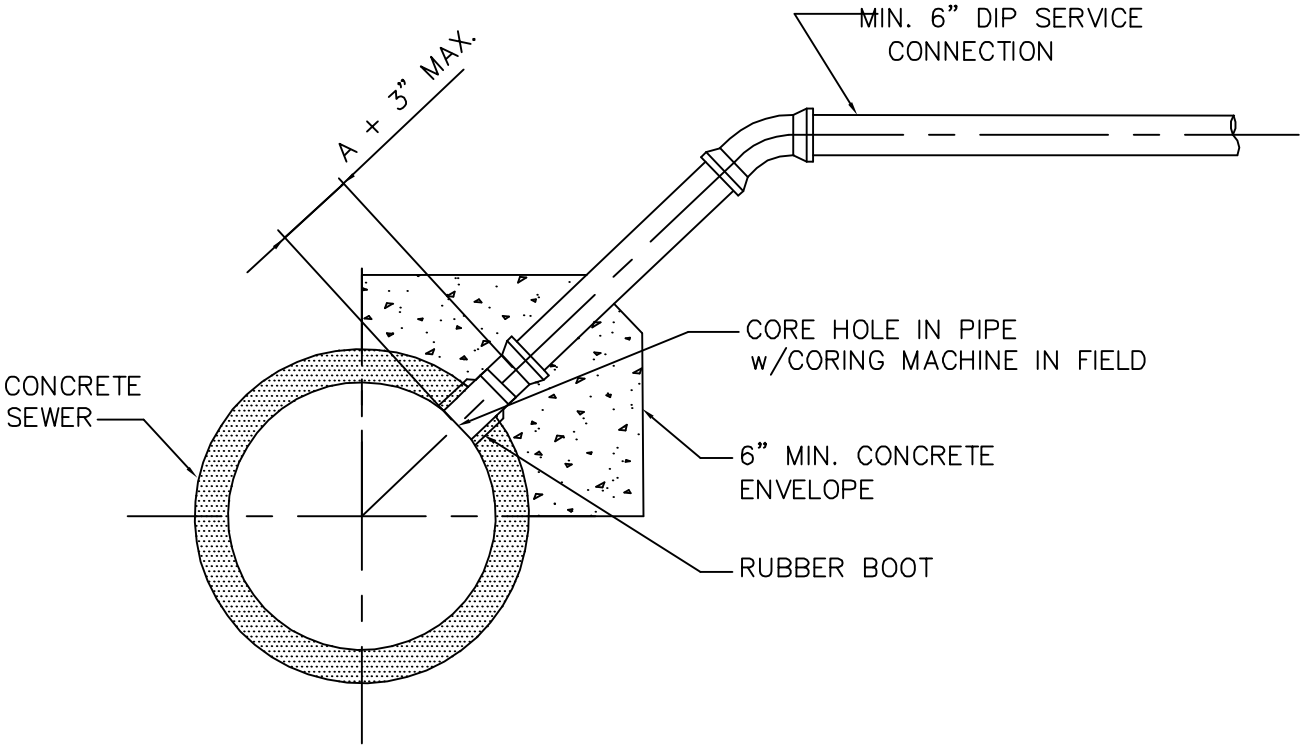
TYPICAL PIPE BEDDING DETAILS

TYPICAL PIPE BEDDING DETAILS

NOT TO SCALE

ROCKDALE WATER RESOURCES

STANDARD DRAWING No. B-12



NOTES:

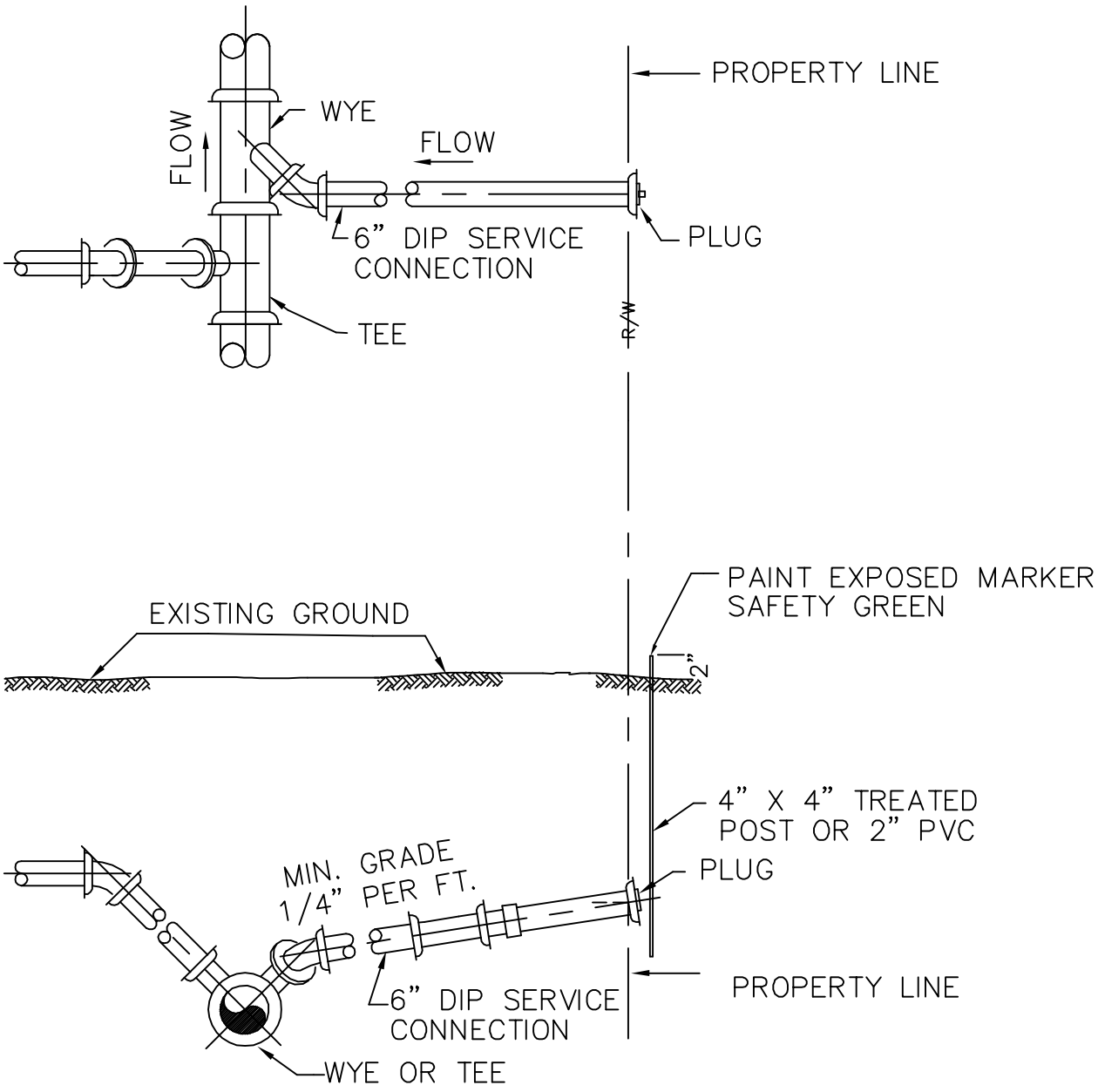
1. ALTERNATE IS AN OUTLET CAST IN PIPE WALL BY PIPE MANUFACTURER.
2. THIS DETAIL IS FOR 18" AND LARGER CONCRETE PIPE.

ROCKDALE WATER RESOURCES

SERVICE CONNECTION DETAIL

NOT TO SCALE

STANDARD DRAWING No. B-13



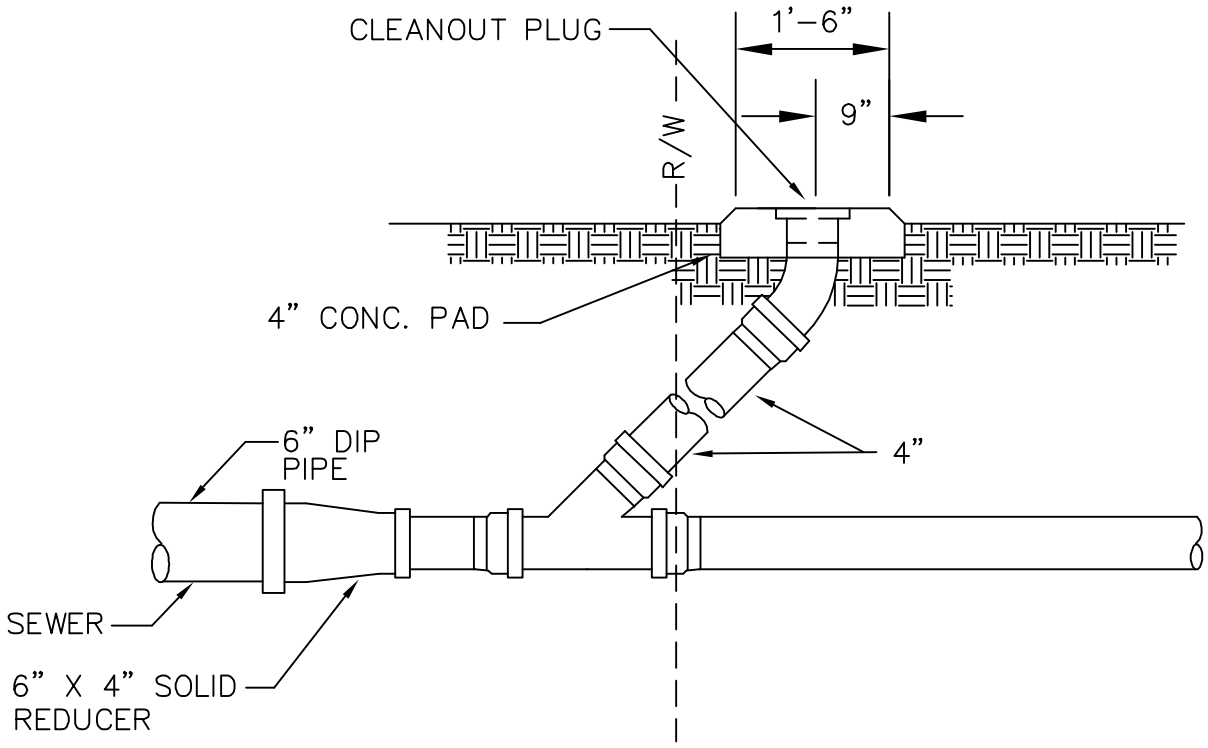
ALL SERVICE CONNECTIONS SHALL BE DIP.

ROCKDALE WATER RESOURCES

SERVICE CONNECTION DETAIL

NOT TO SCALE

STANDARD DRAWING No. B-14



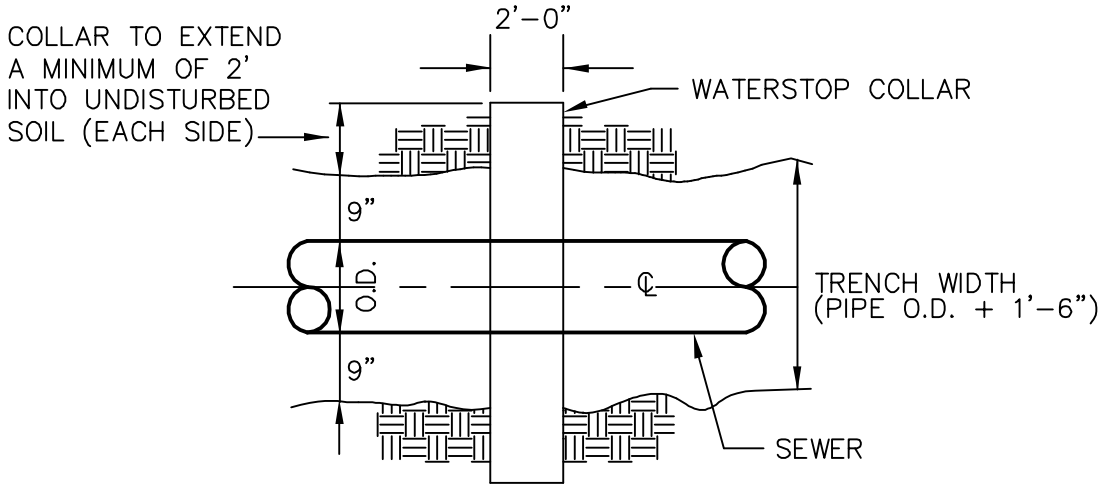
CLEANOUT TO BE INSTALLED BY THE DEVELOPER

ROCKDALE WATER RESOURCES

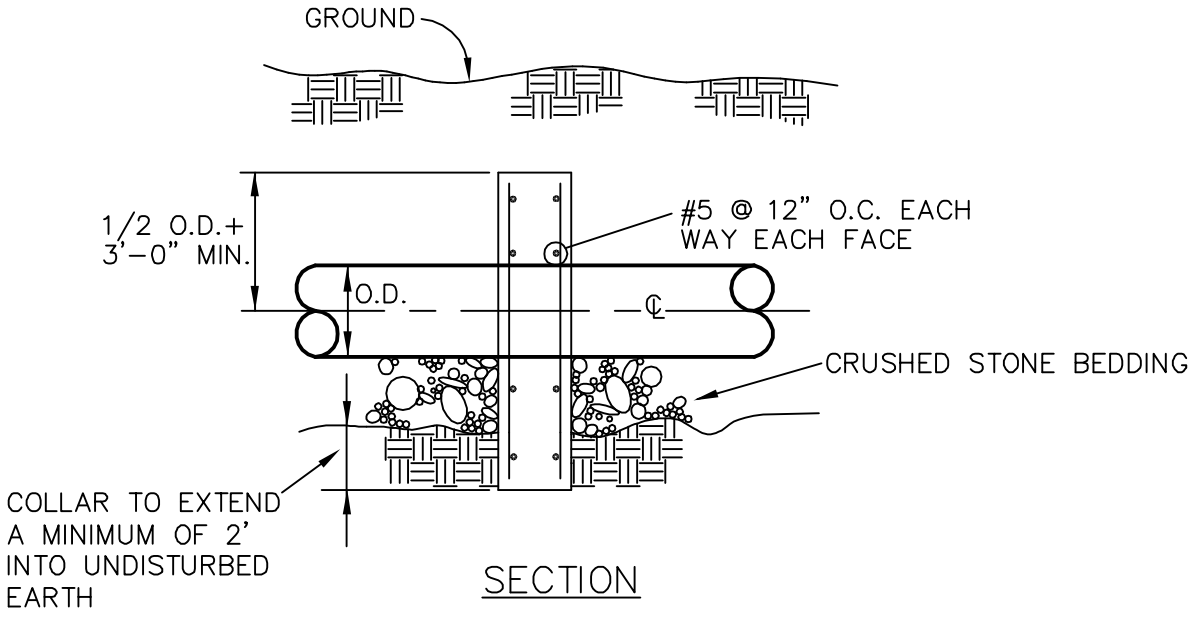
CLEANOUT DETAIL

NOT TO SCALE

STANDARD DRAWING No. B-15



PLAN



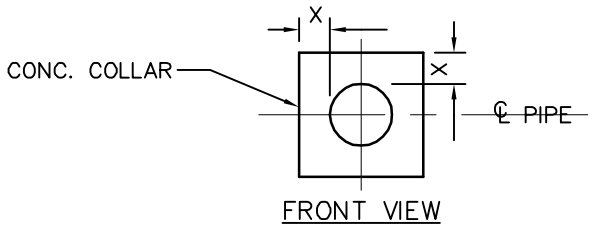
SECTION

ROCKDALE WATER RESOURCES

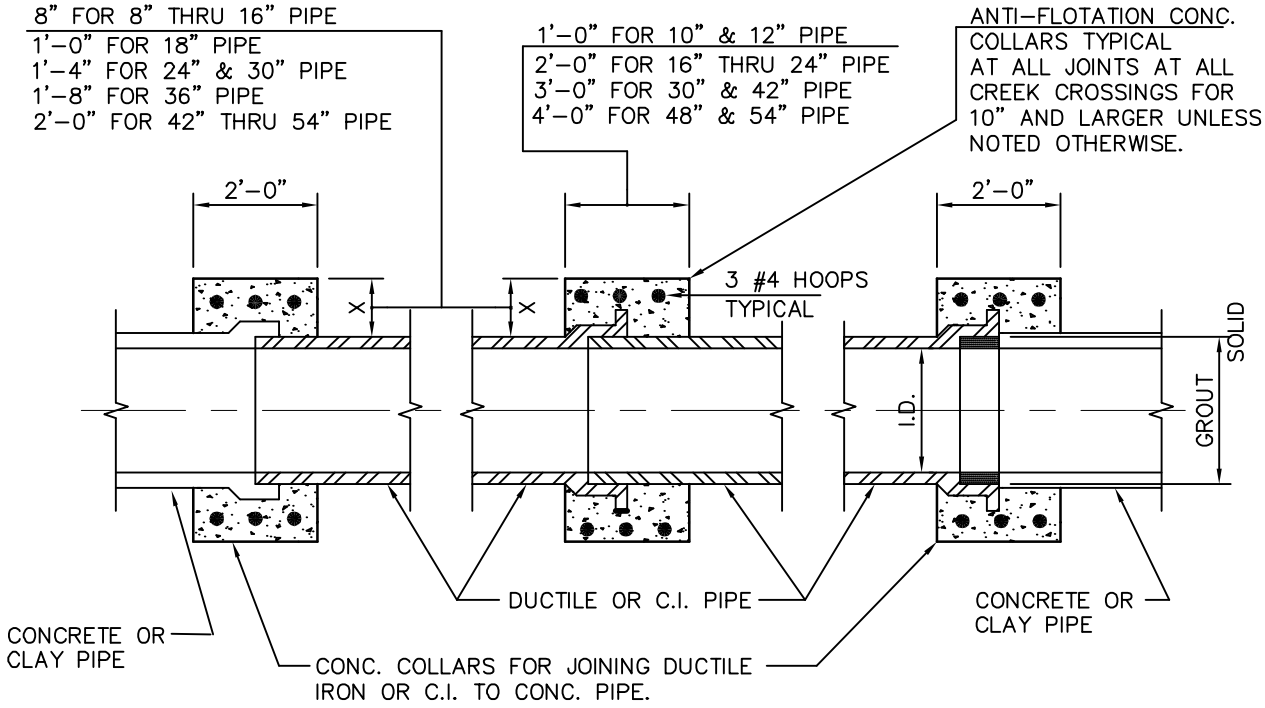
WATERSTOP COLLAR DETAIL

NOT TO SCALE

STANDARD DRAWING No. B-16



FRONT VIEW

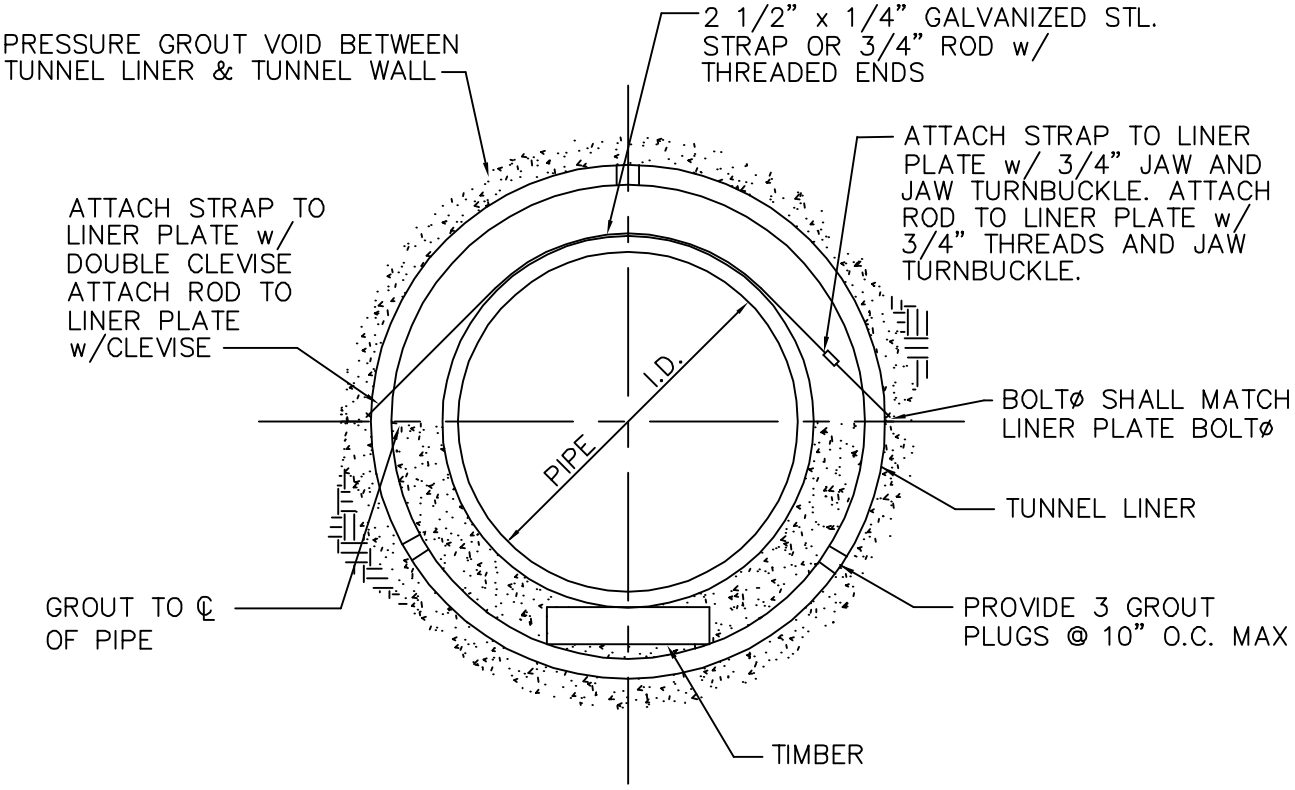


ROCKDALE WATER RESOURCES

CONCRETE COLLAR DETAIL

NOT TO SCALE

STANDARD DRAWING No. B-17



NOTE: FILLING ENTIRE VOID BETWEEN PIPE & LINER PLATE WITH GROUT, AS PER SPECIFICATIONS, IN LIEU OF TIE–DOWNS WILL BE PERMITTED.

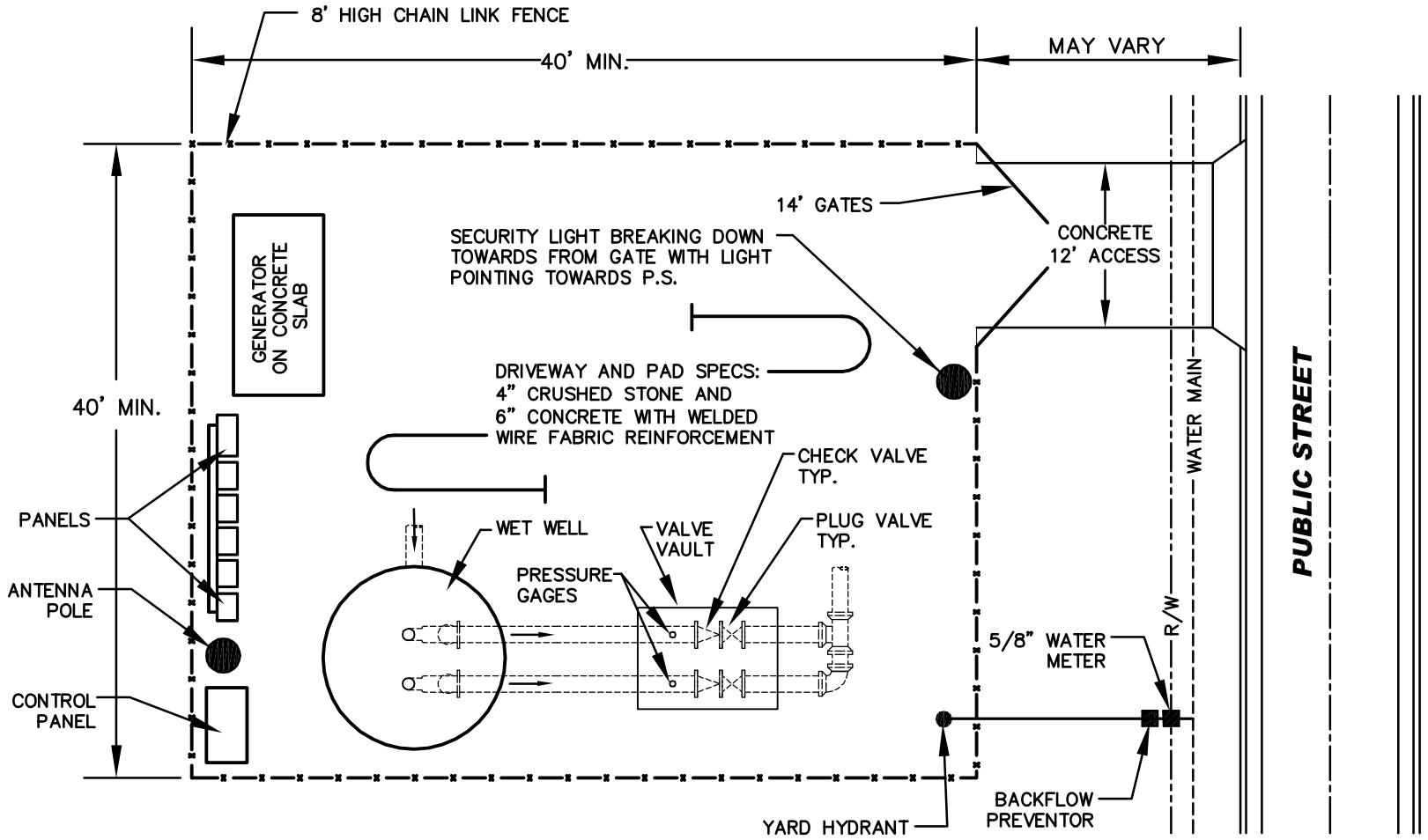
ROCKDALE WATER RESOURCES

TUNNEL DETAIL

NOT TO SCALE

STANDARD DRAWING No. B-18

1. THIS IS GENERAL SCHEMATIC LAYOUT. LOCATIONS OF EQUIPMENT MAY VARY ACCORDING TO THE EQUIPMENT AND SITE REQUIREMENTS.
2. WATER METER SHALL BE NEPTUNE WTH E-CODER (BY DEVELOPER).
3. BFP – SEE DETAIL A-12 WATER SYSTEM STANDARDS AND SPECIFICATIONS (BY DEVELOPER).

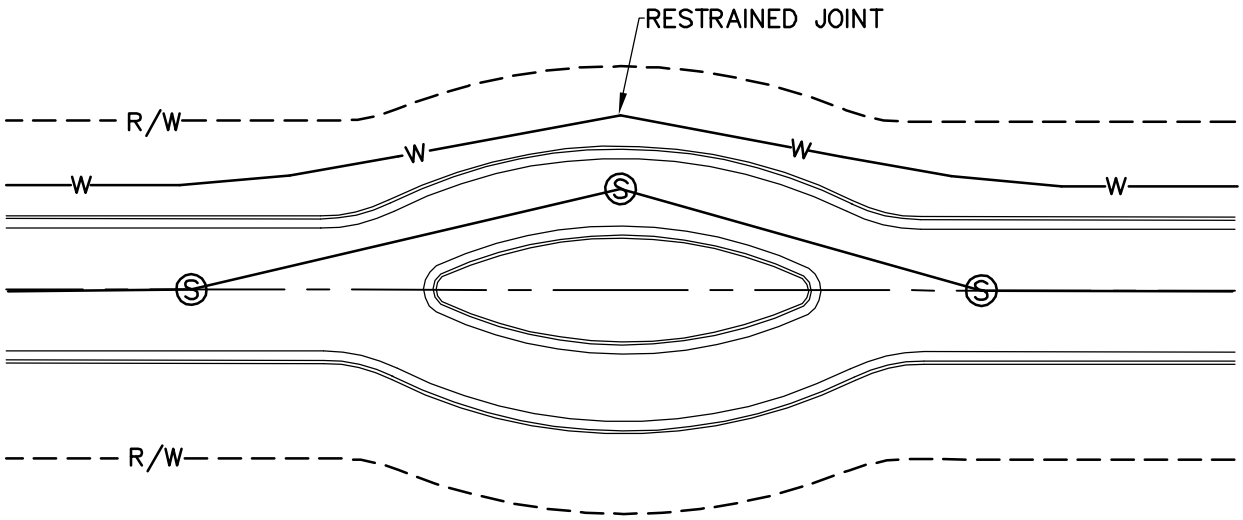


ROCKDALE WATER RESOURCES

PUMP STATION SITE LAYOUT

NOT TO SCALE

STANDARD DRAWING No. B-19



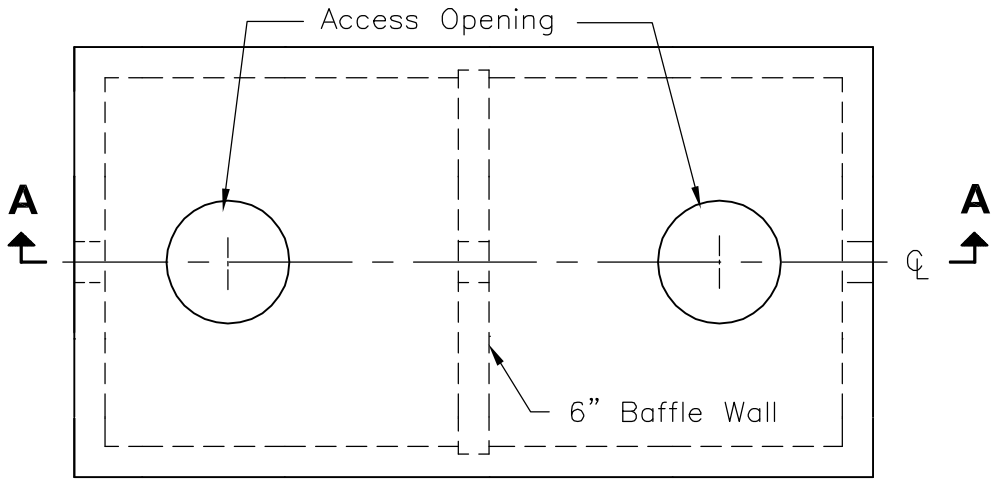
NO LATERALS SHALL BE INSTALLED UNDER THE TRAFFIC ISLAND.

NOT TO SCALE

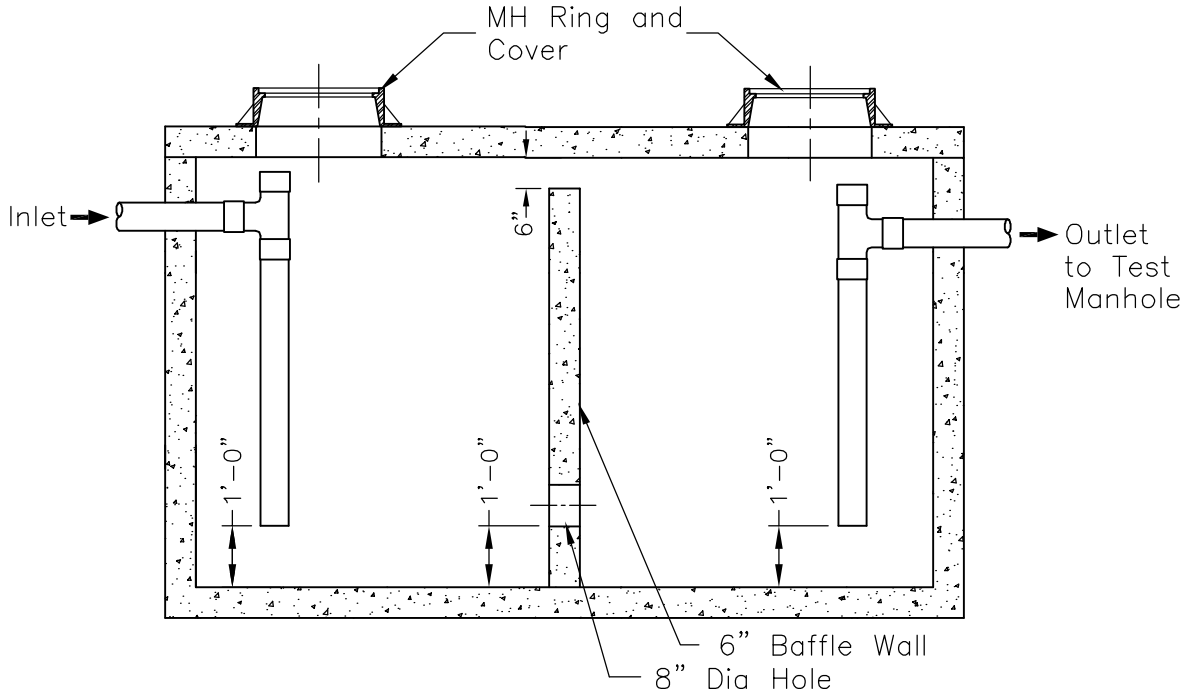
ROCKDALE WATER RESOURCES

UTILITY PLACEMENT AT TRAFFIC CALMING DEVICES

STANDARD DRAWING No. B-20



PLAN VIEW



SECTION VIEW A-A

NOTES:

1. ALL PIPES SIZES SHALL MATCH INLET/OUTLET NOMINAL PIPE SIZES.
2. SET INLET INVERT 3"±0.5" ABOVE OUTLET INVERT.
3. PIPE & FITTINGS SHALL BE SOLVENT WELD SCHD.40 PVC.
4. GREASE TRAPS LOCATED WITHIN PARKING OR DRIVE AREAS SHALL BE DESIGNED AND CONSTRUCTED FOR H-20 LOAD RATING.

NOT TO SCALE

ROCKDALE WATER RESOURCES

GREASE TRAP

STANDARD DRAWING No. B-21