STANDARD

WATER MAIN

and

SANITARY SEWER SPECIFICATIONS

for the

CITY OF MONROE, GEORGIA

NOVEMBER 2001
Revised November 2007

Preface to the November 2007 Revision

1) The cover page has been changed to reflect The City of Monroe, Georgia in place of the Monroe Utilities Network.
2) The last sentence of paragraph A.1.2 has been deleted.
3) Paragraph A.3.4 has been changed so that developers must submit four (4) copies of plans to The City of Monroe.
4) The last sentence of paragraph A.4.3 has been deleted.
5) Paragraph A.4.4 has been deleted.
6) The first word of paragraph A.4.5, now paragraph A.4.4, has been changed from "Option B)" to "The".
7) "PC 200" has been deleted from both paragraphs B.2.10 and B.3.3.
8) Class 160 PVC conduit has been changed to class 150 in paragraph B.2.15.
9) Paragraph B.4.2 has been revised so that hydrants are set according to utility placement drawings or the inspector.
10) Paragraph B.5.7 has been added.
11) Installation depths for different materials of sanitary sewer pipes have been added to paragraph B.7.3.
12) Paragraph B.7.4 has been revised to include that services shall extend 2' past the R/W.
13) Paragraph 1.10.2 has been revised to include that utility contractors must submit a copy of their license.
14) Paragraph 4.2.4 has been revised to list Mueller as the only City of Monroe approved manufacturer for gate valves.
15) Paragraph 4.3.1 has been revised to state that the contractor must supply and install tapping sleeves and the City of Monroe will inspect the installation.
16) Paragraph 4.6.10 has been revised to state that residential water service taps must be a minimum of 24 inches apart and a minimum of 24 inches from the bell of the pipe.
17) The last sentence of paragraph 8.4.5 has been deleted and replaced.
18) Paragraph 8.10.1 has been revised to include that back-filling shall only take place after an inspection has been completed.
19) A specification for pile piers using steel "H" piles has been added.(Paragraph 8.16.12)
20) Paragraph 8.20.1 has been revised to include that sewer lines shall be provided out to the R/W at all buildings and dwellings.
21) Paragraph 8.20.2 has been revised to include that sewer service lines shall extend to a minimum of 2-foot behind the R/W.
22) Paragraph 8.20.7 has been revised to include that two (2) clean outs are required at each sewer lateral.
23) The second half of the second sentence in paragraph 8.21.2 has been deleted.
24) The word 'Contractor' has been replaced with 'Developer's Engineer' in paragraphs 9.2.2 and 9.2.3.

25) The subdivision utility location drawing D-1 has been amended.

26) The Cul-de-sac standard detail drawing D-8 has been amended.

27) The Service Connections standard detail drawing D-11 has been amended.

28) The large water meter standard detail drawing D-17 has been amended.

29) The backflow preventer standard detail drawing D-18 has been removed.

30) The fire service vault standard detail drawing has been changed from D-19 to D-18.

31) The disinfection procedure standard detail drawing has been changed from D-20 to D-19.

32) The typical details of sanitary house service line, drawing H-8, have been amended.

33) The example pump station site plan standard drawing H-15 has been amended.

34) The example pump station section A-A standard drawing H-16 has been amended.

35) The example pump station miscellaneous standard details drawing H-18 has been amended.

36) The force main termination standard detail drawing H-19 has been amended.

37) A standard detail drawing for pile piers (drawing H-21) has been added.

Preface to the November 2005 Revision

1) The Typical Detail of Sanitary House Service Line (Drawing H-8) has been amended.
2) The type of water pipe required has been specified more clearly in Para. B.2.10 and B.3.3 as C-900 DR14, PC 200.
3) Typical Detail of Water Service Connections (Drawing D-11) has been amended to correct measurements.
4) The pump station requirements have been amended to include telecommunications capabilities to access MUN's SCADA system (Para. 9.1.2) and provision of a hoist for pumps over 50 lbs (Para. 9.3.4.3).
5) The chlorination procedures in Sec. 6.3 have been amended to add Para. 6.3.10 regarding tampering with valve while testing.
6) Drawing D-1 has been amended to show subdivision set-backs inside and outside the city limits.

Preface to the August 2005 Revision

1) A detail for the water line chlorination procedures described in Paragraph 6.3 was added as Drawing D-19 in the appendix.
2) Paragraph A.5.4 has been amended to include the Statement of Approval for Monroe Utilities Network.

Preface to the March 2005 Revision

1.) Water line disinfection procedures have been revised in Paragraph 6.3.

2.) Paragraph 4.6.5.2.2 - Residential water line connection has been revised to require a Ford FB-600-4 corporation stop, only. The "or equal" clause has been deleted. Drawing D-11 has also been revised accordingly.

3.) A detail for the force main termination described in Paragraph 9.12.3 has added as Drawing H-19.

Preface to the December 2004 Revision

In addition to correcting several minor typographical errors, the following changes have been since the 2003 revisions:

Appendix A – Water Service for subdivisions application has been modified to include sewer service information needed by MUN and now has the title: Preliminary Application for Water/Sewer Service.

Appendix I has been added. It is a decision chart illustrating the Water and Sewer Development Review and Approval procedure that has is already in place.

Paragraph A.5.5 has been inserted in the procedures to more clearly identify when a Certificate of Occupancy (C.O.) may be issued after completion of sewer line construction. It also adds a state mandated prohibition of "Pump and Haul" operations as a means of providing temporary sewer service.

B.8.21 and 2.13.5 -7 and 8.15.4, Table 8-1 have been corrected to reflect current pipe bedding classes. Only bedding types "2", "4", and "5" are permitted. Table 8-1 has been corrected to read "Minimum Height of Cover" instead of "Maximum Height of Cover".

2.7.6.2 regarding initial backfill procedures has been modified to reflect better construction practice.

Section 3.2 - SDR 21 PVC pipe will no longer be acceptable for water line use. Only Class 200 C900 PVC pipe or Class 200 (minimum) Ductile Iron pipe shall be used in water line construction.

A new section, 4.10 for large residential (multifamily) or commercial water meters, has been added, along with Drawing D-17 in Appendix D.

Section 7 (Erosion Control) has been modified to reflect current Georgia EPD erosion control regulations and standards.

8.18.1 The statement: "By-passing raw wastewater directly or indirectly into a stream or onto the ground is strictly prohibited and punishable under Georgia state law" has been added to the end f the paragraph.

8.20 Several changes have been made to the methods and materials used in house sewer service lines. See also Drawing H-8 in the Appendix.

8.22.5 Table 8-3 has been substantially expanded to define minimum pressure leak-down specifications for low pressure air testing of sewer lines.

9.1.6 has been modified to reflect MUN's requirement for only two pump manufacturer without prior approval of the Utility.

9.3 types of pump station have been restricted to either submersible to wetwell/dry well. Suction lift type pump stations have been eliminated.

9.7.14 eliminated galvanized supports, fasteners and hardware for mounting electrical cabinets and boxes. Only stainless steel and aluminum materials may be used.

9.9 Controls have been modified to reflect requirement for Flygt "Multitrode" system for pump level control in order to standardize MUN's pump station system and improve reliability.

9.9.12-14 Has been added to address specific requirements of the radio telemetry system that is to be installed in each pump station.

Several drawings in the Appendix have been updated to reflect current practices by the Utility or to correct and/or improve previous renderings. These include:

- B-3 Sample Plan
- B-6 Pavement Patch Detail
- D-1 Subdivision Utility Location
- D-2A Concrete Blocking Details
- D-7 Backtap Installation
- D-8 Cul-De-Sac Detail
- D-9A Line Blocking Details
- D-9B Line Blocking Dimensions
- D-10 Air Release Valves
- D-11 Service Connections
- D-14 Silt Fence Detail
- H-2 Bedding Types
- H-8 Typical Detail of Sanitary House Service Line
- H-14 Pump Station By-Pass
- H-15 Example Pump Station Site Plan
- H-16 Example Pump Station Section A-A
- H-17 Example Pump Station Electrical Diagram
- H-18 Example Pump Station Miscellaneous Details

Additional Drawings include:

- D-17 Large Water Meter
- D-18 Backflow Preventer

Revision 2004-1

Preface to the 2003 Revision

After approximately two years' experience using the revised Standard Water and Sewer Specifications, it has become apparent that a few refinements and additions to the 2001 revisions would add clarity and improve the overall document.

The following bullet points highlight the more significant changes, corrections and additions in this 2003 revision:

- The formula on page 6, paragraph B.1.10. has been clarified with the addition of parentheses in both the numerator and denominator of the right-hand side of the equation.
- Paragraph B.3.3. has been corrected to read "Piping shall be SDR 21, class 200 PVC or C-900, Class 150 D.I.P. ..."
- Paragraph A.5.1 has been modified to include a requirement for development as-built drawings to be made in AutoCAD 2000 on CD-ROM disk, prior to final acceptance of the development. This will enable to the MUN to more easily update its water and sewer utility map as part of its Geographical Information System (GIS) and to meet environmental regulatory requirements for maintaining accurate maps of its water and sewer system.
- Paragraph A.4.1 has been added to require metering of all water service connections, including temporary connections.
- Section A.5 includes a number of changes in requirements for obtaining final approval of a development project, including providing the Utility with a maintenance bond for water and sewer infrastructure during the one-year warranty period that follows project acceptance.
- Changes in B.7 limit gravity sewer line velocities and slopes on which sewer lines may be constructed.
- Additional required plan details have been inserted as paragraphs B.8.15 - B.8.24.
- Paragraph B.9.5. has been added to include a requirement to submit as-built drawings in AutoCAD 2000 format on a CD-ROM disk in addition to a printed set.
- Paragraph 3.2.1 and 3.2.3 have been inserted to alert the reader of more stringent PVC pipe material standards.
- Paragraph 4.6.4.1 has been added to specify the type of non-metallic tubing for use in residential water service lines.
- Paragraph 4.10 and drawing D-17 has been added to address meter vault requirements for 4-inch and larger residential (multi-family) and commercial water meters.
- Paragraph 7.8 has been added to address storm water management.
- Paragraph 8.21.2 has added the requirement for all new sewer lines to be inspected via TV camera prior to approval of any sewer lines. Paragraph 8.22 has been modified to require vacuum testing for new sewer manholes. Also, paragraph 8.23.1 has been modified to reflect this requirement as a condition of final acceptance.
- Paragraph 9.2.1 has been added to minimize the proliferation of small sewage pump stations by requiring a pump station design of sufficient capacity to handle flows from the proposed development plus the potential flows from future development upstream that would be tributary to the proposed pump station.

- Paragraph 9.3.3 has been added to require adequate corrosion protection for manholes used for pumping station wet wells and/or discharge f force mains.
- Paragraphs 9.7.3 and 9.7.4 have been added to address three phase motor and power requirements for reliability and protection of electrical equipment.
- Paragraph 9.11.1 has been modified to increase the minimum force main diameter from 4-inches to 6-inches.
- Additional drawings D-14 and D-15 have been added to Appendix D for erosion control details and D-16 has been added to show details for a standard water sample station.
- A sample letter for MUN's Notice of Project Acceptance has been added to Appendix F.
- A set of drawings, H-15 through H-18, which illustrate specific sewage pump station requirements previously defined in Section 9 of the Standard Water and Sewer Specifications. The intent is to help those who submit development plans for review to avoid delays due to insufficient or incorrect information about the pump station they've proposed to serve their development. H-15 is an example of a site plan for a submersible sewage pump station. Although each pump station site is unique, all of the features that are required are shown on this example drawing; the developer only needs to adapt it for his/her particular application and provide the specific design information where indicated. H-16 through H-18 gives more specific details required for a complete pump station design. Incorporating these design standards into every future pump station will help the MUN to provide reliable service to the community for years to come as well as meet current environmental regulatory requirements.

Revision 2003-01

PREFACE TO 2001 REVISION

In response to the growth in the City of Monroe and surrounding area in Walton County, the Monroe Utilities Network, formerly known as the Water, Light and Gas Commission, has expanded its role in providing services to the citizens in its jurisdiction.

In order to assure high standards, uniform quality, and reliability, the Monroe Utilities Network (Utility) has undertaken the revision of these water and sewer standards in accordance with the latest environmental guidelines and with the best technology in mind.

Revision 2001-01

TABLE OF CONTENTS

SECTION	PAGE NO.

SECTION	PAGE NO.

SECTION A - POLICY AND PROCEDURE

A.1. FINANCIAL PARTICIPATION

A.1.1. It is the sole responsibility of the developer to pay for and install water lines, valves, hydrants, and other water line appurtenances and sanitary sewer lines, manholes and other sanitary sewer line appurtenances within the bounds of the proposed subdivision site and along the county road or highway adjacent to the subdivision site, if required.

A.1.2. If the subdivision site is not located adjacent to an existing water or sanitary sewer line, or the existing water and/or sanitary sewer line is not large enough to serve the subdivision.

A.1.3. The developer shall bear the full expense of water or sanitary sewer line and appurtenances from existing lines toward the subdivision site. The Utility may choose, on a case by case basis, to share in the construction cost of installing the remaining water or sanitary sewer line up to the subdivision property. The Utility may require the Developer to upgrade the water or sanitary sewer lines and appurtenances (including proposed sewage pumping station), within and up to the subdivision for the sole purpose of improving the overall performance of the Utility's system. In this instance, the Utility's financial participation will be agreed upon on a case by case basis.

A.1.4. If the Utility agrees to share in any cost with the developer, the exact amount of participation must be agreed upon by both parties and recorded on the Application form shown in Appendix A before construction begins. Under no circumstances will the Utility negotiate an amount of participation after construction of water or sanitary sewer line has begun.

A.1.5. The Developer shall be solely responsible for the preparation and expense of all permits required for the installation of water or sanitary sewer lines up to and within the subdivision, including but not limited to the Department of Transportation Utility Encroachment Permits, Railroad Crossing Permits, Land Disturbance Permits, and Environmental Protection Division approval.

A.1.6. An application fee shall be paid to the Utility by the Developer for each proposed subdivision or new subdivision phase to cover administrative expenses incurred by the Utility. The application fee shall be paid when preliminary plans are submitted for review. The amount of the application fee shall be established by the Utility as set forth in its standard schedule of fees which are modified from time to time to reflect the relevant expenses incurred of the Utility.

A.1.7. The Utility shall bill the Developer for engineering expenses associated with the review and approval of the proposed subdivision water and sewer line installations. The review shall be performed by the engineer that is delegated by the Georgia Environmental Protection Division to serve as the authority in approving water and sewer system additions in

subdivisions within Walton County. The bill shall reflect all time and direct expenses incurred by the approving engineer during review. The Developer shall also be billed for all water and sewer inspections and re-inspection services performed by the Utility at a rate set forth in the Utility's schedule of fees. All engineering and inspection/re-inspection fees shall be paid in full before the final subdivision plat can be signed by the Utility.

A.1.8. Relevant water and sewer tap fees associated with a proposed development shall be paid in full to the Utility after the time drawings are approved but before construction can begin.

A.1.9. All new water service connections shall be metered in accordance with the specifications provided herein.

A.2. APPROVAL PROCEDURE

A.2.1. The following process applies to the approval for the installation of water mains, fire hydrants, valves, sanitary sewer lines, manholes and appurtenances in residential developments to be operated by the City of Monroe. The process includes 1) Application and Preliminary Approval, 2) Construction and Inspection, and 3) Final Acceptance. A procedure chart is provided in Appendix I.

A.3. APPLICATION AND PRELIMINARY APPROVAL

A.3.1. The developer must submit to the Utility 3 copies of the preliminary plans showing the location and general plan for water or sanitary sewer supply along with the Application form and application fee. If the subdivision is to be constructed in phases, the developer should also include a general layout of the entire subdivision as well as the more detailed layout of the specific phase(s) to be approved at that time.

A.3.2. The Utility will evaluate the site for water or sanitary sewer service as well as the potential need for looping water mains by conducting flow and pressure tests, and/or computer modeling in the area of the proposed development.

A.3.3. The Developer or a representative of the Developer must bring a formal request for water to the City of Monroe. The Utility will take action to commit to serve a specific number of lots in the subdivision as presented to the Board, modify the request, or reject the request entirely. The Utility will also determine the Utility's financial participation in waterline construction, as appropriate. Written notice of the Utility's action will be transmitted to the developer within 3 working days after the action. The notice will include any easement requirements deemed necessary.

A.3.4. If the Utility commits to supply the proposed subdivision, the developer must submit to the Utility office four (4) copies of the plans designed in

accordance with the Georgia Environmental Protection Division's (EPD) approved Standard Design Criteria and Specification for the City of Monroe. The Utility will respond within 30 working days of the date of submittal.

A.3.5. If approved as submitted, 2 copies of the plans stamped "Approved for Construction" will be retained by the Utility and the remaining copy returned to the developer.

A.3.6. If changes are required, a checklist will be returned to the developer.

A.3.7. After the changes have been made, the developer must submit three (3) additional copies of the revised construction plans to the Utility for review.

A.3.8. After all changes have been properly made, 2 copies of the plans stamped "Approved for Construction" will be retained by the Utility and the remaining copy returned to the developer.

A.3.9. The Utility shall bill the developer for all research and engineering time on the application and approval process.

A.3.10. The plans stamped "Approved for Construction" are effective for 1 year from the date of approval. If construction on the specific subdivision phase has not begun within the 1-year period, the Developer must reapply for design approval.

A.4. CONSTRUCTION AND INSPECTION

A.4.1. All new water service connections, both permanent and temporary (i.e., from fire hydrant) shall be metered.

A.4.2. A representative of the developer, the installation contractor, and Utility shall attend a pre-construction conference at the Utility's office at least 2 working days prior to the start of any construction. The purpose of this conference will be to clearly define roles and responsibilities for the correct execution of the proposed water or sanitary sewer line installation.

A.4.3. All water or sanitary sewer line installations shall be inspected during construction.

A 4.4. The Utility personnel shall inspect and certify that all work was installed in accord with the Construction Standards of the Utility and the design provided by the developer. The Utility shall receive a set of as-built drawings, as prepared by the design engineer, at the completion of all work. Payment for the inspection services provided by the Utility will be billed by the Utility to the Developer within 7 days of final inspection.

A.4.5. The contractor shall notify the Utility 24 hours in advance of starting construction.

A.4.6. The contractor shall flush lines and perform pressure tests. The construction inspector shall be present during pressure tests and keep detailed records for the Utility.

A.4.7. For all new water mains, the contractor shall disinfect, flush lines, and prepare the system for bacteriologic testing. It is the sole responsibility of the Utility to secure the samples and have them tested in an EPD approved water laboratory. The developer will be notified within 4 working days if the sample passed. Successful bacteriologic testing must be completed prior to the acceptance by the Utility.

A.4.8. The developer must have an executed Change Order (Appendix G) in hand before making any field changes that do not conform to the plans stamped "Approved for Construction".

A.5. FINAL APPROVAL AND SYSTEM OPERATIONS

A.5.1. Prior to final approval, the developer/contractor shall submit to the Utility, three (3) copies of the as-built drawings stamped by a registered Professional Engineer. In addition, a copy of the as-built drawings showing all existing water and sewer lines, streets, drainage, easements and topographic information will be submitted to the Utility in AutoCAD 2000 format on a clearly labeled CD-ROM disk. If the developer's design engineer inspected the job, the engineer certification must be submitted at this time as well.

A.5.2. The developer must submit one original copy of the Developer's Certification (Appendix F).

A.5.3. The Developer must complete all inspections and pay all fees in full before requesting final inspection, including TV camera inspections, application fees, inspection fees, engineering review fees, and other incidental costs that may have been incurred by the City of Monroe related to the development.

A.5.4. The Final Plat shall include the following statement for approval by the City of Monroe:

CERTIFICATE OF APPROVAL BY THE CITY OF MONROE:

The lots shown hereon and plans for water and sewage collection and disposal have been reviewed and approved by the City of Monroe.

Dated this _____ day of _____, 20_____

By: _____

Title: _____

A.5.5. The General Manager of the Utility is delegated by the Utility to make final acceptance for ownership, operation and maintenance of the water or sanitary sewer line installation. Final approval will not be made until all utilities associated with the City of Monroe have been installed in the subdivision and a final inspection has taken place by a City of Monroe inspector.

A.5.6. Certificates of Occupancy shall not be issued until completion of the all of the above requirements has been satisfied. Only then will the General Manager notify the Building Department that the sewer system related to the development may receive flow and that Certificates of Occupancy may be issued. Temporary "Pump and Haul" arrangements SHALL NOT be allowed under any circumstances, including as a provisional method of providing sewer service to a building or development that is otherwise ready for occupancy. "Pump and Haul" operations are strictly prohibited by the Georgia EPD.

A.5.7. The Developer is required to maintain and warranty the water and/or sanitary sewer lines, pumping stations and related infrastructure for a period of one-year. Submittal of a maintenance bond will be required to cover the warranty period before the Notice of Project Acceptance is given. The amount of the maintenance bond will be determined by the City of Monroe after final inspection has taken place. The one-year warranty shall begin on the date of written notice as outlined in A.5.8 below.

A.5.8. Once the General Manager of the Utility has accepted construction of the water and/or sanitary sewer improvements by issuing a written Notice of Project Acceptance to the developer (see sample notice in Appendix F), the final plat shall be recorded, water and/or sanitary sewer service shall begin to be extended to customers, and the one-year warranty period shall begin.

A.5.9. Release of the maintenance bond will occur after the one-year warranty period; provided that any and all defects discovered during the one-year period are repaired or corrected. Failure to repair or correct such defects

will result in extension of the warranty period and/or execution of the maintenance bond as may be required.

A.5.10. During the warranty period, the developer shall provide pumping station access upon request, by authorized City of Monroe employees and/or officials of the state EPD bearing proper identification for the purpose of periodic inspection. Any pump station malfunction, for any reason, including failure of the pump station electrical system or electrical supply that results in an overflow of raw sewage to the environment, may subject the developer to legal action by the Utility and/or the state EPD.

A.5.11. The City of Monroe will be responsible for maintenance of the water or sanitary sewers only after successful completion of the one-year (or extended) warranty period.

SECTION B - DESIGN CRITERIA

B.1. GENERAL

B.1.1. The Technical Specifications section and Design Details found in the Appendix are considered an integral part of the design criteria.

B.1.2. Any pipe, solder or flux used in the installation or repair of the water lines must be lead-free. Pipes and fittings must not contain more than 8.0% lead and solders and flux must not contain more than 0.2% lead.

B.1.3. A horizontal separation of at least 10 feet must be maintained between all water mains and any existing or proposed parallel sewer. When water mains cross sewers, a minimum vertical separation of 18 inches must be provided between the two pipes (measured edge to edge), and the water main must cross over the sewer line. At crossing, one full length of water pipe must be located so that both joints are as far from the sewer as possible.

B.1.4. Water mains must not be installed on or in close proximity of an abandoned landfill site or any site used for waste disposal.

B.1.5. The following flows for the design year shall be identified and used as a basis for design for sewers and lift stations. Where any of the terms defined in a Section are used in these design standards, the definition contained in this Section applies.

B.1.6. Design Average Daily Flow: The design average flow is the average of the daily volumes to be received for a continuous 12-month period expressed as a volume per unit time. However, the design average flow for facilities having critical season high hydraulic loading periods (e.g., recreational areas, campuses, industrial facilities) shall be based on the daily average flow during the seasonal period.

B.1.7. Design Maximum Day Flow: The design maximum day flow is the largest volume of flow to be received during a continuous 24-hour period expressed as a volume per unit time (e.g., gallons per day or GPD).

B.1.8. Design Peak Hourly Flow: The design peak hourly flow is the largest volume of flow to be received during a one hour period expressed as a volume per unit time (e.g., gallons per minute or GPM).

B.1.9. Design Peak Instantaneous Flow: The design peak instantaneous flow is the instantaneous maximum flow rate to be received.

B.1.10. Calculation of Average daily flow:

$Q = G \times P$

Where,

Q = Average daily flow

G = Gallons per capita per day

P = Population

OR:

$Q = G \times U$

Where,

Q = Average Daily Flow

G = Gallons per day per unit

U = Number of units

B.1.11. The peak hourly flow shall be determined by multiplying the average daily flow by a peaking factor. In the case of residential flows,

$Q_h = Q \times F$

Q_h = Peak hourly flow

Q = Average daily flow

F = Peaking factor

$F = (18 + (P)^{1/2}) / (4 + (P)^{1/2})$

Where, P = population in thousands

B.2. WATER LINES INSTALLED WITHIN SUBDIVISIONS

B.2.1. Water lines shall have a minimum diameter of 8 inches. The lines must be large enough to meet peak residential demand of the proposed subdivision and fire flow requirements combined. Acceptable fire flow is a minimum of 500 gpm at 20 psi during times of peak demands. The Georgia EPD has established guidelines for acceptable flows for peak demands in residential communities and the designed flows must comply with the standard as published in "Minimum Standards for Public Water Systems" in May, 2000, or most recent revision.

B.2.2. The EPD delegated approving engineer shall make the final determination as to size of pipe required to meet the residential and fire flow in the proposed subdivision as well as the possible upgrade needed for total system performance.

B.2.3. Looping and Easements:

B.2.4. The overall distribution plan adhered to by the Utility utilizes extensive looping of water lines. This looping allows the use of relatively small lines in most cases and provides adequate fire flow protection while eliminating dead ends and stagnated water.

B.2.5. It is the Utility's policy to require 20-ft. wide utility easements between lots on any new subdivision where a loop could be installed to connect to another subdivision or main line in the future. The design engineer should determine the location of possible future development around the proposed subdivision, consider the ease of construction of a loop to the future development, and discuss with the Utility. All easements must be shown on the plans and on the final recorded plate as 20 ft. utility easements dedicated to the City of Monroe, Georgia.

B.2.6. The Developer must lay the water line along the entire length of each required easement to the adjoining property with a dead-end gate valve at the end.

B.2.7. Water lines are to be installed only on dedicated rights-of-way. In general, easements dedicated to the Utility will be entered by Utility personnel for maintenance purposes only. Non-permanent structures, such as fences, shrubs, and trees shall be allowed within the water line easements.

B.2.8. Water lines within subdivisions shall be located on the north side of east-west streets, and the west side of north-south streets, unless otherwise agreed to by the Utility. The water lines shall be located as shown on the location detail found in Appendix D-1.

B.2.9. Subdivision water lines shall have a minimum cover of 3 ft. to the top of the pipe.

B.2.10. Piping shall be minimum Class 200 D.I.P., or C-900 DR-14 pipe, within the subdivision.

B.2.11. All water lines over cross-drains, under stream crossings, and anywhere else specifically requested by the Utility shall be pressure Class 350 D.I.P. Aerial crossings shall be as shown in Drawing H-5 in the Appendix.

B.2.12. Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair. Sampling taps shall be installed at each end of the crossing, and permanent taps shall be made for testing and determining leaks.

B.2.13. The cul-de-sac water line configuration is to be as shown in Appendix D-8.

B.2.14. A ¾ inch service tap and corporation stop for chlorination shall be indicated on the plans within 3 to 5 feet from the beginning point of the waterline installation.

B.2.15. All services crossing streets inside the subdivision shall be installed inside 1 ½" or 2" Class 150 PVC conduit. Conduit shall extend to a minimum of 5 ft. on each side of the curb/pavement.

B.2.16. At least one water sampling station shall be included in the first phase of each subdivision. The station shall be shown on plans for location approval by the Utility. An example of a water sampling station is shown as Drawing D-16 in the Appendix.

B.2.17. Developer shall be responsible for contacting the power company and determining where the transformers will be positioned so as to avoid conflict with meter set and fire hydrant locations.

B.3. WATER LINES INSTALLED OUTSIDE OF SUBDIVISION SITE

B.3.1. Water lines shall be located within 5 ft. of the right-of-way limits with a minimum cover of 36 inches on county roads, state routes, and federal highways. All bores shall have steel casing, with the minimum casing length equal to the width of the pavement plus 10 ft. on each side.

B.3.2. If any portion of a project is within a D.O.T. right-of-way, then a D.O.T. permit application will be required. The Developer must put together a complete application package and send it to the Authority for submittal to the GA D.O.T. See Appendix B for the DOT Application Checklist and the required forms.

B.3.3. Piping shall be minimum Class 200 D.I.P., or C-900 PVC DR-14 pipe. All lines over cross-drains or under stream crossings, and anywhere specifically requested by the Utility shall be Class 350 DIP. Large streams wider than 15 feet shall require TR Flex D.I. pipe as manufactured by U. S. Pipe or approved equal. Aerial crossings shall be constructed as shown in Drawing H-5 in the Appendix.

B.3.4. Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair. Sampling taps shall be installed at each end of the crossing, and permanent taps shall be made for testing and determining leaks.

B.4. FIRE HYDRANTS (WATER)

B.4.1. Fire Hydrants are to be spaced a maximum distance of 500 ft. apart inside a proposed subdivision and a maximum of 1,000 ft. outside the subdivision, measured from hydrant to hydrant along the roadway.

B.4.2. Hydrants are to be set according to utility placement drawing or inspector and are to be set on property lines where possible.

B.4.3. Fire hydrants shall be required at the end of all dead-end lines such as those installed in cul-de-sacs. Flushing velocities of 2.5 feet per second or greater are required.

B.4.4. Each fire hydrant shall have a 6" gate valve bolted directly to a hydrant tee.

B.5. VALVES (WATER)

B.5.1. Shall be resilient seated gate valves.

B.5.2. Every tee shall have two valves away from the source, and every cross shall have three valves away from the source.

B.5.3. An in-line valve shall be installed every 1,000 ft. of water line within a subdivision, and every 2,000 ft. outside of the subdivision.

B.5.4. Air release valves are to be installed at high points in the proposed subdivision. At least one air release valve is required for each subdivision, unless otherwise agreed upon by the approving engineer.

B.5.5. All connections to existing water mains shall be made with tapping sleeves and tapping valves. All back-taps shall be shown on the drawings and labeled as such.

B.5.6. All stub-out valves and dead-end valves shall be shown to have a mechanical joint cap on the plans. These devices shall be properly restrained to allow for future connections.

B.5.7. ¾" –1" backflow provided by utility. Anything larger than 1" needs to be supplied by the contactor.

B.6. SERVICES

B.6.1. Developer shall install double meter sets for all lots, and single meter services only on the property lines where double meter sets are impractical. See Drawing D-11 in Appendix. Meters and back-flow preventers shall be installed by the Utility.

B.7. SANITARY SEWER LINES INSTALLED WITHIN SUBDIVISIONS

B.7.1. Sanitary sewer lines shall have a minimum diameter of 8 inches. The lines must be large enough to meet the residential demand of the proposed subdivision. The design engineer shall make the determination as to size of pipe required to meet the residential flow in the proposed subdivision.

B.7.2. The sanitary sewer lines shall be located in the center of the streets where possible. All lines outside the streets will require a 20 ft. wide easement for future access. All easements must be shown on the plans and on the final recorded plat as 20 ft. utility easement dedicated to the City of Monroe, Georgia.

B.7.3. At a minimum, piping shall be type PSM SDR 26 PVC Sewer Pipe or Class 150 Ductile Iron Pipe. If the depth is 0'-5', DIP Sewer Pipe shall be used. If the depth is 5'-16', PVC Sewer Pipe shall be used. Any depth over 16' will require DIP Sewer Pipe.

B.7.4. All services shall have a minimum diameter of 6 inches and it shall extend 2' past the R/W.

B.7.5. Manholes shall be concrete (precast) with a minimum diameter of 4 feet.

B.7.6. Buoyancy of sewers shall be considered and flotation of the pipe shall be prevented with appropriate construction where high groundwater conditions are anticipated.

B.7.7. All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second, based on Manning's formula using an "n" value of 0.013. The following are the minimum slopes that shall be provided. However, greater slopes are desirable.

Nominal Sewer Size	Minimum Slope in Feet Per 100 Feet
8 inch	0.40
10 inch	0.28
12 inch	0.22
14 inch	0.17
15 inch	0.15

B.7.8. The pipe diameter and slope shall be selected to obtain the greatest practical velocities to minimize settling problems. Oversize sewers will not be approved to justify using flatter slopes. If the proposed slope is less than the minimum slope of the smallest pipe which can accommodate the design peak hourly flow, the actual depths and velocities at minimum, average, and design maximum day and peak hourly flow for each design selection of the sewer shall be calculated by the design engineer and be included with the plans.

B.7.9. Sewers shall be laid with uniform slope between manholes.

B.7.10. Manholes shall be installed 1) at the end of each line, 2) at all changes in grade, size, or alignment, 3) and at distances not greater than 400 feet for sewers 15 inches in diameter or less, and no more than 500 feet for sewers greater than 15 inches in diameter.

B.7.11. Velocities greater than 15 feet per second shall not be permitted. Where velocities greater than 10 feet per second are attained, special provision shall be made to protect against displacement by erosion and impact.

B.7.12. Sewers on shall not be laid on slopes with grades of 20 percent or greater.

B.7.13. When a smaller sewer joins a larger one, the invert of the larger sewer shall be lowered sufficiently to maintain the same energy gradient. An approximate method for securing these results is to place the 0.8 depth point of both sewers at the same elevation.

B.8. PLANS FOR PROPOSED SUBDIVISION WATER OR SANITARY SEWER SYSTEM

B.8.1. Design engineer/Developer is to submit drawings on 24" x 36" paper stamped by a professional engineer registered in Georgia. Water or sanitary sewer line details included in this document are part of the plans and specifications. Special details not included in this document should also be shown on the drawings. Drainage design details, erosion control, and other plans required by the City or County should not be submitted with the water or sanitary sewer line plans.

B.8.2. Scale is to be 1" = 100'horizontal (maximum).

B.8.3. Site plans shall include:

B.8.4. Streets and street names with lot layout and district.

B.8.5. Location of storm drains, drainage easements, and any retention ponds.

B.8.6. Location map and topography of subdivision.

B.8.7. Water line layout with all gate valves, air release valves, fittings, tapping sleeves, hydrants, chlorination taps and sampling station(s) including materials and size labels for each.

B.8.8. Any rock outcroppings.

B.8.9. All easements with labels.

B.8.10. County road and DOT right-of-ways.

B.8.11. Existing water lines, hydrants, and valves in surrounding area including material and size labels for each.

B.8.12. Service laterals.

B.8.13. Water line legend with symbols as shown in Appendix C.

B.8.14. Details of special water line installations such as stream crossings, elevated lines on piers, bridges, etc.

B.8.15. Indicate sanitary sewer line layout with pipe sizes, type pipe, percent slope, manhole locations and numbers, pipe material, station number, invert elevations and services.

B.8.16. Provide an aerial plan of the sewer.

B.8.17. Provide a profile view of the sewer.

B.8.18. Provide sewer line aerial and profile view match line statements. These statements indicate where each sewer line segment attaches to the next sewer line segment.

B.8.19. If any gravity sewer is located within a 100 year flood zone, indicate whether manholes associated with this gravity sewer system segment are gasketed and bolted down and or the manhole tops are at an elevation above the 100-year flood elevation.

B.8.20. Indicate the proximity of gravity sewer lines, force mains, and pumping stations to any nearby residence, school, day care center, assisted living center, church, septic tank drain field, potable water well, water supply reservoir and all waters of the State.

B.8.21. Details of sewer construction appurtenances including: standard precast manhole, drop connection for precast manhole, standard invert dimensions, typical pavement patch, typical manhole step, Type "2", "4" and "5" bedding, ASTM Standard for bedding plastic pipe, concrete encasement, bedding schedule for different diameter pipes, aerial pier, air-relief valve, concrete collar transition, sheeting and shoring details, standard manhole ring and cover, and thrust blocking details.

B.8.22. Provide a note on each plan sheet indicating that the contractor must call the Utilities Protection Inc. "Call Before You Dig", telephone number 1-800-282-7411.

B.8.23. Provide a cover sheet with: a) Title of the project, b) Owner's name, address, telephone number, fax number, c) Consulting Engineer's/surveyor's company name, address, telephone number, fax number, d) Provide a detailed location map, e) Index sheet, f) Symbol legend, g) Remove all standard details from the cover sheet – construction notes are acceptable on the cover sheet.

B.8.24. When a body of water is located adjacent to a project, indicate the 100-year flood zone elevation of the stream, river or the high water/winter pool elevations of lakes or reservoirs.

B.8.25. Project name with specific phase(s) to be reviewed for approval clearly marked on the plans.

B.8.26. All proposed water or sanitary sewer lines and appurtenances shall have a line weight equivalent to a #3 pen. All other lines shall have a line weight equivalent to a #1 or #2 pen.

B.8.27. The water or sanitary sewer line plans "Approved for Construction" shall not be changed except by formal Change Order. A copy of the Change Order form is included in Appendix G.

B.8.28. If the subdivision consists of multiple phases or units, two copies of the overall subdivision plan shall be submitted with the phase(s) or unit(s) being requested for approval. Scales of the overall plans may vary.

B.9. AS BUILT DRAWINGS

B.9.1. As-builts must be submitted before a project can receive final approval by the Authority.

B.9.2. Copies must be clear, clean, and legible

B.9.3. Drawings shall include a site plan of the water or sanitary sewer lines and appurtenances as they were installed with any shop drawings needed for clarification or as requested by the Utility.

B.9.4. As-builts must be stamped by a Professional Engineer registered in the State of Georgia.

B.9.5. In addition to a printed set, a copy of the as-built drawings showing all existing and new water and sewer lines, streets, drainage, easements and topographic information shall be submitted to the Utility in AutoCAD 2006 format on a clearly labeled CD-ROM disk. The files must be georeferenced to the earth's surface using State Plane 1983 Coordinate System (feet).

TECHNICAL SPECIFICATIONS

SECTION 1 – GENERAL REQUIREMENTS

1.1. SCOPE OF WORK

1.1.1. Work shall include the furnishing of all materials, equipment, labor, and means of construction necessary for the installation of the water and sewer lines as approved herein.

1.1.2. The Contractor shall be responsible for obtaining and paying for all necessary local and state construction licenses and permits.

1.1.3. No work shall begin until after the pre-construction conference is held and all questions of responsibility during construction are resolved.

1.1.4. The Contractor will not be allowed to start the installation on water mains unless all road beds and ditch lines, or all curbs and gutters have been established at finished grade.

1.1.5. The Contractor is required to hold a copy of the drawings stamped " Approved for Construction" on the job site at all time during construction.

1.1.6. The Utility or its representative retains the right to reject any subdivision water and/or sewer lines that are not installed according to the approved drawings and specifications.

1.1.7. The Contractor shall not begin installation of pipe until all sedimentation and erosion control devices are installed according to the approved Land Disturbance Permit.

1.1.8. Any pipe, solder or flux used in the installation or repair of the water lines must be lead-free. Pipes and fittings must not contain more than 8.0% lead and solders, and flux must not contain more than 0.2% lead.

1.2. HEALTH AGENCY APPROVAL

1.2.1. These specifications require approval of the Georgia Department of Natural Resources. The drawings require approval from the Georgia Department of Natural Resources through the agency granted approval authority for the City of Monroe.

1.2.2. No construction work on the system shall be started prior to written approval by this agency.

1.3. SAFETY REQUIREMENTS

1.3.1. All construction work on streets, railway, or highway rights-of-way shall be done in accordance with the rules and regulation of the agencies having control. Safety plans and equipment on highway rights-of way shall generally conform to the requirements of the "Georgia Manual on Traffic Control Procedures for Utilities" as approved by the Georgia Department of Transportation. The Contractor shall furnish all safety equipment and markings.

1.3.2. All construction work shall be performed in accordance with established construction safety standards and the requirements of the Occupational Safety and Health Administration. The Contractor shall be responsible for the safety of the employee and the public in the work area.

1.4. COORDINATION WITH THE PROJECT REPRESENTATIVE

1.4.1. During the course of the work under this contract, the Contractor shall be responsible for keeping the Utility's representative informed of his work schedule, and of his requirements concerning matters such as inspections as herein specified.

1.4.2. Any work subject to inspection or testing by the Utility which is installed without notification in time for such testing or inspection to be done shall be subject to removal and replacement by the Contractor.

1.4.3. The Contractor shall put no workmen on the job nor perform any work on any portion of the project without prior knowledge of the Owner that such work is to be done, the place of work, and the scheduled starting time. A 24-hour notification to the Utility shall be considered the minimum notification requirement for such activity.

1.4.4. The Contractor shall not be permitted to work on Saturdays, Sundays, or at night without the approval of the Utility.

1.5. LOCATION OF EXISTING UTILITIES

1.5.1. Contractor shall be responsible for locating existing waterlines, storm drains, sewers and appurtenances.

1.5.2. Locations of underground utilities such as power, gas, and telephone shall be obtained by the Contractor by properly notifying the utility companies and providing sufficient time for representatives to mark locations of underground facilities and, if necessary, to protect them during the construction period. In no case shall the Contractor begin underground excavation without providing proper notification and time for response.

1.6. PROTECTION AND REPLACEMENT OF EXISTING UTILITIES

1.6.1. The Contractor shall protect existing underground utilities from damage during his operations.

1.6.2. In cases where the Contractor damages or disrupts existing water, gas, telephone, sewer lines, or other underground service facilities, such facilities shall be replaced or repaired at no expense to the Utility.

1.6.3. Parallel Installation: Water mains shall be laid at least 10 feet horizontally from any existing or proposed sewer line. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation, the Utility may allow deviation on a case by case basis, if supported by data from the design engineer. Such deviation may allow installation of the water line closer to the sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

1.6.4. Crossings: Water mains crossing sewers shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer with preference to the water main located above the sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.

1.7. APPROVAL OF MATERIAL AND EQUIPMENT

1.7.1. The Contractor shall Submit shop drawings and/or manufacturer's description sheets for the following materials and/or equipment for the approval of the Authority at the pre-construction conference:

1.7.1.1. Pipe and fittings.

1.7.1.2. Valves, air relief valves, tapping sleeves and valves.

1.7.1.3. Fire Hydrants.

1.7.1.4. Sampling Station.

1.7.1.5. Service lines, saddles, corporation stops.

1.7.1.6. Pump station (if required) and all related pump station appurtenances, such as emergency generator, controls, telemetry, flow meter, valves, etc.

1.7.2. Submittals shall include three copies for each item. Drawings and manufacturer's descriptive material shall include sufficient detail to clearly establish that the item submitted meets the specifications in the Contract Documents.

1.7.3. Items installed without approval of the Utility shall be subject to removal and replacement at the Contractor's cost.

1.8. TESTING

1.8.1. Testing will be performed in accordance with the procedures detailed for each section of the utility system improvements.

1.9. PRECONSTRUCTION CONFERENCE

1.9.1. After the approved plans are in hand and prior to the start of any construction, a preconstruction conference shall be held.

1.9.2. The following people shall be invited to attend:

1.9.2.1. Developer/Owner.

1.9.2.2. Utility Contractor.

1.9.2.3. DOT Representative (If applicable).

1.9.2.4. Electric Utility Representative.

1.10. CONTRACTOR'S QUALIFICATIONS

1.10.1. The Contractor shall be required to have a business telephone that is staffed during normal working hours.

1.10.2. The Utility requires that all utility Contractors performing work be licensed and to submit a copy of the license as Utility Contractors by the State of Georgia.

SECTION 2 - EXCAVATION AND BACK-FILL

2.1. GENERAL

2.1.1. Work under this section shall include all clearing, grubbing, trench excavation, preparation of the trench for pipe installation, pipe bedding, trench back-fill and compaction, dressing, seeding, and other restoration of the surfaces to a condition which is nearly equal to the original and which is satisfactory to the Utility.

2.1.2. Prior to any excavation, the Contractor shall contact local utilities and determine as accurately as possible the location of existing water and sewer lines, storm drains, and all buried cables. The Contractor shall coordinate with the utilities, and shall allow sufficient time for their representatives to locate and otherwise protect their facilities before any digging occurs. In the event of accidental damage to any existing structures, repair and restoration shall be made at once, and no backfill shall be placed until repairs are accomplished.

2.2. CLOSING OF STREETS AND DRIVES

2.2.1. The Utility shall be notified in advance of the Contractor's plan to close or partially close any street or drive, and approval shall be given before any closure occurs. Notification shall include a scheduled time for closing the street and a schedule for completion of the work.

2.2.2. The Contractor shall not close more that one city block at any one time to traffic, and shall be required to maintain not less than one lane open to local traffic. Exceptions to this section shall occur only with the approvals of the Utility.

2.2.3. Driveways that are cut for the installation of pipe shall be backfilled and returned to serviceable condition within four hours of being cut. No driveways shall be left in unserviceable condition overnight. Property owners shall be notified in any cases where conditions are such that restoration of driveways may be delayed.

2.3. REPLACEMENT OF PAVEMENT

2.3.1. Pavement to be removed for installation of trenches shall have edges saw cut straight and smooth. No ripping or tearing of pavement shall be permitted during removal.

2.3.2. Replacement paving shall be installed in accordance with the details on the drawings and with these specifications.

2.4. CLEARING AND GRUBBING

2.4.1. Clearing and grubbing includes, but is not limited to, removing from the project site, trees, stumps, roots, brush, structures, abandoned utilities, trash, debris and all other materials found on or near the surface of the ground in the construction area and understood by generally accepted engineering practice not to be suitable for construction of the type contemplated. Precautionary measures that will prevent damage to existing features are part of the Work.

2.4.2. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion and sedimentation control procedures.

2.4.3. The Contractor shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction over the Project. All required permits of a temporary nature shall be obtained for construction operations by the Contractor.

2.4.4. The Contractor shall furnish equipment of the type normally used in clearing and grubbing operations including, but not limited to, tractors, trucks, loaders and root rakes.

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

2.4.6. Materials to be cleared, grubbed and removed from the project site include, but are not limited to, all trees, stumps, roots, brush, trash, organic matter, paving, miscellaneous structures, houses, debris and abandoned utilities.

2.4.7. 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 two feet below the limits of excavation for structures, trenches and roadways or two feet below finish grade, whichever is lower.

2.4.8. Landscaping features shall include, but are not necessarily limited to, fences, cultivated trees, cultivated shrubbery, property corners, man-made improvements, subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features. Fences shall be provided with a gate across the permanent easement. Existing structures shall be relocated such that they are off the easement.

2.4.9. Surface rocks and boulders shall be grubbed from the soil and removed from the site if not suitable as riprap.

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

2.4.11. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.

2.4.12. All fences adjoining any excavation or embankment that, in the Contractor's opinion, may be damaged or buried, shall be carefully removed, stored and replaced. Any fencing that, in the Engineer's opinion, is significantly damaged shall be replaced with new fence material.

2.4.13. The Contractor shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, etc. situated within the limits of the construction area but not directly within excavation and/or fill limits. The Contractor shall be held liable for any damage the Contractor's operations have inflicted on such property.

2.4.14. The Contractor shall be responsible for all damages to existing improvements resulting from Contractor's operations.

2.4.15. The debris resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Contractor 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 or debris be left on the Project, shoved onto abutting private properties or buried on the Project.

2.5. QUALITY ASSURANCE

2.5.1. Density: All references to "maximum dry density" shall mean the maximum dry density defined by ASTM D 698, except that for cohesionless, free draining soils "maximum dry density" shall mean the maximum index density as determined by ASTM D 4253.

2.5.2. Determination of the density of foundation, bedding, haunching, or backfill materials in place shall meet with the requirements of ASTM D 1556, ASTM D 2922 or ASTM D 2937.

2.5.3. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specifications shall be performed by an independent testing laboratory.

2.6. SAFETY

2.6.1. Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P "Excavation, Trenching & Shoring" as described in OSHA publication 2226.

2.7. TRENCH EXCAVATION

2.7.1. The trench is divided into five specific areas:

2.7.1.1. Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.

2.7.1.2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.

2.7.1.3. Haunching: The area above the bedding or trench bottom (or foundation) and below the top of the barrel of the pipe.

2.7.1.4. Initial Backfill: The area above the haunching material and below a plane 12-inches above the top of the barrel of the pipe.

2.7.1.5. Final Backfill: The area above a plane 12-inches above the top of the barrel of the pipe.

2.7.2. Trench Foundation Materials: Crushed stone shall be utilized for trench foundation (trench stabilization) and shall meet the requirements of the Georgia Department of Transportation Specification 800.01, Group I (limestone, marble or dolomite) or Group II (quartzite, granite or gneiss). Stone size shall be between No. 57 and No. 4, inclusive.

2.7.3. Bedding and Haunching Materials:

2.7.4. Unless specified otherwise, bedding and haunching materials shall be earth materials as specified below.

2.7.5. Crushed stone utilized for bedding and haunching shall meet the requirements of the Georgia Department of Transportation Specification 800.01, Group I (limestone, marble or dolomite) or Group II (quartzite, granite or gneiss). Stone size shall be between No. 57 and No. 4, inclusive.

2.7.6. Initial Backfill

2.7.6.1. Initial backfill material shall be select earth materials or crushed stone as specified for bedding and haunching materials.

2.7.6.2. Select backfill materials shall consist of finely divided earth, stone, dust, sand, crushed stone, or other approved material carefully placed about the pipe in uniform succeeding layers not exceeding six (6) inches in thickness. Each layer shall be uniformly placed and tamped with proper hand tools in a manner which will not disturb or injure the pipe. Backfilling shall be carried on simultaneously on both sides of the pipe in a manner which will prevent injurious side pressures from occurring. If suitable select materials are not available from trench excavation, the Contractor will be required to obtain them elsewhere.

2.7.6.3. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as initial backfill material, provide select material conforming to the requirements of this Section.

2.7.7. Final Backfill

2.7.7.1. Final backfill material shall be general excavated earth materials, shall not contain rock larger than 2-inches at its greatest diameter, cinders, stumps, limbs, man-made wastes and other unsuitable materials.

2.7.7.2. If materials excavated from the trench are not suitable for use as final backfill material, provide select material conforming to the requirements of this Section.

2.7.8. Select Backfill: Select backfill shall be materials which meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.

2.7.9. Concrete

2.7.9.1. Concrete for bedding, haunching, initial backfill or encasement shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches.

2.7.9.2. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

2.7.10. Flowable Fill

2.7.10.1. Flowable fills, where required for trench backfill, shall meet the requirements of Georgia Department of Transportation Standard Specifications, Section 600 for Excavatable or Non-Excavatable type.

2.7.11. Granular Material

2.7.11.1. Granular material, where required for trench backfill, shall be sand, river sand, crushed stone or aggregate, pond screenings, crusher run, recycled concrete, or other angular material.

2.7.11.2. Granular material shall meet gradation requirements for Size No. 57 or finer.

2.8. METHODS

2.8.1. Trench Excavation.

2.8.1.1. Topsoil and grass shall be stripped a minimum of 6-inches over the trench excavation site and stockpiled separately for replacement over the finished grading areas.

2.8.2. Trench Width for Pipelines.

2.8.2.1. The sides of all trenches shall be vertical, as much as possible, to a minimum of one foot above the top of the pipe. Unless otherwise indicated on the Drawings, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.

2.8.2.2. Excavate the top portion of the trench to any width within the construction easement or right-of-way that will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.

2.8.2.3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe or manhole. The maximum allowable width of rock excavation for payment shall be based

on a trench width equal to the outside diameter of the pipe barrel plus 18-inches, but the total allowable rock excavation width for payment will not be less than 36-inches.

2.8.2.4. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher Type of bedding and haunching for the full trench width as actually cut. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the Engineer or the Utility.

2.8.3. Depth.

2.8.3.1. The trenches shall be excavated to the required depth or elevation that allow for the placement of the pipe and bedding to the dimensions shown on the Drawings.

2.8.3.2. Where rock is encountered in trenches for pipelines, 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, manhole or accessory.

2.8.4. Excavated Materials.

2.8.4.1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Topsoil shall be carefully separated and lastly placed in its original location.

2.8.4.2. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

2.9. SHEETING, BRACING AND SHORING

2.9.1. Sheeting, bracing and shoring shall be performed in any of the following instances:

2.9.1.1. Where sloping of the trench walls do not adequately protect persons within the trench from slides or cave-ins.

2.9.1.2. In caving ground.

2.9.1.3. In wet, saturated, flowing or otherwise unstable materials. The sides of all trenches and excavations shall be adequately sheeted, braced and shored.

2.9.1.4. Where necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees or private properties which are required to remain.

2.9.1.5. Where necessary to maintain the top of the trench within the available construction easement or right-of-way.

2.9.2. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970, as amended.

2.9.3. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.

2.9.4. Steel Sheeting and 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 and live loads. 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. The Contractor shall provide closure and sealing between sheet piling and existing facilities.

2.9.5. 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 haunching 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 shall 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.

2.9.6. 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 the Engineer it cannot be safely removed or is within three feet of an existing structure, utility, or pipeline. Cut off any sheeting left in place at least two feet below the surface.

2.9.7. Sheet piling within three feet of an existing structure or pipeline shall remain in place, unless otherwise directed by the Engineer.

2.10. TRENCH ROCK EXCAVATION

2.10.1. Definition of Trench Rock: Any material that cannot be excavated with conventional excavating equipment, and is removed by drilling and blasting, and occupies an original volume of at least one cubic yard.

2.10.2. Blast Monitoring: Exhaust other practical means of excavating prior to utilizing blasting as a means of excavation. Provide licensed, experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all buildings and structures from the effects of the blast. Repair any resulting damage. If the Contractor repeatedly uses excessive blasting charges or blasts in an unsafe or improper manner, the Engineer may direct the Contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.

2.10.3. Removal of Rock: Dispose of rock off site that is surplus or not suitable for use as rip rap or backfill.

2.10.4. The Contractor shall notify the Engineer prior to any blasting. Additionally, the Contractor shall notify the Engineer and local fire department before any charge is set.

2.10.5. Following review by the Engineer regarding the proximity of permanent buildings and structures to the blasting site, the Engineer may direct the Contractor to employ an independent, qualified specialty sub-contractor, approved by the Engineer, to monitor the blasting by use of a seismograph, identify the areas where light charges must be used, conduct pre-blast and post-blast inspections of structures, including photographs or videos, and maintain a detailed written log.

2.11. DEWATERING EXCAVATIONS

2.11.1. Dewater excavation continuously to maintain a water level two feet below the bottom of the trench.

2.11.2. Control drainage in the vicinity of excavation so the ground surface is properly pitched to prevent water running into the excavation. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations.

2.11.3. Where the utility crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.

2.11.4. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet below the trench bottom. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10-inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing

2.12. TRENCH FOUNDATION AND STABILIZATION

2.12.1. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.

2.12.2. If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the pipe, the trench will be determined to be unsuitable and the Engineer shall then order trench stabilization by directing the Contractor to over excavate trench bottom and fill with crushed stone.

2.12.3. Where the replacement of unsuitable material with crushed stone does not provide an adequate trench foundation, the trench bottom shall be excavated to a depth of at least two feet below the specified trench bottom. Place stabilization fabric in the bottom of the trench and support the fabric along the trench walls until the trench stabilization, bedding, haunching and pipe have been placed at the proper grade. The ends of the filter fabric shall be overlapped above the pipe.

2.12.4. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

2.13. BEDDING AND HAUNCHING

2.13.1. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders or large dirt clods.

2.13.2. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings. All bedding shall extend the full width of the trench bottom. The pipe shall be placed and brought to grade by tamping the bedding material or by removal of the excess amount of the bedding material under the pipe. Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint.

2.13.3. At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.

2.13.4. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders or dirt clods.

2.13.5. Water Mains

2.13.5.1. Ductile Iron Pipe

2.13.5.1.1. Unless otherwise shown on the Drawings or specified, utilize earth materials for bedding and haunching. Type 2, 4 and 5 bedding shall be as detailed on the Standard Drawing Details herein.

2.13.5.1.2. Unless specified or shown otherwise, bedding shall meet the requirements for Type 2 Pipe Bedding. Unless specified or shown otherwise for restrained joint pipe and fittings, bedding shall meet the requirements for Type 5 Pipe Bedding.

2.13.5.1.3. Type 4 or Type 5 Pipe Bedding called for on the Drawings, specified or ordered by the Engineer, shall meet requirements for Type 4 or Type 5 Pipe Bedding, utilizing crushed stone bedding and haunching material.

2.13.5.2. Polyvinyl Chloride Pipe

2.13.5.2.1. Unless shown otherwise on the Drawings, utilize stone materials for bedding and haunching.

2.13.5.2.2. Unless shown otherwise on the Drawings, bedding and haunching shall meet the requirements for Type 2 Pipe Bedding, as detailed on the Standard Drawing Details herein.

2.13.6. 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.

2.13.7. Excessive Width and Depth

2.13.7.1. If the trench is excavated to excess width, provide the next higher type or class of pipe bedding, but a minimum of Type 4, as detailed on the Drawings.

2.13.7.2. If the trench is excavated to excessive depth, provide crushed stone to place the bedding at the proper elevation or grade.

2.14. INITIAL BACKFILL

2.14.1. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.

2.14.2. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 12-inches above the pipe barrel. Layer depths shall be a maximum of 6-inches for pipe 18-inches in diameter and smaller and a maximum of 12-inches for pipe larger than 18-inches in diameter.

2.14.3. Backfill on both sides of the pipe simultaneously to prevent side pressures.

2.14.4. Compact each layer thoroughly with suitable hand tools or tamping equipment.

2.14.5. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless shown or specified otherwise.

2.14.6. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section for initial backfill.

2.15. CONCRETE ENCASEMENT FOR PIPELINES

2.15.1. Where concrete encasement is shown on the Drawings for pipelines, excavate the trench to provide a minimum of 12-inches clearance from the barrel of the pipe. Lay the pipe to line and grade on solid concrete blocks or solid bricks. In lieu of bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than 12-inches above the pipe bell. The trench shall not be backfilled for a period of at least 24 hours after concrete is placed.

2.16. FINAL BACKFILL

2.16.1. Backfill carefully to restore the ground surface to its original condition.

2.16.2. The top 6-inches shall be topsoil obtained as specified in the "Trench Excavation" portion of this Section.

2.16.3. Excavated material that is unsuitable for backfilling, and excess material, shall be disposed of in a manner approved by the Engineer. Surplus soil may be neatly distributed and spread over the site, if approved by the Engineer, except that surplus soil shall not be distributed and spread over the site in areas under Corps of Engineers jurisdiction. If such spreading is allowed, the site shall be left in a clean and presentable condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.

2.16.4. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

2.16.5. After initial backfill material has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:

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

2.16.5.2. In 12-inch layers, if using heavy tamping equipment, such as hammer with tamping feet.

2.16.5.3. In 24-inch layers, if using a Hydro-Hammer.

2.16.6. Settlement: If trench settles, re-fill, compact and grade the surface to conform to the adjacent surfaces.

2.16.7. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise.

2.17. ADDITIONAL MATERIAL

2.17.1. Where final grades above the pre-construction grades are required to maintain minimum cover, additional fill material will be as shown on the Drawings. 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 additional suitable fill material.

2.18. BACKFILL WITHIN RIGHT-OF-WAYS

2.18.1. Compact backfill underlying pavement and sidewalks, and backfill under dirt and gravel roads to a minimum 95 percent of the maximum dry density.

2.19. BACKFILL WITHIN GEORGIA D.O.T.RIGHT-OF-WAYS

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

2.20. FLOWABLE FILL

2.20.1. Where flowable fill is required, excavate the trench to provide a minimum of 6-inches clearance on either side of the pipe barrel. Lay the pipe to line and grade on solid concrete

blocks or bricks. In lieu of bedding, haunching and initial backfill, place flowable fill to the full width and depth of the trench.

2.20.2. Flowable fill shall be protected from freezing for a period of 36 hours after placement. Minimum temperature of flowable fill at point of delivery shall be 50 degrees F.

2.20.3. The Contractor shall provide steel plates over flowable fill in road locations.

2.21. COMPACTED GRANULAR MATERIAL

2.21.1. Where compacted granular material is required as initial and final backfill material, it shall be placed after bedding and haunching material specified elsewhere has been placed. Compacted granular material shall be compacted to a minimum 95 percent of the maximum dry density.

2.22. TESTING AND INSPECTION

2.22.1. The soils testing laboratory is responsible for the following:

2.22.1.1. Compaction tests shall be performed such that each layer shall be thoroughly tamped to a density equivalent to at least 95% of the Standard Proctor maximum dry density in accordance with ASTM D 698, as amended to date.

2.22.1.2. Field density tests for each two feet of lift, one test site between each manhole, every 100 feet within road rights-of-way, or more frequently if ordered by the Utility or the Utility's Engineer. The Utility's Engineer shall direct where density tests will be performed along the Project route.

2.22.1.3. Inspecting and testing stripped site, subgrades and proposed fill materials.

2.22.2. The Contractor's duties relative to testing include:

2.22.2.1. Notifying laboratory of conditions requiring testing.

2.22.2.2. Coordinating with laboratory for field testing.

2.22.2.3. Paying costs for additional testing performed beyond the scope of that required and for re-testing where initial tests reveal non-conformance with specified requirements.

2.22.2.4. Providing excavation as necessary for laboratory personnel to conduct tests.

2.22.3. Inspection

2.22.3.1. Earthwork operations, acceptability of excavated materials for bedding or backfill, and placing and compaction of bedding and backfill is subject to inspection by the Engineer.

2.22.3.2. Foundations and shallow spread footing foundations are required to be inspected by a geotechnical engineer, who shall verify suitable bearing and construction.

2.22.4. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.

SECTION 3: WATER MAIN PIPING

3.1. GENERAL

3.1.1. Work included under this section shall also include specific installation precautions as specified herein for a particular kind of pipe and surge blocking required for water main installation.

3.1.2. All materials used that will come into contact with drinking water during its distribution shall not adversely effect drinking water quality and the public health and must be certified for conformance with American National Standards Institute/National Sanitation Foundation Standard 61(ANSI/NSF Standard 61).

3.2. POLYVINYL CHLORIDE PIPE

3.2.1. Polyvinyl chloride (PVC) plastic pipe supplied for water main installations shall:

3.2.1.1. Be bell and ring type integral bell or gasketed coupling, supplied in 13 ft. or 20 ft. nominal laying lengths.

3.2.1.2. Meet all requirements set forth in ASTM Standard D2241 and must bear the National Sanitation Foundation (NSF) seal of approval for potable water use. All service lines must bear the NSF seal for potable water use.

3.2.1.3. Meet the approval of the American Water Works Association, meet the minimum standards of AWWA C900 DR-14 PVC pipe, which is pressure class 200 psi.

3.2.1.4. Be marked at intervals of not more than five feet with the above mentioned ratings.

3.2.1.5. Be provided with rubber rings conforming to ASTM-D-1869.

3.2.1.6. Be manufactured by J-M Manufacturing Co., Davis, Certainteed Products Corporation, or approved equal.

3.2.2. Fittings for PVC pipe shall be mechanical joint ductile iron fittings conforming to ANS1/AWWA C153, with a working pressure of 350 psi. Fittings shall be supplied with rubber transition gaskets designed for the specific purpose of jointing to SDR rated PVC pipe as needed.

3.2.3. PVC pipe shall be installed in accordance with AWWA M23 and manufacturer's written instructions.

3.3. DUCTILE IRON PIPE

3.3.1. Ductile iron pipe, where called for on the drawings, shall:

3.3.1.1. Conform to ANS1/AWWA C151/A21.51

3.3.1.2. Be Pressure Class 200 D.I.P., minimum.

3.3.1.3. Be cement lined in accordance with ANS1/AWWA C 104/A21.4

3.3.1.4. Be Type III, Grade B. and Pressure Class 200 of Federal Specification WW-P-421C

3.3.1.5. Have rubber gasket joints conforming to ANS1/AWWA C111/A21.11

3.3.2. Where Ductile Iron Pipe is joined to SDR rated PVC pipe, a ductile iron mechanical joint solid sleeve shall be used. The sleeves shall be the long pattern type with the required transition gaskets.

3.3.3. As shown on the plans or at the direction of the Utility during construction, the Contractor shall install Mega Lugs on each joint of ductile iron pipe.

3.4. SURGE BLOCKING

3.4.1. Concrete surge blocking shall be installed at all bends of 11 ¼ or greater in the pipe line, and at all fire hydrants, valves, plugs, tees, and caps. A concrete dead-man shall be required at all ends of lines as shown in Appendix D-4.

3.4.2. Surge Blocking shall be placed against firm, undisturbed earth and installed with minimum dimensions not less than shown in Appendix D-2.

3.4.3. Fire hydrants, valves, and fittings shall be installed with proper joint restraint. Threaded rods shall not be used as a means of joint restraint.

3.5. FLEXIBLE JOINT PIPE

3.5.1. When flexible joint pipe is required for stream crossings and indicated on the plans, the pipe shall be ductile iron pipe conforming to ANS1/AWWA C151/A21.51, designed for a water working pressure of 350 psi.

3.5.2. The restrained joint fittings shall meet the requirements of ANS1/AWWA C110/A21.10 and/or C153/A21.43 and be capable of being deflected after assembly. Pipe shall be TR Flex manufactured by U. S. Pipe or approved equal.

SECTION 4 – WATER VALVES AND SPECIALTIES

4.1. GENERAL

4.1.1. The work included in this section consists of the installation of valves, fire hydrants, and service connections.

4.1.2. Surge blocking at valves and fire hydrants shall be installed according to details and dimensions given in Appendix D-2A and D-2B.

4.1.3. Excavation for all specialties shall be stabilized with gravel or sand cushion, if necessary due to unsuitable foundation conditions and tamped. Surge blocking shall be provided after the item is placed, and backfill shall be hand or mechanically tamped in no more than 6" lifts.

4.1.4. Depth adjustment shall be provided for valve boxes, and valves to be set in roadways or paved areas shall be adjusted to finished surfaces.

4.1.5. Detection wire shall be installed along the length of PVC pipe as shown on the plans (not required if D.I.P. is used). It shall be THHN 12 gauge (minimum) solid copper wire, and shall form a single electrical conductor along the length of the pipe. Each splice shall be made with copper split bolt wire connectors and completely wrapped in electrical tape. Wire shall be wrapped around each hydrant barrel and main line valve box, accessible for direct connection of locating equipment to the wire (see valve and hydrant details, Appendix D). If the connections or wire is broken during installation of the pipe, the Contractor will be required to excavate and make the repairs. Metallic detection tape shall not be acceptable.

4.2. GATE VALVES

4.2.1. Gate valves shall be located as shown on the drawings and installed as detailed on the drawings complete with cast iron valve boxes and concrete pad. Any valve which is installed on pipe having a depth of cover of more than 5 feet shall be provided with a permanently installed valve stem extension and guide.

4.2.2. Gate valves shall:

4.2.2.1. Conform to the latest revision of AWWA-C509.

4.2.2.2. Be resilient seated valves.

4.2.2.3. Have non-rising stem with "O"-ring seals.

4.2.2.4. Have cast iron, bronze mounted bodies.

4.2.2.5. Have rubber-covered gates.

4.2.2.6. Open to the left.

4.2.2.7. Have mechanical-joint type connections.

4.2.3. Contractor shall locate each valve by measurements to two prominent terrain features or structures (i.e., center of road, fire hydrant, power pole). Each measurement should be taken, as perpendicular to the other as possible and a record of these location distances shall be submitted to the owner at the conclusion of the work. The sketch of each location shall be neatly drawn on a separate 5" x 7" card and shall be considered part of and referenced to as-built drawings.

4.2.4. Valves shall be manufactured by Mueller.

4.3. TAPPING SLEEVES AND TAPPING VALVES

4.3.1. The contractor will furnish and install tapping sleeves and valves suitable for connection to the existing water mains at locations indicated in the drawings. The City of Monroe will test tapping after installation.

4.4. AIR RELEASE VALVES

4.4.1. Air release valves shall be installed where shown on the plans and as shown in Appendix D-10. It shall be designed to exhaust small quantities of air which collect in the line while operation under pressure.

4.4.2. Valve shall have a 1-inch inlet and operate by float and compound lever with an orifice size of 7/32 inches. Valve shall be designed for a minimum working pressure of 200 psi.

4.4.3. Valve shall be an APCO, Model No. 200A or approved equal.

4.5. FIRE HYDRANTS

4.5.1. Fire hydrants shall meet the requirements of the latest revision of AWWA Specification C-502.

4.5.2. Fire hydrants shall have a 4 ½ inch valve opening, two 2 ½ inch hose nozzles and one 4 ½ inch pumper nozzle.

4.5.3. All fire hydrants shall have 6 inch gate valves as specified above and shall be located as shown on the drawings and installed as shown in Appendix D-3.

4.5.4. Each fire hydrant shall have a 6-inch diameter PVC lead with a minimum cover of 3 ft.

4.5.5. Hydrants shall be compression type, non-freezing, provided with safety flange and coupling, and may be oil or grease lubricated. Drain mechanism shall be simple, positive, and automatic in operation.

4.5.6. The safety flange on barrel and safety coupling on valve stem shall be constructed so as to reduce damage to barrel and stem in case of traffic accident. The force of impact shall break the flange and spread the coupling. The construction of flange and coupling shall be such as to permit rapid and inexpensive replacement of the hydrants. Traffic flanges shall be located at or close to the ground line.

4.5.7. Fire hydrants shall be Mueller.

4.6. RESIDENTIAL SERVICE CONNECTIONS

4.6.1. The work covered by this Section includes furnishing all materials and equipment, providing all required labor and installing water service connections and all appurtenant work according to these Specifications and/or to the Water Connection Detail as shown schematically on the Detail Drawings in the Appendix herein.

4.6.2. Water meters are not to be furnished nor installed. However, the water meter connection must be compatible with the water meters currently used by the Utility.

4.6.3. No galvanized pipe or fittings shall be used on water services.

4.6.4. Service Lines

4.6.4.1. Non-metallic Tubing: Non-metallic tubing used for services shall be CTS Tubing PE 3408-C-3-SDR-9-200-PSI @ 73 Fahrenheit conforming to ASTMD 2737, AWWA C901, and as manufactured by Charter Plastics, Inc.

4.6.4.2. Copper Tubing: Tubing shall be ASTM B 88, Type K, rolled type. Fittings shall be brass with flare connection inlets and outlets, ANSI B16.26. Where required, adapters shall be brass. Unions shall be cast bronze. Joints shall be flare type. All fittings shall be of bronze construction with flare type connections.

4.6.4.2. Provide detection wire over all service lines. Detection wire shall be installed along the length of the pipe as shown on the plans. It shall be THHN 12 gauge solid copper wire, and shall form a single electrical conductor along the length of the pipe. Each splice shall be made with split bolt wire connectors and completely wrapped in electrical tape. Wire shall be wrapped around each hydrant barrel and main line valve box, accessible for direct connection of locating equipment to the wire (see valve and hydrant details, Appendix D). If the connections or wire is broken during installation of the pipe, the Contractor will be required to excavate and make the repairs. Metallic detection tape shall not be acceptable.

4.6.4.3. Copper tubing between tap and water meter shall be one continuous length of pipe with no intermediate joints or connections. The service line shall be placed without sharp turns or bends from the water main to the meter box.

4.6.4.4. When meters are located on the opposite side of the street from the water main, new copper service lines shall be extended through a common 6-inch bore, Schedule 160 PVC conduit to the service side. Replacement of existing services may be by free bore without a casing.

4.6.4.5. Water services (meter box installation only) shall be made in accordance to Drawing D-11 in the Appendix. Meter boxes must be set to grade. The City of Monroe will not install the water meter if the meter box is found not set to grade.

4.6.5. Valves and Accessories

4.6.5.1. Ball valves shall be full port bronze, heavy duty type. Valve ends shall be threaded. Valves shall have a minimum 200 psi working pressure for water. Valves shall have stainless steel nut and handle. Valves shall be made in the U.S.A.

4.6.5.2. Corporation Cocks

4.6.5.2.1. Corporation cocks shall be ground key type, shall be made of bronze conforming to ASTM B61 or B62 and shall be suitable for the working pressure of the system. Ends shall be suitable for flare type joint. Coupling nut for connection to flared copper tubing shall conform to ANSI B16.26.

4.6.5.2.2. Corporation cocks shall be Ford FB-600-4.

4.6.6. Immediately following completion of the water main system, the Contractor shall install water taps and meter boxes for each planned lot of the subdivision. All taps shall remain exposed at the main until the system has been successfully inspected, disinfected and tested for pressure.

4.6.7. Installation shall conform to the details for water service connections appearing schematically on the Drawings. Contractor shall provide any and all appurtenant work required to provide the intended water service connections.

4.6.8. The Contractor shall be prepared to make emergency repairs to the water system, if necessary, due to damage by others working in the area. In conjunction with this requirement, the Contractor shall furnish and have available at all times, a tapping machine, for the purpose of making temporary water service taps or emergency repairs to damaged water services. The Contractor shall furnish the Utility with the phone number of an individual with the authority to initiate emergency repair work. This number must be provided prior to starting work on the project.

4.6.9. All residential services connected to water main shall be through a 1-inch direct tap, regardless of service and meter size.

4.6.10. The water main shall be tapped with a tapping machine specifically designed for that purpose. The tap shall be a direct tap into the water main through a 1-inch brass corporation cock. All taps shall be supervised by the Utility. All taps shall be made on the water main at a position so as not to be the top side of the pipe nor the bottom of the pipe. Distance between taps must be a minimum of 24-inches apart and a minimum of 24" from the bell of the pipe.

4.6.11. Relocation of Service Lines

4.6.11.1. Relocate the existing meter to the new right-of-way limits and reconnect to the house service. Existing meters already located at the new right-of-way limits will not need relocating.

4.6.11.2. Before disconnecting the existing meter, the existing corporation in the main shall be closed. All existing meters and meter boxes shall be removed, if not already located at the right-of-way, reinstalled and reconnected as indicated on the Drawings.

4.6.11.3. Existing service lines shall be field-located by the Contractor. The Contractor shall be responsible for locating existing water meters, relocating the meters and meter boxes as necessary, and determining the existing size service line to reconnect the meters to the new water mains. All service lines installed under existing pavement, including streets, driveways and sidewalks, shall be installed by boring.

4.6.11.4. Immediately before connecting to the relocated or existing meter, all service lines shall be flushed to remove any foreign matter. Any special fittings required to reconnect the existing meter to the new copper service line, or the existing private service line, shall be provided by the Contractor. To minimize out of service time, the Contractor shall determine the connections to be made and have all the required pipe and fittings on hand before shutting off the existing service. After completing the connection, the new corporation stop shall be opened and all visible leaks shall be repaired.

4.6.11.5. The tap, service line and meter box shall remain under the developer's maintenance responsibility for the same warranty period as the water main. The developer shall promptly repair any damage to the water system during the warranty period.

4.7. WATER QUALITY SAMPLING STATIONS

4.7.1. Sampling Stations:

4.7.2. Sampling Stations shall be buried 3 ft. with a ¾" FIP inlet, and a ¾" unthreaded nozzle. All stations shall be enclosed in a lockable, non-removable, aluminum-cast housing. When opened, the station shall require no key for operation, and the water flow in an all brass waterway. All working parts will also be of brass and be removable from above ground with no digging.

4.7.3. A copper vent tube will enable each station to be pumped free of standing water to prevent freezing and to minimize bacteria growth. The exterior piping shall be galvanized, and exterior cover shall be painted green. The unit shall be an Eclipse No. 88 sampling station as manufactured by Kupferle Foundry (800-231-3990), or approved equal. See detail drawing D-16 in Appendix D.

4.8. INSPECTION

4.8.1. All valves, fire hydrants, service lines, and connections shall be subject to inspection and approval by the Utility Inspector.

4.8.2. All pipe trenches, hydrant connections, and valves shall be left completely uncovered for approval by the inspector before back-filling. If any portion of the water line trench is back-filled before the installation is approved by the inspector, the Contractor shall re-excavate the trench for inspection and re-back fill at his own expense.

4.9. VALVE MARKERS

4.9.1. Contractor shall furnish and install valve markers for all main line valves. Concrete type set at right-of-way limits and distance stamped in feet shall be acceptable.

4.10. LARGE RESIDENTIAL (MULTI-FAMILY) OR COMMERCIAL WATER METERS

4.10.1. Water meters 4-inch and larger shall be installed in a concrete vault as detailed on drawing D-17 in Appendix D.

4.10.2. Meter vaults shall be located out of traffic areas whenever possible. Meters that must be located such that they are subject to vehicle loads (i.e., parking lot, driveway, etc.) shall be equipped with traffic rated cast-in-place frame and water-tight access cover(s).Meter vaults not subject to vehicle loads shall have an aluminum BilCo-type access hatch with cast-in-place aluminum frame and lockable latch.

4.10.3. Meter vaults shall be water-tight and have concrete bottoms sloping to a drain hole that empties to a gravel sump below the bottom slab.

4.10.4. On commercial developments, the City of Monroe's responsibility for maintenance and repair of waterlines stops at the vault or right-of-way.

4.10.5. All individual lots or units shall have their own individual water and sewer taps. (i.e. no master meters)

SECTION 5 - HIGHWAY & RAILROAD CROSSINGS

5.1. GENERAL

5.1.1. Work included in this section of the specifications consists of the installation of water and/or sewer pipe and appurtenances across highway rights-of-way and railroad rights-of-way.

5.1.2. Work performed on rights-of way controlled by the Georgia Department of Transportation shall be done only after obtaining written permission or permits from the Department of Transportation. Work performed on railroad rights-of-way shall be done only after obtaining written permission from the railroad company.

5.1.3. It generally shall be the responsibility of the Contractor to notify the Department of Transportation Field Engineer or the responsible party with the railroad before performing any work in right-of-way controlled by or owned by these entities.

5.1.4. All work performed in crossing highways shall be in strict accordance with the specifications published by the Georgia Department of Transportation. Work performed in crossing railroads shall be in general conformance with standards published by the American Railroad Engineering Association and with any specific requirements of the railroad owner which may be stated as a condition of the permit.

5.2. CASING

5.2.1. All dirt road, improved road, railroad and highway crossings shall be cased in steel pipe with a nominal diameter not less that the nominal diameter of the carrier pipe plus 6 inches. Casing shall be new and unused pipe. The steel plate shall also meet the chemical requirements of ASTM A 36. Casing pipe shall be plain, uncoated steel, having a yield strength not less than 36,000 psi, and manufactured in conformance with the following general specifications:

5.2.1.1. AWWA C201 "Fabricated Elect. Welded Steel Water Pipe"

5.2.1.2. AWWA C202 "Mill-Type Steel Water Pipe"

5.2.1.3. ASTM A53 "Welded and Seamless Steel Pipe"

5.2.2. Pipe used for casing shall conform to the minimum wall thickness indicated in Tables 5-1 and 5-2.

5.2.3. The thickness of casing shown below in Tables 5-1 and 5-2 are minimum thicknesses. Actual thickness shall be determined by the casing installer, based on its evaluation of the required forces to be exerted on the casing when jacking. Any buckling of the casing due to jacking forces shall be repaired at no additional cost to the Utility.

5.2.4. The diameters of casing shown in Tables 5-1 and 5-2 herein and shown on the Drawings are minimums. Larger casings, with the Engineer's approval, may be provided at no additional cost to the Utility, for whatever reasons the Contractor may decide, whether casing size availability, line and grade tolerances, soil conditions, etc.

Table 5-1: Railroad Crossing Criteria

Under Railroads		
Pipe Diameter, inches	**Casing Diameter, inches**	**Wall Thickness, inches**
6	14	0.282
8	18	0.313
10	20	0.344
12	22	0.375
14	24	0.407
16	30	0.469
18	30	0.469
20	32	0.501
24	36	0.532
30	42	0.563
36	48	0.688
42	54	0.813
48	60	0.876
54	66	1.000
60	72	1.125
64	76	1.125

Table 5-2: Highway Crossing Criteria

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
18	30	0.312
20	30	0.312
24	36	0.375
30	42	0.375
36	48	0.500
42	56	0.500
48	60	0.500
54	66	0.750
60	72	0.750
64	78	1.000

5.2.5. Casing Spacers: Casing spacers shall meet one of the following requirements:

5.2.5.1. Casing spacers shall be flanged, bolt-on style with a two-section stainless steel shell lined with a PVC liner, minimum 0.09-inch thick also having a hardness of 85-90 durometer. Runners shall be attached to stainless steel risers which shall be properly welded to the shell. The height of the runners and risers shall be manufactured such that the pipe does not float within the casing. Casing spacers shall be Cascade Waterworks Manufacturing Company or Advanced Products & Systems, Inc.

5.2.5.2. Casing spacers shall be a two-section, flanged, bolt on style constructed of heat fused PVC coated steel, minimum 14 gauge band and 10 gauge risers, with 2-inch wide glass reinforced polyester insulating skids, heavy duty PVC inner liner, minimum 0.09-inch thick having a hardness of 85-90 durometer, and all stainless steel or cadmium plated hardware shall be Pipeline Seal and Insulator, Inc.

5.2.6. Grout: Grout may be used for filling the void between the casing pipe and the carrier pipe. Cement shall conform to ASTM C 150, Type I or Type II. Grout shall have a minimum compressive strength of 100 psi attained within 24 hours.

5.2.7. Carrier Pipe: Carrier pipes shall meet requirements as specified in the following:

5.2.7.1. After construction of the casing is complete, and has been accepted by the Engineer, install the pipeline in accordance with the Drawings and Specifications.

5.2.7.2. Check the alignment and grade of the casing and prepare a plan to set the pipe at proper alignment, grade and elevation, without any sags or high spots.

5.2.7.3. The carrier pipe shall be held in the casing pipe by means of casing spacers and shall conform to the following requirements:

5.2.7.3.1. The casing spacers shall adhere to the specifications described above in Section 5.2.5.

5.2.7.3.2. The pipe shall be supported within the casing by use of casing spacers sized to limit radial movement to a maximum of 1-inch. Provide a minimum of one casing spacer per nominal length of pipe. Casing spacers shall be attached to the pipe at maximum 18 to 20-foot intervals.

5.2.7.4. Close the ends of the casing with 4-inch brick walls.

5.2.8. Surface Settlement Markers: Surface settlement markers within pavement areas shall be P.K. nails. Surface settlement markers within non-paved areas shall be wooden hubs.

5.3. CASING INSTALLATION

5.3.1. Shaft

5.3.1.1. Conduct boring and jacking operations from a shaft excavated at one end of the section to be bored. Where conditions and accessibility are suitable, place the shaft on the downstream end of the bore.

5.3.1.2. The shaft shall be rectangular and excavated to a width and length required for ample working space. If necessary, sheet and shore shaft properly on all sides. Shaft sheeting shall be timber or steel piling of ample strength to safely withstand all structural loadings of whatever nature due to site and soil conditions. Keep preparations dry during all operations. Perform pumping operations as necessary. The contractor is responsible for the proper design and safety of the bore pits and shafts.

5.3.1.3. The bottom of the shaft shall be firm and unyielding to form an adequate foundation upon which to work. In the event the shaft bottom is not stable, excavate to such additional depth as required and place a gravel sub-base or a concrete sub-base if directed by the Engineer due to soil conditions

5.3.2. Jacking Rails and Frame

5.3.2.1. Set jacking rails to proper line and grade within the shaft. Secure rails in place to prevent settlement or movement during operations. The jacking rails shall cradle and hold the casing pipe on true line and grade during the progress of installing the casing.

5.3.2.2. Place backing between the heels of jacking rails and the rear of the shaft. The backing shall be adequate to withstand all jacking forces and loads.

5.3.2.3. The jacking frame shall be of adequate design for the magnitude of the job. Apply thrust to the end of the pipe in such a manner to impart a uniformly balanced load to the pipe barrel without damaging the joint ends of the pipe

5.3.3. Boring and jacking of casing pipes shall be accomplished by the dry auger boring method without jetting, sluicing or wetboring.

5.3.4. Auger the hole and jack the casing through the soil simultaneously.

5.3.5. Bored installations shall have a bored-hole diameter essentially the same as the outside diameter of the casing pipe to be installed.

5.3.6. Execute boring ahead of the casing pipe with extreme care, commensurate with the rate of casing pipe penetration. Boring may proceed slightly in advance of the penetrating pipe and shall be made in such a manner to prevent any voids in the earth around the outside perimeter of the pipe. Make all investigations and determine if the soil conditions are such as to require the use of a shield.

5.3.7. Any casing pipe damaged in jacking operations shall be repaired, if approved by the Engineer, or removed and replaced at Contractor's own expense.

5.3.8. Lengths of casing pipe, as long as practical, shall be used except as restricted otherwise. Joints between casing pipe sections shall be butt joints with complete joint penetration, single groove welds, for the entire joint circumference, in accordance with AWS recommended procedures. Prior to welding the joints, the Contractor shall ensure that both ends of the casing sections being welded are square.

5.3.9. The Contractor shall prepare a contingency plan which will allow the use of a casing lubricant, such as bentonite, in the event excessive frictional forces jeopardize the successful completion of the casing installation.

5.3.10. Once the jacking procedure has begun, it should be continued without stopping until completed, subject to weather and conditions beyond the control of the Contractor.

5.3.11. Care shall be taken to ensure that casing pipe installed by boring and jacking method will be at the proper alignment and grade.

5.3.12. Adequate sheeting, shoring and bracing for embankments, operating pits and other appurtenances shall be placed and maintained to ensure that work proceeds safely and expeditiously. Upon completion of the required work, the sheeting, shoring and bracing shall be left in place, cut off or removed, as designated by the Engineer.

5.3.13. Trench excavation, all classes and types of excavation, the removal of rock, muck, debris and the excavation of all working pits are discussed in Section 2 of this document. The following further discusses the Backfilling requirements.

5.3.13.1. Selected Backfilling: All trenches shall be backfilled immediately after pipes are laid therein and joints have been inspected, unless other protection of the pipe line is directed. Selected backfill material shall consist of finely divided earth, stone dust, sand, crushed stone, or other approved material carefully placed about the pipe and up to a height of at least eighteen inches (18") above the top of the pipe barrel, in uniform layers not exceeding six inches (6") (not compacted) in thickness. Each layer shall be uniformly placed and tamped with proper hand tools in a manner which will not disturb or injure the pipe. Backfilling shall be carried on simultaneously on both sides of the pipe in a manner which will prevent injurious side pressures from occurring. If suitable select materials are not available from trench excavation, the Contractor will be required to obtain them elsewhere.

5.3.13.2. General Backfilling: After selected backfill material has been placed and tamped, the remainder of the trench may be backfilled with general excavated material, except that no rock, unless in small shattered fragments, will be permitted to be mixed with other backfill material. Each layer shall be thoroughly tamped to a density equivalent to at least 95% of the Standard Proctor maximum dry density in accordance with ASTM D 698, as amended to date.

Backfill material shall be placed in uniform layers not exceeding six inches (6") in thickness, with each layer thoroughly compacted with heavy duty tampers ("Whacker" or equal) to a height of at least thirty six inches (36") or forty eight (48") above the top of the pipe barrel. The remainder of the ditch may be backfilled and tamped in the same manner or if the Contractor so elects he may place backfill in layers not exceeding twelve inches (12") and use wheel loading or heavy duty power tamping equipment ("Hydro-Hammer" or equal). Pipe shall have at least thirty six inches (36") of cover before wheel loading and at least forty-eight inches (48") of cover before using heavy duty tamping equipment ("Hydro-Hammer" or equal). If suitable general backfill materials are not available from trench excavation to permit 95% compaction, the Contractor shall be required to obtain them elsewhere.

5.3.14. All surplus material shall be removed from the right-of-way and the excavation finished flush with the surrounding ground.

5.3.15. Grout backfill shall be used for unused holes or abandoned pipes.

5.3.16. Any replacement of carrier pipe in an existing casing shall be considered a new installation, subject to the applicable requirements of these Specifications.

5.4. FREE BORING

5.4.1. Where the Drawings indicate a pipeline is to be installed by boring without casing, the Contractor shall construct the crossing by the free bore method. The free bore method shall be accomplished by the dry auger boring method without jetting, sluicing, or wet boring. Free boring may or may not be approved by the Utility during plan review and its use shall be minimized.

5.4.2. The diameter of the free bore shall not exceed the pipe bell outside diameter or the pipe barrel outside diameter plus 1-inch, whichever is greater.

5.4.3. Free boring, where indicated on the Drawings, is to be performed at the Contractor's option. The Contractor may choose to construct the crossing by the conventional bore and jack casing methodology.

5.4.4. The Contractor shall be responsible for any settlement of the roadway caused by the free bore construction activities.

5.5. VENTILATION AND AIR QUALITY

5.5.1. Provide, operate and maintain for the duration of casing project a ventilation system to meet safety and OSHA requirements.

5.6. ROCK EXCAVATION

5.6.1. In the event that rock is encountered during the installation of the casing pipe which, in the opinion of the Engineer, cannot be removed through the casing, the Engineer may authorize the Contractor to complete the crossing by a method established in a change order at no additional costs to the Utility.

5.6.2. At the Contractor's option, the Contractor may continue to install the casing and remove the rock through the casing at no additional cost to the Utility.

5.7. INSTALLATION OF PIPE

5.7.1. The carrier pipe shall be held in the casing pipe and installed according to the specifications discussed in Section 5.2.7.

5.8. SHEETING REMOVAL

5.8.1. Remove sheeting used for shoring from the shaft and off the job site. The removal of sheeting, shoring and bracing shall be done in such a manner as not to endanger or damage either new or existing structures, private or public properties and also to avoid cave-ins or sliding in the banks.

5.9. HIGHWAY CROSSINGS

5.9.1. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the highway right-of-way and posting of appropriate permits.

5.9.2. Work along or across the highway department rights-of-way shall be subject to inspection by such highway department. All installations shall be performed to leave free flows in drainage ditches, pipes, culverts or other surface drainage facilities of the highway, street or its connections.

5.9.3. No excavated material or equipment shall be placed on the pavement or shoulders of the roadway without the express approval of the highway department.

5.9.4. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed, which are placed on the right-of-way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the roadway.

5.9.5. The Contractor shall be responsible for providing the Utility sufficient information to obtain a blasting permit in a timely manner.

5.10. RAILROAD CROSSINGS:

5.10.1. The Contractor shall secure permission from the Railroad to schedule work so as not to interfere with the operation of the Railroad.

5.10.2. Additional insurance should be obtained as required by the Railroad for each railroad crossing. The Contractor shall furnish the Railroad with such additional insurance as may be needed, cost of the same shall be borne by the Contractor. To obtain a permit for a bore under a CSX Railroad, the Contractor must acquire a Comprehensive General Liability policy with combined single limit of at least $3,000,000 or higher if required by CSX. The Contractor is required by the Railroad to file a copy of the policy showing a 30 day notice of cancellation to CSX Transportation with the permit application.

5.10.3. All work on the Railroad right-of-way, including necessary support of tracks, safety of operations and other standard and incidental operation procedures may be under the supervision of the appropriate authorized representative of the Railroad affected and any decisions of this representative pertaining to construction and/or operations shall be final and construction must be governed by such decisions.

5.10.4. If, in the opinion of the Railroad, it becomes necessary to provide flagging protection, watchmen or the performance of any other work in order to keep the tracks safe for traffic, the Contractor shall coordinate such work and shall reimburse the Railroad, in cash, for such services, in accordance with accounting procedures agreed on by the Contractor and affected Railroad before construction is started.

5.10.5. No blasting shall be permitted within the Railroad right-of-way.

5.11. OPEN CUT ROAD CROSSINGS

5.11.1. Pipe and casing installed by open-cut across dirt and improved roads shall be bedded in a shaped trench and backfilled with 6" layers of select backfill, with each layer being mechanically or hand tamped before placement of the following layer. Backfill shall be tamped to the full depth of the trench. Paving replacement for open-cut trenching shall be in accordance with the Pavement Patch details shown in Appendix D-13.

5.11.2. Casing laid in open trench across roadway shall have a minimum cover of 48 inches under the pavement and a minimum depth of cover under ditch bottoms of 30 inches.

5.11.3. Casing length shall be equal to the width of the pavement plus a minimum of 10ft. on each side of the pavement.

5.12. BORED CROSSINGS

5.12.1. Unless specifically shown otherwise on the plans, all paved road and highway crossings shall be bored and cased with casing and carrier pipe sizes as specified on the plans.

5.12.2. Bore pits shall be excavated in a location so as to minimize the disturbance of fences, yards, driveways, etc. Bore pits shall be kept entirely within the DOT and/or county rights-of way unless specific permission has been granted from the land owner and the Authority for the excavation of a bore pit on private property.

5.12.3. Casing shall have a minimum depth of 4 ft. under the pavement surface and a minimum of 36 inches of cover at the ditch line. Under no circumstances shall either end of the casing be more than 6 ft. under the pavement surface unless specifically approved by the Utility.

5.12.4. Following construction, the Contractor shall be responsible for backfilling and bringing to original grade any pits used for boring. Backfill placed in bore pits shall be satisfactorily compacted so as to prevent settlement. Contractor shall be responsible for dressing, shaping, and re-seeding as required to restore shoulders, ditch lines, and slopes to a condition as close as possible to the original condition before construction. The Contractor shall maintain such disturbed areas until adequate ground cover is established to stabilized slopes and ditch lines.

5.13. GROUNDWATER CONTROL

5.13.1. The Contractor shall control the groundwater throughout the construction of the casing.

5.13.2. Methods of dewatering shall be at the option and responsibility of the Contractor. Maintain close observation to detect settlement or displacement of surface facilities due to dewatering. Should settlement or displacement be detected, notify the Engineer immediately and take such action as necessary to maintain safe conditions and prevent damage.

5.13.3. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24 hour basis keeping excavations free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum. Dewater to comply with the requirements specified in the following:

5.13.3.1. Dewater excavation continuously to maintain a water level two feet below the bottom of the trench.

5.13.3.2. Control drainage in the vicinity of excavation so the ground surface is properly pitched to prevent water running into the excavation.

5.13.3.3. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations. Where the utility crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property.

5.13.3.4. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.

5.13.3.5. Where dewatering is performed by pumping the water from a sump, crushed stone shall be used as the medium for conducting the water to the sump. Sump depth shall be at least two feet below the bottom of the trench, Pumping equipment shall be of sufficient quantity and/or capacity to maintain the water level in the sump two feet below the bottom of the trench. Pumps shall be a type such that intermittent flows can be discharged. A standby pump shall be required in the event the operating pump or pumps clog or otherwise stop operation.

5.13.3.6. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet below the trench bottom. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10-inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing.

5.14. SURFACE SETTLEMENT MONITORING

5.14.1. Provide surface settlement markers for casings 24-inches in diameter and larger. Place marker as specified and as directed by the Engineer. The Contractor shall place settlement markers outside of pavement area, along the centerline of the casing at 20 foot intervals and offset 10 feet each way from the centerline of the casing. Markers shall also be placed at each shoulder of the roadway, at each edge of pavement, at the centerline of the pavement and at 10 and 25 feet in each direction from the centerline of the casing. Tie settlement markers to bench marks and indices sufficiently removed as not to be affected by the casing operations.

5.14.2. Make observations of surface settlement markers, placed as required herein, at regular time intervals acceptable to the Engineer. In the event settlement or heave on any marker exceeds 1-inch, the Contractor shall immediately cease work and using a method approved by the Engineer and the authority having jurisdiction over the project site, take immediate action to restore surface elevations to that existing prior to start of casing operations.

5.14.3. Take readings and permanently record surface elevations prior to start of dewatering operations and/or shaft excavation. The following schedule shall be used for obtaining and recording elevation readings: all settlement markers, once a week; all settlement markers within 50 feet of the casing heading, at the beginning of each day; more frequently at the Engineer's direction if settlement is identified. Make all elevation measurements to the nearest 0.01 foot.

5.14.4. The Contractor shall cooperate fully with jurisdictional personnel. Any settlement shall be corrected by, and at the expense of, the Contractor.

5.14.5. Promptly report any settlement and horizontal movement immediately to the Engineer and take immediate remedial action.

5.15. SAFETY

5.15.1. The Contractor shall provide all necessary bracing, bulkheads and shields to ensure complete safety to all traffic, persons and property 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.

5.15.2. The Contractor shall observe all applicable requirements of the regulations of the authorities having jurisdiction over this site. Conduct the operations in such a manner that all work will be performed below the level of the roadbed.

5.15.3. The Contractor shall perform all activities in accordance with the Occupational Safety and Health Act of 1970 (PL-596), as amended, applicable regulations of the Federal Government, OSHA 29CFR 1926 and applicable criteria of ANSI A10.16-81, "Safety Requirements for Construction of Tunnel Shafts and Caissons".

5.15.4. The Contractor shall be equipped with sufficient orange traffic cones, warning signs, safety vests, flags, barricades and warning lights to control and direct traffic around the work area and to provide for the safety of the workmen.

5.15.5. All materials, equipment, and traffic control plans used shall meet the general requirements of the "Georgia Manual for Uniform Traffic Control Devices for Streets and Highways" as published by the Department of Transportation.

5.16. REMOVING AND REPLACING PAVEMENT

5.16.1. The work to be performed under this Section shall consist of removing and replacing existing pavement in paved areas where such have been removed for construction of utilities and appurtenances.

5.16.2. Existing pavement, sidewalks and curbs shall be replaced to the current City/County standards or to match existing, whichever is more stringent.

5.16.3. If required by the Utility or Engineer, provide certificates stating that materials supplied comply with Specifications. Certificates shall be signed by the asphalt producer and the Contractor.

5.16.4. Weather Limitations

5.16.4.1. Apply bituminous tack coat only when the ambient temperature in the shade has been at least 50 degrees F for 12 hours immediately prior to application.

5.16.4.2. Do not conduct paving operations when surface is wet or contains excess of moisture which would prevent uniform distribution and required penetration.

5.16.4.3. Construct asphaltic courses only when atmospheric temperature in the shade is above 40 degrees F, when the underlying base is dry and when weather is not rainy.

5.16.4.4. Place base course when air temperature is above 35 degrees F and rising.

5.16.5. Grade Control: Establish and maintain the required lines and grades for each course during construction operations.

5.16.6. Graded Aggregate Base Course: Graded aggregate base course shall be of uniform quality throughout and shall meet the requirements of Section 815.01 of the Georgia Department of Transportation Standard Specifications.

5.16.7. Black Base: Black base course shall be of uniform quality throughout and shall conform to the requirements of Section 828 of the Georgia Department of Transportation Standard Specifications.

5.16.8. Bituminous Tack Coat: The bituminous tack coat shall conform to the requirements of Section 400 of the Georgia Department of Transportation Standard Specifications.

5.16.9. Surface Course: The surface course for all asphaltic concrete pavement shall conform to the requirements of Section 400, Type "F" of the Georgia Department of Transportation Standard Specifications.

5.16.10. Concrete: Provide concrete and reinforcing for concrete pavement or base courses in accordance with the requirements of the Georgia Department of Transportation Standard Specifications, Section 430.

5.16.11. Special Surfaces: Where driveways or roadways are disturbed or damaged which are constructed of specialty type surfaces, e.g., brick or stone, these driveways and roadways shall be restored utilizing similar, if not original, materials. Where the nature of these surfaces dictate, a specialty contractor shall be used to restore the surfaces to their previous or better condition. Special surfaces shall be removed and replaced to the limits to which they were disturbed.

5.16.12. All existing pavement removed, destroyed or damaged by construction shall be replaced with the same type and thickness of pavement as that existing prior to construction, unless otherwise directed by the Engineer. Materials, equipment and construction methods used for paving work shall conform to the Georgia Department of Transportation specifications applicable to the particular type required for replacement, repair or new pavements.

5.16.13. Aggregate Base: Aggregate base shall be constructed in accordance with the requirements of Section 310 of the Georgia Department of Transportation Standard Specifications. The maximum thickness to be laid in a single course shall be 6 inches compacted. If the design thickness of the base is more than 6-inches, it shall be constructed in two or more courses of approximate equal thickness. After the material placed has been shaped to line, grade and cross-section, it shall be rolled until the course has been uniformly compacted to at least 100 percent of the maximum dry density when Group 2 aggregate is used, or to at least 98 percent of maximum dry density when Group 1 aggregate is used.

5.16.14. Concrete Pavement: Concrete pavement or base courses shall be replaced with concrete. The surface finish of the replaced concrete pavement shall conform to that of the existing pavement. The surface of the replaced concrete base course shall be left rough. The slab depth shall be equivalent to the existing concrete pavement or base course, but in no case less than 6-inches thick. Transverse and longitudinal joints removed from concrete pavement shall be replaced at the same locations and to the same types and dimensions as those removed. Concrete pavements or concrete base courses shall be reinforced.

5.16.15. Asphaltic Concrete Base, Bituminous Tack Coat and Surface Course: Asphaltic concrete base, tack coat and surface course construction shall conform to Georgia Department of Transportation Standard Specifications, Section 400. The pavement mixture shall not be spread until the designated surface has been previously cleaned and prepared, is intact, firm, properly cured, dry and the tack coat has been applied. Apply and compact the base in maximum layer thickness by asphalt spreader equipment of design and operation approved by the Engineer. After compaction, the black base shall be smooth and true to established profiles and sections. Apply and compact the surface course in a manner approved by the Engineer. 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.

5.16.16. Surface Treatment Pavement: Bituminous penetration surface treatment pavement shall be replaced with a minimum thickness of 1-inch conforming to Section 424, Georgia Department of Transportation Standard Specifications.

5.16.17. Gravel Surfaces: Existing gravel road, drive and parking area replacement shall meet the requirements of graded aggregate base course. This surfacing may be authorized by the Engineer as a temporary surface for paved streets until replacement of hard surfaced pavement is authorized.

5.16.18. Temporary Measures: During the time period between pavement removal and complete replacement of permanent pavement, maintain highways, streets and roadways by the use of steel running plates anchored to prevent movement. The backfill above the pipe shall be compacted, as specified in Section 2 of these Specifications, up to the existing

pavement surface to provide support for the steel running plates. All pavement shall be replaced within seven calendar days of its removal.

5.16.19. The Contractor shall maintain the surfaces of roadways built and pavements replaced until the acceptance of the Project. Maintenance shall include replacement, scraping, reshaping, wetting and rerolling as necessary to prevent raveling of the road material, the preservation of reasonably smooth surfaces and the repair of damaged or unsatisfactory surfaces, to the satisfaction of the Engineer. Maintenance shall include sprinkling as may be necessary to abate dust from the gravel surfaces.

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

5.16.21. Obtain the Engineer's approval of restoration of pavement, such as private roads and drives, that are not the responsibility of a regulatory agency.

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

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

5.17. SIDEWALK AND CURB REPLACEMENT

5.17.1. Gravel: The work to be performed under this Section shall consist of removing and replacing existing sidewalks and curbs in paved areas where such have been removed for construction of utilities and appurtenances.

5.17.2. All concrete sidewalks and curbs shall be replaced with concrete.

5.17.3. Preformed joints shall be 1/2-inch thick, conforming to the latest edition of AASHTO M 59 for sidewalks and AASHTO M 123 for curbs.

5.17.4. Forms for sidewalks shall be of wood or metal, shall be straight and free from warp, and shall be of sufficient strength, when in place, to hold the concrete true to line and grade without springing or distorting.

5.17.5. Forms for curbs shall be metal and of an approved section. They shall be straight and free from distortions, showing no vertical variation greater than 1/8-inch in 10 feet and no lateral variation greater than 1/4-inch in 10 feet from the true plain surface on the vertical face of the form. Forms shall be of the full depth of the structure and constructed such to permit the inside forms to be securely fastened to the outside forms.

5.17.6. Securely hold forms in place true to the lines and grades indicated on the Drawings.

5.17.7. Wood forms may be used on sharp turns and for special sections, as approved by the Engineer. Where wooden forms are used, they shall be free from warp and shall be the nominal depth of the structure.

5.17.8. All mortar and dirt shall be removed from forms and all forms shall be thoroughly oiled or wetted before any concrete is deposited.

5.17.9. When a section is removed, the existing sidewalk or curb shall be cut to a neat line, perpendicular to both the centerline and the surface of the concrete slab. Existing concrete shall be cut along the nearest existing construction joints; if such joints do not exist, the cut shall be made five feet back.

5.17.10. Existing concrete sidewalks and curbs that have been cut and removed for construction purposes shall be replaced with the same width and surface as the portion removed. Sidewalks shall have a minimum uniform thickness of 4-inches. The new work shall be neatly jointed to the existing concrete so that the surface of the new work shall form an even, unbroken plane with the existing surfaces.

5.17.11. The subgrade shall be formed by excavating to a depth equal to the thickness of the concrete, plus 2-inches. Subgrade shall be of such width as to permit the proper installation and bracing of the forms. Subgrades shall be compacted by hand tamping or rolling. Soft, yielding or unstable material shall be removed and backfilled with satisfactory material. Place 2-inches of porous crushed stone under all sidewalks and curbs and compacted thoroughly, then finish to a smooth, unyielding surface at proper line, grade and cross section.

5.17.12. Joint for Curbs

5.17.12.1. Joints shall be constructed to match existing and as specified. Construct joints true to line with their faces perpendicular to the surface of the structure and within 1/4-inch of their designated position.

5.17.12.2. Thoroughly spade and compact the concrete at the faces of all joints filling all voids.

5.17.12.3. Install expansion joint materials at the point of curve at all street returns. Install expansion joint material behind the curb at abutment to sidewalks and adjacent structures.

5.17.12.4. Place contraction joints every 10 feet along the length of the curbs and gutters. Form contraction joints using steel templates or division plates which conform to the cross section of the structure. Leave the templates in place until the concrete has set sufficiently to hold its shape, but remove them while the forms are still in place. Contraction joint templates or plates shall not extend below the top of the steel reinforcement or they shall be notched to permit the reinforcement to be continuous through the joint. Contraction joints shall be a minimum of 1-1/2-inches deep.

5.17.12.5. Expansion joints shall be required to replace any removed expansion joints or in new construction wherever shown on the Drawings. Expansion joints shall be true and even, shall present a satisfactory appearance, and shall extend to within 1/2-inch of the top of finished concrete surface.

5.17.13. Finishing

5.17.13.1. Strike off the surface with a template and finish the surface with a wood float using heavy pressure, after which, contraction joints shall be made and the surface finished with a wood float or steel trowel.

5.17.13.2. Finish the face of the curbs at the top and bottom with an approved finishing tool of the radius to match existing.

5.17.13.3. Finish edges with an approved finishing tool having a 1/4-inch radius.

5.17.13.4. Provide a final broom finish by lightly combing with a stiff broom after troweling is complete.

5.17.13.5. The finished surface shall not vary more than 1/8-inch in 10 feet from the established grade.

5.17.14. Driveway and Sidewalk Ramp Openings

5.17.14.1. Provide driveway openings of the widths and at the locations indicated on the Drawings and as directed by the Engineer.

5.17.14.2. Provide sidewalk ramp openings to match existing in conformance with the applicable regulations and as directed by the Engineer.

5.17.15. Joint for Curbs: Concrete shall be suitably protected from freezing and excessive heat. It shall be kept covered with burlap or other suitable material and kept wet until cured. Provide necessary barricades to protect the work. All damage caused by people, vehicles, animals, rain, the Contractor's operations and the like shall be repaired by the Contractor, at no additional expense to the Utility.

5.18. CLEANING

5.18.1. The Contractor shall remove all surplus excavation materials and debris from the street surfaces and rights-of-way and shall restore street, roadway or sidewalk surfacing to its original condition.

SECTION 6 – WATER MAIN TESTING & DISINFECTING

6.1. GENERAL

6.1.2. All branches of the new water distribution system shall be disinfected by chlorination, and shall be pressure tested by the Contractor before acceptance of work by the owner. Disinfection of water lines and the disposal of heavily chlorinated water following disinfection must be accomplished in accordance with AWWA Standard C651 (latest revision) and the guidelines established by the Georgia EPD.

6.1.3. The system shall not be disinfected and tested by sections as the pipe laying work progresses. Sections which have not been disinfected shall not be tied in with previously disinfected sections of the system.

6.1.4. The Contractor shall notify the Utility at least 48 hour prior to disinfecting and testing of any part of the system and shall provide all necessary supplies, equipment, labor, and apparatus for conduction the tests. An City of Monroe inspector MUST be present during flushing AND during pressure test.

6.2. LEAKAGE & PRESSURE TEST

6.2.1 Each line of the new piping in the system shall be subjected to a test pressure of 200 pounds per square inch gauge. The duration of each pressure test shall be 2 hours. If the pressure drops during the test, repairs are to be made and the test repeated.

6.2.2 At the option of the Inspector, the Contractor shall perform a leakage test. The duration of each leakage test shall be 24 hours, and during the test the system shall be subjected to a pressure of 200 pounds per square inch gauge or system pressure, whichever is higher.

6.2.3 All tests shall be performed before any part of the system is connected to the tested portion of system, and shall, in general, conform to AWWA Standard C 600-82. All results shall be witnessed by the City of Monroe Representative.

Table 6-1: Leakage Allowance (Gallons per hour per 1,000 feet of pipe)

Pipe Diameter	Pressure 150 PSI
8"	0.74 Gal
10"	0.92 Gal
12"	1.10 Gal

6.2.4 A twin gasket coupling is two joints. A single gasket is one joint.

6.3 DISINFECTING AND SAMPLING

6.3.1 All branches of the new distribution system shall be disinfected by chlorination, and shall be pressure tested by the Contractor before acceptance of work by the owner. Disinfection of all new mains in the system shall be as follows:

6.3.2 All new water lines must be disinfected using the procedure outlined in the AWWA Standard for Disinfecting Water Mains (ANSI/AWWA C651-99).

6.3.3 Mains must be adequately flushed to clean out construction debris prior to chlorination.

6.3.4 Mains must pass the pressure test prior to chlorination.

6.3.5 Prior to chlorination, the person who will chlorinate a new line must submit to the City of Monroe the calculations he/she used to determine the type and amount of chemicals needed for the chlorination as well as an explanation of the procedure that will be used for the chlorination. See Drawing D-19 for the Typical Chlorination Detail. The procedure can be adjusted, if necessary, with the prior approval of a City of Monroe representative.

6.3.6 During chlorination a back-flow prevention device must be employed to protect the distribution system from contamination with the heavily chlorinated solution used to disinfect the line. A double check valve assembly or a reduced pressure zone assembly should be used for this purpose. See Drawing D-19 for the Typical Chlorination Detail.

6.3.7 The City of Monroe personnel must be present, once chlorination equipment is set up but prior to the onset of chlorination, to observe the equipment and procedure used.

6.3.8 The water used to disinfect the new line shall be chlorinated so that after a 24 hour holding period in the main there will be a free chlorine residual of not less than 10mg/l prior to the line being flushed. The City of Monroe personnel will analyze the chlorine content of the water prior to flushing to verify the required 10mg/l concentration is present. If <10mg/l chlorine is present the line must be re-chlorinated and rechecked.

6.3.9 After chlorination and holding period the line must be flushed until the chlorine residual of the water leaving the main is no higher than that generally found in the distribution system (i.e., at least 2.0 mg/l). The City of Monroe personnel must be contacted to confirm the chlorine level is within the acceptable range or if further flushing is necessary. To facilitate the procedure, please contact the City of Monroe so we can check the chlorine content before the flushing crew leaves the site.

6.3.10 The valve that feeds the chlorination must stay closed during testing. Tampering during chlorination testing could result in fines.

6.3.11 Dispose of heavily chlorinated water per current EPA requirements.

6.3.12 The newly disinfected line must pass two consecutive bacteriological tests with samples taken at least 24 hours apart in order to be approved for use. The line is not to be flushed between the collection of these two sample sets. The person who collects the sample will make certain to run the hydrant or sample line long enough to get a representative sample.

6.3.13 Samples for bacteriological analysis on the new line are to be collected at least every 1200 feet, plus one sample at the end of the line and one sample from each branch off

the line. Samples are to be analyzed in accordance with *Standard Methods for the Examination of Water and Wastewater* and shall show the absence of coliform bacteria.

6.3.14 If initial disinfection fails to produce a satisfactory bacteriological result or if other water quality factors are affected, the main may be reflushed and resampled. If the bacteriological result is still unsatisfactory the main must be re-chlorinated until acceptable bacteriological results are obtained.

6.3.15 In locations where hydrants are not available and at the request of the Utility, the contractor shall install a ¾" tap with two corporation stops and sufficient service tubing for acquiring a sample. Once testing is complete, both corporation stops shall be shut off and the tubing shall be coiled up inside of a meter box installed flush with the ground surface.

NOTE: All chlorine analyses must be done using an EPA approved method.

From AWWA Standard for Disinfecting Water Mains:

Sec. 4.2 Basic Disinfection Procedure

The basic disinfection procedure consists of:

1. Inspecting all materials to be used to ensure the integrity of the materials.
2. Preventing contaminating materials from entering the water main during storage, construction, or repair and noting potential contamination at the construction site.
3. Removing, by flushing or other means, those materials that may have entered the water main.
4. Chlorinating any residual contamination that may remain, and flushing the chlorinated water from the main.
5. Protecting the existing distribution system from backflow caused by hydrostatic pressure test and disinfection procedures.
6. Documenting that an adequate level of chlorine contacted each pipe to provide disinfection.
7. Determining the bacteriological quality by laboratory test after disinfection.
8. Final connection of the approved new water main to the active distribution system.

New Water Main Information Checklist

Date:_____

Subdivision/Road Name: _____

Contractor Name: _____Phone #: _____

1. Road Name: _____

A. Pipe length: _____

B. Pipe Diameter: _____

C. Number of Branches off main line: _____

D. Construction Debris Flush Date: _____

I affirm the construction debris was flushed from the above indicated pipe per The City of Monroe's specifications and on the date stated in D above.

Name: _____ **Title:** _____

E. Pressure Test Acceptance Date_____

I affirm the above indicated pipe was pressure tested per The City of Monroe's specifications and met The City of Monroe's requirements on the date stated on E above.

Name: _____ **Title:** _____

F. Chlorination Date_____

1. Chlorine Concentration used_____
2. 24hr chlorine concentration_____
3. Is repeat chlorination necessary? Y / N
4. Post-flushing chlorine concentration_____

I affirm the above indicated pipe was chlorinated per The City of Monroe's specifications and met The City of Monroe's requirements on the date stated on F above.

Name: _____ **Title:** _____

G. Bacteriological Analysis

1. Date_____ Result_____
2. Date_____ Result_____
3. Is repeat flushing and bacteriological analysis necessary? Y / N
4. Is repeat chlorination necessary? Y / N

I affirm the above indicated pipe has passed the required 2 bacteriological sample sets as indicated in G above.

Name: _____ **Title:** _____

SECTION 7 – SEDIMENTATION AND EROSION CONTROL

7.1. GENERAL

7.1.1. The Contractor is responsible for providing all materials and labor necessary to meet the erosion control requirements when constructing new water and sewer infrastructure and related work. Temporary erosion controls, include, but are not limited to, grassing, mulching, watering and reseeding on-site surfaces and spoil and borrow area surfaces, and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the Official Code of Georgia 12-7-1, DNR Rules 391-3-7, EPD General Permits, and relevant local ordinances.

7.1.2. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, filter stone and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the Federal Clean Water Act of 1987, as amended.

7.1.3. Land disturbance activity shall not commence until the Building Permit has been issued, which authorizes land disturbance activities. The Contractor's construction plans shall include a Sedimentation and Erosion Control Plan that has been prepared and stamped by a Professional Engineer.

7.1.4. Temporary Erosion and Sedimentation Control: In general, temporary erosion and sedimentation control procedures shall be directed toward:

7.1.4.1. Preventing soil erosion at the source.

7.1.4.2. Preventing silt and sediment from entering any waterway if soil erosion cannot be prevented.

7.1.4.3. Preventing silt and sediment from migrating downstream in the event it cannot be prevented from entering the waterway.

7.1.5. Permanent Erosion Control: Permanent erosion control measures shall be implemented to prevent sedimentation of the waterways and to prevent erosion of the Project site.

7.2. BASIC PRINCIPLES

7.2.1. Conduct the earthwork and excavation activities in such a manner to fit the topography, soil type and condition.

7.2.2. Minimize the disturbed area and the duration of exposure to erosion elements.

7.2.3. Stabilize disturbed areas immediately.

7.2.4. Safely convey run-off from the site to an outlet such that erosion will not be increased off site.

7.2.5. Retain sediment on site that was generated on site.

7.2.6. Minimize encroachment upon watercourses.

7.3. MONITORING

7.3.1. Discharges of storm-water runoff from disturbed areas shall be controlled using Best Management Practices (BMP) as defined by the Georgia Erosion and Sedimentation Act, Chapter 391-3-7, latest revision. Turbidity of receiving waters shall be monitored as provided for in OCGA 12-7-1.

7.4. PRODUCTS

7.4.1. Temporary Erosion And Sedimentation Control Materials.

7.4.2. Silt Fence: Silt fence shall meet the requirements of Section 171 - Temporary Silt Fence of the Department of Transportation, State of Georgia, Standard Specification, latest edition. Silt fence fabric must be on the Georgia DOT Qualified Product List.

7.4.3. Hay bales shall be clean, seedfree cereal hay type.

7.4.4. Netting shall be 1/2-inch, galvanized steel, chicken wire mesh.

7.4.5. Filter stone shall be crushed stone conforming to Georgia Department of Transportation Table 800.01H, Size Number 3.

7.4.6. Concrete block shall be hollow, non-load-bearing type.

7.4.7. Plywood shall be 3/4-inch thick exterior type.

7.4.8. Installation of silt fence shall be as shown in Appendix drawing D-14. When the accumulated silt covers the silt fence to the point that only 12 inches of fabric is showing the accumulated silt shall be removed and placed back in the construction area.

7.4.9. Rip Rap: 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 greater. Rip rap shall have less than 66 percent wear when tested in accordance with AASHTO T-96. Unless shown or specified otherwise, stone rip rap shall be Type 1 rip rap. Type 1 rip rap shall be such that the largest pieces shall have a maximum volume of two cubic feet. At least 35 percent of the mass shall be comprised of pieces which weigh 125 pounds or more. The remainder shall be well graded down to the finest sizes. Rock fines shall comprise a maximum of 10 percent of the total mass. Rock fines are defined as material passing a No. 4 sieve. Rip rap size shall conform to Georgia Department of Transportation Section 805.01 Stone Dumped Rip Rap, Type 1. All Type 3 rip rap shall be such that the largest pieces shall have a maximum approximate volume of one cubic foot. At least 35 percent of the mass shall be comprised of pieces that weigh 15 pounds or more. The remainder shall be well graded down to the finest sizes. Rock fines shall comprise a maximum of 10 percent of the total mass. Rock fines are defined as material passing a No. 4 sieve. Rip rap size shall conform to Georgia Department of Transportation Section 805.01 Stone Dumped Rip Rap, Type 3. 200 Pound rip rap shall be such that the minimum weight of individual stones shall be 200 pounds.

7.4.10. Filter Fabric: The filter fabric for use under rip rap shall be a monofilament, woven fabric or a non-woven fabric meeting the specifications as established by Task Force 25 for the Federal Highway Administration. The filter fabric shall have an equivalent opening size (EOS) of 70. Filter fabric under rip rap shall be equal to Mirafi, Amoco or Exxon.

7.4.11. Concrete: Concrete shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

7.5. METHODS

7.5.1. Temporary Erosion and Sedimentation Control: Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt and sediment from entering the creeks. An undisturbed natural buffer, extending a minimum of 25 feet from the top of the bank is required. Any disturbance within the 25-foot buffer will require a variance from the Georgia EPD. Obtaining required stream buffer variances will be the sole responsibility of the Contractor.

7.5.2. Silt dams, silt fences, traps, barriers, check dams, appurtenances and other temporary measures and devices shall be installed as indicated on the approved plans and working drawings, shall be maintained until no longer needed, and shall then be removed. Deteriorated hay bales and dislodged filter stone shall be replaced with new materials. Detention ponds, if constructed, shall be maintained in a condition ensuring that unfiltered water will not leave the pond.

7.5.3. Where permanent grassing is not appropriate, and where the Contractor's temporary erosion and sedimentation control practices are inadequate, the Engineer may direct the Contractor to provide temporary vegetative cover with fast growing seedings. Such temporary vegetative cover shall be provided by the Contractor in compliance with the Manual for Erosion and Sedimentation Control in Georgia, specifically in the selection of species, planting dates and application rates for seedings, fertilizer and mulching, with the exception that kudzu shall not be permitted.

7.5.4. All erosion and sedimentation control devices, including check dams, shall be inspected by the Contractor at least weekly and after each rainfall occurrence and cleaned out and repaired by the Contractor as necessary.

7.5.5. Temporary erosion and sedimentation control devices shall be installed and maintained from the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

7.5.6. Permanent Erosion Control

7.5.6.1. Permanent erosion control shall include:

7.5.6.1.1. Restoring the work site to its original contours, unless shown otherwise on the Drawings or directed by the Engineer.

7.5.6.1.2. Permanent vegetative cover shall be performed in accordance with Section 7.6 of this document.

7.5.6.1.3. Permanent stabilization of steep slopes and creeks shall be performed in accordance with Section 7.7 of this document.

7.5.6.2. Permanent erosion control measures shall be implemented as soon as practical after the completion of pipe installation or land disturbance for each segment of the Project. In no event shall implementation be postponed when no further construction activities will impact that portion or segment of the Project. Final Approval may be denied for those portions of the Project not complying with this requirement.

7.6. GRASSING

7.6.1. General: All references to grassing, unless noted otherwise, shall relate to establishing permanent vegetative cover as specified herein for seeding, fertilizing, mulching, etc.

7.6.1.1. When final grade has been established, all bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized and mulched in an effort to restore to a protected condition. Critical areas shall be sodded as approved or directed by the Engineer.

7.6.1.2. Specified permanent grassing shall be performed at the first appropriate season following establishment of final grading in each section of the site.

7.6.1.3. Permanent grassing shall be of a perennial species.

7.6.2. Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Where sod is removed or damaged, replant such areas using sod of the same species of grass at the first appropriate season. Outside of residential or landscaped areas, grass the entire area disturbed by the work on completion of work in any area. In all areas, promptly establish successful stands of grass.

7.6.3. Grassing activities shall comply with the Manual for Erosion and Sediment Control in Georgia, specifically for the selection of species, with the exception that kudzu shall not be permitted, 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 must return to the site (at the appropriate season) to install permanent vegetation in areas that have received temporary vegetative cover.

7.6.4. The Contractor shall be responsible for maintaining all seeded areas including mowing, watering, and reseeding defective areas until a satisfactory stand of grass is accomplished and final acceptance of the work by the Utility is obtained. Areas showing evidence of settlement or erosion shall be rebuilt and reseeded as required.

7.7. RIP RAP

7.7.1. Unless shown otherwise on the Drawings, rip rap shall be placed where ordered by the Engineer, at all points where banks of streams or drainage ditches are disturbed by

excavation, or at all points where natural vegetation is removed from banks of the streams or drainage ditches. Carefully compact backfill and place rip rap to prevent subsequent settlement and erosion. This requirement applies equally to construction along side a stream or drainage ditch as well as crossing a stream or drainage ditch.

7.7.2. When trenching across a creek, place rip rap a distance of 10 feet upstream and 10 feet downstream from the top of the trench excavation. Place rip rap across creek bottom, across creek banks and extend rip rap placement five feet beyond the top of each creek bank.

7.7.3. Preparation of Foundations: The ground surface upon which the rip rap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before placement is commenced. Where filling of depressions is required, the new material shall be compacted with hand or mechanical tampers. Unless at creek banks or otherwise shown or specified, rip rap shall begin in a toe ditch constructed in original ground around the toe of the fill or the cut slope. The toe ditch shall be two feet deep in original ground, and the side next to the fill or cut shall have that same slope. After the rip rap is placed, the toe ditch shall be backfilled and the excess dirt spread neatly within the construction easement.

7.7.4. Placement of Filter Fabric: The surface to receive fabric shall be prepared to a relatively smooth condition free from obstructions, depressions and debris. The fabric shall be placed with the long dimension running up the slope and shall be placed to provide a minimum number of overlaps. The strips shall be placed to provide a minimum width of one foot of overlap for each joint. The filter fabric shall be anchored in place with securing pins of the type recommended by the fabric manufacturer. Pins shall be placed on or within 3-inches of the centerline of the overlap. The fabric shall be placed so that the upstream strip overlaps the downstream strip. The fabric shall be placed loosely so as to give and therefore avoid stretching and tearing during placement of the stones. The stones shall be dropped no more than three feet during construction. The fabric shall be protected at all times during construction from clogging due to clay, silts, chemicals or other contaminants. Any contaminated fabric or any fabric damaged during its installation or during placement of rip rap shall be removed and replaced with uncontaminated and undamaged fabric at no expense to the Utility.

7.7.5. Placement of Rip Rap

7.7.5.1. Rip rap shall be placed on a 6-inch layer of proper filter stock (soil, crushed stone or sand) overlaying the filter fabric. This 6-inch layer shall be placed to maximize the contact between the soil beneath the filter fabric and the filter fabric. Rip rap shall be placed with its top elevation conforming with the finished grade or the natural slope of the stream bank and stream bottom.

7.7.5.2. Stone rip rap shall be dumped into place to form a uniform surface and to the thickness specified on the Drawings. The thickness tolerance for the course shall be -6-inches and +12-inches. If the Drawings or the Bid do not specify a thickness, the course shall be placed to a thickness of not less than 18-inches.

7.8. STORM WATER DISCHARGE PERMIT

7.8.5. The Contractor will be responsible for preparing an Erosion and Sedimentation Plan as required by the The City of Monroe. The plan shall be submitted to the City for review and issuance of a Land Disturbance Permit No construction activities can commence until the Erosion and Sedimentation Plan has been submitted and a Land Disturbance Permit Issued.

7.8.6. The Contractor shall prepare and submit a plan that provides for an appropriate and comprehensive system of best management practices required by the "Manual for Erosion and Sediment Control in Georgia" and by the Georgia Water Quality Control Act and the Federal Clean Water Act. It is intended that the Contractor shall be the only primary permitee.

7.8.7. The Contractor will be responsible for requirements of the permit issued by the City including, but not limited to, installation and maintenance of all erosion control measures, inspections, inspection reports, measuring rainfall, sampling, analysis, monitoring reports and modifications to the plan.

SECTION 8 - SEWER AND APPURTENANCES

8.1. SEWER PIPE

8.1.1. Quality and Inspection: Latitude in workmanship and finish allowed by ASTM notwithstanding, all pipe shall have smooth exterior and interior surfaces; be first quality, be free from cracks, blisters, and other imperfections, and be true to theoretical shapes and forms throughout each length. Pipe shall be subject to inspection by the Engineer at the pipe plant, trench, and other points of delivery for the purpose of culling and rejecting pipe, independent of laboratory tests, which does not conform to the requirements of this section. Pipe that does not conform will be so marked by the engineer, and shall not be used in the work. On-the-job repairing of rejected pipe will not be permitted.

8.1.2. Experience of Manufacturer: The pipe manufacturer shall submit evidence, if required, of having consistently produced pipe and joints of the quality specified herein, and which have exhibited satisfactory performance results in service over a period of not fewer than two years. The pipe manufacturer and the pipe manufacturing process shall be subject to approval by the engineer.

8.2. POLYVINYL CHLORIDE (PVC) SEWER PIPE AND FITTINGS

8.2.1. Polyvinyl Chloride (PVC) Sewer Pipe: Polyvinyl Chloride (PVC) sewer pipe shall be bell and spigot pipe, shall be in lengths not exceeding 20 ft. laying lengths and shall have minimum wall thickness conforming to ASTM D 3034 under the classification for SDR 26 pipe, as amended to date. Polyvinyl chloride (PVC) sewer pipe fittings shall be bell and spigot or bell and plain end and shall conform to ASTM D 3034, as amended to date.

8.2.2. Markings: PVC pipe shall be marked at intervals of 5 ft. or less with the following information: manufacturer's name or trademark, plan code, date of manufacture, nominal pipe size, PVC cell classification, the legend "Type PSM SDR 26 PVC Sewer Pipe" and ASTM designation D 3034. Fittings shall be marked with the following information: manufacturer's name or trademark, nominal size, designations PVC and PSM and ASTM designation D 3034. All markings shall remain legible during normal handling, storage and installation.

8.2.3. Certification: The Contractor shall furnish the Engineer with a written statement from the manufacturer that all pipe and fittings furnished have been sampled, tested and inspected in accordance with ASTM D 3034, as amended to date. Each certification so furnished shall be signed by an authorized agent of the manufacturer.

8.2.4. Joints: The pipe shall be made and joined with an integral bell, bell-and-spigot rubber gasketed joint. Each integral bell joint shall consist of a formed bell complete with a single rubber gasket. Gaskets shall conform to ASTM F 417, as amended to date. Joints shall meet the requirements specified in ASTMD 3212, as amended to date.

8.2.5. Service Branch Connection for PVC Pipe: Service branch connection for PVC pipe shall consist of molded or fabricated "T" or "Y" branch fitting with all gasketed connections. Taps will not be permitted. Cemented mitered connections without socket reinforcement shall be used.

8.3. DUCTILE IRON SEWER PIPE AND FITTINGS

8.3.1. The Contractor shall furnish iron pipe and fittings for sewer construction as follows:

8.3.2. Ductile Iron Pipe: Pipe shall be centrifugally cast and shall conform to ANSI Specification A21.51 (AWWA C151) as amended to date, with mechanical or push-on joints and laying lengths of at least 18 ft. with minimum Class 200 wall thickness for all pipe unless indicated otherwise herein and/or the drawings.

8.3.3. Fittings: Fittings shall be cast from gray or ductile iron and shall conform to ANSI Specifications A 21.10 (AWWA C 110) as amended to date. All fittings shall have standard mechanical joints. Fittings for pipe sizes through 24 inch shall be Class 350 and for fittings above 24-inch through 48-inch shall be Class 250.

8.3.4. Lining and Coating: Pipe and fittings shall be cement-lined (standard thickness) inside and bituminous coated outside, in accordance with the applicable provisions of ANSI Specification A 21.4 (AWWA C 104) and, ANSI A 21.51 (AWWA C 151), as amended to date. The inside cement lining shall be treated with a bituminous seal coat.

8.3.5. Weights and Marking: Weights of pipe and fittings shall conform strictly to the requirements to ANSI specifications. The class designations for the various classes of pipe and fittings shall be cast on fittings in raise numerals, and cast or stamped on the outside of each joint of pipe. Weights shall be plainly and conspicuously painted in white on the outside of each joint of pipe and each fitting after the exterior coating has hardened.

8.3.6. Certification: The manufacturer of iron pipe and fittings shall furnish both the engineer and the owner with certified reports stating that inspection and specified tests have been made and that the results thereof comply with the applicable ANSI specification for each.

8.4. PRECAST CONCRETE MANHOLES

8.4.1. The Contractor shall furnish precast concrete manholes as follows:

8.4.2. Precast Concrete Manholes: Precast concrete manholes shall consist of precast reinforced concrete riser sections, concentric top section and a base section conforming to typical details shown on detail drawings. Precast manhole sections shall be manufactured in accordance with ASTM C 478, as amended to date, and these specifications. Concrete shall have a minimum compressive strength of 4,000 psi when tested in accordance with ASTM C 39, as amended to date. Steel reinforcement shall be as specified in ASTM C 478, as amended to date. Wall and bottom section shall have a minimum thickness of five inches (5").

8.4.3. Base Sections: Base sections for precast concrete manholes shall have a bottom poured monolithically with the walls. Base sections shall be furnished with inside diameters of 4, 5, and 6 feet as required. Base sections shall be furnished with a minimum height of 24 inches for pipes having a diameter of 8, 10, 12 inches and a minimum height of 36 inches for pipes having a diameter of 15 or 18 inches. Minimum height for 5 or 6 ft diameter base sections shall be 48 inches regardless of

pipe size. Base sections with 5 or 6 ft inside diameters shall be reduced to 4 ft inside diameter by means of an adapter ring or transition top. The openings in the base section for the accommodation of the pipe shall be cast to closely conform to job conditions and shall provide a minimum clearance of three inches (3") between the inside bottom of the base and outside bottom of the pipe barrel.

8.4.4. Riser Sections: The riser sections shall be furnished in a minimum of six inch (6") increments and shall be four ft (4') in diameter with (a) tongue and groove joint to be sealed with approved butyl rubber or bitumastic material or (b) O-ring gasket type joint conforming to ASTM C 443, as amended to date. The gasket joint shall be thoroughly cleaned of all loose materials and brushed with an approved epoxy to give a smooth surface free of any honeycomb.

8.4.5. Alteration to Manholes: In the event that the manhole has to be altered after delivery to the job site the contractor may, with permission of the engineer, core and grout the opening with a non-shrink grout..

8.4.6. Repaired and Patched Sections: Repaired and patched sections will not be acceptable unless each individual section so repaired or patched shall first have been inspected and approved by the engineer for repair and patching at the manhole plant. Repairs to and patching of O-ring grooves and shoulders will not be permitted.

8.4.7. Absorption: Absorption shall not exceed 9% when determined in accordance with ASTM C497, as amended to date.

8.4.8. Testing and Stamping: An inspection, by an independent testing laboratory approved by the engineer, of the manufacturer's plant and product will be required to assure conformity of the precast manholes to these specifications, and the minimum requirements of ASTM C 478, as amended to date. Each section of precast concrete manhole shall be stamped with the laboratory's stamp. Each stamped section shall indicate the laboratory's configuration that it was accepted in accordance with applicable ASTM specifications. Job site inspection shall be visual for shape, uniformity, and density.

8.5. MANHOLE BRICK

8.5.1. Manholes shall be constructed of pre-cast concrete only as described in Section 8.4 herein. Brick manhole construction will not be permitted. Raising ring and cover assemblies up to grade may be accomplished with brick, using a maximum of three (3) courses of brick. Brick may be used in the construction of manhole inverts only. Brick used for this purpose shall be whole, hard-burned, common brick conforming to ASTM C 32 Grade MS, as amended to date.

8.6. STEEL PIPE CASING

8.6.1. The Contractor shall furnish steel pipe casing and related materials as follows:

8.6.2. Steel Pipe Casing: Steel pipe casing shall be manufactured from steel conforming to ASTM A 252 grade 2, as amended to date, with a minimum yield strength of 35,000 psi before cold forming. Pipe may be straight seam or spiral weld. A protective coating will not be required.

8.6.3. Diameter and Wall Thickness: The diameter and wall thickness of steel pipe casing shall be shown on the drawings.

8.7. UNLOADING, HAULING, DISTRIBUTING AND STORING PIPE AND RELATED MATERIALS

8.7.1. The Contractor shall unload, haul, distribute and store pipe and related materials as outlined in the following paragraphs.

8.7.2. Unloading: Equipment and facilities for unloading, hauling, distributing and storing materials shall be furnished by the Contractor and shall at all times be available for use in unloading materials. Delays in unloading railroad cars, unloading trucks, or hauling from freight terminal which incur demurrage, truck waiting charges or terminal charges shall be at the expense of the Contractor.

8.7.3. Handling: Pipe, fittings and other material shall be carefully handled so as to prevent breaking and/or damage. Pipe may be unloaded individually by hand but shall not be unloaded by rolling or dropping off of trucks or cars. Preferred unloading is in units using mechanical equipment, such as forklifts, cherry pickers or front end loaders with forks. If fork lift equipment is not available, units may be unloaded with use of spreader bar on top and nylon strips or cables (cushioned with rubber hose sleeve) looped under the unit.

8.7.4. Distributing: Materials shall be distributed and placed so as to least interfere with traffic. No street or roadway may be closed without first obtaining permission of the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets, and roadways upon which material is distributed. No distributed materials shall be placed in drainage ditches.

8.7.5. Storage: All pipe fittings and other materials which cannot be distributed along the route of the work shall be stored for subsequent use when needed. The Contractor shall make his own arrangements for the use of storage areas.

8.7.6. PVC Pipe: PVC pipe must be stockpiled on level ground. If pipe is unloaded individually by hand, timbers must be used under the pipe for a base, spaced the same as factory load, with stop blocks nailed at either end. Stockpile must be built up the same manner as it was stocked for shipment, transferring dunnage and chock blocks from load to stockpile. Individual lengths of pipe shall not be stacked in piles any higher than five feet (5'). If pipe is unloaded, in units, the units must be placed on level ground and shall not be stacked more than two (2) units high. Units must be protected by dunnage in the same way they were protected while loaded on the truck or car. The dunnage must support the weight of all units so that pipe lengths do not carry the weight of the unit loaded above. If pipe is to be stored outside and exposed to sunlight for a number of months, the pipe must be protected by covering with canvas or other opaque material. The cover shall be loose enough to allow for air circulation around the pipe. The use of clear plastic sheets will not be permitted.

8.8. ORDER OF WORK:

8.8.1. The owner reserves the right to accept and use portions of the work when it is considered to be in the public's interest to do so.

8.9. INSPECTION:

8.9.1. All work done and material furnished shall be subject to inspection by the Utility's authorized representative. Improper work shall be reconstructed and materials which do not conform to the requirements of this section shall be removed from the work upon notice being received from the Utility of the rejection of those materials. The Utility shall have the right to mark rejected materials and/or the Contractor shall segregate said materials to distinguish them as such.

8.10. ORGANIZATION OF WORK

8.10.1. The Contractor shall so organize his work that back-filling and cleanup shall closely follow pipe laying operations and manhole construction only after inspection.

8.10.2. In general, not more that one block of a street or roadway shall be closed for construction at any one time. Before proceeding with trenching operations in a succeeding block, the proceeding section shall be back-filled, cleanup completed, and the street opened to traffic.

8.10.3. For work outside the streets and roadways, back-filling, and windowing, in accordance with the provisions of "General Back-filling" paragraph shall be performed in such manner that not more than five hundred (500') feet of trench shall remain open at any one time.

8.10.4. Failure on the part of the Contractor to comply with the above provisions in a reasonable manner, in the opinion of the engineer, shall be sufficient cause for the engineer to order a temporary shut down of further trenching and pipe laying operations until the provisions have been met.

8.11. CLEARING

8.11.1. The Contractor shall perform all clearing necessary for installation of the complete work. Clearing shall consist of removing all trees, stumps, roots, brush, and debris in the way of the work. All combustible material shall be completely burned or otherwise disposed of in a satisfactory manner. Burning shall be in accordance with local regulations.

8.12. EXCAVATION

8.12.1. Perform all excavation of every description and of whatever substance encountered to the depth shown or specified, or both, for all sewers, manholes, piers, conduit, and other appurtenances. Excavation shall be accomplished by open cut, unless otherwise directed. No tunneling shall be done.

8.12.2. The top portion of the sewer pipe trenches may have sloping or vertical sides to widths which will not cause damage to adjoining structures, roadways, pavements, utilities, and private property. For untimbered trenches and trenches held by stay bracing only, the width of the lower portion of the trench to a height of two feet (2') above the top of the pipe shall not exceed the trench widths specified in the "Trench Widths" paragraph. Where skeleton and solid sheeting is used, trench width may be increased to dimensions approved by the engineer, but shall be not greater than that necessary to clear the walers when lowering pipes into the trench. Where trench excavation may damage adjoining poles, roadways, utilities and private property, the Contractor shall install suitable sheeting for their protection. Such orders shall in no way relieve the contractor from his responsibility of protection of the facilities, nor shall the lack of those orders relieve the contractor from that responsibility. If trenches are excavated to widths in excess of the above limitations, or collapse because of insufficient bracing and sheeting, the contractor will be required to use special methods of constructing pipe foundations and backfilling as specified herein at his own expense.

8.12.3. Trench excavation shall not advance more than five hundred (500) feet ahead of pipe laying.

8.12.4. Excavation in excess of depth required for proper bedding shall be corrected by one of the special methods specified herein, as directed by the engineer. Bell holes shall be excavated in a manner which will relieve pipe bells of all load, but holes shall be small enough to insure that support is provided throughout the length of the pipe barrel. Excavation in excess of the depths required for manholes and other structures shall be corrected by placing a sub-foundation of Class "C" concrete or crushed stone.

8.13. DEWATERING TRENCHES

8.13.1. All excavation shall be dewatered properly before laying pipe. Where running sand is encountered, dewatering shall be done by well pointing whenever possible. Where soil conditions are not favorable for use of well points, french drains of graded stone shall be constructed to suitably located pumps and the water removed by bailing and pumping.

8.14. TRENCH STABILIZATION

8.14.1. Wherever the subgrade is, by nature, too soft and mucky for the proper installation of the sewer, the Contractor shall undercut the ditch and backfill with crushed stone conforming to the latest revision of ASTM C 33, as amended to date, graduation Size No. 57. The stone shall be brought to grade and compacted.

8.15. TRENCH WIDTHS

8.15.1. Trench widths and depths (where applicable) for PVC pipe.

8.15.2. PVC Pipe: The maximum trench widths and depths with the various classes of bedding and required compaction shall be as specified herein.

8.15.3. Trench Width: The maximum clear trench width at the top of the pipe shall not exceed a width equal to the nominal pipe diameter plus eighteen inches (18"). If this width is exceeded or the pipe is installed in a compacted embankment, pipe embedment shall be compacted to a point at least 2.5 pipe diameters from the pipe on both sides of the pipe or to the trench walls, whichever is less.

8.15.4. Trench Minimum Cover:

Table 8-1: Pipe Sizes 8-Inch to 15-Inch Inclusive

Bedding Class	Class of % of Proctor Density Range	Minimum Height of Cover
2,4, 5	95	30 in.

8.15.5. Compaction: If the proper compaction cannot be obtained with materials from trench excavation, the Contractor will be required to obtain them elsewhere.

8.16. LAYING GRAVITY SEWER PIPE

8.16.1. General: All sewer pipe shall be laid upgrade, spigots shall point downgrade. The pipe and specials shall be laid in the trench so that, after the sewer is completed, the invert surface shall conform accurately to the grades and alignment. The interior of all pipes shall be carefully cleaned of all dirt and superfluous material of every description, as pipe laying proceeds. Defective joints discovered after laying shall be repaired and made tight. Defective pipe shall be removed and proper replacement made. All sewer pipe shall be laid on a bed of crushed stone which is to extend to flow line of pipe.

8.16.2. PVC Pipe with Elastomeric Joints: Proper implements tools and equipment shall be used for placement of the pipe in the trench to prevent damage. Under no circumstances may the pipe be dropped into the trench. In subfreezing temperatures, caution shall be exercised in handling pipe to prevent impact damage. All pipe shall be carefully examined for cracks, nicks, gouges, severe scratches, voids, inclusions and other defects before laying.

8.16.3. Defective Pipe: If any pipe is discovered to be defective after having been laid, it shall be removed and replaced with sound material at the expense of the Contractor. PVC pipe shall be installed in accordance with ASTM D2321 (as amended to date) and the specifications herein. In the event of a conflict between ASTM D2321 and these specifications, the requirements of these specifications, the requirements of these specifications shall govern.

8.16.4. Assembly of Gasketed Joint: The assembly of the gasketed joint shall be performed as recommended by the pipe manufacturer. When gaskets are color coded, the Contractor shall consult the pipe manufacturer or his literature for the significance. In all cases the gasket, the bell, especially the groove area and the spigot area shall be cleaned with a rag, brush or paper towel to remove any dirt or foreign material before the assembling. The gasket pipe spigot bevel, gasket groove, and sealing surfaces shall be inspected for damage or deformation. Only gaskets which are designed for and supplied with the pipe shall be used. They shall be inserted as recommended by

the manufacturer. Lubricant used shall be supplied by the pipe manufacturer and shall be applied as specified by the pipe manufacturer.

8.16.5. Lubrication: After lubrication, the pipe is ready to be joined. Good alignment of the pipe is essential for ease of assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Do not swing or "stab" the joint, that is, do not suspend the pipe and swing it into the bell. The spigot end of the pipe is marked by the manufacturer to indicate the proper depth of insertion. If undue resistance to insertion of the pipe end is encountered or the reference mark does not position properly, the joint shall be disassembled and the position of the gasket checked. If it is twisted or pushed out of its seat ("fish-mouthed"), the Contractor shall inspect components, repair or replace damaged items, clean the components, and repeat the assembly steps. Both pipe lengths must be concentric alignment. If the gasket was not out of position, the Contractor shall verify proper location of the reference mark. The reference mark shall be relocated if it is out of position.

8.16.6. Field Cut: Field cut pipe to be joined shall be square cut using a hacksaw, handsaw or power saw with a steel blade or abrasive disc. The pipe shall be marked around its entire circumference prior to cutting to assure a square cut. A factory-finished beveled end shall be used as a guide for proper bevel angel, and depth of bevel plus the distance to the insertion reference mark. The end may be beveled using a pipe beveling tool or a wood rasp that will cut the correct taper. A portable sander or abrasive disc may be used to bevel the pipe end. Any sharp edges on the leading edge of the bevel must be rounded off with a pocketknife or a file.

8.16.7. Deflection Testing: The maximum deflection in the installed PVC pipeline shall not exceed 5% of the pipes original internal diameter. Deflection testing will be required using either a deflectometer or a "GO-NO-GO" mandrel. The Utility shall randomly select portions of the project to be deflection tested. Such portions shall consist of not less than 5% of the total reaches (reach being length of pipe between two manholes) in the project (excluding house leads). Where deflection is found to be in excess of 5% of the original pipe diameter, the Contractor shall excavate to the point of excess deflection and carefully compact around the point where excess deflection was found. The line shall then be re-tested for deflection. However, should after the initial testing the deflected pipe fails to return to the original size (inside diameter), the line shall be replaced. In the event that deflection occurs beyond the 5% limit in any section of 5% or more of the reaches tested, the entire system shall be tested.

8.16.8. Ductile Iron Pipe with Mechanical or Push-on Joints: Proper and suitable tools and equipment shall be used for the safe and convenient handling and laying of ductile iron pipe. Care shall be taken to prevent damage to the exterior coating and interior cement lining. All pipe shall be carefully examined for cracks and other defects before laying. If any pipe or fitting is discovered to e defective after having been laid, it shall be removed and replaced with sound material at the expense of the Contractor. Whenever pipe is required to be cut, the cutting shall be done by skilled workmen using an abrasive wheel cutter. Use of a cold chisel or oxyacetylene torch will not be permitted.

8.16.9. Mechanical Joints: Mechanical joints shall be made only by experienced mechanics. Sockets and spigots shall be washed with soapy water before slipping and gland and gasket over the spigot end of the pipe. The spigot shall be inserted into the socket full depth, then backed off ¼ inch to provide clearance for expansion. The gasket shall be brushed with soapy water and shall be pushed into position making sure that it is evenly seated in the socket. The gland shall then be moved into position for compressing the gasket. All bolts and nuts shall be made "finger-tight". For joints made in trenches, the bolts shall be tightened to a uniform permanent tightness, using a torque wrench for tightening. Bolts shall be tightened alternately 180 degrees apart.

8.16.10. Push-On Joints: The groove and bell socket shall be thoroughly cleaned and lubricated before the gasket is inserted. Before inserting the gasket, it shall be thoroughly lubricated and manufacturer's instructions shall be followed for proper facing and seating of gasket. After the gasket is in place and just prior to joint assembly, a generous coating of lubricant shall be applied to the exposed gasket surface. The lubricant used shall be lubricant supplied by the pipe manufacturer. The plain end shall be inspected and any sharp edges which might damage the gasket shall be removed by means of a file or power grinder. Pipe that is cut in the field must be ground and beveled before assembly. Prior to inserting the plain end of the pipe into bell socket, lubricant shall be applied to the beveled nose of the pipe. Small pipe may be pushed home with a long bar but large pipe may require additional power such as a jack, lever or back-hoe. A timber header shall be used between the bell and bar or other power to avoid damage to the pipe. During assembly of the pipe, the joint must be kept straight while pushing. Pipe may be deflected if desired but only after the assembly is completed.

8.16.11. Mechanical Joint or Push-on Joint Pipe on Piers: Mechanical or Push-on Joint Pipe may be used on piers in gravity sewer lines. Pipe shall be laid with ¼ inch clearance in each joint to provide for expansion. Jointing of pipe shall be as described above. On mechanical joint pipe, the bolts shall be tightened alternately 180 degrees apart, but left "finger-tight" until the sewage is diverted into the sewers; then bolts shall be further tightened a sufficient amount which will prevent leakage of the joint, but which will not prevent slippage which may occur because of temperature stresses.

8.16.12. Pile Piers using Steel "H" Piles: Bearing piles for piers, headwalls, shall be steel "H" piles sizes as required by the drawings. Structural steel in piles, caps, and splices shall be of open-hearth steel conforming to ASTM A 283 or A 36, as amended to date. The head of each pile shall be capped with a steel plate 1" thick welded to the pile with 5/16" filler weld. The pile head shall be smooth, perpendicular to the axis of the pile and shall fit the plate snugly.

If splices are necessary, they shall be made with 6" x 16" x 1/2" steel splice plates welded with 5/16" filler welds to each flange of the pile. Pile ends shall be separated 1/8" and the entire periphery of the pile joint shall then be welded.

The Contractor shall be required at his own expense to determine the length of piles required by driving test piles. At Contractor's option the piles may be used as permanent piles in a structure in which case the piles shall be of the specified section and of sufficient length to cut off at plan grade. No splices in pile will be compensated for unless extra length, in excess of two feet (2') of length as determined by test pile, is required to obtain the minimum bearing value.

Each pile shall be driven to a safe bearing value of ten (10) tons or more with at least ten feet (10') penetration; or shall be driven to refusal in rock; as indicated on the drawings, each as directed by the Engineer. The safe bearing shall be determined by one of the Engineering News-Record formulas, as follows:

For drop hammers $R = \frac{2WH}{S+1}$

For single acting hammers $R = \frac{2WH}{S+0.1}$

Where:

R is allowable load in pounds.
W is weight of striking part, lbs.
H is effective height of fall, feet.
S is average penetration of last five blows of approx. equal penetration.

(A) Payment: Measurement for payment for steel "H" piles will be for the actual length of the pile from tip of cut-off driven in place to safe bearing and accepted. Payment will be allowed for each splice when extra length is required to obtain minimum bearing as provided heretofore.

8.17. PLACING PRECAST CONCRETE MANHOLES

8.17.1. Precast concrete manholes shall be placed or constructed where shown. Manholes shall be 4, 5 and 6 feet in diameter as determined from the schedule of pipe size and line deflection, or as shown. The top of manholes outside of roads, streets, and highways shall be built to grades twelve inches (12") above ground surface unless otherwise shown on the drawings. Manholes in roads, etc. shall be built to grade.

8.17.2. Manholes shall be installed as follows:

8.17.3. Precast Concrete Manholes: Precast concrete manholes shall be bedded on not less than six inches (6") of compacted crushed stone at Contractor's expense. The crushed stone shall extend not less than six inches (6") outside the walls of the manhole, and shall be compacted under entire length of pipe within manhole excavation.

8.17.4. Connection of Pipe to Manhole: Connection of pipe to manhole for 4 inch through 15 inch pipe shall be made with a flexible joint system. The joint system shall be a neoprene or synthetic rubber boot or sleeve, either cast or core drilled in the wall of manhole. The boot or sleeve shall be clamped and seated to the pipe with a stainless steel band. The boot or sleeve system shall be "LOCK JOINT FLEXIBLE MANHOLES SLEEVE" as manufactured by Interpace Corporation, Parispany, New Jersey or "KOR-N-SEAL" as manufactured by National Pollution Control System, Inc., Nashua, New Hampshire, or equal. Connection of pipe to manhole for 18 inch pipe and above shall be made with a collar of mortar and brick. The opening between the pipe and the manhole shall have a minimum clearance of one inch (1") and shall be filled from the inside of the manhole with a non-shrink grout.

8.17.5. Adjustment: The top of the concentric top section shall have a minimum wall thickness of eight inches (8") to accommodate brick courses for height adjustment. A maximum of three (3) brick courses will be allowed for adjustment of manhole to required grade.

8.17.6. Drop Connections: Drop connections will be required, where called for on the drawings, or as determined by the dimensions shown in "Drop Manhole Schedule", shown on the drawings. Drop pipe shall be not smaller than 8 inches. Generally, drop pipe shall be one size smaller than the sewer which they serve. Openings in walls of precast concrete manholes for drop connections shall not be made at joints. Drop connection fittings and riser pipe shall be encased in brick and mortar or formed Class "C" concrete. Drop connections for precast concrete manholes shall conform with typical details as shown on the drawings. Drop connections shall be carefully backfilled to prevent dangerous side pressures. A drop pipe shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert shall be filleted to prevent solids deposition.

8.17.7. Manhole Inverts: Manhole inverts shall be carefully constructed with cement grout, Class "B" concrete, or cement mortar brickwork; special care shall be taken to lay the channel and adjacent pipes to grade. Cement mortar shall be made of one (1) part cement and two (2) parts clean sharp sand. Channels shall be properly formed, rounded, and trowelled smooth. The connections of the sewer with the wall and channel of the manhole shall be tight and smooth.

8.17.8. Manhole Steps: Manhole steps shall conform to the details shown. Steps for precast concrete manholes shall be installed along a vertical centerline, on approximately 14" to 16" centers.

8.17.9. Future Sewer Connections: Where shown, a twelve inch (12") long pipe stub for future sewers, of such size as may be designated, shall be laid to proper grade and alignment and plugged with a factory plug with same type joint as used on the sewer pipe.

8.17.10. Manhole Frames and Covers: Manhole frames and covers shall be as detailed and shown on the drawings and as called for in the proposal and shall include setting to finished grade as required and grouting in place.

8.18. CONNECTION TO EXISTING MANHOLES

8.18.1. At locations where new sewers are shown to be connected to existing manholes, the Contractor may temporarily block and/or divert sewage flows to facilitate construction operations. The work shall consist of coring an appropriate size hole in the manhole wall, inserting the new pipe to the elevation shown, and using an appropriate link seal to seal and hold the pipe in place. High early strength cement shall be used for mortar in constructing and remodeling the manhole invert in order that proper channels may be formed in manhole bottoms with a minimum interruption of service to the existing sewer. By-passing raw wastewater directly or indirectly into a stream or onto the ground is strictly prohibited and punishable under Georgia state law.

8.19. CONNECTION TO EXISTING SEWERS

8.19.1. At location where new sewers are shown to be connected to existing sewers at a new manhole, the Contractor shall first expose the existing sewer and install a supporting timber beam with suitable straps around the pipe so as to bridge the excavation for the new manhole. The manhole shall then be constructed complete with invert and frame and cover. Under special conditions the Contractor may temporarily block and/or divert sewage flows to facilitate construction operations. Actual physical connection of the sewers will be made at a later date, as directed.

8.20. HOUSE SERVICE LINES

8.20.1. On all sewer lines, 6-inch service lines out to R/W shall be provided at all buildings and dwellings and at such other locations as directed by the Utility.

8.20.2. Service Lines: Service lines shall extend from the main sewer in the street to a minimum of 2' behind R/W.

8.20.3. Risers: Service laterals from the main sewer shall exit at an angle no greater than 45 degrees from the horizontal. Where trench depths are twelve (12) feet or more that vertical risers are required, service lines shall be installed in a rigid sleeve supported by concrete as shown in Drawing H-8. Vertical risers should utilize a single length of pipe for the riser section, whenever possible. Transitions from horizontal to vertical shall be smooth and well supported. Bends shall be used to connect the riser to the house service lines.

8.20.4. Stoppers, Caps and Plugs: All house service connections shall be closed with factory manufactured pipe stopper of such design and secured in such a manner as to not leak under a maximum hydrostatic head of ten feet (10') or five (5) psi air pressure. The pipe stopper shall be able to be removed without special tools, excessive force or breakage of the pipe bell.

8.20.5. House Service Branches: In general, house service branches shall incline upward at approximately 45 degrees above a horizontal line normal to the direction of flow in the street main. Service lines shall be laid on a straight line and have a minimum grade of 1/8-in per foot from the sewer or riser to the property line, and in no event shall service lines be less than three and one-half feet (3-½') deep to invert of the pipe at the property line. Laterals extending to the house inside the property line shall be a minimum of two feet (2'-0") deep. Laterals have less than two feet of cover must be ductile or cast iron.

8.20.6. Service lines shall be backfilled and compacted with natural earth materials, free of rocks, clods and debris. No backfill shall be placed until the work has been inspected and approved.

8.20.7. A minimum of two clean-outs shall be installed in each sewer service lateral as shown on Drawing H-8. One clean-out at R/W and one clean-out at house with backflow preventer shall be installed. Clean-outs shall be required every ninety feet (90') in the service lateral.

8.20.8. A backflow check valve shall be installed in the sewer lateral to prevent reversal of flow from the sewer main during high water. The backflow valve shall be installed with an access cover at grade and shall have a clean-out installed immediately downstream in the lateral.

8.20.9. When required, two (2) 45-degree bends shall be used to connect the service branch to the house service line. Standard 90-degree bends shall not be used. Pipe service branches, together with bend(s), shall be placed on a compacted bed of crushed stone in such a manner as to be self-supporting and to relieve the strain on branches and bends. Service connections to the sewer main shall be made to an existing wye and shall be water tight and not protrude into the sewer. If a saddle type connection is used, it shall be a device designed to join with the types of pipe which are to be connected. All materials used to make the service connections shall be compatible with each other and with the pipe materials to be joined and shall be corrosion proof.

8.21. TESTING AND CLEANING

8.21.1. Before acceptance of any sewer or systems of sewers, lines shall be cleaned and tested in accordance with these specifications. Where any obstruction is met, the Contractors will be required to clean the sewers by means of rods, swabs, or other instruments. Lines and manholes shall be clean before final inspection. Pipe lines shall be straight and show a uniform grade between manholes. The Contractor shall be required to correct any variations therefrom, which may be disclosed during the inspection.

8.21.2. All new gravity sewer lines shall be inspected using video camera equipment designed for this application. Inspection will be performed by the Utility. Video inspections will be recorded on VHS video tape or other media approved by the Utility in NTSC format and shall be retained by the Utility for future reference. The video recording shall include sufficient audio and on-screen information so as to enable the viewer to identify the line segments and distances downline as the inspection progresses. Line defects observed on the video recording shall be corrected and reinspected a second time by video. The cost of all video recording services, whether performed by the Utility or by its designated contractor will be the responsibility of the sewer line contractor.

8.22. LEAKAGE TESTS

8.22.1. All manholes in wet areas shall be tested by the vacuum method as provided in 8.22.2 below. All sewer lines, including house service lines, shall be tested for leakage, using one or a combination of the other three methods as provided in 8.22.3, 8.22.4, or 8.22.5. All tests shall be conducted in the presence of the Utility Inspector, the utility's engineer or his representative, before being placed into service.

8.22.2. Manhole Vacuum Testing: All incoming and outgoing sewer and service lines shall be plugged, the plugs restrained and the vacuum tester head placed on the manhole frame and sealed. A vacuum of 10 inches Hg shall be drawn on the manhole and the time measured for the vacuum to drop to 9 inches Hg. This time shall not be less than 40, 50, or 60 seconds per manhole with diameters of 48, 60, and 72 inches respectively. For manholes deeper than 20 feet, the test times shall be increased by 2 seconds per foot of additional manhole depth.

8.22.3. Infiltration Test: Where natural ground water levels stand a minimum of two feet (2') above the top of the pipe, the amount of leakage may be determined from measurements made at the lower end of the sewer section under test. Sewers above the test section shall be closed before testing by the installation of suitable watertight bulkheads. The length of the test section shall be determined by the engineer. The average of six readings at five-minute intervals will be used to determine the rate of infiltration for any one test section. The rate of infiltration of ground water into any test section of sewer, including manholes, shall not exceed 25 gallons per day per inch diameter per mile of pipe or according to the following values given per foot of sewer:

Table 8-2: Acceptable Infiltration Rates per Sewer Size

Size of Sewer (inches)	Gallons Per 24 Hours Per Foot of Sewer
8"	0.038
10"	0.047
12"	0.057
15"	0.071

8.22.4. Exfiltration Test: Where natural ground water levels do not stand two feet (2') above the top of the pipe, an exfiltration test shall be conducted on each section of sewer. The test shall be performed up to an average maximum hydrostatic head of ten feet (10'). The test shall be conducted in the following manner. 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 riser pipe shall be installed. 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 twenty-four (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 thirty (30) minutes, 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 thirty (30) minute test period shall no exceed that shown for infiltration in the table above.

8.22.5. Low-Pressure Air Test: Where sewer grades are such that preclude performance of the exfiltration test or at the Contractor's option, a low-pressure air test shall be conducted on each section of sewer after completion and before acceptance. 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 Contractor's option, sewers may be tested in lengths between manholes or in short sections (25 ft 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 tests. If a 1.0 psi drop does not occur within the test time, then the line has passed 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 require the necessary repairs and retest the line. Minimum test time for various pipe sizes, in accordance with ASTM F 1417, Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air (latest rev.) as follows:

Table 8-3: Minimum Specified Time Required for a 1.0 psig Pressure Drop for Size and Length of Pipe Indicated for Q=0.0015 CFM/SF

Pipe Diameter, inches	Min. Time, min:s	Length for min. Time, ft.	Time for Longer Length, ft.	SpecificationTime for Length, (L) Shown, min.:s							
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:34	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:52	11:52	13:51	15:49	17:48
12	11:20	199	3.148 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04

8.22.6. Required test equipment includes 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 ±2%. The Contractor shall keep records of all tests made. A copy of such records will be given to the engineer or the owner. Such records shall date, line number and stations, operator and such other pertinent information as required by the engineer. The Contractor 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. Every precaution shall be taken to avoid the possibility of over-pressurizing the sewer line.

8.22.7. Repairs: All visible leaks shall be repaired regardless of whether infiltration exfiltration or air twist is within allowable limits. No sewer will be accepted until leakage tests demonstrate compliance with one of the above leakage test methods.

8.23. ACCEPTANCE OF WORK

8.23.1. Sewer lines and appurtenances will not be considered ready for acceptance until all provisions of the specifications have been complied with, until all tests have been satisfactorily completed, and until inspection of the work has been made. Sewage flows shall not be diverted into new sewers until after such time as final inspection of

the lines has been made by the Utility, including satisfactory video inspection as provided in paragraph 8.21.2, and permission granted therefore.

SECTION 9 - SEWAGE PUMPING STATIONS AND FORCE MAINS

9.1. GENERAL

9.1.1. Flooding: Wastewater pumping station structures and related electrical and mechanical equipment shall be protected from physical damage by a 100-year flood event.

9.1.2. Telecommunications Accessibility: The pumping station shall be equipped with proper telecommunications equipment to provide accessibility to the City of Monroe's SCADA system.

9.1.3. Security and Accessibility: The pumping station shall be situated so as to provide access by maintenance vehicles during all weather conditions. An all-weather access drive on a dedicated easement shall be provided. Security fencing and/or locking hatches and covers shall be provided as determined on a case by case basis.

9.1.4. Safety: Adequate provision to effectively protect maintenance personnel from hazards shall be made including equipment for confined space entry in accordance with OSHA and other regulatory agency requirements.

9.1.5. Water Supply: A potable water supply line with a freeze proof standard hose bibb shall be provided at the pump station. An approved RPZ backflow preventer, at least ¾-inch size shall be installed to protect the water supply from accidental contamination.

9.1.6. Operation and Maintenance Manuals: Wastewater pumping stations and portable equipment shall be supplied with a complete set of operational instructions (in English), including emergency procedures, maintenance schedules, tools and such spare parts as may be necessary.

9.1.7. Pump Station Supplier: For the purpose of standardization, the submersible pump station equipment, including pumps and controls, shall be provided by ITT Flygt or Fairbanks Morse. Other reputable manufacturers must be pre-approved by the Utility prior to submittal, and have at least ten years experience in the design and manufacture of pumps and controls for the pumping of raw wastewater. Pump replacement parts and repair services shall be available in the Metro-Atlanta area or closer.

9.2. DESIGN BASIS

9.2.1. Pump stations shall be sized to serve the proposed development and all future phases that may be tributary to it. In order to avoid the proliferation of small pumping stations, each development will be analyzed by the City of Monroe in regard to the potential for serving future development upstream. If such potential exists, the pump station and force main shall be sized according to the City of Monroe's engineering recommendation for pumping capacity and total dynamic head.

9.2.2. The Developer's Engineer shall provide his/her basis of design for the development, including gallons per capita per day, population or population equivalent, average

daily flow, peak hourly flow, number of pump cycles at peak flow and any other pertinent information requested by the Utility.

9.2.3. The Developer's Engineer shall submit pump curves for the units which (s)he proposes to supply, and design parameters showing Total Dynamic Head, NPSH calculations, static head, system curve, wet well volume, cycle time, pump station friction losses, force main friction losses, buoyancy calculations, force main diameter and length, pump efficiency, brake horsepower, power input to electric drive motor and overall and overall efficiency of the pumping unit for the various conditions under which the units are to operate, together with descriptive data and specifications describing in detail the construction of the complete units

9.2.4. Storage shall be provided above the high-level alarm equal to three (3) hours at design flow. Storage volume is calculated to be that volume between the high-level alarm and the lowest point of overflow (including basement elevations regardless of backflow valves in service lines). Said storage may consist of any combination of line capacity, manhole capacity, and wetwell volume. No corrugated metal pipe may be utilized for storage. efficiency of the pumping unit for the various conditions under which the units are to operate, together with descriptive data and specifications describing in detail the construction of the complete units.

9.2.5. The wetwell shall be sized to prevent excessive cycling of the pumps. Starts shall be limited to one start per ten minutes unless otherwise recommended by the pump manufacturer. Size shall be as recommended by the pump supplier and shall be approved by the Utility, (Minimum 8-foot diameter).

9.3. DESIGN FEATURES

9.3.1. Type: Wastewater pumping stations shall be one of the following two types: wet well/dry well or submersible.

9.3.2. Size: For the purpose of these specifications, pumping stations will be under 700 gallons per minute (GPM) or 1 million gallons per day (MGD). Design of larger size pumping stations shall be coordinated with the Utility and their engineer prior to the submittal of construction plans and specifications.

9.3.3. Corrosion Protection: Manholes used for pump stations or receiving pump station discharge shall be coated with a two-part epoxy to prevent corrosion from hydrogen sulfide gas.

9.3.4. Wet Well/Dry Well Pumping Stations: The pumping stations for both wet and dry wells should adhere to the following design criteria:

9.3.4.1. Wet well/dry well facilities shall have the dry well completely separated from the wet well. Common walls shall be gas tight.

9.3.4.2. The design fill time and minimum pump time shall be considered in the sizing of the wet well. The effective volume of the wet well shall be based on design average flow and a filling time not to exceed 30 minutes. The pump manufacturer's duty cycle recommendations shall be utilized in selecting the

minimum cycle time. Wetwell and total storage volume shall meet the requirements of 9.2.4 and 9.2.5 above.

9.3.4.3. Provision shall be made for direct access of equipment to allow removal of pumps, motors and other mechanical and electrical equipment through hatchways, doorways or other convenient means, and without removal of any wall, floor or roof panels or structural members. A hoist must be provided by developer for any pumps weighing over 50 lbs.

9.3.4.4. A suitable and safe means of access for persons wearing self-contained breathing apparatus shall be provided to dry wells and to wet wells.

9.3.4.5. Buoyancy: Where high groundwater conditions are anticipated, buoyancy of the wastewater pumping station structures shall be considered and, if necessary, adequate provisions shall be made for protection.

9.3.4.6. Corrosion: Materials shall be selected that are appropriate under conditions of exposure to hydrogen sulfide and other corrosive gases, greases, oils and other constituents frequently present in wastewater. Contact between dissimilar metals shall be avoided. Provisions shall be made to minimize galvanic action.

9.3.5. Submersible Pumping Stations: Submersible pumps shall meet the applicable requirements of these specifications, except as modified below.

9.3.5.1. Submersible Pumps and motors shall be designed specifically for raw wastewater use, including totally submerged operation during a portion of each pumping cycle and shall meet the requirements of the National Electrical Code for such units. An effective method to detect shaft seal failure and potential seal failure shall be provided.

9.3.5.2. Submersible pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping in the wet well. Hatch doors shall be sized by the pump supplier to allow adequate clearance to easily remove the pumps.

9.3.5.3. Electrical: Electrical supply, control, and alarm circuits shall be designed to provide strain relief and to allow disconnection from outside the wet well. Terminals and connectors shall be protected from corrosion by location outside the wet well or through use of watertight seals.

9.3.5.4. Motor Control Centers: The motor control center shall be located outside the wet well, be readily accessible, and be protected by a conduit seal or other appropriate measures meeting the requirements of the National Electric Code, to prevent the atmosphere of the wet well from gaining access to the control center. The seal shall be so located that the motor may be removed and electrically disconnected without disturbing the seal. When such equipment is exposed to weather, it shall meet the requirements of NEMA 3R or 4X.

9.3.5.5. Wiring: The pump motor cords shall be designed for flexibility and serviceability under conditions of extra hard usage and shall meet the requirements of the National Electrical Code standards for flexible cords in wastewater pump stations. Ground fault interruption protection shall be used to de-energize the circuit in the

event of any failure in the electrical integrity of the cable. Power cord terminal fittings shall be corrosion-resistant and constructed in a manner to prevent the entry of moisture into the cable, shall be provided with strain relief appurtenances, and shall be designed to facilitate field connecting. Only copper wire shall be used in the electrical system of the pump station.

9.3.5.6. Valves: Valves required under paragraph 9.6 shall be located in a separate valve pit. Provisions shall be made to remove or drain accumulated water from the valve pit. The valve pit may be dewatered to the wet well through a drain line with a gas and watertight valve. Check valve vaults shall be precast concrete as shown on in Appendix H. All valve vaults shall have a minimum 48" x 48" double leaf aluminum hatch and all hatches shall have metal safety grates.

9.4. VENTILATION

9.4.1. Covered wet wells shall have provisions for air displacement to the atmosphere.

9.4.2. Adequate ventilation shall be provided for all pump stations. Where the dry well is below the ground surface, mechanical ventilation is required. If screens or mechanical equipment requiring maintenance or inspection are located in the wet well, permanently installed ventilation is required. There shall be no interconnection between wet well and dry well ventilation systems. Ventilation for all pumping stations shall be designed in compliance with current NFPA 820 Regulations and Guidelines.

9.4.3. In dry wells over 15 feet deep, multiple inlets and outlets shall be provided. Dampers shall not be used on exhaust or fresh air ducts. Fine screens or other obstructions in air ducts should be avoided to prevent clogging. Switches for operation of ventilation equipment shall be marked and located conveniently.

9.4.4. All intermittently operated ventilation equipment shall be interconnected with the respective pit lighting system.

9.4.5. All mechanically ventilated spaces shall have both supply and exhaust fans. The fan wheel shall be constructed of non-sparking material. Automatic heating and dehumidification equipment shall be provided in the dry wells.

9.4.6. Wet well ventilation may be either continuous or intermittent. Ventilation, if continuous, shall provide at least 12 complete air changes per hour; if intermittent, at least 30 air changes per hour. Air shall be forced into the wet well by mechanical means rather than solely exhausted from the wet well. The air change requirements shall be based on 100 percent fresh air. Portable ventilation equipment shall be provided for use at submersible pump stations and wet wells with no permanently installed ventilation equipment.

9.4.7. Dry well ventilation may be either continuous or intermittent. Ventilation, if continuous, shall provide at least 6 complete air changes per hour; if intermittent, at least 30 complete air changes per hour. A system of two-speed ventilation with an initial ventilation rate of 30 changes per hour for 10 minutes and automatic switch over to 6 changes per hour for 10 minutes may be used to conserve heat. The air change requirements shall be based on 100 percent fresh air.

9.5. PUMPS

9.5.1. In any pump station design, a minimum of two pumps shall be provided. Where only two pumps are provided, they shall be of the same size. The pumps shall have capacity such that the facility shall be capable of pumping the design peak hourly flow with any unit out of service.

9.5.2. Pumps shall be capable of passing spheres of at least 3 inches in diameter. Pump suction and discharge openings shall be at least 4 inches in diameter.

9.5.3. Each pump shall have an individual intake. Wet well and intake design shall avoid turbulence near the intake and to prevent vortex. The pumps shall be placed so that under normal operating conditions will operate under positive suction head.

9.5.4. The station capacity shall be based on peak hourly flow and shall be adequate to maintain a minimum velocity of 2 feet per second in the force main.

9.6. VALVES

9.6.1. Suction line valves for shutoff shall be placed on the suction line of dry pit pumps.

9.6.2. Suitable shutoff and check valves shall be placed on the discharge line of each pump. The check valve shall be located between the shutoff valve and the pump. Check valves shall be suitable for the material being handled and shall be placed on the horizontal portion of the discharge piping. Valves shall be capable of withstanding normal pressure and water hammer.

9.6.3. All shutoff valves and check valves shall be operable from the floor level and accessible for maintenance. Outside levers are required on swing check valves.

9.7. ELECTRICAL

9.7.1. Devices and materials shall be listed and/or labeled by Underwriters' Laboratories, Inc., wherever standards have been established by that agency. Where Underwriters' Laboratories listing is not available for equipment, certified test reports shall be submitted of adequately equipped, recognized, independent testing laboratory, approved by the local inspecting authority, indicating that equipment is in conformance with local code requirements or any other applicable requirements. In lieu of independent test reports, written approval of equipment by local electrical inspecting authority will be acceptable.

9.7.2. Equipment, devices and material shall be clearly marked with name or trademark of manufacturer and rating in volts and amperes and other pertinent information on a nameplate.

9.7.3. All pump motors shall utilize three phase power, and shall be type NEMA B.

9.7.4. Three phase power systems shall have phase monitor relays on each power leg to prevent operation during loss of phase or low voltage. Surge protection shall also be provided to protect the MCC as well as the pump motors.

9.7.5. Complete wiring diagrams shall be furnished covering all electrical circuits, controls and subsystems.

9.7.6. Electrical systems and components in raw wastewater wet wells or in enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapors may be present, shall comply with the National Electrical Code requirements for Class I Group D, Division1 locations.

9.7.7. Equipment located in the wet well shall be suitable for use under corrosive conditions. Flexible cables shall be provided with watertight seals and separate strain relief. Conduit/cables shall be sealed at the wet well and at the control panel to prevent corrosive gases from entering the electrical control system. Splicing of cables inside the wetwell will not be permitted.

9.7.8. A fused disconnect switch shall be located above ground for the main power feed and if exposed to weather, shall meet the requirements of weatherproof equipment NEMA 3R or NEMA 4. Lighting and surge protection shall be provided.

9.7.9. The surge suppressor shall be U.L. listed and labeled under UL1449 and UL1283. A surge suppressor shall be provided at the power service entrance. The surge suppressor shall have voltage characteristics to match the power service.

The surge suppressor shall be in NEMA-4X enclosure and shall provide line to line, line to neutral, line to ground and neutral to ground protection modes as applicable for the power service.

The surge suppressor shall be provided with an integral disconnect separate from the main breaker. Minimum surge current rating shall be 100KA per mode, 200KA per phase per NEMA LS-1. The surge suppression system shall be duty cycle tested to survive 20KV, 10KA, IEEE C62.41 category surge current with less than 5% degradation of clamping voltage. The surge suppressor shall have minimum repetitive surge capacity of 2500 impulses per mode and 5000 impulses per phase. Status indicating lights and form 'C' dry alarm contacts shall be provided.

9.7.10. Enclosures for motor starters, relays, instruments and controls shall be NEMA 4X, Stainless Steel or fiberglass, as determined on a case by case basis by the Utility. All enclosures mounted outdoors shall have a device for securing with padlock and key.

9.7.11. A 110-volt power receptacle to facilitate maintenance shall be provided inside the control panel where the control panel is located outdoors.

9.7.12. Stations with pump motors greater than 5 HP shall be furnished with diesel, natural gas or LP gas generator sets having sufficient kW capacity to fully power the pump station during a power outage. The generator set shall be self-starting and be furnished with an automatic transfer switch to automatically transfer the pump station load to the generator and back to normal power when normal power is restored. See Section 9.8 EMERGENCY OPERATION.

9.7.13. Pumping stations with pumps 5 HP or less shall be equipped with a manual transfer switch. An emergency generator receptacle rated for the facility's full load current shall be provided on the main panel to allow connection to a portable generator set. See Section 9.08 EMERGENCY OPERATION.

9.7.14. Minimum requirements for grounding shall be National Electrical Code. Locknut connections to cabinets, pull boxes and junction boxes shall be wrench-tight, with locknut projections driven into the opposing metal surface. No ground connection shall be made except as required by the National Electrical Code or as specified herein. The pump station housing steel shall be bonded to the made electrode grounding system.

9.7.15. All outdoor cabinets and panels shall be secured to stainless steel or aluminum mounting posts set in a concrete base. Stainless steel Uni-strut may be used to secure panels to posts. All fasteners shall be corrosion resistant, stainless steel or aluminum. No galvanized or carbon steel supports will be allowed.

9.8. EMERGENCY OPERATION

9.8.1. Provision shall be made for emergency operation of all wastewater pumping stations. Such provision shall include a station by-pass tap on the force main as shown on Detail H-14. Also, a stand-by electrical power generator shall be provided for all pumping stations with pumps greater than 5 BHP and shall be capable of automatic operation as described herein. Pumping stations with pumps 5 BHP or less shall have a receptacle for connection to a portable emergency generator and shall be equipped with a manual transfer switch.

9.8.2. The emergency power generator required above shall be fueled by the public utility system of natural gas unless the nearest gas supply is more than 500 feet from the pumping station, otherwise, an above ground NFPA approved gas tank shall be provided, sized to provide a minimum of 8 hours of pump station running time at full load.

9.8.3. Gasoline engine driven generators shall not be acceptable.

9.8.4. Where the electrical load of the pumping station is significant, a diesel engine powered generator may be required. The diesel fuel tank for the generator shall be an above-ground type, with double wall containment, Convault or equal, with a storage capacity sufficient to power the generator set for a minimum of 8 hours at full load. Fuel lines from the storage tank to the generator set shall be double wall or otherwise enclosed within a containment vessel to prevent leakage of fuel onto or into the ground. Provision for containment of fuel, oil and grease leakage and spills shall be made for the diesel engine generator set, if mounted outdoors.

9.8.5. The generating unit size shall be adequate to provide power for pump motor starting current and for lighting, ventilation and other auxiliary equipment necessary for safety and proper operation of the lift station.

9.8.6. If mounted outdoors, the generator shall be furnished with a durable protective housing to shield the equipment from the elements.

9.8.7. If liquid-cooled, the generator engine shall be protected from damage from freezing temperatures and shall have pre-heaters for cold weather starting.

9.8.8. The generator engine shall be supplied with a heavy-duty battery and permanently wired battery charging unit.

9.8.9. The generator set shall be furnished with proper gauges for monitoring engine temperature and oil pressure, and generator output voltage and amperage with a line selector switch for each phase/line. A non-re-settable elapsed time meter shall be supplied to record cumulative generator run time.

9.8.10. The operation of only one pump during periods of auxiliary power supply must be justified. Such justification may be made on the basis of the design peak hourly flows relative to single pump capacity, anticipated length of power outage, and storage capacity.

9.8.11. Special sequencing controls shall be provided to start pump motors unless the generating equipment has capacity to start all pumps simultaneously with auxiliary equipment operating.

9.8.12. Protective equipment shall be capable of shutting down the engine and activating an alarm on site and as provided in Section 9.9.7. below.

9.8.13. The engine shall be located above grade with adequate ventilation of fuel vapors and exhaust gases. Emergency equipment shall be protected from damage at the restoration of regular electrical power.

9.8.14. All emergency equipment shall be provided with instructions (in English) indicating the need for regular starting and running of such units at full loads. Provisions shall be made for automatic and manual start-up and load transfer. Provisions shall be made to allow the engine to start and stabilize at operating speed before assuming the load.

9.9. CONTROLS

9.9.1. The pumping station shall be furnished with an automatic pump control system which utilizes a Flygt "Multitrode" and free hanging floats to activate start/stop of pumps and alarms according to wetwell level. Pumps shall be called to start and stop automatically based on adjustable wetwell level settings.

9.9.2. Floats shall be located as not to be unduly affected by turbulent flows entering the well or by the turbulent suction of the pumps. The Multitrode shall be mounted in a turbulent area of the wetwell. A polyurethane squeegee pad shall be provided for cleaning. The Multitrode shall be installed according to the manufacturer's installation instructions.

9.9.3. A minimum of five level settings will be provided to operate the control system for the following operations:

9.9.3.1. Lead Pump ON

9.9.3.2. Lag Pump ON

9.9.3.3. All Pumps OFF

9.9.3.4. High Level Alarm

9.9.3.5. Low Level Alarm

9.9.4. Three floats shall be installed in the pump station wet well to act as a back-up control system to the Multitrode. Two floats shall be installed as high level floats to start the pumps. The lowest high level float shall start the lead pump when the float is activated. The highest high level float shall start the lag pump when the float is activated. One float shall be installed as a low level float to stop all pumps. When the lowest high level float is activated the high level alarm shall also be activated. The floats shall be attached to a stainless steel rod that is suspended from the top of the wet well. The stainless steel rod and floats shall be easily removed through the top of the wet well.

9.9.5. The pump supplier shall provide a pump controller that shall be Multitrode type MT2PC or approved equal. The pump controller shall monitor and control two pumps and three alarms and be capable of discriminating between four different fault conditions. The pump controller should be provided with the necessary keypads, indication, leveling sensing, programming, time delays, fault monitoring and communication to meet the requirements of the City of Monroe's specifications. The pump controller shall be intrinsically safe.

9.9.6. A non-re-settable elapsed time hour meter for each pump shall be mounted in the control panel to record each pump's total run time.

9.9.7. Provision for automatic pump alternation shall be included.

9.9.8. Each pump shall be controlled through a three position switch for "HAND," "OFF" and "AUTOMATIC" operation. When switched to the "HAND" position, the respective pump starter shall engage calling the pump to "RUN" regardless of the status of the automatic level control.

9.9.9. Each circuit breaker, disconnect switch, motor starter, control switch, panel lamp or other devices shall have an identifying nameplate affixed, such as "PUMP #1", "RUN", "HAND-OFF-AUTOMATIC". Nameplates shall be laminated plastic, white engraved letters on black background. Letters shall normally be 1/4" high. Embossed taped strips are not acceptable.

9.9.10. Outdoor control panels shall be mounted in false front cabinets, with all indicator lamps and control switches concealed within the outer cabinet.

9.9.11. Local station alarm systems shall be provided for all pumping stations. The alarm system shall be activated in cases of power failure, high wetwell level, sump pump failure (dry well pumps stations), pump failure, unauthorized entry, or any cause of pump station malfunction. Pumping station alarms shall be telemetered to the wastewater treatment plant facility as described in 9.9.12 below. The local station alarm system shall include a flashing amber or red light mounted outdoors and an

audible 95 dB alarm to indicate during any of the alarm conditions. Audible alarm shall be silenced manually with a momentary contact switch mounted on the station panel.

9.9.12. A telemetering system shall be provided for all pumping stations. The telemetering system shall consist of an RTU mounted in a NEMA 4 fiberglass enclosure. The RTU shall use Modbus compliant communications protocol and support multiple baud rates.

9.9.12.1. The RTU shall provide, as a minimum, 10 digital inputs, 4 analog inputs and 6 digital outputs and shall monitor the following I/O points:

- DI-1 RTU power fail (internal to RTU cabinet).
- DI-2 Pump 1 status (closed contact from MCC when pump is running).
- DI-3 Pump 2 Status (closed contact from MCC when pump is running).
- DI-4 Pump 1 fail or pump fail (closed contact from MCC when pump fails to start).
- DI-5 Pump 2 fail (may be common alarm with #1 if unavailable as separate alarm).
- DI-6 Wet well high alarm (from float switch mounted in wetwell).
- DI-7 Transfer switch (closed contact from the transfer switch when utility power is off).
- DI-8 Generator status (closed contact from the generator when generator is running).
- DI-9 Generator alarm (closed contact from the generator when in alarm).
- AI-1 Level (4-20 mA signal from a level monitoring device).

9.9.12.2. The RTU shall be capable of "Store and Forward" communications methods and shall use VHF Radio compatible with Data Radio Integra TR for communications.

9.9.12.3. The RTU shall be manufactured in the USA and be powered by 120VAC, 20 amp power source.

9.9.13. In addition, the Contractor shall provide:

- Radio path study to ensure reliable communications with the wastewater treatment plant.
- 30-foot pole or tower as required by path study for antenna mast.
- 6db gain yagi antenna and coax. (antenna shall be pointed in proper direction as indicated by the path study).
- Conduit and wiring to RTU enclosure with 3' of wiring left inside enclosure.
- All field connections to MCC, generator and transfer switch shall be the responsibility of the Contractor.

- Modifications to existing central program and Wonderware system to add to the station.

9.9.14. RTU, antenna, coax, path study and modifications to Central program and Wonderware are available from:

J. K. Duren Company, Inc.
875 Old Roswell Road., Suite B-500
Roswell,GA 30076

9.10. GUARANTEES AND TESTS

9.10.1. The installation shall be entirely free from improper grounds, short circuits, or other defects. All tests shall be made in the presence of the Engineer or his authorized representative. The Contractor shall furnish assistance in performing these tests as required by the Engineer.

9.10.2. All protective equipment shall be operated to show it is in proper operating condition. All control systems shall be checked for correct operation before acceptance by the Utility.

9.11. SITE REQUIREMENTS

9.11.1. Pump station site shall conform to the requirements specified herein and as shown on Drawing H-15 in the appendix.

9.11.2. The minimum overall dimensions for the pump station site shall be 150 feet by 150 feet with 60 feet minimum distance from the fence line to any adjoining property.

9.11.3. Earth slopes around the pump station created by "fill" that are steeper than 3 to 1 must be stabilized with a soil stabilization mat in addition to permanent grassing.

9.11.4. A paved entrance drive shall be provided from the main road to the pump station gate. The drive slope shall not be greater than 8% at any point. A smooth vertical transition from the driveway to the frontage road and adequate sight distance is required. Where posted speed on the frontage road is equal to or greater than 35 MPH, a deceleration and acceleration lane along the frontage road may be required at the pump station entrance.

9.11.5. If the entrance drive is over 50 feet in length and/or the frontage road is a main road outside the development, a paved turn-around with a minimum 15-foot radius will be required.

9.12. FORCE MAINS

9.12.1. Velocity and Diameter: At design pumping rates, a cleansing velocity of at least 2 feet per second shall be maintained. The minimum force main diameter for raw wastewater shall not be less than 6 inches.

9.12.2. Air and Vacuum Relief Valve: An air relief valve shall be placed at high points in the force main to prevent air locking. Vacuum relief valves may be necessary to relieve negative pressures on the force mains. The force main configuration and head conditions shall be evaluated as to the need for and placement of vacuum relief valves. The air/vacuum relief valve(s) shall be installed in a manhole per Detail D-10

included in the Appendix. Where reasonable, the relief valve manhole shall be drained to a gravity sewer line with a 4-inch drain line. A 4-inch backwater swing-check, Josam series 67720, or equal, shall be installed on the discharge end of the drain pipe to prevent raw sewage from backing up into the relief valve manhole in the event of a sewer line surcharge.

9.12.3. Termination: Force mains shall enter the gravity sewer system at a point not more than 2 feet above the flow line of the receiving manhole and terminate in an upward-facing 90-degree bend and shall be called out on the submittal drawings. See drawing H-19.

9.12.4. Pipe and design pressure: Pipe and joints shall be equal to water main strength material suitable for design conditions as described in Section 3. The force main, reaction blocking, and station piping shall be designed to withstand water hammer pressures and associated cyclic reversal of stresses that are expected with the cycling of wastewater lift stations. Surge protection chambers should be evaluated.

9.12.5. Force main construction near streams or water works structures and at water main crossings shall meet applicable provisions of Sections 1.05 and 1.06 of this document.

9.12.6. Design friction losses: Friction losses through force mains shall be based on the Hazen and Williams formula or other acceptable methods. For other smooth pipe materials such as PVC, polyethylene, lined ductile iron, etc., a higher "C" value not to exceed 120 may be allowed for design.

9.12.7. Maximum power requirements: When initially installed, force mains will have a significantly higher "C" factor. The effect of the higher "C" factor shall be considered in calculating maximum power requirements and duty cycle time to prevent damage to the motor.

9.12.8. Identification: Where force mains are constructed of material which might cause the force main to be confused with potable water mains, the force main shall be appropriately identified.

APPENDIX

APPENDIX A

SUBDIVISION WATER/SEWER LINE APPLICATION

The City of Monroe, Georgia

Preliminary Application for Water/Sewer Service

1. The following information is to be completed by the applicant for the proposed subdivision:

Name of Subdivision: _____

Phases of Subdivision (If Appropriate) _____

Date Preliminary Application Submitted to Utility Network: _____

Location of Subdivision: _____

Total Lots _____ Total Tract Size in Acres: _____

Lots by Phase (If Appropriate) _____

Highest ground elevation: _____ Lowest Ground Elevation: _____

Public Sewer Required: ( ) Yes ( ) No

Name of Developer: _____

Address of Developer: _____

Phone Number of Developer: _____

Contact Person for Developer: _____

2. The following is a summary of key information about this subdivision to be completed by the City of Monroe

Potential total of length of water lines in subdivision: _____

List adjoining properties potential for looping lines: _____

Calculated domestic residual pressure: _____ With fire flow: _____

Length to closest existing water main and main size: _____

Estimated cost to connect to main: _____ Commission Share: _____

Estimated long term water supply dedicated to this subdivision when built out: _____

Other comments on Preliminary Submittal: _____

3. Recommended for Approval: ( ) Yes ( ) No By: _____

4. Approved by Board: ( ) Yes ( ) No Date _____

Board Approved Conditions: _____

Construction Cost Sharing: _____

APPENDIX B

APPLICATION FOR UTILITY FACILITY ENCROACHMENT
&
GEORGIA D.O.T. STANDARDS

D.O.T. APPLICATION CHECKLIST/INFORMATION REQUIRED

1. State route numbers and names of all highways and roads which appear on the plan should be included. The designation "County Road" is insufficient as it does not identify.
2. Show all roads as paved or unpaved.
3. Width of all existing pavements and Rights-of Way.
4. Distance from centerline to proposed utility installation.
5. Distance from Right-of-Way line to proposed installation.
6. Length, size, pressure, and type material of proposed utility.
7. Location of utility site in respect to nearest towns, intersecting named or numbered roads or highways.
8. North arrow and milepost location.
9. Plans to show name of utility owner and the county in which project is to be located.
10. If applicant has existing utilities within the right of way width, show their location by dashed lines and show proposed by solid lines.
11. Typical section of entire right of way width showing location and depth of proposed underground utility facility. (Separate typical for road crossings)
12. 8" x 11" portion of county or city map where the utility is to be located and the exact location of utility site circled or highlighted.
13. The D.O.T. maintains a policy that all utilities be installed in the back 5 feet of R/W or 3 feet beyond toe of fill slope, ditch or curb line.
14. Individual permits must be submitted for each State Route or County Road.
15. Show depth in feet of proposed underground utilities.
16. Show method of crossing paved roadways (boring and/or open cut methods).
17. If the open cut method is requested, such request must accompany the plans and applications in writing, supported by detailed reasons why some other method is not practical.
18. All dimensions must be shown in English units. Station numbers should be shown in English units.
19. Include the completed computer sheet.
20. Developer must submit a completed application request on an original "D.O.T. Application and Permit for Utility Facility Encroachment" form, including green, blue, yellow, and white sheets. Original application forms can be obtained from the District 3 D.O.T. office in Gainesville, GA.
21. All drawings must be on 8 ½" x 11" sheets. No fold-outs or full sized plans can be accepted.

General Instructions:

The Developer must submit 4 copies of the above application information to the City of Monroe, Georgia (Owner) for signature and submission to the District #1 Department of Transportation located in Gainesville, GA. The Developer should allow up to two weeks after submission to the Commission for final approval by the D.O.T. If the application is rejected by the D.O.T., the Authority will return the application to the Developer for the required modifications.

DEPARTMENT OF TRANSPORTATION
State of Georgia
Atlanta, Georgia 30334

Tracking #_____

APPLICATION AND PERMIT FOR UTILITY FACILITY ENCROACHMENT

APPLICATION IS HEREBY MADE TO THE GEORGIA DEPARTMENT OF TRANSPORTATION BY:

_____
(UTILITY – NAME AND ADDRESS)

FOR PERMISSION TO CONSTRUCT, OPERATE AND MAINTAIN THE FOLLOWING DESCRIBED UTILITY FACILITY WITHIN OR FROM THE RIGHT-OF-WAY OF

STATE HIGHWAY NO._____ COUNTY ROAD NO._____IN_____COUNTY.

DESCRIPTION: _____

LOCATION:_____

THE UTILITY SHALL COMPLY WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), CURRENT EDITION. IT IS ANTICIPATED THAT THE TEMPORARY TRAFFIC CONTROL UTILIZED FOR THIS INSTALLATION WILL BE IN ACCORDANCE WITH ONE OF THE FOLLOWING:

☐ MUTCD PART 6 - TYPICAL APPLICATION PLAN ☐ DETAILED TRAFFIC CONTROL PLAN (ATTACHED) ☐ COMBINATION TYPICAL APPLICATION & DETAIL TRAFFIC CONTROL PLAN (ATTACHED)

THE UTILITY FACILITIES COVERED HEREBY SHALL BE INSTALLED IN ACCORDANCE WITH THE PLANS ATTACHED HERETO AND MADE A PART HEREOF. UTILITY AGREES TO COMPLY WITH AND BE BOUND BY THE DEPARTMENT'S UTILITY ACCOMMODATION POLICY AND STANDARDS, CURRENT EDITION, ON FILE IN THE GENERAL OFFICE OF THE DEPARTMENT OF TRANSPORTATION, MADE A PART HEREOF BY REFERENCE, AND ALL GENERAL PROVISIONS AND SPECIAL PROVISIONS SHOWN ON THE REVERSE HEREOF, OR ATTACHED HERETO, DURING THE INSTALLATION, OPERATION AND MAINTENANCE OF SAID UTILITY FACILITIES WITHIN OR FROM THE RIGHT-OF-WAY.

I THE UNDERSIGNED, DO HEREBY CERTIFY THAT I AM A DULY ELECTED, OR APPOINTED, QUALIFIED, AUTHORIZED REPRESENTATIVE OF SAID UTILITY.

PERMIT REQUESTED THIS _____ DAY OF_____ 20____ BY:_____
(SIGNATURE - BLUE INK)

WITNESS TO SIGNATURE: _____
(TYPED NAME)

_____ _____
(TITLE & PHONE NUMBER)

PERMISSION IS GRANTED FOR THE ABOVE DESCRIBED UTILITY FACILITY ENCROACHMENT IN ACCORDANCE WITH THE PLANS AND PROVISIONS HEREOF.

THIS PERMIT IS TO BE STRICTLY CONSTRUED AND NO WORK OTHER THAN THAT SPECIFICALLY DESCRIBED ABOVE IS HEREBY AUTHORIZED.

PERMIT GRANTED THIS _____ DAY OF _____ 20____. BY: _____
(DISTRICT ENGINEER)

DISTRIBUTION AFTER APPROVAL	(TO BE COMPLETED BY DOT DISTRICT OFFICE)
ORIGINAL – DOT GENERAL OFFICE	DISTRICT NO. _____ COUNTY _____.
COPY – UTILITY	STATE ROUTE NO. _____ U.S. _____ CO. RD. NO._____.
COPY – DOT DISTRICT OFFICE	PROJECT NO. _____ACTIVE _____UNDER CONSTR. _____.
COPY – DOT FIELD INSPECTOR	PERMIT NO._____.

GENERAL PROVISIONS

IT IS EXPRESSLY STIPULATED THAT THIS PERMIT IS A LICENSE FOR PERMISSIVE USE ONLY AND THE PLACING OF UTILITY FACILITIES UPON PUBLIC PROPERTY PURSUANT TO THIS PERMIT SHALL NOT OPERATE TO CREATE OR VEST ANY PROPERTY RIGHT IN THE HOLDER.

WHENEVER NECESSARY FOR THE CONSTRUCTION, REPAIR, IMPROVEMENT, MAINTENANCE, SAFE AND EFFECTIVE OPERATION, ALTERATION OR RELOCATION OF ALL OR ANY PORTION OF THE HIGHWAY, AS DETERMINED BY THE DEPARTMENT, ANY OR ALL OF SAID FACILITIES AND APPURTENANCES AUTHORIZED HEREUNDER SHALL BE IMMEDIATELY REMOVED FROM THE RIGHT-OF-WAY, OR RESET OR RELOCATED THEREON, AS REQUIRED BY THE CHIEF ENGINEER, AND AT THE SOLE EXPENSE OF THE UTILITY UNLESS REIMBURSEMENT IS AUTHORIZED BY SEPARATE AGREEMENT. SHOULD THE UTILITY FAIL TO REMOVE OR RELOCATE ITS FACILITIES, UPON DUE NOTICE FROM THE DEPARTMENT, THE UTILITY SHALL BE LIABLE FOR ANY EXTRAORDINARY COSTS OR DAMAGES INCURRED BY THE DEPARTMENT AS A RESULT THEREOF.

IF THE DEPARTMENT UNDERTAKES TO IMPROVE THIS HIGHWAY IT SHALL BE THE RESPONSIBILITY OF THE UTILITY TO PLAN WITH THE DEPARTMENT AND ITS CONTRACTOR A SCHEDULE WHICH WILL CLEARLY SET FORTH AT WHICH STAGE OF OPERATIONS THE UTILITY WILL BE REQUIRED TO PERFORM ANY ADJUSTMENT TO ITS FACILITIES NECESSARY TO ACCOMMODATE THE HIGHWAY IMPROVEMENTS.

DURING THE INITIAL INSTALLATION OR CONSTRUCTION OF FACILITIES AUTHORIZED BY THIS PERMIT, OR DURING ANY FUTURE REPAIR, REMOVAL OR RELOCATION THEREOF OR ANY MISCELLANEOUS OPERATIONS, THE UTILITY SHALL, AT ALL TIMES, MAINTAIN FLAGMEN, SIGNS, LIGHTS, FLARES, BARRICADES, AND OTHER SAFETY DEVICES IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, CURRENT EDITION, AND AS MAY BE NECESSARY TO PROPERLY PROTECT TRAFFIC UPON THE HIGHWAY AND TO WARN AND SAFEGUARD THE PUBLIC AGAINST INJURY OR DAMAGE.

IT IS EXPRESSLY PROVIDED THAT WITH RESPECT TO ANY LIMITED ACCESS HIGHWAY, THE UTILITY SHALL NOT HAVE OR GAIN DIRECT ACCESS, EITHER INGRESS OR EGRESS, FROM THE MAIN TRAVELED WAY OF SAID HIGHWAY OR ITS ON OR OFF RAMPS TO ANY FACILITIES AUTHORIZED BY THE PERMIT EXCEPT UPON SPECIFIC APPROVAL BY THE DEPARTMENT.

IT IS THE UTILITY'S RESPONSIBILITY TO VERIFY THE LIMITS OF RIGHT-OF-WAY FOR LOCATION OF THE UTILITY FACILITIES AUTHORIZED HEREBY.

NO INHERENT OR RETAINED RIGHT OR PRIVILEGE OF ANY ABUTTING PROPERTY OWNER IS AFFECTED BY THIS PERMIT NOR IS THE DEPARTMENT RESPONSIBLE FOR ANY CLAIM WHICH MAY DEVELOP BETWEEN THE UTILITY AND ANY PROPERTY OWNER CONCERNING USE OF THE RIGHT OF WAY. THE UTILITY IS RESPONSIBLE FOR MAINTAINING REASONABLE ACCESS TO PRIVATE DRIVEWAYS DURING INSTALLATION OF ITS FACILITIES AND FOR RESTORATION OF DRIVEWAYS TO THE PROPERTY OWNER'S SATISFACTION.

APPROVAL OF THIS PERMIT DOES NOT CONSTITUTE APPROVAL OF DESIGN OR CONSTRUCTION DETAILS FOR THE PROPOSED UTILITY FACILITIES. THE UTILITY IS RESPONSIBLE FOR COMPLIANCE WITH ALL APPLICABLE GOVERNMENTAL CODES AND REGULATIONS.

USE OF EXPLOSIVES WITHIN THE RIGHT OF WAY IS PROHIBITED UNLESS APPROVED BY SEPARATE PERMIT.

THE UTILITY SHALL GIVE THE DEPARTMENT A MINIMUM OF 24 HOURS NOTICE PRIOR TO BEGINNING ANY WORK UNDER THIS PERMIT.

THIS PERMIT SHALL BE VOID UNLESS WORK HEREUNDER IS BEGUN WITHIN TWELVE (12) MONTHS OF THE DATE OF ITS APPROVAL.

THE PROVISIONS OF THIS PERMIT ARE REGULATORY AND NOT CONTRACTUAL. NO INTEREST OR RIGHT OF A UTILITY GRANTED BY THIS PERMIT MAY BE TRANSFERRED TO ANOTHER EXCEPT BY WRITTEN CONSENT OF THE DEPARTMENT.

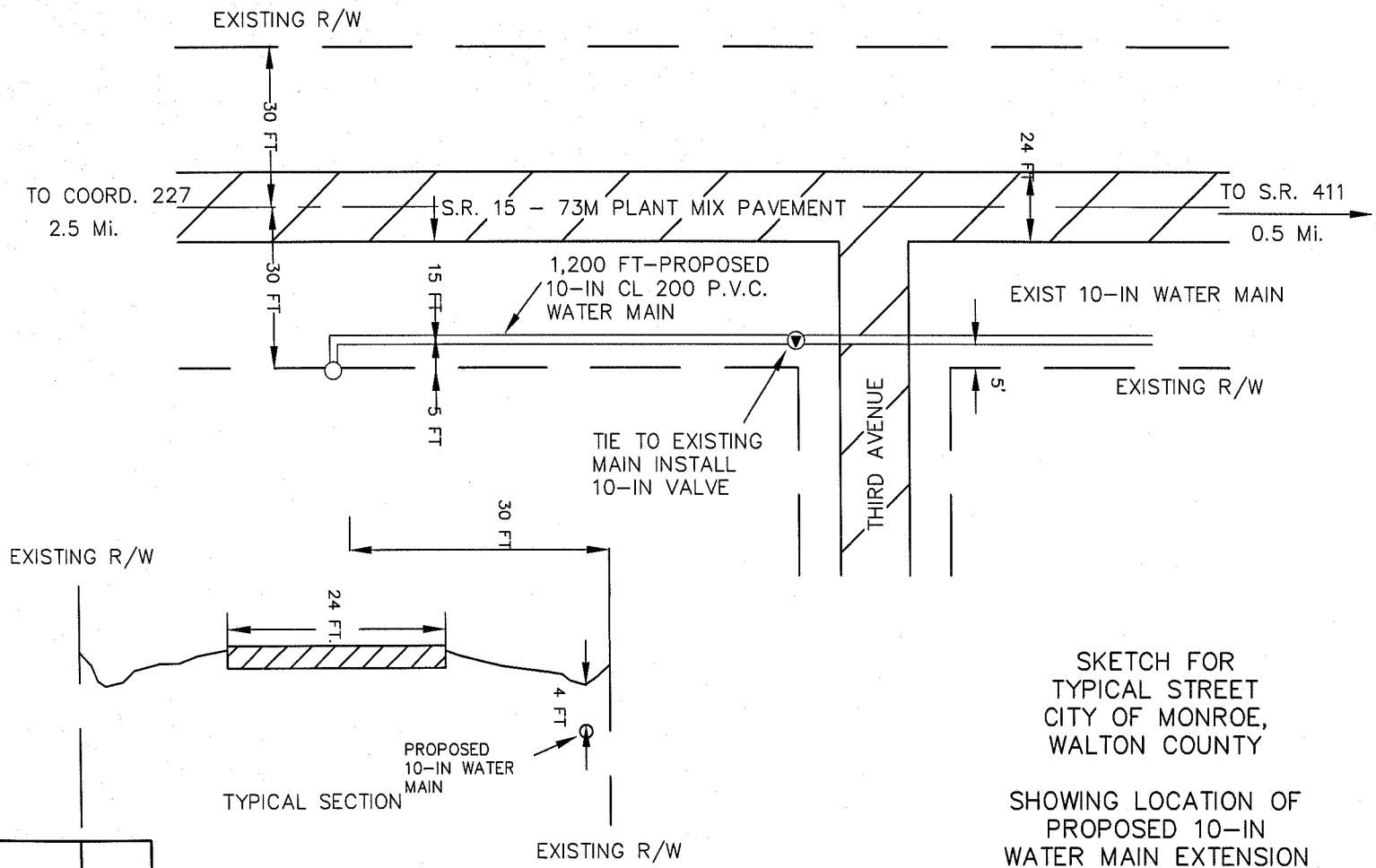
THIS PERMIT MAY BE REVOKED AT THE PLEASURE OF THE DEPARTMENT UPON THIRTY (30) DAYS WRITTEN NOTICE TO THE UTILITY.

FOR DEPARTMENT USE ONLY	FOR DEPARTMENT USE ONLY

THE INSTALLATION COVERED BY THIS PERMIT HAS BEEN COMPLETED IN ACCORDANCE WITH THE PROVISIONS OF THE PERMIT AND THE PLANS ATTACHED HERETO.

DATE:_____ SIGNED:_____

(DEPARTMENT OF TRANSPORTATION)



SKETCH FOR
TYPICAL STREET
CITY OF MONROE,
WALTON COUNTY

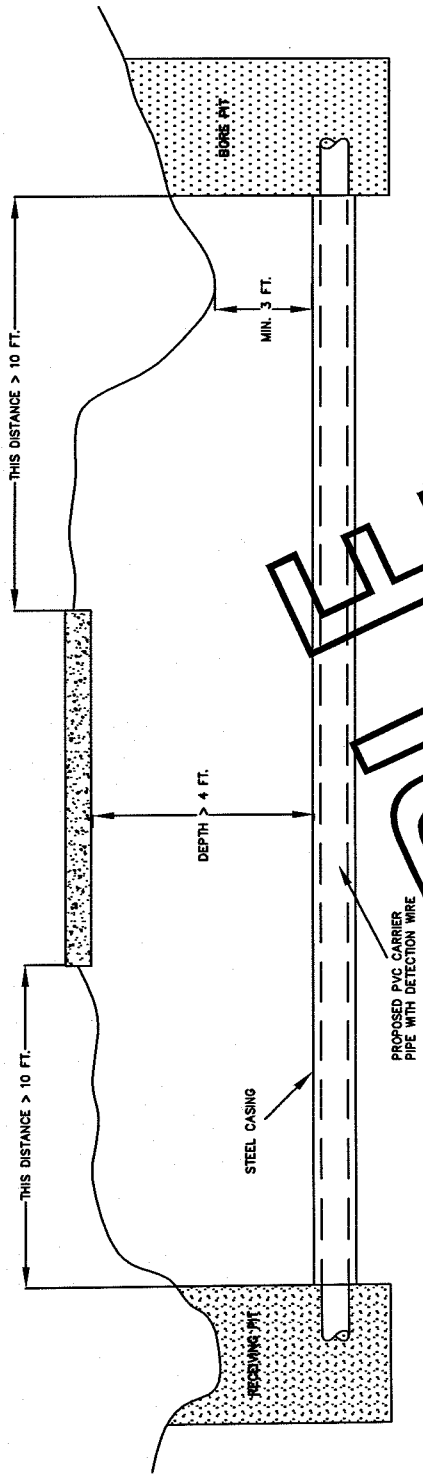
SHOWING LOCATION OF
PROPOSED 10–IN
WATER MAIN EXTENSION

SAMPLE PLAN

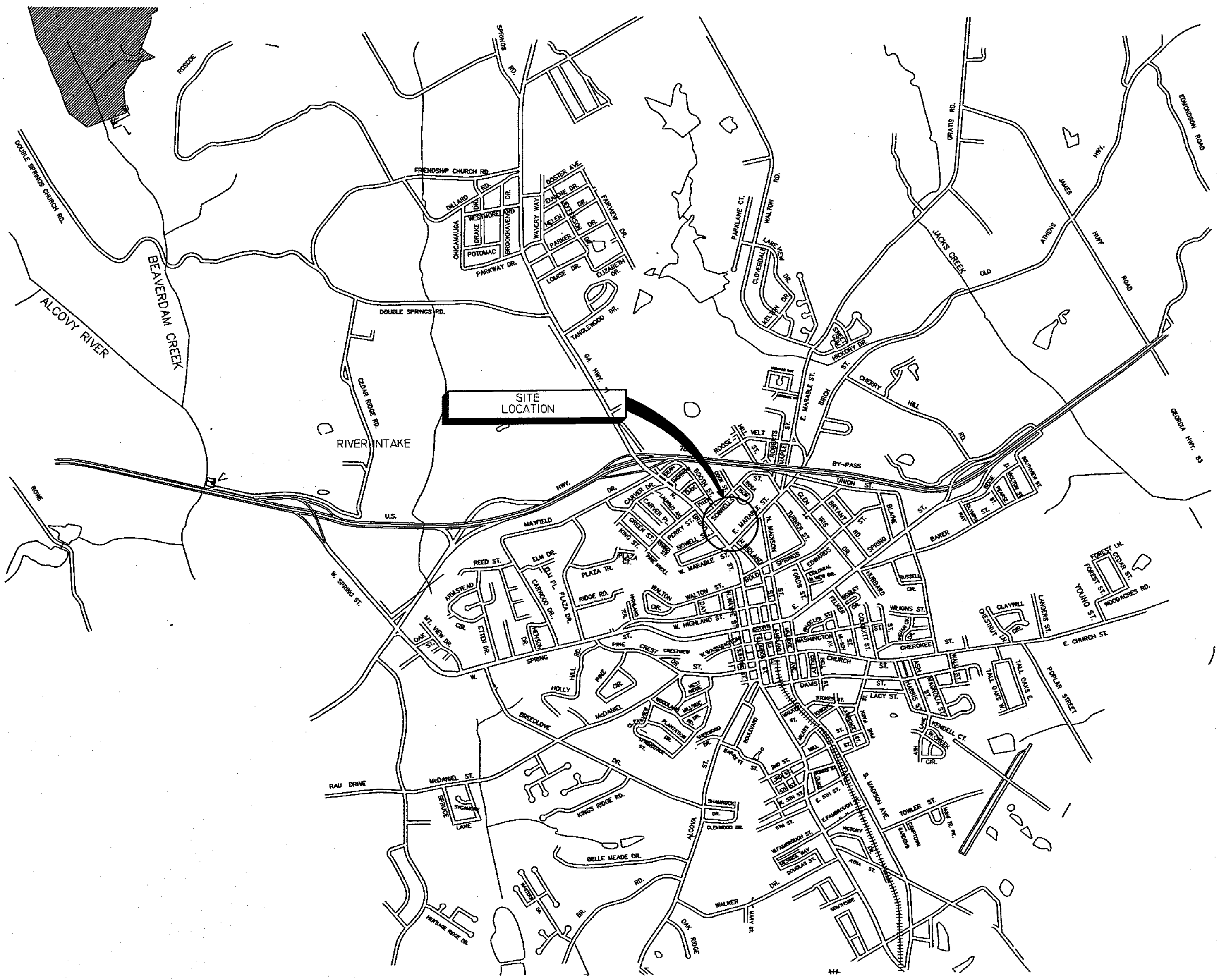
SCALE
NONE

REV. DATE
JUNE 2004

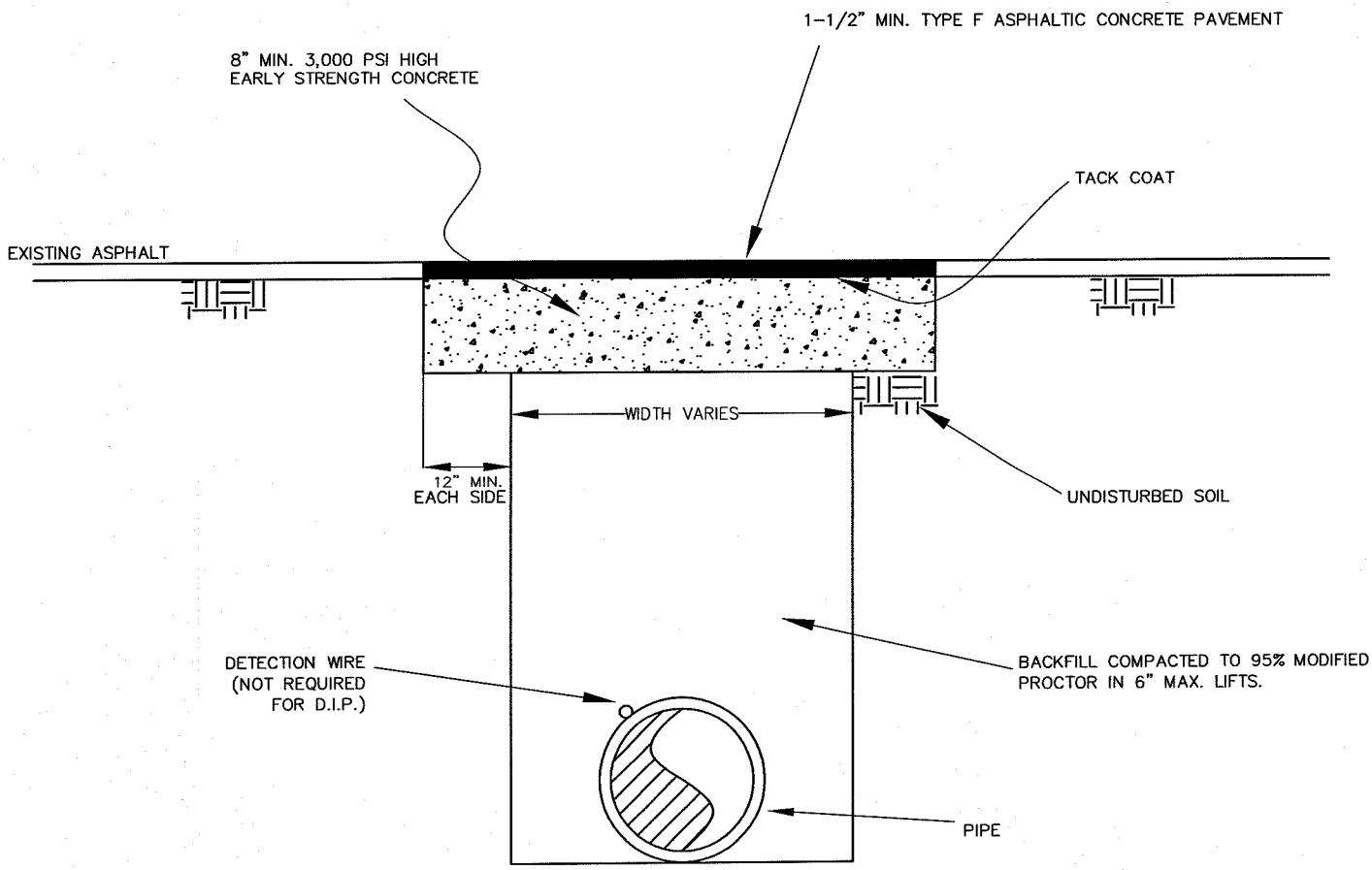
DRAWING NO.
B–3



WATERLINE ROAD BORE SECTION		
		REV. DATE NOV. 2000
SCALE NONE	THE CITY OF Monroe	DRAWING NO. B–4



SAMPLE LOCATION PLAN		
		REV. DATE NOV. 2000
SCALE NONE		DRAWING NO. B–5



SUBDIVISION, COUNTY, OR DOT ROAD
ASPHALT CUT AND PATCH

PAVEMENT PATCH DETAIL		
		REV. DATE JUNE 2004
SCALE NONE		DRAWING NO. B-6

APPENDIX C

SYMBOLOGY

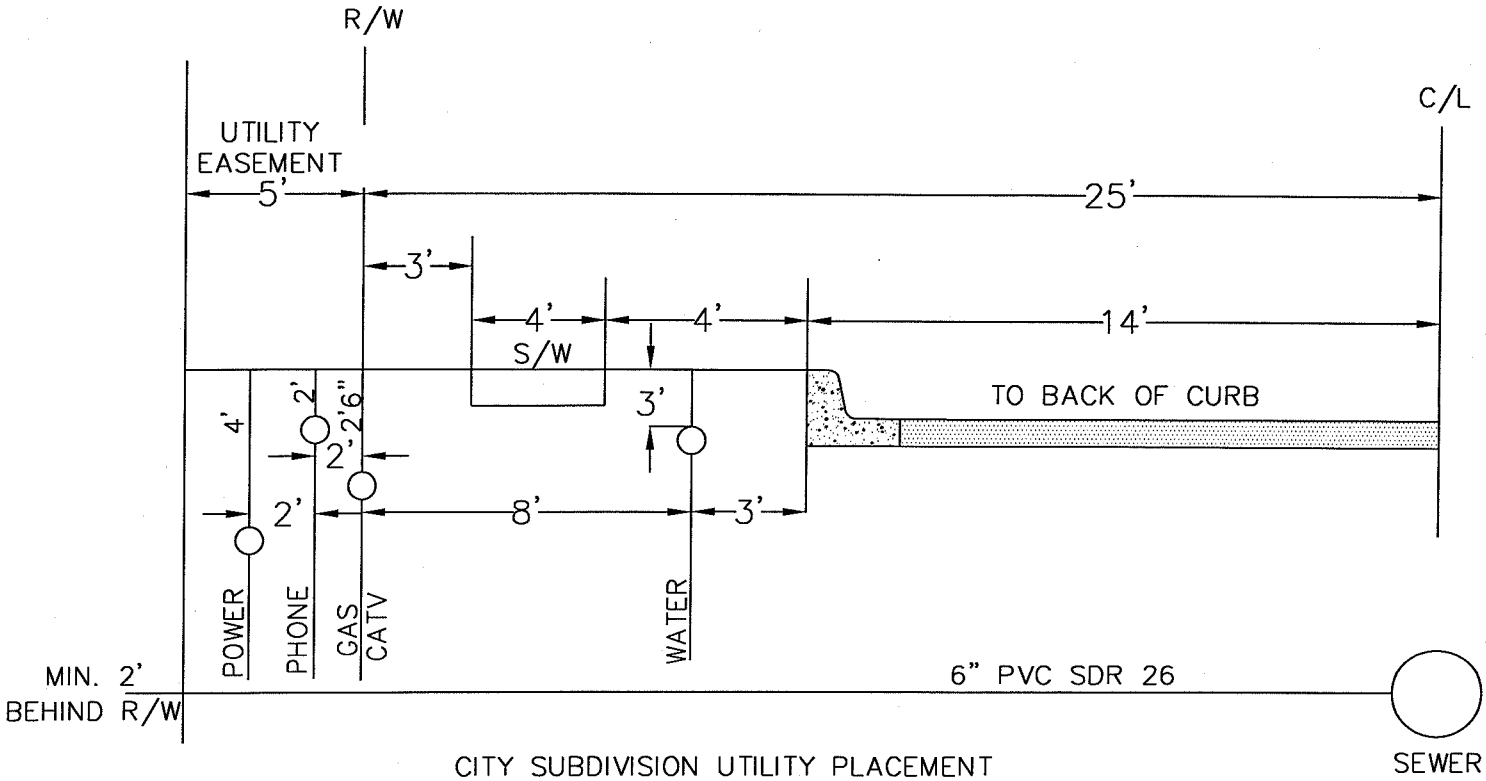
PROPOSED WATER LINE	
EXISTING WATER LINE	
PROPOSED FIRE HYDRANT	
EXISTING FIRE HYDRANT	
PROPOSED GATE VALVE	
EXISTING GATE VALVE	
PROPOSED TAPPING SLEEVE AND TAPPING VALVE	
PROPOSED DOUBLE SET AND SINGLE SET SERVICES	
EXISTING DOUBLE SET AND SINGLE SET SERVICES	
DUCTILE IRON PLUG	
PROPOSED REDUCER	
ELECTRICAL TRANSFORMER	

TYPICAL SYMBOLOGY

		REV. DATE NOV. 2000
SCALE NONE		DRAWING NO. C–1

APPENDIX D

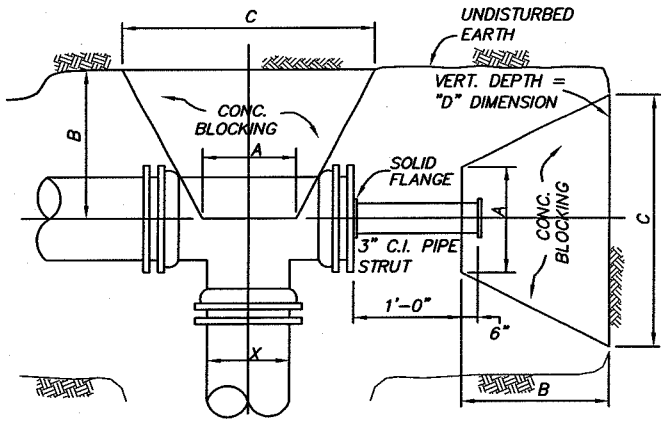
TYPICAL CONSTRUCTION DETAILS



CITY SUBDIVISION UTILITY PLACEMENT

NOTE: On all roads outside of the subdivision, water line shall be located 0 – 5' from the edge of the right of way & located on the north side of east–west streets & on the west side of north–south streets, whenever possible.

SUBDIVISION UTILITY LOCATION		
		REV. DATE NOV. 2007
SCALE NONE		DRAWING NO. D–1



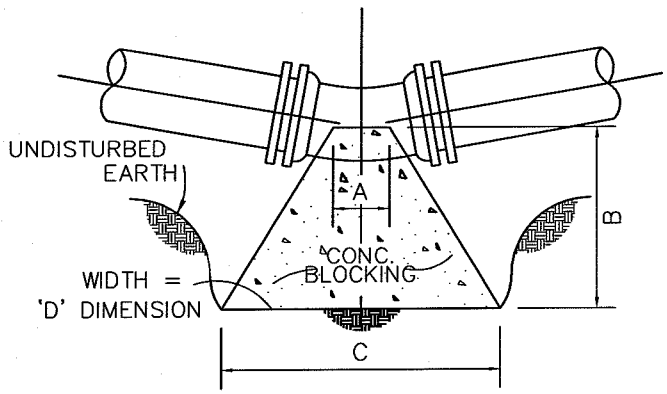
TEES

SECTION

CONC. BLOCKING DIMENSIONS					
X	A	B	C	D	D1
TEES – 12" RUN					
12"	1'-6"	2'-4"	3'-10"	3'-0"	2'-0"
TEES – 8" RUN					
8"	1"-0"	1'-8"	2'-8"	2'-0"	1'-8"
90° BENDS					
12"	1'-2"	3'-6"	4'-8"	3'-6"	2'-0"
8"	10"	2'-2"	3'-0"	2'-8"	1'-8"
45° BENDS					
12"	8"	2'-4"	3'-0"	3'-0"	2'-0"
8"	6"	2'-0"	2'-6"	1'-8"	1'-8"
22 1/2° BENDS					
12"	8"	1'-8"	2'-4"	2'-0"	2'-0"
8"	6"	1'-4"	1'-6"	1'-8"	1'-8"
11 1/4° BENDS					
12"	8"	1'-4"	1'-6"	1'-6"	1'-0"
8"	6"	1'-0"	1'-6"	1'-0"	1'-0"

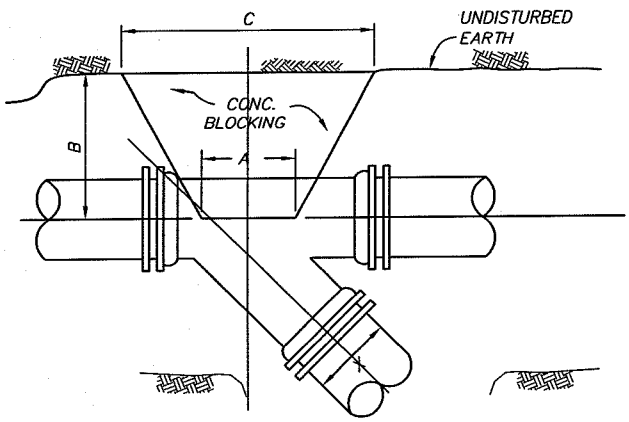
PRESSURE 200 P.S.I. SOIL 2000 P.S.F.

PLUG – SAME AS TEE EXCEPT THAT THE LARGER SIZE IN UNEQUAL RUNS SHALL BE USED

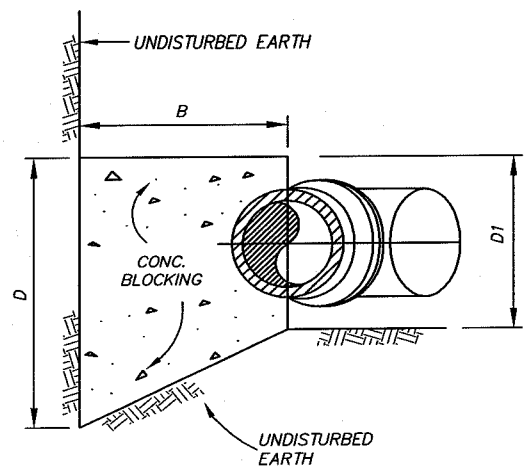


VERTICAL UP BENDS

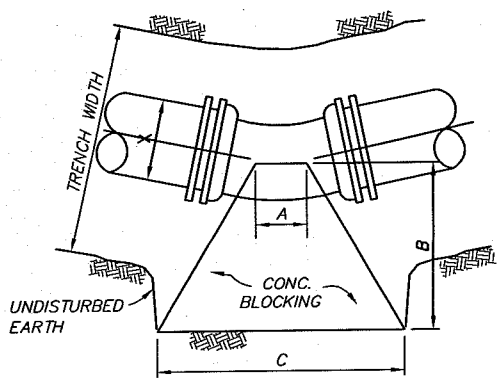
N.T.S.



WYES



SECTION



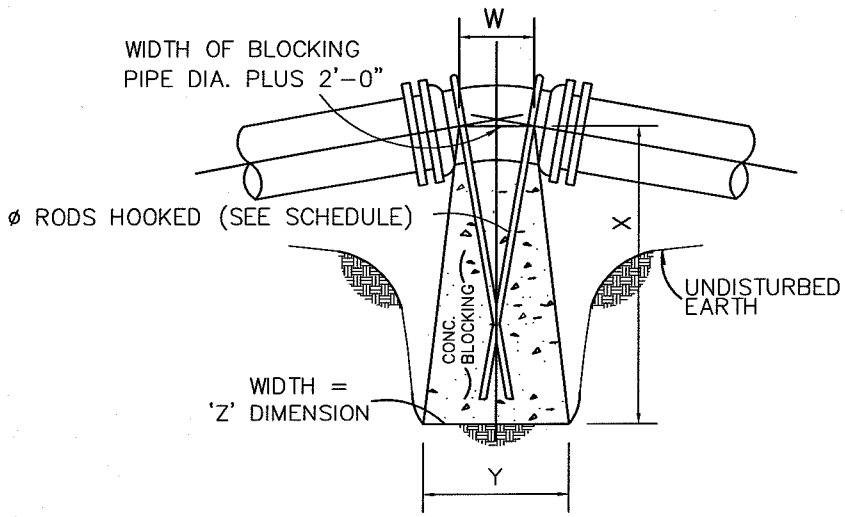
BENDS

CONCRETE BLOCKING DETAILS

REV. DATE
JUNE 2004

SCALE
NONE

DRAWING NO.
D–2A



VERTICAL DOWN BENDS

N.T.S.

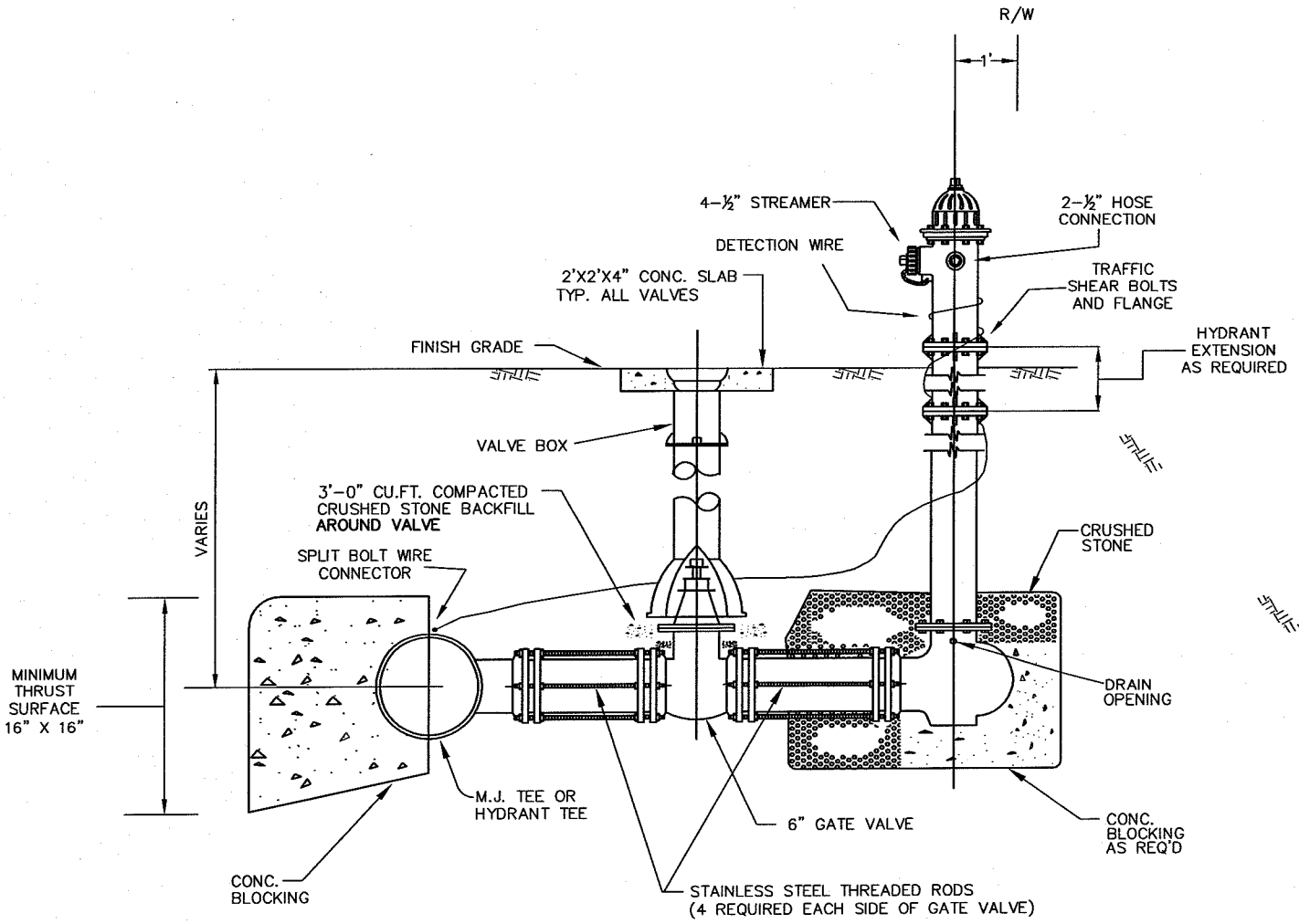
CONCRETE BLOCKING DIMENSIONS FOR VERTICAL DOWN BENDS

45° BEND					
DIAMETER	W	X	Y	Z	øROD DIA.
16"	1'-8"	9'-4"	9'-4"	9'-4"	1"
12"	10"	7'-8"	7'-8"	7'-8"	1"
10"	8"	7'-0"	7'-0"	7'-0"	3/4"
8"	6"	6'-0"	6'-0"	6'-0"	3/4"
6"	6"	5'-0"	5'-0"	5'-0"	3/4"
4"	6"	3'-9"	3'-9"	3'-9"	3/4"

22 1/2° BEND					
DIAMETER	W	X	Y	Z	øROD DIA.
16"	1'-8"	7'-6"	7'-6"	7'-6"	1"
12"	1'-3"	6'-3"	6'-3"	6'-3"	1"
10"	12"	5'-6"	5'-6"	5'-6"	3/4"
8"	10"	4'-9"	4'-9"	4'-9"	3/4"
6"	8"	4'-0"	4'-0"	4'-0"	3/4"
4"	8"	3'-0"	3'-0"	3'-0"	3/4"

PRESSURE: 200 P.S.I.(MAX.)

THRUST BLOCKING DETAILS		
		REV. DATE NOV. 2000
SCALE NONE		DRAWING NO. D-2B

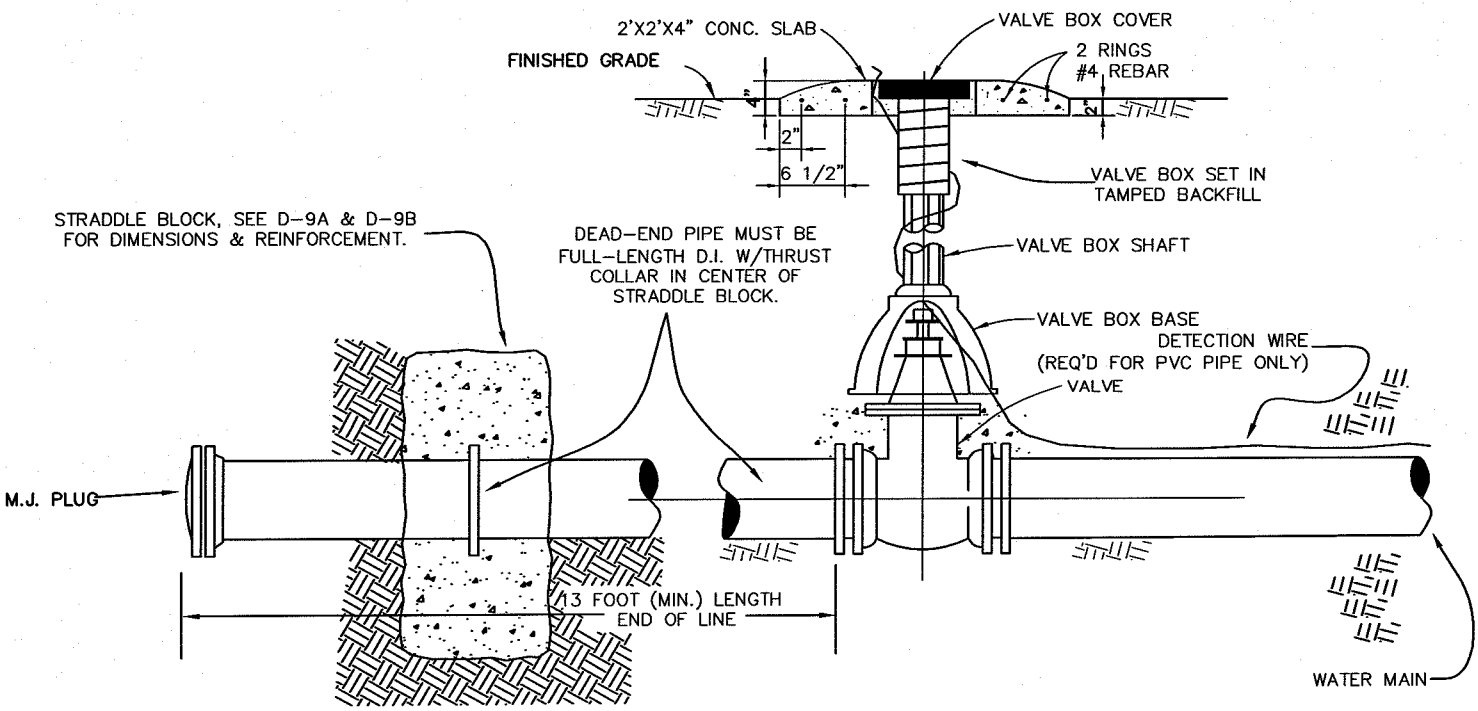


DETAIL OF FIRE HYDRANT CONNECTION

N.T.S

NOTE: On County and D.O.T. regulated roads, the Contractor shall install 12" long ductile iron anchor coupling in lieu of the hydrant branch and threaded rod.

FIRE HYDRANT ASSEMBLY		
		REV. DATE JUNE 2004
SCALE NONE		DRAWING NO. D–3

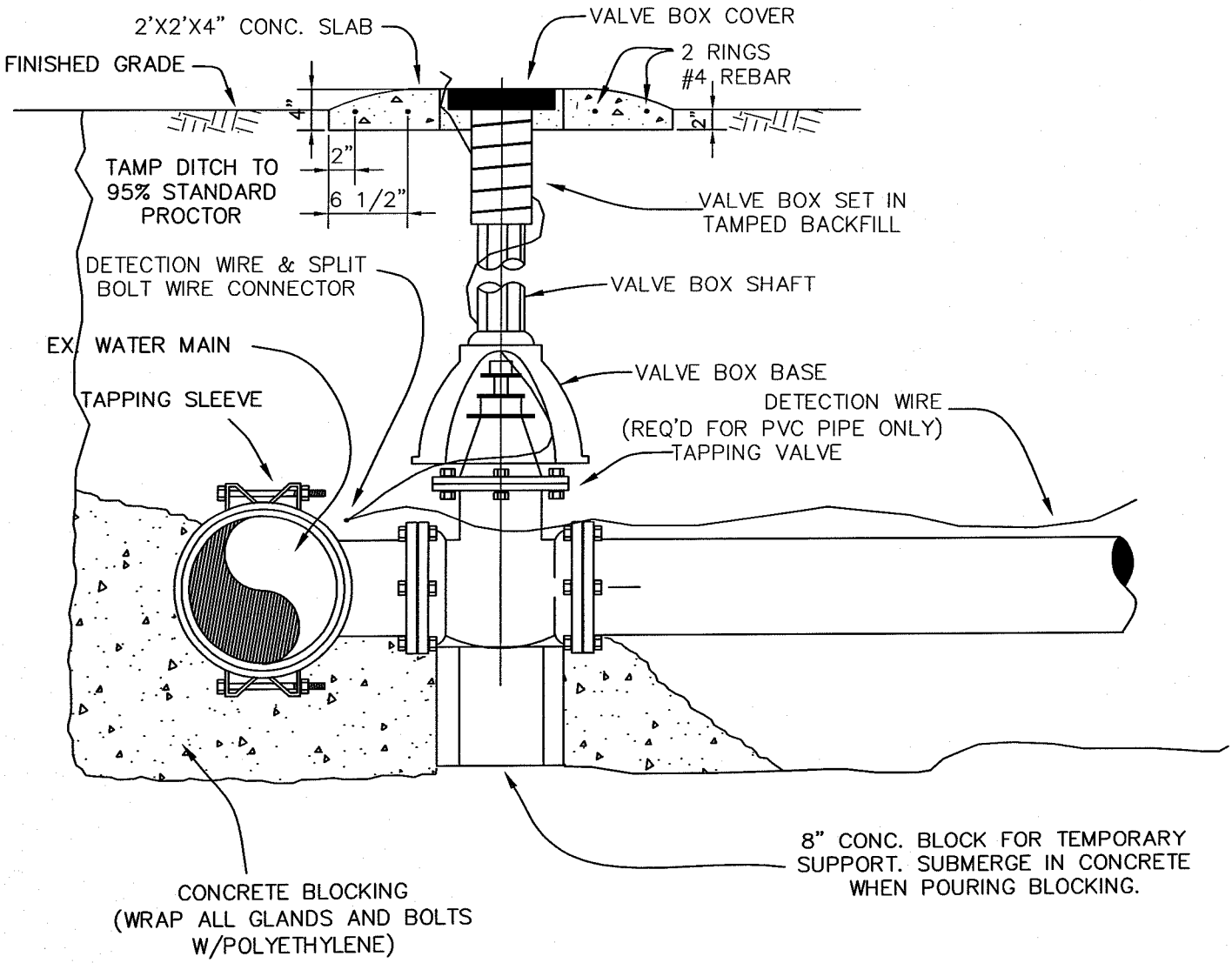


END OF PIPE DETAIL
VALVE, VALVE BOX, STRADDLE BLOCKING

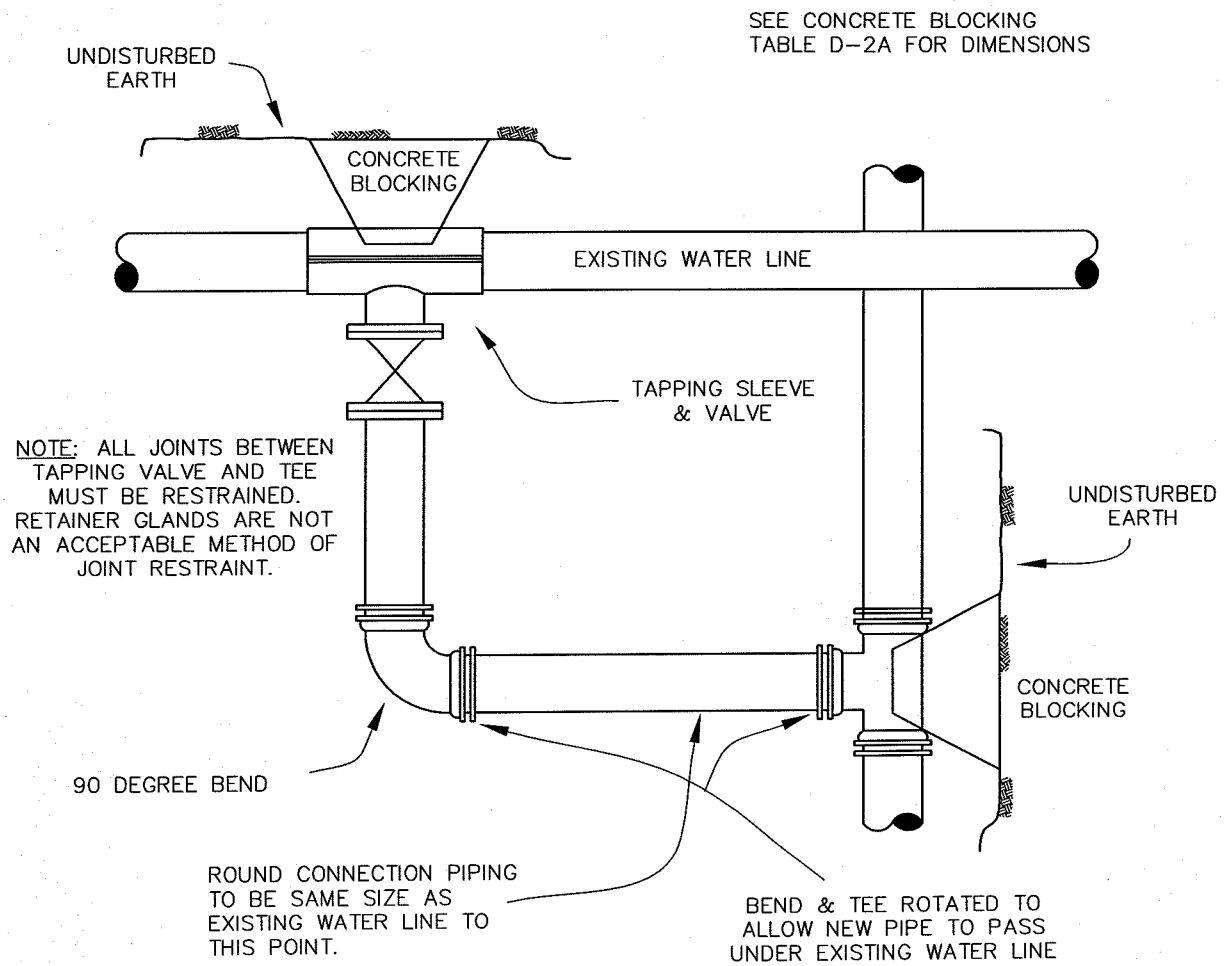
N.T.S.

NOTE:
The detection wire shall be wrapped around valve box, run up between box and concrete pad, and terminated 4 inches above pad. Where valve boxes are located in a street, detection wire shall be routed up inside valve box and terminated near top inside valve box.

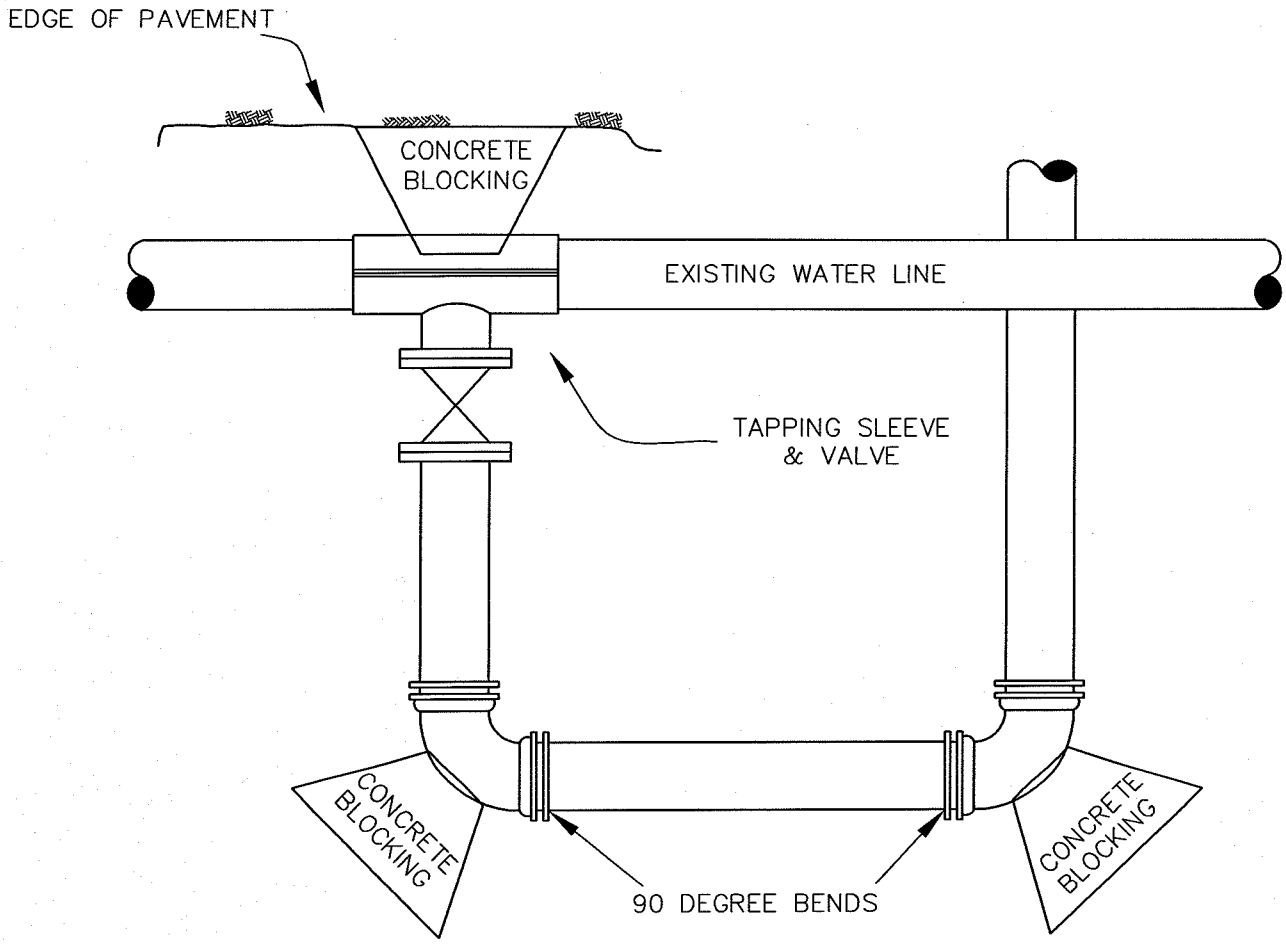
DEAD END VALVE, V. B. DETAIL		
		REV. DATE SEPT 2004
SCALE NONE		DRAWING NO. D-4



TAPPING SLEEVE & VALVE		
		REV. DATE SEPT. 2004
SCALE NONE		DRAWING NO. D-5



ROUND CONNECTION DETAIL		
		REV. DATE NOV. 2000
SCALE NONE		DRAWING NO. D-6

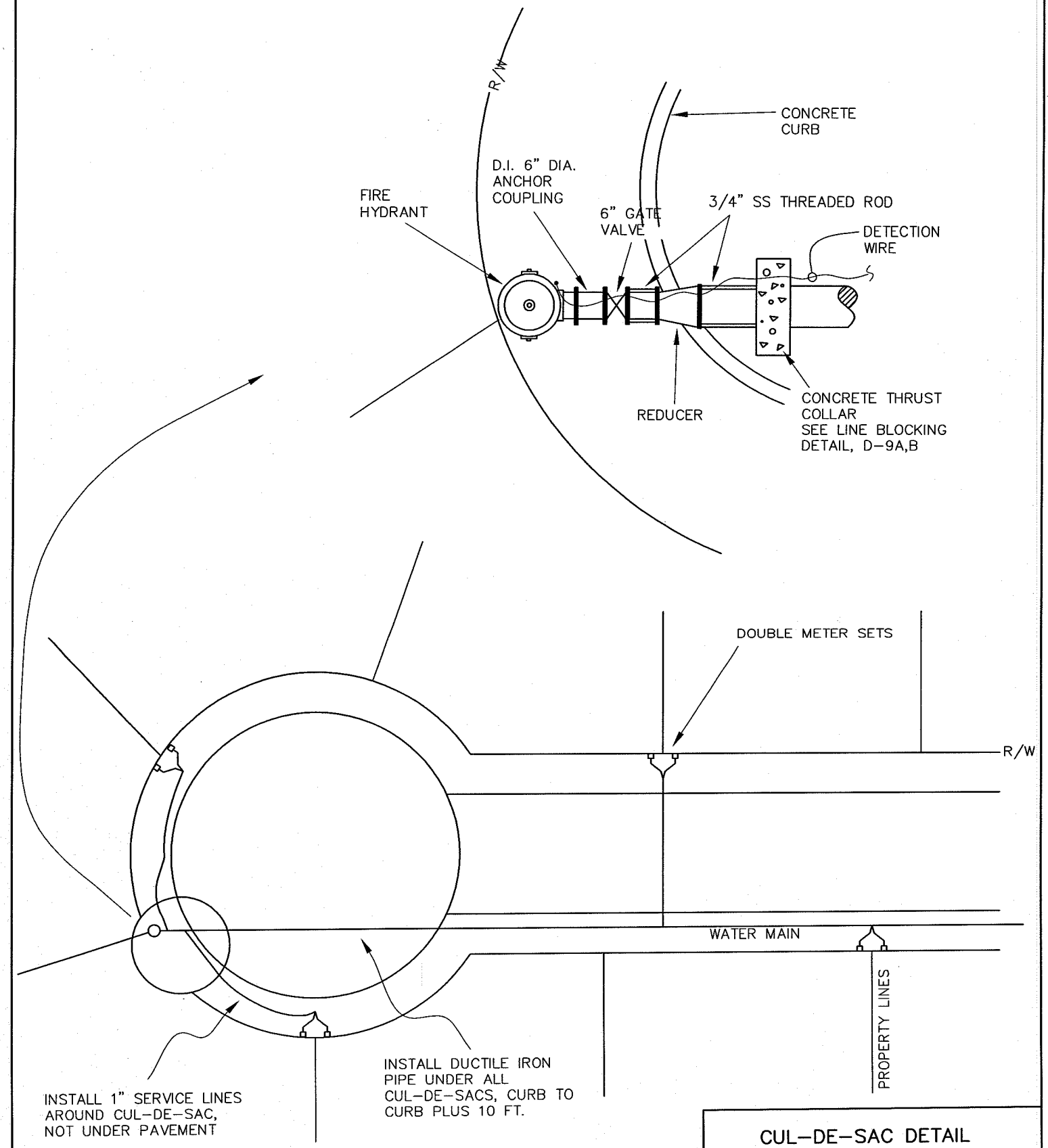


NOTES:

1) THE TAPPING VALVE AND BOTH 90 DEGREE BENDS SHALL BE FULLY RESTRAINED USING MEGA-LUGS. ALL CONCRETE BLOCKING SHALL BE AGAINST UNDISTURBED SOIL.

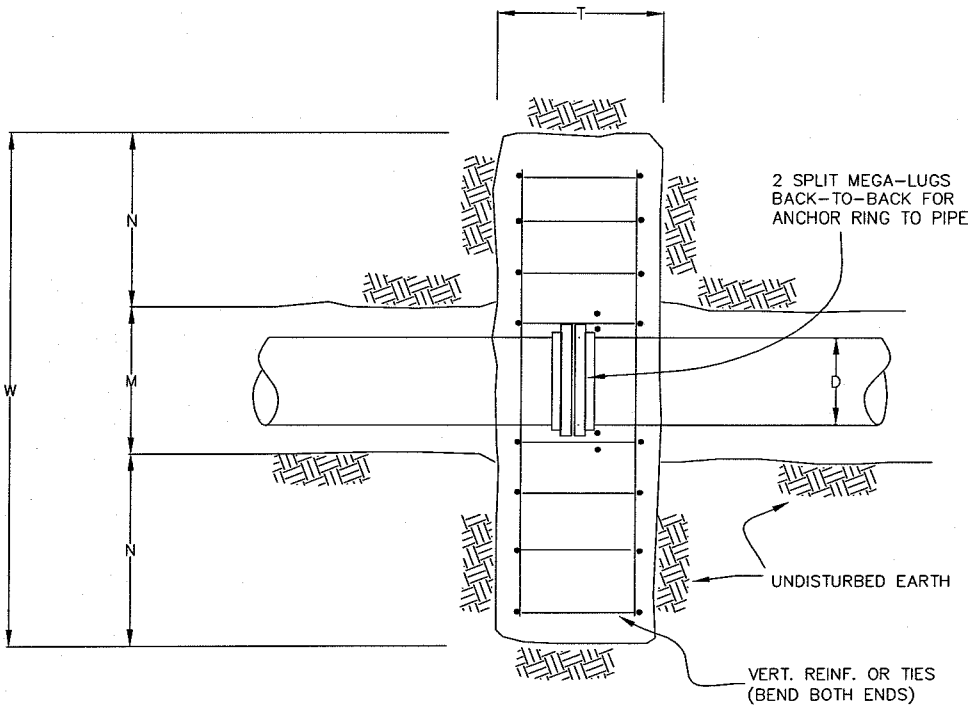
2) A BACKTAP SHALL NOT BE INSTALLED BY THE CONTRACTOR UNLESS SPECIFICALLY SHOWN ON THE WATER LINE DRAWINGS APPROVED FOR CONSTRUCTION.

BACKTAP INSTALLATION		
	THE CITY OF Monroe since 1821	REV. DATE JUNE 2004
SCALE NONE		DRAWING NO. D-7

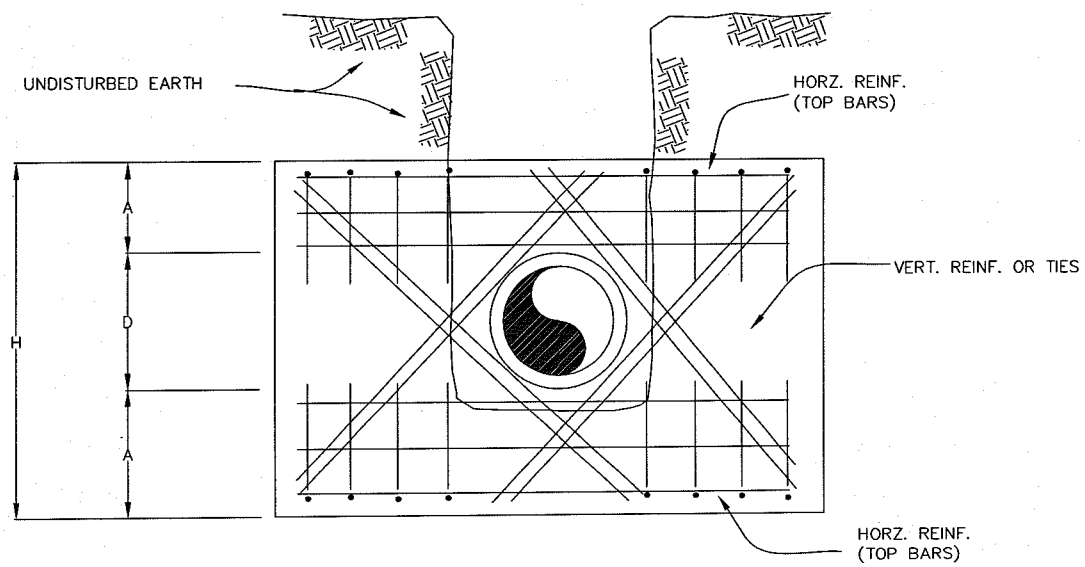


CUL-DE-SAC DETAIL

	THE CITY OF Monroe	REV. DATE NOV. 2007
SCALE NONE		DRAWING NO. D-8



PLAN



ELEVATION

LINE BLOCKING DETAILS

		REV. DATE JUNE 2004
SCALE NONE		DRAWING NO. D-9A

LINE BLOCKING DIMENSIONS REF. D-9A											
PRESSURE: 200 PSI SOIL: 2000 PSF											
CONCRETE BLOCKING									BLOCKING REINFORCEMENT		
									HORZ. (MAIN) REINF.		VERT. REINF.
DIA.	A	H	M	N	W	T	*FT.^{2}	FT.^{3}	TOP	BOT.	(TEMP.)
6"	10"	2'-2"	2'-6"	1'-0"	4'-6"	8"	2.9	6.4	2-#4	2-#4	#4@10"
8"	1'-0"	2'-8"	2'-8"	1'-0"	4'-8"	10"	5.3	10.1	2-#4	2-#4	#4@10"
10"	1'-0"	2'-10"	2'-10"	1'-4"	5'-6"	1'-0"	7.9	15.0	2-#4EF	2-#4EF	#3@12"EF
12"	1'-6"	4'-0"	3'-0"	1'-6"	6'-0"	1'-0"	11.3	23.2	2-#5EF	2-#5EF	#4@12"EF

* INDICATES MINIMUM THRUST AREA W/O SAFETY FACTOR.

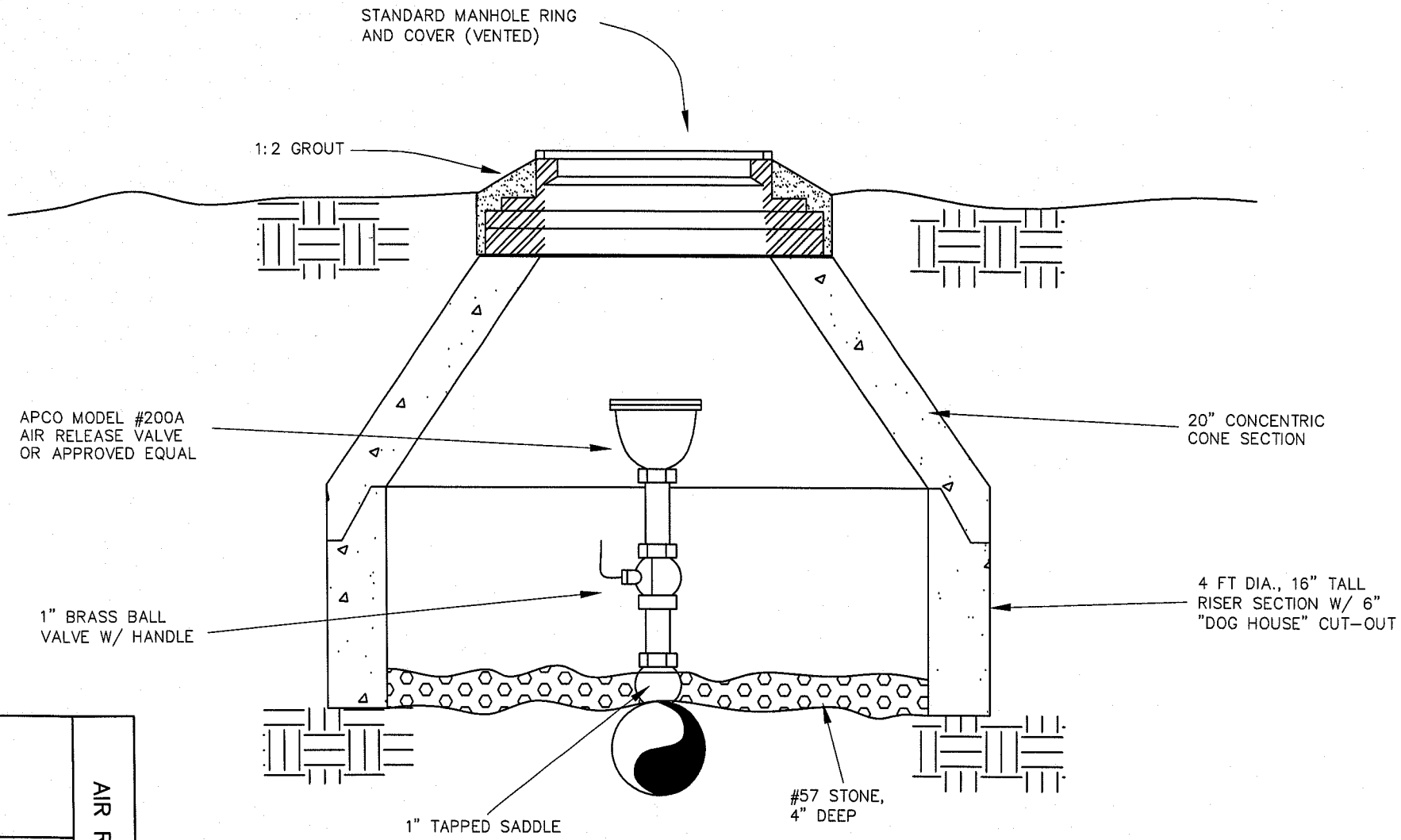
LINE BLOCKING DIMENSIONS

REV. DATE
JUNE 2004

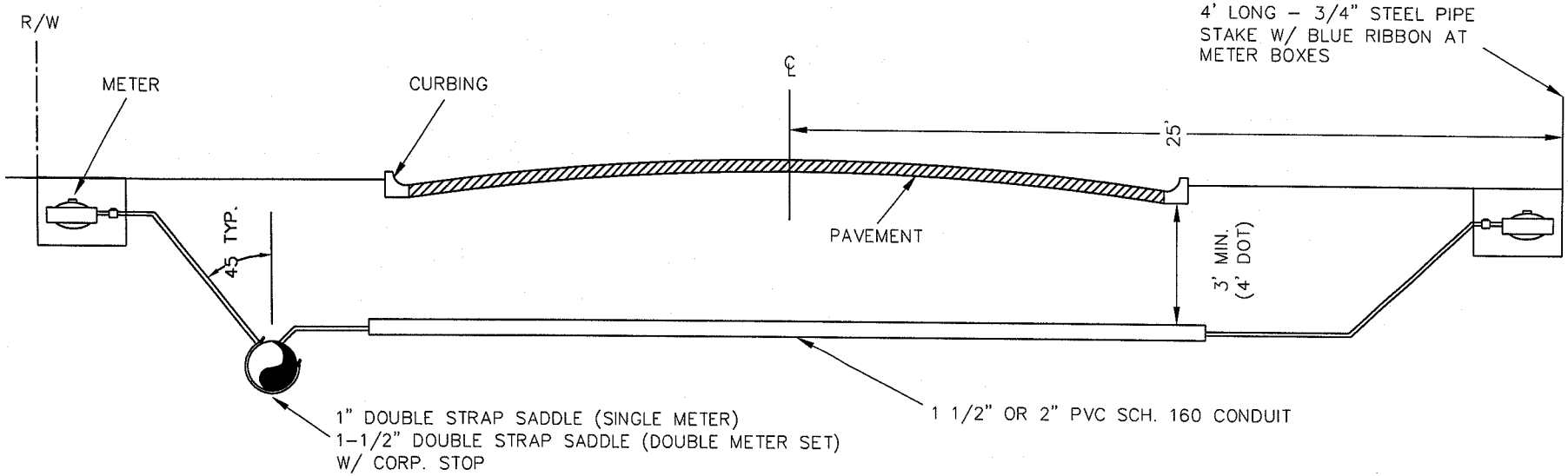
THE CITY OF Monroe Since 1891

SCALE
NONE

DRAWING NO.
D-9B



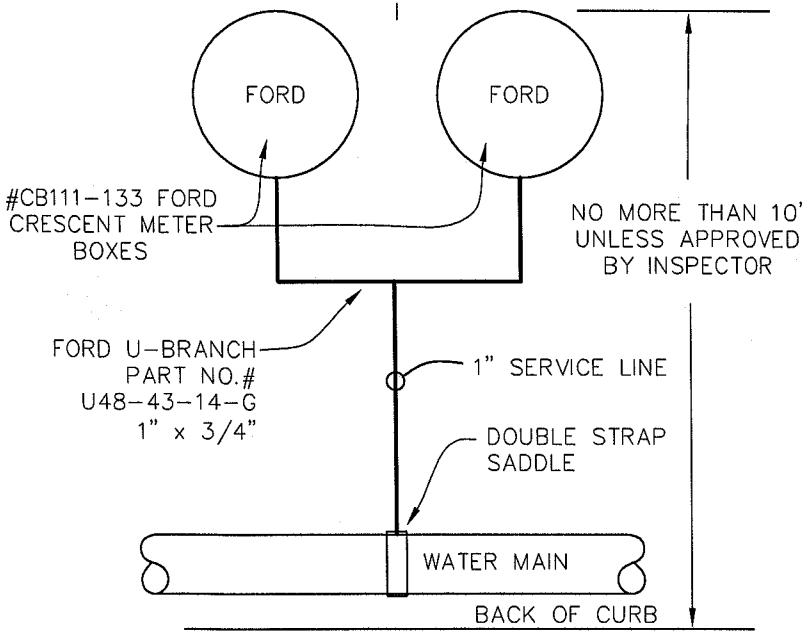
SCALE NONE		AIR RELEASE VALVES
	THE CITY OF Monroe	
DRAWING NO. D-10	REV. DATE JUNE 2004	



NOTE: WATER METER BOX SHOULD NOT BE MORE THAN 10' OFF OF CURB.

P.L.

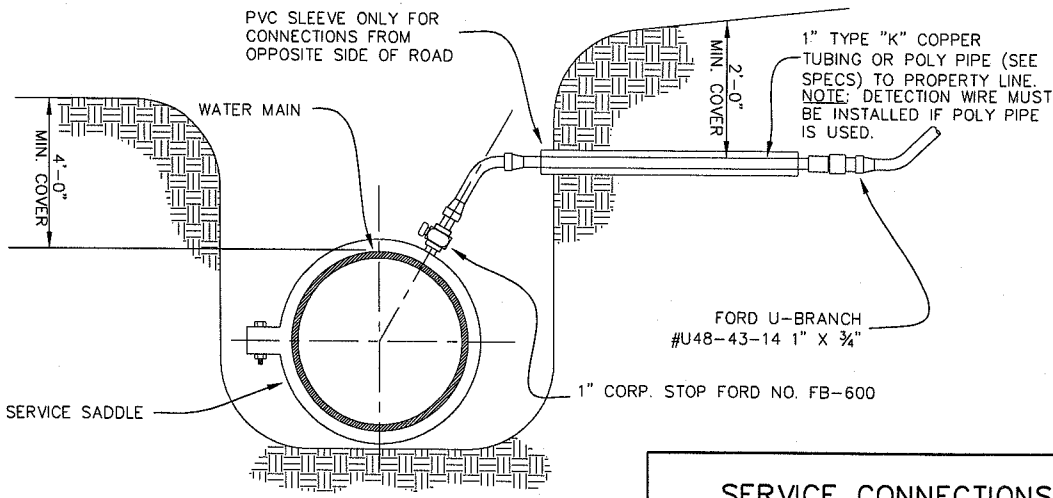
METER BOXES SET TO SPLIT PROPERTY LINE



TYPICAL DUAL RESIDENTIAL WATER METER SERVICE CONNECTION

N.T.S.

DEPTH OF WATER MAIN SHALL BE A MIN. OF 48" BELOW FINISHED GRADE, UNLESS OTHERWISE SHOWN OR DIRECTED BY THE ENGINEER.

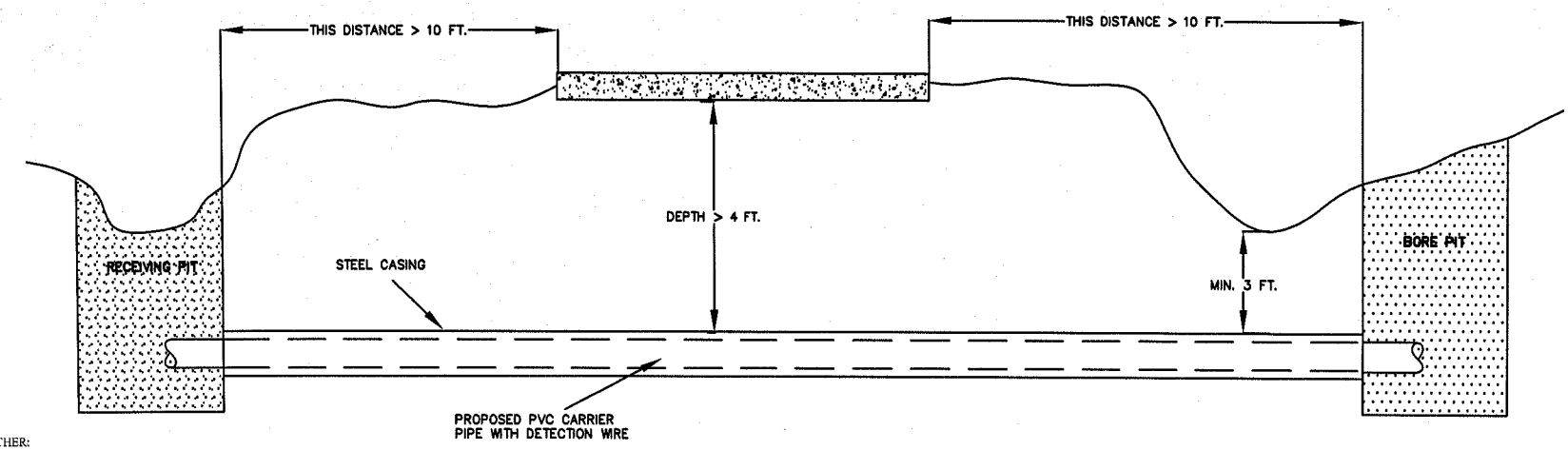


TYPICAL WATER SERVICE CONNECTION

N.T.S.

SERVICE CONNECTIONS

	THE CITY OF Monroe	REV. DATE NOV. 2007
SCALE NONE		DRAWING NO. D-11

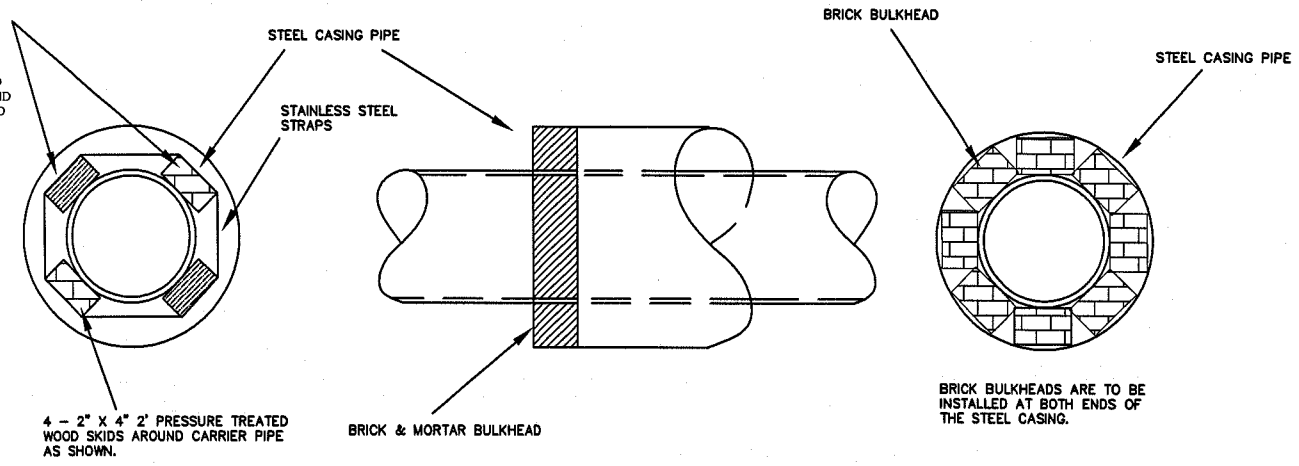


CASING SPACERS SHALL BE EITHER:

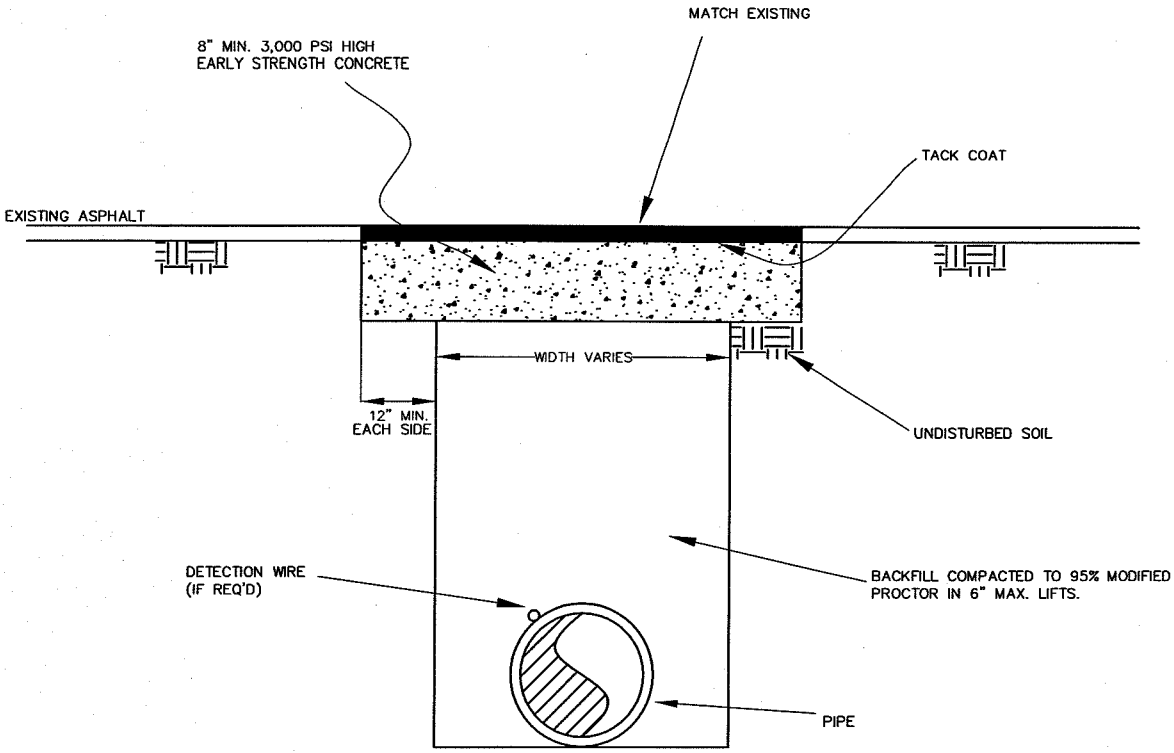
1) FLANGED, BOLT-ON STYLE WITH A TWO-SECTION STAINLESS STEEL SHELL LINED WITH A PVC LINER, MINIMUM 0.09-INCH THICK ALSO HAVING A HARDNESS OF 85-90 DUROMETER. RUNNERS SHALL BE ATTACHED TO STAINLESS STEEL RISERS WHICH SHALL BE PROPERLY WELDED TO THE SHELL. THE HEIGHT OF THE RUNNERS AND RISERS SHALL BE MANUFACTURED SUCH THAT THE PIPE DOES NOT FLOAT WITHIN THE CASING. CASING SPACERS SHALL BE CASCADE WATERWORKS MANUFACTURING COMPANY OR ADVANCED PRODUCTS & SYSTEMS, INC.

OR

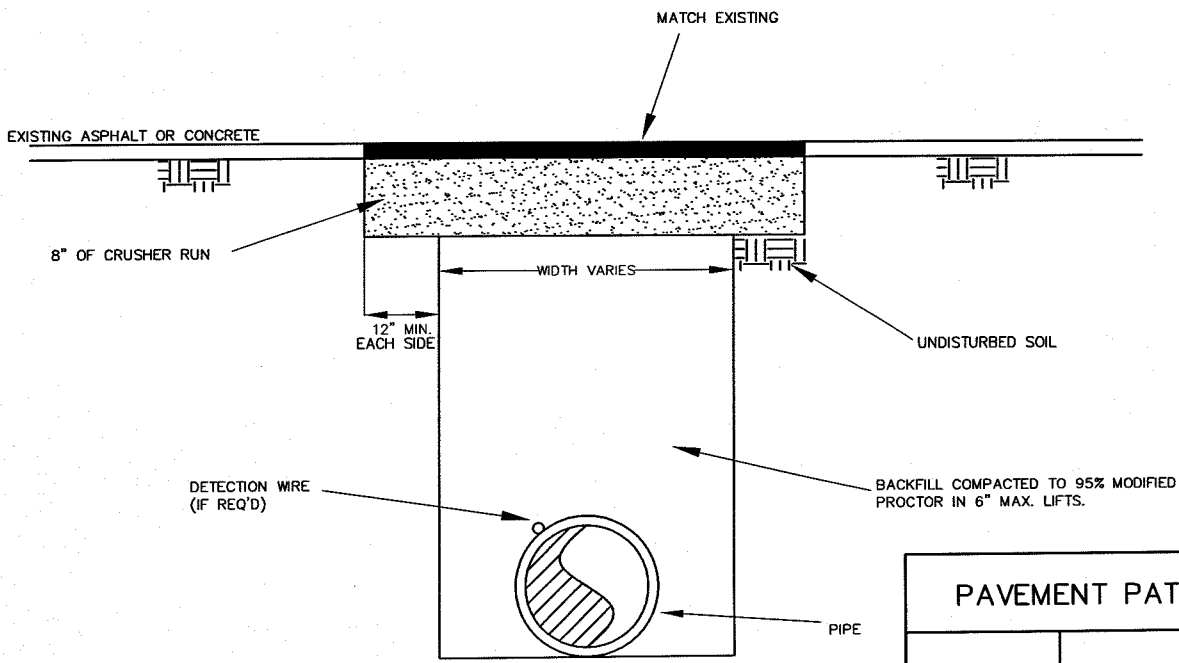
2) A TWO-SECTION, FLANGED, BOLT ON STYLE CONSTRUCTED OF HEAT FUSED PVC COATED STEEL, MINIMUM 14 GAUGE BAND AND 10 GAUGE RISERS, WITH 2-INCH WIDE GLASS REINFORCED POLYESTER INSULATING SKIDS, HEAVY DUTY PVC INNER LINER, MINIMUM 0.09-INCH THICK HAVING A HARDNESS OF 85-90 DUROMETER, AND ALL STAINLESS STEEL OR CADMIUM PLATED HARDWARE SHALL BE PIPELINE SEAL AND INSULATOR, INC.



SCALE NONE		TYPICAL ROAD BORE AND CASING DETAIL
	THE CITY OF Monroe Since 1821	
DRAWING NO. D–12	REV. DATE NOV. 2000	



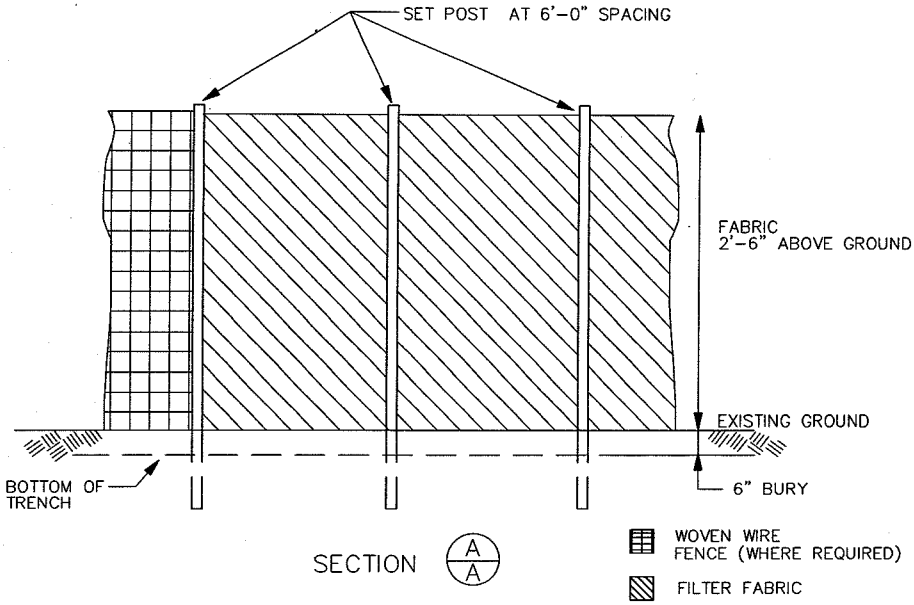
SUBDIVISION, COUNTY, OR DOT ROAD
ASPHALT CUT AND PATCH
N.T.S

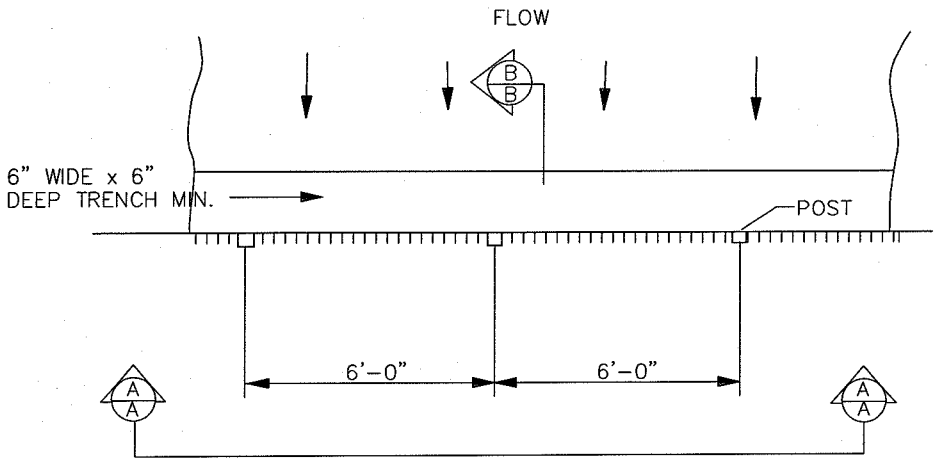


ASPHALT AND CONCRETE DRIVEWAY
CUT AND PATCH
N.T.S.

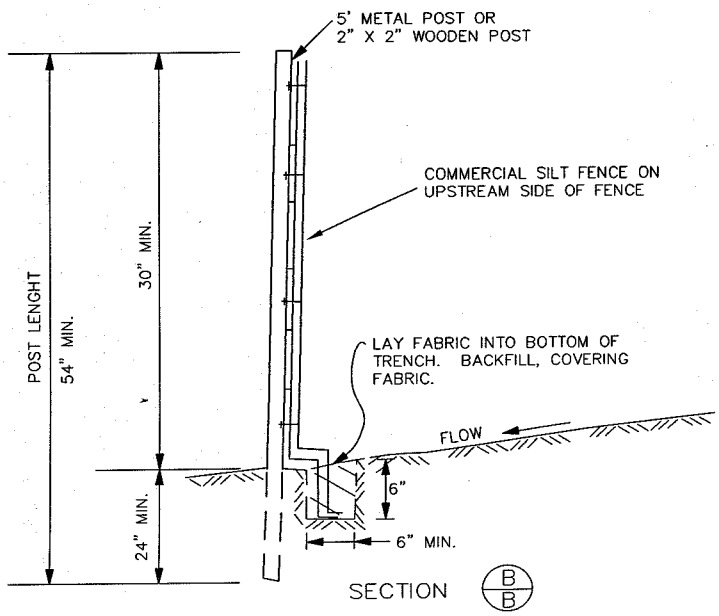
PAVEMENT PATCH DETAIL

		REV. DATE NOV. 2000
SCALE NONE		DRAWING NO. D–13





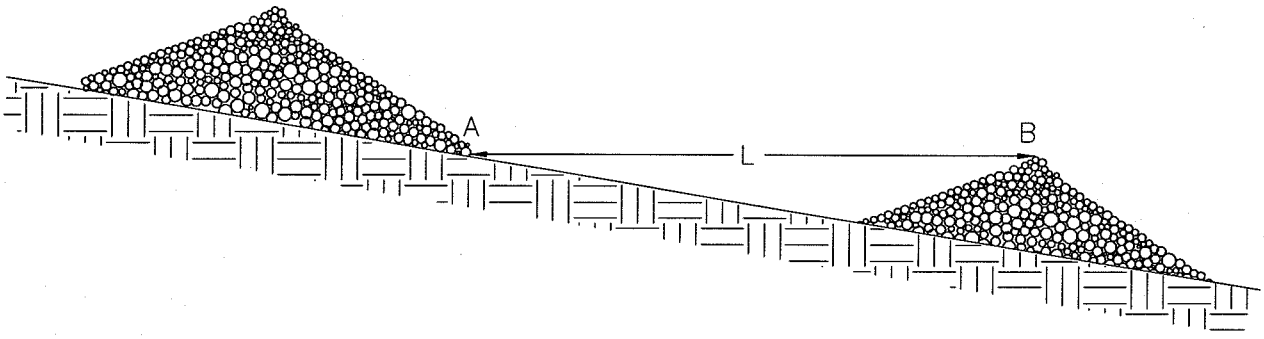
PLAN VIEW



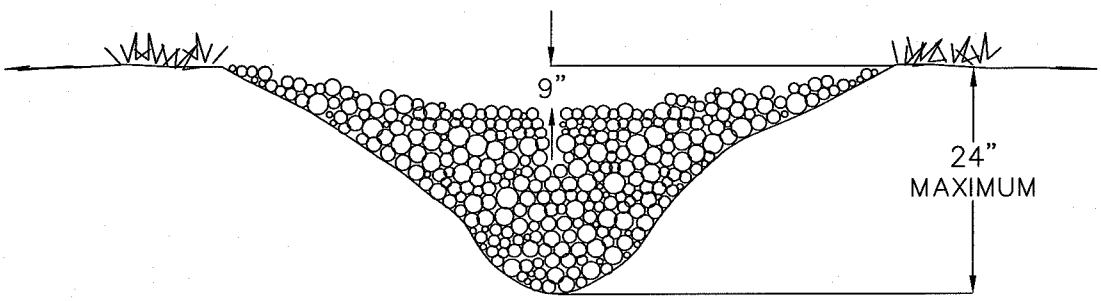
NOTE: INSTALL DOUBLE ROW OF SILT FENCE ALONG STREAM BUFFER.

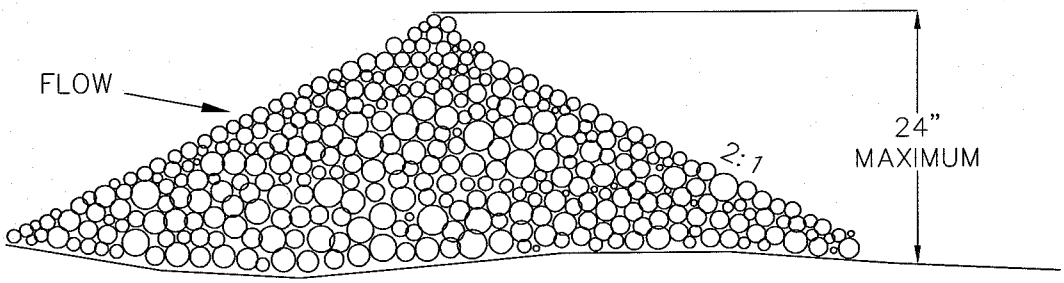
SILT FENCE DETAIL		
EROSION CONTROL DETAILS		REV. DATE JUNE 2004
SCALE NONE		DRAWING NO. D-14

L = THE DISTANCE SUCH THAT POINTS
A AND B ARE OF EQUAL ELEVATION



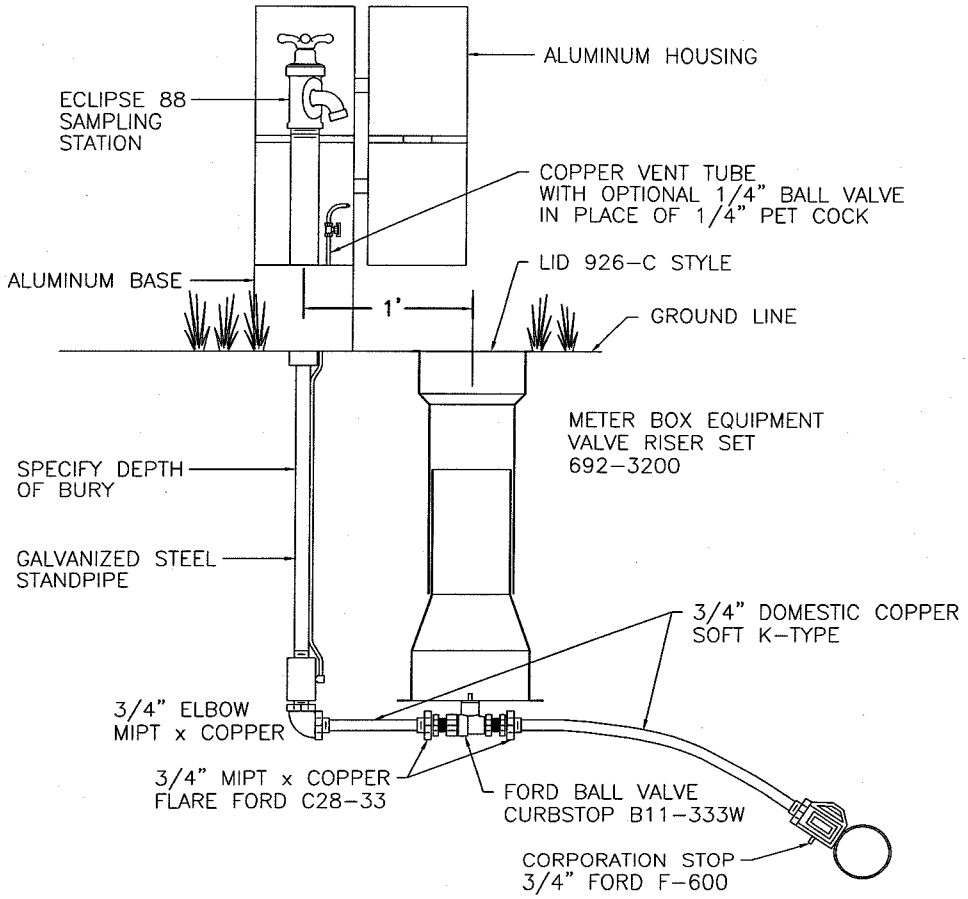
SPACING BETWEEN CHECK DAMS





STONE CHECK DAM DETAILS		
EROSION CONTROL DETAILS	THE CITY OF Monroe	REV. DATE OCT. 2000
SCALE NONE		DRAWING NO. D–15

WATER SYSTEM SAMPLING STATION



Sampling Stations shall be 3' bury (min.), with a 3/4" FIP inlet, and a (3/4" hose or unthreaded) nozzle.

All stations shall be enclosed in a lockable, nonremovable, aluminum-cast housing.

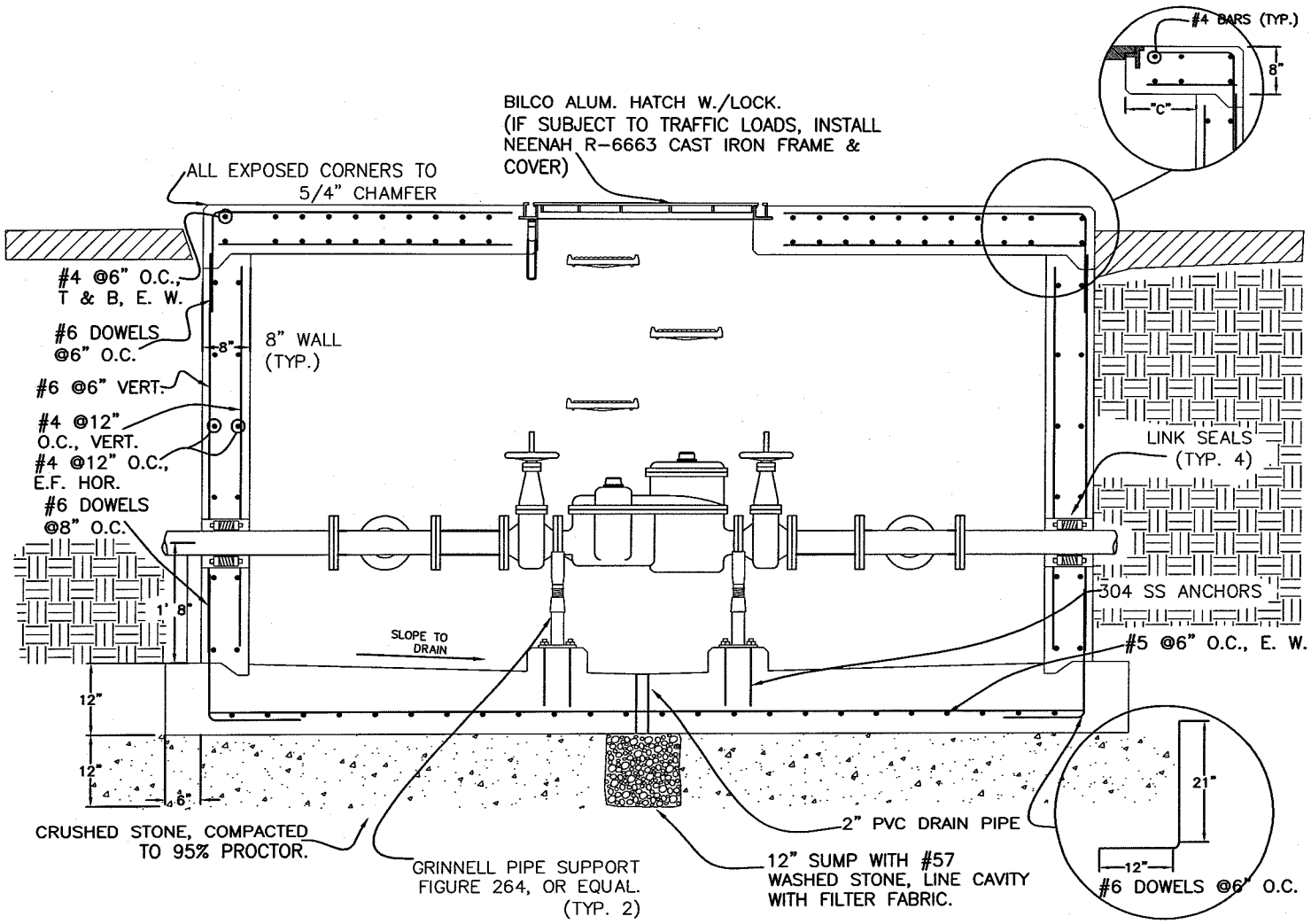
When opened, the station shall require no key for operation, and the water will flow in an all brass waterway.

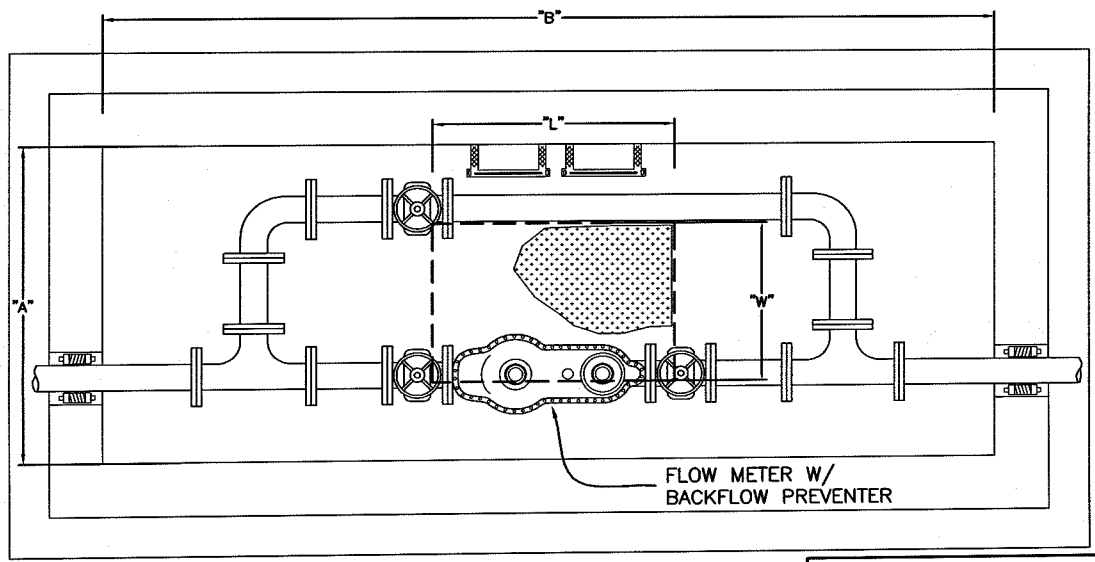
All working parts will also be of brass and be removable from above ground with no digging. Exterior piping shall be galvanized steel (brass pipe also available).

A copper vent tube will enable each station to be pumped free of standing water to prevent freezing and to minimize bacteria growth.

Water Sampling Station shall be Eclipse #88 as manufactured by Kupferle Foundry, St. Louis, MO 63102.
or equal, subject to MUN approval.

WATER SAMPLE STATION		
	THE CITY OF Monroe	REV. DATE NOV. 2005
SCALE NONE		DRAWING NO. D-16





* INSTALL DOUBLE LID FOR IRON HATCH

METER SIZE	A	B	C	L	W
4"	48	78	12	36	24
6" *	54	96	15	48	24
8" *	72	114	18	60	36

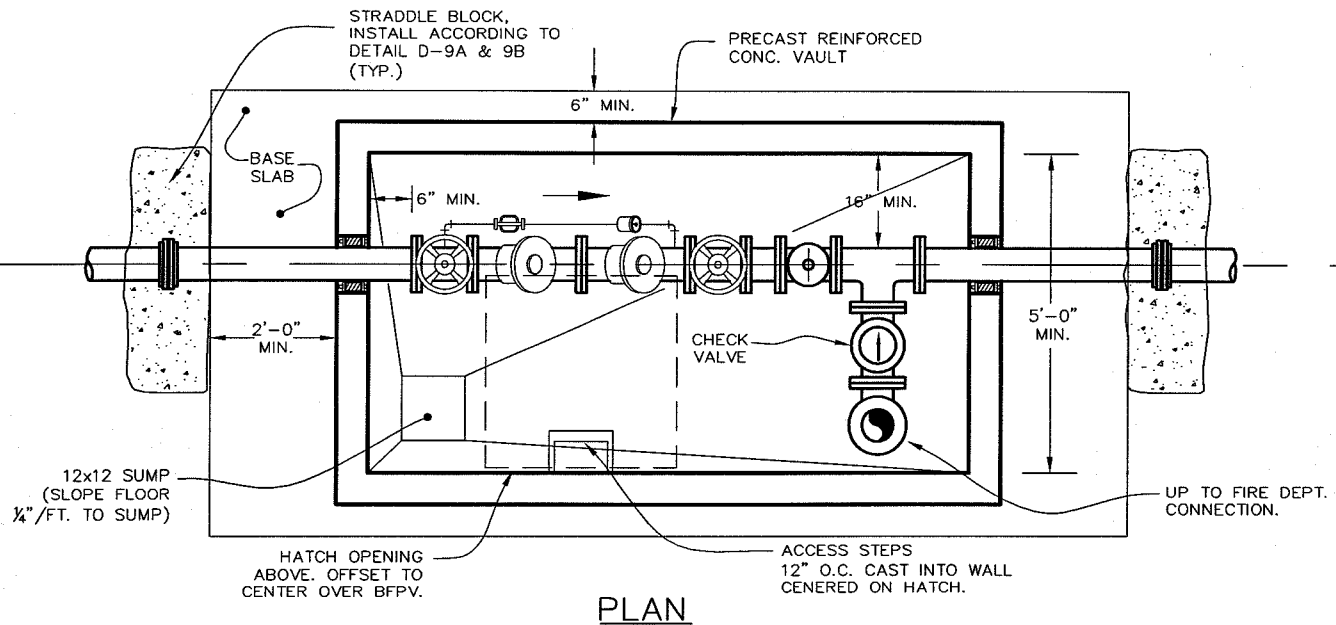
LARGE WATER METER

REV. DATE
NOV. 2007

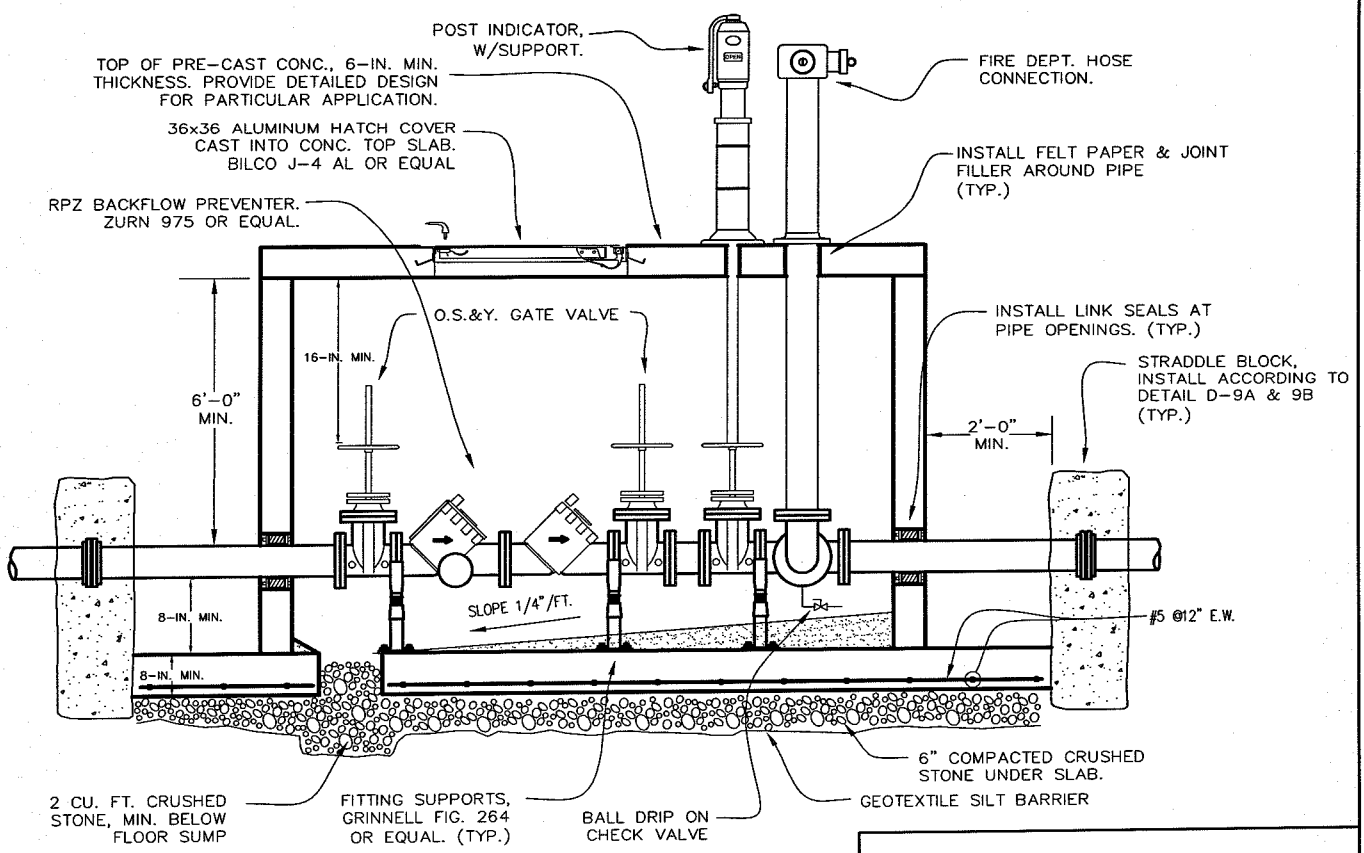
THE CITY OF Monroe

SCALE
NONE

DRAWING NO.
D-17



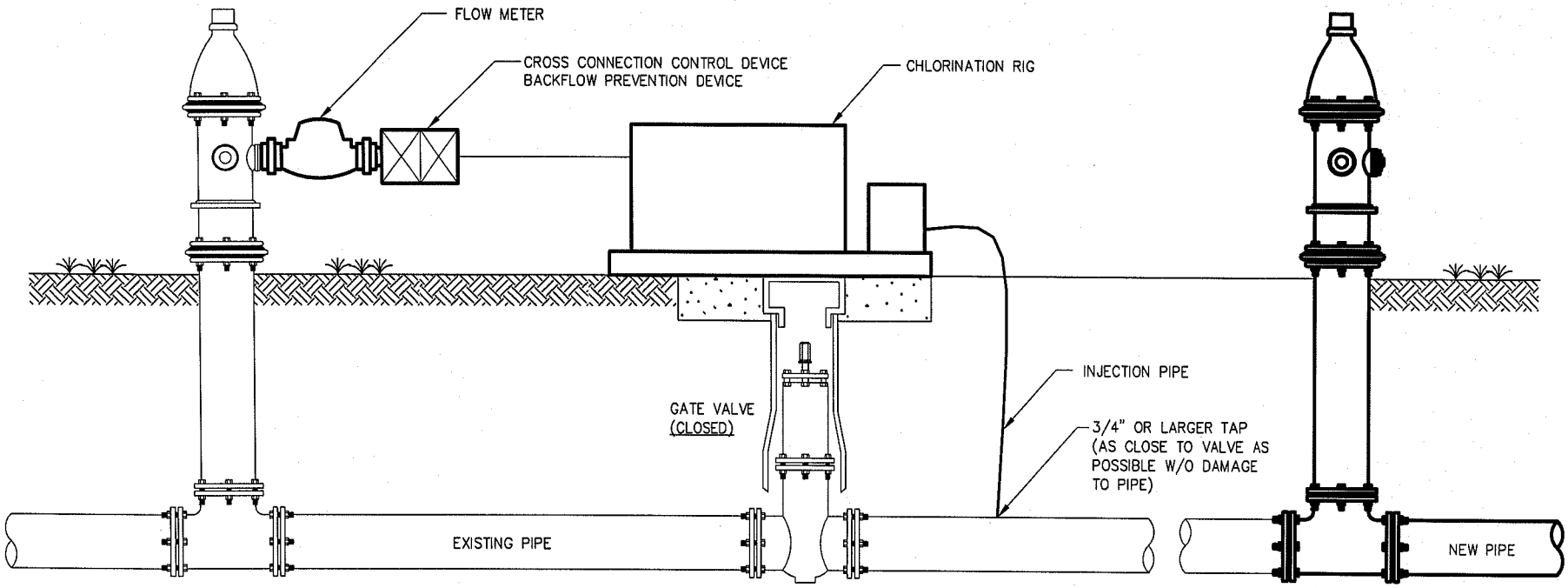
PLAN



SECTION

FIRE SERVICE VAULT

		REV. DATE OCT. 2004
SCALE NONE		DRAWING NO. D-18



NOTE: HAND TOSSED LOOSE CHLORINE POWDER IS NOT ACCEPTABLE.

TYPICAL WATER LINE DISINFECTION DETAIL

N.T.S.

DISINFECTION PROCEDURE		
	THE CITY OF Monroe	REV. DATE NOV 2005
SCALE NONE		DRAWING NO. D-19

APPENDIX E

ENGINEER'S CERTIFICATION

ENGINEER'S CERTIFICATION

I, _____, certify that my firm personally inspected the installation of the water and/or sewer lines in the subdivision known as _____, phase (unit)_____. As a Professional Engineer registered in the State of Georgia, I also certify that the water line location, depth of cover, pipe bedding, pipe size, valve and hydrant location, thrust blocking, water service installation, and all other aspects of the construction conform to the "Standard Water Main and Sanitary Sewer Specifications for the City of Monroe, Georgia" and the subdivision plans stamped "Approved for Construction" including any formal construction Change Order(s) approved and signed by the City of Monroe, Georgia.

_____ _____

Signature Date

_____

Registration Number

APPENDIX F

DEVELOPER'S CERTIFICATION

and

NOTICE OF PROJECT ACCEPTANCE

DEVELOPER'S CERTIFICATION

STATE OF GEORGIA,

COUNTY OF WALTON:

The undersigned being the owner, developer, or contractor of _____ Subdivision, being located on _____, Monroe, Georgia, hereby certifies to the City of Monroe, Georgia that the undersigned has installed the following:

One or more water lines of approximately _____ feet in length at cost of $_____ and/or one or more sewer lines of approximately _____feet in length at a cost of $_____ .

Unless otherwise stated in this certification, the above costs are the current fair market value of such lines.

The undersigned further certifies that said water lines and/or sewer lines were wholly installed within the right-of-way of Monroe, Georgia, or in an easement granted to the City of Monroe, Georgia.

The undersigned is aware that the information furnished in this certification will be provided by the City of Monroe, to its agents and employees for accounting and other related purpose and except for such uses, shall remain confidential unless otherwise required by law.

(SEAL)

_____

_____

Print Name

_____

_____

Address

City of Monroe, Georgia
215 North Broad Street
P.O. Box 725
Monroe, Georgia 30655

January 1, 200_

ABC Development Corp.
123 4th Avenue
Atlanta, GA 30300

RE: Project NAME
Notice of Project Acceptance

Dear Sir or Madam:

In accordance with the City of Monroe, Georgia Standard Water Main and Sanitary Sewer Specifications, Section A.5, you are hereby notified that the above project has met all of the requirements for acceptance by the Utility and the one-year warranty period shall begin on the date of this notice.

Successful completion of the one-year warranty period will be conditioned upon the repair and/or correction of any and all defects discovered in the project utilities during the warranty period. The City of Monroe will then release the maintenance bond and assume the regular day-to-day maintenance of the water and sewer infrastructure in the development.

_____
General Manager
City of Monroe, Georgia

APPENDIX G

CHANGE ORDER FORM

CHANGE ORDER

Order No. _____

Date: _____

Engineer's Plans Approval Date: _____

Name of Subdivision: _____

Developer: _____

Pipeline Contractor: _____

The following changes are hereby made to the plans "Approval for Construction"

Justification:

Approval Required _____

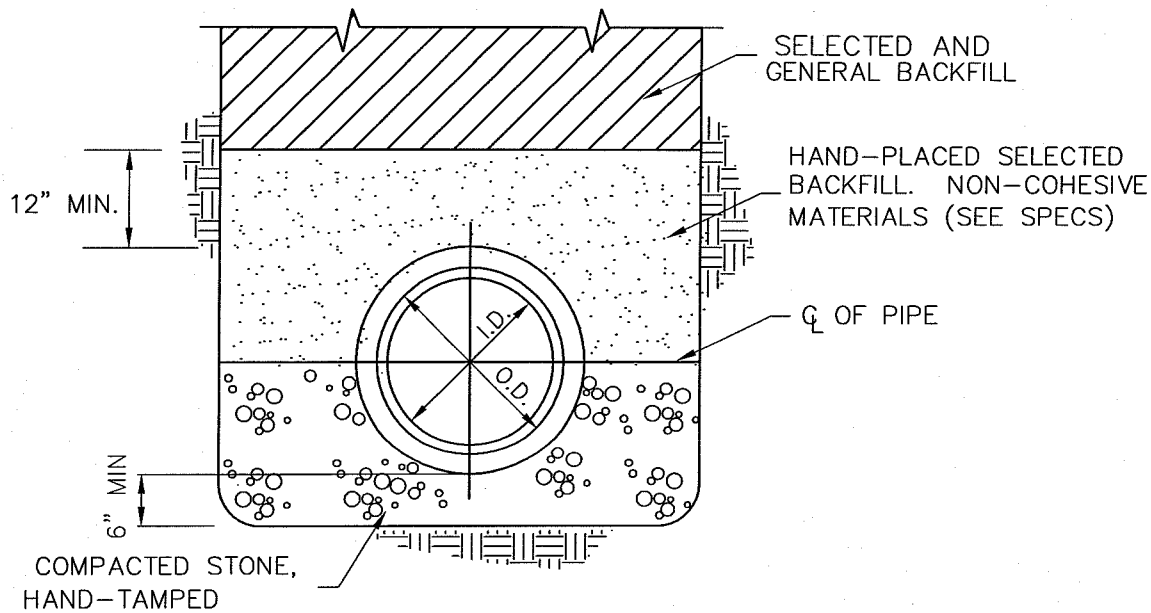
City of Monroe, Georgia: _____

Approval Engineer: _____

Developer: _____

APPENDIX H

TYPICAL SANITARY SEWER LINE CONSTRUCTION DETAILS

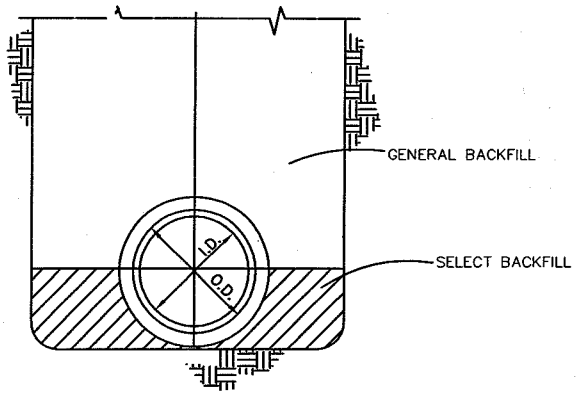


PVC PIPE BEDDING DETAIL (6"-15")

N.T.S

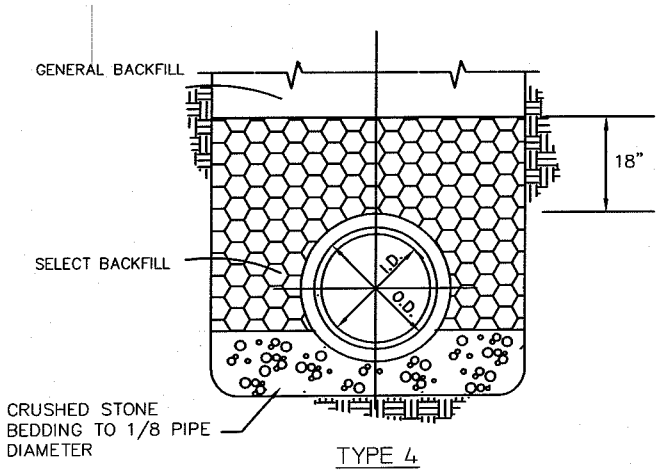
NOTE:
CRUSHED STONE BEDDING SHALL BE ANGULAR 1/4 TO 3/4 INCHES GRADED STONE. LATEST REVISION OF ASTM C33-GRADATION SIZE NO. 57.

STANDARD PVC PIPE BEDDING DETAIL		
		REV. DATE NOV. 2000
SCALE NONE		DRAWING NO. H-1

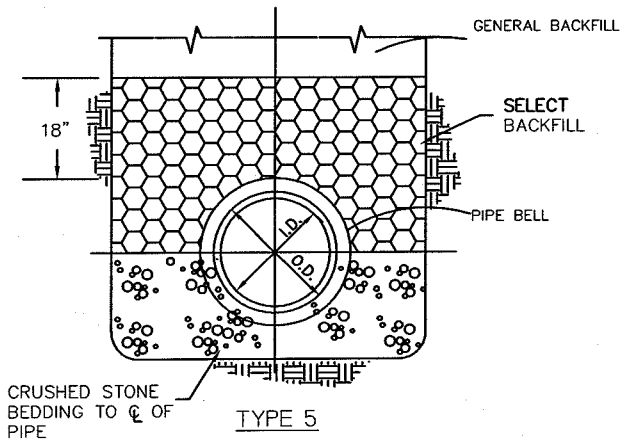


TYPE 2

FLAT-BOTTOM TRENCH WITH GENERAL BACKFILL
UNDERCUT TRENCH @ BELLS



TYPE 4



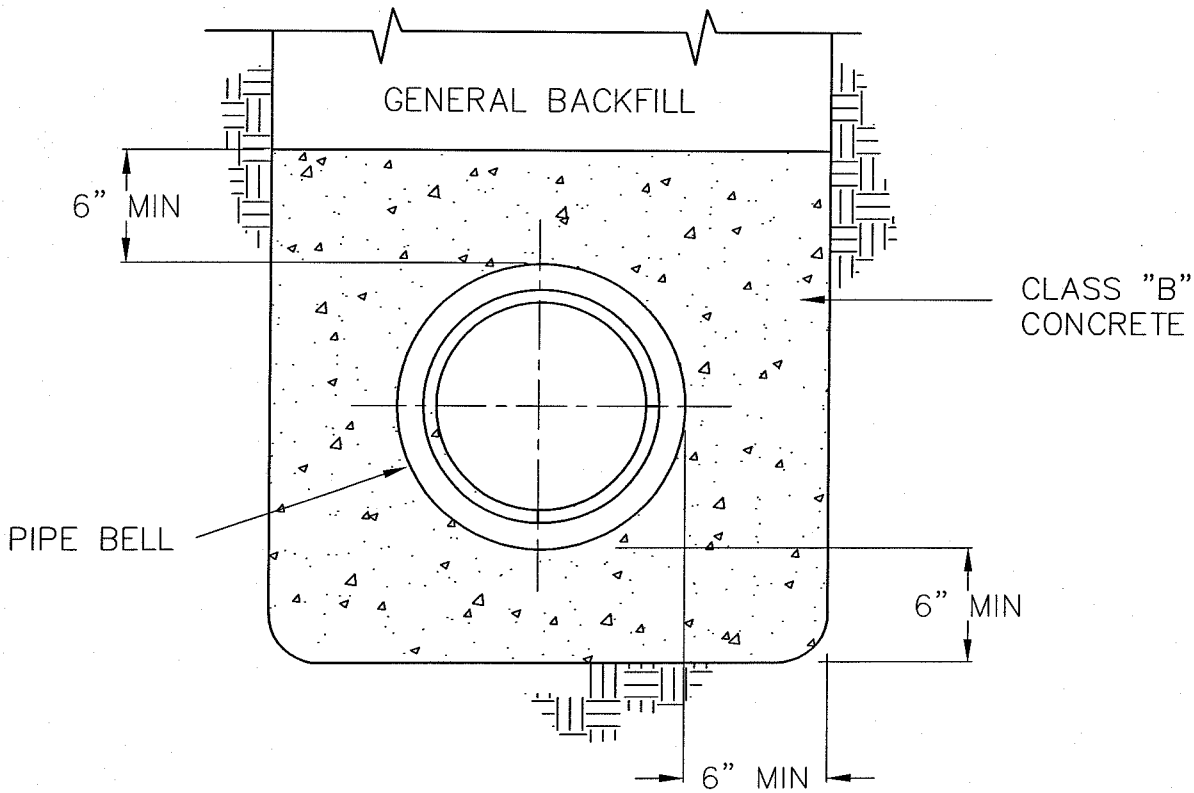
TYPE 5

NOTE:
TYPE 1 AND TYPE 3 ARE NOT FOR USE IN CONSTRUCTION.

BEDDING DETAILS FOR USE WITH DUCTILE IRON PIPE

N.T.S.

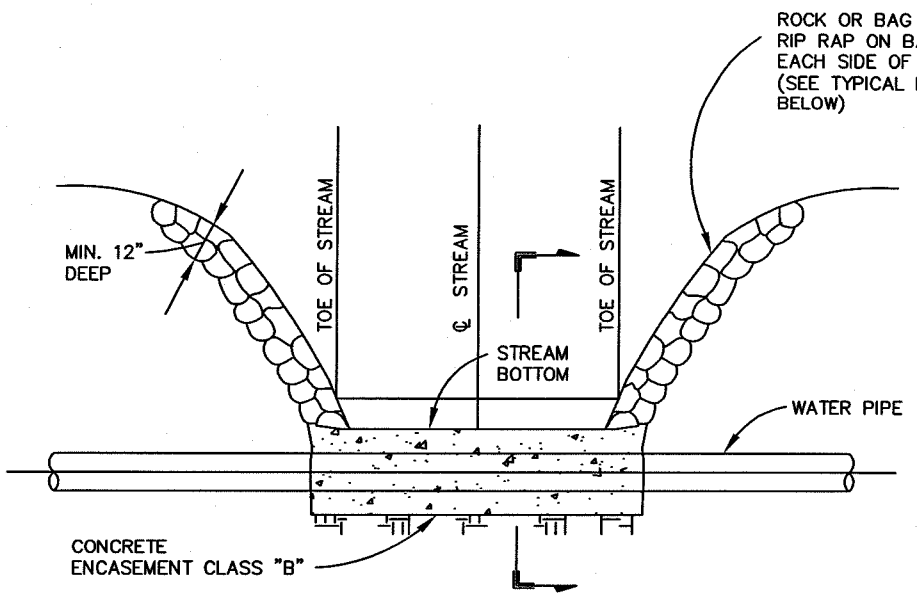
BEDDING TYPES		
		REV. DATE JUNE 2004
SCALE NONE	THE CITY OF Monroe	DRAWING NO. H-2



CONCRETE ENCASEMENT

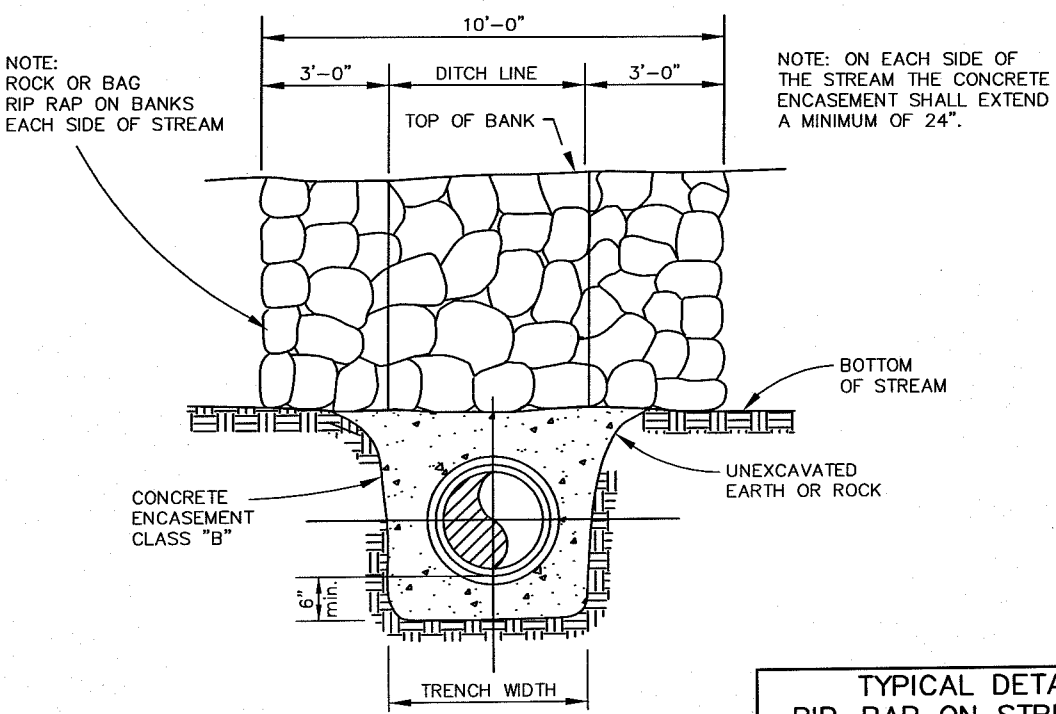
N.T.S

CONCRETE ENCASEMENT STANDARD DETAIL		
		REV. DATE NOV. 2000
SCALE NONE		DRAWING NO. H-3



TYPICAL STREAM CROSSING DETAIL

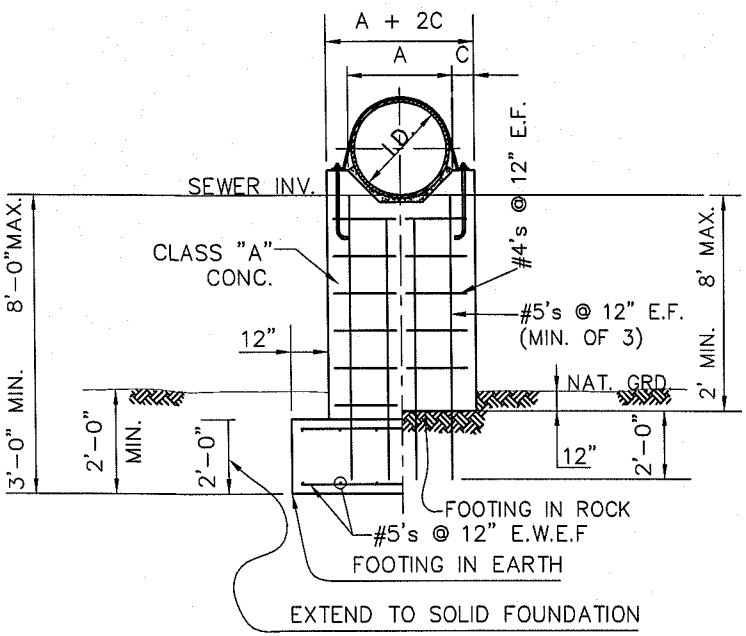
N.T.S

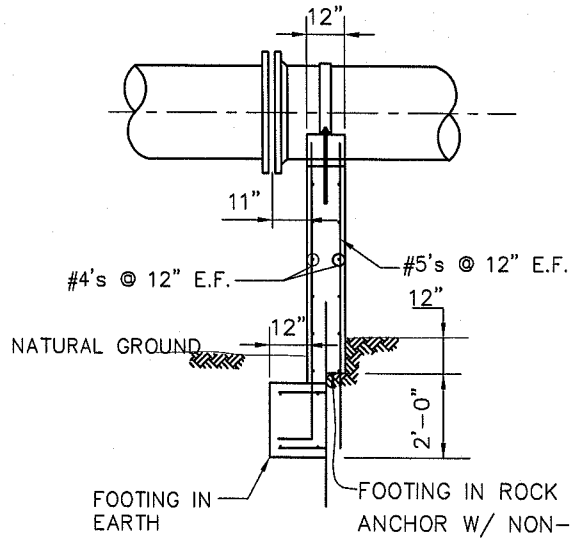


TYPICAL DETAIL FOR RIP RAP
ON BANKS OF STREAM

N.T.S

TYPICAL DETAIL FOR RIP-RAP ON STREAM BANKS		
		REV. DATE NOV. 2000
SCALE NONE	THE CITY OF Monroe	DRAWING NO. H-4





SCHEDULE
GOVERNING DIMENSIONS
CONCRETE PIERS

I.D. PIPE	'A'	'B'	'C'
8"	11 ½"	2"	6 3/4"
10"	13 ½"	2 ½"	5 3/4"
12"	15 ½"	3"	5 3/4"
16"	19"	4"	8"
18"	21"	5"	9"
20"	23"	5"	10"
24"	26"	6"	10"

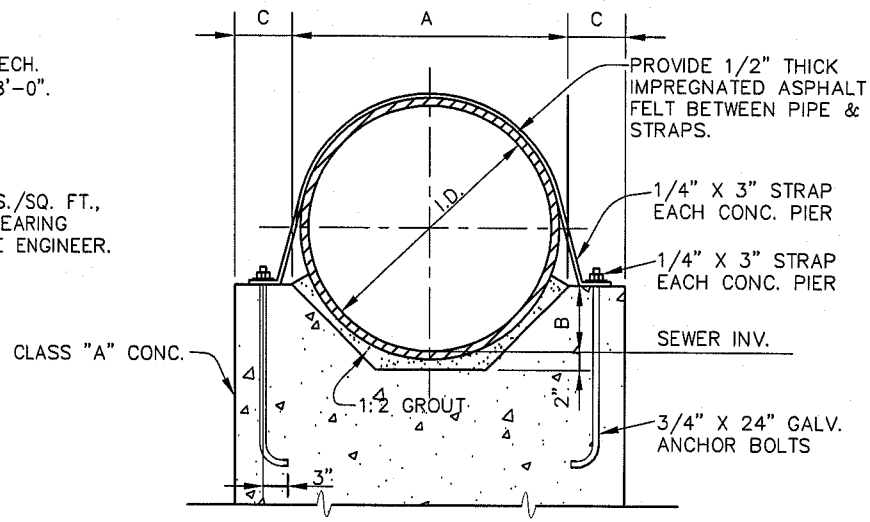
TYPE "A" PIER FOR PIPE SIZES 8" TO 42" INCL., MAX. HEIGHT 8'-0"

N.T.S.

GENERAL NOTES

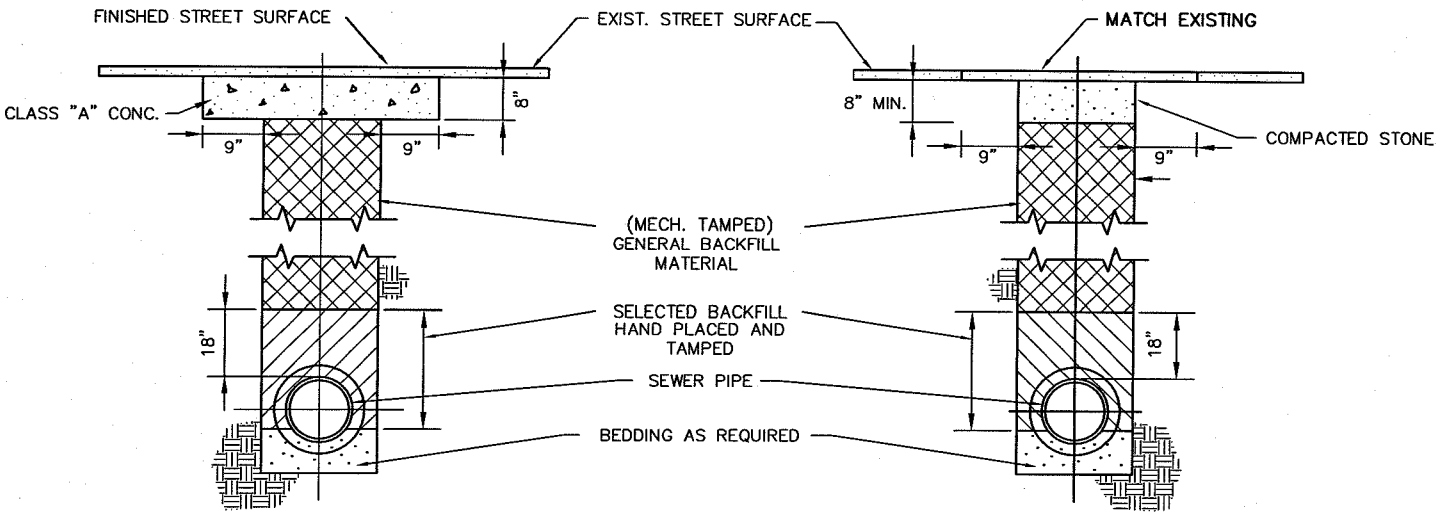
(FOR D.I. PIPE ON PIERS)

1. ALL DUCTILE IRON PIPE ON PIERS SHALL HAVE MECH. JOINTS. MIN. LENGTH OF PIPE BETWEEN JOINTS 18'-0".
2. INSTALL EACH PIPE JOINT WITH 1/4" CLEARANCE BETWEEN SPIGOT END AND SOCKET OF BELL.
3. WHERE BEARING OF SOIL IS LESS THAN 1000 LBS./SQ. FT., AREA OF FOOTING TO BE INCREASED OR STEEL BEARING PILES TO BE CONSTRUCTED, AS DIRECTED BY THE ENGINEER.



TYPICAL CONC. PIER SADDLE

SCALE NONE		TYPE "A" PIER FOR PIPE SIZES 8" TO 42"
	THE CITY OF Monroe	
DRAWING NO. H-5	REV. DATE NOV. 2000	

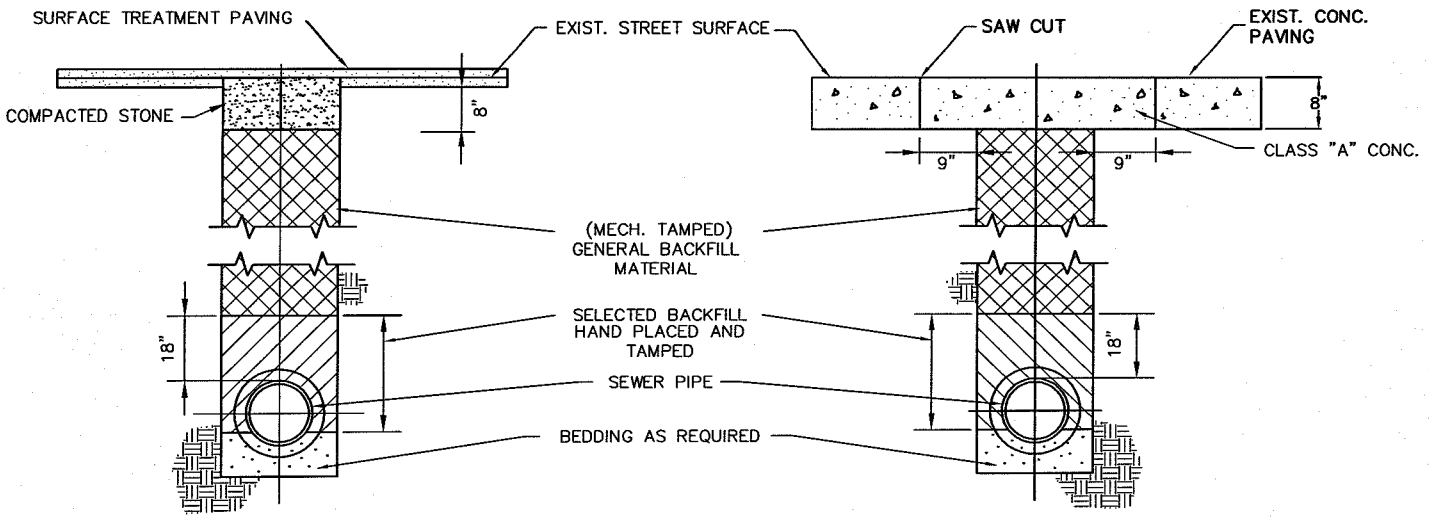


ASPHALTIC CONCRETE PAVEMENT
CONCRETE BASE

N.T.S

ASPHALTIC CONCRETE PAVEMENT
STONE BASE

N.T.S



BITUMINOUS TREATMENT PAVEMENT
STONE BASE

N.T.S

CONCRETE PAVEMENT

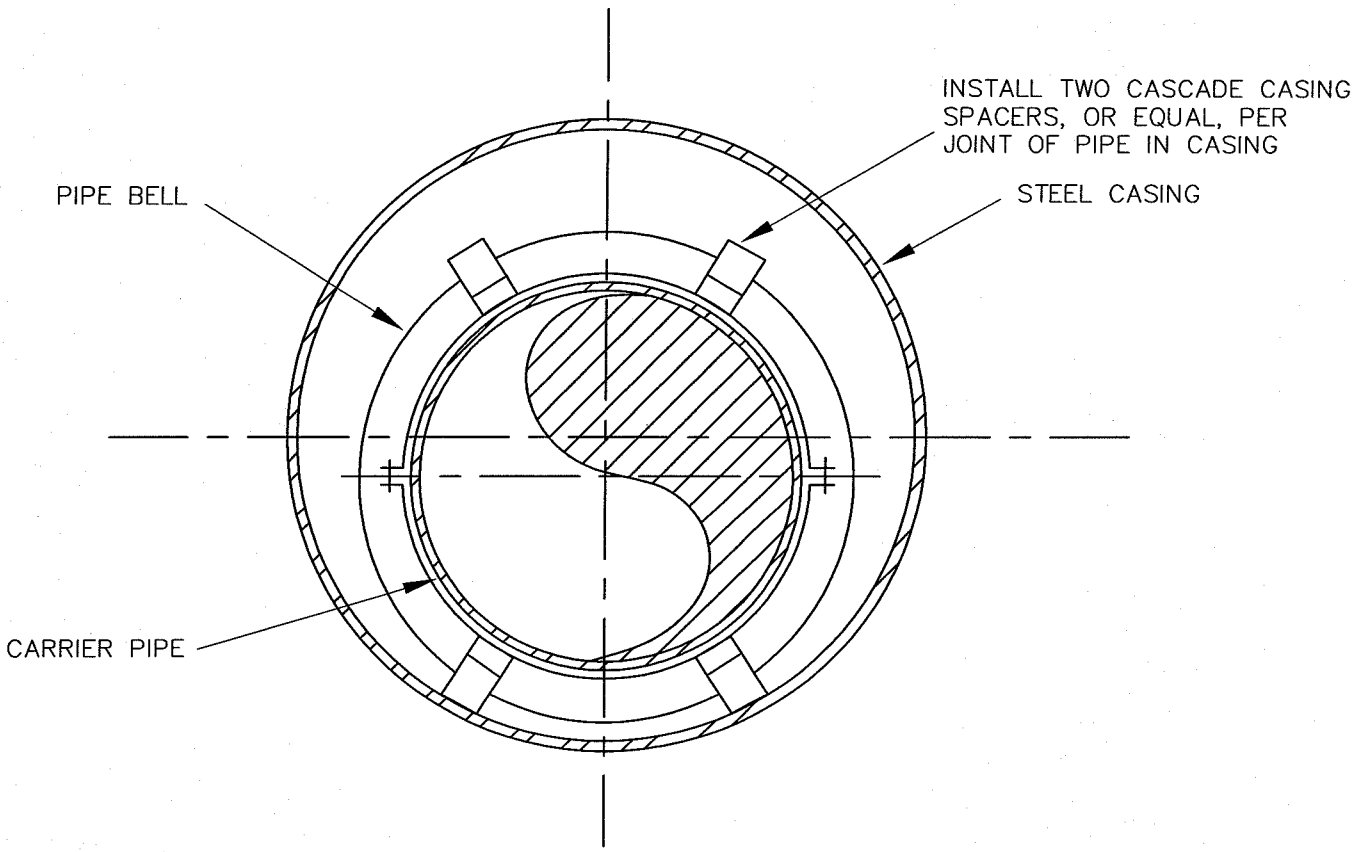
N.T.S

PAVING DETAILS

	THE CITY OF Monroe	REV. DATE NOV. 2000
SCALE NONE		DRAWING NO. H-6

NOTE:

WRAP EACH END OF CASING WITH 4 PLY, 6 MIL THICKNESS POLYETHYLENE. TIE WITH TWO WRAPS NO. 9 GUAGE WIRE. PROVIDE DRAINAGE AT BOTTOM ON LOW END.

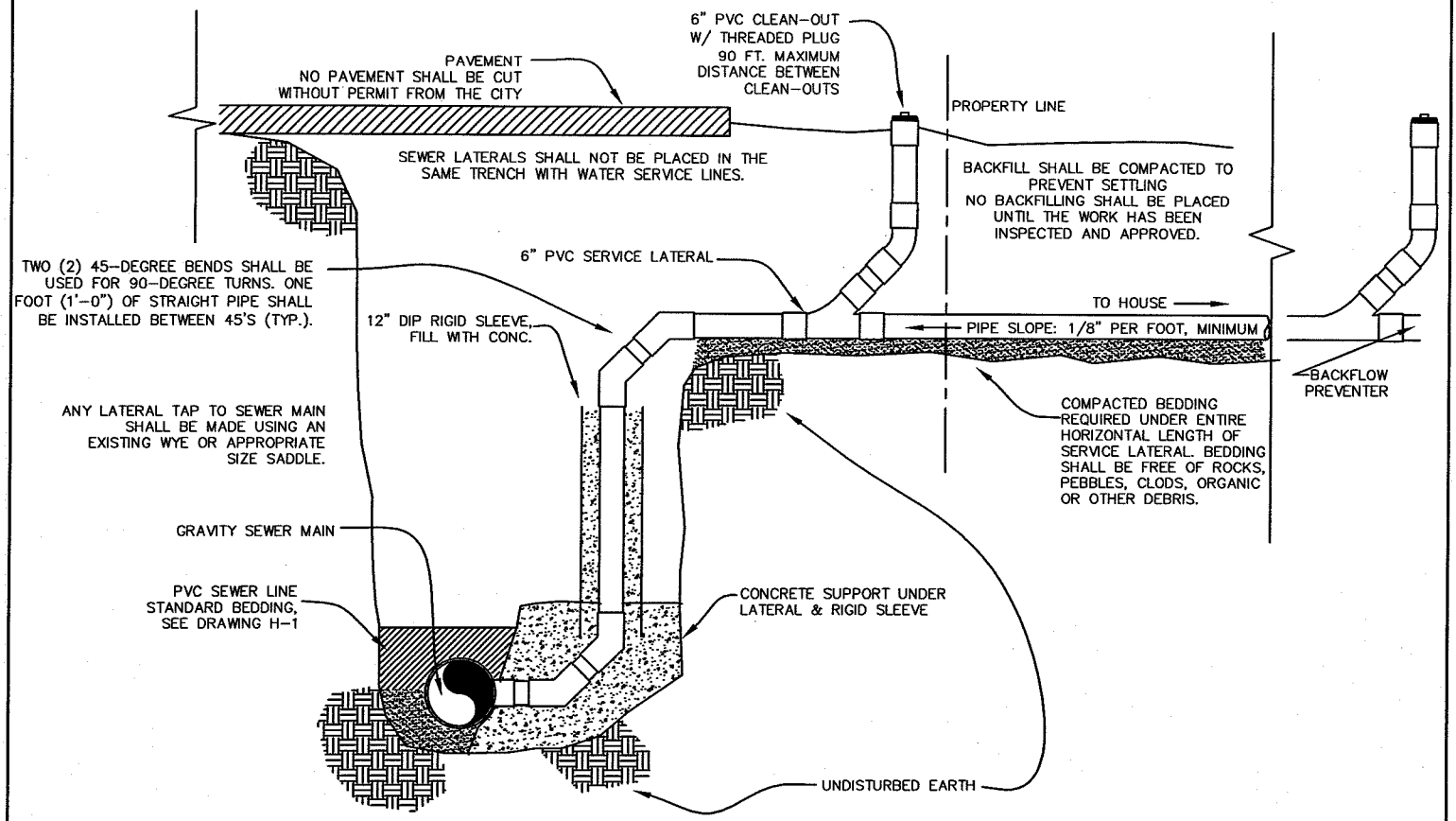


STEEL CASING DETAIL

N.T.S.

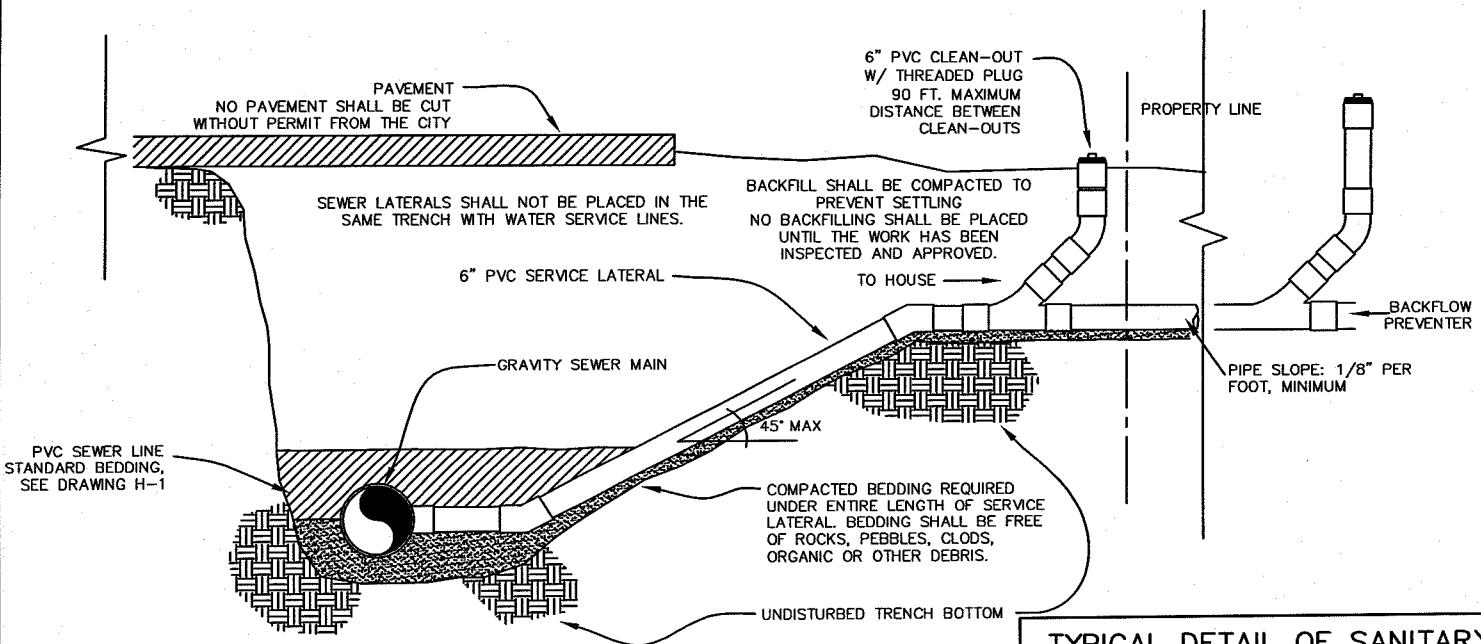
STANDARD DETAIL

STEEL CASING DETAIL		
		REV. DATE NOV. 2000
SCALE NONE		DRAWING NO. H-7



TYPICAL DETAILS OF VERTICAL RISER

N.T.S.

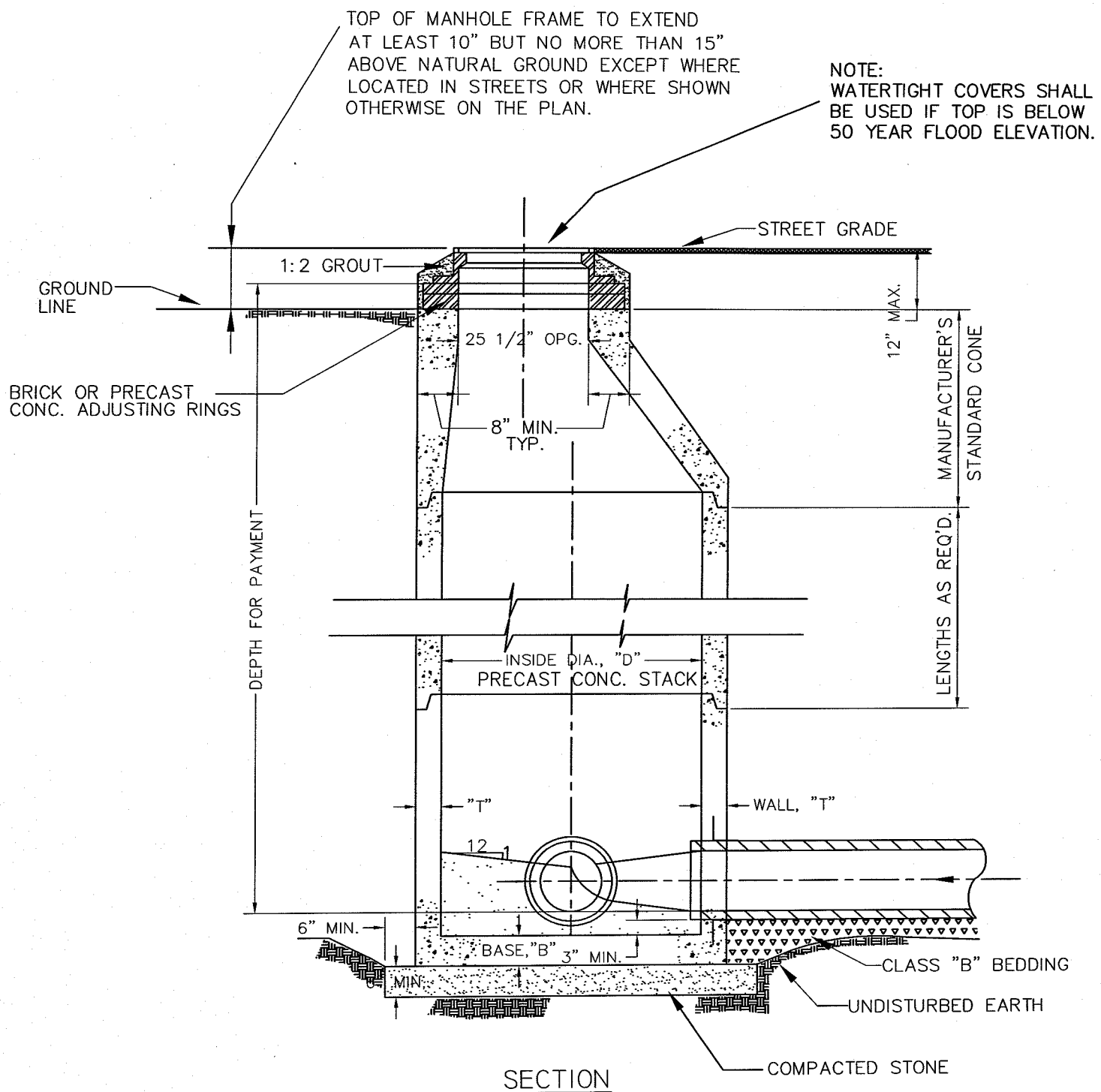


TYPICAL DETAILS OF SANITARY HOUSE SERVICE LINE

N.T.S.

TYPICAL DETAIL OF SANITARY HOUSE SERVICE LINE

	Since 1821 THE CITY OF Monroe	REV. DATE NOV. 2007
SCALE NONE		DRAWING NO. H-8

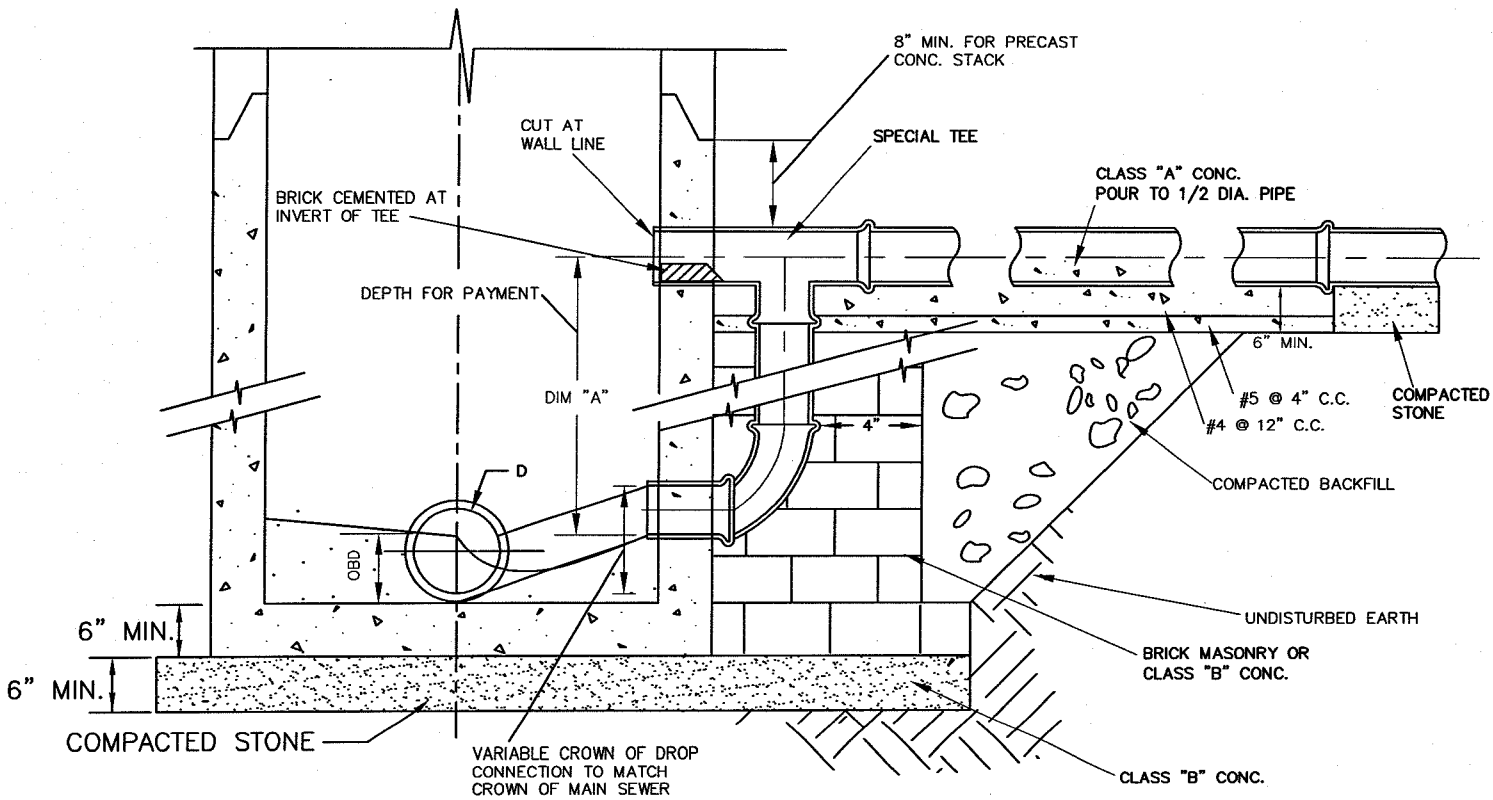


SECTION

PRE-CAST CONCRETE MANHOLE

DIAMETER, "D"	WALL, "T"	BASE, "B"
48–INCHES	5–INCHES	6–INCHES
60–INCHES	6–INCHES	8–INCHES
72–INCHES	7–INCHES	8–INCHES

MANHOLE STANDARD DETAIL		
	THE CITY OF Monroe	REV. DATE NOV. 2000
SCALE NONE		DRAWING NO. H–9

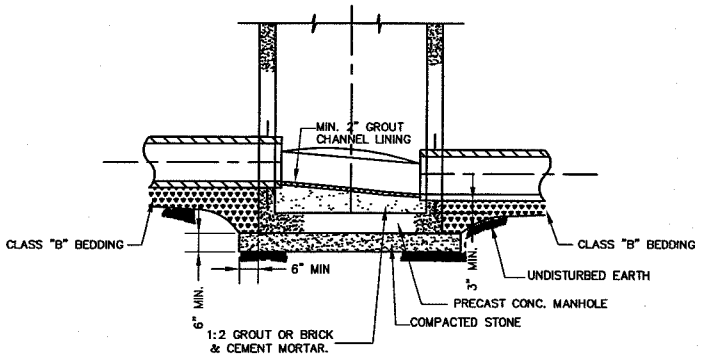


DROP MANHOLE DETAIL

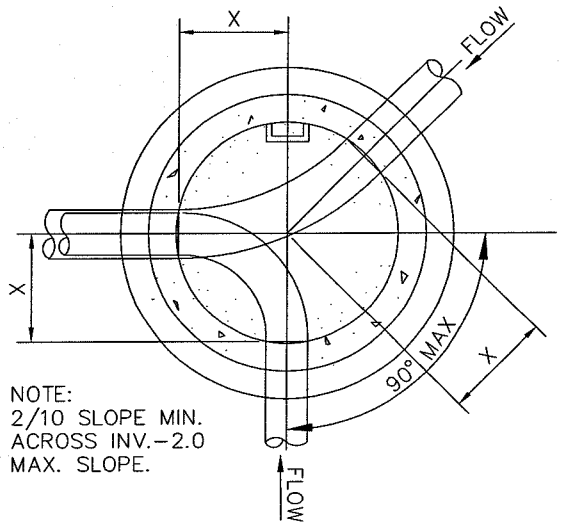
N.T.S.

SCHEDULE FOR DROP CONNECTIONS DIM "A"		
PIPE SIZE	DROP SIZE	MIN. DROP
6"	6"	24"
8"	8"	24"
10"	8"	24"
12"	10"	35"
15"	12"	37"
18"	15"	39"
24"	21"	43"

TYPICAL MANHOLE DROP CONNECTION		
		REV. DATE NOV. 2000
SCALE NONE	THE CITY OF Monroe	DRAWING NO. H-10

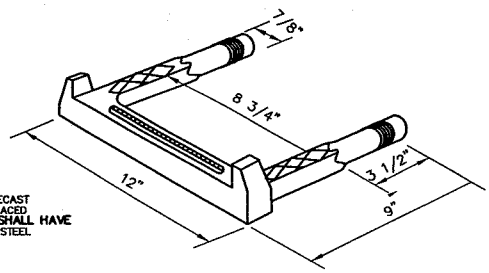


TYPICAL INVERT SECTION
(ALL SIZES)



NOTE:
2/10 SLOPE MIN.
ACROSS INV.-2.0
MAX. SLOPE.

TYPICAL INVERT PLAN
(ALL SIZES)
N.T.S.



NOTE:
ALL MANHOLE STEPS IN PRECAST CONC. MANHOLES TO BE SPACED 14" TO 16" C.C. STEPS SHALL HAVE GRADE 60 3/8" DEFORMED STEEL REINFORCING ROD CENTER

POLYPROPYLENE PLASTIC
MANHOLE STEP DETAIL
FOR PRECAST CONC. M.H.
N.T.S.

GOVERNING DIMENSIONS FOR CIRCULAR MANHOLES			
PIPE SIZE	DEFLECTION	M.H. DIA.	"X"
8" & 15"	0° 90°	4' 0"	1'-10"
18"	0° 60°	4' 0"	1'-8"
18"	60° 90°	5' 0"	2'-3"
21" & 24"	0° 60°	5' 0"	2'-2"
30"	0° 45°	5' 0"	1'-11"
21" & 24"	60° 90°	6' 0"	2'-8"
30"	45° 90°	6' 0"	2'-6"
36"	0° 60°	6' 0"	2'-5"
30" & 36"	60° 90°	7' 0"	3'-0"

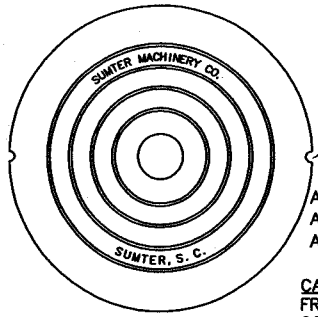
MISCELLANEOUS MANHOLE DETAILS

REV. DATE
NOV. 2000

THE CITY OF Monroe

SCALE
NONE

DRAWING NO.
H-11

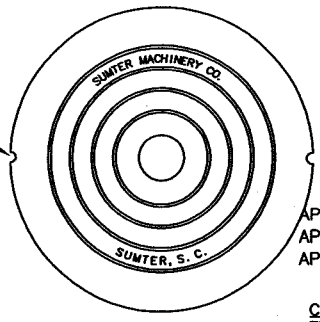


RECESS PICK HOLES
(2 REQUIRED)

APPROX WT. OF FRAME 282#
APPROX WT. OF COVER 178 #
APPROX WT. TOTAL 460#

CATALOG NUMBER
FRAME MF-9
COVER MC-12

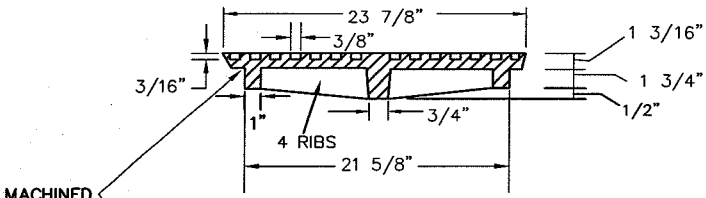
PLAN – COVER



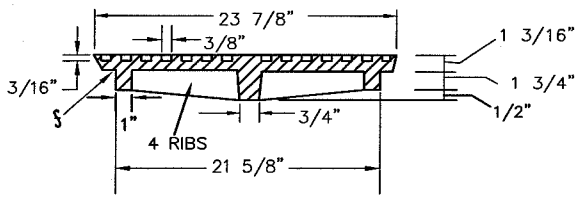
APPROX WT. OF FRAME 192#
APPROX WT. OF COVER 178#
APPROX WT. TOTAL 370#

CATALOG NUMBER
FRAME MF-9-55
COVER MC-12

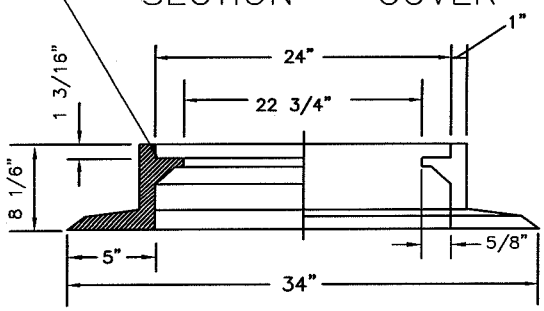
PLAN – COVER



SECTION – COVER

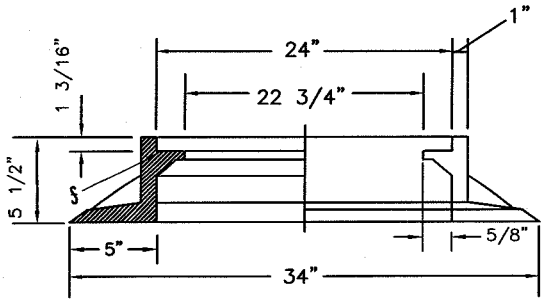


SECTION – COVER



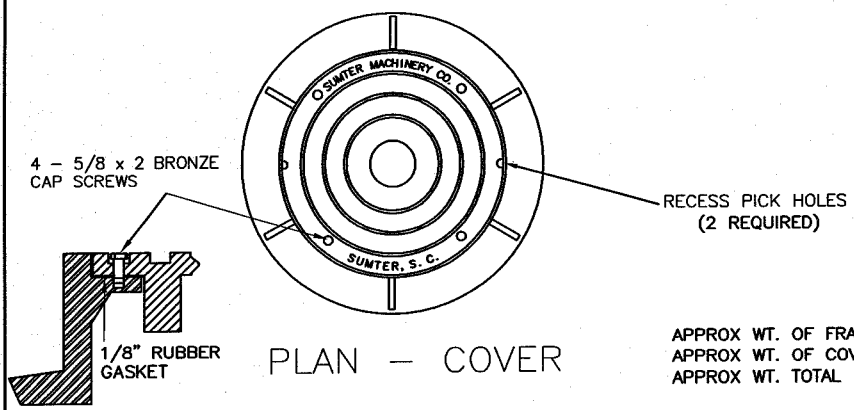
FRAME & COVER

N.T.S.



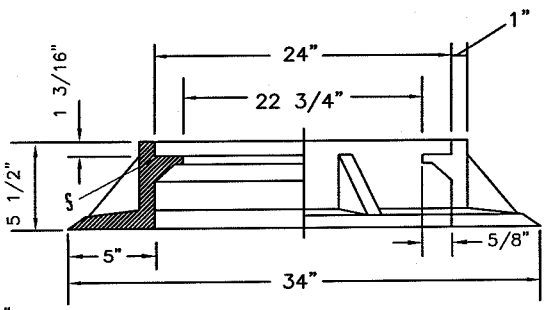
FRAME & COVER

N.T.S.



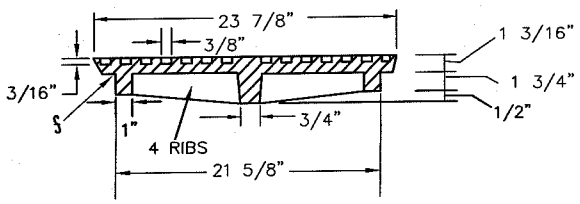
PLAN – COVER

APPROX WT. OF FRAME 192#
APPROX WT. OF COVER 178#
APPROX WT. TOTAL 370#



FRAME & COVER

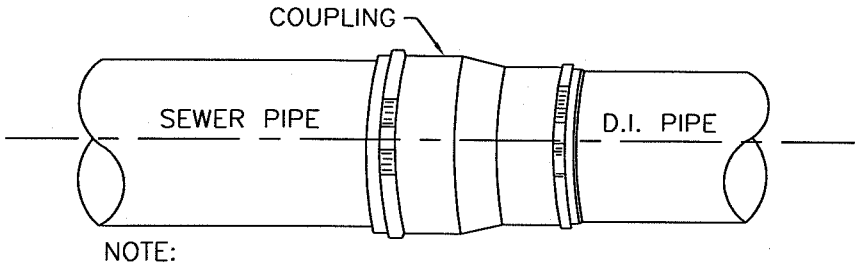
N.T.S.



SECTION – COVER

CATALOG NUMBER
FRAME MF-9-55-BD
COVER MC-12-BD

FRAME AND COVER DETAILS		
		REV. DATE NOV. 2000
SCALE NONE		DRAWING NO. H-12

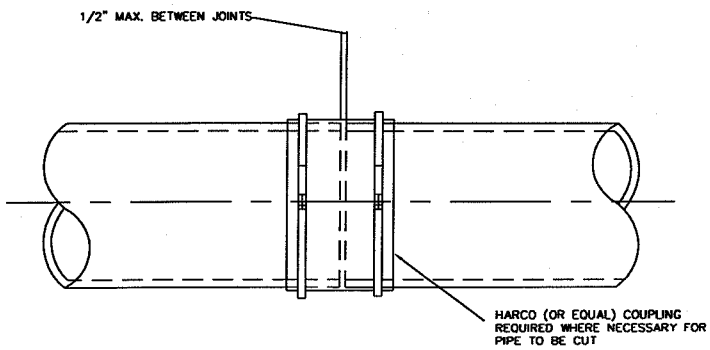


NOTE:
1) CONTRACTOR TO USE COUPLING AS RECOMMENDED BY MFG IN JOINING UNLIKE TYPES OF PIPE.

TYPICAL DETAIL - COUPLING

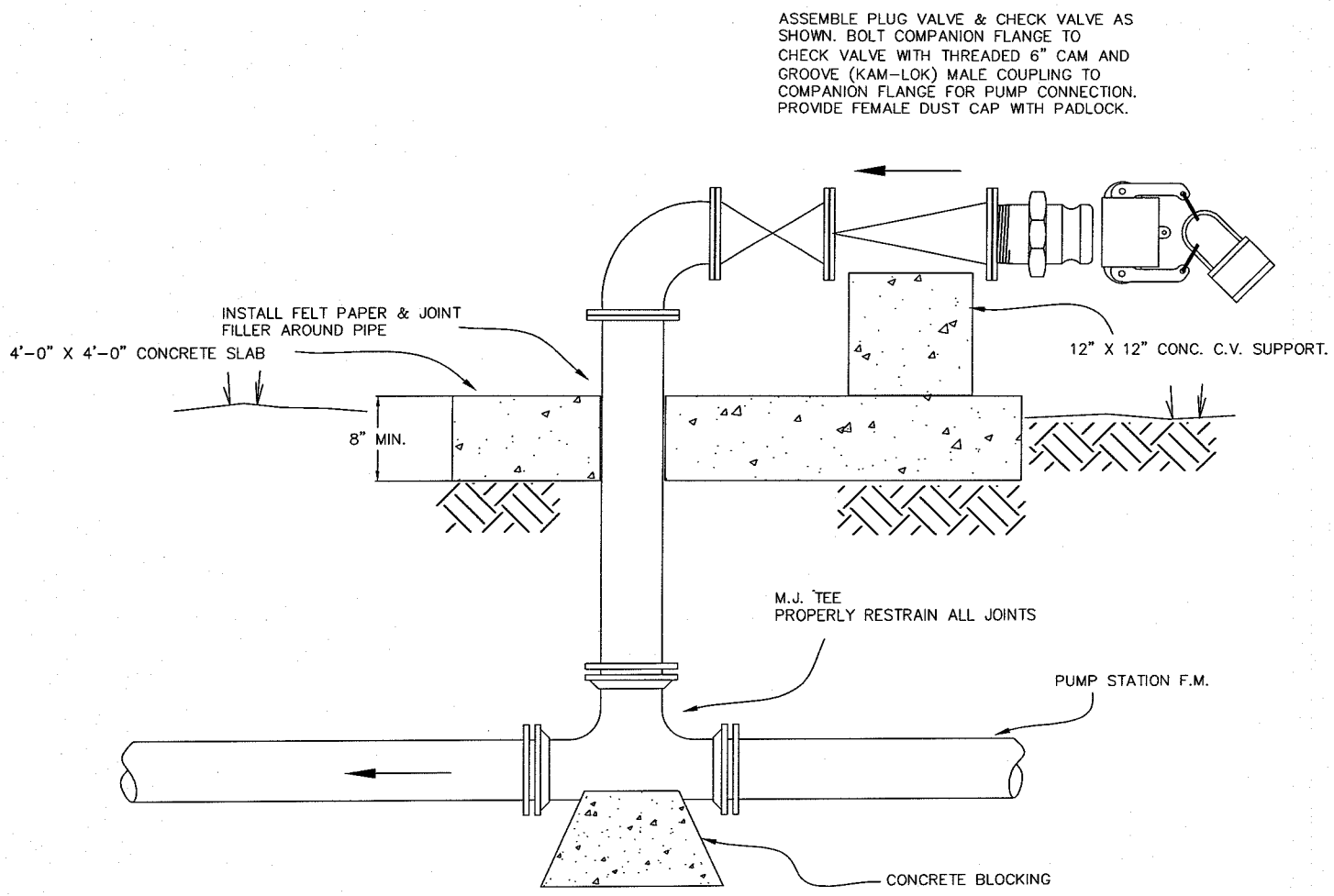
FOR JOINTING D.I. PIPE TO SEWER PIPE

N.T.S.



COUPLING DETAIL
(FOR JOINTING SIMILAR PIPES)
N.T.S

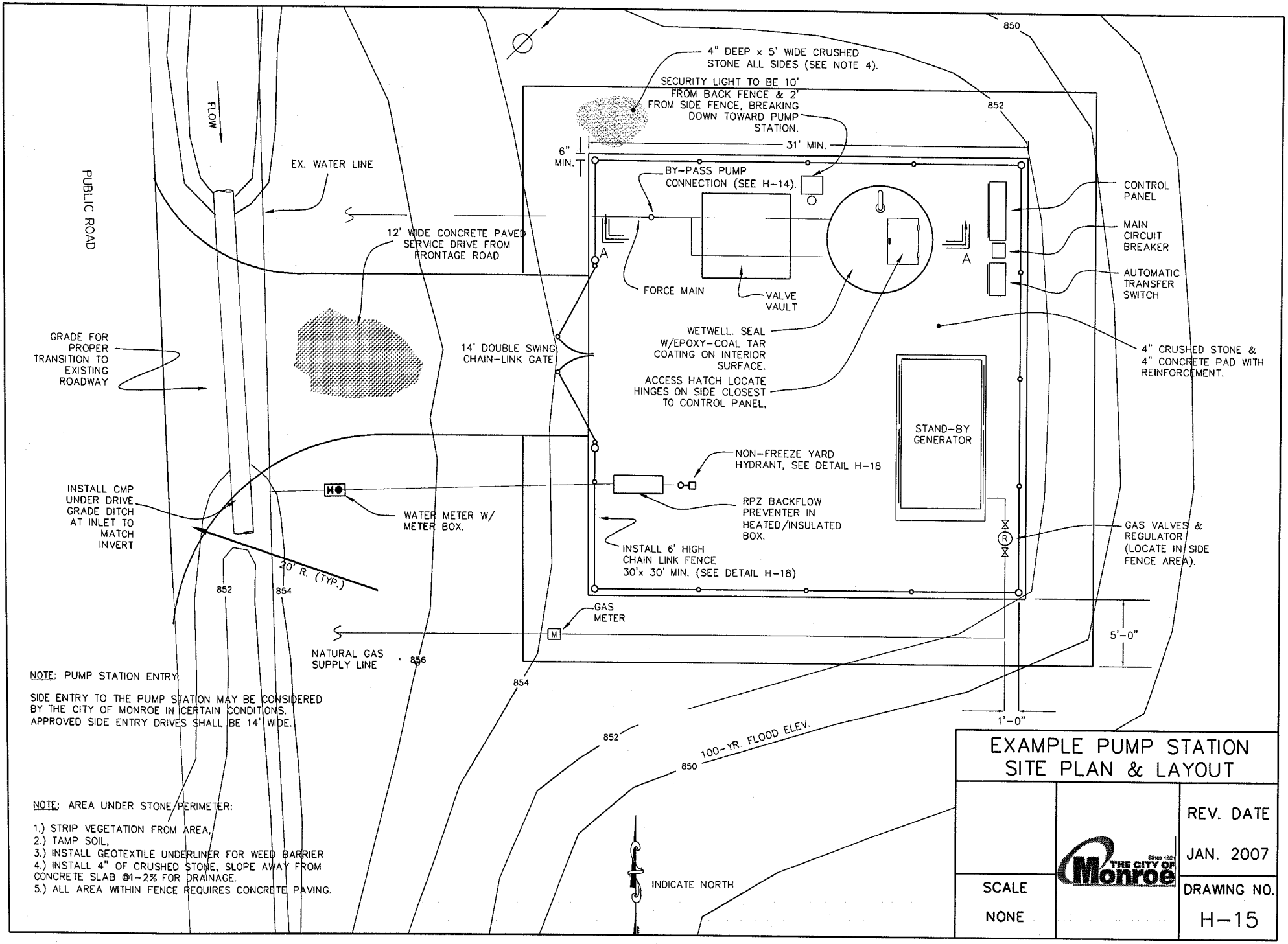
COUPLING DETAIL		
		REV. DATE NOV. 2000
SCALE NONE		DRAWING NO. H-13



EMERGENCY PUMP STATION BY-PASS CONNECTION

N.T.S

PUMP STATION BY-PASS		
		REV. DATE
		NOV. 2004
SCALE		DRAWING NO.
NONE		H-14



NOTE: PUMP STATION ENTRY:

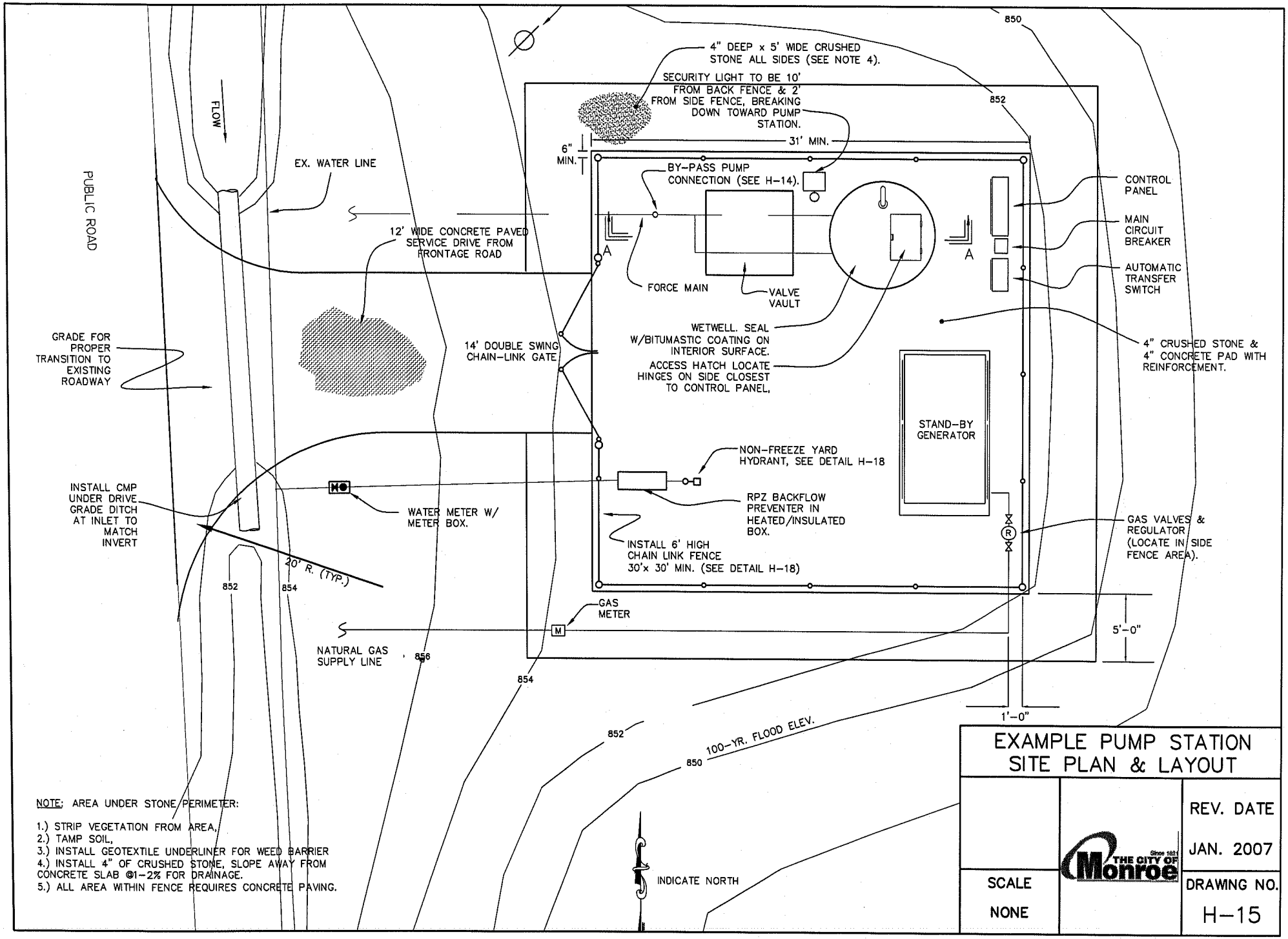
SIDE ENTRY TO THE PUMP STATION MAY BE CONSIDERED BY THE CITY OF MONROE IN CERTAIN CONDITIONS. APPROVED SIDE ENTRY DRIVES SHALL BE 14' WIDE.

NOTE: AREA UNDER STONE PERIMETER:

1.) STRIP VEGETATION FROM AREA,
2.) TAMP SOIL,
3.) INSTALL GEOTEXTILE UNDERLINER FOR WEED BARRIER
4.) INSTALL 4" OF CRUSHED STONE, SLOPE AWAY FROM CONCRETE SLAB @1-2% FOR DRAINAGE.
5.) ALL AREA WITHIN FENCE REQUIRES CONCRETE PAVING.

EXAMPLE PUMP STATION SITE PLAN & LAYOUT

	THE CITY OF Monroe Since 1821	REV. DATE JAN. 2007
SCALE NONE		DRAWING NO. H-15

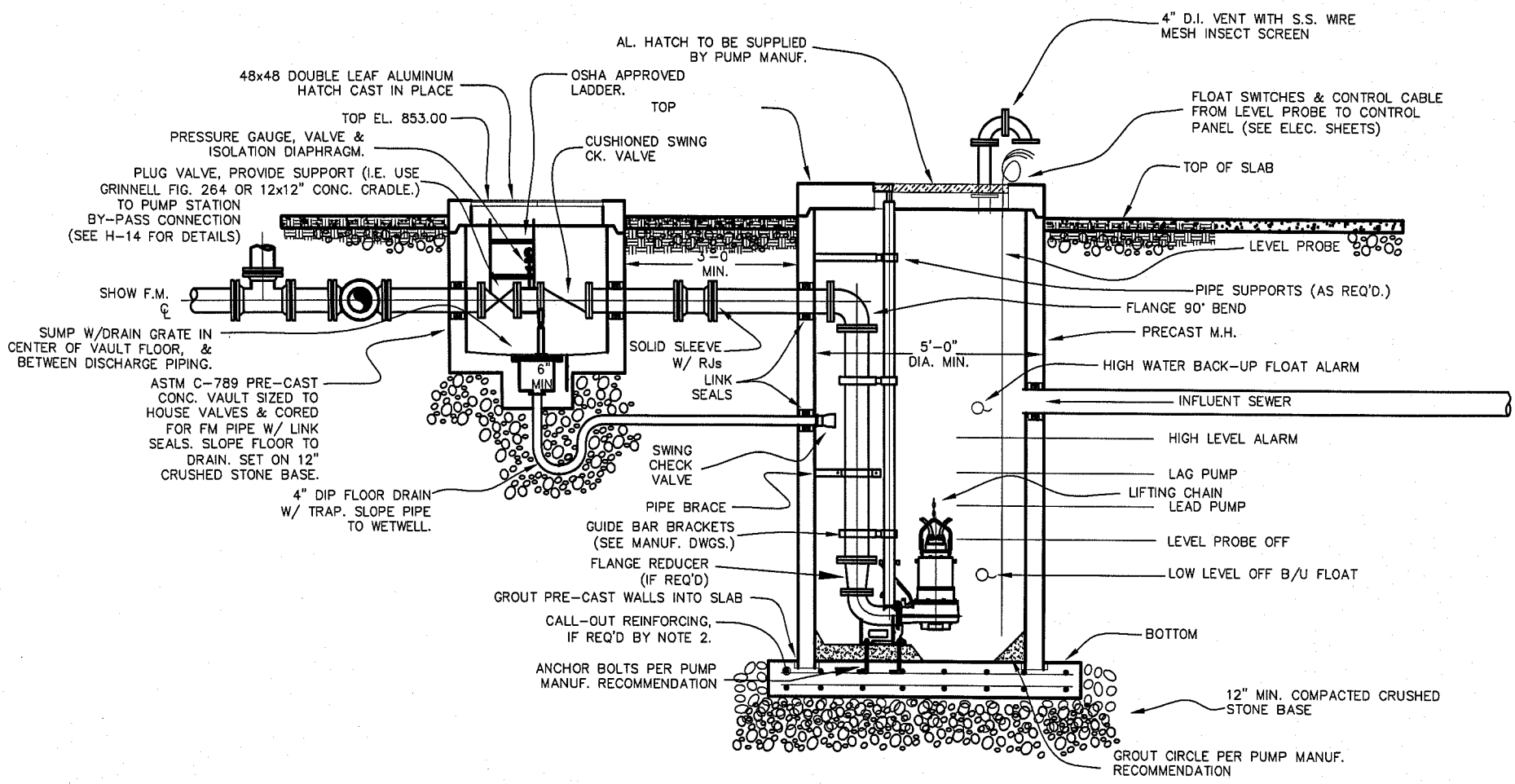


NOTE: AREA UNDER STONE PERIMETER:

1.) STRIP VEGETATION FROM AREA,
2.) TAMP SOIL,
3.) INSTALL GEOTEXTILE UNDERLINER FOR WEED BARRIER
4.) INSTALL 4" OF CRUSHED STONE, SLOPE AWAY FROM CONCRETE SLAB @1-2% FOR DRAINAGE.
5.) ALL AREA WITHIN FENCE REQUIRES CONCRETE PAVING.

EXAMPLE PUMP STATION SITE PLAN & LAYOUT

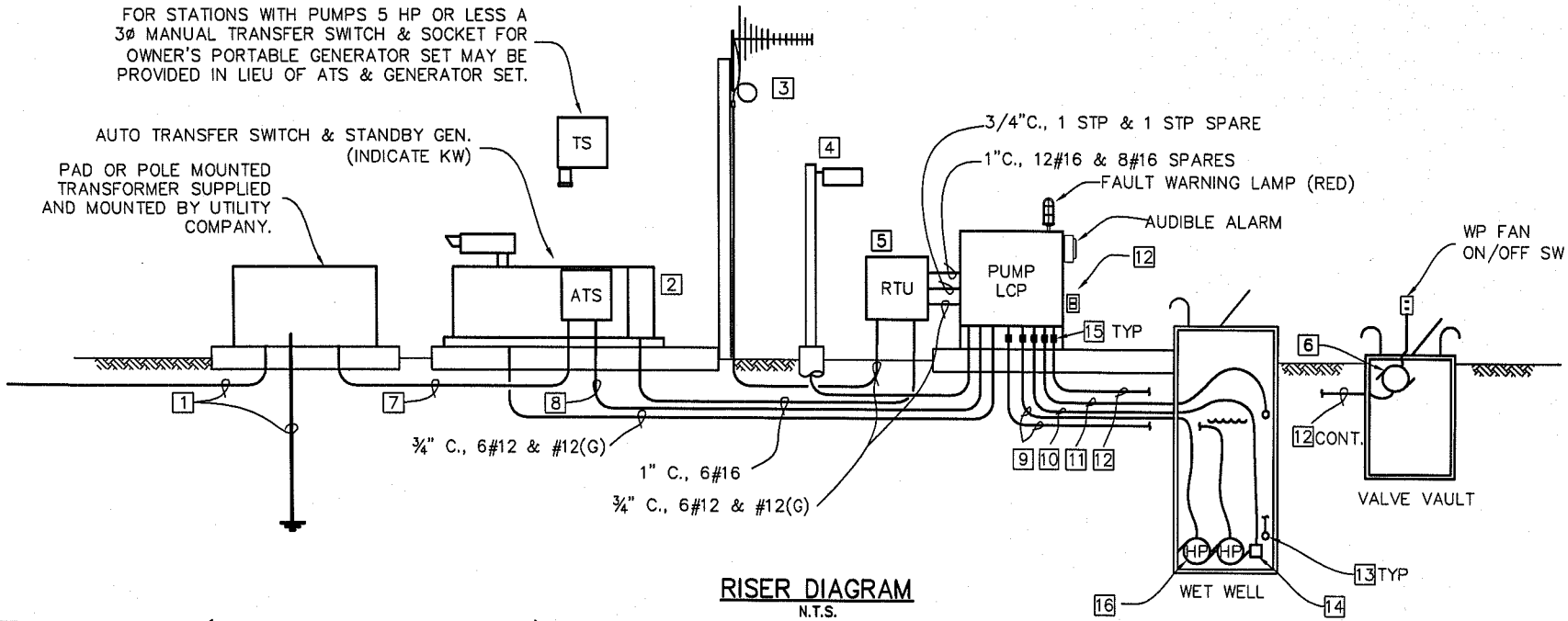
		REV. DATE
	Since 1821 THE CITY OF Monroe	JAN. 2007
SCALE NONE		DRAWING NO. H-15



NOTES:

1. ELEVATIONS SHOWN ARE FOR ILLUSTRATION ONLY. SHOW ACTUAL ELEVATIONS FOR ALL PIPES, STRUCTURES & PUMP OPERATING LEVELS ON SUBMITTAL DRAWINGS.
2. PROVIDE CALCULATIONS LISTING ALL ASSUMPTIONS & SAFETY FACTOR USED FOR DESIGN TO PREVENT FLOTATION OF PUMP STATION. IF STATION BASE IS POURED IN PLACE INSTEAD OF USING MONOLITHIC BASE, SHOW REINFORCEMENT DETAILS.
3. SHOW ALL PIPE & FITTING SIZES & STRUCTURAL DIMENSIONS.
4. PROVIDE BACKUP FLOATS FOR LOW WATER LEVEL AND HIGH WATER LEVEL SETTINGS. FLOATS TO BE MOUNTED TO 1" PVC. PIPE 12" ABOVE EACH FLOAT W/SS U-BOLTS AND NUTS. ADDITIONAL SUPPORTS SHALL BE PROVIDED AS REQUIRED.

EXAMPLE PUMP STATION SECTION A-A		
	THE CITY OF Monroe Since 1821	REV. DATE NOV. 2007
SCALE NONE		DRAWING NO. H-16



RISER DIAGRAM
N.T.S.

KEYED NOTES: (APPLIES TO THIS SHEET ONLY)

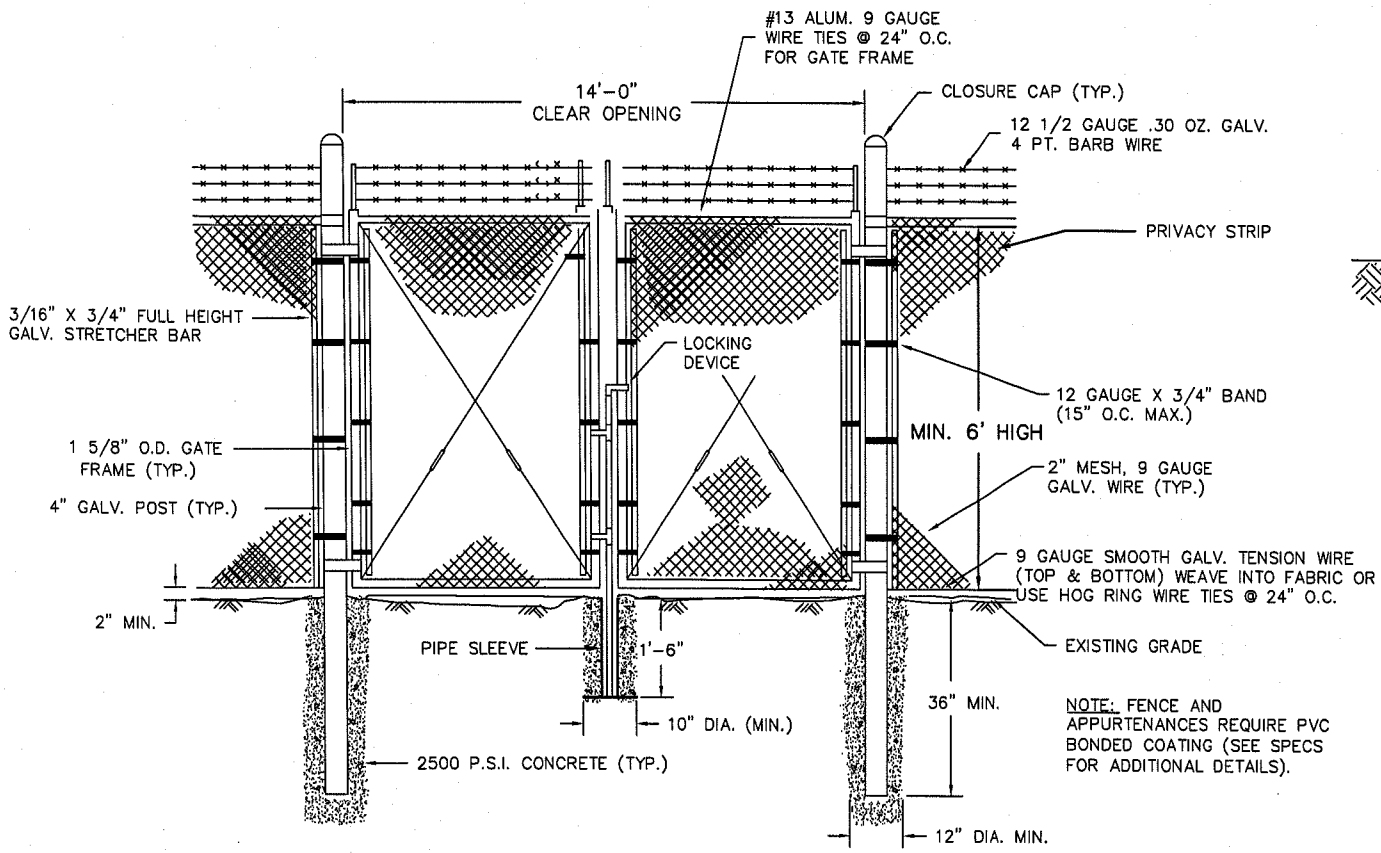
1. 480V, 3 PHASE, 3W SERVICE PROVIDED BY UTILITY CO. COORDINATE LOCATION AND INSTALLATION WITH POWER COMPANY. GROUNDING PER NEC.
2. ACTUAL LOCATION OF GENERATOR TO BE SHOWN ON PLAN DRAWING. GENERATOR SHALL BE POWERED BY DIESEL OR NATURAL GAS.
3. FURNISH AND INSTALL RTU BASED TELEMETRY SYSTEM FOR RADIO TRANSMISSION TO WASTEWATER PLANT. ANTENNA TO BE POLE OR TOWER MOUNTED. SEE SECTION 9.9.10 FOR DETAILS.
4. FURNISH AND INSTALL POLE MOUNTED LIGHTING FIXTURE EQUAL TO RUUD MODEL AC1425-M, 16" SQUARE, 250W METAL HALIDE FIXTURE WITH 15'x4" SQUARE ALUMINUM POLE.
5. ALL SUPPORTS AND HARDWARE TO BE STAINLESS STEEL OR ALUMINUM. PLACE RTU ENCLOSURE AS CLOSE AS POSSIBLE TO THE PUMP CONTROL PANEL.
6. IF VALVE VAULT IS TO BE MORE THAN 4'-0" DEEP, FURNISH AND INSTALL CORROSION RESISTANT CENTRIFUGAL IN-LINE DUCT FAN EQUAL TO KANALFLAKT, INC. MODEL K4, 4" DUCT CONNECTION, 120V, 92 CFM @ 0.25" SP. MOUNT AS HIGH AS POSSIBLE AND EXTEND 4" PVC DUCT DOWN TO 2'-0" AFF. PROVIDE WEATHERPROOF ON/OFF SWITCH TO OPERATE EXHAUST FAN.
7. INDICATE CONDUIT SIZE, NO. & SIZE OF CONDUCTORS (e.g., 3" C., 4#1/0) FROM TRANSFORMER TO 'NORMAL' LINE OF POWER TRANSFER SWITCH.
8. INDICATE CONDUIT SIZE, NO. & SIZE OF CONDUCTORS FROM LOAD SIDE OF POWER TRANSFER SWITCH TO LINE SIDE OF PUMP CONTROL PANEL MAIN.
9. PVC COATED GALV. RIGID STEEL CONDUIT WITH SUBMERSIBLE PUMP CABLES (INDICATE CONDUIT SIZE). COORDINATE SIZE AND QUANTITY OF SUBMERSIBLE CABLES WITH PUMP MANUFACTURER PRIOR TO INSTALLING CONDUIT.
10. PVC COATED GALV. RIGID STEEL CONDUIT WITH LEVEL TRANSMITTER SUBMERSIBLE CABLES INDICATE CONDUIT SIZE).
11. PVC COATED GALV. RIGID STEEL CONDUIT WITH LEVEL SWITCH SUBMERSIBLE CABLES (INDICATE CONDUIT SIZE.
12. 3/4" C., 2#12 & #12 (G) FROM 20/1 CIRCUIT BREAKER IN PUMP CONTROL PANEL TO EXHAUST FAN. ALSO, A SECOND CIRCUIT TO WP GFI DUPLEX SERVICE OUTLET IS TO BE PROVIDED.
13. FLOAT LEVEL SWITCHES FURNISHED WITH EQUIPMENT.
14. LEVEL PROBE FURNISHED WITH EQUIPMENT.
15. SEAL-OFF FITTINGS. FILL WITH GE OR DOW SILICON AFTER CONDUCTORS ARE INSTALLED.
16. INDICATE PUMP HORSEPOWER (HP) BEING PROVIDED.

PUMP STATION RTU INPUT/OUTPUT

DI-1	RTU POWER FAIL	INTERNAL TO RTU CABINET
DI-2	PUMP NO. 1 STATUS	NC WHEN PUMP RUNNING
DI-3	PUMP NO. 2 STATUS	NC WHEN PUMP RUNNING
DI-4	PUMP NO. 1 FAIL	PUMP START FAIL
DI-5	PUMP NO. 2 FAIL	SEE SECTION 9.9.10.1
DI-6	WETWELL HIGH ALARM	FROM FLOAT SW
DI-7	TRANSFER SWITCH	FROM TRANSFER SW
DI-8	GENERATOR STATUS	WHEN GENERATOR RUNS
DI-9	GENERATOR ALARM	FROM GENERATOR ALARM SYSTEM

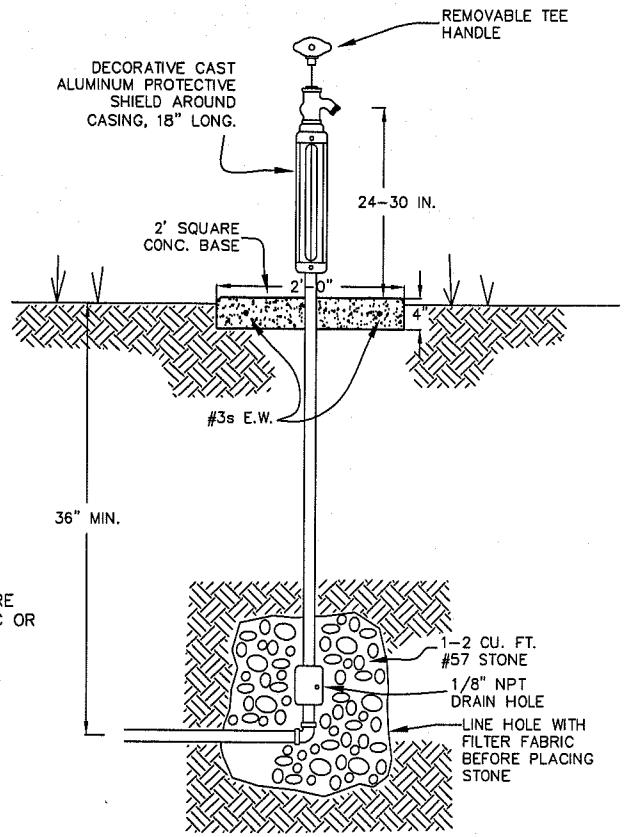
EXAMPLE PUMP STATION ELECTRICAL DIAGRAM

	Since 1821 THE CITY OF Monroe	REV. DATE NOV. 2004
SCALE NONE		DRAWING NO. H-17



DOUBLE SWING GATE & FENCE DETAIL

N.T.S.



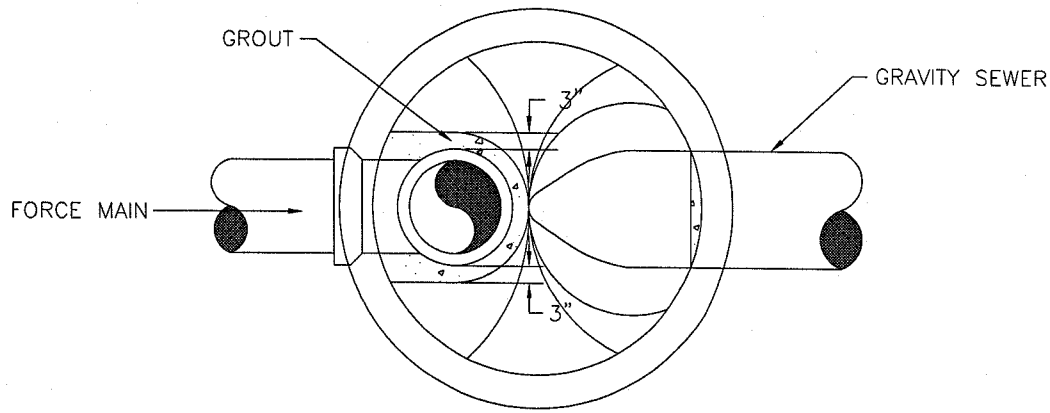
POST-TYPE YARD HYDRANT

NON-FREEZE, JOSAM 71700 SERIES, OR EQUAL.

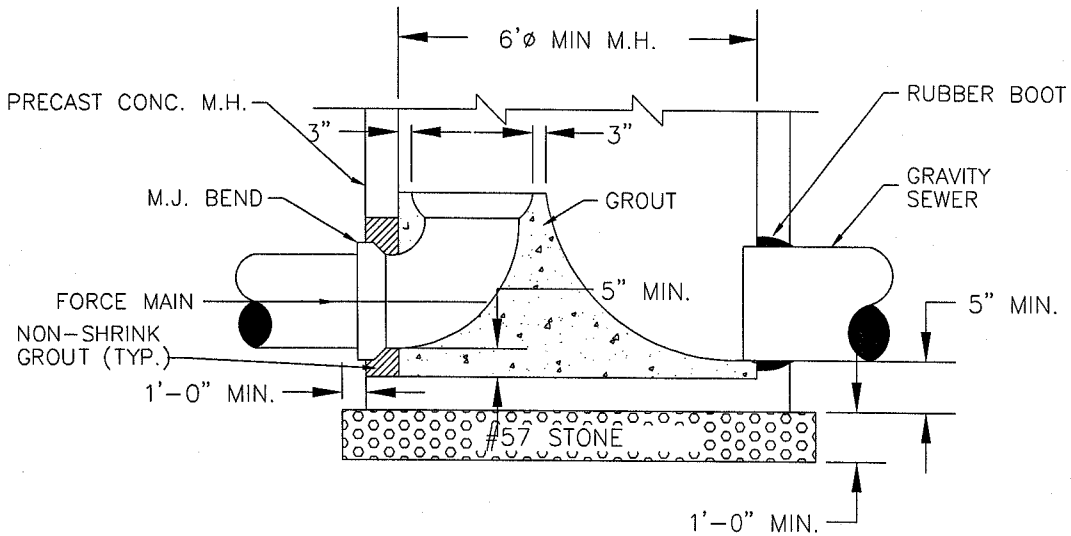
N.T.S.

EXAMPLE PUMP STATION MISCELLANEOUS DETAILS

	THE CITY OF Monroe Since 1821	REV. DATE NOV. 2007
SCALE NONE		DRAWING NO. H-18



PLAN



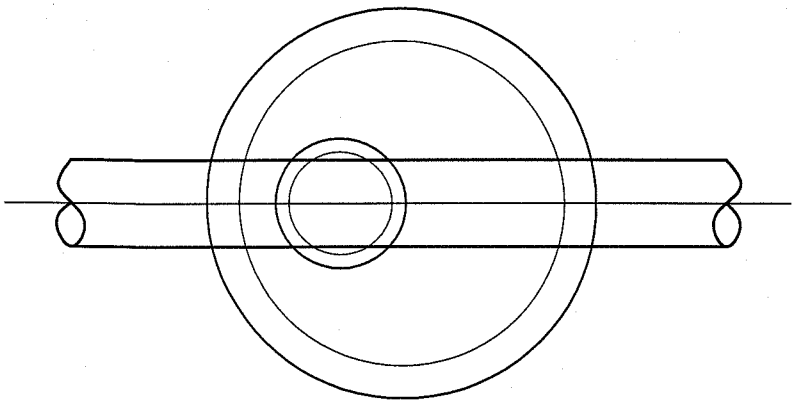
SECTION

FORCE MAIN CONNECTION DETAIL

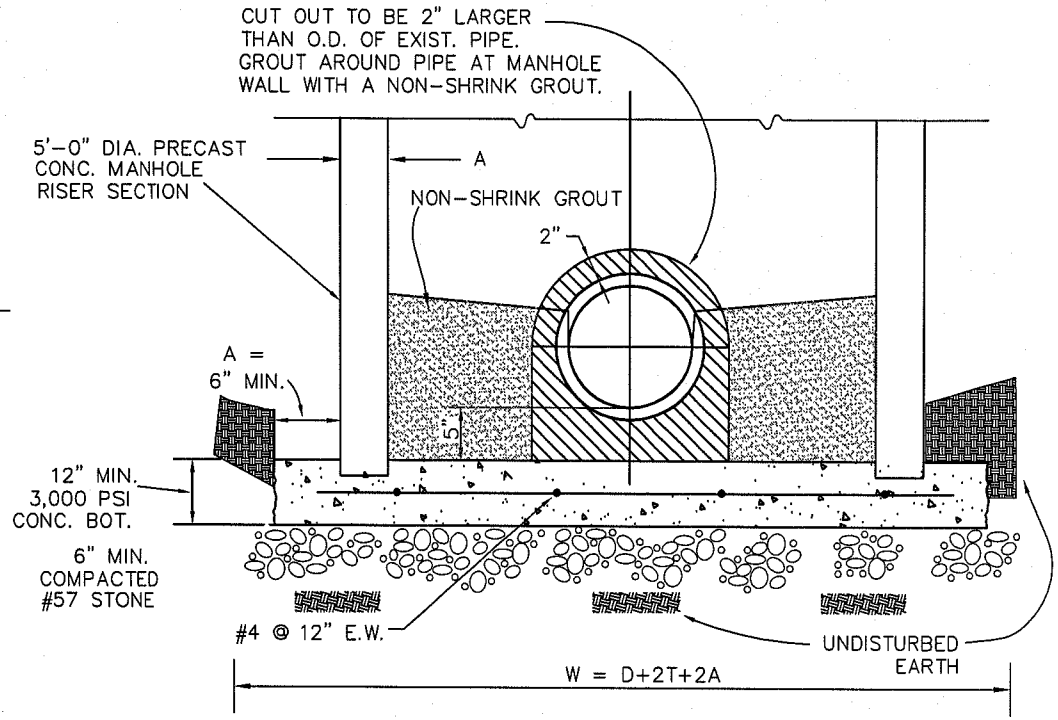
NTS

NOTE: USE VENTED COVER AND BOLT TO FRAME.

FORCE MAIN TERMINATION		
		REV. DATE NOV. 2007
SCALE NONE		DRAWING NO. H-19



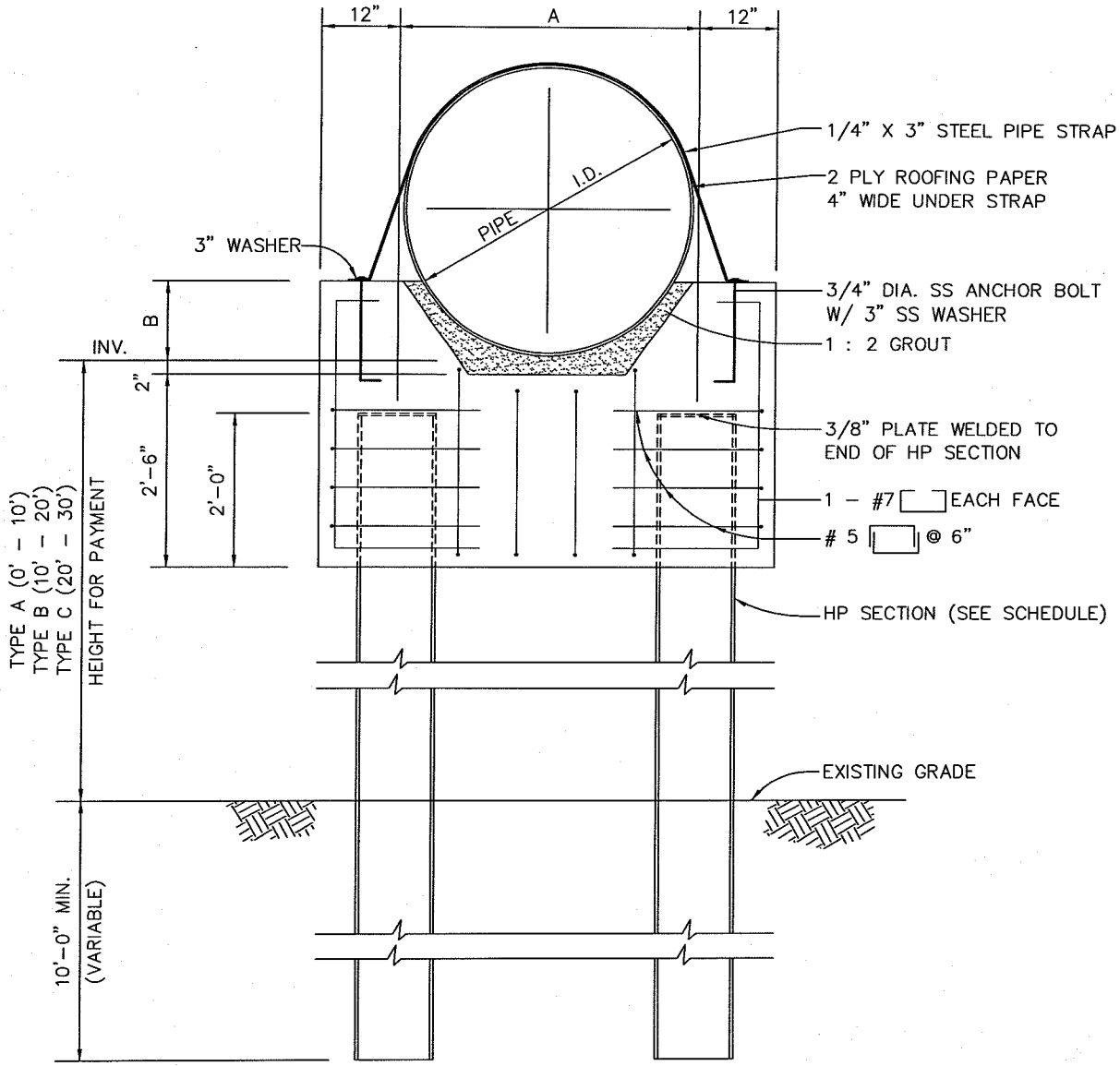
PLAN



DOGHOUSE MANHOLE PLAN & DETAIL

N.T.S.

DOG HOUSE MANHOLE		
		REV. DATE
		APR. 2005
SCALE		DRAWING NO.
NONE		H-20



SCHEDULE OF DIMENSIONS FOR PILE-PIER		
I.D. PIPE	A	B
8"	12"	2"
10"	14"	3"
12"	16"	3"
16"	19"	4"
18"	21"	5"
20"	23"	5"
24"	26"	6"
30"	32"	8"
36"	38"	9"
42"	46"	12"

NOTES:

1) IF ROCK IS ENCOUNTERED PRIOR TO REACHING THE REQUIRED 10'-0" MIN. DEPTH, THE CONTRACTOR WILL DRILL A HOLE LARGE ENOUGH TO ALLOW 2" CLEAR COVER AROUND PILE SECTION AND A DEPTH OF 2'-0" HOLE SHALL THEN BE FILLED WITH NON-SHRINK GROUT.

2) CONC. CAP MIN. 18" THICK MIN. 3" CLEAR CONC. COVER ON ALL STEEL.

3) MAXIMUM CENTERLINE SPACING BETWEEN PIERS 20'-0".

PILE SCHEDULE		
TYPE	HEIGHT	HP SECTION
A	0-10'	8 X 36
B	10'-20'	10 X 57
C	20'-30'	14 X 73

PILE-PIER DETAIL

N.T.S.

PILE-PIER DETAIL

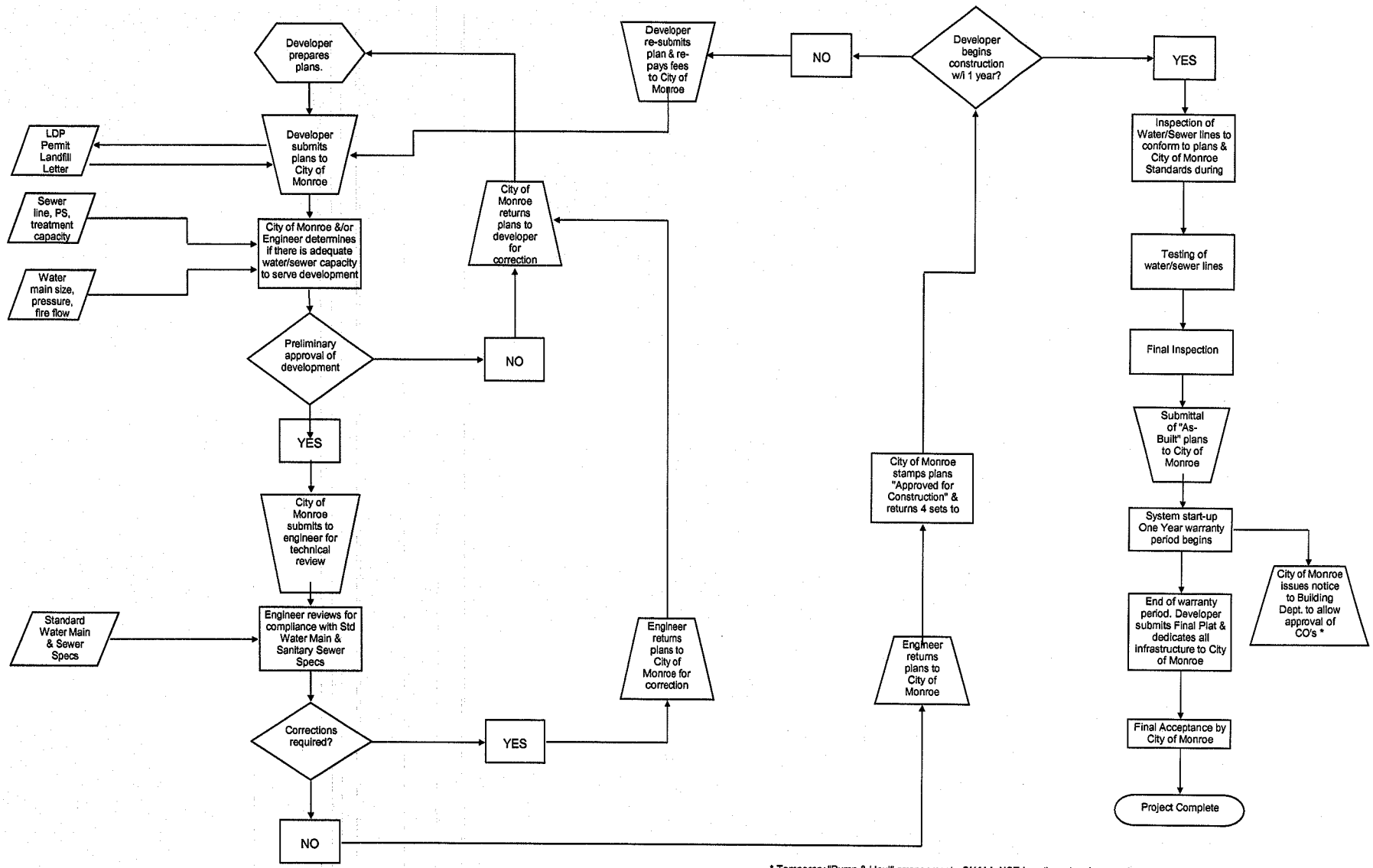
	THE CITY OF Monroe	REV. DATE NOV. 2007
SCALE NONE		DRAWING NO. H-21

APPENDIX I

WATER AND SEWER DEVELOPMENT REVIEW PROCEDURE

THE CITY OF MONROE, GEORGIA

Water and Sewer Development Review Procedure



* Temporary "Pump & Haul" arrangements ***SHALL NOT*** be allowed under any circumstances, including as a provisional method of providing sewer service for a building that is otherwise ready for occupancy.