MANUAL FOR THE
DESIGN AND CONSTRUCTION OF
WATER AND WASTEWATER
SYSTEM EXTENSIONS FOR

Greenville Utilities

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SECTION 1.0

INTRODUCTION

1.1 PURPOSE OF MANUAL

The purpose of this Manual is to provide a standard guideline to the contractor, developer and engineer for the design and construction of water and wastewater system extensions that will become a part of the Greenville Utilities Commission's water and wastewater systems. This publication is not intended to replace previously adopted codes, ordinances or statutes, but serves to consolidate the multitude of information on policy, design, materials, construction and standard detail drawings used by the Water Resources Department of the Greenville Utilities Commission.

The materials, design and construction standards contained within this Manual are established as the minimum for water and sewer extensions which will be accepted for ownership and maintenance by the Greenville Utilities Commission. These minimum standards have been adopted and compiled from information from several sources such as agencies of the State of NC, industry standards and the knowledge and experience of the technical staff of the Greenville Utilities Commission Water Resources Department.

Finally, it is the intent and purpose of this Manual to explain the requirements of the Greenville Utilities Commission relating to water and wastewater system extensions such that all can comprehend these requirements and to provide a consistent, orderly, and sound extension of the Greenville Utilities Commission's water and wastewater systems.

1.2 ORGANIZATIONS, AUTHORITY, AND RESPONSIBILITIES

1.2.1 Greenville Utilities Commission

The Greenville Utilities Commission was created by an act of the NC Legislature to provide utility services to citizens and industry within the City of Greenville and surrounding areas. The Greenville Utilities Commission is owned by the citizens of Greenville and operated by an independent, eight (8) member Board of Commissioners consisting of seven (7) Commissioners appointed from the public and the City Manager. The day to day management of Greenville Utilities Commission is by a general manager with a director for each operating department.

The three (3) operating engineering departments include the Electrical, Water Resources, and Gas Departments all of which are housed in the Engineering Center located on Mumford Road.

The main office for maintenance and construction operations is located in the Operations Center adjacent to the Engineering Center. Administration services are provided through the main office of the Commission at 401 S. Greene Street.

There are various utility systems operated by others throughout Pitt County including electrical, water and sewer, and gas. The areas served by the various utilities of the Greenville Utilities Commission are therefore not coterminous. A map indicating the areas served by Greenville Utilities can be viewed at the Commission's main office on S. Greene Street.

1.2.2 City of Greenville

The Public Works Department has the responsibility to operate and maintain the streets, storm drainage, and solid waste collection systems. The Public Works Department also handles issuance of permits for work within the streets.

The Engineering Division of the Public Works Department is responsible for approval of all subdivision street and storm drainage design, commercial and industrial site development, sedimentation and erosion control plans within the Greenville City Limits and its Extraterritorial Jurisdiction (ETJ). The Inspections Division is responsible for the issuance of permits and inspection of actual building construction.

The City of Greenville Planning and Community Development Department has the responsibility for ensuring zoning compliance and for approval of landscaping plans for all development which occurs within the Greenville City Limits and its ETJ. The City of Greenville Planning and Zoning Commission has the responsibility for approval of all subdivisions including streets and drainage systems inside the Extraterritorial Jurisdiction and City Limits of the City of Greenville.

1.2.3 County of Pitt

The County of Pitt Engineering and Planning Department has the responsibility for approval of all subdivisions including streets and drainage systems and erosion and sedimentation control plans outside the Extraterritorial Jurisdiction of the municipalities within

the county. However, this authority may extend to within the city limits of some of the smaller municipalities that have delegated their responsibility to the County. Any zoning ordinances applicable to the County are also administered by the County Engineering and Planning Department.

1.3 DEFINITIONS AND ABBREVIATIONS

1.3.1 Definitions

Wherever used in this Manual, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof. There are other terms used in this document which are defined in the sections to which they apply.

1.3.1.1 General Definitions

Approved Plans - Water and/or sewer system extension plans which have been reviewed by and received the approval of the Water Resources Department of the Greenville Utilities Commission and the appropriate state and local agencies.

Assistant Director - The Assistant Director of the Water Resources Department of the Greenville Utilities Commission.

Commission - The term "Commission" refers to the Water Resources Department of the Greenville Utilities Commission and those persons employed by and authorized by the Greenville Utilities Commission to act on the behalf of the Water Resources Department in the particular instance cited. Words such as "as required by the Commission" shall also refer to this Manual and the Greenville Utilities Commission Utility Regulations.

Commission's Representative - An authorized employee or representative of the Water Resources Department of the Greenville Utilities Commission.

Contract Documents - The term "Contract Documents", shall refer to the project plans and specifications for water and/or sewer system extensions.

Contractor - The person, business, or corporation responsible for the performance of water or sewer system construction work.

Department Engineer - The term "Department Engineer" refers to a Professional Engineer on the staff of the Water Resources Department of the Greenville Utilities Commission.

Director - The Director of the Water Resources Department of the Greenville Utilities Commission.

Developer - The person(s) or corporations financially responsible for the design and construction of a development for which water or wastewater service by the Greenville Utilities Commission will be requested.

Engineer - The Professional Engineer responsible for the design or construction administration of a water or wastewater system extension.

Professional Engineer - A person who has been duly registered and licensed as a professional engineer by the North Carolina State Board of Registration for Professional Engineers and Land Surveyors.

Manual - The term "Manual" shall refer to all applicable standards, specifications, standard details and policies contained in or referenced by this document.

Terms and Conditions - The latest revision of the Terms and Conditions of Water and/or Sewer Service Part C, of the Greenville Utilities Commission's Utility Regulations, a copy of which is available upon request.

1.3.1.2 Pipe Backfill Zones

The following terms are used in Sections 3.0 and 4.0 in reference to excavation and backfill for pipe. Refer to the standard detail entitled, "Trench Section Detail for the Installation of Sanitary Sewer Pipe".

Foundation - That portion of the pipe support structure bounded by the undisturbed trench bottom, the trench walls, and the pipe Bedding.

The construction of a pipe foundation is generally not required unless unstable materials are encountered in the trench bottom.

Bedding - That portion of the pipe support structure bounded by the Foundation or undisturbed trench bottom, the trench walls and the bottom of the pipe.

Haunching - That portion of the pipe support structure bounded by the Bedding, the trench walls, the outside of the pipe and a horizontal plane having an elevation equal to that of the springline or the pipe.

Initial Backfill - That portion of the backfill lying above the springline of the pipe and below a horizontal plane having an elevation which is one (1) foot above the top of the pipe.

Final Backfill - That portion of the backfill lying above the Initial Backfill.

1.3.2 Abbreviations

AASHTO - American Association of State Highway Transportation Officials

ANSI - American National Standards Institute

ASTM - American Society for Testing and Materials

AWWA - American Water Works Association

DENR-Department of Environment and Natural Resources

GUC - Greenville Utilities Commission

NCDEH - North Carolina Division of Environmental Health

NCDOT - North Carolina Department of Transportation

NCDWQ - North Carolina Division of Water Quality

1.3.3 Standards

Where reference is made by this Manual to published standards such *as* ASTM*,* ANSI, AWWA, etc., the latest revisions of such standard shall apply.

SECTION 2.0

CONCEPTUAL PHASE

2.1 GENERAL

The Engineer and Developer shall become familiar with the water and sewer extension policies of the Greenville Utilities Commission prior to making conceptual plans for developments which will require water and/or sewer service by the Commission. Reference is made to the Terms and Conditions which includes the policy of the Commission in regard to water and wastewater system extensions.

It shall be the responsibility of the Engineer or Developer to obtain the approval of the Greenville Planning and Zoning Commission or Pitt County Planning Board for any proposed projects under their respective jurisdiction prior to submission of Contract Documents for Commission approval.

2.2 INITIAL CONFERENCE

Prior to finalizing any plans for water or wastewater system extensions, the Developer or his Engineer shall consult the Department Engineer so that he may determine if an initial conference will be necessary prior to the submission of plans for approval. If the scope of the proposed development, in the opinion of the Department Engineer, is such that an initial conference will be beneficial prior to the development of final plans and specifications, the Developer or his Engineer will request scheduling of an initial conference. The Developer or his Engineer shall present, at the time of this conference, conceptual schematics or layouts of the proposed extensions and the estimated water and wastewater demands resulting from the proposed development. The Developer or his Engineer shall also provide the Commission with all other information necessary to determine the probable effect of the proposed development on the Commission's existing facilities. This data shall include a projected cost estimate of the extensions, the nature of water usage (domestic, commercial, etc.), the probable character of the wastewater generated, a description of any proposed private water distribution and sewer collection systems, and other pertinent information. The Director and his staff will advise the Developer or his Engineer of Greenville Utilities Commission's water and sewer extension policy and water and sewer use ordinance, including all applicable fees and assessments.

The Director and his staff will take under study and consideration the proposed plans and decide if, in the best interest of the Greenville Utilities Commission, the plan is satisfactory as presented, needs to be revised, or is not at the present time feasible.

2.3 PRE-APPLICATION PACKAGE

When required by the Commission, the Developer or his Engineer shall file a pre-application package with the Director. The purpose of the pre-application package is to present to the Director and his staff sufficient and detailed information concerning the proposed water and sewer extensions and to permit the determination of their compatibility with and impact upon the overall Greenville Utilities Commission's water and wastewater systems. The pre-application package shall include the following information and any other information deemed necessary by the Director and his staff to enable them to make a determination of the acceptability of the proposed plans. All information shall be submitted to the Director and his staff in a package and not in a "piece-meal" manner. After review of the entire pre-application package, the Director will advise the applicant if the proposed project is acceptable to Greenville Utilities Commission.

2.3.1 Conceptual Plans: The applicant shall submit two (2) copies of subdivision plans or site plans at a scale of 1 inch equals 400 feet (or larger scale) showing the proposed layout of the water, and sewer extensions. The conceptual plans should show all proposed pipelines and sizes, manholes, valves, fire hydrants and pump stations and the nearest existing water and sewer facilities to which the proposed new extensions will connect. All proposed easements shall be shown.

2.3.2 Design: The applicant shall submit in his pre-application package preliminary engineering design calculations used to determine line and pump station sizes and fire protection requirements including expected initial and future populations to be served.

2.3.3 Estimated Time Schedules: The applicant shall submit in the pre-application package estimated time schedules identifying the expected dates of completion of the final plans and specifications and expected beginning and completion dates of construction.

2.3.4 Projected Cost Estimate: The applicant shall submit in the preapplication package a cost estimate prepared by an engineer for the proposed water and sewer extensions. The cost estimate shall be as detailed as possible with estimated quantities of specific items of work and their projected unit costs.

2.4 REQUIRED FEES AND CHARGES

The Developer and his Engineer shall thoroughly familiarize themselves with the fees and charges set forth in the Utility Regulations . Based upon the submittal of the pre-application package, the Director and his staff shall determine and furnish the applicant in writing the estimated fees and charges relating to the proposed water and sewer extensions. A final value of the fees and charges will be determined by the Director and his staff upon approval of the plans and specifications.

2.5 REQUIREMENTS FOR PLANNING BOARD APPROVAL

The Commission shall require approval of a proposed development by the Pitt County Planning Board or the City of Greenville Planning and Zoning Commission, whichever has jurisdiction for the proposed development site, prior to acceptance of Contract Documents for review and approval.

SECTION 3.0

DESIGN CONSIDERATIONS FOR WATER SYSTEM EXTENSIONS

3.1 GENERAL

The intent of this section is to provide the Developer or Engineer with Guidelines which will assist in the development of Contract Documents for water system extensions for which acceptance by the Commission will be sought. As a minimum, the Contract Documents for any proposed extension must address satisfactorily the topics contained herein.

3.2 LOCATION AND ALIGNMENT

3.2.1 Depth of Cover

Water mains shall be designed to provide a cover of no less than three feet (3') but no more than five feet (5') as measured from the top (crown) of the pipe to the finished grade. Where this requirement cannot be met due to unavoidable conflicts in grade, the Department Engineer shall be consulted so that a solution acceptable to the Commission may be determined. If, in the opinion of the Department Engineer, conditions warrant greater or lesser depths of cover than that required above, special measures, such as the use of ductile iron pipe for shallow installations, or additional easement widths for deeper installations may be required by the Commission.

3.2.2 Relationship of Mains to Property Lines, Rights-of-Way and Structures

All water mains shall be located within dedicated street rights-of-way or permanent water main easements such that the Commission's maintenance and repair forces have unrestricted access to the line and all appurtenances thereof.

3.2.2.1 Water mains shall be centered in a permanent easement of adequate width to allow excavation and maintenance of the line. In no case shall the permanent easement for water mains be narrower than that given by the table below.

Pipe Diameter	Minimum Easement
Less than 12”	10’
12” - 24”	15’
Greater than 24”	20’

3.2.2.2 Under certain conditions, the Department Engineer may require such additional easement as deemed appropriate. Such easement shall be centered on the water main unless directed otherwise by the Commission.

3.2.2.3 Approval of water main extension plans shall be contingent upon the procurement of all easements necessary to meet the above requirements and upon the execution of an encroachment agreement with the owner of each right-of-way which the proposed main will cross. See Section 5.7 for the requirements for submission of easement documents.

3.2.2.4 Water mains shall be located no closer than ten feet (10’) horizontally to buildings or substantial surface structures.

3.2.3 Relationship of Water Mains to Sanitary Sewers

3.2.3.1 Water mains shall be laid at least ten feet (10’) laterally from existing or proposed sewers, unless local conditions or barriers prevent a ten foot (10’) lateral separation, in which case:

3.2.3.1.1 The water main is laid in a separate trench with the elevation of the bottom of the water main at least eighteen inches (18”) above the top of the sewer; or

3.2.3.1.2 The water main is laid in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least eighteen inches (18”) above the top of the sewer.

3.2.3.2 Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least eighteen inches (18") above the top of the sewer, unless local conditions or barriers prevent an eighteen inch (18") vertical separation; in which case both the water main and the sewer shall be constructed of ferrous materials and with joints which are equivalent to water main standards for a distance of ten feet (10') on each side of the point of crossing.

3.2.3.3 Whenever it is necessary for a water main to cross under a sewer, both the water main and the sewer shall be constructed of ferrous materials for a distance of ten feet (10') on each side of the point of crossing. A section of water main pipe shall be centered over the crossing.

3.2.4 Relationship of Water Mains to Storm Sewers

When underground structures or storm sewers are encountered, twelve inches (12") minimum vertical separation and five feet (5') minimum lateral separation shall be maintained. Water main and storm sewer crossings shall be constructed in accordance with the Standard Details.

3.2.5 Location Under Paved Areas

Water mains shall be located outside of proposed or existing paved areas except where required at intersections, cul-de-sacs, street crossings by water mains, other paved areas which must be crossed, or where structures or other obstacles make this impossible. When a new water main must be located under an existing or proposed paved area it shall have a minimum cover of three feet (3') as measured from the top of the pipe to the finished subgrade. Water mains proposed within paved areas should be designed to avoid parking spaces whenever possible. Water mains located in cul-de-sacs should be projected straight through, and the main should terminate at the property corner with the hydrant or blow off located on the property corner/right-of-way. If design of the cul-de-sac does not allow this, a 90° bend should be used to direct the main to a property corner, thereby allowing water services to be installed in accordance with Section 3.2.9.

3.2.6 Location of Fire Hydrants

3.2.6.1 Fire hydrants shall be installed with the back of the hydrant being located at the right-of-way line with preference being given to street intersections. In no case shall any portion of a hydrant be closer than five feet (5') to the back of the curb or two and one-half feet (2.5') to the backslope of a roadside ditch.

3.2.6.2 Hydrants shall be oriented so that the pumper nozzle faces the roadway and so that the nozzle centerline is a minimum of eighteen inches (18") and a maximum of twenty-four inches (24") above finished grade. See Standard Details.

3.2.6.3 Non-residential structures shall require fire hydrants to be located such that each structure or portion thereof will be within four hundred feet (400') of a hydrant. This determination shall be made via vehicle access routes (roadways, fire lanes, etc.) and by hose placement from the firefighting equipment in lieu of linear measurements.

Multi-family residency (apartments, townhouses, condominiums, etc.) shall require fire hydrants to be located such that each structure or portion thereof will be within four hundred feet (400') of a hydrant. This determination shall be made via vehicle access routes (roadways, fire lanes, etc.) and by hose placement from the firefighting equipment in lieu of linear measurements.

Residential subdivisions (one and two family dwellings) shall require fire hydrants to be located within four hundred feet (400') of the structure.

3.2.6.4 For any non-residential structure that has a fire sprinkler system or a standpipe system, a fire hydrant shall be no more than 100' from the fire department connection. This hydrant shall be dedicated to the fire department connection and shall be in addition to the hydrants required by Section 3.2.6.3. The hydrant shall be located on the supply side of the backflow prevention device.

3.2.6.5 Where possible, fire hydrants shall be located a minimum of fifty feet (50') from any structure.

3.2.6.6 For proposed subdivisions where the location of structures is not known, hydrant spacing shall be measured along the street right-of-way with spacing provided as shown in 3.2.6.3 above. Measurements across lots, which front on different streets, will not be permitted for purposes of satisfying hydrant spacing requirements.

3.2.6.7 Structures located on multi-lane streets or highways shall require fire hydrants located on the same side of the roadway as the structure. Multi-lane shall be defined as a street, highway, avenue, road or thoroughfare having four (4) or more lanes including the center turn lane.

3.2.6.8 In the case of a water main extension along streets with four (4) or more lanes, fire hydrants shall be required on both sides of the street or roadway in accordance with Section 3.2.6.3 above.

3.2.6.9 Dead end mains shall be provided with a hydrant when required by Section 3.2.10 of the Manual.

3.2.6.10 Each phase of a project shall be designed and constructed to provide the minimum number of hydrants necessary to conform with the North Carolina Fire Code (latest edition) upon completion of the phase.

Guidelines for determining the minimum number of hydrants as published in the North Carolina Fire Code, Appendix C are included in this Manual as Appendix B.

3.2.7 Location of Gate Valves

3.2.7.1 Each intersection of water mains shall have one less main valve than the number of intersecting pipes, i.e. crosses shall have three (3) main line valves, a tee intersection shall have two (2) main line valves. Valves shall not be located in the curb and gutter.

3.2.7.2 A proposed connection of a new water line to an existing water line shall include provisions for the addition of sufficient valves to the existing water line to meet the intent of Paragraph 3.2.7.1. If there are existing valves located in close proximity to the proposed connection, the

Commission will not require that valves be added to the existing water line except in unusual circumstances.

3.2.7.3 Each fire hydrant shall have a hydrant branch valve in accordance with the Standard Details. Valves on a hydrant branch shall not be located in curb and gutter.

3.2.7.4 In addition to the valves required at tees, crosses, hydrants, etc., in-line valves shall be provided at intervals no greater than 1,500 feet unless otherwise approved by the Commission because of unusual circumstances.

3.2.7.5 Valve boxes shall be installed on all valves in accordance with Section 3.4.10 of this Manual and as shown in the Standard Details.

3.2.8 Location of Air Release Valves

3.2.8.1 Mains twelve inches (12") or larger in diameter, which have a change in elevation of fifteen feet (15') or greater, shall have an air release valve meeting the requirements of Section 7.8 of the Manual installed at the highest elevation of such change.

3.2.8.2 The Commission may also require air release valves in other instances where, in the opinion of the Department Engineer, the possibility of excess quantities of air accumulating in the proposed main exists.

3.2.8.3 See the Standard Details and Section 7.8 for requirements of the Commission regarding taps for air release valves.

3.2.8.4 Manual air release valves shall be installed in a standard meter box. Automatic air release valves shall be provided with a standard manhole.

3.2.9 Location of Services

3.2.9.1 Plans for projects which propose the creation of lots shall include the provision of water services to each lot, including any residual parcels and areas reserved for

future lots. The size and location of services shall be based upon the anticipated use of the lot and require the Commission's approval. The Commission may agree to waive its requirement that water services be installed to each lot within nonresidential subdivisions if there is insufficient information available to permit proper sizing of services and they can be conveniently installed by the Commission at the time service is requested.

3.2.9.2 Greenville Utilities Commission reserves the right to require individual water and sewer services to each building or tenant space.

3.2.9.3 Water meter boxes shall be set flush with the finished grade and located on the street right-of-way limit at the center of the lot for which service is installed, unless directed otherwise by the Commission or this Manual.

3.2.9.4 When project design dictates that electric cables are to be placed on the same side of the roadway with the sidewalk, the water meter box for that side shall be located six feet behind the edge of the sidewalk.

3.2.9.5 Water meter boxes shall not be located within driveways, sidewalks, or other paved areas subject to vehicular traffic unless approved otherwise by the Commission.

3.2.9.6 Water meter boxes shall not be installed within a ditch slope. Where the right-of-way limit for a street is within a ditch slope, the meter box shall be installed a minimum of 2.5 feet behind the top of the ditch bank.

3.2.9.7 Easement shall be provided for all water meter boxes not located in existing rights-of-way or easement.

3.2.9.8 Water services shall be located perpendicular to the main.

3.2.9.9 Plans should not propose the crossings of public and private utilities.

3.2.10 Location of Blow-Offs and Dead End Hydrants

3.2.10.1 Dead ends on mains six inches (6”) in diameter or larger shall be provided with a standard fire hydrant at the

terminal end. Materials and installation shall be as required by the Commission for standard fire hydrants.

3.2.10.2 Dead ends on mains four inches (4") and smaller in diameter shall be provided with a blow-off meeting the requirements of Section 7.4.2.2 of the Manual and the Standard Details.

3.2.10.3 All water lines shall be terminated in accordance with the Standard Details with blow-offs and hydrants located on property corners whenever possible.

3.2.11 Location Of Backflow Prevention Assemblies

The location of backflow prevention assemblies shall be in accordance with the requirements of the Terms and Conditions.

3.2.11.1 In general, all backflow prevention assemblies shall be located outside of the structure and before any branch connections to the private system, with preference being given to the property line/right of way, unless otherwise approved by the Commission.

3.2.11.2 Backflow assemblies shall be required for any application in which possible pollution or contamination of the public water supply system could result from a backflow cross-connection.

3.2.11.3 In accordance with the Terms and Conditions and the Rules Governing Public Water Supply Systems, the severity of the potential effects shall determine the minimum degree of protection required. The Commission will review each case on an individual basis.

3.3 SIZING OF WATER MAINS

3.3.1 General

Water mains are to be sized in accordance with this Manual and good engineering practice. The standards included herein are minimum standards.
The Engineer shall design the water distribution system based upon the available supply and the project needs.

3.3.2 Pressure Requirements

Water mains shall be sized so that a minimum residual pressure of 20 psi is obtained during peak demand plus fire flow. Where higher pressures are required, it shall be the responsibility of the individual property owner to provide the necessary booster pumping facilities.

3.3.3 Fire Hydrants

All fire hydrants shall be installed on a six-inch (6") leg with a six-inch (6") hydrant branch valve.

3.3.4 Private Mains

Private mains shall be sized by the Engineer in accordance with Section 3.3.5 of this Manual. Backflow prevention shall be provided in accordance with Section 3.2.11 of this Manual.

3.3.5 Minimum Fire Flows

3.3.5.1 General

Unless otherwise required or permitted by the Commission, water distribution systems shall be designed to provide the fire flow required by the guidelines contained in this Section. The Commission's existing facilities may or may not be adequate to provide the required fire flow at the time of design and construction of the planned development; however, the Commission shall provide the Engineer with an estimated value for the system pressure at design fire flow available at the point where the planned development is to connect with the Commission's existing distribution system. This value may be based upon the actual system pressure available or calculation of the pressure which shall be available upon reinforcement of the existing system. The Developer or his Engineer shall provide the Commission with the value (subject to approval) of the design fire flow necessary to meet the requirements of this Section.

The value for design fire flow and supporting documentation shall be submitted with the preapplication package should the Commission require the submission of such a package (See Section 2.3). The design fire flow and supporting documentation shall also be submitted for

approval with the design calculations as required by Section 5.2.

3.3.5.2 Fire Flow Conditions

Selection of the size of the water main for fire flow capacity shall be such that the main will deliver the discharge required by Section 3.3.5.3 and conform to the minimum sizing requirements of Section 3.3.5.4, as applicable, including the peak user demand of the development. A minimum residual pressure of 20 psi shall be available at all points of the planned distribution system at fire flow plus peak user demand.

3.3.5.3 Fire Flow Requirements for Buildings

Guidelines for determining residential peak user demand as published in the North Carolina Administrative Code, Title 15A, Subchapter 18C are included in this Manual as Appendix A.

Fire flows are dependent upon the type of construction, the total floor area of the buildings and other factors within a project. In order to provide an adequate design, developers should consult with the City of Greenville Fire/Rescue Department for required design criteria.

Guidelines for determining fire flow for all residential and non-residential buildings as published in the North Carolina Fire Code, Appendix B are included in this Manual as Appendix B.

3.3.5.3.1 Where buildings are separated by less than ten feet (10') between exterior walls, the minimum draft available to any hydrant serving the development shall be 1500 gallons per minute (gpm) plus peak user demand with a minimum residual pressure of 20 psi.

3.3.5.4 Non-Residential Areas

As a minimum, the recommendation of the Insurance Services Office shall be met. These recommendations include the following for non-residential developments.

a. The minimum size main shall be 8-inch with 8-inch or larger intersecting mains in each street; 12-inch or larger mains shall be used on the principal streets and for all long lines that are not connected to other mains at intervals close enough for mutual support.

b. Arrangements using very small mains, designed for domestic service only and incapable of providing fire protection supplied by larger mains in a gridiron too wide to provide good fire protection are considered unsatisfactory. The use of dead end 6-inch and smaller mains to provide fire protection shall be avoided.

3.4 INSTALLATION OF WATER MAINS AND APPURTENANCES

3.4.1 General

The Contract Documents for water system extensions shall insure that the following standards and performance requirements are met in regard to the installation of mains and all appurtenances thereof.

3.4.2 Construction Safety

The Contract Documents shall address the responsibility for the safety of the workmen and the general public. The Contractor shall be required to adhere to the requirements of the NCDOT and the City of Greenville with regard to traffic safety and traffic control devices. Additionally, the Contractor shall be required to perform all work in accordance with all applicable federal, state, and local laws. The Contract Documents shall state that the Commission has no responsibility for nor authority to enforce job safety requirements. The "Standard General Conditions of the Construction Contract" prepared by the Engineers Joint Contract Documents Committee may be used as a guideline for preparation of the Contract Documents.

3.4.3 Replacement of Damaged Facilities and Structures

The Engineer shall insure, through the Contract Documents, that all structures, pavements, utilities and other facilities which may be damaged as a result of project work are replaced or repaired in a manner which meets the approval of the owner of such facilities or any governing bodies having jurisdiction.

3.4.4 Connection to Commission Owned Facilities

Language shall be included in the Contract Documents which states that no connection to or alteration (including operation of valves, hydrants, etc.) of the Commission's facilities shall be performed without the Commission's specific approval. The Contract Documents shall require that all pipe, valves, taps, fittings, etc., which could possibly contaminate the Commission's facilities be thoroughly disinfected prior to their use. The Contract Documents shall also include a requirement to keep excavations for such connections completely dewatered and to use the utmost care to avoid contamination of Commission owned facilities.

3.4.5 Salvage of Commission Owned Facilities

When project work results in removal of Commission owned facilities and equipment, the Contractor shall be required to deliver those facilities or equipment undamaged to the Commission's Operations Center, if requested to do so by the Commission.

3.4.6 Water Main Construction and Excavation

3.4.6.1 Pipe installation shall be performed only in the presence of the Commission's Representative, except as authorized by the Commission.

3.4.6.2 The Contract Documents shall specifically address excavation, pipe foundation and bedding, pipe installation and haunching requirements. Satisfactory construction materials shall be identified and either construction methods or performance standards shall be specified. If standard references are cited in lieu of specific requirements, the Engineer shall furnish the Commission, at no cost, two (2) copies of the cited references, if requested to do so.

3.4.6.3 No deviation from the line and grade shown on the Approved Plans shall be permitted by the Contract Documents without the approval of the Commission. Any proposed deviation will require submission of revised Contract Documents to the Commission for review and approval.

3.4.6.4 Pipe cutting, where necessary and where permitted, shall be done in accordance with the written recommendations of the pipe manufacturer.

3.4.6.5 The Engineer shall require fittings at sufficient locations to minimize the possibility that pipe joint deflections will exceed the maximum horizontal or vertical joint deflections recommended by the pipe manufacturer. Unless the Engineer requires the use of a specific manufacturer's pipe, he shall assume, for design purposes, that the allowable deflection is the minimum found in the industry. Layout of plastic pipe larger than six inches (6”) in diameter shall be based upon the assumption that no deflection can be accomplished by bending the pipe barrel.

3.4.6.5.1 Longitudinal deflection for six-inch (6”) diameter and smaller AWWA C900 pipe shall be such that the minimum bending radius (Rb) of the deflected pipe center is equal to or greater than the value obtained by use of the following relationship. Rb = 300 x D where Rb is the minimum bending radius in feet and D is the nominal pipe inside diameter in feet. Longitudinal bending of PVC pipe effected through mechanical means will not be allowed.

3.4.6.5.2 Longitudinal deflections for ductile iron pipe shall not exceed the values given in ANSI/AWWA Standard C600 which are as follows:

MAXIMUM LONGITUDINAL DEFLECTIONS FOR DUCTILE IRON PIPE						
	TYPE OF JOINT					
	PUSH-ON			MECHANICAL JOINT		
NOMINAL PIPE SIZE (INCHES)	DEFLECTION ANGLE (DEGREES)	MAXIMUM OFF SET Joint (Inches)		DEFLECTION ANGLE (DEG-MIN)	MAXIMUM DEFLECTION Joint (Inches)	
		18 Ft.	20 Ft		18 Ft	20 Ft.
4	5	19	21	8-18	31	35
6	5	19	21	7-7	27	30
8	5	19	21	5-21	20	22
10	5	19	21	5-21	20	22
12	5	19	21	5-21	20	22
14	3*	11	12	3-35	13.5	15
16	3*	11	12	3-35	13.5	15
18	3*	11	12	3-0	11	12
20	3*	11	12	3-0	11	12
24	3	11	12	2-23	9	10
30	3*	11	12			
36	3*	11	12			
42	3*	11	12			
48	3*		12			
54	3*		12			

*For 14-in. and larger push-on joints, maximum defection angle may be larger than shown above. Consult the manufacturer.

3.4.6.6 The Contract Documents shall require the Contractor to prevent surface water from accumulating in the trenches. Trenches shall be free of water during pipe installation.

3.4.6.7 The Contract Documents shall require trench excavation to provide vertical curve chords which will not exceed the permissible deflection of the pipe. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each joint of pipe on undisturbed soil at every point along its entire length.

3.4.6.8 The Contract Documents shall provide for the placement of No. 57 crushed stone in the bottom of the trenches when unstable material is encountered. Such unstable material shall be removed to the depth required by the Commission and replaced with No. 57 crushed stone such that the pipe will be adequately supported throughout its entire length. Excavation below the planned pipe invert elevation as shown on the Approved Plans shall be refilled with No. 57 crushed stone.

3.4.6.9 The Contract Documents shall require thrust blocking at each horizontal and vertical change in direction of a main. Trenches shall be excavated to provide uniform support of the blocking on undisturbed soil. The concrete shall be placed as shown in the Standard Details and shall not interfere with the removal of any bolts, fasteners, or fittings. Ductile iron fittings shall be wrapped in polyethylene prior to placement of the concrete blocking.

3.4.6.9.1 In lieu of concrete thrust blocking, piping systems 12 inches and smaller in diameter may be restrained through the use of restrained joint pipe or approved joint restraint devices meeting the requirements of Section 7.2.6. The minimum length of piping to be restrained shall be as set forth in the table below.

*Restrained Length (ft.)

Pipe Size (in.)	4	6	8	10	12
Pipe Cover (ft.)					
3.0	16	24	31	38	46
4.0	15	23	30	37	43
5.0	14	22	29	36	42

* Above values are the lengths of restrained pipe required on each side of fitting. Above values are for 45° horizontal bend. For other horizontal bends multiply above by the following coefficients: 90° - 2.4; 22 1/2° - 0.48; 11 1/4° - 0.24; dead end - 2.4.

The use of joint restraint devices on vertical bends and on piping systems larger than 12 inches in diameter shall not be utilized unless approved by the Commission. The Engineer shall submit documentation to the Commission for its review and approval demonstrating that the joint restraint system to be utilized will provide the needed restraint. The Contract Documents shall specify the joint restraint method to be used and shall clearly indicate the minimum length of piping requiring joint restraint.

3.4.6.9.2 The use of combined thrust restraint systems employing concrete blocking and joint restraint devices, based on each system being designed to resist a percentage of the resultant thrust force, shall not be permitted. The use of combined systems based on each system being designed to resist all of the resultant thrust force are permitted.

3.4.6.10 The Contract Documents shall include the requirement that NC One Call shall be contacted forty-eight (48) hours prior to any excavation. The documents shall also note that locations of existing utilities by NC One Call are valid only for ten (10) days after the date of location.

3.4.6.11 The Contract Documents shall advise the Contractor that pavement cuts within the City of Greenville require a permit from the City of Greenville Public Works Department.

3.4.7 Backfilling

3.4.7.1 Backfilling shall be performed only with the approval of a Commission's Representative.

3.4.7.2 Terms used to indicate backfill zones are capitalized and are defined in Section 1.3.1.2.

3.4.7.3 Special care shall be taken in writing the Contract Documents so that backfilling for water mains and appurtenances will be done in a manner which will provide satisfactory support and restraint of all pipes, fittings, valves, equipment and structures. As a minimum, Initial Backfill for water mains shall be compacted to 95% Standard Proctor as determined by the AASHTO-T99 method.

3.4.7.4 The Haunching and the Initial Backfill shall be free of materials which might in any way damage the pipe or preclude proper compaction of the backfill. Acceptable soil materials are ASTM 2487 soil types SW, SP, SM and SC.

3.4.7.5 The Final Backfill shall be provided using materials and methods suitable to provide the compaction necessary to prevent settlement which would adversely affect existing or proposed land use. Unless otherwise permitted by the Commission, compaction shall be no less than 90% Standard Proctor as determined by AASHTO-T99. Backfilling within the right-of-way of the NCDOT, the City of Greenville, railroads, and other rights-of-way shall be subject to the right-of-way owner's requirements.

3.4.7.6 All water mains shall be installed with three-inch (3") wide metallic detectable tape. The tape shall be clearly marked "Water" and shall be centered over the main, twelve inches (12") below finished grade. Any breaks in the tape shall be repaired in accordance with the manufacturer's recommendations.

3.4.7.7 The Contract Documents shall require the disturbed ground surface to be graded to prevent ponding of water, and to be seeded and mulched upon completion of backfilling operations. Seeding and mulching shall be in accordance with the requirements and recommendations of the Land Quality Section of the Division of Land Resources.

3.4.8 Termination of Water Mains

Water mains shall be terminated in accordance with the Standard Details. Provide either blow-offs or hydrants as required by Section 3.2.10 of the Manual.

3.4.9 Installation of Services

3.4.9.1 Services shall be provided to each lot or individual building unit as required by Section 3.2.9 of this Manual and as shown in the Standard Details. Meter boxes and brick for one-inch (1") services shall be provided by the Contractor as shown on the Standard Details. Meter boxes installed for multi-family developments and ganged together shall be marked with the unit number being served. Markings shall be permanently painted on the inside of the frame section and highly visible.

3.4.9.2 When service is available from two (2) or more water mains, the property shall be served by the main designated by the Commission.

3.4.9.3 Standard services are available utilizing 3/4", 1", 1 I/2", and 2" meters. Service tubing for 3/4", and 1" services shall be 1" diameter. Service pipe for 1-1/2" and 2" services shall be 2" diameter. For additional information, refer to the Standard Details. Larger services such as four-inch (4"), six-inch (6"), eight-inch (8"), etc., may be specified. Services larger than two-inch (2"), if used, shall be designed as a dead-end water main except that a permanent blow-off rather than a hydrant may be provided for flushing purposes.

3.4.9.4 Service connections for one-inch (1") services shall be installed by one of two (2) methods. These are as follows:

3.4.9.4.1 Service connections to PVC (C900) and ductile iron mains six inches (6”) in diameter or larger may be accomplished by direct tapping of the main. Teflon tape or other approved pipe compound shall be applied to the corporation stop threads prior to installation.

3.4.9.4.2 Service connections for mains smaller than six-inches (6”) and all sizes of pressure rated PVC require the use of a service clamp. A service clamp shall also be used as an alternative to tapping wherever required by the Commission.

3.4.9.5 One-inch (1”) service tubing shall be installed with sufficient slack to prevent tension on the line. A maximum of three splices (couplings) per service shall be allowed. Tubing shall have a minimum cover of twenty-four inches (24”). See the Standard Details.

3.4.9.5.1 Service tubing shall be installed with a minimum of six Inches (6”) of vertical separation from an existing or proposed storm drain.

3.4.9.5.2 If the service tubing is damaged during construction such that its flow capacity or its life expectancy is adversely affected, the damaged portion shall be replaced.

3.4.9.6 One and one-half inch (1-1/2”) and two-inch (2”) diameter services shall be installed in accordance with the Standard Details. The installation of the Class 200 PVC service pipe shall be in strict conformance with the requirements for mains, except that the service pipe shall have a minimum cover of twenty-four inches (24").

3.4.10 Setting of Valves and Valve Boxes

3.4.10.1 Valves shall be set at the locations directed in Section 3.2.7 of the Manual and as shown in the Standard Details.

3.4.10.2 All valves shall be installed with a cast iron valve box meeting the specifications of Section 7.3.4 of the Manual. The boxes shall be set plumb with the bottom of the box resting on compacted backfill. Valve boxes for two-inch (2”) ball valves shall be supported by two (2) bricks. The box shall not contact the valve or water main.

The top of the box, when located in unpaved areas, shall be centered and set in a 24-inch X 24-inch X 6-inch depth concrete pad or precast concrete collar set flush with the finished grade. See Standard Details.

3.4.10.3 Valve boxes shall be installed so that a minimum of four inches (4") of upward and four inches (4") of downward [total of eight inches (8")] vertical adjustment is possible without disturbing the base or removal of any box sections. Valve box extensions shall be in accordance with Section 7.3.4 of the Manual.

3.4.11 Setting of Fittings

The specifications shall insure that care is taken in setting fittings so that the joints bell up properly. The fittings shall be properly supported and thrust blocked in accordance with Section 3.4.6.9 of the Manual.

3.4.12 Installation of Air Release Valves and Blow-offs

3.4.12.1 Blow-offs and drainage branches shall not be connected to any sewer, submerged in any stream, or be installed in any other manner which will permit back siphonage into the distribution system.

3.4.12.2 Automatic air release valves shall be installed in standard manholes free of infiltration. In cases where automatic air release valves are permitted or required by the Commission for use on a water main, such valves shall be equipped with a vacuum check device to prevent backflow in the event of main pressure loss.

3.4.12.3 Manual air release valves shall be installed in a standard meter box located outside of traffic areas where possible. The air release valve shall be provided by tapping the main and installing a standard service clamp, a corporation stop, one-inch (1") service tubing and an angle meter stop as shown in the Standard Details. The one-inch (1") tubing shall have a minimum cover of twenty-four inches (24").

3.4.13 Installation of Backflow Prevention Devices

3.4.13.1 Backflow prevention devices shall be located in accordance with Section 3.2.11.

3.4.13.1.1 Reduced Pressure Principle devices shall be installed such that they vent to the atmosphere and are not subject to submergence, or temperatures below freezing. Above ground installations shall meet the applicable requirements of the rights-of-way owner and city zoning setbacks. GUC will not be responsible for the operation and maintenance of the device and recommends to the owner a heating device be installed to prevent freezing.

3.4.13.1.2 Double Check Detector Check devices may be installed either in or above ground, but must have positive drainage away from the vault or enclosure. Installations that do not provide positive drainage away from the vault will require the installation of a sump pump. Above ground installations shall meet the applicable requirements of the rights-of-way owner and city zoning setbacks. GUC will not be responsible for the operation and maintenance of the device and recommends to the owner a heating device be installed to prevent freezing in an above ground installation.

3.4.14 Setting of Fire Hydrants

Fire hydrants shall be installed in accordance with the Standard Details. Restraint of the hydrant branch valve shall be accomplished by utilizing a locked hydrant tee meeting the requirements of Section 7.2.7.

3.4.15 Roadway, Street and Railway Crossings

3.4.15.1 Railway and NCDOT roadway crossings of water mains shall be performed in accordance with the requirements of the right-of-way owner and with the conditions set forth in the encroachment agreement. The materials as a minimum must meet the requirements of the Manual and must in addition meet or exceed the standards of the particular right-of-way owner.

3.4.15.2 The crossing of any street belonging to the City of Greenville, if installed by way of open-cut, requires the installer to obtain a permit from the City of Greenville Public Works Department.

The actual patching of City pavement shall be performed by the City at the expense of the permit holder. As a minimum, ABC stone shall be replaced beginning two inches (2") below the bottom of the existing stone and filled to the grade of the adjacent pavement and compacted. Upon completion of patching, the stone base shall be two inches (2") thicker than the existing stone base course.

3.4.15.3 All boring and jacking installations shall be accomplished with the use of encasement pipe which as a minimum, meets the specifications set forth in Section 7.9 of the Manual. The carrier pipe shall be DIP with "push-on" joints in conformance with the requirements of Section 7.2 of this Manual. The ends of the encasement pipe shall be as shown in the Standard Details.

3.5 CLEANING AND TESTING OF WATER SYSTEM EXTENSIONS

3.5.1 General

The Contract Documents for water system extensions shall provide written requirements for thorough cleaning, testing, and disinfection of the new extension. The following guidelines are intended to aid the Engineer in developing specifications which will insure sound and properly disinfected water lines.

The cleaning and testing of private fire service mains shall be coordinated with the Greenville Fire Prevention Bureau. A copy of their procedural requirements is included in the manual as Appendix H.

3.5.2 Test Sequence

The following test sequence shall be included in all water system extension specifications unless otherwise directed by the Commission.

(1) Perform pretest inspection.
(2) Clean the main.
(3) Perform the hydrostatic tests.
(4) Apply the proper dosage of chlorine.
(5) Allow chlorine solution to remain in the water main a minimum of 24 hours.
(6) Flush the main.
(7) Assist the Commission in taking bacteriological samples.

3.5.3 Pretest Inspection

Prior to the commencement of hydrostatic testing and chlorination, the Commission shall be contacted to request scheduling of inspection and testing. A Commission's Representative shall visually inspect the completed installation prior to testing to insure that all fire hydrants, valves and other appurtenances have been installed and are operable. All defects disclosed by the inspection shall be corrected prior to testing.

3.5.4 Cleaning of The Main

Mains shall be cleaned only in the presence of a Commission Representative. No valves or hydrants owned by the Greenville Utilities Commission shall be operated without the express permission of the Commission.

3.5.4.1 Cleaning of Water Mains Smaller than 4" in Diameter

Mains shall be cleaned by flushing. Flushing velocity shall be adequate to remove all debris and other undesirable material and a minimum of 2-1/2 feet per second.

3.5.4.2 Cleaning of Water Mains 4" and Larger in Diameter

Mains shall be cleaned only in the presence of a Commission Representative. No valves or hydrants owned by the Greenville Utilities Commission shall be operated without the express permission of the Commission. Cleaning shall be accomplished by passing through the pipe a polyurethane "pig" of the appropriate size and density (as manufactured by Poly-Pig or approved equal). Pig(s) shall be furnished by the Contractor. The procedure shall be as follows:

a. The Contractor shall prepare the main for the installation and removal of pig(s) as required:

(1) In general, this will consist of furnishing all equipment, material, and labor to satisfactorily install and remove the pig(s).

(2) Prior to scheduling a preconstruction conference, a “pigging” plan shall be submitted to the Commission for approval.

(3) Where expulsion of the pig is required through a dead end main, the Contractor shall prevent the backflow of purged water into the main after expulsion of the pig. For pipe twelve inches (12”) or less in diameter, purged water can be prevented from re-entering into the pipe by the temporary installation of pipe and fittings as required to provide a riser with an above ground discharge. On larger pipe, additional excavation of the trench may serve the same purpose.

(4) After expulsion of the pig, completion of flushing, and at the direction of the Commission, the Contractor shall complete work at openings by plugging, blocking, backfilling and completion of all appurtenant work necessary to secure the system.

b. Under supervision of the Inspector, pig(s) shall be propelled via water pressure through the main(s) from point of insertion to point of expulsion. Where mains are in the form of a loop, the Contractor shall "pig" the complete system.

c. As an alternative to "pigging", dead end pipes of less than 100 feet in length which are difficult to "pig" may be cleaned by flushing. Flushing shall be accomplished in the same manner as that required for pipes less than four inches (4”) in diameter in accordance with Section 3.5.4.1.

3.5.5 Hydrostatic Test

Unless otherwise permitted, testing shall be performed between each main line valve in accordance with AWWA C600. The Commission will, except when certain circumstances dictate otherwise, permit the lengths of test sections to be a maximum of 1500 feet in subdivisions or other areas where the new main has closely spaced valves. Testing shall be done only in the presence of a Commission’s Representative, unless otherwise directed by the Commission. Testing shall be performed using a suitable pump and an accurate gauge graduated in 1.0 psi increments. The section of the main to be tested shall be subjected to a test pressure of 150 psi for a period of two (2) hours. The leakage of the test section shall be accurately determined and compared to the schedule shown below. All visible leaks shall be repaired regardless of the amount of leakage.

PIPE SIZE	**ALLOWABLE LEAKAGE**

(inches)	(Gallons per hour per 1000 feet of pipe)
2	0.16
4	0.33
6	0.50
8	0.66
10	0.83
12	0.99
14	1.29
16	1.47
18	1.66
20	1.84
24	2.21
30	2.76
36	3.31

If the leakage is greater than the allowable leakage as given by the above table, the Contractor shall replace any defective materials and perform all necessary work to insure that the installation is acceptable and a retest shall be performed subsequent to any repair work performed. Remedial repair work and retesting shall be repeated until the leakage occurring during the test period is less than or equal to the allowable leakage.

3.5.6 Chlorination

3.5.6.1 Chlorination shall be performed only in the presence of the Commission's Representative and shall be performed only after the line is complete and has tested satisfactorily for leakage.

3.5.6.2 Chlorination taps will be made within five (5) pipe diameters of the water main control valve at the upstream end of the line and at all extremities of the line.

3.5.6.3 Sufficient chlorine solution shall be applied to bring the concentration within the main to a minimum of 100 ppm free chlorine residual.

3.5.6.4 The chlorine solution shall be introduced to the main at a constant rate while regulating the flow of water through the main being chlorinated such that the required concentration of chlorine is achieved throughout.

3.5.6.5 All valves within the section of main being chlorinated shall be operated once during the contact period.

3.5.6.6 The chlorine solution shall remain in the lines for no less than twenty-four (24) hours, longer if so directed by the Commission.

3.5.6.7 Services shall be chlorinated at the same time and by the same method utilized for the main.

3.5.6.8 Extreme care shall be taken to prevent contamination of existing water mains during the test period. If, in the opinion of the Commission, an existing main is contaminated, the section of main subjected to the possible contamination shall be flushed and chlorinated in accordance with the requirements for new mains.

3.5.6.9 The Commission will advise the Contractor when a suitable period of time has elapsed for chlorine contact. The main shall be flushed thereafter in the presence of the Commission's Representative. The flushing of the main shall be considered complete when the chlorine concentration within the main is less than or equal to the lesser of the following values:

1. part per million (ppm)
2. free chlorine
3. free chlorine concentration within the existing main to which the extension has been connected.

3.5.6.10 The Contractor shall be responsible for insuring that high-strength chlorine solution is contained on-site and not allowed to make its way to any watercourse, stream, creek, lake, or other body of water.

3.5.7 Bacteriological Testing

3.5.7.1 After completion of chlorination and flushing, the Contractor shall assist the Commission as necessary in obtaining sufficient bacteriological samples for complete testing.

3.5.7.2 The Commission shall determine the location of samples and the number of samples necessary to provide a test group which is representative of the section of main being tested.

3.5.7.3 A failure of any sample of a test group shall constitute failure of the entire test group from which the sample was taken. Such failure shall require two (2) successive passing test groups to substantiate that the main has been satisfactorily chlorinated.

The second of the two successive test groups of samples will not be collected before nor unless the first group has passed. The Contractor may, at his option, rechlorinate and retest the section of water main upon failure of the test group.

3.5.7.4 If two (2) successive bacteriological test groups fail, the section of main from which the group was taken shall be rechlorinated and retested until the main is shown to be properly chlorinated in accordance with Section 3.5.6 above.

3.6 TEMPORARY WATER SERVICE

3.6.1 Temporary water service may be provided in accordance with the Terms and Conditions.

SECTION 4.0

DESIGN CONSIDERATIONS FOR WASTEWATER SYSTEM EXTENSIONS

4.1 GENERAL

The purpose of this section is to provide the Developer or Engineer with a guideline to assist in the development of plans and specifications for sewer system extensions which will meet the requirements and objectives of the Commission. As a minimum, the Contract Documents for any proposed extension must address satisfactorily the topics contained herein.

4.1.1 Private Sewers

Private sewer collection systems shall be designed and constructed in accordance with the standards and requirements of the NCDWQ. In addition, all private sewer mains which connect to the Commission's system shall be tested in accordance with the requirements of Section 4.5 of this Manual.

4.2 LOCATION AND ALIGNMENT

4.2.1 Depth of Cover

4.2.1.1 Sanitary sewers shall have a minimum cover of three feet (3') as measured from the top (crown) of the pipe to the finished grade. Where this requirement is impossible to meet, special precautions such as the use of ductile iron pipe shall be taken to insure protection of the sewer from physical damage. The Commission shall determine the acceptability of such installations.

4.2.1.2 Wherever feasible, gravity sewer shall be installed at such depths as required to allow all discharges to the sewer system to occur without the use of pump stations.

4.2.2 Relationship of Mains to Property Lines and Rights-of-Way

All sanitary sewers shall be located within dedicated rights-of-way or permanent sewer easements such that the Commission has unrestricted access to the line and all appurtenances thereof.

4.2.2.1 Approval of sanitary sewer extension plans shall be contingent upon procurement of the easements and encroachment agreements necessary to meet this requirement. See Section 5.7 for the requirements for submission of easement documents.

4.2.2.2 Sanitary sewers shall be centered in a permanent easement of adequate width to allow excavation and maintenance of the line. In no case shall the permanent easement for sewers be narrower than that given by the following table:

	DEPTH OF COVER (feet)	MIN. EASEMENT (feet)
FORCE MAIN	ALL	10
GRAVITY SEWERS	0 - 6	20
	>6 -15	30
	Greater than 15	40

4.2.2.3 Wider permanent easements may be required by the Commission where, in the opinion of the Department Engineer, conditions warrant. Such easement shall be centered on the main.

4.2.3 Relationship of Sanitary Sewers to Water Mains and Wells

4.2.3.1 See Section 3.2.3 of the Manual for sewer and water main minimum vertical and horizontal separation distances.

4.2.3.2 All sewers shall be located a minimum of one hundred feet (100') away from any well. In those cases where a sewer is located within one hundred feet (100') of a well, ductile iron pipe with mechanical joints shall be specified. In no case shall a sewer be located within fifty feet (50') of a well.

4.2.4 Relationship of Sanitary Sewers to Structures and Pipes

4.2.4.1 Sanitary sewers shall not be installed within twenty feet (20’) of any part of permanent buildings or other structures.

4.2.4.2 Except by special consent of the Commission, the lateral separation between gravity sewer, storm sewers and force mains shall not be less than ten feet (10').

4.2.4.3 When underground structures or storm sewers are encountered, twelve inches (12") vertical separation shall be maintained. Where the minimum separation cannot be maintained, the location and the corrective action specified shall be shown on the plans so that the Commission may determine the acceptability of the planned corrective measures.

4.2.4.4 When a sanitary sewer must be installed under a storm sewer and twenty-four inches (24") of vertical separation cannot be obtained, ductile iron pipe shall be specified. When vertical separation is less than twelve inches (12”), supports shall be provided for the storm sewer in accordance with the Standard Details.

4.2.5 Relationship of Sanitary Sewers to Impoundments and Creeks

4.2.5.1 Sanitary sewers shall not be installed under any part of Impoundments.

4.2.5.2 Sanitary sewers (including manholes) shall be located such that their centerlines are a minimum of forty feet (40’) from the top of the nearest bank of adjacent streams, creeks, ditches, etc. This distance shall be increased by the Commission as it deems appropriate if the bank shows evidence of instability. If documentation satisfactory to the Commission is provided which demonstrates that the sanitary sewer can be more closely located to a particular drainageway without detrimental consequences, the Commission may agree to permit this.

4.2.5.3 Whenever practical sanitary sewers shall be protected from inflow of stormwater runoff by locating manholes in areas which are not subject to flooding. When manholes must be constructed in areas subject to flooding, the elevation of the manhole top shall be two feet (2') above the elevation of the one hundred (100) year flood elevation or the manhole ring and cover shall be watertight and vents shall be provided at intervals no greater than 1000 feet. The vents shall extend a minimum of two feet (2') above the elevation of the one hundred (100) year flood. Manholes which are subject to being pressurized by surcharging or which are likely to be vandalized shall have mechanically restrained covers. Manholes having restrained, watertight covers which are subject to pressurization by surcharging shall be designed to withstand the maximum potential surcharge without damage. For design purposes, the maximum potential surcharge shall be that surcharge which would result from a prolonged outage of the nearest downstream pump station.

4.2.6 Manhole Location and Grade

4.2.6.1 The maximum distance between manholes measured horizontally along the centerline of the gravity sewer shall be 425 feet.

4.2.6.2 Manholes shall be provided at all horizontal and vertical changes in alignment of a gravity sanitary sewer.

4.2.6.3 Any changes in the nominal pipe diameter of a gravity sewer must be accomplished by installation of a manhole.

4.2.6.4 Manholes installed in pavement shall have their cover set flush with finished grade and be located outside of designated parking spaces. Whenever practical, manholes located in streets shall be located in the center of the street.

4.2.6.5 The minimum elevation difference between the "invert in" and the "invert out" of manholes shall be 0.1' . Exceptions are 1) when there is a change in flow direction of greater than 90 degrees the minimum difference shall be 0.2', and 2) when pipes of different sizes converge in a manhole, the inside tops of the pipes shall be at the same elevation.

4.2.6.6 The elevation difference between the "invert in" and invert out" of manholes shall be either (1) < 0.5' or (2) > 2.5'. Manholes having pipes entering at elevations > 2.5' above the outlet shall be drop manholes. Manholes shall not be designed utilizing a difference in invert elevations between 0.5' and 2.5' except as follows. A difference in the "invert in" and the "invert out" elevations of up to 1.0' will be allowed in instances where there is sufficient justification, the incoming sewer is installed at a grade which exceeds the minimum by at least 50% and a smooth flow path is constructed between the influent and effluent piping.

4.2.6.7 Where a natural slope will permit the use of a sewer grade in excess of the NCDWQ minimum slope, the Engineer shall (where feasible) use the available grade to increase the slope of the gravity sewer rather than designing for the minimum slope with large invert drops. The use of invert drops greater than 0.5' shall be unacceptable (except as provided in paragraph 4.2.6.6) where the line may be steepened to absorb all or a portion of the excess grade without exceeding the maximum slope allowable by the NCDWQ.

4.2.6.8 Invert drops shall be accomplished by providing an invert channel of constant slope which meets the elevations of the influent and effluent pipes.

4.2.7 Location of Sewer Services

4.2.7.1 Plans for projects which propose the creation of lots shall include the provision of individual sewer services to each lot including any residual parcels and areas reserved for future lots. The size and location of services shall be based upon the anticipated use of the lot and require the Commission's approval.

4.2.7.2 Services shall be installed at right angles to the gravity sewer. The maximum cleanout spacing as measured along the service line centerline shall be seventy-five feet (75') for four-inch (4") and six-inch (6") services.

4.2.7.3 The service cleanout shall be placed at the right-of-way limit, or edge of the easement, five feet (5') downstream (with respect to sewer flow) of the water meter unless otherwise directed by the Commission..

4.2.7.4 When project design dictates that electric cables are to be placed on the same side of the roadway with the sidewalk, the cleanout for that side shall be placed 6' behind the edge of the sidewalk.

4.2.7.5 Cleanouts located in non-traffic, unpaved areas shall be constructed of PVC. Cleanouts located in traffic or paved areas shall be installed with a sewer cleanout box set to finished grade as shown in the Standard Details.

4.2.7.6 Inverts of services discharging into manholes shall be shown on the plans.

4.2.7.7 Sewer services that include discharges from car washes and similar facilities shall include an oil and sand separator in accordance with the plumbing code.

4.2.7.8 Grease interceptors shall be required for food service facilities in accordance with the Standard Details.

4.2.8 Location of Force Main Appurtenances

4.2.8.1 Manual air release valves as specified in Section 8.5.4 of this Manual shall be located at all peaks of wastewater force mains except where in the opinion of the Commission an automatic air release valve is necessary. A peak shall be defined as the point of maximum elevation of the force main invert which slopes upward toward the hydraulic grade line.

If possible, force mains should be designed without high points and with the top of the force main below the hydraulic grade line at the minimum pumping rate so that air release valves will not be needed. If elimination of high points is not feasible, a manual air-release valve should be installed at each significant high point where air could become trapped. A high point may be considered significant if it is two feet or more above the minimum hydraulic grade line or when pumping is intermittent above the static head line.

4.2.8.2 The maximum interval between air release valves should not exceed 1,500 feet as measured horizontally along the pipe centerline.

4.2.8.3 Where the invert elevation of a force main exceeds the hydraulic grade line, the Engineer shall ensure that the force main pipe is of sufficient strength to withstand the internal vacuum which will exist in the line during maximum service discharge. Upon request, the Engineer shall supply the Commission with documentation demonstrating that the deflection of the pipe due to vacuum will not cause leakage.

4.2.8.4 Air release valves for wastewater force mains shall be installed in standard manholes as shown in the Standard Details.

4.3 SIZING AND DESIGN OF SANITARY SEWERS AND APPURTENANCES

4.3.1 Sizing of Gravity Sewers

4.3.1.1 The minimum gravity main size shall be 8 inches nominal inside diameter. Unless otherwise directed or permitted by the Commission, all gravity sewers shall be designed and sized to serve the entire natural drainage basin area which is adjacent to the route of the proposed main, i.e. the gravity main shall be of sufficient size and placed on an adequate grade to allow extension to the natural basin ridge line.

4.3.1.2 Sanitary sewer design capacity for extensions serving dwelling units shall be based upon a wastewater discharge of 120 gallons per day per bedroom. The minimum design discharge per dwelling unit shall be 240 gallons per day. When the occupancy of a dwelling unit exceeds two (2) persons per bedroom, the volume of sewage shall be determined by the maximum occupancy at a rate of sixty (60) gallons per person per day. Selection of design capacity for sanitary sewers shall be in accordance with the latest NCDWQ guidelines.

4.3.1.3 Sanitary sewer design for non-residential developments shall be in accordance with the latest NCDWQ guidelines and shall be subject to the approval of the Commission.

4.3.1.4 The following table (Table 4-1) shall be used to obtain design flows for areas without existing development. Table 4-1 is intended only as a minimum design standard for the classification listed. The Engineer shall be responsible for insuring that the design discharges utilized in sizing sewer collection facilities are adequate for the area which the extension is to serve.

TABLE 4-1

AVERAGE DESIGN SEWER DISCHARGES FOR UNDEVELOPED RESIDENTIAL, COMMERCIAL AND INDUSTRIAL AREAS

Residential at 80 qpcd	GPD/Ac.
High Density - 12 persons/acre	960
Medium Density - 10 persons/acre	800
Low Density - 7 persons/acre	560
Commercial	880
Industrial (within and adjacent to existing Industrial Park)	1600
Other Industrial Areas	500

4.3.1.5 Gravity sewers shall be sized to carry average design discharge at one-half full flow. Gravity sewers shall also be evaluated as to their ability to carry the peak design (average design discharge X 2.5) at full flow.

4.3.1.6 The slopes of sanitary sewers shall, whenever feasible, exceed the NCDWQ minimum requirements by a factor of 1.5. The NCDWQ minimum slopes for sanitary sewers shall be used only when necessary to serve the required area without the use of a pump station or when other factors make steeper slopes impossible or infeasible. The Engineer shall in all cases strive to use the steepest available slope in the upper reaches of collection systems where further extension is not possible due to topography or other circumstances.

4.3.1.7 Gravity sewers shall be designed to provide mean velocities, when flowing full, of not less than 2.0 feet per second, based on Manning's formula using an "n" factor of 0.013 provided however; that the minimum slopes which shall be used are as set forth in Table 4-2.

TABLE 4-2

NCDWQ MINIMUM AND MAXIMUM DESIGN SLOPES FOR GRAVITY AND SANITARY SEWERS

Pipe Diameter (inches)	Minimum Slope	Maximum Slope	Pipe Diameter (inches)	Minimum Slope	Maximum Slope
4	1.0%	NA	16	0.14%	3.3%
6	0.60%	NA	18	0.12%	2.8%
8	0.40%	8.2%	21	0.10%	2.3%
10	0.28%	6.1%	24	0.080%	1.9%
12	0.22%	4.8%	27	0.067%	1.6%
14	0.17%	3.9%	30	0.058%	1.4%
15	0.15%	3.5%	36	0.046%	1.1%

4.3.1.8 Construction Tolerances/Acceptance of Sewer Lines

The Commission recognizes that a good portion of projects designed in its service area are in flatlands with little or no natural fall to allow design at greater than NCDWQ minimums.
Therefore, acceptable grade tolerances after installation have been established based on the Manning formula utilizing an “n” factor of 0.013 and a required flow velocity of 2 feet per second and are shown on Table 4-3.

Table 4-3 establishes grades as follows:

1) A minimum grade that is acceptable without removing the installation or paying GUC a maintenance fee.

2) A minimum grade that is acceptable without removing the installation but requiring payment of a maintenance fee.

3) A maximum above the design grade which is acceptable without payment of a maintenance fee. Installations on grades steeper than the maximum above the design grade will require payment of a maintenance fee for loss of usable grade.

Maintenance fee calculations are based on the number of miles of collector lines on our system and the cost of maintenance of these lines on a per foot basis.

TABLE 4-3
GUC ACCEPTABLE GRADES AFTER INSTALLATION

(1) Line Size	(2) % Design Grade	(3) % Minimum Grade w/out Maint. Charge	(4) % Minimum Grade w/Maint. Charge	(5) % Grade Above Design Grade w/no Maint. Charge
8”	0.40	0.36	0.33	0.42
10”	0.28	0.27	0.25	0.29
12”	0.22	0.21	0.19	0.23
14”	0.17	0.16	N/A	0.18
15”	0.15	0.14	N/A	0.16

Notes for Table 4-3

1) 8” - 12" lines installed flatter than minimum grade shown in Column 4 must be replaced.

2) 14” and 15" lines installed flatter than minimum grade shown in Column 3 must be replaced.

3) Column 5 will apply in areas where future line extensions are feasible and usable grade has been lost due to increased slope.

4.3.1.9 Construction Tolerances/Manholes

The as-constructed pipe inverts at manholes shall be within 0.05 feet (plus or minus) of the elevations shown on the plans. In the determination of compliance of a sanitary sewer project with established tolerances the more restrictive of paragraph 4.3.1.8 and 4.3.1.9 shall apply.

4.3.2 Sizing of Wastewater Force Mains

4.3.2.1 The minimum force main size shall be four inches. Force mains shall be sized such that the average velocity of flow for the pump design discharge is not less than 2.0 feet per second.

4.3.2.2 Unless otherwise permitted by the Commission, the friction losses due to the force main shall be calculated using the Hazen-Williams formula with a friction factor (C) of 120.

4.3.3 Sizing of Wastewater Pumps and Wet Wells

4.3.3.1 Pumps specified for installation in duplex pump stations shall be sized such that each pump is capable of individually pumping the peak discharge (2.5 x average design inflow) as calculated for the gravity sewer collection system(s) contributing to the system.

Where existing sewers will discharge to the proposed pump station, the design discharge attributable to the existing sewers shall be calculated using the same criteria for new gravity sewers as given in Section 4.3.1.

4.3.3.2 Wet wells shall be sized such that 2-8 pump-on/pump-off cycles (pump starts) occur during each hour at average design sewage inflow.

4.3.4 Gravity Flows Versus Pump Stations

4.3.4.1 Because pump stations are: (1) inherently less reliable, (2) more expensive to operate and, (3) more likely to cause environmental problems than gravity sewers, they shall be incorporated into the design of a project only as a last resort. Projects utilizing pump stations or creating a future need for pump stations will not be approved unless documentation satisfactory to the Commission is submitted justifying the installation of a pump station in lieu of a gravity sewer. In situations where no reasonable alternative exists the Commission may approve the installation of a pump station, provided the area served by gravity sewers has been maximized. In situations where a gravity sewer is not available, the Commission may approve the installation of a privately owned and maintained pump station and force main.

4.3.4.2 The documentation submitted for pump stations must include the following:

4.3.4.2.1 An analysis demonstrating that the receiving sewers have adequate capacity to carry the projected discharge in accordance with Section 4.3.1. The analysis must also include the identification of any uncommitted capacity remaining.

4.3.4.2.2 A cost/benefit analysis which includes initial costs and projected operation and maintenance costs which clearly indicates that a pump station is less expensive than a gravity collection system.

4.3.4.3 The Commission may agree to accept ownership and maintenance of pump stations designed and constructed to the standards set forth in this Manual subject to the following conditions:

4.3.4.3.1 The necessary documentation described in Section 4.3.4.2 must be provided to the Commission.

4.3.4.3.2 The Commission determines that acceptance of ownership is in its best interest.

4.3.4.3.3 Easement, satisfactory to the Commission, is provided for unrestricted access to and operation and maintenance of the pump station.

4.4 INSTALLATION OF SANITARY SEWERS AND APPURTENANCES

4.4.1 General

The Contract Documents for sewer system extensions shall as a minimum direct attention to the following requirements in such a way that insures installation satisfactory to the Commission.
Construction safety shall be addressed in a manner consistent with requirements for water system extensions contained in Section 3.4.2.

4.4.2 Replacement of Damaged Facilities and Structures

The Contract Documents for sewer extension projects shall insure that all structures, pavements, utilities, and other facilities which may possibly be damaged as a result of project work are replaced or repaired in a manner which meets the approval of the owner of such structures or facilities or any governing bodies having jurisdiction.

4.4.3 Connection of New Sewers to Existing Facilities

4.4.3.1 No connection to, or alteration of any existing facilities owned or maintained by the Commission shall be permitted without the express permission of the Commission and, where required, the presence of the Commission's Representative except as directed by the Commission.

4.4.3.2 Where a connection or alteration of any existing facilities is approved, the connection or alteration shall conform to the standards of the Manual for new installations.

4.4.3.3 Connections of new sewers to existing manholes shall be accomplished by machine coring and the installation of a flexible connector meeting the requirements of Section 8.4.5 of the Manual.

4.4.4 Salvage of Commission Owned Facilities

When project work results in removal of Commission owned facilities or equipment, the Contractor shall be required to deliver those facilities or equipment undamaged to the Commission's Operation Center, if requested to do so by the Commission.

4.4.5 Sewer Construction and Excavation

4.4.5.1 Pipe installation shall be performed only in the presence of the Commission's Representative, except as authorized by the Commission.

4.4.5.2 The Contract Documents shall specifically address excavation, pipe Foundation and Bedding, pipe installation, and Haunching requirements. Satisfactory construction materials shall be identified and either construction methods or performance standards shall be specified. If standard references are cited in lieu of specific requirements, the Engineer shall furnish the Commission, at no cost, two (2) copies of the cited references, if requested to do so.

4.4.5.3 No deviation from line and grade shown on the Approved Plans shall be permitted by the Contract Documents without the approval of the Commission. Any proposed deviation will require submission of revised Contract Documents to the Commission for review and approval.

4.4.5.4 Pipe cutting, where permitted, shall be done in accordance with the written recommendations of the pipe manufacturer. Only factory cut ends shall be used for solvent weld joints.

4.4.5.5 The Contract Documents shall require the Contractor to prevent surface water from accumulating in the trenches. Trenches shall be free of water during pipe installation.

4.4.5.6 The Contract Documents shall provide for the construction of a Foundation of No. 57 crushed stone in the bottom of trenches when unstable material is encountered. Such unstable material shall be removed to the depth required by the Commission and replaced with No. 57 crushed stone such that the pipe will be adequately supported throughout the entire length. Excavation below the planned pipe invert elevation as shown on the Approved Plans shall be refilled with No. 57 crushed stone. This stabilization stone shall be in addition to the required 4" of No. 57 crushed stone bedding.

4.4.5.7 The Contract Documents shall ensure that trenches for wastewater force mains are excavated to provide vertical and horizontal curves which will not exceed the permissible longitudinal deflection of the pipe. Longitudinal deflections for wastewater force main pipe shall be addressed in the Contract Documents in a manner which is in accordance with the requirements for water main deflection specifications. The Engineer shall refer to Section 3.4.6.5 for these requirements.

4.4.5.8 The Contract Documents shall require thrust blocking at each horizontal and vertical change in direction of wastewater force mains. Trenches shall be excavated to provide uniform support of the blocking on undisturbed soil. The concrete shall be placed as shown in the Standard Details and shall not interfere with the removal of any bolts, fasteners, or fittings.

4.4.5.8.1 In lieu of concrete thrust blocking, restrained piping systems may be used in a manner which is in accordance with the requirements for water mains as specified in Section 3.4.6.9.1 of this Manual.

4.4.5.9 The Contract Documents shall require trenches for gravity sewer to be excavated in straight lines and uniformly sloped between manholes or junction structures. Trenches for sanitary sewer pipe, except ductile iron pipe, shall be excavated a minimum of four inches (4") below the pipe bottom in order to receive the required Bedding of No. 57 crushed stone. Ductile iron pipe may be laid on stable undisturbed earth, or suitable loose soil compacted to a minimum of 95% Standard Proctor Density by AASHTO-T99 in lieu of No. 57 crushed stone.

4.4.5.10 The Contract Documents shall require excavation for manholes and wet wells to extend a minimum of twelve inches (12”) below the bottom of the structure and backfilling to the proper elevation with No. 57 crushed stone and compacted. Prior to placement of any stone, the subgrade shall be dewatered and inspected by the Commission. The subgrade shall be of undisturbed earth; the surface shall be free from mud, muck and organics; and shall be sufficiently stable to remain firm and intact under the feet of the workmen. If, in the opinion of the Commission, the subgrade is unsuitable, soil bearing pressure testing may be required to verify the adequacy of the subgrade to support the maximum operating bearing pressure of the installed structure plus a 2.0 factor of safety. Testing, if required, shall be performed by a qualified geotechnical engineering firm.

The unsuitable material shall be excavated to the depth required by the Commission's Representative and backfilled with No. 57 crushed stone.

4.4.5.11 The specifications shall include the requirement that NC One Call shall be contacted prior to any excavation and shall also note that locations of existing utilities by NC One Call are good only for ten (10) days after the date of location.

4.4.5.12 The Contract Documents shall advise the Contractor that pavement cuts within the City of Greenville require a permit from the City of Greenville Public Works Department.

4.4.6 Backfilling

4.4.6.1 Backfilling shall be performed only with the approval of the Commission.

4.4.6.2 Terms used to indicate backfill zones in this section are capitalized and are defined in Section 1.3.1.2 of the Manual.

4.4.6.3 Special care shall be taken in writing the Contract Documents so that backfilling for sewers and related structures will be done in a manner which will provide satisfactory support and restraint of all pipes, fittings, equipment, and structures. As a minimum, Bedding, Haunching, and Initial Backfill for sewers, manholes, junction boxes, wet wells, etc. shall be compacted to 95% Standard Proctor (AASHTO-T99).

4.4.6.4 Backfill material shall be free of debris, organic materials, large stones, large clods, frozen conglomerates, or other material which might in any way damage the pipe or preclude proper compaction of the backfill. The Commission reserves the right to reject material which, in its opinion, is unsuitable. Acceptable soil materials are ASTM 2487 soil types SW, SP, SM and SC.

4.4.6.5 The Contract Documents shall require the Bedding, Haunching and Initial Backfill of ABS & PVC composite, solid wall PVC and vitrified clay pipe to be No. 57 crushed stone compacted to 95% Standard Proctor Density (AASHTO T-99) as shown in the Standard Details.

4.4.6.6 The backfill for manholes, wet wells, and structures shall be brought to planned elevation in even lifts on all sides of the structures. Compaction shall be as specified for the adjacent pipe.

4.4.6.7 The Final Backfill shall be provided using materials and methods suitable to provide the compaction necessary to prevent settlement which would adversely affect existing or proposed land use. In all cases compaction shall be no less than 90% Standard Proctor (AASHTO-T99).
Backfilling within the right-of-way of the NCDOT, the City of Greenville, railroads, and other right-of-way owners shall be subject to the owner's requirements.

4.4.6.8 All force mains shall be installed with three inch (3") wide metallic detectable tape. The tape shall be clearly marked "Sewer" and shall be centered over the main twelve inches (12") below finished grade. Any breaks in the tape shall be repaired in accordance with the manufacturer's recommendations.

4.4.6.9 The Contract Documents shall require the disturbed ground surface to be graded to prevent ponding of water and seeded and mulched upon completion of backfilling operations. Seeding and mulching shall be in accordance with the requirements and recommendations of the Land Quality Section of the Division of Land Resources.

4.4.7 Installation of Manholes and Wet Wells

4.4.7.1 Foundations for manholes and wet wells shall be in accordance with Section 4.4.5.10.

4.4.7.2 Ensure that crushed aggregate bedding for manholes and wet wells is properly installed and is true to line and grade. Set structure base on bedding and verify conformance with line and grade as shown on the plans and that the structure is set plumb.

4.4.7.3 Manholes deeper than twelve feet (12') as measured from the top of the manhole ring and cover to the lowest manhole invert or from the finished ground surface elevation at the manhole to the lowest manhole invert, whichever is greater, shall be provided with an extended base. Inverts and benches shall be built in accordance with the Standard Details.

4.4.7.4 The manhole inverts shall be constructed with a width and height equal to that of the effluent pipe and shall be so brushed and trowelled that a minimum energy loss occurs in the manhole due to invert roughness.

4.4.7.5 Placement of concrete shall be limited to those days when the temperature is 34 degrees and rising, unless approval to the contrary is given by the Commission.

4.4.7.6 Manholes less than four feet (4’) in depth shall be given special design considerations. Proper access to the sanitary sewer for inspection and cleaning must be provided. Flat top manholes shall be used only with written approval from the Commission and shall require submission of shop drawings in accordance with Section 5.5 of the Manual.

4.4.8 Installation of Services

4.4.8.1 Services shall be provided to each lot as required by Section 4.2.7 of this Manual and as shown in the Standard Details.

4.4.8.2 The minimum service size is four inches (4"). The size of services shall be subject to the approval of the Commission. Minimum slopes for services shall be in accordance with NCDWQ requirements as given in Section 4.3.1.7 of this Manual.

4.4.8.3 Each service shall be provided with a cleanout located as described in Section 4.2.7.

4.4.8.4 The Contract Documents shall ensure that excavation for services will conform with the requirements for mains given in Section 4.4.5.9 of this Manual. Bedding with No. 57 crushed stone is required for services in accordance with the Standard Details.

4.4.8.5 Whenever practical, services shall discharge directly into manholes. Services to existing or proposed manholes shall be installed with a rubber connection sleeve as required by Section 8.4.5 of the Manual.

4.4.8.6 Where services are installed by dry boring, the service shall be installed within steel encasement pipe meeting the requirements of Section 8.3 of the Manual. The encasement pipe shall extend a minimum of five feet (5') from the edge of the pavement on either side, unless approval to the contrary is given by the Commission.

4.4.8.7 Sewer services larger than six inches (6”) shall be provided with manholes in lieu of cleanouts and shall be connected to the main by use of a standard manhole.

4.4.9 Installation of Air Release Valves for Force Mains

4.4.9.1 Where air release valves are required by the Commission or Section 4.2.8 of this Manual, the valves shall be installed in standard manholes.

4.4.9.2 Manual air release valves shall be provided by tapping the main and installing a standard water service clamp, a corporation stop, one-inch (1") service tubing, and a Mueller P-14258 lock wing angle meter stop in accordance with the Standard Details. The one-inch (1") tubing shall have a minimum cover of twenty-four inches (24").

4.4.10 Pump Installation and Site Work

4.4.10.1 The wet wells and valve vaults for pump stations shall be set plumb at the locations indicated on the Approved Plans. The wet well shall be no closer than twenty feet (20') plus the wet well depth to the pump station site easement, or property line.

4.4.10.2 The backfill around structures such as wet wells and valve vaults shall be placed in even lifts on all sides of the structure and compacted to 95% Standard Proctor Density as determined by AASHTO-T99.

4.4.10.3 The Contract Documents shall ensure that the pump station site area is graded smoothly with no depressions which would permit ponding of water. The slopes shall be such that the site is stable and non-eroding. Seeding and mulching shall be in accordance with the requirements and recommendations of the Land Quality Section of the Division of Land Resources.

4.4.10.4 The site shall feature ample turn around areas for service vehicles and a fourteen foot (14') minimum width stone access road which extends to and meets the grade of a public road or street. The turn around areas and the access road shall have a minimum of six inches (6") of compacted ABC stone.

4.4.10.5 All pump controls, pump and valve vault hatches, and other access points to equipment vulnerable to vandalism shall be secured by a padlock or other locking device subject to the approval of the Commission.

4.4.10.6 The site shall be provided with a high pressure sodium vapor luminar light of 600 watt (minimum) capacity placed so as to illuminate the station area.

4.4.10.7 Installation of the pumps, controls, and related equipment shall be performed in accordance with the written instructions of the manufacturer.

4.4.11 Roadway, Street and Railway Crossings

Refer to Section 3.4.15 of the Manual for the requirements for crossings. In addition to the requirements of Section 3.4.15, all gravity sewer main carrier pipe shall be supported in the casing by means of a steel spider assembly. (See Standard Details)

4.5 TESTING OF SEWER SYSTEM EXTENSIONS

4.5.1 General

4.5.1.1 The Contract Documents for sewer system extensions shall provide for written requirements for thorough testing of new sewers and appurtenances.

4.5.1.2 All final testing and inspections shall be performed in the presence of the Commission's Representative unless otherwise directed by the Commission.

4.5.1.3 The Contract Documents shall require the Contractor to provide all pumps, gauges, instruments, test equipment and personnel required for inspection and testing operations.

4.5.1.4 The Contractor shall be required by the Contract Documents to clean and pretest the sewer system extension prior to notifying the Commission and arranging for final inspections and tests.

4.5.1.5 Materials removed to correct deficiencies revealed by tests and inspections shall not be reused. Pipe removed due to faulty grade shall be replaced with new pipe.

4.5.2 Test Sequence

The following test sequence shall be included in the Contract Documents for all wastewater system extensions unless otherwise permitted by the Commission.

(1) Perform a visual inspection.
(2) Correct defects revealed by visual inspection.
(3) Perform leakage testing.
(4) Make any necessary repairs.
(5) Make the necessary retests.
(6) Perform deflection testing (PVC SDR 35)

4.5.3 Visual Inspection for Gravity Sewers

Gravity sewers shall be visually inspected from every manhole by use of mirrors, television cameras, or other devices. The lines shall appear circular in cross section with no noticeable deflection. Lines which do not meet specified tolerances or which have structural defects shall be replaced to meet the requirements of the Commission prior to leakage testing.

4.5.4 Leakage Testing for Gravity Sewers

Unless otherwise permitted or required by the Commission, leakage testing for gravity sewers shall be by low pressure air test. Infiltration or exfiltration testing of the lines in lieu of air testing shall not be accepted without prior written approval of the Commission. All visible leaks shall be corrected regardless of the results of testing. All services, including those which discharge directly into manholes, shall be leakage tested.

4.5.4.1 Air Test

4.5.4.1.1 All air used for testing shall pass through a single, above ground control panel visible to the Commission's Representative during testing.

4.5.4.1.2 The Contract Documents shall require the groundwater elevation to be determined at 1000- foot intervals unless otherwise permitted or required by the Commission. Determination of groundwater elevation shall be made by vertically installing a six-inch diameter pipe beside the manhole such that the pipe extends into the stone bedding of the manhole. The test pressure shall be increased 0.43 psig per foot of groundwater head above the pipe invert.

4.5.4.1.3 The test pressure shall be 4.0 psig, plus the adjustment for groundwater. The air pressure shall be maintained for a minimum of two (2) minutes by throttling the air supply. The air supply shall then be disconnected and the pressure allowed to drop. At any convenient point at which internal air pressure is greater than 3.5 psig, (plus groundwater adjustment), timing shall commence with a stop watch or other timing device that is at least 99.8% accurate. The time required for the pressure to drop 1.0 psi shall be recorded.

The leakage rate shall be considered acceptable if the pressure does not drop over 1 psi in the time prescribed for the test in Table 4-4. Otherwise, the leakage rate shall be considered unacceptable.

4.5.4.1.4 The Contract Documents shall prohibit manhole entry during the test. The internal pressure on the system shall not exceed 9.0 psig.

4.5.4.1.5 Sewer service lengths shall be ignored for computing required test times for mains. In the event a test section, having a total surface area less than 625 square feet, fails to pass the air test when services have been ignored, the test time shall be recomputed to include all services using the following formula:

TABLE 4-4

MINIMUM TEST TIME FOR VARIOUS PIPE SIZES

1 Pipe Dia. (inch)	2 Minimum Time (min:sec)	3 Maximum Length For Minimum Time (ft)	4 Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.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	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 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
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33

$$T = 0.085 \quad \frac{(D1)(D1)L1 + (D2)(D2)L2 + \ldots (Dn)(Dn)Ln}{D1L1 + D2L2 + \ldots + DnLn} \quad \frac{K}{Q}$$

Where T = Shortest allowable time, in seconds for the air pressure to drop 1.0 psig;

K = 0.000419 (D1IL1 + D2L2 +...DnLn), but not less than 1.0;

Q = 0.0015 cu. ft/min./sq. ft. of internal surface;

D1, D2, ...Dn = Nominal diameters of the different size pipes being tested in inches.

L1, L2, ...Ln = Respective lengths of the different size pipes being tested in feet.

If the recomputed test time is short enough to allow the section to pass, the section undergoing the test shall have passed.

4.5.4.2 Infiltration Test

Infiltration testing shall be an acceptable test method only when the ground is fully saturated and the area is not subject to flooding. Immediately prior to performance of the line acceptance test, the groundwater level shall be determined by the same method used for the air test (see Section 4.5.4.1.2). The allowable infiltration rate shall be fifty (50) gallons per inch of pipe diameter, per mile of pipe, per twenty-four (24) hours.

4.5.4.3 Exfiltration Test

The exfiltration test pressure shall be the greater of the following:

(1) the maximum depth of the sewer test section as measured from the ground surface, plus the groundwater height above the lowest invert of the test section, or;
(2) the 100-year flood elevation minus the lowest invert elevation of the test section, plus the ground water height above the lowest invert of the test section.

The exfiltration of the line shall not exceed fifty (50) gallons per inch of pipe diameter, per mile of pipe, per twenty-four (24) hours. The length of the test period shall be as required by the Commission, but in no case less than fifteen (15) minutes. Where a stream is not readily available as a source of water to use for testing, the commission may agree to provide water. Proper procedures for requesting operation of valves and hydrants will be required.

4.5.4.4 Deflection Testing of Gravity Sewers (PVC SDR 35)

All PVC SDR 35 sewer pipe shall be tested for deflection using a rigid device (mandrel) sized to pass 5% or less deflection (or deformation) of the pipe.

4.5.4.4.1 The mandrel shall be hand pulled by the Contractor in the presence of the Commission Representative, unless directed otherwise by the Commission. Any sections of the sewer not passing the mandrel shall be uncovered and the Contractor shall repair the sewer to

the satisfaction of the Commission. Repaired sections shall be retested in accordance with the provisions of this Section.

4.5.4.4.2 Deflection testing shall be conducted no earlier than 30 days after reaching final trench backfill grade, provided in the opinion of the Commission that sufficient water densification or rainfall has occurred to thoroughly settle the soil throughout the entire trench depth. If this cannot be achieved in the time after installation prior to the project completion date, the mandrel size shall be increased to measure 1/3 less of a deflection allowance.

4.5.4.4.3 The mandrel device shall be cylindrical in shape and constructed with nine or ten evenly spaced arms or prongs. Mandrels with less than nine arms will not be approved for use. The dimensions of the mandrel shall be as listed in the table below. The diameter of the mandrel shall carry a tolerance of plus or minus 0.01 inch.

Nominal Diameter	Contact Length	Mandrel Diameter
8”	8”	7.28”
10”	10”	9.08”
12”	12”	10.79”
15”	12”	13.20”
18”	15”	16.13”
21”	16”	19.00”
24”	17”	21.36”
27”	18”	24.06”

Allowances for piping wall thickness tolerances or ovality (from heat, shipping, poor production, etc.) shall not be deducted from the “D” dimension but shall be counted in as a part of the 5% or lesser defection allowance.

4.5.4.4.4 Contact length shall be measured between points of contact of the mandrel arm. This length shall not be less than that shown in the table above.

4.5.4.4.5 The mandrel may not be used until approved by the Commission. Proving rings provided by the Contractor shall be used to assist in obtaining this approval.

Drawings of the mandrel with complete dimensions shall be furnished by the contractor to the Commission for each diameter and specification of pipe.

4.5.4.4.6 The mandrel device shall be as manufactured by H and H Fabricating of Fairfield, Ohio, Wortco, Inc. of Franklin, Ohio or Hurco Technologies, Inc of Harrisburg, South Dakota and shall be approved by the Commission.

4.5.4.5 Manhole Testing

4.5.4.5.1 The Contract Documents shall require each manhole to be tested for leakage after assembly and prior to backfilling. The test method shall be the vacuum test.

4.5.4.5.2 The Contractor shall provide all materials, labor, and equipment necessary to perform the testing. Testing equipment shall be subject to approval by the Commission.

4.5.4.5.3 The Commission shall be contacted prior to testing to schedule the test time such that the Commission's Representative may be present. The Commission's Representative shall be present during all testing unless otherwise approved by the Commission.

4.5.4.5.4 All lift holes shall be plugged from the outside with an approved non-shrink grout.

4.5.4.5.5 All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole.

4.5.4.5.6 The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturers' recommendations.

4.5.4.5.7 A vacuum of ten inches (10") of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to nine inches (9"). The manhole shall pass if the time is greater than sixty (60) seconds for forty-eight-inch (48") diameter, seventy-five (75) seconds for sixty-inch (60"), and ninety (90) seconds for seventy-two-inch (72") diameter manholes.

4.5.4.5.8 If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

4.5.4.5.9 All visible leaks shall be corrected regardless of the results of testing.

4.5.4.5.10 All leaks shall be repaired in a manner approved by the Commission.

4.5.5 Testing and Cleaning of Force Mains

Force mains shall be cleaned and tested in accordance with the procedures for cleaning and testing water mains given in Sections 3.5.4 and 3.5.5. The allowable leakage shall not exceed the limits given for water mains and any visible leaks shall be repaired regardless of the results of testing. When repair work is necessary to correct leakage, the hydrostatic test shall be repeated upon completion of the work.

4.5.6 Testing and Start-up of Pumps

4.5.6.1 The pumps shall be run under actual field conditions demonstrating that the pumps perform as specified in the Contract Documents. Any deficiencies disclosed by the pump start-up shall be corrected prior to project acceptance.

4.5.6.2 Two (2) copies of the operation and maintenance Manual and two (2) copies of the electrical schematic for the pumps and controls shall be provided to the Commission two (2) weeks prior to the date of the start-up test.

4.5.6.3 Start-up shall be performed by the manufacturer's representative in the presence of the Commission's Representative.

4.5.6.4 The manufacturer must submit a certified report of the pump field start-up performance (electrical and hydraulic) to the Commission as a condition of project acceptance.

SECTION 5.0

SUBMITTALS FOR WATER AND WASTEWATER SYSTEM EXTENSIONS

5.1 GENERAL

This section shall define and describe the submittals required by the Commission prior to the approval of the Contract Documents for any water and sewer system extension, and the permits and other data which must be approved by or submitted to the Commission prior to construction of water and wastewater system extensions.

5.2 ENGINEERING DESIGN CALCULATIONS

All Contract Documents submitted to the Commission for approval must be accompanied with the necessary design calculations as specified herein. The calculations must be prepared either by a Professional Engineer or by an individual under their direct supervision. All data upon which the design calculations are based shall be referenced as to its origin. The calculations shall be submitted in duplicate in a neat and orderly fashion with all steps shown such that the logic and the procedure used may be clearly understood. All calculations shall be bound with a title sheet bearing the seal and signature of the engineer responsible for the calculations.

5.2.1 Water Design Calculations

The following calculations shall be included in the submittals required for water extension projects. The Commission will furnish the designer with information regarding the available flow and pressure to the project.

5.2.1.1 Minimum Pressure Requirements:

Calculations shall be submitted which demonstrate that the water main extension as planned will provide a minimum residual pressure of 20 psi at its termination and at all critical points calculated at peak user demand plus fire flow. The calculations shall be based upon an energy balance accounting for friction losses and minor losses. Friction losses shall be estimated using the Hazen-Williams formula with the C-factor equal to 120.

5.2.1.2 Minimum Fire Flow:

Calculations demonstrating that the new extension will provide the minimum required fire flow plus peak user demand in accordance with Section 3.3.5 shall be submitted. The calculations shall demonstrate that each phase of a project is designed to provide the minimum fire flow. The calculations shall be based upon an energy balance taken from the origin at the existing line to the termination or critical high points of the proposed extension. The friction losses shall be based upon the Hazen-Williams formula with a C-factor of 120.

5.2.2 Sewer Design Calculations

The following calculations shall be included in the submittals required for wastewater system extensions.

5.2.2.1 Gravity Sewers: Gravity sewers shall be shown to have adequate capacity to serve the entire contributing area in accordance with the requirements of Section 4.3.1. The calculations shall be based upon the Manning Formula using an “n” factor of 0.013.

5.2.2.2 Pump Station Capacity and Force Mains: Pump stations shall be shown to have adequate capacity in accordance with Section 4.3.3.1. The total dynamic head for the pumps shall be determined by use of the Hazen-Williams formula with the C-factor of 120. Minor losses shall also be accounted for. The pump station cycle time shall be shown to be in accordance with Section 4.3.3.2. Both pump-on and pump-off times per cycle shall be shown. The average flow velocity within the force main shall be calculated and shown. The capacity of the receiving collection system must be shown to have adequate capacity for the additional discharge due to the pump station. The hydraulic grade line and the profile of the force main shall be submitted.

5.2.2.3 The pump station documentation must also include the benefit/cost comparison described in Section 4.3.4. The cost analysis shall compare the cost of constructing and maintaining the station and constructing and maintaining a gravity sewer extension. This analysis shall be a present worth cost comparison using an interest rate of three percent (3%).

The actual interest rate available at the time of the comparison may be used in lieu of the three percent (3%) rate provided inflation is accounted for.

5.3 CONTRACT DOCUMENTS

5.3.1 General

The submittal of complete detailed Contract Documents is required for all water or wastewater system extensions of the Commission's existing facilities. Contract Documents shall contain the following forms unless otherwise permitted or required by the Commission.

i. Specifications with title sheet
ii. Drawings (Plans)*
iii. Modifications

*Drawings on projects for which a Preliminary Subdivision Plat was required shall include a copy of the Approved (signed) Preliminary Plat.

5.3.2 General Requirements for Drawings

5.3.2.1 The plan and profile drawings shall be prepared by a Professional Engineer. Each sheet shall bear the date, sheet number, and the seal and signature of the Professional Engineer. Project phases must be shown. Contract Documents for projects which do not indicate phases shall be subject to revision if the project is constructed in phases.

5.3.2.2 A letter of transmittal must be included with the drawings indicating the project name and location and the design engineer.

5.3.2.3 The drawings shall have a title page with the name of the project, the Engineer, the date, an index of the plan sheets, revision block, and the project phase, if any.

5.3.2.4 The drawings shall utilize standard drafting practice and include standard symbols for which a legend shall be provided on the title sheet or other prominent location on the plans.

5.3.2.5 The drawings shall include a location map with the site clearly indicated.

5.3.2.6 The drawings shall include the layout of the new extension and its relationship to other utilities, roadways, and other pertinent structures and vegetation.

5.3.2.7 The profile for a particular section of the planned extension shall be included on the same sheet as the plan view with a horizontal scale of one-inch (1") = fifty feet (50') or larger for projects consisting of sewer and water or sewer extensions. The horizontal scale for projects consisting of water extension only shall be one-inch (l") = one hundred feet (100') or larger scale. The vertical scale for profiles shall be one-inch (1") = five feet (5') or larger.

5.3.2.8 The drawings shall include a note stating that the Contractor shall verify all existing elevations and all existing utilities in the field prior to commencement of work.

5.3.2.9 The 100-year flood elevation shall be shown on all plan drawings.

5.3.2.10 The plan drawings shall be placed on 24-inch x 36-inch plan and profile paper.

5.3.2.11 Projects which include new pump station(s) shall include a plot plan for each station with topographic lines of one foot (1') contour intervals.

5.3.2.12 Each plan sheet shall have a title block with a title which is descriptive of the contents of the sheet.

5.3.2.13 Profiles for gravity sewer shall clearly indicate the actual plan slope of each reach of line given in percent slope. The actual length of each reach of gravity line shall be used to calculate pipe slope. This length shall be the distance between manhole centerlines minus the inside radius of both manholes as measured horizontally.

Designs in which the distances between manhole centerlines are used as the pipe length in the calculation of pipe slopes will not be approved.

5.3.2.14 The length of each reach of gravity sewer shall be clearly indicated on the drawings. This length shall be the manhole centerline to centerline length as measured horizontally.

5.3.3 General Requirements for Specifications

5.3.3.1 The specifications shall be prepared by a Professional Engineer.

5.3.3.2 The specifications and all other documents listed in Section 5.3.1, with the exception of the drawings, shall be bound in a single booklet with a title page bearing the project name and location, the Engineer, the date, and the seal and signature of the Professional Engineer who developed the documents. The title sheet shall also include a revision block.

5.3.3.3 As-built drawings shall be submitted with monthly pay estimates to the owner's engineer.

5.3.4 Required Permits for Construction

All water and sewer system extension plans must be granted the permits and encroachment agreements described herein (where applicable) PRIOR TO ANY CONSTRUCTION. The application forms for the following permits shall be obtained from the agency granting the permit and shall be completed except for signatures and notarization. All applications shall be signed by the General Manager of Greenville Utilities Commission or his designated representative.

5.3.4.1 Water System Extensions

An "Application for Approval of Plans and Specifications" is required for any extension of water distribution systems. The form may be obtained from the NCDEH. Three (3) copies of the application form shall be submitted to the Commission with the Contract Documents. There is no fee for this permit.

5.3.4.2 Wastewater System Extensions

A "Nondischarge Permit" from NCDWQ is required for any wastewater system extension. If the plans include a new wastewater pump station or modification of an existing pump station, pump station calculations are required. The NCDWQ requires a processing fee for all wastewater system extension plans or existing wastewater system modifications. The required fee, one original and the appropriate number of copies of the NCDWQ "Non-discharge Permit" application form, and necessary supplements shall be submitted with the Contract Documents. Copies of the required "Nondischarge Permit" applications are included in Appendix C of this Manual.

5.3.4.3 NCDOT Encroachment Agreements

A water or sewer extension which shall encroach upon any NCDOT right-of-way, shall require an encroachment agreement to be executed prior to approval of the plans. In this case, six (6) sets of drawings (1 full size and 5 reduced maximum size 11”x17”) and six (6) copies of the NCDOT Encroachment Agreement Form shall be submitted to the Commission in addition to the copies of Contract Documents required for review under Section 5.4.2 of the Manual. If applicable, a letter from the Land Quality Section of the DENR approving the Erosion Control Plan must be submitted to GUC for forwarding to NCDOT prior to their approval of the encroachment agreement.

5.3.4.4 Erosion and Sedimentation Control Plan

An erosion and sedimentation control plan must be submitted to the DENR Land Quality Section at least 30 days before land disturbance begins on any site one acre or larger.

5.3.4.5 Railway Encroachment Agreements

Whenever a proposed water or sewer extension encroaches upon a railway right-of-way, an encroachment agreement shall be executed prior to construction. The Engineer shall submit for approval copies of the Contract Documents and the encroachment agreement forms to the Commission. Fees shall be determined by the right-of-way owner, after submission of the proposed agreement, and paid by the developer.

Indemnification and Hold Harmless Agreement

Whenever construction of, or other activities associated with, water and sewer facilities for the Commission encroach within the right-of-way of any City or DOT street or highway, the Contractor shall provide to the Commission, prior to scheduling a preconstruction conference, a fully executed, "Indemnification and Hold Harmless Agreement". A copy of the agreement is included in Appendix G of this Manual.

5.4 REQUIRED COPIES OF CONTRACT DOCUMENTS

5.4.1 The Engineer should submit to the Commission two (2) sets of Contract Documents, pertinent calculations, and applicable permits, for a preliminary review prior to submission of all Contract Documents necessary. Preliminary submittals, which do not contain the required calculations and permits, will be returned as incomplete. The Department Engineer and his staff shall review such plans and make the appropriate notes and return one (1) copy of the drawings to the Engineer marked so that the necessary corrections can be made and the Contract Documents may be submitted for the approval of the Commission and the appropriate state agencies.

5.4.2 The Commission shall require submission of the following number of sets of Contract Documents for the approval of the Commission and the appropriate state agencies.

TABLE 5-1

REQUIRED SETS OF PLANS AND SPECIFICATIONS FOR STATE AGENCY APPROVALS

Type of Project	No. of Copies of Drawings	No. of Copies of Specs.	Permit Originals	Permit Copies
Sewer Ext. Only Fast Track Form FTA 6/00	4	4	1	1
Sewer Ext. Only PSFMGSA 10/99	7	4	1	3
Water and Sewer Ext. Fast Track Form FTA 6/00	7	4	3 Water 1 Sewer	1 Sewer
Water and Sewer Ext. PSFMGSA 10/99	10	4	3 Water 1 Sewer	3 Sewer
Water Ext. Only	7	4	3	
NCDOT Encroachment	6	0	6	

5.4.3 The Engineer shall submit all required encroachment application forms, State approval forms, and appropriate fees as outlined above with the necessary copies of Contract Documents when making a formal submission for approval.

5.5 SHOP DRAWINGS

The Engineer's specifications shall include a requirement for the submittal of shop drawings and certifications for the materials, equipment and prefabricated structures used in water or sewer extension projects. The Engineer shall provide the Commission copies of approved shop drawings upon request.

5.6 SURVEY DATA

5.6.1 General

The locations of all benchmarks and control points shall be included in the plans. Benchmarks shall be located in areas which shall not be disturbed by the construction. The Engineer or Developer shall provide all surveys necessary for the work. Survey data shall be made available for the Commission's review upon request.

5.6.2 Vertical Control

The elevations given in the Contract Documents and all benchmarks shall be referenced to USGS elevations. The elevations of all construction benchmarks shall be looped to verify the accuracy of the level work. All construction benchmarks shall be clearly marked on the drawings using standard drafting symbols and shall have their elevations shown.

5.7 EASEMENTS AND RIGHTS-OF-WAY

All required easements and rights-of-way shall be provided to the Commission by one of the two following methods.

5.7.1 Recorded Final Plat

The Developer or Engineer may submit a recorded (20" x 24") final plat of the property to be served with all easement and right-of-way widths shown.

The plat must be recorded at the Pitt County Registry and bear the seal, signature and certification of a Registered Land Surveyor.

5.7.2 Standard Easement Form

The Engineer or Developer may submit a completed standard easement form, included in Appendix E of this Manual, accompanied with a map of each easement acquired. Additional blank copies of the easement form are available upon request from the Commission.

Easement maps accompanying standard easement forms shall be 8-1/2" X 14". They shall be drawn at a scale of 1" = 200 (or less) feet, utilizing standard drafting techniques. The maps shall include the following: (1) Name of the property owner, (2) map book and page number of the recorded property deed, (3) the name of the person(s) or company who prepared the map, (4) Certificate stating the map was prepared under the direct supervision of a registered land surveyor, (5) date of preparation, (6) scale, (7) north arrow (if magnetic, state year), and (8) all other pertinent information including existing rights-of-way, property lines, monuments, etc. Maps submitted as two or more sheets shall have match lines which clearly indicate how the sheets fit together. Drawings which have been photographically reduced shall not be acceptable unless all the information thereon is clearly legible and all other requirements have been met.

SECTION 6.0

GUIDELINES FOR THE CONSTRUCTION PHASE OF WATER AND WASTEWATER SYSTEM EXTENSIONS

6.1 GENERAL

This section shall describe certain conditions and requirements of the Commission concerning water and wastewater system extension construction which shall be addressed in all Contract Documents receiving the approval of the Commission.

6.2 PRECONSTRUCTION CONFERENCE

Prior to commencing any water or sewer extension construction work, the Department Engineer shall be contacted to schedule a preconstruction conference. No construction shall occur until after the preconstruction conference is held. As a minimum, the Engineer and the Contractor shall attend the preconstruction conference. Prior to the scheduling of the preconstruction conference both the “pigging” plan as required in Section 3.5.4 and the executed “Indemnification and Hold Harmless Agreement” shall be submitted and approved by the Commission.

6.3 UTILITIES LOCATION SERVICES

NC One Call Center shall be contacted a minimum of forty-eight (48) hours prior to any excavation. The utilities contacted shall have the opportunity to take the steps which they deem necessary to protect their utilities. The Contract Documents shall note that utilities location by NC One Call Center is not valid after the expiration of a ten (10) day period beginning on the date of such location.

6.4 NORMAL WORK HOURS

Unless approved otherwise by the Commission, all construction shall be performed during the regular office hours of the Commission, i.e. 8:00 a.m. to 5:00 p.m. After hours, holiday, or weekend work should include only such tasks that do not require observation by the Commission's Representative. Under certain conditions, the Commission may agree to provide construction observation after hours or on weekends and holidays. The Contractor shall bear the costs of provision of such construction observation.

6.5 OPERATION OF EXISTING FACILITIES

6.5.1 The Contractor performing water or sewer extension work shall contact the Commission's Representative whenever operation of the Commission's valves or hydrants is necessary to request scheduling of such operation. The Commission shall require the contractor to estimate the length of time service will be interrupted and the number of customers to be affected.

6.5.2 Facilities and equipment belonging to the Commission may not be operated or adjusted without the express permission of the Commission's Representative. In the case of any emergency, the Contractor shall be allowed to take such steps with valves and hydrants as necessary for the protection of life and property.

6.5.3 Valves which control networks not yet accepted but which are connected to the existing system shall be considered system valves. Valves within a network not yet accepted and which do not control the flow of water between new and existing systems are not considered system valves and do not require permission to operate.

6.5.4 Notification to the Commission must be made by the Contractor upon breakage of any Commission maintained water or sewer line or appurtenance thereof. Repair of the Commission's facilities shall be made by the Contractor upon approval of the Department Engineer. Any repairs made with Commission forces will be billed to the Contractor at cost.

6.5.5 Where interruption of service is required, the Commission shall be notified to request approval and subsequent scheduling of such interruption. The Commission shall notify the affected customers should the interruption be approved. A minimum (forty-eight) 48-hour notice shall be given the affected customers.

6.6 QUALITY CONTROL

6.6.1 General

In order to insure that water and sewer system extensions are constructed in accordance with the standards of the Commission; testing, inspection, and surveying for construction work shall meet the requirements set forth herein.

6.6.2 Materials Testing

All materials testing and testing equipment and procedures shall be in accordance with the applicable industry standards.

6.6.3 Inspection Services

The Developer shall provide complete engineering services; including design, survey and grade control, and construction observation. These services shall be rendered by competent, experienced, personnel with a clear understanding of the work at hand. The Commission's Representative shall periodically observe the work while the construction is in progress. It shall not be the duty of the Commission's Representative to supervise construction, establish grades, or to provide solutions to grade, construction, or design problems. The Developer shall ensure that the installation of the water or wastewater system extensions is in accordance with the approved Contract Documents. Failure of the Commission's Representative to discover deficiencies at the time of construction shall not relieve the Developer of responsibility to correct such defects. Each construction crew of the Contractor shall have a set of Contract Documents bearing the Commission's stamp of approval at the project site at all times.

6.6.4 Construction Staking

6.6.4.1 The Contract Documents shall require that construction staking be performed by a Registered Land Surveyor at least twenty-four (24) hours and three hundred feet (300') in advance of construction and shall identify the party responsible for payment for same.

6.6.4.2 The Drawings shall identify the permanent baseline and all references from which dimensions are to be measured. In addition, benchmarks shall be shown on the drawings as required by Section 5.6.2.

6.6.4.3 The Contract Documents shall require stakes or hubs at the following locations:

i. Along the centerline of proposed water lines, at all points of horizontal curvature and tangency and at maximum intervals of one hundred feet (100') in tangent sections and twenty-five feet (25') in curved sections.

ii. In addition to (i) above, the Commission reserves the right to require that the centerline of proposed water lines be marked by a continuous paint stripe where there is concern for the quality of work being provided.

iii. At offsets out of the way of construction operations for each point on the centerline required by (i.) above.

iv. At all valves, fittings, hydrants, air release valves, cleanouts, water meters and other appurtenances. Such stakes shall have offsets out of the way of construction.

v. Hubs shall be provided for all pump station plot property or easement corners and at the wet well and valve vault locations.

vi. Hubs shall be provided at all manhole locations. Each hub shall have a guard stake indicating the manhole number and station number and shall have an offset out of the way of construction.

vii. The Contract Documents shall require the Contractor to stake the easement line location when requested to do so by the Commission.

6.7 PROJECT CLOSE-OUT

6.7.1 Pre-Final Inspection

Upon completion of construction, the Contractor or Developer shall contact the Commission's Representative to schedule a pre-final inspection. At the scheduled pre-final inspection, the Commission's Representative shall perform a visual inspection of the work in the presence of the Contractor. Any deficiencies discovered shall be recorded by the Commission's Representative and the Contractor. Any defective items noted shall be corrected prior to the final inspection.

6.7.2 Final Inspection

Upon completion of the items on the pre-final punch list, the Contractor or Developer shall contact the Commission to schedule the final inspection. The final inspection will not be scheduled until the following requirements are met:

i. The work shall be in accordance with the requirements of the Commission.

ii. A copy of the final estimate has been submitted and approved by the Commission.

iii. The easements and dedicated property required for the work by this Manual have been obtained and are recorded at the Register of Deeds.

iv. The as-built plans for the work have received the approval of the Department Engineer.

v. All fees applicable to the project have been received by the Commission.

vi. When a project includes sewer system extensions, the Commission has received the official NCDENR final certification form submitted by a Professional Engineer indicating that the sewer system installation conforms with all regulations, design criteria and the permit.

vii. When a project includes water system extensions, the Commission has received certification by a Professional Engineer stating that the water system installation conforms with the requirements of the approved Contract Documents as required by Section .0903 of the NCDHS regulations (G.S. 130A-315; 130A-317).

At the scheduled final inspection, the Department Engineer or his Designated Representative shall perform a visual inspection in the presence of representatives of the Contractor and the Engineer. The Engineer or his representative shall prepare a detailed punch list of any deficiencies discovered and provide copies to the Developer, Contractor, and the Commission. Any defective items noted shall be corrected prior to acceptance.

No service shall be provided prior to project acceptance.

6.7.3 <u>As-Built Drawings</u>

6.7.3.1 No Service shall be provided until after the as-built plans are reviewed and accepted. The initial submittal shall consist of two (2) prints. Upon approval, the Contractor shall submit to the Commission either a mylar reproducible or a digital copy of the approved as-built drawings. One (1) print of the final as-built drawing shall also be provided. The as-built shall include both water and sewer combined on each drawing. The sewer as-built shall include plan and profile. The Contractor shall

submit two (2) prints of the as-built drawings with each partial pay estimate to the Owner's engineer. The minimum sheet size for as-built drawings shall be 18” x 24”.

6.7.3.2 The Commission shall require at least two (2) weeks from date of receipt to complete its review and a reasonable time for review of any resubmittals.

6.7.3.3 The scale for as-built plans shall be the same as that of the construction plans.

6.7.3.4 Revised construction plans are acceptable if standard drafting techniques and practices are followed.

6.7.3.5 If the project has developed in phases, all lines should be clearly indicated and the title block of the plan sheets shall indicate the phase number and section number (where applicable) and all building units/lots being served with the particular phase being submitted. Lots and building unit numbers must reflect the numbers that will later accompany the service application (request for service).

6.7.3.6 The as-built drawings shall show the location by station number, referenced to the downstream manhole, and the length of all services and shall indicate by lot, unit number or address of the unit which each connection will serve.

6.7.3.7 The plans shall indicate street names, pavement widths, rights-of-way, and easements.

6.7.3.8 Apartments, condominiums, and other developments with walkways and off street parking shall have these facilities shown on the as-built drawings.

6.7.3.9 New water lines shall be located by horizontal dimensions from highly visible, permanent, fixed objects; such as the back of the street-curb and gutter, the edge of a walkway, street center-line, etc.

6.7.3.10 Valves shall each be located by reference to two (2) permanent, visible objects, such as right-of-way monuments, fire hydrants, manholes, catch basins, etc.

6.7.3.11 Indicate the type and size of each water line, sewer line, and service installed.

6.7.3.12 Station numbers identifying location of services, fittings, crossings, etc., shall begin at zero at each in-line valve. The distance between valves shall be shown.

6.7.3.13 Where more than one (1) type of material is used for water or sewer pipe, note the station of change from one material to another at the beginning of each change.

6.7.3.14 Designate on the as-built drawings if metallic detectable tape has been installed.

6.7.3.15 All appurtenances of water mains and force mains such as valve boxes and blow-offs shall be provided with station numbers. Indicate by station the location of all fittings for water mains and wastewater force mains.

6.7.3.16 Lengths of gravity sewer between manholes shall be shown on the drawings. The plan section should indicate lengths as measured horizontally between manhole centerlines. The profile section should indicate grades as measured from inside manhole wall to inside manhole wall (invert out to invert in).

6.7.3.17 The actual elevation, based on USGS datum only, of manhole tops, inverts (including services and taps) and the actual gravity sewer slopes shall be shown.

6.7.3.18 Sewer services are to be stationed from the center line of the downstream manhole ring and cover.

6.7.3.19 All privately owned sewer and water lines shall be indicated “as private”.

6.7.3.20 As-built drawings shall be prepared by and bear the seal and signature of a Professional Engineer.

6.7.3.21 The recorded plat or standard easement forms conveying easements and rights-of-way for the property to be served shall accompany the as-built drawings. Drawings submitted without the required plat or easement document will be returned as incomplete.

6.8 CONTRACTOR'S AND DEVELOPER'S BILL OF SALE

The Commission will not accept any new water or sewer system extensions until the Developer has submitted an executed Bill of Sale. Examples of the Commission's Bill of Sale form are shown in Appendix F. Blank copies are available from the Commission.

6.9 SATISFACTORY COMPLETION

If all required documentation has been obtained and the final inspection by the Commission reveals no defects in materials or workmanship, the Commission may issue a Certificate of Satisfactory Completion. The Commission shall be responsible for the general maintenance of the water and sewer system from the date of issuance of the Certificate. All damages occurring to the work prior to issuance of the Certificate shall be repaired by the Contractor at no expense to the Commission.

6.10 WARRANTY

The Developer shall warrant the project work to be free of defects in materials or workmanship for a period of one (1) year from the date of the Commission’s acceptance of the water or sewer system for permanent operation and maintenance.

SECTION 7.0

MATERIAL SPECIFICATIONS FOR WATER SYSTEM EXTENSIONS

7.1 GENERAL

The materials used for the construction of water mains and all accessories and appurtenances thereof shall be new, free of defects in product and workmanship and of the highest quality available in the industry. Materials not specified but deemed equal to those specified may be approved for use provided the documentation and samples necessary for approval are provided to the Commission thirty (30) days prior to the ordering of said materials. WRITTEN APPROVAL must be issued by the Commission before such material may be used in construction. Current specifications (latest revisions) shall apply in all cases where materials are described by reference to published standards such as ASTM, AWWA, ANSI., etc.

7.2 WATER MAIN AND FITTINGS

Water mains shall be constructed of polyvinyl chloride (PVC) or ductile iron pipe (DIP) at the option of the Developer or Engineer, except in instances where the Manual or the Commission specifically requires a particular pipe material be utilized for an installation. All plastic pipe shall bear the seal of the National Sanitation Foundation.

7.2.1 PVC water main four inches and larger shall be manufactured in accordance with AWWA Standard C-900. The pipe shall have push-on type joints with elastomeric gaskets. The pipe shall be pressure rated at 150 psi with a dimension ratio of 18 for both bell and pipe thickness. Pipe shall be furnished in nominal twenty-foot (20') lengths.

7.2.2 PVC water main of two-inch (2") size shall be Class 200 SDR 21 conforming to ASTM D1784 and ASTM D2241 with "push-on" joints. Fittings shall be Schedule 80 PVC with solvent weld joints and shall bear the NSF seal. Pipe shall be furnished in nominal twenty-foot (20') lengths.

7.2.3 Tees, elbows and other fittings for PVC C-900 pipe and ductile iron pipe shall be of ductile iron unless otherwise permitted or required by the Commission. Standard dimension fittings or compact fittings may be used in accordance with the requirements of this Section.

7.2.3.1 The interior of all fittings shall be cement mortar lined with an asphaltic coating in accordance with AWWA Standard C-104 (ANSI 21.4). The exterior of all fittings shall have a one (1) mil bituminous coating in accordance with AWWA Standard C-110 (ANSI A21.10).

7.2.3.2 Compact fittings shall be ductile iron with either push-on or mechanical joints in accordance with ANSI/AWWA C153/A21.53-84. Cement lining and asphaltic coating shall be provided in accordance with ANSI/AWWA C104/A21.4.

7.2.3.3 Standard dimension fittings for PVC C-900 pipe and ductile iron pipe shall be of ductile iron with either "push-on" or mechanical joints (See Section 3.4.6.5). The fittings shall comply with all requirements of AWWA Standard C-110 (ANSI A21.10) and shall be designed for a minimum working pressure of 150 psi plus 100 psi surge pressure.

7.2.4 Ductile iron pipe for water mains shall be manufactured in conformance with AWWA C-151 and shall be cement-mortar lined with an asphaltic coating in accordance with AWWA C-104. The exterior of the pipe shall be bituminous coated in accordance with AWWA C-151. The minimum thickness Class of pipe shall be Class 50. Pipe shall be furnished in nominal 18 or 20 foot lengths. Pipe joints for ductile iron pipe shall be "push-on" unless the additional pipe deflection allowed by mechanical joints is necessary or other considerations dictate the use of mechanical joints (See Section 3.4.6.5). The joints for ductile iron pipe shall conform to AWWA Standard C-111 revision (ANSI, A21.11).

7.2.4.1 Polyethylene encasement shall be applied to all underground ductile iron pipe and fitting installations. Materials and installation procedures shall be in accordance with ANSI/AWWA C-105/A21.5-88.

7.2.5 Detectable marking tape shall be installed in accordance with Section 3.4.7.6. Tape shall be three (3) inches in width with a minimum thickness of 0.5 millimeters (minimum solid center foil thickness of 0.35 millimeters). Color of the tape shall be blue meeting the American Water Works Association color code. Tape shall read: “Caution – Buried Water Line Below”. Tape shall be manufactured by Lineguard, Inc., Pro-Line Safety Products Co., Empire Level Mfg. Corp., or approved equal.

7.2.6 <u>Restraint Devices</u>

7.2.6.1 Restraint devices for use on ductile iron and C-900 PVC “push-on” joints shall be constructed of high strength ductile iron, ASTM A536, Grade 65-45-12 and shall incorporate machined serrations on the inside diameter to provide positive restraint, exact fit, full circle contact and support of the pipe in an even and uniform manner. Bolts and connecting hardware shall be of high strength, low alloy material in accordance with ANSI/AWWA C111/A21.11, latest revision thereof. All devices shall have a safety factor of no less than 2:1 at the full rated pressure of the pipe on which it is installed. They shall be UL listed and Factory Mutual approved. Restraining devices shall be Uni-Flange Block Buster Series 1390-C, Star Pipe Products Allgrip series 3600 and Pipe Restrainers Series 1200S, or approved equal.

7.2.6.2 Restraint devices for use on mechanical joint to C-900 PVC, shall be constructed of high strength ductile iron, conforming to the requirements of ASTM A536, Grade 65-45-12, and shall incorporate machined serrations on the inside diameter to provide positive restraint, exact fit, full circle contact and support of the pipe in an even and uniform manner. Bolts and connecting hardware shall be of high strength low alloy material in accordance with ANSI/AWWA C111/A21.11, latest revision thereof. All devices shall have a safety factor of no less than 2:1 at the full rated pressure of the pipe on which it is installed. They shall be UL listed and Factory Mutual approved. Restraining devices shall be Uni-Flange Series 1500, Star Pipe Products, Allgrip Series 3600, Romac Industries, Inc GripRing or approved equal.

7.2.6.3 Restraint devices for use on mechanical joint ductile iron, shall be constructed of high strength ductile iron, conforming to the requirements of ASTM A536, Grade 65-45-12, and shall incorporate machined serrations on the inside diameter to provide positive restraint, exact fit, full circle contact and support of the pipe in an even and uniform manner. Bolts and connecting hardware shall be of high strength low alloy material in accordance with ANSI/AWWA C111/A21.11, latest revision thereof. All devices shall have a safety factor of no less than 2:1 at the full rated pressure of the pipe on which it is installed. They shall be UL listed and Factory Mutual approved. Restraining devices shall be Uni-Flange Series 1300-C, Star Pipe Products, Allgrip Series 3600, Romac Industries, Inc. GripRing or approved equal.

7.2.6.4 Locked hydrant tees and fittings for fire hydrants shall meet the requirements of AWWA Standard C-111 (ANSI A21-11). Locked tees shall be as manufactured by American Cast Iron Pipe Company, Clow, U.S. Pipe, or approved equal.

7.2.6.5 Bolted Couplings for PVC C-900 pipe and ductile iron pipe shall be constructed of a center sleeve and end rings of ductile iron in accordance with ASTM A536. Bolts and nuts shall be of high strength, low alloy steel per ASTM A242 and AWWA C-111. Center sleeve and end rings shall have a paint finish coat. Couplings shall be Ford Style FC1, Romac 501 Series, Smith Blair 441, or JCM 201.

7.3 MAIN VALVES AND BOXES

7.3.1 General

Main line valves for 12-inch nominal diameter mains and smaller shall be resilient-seated gate valves. All larger water main valves shall be rubber seated butterfly valves. Valve boxes shall be cast iron with traffic bearing capability.

7.3.2 Gate Valves

Gate valves shall conform to the requirements of the latest revision of AWWA Specification C-509/C-515 for resilient-seated gate valves.

7.3.2.1 The valve body shall be ASTM A-126 Class B cast iron or ductile iron and shall conform to ASTM A395 or ASTM A536. In addition, ductile iron shall contain no more than 0.08 percent phosphorus.

7.3.2.2 All interior valve parts and surfaces shall be of corrosion resistant materials or have an epoxy coating sufficient to prevent corrosion. Such coating shall be recognized by the AWWA for potable water use. Exterior valve parts and surfaces shall be epoxy coated or have the Standard AWWA coating.

7.3.2.3 The valves shall open counterclockwise and have non-rising stem operation with 2-inch square operating nuts. The maximum number of turns required to fully open or close the valve shall equal three times the pipe diameter plus two.

7.3.2.4 The stem shall be of corrosion resistant material and have "O" ring seals.

7.3.2.5 Valves shall provide zero leakage at a working pressure of 200 psi in either direction of line flow.

7.3.2.6 Valves shall have flange connections conforming to ANSI B16.1 Class 125 or mechanical joints conforming to AWWA C-111.

7.3.2.7 Valves shall be manufactured by Clow, American Flow Control or Mueller.

7.3.3 Butterfly Valves

Butterfly valves shall be rubber seated manufactured in conformance with AWWA C-504.

7.3.3.1 The valve body shall be ASTM A-126 Class B cast iron.

7.3.3.2 All interior valve parts and surfaces shall be of corrosion resistant materials or have a suitable epoxy coating recognized by the AWWA for potable water use. Exterior valve parts and surfaces shall be epoxy coated or have the Standard AWWA coating.

7.3.3.3 The shaft shall be of sufficient diameter and strength to comply with the requirements for maximum operating torque set forth in AWWA C 504 for Class 150 B.

7.3.3.4 Operation shall be by way of a geared actuator suitable for direct bury installations. The maximum number of turns required to fully open or close the valve shall equal three times the pipe diameter plus two. Access to the operating nut shall be provided by standard telescoping cast iron valve box in compliance with Section 7.3.4.

7.3.3.5 Valves shall provide a bubble tight seal with a pressure differential of 150 psi in either direction of line flow.

7.3.3.6 Valves shall have flange connections conforming to ANSI B16.1 Class 125 or mechanical joints conforming to AWWA C-111.

7.3.3.7 Valves shall be manufactured by Clow, American Flow Control, Mueller, or Pratt.

7.3.4 Valve Boxes

7.3.4.1 Valves 2” through 10” - Valve boxes shall be of cast iron suitable for H-20 loading. The manufacturer’s name and part number shall be cast into each component of the box. The box shall be of the telescoping (slip) type consisting of a base section, center extensions as necessary, and a top section with a cover marked "WATER". Sections shall be selected and installed such that a minimum of four inches (4”) of future adjustment (upward and downward) is possible without section removal or replacement and without the use of adapters. Valve boxes and extensions shall be either of the following:

- Tyler

- - East Jordan Iron Works Global Cast: G-8472 Slip-Type Valve Box Series

Valve boxes shall be installed in accordance with the Standard Details.

7.3.4.2 Valves 12” and Larger – Valve box shall consist of an East Jordan Iron Works – 157801 frame and cover with a valve box bottom and extensions, as needed in accordance with Section 7.3.4.1. Installation shall be in accordance with the Standard Details.

7.4 HYDRANTS

7.4.1 Fire Hydrants

7.4.1.1 Fire hydrants shall be in accordance with AWWA Standard C-502, latest revision thereof, suitable for an operating pressure of not less than 150 pounds per square inch and shall have a traffic breakable feature (safety flange and stem coupling), dry top, sealed lubrication reservoir and a main valve which is held closed with pressure. The hydrant body shall be of cast iron with "O" ring seals and bronze threads on the seat ring and drain ring, and shall have two (2) 2-1/2-inch nozzles with caps having National Standard threads and one (1) 5-inch nozzle with a factory fitted Storz connection and cap. The hydrant main valve shall be a minimum of 5-1/4 inches in diameter. All continuously wetted hydrant parts and surfaces shall be of corrosion resistant materials or be epoxy coated with epoxy recognized by AWWA for potable water use. The epoxy coating shall be of a color other than black (unless the word "epoxy" is stenciled on the base) to permit distinction between standard and epoxy coatings to be made easily. Hydrants shall be American Flow Control B-84-B-5, Clow Medallion or Mueller A-423.

7.4.1.2 The inlet shoe for a fire hydrant shall have a six-inch (6") inside diameter and shall be cast or ductile iron with mechanical joint fittings in accordance with AWWA Standard C-110.

7.4.2 Hydrants for Blow-Offs

7.4.2.1 Blow-offs as provided for in Section 3.2.10.1 of the Manual shall be standard fire hydrants meeting the requirements of Section 7.4.1(above).

7.4.2.2 Blow-offs as required by Sections 3.2.10.2 and 3.2.10.3 of the Manual shall be as shown in the Standard Details.

7.5 WATER SERVICE MATERIALS

7.5.1 Materials for ¾" and 1" Services

The materials for 3/4" and 1" services are identical except for the meter which is installed by the Commission. Also, materials for 1-1/2" and 2" services are identical except for the meter vault which is installed by the Commission.

7.5.1.1 Service saddles shall be made of materials conforming to AWWA copper alloy No. C83600 with 1" (AWWA) CC outlet thread and an O-Ring cemented in a confined groove. Service saddles shall be only those listed below.

TYPE MAIN	DIA	APPROVED SADDLE MFS & MOD #
PVC (IPS)	2"	Ford S70-204, Hayes 527A.0400 Series, Mueller H-13420, A Y McDonald Style 3801
ACP/DIP/CIP	4"-12"	Ford Style 202B, AY McDonald #3825 Mueller BR 2 B Series
PVC (C-900)	4"-12"	Ford S90 Series, Hayes 529 Series, Mueller H-13440 through H-13444 Series, A Y McDonald Style 3805
PVC (Sch 40 & IPS) Steel Pipe	4"-12"	Ford S70 Series, Hayes 527 Series, Mueller H-13428 through H-13435 Series, A Y McDonald Style 3801

7.5.1.2 One inch (1") corporation stops shall be bronze body with (AWWA) CC tapered threaded inlet and compression connection outlet. Stops shall be Hayes 4400CJ, Mueller P-15008, Ford F1000-4, A Y McDonald 4701-22, or approved equal.

7.5.1.3 Service tubing shall be one inch (1") diameter seamless copper type K suitable for underground water services. Materials shall be supplied in conformance with ASTM B88, type K.

7.5.1.4 One inch (1") angle ball valve meter stops shall be bronze body with compression seal inlet connection and threaded outlet for meter connection. Stops shall be Ford BA43-444W, Hayes 252OCJ, A Y McDonald 4602B-22, Mueller P-24258 or approved equal.

7.5.1.5 Service Couplings for 1" water services shall be bronze body with compression seal inlet connections with a stainless steel set screw. Couplings shall be Ford C44-44, Hayes 5615CJ, A Y McDonald 4758-22, Mueller P-15403, or approved equal.

7.5.1.6 Water meter boxes shall be manufactured of Class 30 cast iron in conformance with ASTM-A48 (latest revision thereof). The manufacturer's name and part number shall be cast into each component and the words "water meter" shall be cast into the cover. Boxes shall be Vulcan Foundry G8404-1 Frame with G-8404 lid, Sigma MB 382 or Capitol Foundary MBX-1.

7.5.2 Materials for 1-1/2" and 2" Services

7.5.2.1 Service saddles shall be made of materials conforming to AWWA copper alloy No. C83600 with 2" (NPT) FIP outlet thread and an O-Ring cemented in a confined groove. Service saddles shall be only those listed below.

TYPE MAIN	DIA	APPROVED SADDLE MFS & MOD #
PVC (IPS & Sch 40)	4"-12"	Ford S71 Series, Hayes 527P Series, A Y McDonald Style 3802
ACP/DIP/CIP	4"-12"	Ford Style 202B, AY McDonald #3826 Mueller BR 2 B Series
PVC (C-900)	4"-12"	Ford S91Series, Hayes 529P Series, Mueller H-13490 through H-13494 Series, A Y McDonald Style 3806

7.5.2.2 Ball valves shall be bronze body with tee head. The turn required to travel from fully closed to fully open position shall be 90 degrees. Ball valves shall incorporate a check allowing a maximum turn of 90^{o}. Ball valves shall be Hayes 4300, Ford B11-777 A Y McDonald 6101, Mueller B-20283 or approved equal.

7.5.2.3 Service pipe shall be PVC Class 200 (IPS) conforming to the latest revisions of ASTM D1784 and ASTM D2241. The pipe joints shall be of the integral bell type with rubber gaskets conforming to ASTM D3139 and F477.

The pipe shall be SDR 21 and shall bear the National Sanitation Foundation seal for potable water. Fittings shall be schedule 80 PVC with solvent weld joints.

7.5.3 Materials for Services Larger Than 2”

The materials for services larger than 2” shall be identical to those required for water mains.

7.6 BACKFLOW PREVENTION ASSEMBLIES

Control assemblies such as reduced pressure principal assemblies, double check valve assemblies and double detector check valve assemblies shall be limited to those approved by the Commission and the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California. Devices shall be utilized where required by Section 18 of the Terms and Conditions.

7.7 TAPPING SLEEVES

Tapping sleeves shall be all stainless steel body and flange with a full circumferential gasket, or ductile iron body, mechanical joint designed to accommodate a minimum operating pressure of 150 pounds per square inch. All tapping sleeves shall be pressure tested prior to tapping the main. Stainless steel tapping sleeves shall be Ford Model FAST, JCM Model 432, Mueller Model H304 or Romac Model SST. Ductile iron body, mechanical joint sleeves shall meet the requirements of Section 7.2.3 of this Manual.

7.7.1 Tapping Valves

Tapping valves shall conform to the requirements of the latest revision of AWWA Specification C-509 for resilient-seated gate valves. The valve body shall be ASTM A-126 Class B cast iron. All internal valve parts and surfaces shall be of corrosion resistant materials or have an epoxy coating sufficient to prevent corrosion. Such coating shall be recognized by the AWWA for potable water use. Exterior valve parts and surfaces shall be epoxy coated or have the Standard AWWA coating. The valves shall open counterclockwise and have non-rising stem operation with a two-inch square operating nut. The maximum number of

turns required to fully open or close the valve shall equal three times the pipe diameter plus two.
The stem shall be of corrosion resistant material and have 0-ring seals. Valves shall provide zero leakage at a working pressure of 200 psi in either direction of line flow. Valves shall have a flange connection conforming to ANSI B16.1 Class 125 and a mechanical joint conforming to AWWA C-111. Valves shall be manufactured by Mueller, Clow or American Flow Control. Tapping valves shall be installed and pressure tested prior to tapping the water line.

7.8 AIR RELEASE VALVES

Air release valves shall be manually operated valves unless otherwise required by the Commission.

7.8.1 Manual Air Release Valves

Manual air relief valves shall be of materials identical to those of a one-inch (1") service with the exception that 1) a service saddle or clamp is required (no direct tapping is permitted), and 2) the tap shall be made at the top (crown) of the main.

7.8.2 Automatic Air Release Valves

Automatic air release valves shall be small orifice valves designed for the working pressure which will exist in the main at the point of placement. The design and selection of automatic air release valves shall be in accordance with the direction of the Commission and shall be handled on a case by case basis.

7.9 STEEL ENCASEMENT PIPE

7.9.1 Steel encasement pipe shall be spiral welded or smooth wall seamless, consisting of grade "B" steel with a minimum yield strength of 35,000 psi and manufactured in accordance with ASTM A139 and A283. The pipe thickness shall be in accordance with the requirements of the right-of-way owner, but in no case less than that shown in the following table. The ends shall be beveled and prepared for field welding at the circumferential joints.

MINIMUM WALL THICKNESS FOR STEEL ENCASEMENT PIPE

Nominal Diameter in inches	Minimum Thickness in inches
4-12 3/4	0.188
14	0.219
16-18	0.250
20	0.281
22	0.312
24	0.344
26	0.375
28-30	0.406
32	0.438
34-36	0.469
38-42	0.500

7.9.2 The encasement pipe shall be uncoated inside and out unless required otherwise by the right-of-way owner or the Commission.

7.9.3 Encasement pipe and joints shall be of leak proof construction, capable of withstanding design loading. The inside diameter of the encasement pipe shall be at least 2 inches greater than the largest outside diameter of the carrier pipe, joints or couplings, for carrier pipe less than 6 inches in diameter; and at least 4 inches greater for carrier pipe 6 inches and larger in diameter. In general, to determine the casing size you should double the size of the carrier pipe, i.e., a 6” carrier pipe requires a 12” casing pipe. The engineer shall verify the clearance is sufficient to allow the carrier pipe to be removed without disturbing the casing pipe.

SECTION 8.0

MATERIAL SPECIFICATIONS FOR WASTEWATER SYSTEM EXTENSIONS

8.1 GENERAL

The materials used for the construction of sewer extensions and all accessories and appurtenances thereof shall be new, free of defects in product workmanship and of the highest quality available in the industry. Materials not specified but deemed equal to those specified may be approved for use provided the documentation and samples necessary for approval are provided to the Commission thirty (30) days prior to the ordering of said materials. WRITTEN APPROVAL must be issued by the Commission before such material may be used in construction. Current specifications (latest revisions) shall apply in all cases where materials are described by reference to published standards such as ASTM, ANSI, etc.

8.2 GRAVITY SEWER PIPE AND FITTINGS

Gravity sewers shall be constructed of ABS composite (truss) pipe, PVC composite (truss) pipe, PVC pipe (in accordance with Section 8.2.4 and 8.2.5) ductile iron pipe, or extra strength vitrified clay pipe, at the option of the Engineer or Developer, except for circumstances where the Manual or the Commission specifically requires a particular pipe material be utilized for an installation.

8.2.1 ABS Composite Pipe

ABS pipe shall conform to the requirements of ASTM D2680, Standard Specification for Acrylonitrile-Butadiene-Styrene Composite pipe. Joints and fabricated fittings shall be chemically welded using a cement and primer recommended by the pipe manufacturer. The pipe shall be similar in all respects to Armco Truss Pipe as manufactured by Contech Construction Products, Inc. ABS pipe shall be supplied in 12.5-foot lengths.

8.2.2 Ductile Iron Pipe

8.2.2.1 All ductile iron pipe shall be manufactured in compliance with ANSI Standard A21.51. The interior of the pipe shall be cement-mortar lined in accordance with ANSI A21.4.

The exterior of the pipe shall have a one (1) mil bituminous coating in accordance with ANSI A21.51. The thickness class for ductile iron pipe shall be Class 50 unless required otherwise by the Commission. Pipe shall be in nominal 18-20 foot laying lengths. The pipe joints for ductile iron pipe shall be "push-on" manufactured in accordance with ANSI 21.11. Where fittings are required, as in the installation of drop manholes, the fittings shall conform to the requirements of Section 7.2.3 for water main fittings.

8.2.2.2 Polyethylene encasement shall be applied to all underground ductile iron pipe installations. Materials and installation procedures shall be in accordance with ANSI/AWWA C105/A21.5.88.

8.2.3 Vitrified Clay Pipe

Vitrified clay sewer pipe shall be extra strength, unglazed, conforming to ASTM C700. Pipe shall have polyester joint material as manufactured by Logan Pipe or approved equal. Joints for vitrified clay pipe shall be in accordance with ASTM C425 for joints using materials having resilient properties.

8.2.4 Polyvinyl Chloride (PVC) Pipe 8"-15"

PVC pipe shall conform to the requirements of ASTM D3034 (SDR35). Joints and fabricated fittings shall be elastomeric (gasket) joints and shall be assembled in accordance with the pipe manufacturer's recommendations and Specification D3212. Gaskets shall meet the requirements of ASTM F477. Minimum cell class shall be 12454B. PVC pipe shall be supplied in 13.0-foot lengths.

8.2.5 Polyvinyl Chloride (PVC) Pipe 18” - 24”

PVC pipe shall conform to the requirements of ASTM F679 (wall thickness T-1). Joints and fabricated fittings shall be elastomeric (gasket) joints and shall be assembled in accordance with the pipe manufacturer’s recommendations. Gaskets shall meet the requirements of ASTM F477. Minimum cell class shall be 12454C. PVC pipe shall be supplied in 13.0-foot lengths.

8.2.6 PVC Composite Pipe

PVC composite pipe shall conform to the requirements of ASTM D2680, Standard Specification for Poly (Vinyl Chloride). Joints and fabricated fittings shall be elastomeric (gasket) joints and shall be assembled in accordance with the manufacturer's recommendations. Minimum cell class shall be 12454B. The pipe shall be similar in all respects to Armco Truss Pipe as manufactured by Contech Construction Products, Inc. PVC composite pipe shall be supplied in 12.5-foot lengths.

8.2.7 Sewer Service Pipe

Sewer service pipe shall be Schedule 40 PVC-Drain, Waste and Vent (DWV) pipe in accordance with ASTM D2665 and ASTM D1785. Cleanouts shall be constructed of pipe and fittings which also meet the ASTM requirement for Schedule 40 PVC-DWV pipe. Cleanout caps shall be Charlotte 110 or Jones BP134CSK flush cap Cleanouts located in traffic or paved areas shall be installed with a sewer cleanout box set to finished grade as shown in the standard details.

8.2.8 Service Fittings

8.2.8.1 Service saddles for use with ABS composite sewers shall be ABS saddle wyes as manufactured by Contech Construction Products, Inc. or approved equal. Wyes shall be chemically welded using the manufacturer's recommended primer, cement, and stainless steel bands.

8.2.8.2 Services from vitrified clay sewers shall be made by means of wye branches conforming to ASTM 700.

8.2.8.3 Service from ductile iron pipe less than 18” in diameter shall be provided by means of ductile iron wyes meeting the requirements for water main fittings as given in Section 7.2.3 of the Manual. Services from ductile iron pipe 18" in diameter and larger shall be provided by ductile iron wyes unless an alternate method, acceptable to the Commission, offers significant economy without sacrificing performance.

8.2.8.4 Service fittings for use on PVC composite pipe shall be PVC standard gasketed wyes manufactured or approved by the pipe manufacturer and shall conform to the requirements of ASTM D2680.

8.2.8.5 Service fittings for use on PVC (SDR35) pipe shall be a standard gasketed wyes, manufactured or approved by the pipe manufacturer and shall conform to the requirements of ASTM D3034.

8.2.8.6 Service fittings for use on PVC pipe sizes 18 to 27 inches shall be standard gasketed wyes manufactured or approved by the pipe manufacturer and shall conform to the requirements of ASTM F679.

8.2.9 Manhole Vent Piping

Pipe and fittings used on manhole vents shall be Ductile Iron in accordance with Section 8.2.2.

8.2.10 Transition Couplings For Gravity Sewers

8.2.10.1 The preferred transition connection between different sewer line materials shall be a standard manhole installation.

8.2.10.2 Pipe material changes between manholes may be permitted provided there is not a substantial difference in inside diameters, a smooth uniform flow line is maintained, and a watertight rubber sleeve or mechanical coupler conforming to ASTM C-425 is used to make the transition. All metal hardware shall be stainless steel. Transition sleeves shall be manufactured by Fernco or Indiana Seal.

8.3 STEEL ENCASEMENT PIPE

Steel encasement pipe shall be of ASTM A139 Grade B Steel. The encasement pipe shall meet the requirements of Section 7.9 of the Manual.

8.4 MANHOLES

8.4.1 Manholes shall be precast and have a monolithic bottom section unless otherwise approved by the Commission in writing. Manholes with a depth greater than 6 feet shall have eccentric cones, manholes with a depth of 6 feet or less shall have a concentric cone. Manholes shall conform to ASTM C-478. Joints shall be water tight and conform to the ASTM C478 standard for section joints designed for cold applied sealing compound. The sealing compound shall be CPS-210, Concrete Products Supply Company ,Concrete Sealants or approved equal.

8.4.2 Flat top manholes for gravity sewers shall be used only when approved in writing on a case by case basis by the Commission. Manholes of depth less than four feet (4') as measured from the top of the ring and cover to the lowest pipe invert shall require special design considerations. Shop Drawings shall be submitted to the Commission for such manholes.

8.4.3 The minimum inside diameter of manholes shall be 4.0 feet. Larger manholes shall be required for gravity sewers twenty inches (20”) in diameter and larger. See the Standard Details.

8.4.4 Manholes more than twelve feet (12’) in depth, as measured from the top of the ring and cover to the lowest invert, or as measured from surrounding finished ground elevation at the manhole location to the lowest manhole invert, whichever is greater, shall have an integral precast extended base as shown in the Standard Details.

8.4.5 Points of exit and entry for all pipe including services; shall be provided with flexible manhole sleeves and all stainless steel take up clamps in accordance with ASTM C-923. Manholes exceeding twenty-three feet in depth shall require a certification from the manufacturer that the flexible sleeves provided are capable of withstanding a hydrostatic pressure equal to the depth of the installed manhole. Points of entry for mains or services which are added after fabrication of the manhole shall be provided by coring and installation of a flexible sleeve. All pipes shall extend through the manhole walls a minimum of 2 inches. Core holes, factory or field installed, shall be surrounded by no less than four inches (4”) of full wall cross-sectional thickness.

8.4.6 Manholes with preformed invert channels and benches may be utilized. Preformed invert channels must conform with Section 4.2.6.5 of the Manual. Points of pipe exit and entry shall conform with Section 8.4.5 of the Manual. Manholes with inverts that are field constructed shall be done in accordance with the Standard Details.

8.4.7 Manhole rings and covers shall be manufactured in the USA of Class 30, gray cast iron conforming to the requirements of ASTM-A48 (latest revision thereof). The manufacturer's name and part number shall be cast into each component and the words "Sanitary Sewer" shall be cast into the cover. Pick holes shall be the non-penetrating type. Bearing surfaces of both ring and cover shall be machined to insure proper fit and to prevent rattling.

APPROVED MANHOLE RING AND COVERS

	Model No.	Manufacturer
Standard	V-1384	East Jordan Iron Works/Vulcan Foundry
	USF 669 Frame & KLCover	US Foundry
Low Profile	V-1384-3	East Jordan Iron Works/Vulca Foundry
	USF 664 Frame & KL Cover	US Foundry
Watertight	202701	East Jordan Iron Works/Vulca Foundry
	USF 710 Frame & LJ-SSG Cover	US Foundry
Locking	202704	East Jordan Iron Works/Vulca Foundry
	USF 710 Frame & LJ-SSG-LOC Cover	US Foundry

Watertight units, when required to be lockable, shall contain a locking device comprised of a stainless steel pentagon head bolt locking device which functions in the manner of a quarter turn fastener, as a part of the cover. The low profile ring is to be used only when grades will not allow use of a standard height casting. All castings shall meet industry standards in regard to appearance and tolerances for dimensions and weight.

8.4.8 Manhole steps shall be constructed of 1/2” Grade 60 steel bars with a plastic coating and shall meet Federal

Specification RR--F-621C. Maximum vertical step spacing shall be sixteen inches (16") on center.

8.5 FORCE MAIN PIPE AND APPURTENANCES

8.5.1 Sewer force main pipe shall be a minimum of Class 200 PVC pipe or Class 50 ductile iron pipe.

8.5.1.1 PVC shall be Class 200 SDR 21 conforming to ASTM D1784 and ASTM D2241 (latest revisions). Fittings for PVC force main shall be ductile iron meeting the requirements of ANSI A21.10 and shall be designed for a minimum working pressure of 150 psi plus 100 psi surge pressure. The interior of all fittings shall be cement-mortar lined in accordance with ANSI 21.4 and the exterior of the fittings shall be bituminous coated in accordance with ANSI 21.51.

8.5.1.2 Ductile iron force main and fittings shall meet the requirements for ductile iron water main set forth in Section 8.2.2.

8.5.1.3 All force mains shall include installation of a tee and valve with 6” quick connect and cap outlet to allow for future temporary bypassing of the pump station. This arrangement shall be installed on the discharge side of the pump station concrete valve vault.

8.5.2 Force Main Valves

8.5.2.1 Plug valves for sewage service shall be non-lubricated eccentric type plug valves, with cast iron body, resilient faced plug suitable for sewage service. Valves shall utilize a corrosion resistant seat material of ninety percent (90%) welded nickel machined to a smooth surface as per AWWA C-507-. All valve parts and surfaces shall be of corrosion resistant materials or have an epoxy coating sufficient to prevent corrosion. Bearings shall be sleeve-type, replaceable, stainless steel per AWWA C-507. Valve packing area shall comply with AWWA C-507 by using a multi V-ring configuration that is adjustable and field replaceable. Valves shall have flanged faces drilled in accordance with American Standard for

125 pounds and shall be suitable for an operating pressure of 175 psi.
Plug valves eight inches (8") and larger shall be geared to provide suitable operation of the valve. Plug valves shall be as manufactured by Dezurik or approved equal.

8.5.2.2 Resilient seated gate valves shall comply with the requirements of AWWA. The valve body shall be ASTM A-126 Class B cast iron. All valve parts and surfaces shall be of corrosion resistant materials or have an epoxy coating sufficient to prevent corrosion. The valves shall open counterclockwise and have non-rising stem operation with 2-inch square operating nuts. The stem shall be of corrosion resistant material and have "O" ring seals. Valves shall provide zero leakage at a working pressure of 200 psi in either direction of line flow. Valves shall be manufactured by American Flow Control, Clow, or Mueller.

8.5.3 Check Valves

Check valves, unless otherwise directed by the Commission, shall be lever and spring type, iron body, bronze mounted with pin, seat ring and disc of brass or bronze designed for working pressure of not less than 150 pounds per square inch. Valves shall have a suitable opening for cleaning without disconnection from the pipe. Valves shall be manufactured by American Flow Control, Mueller or Clow.

8.5.4 Air Relief Valves

Air relief valves shall be manually operated unless otherwise required by the Commission.

8.5.4.1 Manual air relief valves shall be identical to the valve described in Section 7.8.1 of the Manual, except that 1) the control valve shall be installed in a standard manhole, and 2) the service tubing shall be SDR 9 polyethylene in lieu of copper.

8.5.4.2 The design and selection of automatic air release valves shall be in accordance with the direction of the Commission and shall be handled on a case by case basis.

8.6 WASTEWATER PUMP STATIONS

8.6.1 Pumping stations shall be of the submersible pump type, unless specifically approved otherwise by the Commission. The stations shall be equipped with a minimum of two (2) pumps, each capable of pumping at a rate equal to the peak design flow. The pumps installed in duplex pumping stations shall be of equal capacity.

8.6.2 Sewage pumping stations, structures, controls, and appurtenances shall withstand the 100-year flood without physical damage. Pumping stations shall not be located in areas subject to frequent flooding (areas inundated by the 10-year or greater frequency flood).

8.6.3 All sewage pump stations which are adjacent to streams classified as A-I, A-II or B waters shall be equipped with an alternate power source. Alternate power sources include on site standby power, dual power feed from separate electric substations, or portable generator.

8.6.4 All pump stations shall include a separate concrete valve vault suitable for an H-20 highway loading which shall house a lever and spring type check valve and pressure gauge for each pump discharge line. These valves shall be of the same size as the discharge pipes and shall meet the requirements of Section 8.5.

8.6.5 Wet wells shall be constructed of precast reinforced concrete manhole sections unless otherwise directed by the Commission. The sections shall conform to ASTM Specification C 478. The inside diameter of the wet well shall be no less than that required for installation and removal of the pump equipment and in no case less than 6.0 feet inside diameter. Wet wells shall be provided with base slabs meeting all applicable requirements of the ACI Code and of sufficient dimensions to protect the wet well from settlement and from flotation. Top slab shall be suitable for H-20 highway loading. Joint sealant shall be in conformance with Section 8.4.1. of this Manual. The interior of the wet well shall receive two (2) coats of Koppers "Super Service Black", or a suitable coal tar epoxy of at least 24-mil thickness. Wet wells shall be properly vented. Pipe and fittings used on vents shall be Ductile Iron in accordance with Section 8.2.2.

Reinforced concrete used in the construction of slabs and other structures related to wet wells shall conform to applicable sections of the NCDOT Standard Specifications for Roads and Structures. Concrete used in structures shall be Class A, 4,000 psi compressive strength, in accordance with Section 900. Reinforcing steel shall conform to ASTM A615 (Grade 60. Steel-mesh reinforcement shall conform to A185. Cover slabs for wet wells and valve vaults shall be specially reinforced at hatch openings.

Mortar shall meet the requirements of ASTM C144 for aggregate and strength. No mortar shall be used which has been mixed longer than forty-five (45) minutes.

8.6.6 Pumps

Pumps shall be as manufactured by Flygt, Hydromatic, or Fairbanks Morse. The pumps shall be suitable for pumping raw, unscreened sewage. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump(s) shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump. A sliding guide bracket shall be an integral part of the pump unit. The entire weight of the pumping unit shall be guided by no less than two (2) guide bars and pressed tightly against the discharge connection elbow with metal-to-metal contact. Sealing of the discharge interface by means of diaphragm, 0-ring, or other devices will not be acceptable. No portion of the pump shall bear directly on the floor of the wetwell. The pump, with its appurtenances and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of sixty-five feet (65').

8.6.7 Pump Construction

Major pump components shall be of gray cast iron, Class 30, with smooth surfaces devoid of blow holes and other irregularities. All exposed nuts and bolts shall be of stainless steel 300 series .

All surfaces coming into contact with sewage other than stainless steel or brass, shall be protected by an approved sewage resistant coating (Tnemec series epoxy or approved equal). All mating surfaces where watertight sealing is required shall be machined and fitted with rubber 0-rings.

Discharge fitting shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. No secondary sealing compounds, rectangular gaskets, elliptical 0-rings, grease or other devices shall be used.

8.6.8 Cable

The cable entry shall be an integral part of the stator casing. As a minimum the cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by washers and a ferrule designed with close tolerance fit against the cable outside diameter and the entry inside diameter, or shall be triple protected with a compression fitting and two epoxy potted areas at the power cord entry to the pump.

8.6.9 Motor

Pump motor shall be squirrel-cage, induction, shell type design, housed in a watertight chamber. The stator winding and stator leads shall be insulated with moisture resistant Class F insulation which will resist a temperature of l55 degrees C (311 F). The stator shall be dipped and baked three (3) times in Class F varnish. The motor shall be designed for continuous duty, capable of sustaining a minimum of ten (10) starts per hour and shall be thermally protected. Motor shall be NEMA design B. Each unit shall be provided with an adequately designed cooling system. Thermal radiators (cooling fins) integral to the stator housing, shall be adequate to provide the cooling required by the motor. Water jackets or other devices shall not be necessary for continuous pumping at sump liquid levels below midpoint of stator housing.

8.6.10 Shaft

The pump shaft shall be of stainless steel 300 or 400 series. The shaft shall be designed with a constant outside diameter for its entire length and without machined shoulders for bearings.

Sleeve spacers between rotor and bearings shall be sufficient to provide shoulder function for the bearings. A surface finish with minimum roughness values of 12 micro-inches shall be required.

8.6.11 Seals

Each pump shall be provided with two separate tandem mechanical rotating shaft seal system. Seals shall run in an oil reservoir. Seal failure sensors shall be included. Lapped seal faces shall be hydrodynamically lubricated at a constant rate. The seal units shall contain one (1) stationary carbon and one (1) positively driven rotating tungsten carbide or ceramic ring. Each interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. Each pump shall be provided with an oil chamber for the shaft sealing system. The oil chamber shall be designed to assure that air is left in the oil chamber, to absorb the expansion of the oil due to temperature variations. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside.

8.6.12 Bearings

The pump shaft shall rotate on two (2) permanently lubricated bearings or continuously lubricated in an oil bath with a minimum B-10 life expectancy rating. The upper bearing shall be a single row ball bearing and the lower bearing a two (2) row angular contact ball bearing.

8.6.13 Impeller

The impeller shall be of gray cast iron, Class 30, dynamically balanced, double shrouded non-clogging design having a long thrulet without acute turns. The impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in normal sewage applications. The impeller shall be of a single or two vane design. The pump manufacturer shall, upon request, furnish mass moment of inertia data for the proposed impeller. The impeller shall be capable of passing a minimum 3" solid sphere. The fit between the impeller and the shaft shall be a sliding fit on a key with a impeller nut which can be tightened and locked down with a set screw or a nylok keeper.

8.6.14 Volute

The volute shall be of single piece design and shall have smooth fluid passages large enough at all points to pass any size solids, which can pass through the impeller.

8.6.15 Wearing Ring

A wearing ring system shall be installed to provide efficient sealing between the volute and impeller. The stationary wear ring shall be made of stainless steel or nitrile rubber. The rotating wear ring shall be made of stainless steel. The wear rings are to be drive fitted to the impeller and volute inlet.

8.6.16 Power Cord

The electrical power cord shall be water resistant, rated 600 volt, 60^{o} C, be UL and CSA approved. Cable sizing shall conform to NEC specifications for pump motors.
The pump motor cable, installed, shall be continuous without splices and shall be suitable for submersible pump application which shall be indicated by a code or legend permanently embossed on the cable.

8.6.17 Guide Bars

Lower guide bar holders shall be integral with discharge connection. Guide bars shall be of at least standard weight galvanized steel pipe. The guide bars shall not support any portion of the weight of the pump.

8.6.18 Controls

For each pump motor, there shall be included: a combination overload breaker, with manual reset for dual protection against current overloads and short-circuit protection, overload relay to be precalibrated to match motor characteristics and factory sealed to insure trip setting is tamper proof; across-the-line magnetic starter and hand/off/automatic selector switch. Soft starts are not acceptable on applications under 25 horsepower. Variable frequency drives may be required on certain applications as deemed necessary by the Commission.

A twenty-four (24) volt control circuit transformer with disconnect circuit breaker and overload protection shall be included with an automatic, electric alternator for a duplex station (providing alternating operation of pumps under normal conditions, or in cases of high level, allowing both pumps to operate simultaneously). A terminal board for connection of level sensors shall be provided. All items inside or on the panel shall be adequately labeled. Provisions shall be made to provide the following signals to an autodialer:

(1) Wet well high water alarm
(2) Phase failure or unbalance
(3) Pump motor overload 1 & 2
(4) Pump seal failure 1 & 2
(5) Pump runtime status 1 & 2
(6) Entry alarm

The following items shall be provided with the panel:

(1) NEMA 4 watertight, lockable enclosure with swing out panel allowing access to terminal board.
(2) High Level Alarm
    (a) Alarm light with cage protector
    (b) Alarm bell
    (c) Panel powered contact
    (d) Unpowered contact
(3) Condensation heater
(4) Running time meter(s)
(5) Pump run light(s)
(6) Lightning arrestor
(7) Pedestal mounting
(8) Pole mounting bracket
(9) 110V GFI protected duplex receptacle - minimum 25A rating
(10) Autodialer (Raco Verbatim) Series VSS eight channel minimum capable of tracking run time, Royce eight channel minimum capable of tracking run time or as approved by GUC.

8.6.19 Liquid Level Sensors

Level sensors shall be mercury switches encapsulated in a buoyant waterproof housing with a two (2) conductor, 16 AWA, Type SJO cable. A chain and anchor assembly of noncorrosive materials shall be provided.

8.6.20 Piping and Valves

Discharge piping shall be ductile iron pipe meeting the requirements of Section 7.2.4 of the Manual. Fittings for discharge piping shall comply with all applicable provisions of ANSI 21.10 and have a cement-mortar lining in accordance with ANSI 21.4. Joints for discharge piping shall be flanged and shall comply with ANSI B16.1. Discharge piping shall include swing check valve(s) of the outside lever and spring type, eccentric plug valves(s) or gate valve(s) and all necessary fittings and tees. Where piping passes through a wall, nonshrink grout or other approved means shall be used to make a watertight joint.

8.6.21 Access Hatches

Access hatches, hinged and lockable, shall be provided for wet well and valve vault. The frames shall be a continuous aluminum or stainless steel frame, with a continuous concrete anchor. The doors shall be ¼" thick aluminum diamond plate. The doors shall be lift assisted and shall open to 90 degrees and lock automatically in that position. All hardware and hinges shall be stainless steel. Access door shall have a minimum live load capacity of 300 lbs. per SF. Access hatches shall be as manufactured by Bilco, U.S. Foundry, Halliday Products or approved equal. Hatches shall be provided with factory installed padlock hasps.

8.6.21.1 Safety Net

Pump access hatches shall be provided with a rail mounted safety net system for fall through protection. The safety net shall be designed to slide on guide rails to facilitate entry and repositioning. Slide rails and hooks shall be constructed of aluminum with stainless steel corner hooks and eyebolts. Netting material shall be polyester. The safety net system shall be Hatch Net as manufactured by Safe Approach, Inc., or approved equal.

8.6.22 Screening Basket

When required by the Commission, pump stations will be provided with one (1) type 304 stainless steel or basket of a design approved by the Commission.

The basket shall be tract mounted and retrievable from a dedicated access hatch conforming to Section 8.6.21 of this Manual.

8.6.23 Emergency Transfer Switch

Provide at the electrical service entrance a power supply transfer switch for portable generator hookup. Switch unit shall have a watertight, NEMA 4 enclosure and shall be sized to carry the maximum station load. Connection shall be Crouse Hinds, Appleton or approved equal and shall be compatible with the Commission's existing emergency generator connection.

8.6.24 Odor Control

The need for odor control shall be evaluated and the provisions for such, if required, approved by the Commission.

APPENDIX A

RESIDENTIAL PEAK USER DEMAND

This Appendix contains excerpts from the North Carolina Administrative Code, Title 15A, Subchapter 18C, Section .0802, Parts (a) and (b). The guidelines contained herein shall be used to determine the peak user demand for all developments covered under Section 3.3.5.3 of the Manual.

SECTION .0800 - HYDROPNEUMATIC STORAGE TANKS

Rules .0801 - .0805 of Title 15A Subchapter 18C of the North Carolina Administrative Code (T15A.18C .0801 - .0805); has been transferred and recodified from Rules .2001 - .2005 Title 10 Subchapter 10D of the North Carolina Administrative Code (T10.10D .2001 - .2005), effective April 4, 1990.

.0801 CAPACITIES: DETERMINING MINIMUM EFFECTIVE VOLUME

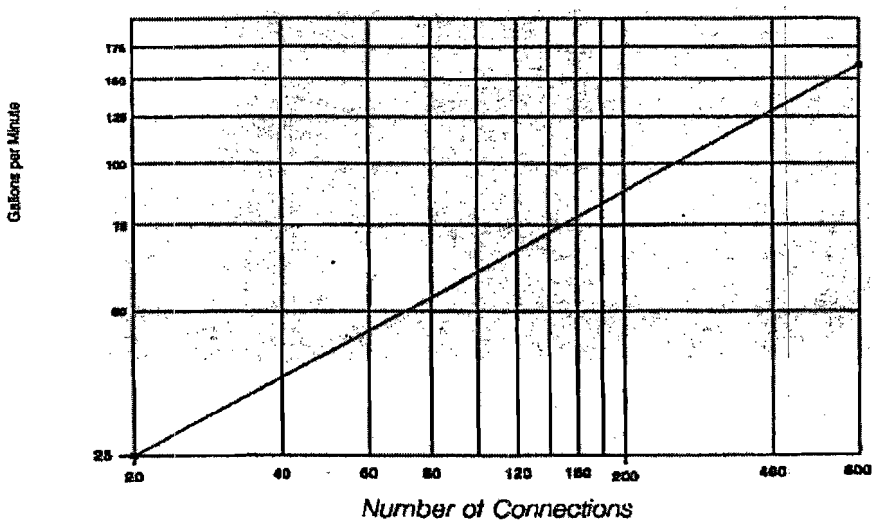
The minimum effective volume of pressure tanks, in gallons, shall equal the peak demand, in gallons per minute, minus the pumping capacity (gpm), multiplied by 20.

History Note: Statutory Authority G.S. 130A-315; 130A-317; P.L. 93-523;
Eff. January 1, 1977;
Readopted Eff. December 5, 1977.

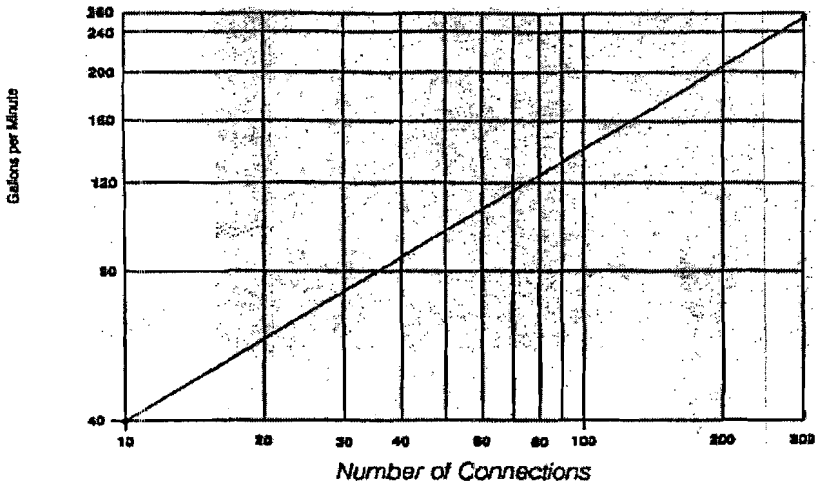
.0802 CAPACITIES: DETERMINING PEAK DEMAND

(a) The following charts shall be used to determine the peak demand for residential communities, and mobile home parks, and campgrounds:

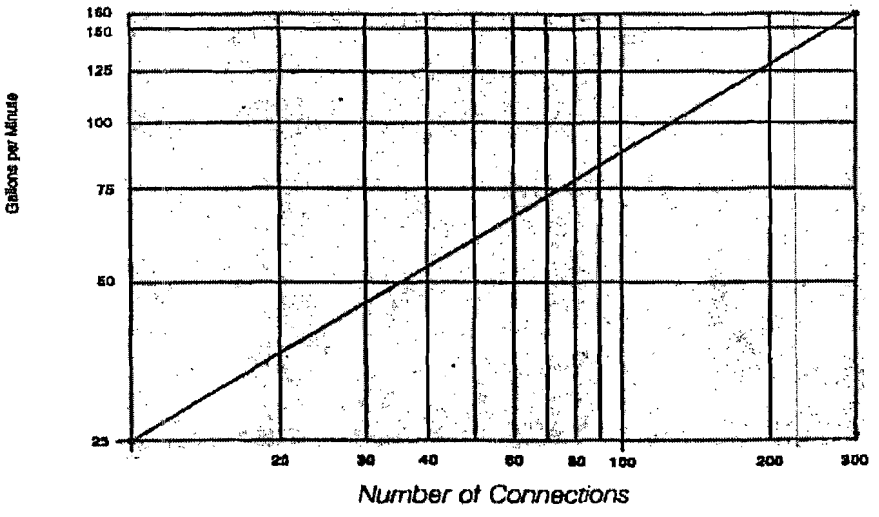
PEAK DEMAND FOR CAMPGROUND AND TRAVEL TRAILER WATER SYSTEMS
(Number of Connections vs Gallons per Minute)



PEAK DEMAND FOR RESIDENTIAL COMMUNITY WATER SYSTEMS
(Number of Connections vs Gallons per Minute)



PEAK DEMAND FOR MOBILE HOME PARK WATER SYSTEMS
(Number of Connections vs Gallons per Minute)



(b) The peak demand for non-transient, non-community water systems shall be determined based on the total demand weight of fixtures in accordance with the procedures of the North Carolina State Building Code, Volume II, Plumbing Section which are hereby incorporated by reference including any subsequent amendments and editions. This material is available for inspection at the Department of Environment, Health, and Natural Resources, Division of Environmental Health, 1330 Saint Mary's Street, Raleigh, North Carolina. Copies may be obtained from the North Carolina Department of

Insurance, Engineering Division, 410 North Boylan Avenue, Raleigh, North Carolina at a cost of forty-five dollars ($45.00) per copy.

History Note: Statutory Authority G.S. 130A-315; 130A-317; P.L. 93-523;
Eff. January 1, 1977;
Readopted Eff. December 5, 1977;
Amended Eff. July 1, 1994; June 30, 1980.

.0803 CAPACITIES: DETERMINING TOTAL VOLUME

The total volume of a pressure tank shall be calculated by using the principle of Boyle's Law. The total volume (gallons) shall be not less than 25 times the number of connections or 500 gallons, whichever is greater for a mobile home park. In the case of a residential community (community water system) the total volume shall not be less than 40 times the number of connections or 500 gallons, whichever is greater. In the case of campgrounds, the total volume shall not be less than 10 times the number of connections or 500 gallons, whichever is greater.

History Note: Statutory Authority G.S. 130A-315; 130A-317; P.L. 93-523;
Eff. January 1, 1977;
Readopted Eff. December 5, 1977;
Amended Eff. July 1, 1994; March 31, 1980.

.0804 CAPACITIES: GROUND STORAGE PLUS HYDROPNEUMATIC TANKS

When ground level storage tanks and high-service pumps are to be used, hydropneumatic tanks shall be sized in relation to peak demand and the high-service pump capacity

History Note: Statutory Authority G.S. 130A-315; 130A-317; P.L. 93-523;
Eff. January 1, 1977;
Readopted Eff. December 5, 1977;
Amended Eff. July 1, 1994.

.0805 CAPACITIES: ELEVATED STORAGE

(a) Where feasible, elevated storage capacity shall meet the requirements of Fire Insurance Rating Bureau the Fire Suppression Rating Schedule which are hereby incorporated by reference including any subsequent amendments and editions. This material is available for inspection at the Department of Environment, Health, and Natural Resources, Division of Environmental Health, 1330 St. Mary's Street, Raleigh, North Carolina. Copies may be obtained from ISO Commercial Risk Services, Incorporated, Accounting Division, 7 World Trade Center, New York, New York 10048 at a cost of forty dollars ($40.00) per copy.

(b) The elevated storage for a municipality shall be sufficient to minimize the effect of fluctuating demand plus provide a reserve for fire protection, but not be less than 75,000 gallons in capacity.

(c) The combined elevated and ground storage of the finished water for community and non-transient, non-community water systems shall be a minimum of one-half day's supply of the average annual daily demand.

History Note: Statutory Authority G.S. 130A-315; 130A-317; P.L. 93-523;
Eff. January 1, 1978;
Amended Eff. July 1, 1994.

APPENDIX B

FIRE FLOW REQUIREMENTS & FIRE HYDRANT DISTRIBUTION

This Appendix contains Appendix B of the North Carolina Fire Code, "Fire Flow Requirements for Buildings" and Appendix C of the North Carolina Fire Code, "Fire Hydrant Locations and Distribution". The guidelines contained herein shall be used to determine fire hydrant distribution and fire flows for all developments covered under Sections 3.2.6.10 and 3.3.5.3 of the Manual.

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION B101
GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102
DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m^2), used to determine the required fire flow.

SECTION B103
MODIFICATIONS

B103.1 Decreases. The fire chief is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire chief is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the fire code official is authorized to utilize NFPA 1142.

SECTION B104
FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the exterior walls, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings which are separated by fire walls without openings, constructed in accordance with the *International Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105
FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings. The minimum fire-flow requirements for one- and two-family dwellings having a fire-flow calculation area which does not exceed 3,600 square feet (344.5 m^2) shall be 1,000 gallons per minute (3785.4 L/min). Fire flow and flow duration for dwellings having a fire-flow calculation area in excess of 3,600 square feet (344.5 m^2) shall not be less than that specified in Table B105.1.

Exception: A reduction in required fire flow of 50 percent, as approved, is allowed when the building is provided with an approved automatic sprinkler system.

B105.2 Buildings other than one- and two-family dwellings. The minimum fire flow and flow duration for buildings other than one- and two-family dwellings shall be as specified in Table B105.1.

Exception: A reduction in required fire flow of up to 50 percent, as approved, is allowed when the building is provided with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 of the *International Fire Code*. Where buildings are also of Type I or II construction and are a light-hazard occupancy as defined by NFPA 13, the reduction may be up to 75 percent. The resulting fire flow shall not be less than 1,500 gallons per minute (5678 l/min) for the prescribed duration as specified in Table B 105.1.

SECTION B106
REFERENCED STANDARDS

ICC	IBC	International Building Code	B104.2, Table B105.1
ICC	IFC	International Fire Code	B105.2
ICC	IUWIC	International Urban-Wildland Interface Code	B103.3
NFPA	1142	Standard on Water Supplies for Suburban and Rural Fire Fighting	B103.3

TABLE B105.1
MINIMUM REQUIRED FIRE FLOW AND FLOW DURATION FOR BUILDINGS[a]

FIRE-FLOW CALCULATION AREA (square feet)					FIRE FLOW (gallons per minute)[c]	FLOW DURATION (hours)
Type IA and IB[b]	Type IIA and IIIA[b]	Type IV and V-A[b]	Type IIB and IIIB[b]	Type V-B[b]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. The minimum required fire flow shall be allowed to be reduced by 25 percent for Group R.

b. Types of construction are based on the *International Building Code*.

c. Measured at 20 psi.

APPENDIX C

FIRE HYDRANT LOCATIONS AND DISTRIBUTION

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION C101 GENERAL

C101.1 Scope. Fire hydrants shall be provided in accordance with this appendix for the protection of buildings, or portions of buildings, hereafter constructed.

SECTION C102 LOCATION

C102.1 Fire hydrant locations. Fire hydrants shall be provided along required fire apparatus access roads and adjacent public streets.

SECTION C103 NUMBER OF FIRE HYDRANTS

C103.1 Fire hydrants available. The minimum number of fire hydrants available to a building shall not be less than that listed in Table C105.1. The number of fire hydrants available to a complex or subdivision shall not be less than that determined by spacing requirements listed in Table C105.1 when applied to fire apparatus access roads and perimeter public streets from which fire operations could he conducted.

SECTION C104 CONSIDERATION OF EXISTING FIRE HYDRANTS

C104.1 Existing fire hydrants. Existing fire hydrants on public streets are allowed to be considered as available. Existing fire hydrants on adjacent properties shall not be considered available unless fire apparatus access roads extend between properties and easements are established to prevent obstruction of such roads.

SECTION C105 DISTRIBUTION OF FIRE HYDRANTS

C105.1 Hydrant spacing. The average spacing between fire hydrants shall not exceed that listed in Table C105.1.

Exception: The fire chief is authorized to accept a deficiency of up to 10 percent where existing fire hydrants provide all or a portion of the required fire hydrant service.

Regardless of the average spacing, fire hydrants shall be located such that all points on streets and access roads adjacent to a building are within the distances listed in Table C105.1.

TABLE C105.1
NUMBER AND DISTRIBUTION OF FIRE HYDRANTS

FIRE-FLOW REQUIREMENT (gpm)	MINIMUM NUMBER OF HYDRANTS	AVERAGE SPACING BETWEEN HYDRANTS[a, b, c] (feet)	MAXIMUM DISTANCE FROM ANY POINT ON STREET OR ROAD FRONTAGE TO A HYDRANT[d]
1,750 or less	1	500	250
2,000-2,250	2	450	225
2,500	3	450	225
3,000	3	400	225
3,500-4,000	4	350	210
4,500-5,000	5	300	180
5,500	6	300	180
6,000	6	300	150
6,500-7,000	7	250	150
7,500 or more	8 or more[e]	200	120

N/A

*Refer to GUC Manual Section 3.2.6 for Fire Hydrant Spacing

For SI: 1 foot = 304.8 mm, 1 gallon per minute = 3.785 L/m.

a. Reduce by 100 feet for dead-end streets or roads.

b. Where streets are provided with median dividers which can be crossed by fire fighters pulling hose lines, or where arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 feet on each side of the street and be arranged on an alternating basis up to a fire-flow requirement of 7,000 gallons per minute and 400 feet for higher fire-flow requirements.

c. Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards.

d. Reduce by 50 feet for dead-end streets or roads.

e. One hydrant for each 1,000 gallons per minute or fraction thereof.

APPENDIX C

SAMPLE "NONDISCHARGE PERMIT" APPLICATION

This Appendix contains sample "Nondischarge Permit" Applications. One original and the specified number of completed copies of the appropriate application form must be submitted with all wastewater system extension plans as required by Section 5.4.2 of the Manual. Additional blank copies of the forms are available from the DENR, Division of Environmental Management, Raleigh, North Carolina.

Please note that Greenville Utilities' requirements for copies of the application form, plans and specifications may differ from the DENR instructions.

Also note that form FTA 12/07 begins on page C-1 and form PSFMGSA 12/07 begins on page C-3.

State of North Carolina
Department of Environment and Natural Resources
Division of Water Quality

FAST-TRACK APPLICATION

(FTA 12/07_ver2)

for GRAVITY SEWERS, PUMP STATIONS, AND FORCE MAINS

(Pressure & Vacuum sewer systems are not to be included as part of this application package)

INSTRUCTIONS: Indicate that you have included/addressed the following list of required application package items by checking the space provided next to each applicable item. Failure to submit all required items will lead to your application being returned as incomplete. *Forms are available from the web site or by calling the Regional Office serving your county: http://h2o.enr.state.nc.us/percs/Collection%20Systems/CollectionSystemApplications.html*

☐ **A. Application Form** - Submit one original and one copy of the completed and appropriately executed application form. The application should include a project narrative describing the final build-out design (i.e. system and/or pump station to ultimately serve 500 homes, but flow for only 100 homes being requested now). For modifications, clearly explain the reason for the modification (i.e. adding another phase, changing line size/length, etc.). Only include the modified information in this permit application - do not duplicate project information that has already been included in the original permit.

Any changes to this form will result in the application being returned. The Division of Water Quality (Division) will only accept application packages that have been fully completed with all applicable items addressed. You do not need to submit detailed plans and specifications unless you respond NO to Item B(13).

Separate applications should be made for non-contiguous sewer systems.

☐ **B. Application Fee** - Submit a check in the amount of $480 made payable to: North Carolina Department of Environment and Natural Resources (NCDENR). Checks shall be dated within 90 days of application submittal.

☐ **C. Certificates of Public Convenience and Necessity** – If the application is being submitted in the name of a privately-owned public utility, submit two copies of the Certificate of Public Convenience and Necessity (CPCN) which demonstrates that the public utility is authorized to hold the utility franchise for the area to be served by the sewer extension. If a CPCN has not been issued, provide two copies of a letter from the North Carolina Utilities Commission's Public Staff that states that an application for a franchise has been received, that the service area is contiguous to an existing franchised area, and/or that franchise approval is expected. The project name in the CPCN or letter must match that provided in Item A(2)a of this application.

☐ **D. Operational Agreements** – Submit one original and two copies of a properly executed operational agreement, as per 15A NCAC 02T .0115, if the application is submitted by a private applicant and will be serving residential or commercial lots (e.g., houses, condominiums, townhomes, outparcels, etc.) that will be sold to another entity. If the applicant is a home or property owner's association, use Form HOA 02/03. If the applicant is a developer, use Form DEV 02/03. EVEN IF THE PROJECT MAY BE TURNED OVER TO A MUNICIPALITY UPON COMPLETION, FORM DEV 02/03 IS REQUIRED.

☐ **E. Downstream Sewer, WWTF Capacity and Flow Tracking/Acceptance** – FORM FTSE 10/07 (Flow Tracking/Acceptance for Sewer Extension Permit Applications) is required with every application. The applicant (and owners of downstream sewers, pump stations and/or treatment facilities submitting FORM FTSE-10/07) certifies that, to the best of their knowledge, the addition of the volume of wastewater to be permitted in this project has been evaluated along the route to the receiving treatment plant, and that the flow from this project will not cause capacity related sanitary sewer overflows or overburden any downstream pump station en route to the receiving wastewater treatment plant. Where the applicant is not the owner of the downstream sewer, submit two copies of FORM FTSE 10/07 from the owner of the downstream sewer **and** owner of the WWTF, if different. The flow acceptance indicated in FORM FTSE-10/07 must not expire prior to permit issuance and must be dated less than one year prior to the application date. **Submittal of this application and FORM FTSE-10/07 indicates that owner has adequate capacity and will not violate G.S. 143-215.67(a).** Intergovernmental agreements or other contracts will not be accepted in lieu of project-specific FTSE 10/07.

☐ **F Map** – Submit an 8.5-inch by 11-inch **COLOR** copy of a USGS Topographic Map of sufficient scale to identify the entire project area and the closest surface waters. Each map or maps must show the location of the sewer line and pump stations and be of reproducible quality. Include a street level map showing the downstream connection point, and the permit number for the downstream sewer, if known.

☐ **G. Stream Classifications – Watershed Classification Attachment (Form WACAS-12/07)** If any portion of the project boundary is within 100 feet of any surface water or wetlands, the Watershed Classification Attachment must be completed.

☐ **H Environmental Assessments – If this project is subject to an Environmental Assessment (EA) [15A NCAC 01C], this application cannot be used.** Send the project application on the most current version of Form PSFMGSA to the Design Management Unit, 1633 Mail Service Center, Raleigh, NC 27699-1633. Applications cannot be accepted until a Finding of No Significant Impact (FONSI) or Environmental Impact Statement (EIS) has been issued. A copy is to be submitted with that permit application.

☐ **I. Flow Direction** – Many wastewater treatment systems are entering into agreements for regionalization efforts and emergency treatment capacity. Parts of the system are installed so that the wastewater flow can be directed to more than one treatment facility. If this is the case with this project, please indicate in B(12) and give the permit number of the second treatment facility.

☐ **J. Certifications – Section C**
The application must be certified by both the applicant and the design engineer who is a North Carolina Registered Professional Engineer (PE). The applicant signature must match the signing official listed in Item A(1b). The PE should **NOT** certify the application if he/she is unfamiliar with 15A NCAC Chapter 2T, the Gravity Sewer Minimum Design Criteria (most recent version) and the Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains (most recent version), as applicable to the project.

THE COMPLETED FTA 12/07 APPLICATION PACKAGE, INCLUDING ALL SUPPORTING DOCUMENTS AND $480 FEE, SHOULD BE SENT TO THE APPROPRIATE REGIONAL OFFICE:

REGIONAL OFFICE	ADDRESS	COUNTIES SERVED
Asheville Regional Office	2090 US Highway 70 Swannanoa, North Carolina 28778 (828) 296-4500 (828) 299-7043 Fax	Avery, Buncombe, Burke, Caldwell, Cherokee, Clay, Graham, Haywood, Henderson, Jackson, Macon, Madison, McDowell, Mitchell, Polk, Rutherford, Swain, Transylvania, Yancey
Fayetteville Regional Office	225 Green Street Suite 714 Fayetteville, North Carolina 28301-5094 (910) 433-3300 (910) 486-0707 Fax	Anson, Bladen, Cumberland, Harnett, Hoke, Montgomery, Moore, Robeson, Richmond, Sampson, Scotland
Mooresville Regional Office	610 E. Center Avenue Mooresville, North Carolina 28115 (704) 663-1699 (704) 663-6040 Fax	Alexander, Cabarrus, Catawba, Cleveland, Gaston, Iredell, Lincoln, Mecklenburg, Rowan, Stanly, Union
Raleigh Regional Office	1628 Mail Service Center Raleigh, North Carolina 27699-1628 (919) 791-4200 (919) 788-7159 Fax	Chatham, Durham, Edgecombe, Franklin, Granville, Halifax, Johnston, Lee, Nash, Northampton, Orange, Person, Vance, Wake, Warren, Wilson
Washington Regional Office	943 Washington Square Mall Washington, North Carolina 27889 (252) 946-6481 (252) 975-3716 Fax	Beaufort, Bertie, Camden, Chowan, Craven, Currituck, Dare, Gates, Greene, Hertford, Hyde, Jones, Lenoir, Martin, Pamlico, Pasquotank, Perquimans, Pitt, Tyrrell, Washington, Wayne
Wilmington Regional Office	127 Cardinal Drive Extension Wilmington, North Carolina 28405 (910) 796-7215 (910) 350-2004 Fax	Brunswick, Carteret, Columbus, Duplin, New Hanover, Onslow, Pender
Winston-Salem Regional Office	585 Waughtown Street Winston-Salem, North Carolina 27107 (336) 771-5000 (336) 771-4630 Fax	Alamance, Alleghany, Ashe, Caswell, Davidson, Davie, Forsyth, Guilford, Rockingham, Randolph, Stokes, Surry, Watauga, Wilkes, Yadkin

For more information, please visit our web site at: http://h2o.enr.state.nc.us/percs/ or contact the Regional Office serving your county.

USE THE TAB KEY TO MOVE FROM FIELD TO FIELD!

Application Number:
(to be completed by DWQ)

A. APPLICATION INFORMATION

1. **Owner/Permittee:**

1a. Greenville Utilities Commission
Full Legal Name (company, municipality, HOA, utility, etc.)

1b. Clifton H. Cahoon, PE, Construction/Contracts Engineer
Signing Official Name and Title (Please review 15A NCAC 2T .0106 (b) for authorized signing officials!)

1c. The legal entity who will own this system is:
☐ Individual ☐ Federal ☐ Municipality ☐ State/County ☐ Private Partnership ☐ Corporation ☐ Other (specify):

1d. PO Box 1847 — Mailing Address
1e. Greenville — City
1f. North Carolina — State
1g. 27835 — Zip Code
1h. 252-551-3386 — Telephone
1i. 252-551-1598 — Facsimile
1j. cahoonch@guc.com — E-mail

2. ***Project (Facility) Information:***

2a. _____ — Brief Project Name (permit will refer to this name)
2b. Pitt — County Where Project is Located

3. ***Contact Person:***

3a. _____
Name and Affiliation of Someone Who Can Answer Questions About this Application

3b. _____ — Phone Number
3c. _____ — E-mail

B. PERMIT INFORMATION

1. Project is ☐ New ☐ Modification (of an existing permit) If Modification, Permit No.:

2. Owner is ☐ Public (*skip to Item B(3)*) ☐ Private (*go to Item 2(a)*)

2a. If private, applicant will be:
☐ Retaining Ownership (i.e. store, church, single office, etc.) **or**
☐ Leasing units (lots, townhomes, etc. - ***skip to Item B(3)***)
☐ Selling units (lots, townhomes, etc. - ***go to Item B(2b)***)

2b. If sold, facilities owned by a (must choose one)
☐ Public Utility **(Instruction C)**
☐ Homeowner Assoc./Developer **(Instruction D)**

3. Greenville Utilities Commission
Owner of Wastewater Treatment Facility (WWTF) Treating Wastewater From This Project

4a. Greenville Utilities Commission — Name of WWTF
4b. NC0023931 — WWTF Permit No.

5a. Greenville Utilities Com. — Owner of Downstream Sewer
5b. _____ — Receiving Sewer Size
☐ Gravity ☐ Force Main
5c. _____ — Permit # of Downstream Sewer **(Instruction E)**

6. The origin of this wastewater is (check all that apply):

☐ Residential Subdivision
☐ Apartments/Condominiums
☐ Mobile Home Park
☐ School
☐ Restaurant
☐ Office

☐ Retail (Stores, shopping centers)
☐ Institution
☐ Hospital
☐ Church
☐ Nursing Home
☐ Other (specify):_____

_____% Domestic/Commercial
_____ % Industrial (attach description.)
(RO: contact your Regional Office Pretreatment staff)
_____ % Other (specify):

7. Volume of wastewater to be allocated or permitted for this particular project: _____ gallons per day
***Do not include future flows or previously permitted allocations**

8. If the permitted flow is zero, indicate why:

☐ Pump Station, Outfall or Interceptor Line where flow will be permitted in subsequent permits that connect to this line
☐ Flow has already been allocated in Permit No. _____
☐ Rehabilitation or replacement of existing sewer with no new flow expected (see 15A NCAC 02T .0303 to determine if a permit is required)

B. PERMIT INFORMATION (CONTINUED)

9. Provide the wastewater flow calculations used in determining the permitted flow in accordance with 15A NCAC 2T .0114 for the value in Item B(7) **AND/OR** the design flow for line or pump station sizing if a reduced or zero flow is being requested in Item B(7). Values other than that in 15A NCAC 2T .0114 (b) and (c) must be supported with actual water or wastewater use data in accordance with 15A NCAC 2T .0114 (f).

10. Summary of **Sewer Lines** to be Permitted (attach additional sheets if necessary)

Size (inches)	Length (feet)	New Gravity or Additional Force Main

11. Summary of **Pump Stations w/ associated Force Mains** to be Permitted (attach additional sheets as necessary)

Pump Station Location ID ______________________________ (self chosen - as shown on plans/map for reference)

Design Flow (MGD)	Operational Point GPM @TDH	Power Reliability Option 1 - permanent generator w/ATS; 2 - portable generator w/MTS	Force Main Size	Force Main Length

Pump Station Location ID______________________________ (self chosen - as shown on plans/map for reference)

Design Flow (MGD)	Operational Point GPM @TDH	Power Reliability Option 1 - permanent generator w/ATS; 2 - portable generator w/MTS	Force Main Size	Force Main Length

Pump Station Location ID______________________________ (self chosen - as shown on plans/map for reference)

Design Flow (MGD)	Operational Point GPM @TDH	Power Reliability Option 1 - permanent generator w/ATS; 2 - portable generator w/MTS	Force Main Size	Force Main Length

12. Will the wastewater flow in the proposed sewer lines or pump stations be able to be directed to another treatment facility?

☐ Yes ☐ No   If Yes, permit number of 2nd treatment facility ______________________

(RO – if "yes" to B,12 please contact the Central Office PERCS Unit)

13. Does the sewer system comply with the Minimum Design Criteria for the Fast Track Permitting of Pump Stations and Force Mains (latest version), the Gravity Sewer Minimum Design Criteria (latest version) and 15A NCAC Chapter 2T as applicable?

☐ Yes ☐ No   **If No, please reference the pertinent minimum design criteria or regulation and indicate why a variance is requested. SUBMIT TWO COPIES OF PLANS, SPECIFICATIONS OR CALCULATIONS PERTINENT TO THE VARIANCE WITH YOUR APPLICATION**

14. Have the following permits/certifications been submitted for approval for the system or project to be served?

Wetland/Stream Crossings - General Permit or 401Certification? ☐ Yes ☐ No ☐ N/A

Sedimentation and Erosion Control Plan? ☐ Yes ☐ No ☐ N/A

Stormwater? ☐ Yes ☐ No ☐ N/A

15. Does this project include any high priority lines, [see 15A NCAC 02T .0402 (2)] involve aerial lines, siphons, or interference manholes)? **These lines will be considered high priority and must be checked once every six months**

Check if Yes: ☐ and provide details

C. CERTIFICATIONS

1. Owner/Permittee's Certification: **(Signature of Signing Official and Project Name)**

I, Clifton H. Cahoon, attest that this application for_____ has been reviewed by me and is accurate and complete to the best of my knowledge. I understand that if all required parts of this application are not completed and that if all required supporting documentation and attachments are not included, this application package is subject to being returned as incomplete. Note: In accordance with North Carolina General Statutes 143-215.6A and 143-215.6B, any person who knowingly makes any false statement, representation, or certification in any application shall be guilty of a Class 2 misdemeanor, which may include a fine not to exceed $10,000 as well as civil penalties up to $25,000 per violation.

1a. _____

Signing Official Signature Date

ENGINEERING DESIGN DOCUMENTS MUST BE COMPLETED PRIOR TO SUBMITTAL OF THIS APPLICATION. THESE DOCUMENTS MUST INCLUDE PLAN AND PROFILE OF SEWERS, THEIR PROXIMITY TO OTHER UTILITIES, DESIGN CALCULATIONS. ETC. REFER TO 15A NCAC 02T .0305

2. Professional Engineer's Certification: **(Signature of Design Engineer and Project Name)**

I, _____, attest that this application for _____ has been reviewed by me and is accurate, complete and consistent with the information in the engineering plans, calculations, and all other supporting documentation to the best of my knowledge. I further attest that to the best of my knowledge the proposed design has been prepared in accordance with the applicable regulations, Gravity Sewer Minimum Design Criteria for Gravity Sewers adopted February 12, 1996, and the Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains adopted June 1, 2000 and the watershed classification in accordance with Division guidance. Although other professionals may have developed certain portions of this submittal package, inclusion of these materials under my signature and seal signifies that I have reviewed this material and have judged it to be consistent with the proposed design. Note: In accordance with NC General Statutes 143-215.6A and 143-215.6B, any person who knowingly makes any false statement, representation, or certification in any application shall be guilty of a Class 2 misdemeanor which may include a fine not to exceed $10,000 as well as civil penalties up to $25,000 per violation.

2a. _____

Professional Engineer Name

2b. _____

Engineering Firm

2c. _____

Mailing Address

2d. _____ 2e. _____ 2f. _____

City State Zip

2g. _____ 2h. _____ 2i. _____

Telephone Facsimile E-mail

NC PE Seal, Signature & Date

APPENDIX D

SAMPLE DIVISION OF HEALTH SERVICES APPLICATION

This Appendix contains sample forms of the NCDEH "Application for Approval of Plans and Specifications for Water Supply Systems". Three (3) completed copies of this application form must be submitted with all water system extension plans as required by Section 5.3.4.1 of the Manual. Additional blank copies of the forms are available from the NCDEH, Public Water Supply Section, Raleigh, North Carolina.

North Carolina Department of Environment
And Natural Resources
Division of Environmental Health
Public Water Supply Section

Application for Approval of Engineering Plans and Specifications For Water Supply Systems

Instructions & Checklist: To apply for approval for plans and specifications, submit the following materials & information:

Project Name: _____
(This is the name to appear on Public Water Supply records and tracking system)

Attached are three copies of each of the following items:

- ☐ This completed "Application for Approval…;"
- ☐ The plan drawings;
- ☐ The Engineering Report (ER) addressing each of the items listed in 15A NCAC 18C .0307(b), including the design basis of the project.[15A NCAC 18C .0307(b)(12)]

One of the following:

- ☐ The project will use the following system's previously approved standard specifications:

  Name of System: Greenville Utilities Commission

  PWS Approval Number & Date: 89-6971-R November 29, 2000

OR

- ☐ Attached are three copies of the specifications.

One of the following:

- ☐ The applicant is the Public Water System;

OR

- ☐ Attached is a letter from the Owner of the Public Water System agreeing to serve the project and stating that the system has adequate supply.

Note the following:

- ☐ Beginning January 1, 2007, attached is a check for the proper plan review fee amount, in accordance with NCGS 130A-328. See note 4 on page 4.

Date _____ Serial No. _____
(for DENR use only) (for DENR use only)

To: Division of Environmental Health,
Department of Environment and Natural Resources

The Board of Commissioners
(name of board, or council, authorized official and title, or owner)

of Greenville Utilities Commission
(name of city, town, corporation, sanitary district, water company or other)

in the County of Pitt , State of North Carolina authorized by law to act for the said

Greenville Utilities Commission
(name of city, town, corporation, sanitary district, water company or other)

and to expend its funds for the water project described below, herewith submit for the counsel and advice of the Division of Environmental Health plans and specifications prepared by _____
(engineer or firm)

_____ _____
(Phone Number of Engineer – optional for faster contact) (Email Address of Engineer – optional for faster contact)

of _____ for the installation or construction of
(address of engineer)

_____ ,
(description of project)

_____
(location of project)

in _____ County, and make application to the Division of Environmental Health for the approval of said plans and specifications as related to public health and protection of public water supplies and public water systems.

These plans have been approved and accepted by the applicant.

This application is made under and in full accord with the provision of NCGS 130A-317, and such other statutes as related to public water systems. The applicant agrees that no change or deviation from the engineering plans and specifications approved by the Division of Environmental Health will be made except as allowed by 15A NCAC 18C .0306 or with the written consent and approval of the Division of Environmental Health or its authorized representative. The applicant agrees that a professional engineer licensed to practice in the State of North Carolina shall submit a statement reflecting that adequate observations during and upon completion of construction, by the engineer or by a representative of the engineer's office who is under the engineer's supervision, indicates that construction was completed in accordance with approved plans and specifications.

Remarks: _____

_____ PO Box 1847
(Signature of Owner, Manager, Mayor or Chairman) (Street or Box Number)

Clifton H. Cahoon, Const/Cont. Eng. Greenville, NC 27835-1847
(Type Name Signed Above) (City, State, Zip Code)

252-551-3386 cahoonch@guc.com
(Phone Number – optional for faster contact) (Email Address – optional for faster contact)

Status of Water System Management Plan (WSMP)
Check one of the following, and if applicable, provide the required information:

☐ The WSMP for the project, as defined in the attached engineering plans and specifications, is submitted with this application.

☐ The WSMP that includes this project, as defined in the attached engineering plans and specifications, was previously submitted.

Provide the following:

Water System Name: Greenville Utilities Commission

Owner Name: Greenville Utilities Commission

PWS I.D. No.: 04-74-010

WSMP No.: 00-01453

WSMP Submittal Date: 6/2/2000

County: Pitt

By my signature below, I certify that the previously submitted WSMP contains the information required by 15A NCAC 18C .0307(c) for the project defined in the attached engineering plans and specifications.

NAME: Clifton H. Cahoon
(Type or Print Name)

SIGNATURE: _____ DATE: _____
(Owner, Manager, Mayor or Chairman)

☐ The WSMP for the project, as defined in the attached engineering plans and specifications, has not been submitted.

Note: When the WSMP is submitted, the applicant must clearly identify the previously submitted project engineering plans and specifications for which the WSMP was prepared.

Status of Engineer's Report
Check one of the following, and if applicable, provide the required information.

☐ The Engineer's Report for the project, as defined in the attached engineering plans and specifications, is submitted with this application.

☐ The Engineer's Report that includes this project, as defined in the attached engineering plans and specifications, was previously submitted.

Provide the following:

Water System Name: _____

Owner Name: _____

PWS I.D. No.: _____

Engineer's Report No.: _____

Engineer's Report Title: _____

Engineer's Report Submittal Date: _____

County: _____

Note: If the previously submitted Engineer's Report covered multiple projects, then attach to this Application, a letter from the engineer stating that the previously submitted Engineer's Report contains the information required by 15A NCAC 18C .0307(b) for the project defined in the attached engineering plans and specifications.

****

In accordance with NCGS 130A-328, there will be a fee charged for plan review by the NC DENR Public Water Supply Section. **Any documents submitted for review on or after January 1, 2007 must be accompanied by a check payable to *DENR-Public Water Supply Section* before the review will begin.**

** There is a $25 fee for returned checks **

The charges for review of plans are shown below. Check one of the following.

Distribution System fees		
☐	Construction of water lines, less than 5000 linear feet	**$150**
☐	Construction of water lines, 5000 linear feet or more	**$200**
☐	Other construction or alteration to a distribution system	**$ 75**
Ground Water System fees		
☐	Construction of a new ground water system or adding a new well	**$200**
☐	Alteration to an existing ground water system	**$100**
Surface water system fees		
☐	Construction of a new surface water treatment facility	**$250**
☐	Alteration to existing surface water treatment facility	**$150**
Other fees		
☐	Water System Management Plan review	**$ 75**
☐	Miscellaneous changes or maintenance not covered above	**$ 50**

Notes:

1. The fee is not refundable if the plans are not approved
2. Revisions to plans to address PWS or other state agency's comments do not incur an additional fee.
3. If one set of plans has multiple related sheets, such as a new well with construction of water lines, only one fee must be submitted for highest price item (the amounts are not cumulative, except fees for Water System Management Plans).
4. Water System Management Plan review fees stand alone and must be included in addition to those for the review of the plans themselves.
5. **Ten days after the receipt of plans and specifications for approval, if the appropriate plan review fee is not received, then all plan documents will be recycled. A new set of documents must then be submitted with the appropriate fee for approval.**

****

These plans and specifications cited in the foregoing application, including any provisos in the approval letter, are approved insofar as the protection of public health is concerned as provided in the rules, standards and criteria adopted under the authority of NCGS 130A-315 and 130A-317. This approval does not address all applicable laws, rules, standards and criteria, and other approvals and licenses that may be required by the local, state or federal government.

This approval is given with the understanding that upon installation of such works, its operation shall be placed under the care of a competent person, and the operation shall be carried out according to best accepted practice and in accordance with the recommendations of the Division of Environmental Health.

The official copies of plans and specifications accompanying this application have been sealed and stamped with the serial number of this application _____. Any erasures, additions or alterations of the proposed improvements except those permitted in 15A NCAC 18C .0306 will make this approval null and void.

This approval does not constitute a warranty of the design, construction or future operation of the water system.

Signed: _____
Public Water Supply Section
Division of Environmental Health

North Carolina Department of Environment
And Natural Resources
Division of Environmental Health
Public Water Supply Section

Application for Approval of Engineering Plans and Specifications For Water Supply Systems

Instructions & Checklist: To apply for approval for plans and specifications, submit the following materials & information:

Project Name: Greenville Utilities Commission
(This is the name to appear on Public Water Supply records and tracking system)

Attached are three copies of each of the following items:

☒ This completed "Application for Approval...;"

☒ The plan drawings;

☒ The Engineering Report (ER) addressing each of the items listed in 15A NCAC 18C .0307(b), including the design basis of the project.[15A NCAC 18C .0307(b)(12)]

One of the following:

☒ The project will use the following system's previously approved standard specifications:

Name of System: Greenville Utilities Commission

PWS Approval Number & Date: 89-6971-R Dated November 29, 2000

OR

☐ Attached are three copies of the specifications.

One of the following:

☒ The applicant is the Public Water System;

OR

☐ Attached is a letter from the Owner of the Public Water System agreeing to serve the project and stating that the system has adequate supply.

Note the following:

☒ Beginning January 1, 2007, attached is a check for the proper plan review fee amount, in accordance with NCGS 130A-328. See note 4 on page 4.

Date _____ Serial No. _____
(for DENR use only) (for DENR use only)

To: Division of Environmental Health,
Department of Environment and Natural Resources

The Board of Commissioners
(name of board, or council, authorized official and title, or owner)

of Greenville Utilities Commission
(name of city, town, corporation, sanitary district, water company or other)

in the County of Pitt , State of North Carolina authorized by law to act for the said

Greenville Utilities Commission
(name of city, town, corporation, sanitary district, water company or other)

and to expend its funds for the water project described below, herewith submit for the counsel and advice of the Division of Environmental Health plans and specifications prepared by _____
(engineer or firm)

_____ _____
(Phone Number of Engineer – optional for faster contact) (Email Address of Engineer – optional for faster contact)

of _____ for the installation or construction of
(address of engineer)

_____ ,
(description of project)

_____
(location of project)

in _____ County, and make application to the Division of Environmental Health for the approval of said plans and specifications as related to public health and protection of public water supplies and public water systems.

These plans have been approved and accepted by the applicant.

This application is made under and in full accord with the provision of NCGS 130A-317, and such other statutes as related to public water systems. The applicant agrees that no change or deviation from the engineering plans and specifications approved by the Division of Environmental Health will be made except as allowed by 15A NCAC 18C .0306 or with the written consent and approval of the Division of Environmental Health or its authorized representative. The applicant agrees that a professional engineer licensed to practice in the State of North Carolina shall submit a statement reflecting that adequate observations during and upon completion of construction, by the engineer or by a representative of the engineer's office who is under the engineer's supervision, indicates that construction was completed in accordance with approved plans and specifications.

Remarks: _____

_____ PO Box 1847
(Signature of Owner, Manager, Mayor or Chairman) (Street or Box Number)

Clifton H. Cahoon Greenville, NC 27835-1847
(Type Name Signed Above) (City, State, Zip Code)

252-551-1551 cahoonch@guc.com
(Phone Number – optional for faster contact) (Email Address – optional for faster contact)

Status of Water System Management Plan (WSMP)
Check one of the following, and if applicable, provide the required information:

☐ The WSMP for the project, as defined in the attached engineering plans and specifications, is submitted with this application.

☒ The WSMP that includes this project, as defined in the attached engineering plans and specifications, was previously submitted.

Provide the following:

Water System Name: Greenville Utilities Commission

Owner Name: Greenville Utilities Commission

PWS I.D. No.: 04-74-010

WSMP No.: 00-01453

WSMP Submittal Date: 6/2/2000

County: Pitt

By my signature below, I certify that the previously submitted WSMP contains the information required by 15A NCAC 18C .0307(c) for the project defined in the attached engineering plans and specifications.

NAME: Clifton H. Cahoon
(Type or Print Name)

SIGNATURE: _____ DATE: _____
(Owner, Manager, Mayor or Chairman)

☐ The WSMP for the project, as defined in the attached engineering plans and specifications, has not been submitted.

Note: When the WSMP is submitted, the applicant must clearly identify the previously submitted project engineering plans and specifications for which the WSMP was prepared.

Status of Engineer's Report
Check one of the following, and if applicable, provide the required information.

☒ The Engineer's Report for the project, as defined in the attached engineering plans and specifications, is submitted with this application.

☐ The Engineer's Report that includes this project, as defined in the attached engineering plans and specifications, was previously submitted.

Provide the following:

Water System Name: _____

Owner Name: _____

PWS I.D. No.: _____

Engineer's Report No.: _____

Engineer's Report Title: _____

Engineer's Report Submittal Date: _____

County: _____

Note: If the previously submitted Engineer's Report covered multiple projects, then attach to this Application, a letter from the engineer stating that the previously submitted Engineer's Report contains the information required by 15A NCAC 18C .0307(b) for the project defined in the attached engineering plans and specifications.

****

In accordance with NCGS 130A-328, there will be a fee charged for plan review by the NC DENR Public Water Supply Section. **Any documents submitted for review on or after January 1, 2007 must be accompanied by a check payable to *DENR-Public Water Supply Section* before the review will begin.**

** There is a $25 fee for returned checks **

The charges for review of plans are shown below. Check one of the following.

Distribution System fees		
☐	Construction of water lines, less than 5000 linear feet	**$150**
☐	Construction of water lines, 5000 linear feet or more	**$200**
☐	Other construction or alteration to a distribution system	**$ 75**
Ground Water System fees		
☐	Construction of a new ground water system or adding a new well	**$200**
☐	Alteration to an existing ground water system	**$100**
Surface water system fees		
☐	Construction of a new surface water treatment facility	**$250**
☐	Alteration to existing surface water treatment facility	**$150**
Other fees		
☐	Water System Management Plan review	**$ 75**
☐	Miscellaneous changes or maintenance not covered above	**$ 50**

Notes:

1. The fee is not refundable if the plans are not approved
2. Revisions to plans to address PWS or other state agency's comments do not incur an additional fee.
3. If one set of plans has multiple related sheets, such as a new well with construction of water lines, only one fee must be submitted for highest price item (the amounts are not cumulative, except fees for Water System Management Plans).
4. Water System Management Plan review fees stand alone and must be included in addition to those for the review of the plans themselves.
5. **Ten days after the receipt of plans and specifications for approval, if the appropriate plan review fee is not received, then all plan documents will be recycled. A new set of documents must then be submitted with the appropriate fee for approval.**

****

These plans and specifications cited in the foregoing application, including any provisos in the approval letter, are approved insofar as the protection of public health is concerned as provided in the rules, standards and criteria adopted under the authority of NCGS 130A-315 and 130A-317. This approval does not address all applicable laws, rules, standards and criteria, and other approvals and licenses that may be required by the local, state or federal government.

This approval is given with the understanding that upon installation of such works, its operation shall be placed under the care of a competent person, and the operation shall be carried out according to best accepted practice and in accordance with the recommendations of the Division of Environmental Health.

The official copies of plans and specifications accompanying this application have been sealed and stamped with the serial number of this application _____. Any erasures, additions or alterations of the proposed improvements except those permitted in 15A NCAC 18C .0306 will make this approval null and void.

This approval does not constitute a warranty of the design, construction or future operation of the water system.

Signed: _____
Public Water Supply Section
Division of Environmental Health

A P P E N D I X E

SAMPLE EASEMENT DOCUMENTS

This Appendix contains copies of the Greenville Utilities Commission Standard Easement Document. Easements recorded in accordance with Section 5.7.2 of the Manual must be recorded on this standard form. Additional blank copies may be obtained from the Commission.

GRANT OF EASEMENT

BY

A CORPORATION

CORPORATION

GRANT OF ALL UTILITIES EASEMENT

DATE_____

KNOW ALL MEN BY THESE PRESENTS, that the undersigned "GRANTOR" (whether one or more), for and in consideration of the sum of ONE DOLLAR ($1.00) and other good and valuable consideration to it in hand paid by GREENVILLE UTILITIES COMMISSION of the City of Greenville, Pitt County, North Carolina, hereinafter referred to as the "COMMISSION", the receipt of which is hereby acknowledged, does hereby grant the City of Greenville, a body politic and corporate in Pitt County, North Carolina, for use of the "COMMISSION", its licensees, successors and assigns, the right, privilege and easement to go in, through, under, and upon lands of the GRANTOR located in _____ Township, Pitt County, North Carolina, and more fully described as follows:

_____

_____

(Reference is hereby made to _____ Book _____, at Page _____, in the Office of the Register of Deeds of Pitt County, North Carolina) and to construct, install, operate and maintain sanitary sewer lines, water lines, gas lines and electrical lines in a manner suitable to the Commission upon, across, under and through said premises within an easement and right of way strip of the width, location and approximate length hereinafter defined and to be utilized by the Commission a permanent easement for the public use with the right to do all things necessary or convenient thereto, including the following:

(a) the right of officers, agents, and workmen of the Commission and its contractors to go to and from said right of way strip at all times over the above described land by such route or routes as shall occasion the least practicable inconvenience to Grantor, including private roads and ways then existing thereon, on foot or by conveyance, with materials, machinery, supplies and equipment as may be desirable; provided that except in emergencies, existing roads and ways thereon shall be used to the extent that they afford ingress and egress to and from the right of way strip; and to construct, reconstruct, work upon, repair, alter, inspect and in general do any other thing necessary or convenient to maintain and operate said lines for the purpose aforesaid;

(b) the right and privilege to enter upon the land included in the construction easement hereinabove described for the purpose of constructing said utility facilities, and the right and privilege at all times to enter upon the land included in the area of the permanent easement hereinabove described for the maintenance and repair of said utility facilities;

(c) the right to clear, and keep cleared, from said right of way strip all structures (other than ordinary fences, but when Commission desires, such fences may be opened and reclosed or temporarily removed and replaced, or Commission may provide suitable gates therein) and all vegetation which may interfere with the utility facilities herein described and to use (1) chemicals which are not injurious to human beings, domestic animals, fish or game, (2) machinery, and (3) other forms of equipment and devices in so doing;

(d) the right to install, construct, repair, maintain and operate all utility lines, structures and appurtenant facilities of the Commission.

Description:

The structures and appurtenant facilities installed by the Commission shall be and remain the property of the Commission and may be removed by it at any time and from time to time.

Grantor reserves the right to use the lands in and over which the right of way and easement rights are hereby granted for all purposes not inconsistent with said right of way and easement rights, except that Grantor agrees that (1) no buildings or permanent structures, wells, septic tanks, absorption pits, underground or overhead storage tanks, burial plots, or any other obstruction which might interfere with the construction, maintenance and operation of said utility facilities shall be placed within the area of said strip without the express written permission of the Commission; and (2) the Commission's facilities shall in no way be interfered with or endangered by the Grantor or Grantor's licensees, successors or assigns, without the express written permission of the Commission.

The Commission agrees that it will repair, rebuild, replace or pay the actual damages sustained as mutually agreed upon by the Commission and Grantor, and pay the actual damages to actual crops inside said right of way strip on the above land caused by the construction, operation, maintenance, inspection, rebuilding and removal of said lines, and in going to and from said right of way strip, and will repair any extraordinary damage to any bridge or to any road due to heavy hauling to and from the said right of way strip if claim is made within a period of thirty (30) days after such damages are sustained by Grantor.

Any notice to be given by one party to the other party hereunder may be delivered or deposited postage prepaid addressed to the following:

GRANTOR: NAME:_____

ADDRESS:_____

CITY/STATE/ZIP CODE:_____

COMMISSION: Greenville Utilities Commission
P. O. Box 1847
200 Martin Luther King Jr. Drive
Greenville, North Carolina 27835-1847

TO HAVE AND TO HOLD the aforesaid rights, privileges and construction easement unto the Grantee for such period of time as may be required to complete the construction of said utility facilities, and thereafter a permanent easement unto the Grantee and its successors, licensees and assigns for the uses and purposes hereinabove set forth.

And Grantor, for the Grantor and for the Grantor's heirs, executors, administrators, licensees, successors and assigns, covenants to and with the Commission, its licensees, successors and assigns, that Grantor is lawfully seized of the above described land in fee and has the right to convey the said rights, easements and privileges herein described; that the same is free and clear from any and all encumbrances not satisfactory to the Commission; that the Commission shall have quiet and peaceful possession, use and enjoyment of the aforedescribed easement of right of way, rights and privileges; that the Grantor shall execute such further assurances thereof as may be reasonably required by the Commission; and Grantor will forever warrant and defend the title to the said easement of right of way, rights and privileges against the lawful claims of all persons whomsoever.

The singular shall include the plural and reference to gender shall include masculine, feminine and neuter.

IN WITNESS WHEREOF, the Grantor has adopted the word "SEAL" as his seal and has hereunto set his hand and seal, or if Grantor be a corporation, Grantor has caused these presents to be signed in its corporate name by its corporate officers, duly attested and its corporate seal hereunto affixed, all by authority of its Board of Directors duly given, this the day and year first above written.

_____
CORPORATION NAME

BY:_____(SEAL)
PRESIDENT

ATTEST

_____
SECRETARY

NORTH CAROLINA

PITT COUNTY

I, _____, a Notary Public of the aforesaid County and State, hereby certify that _____ personally appeared before me this day and acknowledged that he is Secretary of _____, a corporation, and that by authority duly given and as the act of the corporation, the foregoing instrument was signed in its name by its President, _____, sealed with its corporate seal, and attested by himself as its Secretary.

Witness my hand and Notarial Seal, this the _____ day of _____, 19_____.

_____
NOTARY PUBLIC

My commission expires:

_____

NORTH CAROLINA

PITT COUNTY

The foregoing certificate(s) of _____, Notary Public(s) of the aforesaid County and State, is/are certified to be correct.

This the _____ day of _____, _____.

_____
REGISTER OF DEEDS, PITT COUNTY,
NORTH CAROLINA

FORM FOR GRANT OF EASEMENT

BY

AN INDIVIDUAL OR PARTNERSHIP

INDIVIDUAL

GRANT OF ALL UTILITIES EASEMENT

DATE_____

KNOW ALL MEN BY THESE PRESENTS, that the undersigned "GRANTOR" (whether one or more), for and in consideration of the sum of ONE DOLLAR ($1.00) and other good and valuable consideration to it in hand paid by GREENVILLE UTILITIES COMMISSION of the City of Greenville, Pitt County, North Carolina, hereinafter referred to as the "COMMISSION", the receipt of which is hereby acknowledged, does hereby grant the City of Greenville, a body politic and corporate in Pitt County, North Carolina, for use of the "COMMISSION", its licensees, successors and assigns, the right, privilege and easement to go in, through, under, and upon lands of the GRANTOR located in _____ Township, Pitt County, North Carolina, and more fully described as follows:

_____

_____.

(Reference is hereby made to _____ Book _____, at Page _____, in the Office of the Register of Deeds of Pitt County, North Carolina) and to construct, install, operate and maintain sanitary sewer lines, water lines, gas lines and electrical lines in a manner suitable to the Commission upon, across, under and through said premises within an easement and right of way strip of the width, location and approximate length hereinafter defined and to be utilized by the Commission a permanent easement for the public use with the right to do all things necessary or convenient thereto, including the following:

(a) the right of officers, agents, and workmen of the Commission and its contractors to go to and from said right of way strip at all times over the above described land by such route or routes as shall occasion the least practicable inconvenience to Grantor, including private roads and ways then existing thereon, on foot or by conveyance, with materials, machinery, supplies and equipment as may be desirable; provided that except in emergencies, existing roads and ways thereon shall be used to the extent that they afford ingress and egress to and from the right of way strip; and to construct, reconstruct, work upon, repair, alter, inspect and in general do any other thing necessary or convenient to maintain and operate said lines for the purpose aforesaid;

(b) the right and privilege to enter upon the land included in the construction easement hereinabove described for the purpose of constructing said utility facilities, and the right and privilege at all times to enter upon the land included in the area of the permanent easement hereinabove described for the maintenance and repair of said utility facilities;

(c) the right to clear, and keep cleared, from said right of way strip all structures (other than ordinary fences, but when Commission desires, such fences may be opened and reclosed or temporarily removed and replaced, or Commission may provide suitable gates therein) and all vegetation which may interfere with the utility facilities herein described and to use (1) chemicals which are not injurious to human beings, domestic animals, fish or game, (2) machinery, and (3) other forms of equipment and devices in so doing;

(d) the right to install, construct, repair, maintain and operate all utility lines, structures and appurtenant facilities of the Commission.

Description:

The structures and appurtenant facilities installed by the Commission shall be and remain the property of the Commission and may be removed by it at any time and from time to time.

Grantor reserves the right to use the lands in and over which the right of way and easement rights are hereby granted for all purposes not inconsistent with said right of way and easement rights, except that Grantor agrees that (1) no buildings or permanent structures, wells, septic tanks,

absorption pits, underground or overhead storage tanks, burial plots, or any other obstruction which might interfere with the construction, maintenance and operation of said utility facilities shall be placed within the area of said strip without the express written permission of the Commission; and (2) the Commission's facilities shall in no way be interfered with or endangered by the Grantor or Grantor's licensees, successors or assigns, without the express written permission of the Commission.

The Commission agrees that it will repair, rebuild, replace or pay the actual damages sustained as mutually agreed upon by the Commission and Grantor, and pay the actual damages to actual crops inside said right of way strip on the above land caused by the construction, operation, maintenance, inspection, rebuilding and removal of said lines, and in going to and from said right of way strip, and will repair any extraordinary damage to any bridge or to any road due to heavy hauling to and from the said right of way strip if claim is made within a period of thirty (30) days after such damages are sustained by Grantor.

Any notice to be given by one party to the other party hereunder may be delivered or deposited postage prepaid addressed to the following:

GRANTOR: NAME:_____

ADDRESS:_____

CITY/STATE/ZIP CODE:_____

COMMISSION: Greenville Utilities Commission
P. O. Box 1847
200 Martin Luther King Jr. Drive
Greenville, North Carolina 27835-1847

TO HAVE AND TO HOLD the aforesaid rights, privileges and construction easement unto the Grantee for such period of time as may be required to complete the construction of said utility facilities, and thereafter a permanent easement unto the Grantee and its successors, licensees and assigns for the uses and purposes hereinabove set forth.

And Grantor, for the Grantor and for the Grantor's heirs, executors, administrators, licensees, successors and assigns, covenants to and with the Commission, its licensees, successors and assigns, that Grantor is lawfully seized of the above described land in fee and has the right to convey the said rights, easements and privileges herein described; that the same is free and clear from any and all encumbrances not satisfactory to the Commission; that the Commission shall have quiet and peaceful possession, use and enjoyment of the aforedescribed easement of right of way, rights and privileges; that the Grantor shall execute such further assurances thereof as may be reasonably required by the Commission; and Grantor will forever warrant and defend the title to the said easement of right of way, rights and privileges against the lawful claims of all persons whomsoever.

The singular shall include the plural and reference to gender shall include masculine, feminine and neuter.

IN WITNESS WHEREOF, the Grantor has adopted the word "SEAL" as his seal and has hereunto set his hand and seal, or if Grantor be a corporation, Grantor has caused these presents to be signed in its corporate name by its corporate officers, duly attested and its corporate seal hereunto affixed, all by authority of its Board of Directors duly given, this the day and year first above written.

_____(SEAL) _____(SEAL)

NORTH CAROLINA

PITT COUNTY

I, _____, a Notary Public of the aforesaid County and State, hereby certify that _____ personally appeared before me this day and acknowledged the due execution of the foregoing and annexed instrument for the purposes therein expressed.

Witness my hand and Notarial Seal, this the _____ day of _____, _____.

_____
NOTARY PUBLIC

My commission expires:

_____

NORTH CAROLINA

PITT COUNTY

I, _____, a Notary Public of the aforesaid County and State, hereby certify that _____ personally appeared before me this day and acknowledged the due execution of the foregoing and annexed instrument for the purposes therein expressed.

Witness my hand and Notarial Seal, this the _____ day of _____, _____.

_____
NOTARY PUBLIC

My commission expires:

_____

NORTH CAROLINA

PITT COUNTY

The foregoing certificate(s) of _____, Notary Public(s) of the aforesaid County and State, is/are certified to be correct.

This the _____ day of _____, _____.

_____
REGISTER OF DEEDS, PITT COUNTY,
NORTH CAROLINA

PARTNERSHIP

GRANT OF ALL UTILITIES EASEMENT

DATE_____

KNOW ALL MEN BY THESE PRESENTS, that the undersigned "GRANTOR" (whether one or more), for and in consideration of the sum of ONE DOLLAR ($1.00) and other good and valuable consideration to it in hand paid by GREENVILLE UTILITIES COMMISSION of the City of Greenville, Pitt County, North Carolina, hereinafter referred to as the "COMMISSION", the receipt of which is hereby acknowledged, does hereby grant the City of Greenville, a body politic and corporate in Pitt County, North Carolina, for use of the "COMMISSION", its licensees, successors and assigns, the right, privilege and easement to go in, through, under, and upon lands of the GRANTOR located in _____ Township, Pitt County, North Carolina, and more fully described as follows:

_____

_____.

(Reference is hereby made to _____ Book _____, at Page _____, in the Office of the Register of Deeds of Pitt County, North Carolina) and to construct, install, operate and maintain sanitary sewer lines, water lines, gas lines and electrical lines in a manner suitable to the Commission upon, across, under and through said premises within an easement and right of way strip of the width, location and approximate length hereinafter defined and to be utilized by the Commission a permanent easement for the public use with the right to do all things necessary or convenient thereto, including the following:

(a) the right of officers, agents, and workmen of the Commission and its contractors to go to and from said right of way strip at all times over the above described land by such route or routes as shall occasion the least practicable inconvenience to Grantor, including private roads and ways then existing thereon, on foot or by conveyance, with materials, machinery, supplies and equipment as may be desirable; provided that except in emergencies, existing roads and ways thereon shall be used to the extent that they afford ingress and egress to and from the right of way strip; and to construct, reconstruct, work upon, repair, alter, inspect and in general do any other thing necessary or convenient to maintain and operate said lines for the purpose aforesaid;

(b) the right and privilege to enter upon the land included in the construction easement hereinabove described for the purpose of constructing said utility facilities, and the right and privilege at all times to enter upon the land included in the area of the permanent easement hereinabove described for the maintenance and repair of said utility facilities;

(c) the right to clear, and keep cleared, from said right of way strip all structures (other than ordinary fences, but when Commission desires, such fences may be opened and reclosed or temporarily removed and replaced, or Commission may provide suitable gates therein) and all vegetation which may interfere with the utility facilities herein described and to use (1) chemicals which are not injurious to human beings, domestic animals, fish or game, (2) machinery, and (3) other forms of equipment and devices in so doing;

(d) the right to install, construct, repair, maintain and operate all utility lines, structures and appurtenant facilities of the Commission.

Description:

The structures and appurtenant facilities installed by the Commission shall be and remain the property of the Commission and may be removed by it at any time and from time to time.

Grantor reserves the right to use the lands in and over which the right of way and easement rights are hereby granted for all purposes not inconsistent with said right of way and easement rights, except that Grantor agrees that (1) no buildings or permanent structures, wells, septic tanks,

absorption pits, underground or overhead storage tanks, burial plots, or any other obstruction which might interfere with the construction, maintenance and operation of said utility facilities shall be placed within the area of said strip without the express written permission of the Commission; and (2) the Commission's facilities shall in no way be interfered with or endangered by the Grantor or Grantor's licensees, successors or assigns, without the express written permission of the Commission.

The Commission agrees that it will repair, rebuild, replace or pay the actual damages sustained as mutually agreed upon by the Commission and Grantor, and pay the actual damages to actual crops inside said right of way strip on the above land caused by the construction, operation, maintenance, inspection, rebuilding and removal of said lines, and in going to and from said right of way strip, and will repair any extraordinary damage to any bridge or to any road due to heavy hauling to and from the said right of way strip if claim is made within a period of thirty (30) days after such damages are sustained by Grantor.

Any notice to be given by one party to the other party hereunder may be delivered or deposited postage prepaid addressed to the following:

GRANTOR: NAME:_____

ADDRESS:_____

CITY/STATE/ZIP CODE:_____

COMMISSION: Greenville Utilities Commission
P. O. Box 1847
200 Martin Luther King Jr. Drive
Greenville, North Carolina 27835-1847

TO HAVE AND TO HOLD the aforesaid rights, privileges and construction easement unto the Grantee for such period of time as may be required to complete the construction of said utility facilities, and thereafter a permanent easement unto the Grantee and its successors, licensees and assigns for the uses and purposes hereinabove set forth.

And Grantor, for the Grantor and for the Grantor's heirs, executors, administrators, licensees, successors and assigns, covenants to and with the Commission, its licensees, successors and assigns, that Grantor is lawfully seized of the above described land in fee and has the right to convey the said rights, easements and privileges herein described; that the same is free and clear from any and all encumbrances not satisfactory to the Commission; that the Commission shall have quiet and peaceful possession, use and enjoyment of the aforedescribed easement of right of way, rights and privileges; that the Grantor shall execute such further assurances thereof as may be reasonably required by the Commission; and Grantor will forever warrant and defend the title to the said easement of right of way, rights and privileges against the lawful claims of all persons whomsoever.

The singular shall include the plural and reference to gender shall include masculine, feminine and neuter.

IN WITNESS WHEREOF, the Grantor has adopted the word "SEAL" as his seal and has hereunto set his hand and seal, or if Grantor be a corporation, Grantor has caused these presents to be signed in its corporate name by its corporate officers, duly attested and its corporate seal hereunto affixed, all by authority of its Board of Directors duly given, this the day and year first above written.

NAME OF PARTNERSHIP

BY:_____
General Partner

ATTEST:

_____

NORTH CAROLINA

PITT COUNTY

I, _____, a Notary Public of the aforesaid County and State, hereby certify that _____, General Partner of _____ _____, a partnership, personally appeared before me this day and acknowledged the due execution of the foregoing and annexed instrument for the purposes therein expressed.

Witness my hand and Notarial Seal, this the _____ day of _____, _____.

_____
NOTARY PUBLIC

My commission expires:

_____

NORTH CAROLINA

PITT COUNTY

The foregoing certificate of _____, a Notary Public of the aforesaid County and State, is certified to be correct.

This the _____ day of _____, _____.

_____
REGISTER OF DEEDS, PITT COUNTY,
NORTH CAROLINA

A P P E N D I X F

BILL OF SALE

Enclosed are blank copies of the Greenville Utilities Bill of Sale which must be executed prior to acceptance of any projects which are to be owned and operated by the Commission as required by Section 6.8 of the Manual. Additional blank copies may be obtained from the Commission.

NORTH CAROLINA

PITT COUNTY

This BILL OF SALE, made and entered into on this the _____ day of _____, 2000, by and between_____ _____ , if one or more individuals, or _____ _____ , a partnership composed of _____ , and _____ _____, and _____, partners, or _____, a corporation existing under and by virtue of the laws of the State of North Carolina, with one of its principal offices and places of business at _____, hereinafter called "OWNER", unto GREENVILLE UTILITIES COMMISSION OF THE CITY OF GREENVILLE, NORTH CAROLINA, hereinafter called "COMMISSION";

W I T N E S S E T H:

THAT for and in consideration of the sum of Ten (10.00) Dollars and other good and valuable consideration passing from each party to the other, the receipt of which is hereby respectively acknowledged by each of the parties, and in further consideration of COMMISSION's willingness to accept responsibility for the maintenance of the property hereinafter described, OWNER does hereby transfer and convey to COMMISSION, absolutely and unconditionally, all right, title and interest of the OWNER in and to the personal property described on Schedule "A", which is attached hereto and made a part hereof as fully as if set forth herein verbatim, and incorporated herein by reference;

TO HAVE AND TO HOLD the said personal property to COMMISSION, absolutely and unconditionally.

OWNER hereby covenants that OWNER is the owner of the said personal property as described on said Schedule "A", and has the right to convey the same to COMMISSION absolutely and unconditionally, and that the same is free and clear of all encumbrances, except as are set forth and described with Particularity on Schedule "A", which is attached hereto, and that OWNER will forever warrant and defend the title to the same against the lawful claims of all persons whomsoever.

Words of gender used in this Bill of Sale shall be deemed to include any other gender, and a reference to the singular shall include the plural, and vice versa, unless the context indicates that such reading would be inappropriate.

IN TESTIMONY WHEREOF, OWNER, if one or more individuals, has each adopted the word "SEAL" as his or her seal, and has hereunto set his or her hand and seal to this Bill of Sale, or OWNER, if a partnership, has caused this Bill of Sale to be executed in its name by its partners, trading and doing business as _____, hereinabove referred to as "OWNER", and each partner has adopted the word "SEAL" as his or her seal, and each has hereunto set his or her hand and seal to this Bill of Sale, or OWNER, if a corporation, has caused this Bill of Sale to be executed in its name by its_____ President, as attested by its _____ Secretary, as evidenced by the affixing of the seal of the corporation by its _____ Secretary, all pursuant to authority duly given, all on this the day and year first above written.

OWNER: _____ (SEAL)
(individual [s])

_____ (SEAL)

OWNER: _____
(Partnership) (Partnership Name)

BY _____ (SEAL)
Partner

BY _____ (SEAL)
Partner

BY _____ (SEAL)
Partner

OWNER: _____
(Corporation) (Corporation Name)

BY_____
President

SEAL

ATTEST:

_____
Secretary

NORTH CAROLINA

PITT COUNTY

I, _____, a Notary Public in and for the aforesaid County and State, do hereby certify that _____ and _____ personally appea4red before me this day and acknowledged the due execution of the foregoing BILL OF SALE for the purposes therein expressed.

WITNESS my hand and notarial seal, this the _____ day of _____, 2000.

_____
Notary Public

My Commission Expires:

_____

NORTH CAROLINA

PITT COUNTY

I, _____, a Notary Public in and for the aforesaid County and State, do hereby certify that _____, _____and _____, Partners of _____, personally appeared before me this day and acknowledged the due execution of the foregoing BILL OF SALE for the purposes therein expressed.

WITNESS my hand and Notarial seal, this the _____ day of _____,2000.

_____
NOTARY PUBLIC

NORTH CAROLINA

PITT COUNTY

I, _____, a Notary Public in and for the aforesaid County and State, do hereby certify that _____ personally appeared before me and acknowledged that he/she is _____ Secretary of _____ _____ and that by authority duly given and as the act of the Corporation, the foregoing instrument was signed in its name by its _____ President, sealed with its corporate seal, and attested by _____ and its _____ Secretary.

WITNESS my hand and notarial seal, this the _____ day of _____, 2000.

_____
NOTARY PUBLIC

My Commission Expires:

_____

APPENDIX G

SAMPLE INDEMNIFICATION AND HOLD HARMLESS AGREEMENT

This Appendix contains a copy of the Greenville Utilities Commission Standard Indemnification and Hold Harmless Agreement. Requirements for the document shall be in accordance with Section 5.3.4.6 of the Manual. Additional blank copies may be obtained from the Commission.

STATE OF NORTH CAROLINA
COUNTY OF PITT

INDEMNIFICATION AND HOLD HARMLESS AGREEMENT

The undersigned Contractor, contemporaneously with the execution of a contract with a private entity, for constructing water and/or wastewater facilities for, _____ _____,where said facilities are intended to be owned, operated and
(Name of Project)
maintained by the GREENVILLE UTILITIES COMMISSION (the Commission) upon acceptance by the Commission and as a precondition of such contract, hereby agrees to indemnify and hold harmless the Commission, its officers, employees, and agents from and against all liability for damages or injuries, including cost and reasonable attorney fees, which may result from the construction or other activity by the undersigned contractor of facilities for the above named project within the right of way of any municipal or NCDOT street or highway. All such construction shall be in conformity and compliance with the Commission's Manual for the Design and Construction of Water and Wastewater System Extensions and municipal and NCDOT requirements for construction within their respective rights of way.

IN TESTIMONY WHEREOF, the undersigned Contractor has caused this Indemnification and Hold Harmless Agreement to be executed pursuant to the authority duly given by its authorized officer or agent, for the purposes herein expressed, on this the _____ day of _____, 20____.

CONTRACTOR: _____

By: _____
Authorized Agent

STATE OF NORTH CAROLINA
COUNTY OF PITT

I, _____, a Notary Public of the aforesaid County and State, do hereby certify that _____ personally appeared before me this day and acknowledged the due execution of the foregoing and annexed Indemnification and Hold Harmless Agreement for the purposes herein expressed.

WITNESS my hand and seal, this the _____ day of _____, 20____.

_____
NOTARY PUBLIC

My Commission Expires:

_____

APPENDIX H

GREENVILLE FIRE PREVENTION BUREAU

PROCEDURES FOR CLEANING AND TESTING PRIVATE FIRE SERVICE MAINS

This Appendix contains the procedural requirements of the City of Greenville Fire Prevention Bureau for cleaning and testing private fire service mains. This document is being provided by the Greenville Utilities Commission for information only and to make known the need to coordinate the described activities with the regulatory authority.

GREENVILLE FIRE PREVENTION BUREAU

Procedures for Cleaning and Testing Private Fire Service Mains

The purpose of this document is to aid contractors in the procedural requirements for cleaning and testing of new private fire service mains throughout the City of Greenville and within the extra territorial jurisdiction (ETJ) governed by the Greenville Fire Prevention Bureau. Private systems commence at the public water purveyor's point of service (typically defined as the inlet side of the backflow prevention device).

The following operations shall be conducted for and witnessed by the Greenville Fire Prevention Bureau prior to approval of any new system for service.

1. Cleaning of Piping
2. Hydrostatic Testing

Cleaning of Piping

Private fire service mains and lead-in connections to system risers shall be cleaned thoroughly before connection is made to the sprinkler system piping in order to remove foreign materials that might have entered the main during the installation. The cleaning can be accomplished either by flushing with water or use of an approved polyurethane pig in accordance with the following:

Mains smaller than 4″ in diameter shall be cleaned by flushing with water. The minimum rate of flow shall not be less than the water demand rate of the system, which is determined by the system design, or not less than that necessary to provide a velocity of 10 ft/s (3 m/s), whichever is greater. The flushing operation shall continue for a sufficient time to ensure thorough cleaning.

Mains 4″ and larger in diameter shall be cleaned by passing through the pipe a polyurethane "pig" of the appropriate size and density (as manufactured by Poly-Pig or approved equal). Pig(s) shall be furnished by the contractor. As an alternative to "pigging", pipes of less than 100 feet in length which are difficult to "pig" may be cleaned by flushing with prior approval. Flushing shall be accomplished in the same manner as that required for pipes less than four inches (4″) in diameter.

When planning the appropriate cleaning operation, consideration shall be given to disposal of the water issuing from the outlet.

Hydrostatic Test Requirements

All private fire service mains shall be tested hydrostatically at not less than 200 psi for two hours. The allowable leakage shall be as specified by the National Fire Prevention Association (NFPA). Additives shall not be used to stop leaks while hydrostatically testing the system.

Each fire hydrant shall be fully opened and closed under system pressure.

Schedule/Fees

The contractor shall contact the Greenville Fire Prevention Bureau at least 24 hours in advance to schedule the appropriate test. Office hours are 8-5 Monday-Friday and the telephone number is (252) 329-4415.

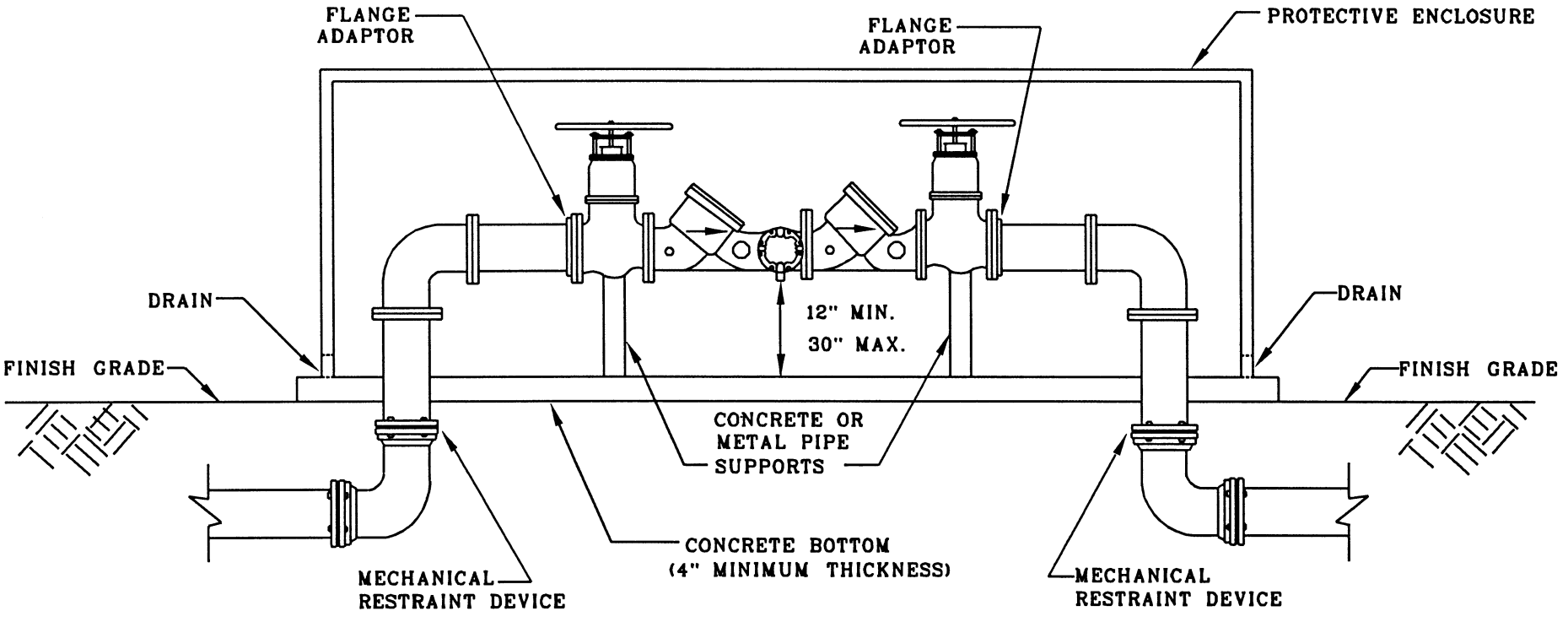
Each scheduled visit will be billed at a rate of $30.00 or $60.00 for project sites inside or outside of the City of Greenville Corporate Limits respectively. It is the aim of the Greenville Fire Prevention Bureau to promote the protection of life and property from fire, through the proper cleaning and testing of private fire service mains, as set forth herein.

APPENDIX I

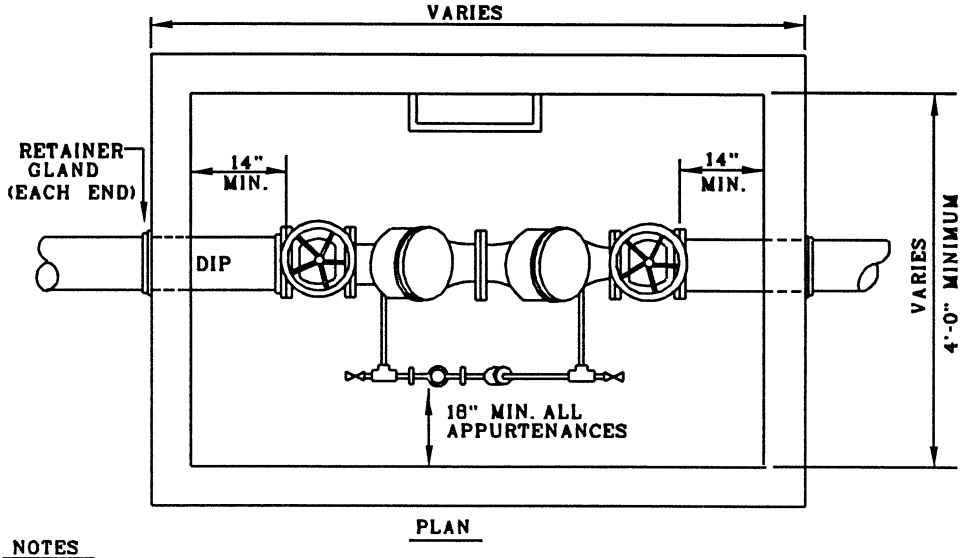
STANDARD DETAILS

NOTES

1. ALL FLANGE BOLTS SHALL BE GALVANIZED.
2. USE ONLY CONTROL DEVICES APPROVED BY GUC AND THE FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH, UNIVERSITY OF SOUTHERN CALIFORNIA.
3. SUBMITTAL SHALL SHOW ALL PIPING & APPURTENANCES WITHIN THE PROTECTIVE ENCLOSURE WITH MEASUREMENTS & CLEARANCES CLEARLY LABELED.
4. ENCLOSURE MUST BE SIZED TO ALLOW ADEQUATE ROOM FOR TESTING, MAINTENANCE AND OPERATION.
5. DRAIN OPENINGS SHALL BE SIZED TO ADEQUATELY RELIEVE MAXIMUM DISCHARGE OF APPROPRIATE DEVICE.
6. REDUCED PRESSURE PRINCIPLE ASSEMBLIES (RPZ) SHALL REQUIRE AN ABOVE GROUND INSTALLATION.
7. IT IS RECOMMENDED THAT THE CUSTOMER PROVIDE ADEQUATE FREEZE PROTECTION.
8. REFER TO DETAIL W-12 FOR REACTION BLOCKING.

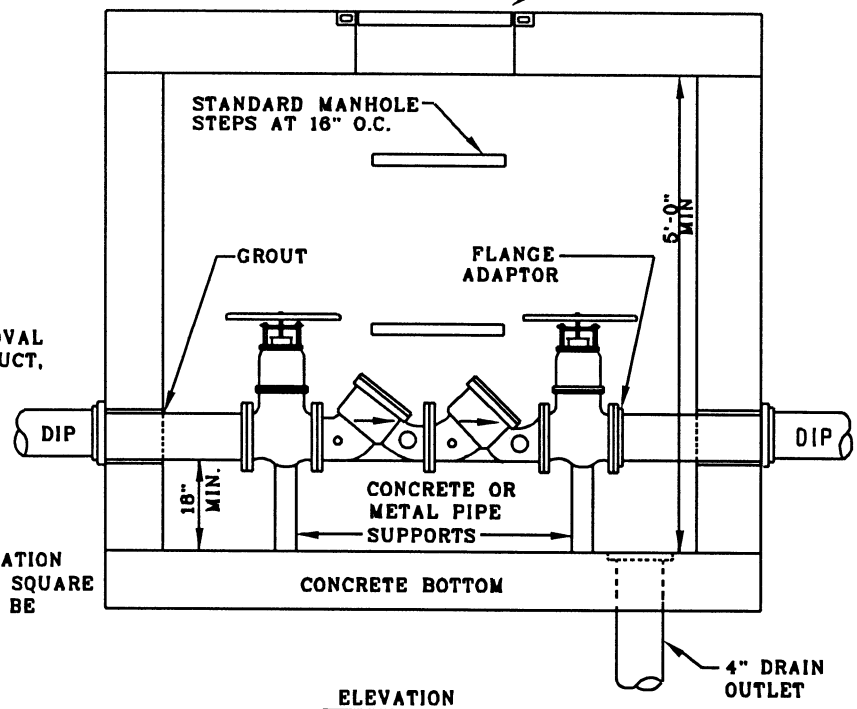


ABOVE GROUND INSTALLATION FOR RP ASSEMBLY (ALTERNATIVE INSTALLATION FOR DCVA)			GREENVILLE UTILITIES GREENVILLE, N.C.		NO.	DATE / DESCRIPTION
SHEET 1 OF 1	DWG. NO. W-17	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities		
	DATE 5-14-99	APP H. COREY				



PLAN

BILCO TYPE J-3AL, HALLIDAY WIS 24 36 OR US FOUNDRY MODIFIED TO CONFORM TO GRADE. HATCH AND STEPS MUST BE LOCATED ON SIDE OPPOSITE DETECTOR CHECK TEST TAPS. HATCHES USED ON VAULTS IN PAVED AREAS SHALL BE APPROVED FOR H-20 LOADING.



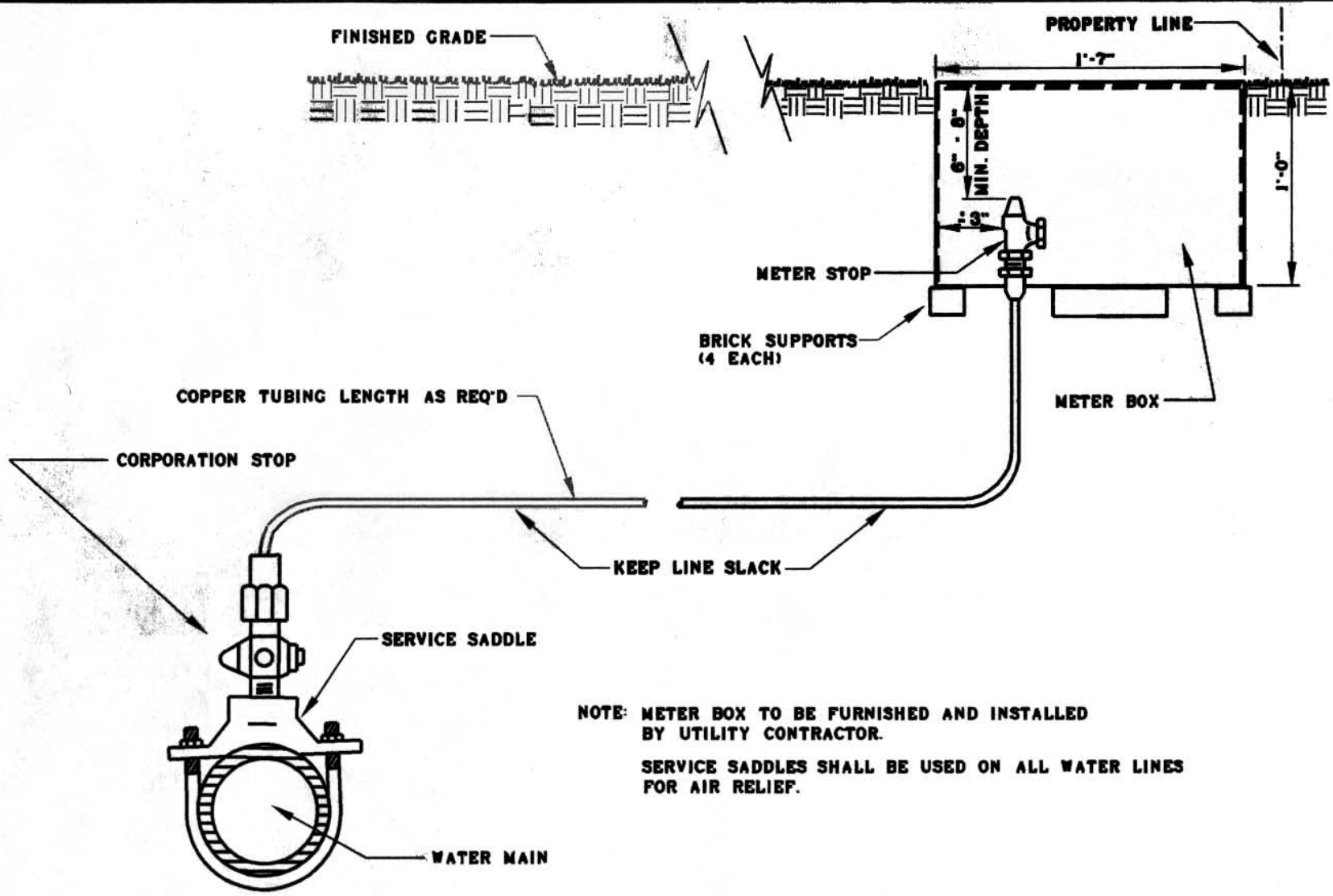
ELEVATION

DETECTOR CHECK NOT SHOWN IN THIS VIEW

NOTES

1. ALL FLANGE BOLTS SHALL BE GALVANIZED
2. USE ONLY CONTROL DEVICES APPROVED BY THE FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH, UNIVERSITY OF SOUTHERN CALIFORNIA.
3. THE VAULT SHOWN IS A GUIDE TO INDICATE MINIMUM REQUIREMENTS ACCEPTABLE TO GUC. PLANS AND SPECIFICATIONS SHALL BE SUBMITTED FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION. PLANS SUBMITTED SHALL INDICATE ONLY ONE ITEM, PRODUCT, SIZE, MEANS OF CONSTRUCTION, ETC. THE TERM " OR APPROVED EQUAL" WILL NOT BE ALLOWED.
4. VAULT TO BE CONSTRUCTED OF REINFORCED CONCRETE OR REINFORCED MASONRY BLOCK AND SHALL BE ADEQUATELY SIZED TO FACILITATE ASSEMBLY WITHOUT REQUIRING MODIFICATION TO THE VAULT BY EITHER CUTTING OR CORING. INDICATE TYPE OF CONSTRUCTION AND REINFORCEMENT ON SUBMITTAL.
5. PROVIDE VAULT WITH 4" OUTLET DRAIN, GRATE AND P-TRAP, INDICATE INVERT ELEVATION OF VAULT AND AT DISCHARGE POINT. IF GRAVITY DRAIN IS IMPRACTICAL, FORM 18" SQUARE BY 12" DEEP SUMP IN VAULT FLOOR. PROVIDE SUMP PUMP, ELECTRICAL SERVICE TO BE PROVIDED AND MAINTAINED BY THE OWNER.
6. PROVIDE REQUIRED CLEARANCE FOR RISING STEM GATE VALVES.
7. SUBMITTAL SHALL SHOW ALL PIPING & APPURTENANCES WITHIN THE VAULT WITH MEASUREMENTS & CLEARANCES CLEARLY LABELED.

DOUBLE CHECK/ DETECTOR CHECK VAULT FOR 6" AND LARGER SERVICES			GREENVILLE UTILITIES GREENVILLE, N.C.		NO.	DATE / DESCRIPTION
SHEET	DWG. NO. W-16	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities		
1 OF 1	DATE 3-12-99	APP H. COREY				



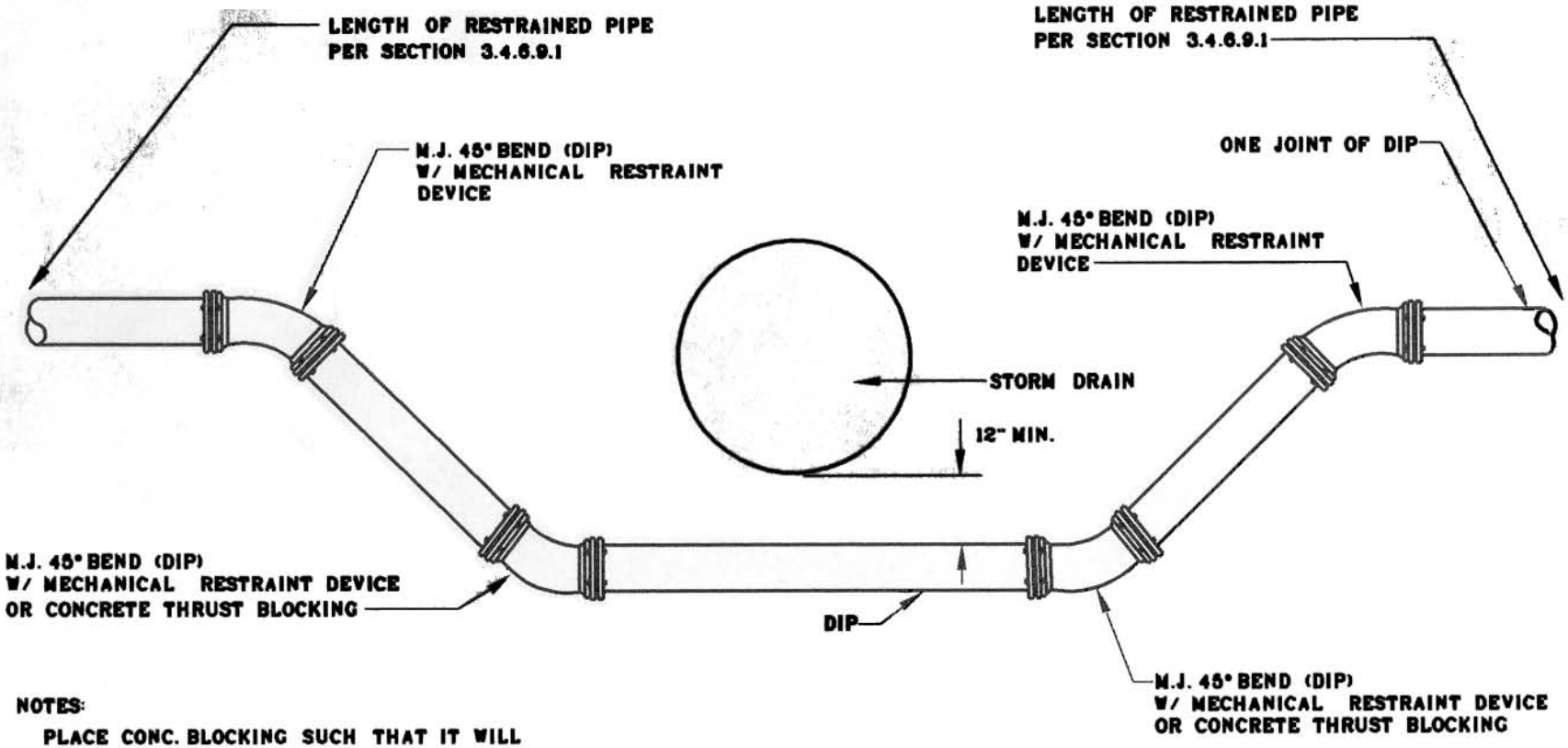
NOTE: METER BOX TO BE FURNISHED AND INSTALLED BY UTILITY CONTRACTOR.

SERVICE SADDLES SHALL BE USED ON ALL WATER LINES FOR AIR RELIEF.

MANUAL AIR RELEASE FOR WATER			GREENVILLE UTILITIES GREENVILLE, N.C.
SHEET 1 OF 1	DWG. NO. W-15	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.
	DATE 3-12-99	APP H. COREY	

Greenville Utilities

NO.	DATE	DESCRIPTION



NOTES:

PLACE CONC. BLOCKING SUCH THAT IT WILL NOT INTERFERE WITH REMOVAL OF BOLTS.

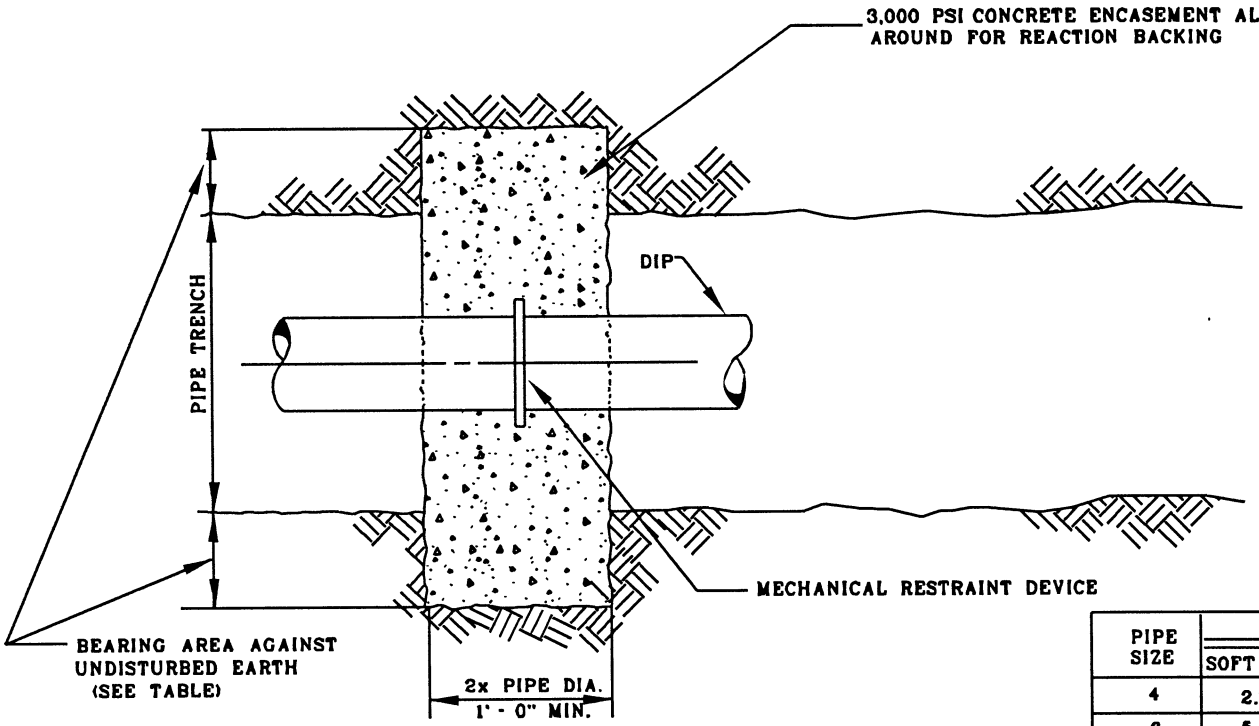
PIPE DIAMETER GREATER THAN 12" SEE GUC ENGINEERING DEPT.

PIPE LENGTHS SHALL BE AS REQUIRED TO CONSTRUCT CROSSING.

ALL JOINTS TO BE RESTRAINED IN ACCORDANCE WITH MANUAL.

WATER MAIN AND STORM DRAIN CROSSING			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities
SHEET	DWG. NO. W-14	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	
1 OF 1	DATE 3-12-99	APP H. COREY		

NO.	DATE	DESCRIPTION



SOIL	BEARING LOAD (lb/sq.ft.)
MUCKY	0
SOFT CLAY	1,000
SILT	1,500
SANDY SILT	3,000
SAND	4,000
SANDY CLAY	6,000
HARD CLAY	9,000

NOTE: MIN. BEARING AREAS ARE BASED UPON THE TABLE ABOVE. FOR SOILS HAVING BEARING CAPACITIES DIFFERENT THAN THAT SHOWN ADJUST AREA AS NECESSARY TO PROVIDE EQUIVALENT RESTRAINT.

PIPE SIZE	MIN. BEARING AREA (SQ. FT.)					
	SOFT CLAY	SILT	SANDY SILT	SAND	SAND CLAY	HARD CLAY
4	2.7	1.8	1.0	1.0	1.0	1.0
6	5.6	3.7	1.9	1.4	1.0	1.0
8	9.7	6.4	3.2	2.4	1.6	1.1
10	15	10	4.8	3.6	2.4	1.6
12	21	14	6.8	5.1	3.4	2.3
14	28	18	9.2	6.9	4.6	3.1
16	36	24	12	8.9	5.9	4.0
18	45	30	15	11	7.4	5.0
20	55	37	18	14	9.2	6.1
24	78	52	26	20	13	8.7
30	121	81	40	30	20	13
36	173	115	56	43	29	19

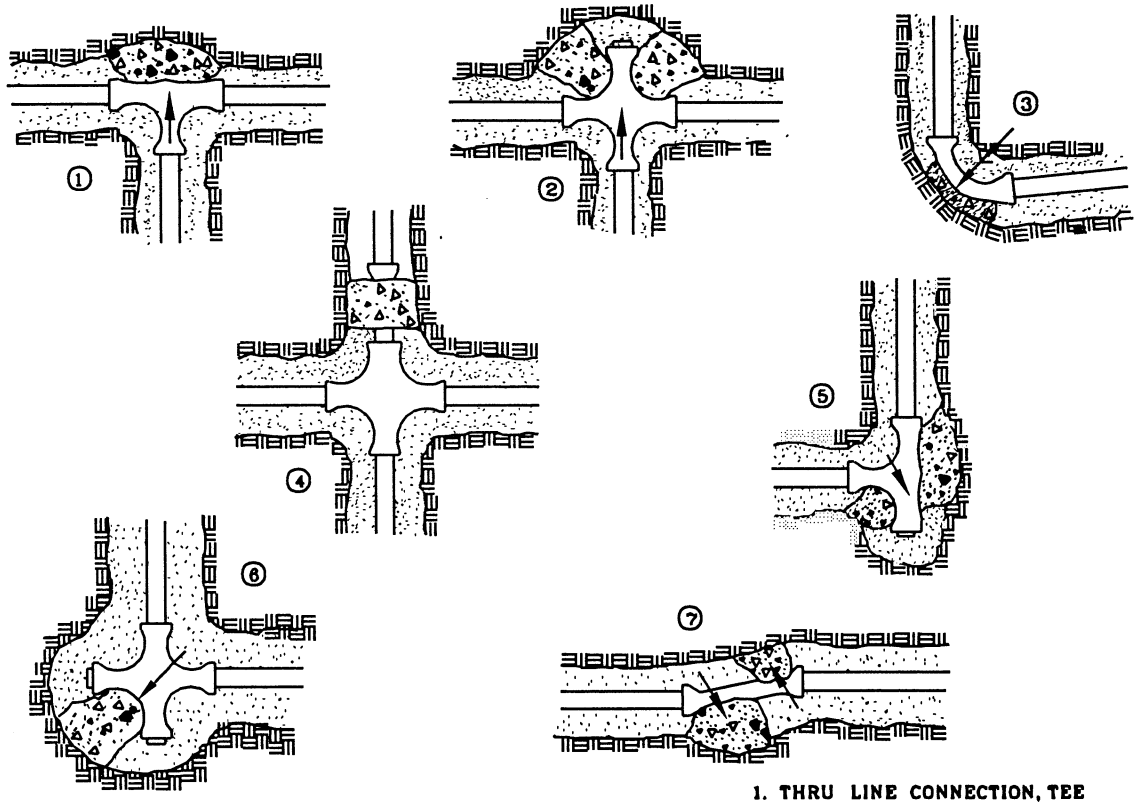
NOTE: ALTERNATE METHOD OF RESTRAINT SHOULD BE CONSIDERED FOR SITUATIONS FALLING WITHIN OUTLINED AREA.

THRUST RESTRAINT WITH ANCHOR RING			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities	NO. / DATE / DESCRIPTION
SHEET 1 OF 1	DWG. NO. W-13	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.		
	DATE 3-12-99	APP H. COREY			

RESULTANT THRUST AT FITTING AT 150 PSI WATER PRESSURE

NOM. PIPE DIA.	TOTAL POUNDS DEAD END	90° BEND	45° BEND	22-1/2° BEND	11-1/4° BEND
4"	2,700	3,800	2,100	1,100	530
6"	5,600	8,000	4,300	2,200	1,100
8"	9,700	13,600	7,400	3,800	1,900
10"	14,500	20,500	11,100	5,700	2,900
12"	20,500	29,000	15,700	8,000	4,000
14"	27,600	39,000	21,100	11,000	5,400
16"	35,700	50,400	27,300	14,000	7,000
18"	44,800	63,400	34,400	17,500	8,800
20"	55,000	77,000	42,100	21,500	10,800
24"	78,500	110,000	60,000	31,600	15,400
30"	120,600	170,600	92,300	47,100	23,600
36"	172,800	244,400	132,300	67,500	33,900
42"	233,300	330,000	178,600	91,000	45,700
48"	304,000	430,000	232,700	118,600	59,600
54"	384,100	543,200	294,000	149,000	75,300

TYPES OF THRUST BLOCKING



SOIL	BEARING LOAD (LB./SQ. FT.)
MUCK	0
SOFT CLAY	1,000
SILT	1,500
SANDY SILT	3,000
SAND	4,000
SANDY CLAY	6,000
HARD CLAY	9,000

POLYWRAP SHALL BE USED TO COVER FITTINGS AND BOLTS.

TO DETERMINE THE SIZE OF A CONCRETE THRUST BLOCK, DIVIDE THE TOTAL FORCE BY THE BEARING VALUES OF THE SOIL. THE QUOTIENT WILL BE THE SIZE OF THE BEARING AREA OF THE THRUST BLOCK IN SQUARE FEET. APPROXIMATE VALUES FOR VARIOUS TYPES OF SOIL ARE LISTED IN TABLE.

NO RESPONSIBILITY CAN BE ASSUMED FOR THE ACCURACY OF THE DATA IN THIS TABLE DUE TO THE WIDE VARIATION OF BEARING LOAD CAPABILITIES FOR EACH SOIL TYPE.

1. THRU LINE CONNECTION, TEE
2. THRU LINE CONNECTION, TEE CROSS USED AS TEE
3. DIRECTION CHARGE, ELBOW
4. CHANGE LINE SIZE, REDUCER
5. DIRECTION CHANGE, TEE USED AS ELBOW
6. DIRECTION CHANGE, CROSS USED AS ELBOW
7. DIRECTION CHANGE

THRUST BLOCKING DETAIL

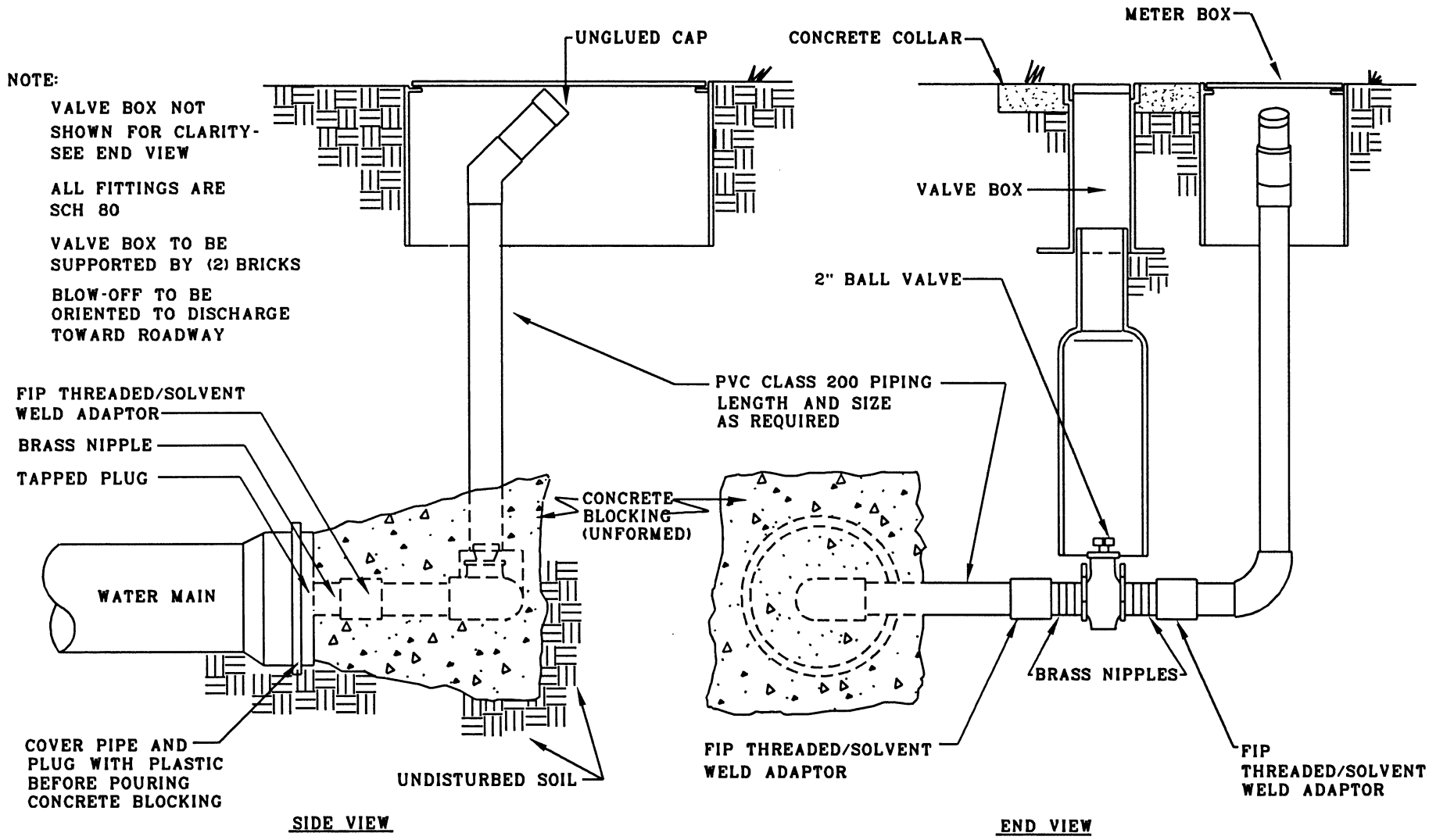
GREENVILLE UTILITIES
GREENVILLE, N.C.

SHEET 1 OF 1 | DWG. NO. W-12 | DATE 3-12-99 | DWG N. WOOTEN | APP H. COREY

WATER RESOURCES ENGINEERING
GREENVILLE, N.C.

Greenville Utilities

NO.	DATE	DESCRIPTION

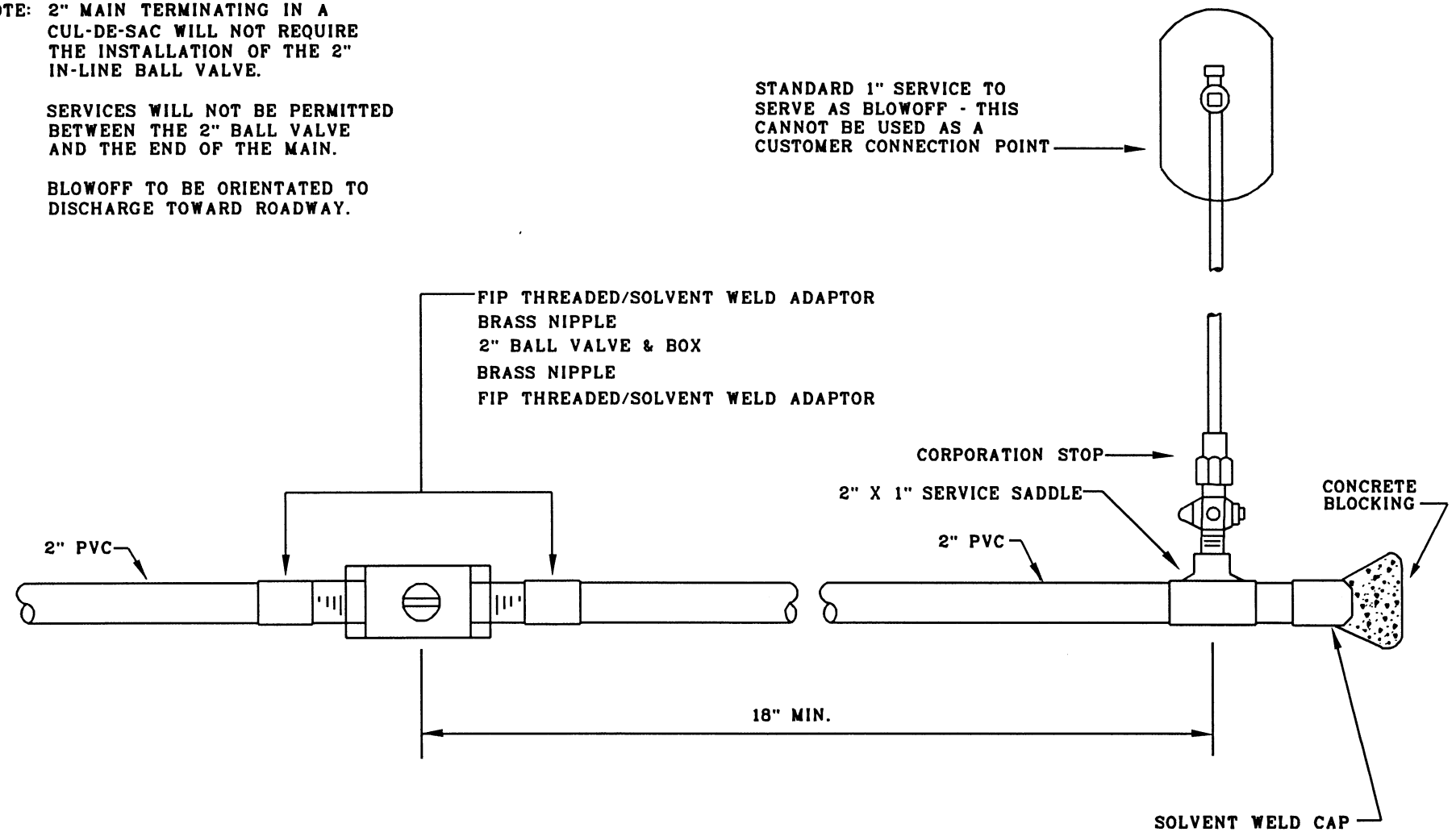


PERMANENT 2" BLOWOFF DETAIL			GREENVILLE UTILITIES GREENVILLE, N.C.		NO.	DATE / DESCRIPTION
SHEET	DWG. NO. W-11	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities		
1 OF 1	DATE 3-12-99	APP H. COREY				

NOTE: 2" MAIN TERMINATING IN A CUL-DE-SAC WILL NOT REQUIRE THE INSTALLATION OF THE 2" IN-LINE BALL VALVE.

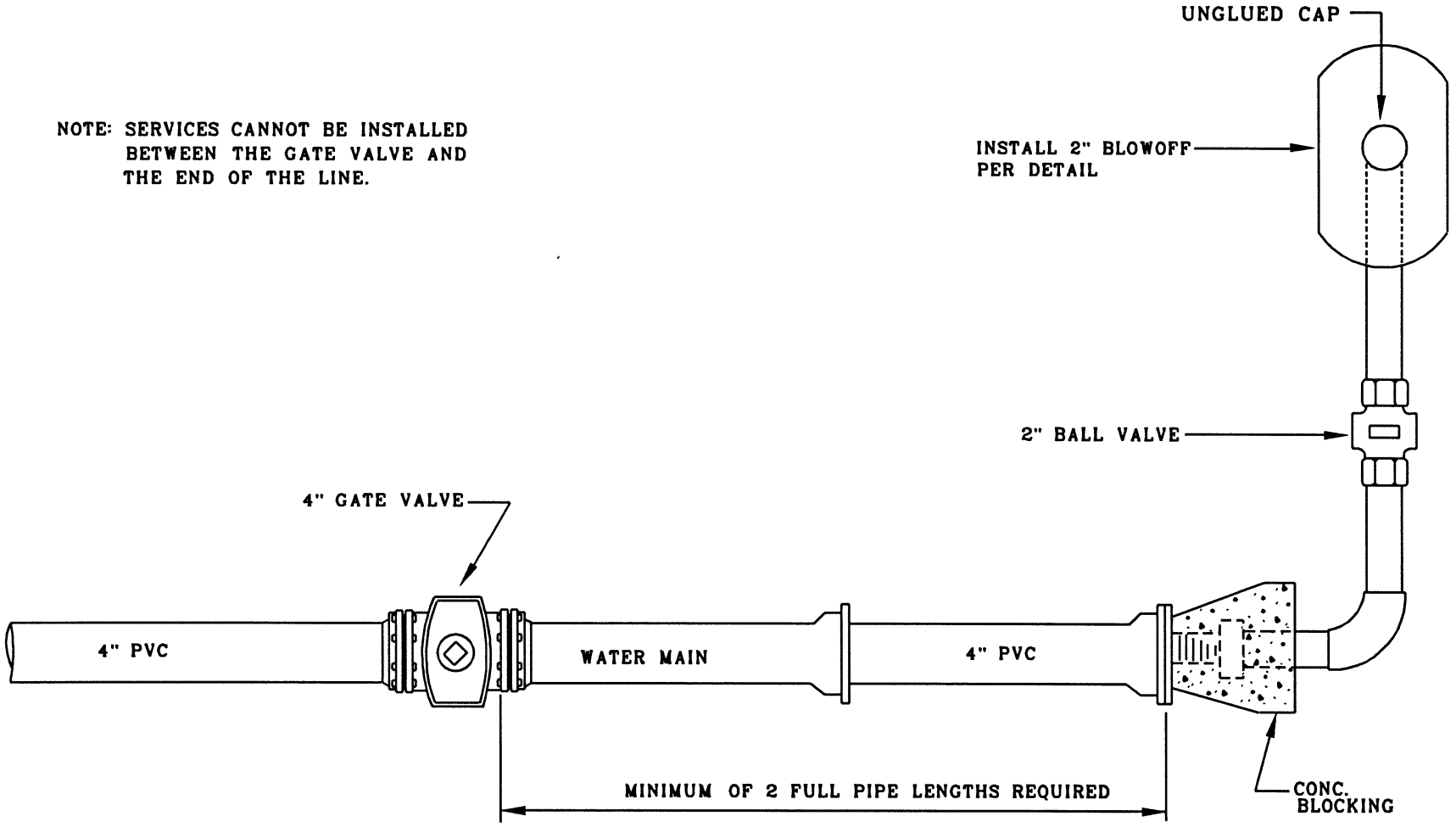
SERVICES WILL NOT BE PERMITTED BETWEEN THE 2" BALL VALVE AND THE END OF THE MAIN.

BLOWOFF TO BE ORIENTATED TO DISCHARGE TOWARD ROADWAY.



TERMINATION OF 2" WATER MAIN			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities	NO.	DATE	DESCRIPTION
SHEET 1 OF 1	DWG. NO. W-10 DATE 3-12-99	DWG N. WOOTEN APP H. COREY	WATER RESOURCES ENGINEERING GREENVILLE, N.C.				

NOTE: SERVICES CANNOT BE INSTALLED BETWEEN THE GATE VALVE AND THE END OF THE LINE.



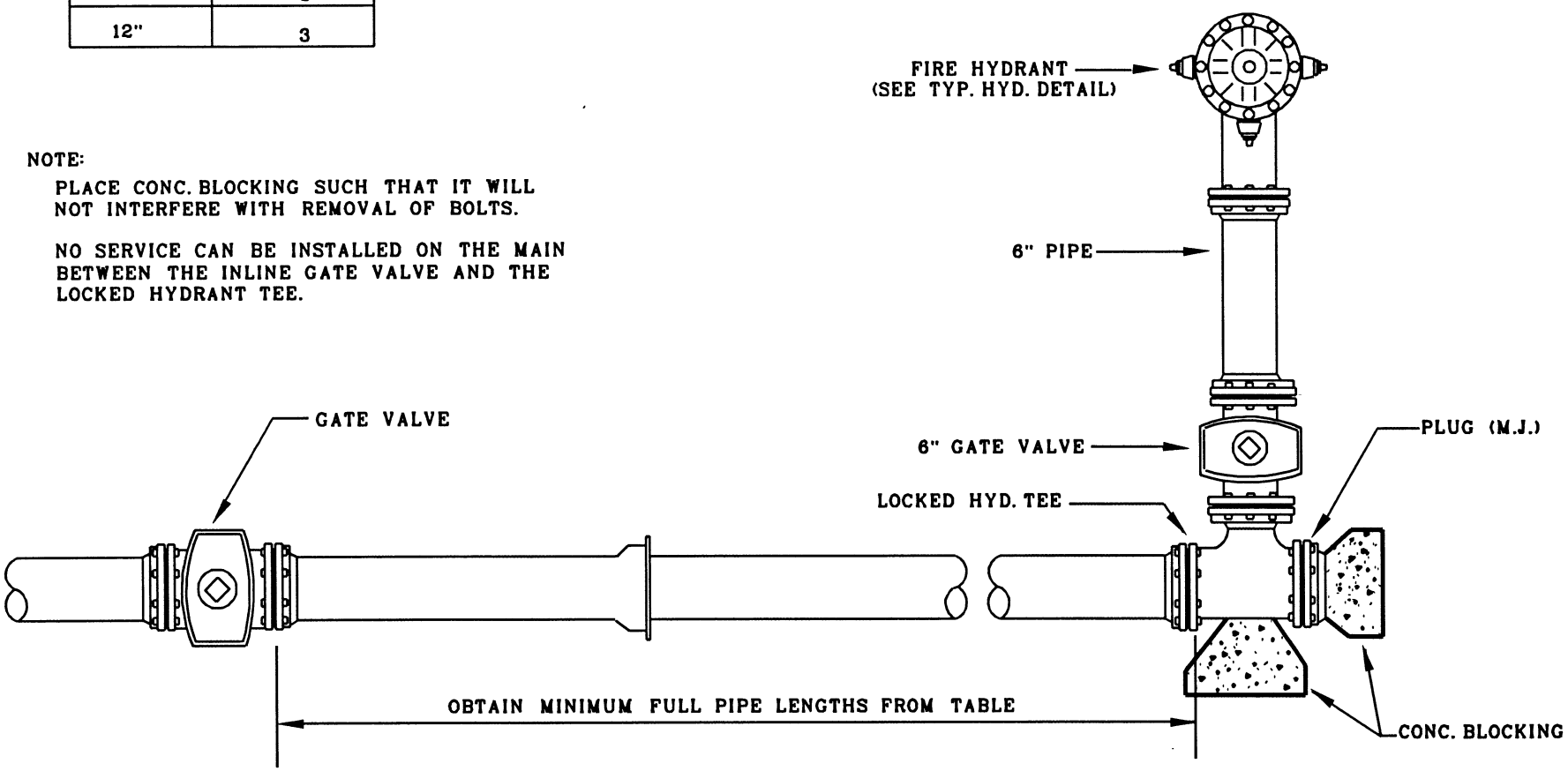
TERMINATION OF 4" WATER MAIN			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities	NO.	DATE	DESCRIPTION
SHEET	DWG. NO. W-9	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.				
1 OF 1	DATE 3-12-99	APP H. COREY					

PIPE DIA. (IN.)	MIN. FULL PIPE LENGTHS
6"	2
8"	3
10"	3
12"	3

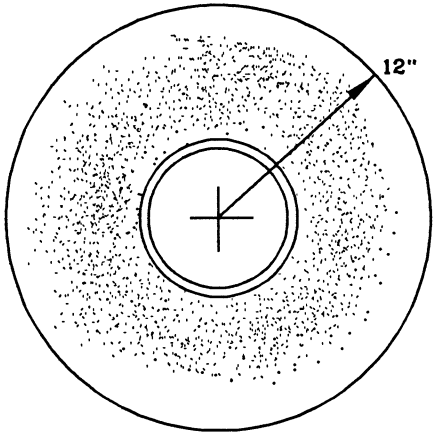
NOTE:

PLACE CONC. BLOCKING SUCH THAT IT WILL NOT INTERFERE WITH REMOVAL OF BOLTS.

NO SERVICE CAN BE INSTALLED ON THE MAIN BETWEEN THE INLINE GATE VALVE AND THE LOCKED HYDRANT TEE.

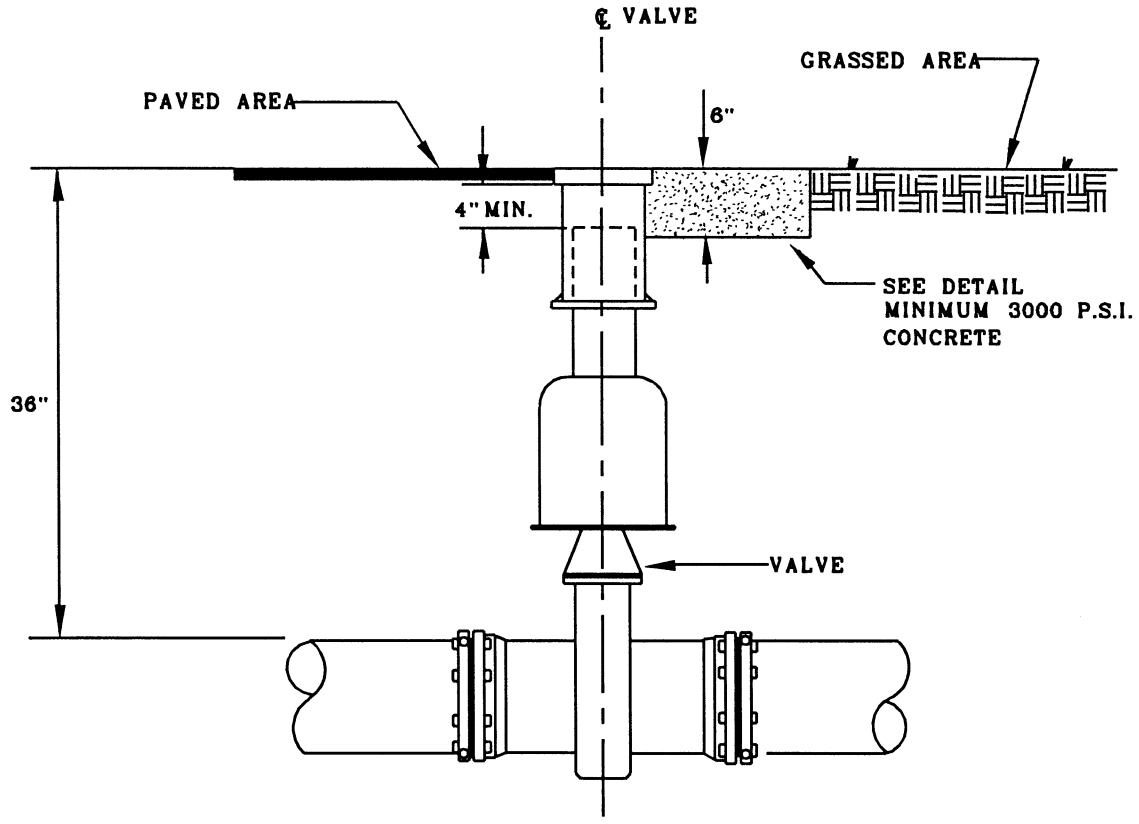


TERMINATION OF 6" - 12" WATER MAIN			GREENVILLE UTILITIES GREENVILLE, N.C.		NO.	DATE	DESCRIPTION
SHEET	DWG. NO. W-8	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities			
1 OF 1	DATE 3-12-99	APP H. COREY					



DETAIL

PRECAST CONCRETE COLLAR



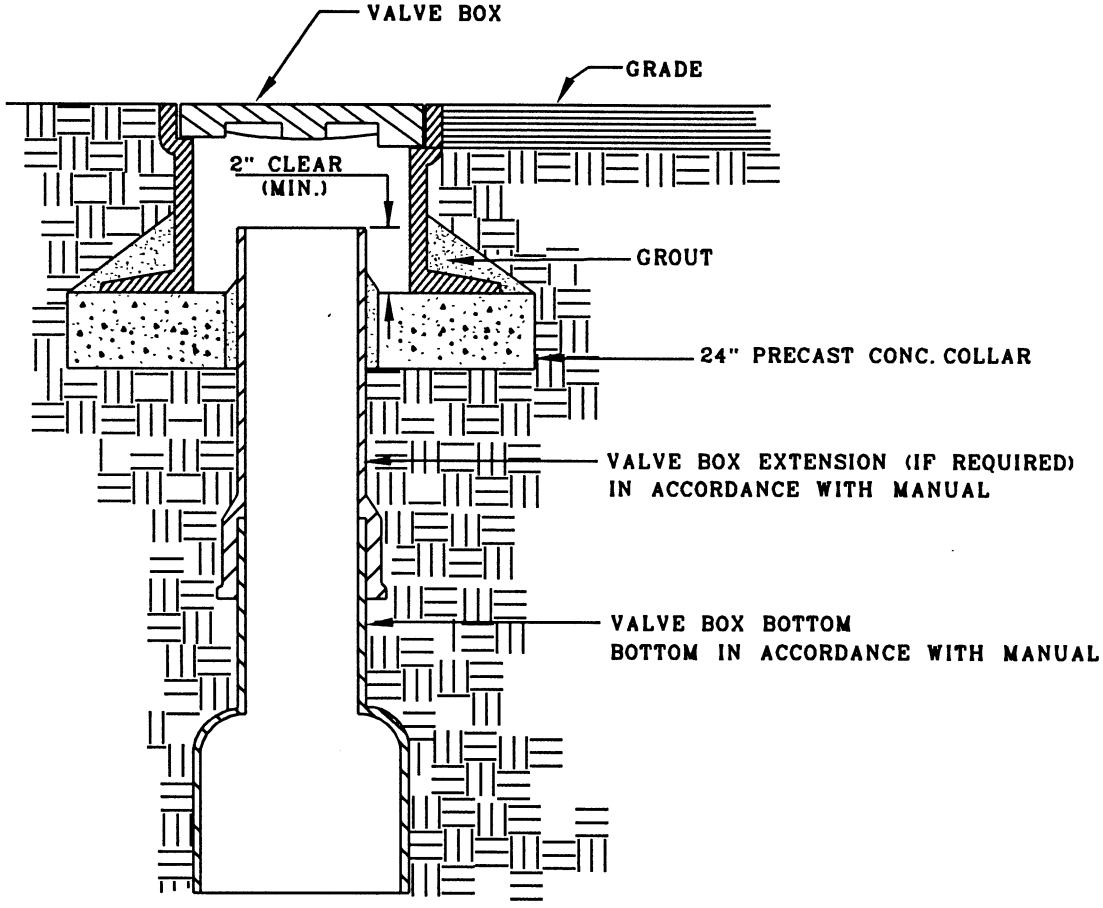
NOTE:

VALVE BOX SHALL NOT BE INSTALLED IN CURB AND GUTTER.

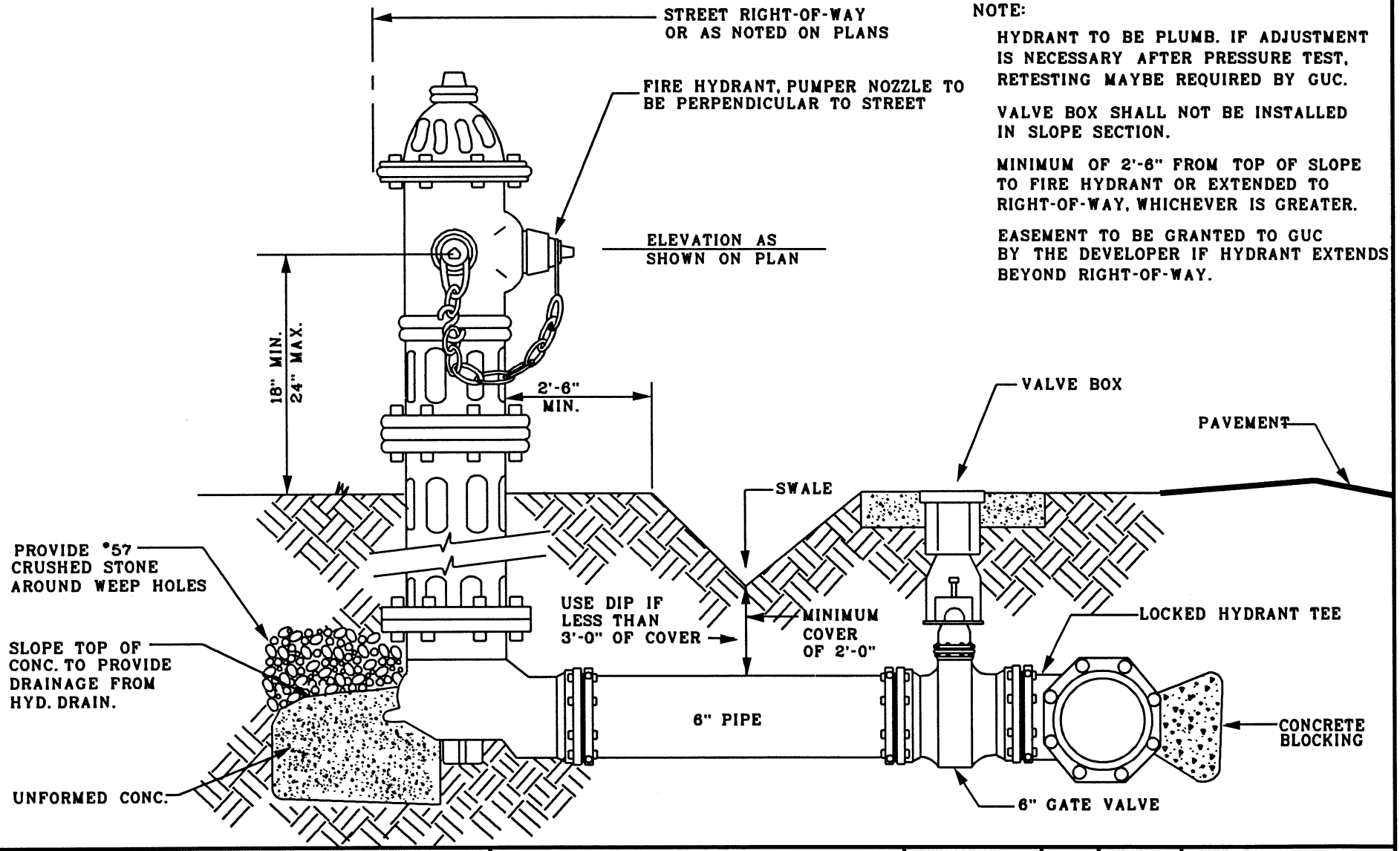
VALVE BOX SHALL BE IN ACCORDANCE WITH MANUAL.

VALVE BOX SHALL BE CENTERED AND PLUMBED OVER VALVE.

VALVE BOX DETAIL FOR VALVES SMALLER THAN 12"			GREENVILLE UTILITIES GREENVILLE, N.C.		NO.	DATE / DESCRIPTION
SHEET	DWG. NO. W-7	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities		
1 OF 1	DATE 3-12-99	APP H. COREY				



VALVE BOX DETAIL FOR VALVES 12" AND LARGER			GREENVILLE UTILITIES GREENVILLE, N.C.		NO.	DATE / DESCRIPTION
SHEET	DWG. NO. W-6	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities		
1 OF 1	DATE 3-12-99	APP H. COREY				



NOTE:

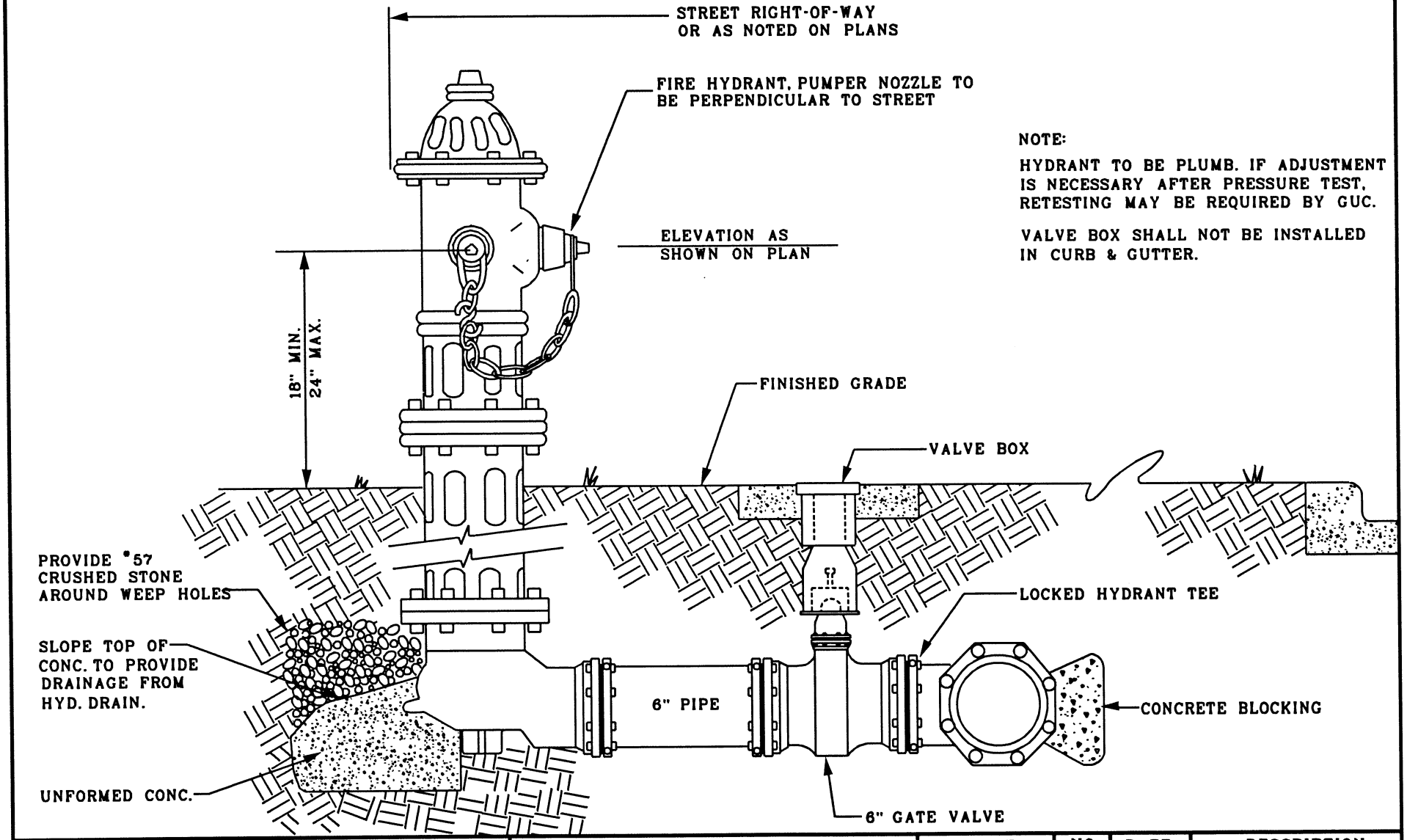
HYDRANT TO BE PLUMB. IF ADJUSTMENT IS NECESSARY AFTER PRESSURE TEST, RETESTING MAYBE REQUIRED BY GUC.

VALVE BOX SHALL NOT BE INSTALLED IN SLOPE SECTION.

MINIMUM OF 2'-6" FROM TOP OF SLOPE TO FIRE HYDRANT OR EXTENDED TO RIGHT-OF-WAY, WHICHEVER IS GREATER.

EASEMENT TO BE GRANTED TO GUC BY THE DEVELOPER IF HYDRANT EXTENDS BEYOND RIGHT-OF-WAY.

FIRE HYDRANT INSTALLATION (FOR AREAS WITHOUT CURB & GUTTER)			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities	NO.	DATE	DESCRIPTION
SHEET	DWG. NO. W-5	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.				
1 OF 1	DATE 3-12-99	APP H. COREY					



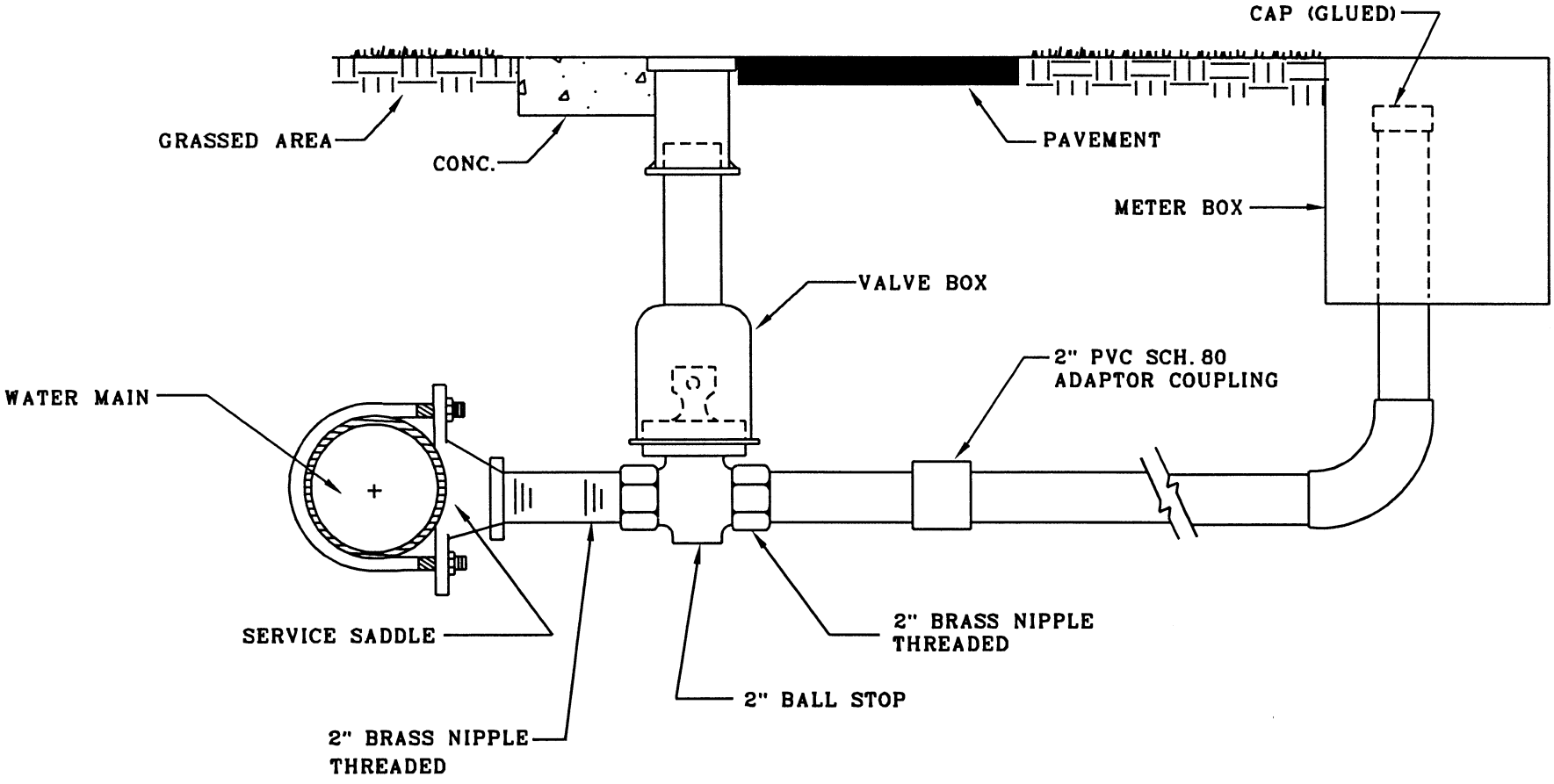
NOTE:

HYDRANT TO BE PLUMB. IF ADJUSTMENT IS NECESSARY AFTER PRESSURE TEST, RETESTING MAY BE REQUIRED BY GUC.

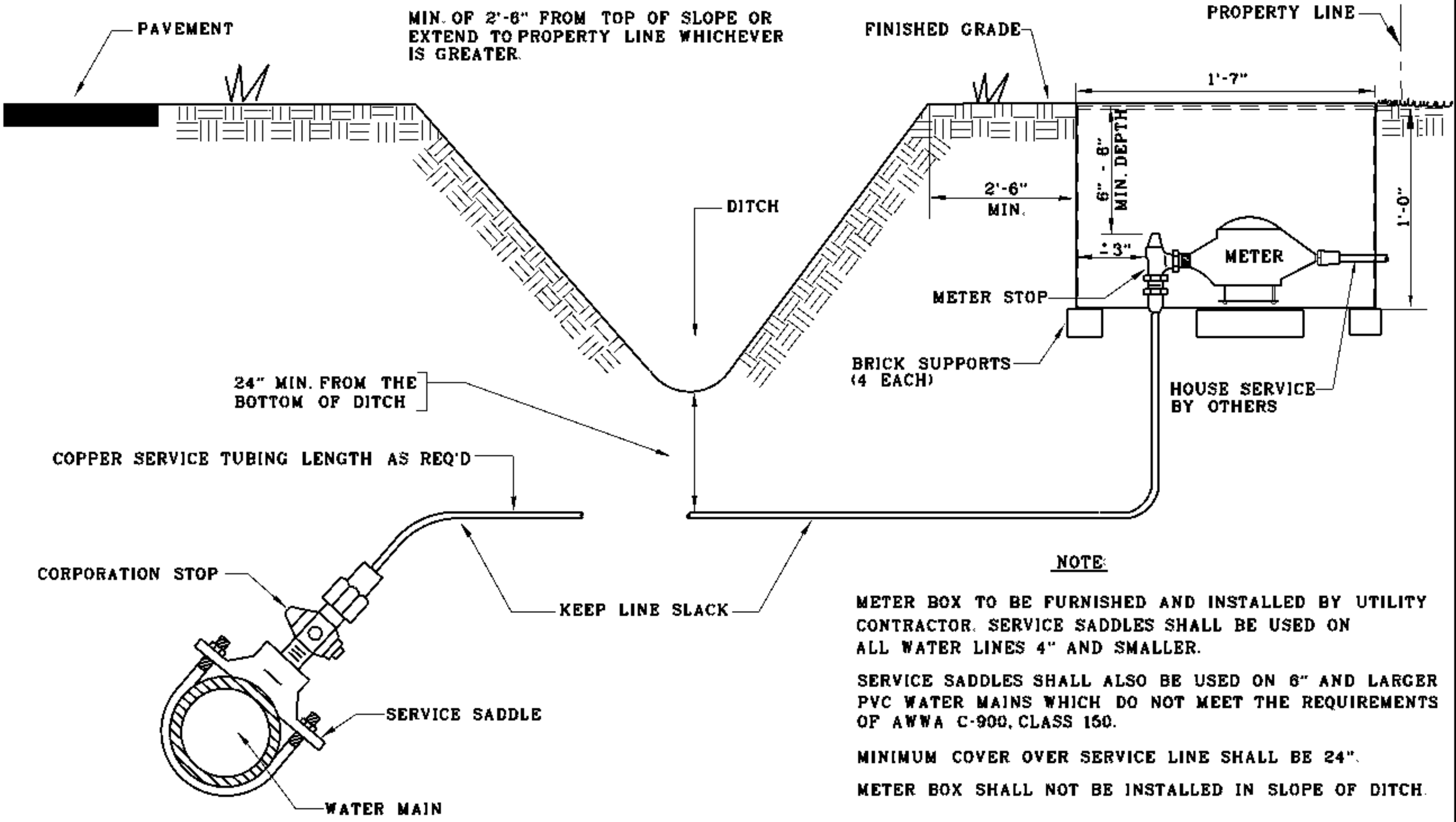
VALVE BOX SHALL NOT BE INSTALLED IN CURB & GUTTER.

FIRE HYDRANT INSTALLATION (FOR AREAS WITH CURB AND GUTTER)			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities	NO. / DATE / DESCRIPTION
SHEET 1 OF 1	DWG. NO. W-4	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.		
	DATE 3-12-99	APP H. COREY			

VALVE BOX TO BE
SUPPORTED BY TWO BRICKS



TYPICAL 1-1/2" AND 2" WATER SERVICE CONNECTION			GREENVILLE UTILITIES GREENVILLE, N.C.		NO.	DATE / DESCRIPTION
SHEET	DWG. NO. W-3	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities		
1 OF 1	DATE 3-12-99	APP H. COREY				



NOTE:

METER BOX TO BE FURNISHED AND INSTALLED BY UTILITY CONTRACTOR. SERVICE SADDLES SHALL BE USED ON ALL WATER LINES 4" AND SMALLER.

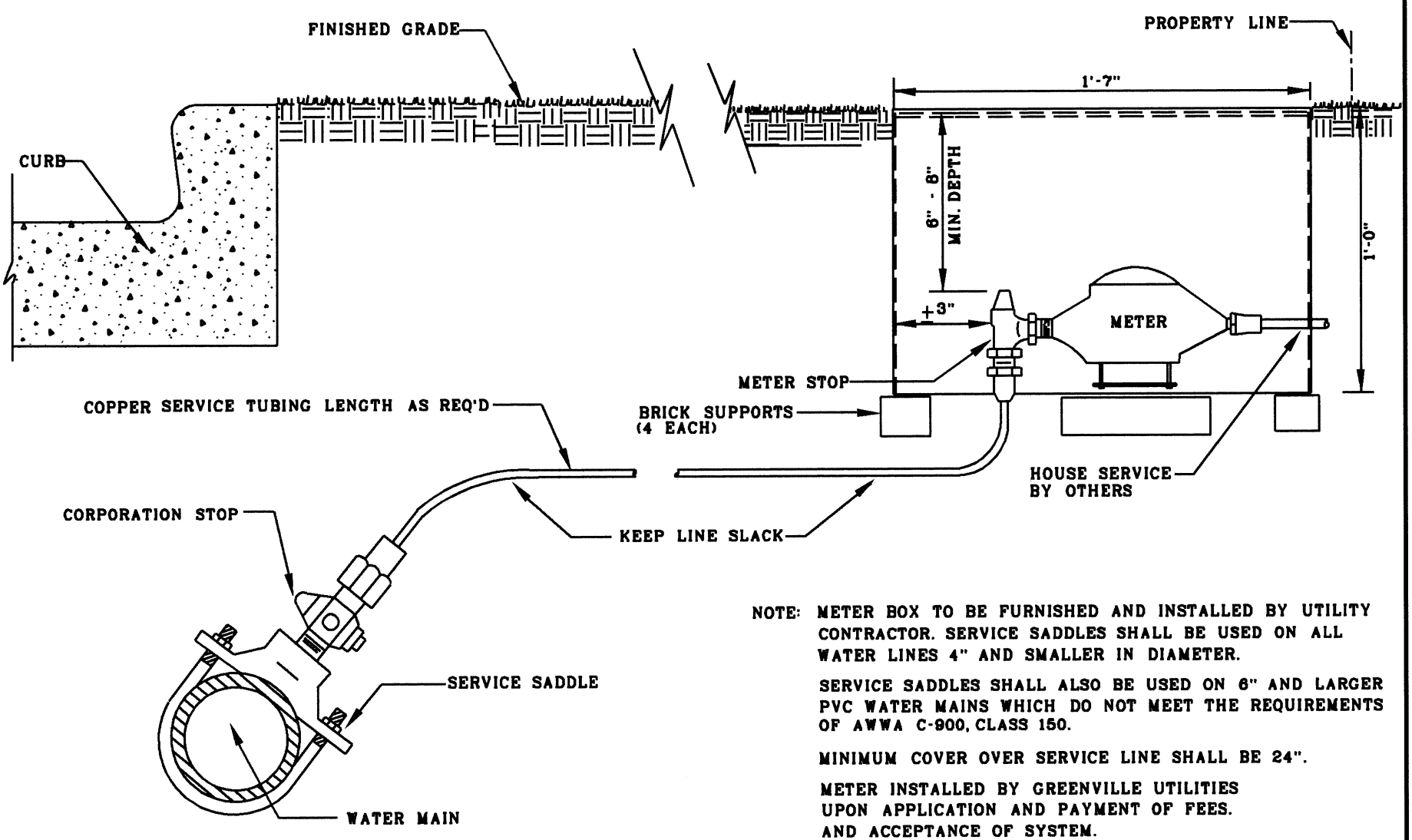
SERVICE SADDLES SHALL ALSO BE USED ON 6" AND LARGER PVC WATER MAINS WHICH DO NOT MEET THE REQUIREMENTS OF AWWA C-900, CLASS 150.

MINIMUM COVER OVER SERVICE LINE SHALL BE 24".

METER BOX SHALL NOT BE INSTALLED IN SLOPE OF DITCH.

1" WATER SERVICE DETAIL FOR AREAS WITHOUT CURB AND GUTTER			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities
SHEET	DWG. NO. W-2	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	
1 OF 1	DATE 3-12-99	APP H. COREY		

NO.	DATE	DESCRIPTION



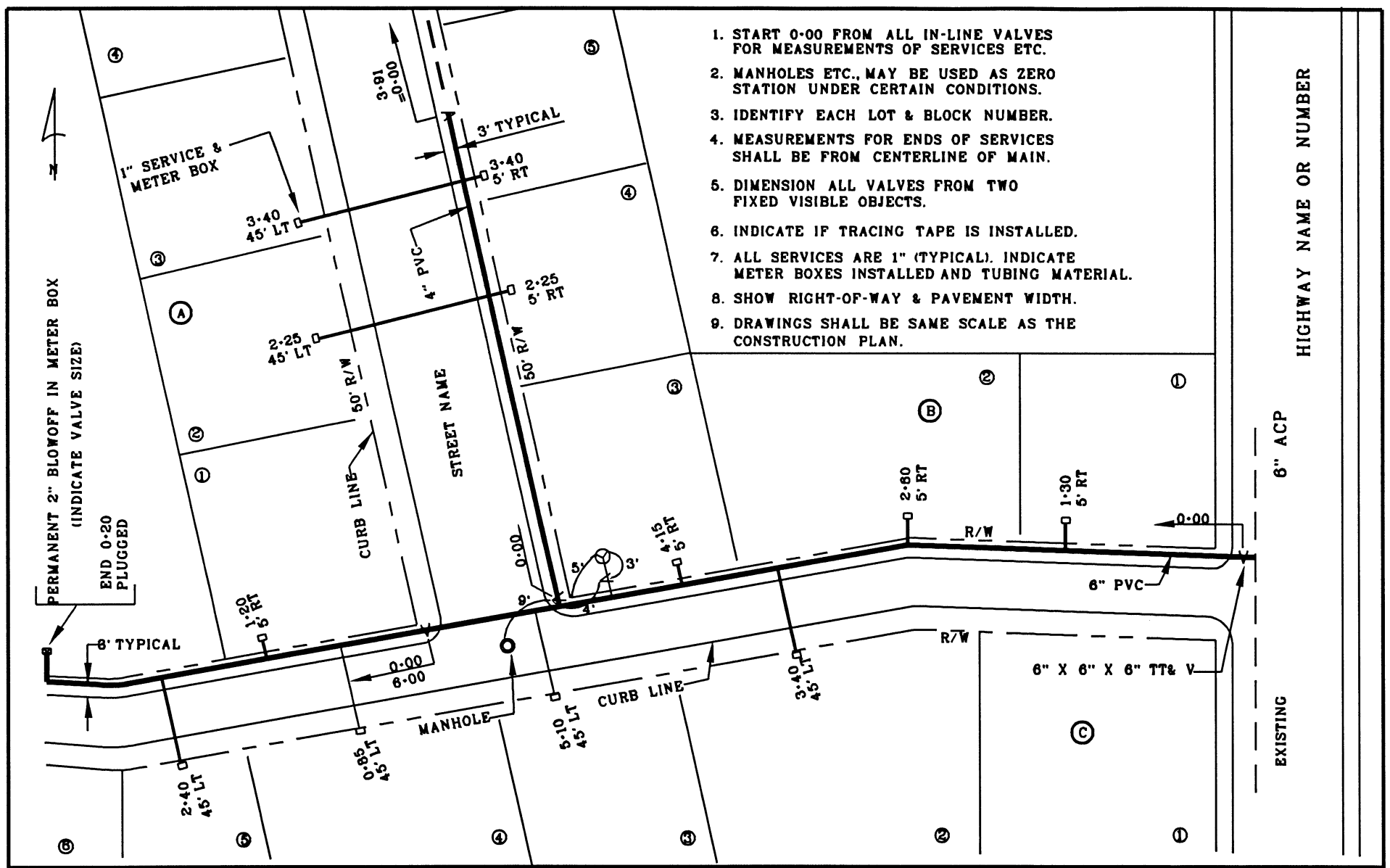
NOTE: METER BOX TO BE FURNISHED AND INSTALLED BY UTILITY CONTRACTOR. SERVICE SADDLES SHALL BE USED ON ALL WATER LINES 4" AND SMALLER IN DIAMETER.

SERVICE SADDLES SHALL ALSO BE USED ON 6" AND LARGER PVC WATER MAINS WHICH DO NOT MEET THE REQUIREMENTS OF AWWA C-900, CLASS 150.

MINIMUM COVER OVER SERVICE LINE SHALL BE 24".

METER INSTALLED BY GREENVILLE UTILITIES UPON APPLICATION AND PAYMENT OF FEES. AND ACCEPTANCE OF SYSTEM.

1" WATER SERVICE DETAIL FOR AREAS WITH CURB AND GUTTER			GREENVILLE UTILITIES GREENVILLE, N.C.		NO.	DATE / DESCRIPTION
SHEET	DWG. NO. W-1	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities		
1 OF 1	DATE 3-12-99	APP H. COREY				

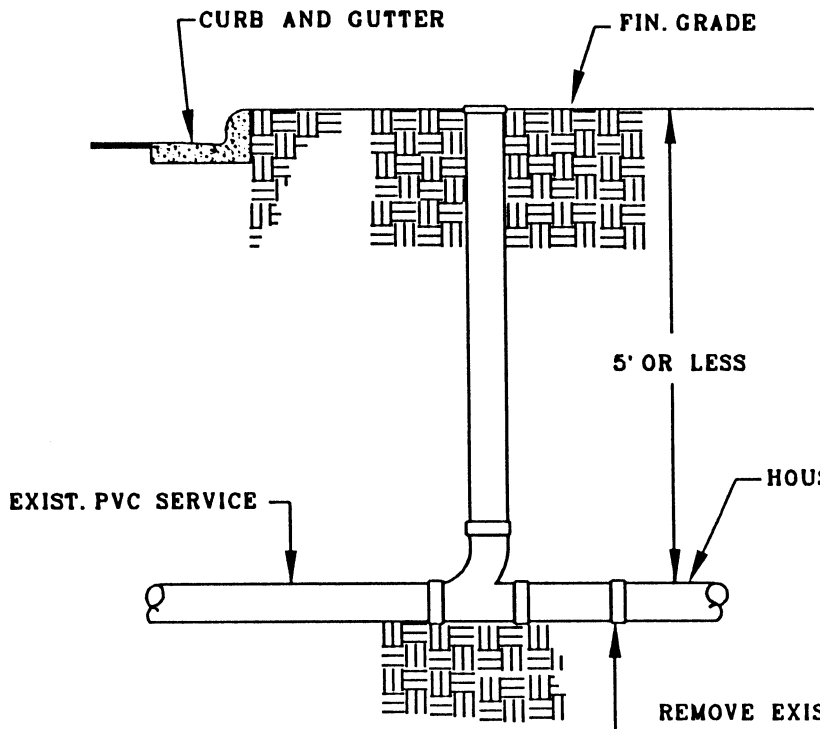


TYPICAL WATER SYSTEM AS-BUILT			GREENVILLE UTILITIES GREENVILLE, N.C.		
SHEET 1 OF 1	DWG. NO. W-18	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities	
	DATE 3-12-99	APP H. COREY			

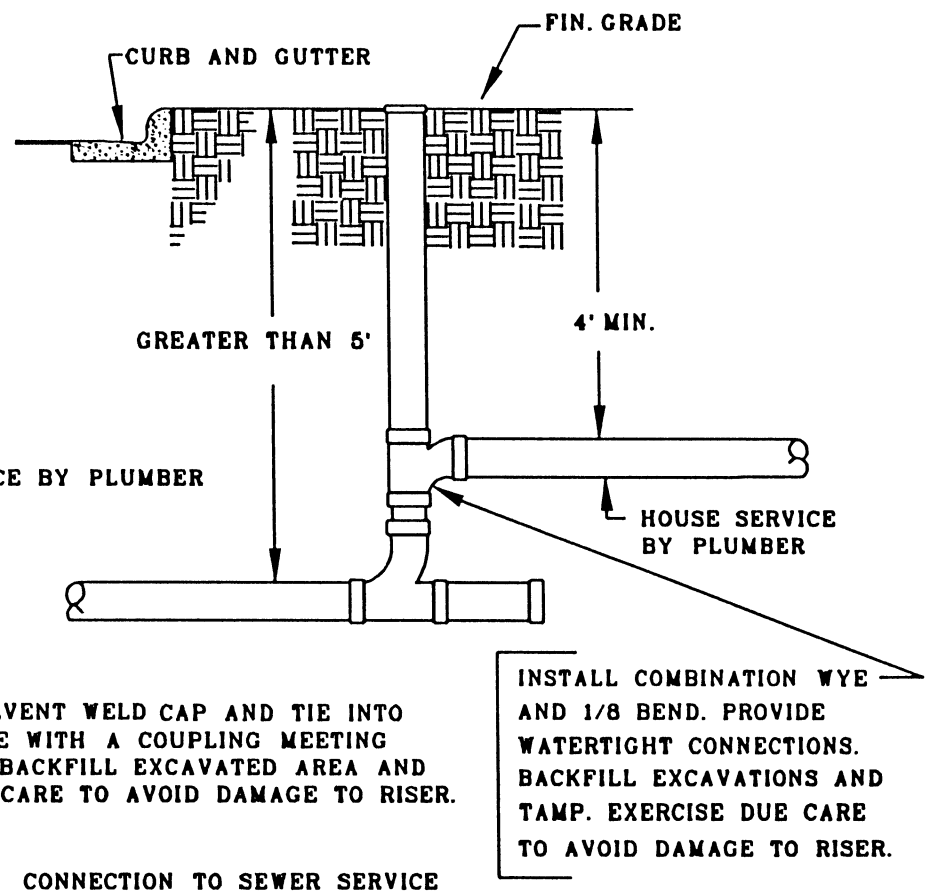
NO.	DATE	DESCRIPTION

NOTE:

ALL PIPING AND FITTINGS SHALL BE SCH. 40
PVC-DWV SEWER SERVICE PIPE (ASTM D-2665, D-1765)

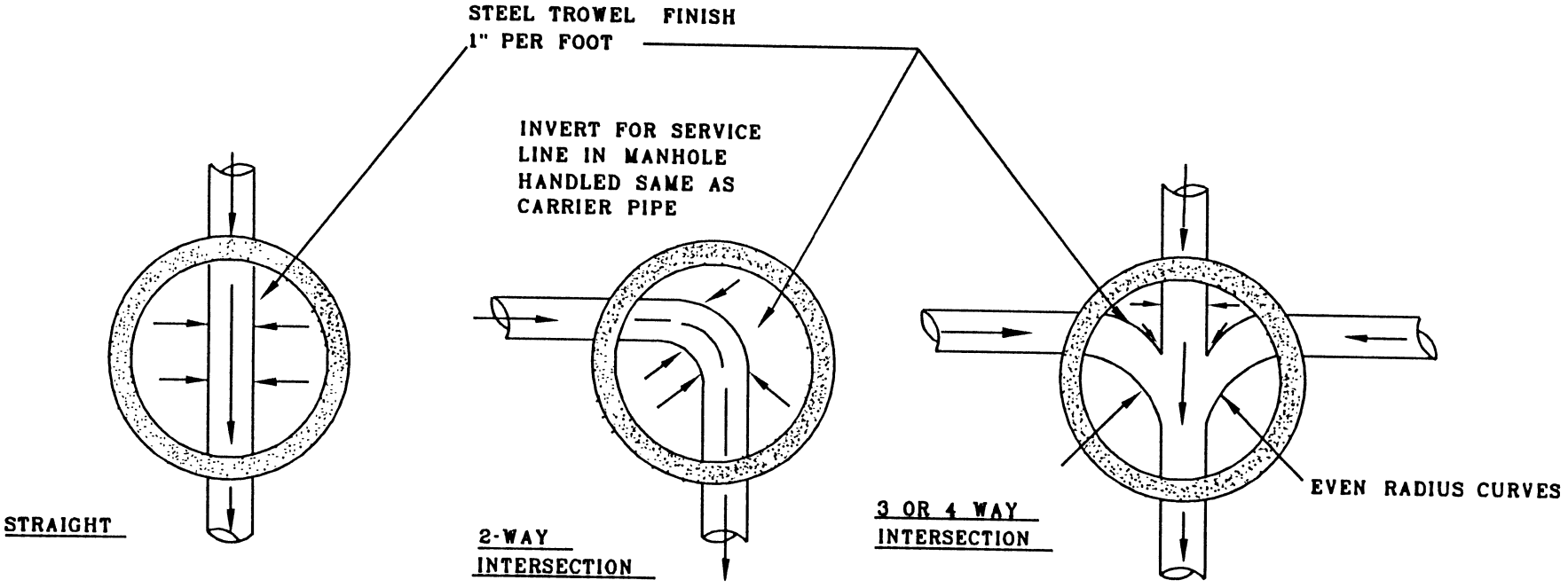


CONNECTION TO SEWER SERVICE 5'
OR LESS IN DEPTH



CONNECTION TO SEWER SERVICE
GREATER THAN 5' IN DEPTH

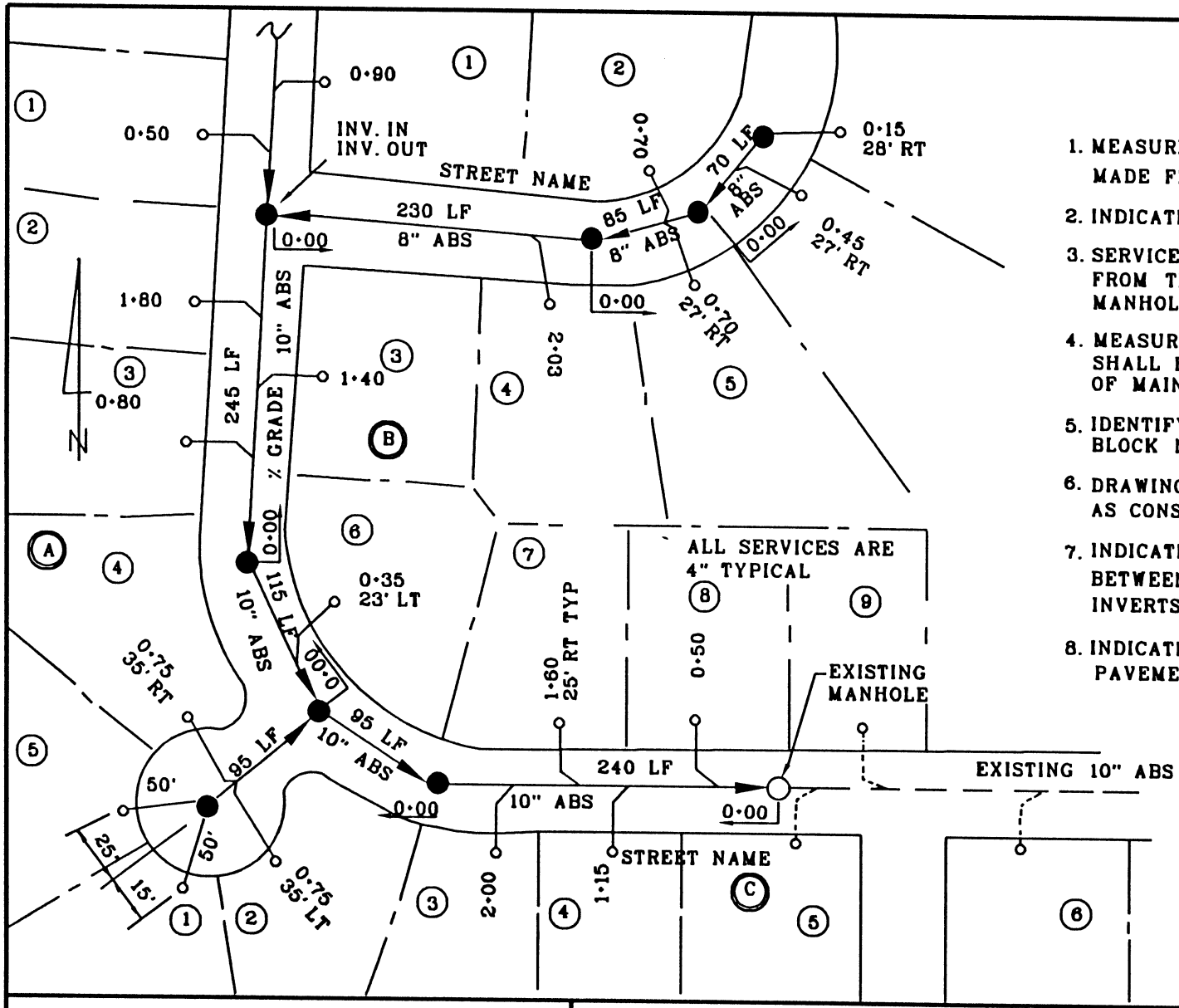
PVC SEWER SERVICE CONNECTION			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities	NO.	DATE	DESCRIPTION
SHEET 1 OF 1	DWG. NO. S-18 DATE 3-12-99	DWG N. WOOTEN APP H. COREY	WATER RESOURCES ENGINEERING GREENVILLE, N.C.				



NOTE:

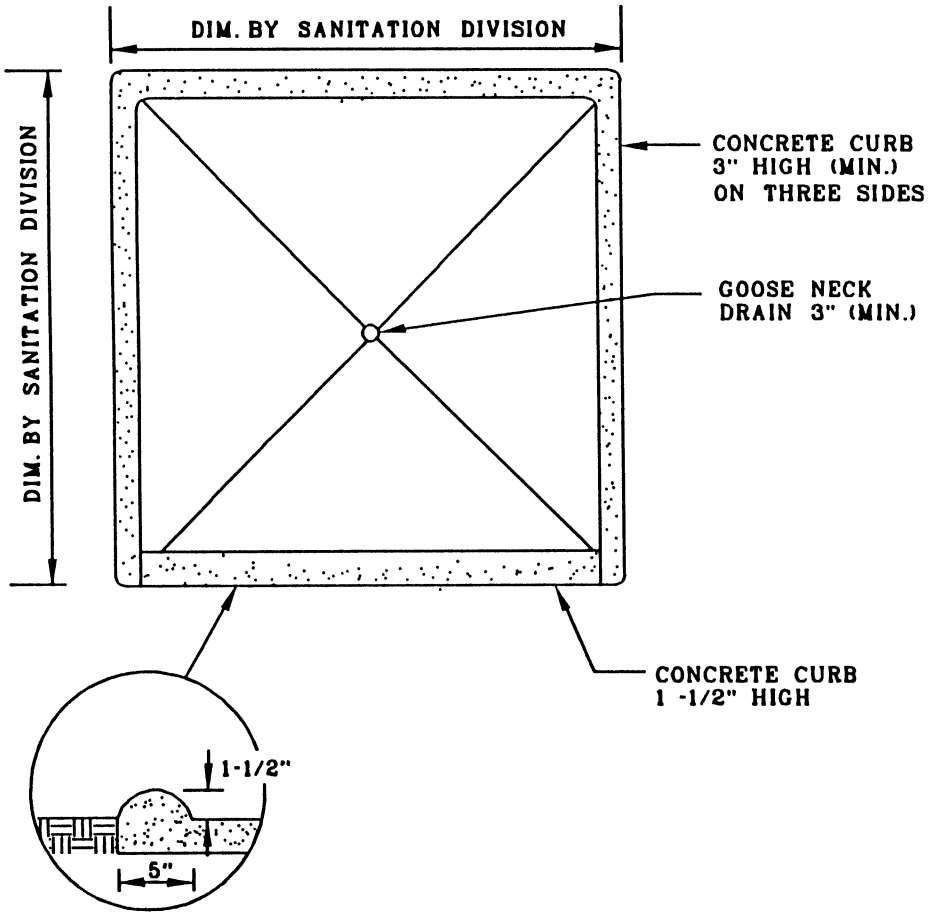
ACCURATELY SHAPE THE INVERTS TO A SMOOTH SEMI-CIRCLE CONFORMING TO THE INSIDE CONTOUR OF THE ADJACENT SEWER SECTIONS. ALL ENTERING BRANCHES AND CHANGES IN DIRECTIONS SHALL BE FORMED BY A CIRCULAR CURVE IN THE INVERT OF AS LARGE A RADIUS AS THE SIZE OF MANHOLE WILL PERMIT. CHANGES IN SIZE AND GRADE OF THE CHANNELS SHALL BE MADE GRADUALLY AND EVENLY. THE INVERT CHANNELS SHALL BE FORMED DIRECTLY IN THE CONCRETE OF THE MANHOLE BASE, OR SHALL BE BUILT UP WITH BRICK AND MORTAR. THE FLOOR OF THE MANHOLE OUTSIDE THE CHANNELS SHALL BE SMOOTH AND SHALL SLOPE TOWARD THE CHANNELS NOT LESS THAN 1 INCH PER FOOT NOR MORE THAN 2 INCHES PER FOOT.

MANHOLE INVERTS			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities	NO.	DATE	DESCRIPTION
SHEET	DWG. NO. S-17	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.				
1 OF 1	DATE 3-12-99	APP H. COREY					



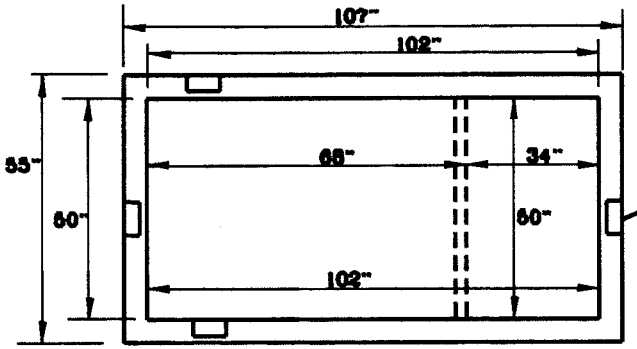
1. MEASUREMENTS ON SEWER LINES ARE MADE FROM ℄ TO ℄ OF MANHOLES
2. INDICATE CLEANOUTS.
3. SERVICE MEASUREMENTS ARE MADE FROM THE NEAREST DOWNSTREAM MANHOLE.
4. MEASUREMENTS FOR ENDS OF SERVICES SHALL BE FROM THE CENTERLINE OF MAIN.
5. IDENTIFY EACH LOT BY LOT AND BLOCK NUMBER.
6. DRAWINGS SHALL BE SAME SCALE AS CONSTRUCTION PLANS.
7. INDICATE SEWER LINE GRADE BETWEEN EACH MANHOLE AND INVERTS.
8. INDICATE R/W, CURB & GUTTER AND/OR PAVEMENT WIDTH.

TYPICAL SEWER SYSTEM "AS BUILT"			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities	NO.	DATE	DESCRIPTION
SHEET 1 OF 1	DWG. NO. S-16	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.				
	DATE 3-12-99	APP H. COREY					



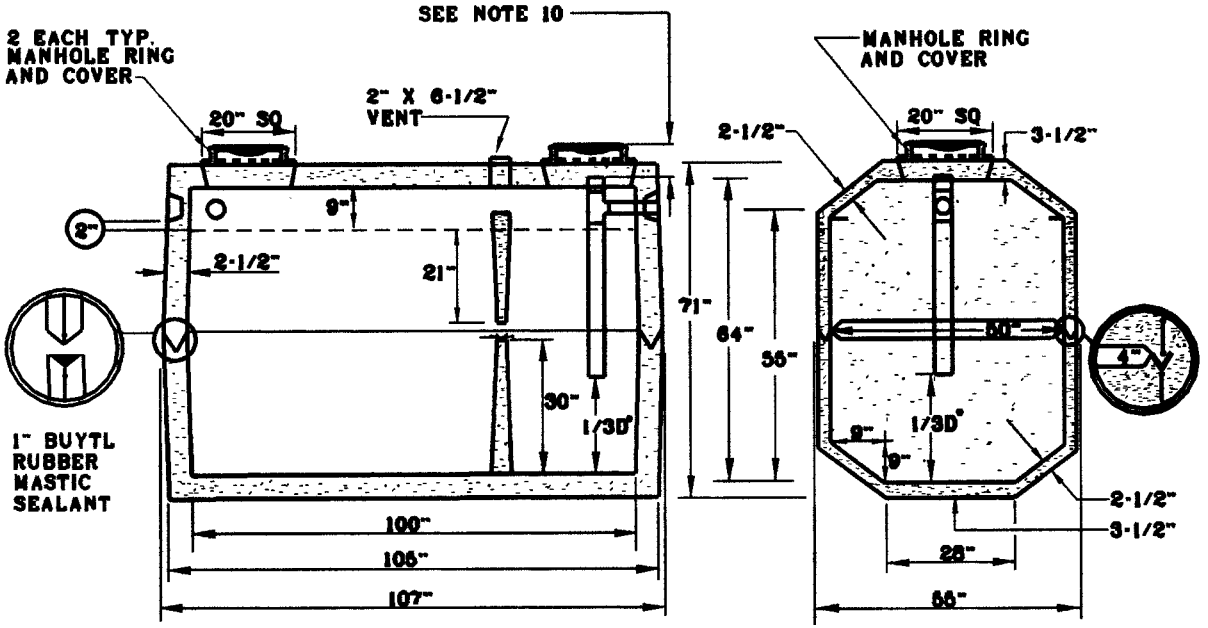
- PAD AREA SHOULD BE NO MORE THAN 50% IN EXCESS OF THE SPACE REQUIRED FOR DUMPSTER OR OTHER SOLID WASTE CONTAINERS.
- PAD DRAINS, OF NO LESS THAN 3" DIAMETER, SHOULD BE TIED INTO THE SEWER SYSTEM OF THE SITE AND SHALL BE EQUIPPED WITH A GOOSE NECK OF DESIGN SUFFICIENT TO BLOCK ODORS FROM THE SANITARY SEWER AND ELIMINATE ANY PATHWAY FOR UNDESIRABLE INSECTS, RODENTS, ETC.
- PAD DRAINS SHALL BE ROUTED THROUGH A GREASE INTERCEPTOR PRIOR TO CONNECTION TO THE SEWER.
- SEPARATE WATER AND/OR SEWER TAPS FROM CITY MAINS WILL NOT BE ALLOWED UNLESS SPECIFICALLY APPROVED BY GENERAL MANAGER OF GREENVILLE UTILITIES.
- PAD DRAINS ARE REQUIRED ONLY FOR FOOD HANDLING ESTABLISHMENTS, FISH MARKETS, ETC. OR AS OTHERWISE REQUIRED BY THE PITT COUNTY ENVIRONMENTAL HEALTH DEPARTMENT.
- PAD TO BE LOCATED ON THE LOT AT SUCH A LOCATION AS TO ELIMINATE THE ENTRANCE OF RUNOFF WATER INTO THE PAD DRAIN.
- LOCATION OF PAD MUST BE COORDINATED WITH SANITATION DIVISION OF PUBLIC WORKS.

TYPICAL DUMPSTER PAD WITH DRAIN			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities	NO.	DATE	DESCRIPTION
SHEET	DWG. NO. S-15	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.				
1 OF 1	DATE 3-12-99	APP H. COREY					



ALL BLOCKOUTS TO RECEIVE 4" MIN. TO 6" MAX. PIPE

1" MINIMUM THICKNESS IN ALL UNUSED KNOCKOUTS



•D• LIQUID DEPTH

NOTES

1. TANKS SHALL BE INSTALLED ON ALL KITCHEN WASTE & DRAIN LINES FROM RESTAURANTS, CAFES, MEAT MARKETS, & OTHER FOOD HANDLING ESTABLISHMENTS. GREENVILLE UTILITIES SHALL BE CONTACTED (252) 551-1551, 48 HOURS PRIOR TO INSTALLATION TO SCHEDULE INSPECTION OF THE INSTALLATIONS.
2. TANK SHOWN IS 1200 GAL. CAPACITY AND IS AVAILABLE LOCALLY.
3. 1200 GAL. CAPACITY SHALL BE THE STANDARD REQUIRED SIZE.
4. SMALLER OR LARGER TANKS MAY BE APPROVED FOR SPECIFIC INSTALLATIONS.
5. PROVIDE PROTECTION FOR TANK IN TRAFFIC AREAS OR CONSTRUCT TANK TO WITHSTAND TRAFFIC LOADS.
6. PROVIDE SCHEDULED PERIODIC CLEANING OF TANK SOLIDS.
7. IN MARGINAL INSTALLATIONS, THE DECISION AS TO THE NEED OF AN INTERCEPTOR SHALL BE MADE BY GREENVILLE UTILITIES.
8. ANY DESIGN NOT CONFORMING TO THIS DRAWING SHALL BE SUBMITTED TO GREENVILLE UTILITIES FOR APPROVAL.
9. ADJACENT SURACE AREAS SHALL BE GRADED TO PREVENT THE DRAINING OF WATER ACROSS OR THE PONDING OF WATER OVER THE GREASE INTERCEPTOR.
10. TOP OF OUTLET TEE PIPING TO BE 10" BELOW TOP OF RING AND COVER

TWO COMPARTMENT GREASE INTERCEPTOR

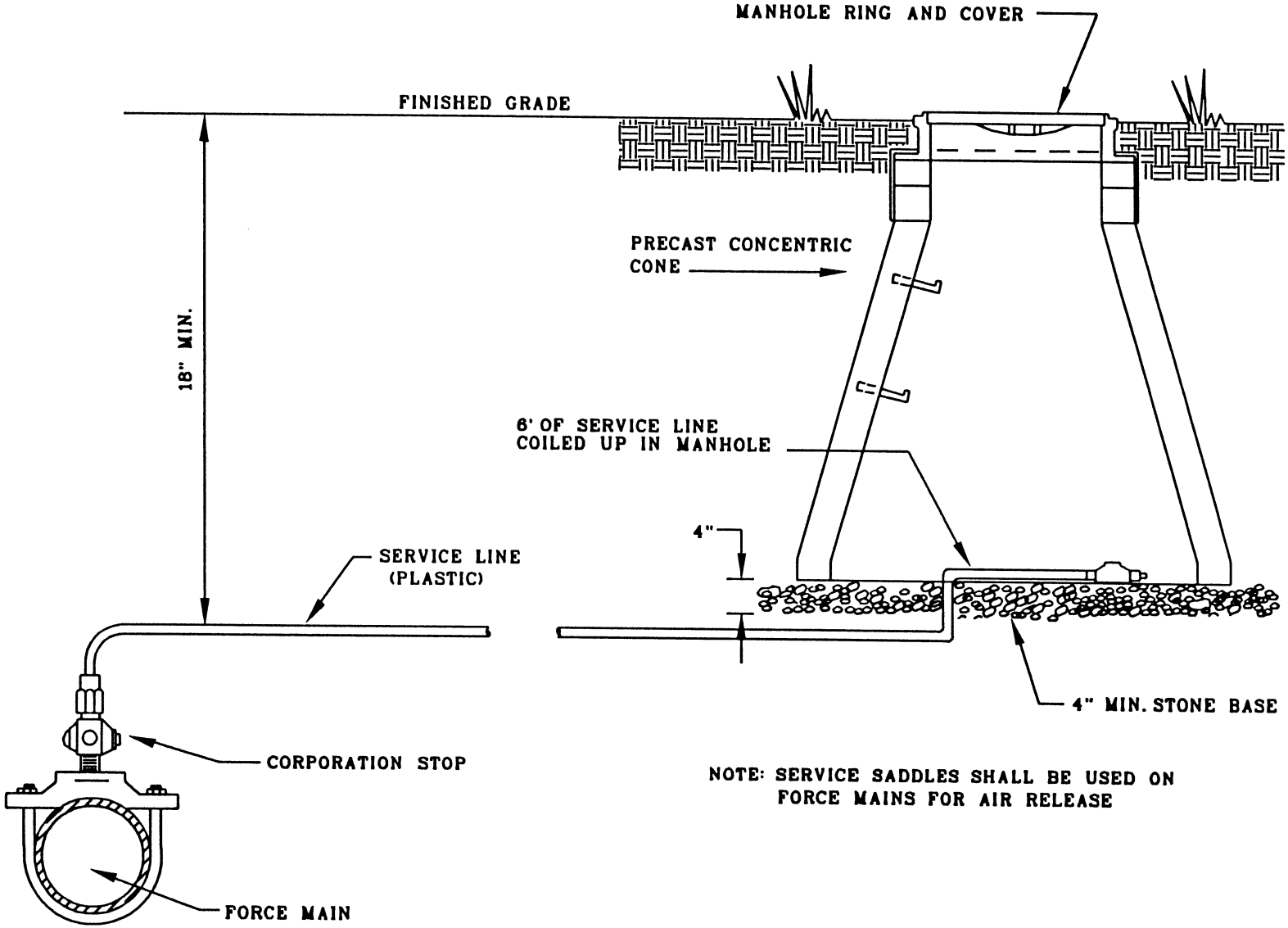
GREENVILLE UTILITIES
GREENVILLE, N.C.

WATER RESOURCES ENGINEERING
GREENVILLE, N.C.

Greenville Utilities

SHEET	DWG. NO. S-14	DWG N. WOOTEN
1 OF 1	DATE 3-12-99	APP H. COREY

NO.	DATE	DESCRIPTION

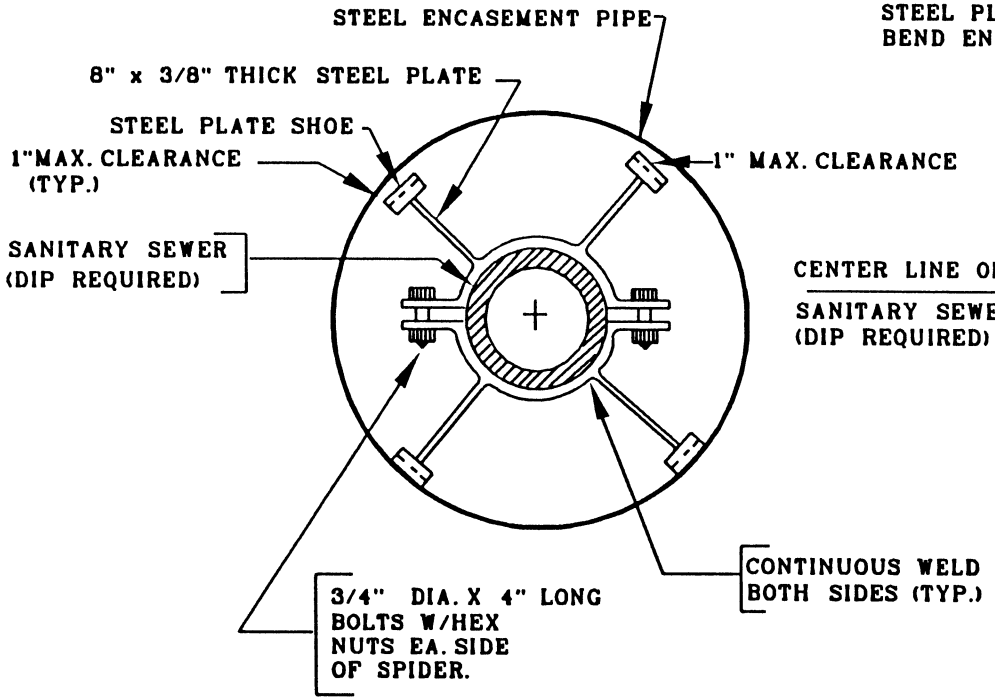


NOTE: SERVICE SADDLES SHALL BE USED ON FORCE MAINS FOR AIR RELEASE

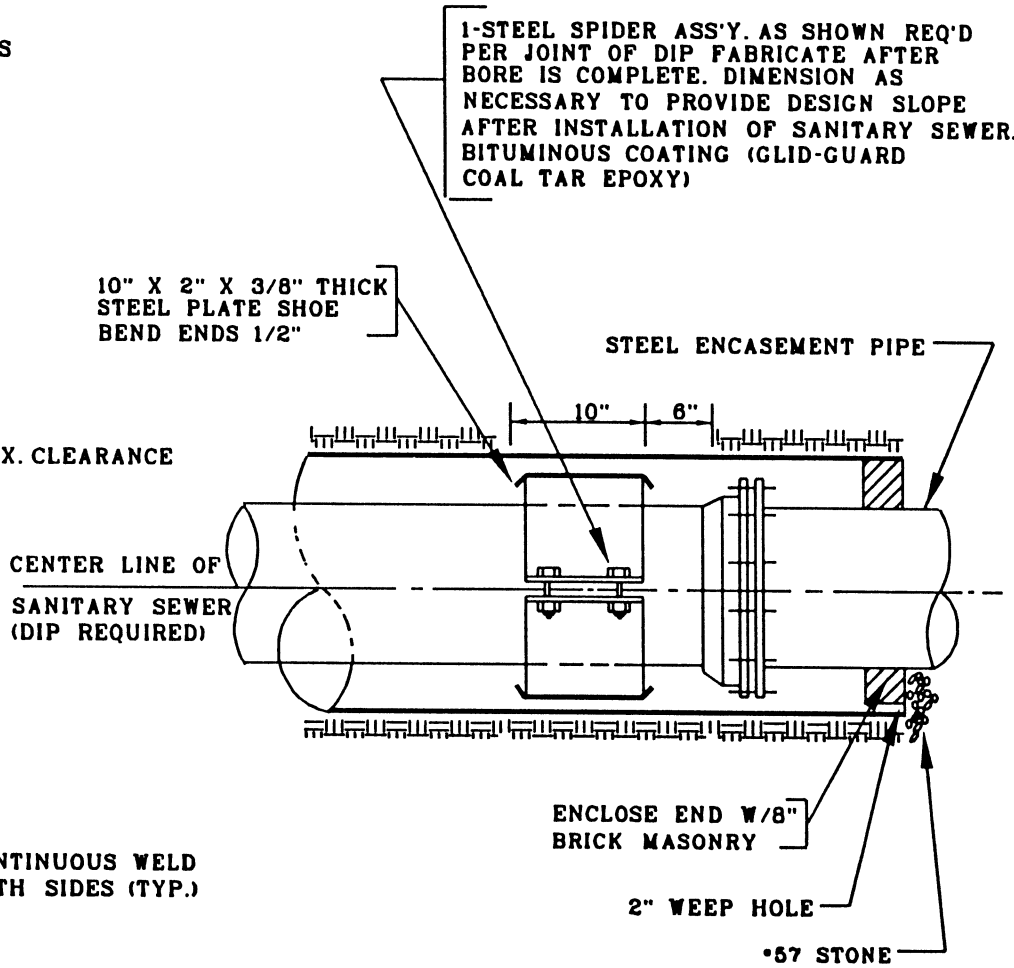
MANUAL AIR RELEASE FORCE MAIN			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities	NO.	DATE	DESCRIPTION
SHEET	DWG. NO. S-13	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.				
1 OF 1	DATE 3-12-99	APP H. COREY					

NOTE:

- ENTIRE SPIDER ASSEMBLY TO BE BITUMINOUS COATED AFTER FABRICATION.
- STEEL ENCASEMENT TO BE INSTALLED IN ACCORDANCE WITH DESIGN PLANS - ALL REVISIONS OR MODIFICATIONS REQUIRE PRIOR APPROVAL.



END ELEVATION

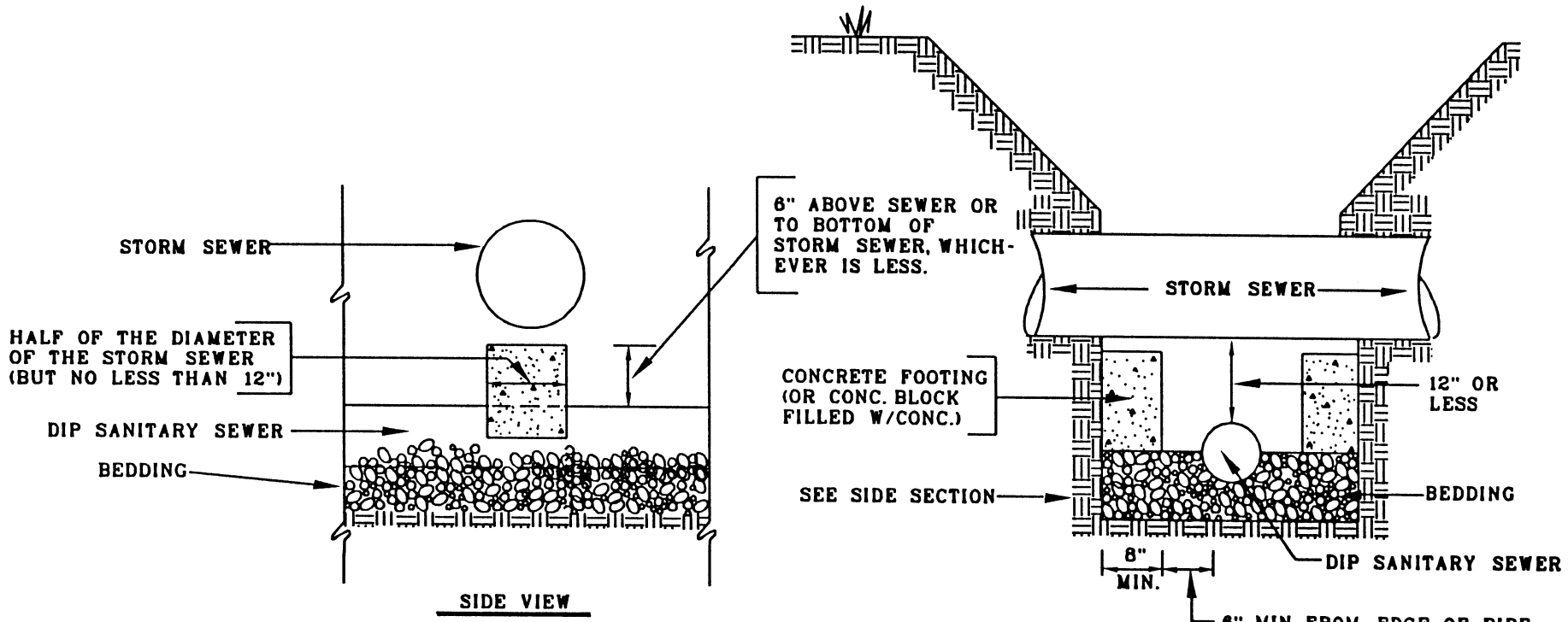


CASING SECTION

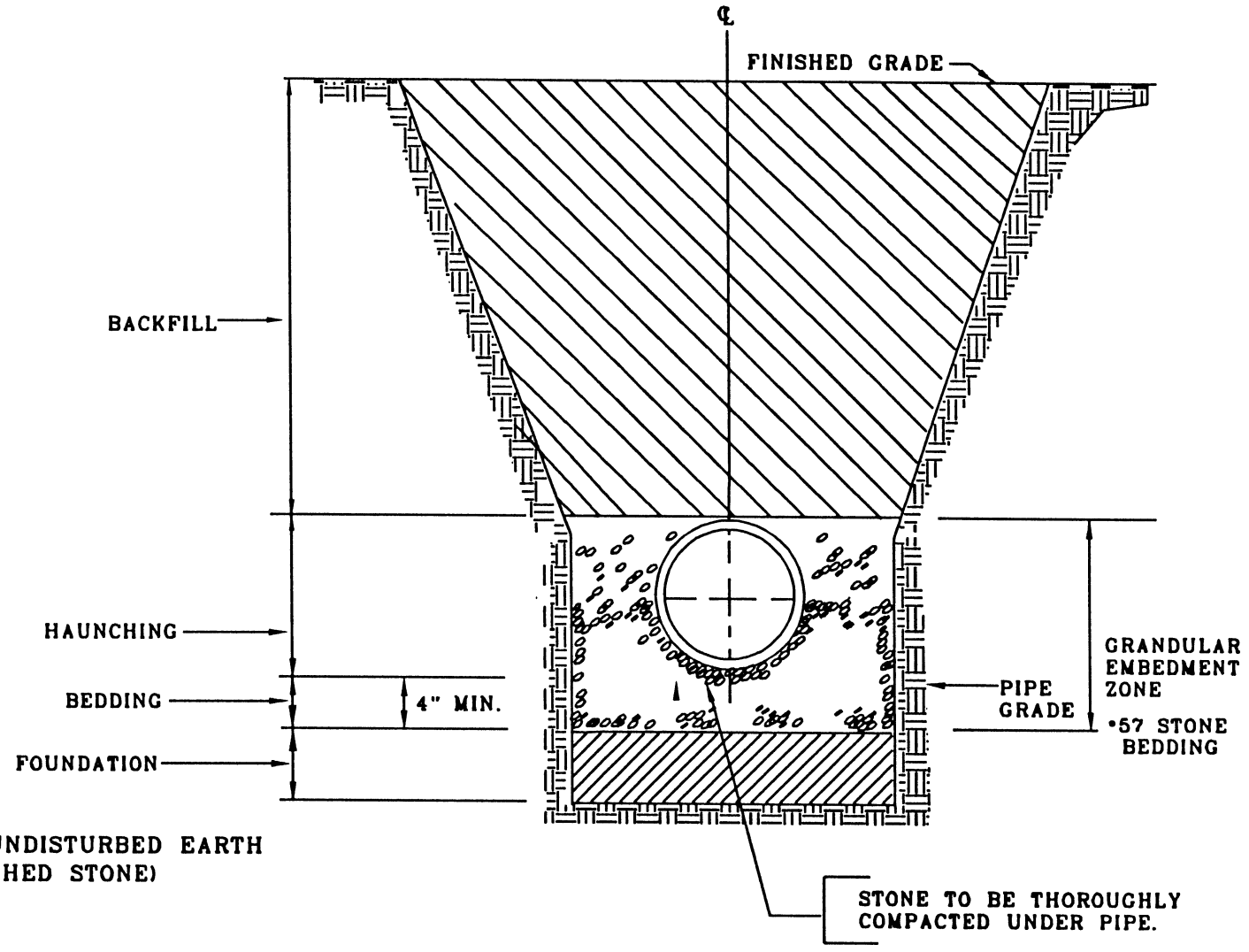
SANITARY SEWER ENCASEMENT DETAIL			GREENVILLE UTILITIES GREENVILLE, N.C.		NO.	DATE / DESCRIPTION
SHEET 1 OF 1	DWG. NO. S-12	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities		
	DATE 3-12-99	APP H. COREY				

NOTE:

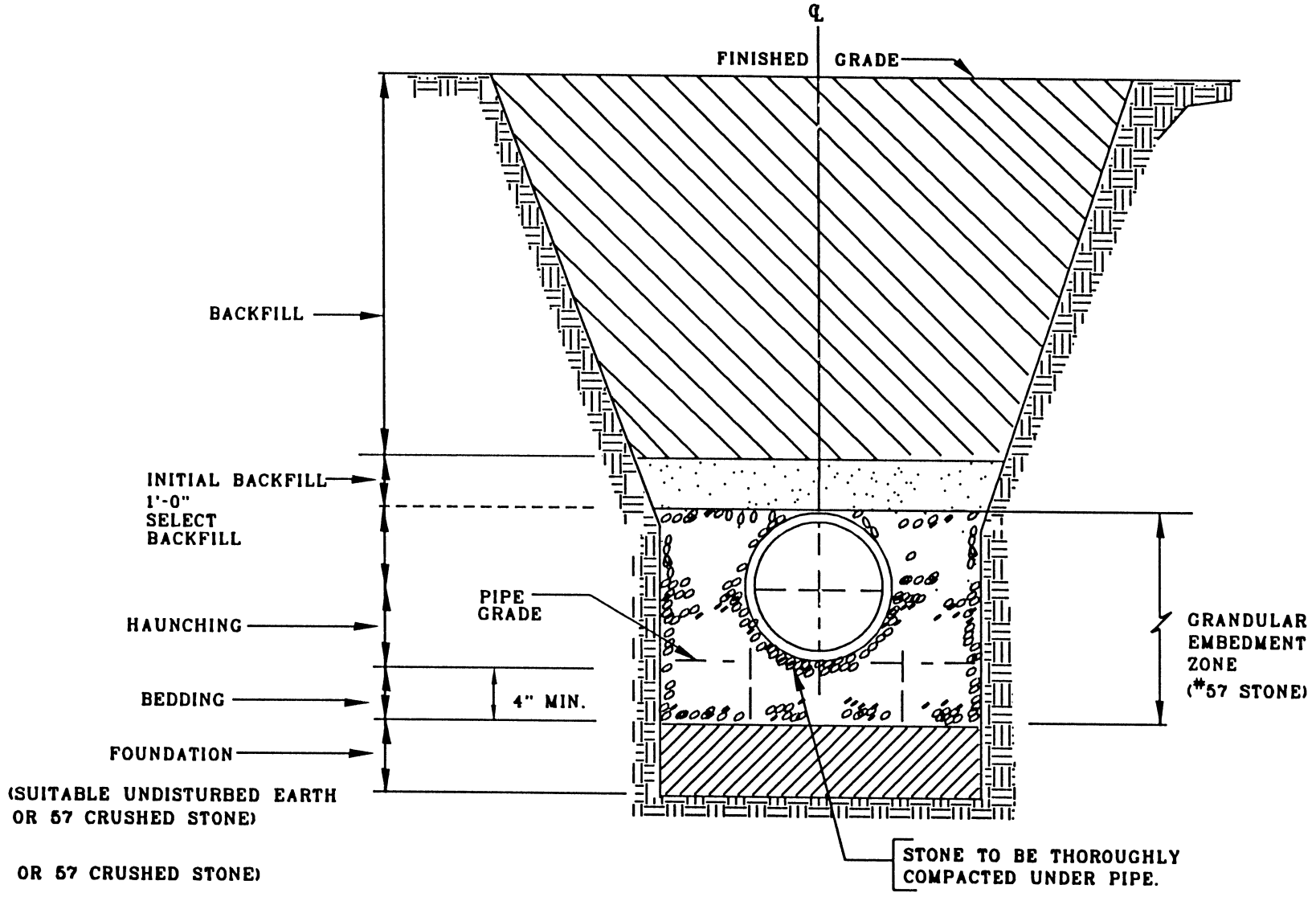
WHEN A SANITARY SEWER MUST BE INSTALLED UNDER A STORM SEWER AND 12" OF VERTICAL SEPARATION CANNOT BE OBTAINED, SUPPORTS SHALL BE PROVIDED FOR THE STORM SEWER. WHEN SEWER IS SDR 35 PVC BEDDING SHALL BE IN ACCORDANCE WITH DETAIL *S-4



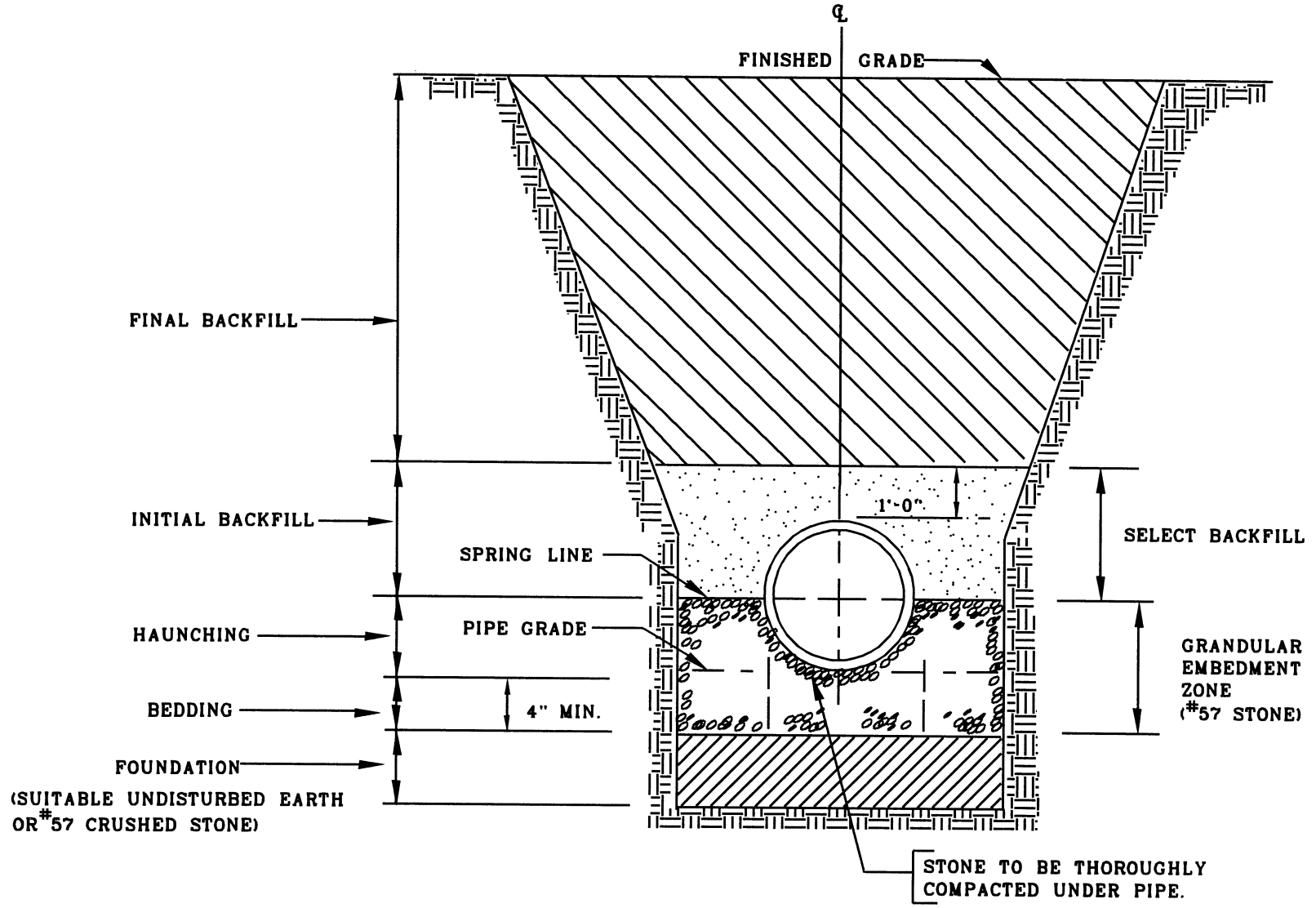
SEWER CROSSING BELOW STORM SEWER			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities	NO.	DATE	DESCRIPTION
SHEET	DWG. NO. S-11	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.				
1 OF 1	DATE 3-12-99	APP H. COREY					



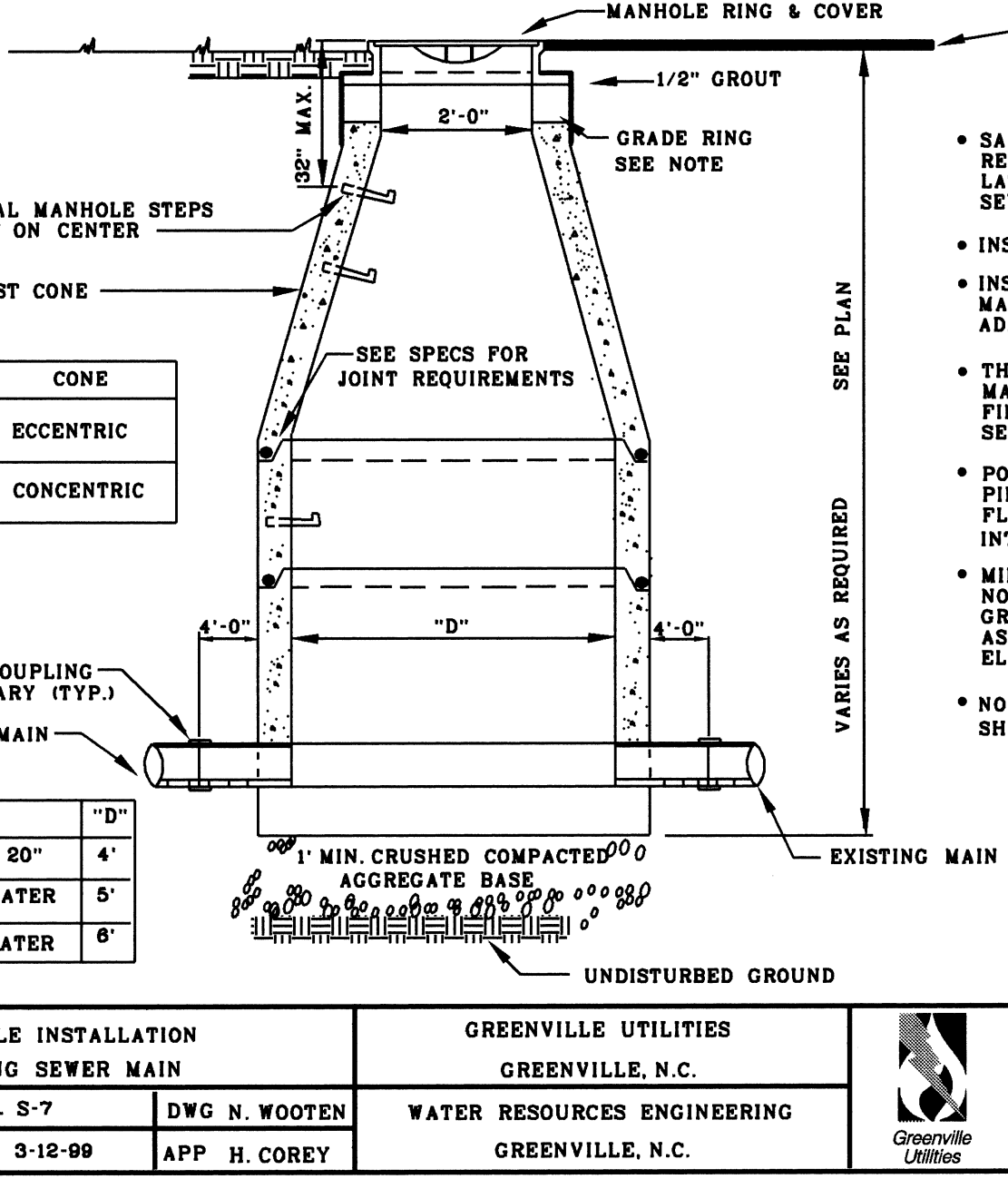
TRENCH SECTION DETAIL FOR THE INSTALLATION OF PVC SANITARY SEWER SERVICE PIPE - SCH40 DWV			GREENVILLE UTILITIES GREENVILLE, N.C.		NO.	DATE / DESCRIPTION
SHEET	DWG. NO. S-10	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities		
1 OF 1	DATE 3-12-99	APP H. COREY				



TRENCH SECTION DETAIL FOR THE INSTALLATION OF PVC SANITARY SEWER PIPE (NOT INCLUDING TRUSS)			GREENVILLE UTILITIES GREENVILLE, N.C.		NO.	DATE / DESCRIPTION
SHEET	DWG. NO. S-9	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities		
1 OF 1	DATE 3-12-99	APP H. COREY				



TRENCH SECTION DETAIL FOR THE INSTALLATION OF VITRIFIED CLAY, ABS & PVC TRUSS SANITARY SEWER PIPE			GREENVILLE UTILITIES GREENVILLE, N.C.		NO.	DATE / DESCRIPTION
SHEET	DWG. NO. S-8	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities		
1 OF 1	DATE 3-12-99	APP H. COREY				



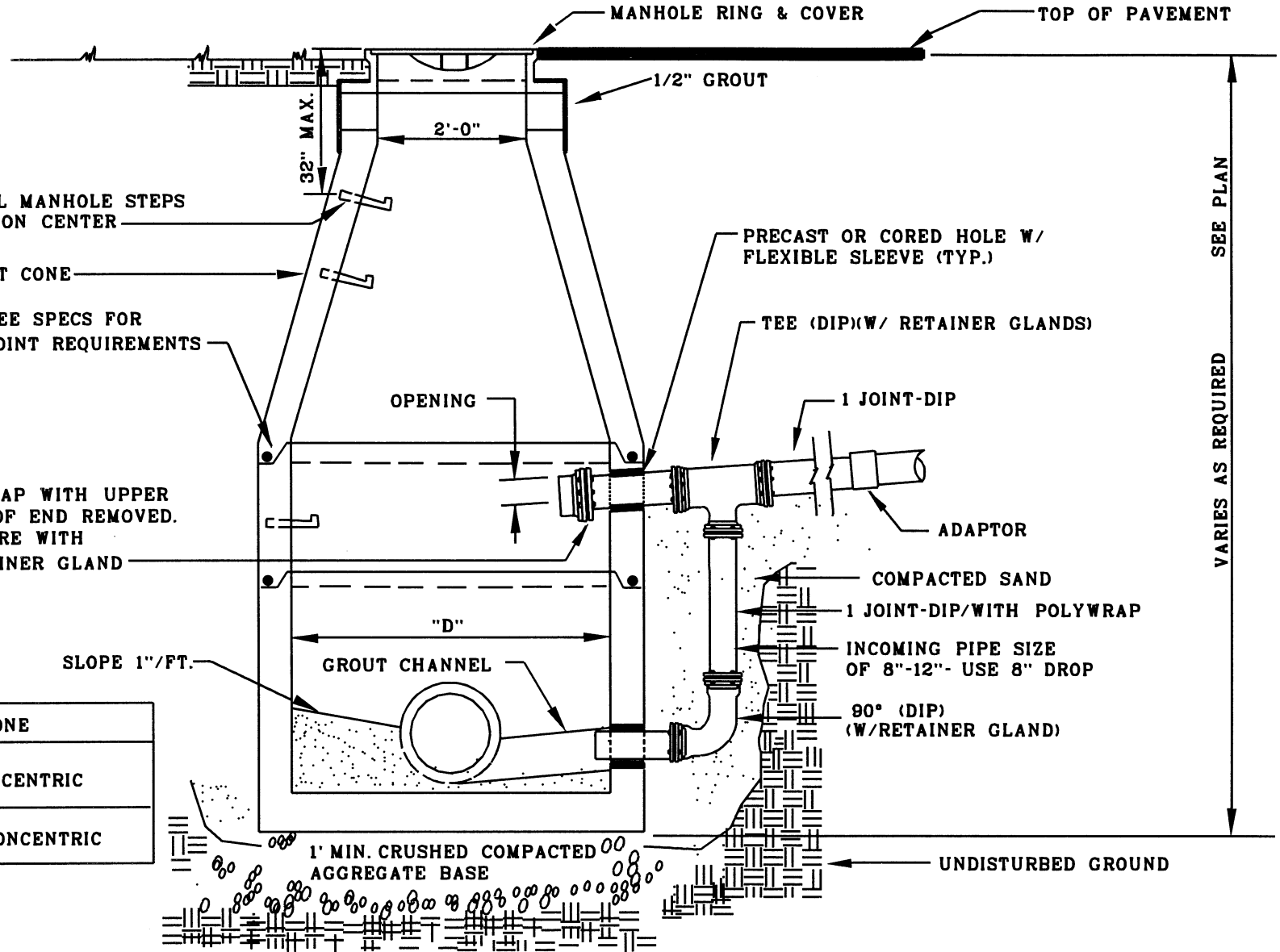
DEPTH	CONE
GREATER THAN 6'	ECCENTRIC
6' OR LESS	CONCENTRIC

PIPE SIZE	"D"
LESS THAN 20"	4'
20" OR GREATER	5'
30" OR GREATER	6'

- SAW CUT EXISTING SEWER MAIN AND REMOVE SECTION TO ALLOW INSTALLATION OF PRECAST MANHOLE AND SEWER MAIN.
- INSTALL PIPE THROUGH MANHOLE
- INSTALL ABS COUPLINGS (EXISTING MAIN TO PROPOSED MAIN) AND ADAPTOR COUPLINGS AS NECESSARY.
- THE DISTANCE FROM THE TOP OF MANHOLE RING AND COVER AND FINISHED GRADE MAY VARY WIDELY, SEE PLAN.
- POINTS OF EXIT AND ENTRY FOR PIPE SHALL BE PROVIDED WITH FLEXIBLE SLEEVES, PREFORMED INTO THE MANHOLE
- MINIMUM (1) GRADE RING REQUIRED IN NON-PAVED AREAS. IN PAVEMENT GRADE RING NOT REQUIRED EXCEPT AS NECESSARY TO MEET FINISHED ELEVATION.
- NO MORE THAN 2-4" RINGS SHALL BE INSTALLED.

PRECAST MANHOLE INSTALLATION OVER EXISTING SEWER MAIN			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities
SHEET	DWG. NO. S-7	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	
1 OF 1	DATE 3-12-99	APP H. COREY		

NO.	DATE	DESCRIPTION



DEPTH	CONE
GREATER THAN 6'	ECCENTRIC
6' OR LESS	CONCENTRIC

TYPICAL
DROP MANHOLE DETAIL

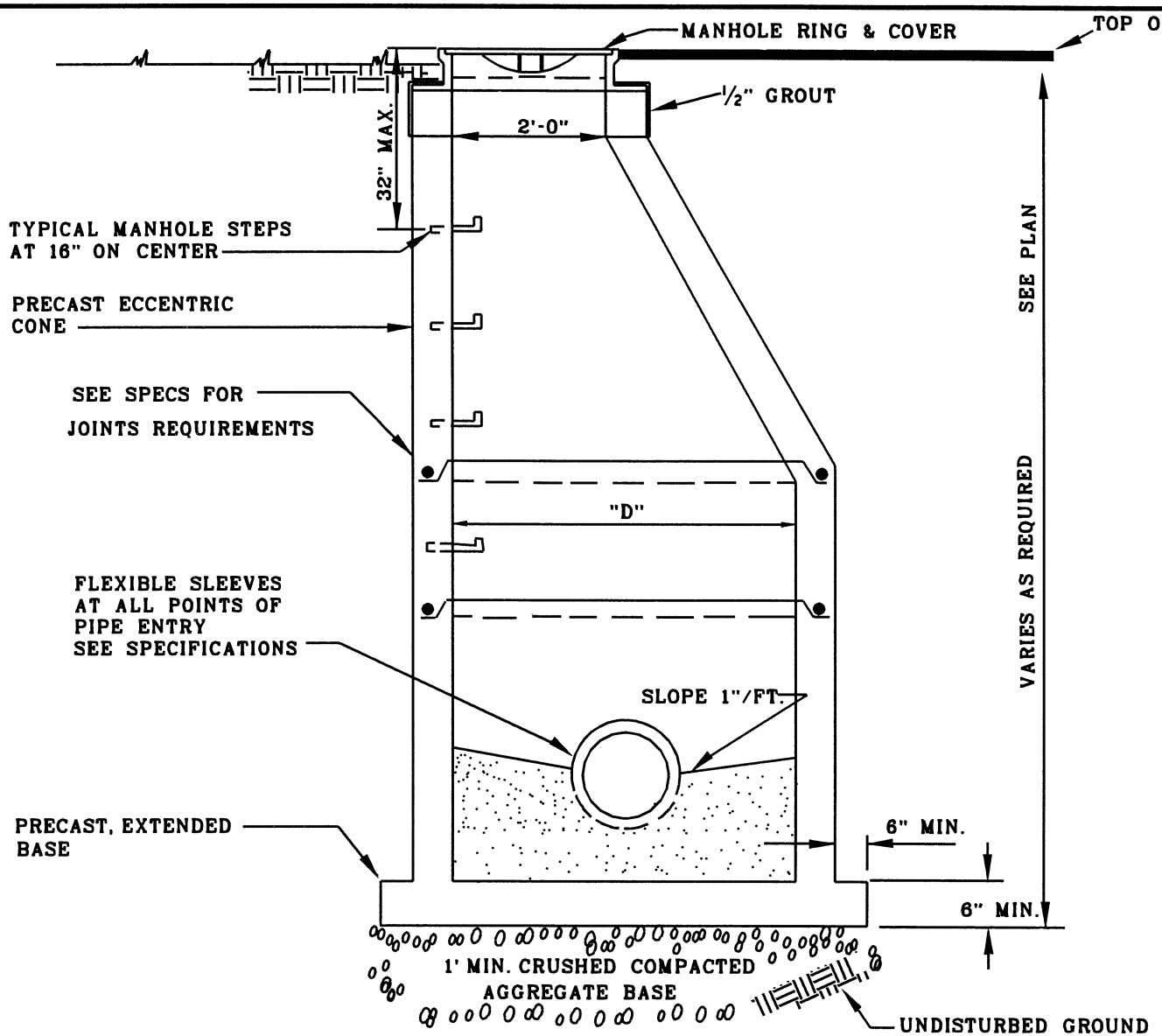
GREENVILLE UTILITIES
GREENVILLE, N.C.

SHEET	DWG. NO. S-6	DWG N. WOOTEN
1 OF 1	DATE 3-12-99	APP H. COREY

WATER RESOURCES ENGINEERING
GREENVILLE, N.C.

Greenville Utilities

NO.	DATE	DESCRIPTION



- THE DISTANCE FROM THE TOP OF MANHOLE RING AND COVER AND FINISHED GRADE MAY VARY WIDELY. SEE PLAN
- EXTEND PIPE INSIDE MANHOLE WALL MAX 2" DEPENDING ON PIPE SIZE.
- MIN. (1) GRADE RING REQ'D IN NON-PAVED AREAS. IN PAVEMENT, GRADE RING NOT REQ'D EXCEPT AS NECESSARY TO MEET FINISHED ELEVATION.
- NO MORE THAN 2-4" GRADE RINGS SHALL BE INSTALLED.
- MANHOLES EXCEEDING 23' IN DEPTH SHALL REQUIRE CERTIFICATION IN ACCORDANCE WITH THIS MANUAL.

PIPE SIZE	"D"
LESS THAN 20"	4'
20" OR GREATER	5'
30" OR GREATER	6'

TYPICAL PRECAST MANHOLE FOR MANHOLES OVER 12' IN DEPTH

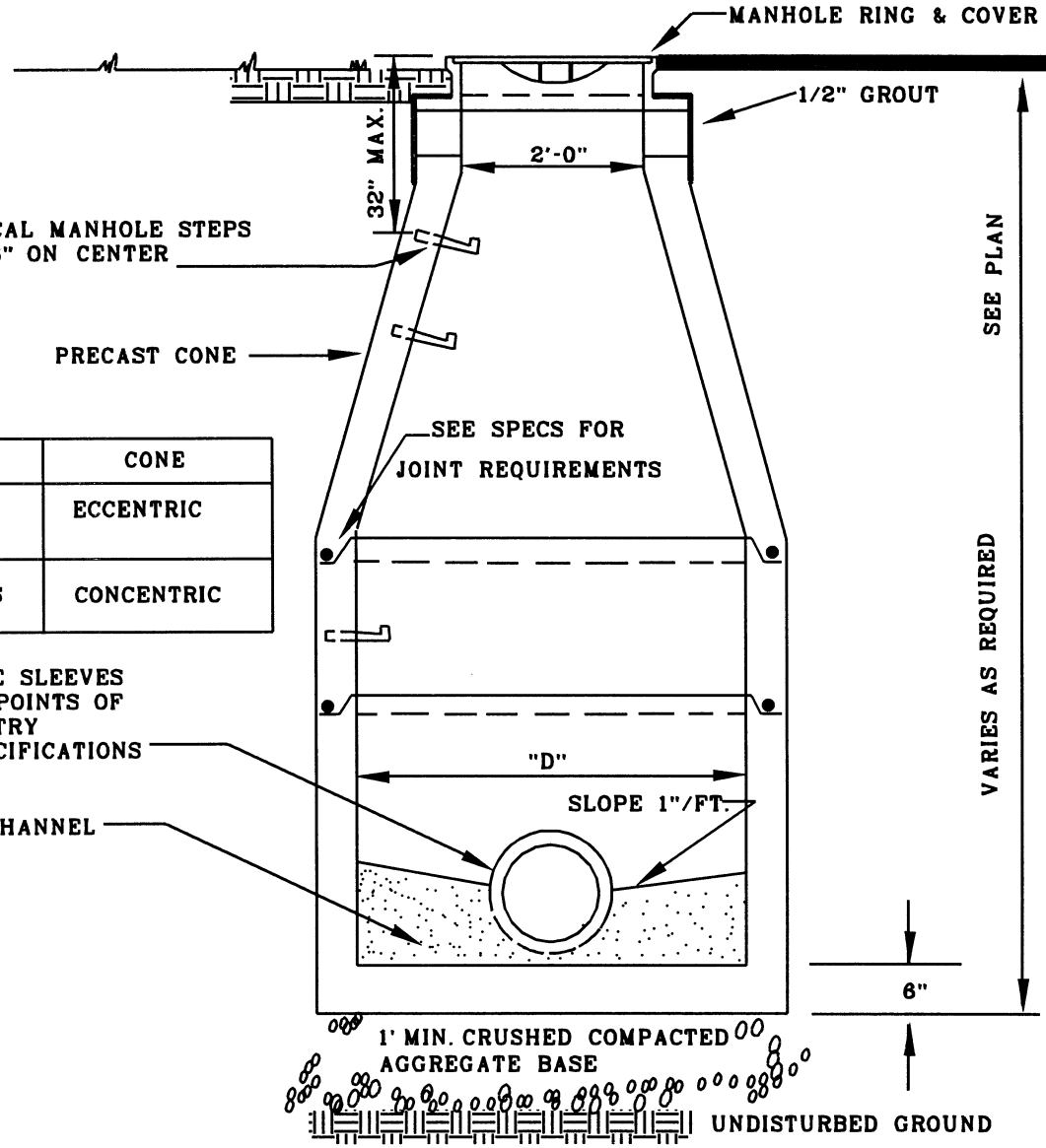
GREENVILLE UTILITIES
GREENVILLE, N.C.

SHEET	DWG. NO. S-5	DWG N. WOOTEN
1 OF 1	DATE 3-12-99	APP H. COREY

WATER RESOURCES ENGINEERING
GREENVILLE, N.C.

Greenville Utilities

NO.	DATE	DESCRIPTION



DEPTH	CONE
GREATER THAN 6'	ECCENTRIC
6' OR LESS	CONCENTRIC

- WHEN INSTALLED IN PAVEMENT MANHOLE TOP SHALL BE FLUSH WITH THE FINISHED PAVEMENT.
- THE DISTANCE FROM THE TOP OF MANHOLE RING AND COVER AND FINISHED GRADE MAY VARY WIDELY. SEE PLAN
- EXTEND PIPE INSIDE MANHOLE WALL MAX 2", AT CLOSEST POINT.
- MIN. (1) GRADE RING REQ'D IN NON-PAVED AREAS. IN PAVEMENT, GRADE RING NOT REQ'D EXCEPT AS NECESSARY TO MEET FINISHED ELEVATION.
- NO MORE THAN 2-4" GRADE RINGS SHALL BE INSTALLED.

PIPE SIZE	"D"
LESS THAN 20"	4'
20" OR GREATER	5'
30" OR GREATER	6'

TYPICAL PRECAST MANHOLE FOR MANHOLES 12' OR LESS IN DEPTH		GREENVILLE UTILITIES GREENVILLE, N.C.
SHEET 1 OF 1	DWG. NO. S-4	DWG N. WOOTEN
	DATE 3-12-99	APP H. COREY
		WATER RESOURCES ENGINEERING GREENVILLE, N.C.

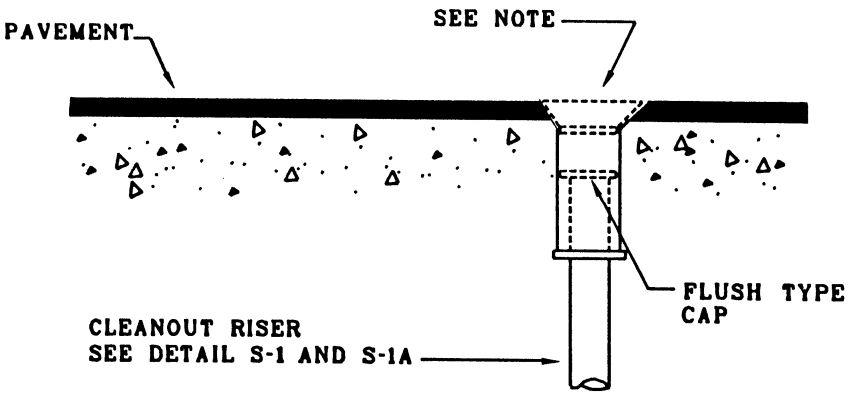
Greenville Utilities

NO.	DATE	DESCRIPTION

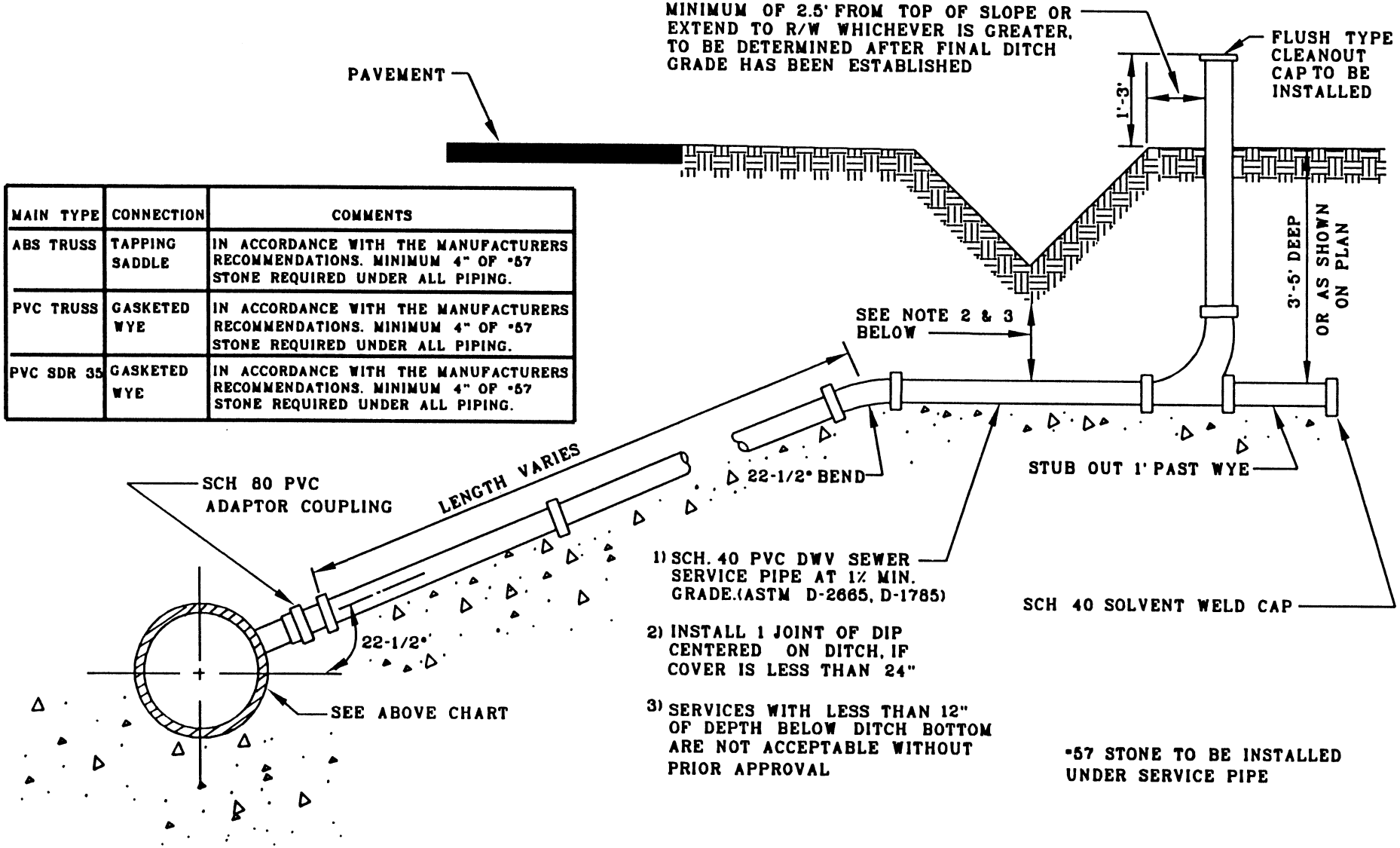
NOTE

FOR 4" SERVICE, BOX TO BE VULCAN MODEL #G8471 WITH #G8460 LID MARKED SEWER.

FOR 6" SERVICE, BOX TO BE EAST JORDAN #15742 W/LID MARKED SEWER.



CLEANOUT DETAIL FOR PAVED AREAS			GREENVILLE UTILITIES GREENVILLE, N.C.	Greenville Utilities	NO.	DATE	DESCRIPTION
SHEET	DWG. NO. S-3	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.				
1 OF 1	DATE 3-12-99	APP H. COREY					



MAIN TYPE	CONNECTION	COMMENTS
ABS TRUSS	TAPPING SADDLE	IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. MINIMUM 4" OF #57 STONE REQUIRED UNDER ALL PIPING.
PVC TRUSS	GASKETED WYE	IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. MINIMUM 4" OF #57 STONE REQUIRED UNDER ALL PIPING.
PVC SDR 35	GASKETED WYE	IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. MINIMUM 4" OF #57 STONE REQUIRED UNDER ALL PIPING.

1) SCH. 40 PVC DWV SEWER SERVICE PIPE AT 1% MIN. GRADE.(ASTM D-2665, D-1785)

2) INSTALL 1 JOINT OF DIP CENTERED ON DITCH, IF COVER IS LESS THAN 24"

3) SERVICES WITH LESS THAN 12" OF DEPTH BELOW DITCH BOTTOM ARE NOT ACCEPTABLE WITHOUT PRIOR APPROVAL

#57 STONE TO BE INSTALLED UNDER SERVICE PIPE

PVC SANITARY SEWER SEWER SERVICE DETAIL
FOR AREAS WITHOUT CURB AND GUTTER
FOR MAINS WITH A MAXIMUM DEPTH OF 12'

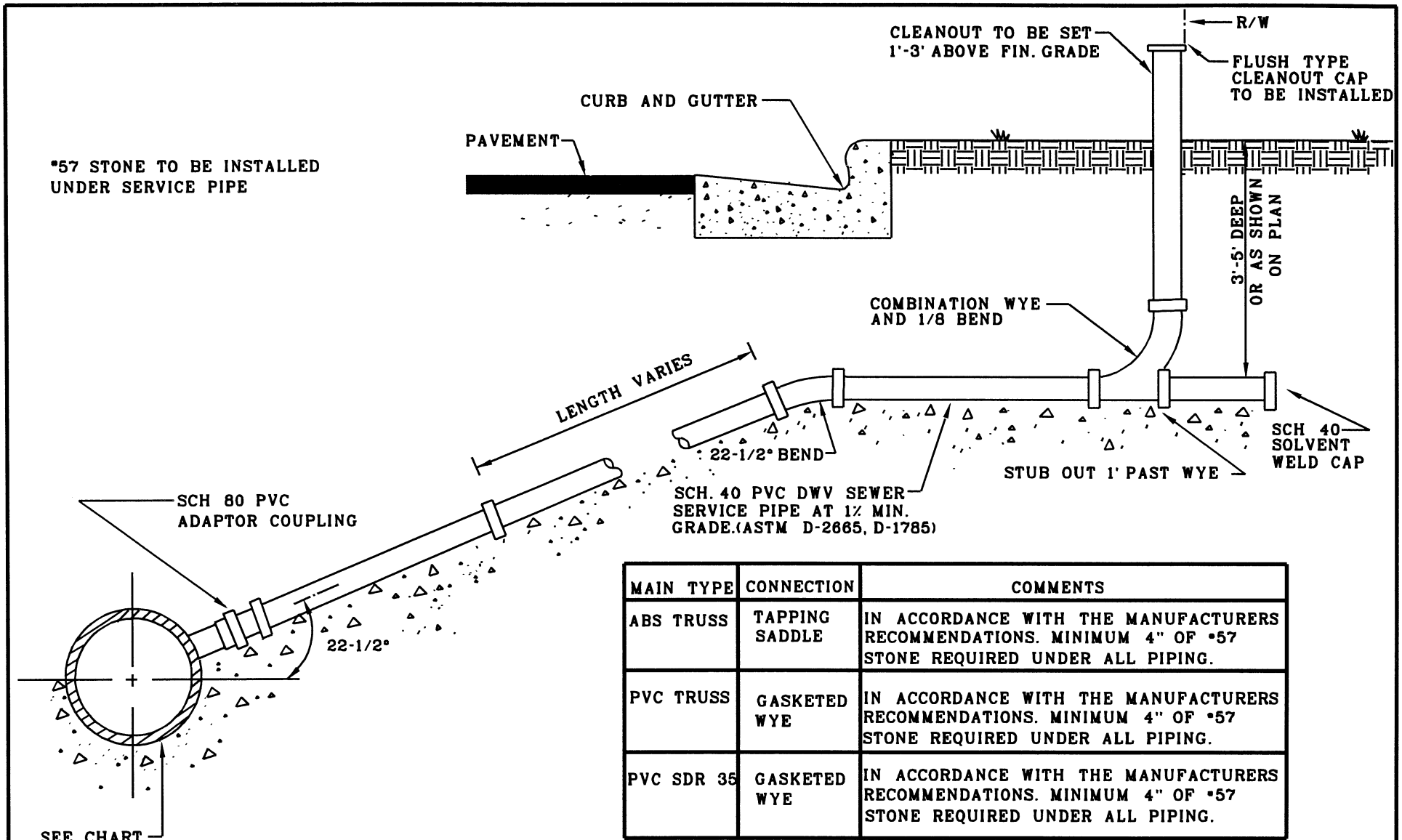
GREENVILLE UTILITIES
GREENVILLE, N.C.

WATER RESOURCES ENGINEERING
GREENVILLE, N.C.

Greenville Utilities

SHEET	DWG. NO. S-2	DWG N. WOOTEN
1 OF 1	DATE 3-12-99	APP H. COREY

NO.	DATE	DESCRIPTION



MAIN TYPE	CONNECTION	COMMENTS
ABS TRUSS	TAPPING SADDLE	IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. MINIMUM 4" OF *57 STONE REQUIRED UNDER ALL PIPING.
PVC TRUSS	GASKETED WYE	IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. MINIMUM 4" OF *57 STONE REQUIRED UNDER ALL PIPING.
PVC SDR 35	GASKETED WYE	IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. MINIMUM 4" OF *57 STONE REQUIRED UNDER ALL PIPING.

PVC SANITARY SEWER SERVICE DETAIL
FOR AREA WITH CURB AND GUTTER
FOR MAINS WITH A MAXIMUM DEPTH OF 12'

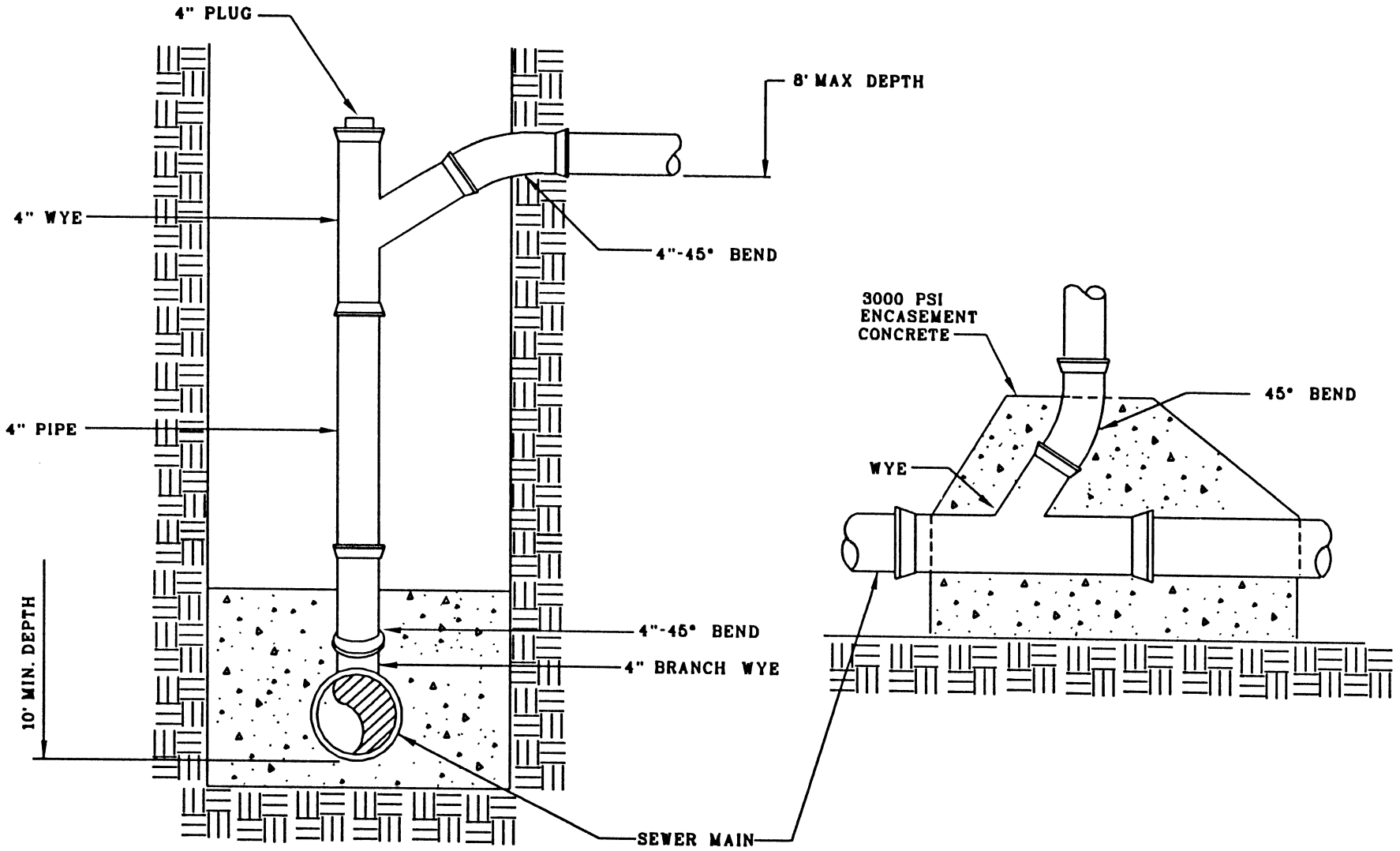
GREENVILLE UTILITIES
GREENVILLE, N.C.

SHEET	DWG. NO. S-1	DWG N. WOOTEN
1 OF 1	DATE 3-12-99	APP H. COREY

WATER RESOURCES ENGINEERING
GREENVILLE, N.C.

Greenville Utilities

NO.	DATE	DESCRIPTION



VERTICAL STACK SEWER SERVICE.			GREENVILLE UTILITIES GREENVILLE, N.C.		NO.	DATE	DESCRIPTION
SHEET	DWG. NO. S-19	DWG N. WOOTEN	WATER RESOURCES ENGINEERING GREENVILLE, N.C.	Greenville Utilities			
1 OF 1	DATE 3-12-99	APP H. COREY					