

City of Raleigh

Public Utilities Department



KODACHROME
MAKE IN USA



KODACHROME
MAKE IN USA



KODACHROME
MAKE IN USA

Serving the Areas of:

- Garner • Wake Forest • Knightdale
- Wendell • Zebulon • Rolesville



KODACHROME
MAKE IN USA



Handbook

Effective January 21, 2014



KODACHROME
MAKE IN USA

TABLE OF CONTENTS

| | |
|--|-----|
| GENERAL POLICIES AND REGULATIONS | 1 |
| INTRODUCTION | 2 |
| DEFINITIONS | 3 |
| PUBLIC WATER, SEWER, AND REUSE EXTENSION POLICIES | 8 |
| EXISTING LOTS - INSIDE CITY | 8 |
| EXISTING LOTS – OUTSIDE CITY | 8 |
| NEW DEVELOPMENTS | 9 |
| CITY ACCEPTANCE OF PRIVATE UTILITY SYSTEMS | 10 |
| CAPITAL FACILITIES FEE REIMBURSEMENT | 11 |
| JOINT VENTURE AGREEMENT | 12 |
| INFILL POLICY | 12 |
| USE OF THE SANITARY SEWER SYSTEM | 13 |
| USE OF THE REUSE SYSTEM | 14 |
| OTHER POLICIES | 14 |
| Sewage backflow policy | 15 |
| Flood policy | 15 |
| LOCATION OF UNDERGROUND UTILITIES | 16 |
| SERVICE CONNECTIONS IN SEWER EASEMENTS | 16 |
| SEWER MAIN/EASEMENT RELOCATION POLICY | 16 |
| CONNECTION OF POOLS AND FOUNTAINS TO SANITARY SEWER | 16 |
| CONSTRUCTION WATER/ FILLING OF SWIMMING POOLS/THEFT OF WATER | 16 |
| WATER & REUSE BACKFLOW/CROSS CONNECTION | 17 |
| WATER SYSTEM AND REUSE SYSTEM CONNECTIONS | 17 |
| WELL POLICY FOR IRRIGATION SYSTEMS | 17 |
| GROUNDWATER RECLAMATION WELLS | 17 |
| DUAL UTILITY SERVICE POLICY FOR EXTRATERRITORIAL JURISDICTION AREA (TWO ACRE RULE) | 18 |
| SCHEDULING REUSE SERVICES | 18 |
| WATER, SEWER, AND REUSE FEES | 19 |
| PERMITS | 21 |
| CITY OF RALEIGH PERMITS | 21 |
| BLASTING PERMIT | 22 |
| WATER, WASTEWATER, AND REUSE SYSTEMS PERMITS | 22 |
| Wastewater Discharge Permits | 22 |
| Water Supply System Permits | 22 |
| Reuse Supply System Permits | 22 |
| NEUSE RIVER RIPARIAN BUFFER RULE | 22 |
| WETLAND PERMITS | 22 |
| NCDOT ENCROACHMENT PERMITS | 23 |
| EASEMENT MAP REQUIREMENTS | 23 |
| WATER DESIGN, MATERIAL, AND CONSTRUCTION STANDARDS | 34 |
| SEWER DESIGN, MATERIAL, AND CONSTRUCTION STANDARDS | 70 |
| REUSE DESIGN, MATERIAL, AND CONSTRUCTION STANDARDS | 128 |
| | |
| APPENDIX A – Cross Connection Design Standards | |
| APPENDIX B- Standard Water, Sewer and Reuse Details | |
| APPENDIX C- Water, Sewer & Reuse Permit Applications | |
| APPENDIX D- Standard Notes and Signature Blocks | |
| APPENDIX E- CORPUD Standard Operating Procedures | |
| APPENDIX F- Water and Sewer Permitting Scenarios | |

GENERAL POLICIES AND REGULATIONS

INTRODUCTION

The City of Raleigh Public Utilities Department has prepared this Handbook to summarize the policies, standards, and specifications of the Department. The Raleigh Public Utilities Department has the responsibility for operating, maintaining, repairing, replacing and expanding the water, sewer, and reuse systems of the City of Raleigh and the towns of Garner, Rolesville, Knightdale, Wendell, Zebulon and Wake Forest.

The Raleigh City Charter gives the City Council the authority to create a Public Utilities Department and further states that the Public Utilities Department will be self-sustaining through its water and sewer rates and other fees. The City Code of Ordinances details the requirements, duties, functions, and policies of the Raleigh Public Utilities Department.

The town councils of Garner, Wake Forest, Rolesville, Knightdale, Wendell and Zebulon agreed to merge their respective utility systems with the City of Raleigh water, sewer and reuse utility system.

In addition to the retail customers, there are also 2 wholesale customers that buy water in bulk from the City. The wholesale customers are the towns of Holly Springs and Fuquay -Varina.

Falls Lake is the primary drinking water supply with a capacity of 100 million gallons per day (MGD) allocated for drinking water. The City of Raleigh is the sole entity that is permitted to use Falls Lake water for drinking water.

Falls Lake was completed in 1983 by the United States government with a surface area of 12,500 acres. The US Army Corps of Engineers manages the lake and the State of North Carolina manages the recreational facilities on the lake.

The City of Raleigh has two water treatment plants. These are the E.M. Johnson Water Treatment Plant and the Dempsey E. Benton Water Treatment Plant. The E.M. Johnson Water Treatment Plant draws source water from Falls Lake. The Dempsey E. Benton Water Treatment Plant opened on May 12th, 2010 and draws source water from Lake Benson, a 500-acre reservoir, and Lake Wheeler, a 650-acre reservoir, located on Swift Creek in southeastern Wake County.

The Neuse River Wastewater Treatment Plant is state of the art and permitted to treat up to 60 MGD. Currently, this facility treats 44 MGD. In addition to treating wastewater, the Raleigh Public Utilities Department has several marketable products grown at the Neuse River Wastewater Treatment Plant. These products are soybeans, corn, hay, wheat, sorghum and lime stabilized sludge as a soil amendment. The City is also developing its reuse water system to provide an alternative water resource for demands not requiring potable water quality such as water for landscape irrigation.

Another treatment facility, the Smith Creek Wastewater Treatment Plant was designed to serve the Town of Wake Forest and was transferred to the City of Raleigh in 2005. The plant is located in Wake Forest, approximately 14 miles north of Raleigh and operates with a treatment capacity of 2.4 MGD.

Additionally, the Public Utilities Department operates and maintains the Little Creek Wastewater Treatment Plant, which was conveyed as a result of the merger with Zebulon and treats flow from the Zebulon service area.

The utility system is also supported by the Raleigh Public Utilities Operations Center. The Operations Center provides the meter reading, maintenance, construction, and warehouse functions for the Department. There are over 2,200 miles of water main and 2,300 miles of sewer main between 2 and 72 inches and 62,000 manholes maintained by the City.

The Administrative Office for the Raleigh Public Utilities Department is located in Suite 620 of the One Exchange Plaza Building on Fayetteville Street. The staff in the Administrative Office assists in the map location of the existing water, sewer, and reuse mains, assists with questions regarding water, sewer, and reuse extension policies, and is able to show the locations for utility development and redevelopment. Copies of the existing water, sewer, and reuse system maps may be obtained from this office through electronic mail or by calling the Administrative Office at (919) 996-4540.

This Handbook is designed to facilitate understanding by developers, engineers, contractors, and the citizens in general of how the Raleigh Public Utilities Department does business both inside the City limits, in towns where the utility system has merged with Raleigh's utility system and in the City's extraterritorial jurisdiction. **This handbook is not intended to replace the Charter, Municipal Code, or standards**, but to group information on policy, design, material, construction, and standard detail drawings used by the Raleigh Public Utilities Department.. The contents of this Handbook are subject to change at any time, without notice.

The organization of this material falls into four primary areas. General Policies/Regulations, Water, Sewer, and Reuse. The Water, Sewer, and Reuse sections will each cover the respective design, materials, construction, and standard details for that utility. Appendices are attached with additional reference information.

Much of the information covered in this Handbook has been adopted from other sources such as State and National Standards and Regulations, "good engineering practice", and the experience of the staff of the City of Raleigh Public Utilities and Public Works Departments. **The standards, policies, and specifications indicated in this book shall be considered final and exceptions may only be granted by the Raleigh Public Utilities Director or his designee upon written request PRIOR to construction.**

DEFINITIONS

Throughout this Handbook, the following terms shall have the meanings indicated below:

Adjacent lot: That parcel of land that shares a common boundary and/or a common right of way with an existing lot seeking sewer service and lies upstream of the existing lot.

Air-gap: An unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture, or any other device and the flood level rim of the receptacle. The vertical separation shall be at least the diameter of the supply pipe or fixture opening, but in no case shall the air-gap be less than one (1) inch.

Approved: Certified in writing by the Raleigh Director of Public Utilities or his designee as an acceptable device or methodology used within the City of Raleigh Public Utilities System.

Atmospheric vacuum breaker: A device designed to allow air to enter the downstream water line to prevent backsiphonage as described in AWWA Recommended Practice for Backflow Prevention and Cross-Connection Control Manual M-14.

Auxiliary intake: Any piping connection or other device whereby water may be secured from a source other than the public water supply.

Backflow: Any flow of water into the public water supply from any other source due to a cross-connection, auxiliary intake, interconnection, backpressure, backsiphonage, any combination thereof, or other cause.

Backflow Assembly: An approved effective assembly or method used to control backflow from occurring in the potable water supply. The type of assembly required *shall* be based on degree of hazard, existing or potential. An assembly is testable in a line to its utilization and is unaltered from the manufacturer's configuration.

Backpressure: Any pressure on any source of water other than the public water supply which may be greater than the pressure on the public water supply and may result in a backflow.

Backsiphonage: Any circumstance in which the pressure on the public water supply may be reduced to the point that the elevation and atmospheric pressure on a source of water other than the public water supply may result in a pressure to be greater than the pressure on the public water supply and may result in a backflow.

Certified tester: A person who has proven his/her competency to test, repair, overhaul and make reports on backflow prevention assemblies as evidenced by certification of successful completion of a training program approved by the Raleigh Director of Public Utilities or his designee.

Confinement assembly or device: A backflow prevention device, as approved and required, installed within a private plumbing or distribution system to isolate a localized hazard from the remainder of said system.

Containment assembly: A backflow prevention assembly, as approved and required, installed at the point of separation between the public water supply and a private service or private distribution system or at the point of metering.

Cross-connection: Any physical connection whereby the public water supply is connected with any other water supply system, whether public or private, either inside or outside of any building or buildings, in such a manner that a flow of water into the public water supply is possible either through the manipulation of valves or because of ineffective check or back-pressure valves, or because of any other arrangement.

Cross connection control coordinator: The official position established and authorized by the City and designated by the Raleigh Director of Public Utilities to administer and interpret the cross connection section of these specifications and who shall also be a certified tester.

Dedicators: Dedicator shall mean or include the person owning or constructing any private utility system being dedicated to the city.

Developer: Developer shall mean a person who makes an application to the city for the city's approval of a site plan or subdivision.

Development: Development shall mean any human caused change to improved or unimproved real estate including, but not limited to, constructing or changing any building or other structure, clearing, grading, mining, dredging, filling, paving, excavation, drilling operations (except to obtain soil sample) or depositing any waste. Development also means any subdivision of land.

Director of Public Utilities: The person designated by the City to supervise the operation of the publicly-owned treatment works and who is charged with certain duties and responsibilities by the Charter and the City Code, or his duly authorized representative

Double check valve backflow prevention assembly: An approved assembly composed of two (2) single, spring-loaded independently operating check valves, including tightly closing shut-off valves located at

each end of the assembly, and having suitable connections for testing the water tightness of each check valve.

Dual check valve: An approved device containing two (2) independently acting check valves in series.

Existing Lot: Existing lot shall mean any lot that has been recorded in the register of deeds of the county in which the land resides prior to the application for connection to City of Raleigh utilities.

Fire line: A system of pipes and equipment used to supply water in an emergency for extinguishing fire.

Food preparation or serving facility: Any commercial or industrial facility that prepares or serves food, including a restaurant, cafe, cafeteria, snack bar, grill, deli, catering service, bakery, grocery store, butcher shop, or similar establishment.

Indirect discharge or discharge: The discharge or the introduction from any non-domestic source regulated under §307(b), (c), or (d) of the Act (33 U.S.C. 1317), into the POTW (including holding tank waste discharged into the system).

Interconnection: Any system of piping or other arrangement whereby the public water supply is connected directly with a sewer, drain, conduit, pool, heat exchanger, storage reservoir, or other device which does or may contain sewage or other waste or substance which would be capable of imparting contamination to the public water supply.

Interference: The inhibition or disruption of the POTW collection system, treatment processes, operations, or its sludge process, use, or disposal, which causes or contributes to a violation of any requirement of the *Control Authority's* (and/or the POTW's if different from the *Control Authority's*) NPDES or non-discharge permit or prevents sewage sludge use or disposal in compliance with specified applicable state and Federal statutes, regulations or permits. The term includes prevention of sewage sludge use or disposal by the POTW in accordance with §405 of the Act (33 U.S.C. 1345) or any criteria, guidelines, or regulations developed pursuant to the Solid Waste Disposal Act (SWDA) (42 U.S.C. 6901, *et seq.*), the Clean Air Act, the Toxic Substances Control Act, the Marine Protection Research and Sanctuary Act (MPRSA) or more stringent state criteria (including those contained in any state sludge management plan prepared pursuant to Title IV of SWDA) applicable to the method of disposal or use employed by the POTW.

Major utility mains: Those water, reuse water, and/or sewer lines which are twelve (12) inches in diameter or greater.

Minor utility mains: Minor utility mains shall mean water and/or sewer lines which are less than twelve (12) inches in diameter.

Person: Any individual, partnership, co-partnership, firm, company, corporation, association, joint stock company, trust, estate, governmental entity or any other legal entity, or their legal representatives, agents or assigns. This definition includes all Federal, state, and local government entities.

Publicly-owned treatment works (POTW) or municipal waste water system: A treatment works as defined by §212 of the Act (33 U.S.C. 1292) which is owned in this instance by the City. This definition includes any devices or systems used in the collection, storage, treatment, recycling, and reclamation of municipal sewage or industrial wastes of a liquid nature. It also includes sewers, pipes, and other conveyances only if they convey waste water to the POTW treatment plant. For the purposes of this Handbook, POTW shall also include any sewers that convey waste waters to the POTW from persons outside the City who are, by contract or agreement with the City, or in any other way, users of the City's POTW.

Pressure vacuum breaker: An approved assembly containing an independently operating spring loaded check valve and an independently operating loaded air inlet valve located on the discharge side of the check valve. The assembly must be equipped with suitable connections for testing the proper operation of the device and tightly closing shut-off valves located at each end of the assembly.

Pretreatment or treatment: The reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in waste water prior to or in lieu of discharging or otherwise introducing such pollution into a POTW. The reduction or alteration can be obtained by physical, chemical or biological processes, or process changes or other means, except by diluting the concentration of the pollutants unless allowed by an applicable pretreatment standard.

Public water supply or system: The water and waterworks system of the City of Raleigh, and its customers outside the corporate limits, for general use and which supply is recognized as the public water supply by the North Carolina Department of Environment and Natural Resources.

Reduced pressure principle zone backflow prevention assembly (RPZ): An approved assembly containing within its structure two (2) spring loaded independently operating check valves, together with an automatically operating pressure differential relief valve located between the two (2) check valves. The first check valve reduces the supply pressure a predetermined amount so that during normal flow and at cessation of normal flow the pressure between the checks shall be less than the supply pressure. In case of leakage of either check valve, the differential relief valve, by discharging to the atmosphere, shall operate to maintain the pressure between the check valves less than the supply pressure. This assembly shall have suitable connections for testing the proper operation of the assembly, including tightly closing shut-off valves located at each end of the assembly.

Reuse water: Wastewater that has been treated to water quality standards as defined by the applicable section of the North Carolina Administrative Code and is intended to be distributed for non-potable uses such as irrigation and/or industrial processes.

Reuse water service stubs: Those portions of the reuse water service pipes that connect to the City's reuse water mains and extend to the boundaries of public easements and rights-of-way.

Right-of Way.(ROW) :An interest in land to the *City* which provides for the perpetual right and privilege of the *City*, its agents, franchise holders, successors, and assigns to construct, install, improve, reconstruct, remove, replace, inspect, repair, maintain and use a public street, including related and customary uses of street rights-of-way such as sidewalks, bike paths, landscaping, mass transit facilities, traffic control devices signage, sanitary sewer, storm water drainage, water supply, cable vision, electric power, gas and telephone transmission and related purposes in, upon, over, below, and across the rights of way. The *City* is authorized to remove, and keep removed from the Rights-of-way all trees, vegetation, and other obstructions as is determined to be necessary by the *City* to maintain, repair, and protect facilities located in the Right-of-way.

Sewer Interceptor/Outfall: Gravity sewer mains equal to or larger than 12" in size.

Stormwater: Any flow occurring during or following any form of natural precipitation and resulting therefrom.

Structure: Anything constructed, installed, or portable, the use of which requires a location on a parcel of land. This includes a fixed or movable building which can be used for residential, recreational, business, commercial, agricultural, institutional or office purposes, either temporarily or permanently. Structure also includes, but is not limited to fences, decks, garages, swimming pools, hot tubs, children's play sets,

barbeque pits, tennis courts, signs, walls, heating, ventilation and air conditioning units, storage tanks, sheds, docks, mooring areas, and other accessory construction.

Tap size: The nominal diameter of the connection of a water service or reuse line installed between a meter assembly and main connected to the water or reuse utility system of Raleigh, without regard to the configuration of that water or reuse assembly, or ownership of the water or reuse meter assembly, service, or water or reuse main.

Utility system, utility mains: Water mains, reuse water mains, and sewer mains (individually or collectively as determined by the context), and shall include all pipes, valves, valve boxes, hydrants, water service stubs, sewer service stubs, cleanouts, meters and other appurtenant fixtures, equipment, and apparatus connected to and forming a part of the main water, reuse water, or sewer main, pipelines and systems or both, and all appliances necessary and convenient thereto. The utility lines dedicated to the City as public shall include only main distribution pipes, valves, hydrants and other apparatus, fixtures and equipment forming a part of the lines laid in public streets, roads, highways and alleys or across City utility or sanitary sewer easements on private property, and shall not include services leading from mains to building connections on private property and shall not include the water, reuse water, or sewer lines within any residences or other privately-owned building or structure.

Vehicle maintenance facility: Any commercial or industrial facility where automobiles, trucks, or equipment are serviced or maintained, including garages, service stations, repair shops, oil and lubrication shops, or similar establishments.

Wastewater: The liquid and water-carried industrial or domestic wastes from dwellings, commercial buildings, industrial facilities, mobile sources, treatment facilities and institutions, together with any groundwater, surface water, and stormwater that may be present, whether treated or untreated, which are contributed into or permitted to enter the POTW.

Water service stubs, sewer service stubs and reuse water service stubs: Those portions of the water service, building sewer, and reuse water pipes which connect to the City's water, sewer, or reuse water mains and extend to the boundaries of public easements and rights-of-way with private property.

Water and Sewer Mains: are defined as Public water supply or system: The water and waterworks system of the City of Raleigh, and its customers outside the corporate limits, for general use and which supply is recognized as the public water supply by the North Carolina Department of Environment and Natural Resources.

GENERAL POLICIES/REGULATIONS

The City of Raleigh shall control and schedule the availability of water, sewer, and reuse services to its customers. Applications for permanent water, sewer, and reuse service connection are available through the Development Services Customer Service Center located on the 4th floor of One Exchange Plaza, Raleigh, NC, 27601. Application for service in the merger communities should be made through the appropriate municipality. Sufficient lead-time (6 weeks) should be provided for all new service taps and all fees must be paid in full prior to the work order being authorized.

Water and reuse service shall be provided on an as-available basis to the customer's meter. All customers shall hold the City not responsible from any and all claims, damages, liabilities, or expenses caused in whole or in part by pressure conditions, water quality variation, or interruptions in service. The customer shall be responsible for installation of booster pumps to increase pressure when necessary.

All water, sewer, and reuse main extensions and service connections to the City's water, sewer, and reuse systems must be approved, prior to construction, by the Public Utilities Department. All water and sewer main extensions outside the corporate limits must be approved by the City Council. The minimum size water main is six inches for single family residential areas, however four-inch water mains will be allowed under certain conditions. All other land uses shall have an eight-inch main as the minimum size for water. The minimum sanitary sewer main shall be eight inches in all areas. The minimum size reuse main is four inches unless dictated otherwise by sound engineering and approved by the Public Utilities Department prior to construction.

All water, sewer, and reuse services in public rights-of-way are to be installed by the City or by a licensed utility contractor. Sewer services in easements will either be made by licensed utility contractors or licensed plumbers. All water, sewer, and reuse services in new subdivisions are the responsibility of the developer. To qualify for service, the total property frontage must abut a water main, sewer main, and/or reuse main. All potable and reuse water services will be metered, and the meter will be located at the right-of-way or in a 2-foot dedicated utility easement adjacent to the right-of-way. **The City of Raleigh does not allow sub-metering for purposes of charging for more than the City rate for water, sewer, and reuse.**

Each house, building or structure that connects to the City's utility system shall have a separate and independent water meter and water and sewer connection. The property owner will be responsible for connection to both water and sewer. Sewer alone shall not be provided if water connection is available. Available for the purpose of this subsection shall be defined to mean that the utility is located within one thousand (1,000) feet of the nearest point on the property. If a lot cannot be served as provided for, wells and/or septic tanks may be installed only if authorized by the Wake County Department of Environmental Services.

PUBLIC WATER, SEWER, AND REUSE EXTENSION POLICIES

To reimburse major utility mains, capital facilities water and sewer fees will be charged to all property owners inside or outside the City for connecting to the City's water and sewer systems. This fee will be collected at the time of building permit application for new construction or at the time of the connection for existing buildings.

Each merger municipality may have a different policy on capital facilities water and sewer fees collection and reimbursement. These policies are subject to change. **Currently there are no capital facilities fees reimbursements in Knightdale, Wendell, or Zebulon.** Please contact the appropriate municipality or Raleigh Public Utilities for more information.

EXISTING LOTS- INSIDE CITY

Utility main extensions and replacements inside the corporate limits and constructed by the City, or by the City's contractor, will be made by assessment to the property owners who benefit from the improvements. As mentioned above, the standard size mains are four-inch, six-inch, and eight-inch for reuse, water, and sewer mains, respectively. If larger size mains are proposed, then the differential cost for larger size mains permitted by City standards will be paid for by the City. For deteriorating pipe, property will be assessed for the difference in cost between cost of existing inadequate mains at current prices and the cost of the size installed not to exceed the cost of six-inch water mains or eight-inch sewer mains. For corner and dual frontage lots, the property owner will receive a 150-foot exemption as follows:

- a. If water, sewer, and/or reuse mains are installed simultaneously in both streets on which a lot abuts, assessment of the costs of the installation shall be based upon the entire frontage of one street (short side) plus the frontage of the other street in excess of 150-feet.
- b. If a lot abuts water, sewer and/or reuse mains that meet all City standards on one abutting street, any installation of the same service(s) on an abutting street will not be assessed for an existing residential-zoned single family house.

The 150-foot exemption for the corner lot will not apply when the abutting property is served by facilities less than the standard size mains. In this case, the installation on the abutting street will be assessed against the property. Along with the corner lot exemption, there is a 150-foot exemption for duplicating service when standard size or larger mains are existing in the street right-of-way and an additional main is installed. In order for these exemptions on corner lots and duplicating services to apply, the existing mains must have been assessed against the property or were installed by a developer without charge to the City.

EXISTING LOTS – OUTSIDE CITY

A charge in lieu of assessment will be made when the water, sewer, and/or reuse mains are located outside the corporate limits and were paid for by the City. A fee equal to the assessed cost of the mains will be collected from the property owner connecting. A charge in lieu of assessment must be paid prior to ownership transfer or at the time of property subdivision.

In addition to the charge in lieu of assessment, all other fees for water and/or sewer connections still apply.

The property owner must submit a petition for annexation to be eligible to connect to either water and/or sewer.

NEW DEVELOPMENTS

All standard size mains and services in new subdivisions shall be installed by the developers. Outside the City limits and not one of the merger communities, the developer must have the City Council approval to extend the utility lines to the development, and this extension will be done at no cost to the City. If the subdivision is outside the corporate limits, and water, sewer, and/or reuse mains are available, or will be available within twelve months after recording the plat, the developer shall connect to the City's utility system. For subdivisions outside the corporate limits, but inside the extraterritorial jurisdiction, the extensions of utilities beyond the corporate limits must be approved by the City Council. Those utilities less than 12 inches in size located outside the corporate limits will be paid for by the developer and are not reimbursable. It will be the developer's responsibility to acquire any necessary easements for the extensions. These easements must have functional access to public right of way and be properly recorded. Plan and elevation drawings of all access roads shall be shown on the plans prior to approval. The recording procedure is outlined in the City of Raleigh Public Utilities Department Standard Procedure 602-4 (see Appendix E).

Details of the extensions and appropriate reimbursement procedures will be described below. The extensions must serve the total tract of land and meet all City requirements.

Inside the City limits, the City will be responsible for extending the facilities, or reimburse the developer for extending mains to the property provided City reimbursement policy is followed. If the proposed subdivision is inside the corporate limits, or if it is agreed that the area will be

annexed, and over-sized mains are installed, then the City will pay the cost differential between a 6-inch and 8-inch main for water, between an 8-inch and 10-inch main for sewer, and between a 4-inch and 6-inch for reuse, provided that the extra size is not needed to serve that particular development. So that these costs can be reimbursed, the plans and specifications must be approved by the Raleigh Public Utilities Director. After completion and acceptance of the utility work, the developer shall furnish the Chief Engineer an itemized list of the costs to be reimbursed. The details of this reimbursement procedure are fully described in the City of Raleigh Public Utilities Department Standard Procedure 700-6 (see Appendix E).

Once the mains have been installed, the individual service connections can be made. Below, two procedures are listed: the first procedure being for service connections on existing mains and the second procedure being for developers making the extensions and the service connections.

- 1) The procedure for water, sewer, and/or reuse service connections to existing mains, is outlined below:
 - (a) The owner shall complete an application form and submit it to Development Services.
 - (b) Development Services collects the appropriate fees prior to the issuance of the utility permit, and then installation may occur by a licensed utility contractor.

- 2) The procedure for water, sewer, and/or reuse service connections that must be extended for new developments within the City of Raleigh planning area is listed below:
 - (a) The applicant must have subdivision or site plans prepared by a registered engineer showing the water, sewer, and/or reuse lines necessary to serve the property.
 - (b) The applicant must submit the above plans, application, and plats to the Planning and Development Department for City approval.
 - (c) After proper approval, the Planning and Development Department shall notify the applicant.
 - (d) Tracings for the utility extensions shall be submitted to Development Services for City routing and approval.
 - (e) Once the applicant has received the approved plans, they must provide 10 sets back to the City within 10 working days and the installation of the mains may proceed.
 - (f) The charges for connections to the mains will be determined and collected by Development Services. The individual service connections will be made by the developer's contractor.
 - (g) Projects that have not begun construction after 1 year of receiving approved permitted plans are subject to new standards.

Procedures for the Towns of Garner, Wake Forest, Rolesville, Knightdale, Wendell, and Zebulon may be obtained by contacting the respective town planning department.

CITY ACCEPTANCE OF PRIVATE UTILITY SYSTEMS

Any existing private utility system desiring to make connection to the City of Raleigh system will submit a letter of request to the Raleigh Public Utilities Director and the owner must make a written application to the City Council for permission to make such connections. The application must be accompanied with a map made by a professional engineer or registered land surveyor and

sealed plats of the property to be served. Additionally, construction plans shall be accompanied by any necessary federal, state, county and city permits or applications for permits.

The plans, maps, and other documents for water, sewer, and reuse lines will be reviewed by the Public Utilities Department for a recommendation on whether to approve or disapprove the application. The water and sewer extension recommendations will be sent to the City Council so a final decision concerning the connection may be made. All water, sewer, and reuse lines providing service to adjoining properties shall be properly dedicated to the City prior to the connection of the system and shall be built to City standards, where applicable. The utility lines dedicated to the City shall include main distribution lines, services from mains to meters, valves, hydrants, and other fixtures to form the system, but will not include service lines leading from the meter to the building connections.

If any easements or right-of-way contracts are needed for the extension of mains over privately-owned lands, the developer shall acquire these easements at no cost to the City. In this case, all easements shall have functional access to public right of way, be properly recorded, and the City of Raleigh Public Utilities Department Standard Procedure 602-4 (see Appendix E) shall be followed. Plan and elevation drawings of all access roads shall be shown on the plans prior to approval.

Once a utility system has been accepted, the City shall have complete control over the mains and connections for the purpose of making inspections and turning the water and/or reuse services on and off.

In times of emergency when the City needs the water to supply the needs of the citizens inside the corporate limits, the service to outside customers will be discontinued and ample notice of the cut-off will be provided to these users. The City cannot be held responsible to provide a certain water pressure and to furnish fire protection to those customers along these lines installed outside the corporate limits.

The following policy shall serve as minimum conditions under which the City shall eventually take responsibility for and accept private community utility lines into the public system:

1. City standards were used as the minimum design and construction standards for such a system.
2. The system is supplied by a central temporary source from wells, pumps, and tanks and/or a sewage disposal system.
3. The system owner shall provide for the water, sewer, and/or reuse systems in streets and easements to become part of the City's utility system without any cost to the City.
4. The system owner shall properly abandon the wastewater treatment plant pursuant to applicable laws and regulations at no cost to the City. All lots connecting to the utility system shall bear their share of the utility connection fee, which must be paid as a lump sum.

CAPITAL FACILITIES FEE REIMBURSEMENT

Developers may be reimbursed for major utility mains if certain conditions are met. The major mains are those water, sewer, and reuse water lines that are 12 inches and larger in diameter. The policy is to reimburse the developer for the cost differential between the major mains and a 6-inch water and 8-inch sewer, whether inside or outside the corporate limits, from the capital facilities fees collected, subject to a 10-year limitation on the reimbursement. In order to qualify for the reimbursement, the developer must have properly prepared plans and profiles for the major mains. These plans will have to be approved by the City. Should the developer fail to execute the reimbursement contract within one year of the City's acceptance of the utility improvements, the

City shall have no further obligation to reimburse the developer for the cost of the main or interceptor facilities. Approval of the reimbursement contract must be granted by the City Council.

The reimbursement payments may be a one-time payment if the Raleigh Director of Public Utilities or his designee determines that there are sufficient funds to meet all outstanding obligations and the immediate request for reimbursement. Otherwise, reimbursement shall be in annual installment payments over a period up to ten years beginning on January 1 immediately following the execution of the contract. If more than one contract is outstanding, then the reimbursements will be made based on the order that the contracts were signed. The details of this reimbursement are outlined in the City of Raleigh Public Utilities Department Standard Procedure 700-6 (see Appendix E).

Each merger municipality may have a different policy on Capital Facilities Fee collection and reimbursement. These policies are subject to change. Currently the towns of Knightdale, Wendell, and Zebulon do not participate in capital facilities fee reimbursement. Please contact the appropriate municipality or Raleigh Public Utilities for more information.

JOINT VENTURE AGREEMENT

Joint venture agreements in accordance with this procedure are defined as private reimbursement contracts and are subject to City Council approval of the plans and/or subdivision, site plan, etc. Joint venture agreements are entered into to provide water and sewer service as part of the City's plan to serve an area in the extraterritorial jurisdiction or to eliminate a public health and/or environmental concern. At least 1,000 linear feet of utility service must be provided and an area of 100 acres must be served. The developer must agree to petition for annexation, must either assign part of the reimbursement cost to the City or pay the City directly for the easement acquisition, must convey positive economic benefits to the City, and the developer agrees to provide a financial security deposit for the full cost of the project. The design must be completed by the project developer within six months of the City agreeing to the project. Pump stations are not eligible for participation by the City, and projects that can be served by gravity sewer may not be served by a pump station.

After approval of the concept, the developer must have the engineering plans prepared for the extension(s) of utilities outside of the proposed project site and provide such funds to cover the cost of installation. The City handles this as a public assessment project and holds the necessary public hearings so that assessments can be levied against the property. A public hearing will be scheduled and held for the project. After the project is approved by the Council, the City will finalize the acquisition of any necessary easements, the cost of which will be paid by the developer. The project will be publicly bid and a contract awarded. Construction is administered by the City. As assessments or fees in lieu of assessments are received, the City will use these funds to repay the developer, but reimbursements cannot exceed the contract amount. In the case of capital facilities fees and private reimbursement contracts, the total reimbursements will not exceed the actual construction costs plus **any accrued interest**. All reimbursements are made yearly, and these payments are made in January of each year, following the execution of the contract which requires acceptance of the utilities.

INFILL POLICY

It is the policy of the City of Raleigh Public Utilities Department (CORPUD) to achieve the replacement of vitrified clay sanitary sewer mains, galvanized water mains, and other deteriorated and/or undersized mains when "infill" development projects occur on or adjoining the property on which those mains are located.

The engineering plans review personnel in the CORPUD Administrative Office will identify instances in which this policy applies and determine the size and linear extent of the replacement needed. They will notify the engineer through the normal plan review comment process. The plans will be re-submitted and permitted including the needed replacement.

The developer and/or engineer will obtain, through informal quotes or public bidding as appropriate from a North Carolina licensed utility contractor, a price for the replacement main work. The developer and/or engineer will submit that price and the name of the utility contractor to the Raleigh Public Utilities Director or his designee for approval prior to commencing work on the main replacement work. Upon approval of the project cost by the City, the contractor shall proceed with the main replacement work.

The main replacement work will be considered as part of the general project scope in terms of inspection, acceptance, etc. Upon final acceptance of the replacement work, as documented by City inspectors, CORPUD will reimburse the developer the cost of the replacement main, based upon initial cost submittal or the effective full diameter price for that size of main based upon current Capital Facilities Fee reimbursement tables, whichever is **less**. In those cases in which the cutting and restoration of public streets, replacement of aerial mains, or other special work are required in order to accomplish the required main replacement, additional compensation or provisions will be established by the Raleigh Public Utilities Director or his designee for that work. The developer is responsible for all of the costs other than the main replacement cost, which is reimbursed by the City.

USE OF THE SANITARY SEWER SYSTEM

The use of the sanitary sewer system in the City of Raleigh is fully described in Part 8, Article C of the City Code. A brief summary of the City Code that is applicable to the sewage treatment system is listed below:

- Section 8-2013 of the City Code makes it unlawful to destroy or interfere in any way with any part of the City sewer system.
- Section 8-2196 makes it unlawful to deposit any solid or liquid substances directly into any manhole.
- Section 8-2113 sets a limit on certain amounts of biological and toxic wastes that can be discharged into the sewage system. Failure to comply with any of these can result in civil penalties. These limits are necessary so that the biological treatment process can be maintained at acceptable levels.
- In Section 8-2114, a procedure has been developed so that persons generating waste over the prescribed limits may pre-treat it, apply to the City for permission to regulate the rate of discharge so that it is at an acceptable level, or apply to the City for permission to discharge certain wastes, but to pay a surcharge equal to the extra treatment cost.
- In Section 8-2127, the City of Raleigh outlines the Industrial Pretreatment Program. The City Code details discharges exceeding the defined waste limits must submit an industrial pretreatment application, in addition to the surcharges. The application must be approved by the City prior to connection and discharge into the public sewer system.

- The City policy is to utilize gravity flow sewers unless it has been determined to be economically infeasible or physically impossible by the City to provide sewer service without relying on pump stations. In situations where the City has offered a joint venture, a pump station may not be used. In situations where gravity sewer is not available and a pump station could be put in to just serve the property, the City may consider the installation of a privately owned and maintained pump station and force main. *See the Sewer Designs Standards Section of this book and Details S-35 through S-37.*
- The City Code in Section 8-2119 states: “All *food preparation or serving facilities* and all vehicle maintenance facilities connected to the *City’s sanitary sewer system shall* install, maintain, and keep in continuous operation a grease trap interceptor. The interceptor shall be sized in accordance with standards established by the Raleigh Public Utilities Department”. *See Details S-40 and S-41.* The facilities where grease trap interceptors are located must have records on-site and available for staff review, indicating the history of their grease trap maintenance. Failure to comply with the requirements of this section of the Code, will result in the issuance of a Notice of Violation, Civil Penalty assessment, and, if necessary, temporary or permanent interruption of water, sewer, and/or reuse service from the City of Raleigh.

USE OF THE REUSE SYSTEM

The use of the reuse system in the City of Raleigh is fully described in Article F of the City Code. The City of Raleigh encourages the beneficial use of the State’s water resources concurrent with the protection of public health and the environment. As such, the City encourages the use of reuse water for any approved purpose when economically and technically feasible. Utilization of reuse water for non-potable purposes alleviates demand on our limited potable water resources and helps protect the environment by reducing discharges to our rivers.

The City of Raleigh has developed a master plan for a reuse distribution system, which can be reviewed in [list section of Code or handbook?]. Development projects may be required to install reuse distribution systems in accordance with the master plan. Please contact the City of Raleigh Public Utilities Department to determine if reuse water is available to a development site.

Reuse water is not intended for direct human consumption. All North Carolina State requirements for reclaimed water must be met as specified by NC DENR. Public protection is ensured through State Laws (North Carolina Administrative Code Title 15A, Subchapter 2T or 02U.0100), identification of reuse water through signage and the use of purple-colored piping and equipment, and continuous monitoring of water quality. All buffers and runoff requirements specified in Section 8-2187 of the City Code must be met for irrigation with reuse water.

OTHER POLICIES

SEWER CAPACITY ANALYSIS

To facilitate the efficient and adequate provision of water and sewage, every subdivision plan and site plan shall be subject to a determination of the sufficiency of infrastructure as defined in section 8.2.1(B) and 8.2.1(C) of the Unified Development Ordinance. The engineer shall provide certification that the proposed project or site shall not have a greater than 50% pipe capacity during periods of peak flow. Please refer to Departmental Operating Instruction (DOI) for details on requirements.

REQUIREMENT OF PERFORMANCE BOND 8.1.3 in UDO

If all utility development-related improvements and installations are not completed and accepted by the City prior to a request to record all or a part of any subdivision or issuance of a building permit for any site plan, whichever first occurs, a security instrument shall be posted, in lieu of completion of the utility work, providing for and securing to the City the actual construction and installation of those utility improvements. For mains twelve (12) inches and above, the bond amount will be calculated using the reimbursement costs as set forth for major mains in City Code § 8-2094© based on construction cost per linear foot. For mains under twelve inches (12), the bond amount shall be calculated using the costs to be reimbursed as set forth in City Code § 8-2077 based on unit cost per linear foot.

PRESSURE-REDUCING VALVES

Any water service consumer of the City's water system whose water service has a water pressure exceeding eighty (80) pounds per square inch is required to install and maintain a pressure-reducing valve on the building side of the meter. No connection to the water system shall be made without installing the pressure-reducing valve herein required and in no event shall the City be responsible for any liability for damages which might result from the failure to install and maintain the said pressure-reducing valve.

SEWAGE BACKFLOW POLICY-NEW DEVELOPMENT AND EXISTING SERVICE

N.C. Plumbing Code Section 715.1 requires where the flood level rims of plumbing fixtures are below the elevation of the manhole cover of the next upstream manhole in the public sewer, such fixtures shall be protected by a backwater valve installed in the building drain, branch of the building drain or horizontal branch serving such fixtures. Plumbing fixtures having flood level rims above the elevation of the manhole cover of the next upstream manhole in the public sewer shall not discharge through a backwater valve. Section 10-6084 of the City Code deals with fixtures and drains subject to sewage backflow. This section requires that the all-plumbing traps shall be installed with an elevation at least one foot higher than the elevation of the top of the next manhole upstream from the property connection. For existing service that have flood level rims of plumbing fixtures below the elevation of the manhole cover of the next upstream manhole in the public sewer and that do not have a backwater valve installed, the property owner must sign a sewer release form waiving the City's liability in case of a backflow. This form will be recorded in the register of deeds office. The liability sewer release form can be obtained in the City Inspections Department.

FLOOD POLICY

Section 8-2009 of the City Code states that in flood prone areas, the manholes must be watertight and vented to three feet above the 100-year flood elevation Pump stations must be constructed above the 100-year flood elevation as determined by the U.S. Army Corps of Engineers.

MANHOLES IN STREETS

All manhole covers installed within streets, parking lots, and other paved areas shall have only one one-inch hole, which shall be off center, unless seal-down manholes are required. All covers must be domestically cast and so indicated by manufacturer name and "USA" in castings. Covers shall have "DANGER PERMIT REQUIRED – CONFINED SPACE DO NOT ENTER" cast onto the face as shown in details W-21 and S-25. A rubber grommet should only be installed by maintenance personnel when an area is identified as a problem.

LOCATION OF UNDERGROUND UTILITIES

Before commencing any excavations in any highways, streets, public spaces, or in an easement, the State of North Carolina Underground Damage Prevention Act Article 8, § 87-102 requires notification of each utility owner having underground utilities located in the proposed area to be excavated, either orally or in writing, not less than two nor more than ten working days prior to starting, of the intent to excavate. If planning on digging, excavating, demolishing, or moving the earth in any way that could damage underground utility facilities, call the North Carolina One-Call Center toll free number (1-800-632-4949) 48 hours before work commences.

SERVICE CONNECTIONS IN SEWER EASEMENTS

Sewer service connections in existing sewer main easements shall be installed only by licensed utility contractors or licensed plumbers. No service connections shall be made to trunk or interceptor sewers 15-inches in diameter and larger. Services on 15-inch and larger mains will require connection at an existing manhole or the installation of a manhole.

SEWER MAIN/EASEMENT RELOCATION POLICY

Encroachments in easements are discouraged. In cases where they are necessary and technically feasible in accordance with the City of Raleigh design standards, the City of Raleigh Public Utilities Department shall consider requests for relocation of sewer mains and easements proposed as a remedial action to resolve conflicts such as encroachment of buildings, houses, and other such permanent structures. All easement relocations require City Council approval through sale of surplus property. The total cost of relocation of sewer mains and dedication of new easements shall be at the expense of the property owner, including engineering cost, survey cost, recordation of maps, surplus property procedure, etc.

SWIMMING POOLS

In residential areas, hydrant meters may only be used for the filling of swimming pools unless prior approval by the Public Utilities Department. Contractors

CONNECTION OF SWIMMING POOLS AND FOUNTAINS TO SANITARY SEWER

Swimming pools or ornamental fountains shall discharge to the stormwater system under the general permit issued by the Division of Water Quality. Where discharge to the storm sewer system is not possible and a swimming pool or ornamental fountain is connected to the sanitary sewer system for the purpose of draining or flushing the pool/fountain or backwashing the filters, the drainage system shall be equipped with a pump or flow restrictor so that the discharge rate to the sanitary sewer does not exceed 50 gallons per minute. The documentation of this flow rate must be provided to the Raleigh Public Utilities Director.

THEFT OF WATER

All water used from the City of Raleigh Public Utilities system must be metered except in the case of fire emergencies. Hydrant meters must be obtained from the Meters Division at (919) 996-2742. Hydrant meters are issued as temporary water service and may be recalled at any time and for any reason by the Raleigh Public Utilities Director. Water used from the City's water system without metering is a violation of the City Code and can result in a fine of a maximum of \$ 500.00/day plus water usage and a \$100.00 tampering fee. On Dec. 31, 2013 a new state law will

take effect where tampering with a water meter or hydrant meter shall result in criminal charges. See the Construction Standards for Water included in this Handbook.

WATER BACKFLOW/CROSS CONNECTION

All existing and proposed water services, dedicated fire and irrigation lines, and private distribution systems must be provided with an approved backflow assembly as determined by the Raleigh Public Utilities Director or his designee. For projects having any combination of these lines, suitable approved devices must be provided to control each level through containment. Questions concerning Raleigh's Backflow/Cross-Connection Program should be directed to the Public Utilities Cross Connection Coordinator at (919) 996-5923. A list of approved devices is provided on the City of Raleigh Public Utilities website.

REUSE BACKFLOW/CROSS CONNECTION

The Raleigh Public Utilities Director may require an approved backflow assembly for any existing or proposed reuse services, dedicated irrigation lines, or private distribution systems. In no case shall a connection be made between the potable and reuse water systems. Where both reuse and potable water are supplied, a reduced pressure principle device or an approved air gap separation shall be installed on the potable water service. If it is necessary to use potable water to supplement the reuse system, an approved air gap separation must be provided to protect the potable water system. The air gap shall be at least double the diameter of the supply pipe, measured vertically above the overflow level of the container. Questions concerning Raleigh's Backflow/Cross-Connection Prevention Program should be directed to the Public Utilities Cross Connection Coordinator at (919) 996-5923. A list of approved devices is provided on the City of Raleigh Public Utilities website

WATER SYSTEM AND REUSE SYSTEM CONNECTIONS

In no case shall a connection be made between the potable and reuse water systems. Where both reuse and potable water are supplied, a reduced pressure principle device or an approved air gap separation shall be installed on the potable water service. If it is necessary to use potable water to supplement the reuse system, an approved air gap separation must be provided to protect the potable water system. The air gap shall be at least double the diameter of the supply pipe, measured vertically above the overflow level of the container.

WELL POLICY FOR IRRIGATION SYSTEMS

The City Code indicates that wells for irrigation systems inside the City will require a permit from the City's Development Services office, along with a permit from the Wake County Department of Environmental Services. There shall be no connection to the City's water system for a well installed for irrigation. Irrigation wells will not be permitted where reuse water is available. The procedure for applying for wells is established in the City of Raleigh Public Utilities Department Standard Procedure 607-4 (see Appendix E).

See Cross Connection Appendix A or Domestic RP requirements when a well is present on the property.

GROUNDWATER RECLAMATION WELLS

Groundwater reclamation wells are prohibited from discharging into the City sewer system.

DUAL UTILITY SERVICE POLICY FOR EXTRATERRITORIAL JURISDICTION AREA (TWO ACRE RULE)

Both water and sewer service connections must be provided for lots greater than two (2) acres existing as of April 17, 1984, in order to be eligible for one or the other of the utilities.

In such case where both utilities are not available to a particular tract of land and the *property* owner wishes to connect to the one that is available, the *property* owner may be allowed to connect to the particular utility that is available. Available for the purpose of this paragraph shall be defined to mean that the utility is located within 1,000 feet of the nearest point on the property. See Raleigh City Code Section 8-2063(b).

SCHEDULING REUSE SERVICES

The City will control and schedule the delivery of reuse water to residences and businesses based upon being able to maintain an acceptable working pressure and safeguarding public health. The City of Raleigh will provide a minimum pressure of 20 pounds per square inch (psi).

FORCE MAIN DISCHARGE POLICY

Force main discharges create the potential for introducing hydrogen sulfide gases into the existing sewer system. These gases, in turn, can cause rapid deterioration of unprotected concrete and metal sewer main materials. In order to prevent this rapid deterioration, it is required that manholes and sewer mains that receive any new force main discharge shall be upgraded by means of replacing the existing concrete, ductile iron, or cast iron main with PVC (if depths allow) or replacing the existing main with ceramic epoxy lined ductile iron and polyurea/polyurethane coated manholes (see “Sewer Materials Standards” for these specifications). The extent of this main replacement will generally be to the next manhole upstream and downstream from the manhole in which the new force main discharges into. The extent of existing main replacement upstream and downstream in no case shall be less than 100’ in each direction. In addition to main replacement, the manhole in which the force main discharges into shall be vented and be replaced with a polyurea/polyurethane coated manhole (see “Sewer Materials Standards”). The developer is responsible for all of the costs associated with this upgrade.

Cured in Place Pipe (CIPP) may also be allowed where the existing main is of a suitable condition and must meet the standards set forth in the Materials and Construction sections of this handbook.

EXISTING MATERIALS POLICY

Any existing water or sewer main materials (i.e. fire hydrants, valves, etc.) that are to be relocated or removed during a specific project shall not be reused in the City of Raleigh Public Utilities System.

IRRIGATION SYSTEM POLICY

All new permanent in-ground irrigation systems shall be individually metered. The irrigation service line can be directly tapped into the main or split off of the domestic service prior to the meter (see Detail W-35). Either method of connection shall be performed by the City of Raleigh Public Utilities Department or a licensed utility contractor. All permanent in-ground irrigation systems shall also be equipped with an approved reduced pressure zone principle (RPZ) backflow assembly. A functional rainfall sensor shall also be installed on all permanent in ground irrigation systems and shall be set at 1/4”. Rain sensor shall be installed per the manufacturer’s

recommendation in a location that will allow for proper operation and be at least 5' from a house or building. Specifications for rain sensors can be found in the "Water Materials Standards" section. Information on tap fees for either connection method can be obtained by calling the City of Raleigh Inspections Department at 919-996-2495. See the Water, Sewer and Reuse Fees section below.

FIRE PUMP FLOW METERING SYSTEM

All commercial and/or industrial facilities required to have an on-site pump system(s) for fire protection shall be equipped with an appropriately sized around the pump flow metering system (UL listed) in order to conserve water. If an existing fire pump system is not equipped with an around the pump flow meter and the fire suppression system is modified, an around the pump flow meter shall be installed in concurrence with the system modification. If no modifications to the fire suppression system are necessary, then all commercial and/or industrial facilities with on-site fire pumps shall install an around the pump flow meter by no later than July 1, 2017. CORPUD reserves the right to require modifications to the approved detail as it deems necessary to comply with individual site conditions.

WATER, SEWER, AND REUSE FEES

The City of Raleigh has several fees, which are related to its water, sewer, and reuse systems. These fees are normally adjusted at the beginning of each fiscal year, which begins on July 1. Please contact Public Utilities at (919) 996-4540 for the current fees. Please contact Development Services at (919) 996-2495 for a determination of the total amount due for a particular site.

The Development Fee Schedule may be found at:

<http://portalprd.raleighnc.gov/search/content/CityMgrDevServices/Articles/DevelopmentFeeSchedule.html>

These fees will be defined and discussed below:

Assessment Fee The minimum size mains are six inch and eight inch for water and sewer mains, respectively. For corner and dual frontage lots, the property owner may receive a 150-foot exemption. When utility mains are installed inside the corporate limits by the City, the adjoining property owners are charged an assessment fee for the improvements. These fees are based on the cost of installing a six-inch water main and an eight-inch sewer main. This fee is a lien on the property and can be paid over a ten-year period at 6% interest. Each fiscal year these fees are revised to reflect changes in the cost of installation.

Capital Facilities Fee - Fee charged for connecting with the water and sewer system of the city, either within or outside the corporate limits of the City. These fees are calculated based upon the sewer and water meter size for the property being served by the connection.

Fee in Lieu of Assessment – Properties outside the City corporate limits are unable to be assessed, resulting in a "fee in lieu of assessment." The "fee in lieu of assessment" is due at the time of connection onto the water and/or sewer system or at the time of annexation into the City.

Fee in Lieu of Construction – Fee may be collected when it is not feasible to construct the required water, sewer and/or reuse water mains as part of a development. Topographic conditions or development requirements will be factors considered when determining the feasibility of this fee.

Right-of-way dedication and all necessary easements shall be dedicated to the City. Infrastructure construction drawings may be required to determine the extent of improvements and easement locations. For mains under twelve (12) inches, fees in lieu shall be calculated using the costs to be reimbursed for minor mains in City Code § 8-2077 based on unit cost per linear foot. For mains twelve (12) inches and above, the fees in lieu payments shall be calculated using the reimbursement costs in City Code § 8-2094(c) based on construction cost per linear foot.

Service Installation ("Tap") Fee - A fee is charged to cover the cost of installation by the City of water, sewer, and reuse service lines extending from the main to the edge of the right-of-way or private property. The City has set fees for ¾ through one-inch water services, four-inch sewer service, and ¾ inch through one-inch reuse service, or a service tap may be installed by a licensed utility contractor. Taps for water services larger than one (1) inch and sewer services larger than four (4) inches *shall* be installed by a private licensed utility contractor retained by the applicant. Tap fees for owner-occupied residential structures may be financed by the *City* for a term of five (5) years at eight (8) per cent interest upon the request of the homeowner. Water and sewer tap fees relating to public extension projects are subject to a one-year freeze following service availability. This freeze *shall* apply only to owners of developed properties within the project area upon which a tap was installed as part of the public extension project. During the one-year freeze period, the eligible property owners may connect to the *City* system(s) and pay the tap fees which were in effect on the date the *City* Council directed construction of the project. All other property owners in the project area *shall* pay the prevailing tap fee(s) in effect on the date service connection is requested.

Meter Installation Fee - The Public Utilities Department installs all water and reuse meters connected to the Raleigh water system. Charges for such installation, based upon meter size, have been adopted and are periodically updated. A Not Ready Fee is charged when the City has attempted to initially install the water meter and determined that the water service stub was either not installed to the property or the water service stub was not installed in accordance with City standards.

Sewer Permit Fees - The City issues sewer extension permits on behalf of the North Carolina Department of Environment and Natural Resources Water Quality Division. These fees are due at the time of submittal of engineering drawings. There is a permit application processing fee charged by the City.

Water Permit Fees – The City issues water extension permits on behalf Department of Environment and Health. These fees are due at the time of submittal of engineering drawings.

Reuse Permit Fees –The City issues reuse extension permits on behalf of the North Carolina Department of Environment and Natural Resources Water Quality Division. Where applicable, these fees are due at the time of submittal of engineering drawings. There is a permit application processing fee for reuse charged by the City if no other utilities are being submitted for review.

Outside Sewer Connection Fee - Property located outside of the City limits will pay a sewer connection fee of \$200 for each dwelling or unit which is tapped onto the City's wastewater system. The fee is collected at the same time as capital facilities fees, as discussed above. In cases where the petitioned annexation will be accepted, the City may waive this fee as determined by the Planning Department.

PERMITS

During the course of designing and prior to constructing a utility project, various permits from the City and State government must be secured. Below are a brief description of some of the major permits that may be required by the City of Raleigh and the State of North Carolina on these projects:

CITY OF RALEIGH PERMITS

Prior to the construction, but after appropriate City approval of the utility project, the listed permits, as well as the permit fees, may be required. The City Development Services Customer Service Center is located at One Exchange Plaza, Suite 400. The Inspections Department Permit Office is located at One Exchange Plaza, 5th Floor. The Permitting Section of the City's Inspections Department and/or the Development Services Customer Service Center can assist the engineer or contractor with the following items:

- a. Land Disturbance, Stormwater, Water Course Buffer or Water Shed Permit - If the disturbed area is in excess of 12,000 square feet, the contractor or engineer must secure a Land Disturbance Permit. Plans showing the soil erosion control measures must be included in the project plans. Grading plans that require cut or fill that reduce the minimum cover or exceed the maximum cover must be submitted to the Public Utilities Department.
- b. Flood Permit - If any construction is taking place in a designated floodplain, a Floodplain Permit must be required. Manholes installed in a floodplain must be built **three feet** above the hundred-year flood elevation or be of a waterproof design.
- c. Stub Permit - A Stub Permit is required to connect to the City service main and requires an inspection of the service line running from the main to the property line or easement line.
- d. Utility Connection Permit - The Utility Connection Permit is the primary permit required to connect to the City water, sewer, and/or reuse system. This permit includes such things as the capital facilities fee, any outstanding assessments on the property, a fee in lieu of assessments when appropriate, and will include the City installation fees if the services are going to be installed by City forces.
- e. Plumbing Permit – The Plumbing Permit includes the inspection fees for the on-site water, sewer, and reuse lines running from the building project back to the service stubs. This is required when a licensed plumber installs a service line and/or irrigation RP is set.
- f. Plumbing Utility Permit – The plumbing utility permit includes the inspection fees for a utility contractor to run water and sewer services to within 5’ of buildings from the main.
- g. Right-of-Way Permits - The Right-of-Way Permits are required and must be approved before actually working in the right-of-way. The contractor must secure a traffic authorization from the Department of Transportation (DOT) for work on major thoroughfares or on the streets with marked centerlines, before the Development Services Customer Service Center can process the right-of-way permit. The details of the special traffic authorization can be found in the City of Raleigh Transportation Department Handbook on Construction Work Zone Signing.
- h. Street Cut Permit - A Street Cut Permit is required to cut the street for installation or excavation in the right-of-way.

- i. Irrigation Well Permit – A Well Permit is required from the Wake County Department of Environmental Services, Water Quality Division for an irrigation well inside the City limits. An electrical permit is also required and must be obtained from the City of Raleigh Development Services.
- j. Fire Permit – Some projects will require hydrant permits.
- k. Urban Forestry Permit – Tree conservation permit.

BLASTING PERMIT

A Blasting Permit is required whenever blasting is taking place. It may be applied for in the Office of the Fire Marshal, (919) 996-6392.

NEUSE RIVER BUFFERS

It is the responsibility of the engineer/developer to verify if a City of Raleigh Watercourse buffer permit is required. If required, it is the developers/engineers responsibility to obtain the necessary permits and approvals and strictly adhere to any conditions. **These permits and approvals must be provided prior to construction plan approval.** The permit/approval number must be clearly identified on the overall utility plan.

WETLAND PERMITS

It is the responsibility of the developer/engineer to verify if wetlands exist on a project. If wetlands are present, it is the developer's/engineer's responsibility to obtain necessary permits from other agencies and strictly adhere to any conditions. **These permits must be provided prior to construction plan approval.** The permit number must be clearly identified on the overall utility plan.

WATER, WASTEWATER, AND REUSE SYSTEMS PERMITS

Prior to City design approval of a project the engineer or owner must secure a Wastewater Discharge Permit, a Water Supply System Permit, and/or a Reuse Supply System Permit for each project, if applicable. **Please see the [Development Services Guide](#) for more information.**

Wastewater Discharge Permits

The Environmental Management Commission of the North Carolina Department of Environment and Natural Resources has delegated the City of Raleigh's Public Utilities Department the authority to issue wastewater discharge permits for projects within the City's jurisdiction.

Water Supply System Permits

The Public Water Supply Section, Division of Environmental Health, North Carolina Department of Environment and Natural Resources has delegated the City of Raleigh's

Public Utilities Department the authority to issue water supply system permits for projects within the City's jurisdiction.

Reuse Supply System Permits

The Public Water Supply Section, Division of Environmental Health, North Carolina Department of Environment and Natural Resources has delegated the City of Raleigh's Public Utilities Department the authority to issue reuse supply system permits for projects within the City's jurisdiction.

A developer, engineer, or contractor shall not proceed with the main installation prior to the construction authorization, which includes signatures on the plans. If a developer, engineer, or contractor does proceed, the City may require the work to be removed and reinstalled subsequent to issuance of the permit(s), and the developer, engineer or contractor shall be fully liable for all costs and actions, including criminal prosecution by the State for proceeding with installation prior to issuance of the appropriate permit(s).

NCDOT ENCROACHMENT PERMIT

If a project involves a State maintained road or highway, the engineer or contractor must submit the necessary highway encroachment forms to the North Carolina Division of Highways. The encroachment agreement must first be executed by the City of Raleigh through the Public Works Department. The engineer then will pick-up the executed forms from Public Works and deliver them to NCDOT. Fully executed encroachment agreements must be provided prior to construction plan approval.

EASEMENT MAP REQUIREMENTS

The City of Raleigh is standardizing the format for plat information. For a complete list of all information required, refer to the Development Services Customer Service Center tab at the City of Raleigh website and link to the "Recorded Maps". The following items must be included:

- 1) Minimum scale established – 1 inch = 50 feet
- 2) Project title – consistent with council authorization
- 3) Vicinity map
- 4) Identify map number of total (example: map #9 of 14)
- 5) Street number on each parcel
- 6) Owner name on each parcel
- 7) Successive lot numbers on each parcel – beginning with Lot #1
- 8) Locate footprint of structure on parcel
- 9) Reference any recorded easements on each parcel
- 10) "Line" legend somewhere on map
- 11) Owner/parcel/take data table somewhere on map to include: Owner's name, street address, Wake county Tax ID # (7 digit #), Lot #, each take listed, Parcel Deed Book and page number
- 12) No easements labeled "utility"
- 13) No overlapping easements

CONSTRUCTION WATER/HYDRANT METERS

The City of Raleigh Public Utilities Department does not provide free or otherwise unmetered construction water for any construction project. Contractors are responsible for adequate construction water for their job sites in one of the following approved manners:

- a. Apply for permanent water service connection at Development Services, 4th floor, One Exchange Plaza, 219 Fayetteville Street, (919)996-2495. Sufficient lead-time (6 weeks) should be provided for all new service taps and all fees must be paid in full prior to the work order being authorized.
- c. Apply in person with the Public Utilities Meters Division Office at 3304 Lake Woodard Drive, for rental of a hydrant meter. Hydrant meters are issued as temporary water service and may be recalled at any time and for any reason by the Raleigh Public Utilities Director. There are a limited number of these meters, which must be reserved in advance by contacting the Meters Division (919-996-2742). A deposit is required along with a rental fee per account. Additionally, there will be a charge for the cost of the water used, at the outside City rate. Hydrant meters are read in 100 cubic feet (ccf). Customers are responsible for notifying the Meters Division if the meter is not registering usage. The following information is required:
 - (1) Meter location;
 - (2) Billing address, telephone number, responsible party name, and federal tax id#
 - (3) Location of hydrant;
 - (4) Water to be used for;
 - (5) Duration of use and frequency of meter reading,
- (6) Meter readings are to be emailed, faxed, or called in by the 7th of each month.
 - c. Hydrant meters accounts are billed monthly. Failure to report usage in a timely manner for billing or accounts that are not paid in full will result in the loss of water service and the closing of the account with the City with a one year forfeiture period.
 - d. Hydrant meters can only be used when the temperature is over 35 degrees. Damage to meters from the cold weather or abuse will be charged to the customers.
 - e. Hydrant meters used for long term use shall be returned at the end of every one year block for inspection.
 - f. Upon completion of hydrant usage, deposits shall be applied to the final bill. Applicable refunds will be refunded to customers within 30 days provided the following has occurred:
 1. Hydrant meter and backflow assembly have been returned in good condition, with no excessive wear or damage.
 - g. The cut off to apply for new accounts is 3:00 PM each business day.
 - h. It is a violation of the City Code to establish a direct connection to a fire hydrant to fill a tank or tank vehicle. It is also illegal to use the test cocks of a backflow assembly for temporary water service. Violations of the City Code will result in loss of service, fines, and other measures as specified by the Code.

- i. Continued use of a hydrant meter, when usage readings are not being registered is considered theft of City water and subject to civil penalties of up to \$5,000.00/day. It is the responsibility of the customer to notify the Meters Division at 919-996-2742 when the meter is not registering/recording the water usage properly.
- j. Hydrant meters and backflow assemblies approved for use in this program are the property of the City of Raleigh Public Utilities Department. Failure to return the hydrant meter and backflow assembly at the end of the rental period will be considered theft of City property and prosecuted to the fullest extent of the law.

Note: Individuals caught using water unmetered and/or unauthorized by the Public Utilities Department will be prosecuted to the fullest extent of the law. This shall include both civil and criminal penalties.

SEALED AS BUILT PLANS

For projects within the City of Raleigh, certified surveyed "As-built" plans and profiles, sealed by a Professional Land Surveyor, shall be furnished to the Public Works Department by the Engineer upon completion and acceptance of the public main by the City and completion of the private systems.

For development projects in the merger towns, as-builts must be submitted directly to the inspector.

City of Raleigh Public Utilities Department Digital As-Built Submittal Requirements

Definitions:

“As-Built” plans shall be the certified plan sealed by a professional land surveyor locating the various features applicable to the project.

The “Infrastructure Construction Plan” shall be the construction document designed and certified by a professional certified engineer whom has periodically monitored the project throughout construction and agrees with the “As-Built” plan as defined above.

Requirements:

The surveyed “As-Built” plan shall be clearly titled and labeled. The plan shall include the following information: install dates, “As-Built” date, revision dates, project title, page numbering, north arrow, scale of drawing, scale bar, permit number, engineer in charge, all easements identified and dimensioned, pipe size, pipe material, pipe length, length of bore and jacks, fitting type defined, valve type defined, manhole size, rim elevations, inverts, top elevations, manhole depth, gravity sewer slope, coating types, lining types, abandoned and or removed features.

In addition to the City of Raleigh Planning and Development Guide and the Public Utilities Handbook requirements, all “As-Built” plans shall include a vicinity map, and be clearly marked as an “As-Built Plan”. All current Wake county parcel information in the project area is to be defined and properly labeled. All streets in the project area shall be defined and labeled. Two manholes, one above and one below, the project area shall be defined and labeled including inverts. All coordinates shall tie into the NC grid coordinate system (NAD1983 State Plane) and the vertical datum NAVD88. All units are to be US survey feet. The closest geodetic monument to the project shall be identified in the “As-Built” drawing.

Water

Surveyed "as-built" plans of installed utilities shall be furnished to the City of Raleigh Engineering Inspections Dept., 400 West Peace Street, Raleigh, N.C. 27602, prior to initial walk-through with the contractor and/or owner. Each plan sheet showing as-built information shall have an engineer's certification with N.C.P.E. seal, signature and date. See certification text below. All "as-built" plans shall include a vicinity map and an overall site or utility plan, and be clearly marked as an "as-built plan". The plan shall include the following information on a 24x36 inch layout (paper for initial walk-through, mylar for final): "as-built" date, project title, page numbering, north arrow, scale of drawing, bar scale, engineer of record, all easements identified and dimensioned, pipe size, pipe material, fitting type defined, valve type defined, abandoned and/or removed features. All current Wake county parcel information in the project area is to be defined and properly labeled with PIN. All streets in the project area shall be defined and labeled. The water distribution system drawings shall show main sizes, materials, and locations, locations of hydrants, valves, blow-off assemblies, FDC's, fittings on main if known, meter boxes, connections to existing utilities and any other relevant information (service laterals, backflow preventers, air release valves, casings, reducers/increasers, etc.). All service stubs shall be shown on the surveyed "as-built" plans. All mains shall be labeled as public or private. The surveyed "as-built" plans shall have North Carolina State Plane grid X and Y coordinates in US Survey feet for all valves, hydrants, backflow preventers, blow-offs and connections to existing utilities. Horizontal datum must be NAD 83, please specify which realization of NAD 83. The NC CORS Base Station Network is referenced to the NAD 83(2011) datum. Vertical datum must be NAVD88, geoid 03 or later and indicated in survey text file. Elevations (taken at ground surface) are not shown on the as-built plan, but are required in the survey text file (detailed below). The COR plan identification number (if applicable) and water permit number information must also be included.

A 24x36 inch paper copy shall be submitted to the Inspections Department for review and comment before initial walk-through. Once these comments are addressed, a 24x36 inch mylar copy of each sheet shall be re-submitted. In addition to hard copy mylars, a PDF file of each signed and sealed mylar sheet must be submitted. A CAD file of utilities should show the overall water system as-built layout along with the property or subdivision boundaries. DWG, DGN, DXF and SHP are acceptable formats. Please save CAD files in "model space" on NC State Plane grid. A comma-delimited text file or Microsoft Excel file of survey information is required with the following columns: FeatureType (Valve, Meter, Tee, etc), X, Y, Z, Size, Description (see example).

Digital as-built data submittals shall be on CD-ROM or DVD-ROM media. Discs shall be labeled with the following information:

1. Project name
2. Name of firm which prepared the data
3. As-built date, as depicted on mylar submittal
4. Permit number(s)
5. COR plan identification number (if applicable)

Each digital as-built submittal shall include the following on digital media:

1. PDF files for each mylar sheet submitted
2. PDF file(s) for recorded plat(s)
3. CAD file (see above)

4. Data file denoting the coordinates and description for each utility feature in the project scope (see above and example below)

| FeatureType | X | Y | Z | Size | Description |
|-------------|------------|------------|--------|---------|----------------------------------|
| Tee | 2086904.78 | 732688.47 | 349.69 | 12x12x6 | DI tee |
| Valve | 2086907.12 | 7326892.41 | 349.78 | 6" | Gate valve |
| Hydrant | 2086910.49 | 7326899.57 | 352.62 | 4.5" | 2012 Mueller Super Centurion 250 |
| Meter Box | 2085638.36 | 731998.1 | 368.23 | 5/8" | specify domestic or irrigation |
| BFP | 2085639.24 | 731996.33 | 368.35 | 3/4" | RPZ |

ENGINEER CERTIFICATION STATEMENT

I, _____, as a duly registered Professional Engineer in the State of North Carolina, having been authorized to observe (___ periodically, ___ weekly, ___ full time) the construction of the project, _____, hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction such that by my inspection of the constructed improvements and my review of the as-built survey data, I hereby certify that the (1)public improvements, (2) private improvements, and (3) public safety of the above referenced project as constructed are in compliance with the requirements of the improvements as prescribed in the approved Construction Drawings, approved design documents, and/or any approved modifications, except as noted in red on the 'As-Built' drawings. Furthermore, I certify that the red-noted exceptions do not adversely affect the required performance or public safety aspects of the improvements.

Name: _____ Date: _____

NCPE Seal:

Sewer

Surveyed "as-built" plans of installed utilities shall be furnished to the City of Raleigh Engineering Inspections Dept., 400 West Peace Street, Raleigh, N.C. 27602, prior to initial walk-through with the contractor and/or owner. Each plan sheet showing as-built information shall have an engineer's certification with N.C.P.E. seal, signature and date. See certification text below. All "as-built" plans shall include a vicinity map and an overall site or utility plan, and be clearly marked as an "as-built plan". The plan should include the following information on a 24x36 inch layout (paper for initial walk-through, mylar for final): "as-built" date, project title, page numbering, north arrow, scale of drawing, bar scale, engineer of record, all easements identified and dimensioned, pipe size, pipe material, pipe length, fitting

type defined, valve type defined, manhole size, rim elevation, inverts, gravity sewer slope, coating types, lining types, abandoned and/or removed features. All current Wake county parcel information in the project area is to be defined and properly labeled with PIN. All streets in the project area shall be defined and labeled. The sewer system drawings should show mains and force mains, sizes, materials and locations of mains and force mains, locations of manholes, cleanouts, fittings, pump stations, grease traps,

| FeatureType | X | Y | Z | InvertIn | InvertOut |
|-------------|------------|------------|--------|----------|-----------|
| Manhole | 2086904.78 | 732688.47 | 349.69 | 336.35 | 339.25 |
| Cleanout | 2086907.12 | 7326892.41 | 349.78 | N/A | N/A |
| Grease Trap | 2086910.49 | 7326899.57 | 352.62 | N/A | N/A |
| Check Valve | 2085639.24 | 731996.33 | 368.35 | N/A | N/A |

connections to existing utilities and any other relevant information (service laterals, oil/water separators, air release valves, casings, etc.). All service stubs shall be shown on the surveyed "as-built" plans. All mains shall be labeled as public or private. The surveyed "as-built" plans shall have North Carolina State Plane grid X and Y coordinates in US Survey feet for all manholes, grease traps, oil/water separators, valves, and blow-offs. Horizontal datum must be NAD 83, please specify which realization of NAD 83. The NC CORS Base Station Network is referenced to the NAD 83(2011) datum. Vertical datum must be NAVD88, geoid 03 or later. Elevations (taken at ground surface) are not shown on the as-built plan, but are required in the required survey text file (detailed below). The COR plan identification number (if applicable) and sewer permit number information must also be included.

A 24x36 inch paper copy shall be submitted to the Inspections Department for review and comment before initial walk-through. Once these comments are addressed, a 24x36 inch mylar copy of each sheet shall be re-submitted. In addition to hard copy mylars, a PDF file of each mylar sheet must be submitted. A CAD file of utilities should show the overall sewer system as-built layout along with the property or subdivision boundaries. DWG, DGN, DXF and SHP are acceptable formats. Please save CAD files in "model space" on NC State Plane grid. A comma-delimited text file or Microsoft Excel file of survey information is required with the following columns: FeatureType (Manhole, Cleanout, etc), X, Y, Z, Size, Description.

Digital as-built data submittals shall be on CD-ROM or DVD-ROM media. Discs shall be labeled with the following information:

1. Project name
2. Name of firm which prepared the data
3. As-built date, as depicted on mylar submittal
4. Permit number(s)
5. COR plan identification number (if applicable)

Each digital as-built submittal shall include the following on digital media:

1. PDF files for each mylar sheet submitted
2. PDF file(s) for recorded plat(s)
3. CAD file (see above)
4. Data file denoting the coordinates and description for each utility feature in the project scope (see above and example below)

ENGINEER CERTIFICATION STATEMENT

I, _____, as a duly registered Professional Engineer in the State of North Carolina, having been authorized to observe (___ periodically, ___ weekly, ___ full time) the construction of the project, _____, hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction such that by my inspection of the constructed improvements and my review of the as-built survey data, I hereby certify that the (1)public improvements, (2) private improvements, and (3) public safety of the above referenced project as constructed are in compliance with the requirements of the improvements as prescribed in the approved Construction Drawings, approved design documents, and/or any approved modifications, except as noted in red on the 'As-Built' drawings. Furthermore, I certify that the red-noted exceptions do not adversely affect the required performance or public safety aspects of the improvements.

Name: _____ Date: _____

NCPE Seal:

Reuse

Surveyed "as-built" plans of installed utilities shall be furnished to the City of Raleigh Engineering Inspections Dept., 400 West Peace Street, Raleigh, N.C. 27602, prior to initial walk-through with the contractor and/or owner. Each plan sheet showing as-built information shall have an engineer's certification with N.C.P.E. seal, signature and date. See certification text below. All "as-built" plans shall include a vicinity map and an overall site or utility plan, and be clearly marked as an "as-built" plan. The plan should include the following information on a 24x36 inch layout (paper for initial walk-through, mylar for final): "as-built" date, project title, page numbering, north arrow, scale of drawing, bar scale, engineer of record, all easements identified and dimensioned, pipe size, pipe material, fitting type defined, valve type defined, abandoned and/or removed features. All current Wake county parcel information in the project area is to be defined and properly labeled with PIN. All streets in the project area shall be defined and labeled. The reuse distribution system drawings should show main sizes, materials, and locations, locations of valves, blow-off assemblies, fittings on main if known, meter boxes, connections to existing utilities and any other relevant information (service laterals, backflow preventers, air release valves, reducers/increasers, casings, etc.). All service stubs shall be shown on the surveyed "as-built" plans. All mains shall be labeled as public or private. The surveyed "as-built" plans shall have North Carolina State Plane grid X and Y coordinates in US Survey feet for all valves, backflow preventers, and blow-offs. Horizontal datum must be NAD 83, please specify which realization of NAD 83. The NC CORS Base Station Network is referenced to the NAD 83(2011) datum. Vertical datum must be NAVD88, geoid 03 or later. Elevations (taken at ground surface) are not shown on the as-built plan, but are required in the required survey text file (detailed below). The COR plan identification number (if applicable) and sewer permit number information must also be included.

A 24x36 inch paper copy shall be submitted to the Inspections Department for review and comment before initial walk-through. Once these comments are addressed, a 24x36 inch mylar copy of each sheet shall be re-submitted. In addition to hard copy mylars, a PDF file of each mylar sheet must be submitted. A CAD file of utilities should show the overall reuse system as-built layout along with the property or subdivision boundaries. DWG, DGN, DXF and SHP are acceptable formats. Please save CAD files in "model space" on NC State Plane grid. A comma-delimited text file or Microsoft Excel file of survey information is required with the following columns: FeatureType (Valve, Meter, Tee, etc), X, Y, Z, Size, Description.

Digital as-built data submittals shall be on CD-ROM or DVD-ROM media. Discs shall be labeled with the following information:

1. Project name
2. Name of firm which prepared the data
3. As-built date, as depicted on mylar submittal
4. Permit number(s)
5. COR plan identification number (if applicable)

Each digital as-built submittal shall include the following on digital media:

1. PDF files for each mylar sheet submitted
2. PDF file(s) for recorded plat(s)
3. CAD file (see above)
4. Data file denoting the coordinates and description for each utility feature in the project scope (see above and example below)

| FeatureType | X | Y | Z | Size | Description |
|-------------|------------|------------|--------|---------|-------------|
| Tee | 2086904.78 | 732688.47 | 349.69 | 12x12x6 | DI tee |
| Valve | 2086907.12 | 7326892.41 | 349.78 | 6" | Gate valve |
| Valve | 2086910.49 | 7326899.57 | 352.62 | 2" | Air Release |
| Bend | 2085639.24 | 731996.33 | 368.35 | 6" | 45 degree |

ENGINEER CERTIFICATION STATEMENT

I, _____, as a duly registered Professional Engineer in the State of North Carolina, having been authorized to observe (___ periodically, ___ weekly, ___ full time) the construction of the project, _____, hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction such that by my inspection of the constructed improvements and my review of the as-built survey data, I hereby certify that the (1)public improvements, (2) private improvements, and (3) public safety of the above referenced project as constructed are in compliance with the requirements of the improvements as prescribed in the approved Construction Drawings, approved design documents, and/or any approved modifications, except as noted in red on the 'As-Built' drawings. Furthermore, I certify that the red-noted exceptions do not adversely affect the required performance or public safety aspects of the improvements.

Name: _____ Date: _____

NCPE Seal:

GENERAL ACCEPTANCE

General Acceptance occurs when the project has met City standards and City specifications. The developer or his representative must notify the Public Works Department's Engineering Inspector, in writing, before installation and for scheduling inspection. In Garner, Rolesville, Wake Forest, Knightdale, Wendell and Zebulon, the developer or his representative must notify the inspector in the Raleigh Public Utilities Department. Once the project is completed, a punch list and inspection is scheduled noting any deficient items. Upon the repair and/or replacement of the deficient items, the developer or his representative shall submit the following items to the City's Public Works Department.

- a. A professional engineer's certified statement of the cost of the public utilities installed
- b. A professional engineer's certified statement indicating that the work has been built in accordance with the City approved set of construction plans
- c. A Release of Liens document signed and notarized from the developer stating that all materials and workmanship associated with the water, reuse water, or sewer mains have been paid in full
- d. Certified surveyed "As-Built" plans and profile shall be furnished by the certifying engineer upon completion and acceptance by the City as stated above;
- e. The developer is responsible for ensuring a one-year written operational warranty to the City prior to issuance of the Letter of Acceptance
- f. The developer and/or engineer shall provide a recorded map to the City of Raleigh showing all public rights-of-way and easements and,
- g. The engineer shall keep a preserved copy of the "As-Built" plans on file indefinitely.

WATER DESIGN, MATERIAL, AND CONSTRUCTION STANDARDS

WATER DESIGN STANDARDS

Unless otherwise indicated, all standards apply to both the public and private water systems. Described in this section are the general design standards, which are to be followed by all parties in preparing subdivision, utility extension, and utility replacement plans for the City of Raleigh. These design standards will ensure that the citizens of Raleigh will continue to have quality water facilities along with an adequate fire protection system.

All engineering plans for public and private water systems must meet State and City minimum design standards as indicated in the most recent amended Rules Governing Public Water Supplies by the N.C. Division of Environmental Health, Public Water Supply Section and/or the City of Raleigh Public Utilities Handbook, whichever is the more stringent. All projects must be certified by the engineer of record or the City Engineer. The engineer shall be responsible for determining the water pressure at the point of connection and adequacy for services at the highest point of the project. Water pressure zone information is available from the Public Utilities Administrative office.

Plan and profile drawings shall be prepared by a registered professional engineer signed, sealed, and dated showing the various elements of the utility mains and shall include an overall utility plan layout on a single sheet with scale no smaller than 1 inch = 200 feet. The design of improvements must be based upon actual field verification by the engineer of existing utilities. The utility drawings shall be on separate sheets, free of landscaping and other details not pertinent to the utility plans. A separate landscaping plan must be submitted with the utility plan showing any proposed landscaping and all water and sewer utilities or easement. All adjacent tracts and topographic information must be shown on the landscaping plan. The water drawings and sewer drawings may be on the same sheets. Landscaping plans shall show all utility engineering drawings and shall be on paper 24 inches by 36 inches.

Plan view must be oriented north with north shown at the top of the page, whenever possible. Stationing must be performed in order of increasing station left to right and from downstream manhole to upstream. Plan and Profile must be shown on one sheet with the plan view on the top of the sheet and the profile sheet on the bottom of the sheet. Water, sewer, storm and any other utilities must be shown on the plan sheet and profile sheet and must not be shown on separate sheets.

Once installed, certified surveyed “as built” plans shall be provided to the City showing the utilities. “As built” drawings for the utilities shall be submitted to the Public Works Department prior to acceptance of the project by the City.

1. WATER DESIGN – PUBLIC

a. Location Conditions for Design

- 1) All mains are to be within dedicated street rights-of-way except major transmission mains not affording direct service connection. Mains within the street right-of-way shall be a minimum of 5 feet from the outside of the pipe to the edge of the right-of-way. Greater separation may be required for greater depth. Water mains as specified by the City of Raleigh will be marked as indicated on Detail W-13.
- 2) Water mains shall be located either in the north or east side of the street pavement.
- 3) No permanent structures or impoundments shall be constructed on water mains, water transmission mains or within water easements.

- 4) When a section of existing water line is replaced with new water pipe, all existing water services along this section must be replaced from the main line to the R/W line. The new water meter assembly shall be connected to the existing service line on the customer side of the R/W.

b. Size

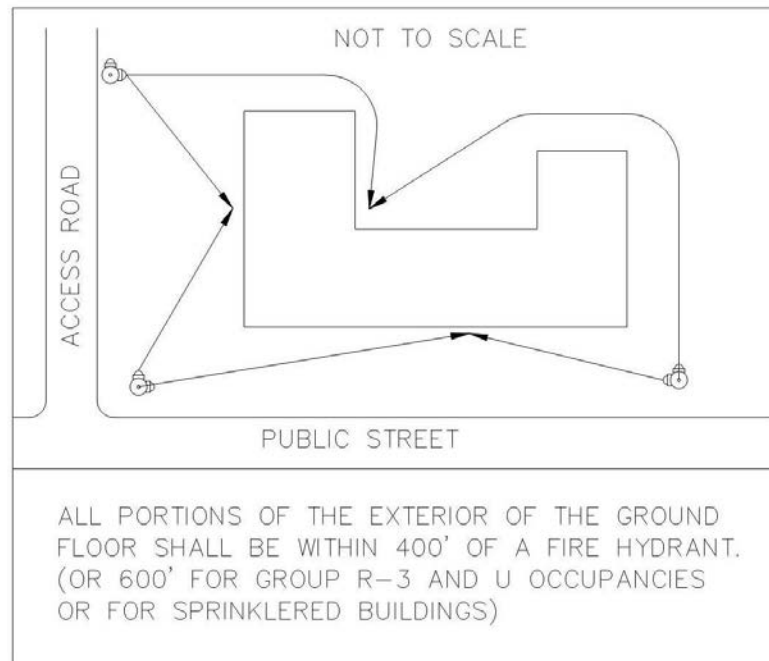
- 1) Major mains are to be sized according to the City of Raleigh Public Utilities Department.
- 2) In all residential districts, mains shall be six inch and eight inch, six inch to be used only where it completes a good gridiron, but in no case in blocks of more than 600 feet in length. Maximum length of six-inch and eight -inch lines, without connection to a larger main are 1200 feet and 2000 feet, respectively. The maximum length of dead end six-inch and eight-inch lines are 600 feet and 1200 feet, respectively, except as provided for cul-de-sacs in #4 below.
- 3) In all other zoning classifications, mains shall be 8-inch and 12-inch, 8-inch used only where it completes a good gridiron. The maximum length of 8-inch lines without connection to a larger main is 1200 feet.
- 4) Within residential cul-de-sacs, 800 feet and less (measured along the cul-de-sac centerline from the street centerline to the cul-de-sac radius point) in length serving densities of R-1 or R-4 a 6-inch water main is permissible and must end with a fire hydrant. If the cul-de-sac is serving a R-6 or greater density development, then a minimum of 8-inch main is required. Water main sizes shall not be reduced except at street intersections or at fire hydrant locations on cul-de-sacs.
- 5) When the proposed project or subdivisions is confined by natural topographic features or existing developments, and it is determined that the streets will not be extended to serve adjacent properties, then the mains shall be sized to provide adequate domestic and fire flows. In this case, the minimum main size for single-family residential zoning districts shall be 6 inch and for all other zoning districts shall be 8-inch.
- 6) The City of Raleigh is required to provide a minimum pressure of 20 pounds per square inch (psi). If an individual needs greater pressure, then it is his/her responsibility to incorporate the necessary booster pumping facilities.
- 7) Private fire lines **servicing hydrants** for all land uses shall be a minimum of six (6) inches in diameter and shall be provided with either a double detector check valve or a reduced pressure detector valve, whichever is applicable and built to City standards.

c. Fire Hydrants

- 1) All fire hydrants shall be installed on a 6-inch branch with a hydrant branch valve on each branch. All hydrants are to be located at the right-of-way or in a two-foot

easement adjacent to the right-of-way and installed as per Detail W-4. Fire hydrants on private property greater than 10 feet from the public right of way shall be private with the appropriate backflow devices. Fire hydrants on private property less than 10 feet from the public right of way shall be installed in recorded City of Raleigh water easements. The branch valve shall be no greater than one foot from the main and inside the pavement when possible. The valve shall be mechanically restrained to the main.

- 2) There shall be a fire hydrant located at each street intersection.
- 3) “All parts of all buildings shall be located within 400’ of a fire hydrant as measured by Pull-the-Hose Method or within 600’ of a fire hydrant for buildings with an approved automatic sprinkler system, or for Group R-3 and Group U occupancies. Please reference Section 508.5.1 of the current edition NC Fire Code for rule updates.”



- 4) In all residential districts, the maximum distance between fire hydrants, measuring along public street centerlines and/or other private travel ways, shall be 400 feet.
- 5) Fire hydrants shall be spaced 300 feet measuring along public street centerlines, and/or other private travel ways if any non-single family residential uses exist on either side of a public street. There shall be a fire hydrant located within 150 feet of all supply connections for stand pipe and sprinkled buildings. Fire trucks must be able to get within 40’ of the FDC connection.
- 6) On divided roads, fire hydrants shall be spaced 300 feet measuring along public street centerlines on alternating sides of the roadway.
- 7) When the relocation of an existing fire hydrant is approved by the Public Utilities Department, the existing hydrant branch will be plugged at the tee or tapping valve

with a mechanical plug with no bends. If the existing main/tee is lead joint, the tap or tee will need to be cut out and a new section of pipe (nipple) installed with a ductile iron repair joint.

- 8) When hydrant extensions are used, they must be manufactured by the same manufacturer as the hydrant on which they are being used and installed in accordance with the manufacturer's instructions. Any proposed hydrant that is at a depth greater than 5 feet from the finish grade level to boot flanges, or installed on an existing water main that exceeds a depth greater than 8 feet shall be installed with a vertical hydrant assembly that meets or exceeds the current AWWA standards. In installations where multiple barrel extensions are required the fire hydrant stems shall be a single one piece unit.
- 9) No services are permitted on any public fire hydrant branch or blow-off assembly.
- 10) Additional fire hydrants may be required by the Fire Departments.
- 11) There shall be a 3' minimum clear distance around all fire hydrants and water meters. This means that nothing shall be within a 3' radius of all hydrants and water meters including but not limited to: trees, shrubs, fencing, guardrail, signs, light and utility poles, etc.

d. Valves

- 1) Each proposed new intersection shall have a main line valve for every leg i.e., a four-way intersection shall have four main line valves, a TEE intersection shall have three main line valves. All valves shall be rodded to a tee or cross in accordance with detail W-15.
- 2) Each fire hydrant shall have a hydrant branch valve, and installed as per Detail W-4.
- 3) Main line valves on straight runs between street intersections shall be spaced no greater than the distances given below and shall be located within fifty (50) feet of the nearest hydrant to their location.

| <u>Main Size</u> | <u>Maximum Spacing</u> |
|------------------|------------------------|
| 6" | 600' |
| 8" | 900' |
| 12" | 1000' |
| 16" | 1000' |
| 24" | 1500' |

- 4) The high and low-pressure water distribution systems may be connected with specific approval of the Public Utilities Director. Such connections shall be made with approved check valves positioned with direction of flow from low to high pressure, and a fire hydrant shall be installed on the high-pressure side of the check valve. The check valve shall be installed in a standard manhole. A four foot manhole shall be used for six and eight-inch valves and a five foot manhole

for twelve-inch valves. Larger size check valves shall be housed in a vault, and the size of the vault shall be approved by the Public Utilities Director.

- 5) Mains twelve inches and larger in diameter which have a change in elevation of fifteen feet or greater shall have an air release valve installed at the highest elevation of such change, as per Detail W-18. Additional air release valves may be required by the Public Utilities Director on mains less than 12-inches based on elevation changes of 15 feet or greater.
- 6) Any water service customer which has a water static pressure greater than eighty (80) psi is required by North Carolina State Building Code to install and maintain a pressure reducing valve. The pressure reducing valve will be installed on the building service line after the meter. Such a device must be installed before the City will allow the actual water connection. This installation is covered by the Plumbing Code and is not maintained by the Public Utilities Department.
- 7) Pressure reducing and/or sustaining stations shall be installed when directed by the Public Utilities Director to connect high and low pressure systems. The pressure reducing valve shall allow enough flow from the high side to maintain a specified pressure on the low side and will not reduce the high side below a certain amount. This type valve will be a pressure sustaining/ pressure reducing valve.
- 8) Valves over 10' in depth must have a valve stem extension to bring operating nut to a depth of no more than 5'. Valve stem extensions in these situations must be a minimum of 1" square stock for water mains 12 inches and larger.
- 9) Insert valves are only to be installed on a case by case basis as approved by the Public Utilities Director.

e. Meters

Private distributions systems shall have a master meter and a master backflow device.

Looped private distribution systems will be discouraged and only allowed to meet fire flow requirements. If looped systems are approved, there must be a water meter and a backflow device at every point of connection to the public main.

All water services will be metered, and the meter will be located in the rights-of-way or in a 2 foot easement adjacent to the rights-of-way.

Meters sizes shall be 5/8", 3/4", 1", 1 1/2", 2", 4", 6", 8", or 10" with no exceptions.

Any single water service that is to be used for domestic and fire service usage will have a minimum pipe size of 6-inch in diameter, pressure class 350 ductile iron pipe.

All single water services that are used for domestic and fire service usage will be required to have a Fire Service Meter with a by-pass meter.

Meters will be the same size in diameter as the service. The only exceptions are a 10-inch Fire Service Meter with a by-pass on a 12-inch water service line and a 5/8" residential meter on a 3/4" water service line.

If a property is subdivided or recombined or a building is sold from the complex, then it will require a separate water service, with an individual meter with those services originating from a City maintained water main. All domestic services, fire lines, and private mains must be installed entirely on the lot for which it serves. Services and fire lines and private mains will not be allowed to cross property lines or to be placed in a private utility easement.

The City will maintain all water connections within the street right-of-way at no charge to the property owner. Repairs on private property shall be the responsibility of the property owner or customer.

All meters will be furnished and set by the Meters Division once all fees are paid and accounts have been set up. Meter installation and spacing shall be in accordance with details W-23 thru W-35

f. Installation Restrictions for Design

- 1) All water mains, of proper size as determined by the Public Utilities Department, shall be installed complete, along all boundaries abutting existing public roadways, from property line to property line regardless of the land use, proposed lot arrangement of the subdivided property or the availability of connection to a main in service. Within all dead-end streets that may be extended, the water main must extend to the property line of the subdivision.
- 2) All water mains shall be installed with a minimum cover of 3 feet from the top of finished ground or surface grade to pipe crown and shall be in accordance with all applicable City Standards. If minimum cover cannot be maintained due to other agency/development infrastructure projects existing water lines shall be relocated or protected with casings or concrete. In no case shall sub grade construction excavations come within less than 2 feet of the existing pipe crown.
- 3) When mains are to be installed to a dead end or mains are stubbed for future extension, at least one 18-foot joint of pipe, or more when required, shall be designed with a welded thrust collar and blow-off in accordance with Details W-7 thru W-12, of these specifications. All mains up to 12-inches in size shall be designed with a blow-off assembly the same size as the diameter of the pipe. The blow-off for 16-inch mains shall be 12-inch. The blow-off for 24-inch and larger mains shall require approval by the Public Utilities Director. Blow-off assemblies shall be in accordance with Details W-21&22 of these specifications. Mains which are determined to be extended in the future must also terminate with a full size main line gate valve prior to the last joint of pipe. Hydrants can be used as blow-offs on 6-inch mains, but must be rodded back to welded thrust collars as shown in Details W-7 & W-8.

- 3) Direct service connections shall be allowed on mains 16-inch and smaller installed in dedicated street rights-of-way. **No taps or services shall be made on 24-inch or larger transmission mains unless approved by the Public Utilities Director.** All service connections will be made perpendicular to the main. When there are two existing water mains in the street right-of-way, the main which provides the best flow and pressure for that parcel shall be tapped. This determination shall be made by the Public Utilities Department. No service connections are to be made off of fire hydrant branches or on fire lines except approved split services in accordance with Detail W-34.
- 4) **45° and 90° bends shall be allowed in the water distribution system for all line sizes when required.**
- 5) Meter installations shall be in accordance with the applicable Details W-23 thru W-35. All meters must be installed in the right-of-way or in approved easements adjoining the right-of-way. Meters must be installed adjoining the property they are serving and located on the same street as property address. All meters will be installed by the Public Utilities Department. Fees for such installation are adopted periodically by the City Council.

The following is a chart with the recommended residential water service sizes:

| Full # Bathrooms | Static water pressure | Recommended service sizes |
|---------------------|-----------------------|------------------------------|
| 1 | any | 3/4" |
| 2-3 | ≥ 60 psi | 3/4" |
| 2-3 | < 60 psi | 1" |
| ≥ 4 | any | 1" |

- 6) When multi-family developments and non-residential land uses are using gang meter installation, then the construction plans shall show the unit and meter numbering sequence for each building. Gang meter assemblies shall be located in front of the building. If the building number is odd, then the unit and meter letter sequence shall be read from left to right when facing the building. If the building number is even, then the unit and meter letter shall read from right to left when facing the building. See Details W-27 & W-28.

All service lines shall be connected to the correct meter based on sequential number or letter assignment. The unit and meter letter identification must be shown on the construction plans for installation approval. The correction of errors in the proper meter/unit pairing, detected later, will be the responsibility of the original installer or subsequent owners. The gang meter installation shall be in accordance with Detail W-26. Upon completion of the installation, tests will be conducted to prove order of connections is correct.

In the case of installation of a gang meter assembly the irrigation meter shall be the last meter in the sequence.

Gang meter assemblies shall be centered on the service line coming from the main as shown in Detail W-26.

In no case shall an irrigation service be installed under or in any part of a building. Please see Cross Connection Section.

Each irrigation service shall serve either an underground automatic sprinkler system, or a yard hydrant behind the backflow preventer.

2. WATER DESIGN - PRIVATE

Private water distribution systems located within the Raleigh Utility Service Area and proposed for connection to the City's public system now or in the future shall conform to all the public system standards listed within this document with the following conditions:

- a. Private water distribution lines shall not be required to be located within public right-of-way or publicly dedicated easements.
- b. Private domestic and fire services should adhere to W-34. In order to allow a deviation from W-34 (connection to a permitted private distribution system internal to the site), the private distribution must serve a minimum of two domestic services.
- c. 4-inch water mains may be installed in private water distribution systems, provided that all parts of all buildings shall be within 300 feet of a public fire hydrant. Private fire hydrants shall be served by distribution systems 6-inches and larger.
- d. Private water systems, which are served by a temporary well as approved through an agreement between the City and the developer/owner and have dedicated streets and individual lots, shall be built to City standards. The only change is in the installation of the fire hydrant. The fire hydrant shall be painted yellow, meaning out of service, and the branch valve will be closed shut with the operating nut removed. The engineer shall note this on the construction plans prior to approval.
- e. Private distributions systems shall have a master meter and a master backflow device. Looped private distribution systems will be discouraged and only allowed to meet fire flow requirements. If looped systems are approved, there must be a water meter and a backflow device at every point of connection to the public main.

Please see Appendix F for private water main permitting Scenarios.

WATER MATERIAL STANDARDS

1. GENERAL MATERIAL REQUIREMENTS Current specifications of the American Society for Testing Materials (ASTM), American Water Works Association (AWWA), Ductile Iron Pipe Research Association (DIPRA), American Association of State Highway and Transportation Officials (AASHTO), and the American National Standards Institute (ANSI) shall apply in all cases where material is covered by an item in these specifications. All material used shall conform fully to these current standards or be removed from the job at the direction of the Public Utilities Director.

Pipe specimens shall be subjected to tests by an independent testing laboratory at such time as the Public Utilities Department may direct or as specified herein. Pipe not meeting these specifications will be ordered removed by the inspector, and such pipe shall be immediately removed from the job site and not transported to any portion of the project being constructed.

Detail or shop drawings of fire hydrants, valves, air release valves, tapping sleeves and tapping saddles must be approved by the Public Utilities Department prior to installation.

These specifications are not to be considered as proprietary in any way. When a particular brand is listed, it is only used as an aid in describing the type of material being requested.

2. MATERIALS – WATER MAIN AND FITTINGS

a. Water Mains

All water mains shall be pressure class or thickness class ductile iron pipe designed in accordance with AWWA Standard C-150. Design shall be done for external and internal pressures separately, using the larger of the two for the next design thickness. An additional allowance shall be made for corrosion and casting tolerances. The thickness design for external and internal pressures shall use the following conditions:

- 1) 3 feet minimum cover or as shown on the plans;
- 2) Laying condition - Type 1;
- 3) A minimum working pressure of 150 psi for pipes 16 inches and smaller in diameter, and for 24 inches and larger pipe, the design working pressure shall be as determined by the Public Utilities Director, and
- 4) A surge pressure of 300 psi.

All calculations for thickness shall be in accordance with AWWA Standard C-150, and the calculations shall be submitted to the Public Utilities Director for approval prior to shipping any pipe. The minimum thickness shall be pressure class 350 for pipes 6 inches through 12 inches and pressure class 250 for pipes 16 inches and larger in diameter.

The ductile iron pipe shall be manufactured in accordance with all applicable requirements of AWWA Standard C-151. The ductile iron pipe shall be supplied in nominal lengths of 18 or 20 feet.

The ductile iron pipe shall be cement-mortar lined with a sealcoat in accordance with AWWA Standard C-104. Ductile iron pipe shall be externally bituminous coated in accordance with AWWA C-151.

Pipe joints shall be mechanical or "push-on" manufactured in accordance with AWWA Standard C-111.

Each joint of ductile iron pipe shall be hydrostatically tested before the outside coating and inside lining are applied at the point of manufacture to 500 psi. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture or leakage of the pipe wall.

All materials used in the production of the pipe are to be tested in accordance with AWWA Standard C-151 for their adequacy within the design of the pipe, and certified test results are to be provided to the City upon request. All certified tests, hydrostatic and material are to be performed by an independent testing laboratory at the expense of the pipe manufacturer.

Push-on and mechanical joint pipe shall be as manufactured by the American Cast Iron Pipe Company, United States Pipe and Foundry Company, Griffin Pipe Products Company, McWane Cast Iron Pipe Company or approved equal.

Restrained joints shall be TR Flex or **HP LOK** as manufactured by U.S. Pipe, **Lok-Ring** or Flex-Ring as manufactured by American Pipe, Super-Lock as manufactured by Clow, **Bolt-Lok or Snap-Lok** as manufactured by Griffin or approved equal.

b. Fittings

All fittings shall be manufactured in accordance with AWWA C-110 or C-153 for ductile iron compact fittings. The fittings shall be tested and the manufacturer shall provide certified test results when requested by the City. This testing shall include hydrostatic proof testing of the fittings.

All fittings shall be mechanical joint with the exception of certain above ground piping which may require flange fittings. Mechanical joints shall be manufactured in accordance with AWWA Standard C-111.

All fittings shall be cast iron or ductile iron and shall have a minimum working pressure rating of 250 psi and minimum iron strength of 30,000 psi.

All fitting interiors shall be cement-mortar lined with a sealcoat in accordance with AWWA Standard C-104, and the outside shall be bituminous coated.

Restrained mechanical glands may be used where restraint is needed except when welded restraining rings are required. Restrained mechanical glands provide additional restraint, but do not take the place of required concrete blocking.

45° and 90° bends shall be allowed in the water distribution system for all line sizes when required.

c. Gate Valves

Cast iron or ductile iron resilient wedge style vertical or horizontal gate valves and tapping valves shall be used for all main line and hydrant branch valves in sizes from 6 inches through 24 inches. American, Mueller, Kennedy, AVK, Clow, M&H, and Waterous valves in accordance with AWWA C-509-94, C-515, or the appropriate AWWA standard

as applicable, shall be used. All resilient wedge valves shall have internal and external epoxy coating, O-ring seals at the stuffing box and bonnet to body and dual O-rings at the stem seal above the thrust collar.

Tapping valves shall be the same valves as gate valves listed above, subject to the standards, providing that tapping valves shall have the tapping ring.

Gate valves twelve (12) inches in diameter and smaller, shall be mechanical joint or hub-end all-bell. They shall be "O" ring, open-left valves of the non-rising stem type. These valves shall be designed for a minimum of 175 psi working pressure and 300 psi hydrostatic test pressure with a two (2) inch operating nut. Valves shall be cast iron or ductile iron.

Valves sixteen (16) inches in diameter or greater may be the horizontal gate type or butterfly type, as specified on construction plans, or gate valves as specified above.

Gate valves, horizontal gate valves or butterfly valves shall be used for all main line and hydrant branch valves in sizes 16 inches through 24 inches.

d. Valve Boxes

Adjustable valve boxes shall be class 35 gray cast iron and manufactured in accordance with ASTM A48 and be of the dimensions specified in Detail W-17 of these specifications. Lids shall have the word "Water" cast into the lid. See Detail W-18. All castings must be domestically cast and so indicated by the manufacturers name and "USA" cast into all sections of the valve box. All castings must meet or exceed AASHTO H-20 load rating. Total valve box weight shall be a minimum of 85 lbs and have a minimum lid weight of 25 lbs. **Mueller Model AJBV 5 adjustables are permissible.**

e. Butterfly Valves

Butterfly valves sixteen inches or greater than (16) inches in diameter shall be Class 150B and shall conform to the latest AWWA Standards C-504, as manufactured by Mueller, Kennedy, Pratt, **DeZURIK**, or **Val-Matic** for rubber sealed butterfly valves and valve operating assemblies. "O" ring seals shall also be used exclusively with worm gear.

All valve end connections shall be mechanical joint or victaulic, as required by the detail drawings. Valve seats shall be stainless steel, bronze mating or resilient material. Resilient seat shall be mechanically attached to the valve disc, or mechanically retained in the valve body. Resilient seat shall be fully field adjustable by mechanical means. The valve disc shaft shall be stainless steel or either stub or thru-shaft design. Shafts shall be provided with two-way disc thrusters that are fully adjustable from the outside. Valve shaft bearings shall be heavy duty bronze, properly fitted into hubs integrally cast in the body of the valves.

All butterfly valve **gear actuators** shall be according to **AWWA C-504**. The valve operator shall be furnished with a two-inch square operating nut, and be so mounted that the valve will open-left (counter-clockwise). The butterfly valve operator shall have AWWA stops, be suitable for submersible service and be sized in accordance with AWWA torque requirements for a full 150B rated valve.

The manufacturer of the butterfly valve shall be fully responsible for the satisfactory performance of the assembled valve and operator unit. The specified operators shall be factory mounted by the valve manufacturer and shipped to the job site as an operating unit. External painting, hydrostatic testing, travel stop adjustments and crating for shipment shall be in complete compliance with the latest AWWA specification for butterfly valves.

All butterfly valves shall be installed in a standard eccentric precast manhole (diameter appropriate with size valve). Standard Detail W-16

f. Fire Hydrants

Fire hydrants shall comply with AWWA C-502-94 as manufactured for the City of Raleigh by Kennedy, Mueller, Clow, American Darling.

City of Raleigh and all merger area fire hydrant nozzles shall have National Standard Threads.

The City of Raleigh may require fire hydrants to resist accidental and deliberate contaminations of the water supply.

All fire hydrants shall have 2-two-and one-half inch nozzles, and 1- 5” Storz connection nozzle. The nozzle shall be an integral part of the fire hydrant and must be furnished by the manufacturer or authorized distributor designated by the manufacturer. Storz connector shall have the following characteristics: brass hydrant nozzle connection; have hard anodized aluminum Storz ramps and lugs (hydrant and cap side); and require a high-torque Storz spanner wrench in order for the cap to be removed.

See Details W-5 through W-6 for hydrant information pertaining to each town.

The hydrant valve opening shall be five and one-quarter inches with no exceptions. Bronze to bronze threads shall be provided between the hydrant seat or seat ring and the seating attaching assembly. All hydrants must include cast or ductile epoxy lined shoe, rubber drain seals and positive, protective valve stop device.

Hydrants shall be open-left type and shall have a six-inch hub-end or mechanical joint elbow. The hydrant barrel shall be of sufficient length to provide a minimum of three and one-half feet of bury and be of the break-away impact type.

Fire Hydrant Colors

City of Raleigh public fire hydrants shall be painted solid red.

Town of Wendell public fire hydrants shall be painted safety yellow with high reflective aluminum silver caps, bonnets, and operating nuts.

Town of Zebulon public fire hydrants shall be painted red with silver bonnets and operating nuts.

Town of Wake Forest and Town of Garner public and private fire hydrants shall be painted safety yellow with silver caps and operating nuts.

Town of Knightdale public fire hydrants shall be painted solid red

Town of Rolesville public fire hydrants shall be shall be painted solid red
Operating nuts on hydrants connected to public mains 12" or larger shall be
painted black.

Operating nuts on hydrants connected to public mains of any other size shall be
painted silver.

g. Air Release Valves

Water Air release valves shall be two-inch Crispin Pressure Air Valves, Model P 20, with a vacuum check unit, or two-inch Val-Matic, Model VM-45, with a vacuum check unit or equal as approved by the Public Utilities Director. These valves shall be suitable for 150 psi working pressure and designed to allow air to escape automatically while the main is in service and under pressure. The valve shall be housed in a City of Raleigh approved eccentric manhole and shall be installed in accordance with Detail W-19 of these specifications. Air release valve locations shall be approved by the Public Utilities Department, or as shown on the plans. The engineer must field stake the air release location.

h. Tapping Sleeves and Tapping Saddles

Tapping sleeves shall be Mueller mechanical joint, Mueller Outlet Seal, American Uniseal, Kennedy Square Seal, or Clow F5205 or F5207. 100% stainless steel sleeves may also be used, as manufactured by **Smith-Blair, Romac, Ford, or JCM** provided that all metallic parts of the sleeves shall be 100% stainless steel including bolts. Ductile iron flanges may be included on sleeves or saddles. **Test assembly seals with water according to AWWA C-223.** All sleeves shall have a minimum of 150 psi working pressure. All taps shall be machine drilled--no burned taps will be allowed.

Tapping saddles may be used on mains 16-inches and larger. In 16 and 24 inch saddles as manufactured by Mueller, American, Kennedy and Clow tapping saddles shall be manufactured of ductile iron providing a factor of safety of 2.5 at a working pressure of 250 psi. In main sizes of 30-inch and larger, ductile iron tapping saddles as manufactured by American Pipe Company or US Pipe Company shall be utilized.

Saddles shall be equipped with a standard AWWA C-110-98 flange connection. Sealing gaskets shall be "O" ring type, high quality molded rubber having an approximate seventy durometer hardness, placed into a groove on the curved surface of the tapping saddle. Straps shall be of alloy steel. Saddles may be used for taps one-half the size of the main or less (i.e. 8-inch tapping saddle for use on a 16-inch main).

i. Water Service Connections

Water service pipe for 3/4 - to 2-inch connections shall be type "K" soft copper with no joints or couplings in the right-of-way. On these water services, the fittings shall be flared copper type brass fittings or compression type fittings.

1 1/2 inch and 2 inch taps may only be made with use of a double strap bronze saddle.

Corporation cocks for direct 3/4" and 1" taps may be used on ductile iron pipe and shall have AWWA Standard tapered threads. Unions shall be three piece copper to copper.

Curb stops used on gang meter assemblies shall be as manufactured by Mueller, Oniseal, Hayes NuSeal, Ford, A.Y. McDonald ball valve. All corporation stops and curb stops shall be bronze ball valves and shall be appropriate material to material corporation and curb stops as manufactured by Mueller, Ford, and A.Y. McDonald and must have a complete ball and installed in a valve box.

Curb stops are required for ¾" through 2" meters and shall be located 1' from the meter box on the street side. Curb stops shall be installed in a curb stop box as manufactured by Ford, A. Y. McDonald, or Trumbull.

Water meter gang assemblies of ¾" and 1" meters may be allowed on ¾-inch to 2-inch service connections and shall conform to the requirements shown in Detail W-26. A deviation from this standard may be warranted in some circumstances. Calculations will be required to support the deviation.

Service saddles shall be all bronze with double bronze straps and with a neoprene "O" ring gasket attached to the body. The clamp shall have corporation cock threads. These clamps shall be as Mueller H-16100 series, Jones J 979 or approved equal.

For services greater than 2 inches, the water service pipe shall be 4, 6, 8 or 12 inches in diameter and shall be of ductile iron pipe. Cast iron or ductile iron fittings shall be used on these services. All taps will be made by using the appropriate size tapping sleeve and valve. See Detail W-14. On a "dry line", the connection may be made with a "TEE and Valve" as shown in Detail W-15.

Coppersettors or copper meter yokes shall be 5/8 inch and 12 inches in height as manufactured by Ford or approved equal. All coppersettors shall have locking wings on the angle valve and be of the Ford angle check type.

Curb stops on gang meter assemblies shall be as manufactured by Mueller, Oniseal, Hayes Nuseal, Ford, and A.Y. McDonald. All corporation stops and curb stops shall be bronze ball valves and shall be appropriate material to material as manufactured by Mueller, Ford, and A.Y. McDonald.

j. Meters

All water meters shall be provided and installed by the City of Raleigh Public Utilities Department Meters Division.

k. Meter Boxes and Vaults

All meter boxes and vaults shall be constructed of cast iron, precast concrete, concrete block, high-density polyethylene, or cast-in-place concrete as on details W-23 thru W-35. Meter vault access doors shall be aluminum slam lock type as manufactured by Halliday, U.S.F. Fabrication, or approved equal.

Meter boxes and vaults shall not be placed within sidewalks or driveways unless no other alternatives are available and approval is obtained by the Public Utilities Director. Traffic rated lids and vaults shall be installed for all meters 1 ½" and larger.

The meter box must be set to grade. If for some reason, the grade is altered, then the meter box must be adjusted to match the new grade. This includes the addition of topsoil by a landscape contractor or homeowner, flower gardens, etc.

l. Steel Encasement Pipe

Steel pipe for boring installations shall be high strength steel, welded or smooth-wall seamless manufactured in accordance with ASTM A252 and consisting of grade 2 steel with a minimum yield strength of 35,000 psi. The minimum casing pipe wall thickness shall be 0.375” for bored encasement.

No coatings required for buried or bored encasements but must conform to the noted wall thickness in the table below. All encasement pipe must be approved by the appropriate controlling agency (i.e. NCDOT, RR, etc.) prior to ordering the material.

All carrier piping shall be restrained joint ductile iron. One joint of restrained pipe must extend beyond the ends of the encasement pipe. The minimum inside diameter of steel encasements shall be eight inches greater than the inside dimension of the carrier pipe. See the following table for encasement diameter and thickness:

| Carrier Pipe Nominal Diameter (inches) | Encasement Minimum Inside Diameter (inches) | Encasement Nominal Wall Thickness (inches) |
|--|---|--|
| 6 | 14 | 0.375 |
| 8 | 16 | 0.375 |
| 10 | 18 | 0.375 |
| 12 | 20 | 0.375 |
| 14 | 24 | 0.375 |
| 16 | 26 | 0.500 |
| 18 | 30 | 0.500 |
| 20 | 32 | 0.500 |
| 24 | 36 | 0.625 |
| 30 | 42 | 0.625 |
| 36 | 48 | 0.750 |
| 42 | 56 | 0.875 |

Both ends of the casing shall be mortared. Metal "spider" pipe alignment devices shall be installed in all casings with a minimum of two “spiders” per pipe joint one fourth of the pipe joint length in from both the bell and spigot ends. See Detail W-40.

m. Irrigation Rain Sensors

Irrigation rain sensors are devices mounted in an open outdoor area at least five feet from any structure and wired to the common wire of all permanent in ground irrigation systems. Rain sensors shall be capable of overriding the irrigation controller when 1/4” of rainfall has occurred to keep the system from watering in the rain. Rain sensors shall also be UL listed and installed per the manufacturer’s recommendations.

n. Irrigation Programmable Controllers

Irrigation programmable controllers are devices installed on all permanent in ground irrigation systems that operate the watering cycle of an irrigation system. Controllers shall be programmable by day of the week and UL listed.

WATER CONSTRUCTION STANDARDS (Public and Private Systems)

As part of the requirement to obtain construction approval for water main extensions, the engineer shall affix the appropriate permit sticker to the original drawings. The various permit stickers are included in appendix D.

The requirements contained in this section shall apply to water main installations constructed for the Public Utilities Department or for private developers who may or may not dedicate the water improvements to the City. All necessary construction permits must be obtained before construction may begin in accordance with North Carolina State Law.

Any Contractor performing work within the City of Raleigh or City of Raleigh Merger Areas such as Garner, Knightdale, Wendell, Zebulon, Wake Forest, and Rolesville, shall have on each job site a copy of these specifications.

1. SCOPE OF WORK

- a. The contractor shall furnish all materials, equipment, and labor for excavation, installation, backfilling of water mains and related appurtenances as shown on the plans. The Public Works Department and/or Public Utilities Department shall conduct all City inspections on main extension projects.
- b. It shall be the contractor's responsibility to notify the Public Utilities and Public Works Departments at least twenty-four hours in advance of beginning any construction work on any project. The contractor must call the Public Utilities Department at 996-4540 and Public Works at 996-6810 and give the location, project name, individual's name, company name, start date and indicate if it involves water extensions.
- c. Contractor shall contact the Public Works department at 996-6810 by 4:15 PM each day to notify where and what will be done the following day. For any work conducted in Garner, Knightdale, Wendell, Zebulon, Wake Forest, and Rolesville or outside the City of Raleigh Service Area the contractor shall contact the Public Utilities Department at 996-4540 by 4:15 PM to notify where and what will be done the following day. Any work requiring inspector observation outside of the normal workday, Monday-Friday, 7:30 a.m. to 4:15 p.m. will be charged to the contractor at the current inspector hourly rate.
- d. If a developer, engineer or contractor proceeds with the main installation prior to permit issuance the City may require the work to be reinstalled and the developer, engineer or contractor shall be fully liable for all actions and costs, including prosecution by the City or the State for proceeding with installation prior to issuance of appropriate permit(s).
- e. "Field changes" are not considered approved by the Public Utilities Department unless revised plans have been submitted to the Public Utilities Department, reviewed and approved. Therefore, the contractor that proceeds with construction prior to this approval, is at his/her own risk.
- f. Contractors working (excavation, boring, or other subsurface breach) around or in the vicinity of existing water lines 12 inches in diameter or larger shall be required to physically spot the existing line to be verified by P.U.D. distribution staff or inspection staff. If other existing lines sizes are in question of conflict the contractor shall be directed by P.U.D. staff of the level of subsurface investigation needed to locate the existing line.

\

2. GENERAL TESTING REQUIREMENTS

The City may perform and shall require the contractor to perform, such destructive and nondestructive testing, as it deems necessary in order to inspect the materials and workmanship. These tests shall be in accordance with the procedures established by ASTM and AASHTO. The City shall reserve the right to modify the procedures in testing ditch and backfill compaction to allow a deeper test to be made by using the sand-core method and/or nuclear testing gauges.

3. HANDLING AND STORAGE OF MATERIALS

- a. The contractor shall be responsible for the shipping and storing of all water materials. The contractor shall replace any material which is damaged or defective.
- b. The loading and unloading of all pipe, valves, hydrants, and other accessories shall be in accordance with the manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material.
- c. The contractor shall locate and provide the necessary storage areas for materials and equipment. If private property is being used for storage areas, then the contractor must have the written consent from the owner. Without this written consent, all material and equipment shall be stored within the existing rights-of-way and easements of the project. Pipe may not be prestrung along job site; it must be delivered to and removed from job site each day. In extenuating circumstances when the inspector authorizes pipe to remain on the project from one day to the next, the ends of the pipe must be sealed.
- d. All materials, once on the job site, shall be stored in accordance with the manufacturer's recommendations.
- e. All pipes shall be kept free of dirt and other debris. Any damage relating to the coating of the various materials for water mains shall be repaired in a manner approved by the City.
- f. The contractor shall be responsible for safeguarding and protecting all material and equipment stored on the job site. The contractor shall be responsible for the storage of materials in a safe and workmanlike manner to prevent injuries, during and after working hours, until the project is complete.

4. BARRICADES, SIGNS AND STREET PROVISIONS

- a. Signs, barricades, warning lights, guard rails and flaggers shall be employed as necessary when construction endangers either vehicular or pedestrian traffic. These devices shall remain in place until the traffic may proceed normally again. The contractor shall hold the City harmless for any damages or injuries caused by the construction of water mains.
- b. Detours and all traffic control measures shall be set up and maintained by the contractor under the direction of the City of Raleigh Department of Transportation and the North Carolina Department of Transportation. Notice must be given a week in advance of the detour so that necessary notification of the traveling public may be made. The contractor will furnish all barricades, signs, lights and other safety devices to protect his/her construction. The contractor is in no way relieved of liability for providing this protection because others approve the detour.

- c. Construction work zone signs and signing procedures shall conform to the MUTCD and supplements and to all applicable federal, state and local codes. The contractor shall be responsible for securing the necessary permits from the City's and the State's Department of Transportation and Inspections for all work to be performed in the public rights-of-way.

5. PROPERTY PROTECTION

Trees, fences, poles and all other property shall be protected unless their removal is authorized, and any property not authorized for removal, but damaged by the contractor, shall be restored by the contractor to the owner's satisfaction.

6. GENERAL CONSTRUCTION SAFETY

- a. The contractor and any subcontractors shall be responsible for the total compliance with all federal, state and local ordinances, laws and regulations as related to safe construction practices and to protecting the employees and the public's health and safety.
- b. The contractor shall ensure that all Occupational Safety and Health Administration (OSHA) regulations and standards are followed during all phases of the construction project.
- c. The City shall not be responsible for the contractor's adherence to OSHA regulations and standards. However, the City may report known violations or unsafe practices to the appropriate enforcement agency.
- d. The contractor shall be required to furnish safety equipment necessary to inspect the work including, but not limited to ladders, gas detectors/oxygen sensors, blowers, etc.

7. ENCROACHMENT CONTRACTS AND PERMITS

- a. Prior to actual construction, the contractor shall acquire the necessary encroachments from NCDOT when working within the rights-of-way of state system roads or highways. The encroachment permit shall be kept on the job site at all times.
- b. The contractor shall be responsible for securing all other local, state and federal permits required for the utility construction.
- c. The contractor must have an approved set of permitted construction plans on site at all times.
- d. For projects which require construction plan approval, all environmental permits and NCDOT encroachments must be provided prior to plan approval. See general policies and regulations section Page 25.

8. PAVEMENT REMOVAL AND REPLACEMENT

- a. All pavements to be removed shall be cut along straight lines with the appropriate saw cut machine. The removal and replacement of the pavement shall conform to the information shown in Details W-1 & W-2.

- b. All cuts of City streets must be patched the same day with a temporary or permanent patch. Once work has been completed, all temporary patches shall be replaced with permanent ones. All work from patching shall be cleaned up at the same time of patching.
- c. The City of Raleigh shall perform density tests as needed to determine contractor's compactive efforts. See Note 2 and 3 of detail W-2.
- d. Pavement cuts shall be confined to a maximum trench bottom width as shown in Details W-1 thru W-3, plus 12 inches on either side.
- e. Asphalt compaction shall be done with a gasoline or diesel powered smooth drum asphaltic roller.
- f. Pavement cuts within NCDOT Right of Way shall not be performed without the proper encroachment permits on site. All patching of NCDOT pavements shall conform to the approved on site encroachment permit.

9. VALVE OPERATIONS

- a. No valve in the existing system shall be operated without following the procedure outlined below. Failure to comply with these requirements shall be grounds for suspension of pipe-laying operations until written assurance can be obtained from a company official that such noncompliance will not occur again. The contractor should be aware that the City regards violations of these requirements as justifying punitive measures.
- b. Notification procedures are as follows:
 - 1) The contractor shall notify the Public Utilities Department's Water Distribution Division at 996-2737 in order to request the operation of any valves. At least twenty-four hours notice must be given to the Public Utilities Department, and at least twenty-four hours notice must be given to each customer affected by a water cut-off. The contractor is responsible for notifying the affected customers. All valve operations shall be done by Public Utilities Department personnel or by the City's inspector for a particular project. It is illegal for anyone other than a City of Raleigh employee to operate an existing water main valve, unless accompanied by a City of Raleigh employee.
 - 2) The contractor shall provide the following information when calling the Water Distribution Division for valve operation:
 - (a) Name of person calling;
 - (b) Name of company;
 - (c) Telephone number of company;
 - (d) Location of valve and map number if available;
 - (e) Reason for requesting operating and whether to be closed or open;
 - (f) Time valve to be opened or closed, and
 - (g) Approximate time water line to be out of service.
- c. Each time a contractor needs a valve operated, he/she shall again secure permission, following the steps outlined.

- d. System valves shall be defined as any valve, which has main pressure against either gate face. Newly installed tapping valves and control valves to networks not yet accepted for service are considered as system valves and should only be operated under guidance of City of Raleigh Inspectors Valves within a network still under construction are not considered as system valves.
- e. All newly installed system valves that connect to the active distribution system shall have a valve box cover painted "red" in color and installed on the corresponding valve box to signify that the valve and main are not in service. The "red" valve box cover shall remain in place until the new main is placed into service, when at such time it shall be replaced with a cover as shown on detail W-18.

10. EXCAVATION

- a. Prior to any excavation or construction, the contractor shall locate all existing utilities in the field. If help is needed in locating utilities operated by the Public Utilities Department, the contractor should contact the Operations Division (996-2737).
- b. Trench width shall be a minimum of twelve inches plus outside diameter of pipe and a maximum of twenty-four inches plus outside diameter of pipe, unless OSHA requires additional trench width. Trench width shall be measured between the faces of the cut at the top elevation of the pipe bell as shown in Detail W-3.
- c. Trench bottom conformation, where no special bedding is required, may be that referred to herein as flat bottom where the trench bottom is excavated slightly above grade and cut down to pipe grade by hand in the fine-grading operation. Where the trench bottom is inadvertently cut below grade, it shall be filled to grade with an approved material and thoroughly compacted to 95% or use #67 stone to bring to grade.
- d. The maximum length of open trench shall be no more than three hundred feet, unless approval is obtained from the Public Utilities Director.
- e. The contractor shall, at his/her own expense, keep all trenches free from water during the excavation for construction of foundations, masonry, water mains. The water shall be pumped out of the trench or check dams shall be built to keep it out of the ditch in such a manner as not to cause injury to the public health, private property or the work in progress. Erosion control measures shall be utilized during this pumping.
- f. In trenches where water is present or dewatering is required, the trench shall be stabilized with #67 stone. When the contractor encounters material during trench excavation, at the opinion of the inspector, or Public Utilities Director, that is unsuitable (i.e. "muck"), this material shall be replaced with material that is considered suitable prior to the pipe laying operations. In this case, construction fabrics may be required to prevent the migration of side support away from the pipe.
- g. Safety and convenience of the public necessitate that all work, including excavation, be done in such a manner as to cause minimum traffic interruption, both pedestrian and vehicular. Utilities such as fire hydrants, valves, etc., shall be accessible at all times. Gutters and drains shall be left open and clear at all times, and the contractor shall be responsible for all drainage around his work. Unless specifically waived by the Public Works Department, provisions shall be made to maintain vehicular traffic on all streets in which work is in progress, and suitable walkways shall be maintained for pedestrian travel.

- h. Sheeting or bracing shall be used wherever necessary to prevent failure of the trench banks. All sheeting shall conform to AASHTO and OSHA safety standards. The decision of the Public Utilities Director or Engineer relative to bracing for the protection of property of the City shall be binding upon the contractor. The removal of sheeting shall be done in such a manner as to minimize the loss of friction between the backfill and trench walls.

11. ROCK EXCAVATION

- a. Rock shall be defined as that solid material that cannot be excavated, in the opinion of the Public Utilities Director or Engineer, by any means other than drilling and blasting, drilling and wedging, or boulders and broken concrete exceeding ½ cubic yard in volume. Rock shall be excavated to the same limits as earth excavation except that the trench shall be made 6- inches lower than the outer bottom of the pipe. This 6-inches shall be refilled with 6-inches of #67 stone and thoroughly compacted to the sub-grade level. All blasting shall be done under the supervision of the City Inspector or Engineer and subject to all applicable regulations. The City reserves the right to require the removal of rock by means other than blasting where any pipe or conduit is either too close to or so situated with respect to the blasting as to make blasting hazardous. Rock taken from the ditch shall immediately be hauled away and disposed of by the contractor.
- b. Blasting procedures shall conform to all applicable local, state and federal laws and ordinances. A blasting permit shall be obtained from the City of Raleigh Fire Marshal's Office, prior to any blasting. The application shall be obtained 24-hours before any blasting takes place, and the Fire Marshal may specify the hours of blasting. The contractor shall take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or overburden. The contractor shall keep explosive materials that are on the job site in special constructed boxes provided with locks. Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting takes place within five-hundred feet of a utility, structure or property which could be damaged by vibration, concussion or falling rock, the contractor shall be required to take seismograph readings and to keep a blasting log containing the following information for each and every shot.
 - 1) Date of shot
 - 2) Time of shot
 - 3) Crew Supervisor
 - 4) Number and depth of holes
 - 5) Approximate depth of overburden
 - 6) Amount and type of explosive used in each hole
 - 7) Type of caps used (instant or delay)
 - 8) The weather
 - 9) Seismograph instrument and readings
- c. This blasting log shall be made available to the Public Utilities Director or Engineer upon request and shall be kept in an orderly manner. It shall be the contractor's responsibility to have adequate insurance to cover any damages resulting from blasting so to hold the City of Raleigh harmless from any claims.

12. TRENCH PREPARATION

- a. Trench excavation shall conform to the line and depth shown on the plans. The trench shall be properly braced and drained so that workers may work therein safely and efficiently. When water is being pumped from the trench, the pump discharge shall follow natural drainage channels, drains or storm sewers. In discharging trench water, it will be necessary to follow standard erosion control measures so as to minimize erosion and sedimentation. In no case may trench water or groundwater be pumped into or allowed to enter the sanitary sewer system.
- b. The width of the trench may vary with the depth of cut and other conditions the trench shall be in accordance with the dimensions set forth by OSHA and other information shown on Detail W-3.
- c. The foundations for ductile iron shall be a firm and stable flat bottom (Type 1) trench with bell holes so that the pipe rests uniformly on the entire barrel length. See Detail W-3.
- d. Pipe clearance in rock shall be a minimum of six inches below and on each side of the pipe for sized sixteen inches and less in diameter. For sizes larger than sixteen inches in diameter, the minimum clearance shall be nine inches below and on each side.

13. PIPE INSTALLATION

- a. Ductile iron pipe shall be installed in accordance with the requirements of AWWA Standard C-600.
- b. Water pipe shall be laid to the line and grade shown on the plans with all valves and hydrants located as shown on the plans.
- c. Protection shall be afforded to all underground and surface structures using methods acceptable to the Public Utilities Director or Engineer. This protection shall be furnished by the contractor at the contractors' own expense.
- d. Deviation from line and grade may be made only on revised plans upon approval by Public Utilities Department and identified on "as built" when such deviations arise from grade or line conflicts with existing utilities, structures or other sources of conflict.
- e. Subsurface explorations shall be made by the contractor at the direction of the Public Utilities Director or Engineer where it is necessary to determine the location of existing pipes, valves or other underground structures.
- f. Depth of pipe cover, unless shown otherwise on the plans shall be three feet above top of pipe. Depth of cover shall be measured from the established street grade or the surface of the permanent improvement to the top of the barrel of the pipe. **If minimum cover cannot be maintained due to other agency/development infrastructure projects existing water lines shall be relocated or protected with casings or concrete. In no case shall sub grade construction excavations come within less than 2 feet of the existing pipe crown.**
- g. After the foundation has been properly graded, bedded when applicable, and the bell holes dug, the pipe and accessories shall be carefully lowered into the trench by approved methods. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. All damaged pipe and accessories shall be removed from the job.

- h. Pipe interior shall be swabbed clean with sodium hypochlorite solution before it is laid, and any pipe which cannot be cleaned with a swab shall be removed and cleaned with suitable apparatus. Any pipe showing evidence of oil, tar or grease shall be permanently marked and removed from the job.
- i. Laying of pipe and jointing of pipe shall be done according to manufacturer's recommendation with care being taken to provide uniform bearing for the pipe. Bell and spigot of pipe shall be cleaned and properly lubricated where a mechanical joint of a "push on" type joint is employed. No chlorine powder or tablets shall be put in the lines during installation.
- j. Open ends of pipe shall be plugged with a standard plug or cap at all times when pipe laying is not in progress. Trench water shall not be permitted to enter pipe.
- k. Pipe cutting for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner in accordance with the manufacturer's recommendations and without damage to the pipe.
- l. Bell ends will face the direction of laying unless otherwise directed by the Public Utilities Director or Engineer. For lines on an appreciable slope, the Public Utilities Director or Engineer may also require that bell ends face upgrade.
- m. Maximum horizontal deflections for ductile iron pipe shall be as follows for an eighteen foot joint of pipe:

| Maximum Deflection in Inches | | |
|------------------------------|-------------|---------------|
| Pipe Size | Mech. Joint | Push-on-joint |
| 6 | 27 | 19 |
| 8 | 20 | 19 |
| 10 | 20 | 19 |
| 12 | 20 | 19 |
| 14 | 13 | 11 |
| 16 | 13 | 11 |
| 18 | 11 | 11 |
| 20 | 11 | 11 |
| 24 | 9 | 11 |
| 30 | 9 | 11 |
| 36 | 8 | 11 |
| 42 | 7 | 7 |
| 48 | 7 | 7 |

- n. When installing water &/or sewer mains, the horizontal separation between utilities shall be 10'. If this separation cannot be maintained due to existing conditions, the variation allowed is the water main in a separate trench with the elevation of the water main at least 18" above the top of the sewer & must be approved by the Public Utilities Director. All distances are measured from outside diameter to outside diameter

Where it is impossible to obtain proper separation, or anytime a sanitary sewer passes over a water main, DIP materials or steel encasement extended 10' on each side of crossing must be specified & installed to waterline specifications

Maintain 18" min. vertical separation at all water main & RCP storm drain crossings; Where adequate separations cannot be achieved, specify DIP materials & a concrete cradle having 6" min. clearance (per CORPUD detail W-41)

All other underground utilities shall cross water & sewer facilities with 18" min. vertical separation required

- o. Maintain 18" min. vertical separation at all water main & storm drain crossings. Where adequate separations cannot be achieved, specify DIP materials & a concrete cradle having 6" min. clearance (per COR PUD details W-41.)
- p. All other underground utilities shall cross water & sewer facilities with 18" min. vertical separation required
- q. Railroad crossings shall be made following all precautionary construction measures required by the railroad officials.
- r. All water crossings under the state system roads shall be made in accordance with the requirements of the NC DOT as defined in their encroachment permits.
- s. Where conditions are, in the opinion of the City Inspector unsuitable for laying pipe because of weather or trench conditions, the contractor shall be required to cease work until permission is given by the City Inspector for work to commence again providing such conditions have been corrected.

14. REACTION BLOCKING

- a. All fittings or components subject to hydrostatic thrust shall be securely anchored by the use of concrete thrust blocks poured in place, unless otherwise directed by the engineer. The reaction areas required for these thrust blocks shall be given to the contractor by the inspector, and the contractor shall install the blocks according to directions provided by the inspector. Where concrete must be reinforced, the contractor shall furnish such reinforcing as is required.
- b. Required reaction bearing areas will be taken from the schedule herein. See Details W-10 & W-11. Areas given are vertical plans measured in solid material normal to the thrust line of the fitting.
- c. Material for reaction blocking shall be transit-mixed concrete. This concrete shall have a twenty-eight day compressive strength of 3000 psi. Any metal used to resist thrust which is not encased in concrete shall be "hot dipped" galvanized.
- d. Valves on ductile iron lines shall be anchored with thrust collars as shown in Details W-7 thru W-9.

15. BACKFILLING PIPE

- a. The backfilling of the trench after the pipe installation and testing shall be in accordance with Details W-3 for ductile iron.

Ductile iron pipe shall be backfilled with suitable native material. No rocks, boulders or stone four inches or larger shall be included in the backfill for at least two feet above the top of the pipe.

- b. All backfill shall be compacted in six-inch lifts measured from the pipe foundation upward. Backfill for roadway shall be compacted to at least 95% of maximum soil density in those areas where the supporting capacity of the soil is of prime consideration. Laboratory determination of maximum soil density will follow the procedure of AASHTO T99-86. Field determination of the density of the soil in place shall follow the procedure of AASHTO T191-86 or T204-86. The result of any one test may be a minimum of 90% of maximum density, but the average of any three tests in an area shall be 95% of maximum density. All tests shall be conducted at the direction of the City Inspector, and the cost of such tests will be borne by the contractor with the provision that the City will test an area two times only where both tests fail. The contractor shall then be required to submit satisfactory evidence that his ditch compaction meets the specifications.
- c. Deficiency of backfill material shall be supplied by the contractor where this deficiency results from any cause other than rejection of unsuitable backfill material (other than rock) by the City Inspector. In cases where the City Inspector directs, the contractor shall dispose of unsuitable backfill material and provide suitable backfill material.

Where excavated material has been rendered unsuitable, either before or after excavation, by inclement weather or type of material, the contractor must correct the moisture or furnish replacement backfill material.

- d. Backfilling shall not be allowed, except with permission of the City Inspector. When a ditch is flooded or the weather is unsuitable, the contractor shall not backfill unless permission is given by the City Inspector. No backfilling with frozen material shall be allowed.

16. SETTING VALVES AND VALVE BOXES

- a. Valves shall be set at locations shown on the plans with care being taken to support the valve properly and to accurately position the valve box over the operating nut of the valve. Where pavement exists, the box shall be adjusted to finished street grade and a concrete pad two-feet square and six inches thick shall be poured around the box two inches from the top of finished grade as shown in Detail W-17. When valves are located in street rights-of-way, but out of pavement, the boxes shall be adjusted to finished grade and a concrete pad two-feet square and six-inches thick shall be poured around the box one-half inch from the top. When valves are located outside of street rights-of-way, the boxes shall be at finish grade, and a concrete block two-feet square and six-inches thick shall be poured around the box at grade line. Valve locations out of street rights-of-way shall be marked with a metal post having a minimum diameter of two inches and a minimum bury of three feet with a minimum of three feet exposed. The exposed portion shall be painted bright orange and shall be placed so that a valve operating tool has free operation.
- b. When a tapping sleeve and valve are being used, the valve, sleeve and machine assembly shall be air tested to hold at 150 psi for a five-minute duration in the presence of the inspector prior to drilling or tapping the main. All tap coupons shall be given to the city inspector. The valve shall be in the closed position during the testing.

- c. Reverse taps are not permitted unless approved by the Public Utilities Director. They must have sufficient cover and be marked with a 4 inch PVC marker at the tapping valve identified with an "R" designation.

17. SETTING FITTINGS

Fittings shall be set at locations shown on the plans with care being taken to properly "bell-up" joints and support the body of the fitting. All dead-end lines shall be plugged with mechanical joint plugs or caps and anchored by using thrust collars and blocking as shown on Details W-7 thru W-12.

18. SETTING HYDRANTS

- a. Specific directions are required for the setting of all hydrants. In streets where paving is proposed in the near future, the contractor will be given line and grade stakes for hydrants. It is mandatory for the contractor to preserve these stakes for the inspector to verify that the hydrant was set correctly. In areas where paving is not anticipated in the near future, hydrants shall be set according to the inspector's directions. When fire hydrants are installed behind guard rails breakaway flanges shall be installed at the ground level and flush with the top of the guard rail. In these installations where multiple barrel extensions are required the fire hydrant stems shall be a single one piece unit. In general, hydrants shall be located in a manner to provide complete accessibility and minimize possibility of damage from vehicles or injury to pedestrians.
- b. Hydrant installation shall be as shown in Detail W-4 and shall be restrained from the main to the hydrant with a mechanical joint pipe restraining system. If the distance is greater than 20 feet the hydrant branch shall be restrained for the entire length with a mechanical joint pipe restraining system. When hydrants are used as blow-off assemblies, the valves shall be rodded to a thrust block. Restraining rods and accessories shall be "hot dipped" galvanized. Detail W-4A is another available option.
- c. Before a hydrant is set, all dirt and foreign matter shall be removed from the interior of the hydrant.
- d. Hydrants shall be bagged to indicate "out of service" until all testing is complete and the mains are placed in service. Bags shall be large enough to cover the entire hydrant and shall be black in color. Bags shall be secured with duct tape at the base of the hydrant and shall be removed immediately after the hydrants are placed in service.

19. SETTING BLOW-OFFS AND RELEASE VALVES

- a. Blow-offs and drainage branches shall not be connected to any sewer, submerged in any stream, or be installed in any other manner that will permit back siphonage into the distribution system.
- b. All air release valves and blow-offs shall be installed as shown on Details W-19 - W-22. Air release valves must be such that provisions can be made by the contractor to get the flow of water to a natural drainage way.

20. SURFACE RESTORATION

- a. All disturbed surfaces and property thereon, shall be restored to a condition equal to that existing before construction began, and the contractor shall maintain and be responsible for all ditches in paved streets, curbs, gutters or sidewalks until the contractor repaves the trench cuts. The contractor, with permission of the inspector, may place temporary or permanent asphaltic material in the cut. Asphalt compaction shall be done with a gasoline or diesel powered smooth drum asphaltic roller.
- b. All easements will be seeded with grass and left so they can be mowed by conventional mowers, unless approved by the Public Utilities Department for rip-rap or other specified material. In remote areas, easements will be seeded with a quality fescue grass. In residential areas, easements will be seeded with either falcon or rebel fescue or leaf mulch at the request of property owner. The contractor shall guarantee a good uniform stand of grass and shall reseed any bare or thin spots. The contractor will be responsible for a one-year warranty on materials and workmanship.

21. EROSION CONTROL

Erosion control measures shall be performed by the contractor, conforming to the requirements of, and in accordance with plans approved by the State of North Carolina Department of Environment and Natural Resources, North Carolina Sedimentation Control Commission and City of Raleigh Inspections Department Erosion Control Division, and as per the erosion control plan portion of the construction drawings and these specifications. The sedimentation and erosion control plan and permit shall remain on site at all times. The contractor shall not allow mud and debris to accumulate in the streets. Should the contractor pump water from trenches during construction, appropriate siltation preventative measures shall be taken prior to the entry into any storm drain or stream. All measures must be taken so that stormwater runoff does not go to the pipes or manholes of the utility system. All materials used for erosion control shall be approved by the Engineer prior to installation by the contractor.

- a. Temporary and permanent erosion control measures shall be shown on the plans. Temporary and permanent erosion control work shall be coordinated throughout the project to provide effective and continuous erosion control throughout construction and post construction, which minimizes siltation of streams, lakes, reservoirs, other water impoundments, ground surface, or other property. Seeding and mulching shall be carried out immediately behind construction.
- b. Temporary erosion control measures shall include but not be limited to swales in the easements, silt fences, crushed stone check dam devices, silt basins (sedimentation traps), mulching, earth berms, and rip-rap.
- c. Permanent erosion control measures shall include but not be limited to swales in the easements, rip rap and seeding of disturbed areas.
- d. Erosion and siltation shall be controlled on projects by using swales to control run-off and convey run-off to controlled discharge points, by silt fences, rip-rap, crushed stone, and earth berms to contain silt, with pipe culverts where major access or haul roads cross drainage ditches or streams, silt basins where pipe lines cross drainage ditches or streams, and seeding and mulching will be performed as soon after pipe installation as possible. When temporary measures are removed after completion of the project the disturbed area must be stabilized, if necessary.

22. MAINTAINING SERVICE

When replacing or extending water mains the contractor shall maintain continuous water service to all existing residences and businesses.

23. GUARANTEE

The contractor shall guarantee all material, equipment and workmanship for a period of at least one-year after final acceptance by the City. The Public Works Department Construction Inspection Division is responsible for the issuance of final acceptance letters by the City.

For projects in Merger Areas the Public Utilities Department Construction Inspection Division is responsible for issuance of final acceptance letters.

24. WETLAND/STREAM BUFFERS

Conditions of 401/404 permits shall be strictly followed to the satisfaction of Corps of Engineers. All Neuse Riparian buffers shall be maintained as required by the North Carolina Division of Water Quality.

25. GENERAL WATER MAIN TESTING SEQUENCE

Water mains shall be tested in the following general sequence:

- a) "Pigging" main (mains with gate valves)
- b) Flush the main (all flush water shall be de-chlorinated using methods acceptable to the City of Raleigh Public Utilities Department);
- c) Perform the hydrostatic tests;
- d) Introduce the appropriate amount of chlorine by tapping the main;
- e) Hold the chlorine solution in the main for at least twenty-four hours and no more than seventy-two hours;
- f) Flush the main (all flush water shall be de-chlorinated using methods acceptable to the City of Raleigh Public Utilities Department);
- g) Sample for the bacteriological tests; and
- h) Water mains shall be placed into service within 48 hours of meeting bacteriological analysis requirements. If no activity is anticipated on a water main for the first 30 days after it is placed into service, the contractor shall notify the City of Raleigh Public Utilities Department at 870-2870 and provide the location and permit number.

26. PIGGING

All new mains with gate valves must be pigged with a polyethylene "pig", 5#/cubic foot density at the conclusion of installation.

The pig must be blown at the end of the main by means of the following:

- a) 4" main - 4" blow-off (private only)
- b) 6" main - fire hydrant or 6" blow-off
- c) 8" and 12" through blow-off assembly as on Details W-21 & W-22
- d) 16" – 24" As determined by the field inspector

The contractor installing the line shall write the name of the company and street name in which the work is taking place on the pig in a manner in which it will not rub off.

27. HYDROSTATIC TESTS

- a. All main installations including private distribution and fire lines to the buildings shall be pressure tested between each main line valve in accordance with AWWA C-600. The test shall be performed using a suitable pump and an accurate pressure gauge. Immediately upon completion of a section of main, 150 psi (\pm 5 psi) of pressure shall be applied and held for two hours. Fire lines shall be tested at 200 psi. The acceptable leakage rate shall not exceed .092 gallons per inch of pipe diameter per 1,000 feet of pipe per hour.

Failure of the water main to comply with the above acceptable leakage rate, shall require the contractor to replace any defective materials to insure a watertight installation. If it is deemed that the existing blow-off valve is the cause of failure, the party responsible for the water main extension shall also be responsible for adding a valve at that location and abandoning the existing valve. After any inadequacies have been corrected, the leakage rate will again be tested. This test shall be repeated until that portion of main is brought to compliance with the permissible leakage rate.

- b. Prerequisite conditions for inspection prior to testing shall be as follows:
 - 1) Hydrants shall be properly located, operable, plumb and at correct elevation.
 - 2) Valves shall be properly located, operable and at correct elevation. Valve boxes or manholes shall be centered over operating nuts, and the top of the box or manhole shall be at proper elevation.
 - 3) Lines shall be properly vented where entrapped air is a consideration.

28. CHLORINATION

- a. All additions or replacements to the water system, including fire lines and backflow prevention devices, shall be chlorinated before being placed in service. Such chlorination must take place under the supervision of an inspector.
- b. Pipe subjected to contaminating materials shall be treated as directed by the Public Utilities Department or Engineer. Should such treatment fail to cleanse the pipe, replacement shall be required. The City shall bear no portion of any cost sustained by the contractor in meeting this specification.
- c. Chlorination of a completed line shall be carried out after completing the pressure test and in the following manner.

- 1) Taps will be made at the control valve at the upstream end of the line and at all extremities of the line including valves. These taps shall be located in such a manner as to allow HTH solution to be fed into all parts of the line.
- 2) A solution of water containing high test hypochlorite (70%) available chlorine or chlorine gas solution shall be introduced into the line by regulated pumping at the control valve tap. The solution shall be of such a concentration that the line shall have a uniform concentration of 50 ppm total chlorine immediately after chlorination. The chart below shows the required quantity of 70% HTH compound to be contained in solution in each 1000-foot section of line to produce the desired concentration of 50 ppm.

| Pipe Size | Pounds of high Test Hypochlorite (70%) Per 1000' of Line |
|-----------|--|
| 6" | .88 |
| 8" | 1.56 |
| 10" | 2.42 |
| 12" | 3.50 |
| 14" | 4.76 |
| 16" | 6.22 |
| 20" | 9.76 |
| 24" | 14.00 |
| 30" | 21.00 |
| 36" | 31.50 |
| 48" | 56.00 |

- 3) The HTH solution shall be circulated in the main by opening the control valve and systematically manipulating hydrants and taps at the line extremities. The HTH solution must be pumped in at a constant rate for each discharge rate in order that a uniform concentration will be produced in the mains.
- 4) Services shall be sterilized by methods acceptable to the Public Utilities Director or Engineer, and the contractor shall have the same responsibility for laterals as for mains in regard to bearing full cost of any corrective measures needed to comply with bacteriological or other requirements.
- 5) HTH solution shall remain in lines for no less than twenty-four hours, unless otherwise directed by the Public Utilities Director or Engineer.
- 5) Extreme care will be exercised at all times to prevent the HTH solution from entering existing mains.

29. BACTERIOLOGICAL SAMPLING

- a. Free residual chlorine after twenty-four hours shall be at least 10 ppm, or the Public Utilities Department or Engineer will require the lines be re-chlorinated.
- b. Mains will be flushed with a blow-off assembly of sufficient size to effectively clean the main. Detail W-22. Flushing of lines may proceed after twenty-four hours, provided the free residual chlorine analysis is satisfactory. Flushing shall be continued until chlorine returns to normal level. In times of water shortages or distribution main problems, the flushing operation may be delayed. The Public Utilities Department shall determine when flushing is allowable. The contractor shall advise the inspector prior to the chlorination and flushing so that the inspector can advise the Public Utilities Department of the construction location, size and length of mains. All tests will be done in the presence of an inspector. Flushing will be for short duration. Sufficient precautions must be taken to the satisfaction of the inspector to ensure that the impact of the water is absorbed and the water is conveyed without erosion or property drainage. All flush water shall be de-chlorinated using methods acceptable to the City of Raleigh Public Utilities Department.
- c. After flushing is completed, the Public Works Department or Public Utilities Department Inspector shall collect samples for turbidity and bacteriological analysis for each section of pipe between main line valves. Sample point locations shall be determined by a representative of the engineer or owner. A custody seal shall be placed on each set of turbidity and bacteriological bottles. A chain of custody form must be completed for sample set(s) collected and must be delivered along with the sample(s). A turbidity test will be done. If the turbidity exceeds 1 NTU, the sample fails and a bacteriological test will not be set up. The Public Utilities Department will perform the turbidity and bacteriological analysis.
- d. Samples will be accepted between 8:00 AM and 12 NOON and 1PM and 3:30 PM Monday through Thursday, excluding holidays. Special arrangements may be made for samples to be accepted outside of this time frame by calling the laboratory in advance.
- e. In the event that two successive bacteriologic tests fail, that section of the main shall be re-chlorinated by the contractor and new tests performed prior to moving to the next section of main.

30. SERVICE CONNECTIONS

- a. Taps shall be made only on a line under pressure and after the main has been tested and chlorinated. No taps on dry lines shall be allowed, unless specific authorization from the **Public Utilities Department** is obtained.
- b. Taps shall be at an angle of forty-five degrees to a perpendicular plane through the center line of the pipe as shown is in Detail W-23.
- c. The maximum size of a direct tap shall be 1" for mains 6" and larger. Larger taps may be made by using a service saddle.
- d. Services larger than two inches shall be made by using a tapping sleeve and valve. Service size shall match tap size.

The typical tapping sleeve and valve is shown in Standard Detail W-14.

- e. No taps or services shall be made on 24-inch or larger transmission mains unless approved by the Public Utilities Director.
- f. Before any water services are installed, the main shall be thoroughly flushed using a flow velocity sufficient to scour the pipe interior. All flush water shall be de-chlorinated using methods acceptable to the City of Raleigh Public Utilities Department.
- g. Each meter yoke shall be flushed before the installation crew proceeds to the next service installation.

31. WATER MAIN AND SERVICE ABANDONMENT

Contractors abandoning water services shall remove the entire service stub. When available, a mechanical plug shall be used to abandon the corporation cock. If equipment necessary to plug the main is not available, the corporation stop shall be turned off and capped. A ½" PVC pipe shall extend a minimum of 12" above the capped corporation stop, wrapped at least 3 times with caution tape to identify an abandoned tap. All remaining portions of the service stub shall be removed from the main to the right of way line and shall be disposed of properly. Water main abandonment must be performed in accordance with a plan approved by the Public Utilities Department. Service and main abandonment requires a stub permit for inspection by the Public Works Department at 919-996-2409 or a Public Utilities Inspector at 919-996-2737, in the merger areas.

General Requirements;

- A Property owner is responsible for proper abandonment of all unused existing service stubs.
- All abandoned meters are to be removed by the Raleigh Meters Division prior to service abandonment. (919-996-2742).
- The Raleigh Public Utilities operations staff will not abandon an existing service stub unless it is part of a service renewal as required by ordinance.
- For circumstances that may not be addressed by this clarification or a variance from this procedure please contact the Raleigh Public Utilities Department Development staff at 919-996-4540.

LICENSED UTILITY CONTRACTOR REQUIRED SERVICE ABANDONMENT PERMITS

Contractor installed domestic (3/4”thru 12”), irrigation water (3/4”thru 10”), sewer (4”thru 8”) and fire hydrant (6”) service stub;

Commercial; All domestic and/or irrigation, sewer and fire hydrant abandonment requires a stub permit for each connection to a water or sewer main.

Residential/Individual; All domestic water and/or irrigation and sewer service stubs abandonment installation requires a stub permit. Exception; Irrigation splits installed with a new domestic service. Irrigation splits on an existing tap requires a stub permit.

Demolition Permits; Plans are required to show all existing services to be abandoned included temporary construction water using existing meter(s). Plan review required.

Sewer Stubs in Easements; A licensed and bonded utility or plumbing contractor may install a sewer stub on a sewer main located within a dedicated easement and requires the issuance of a stub permit. Raleigh Ordinance 10-6082

Street cut permits are required for pavement repair in ROW.

City of Raleigh Capital Projects

A licensed utility contractor performing City contracted water or sewer main replacement work is not required to obtain a stub or street cut permit for abandoned services or mains.

Water and Sewer Main Abandonment

All water and sewer main abandonment requires plan submittal for review by the Raleigh Public Utilities Development Staff by submission of plans through the Raleigh Development Customer Service Center

Sewer Design, Material, and Construction Standards

SEWER DESIGN STANDARDS

Unless otherwise indicated, all standards apply to both the public and private sewer systems. Described in this section are the general design standards which are to be followed by all parties in preparing subdivision, utility extension, and utility replacement plans for the City of Raleigh. These design standards will ensure that the citizens of Raleigh will continue to have a quality sewer collection system.

All engineering plans for public and private sewer systems must meet State and City minimum design standards as indicated in the most recent amended Administrative Code, Title 15A, Subchapter 2T – Waste Not Discharged To Surface Waters by the N.C. Department of Environment, and Natural Resources and/or the City of Raleigh Public Utilities Handbook, whichever, is the more stringent. All projects must be certified by the engineer of record or the City Engineer.

Plan and profile drawings shall be prepared by a registered professional engineer signed, sealed, and dated showing the various elements of the utility mains and shall include an overall utility plan layout on a single sheet with scale no smaller than 1 inch = 200 feet. Design of improvements must be based upon actual field verification by the engineer of existing utilities. The utility drawings shall be on separate sheets, free of landscaping and other details not pertinent to the utility plans. The water and sewer drawings may be on the same sheets. A separate landscaping plan must also be submitted with the utility showing any proposed landscaping and all water or sewer utilities or easement. All adjacent tracts and topographic information must be shown on the landscaping plan. Landscaping plans shall show all utilities and engineering drawings and shall be on paper 24 inches by 36 inches.

Plan view must be oriented north with north shown at the top of the page, whenever possible. Stationing must be performed in order of increasing station left to right and from downstream manhole to upstream. Plan and Profile must be shown on one sheet with the plan view on the top of the sheet and the profile sheet on the bottom of the sheet. Water, sewer, storm and any other utilities must be shown on the plan sheet and profile sheet and must not be shown on separate sheets.

Once installed, certified surveyed “as built” plans shall be provided to the City showing the utilities. “As built” drawings for the utilities shall be submitted to the Public Works Department prior to acceptance of the project by the City.

1. SEWER DESIGN - PUBLIC

a. Location Conditions for Design

- 1) All public sanitary sewer mains shall be installed within dedicated street rights-of-way or City of Raleigh dedicated sanitary sewer easements. When sanitary sewer mains are installed in street rights-of-way, they shall be located in the center of the pavement or right-of-way where practical or in the south or west side of the pavement.
- 2) Minimum widths of permanent and construction sanitary sewer easements, for public sewer mains, are:

| Required Easement Widths | | |
|---------------------------------|------------------|-------------------------------|
| Main Size | Permanent | Temporary Construction |
| 8” – 16” | 30 feet | 10 feet total |
| 18” and larger | 40 feet | 20 feet total |

Larger size easements may be required based upon the depth of installation or other consideration as determined by the Public Utilities Department and Public Works Department. See table below for the extra easement typically required. Sewer mains shall be centered in the easement. Under special conditions, temporary construction easements may be required upon approval of the Public Utilities Department. All sewer easement boundaries must be field staked and flagged by the developer's surveyor and at the developer's expense.

| Additional Easement Required for Deep Sewer | |
|--|-------------------------------------|
| Depth of Sewer | Additional Easement Required |
| 0-15' | See table above |
| 15' – 25' | Add 10' to table above |
| >25' | Add 20' to table above |

- 3) The minimum easement width for sanitary sewer is 30 feet and may not include any other utility. Such easements are to be recorded as "City of Raleigh Sanitary Sewer Easement". Special considerations for a smaller easement width will be given based on site constraints, depth of sewer main, accessibility to easement and other relevant factors.
- 4) All off-site easements shall be acquired by the developer. These off-site easements shall have functional access to public right of way and be recorded by map and by deed of easement prior to construction approval. The easements shall be dedicated to the City of Raleigh and entitled "City of Raleigh Sanitary Sewer Easement". Plan and elevation drawings of all access roads shall be shown on the plans prior to approval.
- 5) No person shall place any part of a structure, construction fill material, permanent equipment, or impoundment on sanitary sewer easements or mains. Prohibited structures include buildings, houses, air conditioning units /heat pumps, decks, garages, tool or storage sheds, swimming pools, stormwater control devices, walls, and fences. Fences may be allowed across easements as long as there is an access gate the full width of the easement. No fences may be installed longitudinally (lengthwise) within easements. All permanent easements shall be graded and smoothed to allow sufficient access and use for mowing equipment and maintenance vehicles prior to acceptance by the City; typically a minimum of 3:1 slope will be required.
- 6) No person shall plant trees, shrubs, or other plants within a sewer easement without prior written approval from the Director of the Public Utilities Department. Any such plantings approved by the Director shall be done so at the risk of the property owner having to replace the plantings due to removal by the City during maintenance activities.
- 7) When preparing the plans for sewer mains, deflection angles for all horizontal turns shall be shown on the drawings. All elevations shall be tied to mean sea datum and the benchmark shall be shown or described on the plans. Spot elevations on 100 foot stations, 75 feet from the centerline on both sides, shall be shown on the plan, or cross-sections supplied to ensure that the sewer can ade-

quately serve the property. The plans shall show the manhole number (MH#1 etc.), top elevation, station, depth along with invert elevations, length of sewer reach, and slope (in percent), diameter, and material. Established creek centerlines and inverts will be plotted on the sewer plan and profile sheets, adjacent to proposed sewer alignment, within 75 feet.

- 8) Proposed sewers paralleling a creek shall be designed to a proper depth to allow lateral connections, such that all creek crossings will be below the stream bottom elevation. When it can be demonstrated by the engineer that such sewer main would need to be at a depth greater than 16 feet to serve the opposite side of the creek, the Public Utilities Department may make an exception to this provision in the plan approval stage. The top of the sewer pipe should be at least one foot below the stream bed elevation and be of ductile iron pipe. All aerial stream crossings will be **restrained joint pipe** from manhole to manhole as shown in Detail S-12. The center line of a main paralleling a creek shall be a minimum of 40 or more feet as required by the Neuse Riparian Buffer from the top of the closest creek bank. Manholes along these sewers must be protected against the 100-year flood by raising top elevation **three feet** above or by providing sealed manholes (see S-24). All sealed manholes must be vented every 1,000 feet along the sewer line as per details S-26 and S-27.
- 9) Aerial sanitary sewer crossings will be permitted only if they follow the Details S-10 thru S-19. The bottom of the aerial creek crossing pipe must be at least one foot above the 25 year flood elevation at the location.
- 10) Connection to non-standard manholes (pipe tees) on large interceptors must follow the Detail S-33. Connection to these manholes must be performed by City forces or a contractor working for the City with the cost borne by the person extending the sewer mains from that point. Contact the Assistant Public Utilities Director of Operations for coordination when making these connections.
- 11) Sewer clean-outs are prohibited in driveways, **sidewalks**, and parking lots and may only be approved upon special request to the Public Utilities Director. When necessary and so approved they must be installed with a standard water-tight clean-out plug within the cast iron valve box with a cast iron lid indicating "Sewer".
- 12) "Doghouse" manholes are allowed only on DIP, PVC, and concrete sewer mains. "Doghouse" manholes on VCP are prohibited. New manholes installed on existing VCP sewer lines shall be replaced with DIP or PVC pipe material from the existing downstream manhole to the existing upstream manhole. When new sewer mains are installed and connected to existing deteriorated or brick manholes, the manhole shall be replaced. **Determination for maintaining or replacement of existing deteriorating manholes must be approved by the Public Utilities Director.**
- 13) **When a section of existing sewer line is replaced with new sewer pipe, all existing sewer services along this section must be replaced from the main line to the R/W line. The new cleanout assembly shall be connected to the existing service line on the customer side of the R/W. Coordinate with the Public Utilities Director for cost sharing options when replacing these existing sewer lines and manholes-**

14) A dedicated and recorded driveway access easement shall be provided to all sanitary sewer siphons. Sanitary sewer siphons are only allowed in special circumstances and require approval of the Public Utilities Director. Plan and elevation drawings of all access roads shall be shown on the plans prior to approval.

15) A distance of 100' shall be maintained between sanitary sewer & any private or public water supply source such as an impounded reservoir used as a source of drinking water. If adequate lateral separation cannot be achieved, ferrous sanitary sewer pipe shall be specified & installed to waterline specifications. However, the minimum separation shall not be less than 25' from a private well or 50' from a public well

When installing water &/or sewer mains, the horizontal separation between utilities shall be 10'. If this separation cannot be maintained due to existing conditions, the variation allowed is the water main in a separate trench with the elevation of the water main at least 18" above the top of the sewer & must be approved by the Public Utilities Director. All distances are measured from outside diameter to outside diameter

Where it is impossible to obtain proper separation, or anytime a sanitary sewer passes over a water main, DIP materials or steel encasement extended 10' on each side of crossing must be specified & installed to waterline specifications

5.0' minimum horizontal separation is required between all sanitary sewer & storm sewer facilities, unless DIP material is specified for sanitary sewer

Maintain 24" min. vertical separation at all sanitary sewer & RCP storm drain crossings. Where adequate separations cannot be achieved, specify DIP materials & a concrete cradle having 6" min. clearance (per CORPUD detail S-49)

All other underground utilities shall cross water & sewer facilities with 18" min. vertical separation required

16) All existing waterworks units, such as basins, wells, or other treatment units, within 200 feet of the proposed sanitary sewer main shall be shown on the engineering plans.

17) Sanitary sewer services are not allowed in private easements. Sewer services cannot be installed inside and parallel to the right of way in order to serve an adjoining property. Private sewer services must remain entirely on the property which it serves. In order for a sewer connection to be allowed, a manhole or sewer main must be located in front of the property which it will serve. In some cases, a 45 degree connection may be allowed to connect to a manhole which does not front on the property.

18) Construction Plans showing a relocation of a sanitary sewer main will be required to provide a table showing a minimum of the following information: Suction MH, Discharge MH, work to be performed, suction static lift, discharge static lift, approximate length of FM and peak flow. Hydraulic pump design is to be submitted by the contractor and sealed by an NC Registered PE.

A note should also be provided on the plans stating:

“A bypass plan sealed by a NC Professional Engineer must be submitted to Public Utilities prior to pumping operations to coordinate with administration engineering staff. Pumps should be sized to handle the peak daily flow (2.5 times the average daily flow) for the line or area of work. The contractor shall secure pumps from a pump supplier according to the provided flow information. Pumping operations must be monitored 24 hours a day for each day of the pumping operation by qualified personnel in order to respond to problems or failures. 100% redundancy is required for pumping operations. In addition, back up pumps are to be connected to the bypass force main to facilitate immediate use upon failure of the primary pumps.”

Sewer Force Main Air Release valves shall be 2” minimum, A.R.I. Flow Control, Model D-020 Combination, with stainless steel body or equal as approved by the Public Utilities Director. These valves shall be suitable for 0.2-16 bar working pressure range and designed to discharge air during filling of the system, admit air during drainage and water column separation, and release entrapped air when the system is pressurized. The valve shall be housed in a City of Raleigh approved eccentric manhole and shall be installed in accordance with Detail S-9 of these specifications. Air release valve locations shall be approved by the Public Utilities Department, or as shown on the plans. The engineer must field stake the air release location

b. Size

- 1) All gravity sewer mains shall be designed and sized to serve the total natural drainage basin. The total off-site drainage area in acres must be shown on the plans and calculations should be submitted to the Public Utilities Department upon request to justify pipe sizing. An 8-inch main shall be the minimum size permitted.
- 2) Sewer size design shall be based on an average daily flow of 100 gpcd and a peak/average ratio of 2.5. This ratio includes an allowance for infiltration. The following table should be used as a guide for determining the Equivalent Persons/Acre and the peak flow for various zoning classifications:

| Zoning Classification | Equivalent Persons Per Acre | Average Flow (gpcpd) | Peak Flow (gpcpd) |
|------------------------------|------------------------------------|-----------------------------|--------------------------|
| Agricultural Production | 2.5 | 250 | 625 |
| Buffer Commercial | 30 | 3,000 | 7,500 |
| Business | 25 | 2,500 | 6,250 |
| Conservation Management | 2.5 | 250 | 625 |
| Industrial 1 | 50 | 5,000 | 12,500 |
| Industrial 2 | 30 | 3,000 | 7,500 |
| Manufactured Housing | 14 | 1,400 | 3,500 |
| Office & Institution - 1 | 13 | 1,300 | 3,250 |
| Office & Institution - 2 | 30 | 3,000 | 7,500 |

| | | | |
|--------------------------|------|-------|--------|
| Office & Institution - 3 | 13 | 1,300 | 3,250 |
| Residential 2 | 5 | 500 | 1,250 |
| Residential -4 | 8 | 800 | 2,000 |
| Residential -6 | 14 | 1,400 | 3,500 |
| Residential -10 | 21 | 2,100 | 5,250 |
| Residential -15 | 31.5 | 3,150 | 7,875 |
| Residential -20 | 42 | 4,200 | 10,500 |
| Residential -30 | 63 | 6,300 | 15,750 |
| Rural Business | 2.5 | 250 | 625 |
| Rural Residential | 2 | 400 | 1,000 |
| Shopping Center | 18 | 1,800 | 4,500 |
| Thoroughfare District | 50 | 5,000 | 12,500 |

For merger towns, use equivalent densities from the table above, or contact the Public Utilities Department.

Sewer size design shall be to half full or 50% capacity for peak flow for all grades.

- 3) Grades for sanitary sewers must be such that a minimum flow velocity of 2 feet per second is maintained. The minimum grade for an 8-inch sewer line is 0.50%. For other pipe sizes, follow the table below from the NC Gravity Sewer Minimum Design Criteria:

| Diameter of Pipe (inches) | Minimum Slope (feet per 100 feet) |
|---------------------------|-----------------------------------|
| 6 | 0.60 |
| 10 | 0.40 |
| 12 | 0.28 |
| 14 | 0.17 |
| 15 | 0.15 |
| 16 | 0.14 |
| 18 | 0.12 |
| 21 | 0.10 |
| 24 | 0.08 |
| 27 | 0.07 |
| 30 | 0.06 |
| 36 | 0.05 |

- 4) Any grades which exceed the maximum of 10% must be approved by the Public Utilities Director and must be accompanied with details of a high velocity manhole as shown in Detail S-23. Any time the grade is greater than 15%, ductile iron pipe shall be used with high velocity blocking (anchoring) provided as per Details S-6 & S-7.
- 5) Pipe diameter changes shall occur in a manhole with the pipe crowns matched provided a minimum drop of approximately 0.20 feet is maintained between inverts.
- 6) Pipe material changes shall only occur in a manhole (i.e. DIP to PVC).

c. Manholes

- 1) Manholes shall be spaced a maximum distance of 400 feet apart for 8-inch through 21-inch diameter pipes, 450 feet apart for 24-inch and 30-inch diameter pipes, 500 feet apart for 36-inch diameter pipes and shall be installed at each deflection of line and/or grade. Manholes shall be vented every 1,000 feet, or every other manhole, whichever is greater. Also see Sewer Materials section for venting of manholes.
- 2) The maximum “free” vertical drop for a gravity main into a manhole shall be 30 inches. Inside and outside drop manholes are not permitted. The maximum “free” vertical drop for a force main discharge into a manhole shall be 12 inches above the crown of the main.

Inside drop manholes may be allowed on a case by case basis.

- 3) Manholes will be supplied with a rubber boot sleeve that meets or exceeds ASTM C923 with stainless steel expansion bands and pipe clamps that meets ASTM C923 and A167 for connecting the sewer pipes with the barrel section. See Details S-20 thru S-29 for manhole standards. All traffic bearing castings must be Class 35 or greater. All exterior joints shall be wrapped with a butyl resin sealant of 8” width.
- 4) Eccentric or concentric cones may be used on 8-inch through 12-inch mains. On 15-inch and larger mains, concentric cones must be used.
- 4) The following minimum diameter manholes shall be used dependent upon the size mains and depth of installation. The larger manhole sizes will be required if either the main size or the depth warrants as follows:

| Manhole Diameter | Sewer Main Size | Depth of Installation |
|------------------|-----------------|-----------------------|
| 4' | 8” - 12” | 0' - 12' |
| 5' | 15” - 30” | 12' - 20' |
| 6' | 36” - 54” | >20' |

Extended manhole bases, maximum six inches, may be used to minimize manhole diameter when a larger manhole is required because of the depth, in which case main size will dictate manhole diameter. Manhole sizes must be clearly identified on the construction plans. Each manhole must be of consistent diameter throughout its height.

- 6) The maximum flow deflection angle in manholes for sewer of 24 inch and greater is 60 degrees. The maximum flow deflection angle in manholes for sewer lines less than 24 inch is 90 degrees.
- 7) All interceptor/outfall manholes on lines 12-inches and larger, or manholes receiving a sanitary sewer force main discharge shall be internally lined with approved coating to prevent hydrogen sulfide corrosion. See Sewer Materials Section for approved coatings and specifications.

d. Installation Restrictions for Design

- 1) Extensions of sanitary sewer mains are to be to the farthest property line of the tract where necessary to serve adjoining properties with gravity sewer along natural drainage patterns. In all instances, plans shall show the total area in acres draining to the uppermost bounds of the tract on any established watercourse. Additional sewer extensions may be required if the Public Utilities Department determines adjacent property can be served from extensions from the proposed site.
- 2) The depth of sewer mains shall be great enough to serve adjoining property, allowing for sufficient grade on the service line. Lateral connections are to be into manhole barrels (not the cone section) or into the top quarter of sewer mains.
- 3) All 4" sewer services may be tapped directly into 8, 10, and 12-inch mains or manholes in accordance with Details S-31 and S-32. Taps can only be made by using a mechanical tapping machine or other approved device. All sanitary sewer service connections 6 inches and larger shall be made into manholes only. On mains 15 inches and larger, service connections are allowed only at manholes. Service clean-outs shall be located at the right-of-way line or the easement boundary line. The maximum vertical drop for a 6-inch service into a manhole shall be 10 feet. Four inch sanitary sewer services shall have no maximum vertical drop.
- 4) All sewer mains in traffic areas shall have a minimum cover of 5 feet measured from finished grade in traffic areas to the pipe crown unless ductile iron pipe is provided in Class I bedding where minimum cover shall be three feet. Sewer mains and services shall be no deeper than 12 feet unless approved by the Public Utilities Director. For installations deeper than 12 feet ductile iron shall be used for mains and services, provided that cast iron may also be used for 4" services. Four inch service "stacks" may be PVC regardless of depth. Mains and services in non-traffic areas shall have a minimum cover of 3 feet (measured from top of finished grade) to the pipe crown. Service laterals shall be of PVC or ductile iron when installed in a public right-of-way or easement. A clean-out is required at the easement or right-of-way line and must be constructed out of ductile iron pipe or if PVC is used then it must be equipped with a bronze clean-out plug to facilitate location if buried. Clean-outs inside the public right of way shall not be installed in sidewalks or driveways unless installed as shown in Detail S-30.
- 5) Private collection systems installed outside of public easements and rights-of-way will be built to the applicable State Plumbing Code and Department of Health and Natural Resources Standards and must meet the requirements of the Public Utilities Department's Private Sewer System Standards.
- 6) The placement of fill dirt around and over existing sanitary sewer mains above the pre-existing ground elevation is prohibited and may only be approved upon written request to the Public Utilities Director. It is illegal to damage, cover or bury a sanitary sewer manhole of the City of Raleigh. When approved, fill must be compacted under, beside and above the sanitary sewer main to 95% compaction. Slopes may not exceed two-to-one and sufficient points for cross drainage must be provided.

- 7) Pressure sewer services are prohibited except in existing pressure sewer collections system areas or by specific approval of the Public Utilities Director.
- 8) Calculation of residential wastewater flow rates are as follows:

One bedroom = 120 gallons/day
Two bedrooms = 240 gallons/day
Three bedrooms = 250 gallons/day

For calculation of other flow rates, see the N.C. Division of Water Quality administrative code section 15A NCAC 02T.0114.

e. Pump Stations

- 1) The City of Raleigh's policy is to utilize gravity sewer extensions to provide sewer services to all corporate properties within the City's service area, the ETJ, and the corporate limits. Therefore sewer pump stations are prohibited and may only be approved by a special written request to the Public Utilities Director. The design engineer and developer must attend a pre-design meeting to discuss the requirements as noted in this section. The engineer for the project shall address the following factors in considering a pump station and force main. Also see Details S-35 thru S-37.
- 2) Vertical suction-lift type pump stations must be the first option and wet well/dry well type shall be the second option.
- 3) The engineer shall evaluate the capacity of the receiving sewer main at the point of discharge and downstream to determine that the system can handle the transferred sewer flow.
- 4) The engineer shall perform a cost analysis of the pump system with appurtenances and gravity system. The gravity system must be at least 2.5 times more expensive for the City to consider a pump station. This cost is not to include rock excavation.
- 5) The engineer shall size the pump station to accommodate the total basin area that could gravity flow into it.
- 6) In some circumstances, the Public Utilities Department may choose to accept for permanent ownership and maintenance pump stations designed in accordance with the City Standards. Those stations suitable for acceptance by the Public Utilities Department must meet the following criteria:
 - (a) Be determined by the Public Utilities Director to be in the "best interest" of the City.
 - (b) Be necessary due to limitations imposed by existing Public Utilities facilities.
- 7) **General Conditions for a Pump Station**

- (a) All pump stations must meet the guidelines set forth in this handbook and the most recent version of Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains as published by NCDENR; whichever is most stringent. This can be found at: <http://portal.ncdenr.org/web/wq/swp/ps/cs/>
- (b) The calculation package submitted with the pump station construction plans should include a minimum of:
 - a) Peak and average daily flow calculations.
 - b) Total dynamic head calculations.
 - c) System curve and pump curve analysis with operation point.
 - d) Pump station cycle and run times.
 - e) Pump station flotation/buoyancy.
 - f) Minimum force main velocity.
 - g) Pump station and force main detention times.
 - h) NPSH calculations.
- (c) A dedicated and recorded driveway access easement to the pump station shall be obtained and shown on the as-built plans. In the case of phased development, future access shall also be addressed. Plan and elevation drawings of all access roads shall be shown on the plans prior to approval.
- (d) The contractor/developer shall be responsible for obtaining all permits and payment of all fees for construction.
- (e) The contractor/developer shall be responsible for establishing an account, payment of fees and connection of all utilities. The contractor/developer shall bear all associated utility costs until the date of final acceptance at which time the City shall assume these accounts and future costs.
- (f) Pump Station driveways must be a minimum 12 feet wide with gravel 12 inches thick for the first 20 feet off the roadway and 6 inches thereafter, with curb cut and apron if on curbed street, and not greater than 10 % slope. A vehicle turnaround area at the pump station shall be provided. The City reserves the right to require concrete or asphalt paving of driveways. Sites with odor control chemical tanks must be accessible by 18 wheel tanker trucks.
- (g) A diesel fueled standby electrical generator in a weatherproof enclosure with automatic start and transfer of load with capacity sufficient to sequentially start and run all pumps and equipment shall be provided.
- (h) The engineer shall address the potential for odor at all sites. Odor control shall be required at all pump stations with force mains greater than 2,500 feet, unless exempted by the Public Utilities Director.
- (i) Remote monitoring equipment as required by the City shall be provided. The engineer shall be responsible for a radio site survey of the proposed pump station site to ensure compatibility with the City's existing system before submitting plans for final approval. The contractor shall be responsible for providing all equipment including RTU's, PLC's, antennas, antenna pole, etc. This system will send and receive data using the existing telemetry network owned and operated by the City of Raleigh. The contractor is required to purchase the RTU SCADA cabinet from

the Public Utilities Department. The contractor shall be required to provide the Wonderware HMI programming at the main server and the testing of all communication points.

- (j) Pump stations shall have 100% reserve peak pumping capacity (dual pumps) with vertical suction-lift type pump stations as the first option and wet well/dry well type as the second option unless specific approval is granted by the Public Utilities Director for use of other type pumps. Detailed engineering plans will need to be approved by the Public Utilities Director prior to construction.
- (k) Force mains shall be made of C900 PVC or ductile iron in accordance with the Sewer Materials Section of these specifications and installed under the same construction specifications as water mains. Force mains shall include a gate valve ten feet outside of the station but inside the fence and an air release valve at all high points. Force mains shall convert to gravity flow at a point where they can reasonably do so. The engineer shall provide calculations to confirm that a surge relief valve is not needed. Force main size and discharge point shall be shown on the as built plans.
- (l) Prior to the station being placed into service private pump stations shall be equipped with a sign indicating a 24-hour on call service number, the current owner and the responsible party.
- (m) Start-up services will be required for all equipment and must be performed by a qualified factory representative. A copy of all start-up reports will be due before final pump station acceptance.
- (n) On-site training by a qualified factory representative is required for all equipment.
- (o) An eight foot high green vinyl coated galvanized steel chain link fence with green privacy slats for restricted access to the site and equipment with a twelve foot wide double- leaf access gate is required at all sites. Wire gauge shall be No. 9 minimum with 2 ½ inch minimum OD vinyl coated posts and 1 5/8 inch minimum OD vinyl coated top rails. Corner posts shall be 3 inch minimum OD vinyl coated and gate posts shall be 4 inch minimum OD vinyl coated. Fence shall be no less than 10' from property/easement line.
- (p) A potable water source with freeze proof yard hydrant shall be provided at site. A 24 inch square concrete pad shall be installed at the base of the yard hydrant. This must be a metered water service from the City of Raleigh unless approved otherwise by the Public Utilities Director.
- (q) Backflow prevention devices shall be provided for the water source per City of Raleigh standards. The unit shall be housed in a heated fiberglass enclosure, above grade. All backflow prevention devices are to be tested by installer and copy of test results provided at final inspection.
- (r) Warranty on all equipment shall commence when the City accepts the pump station for operation.
- (s) All sewer force main valve box caps must be marked SEWER.

- (t) The contractor shall provide the owner with a minimum of three sets of operating and maintenance manuals for all equipment. Manuals must be original as provided by the manufacturer and bound. Spare parts as required by the City of Raleigh shall be boxed for long term storage with part numbers and identification labels. Items subject to handling damage will not be accepted if factory packaging has been opened. All manuals and spare parts are to be turned over at final inspection and acceptance of the pump station.
- (u) A screened vent shall be provided for the wet well. The vent shall be sized by the engineer for the wet well and installed so that gases are directed away from equipment. The vent shall be 4" min. size and supplied with a stainless steel insect screen.
- (v) An aluminum panel backboard and weather hood mounted on galvanized posts with concrete standing pad is required for electric service and telemetry equipment. The weather hood shall be equipped with work lights and a convenience receptacle with weatherproof covers.
- (w) Wet well components must be located such that normal maintenance can be performed without having to physically enter the wet well.
- (x) The site shall have a minimum of one overhead area light with switch and photocell. Weather hoods over panels shall be provided with lights.
- (y) All bolts, mounting brackets, pump lifting chains, etc., shall be of proper corrosion resistance and sized and mounted to support applicable loads.
- (z) New installations are required to meet the latest revised OSHA standards at the time of final acceptance. The contractor shall provide and install all site specific OSHA required labels and signs for the site.
- (aa) The pump station shall have a high wet well alarm in the form of a horn and a light beacon. The horn shall be capable of being silenced through the telemetry system. The alarm light shall be red and mounted so as to be visible in a 360 degree radius.
- (bb) The pump station shall be located three feet above the 100-year flood elevation. 100 year flood elevations shall be shown on the plans.
- (cc) All wet wells shall be internally factory lined with a polyurea/polyurethane coating. **Duramer 1030 shall be applied in** one coat of a 20% solids, deeply penetrating, dual-component polyurea primer (.5-1.0 mils dry film thickness, 150 ft²/gal), one intermediate coat of a dual component polyurea (50-100 mils dry film thickness, 50 ft²/gal) and one top coat of a 65% solids, two-part polyurea (7.5-10 mils dry film thickness, 125 ft²/gal). **All coats shall be applied by brush, spray, or roller. Sherflex Elastomeric Polyurethane shall be applied according to manufacturer's recommendations. Polyurea/polyurethane coatings shall be Duramer 1030 as manufactured by SewerKote, Sherflex Elastomeric Polyurethane as manufactured by Sherwin-Williams, or approved equal.**
- (dd) Landscaping shall be provided in accordance with the City landscaping ordinance.

- (ee) Pump station components that are submitted for installation are to be the latest models by City approved manufacturers.
- (ff) “As Built” plans, digital and paper of the pump station, access easement, force main indicating discharge point, all valves and air releases in force main, and initial float elevation settings must go to the City of Raleigh Public Works Department and the Public Utilities Department.
- (gg) The engineer or contractor shall forward shop drawing submittals for the generator, transfer switch, and package pump station to the City of Raleigh Public Utilities Department for review.
- (hh) Pump Stations will not be allowed to discharge to another pump station under any circumstance.
- (ii) Site visits by City personnel will be required and scheduled as follows;
 1. Before final plan approval,
 2. When pumps are set,
 3. Pump and generator startup testing,
 4. Final Inspection, and when flow is applied and station is ready for service.

8) **Requirements for Pump Station Pumps**

- (a) Multiple pumps (minimum of 2). The pump station must be able to deliver peak flow with the largest pump out of service. The peaking factor shall be 2.5.
- (b) Pump-on/Pump-off elevations shall be set such that 2-8 pumping cycles per hour may be achieved in the pump station at average flow.
- (c) A spare rotating assembly consisting of impeller, key, nut, washer, and mechanical seal shall be included with each pump. A spare impeller, key, nut, and washer of opposite rotation than assembly shall also be furnished.
- (d) A spare electric pump motor shall be provided with the pump station.
- (e) The pumps must be equipped at a minimum with dry contacts for SCADA purposes indicating run time, O/L tripped, pump breaker tripped, priming failure, lag pump start, high wet well, three phase power fail and control power fail for remote telemetry purposes.

9) **Requirements for Pump Station Permanent Standby Generators.**

- (a) The generators shall be sized to sequentially start all pumps and operate all equipment at the site.
- (b) The generators shall be equipped with an automatic transfer switch to start generator and transfer load to emergency in case of utility under-voltage, over-voltage, power loss, phase reversal, or phase loss.
- (c) There shall be a fuel tank with the capacity to run the generator a minimum of 24 hours with a 100% load. Fuel tanks shall be UL listed double wall with leak

detection. Low fuel and leak detection status shall be available both at the site and through the SCADA.

- (d) At time of acceptance of operation by the City of Raleigh, the contractor shall be responsible for topping off the fuel tank.
- (e) The generators shall be equipped with a 304 stainless steel (including all internal components), critical grade exhaust silencer. The silencer shall be equipped with a rain cap and all connections, pipes, nuts, bolts, etc., which shall be 316 stainless steel.
- (f) There shall be dry contacts provided to indicate engine run, common engine fail, common engine warning, transfer switch position, utility power loss, low fuel level, and fuel tank leak for remote telemetry purposes. More items may also be required based upon the site.
- (g) The owner shall be furnished with one complete set of spare air, oil, and fuel filters for the generator. The owner shall also be furnished with one set of spare accessory belts.
- (h) The owner shall be given three copies of the O&M and parts manuals specific for the generator unit and the automatic transfer switch.
- (i) The automatic transfer switch shall have a disconnect on the utility service main side.
- (j) The generator set, controls, and transfer switch shall be furnished by a single supplier. The supplier shall be the authorized dealer of the engine-generator set manufacturer and shall be fully qualified and authorized to provide service and parts for the engine and generator at any time during the day or night. The supplier must be located within a 100 mile radius of the site.

10) **Electrical requirements for the pump station**

- (a) All electrical work shall conform to the latest NEC and local guidelines.
- (b) Control panels shall be labeled as an assembled panel and bear the UL label.
- (c) Sewage pump station utility voltage shall be 480 volt three phase power.
- (d) All wiring shall be identified at each termination. Wiring shall have a unique wire number and shall be labeled at both ends. Wire numbers shall correspond with equipment terminal wire numbers as indicated in the accepted shop drawings. Where no wire numbers are indicated, the contractor shall advise the engineer in writing prior to assigning wire numbers. Wire numbers shall not be duplicated.
- (e) For instrumentation wiring, the contractor shall provide on the shop drawings, a schedule indicating the wire number, color code if applicable, origin and destination devices, and terminals.

- (f) Conductor insulation color coding: (Tape for identification shall only be allowed on conductors larger than #6 AWG.)

| | | |
|----------------------|---------|--------|
| 480 Volt AC Power | Phase A | Brown |
| | Phase B | Orange |
| | Phase C | Yellow |
| | Neutral | White |

| | | |
|-------------------------------------|---------|-------|
| 120/208 or 120/240 Volt Power | Phase A | Black |
| | Phase B | Red |
| | Phase C | Blue |
| | Neutral | White |

| | | |
|----------|---------------|-------|
| DC Power | Positive Lead | Red |
| | Negative Lead | Black |

| | | |
|------------|------------|------|
| DC Control | All wiring | Blue |
|------------|------------|------|

| | | |
|-----------------|--|--|
| 120 VAC Control | Single conductor 120 VAC control wire shall be RED except for a wire entering a motor control center compartment or control panel which is an interlock. This conductor shall be color coded YELLOW. | |
|-----------------|--|--|

| | | |
|-----------------|------------|--------|
| 240 VAC Control | All wiring | ORANGE |
|-----------------|------------|--------|

| | | |
|-------------------------------|------------|-------|
| Equipment Grounding Conductor | All wiring | Green |
|-------------------------------|------------|-------|

- (g) Phase sequence shall be A-B-C from rear to front, top to bottom, or left to right when facing the equipment.
- (h) The use of rigid hot-dipped galvanized steel or rigid aluminum electrical conduit is required. The contractor shall apply a section of heat shrink tubing to the conduit extending through and 12" above and below concrete pads.
- (i) All panels shall be lockable and rated NEMA 4X minimum.
- (j) Weatherproof, insulated throat "Meyers" hubs shall be used on all conduit entries to panels, boxes, and devices without integral hubs.

- (k) All equipment shall be NEMA rated, IEC will not be accepted.
- (l) All electrical and control panels shall have weatherproof identifying labels attached with stainless steel screws, adhesive will not be acceptable.
- (m) All electrical conduits from wet well to control panel must be sealed to prevent gas entry to control panel or pump house enclosure. This only applies to conduit that enters the wet well area.
- (n) No electrical junction boxes or splices are permitted in the wet well.
- (o) All branch circuit panels shall have a typed index identifying breakers. Spare breakers are to be labeled "spare."
- (p) The owner shall be provided one complete set of spare fuses.
- (q) Conduit size, origin, destination, wire size and number of wires shall be shown on the plans.

CITY OF RALEIGH, BASIC TWO PUMP SEWAGE LIFT STATION MONITOR POINTS

| DATA TYPE | DEFINITION | CONTROL HOOKUP |
|------------------|------------------------------------|---|
| DI | CONTROL AC POWER FAIL | DRY CONTACT ON RELAY POWERED BY LOAD SIDE OF CONTROL CIRCUIT PROTECTED BY PHASE MONITOR THAT BREAKS CONTROL CIRCUIT |
| DI | HIGH WETWELL | DRY CONTACT ON HIGH WETWELL RELAY AND SEPARATE DIRECT FLOAT |
| DI | PUMP 1 BREAKER TRIPPED | DRY CONTACT ON RELAY POWERED BY LOAD SIDE OF BREAKER OR INTERNAL TO BREAKER |
| DI | PUMP 2 BREAKER TRIPPED | DRY CONTACT ON RELAY POWERED BY LOAD SIDE OF BREAKER OR INTERNAL TO BREAKER |
| DI | PUMP 1 O/L TRIPPED | AUX. DRY CONTRACT ON O/L |
| DI | PUMP 2 O/L TRIPPED | AUX. DRY CONTRACT ON O/L |
| DI | PUMP 1 RUNNING | AUX. DRY CONTACT ON MOTOR STARTER |
| DI | PUMP 2 RUNNING | AUX. DRY CONTACT ON MOTOR STARTER |
| DI | PUMP 1 PRIME FAIL | DRY CONTACT, MANUFACTURER PROVIDED |
| DI | PUMP 2 PRIME FAIL | DRY CONTACT, MANUFACTURER PROVIDED |
| DI | LAG PUMP RUNNING | DRY CONTACT, MANUFACTURER PROVIDED |
| DI | PM VISIT | ON DOOR OF RTU OR MOUNTED SWITCH |
| DI | GEN. RUN & HOUR METER | DRY CONTACT GENERATOR RUN RELAY |
| DI | GEN. FAIL, COMMON FAULT | DRY CONTACT COMMON FAULT RELAY |
| DI | GEN. WARNING, COMMON FAULT | DRY CONTACT COMMON WARNING RELAY |
| DI | TRX SWITCH EMERG/UTILITY POSITION | DRY CONTACT, TRX. SWITCH |
| DI | TRX SWITCH UTILITY POWER AVAILABLE | DRY CONTACT, TRX. SWITCH |
| DI | GEN. FUEL LOW | DRY CONTACT, MANUFACTURER PROVIDED |
| DI | GEN. FUEL TANK LEAK | DRY CONTACT, MANUFACTURER PROVIDED |
| DO | HIGH WETWELL HORN SILENCE | RELAY TO SILENCE ALARM HORN, NEEDS SCRIPT IN SCADA TO RESET AFTER 1 HOUR |

Alarm wiring to be # 14 stranded MTW blue color. Pull alarm wiring in separate conduit from AC power circuits. Conduit size for alarm circuits to be min. 1" from PS control to RTU, 1" from generator to RTU and ¾" from ATS to RTU.

These are basic points; site specific points will need to be addressed.

CITY OF RALEIGH, NEW SEWAGE PUMP STATION CHECKLIST

SITE:

THIS MUST BE COMPLETED IN FULL BEFORE CITY OF RALEIGH WILL ASSUME OPERATION AND MAINTENANCE OF SITE.

| DATE | ITEM | COMMENTS | INITIAL |
|------|------------------------------------|----------|---------|
| | AS BUILT PLANS PS & FORCE MAIN | NOTE 1 | |
| | O&M MANUALS PS | NOTE 2 | |
| | O&M MANUALS GEN. & TRANSFER SWITCH | NOTE 2 | |
| | O&M MANUALS CHEMICAL FEED | NOTE 2 | |
| | O&M MANUALS AIR RELEASE VALVES | NOTE 2 | |
| | SPARE PARTS PUMP STATION | NOTE 3 | |
| | SPARE PARTS GENERATOR | NOTE 4 | |
| | SPARE PARTS FUSES | NOTE 6 | |
| | RPZ TEST REPORT | | |
| | GENERATOR START-UP TEST REPORT | | |
| | PS START-UP TEST REPORT | | |
| | CHEMICAL FEED START-UP TEST REPORT | | |
| | SITE ADDRESS | | |
| | KEYS, ELEC PANELS, GENERATOR, ETC. | NOTE 7 | |
| | UTILITY BILLING ELECTRICAL SERVICE | NOTE 5 | |
| | UTILITY BILLING WATER SERVICE | NOTE 5 | |
| | | | |
| | | | |
| | | | |

NOTES:

1. Provide 1 hard paper, 1 digital on CD
2. Provide 3 copies O&M, original and bound
3. Provide 1 pump motor, 1 rotating assembly consisting of CW impeller and seal. Provide 1 CCW impeller key, nut and washer, 1 mechanical seal, gaskets
4. Provide 1 set belts and air, fuel and oil filters
5. Provide account info, so City can assume account
6. Provide 1 complete set of each type and size used
Provide 3 minimum

g. Grease Interceptors and Oil Separators

- 1) All food service establishments and vehicle maintenance facilities shall have devices installed for separating and retaining grease and oils known as grease interceptors or separators approved by the Public Utilities Department. Operators of establishments whose grease interceptors or oil separators are not adequately maintained to prevent floatable oils, fats, and grease from entering the sanitary sewer system shall be notified in writing of any noncompliance and required to take corrective action.
 - 2) All food service establishment and vehicle maintenance facility grease interceptors or oil separators shall be subject to review, evaluation, and inspection by City of Raleigh Public Utilities representatives.
 - 3) Food service establishment and vehicle maintenance facility operators who continue to violate the City of Raleigh grease program requirements will be subject to enforcement provisions of the Raleigh City Code.
 - 4) Food service establishment and vehicle maintenance facility operators whose operations cause or allow excessive grease and oil to discharge or accumulate in the City of Raleigh sanitary sewer collection system may be liable to the City of Raleigh for costs related to line blockages, line cleanings, line and pump repairs, etc., including all labor, materials, and equipment. Food service establishment and vehicle maintenance facility operators that fail to pay the related charges will be subject to enforcement provisions of the Raleigh City Code.
 - 5) Regularly scheduled maintenance of grease interceptors and oil separators is required to ensure adequate operation.
 - a. All grease interceptors shall be completely pumped out at a minimum frequency of once per thirty calendar days, unless a variance is allowed for less frequent pumping or a pretreatment discharge permit has been issued specifically for these devices.
 - b. For exterior grease interceptors the City of Raleigh recommends cleaning to be done when 75% of the retention capacity of the device has been reached. (Or when 25% of the total volume of the grease trap is comprised of grease and solids.)
- 1) The owner and leaseholder shall be responsible for ensuring that no waste or wastewater pumped from the grease interceptor or oil separator is reintroduced back into the device. This is a violation of the City of Raleigh Sanitary Sewer Use Ordinance and will result in enforcement action.
 - 2) Any food service establishment or vehicle maintenance facility whose grease interceptor or oil separator effluent discharges to the sanitary sewer collection system is determined by the City of Raleigh to cause interference in the conveyance or operation of the sanitary sewer collection system may be required to sample the wastewater discharge and have it analyzed for oil and grease at the expense of the owner and leaseholder. Results of such analyses shall be reported to the City of Raleigh Public Utilities Department.

- 3) All grease interceptors and oil separators shall be designed, installed, and maintained to allow for complete access for inspection and maintenance of the inner chamber(s) and sampling of effluent wastewater discharged to the sanitary sewer. (Landscaping shall not prevent or inhibit access to the grease interceptor or oil separator.)
- 4) Standards for New Facilities

All new food service establishments or vehicle maintenance facilities shall be required to install an adequately sized grease interceptor or oil separator. Below are the recommended sizing procedures. Other sizing criteria may be considered but should be justified. Variances to the tank size requirements may also be considered if the space available does not allow for the installation of the appropriate sized grease interceptor (see Variance Procedures below).

Sizing Procedure for Food Service Establishments (FSE's)

1) A minimum size shall be 1,000 Gallons.

2) The equation used to for sizing is:

$$\text{Volume of Grease Interceptor (gallons)} = [(A \times B) + C + D] \times F$$

“A” is GPM/fixture:

These values are derived from the Manning’s Equation. The Manning’s Equation takes into account the slope; roughness of the pipe, and pipe diameter size. Listed below are the drainage rates of various pipe diameters using the Manning’s Formula:

| Pipe diameter (inches) | GPM/Fixture |
|------------------------|-------------|
| .5 | .8 |
| 1.0 | 5.0 |
| 1.5 | 15 |
| 2.0 | 33 |
| 2.5 | 59 |
| 3.0 | 93 |

“B” is the Fixture Rating of Greasy Waste Streams

Fixtures that have more grease in their waste stream received higher values while less grease corresponds to a lower rating. The table is shown below:

Table of Common Commercial Kitchen Fixtures and their Corresponding Rating:

| Fixture | Rating |
|-----------------------------------|--------|
| 2 or 3 compartment pot sink | 1.0 |
| 1 or 2 compartment meat prep sink | .75 |

| | |
|--|-----|
| Pre-rinse sink | .75 |
| Wok/tilt kettle | 1.0 |
| 1 or 2 compartment vegetable prep sink | .1 |
| Floor Drain | 0 |

“C” is the Direct Flow from Dishwashers, Sanitizers, Garbage Disposal, Food Waste Grinders, or Glass Washers – These flows must be added directly to the GPM flow.. The manufacturer’s peak discharge rate for flow in GPM must be used.

“D” is the Flow from Can Washes and Mop Sinks – Can washes and mop sinks are typically used intermittently. For the purpose of sizing, 7 GPM will be used for can washes and mop sinks.

“F” is the Twenty-four (24) Minute Retention Time

Example #1: A restaurant with the following fixtures (all fixtures have a 1.5” pipe dia.):

- (1) 3-comp pot sink
- (1) pre-rinse sink
- (1) 2- compartment vegetable prep sink
- (1) dishwasher that discharges 5 GPM
- (1) can wash

1) Use the above formula:

$$\text{Volume of Grease Interceptor (gallons)} = [(A \times B) + C + D] \times F$$

2) Solve for A,B,C, D and F

“A” is 15 GPM/Fixture because the pipe diameter is 1.5” (See table above)

“B” is the Fixture Rating

| Fixture | Rating |
|--|-------------|
| 2 or 3 compartment pot sink | 1.0 |
| Pre-rinse sink | .75 |
| 1 or 2 compartment vegetable prep sink | .1 |
| Total (“B”) = | 1.85 |

“C” is the Direct flow from Dishwashers etc.

The Dishwasher Discharges 5 GPM so “C” = 5GPM

“D” is the Flow From the Can Wash 7GPM

“F” is the 24 min Retention Time

3) Solve the Equation

$$\text{Volume of Grease Interceptor (gallons)} = [(15 \times 1.85) + 5 + 7] \times 24 \text{ minutes} = 954 \text{ gallons}$$

Round up to the minimum size of 1000 gallons.

Example #2: A restaurant with the following fixtures:

At 1.5 inch pipe diameter:

- (1) 3-comp pot sink
- (2) meat prep sinks
- (1) vegetable prep sink
- (1) pre-rinse sink
- (1) dishwasher that discharges 10 GPM
- (1) can wash

1) Use the above formula:

$$\text{Volume of Grease Interceptor (gallons)} = [(A \times B) + C + D] \times F$$

2) Solve for A,B,C, D and F

“A” is 15 GPM/Fixture because the pipe diameter is 1.5” (See table above)

“B” is the Fixture Rating

| Fixture | Rating |
|---------------------|-------------|
| 3 comp pot sink | 1 |
| Meat prep sink | .75 |
| Meat prep sink | .75 |
| Vegetable prep sink | .1 |
| Pre-rinse sink | .75 |
| Total “B”= | 3.35 |

“C” is the Direct flow from Dishwashers etc.

The Dishwasher Discharges 10 GPM so “C” = 10GPM

“D” is the Flow From the Can Wash 7GPM

“F” is the 24 min Retention Time

3) Solve the Equation

$$\text{Volume of Grease Interceptor (gallons)} = [(15 \times 3.35) + 10 + 7] \times 24 \text{ minutes} = 1,614 \text{ gallons}$$

Round up to the next available size: 2000 gallons.

Sizing Procedure for Single Fixture Only

When the space available does not allow for the installation of an exterior grease interceptor, sizing based on fixture size may be considered. A single fixture is considered a utensil wash sink, prep sink, culinary sink or other fixture where wastewater is discharged through a single outlet that contains fats, grease or oils.

- Step 1** Determine the cubic contents of the fixture by multiplying length x width x depth.
- Step 2** Determine the capacity in gallons. 1 gallon = 231 cubic inches.
- Step 3** Determine the actual drainage load. The fixture is usually filled to about 75 percent of capacity with wastewater. The items to be washed displace

about 25 percent of the fixture content. Actual drainage load = .75 x (fixture capacity)

Step 4 Determine the drainage period (usually 1 or 2 min) and calculate the flow rate in GPM equal to or greater than 75 percent of the fixture capacity.

Step 5 Select the grease separation device that matches the calculated design flow rate.

Sizing Procedure for Vehicle Maintenance Facilities

The minimum size is 1,000 gallons

Where automobiles are serviced, greased, repaired, or washed or where gasoline is dispensed, oil/water separators shall have a minimum capacity of 6 cubic feet for the first 100 square feet of area to be drained, plus 1 cubic foot for each additional 100 square feet of area to be drained into the oil/water separator.

Note: Parking garages in which servicing, repairing, or washing is not conducted, and in which gasoline is not dispensed, shall not require an oil/water separator. Areas of commercial garages utilized only for storage of automobiles are not required to be drained through an oil/water separator.

- (a) No new food service establishment or vehicle maintenance facility will be allowed to discharge wastewater to the City's collection system until an adequately sized grease interceptor, or oil/water separator is installed and approved by the Public Utilities Department.
- (b) All grease interceptors and oil/water separators must have each chamber directly accessible from the surface for servicing, maintaining, and sampling the device.
- (c) A basket, screen, trap, or other intercepting device shall prevent passage into the drainage system of solids one-half (1/2) inch or larger in size. The basket or device shall be removable for cleaning purposes.
- (d) All fixtures and drains receiving food service or vehicle maintenance wastewater shall pass through a grease interceptor or separator.
- (e) All new buildings or strip centers containing spaces designated for commercial enterprise are encouraged to provide a stub-out for a separate grease line to accommodate future grease interceptor or oil/water separator installation.
- (f) The owner of a new strip center shall provide suitable property space and sewer gradient that will be conducive for the installation of an exterior, in-ground grease interceptor(s) or oil/water separator(s) for any flex space contained within the strip center. Physical property restrictions and sewer gradient shall not be a defense for failure to install an exterior, in-ground grease interceptor or oil/water separator.
- (g) If a grease waste system is provided for a strip center a minimum 1,000 gallon capacity per food service establishment shall be added for the total size of the installed system. 4 food service establishments = a 4,000 gallon interceptor. A sizing calculation shall be provided for each potential food service establishment on the interior completion. A letter from the management company shall be provided on the plumbing plan sheet (8.5" x 11" attachments will not be accepted) accepting responsibility for the operation, maintenance, and any fines associated

with the grease interceptor(s). This agreement should follow in perpetuity to all property owners.

(h) All oil/water separators that are constructed of porous material must be coated with corrosion resistant epoxy to ensure that the tank will not leak. (Concrete oil separators must be coated with corrosion resistant epoxy.)

(i) Mobile food establishments in a vehicle, cart, or trailer are typically required by the local health department to service these vehicles, trailers, or carts at a regulated commissary kitchen. Please note, these commissary kitchens are considered to be food service establishments and must adhere to the same grease interceptor requirements.

5) Standards for Existing Facilities

(a) All existing food service establishments and vehicle maintenance facilities shall have grease interceptors or separators approved by the Public Utilities Director. Food service establishments and vehicle maintenance facilities without a grease interceptor or separator will be given a compliance deadline of six months from date of notification to have approved and installed a grease interceptor or separator. Failure to do so will be considered a violation of the City of Raleigh Sanitary Sewer Use Ordinance and may subject the facility to penalty assessments and/or service termination.

(b) In the event an existing food service establishment's and/or vehicle maintenance facility's grease interceptor or separator is either undersized or substandard in accordance with this ordinance, the owner and/or leaseholder will be notified of the deficiencies and required improvements, and given a compliance deadline of six months to conform to the requirements of this Ordinance. Failure to do so will be considered a violation of the City of Raleigh Sanitary Sewer Use Ordinance and may subject the facility to penalty assessments and/or service termination.

(c) For cases in which outdoor in-ground grease interceptors are infeasible to install, existing food service establishments will be required to install adequate interior grease traps approved by the Public Utilities Department for use on individual fixtures including dishwashers, sinks, and other fixtures and drains that potentially contain grease (See specifications section G.9. "Sizing Procedure for Single Fixture Only" above).

(d) Sizing of grease interceptors and separators shall be determined in accordance with procedures under specification section G.9.

(e) The exclusive use of enzymes, emulsifiers, etc., is not considered an acceptable grease interceptor or separator maintenance practice.

(f) All new and existing food service establishments or vehicle maintenance facilities shall comply with these provisions as well as all applicable NC State plumbing codes.

(g) Food Service Establishments or Vehicle Maintenance Facilities that are located in grease intensive areas or are out of compliance on a regular basis may be issued a pretreatment discharge permit with a mandated pumping frequency.

6) Maintenance, Reporting & Record Keeping

(a) Maintenance records shall be maintained onsite where the grease interceptor or oil/water separator is located for a period of three years.

(b) Grease interceptor maintenance records must include the following information.

- FSE name and physical location
- Date and time of grease interceptor service
- Name of grease interceptor service company
- Name and signature of person doing said service
- Established service frequency and type of service (Example Full pump out, partial pump out, on site treatment, etc.)
- Number and size of each grease interceptor serviced
- Approximated amount, per best professional judgment, of grease and solids removed from each grease interceptor
- Total volume of waste removed from each grease interceptor
- Destination of removed wastes, food solids, and wastewater disposal

(c) Maintenance records that do not include all the above information will be considered incomplete. Incomplete records are considered a violation of the City of Raleigh Sanitary Sewer Use Ordinance and may subject the facility to penalty assessments and/or service termination.

(d) Facilities for which a specific pretreatment permit has been issued will follow the requirements for maintenance and record keeping as stated in the permit.

12) Variance to Tank Sizing Requirements

(a) Variance Requests are intended to give food service establishments and vehicle maintenance facilities an avenue to provide substantial evidence to reduce the size of the grease interceptor or oil separator. Said variance only applies to the size of the grease interceptor or separator. All other requirements of the City of Raleigh Sanitary Sewer Use Ordinance, NC plumbing code, or City of Raleigh Public Utilities Handbook remain in effect.

(b) Food service establishments and vehicle maintenance facilities shall provide a written explanation for the need to vary from the grease interceptor and/or separator requirements. All establishments requesting a variance shall agree to conform to the given variance stipulations. The City of Raleigh Public Utilities Department has the right to dismiss the variance at any time the grease separation device discharge adversely affects the sanitary sewer collection system and treatment works.

Correspondence from the Public Utilities Department must be obtained prior to plan submittal for a building permit.

(c) The variances request shall be made to the City of Raleigh Public Utilities Department regarding size and shall include at a minimum;

Facility location, menu items, seating capacity, facility square footage, appliance/fixture inventory, service type (single or full service), hours of operation, sizing calculation based on G.9, general plumbing description, and site plan or description. In addition, all variance requests must include a detailed future operation and maintenance plan that identifies the operational constraints, maintenance schedule and oil and grease waste disposal procedures.

(d) Establishments that have been granted variances may be subject to having the allowed variance rescinded if the operation of the establishment changes in any way or if the wastewater discharge from the establishment begins to interfere with the sanitary sewer collection system.

2. SEWER DESIGN – PRIVATE

Private sewer collection systems with a flow rate of 200,000 GPD or more must apply to the NC Division of Water Quality for an operating permit. Please refer to Appendix F for a definition of what constitutes a private collection system. Private sewer collection systems located within the Raleigh Utility Service Area and proposed for connection to the City's public system now or in the future shall conform to all the public system standards listed within this document with the following conditions:

- a. Private sewer collection lines shall not be required to be located in public road right-of-way or publicly dedicated easements.
- b. Change of direction or slope for private 6-inch sewers does not require manholes but does require cleanouts.
- c. Cleanouts shall not be used for connection of private collections systems to public mains. Manholes are required.
- d. Private sewers shall not be sized to handle any off-site sewer flows.
- e. Ductile iron or PVC must be used with a minimum diameter of 6-inches.
- f. Profile drawings will not be required for 6 inch lines however, equivalent information must be provided on detail engineering plans such as minimum depth of cover, culvert elevations, slope, length of reach between manholes/cleanouts, pipe material, vertical separation of sewer from conflicting water main or storm drainage, etc. Profile drawings will be required for main sizes of 8 inch and larger. The minimum slope for 6" lines is 1.0%. Flow will be based on a half full pipe.

All new aerial sewer services shall be constructed of restrained joint pipe with a casing.

SEWER MATERIAL STANDARDS

I. GENERAL MATERIAL

Current specifications of the American Society for Testing Materials (ASTM), American Water Works Association (AWWA), the American National Standards Institute (ANSI), the American Association of State Highway and Transportation Officials (AASHTO), and Ductile Iron Pipe Research Association (DIPRA) shall apply in all cases where material is covered by an item in these specifications. All material used shall conform fully to these current standards or be removed from the job at the direction of the Public Utilities Director.

Pipe specimens shall be subjected to tests by an independent testing laboratory at such time as the Public Utilities Department may direct or as specified herein. Pipe not meeting these specifications will be ordered removed by the inspector, and such pipe shall be immediately removed from the job site and not transported to any portion of the project being constructed.

These specifications are not to be considered as proprietary in any way. When a particular brand is listed, it is only used as an aid in describing the type of material being requested.

2. PIPE MATERIALS (Gravity Mains Only)

a. Centrifugally Cast Fiberglass Reinforced Polymer Mortar (CCFRPM) Pipe

Centrifugally Cast Fiberglass Reinforced Polymer Mortar (CCFRPM) Pipe shall conform to ASTM D3262 for CCFRPM pipe manufactured of "Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) materials and to the following requirements.

1. CCFRPM pipe shall be as manufactured by HOBAS Pipe USA or approved equal.
2. CCFRPM pipe shall only be allowed for 18" diameter and larger pipe.
3. Pipe shall be suitable for laying condition as shown in standard detail S-1 at the depth indicated on the Drawings. Pipe manufacturer to verify pipe selection and document to the Engineer prior to ordering and manufacture of pipe.
4. Pipe shall conform to ASTM D2412 for minimum stiffness and external loading characteristics.
5. Couplings, fittings, and push-on joints shall be manufactured with flexible elastomeric seals conforming to the requirements of ASTM D4161 and ASTM F477 and shall meet or exceed the pipe class at the location of its installation.
6. Pipe joint shall be push-on type couplings unless specified otherwise.
7. Pipe shall meet the minimum requirements of ASTM D3681 and ASTM D3262. Manufacturer shall provide complete 10,000-hour test results on pipe produced at the proposed location of manufacture. Results shall reflect that the pipe has a minimum allowable strain of no less than .9% at fifty years when tested in accordance with ASTM D3681 and ATM 3262
8. Normal production pipe for this project shall not incorporate raw materials that are not in compliance with ASTM D3681 and ASTM D3262
9. Interior of the pipe shall be manufactured using a non structural resin with a minimum allowable elongation of 50% when measured in accordance with ASTM D638. The liner nominal thickness shall be 40-mils.
10. Exterior pipe surfaces shall be comprised of a layer of sand and resin to provide UV protection to the exterior.

11. For pipe installed in steel encasement pipe joint shall be flush type and capable of meeting the above requirements.

b. Ductile Iron Pipe and Fittings

Ductile iron pipe and fittings used for sanitary sewers shall be manufactured in accordance with AWWA Standards C-150 and C-110 respectively. The minimum pressure class pipe shall be class 250 or a greater class may be required based upon the depth of cover and laying conditions. Pipe shall be supplied in 18 or 20 foot nominal lengths. Pipe and fittings shall have a minimum working pressure of 250 psi, and minimum iron strength of 30,000 psi. Ductile iron may be used for any sewer main 8-inch and larger. Pipe joints shall be the "Push-on" type manufactured in accordance with AWWA Standard C-111-95.

Interior Linings for Ductile Iron Force Mains and Sewer Interceptors

All force mains, fittings, and gravity interceptors 12-inches and larger shall be lined with an amine cured novalac ceramic epoxy containing at least 20% by volume of ceramic quartz pigment. The lining material shall have a permeability rating of zero when tested in accordance with Method A – ASTM E96-66, Procedure A with test duration of 30 days. The lining shall be applied by a competent firm with a successful history of applying linings to the interior of ductile iron pipe and fittings. Within 8 hours of surface preparation, the interior of the pipe shall receive 40 mils nominal DFT. No lining shall take place when the substrate or ambient temperature is below 40° F. The surface shall also be dry and dust free. The lining shall not be used on the faces of the flanges (if applicable).

Due to the tolerances involved, the gasket area and spigot end up to 6-inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum of PROTECTO Joint Compound or approved equal. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

The number of coats of lining material applied and the touch up and repair of the lining shall be as recommended by the manufacturer. The pipe manufacturer shall provide a certification attesting that the application meets or exceeds the requirements of these specifications.

Lining material shall be PROTECTO 401, or approved equal.

c. PVC Gravity Sanitary Sewer Pipe

PVC gravity sanitary sewer pipe and related fittings shall be manufactured in accordance with all the requirements of ASTM D-3034-98 SDR 35 Type PSM polyvinyl chloride sewer pipe and fitting. PVC gravity sewer pipe may be used for 8, 10, 12 or 15 inch mains and shall be supplied in 12.5 foot lengths with bell-and-spigot joints. ASTM F679-95 shall establish the requirements for 18, 21, 24 and 27-inch diameter PVC, SDR 35 gravity sewer pipe. The length of joints shall be at least 11 feet for the larger PVC pipe, unless approved differently by the Public Utilities Director. All fittings shall use rubber gaskets, which conform to the requirements of ASTM F477-99.

3. PIPE MATERIALS (Force Mains)

a. Ductile Iron Pipe and Fittings

All Ductile Iron sewer force mains shall be pressure class or thickness class ductile iron pipe designed in accordance with AWWA Standard C-150. Design shall be done for external and internal pressures separately, using the larger of the two for the next design thickness. An additional allowance shall be made for corrosion and casting tolerances. The thickness design for external and internal pressures shall use the following conditions:

- 1) 3 feet minimum cover or as shown on the plans;
- 2) Laying condition - Type 1;
- 3) A minimum working pressure of 150 psi for pipes 16 inches and smaller in diameter, and for 24 inches and larger pipe, the design working pressure shall be as determined by the Public Utilities Director, and
- 4) A surge pressure of 300 psi.

All calculations for thickness shall be in accordance with AWWA Standard C-150, and the calculations shall be submitted to the Public Utilities Director for approval prior to shipping any pipe. The minimum thickness shall be pressure class 350 for pipes 6 inches through 12 inches and pressure class 250 for pipes 16 inches and larger in diameter.

The ductile iron pipe shall be manufactured in accordance with all applicable requirements of AWWA Standard C-151. The ductile iron pipe shall be supplied in nominal lengths of 18 or 20 feet.

Ductile iron pipe shall be externally bituminous coated in accordance with AWWA C-151.

Pipe joints shall be mechanical or "push-on" manufactured in accordance with AWWA Standard C-111.

Each joint of ductile iron pipe shall be hydrostatically tested before the outside coating and inside lining are applied at the point of manufacture to 500 psi. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture or leakage of the pipe wall.

All materials used in the production of the pipe are to be tested in accordance with AWWA Standard C-151 for their adequacy within the design of the pipe, and certified test results are to be provided to the City upon request. All certified tests, hydrostatic and material are to be performed by an independent testing laboratory at the expense of the pipe manufacturer.

Push-on and mechanical joint pipe shall be as manufactured by the American Cast Iron Pipe Company, United States Pipe and Foundry Company, Griffin Pipe Products Company, McWane Cast Iron Pipe Company or approved equal.

Restrained joints shall be TR Flex or **HP LOK** as manufactured by U.S. Pipe, **Lok-Ring** or **Flex-Ring** as manufactured by American Pipe, Super-Lock as manufactured by Clow, **Bolt-Lok** or **Snap-Lok** as manufactured by Griffin or approved equal.

Interior Linings for Ductile Iron Force Mains

All force mains and fittings shall be lined with an amine cured novalac ceramic epoxy containing at least 20% by volume of ceramic quartz pigment. The lining material shall have a permeability rating of zero when tested in accordance with Method A – ASTM E96-66, Procedure A with test duration of 30 days. The lining shall be applied by a competent firm with a successful history of applying linings to the interior of ductile iron pipe and fittings. Within 8 hours of surface preparation, the interior of the pipe shall receive 40 mils nominal DFT. No lining shall take place when the substrate or ambient temperature is below 40° F. The surface shall also be dry and dust free. The lining shall not be used on the faces of the flanges (if applicable).

Due to the tolerances involved, the gasket area and spigot end up to 6-inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum of PROTECTO Joint Compound or approved equal. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

The number of coats of lining material applied and the touch up and repair of the lining shall be as recommended by the manufacturer. The pipe manufacturer shall provide a certification attesting that the application meets or exceeds the requirements of these specifications.

Lining material shall be PROTECTO 401, or approved equal.

b. Polyvinyl Chloride (PVC) Force Main Pipe and Fittings

Pipe and fitting size, pressure class and DR shall be as indicated on the drawings.

PVC Materials shall comply with ASTM D1784 with a cell classification of 12454-B.

PVC force mains 4"-12" shall conform to AWWA C900 and the following requirements:

1. outside diameter shall conform to Ductile Iron pipe.
2. Pipe shall be a minimum of pressure class 200 with a minimum standard dimension ration of DR14.
3. Pipe shall have plain end and elastomeric-gasket bell ends.
4. Fittings shall conform to AWWA C100 or C153 and have mechanical joints. Fittings shall be made of gray-iron or ductile iron. Interior of fittings shall be lined with Protecto 401 as specified above.

PVC force mains 14"-24" shall conform to AWWA C905 and the following requirements:

1. Outside diameter shall conform to Ductile Iron pipe.
2. Pipe shall be a minimum of pressure class 200 with a minimum standard dimension ration of DR14.
3. Pipe shall have plain end and elastomeric-gasket bell ends.
4. Fittings shall conform to AWWA C100 or C153 and have mechanical joints. Fittings shall be made of gray-iron or ductile iron. Interior of fittings shall be lined with Protecto 401 as specified above.

4. STEEL PIPE (AERIAL and BORED)

Steel pipe for aerial creek crossings shall be high strength steel, helical or straight seam welded manufactured in accordance with ASTM A 139 and consisting of grade “B” steel with a minimum yield strength of 35,000 psi. Thickness, diameter, and allowable spans shall be according to Detail S-12.

Boring installations shall be high strength steel, spiral welded or smooth-wall seamless manufactured in accordance with ASTM A252 and consisting of grade 2 steel with a minimum yield strength of 35,000 psi. The minimum inside diameter of steel encasements shall be eight inches greater than the inside dimension of the carrier pipe. The minimum casing pipe wall thickness shall be 0.375” for bored encasement and in accordance with the table provided below. Thicker encasement pipe may be required by the North Carolina Department of Transportation, railroads, or other agencies.

| Carrier Pipe Nominal Diameter (inches) | Encasement Minimum Inside Diameter (inches) | Encasement Nominal Wall Thickness (inches) |
|--|---|--|
| 6 | 14 | 0.375 |
| 8 | 16 | 0.375 |
| 10 | 18 | 0.375 |
| 12 | 20 | 0.375 |
| 14 | 24 | 0.375 |
| 16 | 26 | 0.500 |
| 18 | 30 | 0.500 |
| 20 | 32 | 0.500 |
| 24 | 36 | 0.625 |
| 30 | 42 | 0.625 |
| 36 | 48 | 0.750 |
| 42 | 56 | 0.875 |

The outside of steel pipe for aerial crossings shall be coated with 1 coat of a compatible acrylic polyurethane with a total dry film thickness of 2 – 5 mils per coat. The Acrylic Polyurethane coating shall be Tnemec Endura Shield Series 73, or approved equal. Primer shall be applied as recommended by the manufacturer.

No coatings required for buried or bored encasements but must conform to the noted wall thickness in the table above. All encasement pipe must be approved by the appropriate controlling agency (i.e. NCDOT, RR, etc.) prior to ordering the material.

All carrier piping shall be restrained joint ductile iron TR Flex as manufactured by U.S. Pipe, Lok-Ring or Flex-Ring as manufactured by American Pipe, Super-Lock as manufactured by Clow, Bolt-Lok or Snap-Lok as manufactured by Griffin or approved equal. One joint of restrained pipe must extend beyond the ends of the encasement pipe for boring installations. The restrained joint pipe shall be from manhole to manhole in aerial installations. The minimum inside diameter casing pipe shall be eight inches greater than the inside dimension of the carrier pipe.

Both ends of the casing shall be mortared. Metal "spider" pipe alignment devices shall be installed in all casings with a minimum of two spiders per pipe joint one fourth of the pipe joint length in from both the bell and spigot ends. See Detail S-39.

5. CURED IN PLACE PIPE LINING (CIPP)

CIPP lining may be allowed in lieu of replacing the existing downstream sewer main with Protecto 401 lined DIP or PVC pipe when a new forcemain discharges to an existing sanitary sewer main,

When allowed, the CIPP must adhere to the following specifications.

References:

The latest revision of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. American Society of Testing Materials (ASTM)
 - a. D790 Test Method for Flexural Properties of Unreinforced Plastics and Electrical Insulation Materials
 - b. D2412 Test Method for determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
 - c. F1216 Practice for Rehabilitation of Existing Pipe Lines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.

Fabricate a flexible tube to a size that when installed will neatly fit the internal circumference of the conduit specified. Allowance shall be made for circumferential stretching during insertion.

The minimum length shall be that deemed necessary by the contractor to effectively span the distance from the inlet to the outlet of the respective manholes. The contractor shall verify the lengths in the field before impregnation. Individual inversion runs can be made over one or more manhole sections as determined in the field by the contractor and approved by the Engineer.

Furnish a general purpose, unsaturated, polyester resin and catalyst system compatible with the reconstruction inversion process that provides the cured physical strengths specified. CIPP lining shall be Insituform by Insituform Technologies, INC., Inliner by Inliner USA, Inc., KM-Inliner by Spiniello Limited, Inc. or Cure-Line by pipelining Products, Inc. or approved equal.

Physical Strength:

| <u>U.S. Licensor Standard</u> | <u>Results</u> |
|--------------------------------|---------------------------------------|
| Flexural Stress | #101 (Modified ASTM D-790) 4,500 psi |
| Flexural Modulus of Elasticity | #101 (Modified ASTM D-790) 250,000psi |

Design Thickness:

The liner shall be designed in accordance with the applicable provision of the referenced ASTM standards as structural pipe linings for “fully deteriorated gravity pipe conditions” and shall meet the following design conditions:

1. AASHTO H-20 Live Load with two trucks passing for FFP in streets.
2. Soil weight 120 pounds per cubic foot. Coefficient of friction $K' = .130r$ for the installed depths.
3. Estimated maximum groundwater levels at the height of the manholes.
4. Service temperature range shall be 40-150 degrees F.

6. MANHOLES AND RELATED MATERIALS

Manholes will be precast reinforced concrete. Eccentric or concentric cones may be used on 8 through 12-inch mains. Concentric cones will be used on all 15 inch and larger mains. These different type manholes shall conform to these specifications and the City of Raleigh Standard Details. All manholes located outside public right-of-way must be **three feet** above the 100-year flood or be sealed as per Details S-24 & S-27. “Candy cane” vent stacks on sewer manholes must be “factory” fabricated and “hot dipped” galvanized, NOT field fabricated and galvanized. All manholes with vent stacks shall be water tight per Detail S-24. All Cam Lock manhole covers outside the 100-year flood plain must be vented with one 1-inch hole in the cover and as per Detail S-27. All manhole covers installed within streets, parking lots, and other paved areas shall have only one 1-inch hole, which shall be off center and fitted with a rubber grommet, unless seal-down manholes are required.

Interior Linings for Precast Reinforced Concrete Manholes

All sanitary sewer interceptor/outfall manholes **on lines 12-inches and larger**, and manholes receiving a sanitary sewer force main discharge shall be internally coated with a **polyurea/polyurethane coating. Duramer 1030** shall be applied in one coat of a 20% solids, deeply penetrating, dual-component polyurea primer (0.5 – 1.0 mils dry film thickness, 150 ft²/gal), one intermediate coat of a dual component polyurea (50-100 mils dry film thickness, 50 ft²/gal) and one top coat of a 65% solids, two-part polyurea (7.5-10 mils dry film thickness, 125 ft²/gal). All coats can be applied by brush, spray, or roller. **Sherflex Elastomeric Polyurethane shall be applied according to manufacturer’s recommendations.** Polyurea/polyurethane coatings shall be Duramer 1030 as manufactured by SewerKote, **Sherflex Elastomeric Polyurethane as manufactured by Sherwin-Williams**, or approved equal.

a. **Precast Reinforced Concrete Manholes**

The concentric and eccentric manholes shall be designed and manufactured in accordance with ASTM C478-97. Manhole diameters shall be 4, 5, or 6 feet in diameter as determined by the table within Sewer Design standards for main size or depth. The walls shall be a minimum of 5 inches thick and have a 6-inch minimum base. O-ring or "ram neck" joint seal shall be used for all manhole joints. All exterior joints shall be wrapped with a butyl resin sealant of 8” width. The "O" ring joint shall conform to the requirements of ASTM C443-98. A flexible rubber boot shall be supplied with the manholes to tie the pipe to the barrel section. These gaskets and clamps shall meet the requirements of ASTM C923. See Detail S-24 – S-27.

The manufacturer shall submit drawings showing the reinforcing, pipe openings and other details for approval by the Public Utilities Director. Also, the manufacturer shall provide

certified test reports indicating that the materials comply with the requirements of ASTM C478-97. "Extended base" precast sections must comply with Detail S-21 dimensions and equivalent reinforcing.

b. Related Materials

- 1) Manhole rings and covers shall be manufactured to the dimensions shown on the Details S-25 through S-27 and shall be made from Class 30 gray iron, meeting the requirements of ASTM A48-94ae1. All covers must be domestically cast and so indicated by manufacturer name and "USA" in castings. Covers shall have "DANGER PERMIT REQUIRED – CONFINED SPACE DO NOT ENTER" cast onto the face as shown in Detail S-25. All manhole rings on flat-top manholes shall be cast into the manhole top, as shall be the flange for the vent stack, if applicable. See Details S-24. **Cam Lock covers shall be used on all manholes that are within easements. See details 24 & 27.**
- 2) Manhole steps shall be made from reinforcing steel which is rubber plastic coated to provide for safer footing. These steps shall be furnished in accordance with the Detail S-28 and the applicable OSHA regulations. Steps shall also be provided on outside of raised manholes when top elevation is greater than three (3) feet above existing ground elevation. All traffic bearing castings must be Class 35 or greater.
- 3) Cement used in masonry or reinforced concrete units shall be Type I, CSA normal, meeting ASTM C150-99, unless otherwise approved by the Public Utilities Director.
- 4) Concrete shall be only plant-mixed or transit-mixed concrete conforming to ASTM C33-99ae1 as to aggregates and to ASTM C94/C94M-99e1 for ready-mixed concrete.

Concrete shall be of three types as based on 28-day compressive strength:

| | |
|---------|-----------|
| Type AA | 4500 psi. |
| Type A | 3000 psi. |
| Type B | 2500 psi. |

Concrete shall be air-entrained, unless specified otherwise, with 4 to 6% air. Retarders and accelerators shall be used only as directed by the engineer.

Concrete used for structures such as sewage lift stations and other reinforced concrete structures shall meet all applicable provisions of the NCDOT specifications regarding manufacturer, delivery and placement.

- 5) Steel reinforcing for concrete structures shall meet all applicable provisions of the NCDOT specifications as to manufacture, fabrication and placement.
- 6) Mortar used for sewer structures shall conform to ASTM specification C144-99 as to aggregate and strength. Mortar shall be prepared from cement in perfect condition and shall be prepared in boxes for that purpose. No mortar that has stood beyond forty-five minutes shall be used. Proportion by volume for different kinds of work shall be:

Brick Masonry - 1 part cement to 2 parts sand

Pointing - 1 part cement to 1 part sand

- 7) Rubber boot sleeves shall meet or exceed ASTM C923 for connecting pipes to thru the barrel section of the manhole. Boot sleeves shall have stainless steel expansion bands and pipe clamps that meet or exceed ASTM C923 and A167.
- 8) Manhole inverts shall be constructed with a width equal to that of the effluent pipe, height to the springline and invert “shelves” from that point upward at a 60 deg. angle to the manhole walls. The invert shall be brushed and troweled that a minimum energy loss occurs in the manhole from invert roughness. “Bowl” shaped invert will not be allowed.

7. MISCELLANEOUS MATERIALS

a. PVC Sewer Service Pipe

PVC sewer service pipe shall be schedule 40 PVC including the clean-out stack provided that a bronze clean-out slotted plug for location purposes.

b. PVC Sewer Pipe and Saddles

PVC sewer pipe, saddles and adapters shall conform to the requirements of ASTM D3034-98. The saddle shall be installed in accordance with Standard Details S-31 and S-32.

c. Sewer Air Release/Vacuum Breaker Valve Material

Air release/vacuum breaker valves on sewer force mains shall be in accordance with Detail S-9.

d. Concrete Structures and Access Hatches

All other concrete structures and access hatches installed within highway right of ways shall be H-20 load rated.

CONSTRUCTION SPECIFICATIONS FOR SEWER MAINS

As part of the requirement to obtain construction approval for sewer main extensions, the engineer shall affix the appropriate permit sticker to the original drawings. **The various permit stickers are included in appendix D.**

The requirements contained in this section shall apply to sanitary sewer main installations constructed for the Public Utilities Department or for private developers who may or may not dedicate the sewer improvements to the City. All necessary construction permits must be obtained before construction may begin in accordance with the North Carolina State Law. A sewer plug permit must also be obtained.

Any Contractor performing work within the City of Raleigh or City of Raleigh Merger Areas such as Garner, Knightdale, Wendell, Zebulon, Wake Forest, and Rolesville , shall have on each job site a copy of these specifications.

1. SCOPE OF WORK

- a. The contractor shall furnish all materials, equipment, and labor for excavation, installation, backfilling of sewer mains and related appurtenances as shown on the plans. The Public Works Department and/or Public Utilities Department shall conduct all City inspections on main extension projects.
- b. It shall be the contractor's responsibility to notify the Public Utilities and Public Works Departments at least twenty-four hours in advance of beginning any construction work on any project. The contractor must call the Public Utilities Department at 996-4540 and Public Works Department at 996-6810 and give the location, project name, individuals name, company name, start date and indicate if it involves a sewer extension and state the start date. Contractors must call the Public Utilities Inspections staff at 996-2737 at least twenty-four hours in advance for an inspection in the Garner, Knightdale, Wendell, Zebulon, Wake Forest, and Rolesville Utility area.
- c. Once construction has begun, the contractor shall contact Public Works at 890-3030 each morning by 9:00 a.m. to notify where and what will be done that day. The City requires a 24 hour notice prior to an inspection. Any work requiring inspector's observation outside of the normal work day, shall be charged at the current inspector hourly rate.
- d. **In all Sewer Bypass Pumping operations, a bypass plan sealed by a N.C. Professional Engineer must be submitted for approval to the Public Utilities Department prior to pumping operations (Plans may be submitted to administration staff at One Exchange Plaza, Suite 620, Raleigh, NC 27601) Pumps should be sized to handle the peak daily flow (2.5 times the average daily flow) for the line or area of work. The contractor shall secure pumps from a pump supplier according to the provided flow information. Pumping operations must be monitored 24 hours a day for each day of the pumping operation by qualified personnel in order to respond to problems or failures. 100% redundancy is required for pumping operations. In addition, back up pumps are to be connected to the bypass force main to facilitate immediate use upon failure of the primary pumps. Sewer service outages must be scheduled one week in advance and may not last longer than eight hours.**
- e. If a developer, engineer or contractor proceeds with the main installation prior to permit issuance the City requires the main to be reinstalled and the developer, engineer or

contractor shall be fully liable for all actions and costs, including prosecution by the City or the State for proceeding with installation prior to issuance of appropriate permit(s).

- f. "Field changes" are not considered approved by the Public Utilities Department unless revised plans have been submitted to the Public Utilities Department, reviewed and approved. Therefore, the contractor that proceeds with construction prior to this approval is at his/her own risk.
- g. Contractors working (excavation, boring, or other subsurface breach) around or in the vicinity of sewer force mains 8 inches in diameter or larger shall be required to physically spot the existing line to be verified by P.U.D. distribution staff or inspection staff. If other existing lines sizes are in question of conflict the contractor shall be directed by P.U.D. staff of the level of subsurface investigation needed to locate the existing line.

2. GENERAL TESTING REQUIREMENTS

- a. The City may perform and shall require the contractor to perform, such destructive and nondestructive testing, as it deems necessary in order to inspect the materials and workmanship. See specific testing requirements within this section. These tests shall be in accordance with the procedures established by ASTM and AASHTO. The City shall reserve the right to modify the procedures in testing ditch and backfill compaction to allow a deeper test to be made by using the sand-cone method and/or nuclear testing gauges.
- b. All new sanitary sewer mains must be cleaned to the satisfaction of the inspector by jetting or balling prior to final inspection and acceptance by the City.
- c. Prior to final inspection all sanitary sewer mains shall be camera inspected. In areas where the manholes are installed within the street, the camera inspection shall take place just prior to the final lift of surface course asphalt. Failed inspections will require a follow up inspection and subsequent re-inspection fee.

3. SEWER CONSTRUCTION PLUGS

- a. A sewer plug permit must be obtained prior to beginning construction. See General Policies and Regulation Section for application.
- b. Mechanical plugs (non-pneumatic) must be installed for the duration of construction of any sanitary sewer extension. Plugs are to be installed on the upstream end of the new main at the first manhole from the existing tie-in, until final acceptance.
- c. All plugs must be securely tied off with steel cable within the manhole and must have a secure marking attached to the plug indicating the utility contractor to whom the plug belongs.
- d. All plugs must be monitored during construction to insure the plug is functioning as required.
- e. Prior to removing the plug, the contractor must sign a plug removal form verifying that the sewer facilities are sufficient and functionally complete. All plugs must be removed by the contractor upon acceptance that the sewer facilities are sufficiently functionally complete

to accept flow and PRIOR to the mains above the plug location being placed into service and/or accepting any flow of sewage.

4. HANDLING AND STORAGE OF MATERIALS

- a. The contractor shall be responsible for the shipping and storing of all sewer materials. Any material which is damaged or defective shall be replaced by the contractor at the contractors' own expense.
- b. The loading and unloading of all pipe, manholes and other accessories shall be in accordance with the manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material.
- c. The contractor shall locate and provide the necessary storage areas for materials and equipment. If private property is being used for storage areas, then the contractor must have the written consent from the owner. Without this written consent, all material and equipment shall be stored within the existing rights-of-way and easements of the project. Pipe may not be prestrung along job site; it must be delivered to and removed from job site each day.
- d. All materials, once on the job site, shall be stored in accordance with the manufacturer's recommendations. All PVC sewer pipe shall be protected from the sun's ultra violet rays if stored on the job site longer than twenty days.
- e. All pipes shall be kept free of dirt and other debris. Any damage relating to the coating of the various materials for sewer and water mains shall be repaired in a manner approved by the City. Machined manhole frames and covers shall remain intact until construction is complete.
- f. The contractor shall be responsible for safeguarding and protecting all material and equipment stored on the job site. The contractor shall be responsible for the storage of materials in a safe and professional manner to prevent injuries, during and after working hours, until the project is complete.

5. BARRICADES, SIGNS AND STREET PROVISIONS

- a. Signs, barricades, warning lights, guard rails and flaggers shall be employed as necessary when construction endangers either vehicular or pedestrian traffic. These devices shall remain in place until the traffic may proceed normally again. The contractor shall hold the City harmless for any damages or injuries caused by the construction of sewer mains.
- b. Detours shall be set up and maintained by the contractor under the direction of the City of Raleigh Department of Transportation and North Carolina Department of Transportation. Notice must be given a week in advance of the detour so that necessary notification of the traveling public may be made. The contractor will furnish all barricades, signs, lights and other safety devices to protect his/her construction. The contractor is in no way relieved of liability for providing this protection because the detour is approved by others.
- c. Construction work zone signs and signing procedures shall conform to the MUTCD and supplements and to all applicable federal, state and local codes. The contractor shall be responsible for securing the necessary permits from the City's Transportation and

Inspections Departments for all work to be performed in the public rights-of-way.

6. PROPERTY PROTECTION

Trees, fences, poles and all other property shall be protected unless their removal is authorized, and any property not authorized for removal, but damaged by the contractor, shall be restored by the contractor to the owner's satisfaction. Existing manholes within the work zone and outside of the pavement shall be protected by orange safety fence.

7. GENERAL CONSTRUCTION SAFETY

- a. The contractor and any subcontractors shall be responsible for the total compliance with all federal, state and local ordinances, laws and regulations as related to safe construction practices and to protecting the employees and the public's health and safety.
- b. The contractor shall ensure that all Occupational Safety and Health Administration (OSHA) regulations and standards are followed during all phases of the construction project.
- c. The City shall not be responsible for contractor's adherence to OSHA regulations and standards. However, the City may report known violations or unsafe practices to the appropriate enforcement agency.
- d. The contractor shall furnish safety equipment necessary to inspect the work including, but not limited to ladders, gas detectors/oxygen sensors, blowers, etc.

8. ENCROACHMENT CONTRACTS AND PERMITS

- a. Prior to actual construction, the contractor shall acquire the necessary encroachments from NCDOT when working within the rights-of-way of state system roads or highways. The encroachment permit shall be kept on the job site at all times.
- b. The contractor shall be responsible for securing all other local and state and federal permits required for the utility construction. The contractor must have an approved set of permitted construction plans on site at all times.
- c. The contractor must have an approved set of permitted construction plans on site at all times.
- d. For projects which require construction plan approval, all environmental permits and NCDOT encroachments must be provided prior to plan approval. See general policies and regulations section Page 25.

9. PAVEMENT REMOVAL AND REPLACEMENT

- a. Any pavement that must be removed shall be cut along straight lines with the appropriate saw cut machine. A street cut permit is required. The removal and replacement of the pavement shall conform to the information shown in Details S-1 thru S-4.

- b. All cuts of City streets must be patched the same day with a temporary or permanent patch. Once work has been completed, all temporary patches shall be replaced with permanent ones. All work from patching shall be cleaned up at the same time of patching
- c. The City of Raleigh shall perform density tests as needed to determine contractor's compactive efforts. See Notes 2 and 3 of details S-3 & S-4.
- d. Pavement cuts shall be confined to a maximum trench bottom width as shown in Details S-4 & S-5, plus 12 inches on either side.
- e. Asphalt compaction shall be done with a gasoline or diesel powered smooth drum asphaltic roller.
- f. Pavement cuts within NCDOT Right of Way shall not be performed without the proper encroachment permits on site. All patching of NCDOT pavements shall conform to the approved on site encroachment permit.

10. EXCAVATION

- a. Prior to any excavation or construction, the contractor shall locate all existing utilities in the field. If help is needed in locating utilities operated by the Public Utilities Department, the contractor should contact the Operations Division (996-2737).
- b. Trench width shall be a minimum of twelve inches plus outside diameter of pipe and a maximum of twenty-four inches plus outside diameter of pipe, unless additional trench width is required by OSHA. Trench width shall be measured between the faces of the cut at the top elevation of the pipe bell as shown in Details S-4 & S-5.
- c. Trench bottom conformation, where no special bedding is required, may be that referred to herein as flat bottom where the trench bottom is excavated slightly above grade and cut down to pipe grade by hand in the fine-grading operation. Where the trench bottom is inadvertently cut below grade, it shall be filled to grade with an approved material and thoroughly tamped.
- d. The maximum length of open trench shall be no more than three-hundred feet unless approval is obtained from the Public Utilities Director.
- e. The contractor shall, at the contractor's own expense, keep all trenches free from water during the excavation for construction of sewer mains. The water shall be pumped out of the trench or build check dams to keep it out of the ditch in such a manner as not to cause injury to the public health, private property or the work in progress. Erosion control measures shall be taken during this pumping.
- f. In trenches where water is present or dewatering is required, the trench shall be stabilized with #67 stone. When the contractor encounters material during trench excavation, at the opinion of the inspector or Public Utilities Director, that is unsuitable (i.e. "muck"), this material shall be replaced with material that is considered suitable prior to the pipe laying operations. In this case, construction fabrics may be required to prevent the migration of side support away from the pipe.
- g. Safety and convenience of the public necessitate that all work, including excavation, be done in such a manner as to cause minimum traffic interruption, both pedestrian and

vehicular. Utilities such as fire hydrants, valves, etc., shall be accessible at all times. Gutters and drains shall be left open and clear at all times, and the contractor shall be responsible for all drainage around his work. Unless specifically waived by the Public Works Department, provisions shall be made to maintain vehicular traffic on all streets in which work is in progress, and suitable walkways shall be maintained for pedestrian travel.

- h. Sheeting or bracing shall be used wherever necessary to prevent failure of the trench banks. All sheeting shall conform to AASHTO and OSHA safety standards. The decision of the Engineer relative to bracing for the protection of property of the City shall be binding upon the contractor. The removal of sheeting shall be done in such a manner as to minimize the loss of friction between the backfill and trench walls

11. ROCK EXCAVATION

- a. Rock shall be defined as that solid material that cannot be excavated, in the opinion of the Public Utilities Director or Engineer, by any means other than drilling and blasting, drilling and wedging, or boulders and broken concrete exceeding ½ cubic yard in volume. Rock shall be excavated to the same limits as earth excavation except that the trench shall be made six inches lower than the outer bottom of the pipe, and this six inches shall be refilled with six inches of #67 stone and thoroughly compacted to the sub-grade level. All blasting shall be done after coordination with the City Inspector and subject to all applicable regulations. The City reserves the right to require the removal of rock by means other than blasting where any pipe or conduit is either too close to or so situated with respect to the blasting as to make blasting hazardous. Rock taken from the ditch shall immediately be hauled away and disposed of by the contractor.
- b. Blasting procedures shall conform to all applicable local, state and federal laws and ordinances. A blasting permit shall be obtained from the City of Raleigh Fire Marshal's Office, prior to any blasting. The application shall be obtained 24-hours before any blasting takes place, and the Fire Marshal may specify the hours of blasting. The contractor shall take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or overburden. The contractor shall keep the explosive materials that are on the job site in specially constructed boxes provided with locks. Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting takes place within five-hundred feet of a utility, structure or property which could be damaged by vibration, concussion or falling rock, the contractor shall be required to take seismograph readings and to keep a blasting log containing the following information for each and every shot.
 - 1) Date of shot
 - 2) Time of shot
 - 3) Crew Supervisor
 - 4) Number and depth of holes
 - 5) Approximate depth of overburden
 - 6) Amount and type of explosive used in each hole
 - 7) Type of caps used (instant or delay)
 - 8) The weather
 - 9) Seismograph instrument and readings

- c. This blasting log shall be made available to the Public Utilities Director or Engineer upon request and shall be kept in an orderly manner. It shall be the contractor's responsibility to have adequate insurance to cover any damages resulting from blasting so to save the City of Raleigh harmless from any claims.

12. TRENCH PREPARATION

- a. Trench excavation shall conform to the line and depth shown on the plans. The trench shall be properly braced and shored so that workers may work safely and efficiently. When water is being pumped from the trench, the pump discharge shall follow natural drainage channels, drains or storm sewers. In no case may trench water or groundwater be pumped into or allowed to enter the sanitary sewer system. See erosion control section for appropriate siltation prevention measures prior to pumping.
- b. The width and type of trench may vary with the depth of cut, and the trench shall be constructed in accordance with the dimensions and other information shown on Details S-4 & S-5.
- c. Pipe Clearance in rock shall be a minimum of six inches on each side and bottom for mains fifteen inches in diameter and less. For larger size mains, the minimum clearance shall be nine inches on the sides and bottom.
- d. If unstable conditions are encountered, the trench shall conform to the requirements as stated in this Handbook.

13. PIPE INSTALLATION

- a. The pipe material listed above shall be installed in accordance with the manufacturer's recommendations and the requirements of these specifications.
- b. All sewer mains and manholes shall be laid to the line and grade shown on the plans.
- c. No deviations from line and grade shall be made, unless they have been approved by the Public Utilities Department or Engineer and identified on the "as-builts".
- d. The sewer pipe installation shall start at the outlet end and proceed upstream to the termination of the project as shown on the plans. The bell ends shall point upstream. Exceptions to this provision will be considered on a case by case basis, when requested in writing by the owner of the development at the time engineering construction plans are submitted to the City for review and approval. The development owner must agree to hold the City harmless. He must accept full responsibility for compliance with state and federal regulations of the Clean Water Act, including any associated penalties which could reach up to \$25,000/ day, for the release of wastewater from sanitary sewer to the environment, which are not connected to existing sewer due to the granting of an exception to the pipe laying sequence required in the Public Utilities Handbook. The development owner must further agree to not request building permits, if an exception is granted for that portion of the development, until connecting sewer is constructed and accepted by the City.

- e. While working on any part of an existing sewer main, the contractor shall maintain the existing sewage flow. No discharge of sewage to the storm waters will be allowed. Water for the flushing of new sanitary sewer mains must be obtained through a fire hydrant meter and must be pumped out and may not be discharged into the sanitary sewer system. Construction requiring existing sewer flow to be pumped from existing manholes shall be the responsibility of the contractor and must be approved prior to proceeding by the Public Utilities Director or the City Inspector according to **Section 1. d., Scope of Work for Bypass Pumping.**
- f. After the trench foundation has been properly graded with bell holes, the pipe shall be carefully lowered into the trench with approved methods. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. All damaged pipe shall be properly repaired or replaced at the contractor's expense.
- g. The pipe interior shall be kept clean before and after installation by means approved by the Public Utilities Director or Engineer. Pipe ends shall be plugged at the end of each workday or when work is temporarily stopped. The plugs shall be watertight so the water and debris will be kept out.
- h. When installing a sewer main, the horizontal separation from any water main shall be ten feet. If this separation cannot be maintained due to existing conditions, the variation allowed is the water main in a separate trench with the elevation of the water main at least 18 inches above the top of the sewer and must be approved by the Public Utilities Director. All distances are measured from the outside diameter to outside diameter. Where it is impossible to obtain proper separation, or anytime a sanitary sewer passes over a water main, DIP materials or steel encasement extended 10' on each side of crossing must be specified & installed to waterline specifications.
- i. Maintain 24" min. vertical separation at all sanitary sewer & storm drain crossings. Where adequate separations cannot be achieved, specify DIP materials & a concrete cradle having 6" min. clearance (per COR PUD detail S-49)
- j. All other underground utilities shall cross water & sewer facilities with 18" min. vertical separation required
- k. Railroad crossings shall be made following all precautionary construction measures required by the railroad officials.
- l. All sewer crossings under state system roads shall be made in accordance with the requirements of NC DOT as defined in their encroachment permits.
- m. Where conditions are, in the opinion of the Public Utilities Department or Engineer, unsuitable for laying pipe because of weather or trench conditions, the Contractor shall be required to cease work until permission is given by the Public Utilities Director or Engineer for work to commence again, providing such conditions have been corrected.

14. LAYING CCFRPM GRAVITY SEWER PIPE

All CCFRPM pipe shall be installed per manufacturer recommendations and the following requirements:

- a. Do not exceed forces recommended by the manufacturer when joining pipe.

- b. Gasket shall be wiped clean prior to joining. Damaged, defective, or bulging gaskets shall be replaced with a new coupling.
- c. Wipe the plain end of pipe clean prior to insertion in the socket.
- d. Apply joint lubricant, as approved by the pipe manufacturer, to pipe end and elastomeric gaskets.
- e. For handling pipe, use textile slings or other suitable materials or a forklift. Use of cables or chains is not permitted. Damaged pipe will be rejected.
- f. Pipe shall be free of nicks, scratches, and gouges at the time of installation. Visible gouges shall be cause for rejection of pipe.

For depths of cover of 0' to 40' CCFRPM pipe shall be bedded in a minimum of 6" Class I material. Embedment and initial backfill shall be Class I material to 6" above the top of pipe. Backfill the remaining 6" of initial backfill with Class I, II, or III material. See Detail S-1.

15. LAYING PVC GRAVITY SEWER PIPE

The foundation for PVC gravity sewer pipes shall be a firm flat bottom trench of 4 inches of Class I material as defined in ASTM D2321-89(1995) compacted with bell holes. See Details S-2, S-3, & S-5. Class II material may be used if contractor can verify that this type of soil is native to the site by having soil tests made by a soil testing agency. Sample borings shall be taken on 200 feet intervals and to a depth equal to or greater than the trench bottom shown on the plans. The results must be approved by the Public Utilities Director prior to pipe installation.

16. LAYING PVC FORCE MAIN PIPE

Install C900 and C905 PVC pipe in conformance with AWWA C605. Clean bell and spigot ends prior to jointing. Ends of field cut pipe shall be beveled with file. Gasket shall be clean and lightly lubricated. Joint shall be made as recommended by the manufacturer.

17. LAYING DUCTILE IRON SEWER PIPE

- a. Ductile iron pipe shall be installed in accordance with the requirements of AWWA Standard C-600. See Detail S-4.
- b. Sewer pipe shall be laid to the line and grade shown on the plans. There shall be a minimum horizontal separation between water and sewer utilities of ten feet and a vertical separation of 18 inches.
- c. Protection shall be afforded to all underground and surface structures using methods acceptable to the Public Utilities Director or Engineer. This protection shall be furnished by the contractor at the contractors' own expense.
- d. Deviation from line and grade may be made on revised plans upon approval by the Public Utilities Department and identified on "as built" when such deviations arise from grade or line conflicts with existing utilities, structures or other sources of conflict.
- e. Subsurface explorations shall be made by the contractor at the direction of the Public Utilities Director or Engineer where it is necessary to determine the location of existing pipes, valves or other underground structures.
- f. Depth of pipe cover, unless shown otherwise on the plans shall be a minimum of three feet outside of travel ways and five feet inside of travel ways. Depth of cover shall be

measured from the established street grade or the surface of the permanent improvement to the top of the barrel of the pipe.

- g. After the foundation has been properly graded, bedded when applicable, and the bell holes dug, the pipe and accessories shall be carefully lowered into the trench by approved methods. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. All damaged pipe and accessories shall be removed from the job. All damaged pipe shall be replaced at the expense of the contractor.
- h. installation of pipe and jointing of pipe shall be done according to manufacturer's recommendation with care being taken to provide uniform bearing for the pipe. Bell and spigot of pipe shall be cleaned and properly lubricated where a mechanical joint of a "push on" type joint is employed.
- i. Open ends of pipe shall be plugged with a standard plug or cap at all times when pipe installation is not in progress. Trench water shall not be permitted to enter pipe.
- j. Bell ends will face the direction of installation which must be upgrade unless otherwise directed by the Public Utilities Director or Engineer.
- k. Where conditions are, in the opinion of the City Inspector, unsuitable for pipe installation because of weather or trench conditions, the contractor shall be required to cease work until permission is given by the City Inspector for work to commence again providing such conditions have been corrected.

18. INSTALLING CIPP LINER

Installation Preparations

Adhere to the methods listed below to produce a high quality rehabilitated pipeline by the cured-in-place inversion method. The finished product is to be of highest quality and shall eliminate infiltration problems which exist in the existing wastewater pipeline.

Installation Preparation: The following installation preparation procedures shall be adhered to by the Contractor.

- a. Cleaning of Sewer Line: Remove debris from the sewer line in accordance with Public Utilities standards
- b. Inspection of Pipelines: perform inspection of pipelines shall be by experienced personnel trained in locating breaks, obstacles, and service connections by closed circuit television. Carefully inspect the interior of the pipeline to determine the location of conditions which may prevent proper installation and it shall be noted so that these conditions can be corrected. Internal T.V. inspection shall be in accordance with Public Utilities standards
- c. Bypassing Sewage: Provide for the flow of sewage around the section or sections of pipe designated for reconstruction. The bypass shall be made in accordance with City of Raleigh Standards set forth in this handbook.
- d. Line Obstructions: Clear the line of obstruction such as solids, dropped joints, protruding service connections or collapse pipe that will prevent the installation. If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, then make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the engineer prior to the commencement or the work.

Installation Procedure

- a. Designate a location where the reconstruction tube will be vacuum impregnate prior to the installation. Allow the engineer to inspect the materials and “wet-out” procedure. Use a catalyst system compatible with the resin and reconstruction tube.
- b. The wet out reconstruction tube shall be inserted through an existing manhole or other approved access by means of an inversion process and the application of hydrostatic head sufficient to fully extend it to the next designated manhole or termination point. Insert the reconstruction tube into the vertical inversion standpipe with the impermeable plastic membrane side out. At the lower end of the inversion standpipe, the reconstruction tube shall be turned inside out and attached to the standpipe so that a leak proof seal is created. The inversion head will be adjusted to be of sufficient height to cause the impregnate tube in the invert from manhole to manhole and hold the tube tight to the pipe wall, produce dimples at side connections and flared ends at the manholes. The use of a lubricant is recommended. Care shall be taken during the elevated curing temperature so as not to overstress the felt fiber. In certain cases, the contractor may elect to use a top inversion where the reconstruction tube is attached to the top ring and the standpipe is formed from the reconstruction tube itself.
- c. Curing: After inversion is completed, supply a suitable heat source and water recirculation equipment. Equipment shall be capable of delivering hot water throughout the section by means of a pressuring hose to uniformly raise the water temperature above the temperature required to affect a cure of the resin. The temperature shall be determined by the resin\catalyst system employed.
- d. Fit heat source with suitable monitors to gauge the temperature of the incoming and outgoing water supply. Place a gauge between the impregnated reconstruction tube and the pipe invert at the remote manhole to determine the temperature during cure. Water temperature in the line during the cure period shall be as recommended by the resin manufacturer. Initial cure shall be deemed to be completed when inspection of the exposed portion of cured pipe appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exothermic. The cur period shall be of a duration recommended by the resin manufacturer, as modified for the cured in place inversion process, during which time the recirculation of the water and cycling of the heat exchanger to maintain the temperature continues.
- e. Cool down: cool the hardened pipe to a temperature below 100° F before relieving the static head in the inversion standpipe. Cool-down may be accomplished by the introduction of cool water into the inversion standpipe to replace water being drained from a small hole made in the downstream end. Care shall be taken in the release of the static head so that a vacuum will not be developed that could damage the newly installed pipe.
- f. Finish: the finished pipe shall be continuous over the entire length of an inversion run and be as free as commercially practicable from vision defects such as foreign inclusions, dry spots, pinholes and delaminating.
- g. Sealing pipe at manholes: if due to broken or misaligned pipe at the manhole wall, the new pipe fails to make a tight seal, apply the seal at that point. The seal shall be of a resin mixture compatible with the pipe.
- h. Service connections: Fully reopen the existing active service connections in each length of sewer following lining. Reopen service connections from inside the sewer by means of a closed-circuit television camera, controlled cutting device appropriate for CIPP lining and the rehabilitates sewer pipe. Clean and neatly cut openings flush with the lateral pipe. Liner penetrations of openings shall be watertight.
- i. Air test and Camera the main per specifications below.

19. SEWER LATERALS

- a. Pipe for 4 inch sewer laterals shall be PVC pipe or DIP. Where installation by boring is specified, four-inch ductile iron pipe shall be used. DIP (4" only) must be used for deep or shallow installations under the same standards as sewer mains. Aerial service installations shall be constructed of 4" DIP. A minimum grade of 1% shall be maintained with four and six-inch pipe. Each lateral shall be sealed at the end with an approved watertight plug. Lateral installation for four-inch services shall conform to Standard Detail S-30. A six-inch service lateral must connect to a manhole. All laterals shall be left exposed until the inspectors can verify the installation of each plug.
- b. Each sewer lateral shall be installed from the main to the street right-of-way line or easement line where a one piece combination wye and 1/8 bend and cleanout stack will be installed. The wyes on the laterals shall be sealed at the property line with a permanent plug.
- c. Trench support, bedding and backfill for laterals shall conform to the same specifications as those for sewer mains. **Class II, III, and IV materials may be used for PVC sewer lateral bedding in lieu of Class I materials.** The contractor shall properly backfill under all wye and lateral connections at the main. The lateral connection at the main shall be backfilled with #67 stone.
- d. Where laterals are bored, the face of the bore cut shall be a distance of five feet from the edge of the pavement on either side, unless approval to the contrary is given by the Public Utilities Director.
- e. Sewer laterals four inches in diameter shall be connected to the main by means of an in-line wye or a tap and saddle, installed over a hole cut in the top quadrant of the main at an angle of forty-five degrees, with respect to direction of flow. The hole shall be cut with a mechanical circle type saw cutter designed for the particular use and rendering a smooth, uniform cut with no damage to the main and which retrieves the coupon. See saddle installations on Standard Detail S-31.
- f. All 4" sewer services may be tapped directly into 8, 10, and 12-inch mains or manholes in accordance with Details S-31 and S-32. Taps can only be made by using a mechanical tapping machine or other approved device. All sanitary sewer service connections 6 inches and larger shall be made into manholes only. Service connections on mains 15 inches and larger are only allowed at manholes. Service clean-outs shall be located at the right-of-way line or the easement boundary line. The maximum vertical drop for a 6-inch service into a manhole shall be 10 feet.
- g. All laterals tapped on newly constructed mains shall be air tested with the main. All laterals tied to a newly constructed manhole shall be vacuum tested with the manhole or conduct a separate air or water head test before any plumber connections are made.

20. MANHOLES

- a. Manhole dimensions shall conform to those shown on Detail S-24. Manholes on all lines twelve inches in diameter or smaller shall have an inside diameter of four feet.

- b. Inverts shall be constructed with a width equal to that of the effluent pipe, height to the springline and invert "shelves" from that point upward at 60 deg. to manhole walls, it shall be so brushed and troweled that a minimum energy loss occurs in the manhole from invert roughness. The maximum grade on an invert of less than 2.5 feet shall be no greater than 6 inches across the manhole. "Bowl" shaped inverts shall not be allowed in the sanitary sewer collection system. What is this trying to achieve?
- c. Foundation for manholes shall be in accordance with Detail S-21, unless approval to the contrary is given by the Public Utilities Director.
- d. All manholes in road right-of-ways will be flush with grade not withstanding 100 year flood requirements. In easements, manholes will be a minimum of 12 inches above ground.
- e. All new manholes must be vacuum tested in accordance with the following procedure:
- 1) The Contractor shall furnish all labor, equipment, and any appurtenant items necessary to satisfactorily perform the vacuum test. All equipment will be approved for vacuum testing.
 - 2) All lifting holes shall be plugged with an approved non-shrink grout.
 - 4) All pipes entering the manhole shall be plugged. The contractor shall securely brace the plugs to keep them from being drawn into the manhole. All service connections tied to manholes shall also be vacuum tested with the manholes.
 - 5) The test head shall be placed inside the top of the cone section of the manhole and the seal inflated in accordance with the manufacturer's recommendations.
 - 6) Manhole vacuum tester shall be as manufactured by Cherne Manhole Testing or approved equal. A vacuum of 10-inches of mercury shall be drawn and the vacuum pump shut off. Inflate the compressor band to effect a seal between the vacuum base and the manhole cone section. Connect the vacuum pump to the outlet port with the valve open. With the valves closed, the time for the vacuum to drop to 9-inches of mercury shall not be less than that shown in the following table.

| Manhole Depth | Diameter of Manhole | | |
|---------------------------|---------------------|----------|----------|
| | 48" Dia. | 60" Dia. | 72" Dia. |
| 10 Ft. or Less | 60 Sec. | 75 Sec. | 90 Sec. |
| >10 Ft. but <15 Ft. | 75 Sec. | 90 Sec. | 105 Sec. |
| >15 Ft. | 90 Sec. | 105 Sec. | 120 Sec. |

(Times shown are minimum elapsed times for a drop in vacuum of 1-inch of mercury).

- 7) If the manhole fails the initial test, necessary repairs shall be made with an approved non-shrink grout while the vacuum is still being drawn. Retesting shall proceed and continue until a satisfactory test is accomplished.
- f. All manhole rings on manholes other than flat-tops shall be bolted to the cone section and sealed down with asphaltic cement or “ram-neck. See Detail S-25.
- g. All manhole joints must be waterproofed with asphaltic cement or “ram-neck”. All exterior joints shall be wrapped with a butyl resin sealant of 8” width.
- h. All main and service pipe connections into manholes must be cored with a concrete coring machine and the pipe connection must be made with a flexible rubber boot.
- i. Adjustment rings used within streets shall be fixed with mortar or a urethane based manhole joint seal by A.I.T. or approved equal.

21. BACKFILLING

- a. The backfilling of the trench after the pipe installation and testing shall be in accordance with Details S-4 & S-5 & S-1 for the various pipe materials.
 - 1) For depths of cover of 0’ to 40’ CCFRPM pipe shall be bedded in a minimum of 6” Class I material. Embedment and initial backfill shall be Class I material to 6” above the top of pipe. Backfill the remaining 6” of initial backfill with Class I, II, or III material. See Detail S-1.
 - 2) The haunching for PVC pipes shall be with #67 stone (Class I material) 4 inches below and up to the springline of the pipe. Care shall be taken to work the haunching well under the bottom of the pipe. The initial and final backfill shall be with suitable native material. No rocks, boulders or stones four inches or larger shall be included in the backfill. The haunching shall be tamped to 95% standard Proctor density in six-inch lifts.
 - 3) For PVC sewer installations, Class II material may be allowed for the bedding, housing and initial backfill if the contractor can verify that this type of soil is native to the site by having soil tests made by a soil testing agency. Soil sample borings shall be taken as directed by the City inspector to a depth equal to or greater than the trench bottom elevation shown on the plans or in the specs. The results must be approved by the Public Utilities Director prior to pipe installation. The bedding and backfilling shall be in conformance with ASTM standards and the various soil classes are defined below:
 - (a) Class I - Angular, 6 to 40mm (1/4 to 1 1/2 inch), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone and crushed shells.
 - (b) Class II - Coarse sands and gravels with maximum particle size of 40mm (1 1/2 inch), including variously graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW and SP are included in this class. (GW - well graded gravel, GP - poorly graded gravel, SW - well graded sand, SP - poorly graded sand.)

- (c) Class III - Fine sand and clay type gravels, including fine sands, sand-clay mixtures and gravel-clay mixtures. Soil Types GM, GC, SM and SC are included in this class. (GM - silty gravel, GC - clayey gravel, SM - silty sand, SC - clayey sand.)
 - (d) Class IV - Silt, silty clays and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH and CL are included in this class. These materials are not recommended for bedding, haunching or initial backfill on PVC pipes. (MH - silty soil with high liquid limit, ML - silty soil with low liquid limit, CH - clayey soil with high liquid limit, CL - clayey soil with low liquid limit.)
- 4) All backfill shall be compacted in six-inch lifts measured from the foundation to one foot above the top of the pipe and then in twelve-inch lifts to the top of the trench when in easements. Sewer mains in street rights-of-way shall be compacted in six-inch lifts all the way to the top of the trench.
 - 5) Material for backfilling shall be approved by the inspector. In areas where settlement or bearing capacity are not a major consideration, the engineer may give permission for a low grade of material to be backfilled from a point two foot above the top of the pipe, but in no event will excavated rock larger than four inches at any point be used for backfill material.
 - 6) Where backfill material is unsuitable, in the opinion of the Public Utilities Director or Engineer, the contractor may be directed to dispose of the unsuitable material and provide material suitable to the Public Utilities Director or Engineer.
 - 7) All backfill shall be compacted in six-inch lifts measured from the pipe foundation upward. Backfill for roadway shall be compacted to at least 95% of maximum soil density in those areas where the supporting capacity of the soil is of prime consideration. Laboratory determination of maximum soil density will follow the procedure of AASHTO T99-86. Field determination of the density of the soil in place shall follow the procedure of AASHTO T191-86 or T204-86. The result of any one test may be a minimum of 90% of maximum density, but the average of any three tests in an area shall be 95% of maximum density. All tests shall be conducted at the direction of the City Inspector, and the cost of such tests will be borne by the contractor with the provision that the City will test an area two times only where both tests fail. The contractor shall then be required to submit satisfactory evidence that his ditch compaction meets the specifications.

PVC Force mains

PVC pipe shall be installed in accordance with AWWA C605. At a minimum, all PVC pipe shall be installed at a Type 3 laying condition as specified by AWWA C605 for depth of installation from 4-ft to 10-ft measured from the top of the pipe. The Type 3 laying condition requires the pipe to be bedded on a minimum of 4-inches of select granular material that will conform to the bottom of the pipe. Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a 0.075 mm (No. 200) mesh sieve and no less than 95 percent by weight passing the 25 mm (1 inch) sieve. Pipe installation on a flat bottom trench is unacceptable.

Embedment material shall be compacted to the top of the pipe. When using mechanical compactors, avoid contact with the pipe. When compacting over the pipe crown, a minimum cover of at least 8-inches or more in conformance with the manufacturer's requirements shall be maintained over the top of the pipe prior to compacting. The maximum embedment sizing shall be limited to materials passing a 3/4-inch sieve for angular materials or 1-1/2-inches for rounded rock. Embedment materials consisting of select material or native soils shall be well drained, granular, free of rocks and other foreign materials and shall be selected and placed to prevent gouges, crimping, or puncture of pipe, joints or appurtenances.

22. SURFACE RESTORATION

- a. All disturbed surfaces and property thereon, shall be restored to a condition equal to that existing before construction began, and the contractor shall maintain and be responsible for all ditches in paved streets, curbs, gutters or sidewalks until the contractor repaves the trench cuts. The contractor, with permission of the inspector, may place temporary or permanent asphaltic material in the cut. Asphalt compaction shall be done with a gasoline or diesel powered smooth drum asphaltic roller.
- b. All easements will be seeded with grass and left so they can be mowed by conventional mowers, unless approved by the Public Utilities Department for rip-rap or other specified material. In remote areas, easements will be seeded with a quality fescue grass. In residential areas, easements will be seeded with either falcon or rebel fescue or leaf mulch at the request of property owner. The contractor shall guarantee a good uniform stand of grass and shall reseed any bare or thin spots. The contractor will be responsible for a one-year warranty on materials and workmanship.

23. EROSION CONTROL

Erosion control measures shall be performed by the contractor, conforming to the requirements of, and in accordance with plans approved by the State of North Carolina Department of Environment and Natural Resources, North Carolina Sedimentation Control Commission and City of Raleigh Inspections Department Erosion Control Division, and as per the erosion control plan portion of the construction drawings and these specifications. The contractor shall not allow mud and debris to accumulate in the streets. The sedimentation and erosion control plan and permit shall remain on site at all times. Should the contractor pump water from trenches during construction, appropriate siltation preventative measures shall be taken prior to the entry into any storm drain or stream. All materials used for erosion control shall be approved by the Engineer prior to installation by the contractor.

- a. Temporary and permanent erosion control measures shall be shown on the plans. Temporary and permanent erosion control work shall be coordinated throughout the project to provide effective and continuous erosion control throughout construction and post construction, which minimizes siltation of streams, lakes, reservoirs, other water impoundments, ground surface, or other property. Seeding and mulching shall be carried out immediately behind construction.
- b. Temporary erosion control measures shall include but not be limited to swaled easements, silt fences, crushed stone check dam devices, silt basins (sedimentation traps), mulching, earth berms, and rip-rap.

- c. Permanent erosion control measures shall include but not be limited to swaled easements, rip-rap, and seeding of disturbed areas.
- d. Erosion and siltation shall be controlled on projects by using swales to control run-off and convey run-off to controlled discharge points, by silt fences, rip-rap, crushed stone, and earth berms to contain silt, with pipe culverts where major access or haul roads cross drainage ditches or streams, silt basins where pipe lines cross drainage ditches or streams, and seeding and mulching will be performed as soon after pipe installation as possible. When temporary measures are removed after completion of the project the disturbed area must be stabilized, if necessary.

24. MAINTAINING SERVICE

When replacing or extending sewer mains, the contractor shall maintain existing service to all property being served through bypass pumping or other means of maintaining service.

25. GUARANTEE

The contractor shall guarantee all material, equipment and workmanship for a period of at least one year after final acceptance by the City. The Public Works Department's Construction Inspection Division is responsible for the issuance of final acceptance letters by the City.

For projects in Merger Areas the Public Utilities Department Construction Inspection Division is responsible for issuance of final acceptance letters.

26. WETLAND/ STREAM BUFFERS

Conditions of 401/404 permits shall be strictly followed to the satisfaction of Corp of Engineers. All Neuse Riparian buffers shall be maintained as required by NCDWQ.

27. TEST AND INSPECTION (GRAVITY SEWERS)

- a. Sewer lines shall be visually inspected from every manhole by use of mirrors, television cameras or other devices for visual inspections, and the lines shall exhibit a fully circular pattern when viewed from one manhole to the next. Lines which do not exhibit a true line and grade and have structural defects shall be corrected to meet these specifications. Manholes that are installed within the street shall be camera inspected just prior to the final lift of surface course asphalt.
- b. Sewer lines will be tested by using the low pressure air test. Sewer laterals will be tested along with the main. It is imperative that proper plugs be installed on the laterals at the cleanout stack. All plugs should be properly installed to withstand the test pressure. Mechanical plugs must be installed throughout the time of construction of any sanitary sewer extension, until final acceptance. All plugs must be securely tied off with steel cable within the manhole and must have a secure marking attached to the plug indicating the utility contractor to whom the plug belongs. All plugs must be removed by the contractor upon acceptance that the sewer facilities are sufficiently functionally complete so as to accept flow and PRIOR to the mains above the plug location being placed into service and/or accepting any flow of sewage.

- c. The low pressure air test in accordance with ASTM F1417 or C924 (F1417 for PVC and Ductile; C924 for Concrete Pipe) will be used on all mains and laterals. Prior to testing, the main shall be clean of debris (to the satisfaction of the inspector) and flushed with water. In doing the air test, it is necessary that plugs be secured properly and braced. In doing the air test, no person will be allowed in the main while it is pressurized. The line is to be pressurized to 4 psi initially and stabilized. After stabilization, the pressure will be decreased to 3.5 psi, and the inspector will determine how long it takes for the pressure in the line to drop to 2.5 psi.

To simplify the ASTM procedure, use the following table to determine the test time. If there are multiple sizes, add the various times together.

| Normal Pipe Size (inches) | Time (Minutes/100ft.) |
|------------------------------|--------------------------|
| 4 | .3 |
| 6 | .7 |
| 8 | 1.2 |
| 10 | 1.5 |
| 12 | 1.8 |
| 15 | 2.1 |
| 18 | 2.4 |
| 21 | 3.0 |
| 24 | 3.6 |
| 27 | 4.2 |
| 30 | 4.8 |
| 33 | 5.4 |
| 36 | 6.0 |
| 42 | 7.3 |

If the pressure stays between 3.5 and 2.5 psi for the test time length, the pipe is acceptable. If not, the section is not properly installed. Correct and retest.

- d. A hydrostatic leakage exfiltration or infiltration test shall not exceed 100 gallons per inch of pipe diameter per mile per day for any section of the system. An exfiltration or infiltration test shall be performed with a minimum positive head of 2 feet. All tests shall be made in the presence of the contractor or his representative and the Public Utilities Director, City Inspector or Engineer.
- f. Materials and construction methods called for in these specifications are of such nature as to insure maximum protection for the sewer from infiltration. The contractor shall be responsible for the sewer conforming to the above limits for a period of one year from the date of final acceptance.
- g. When sanitary sewer services are installed as a part of the same approval of the sanitary sewer mains, such as in new subdivisions/annexation areas, the air test of the sewer mains shall be performed with the services and clean-outs in place. Services tied to a newly constructed manhole shall be vacuum tested with the manhole. Services not tested with newly constructed mains or manholes shall have a separate air test before any plumber connections are made.

28. DEFLECTION TESTING FOR PVC SEWER PIPES

No sooner than thirty days after final backfill installation, a deflection test shall be executed on the sewer line. The maximum allowable deflection shall be five percent for PVC sewer pipes. The test shall use a minimum of nine pronged mandrel pulled through the pipe. The mandrel size shall be calculated by (1-allowable deflection percent) x (Base Inside Diameter). The base inside diameter is the diameter as identified in the shop drawing or advertised pipe literature. It shall not include any additional reduction pipe diameter due to manufacturing tolerances.

The contact length of the mandrel shall be at least eight inches.

Any lines not meeting this test shall be corrected by the contractor and the test repeated.

29. PIGGING (FORCE MAIN SEWERS)

All new mains with gate valves must be pigged with a polyethylene "pig", 5#/cubic foot density, at the conclusion of installation.

The pig must be blown at the end of the main by means of the following:

- a. 4" main - 4" blow-off
- b. 6" main - 6" blow-off
- c. 8" and 12" main - blow-off assembly as shown on Standard Water Details W-21 & W-22
- d. 16" – 24" main – To be determined by the field inspector

The contractor installing the line shall write the name of the company and street name in which the work is taking place on the pig in a manner in which it will not rub off.

30. HYDROSTATIC TESTING (FORCE MAIN SEWERS)

- a. All main installations shall be pressure tested between each main line valve in accordance with the latest AWWA Standard C-600-87. The test shall be performed using a suitable pump and an accurate pressure gauge. Immediately upon completion of a section of main, 150 psi (± 5 psi) of pressure shall be applied and held for two hours. The acceptable leakage rate shall not exceed 0.092 gallons per inch of pipe diameter per 1,000 feet of pipe per hour.

Failure of the force main to comply with the above acceptable leakage rate shall require the contractor to replace any defective materials to insure a watertight installation. After any inadequacies have been corrected, the leakage rate will again be tested. This test shall be repeated until that portion of main is brought to compliance with the permissible leakage rate.

- b. Prerequisite conditions for inspection prior to testing shall be as follows:

- 1) Valves shall be properly located, operable, and at correct elevation. Valve boxes or manholes shall be centered over operating nuts, and the top of the box or manhole shall be at proper elevation.

- 2) Lines shall be properly vented where entrapped air is a consideration.

31. SEWER MAIN AND SERVICE STUB ABANDONMENT

Sewer service stub to a main shall be abandoned by removing the saddle and replacing the saddle with a 360 degree stainless steel sleeve. At in-line wyes the service lateral shall be cut within 12" of the wye and a mechanical cap installed on DIP/cast services or glued to PVC services and the abandoned wye to be surrounded with 1 ft³ of concrete. The remaining portion of the sewer service stub shall be removed from the main to the right of way line and shall be disposed of properly. Sewer main abandonment must be performed in accordance with a plan approved by the Public Utilities Department. Service stub and main abandonment require a stub permit for inspection by the Public Works Department 919-996-4540. Raleigh Public Utilities Department will oversee stub abandonment in the merger towns 919-996-4540.

General Requirements;

- A Property owner is responsible for proper abandonment of all unused existing service stubs.
- All abandoned meters are to be removed by the Raleigh Meters Division prior to service abandonment. (919-996-2742).
- The Raleigh Public Utilities operations staff will not abandon an existing service stub unless it is part of a service renewal as required by ordinance.
- For circumstances that may not be addressed by this clarification or a variance from this procedure please contact the Raleigh Public Utilities Department Development staff at 919-996-4540.

LICENSED UTILITY CONTRACTOR REQUIRED SERVICE ABANDONMENT PERMITS

Contractor installed domestic (3/4" thru 12"), irrigation water (3/4" thru 10"), sewer (4" thru 8") and fire hydrant (6") service stub;

Commercial; All domestic and/or irrigation, sewer and fire hydrant abandonment requires a stub permit for each connection to a water or sewer main.

Residential/Individual; All domestic water and/or irrigation and sewer service stubs abandonment installation requires a stub permit. Exception; Irrigation splits installed with a new domestic service. Irrigation splits on an existing tap requires a stub permit.

Demolition Permits; Plans are required to show all existing services to be abandoned included temporary construction water using existing meter(s). Plan review required.

Sewer Stubs in Easements; A licensed and bonded utility or plumbing contractor may install a sewer stub on a sewer main located within a dedicated easement and requires the issuance of a stub permit. Raleigh Ordinance 10-6082

Street cut permits are required for pavement repair in ROW.

City of Raleigh Capital Projects

A licensed utility contractor performing City contracted water or sewer main replacement work is not required to obtain a stub or street cut permit for abandoned services or mains.

Water and Sewer Main Abandonment

All water and sewer main abandonment requires plan submittal for review by the Raleigh Public Utilities Development Staff by submission of plans through the Raleigh Development Customer Service Center

32. SEALED AS BUILT PLANS

Certified surveyed "As built" plans and profiles, sealed by a Professional Land Surveyor, shall be furnished to the Public Works Department by the engineer upon completion and acceptance of the public main by the City and at completion of private systems. For development projects in the merger towns as-builts must be submitted directly to the inspector.

34. SEWER BACKWATER VALVE

Pursuant to NC State Plumbing Code, homes and other buildings constructed with sanitary sewer drains with an elevation lower than one (1) foot above the next upstream manhole in the sanitary sewer collection system must be equipped with a sewer backwater valve, installed at a location where it can be maintained. See Details S-38 & S-42.

Reuse Design, Material, and Construction Standards

REUSE DESIGN STANDARDS

The words “Reuse” and “Reclaimed” are used interchangeably in this document.

Unless otherwise indicated, all standards apply to Public Reuse systems. Private Reuse Systems are prohibited. Private reuse services with multiple branches and meters may be permitted by the Director on a case by case basis. Unless otherwise indicated, all standards apply to private reuse services. Described in this section are the general design standards, which are to be followed by all parties in preparing subdivision, utility extension, and utility replacement plans for the City of Raleigh. These design standards will ensure that the citizens of Raleigh will have a safe, reliable, and quality reuse water system. Reuse water service is subject to the availability and capacity of facilities, as determined by the City. The City shall control and schedule availability of reuse water.

All engineering plans for reuse systems must meet State and City minimum design standards as indicated in the most recent amended North Carolina Administrative Code Title 15A Subchapter 2T Section .0200 by the N.C. Department of Environment and Natural Resources, Division of Water Quality and/or this City of Raleigh Public Utilities Department Handbook, whichever is the more stringent. All projects except for residential connections must be certified by the engineer of record or the City Engineer. The engineer shall be responsible for determining the reuse water pressure at the point of connection and adequacy for services at the highest point of the project. Reuse water pressure information is available from the Public Utilities Administrative office.

Plan and profile drawings shall be prepared by a professional engineer registered in the State of North Carolina, signed, sealed, and dated showing the various elements of the utility mains and shall include an overall utility plan layout on a single sheet with scale no smaller than 1 inch = 200 feet. The design of improvements must be based upon actual field verification by the engineer of existing utilities. The utility drawings shall be on separate sheets, free of landscaping and other details not pertinent to the utility plans. A separate landscaping plan must be submitted with the utility plan showing any proposed landscaping and all water, sewer, and reuse utilities or easement. Landscaping plans shall include all reuse irrigation system components and show setbacks from streams, wells, property lines, vertical/horizontal separations to water, sewer, reuse lines and any other features required to show compliance with the State and City rules governing reuse water. All adjacent tracts and topographic information must be shown on the landscaping plan. The water, sewer, and reuse drawings may be on the same sheets. Landscaping plans shall show all utility engineering drawings and shall be on paper 24 inches by 36 inches. No private reuse service connection or utilization system may be installed without a reuse utilization permit from the City of Raleigh Reuse Division Superintendent. Please call 919-996-3700 for more information. The Reuse Division Superintendent reserves the right to require additional information on all submitted plans on a case by case basis to determine the appropriate utilization of reuse water. See the flow chart and application in appendix C

Once installed, certified surveyed “as built” plans shall be provided to the City showing the utilities. “As built” drawings for the utilities shall be submitted to the Public Works Department prior to acceptance of the project by the City. For development projects in the merger towns as-builts must be submitted directly to the inspector.

1. REUSE DESIGN – PUBLIC

A. Location Conditions for Design

- 1) All reuse mains shall be installed within dedicated street rights—of-way except major transmission mains not affording direct service connection or within City of Raleigh dedicated reuse easements. Reuse mains within the street right-of-way

shall be a minimum of 5 feet from the outside of the pipe to the edge of the right-of-way. Greater separation may be required for greater depth. Reuse mains as specified by the City of Raleigh will be marked as indicated on Standard Reuse Detail R-10 and as described in the identification section of these specifications (see Page 120-121). The City reserves the right to determine the location of reuse service lines.

- 2) Minimum widths of permanent and construction reuse easements for public reuse mains are 20' each.

Larger size easements may be required based upon the depth of installation or other consideration as determined by the Public Utilities Department and Engineering Department. Reuse mains shall be centered in the easement. All reuse easement boundaries must be field staked and flagged by the developer's surveyor and at the developer's expense.

- 3) The minimum easement width for reuse is 20 feet and may not include any other utility. Such easements are to be recorded as "City of Raleigh Reuse Easement".
- 4) All off-site easements shall be acquired by the developer. These off-site easements shall be recorded by map and by deed of easement prior to construction approval. The easements shall be dedicated to the City of Raleigh and entitled "City of Raleigh Reuse Easement".
- 5) No permanent structures or impoundments shall be constructed on water mains, water transmission mains or within reuse water easements.

B. Main Size

- 1) Major mains shall be sized according to the Reuse Water System Master Plan and/or City of Raleigh Public Utilities Director. The City reserves the right to determine the size of reuse service lines.
- 2) The minimum size reuse main shall be four inches unless dictated otherwise by sound engineering and approved by the Public Utilities Department prior to construction.
- 3) The City of Raleigh is required to provide a minimum pressure of **25 pounds per square inch (psi)**. If an individual needs greater pressure, then it is his/her responsibility to incorporate the necessary booster pumping facilities.

C. Fire Hydrants

The installation of fire hydrants on the reuse system for public or private use is prohibited unless approved by the Public Utilities Director.

D. Reuse Water Main Type

Generally, C900/C905 PVC and Ductile Iron are approved for reuse distribution mains [see Reuse Materials Section of these Standards]. The Public Utilities Director reserves the right to restrict approved water main material to ductile iron pipe when site, soil or system operational conditions dictate, at the discretion of the Director.

E. Valves

- 1) Each proposed new intersection shall have a main line valve for every leg, i.e., a four-way intersection shall have four main line valves and a TEE intersection shall have three main line valves. All valves shall be rodded to a tee or cross in accordance with Standard Reuse Detail R-12.
- 2) Mains twelve inches and larger in diameter that have a change in elevation of fifteen feet or greater shall have an air release valve installed at the highest elevation of such change, as per Standard Reuse Detail R-16. Additional air release valves may be required by the Public Utilities Director on mains less than 12-inches based on elevation changes of 15 feet or greater.
- 3) Pressure reducing and/or sustaining stations shall be installed when directed by the Public Utilities Director to connect high and low pressure systems. The pressure reducing valve shall allow enough flow from the high side to maintain a specified pressure on the low side and will not reduce the high side below a certain amount. This type valve will be a pressure sustaining/ pressure reducing valve.
- 4) All reuse valves and appurtenances shall be color-coded, taped, or otherwise marked to identify the source of the water as being reuse water, as described in the identification section of these specifications (see Pages 120-121).

F. Meters

- 1) All reuse services will be metered, and the meter will be located in the rights-of-way or in a 2-foot easement adjacent to the rights-of-way. In no case shall meters be located inside of buildings. The City will maintain all reuse connections within the street right-of-way at no charge to the property owner. Repairs on private property shall be the responsibility of the property owner or customer.
- 2) All meters will be furnished and set by the Meters Division once all fees are paid and accounts have been set up. Meter installation and spacing shall be in accordance with applicable Standard Water Details W-23 through W-34 and R-18.
- 3) All reuse meters and appurtenances shall be color-coded, taped, or otherwise marked to identify the source of the water as being reuse water, as described in as described in the identification section of these specifications (see Page 120-121).of these specifications.
- 4) A master meter should be used if the building permit and plat show single ownership and a single lot. If a building is sold from the complex, then it will require a separate reuse service, with an individual meter with those services originating from a City maintained reuse main.

G. Installation Restrictions for Design

- 1) All reuse mains, of proper size as determined by the Public Utilities Department, shall be installed complete, along all boundaries abutting existing public roadways, from property line to property line regardless of the land use, proposed lot arrangement of the subdivided property or the availability of connection to a

main in service. Within all dead-end streets that may be extended, the water main must extend to the property line of the subdivision.

- 2) All DIP reuse mains shall be installed with a minimum cover of 4 feet from the top of finished grade to pipe crown and shall be in accordance with all applicable City Standards. All PVC reuse mains shall be installed with a minimum cover of 4 feet from the top of finished grade to pipe crown and shall be in accordance with all applicable City Standards.
- 3) When mains are to be installed to a dead end, or mains are stubbed for future extension, at least one 18-foot joint of pipe, or more when required, shall be designed and fitted with a thrust collar in accordance with Standard Water Details R-4 through R-8, of these specifications. Blow-off assemblies shall be provided on all dead ends or as directed by the Public Utilities Director. In no case shall a blow-off assembly be installed such that the discharge would be to ground surface, drainage ditches, stormwater ponds, stormwater systems, or other non-treated systems. Blow-off assembly sizing shall match pipe sizing through 12-inch diameter. The blow-off for 24-inch and larger mains shall require approval by the Public Utilities Director. Blow-off assemblies shall be in accordance with Standard Reuse Details R-19 and R-20 of these specifications. Mains that are determined to be extended in the future must also terminate with a full-size main line gate valve prior to the last joint of pipe.

H. Identification

- 1) All reuse piping, valves, outlets, and other appurtenances shall be color-coded and taped, or otherwise marked to identify the source of the water as being reuse water. All new distribution piping in the reuse water system, including service lines, valves and other appurtenances shall either be colored purple and embossed or be integrally stamped/marked with the words "CAUTION: RECLAIMED WATER - DO NOT DRINK," or be installed with a purple identification tape, and a purple polyethylene vinyl wrap. The warning shall be stamped on opposite sides of the pipe and repeated every 3-feet or less. Existing potable or nonpotable water lines that are being converted to reuse water use should first be accurately located and tested in accordance with regulatory requirements. If required, the necessary actions to bring the line and appurtenances into compliance with regulatory standards should be taken. If the existing lines meet approval of the reuse water supplier and NCDENR, the lines can be approved for reclaimed water distribution. If verification of the existing lines is not possible, the lines should be uncovered, inspected, and identified prior to use.
- 2) Polyethylene Wrap: Buried ductile iron pipe, fittings, gate valves and other appurtenances shall either be painted Pantone 522 purple and marked "Caution: Reclaimed Water – Do Not Drink" and/or wrapped with a Pantone 522 purple polyethylene membrane conforming to ANSI A21.5, and installed in accordance with AWWA C105. The polyethylene sheets shall be 8 mils thick, minimum.
- 3) Tracer wire shall be installed along all PVC reclaimed water mains and must conform to a requirements described in the Reuse Materials section of these Standards.

- 4) Identification Tape: Identification tape shall be required for all instances in which the reclaimed water piping for main lines is not labeled, embossed or integrally stamped/marked with the words “CAUTION: RECLAIMED WATER - DO NOT DRINK,” repeated on opposite sides of the pipe every 3-feet or less. Identification tape shall be prepared with white or black printing on a purple field 522) having the words “CAUTION: RECLAIMED WATER - DO NOT DRINK.” The overall width of the tape should be at least 3 inches. Identification tape shall be installed on the top of the distribution piping longitudinally and should be centered over the pipe. The identification shall be continuous in its coverage on the pipe and should be fastened to each pipe length in at least 10-ft intervals. Tape attached to sections of pipe before they are placed in the trench should have flaps sufficient for continuous coverage. Other satisfactory means of securing the tape during backfill of the trench may be used if suitable for the work, as determined by the Director of Public Utilities. The identification tape differentiating the reclaimed water piping from other utility lines should be consistent throughout the service area.

2. REUSE DESIGN - PRIVATE

Private reuse systems are prohibited.

- a. Multibranch reuse services located behind a master reuse meter will be built to the applicable State Plumbing Code and the Department of Human Services regulations.
- b. In no case shall aboveground hose bibs (spigots or other hand-operated connections) be installed on the private reuse system. Hose bibs for private reuse systems shall be installed downstream of the backflow preventer, in below-ground service boxes, lockable or designed to be operated with the use of a special tool, and clearly labeled “REUSE WATER – DO NOT DRINK”.
- c. Private reuse services may not cross property lines, may not serve more than one parcel, and may not be installed in private easements.

A. Conversion to Reuse Service

When a user proposes the conversion of any existing potable water irrigation system to a reuse water irrigation system, a comprehensive investigation of the proposed reuse water system shall be performed for the City at the expense of the user. On a case-by-case basis, the City shall review the as-built drawings and other available records, and determine the measures necessary to bring the existing system into full compliance with the requirements of this Handbook. The City may deny issuance of a reuse water permit if the City determines that the proposed conversion cannot be safely made.

REUSE MATERIAL STANDARDS

1. GENERAL MATERIAL REQUIREMENTS

Current specifications of the American Society for Testing Materials (ASTM), American Water Works Association (AWWA), Ductile Iron Pipe Research Association (DIPRA), American Association of State Highway and Transportation Officials (AASHTO), and the American National Standards Institute (ANSI) shall apply in all cases where material is covered by an item in these specifications. All material used shall conform fully to these current standards or be removed from the job at the direction of the Public Utilities Director.

Pipe specimens shall be subjected to tests by an independent testing laboratory at such time as the Public Utilities Department may direct or as specified herein. Pipe not meeting these specifications will be ordered removed by the inspector, and such pipe shall be immediately removed from the job site and not transported to any portion of the project being constructed.

Detail or shop drawings of valves, air release valves, tapping sleeves and tapping saddles must be approved by the Public Utilities Department prior to installation.

These specifications are not to be considered as proprietary in any way. When a particular brand is listed, it is only used as an aid in describing the type of material being requested.

2. REUSE SYSTEM MATERIALS

The words “Reuse” and “Reclaimed” are used interchangeably in this document.

A. Reuse Mains

All 4 through 24 inch reuse mains shall be either buried polyvinyl chloride (PVC) pressure pipe or ductile iron pipe (DIP) as specified herein.

Polyvinyl Chloride (PVC) Pressure Pipe

PVC pressure reuse mains shall conform to the applicable requirements of ANSI/AWWA C900 for 4-inch through 12-inch pipe and ANSI/AWWA C905 for 14-inch through 24-inch diameter pipe. PVC pipe and fittings shall be provided with cast-iron-pipe-equivalent outside diameters. Wall thickness dimension ratios for 12-inch and smaller pipe shall be DR 14 in accordance with the applicable requirements of ANSI/AWWA C900. Wall thickness dimension ratios for 14-inch and larger pipe shall be DR 18 in accordance with the applicable requirements of ANSI/AWWA C905. PVC pipe shall be designed in accordance with AWWA M23, PVC Pipe – Design and Installation, 1980.

All PVC pipe joints shall be provided with an approved method of restraint, as determined by the Public Utilities Director. All PVC pipe supplied for reclaimed water applications shall be color coded purple, Pantone 522 as required by the North Carolina Administrative Code, 15A, NCAC, 02T 0909. Pipe identification for reclaimed water by the manufacturer with the words “CAUTION - RECLAIMED WATER DO NOT DRINK” repeated on opposite sides of the pipe every 3-feet or less.

PVC pressure pipe shall be furnished complete with all fittings, jointing materials, anchors, blocking, encasement, and other necessary appurtenances. All fittings shall be appropriately marked, wrapped and color coded as detailed elsewhere in these standards.

Polyethylene encasement shall be tube or sheet type and conform to ANSI/AWWA C105/A21.5. Joint tape shall be self-sticking, PVC or polyethylene, 10 mils thick; such as Chase "Chasekote 750", Kendall "Polyken 900", or 3M "Scotchrap 50".

All PVC pipe shall be provided with tracer tape to allow for location of the buried pipe. The tracer tape shall be at least 3 inches wide and 0.5 mil thick. The tracer tape shall have an aluminum foil core and be encased in a protective inert plastic jacket. The tracer tape shall have a minimum tensile strength of 5,000 psi and a minimum mass of 2.5 lbs per inch per 1,000 feet. The tracer tape shall be Allen Systems "Detectatape", Lineguard "Type III", or Reef Industries "Terra Tape D". Tracer tape shall be buried beside the PVC pipe, not more than 2 feet below the ground surface.

Pipe, fittings, and accessories shall be handled in accordance with Chapter 6 of AWWA Manual M23, to ensure installation in sound, undamaged condition. Pipe shall not be stored uncovered in direct sunlight.

Ductile Iron Pipe (DIP)

All DIP reuse mains shall be pressure class or thickness class designed in accordance with AWWA Standard C-150. Design shall be done for external and internal pressures separately, using the larger of the two for the next design thickness. An additional allowance shall be made for corrosion and casting tolerances. To be painted Pantone 522 purple and marked "Caution: Reclaimed Water – Do Not Drink". The thickness design for external and internal pressures shall use the following conditions:

- 1) 4 feet minimum cover or as shown on the plans;
- 2) Laying condition - Type 1;
- 3) A minimum working pressure of 150 psi for pipes 16 inches and smaller in diameter, and for 24 inches and larger pipe, the design working pressure shall be as determined by the Public Utilities Director, and
- 4) A surge pressure of 300 psi.

All calculations for thickness shall be in accordance with the latest AWWA Standard C-150, and the calculations shall be submitted to the Public Utilities Director for approval prior to shipping any pipe. The minimum thickness shall be pressure class 350 for pipes 4 inches through 12 inches and pressure class 250 for pipes 16 inches and larger in diameter.

The ductile iron pipe shall be manufactured in accordance with all applicable requirements of the latest AWWA Standard C-151. The ductile iron pipe shall be supplied in nominal lengths of 18 or 20 feet.

The ductile iron pipe shall be cement-mortar lined with a sealcoat in accordance with the latest AWWA Standard C-104. Ductile iron pipe shall be externally bituminous coated in accordance with the latest AWWA Standard C-151.

Pipe joints shall be mechanical or "push-on" manufactured in accordance with the latest AWWA Standard C-111-95

Each joint of ductile iron pipe shall be hydrostatically tested before the outside coating and inside lining are applied at the point of manufacture to 500 psi. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture or leakage of the pipe wall.

All materials used in the production of the pipe are to be tested in accordance with the latest AWWA Standard C-151 for their adequacy within the design of the pipe, and certified test results are to be provided to the City upon request. All certified tests, hydrostatic and material are to be performed by an independent testing laboratory at the expense of the pipe manufacturer.

Push-on and mechanical joint pipe shall be as manufactured by the American Cast Iron Pipe Company, United States Pipe and Foundry Company, Griffin Pipe Products Company, McWane Cast Iron Pipe Company, or approved equal.

Restrained joints shall be TR Flex or HP LOK as manufactured by U.S. Pipe, Lok-Ring or Flex-Ring as manufactured by American Pipe, Super-Lock as manufactured by Clow, Bolt-Lok or Snap-Lok as manufactured by Griffin or approved equal.

B. Fittings

Polyvinyl Chloride (PVC) Pressure Pipe Fittings:

All fittings to be used with PVC pipe shall be cast iron and conform to the applicable requirements of ANSI/AWWA C110/A21.10 with a 250 psi pressure rating, except shorter laying lengths will be acceptable.

PVC to PVC joints shall be stab type, with elastomeric synthetic rubber gaskets, and conform to ANSI/AWWA C900. PVC to cast iron joints shall conform to ANSI/AWWA C111/A21.11, except gaskets shall be synthetic rubber. Natural rubber gaskets will not be acceptable. All surfaces for gasketed joints shall be lubricated immediately before the joint is completed. Gaskets and lubricants shall be supplied by the pipe manufacturer, shall be suitable for use in potable water, shall be compatible with the pipe materials, shall be stored in closed containers, and shall be kept clean. Each spigot shall be suitably beveled to facilitate assembly. All PVC pipe fittings shall be provided with an approved method of restraint.

Ductile Iron Pipe (DIP) Fittings:

All ductile iron pipe fittings shall be manufactured in accordance with AWWA Standard C-110-98 or C-153-88 for ductile iron compact fittings. The fittings shall be tested and the manufacturer shall provide certified test results when requested by the City. This testing shall include hydrostatic proof testing of the fittings.

All fittings shall be all-bell or mechanical joint. Mechanical joints shall be manufactured in accordance with the latest AWWA Standard C-111 and painted Pantone 522.

All fittings shall be cast iron or ductile iron and shall have a minimum working pressure rating of 250 psi and a minimum iron strength of 30,000 psi.

All fitting interiors shall be cement-mortar lined with a sealcoat in accordance with the latest AWWA Standard C-104-95, and the outside shall be bituminous coated.

Restrained mechanical glands may be used where restraint is needed except when welded restraining rings are required.

C. Gate Valves

Cast iron or ductile iron resilient wedge style vertical or horizontal gate valves and tapping valves shall be used. Gate valves twelve (12) inches in diameter and smaller, shall be mechanical joint or hub-end all-bell. They shall be "O" ring, open-left valves of the non-rising stem type. These valves shall be designed for a minimum of 175 psi working pressure and 300 psi hydrostatic test pressure with a two (2) inch operating nut.

Gate valves, horizontal gate valves, or butterfly valves shall be used for all main line valves in sizes 16 inches through 24 inches.

Gate valves shall be as manufactured by American, Mueller, Kennedy, AVK, Clow, M&H, or Waterous valves, in accordance with the latest AWWA Standard C-509-94, C-515, or the appropriate AWWA standard. All resilient wedge valves shall have internal and external epoxy coating, O-ring seals at the stuffing box and bonnett to body and dual O-rings at the stem seal above the thrust collar.

Tapping valves shall be the same valves as gate valves listed above, subject to the standards, providing that tapping valves shall have the tapping ring.

D. Valve Boxes

Adjustable valve boxes shall be class 35 gray cast iron and manufactured in accordance with ASTM A48 and be of the dimensions specified in Detail R-14 and R-15 of these specifications. Lids shall have the word "Reuse", "Reuse Water", or "Reclaimed Water" cast into the lid. See Detail W-18. All castings must be domestically cast and so indicated by the manufacturers name and "USA" cast into all sections of the valve box. All castings must meet or exceed AASHTO H-20 load rating. Total valve box weight shall be a minimum of 85 lbs and have a minimum lid weight of 25 lbs. All valve boxes shall be furnished with an approved operating key which shall allow operation by authorized personnel only

E. Butterfly Valves

Butterfly valves sixteen inches or greater than (16) inches in diameter shall be Class 150B and shall conform to the latest AWWA Standards C-504, as manufactured by Mueller, Kennedy, Pratt, DeZURIK, or Val-Matic for rubber sealed butterfly valves and valve operating assemblies. "O" ring seals shall also be used exclusively with worm gear.

All valve end connections shall be mechanical joint or victaulic, as required by the detail drawings. Valve seats shall be stainless steel, bronze mating or resilient material. Resilient seat shall be mechanically attached to the valve disc, or mechanically retained in the valve body. Resilient seat shall be fully field adjustable by mechanical means. The valve disc shaft shall be stainless steel or either stub or thru-shaft design. Shafts shall be provided with two-way disc thrusters that are fully adjustable from the outside. Valve shaft bearings shall be heavy duty bronze, properly fitted into hubs integrally cast in the body of the valves.

All butterfly valve gear actuators shall be according to AWWA C-504. The valve operator shall be furnished with a two-inch square operating nut, and be so mounted that the valve will open-left (counter-clockwise). The butterfly valve operator shall have AWWA stops, be suitable for submersible service and be sized in accordance with AWWA torque requirements for a full 150B rated valve.

The manufacturer of the butterfly valve shall be fully responsible for the satisfactory performance of the assembled valve and operator unit. The specified operators shall be factory mounted by the valve manufacturer and shipped to the job site as an operating unit. External painting, hydrostatic testing, travel stop adjustments and crating for shipment shall be in complete compliance with the latest AWWA specification for butterfly valves.

All butterfly valves shall be installed in a standard eccentric precast manhole (diameter appropriate with size valve). See Standard Reuse Detail R-13.

F. Air Release Valves

Reuse Air release valves shall be two-inch Crispin Pressure Air Valves, Model P 20, with a vacuum check unit, or two-inch Val-Matic, Model VM-45, with a vacuum check unit or equal as approved by the Public Utilities Director. These valves shall be suitable for 150 psi working pressure and designed to allow air to escape automatically while the main is in service and under pressure. The valve shall be housed in a City of Raleigh approved eccentric manhole and shall be installed in accordance with Standard Reuse Detail R-16 of these specifications. Air release valve locations shall be approved by the Public Utilities Department, or as shown on the plans. The engineer must field stake the air release location. Cover, hatch and interior of the air release valve manhole or vault must be painted with standard reuse identification color Pantone 522 C.

G. Tapping Sleeves and Tapping Saddles

Tapping sleeves shall be Mueller mechanical joint, Mueller Outlet Seal, American Uniseal, Kennedy Square Seal, or Clow F5205 or F5207. 100% stainless steel sleeves may also be used, as manufactured by Smith-Blair, Romac, Ford, or JCM provided that all metallic parts of the sleeves shall be 100% stainless steel including bolts. Ductile iron flanges may be included on sleeves or saddles. Test assembly seals with water according to AWWA C-223. All sleeves shall have a minimum of 150 psi working pressure. All taps shall be machine drilled--no burned taps will be allowed.

Tapping saddles may be used on mains 16-inches and larger. In 16 and 24-inch saddles as manufactured by Mueller, American, Kennedy and Clow, tapping saddles shall be manufactured of ductile iron providing a factor of safety of 2.5 at a working pressure of 250 psi. In main sizes of 30-inch and larger, ductile iron tapping saddles as manufactured by American Pipe Company or US Pipe Company shall be utilized.

Saddles shall be equipped with a standard AWWA C-110-98 flange connection. Sealing gaskets shall be "O" ring type, high quality molded rubber having an approximate seventy durometer hardness, placed into a groove on the curved surface of the tapping saddle. Straps shall be of alloy steel. Saddles may be used for taps one-half the size of the main or less (i.e. 8-inch tapping saddle for use on a 16-inch main).

H. Reuse Service Connections

Reuse service pipe shall be a minimum of 1-inch. Service connections up to 2-inch shall be type "K" soft copper with purple polyethylene wrap consistent with the identification section of these standards. On these reuse services, the fittings shall be flared copper type brass fittings or compression type fittings.

1 ½" and 2" taps may only be made with use of a double strap bronze saddle.

Corporation cocks for direct taps may be used on ductile iron pipe, shall be bronze-construction, and shall have AWWA Standard tapered threads. Unions shall be three piece copper-to-copper.

Curb stops shall be as manufactured by Mueller, Oniseal, Hayes NuSeal, Ford, A.Y. McDonald ball valve. All corporation stops and curb stops shall be bronze ball valves and shall be appropriate material to material corporation and curb stops as manufactured by Mueller, Ford, and A.Y. McDonald and must have a complete ball and installed in a valve box.

Curb stops are required for 1" meters and shall be located 1' from the meter box on the street side. If this conflicts with sidewalk, Curb stop may be installed between sidewalk and curb. Curb stops shall be installed in a curb stop box as manufactured by Ford, A. Y. McDonald, or Trumbull.

Service saddles shall be all bronze with double bronze straps and with a neoprene "O" ring gasket attached to the body. The clamp shall have corporation cock threads. These clamps shall be as Mueller H-16100 series, Jones J 979 or approved equal.

For services 2" and smaller, the reuse service pipe shall be wrapped with purple polyethylene. Services 4, 6, 8 or 12 inches in diameter shall be of ductile iron pipe or PVC as specified above. Cast iron fittings shall be used on these services as specified above. All taps will be made by using the appropriate size tapping sleeve and valve. See Standard Reuse Details R-11, and R-18. On a "dry line", the connection may be made with a "TEE and Valve" as shown in Standard Reuse Detail R-12.

Coppersettors or copper meter yokes shall be 1 by 1.25 inches and 12 inches in height as manufactured by A. Y. McDonald, Ford Meter Box Company, or approved equal. All coppersettors shall have locking wings on the angle valve and be of the angle check type. All service lines shall be wrapped with a Pantone 522 purple polyethylene membrane conforming to ANSI A21.5, and installed in accordance with AWWA C105. The polyethylene sheets shall be 8 mils thick, minimum. All DIP service lines shall also be identified with two 3-inch strips running the length of the pipe on polar opposites of the pipe exterior.

I. Meters

All reuse meters shall be installed by the City of Raleigh Public Utilities Department Meters Division

1" reuse meters shall be Neptune with 1" inlets and 1 ¼" outlets.

Meters 2" and larger must have sample ports.

J. Meter Boxes and Vaults

For users with potable water service, reuse meter boxes shall be located within 5 feet of the potable water meter boxes.

All meter boxes and vaults shall be constructed of cast iron, precast concrete, concrete block, high density polyethylene, or cast-in-place concrete as on Standard Reuse Detail R-3. No synthetic polymer or plastic boxes shall be allowed, on either public or private systems connected to the City reuse system.

Meter boxes and vaults shall not be placed within sidewalks or driveways unless no other alternatives are available (i.e. downtown). If placed within five feet of driveways traffic rated lids shall be used.

Meter Boxes for 1-inch Services: Meter boxes for 1-inch reclaimed water services shall be high density polyethylene construction with a wall thickness of no less than 0.550 inches or heavy duty fiberglass reinforced polymer. The box shall be molded as one piece and provided in a circular shape with a diameter of 21-inches and a depth of 24-inches, Bingham and Taylor or approved equal. The box shall be provided with pre-cut entry areas approximately 3-inches wide by 4-inches high for the service pipe entrance and exit. The plastic box shall be provided with a black exterior and a reflective white on the interior. The meter box cover shall be made of light weight polymer concrete dyed purple, Pantone 522 with the words, "CAUTION RECLAIMED WATER - DO NOT DRINK", embossed in the cover. The meter box cover shall be provided as a solid polymer cement cover with no reader door. A 1.5-inch diameter hole shall be provided by the manufacture to allow installation of AMR telemetry units through the lid. The meter box cover shall be provided with 1 stainless steel locking bolt. The stainless steel locking bolt shall be provided in a penta head configuration. The box and cover shall be load rated for a vertical load of 20,000-lbs. The inside of the meter box shall be painted Pantone 522 purple and text shall be stenciled on the inside of the interior indicating, "CAUTION RECLAIMED WATER - DO NOT DRINK" in lettering at least 1-1/2 inches in height that is clearly legible when opening the cover. The lid shall be Bingham Taylor BTPLASA 12.25RECV2 Purple and BTA-32 frame or approved equal.

Meter Box Assembly and Setters for 1-½ and 2 inch services: Meter Boxes for 1-½" and 2" services shall be made of fiberglass reinforced polymer and provided with heavy duty rated polymer concrete covers. All meter box covers shall be consistently color-coded purple (Pantone 522 C) and marked on the top surface with a recognizable inscription indicating "RECLAIMED WATER - DO NOT DRINK". Meter box covers shall be provided as a solid polymer cement cover with no reader doors and provided with 2 stainless steel bolt locks on opposite ends of the meter box cover. A 1.5-inch diameter hole shall be provided by the manufacture to allow installation of AMR telemetry units through the lid. The stainless steel bolts for locking the cover shall be provided in a penta head configuration. The box shall have an open bottom to allow drainage through stone. The inside of the meter box shall be painted Pantone 522 purple and text shall be stenciled on both sides of the interior indicating, "CAUTION RECLAIMED WATER - DO NOT DRINK" in lettering at least 1-1/2 inches in height that is clearly legible when opening the cover. The setter and meter shall also be painted or provided in Pantone 522 purple.

Meter Vaults for Services Larger than 2-inches in Diameter: Please contact CORPUD to determine design criteria for reclaimed water services larger than 2-inches in diameter.

K. Steel Encasement Pipe

Steel pipe for boring installations shall be high strength steel, welded or smooth-wall seamless manufactured in accordance with ASTM A252 and consisting of grade 2 steel with a minimum yield strength of 35,000 psi. The minimum inside diameter of steel encasements shall be eight inches greater than the inside dimension of the carrier pipe. The minimum casing pipe wall thickness shall be 0.375" for bored encasement. See the following table for encasement diameter and thickness:

| Carrier Pipe Nominal Diameter (inches) | Encasement Minimum Inside Diameter (inches) | Encasement Nominal Wall Thickness (inches) |
|--|---|--|
| 6 | 14 | 0.375 |
| 8 | 16 | 0.375 |
| 10 | 18 | 0.375 |
| 12 | 20 | 0.375 |
| 14 | 24 | 0.375 |
| 16 | 26 | 0.500 |
| 18 | 30 | 0.500 |
| 20 | 32 | 0.500 |
| 24 | 36 | 0.625 |
| 30 | 42 | 0.625 |
| 36 | 48 | 0.750 |
| 42 | 56 | 0.875 |

No coatings required for buried or bored encasements but must conform to the noted wall thickness in the table above. All encasement pipe must be approved by the appropriate controlling agency (i.e. NCDOT, RR, etc.) prior to ordering the material.

All carrier piping shall be restrained joint ductile iron and the minimum inside diameter casing pipe shall be eight inches greater than the inside dimension of the carrier pipe. Restrained joint pipe shall extend one joint beyond the ends of the encasement pipe.

Both ends of the casing shall be mortared. Metal "spider" pipe alignment devices shall be installed in all casings with a minimum of two "spiders" per pipe joint one fourth of the pipe joint length in from both the bell and spigot ends. See Standard Water Detail W-40.

M. Ground Hydrants

Ground hydrants are only acceptable in non-residential applications.

Hose bibs for private reuse systems shall be below grade non-freeze ground hydrants that are lockable or designed to be operated with the use of a special tool. Below ground hose bibs shall be identified as reuse and purple in color. Ground hydrants shall be Watts HY-500, Woodford Y95, Zurn Z-1360, or approved equal.

N. Paint

An approved Pantone 522 purple is required to meet color identification requirements under NC ACAC 02T .0909 and referenced herein as the color code identification for reclaimed water piping, valves and other appurtenances. Field application of Pantone 522 purple to valves, fittings, manholes and other appurtenances shall be implemented in conformance with manufacturer specifications including surface preparation. In all cases a minimum film thickness of 10-mils shall be applied. For applications open to daylight, the paint shall have UV protection. The paint shall consist of a two coat system consisting of a part high solids cured epoxy as the primer with a polyurethane top coat. For applications not exposed to sunlight, the paint shall be a two coat application of a high solids cured epoxy.

REUSE CONSTRUCTION STANDARDS

The words "Reuse" and "Reclaimed" are used interchangeably in this document.

As part of the requirement to obtain construction approval for reuse main extensions, the engineer shall affix the appropriate permit sticker to the original drawings. The various permit stickers are included in appendix D.

The requirements contained in this section shall apply to all reuse main installations whether public or private. All necessary construction permits must be obtained before construction may begin in accordance with North Carolina State Law.

Any contractor performing work within the City of Raleigh or merger Areas such as Garner, Knightdale, Wendell, Zebulon, Wake Forest, or Rolesville, shall have on each job site a copy of these specifications.

1. SCOPE OF WORK

- a. The contractor shall furnish all materials, equipment, and labor for excavation, installation, and backfilling of reuse mains and related appurtenances as shown on the plans. The Public Works Department and/or Public Utilities Department shall conduct all City inspections on reuse main extension projects.
- b. It shall be the contractor's responsibility to notify the Public Utilities and Public Works Departments at least twenty-four hours in advance of beginning any construction work on any project. The contractor must call the Public Utilities Department at (919) 996-4540 and Public Works at (919) 996-3030 and give the location, project name, individual's name, company name, start date, and indicate if it involves reuse extensions.
- c. Contractor shall contact the Public Works department at 996-6810 by 4:15 PM each day to notify where and what will be done the following day. Any work conducted in Garner, Knightdale, Wendell, Zebulon, Wake Forest, or Rolesville, or outside the City of Raleigh Service Area shall contact the Public Utilities Department at 996-2737 by 4:15 PM to notify where and what will be done the following day. Any work requiring inspector observation outside of the normal workday, Monday-Friday, 7:30 a.m. to 4:15 p.m. will be charged to the contractor at the current inspector hourly rate.
- d. If a developer, engineer, or contractor proceeds with the reuse main installation prior to permit issuance, the City may require the work to be reinstalled and the developer, engineer, or contractor shall be fully liable for all actions and costs, including prosecution by the City or the State for proceeding with installation prior to issuance of appropriate permit(s).
- e. "Field changes" are not considered approved by the Public Utilities Department unless revised plans have been submitted to the Public Utilities Department, reviewed, and approved. Therefore, the contractor that proceeds with construction prior to this approval is at his/her own risk.
- f. No one shall make any changes to the reuse system without prior approval from the Public Utilities Department. Any changes to existing facilities, whether intentional or unintentional, shall be reported immediately to the Public Utilities Department at (919) 996-4540.

- g. Contractors working (excavation, boring, or other subsurface breach) around or in the vicinity of reuse mains 6 inches in diameter or larger shall be required to physically spot the existing line to be verified by P.U.D. distribution staff or inspection staff. If other existing lines sizes are in question of conflict the contractor shall be directed by P.U.D. staff of the level of subsurface investigation needed to locate the existing line.

2. GENERAL TESTING REQUIREMENTS

The City may perform and shall require the contractor to perform such destructive and nondestructive testing as it deems necessary in order to inspect the materials and workmanship. These tests shall be in accordance with the procedures established by ASTM and AASHTO. The City shall reserve the right to modify the procedures in testing ditch and backfill compaction to allow a deeper test to be made by using the sand-core method and/or nuclear testing gauges.

3. HANDLING AND STORAGE OF MATERIALS

- a. The contractor shall be responsible for the shipping and storing of all reuse materials. The contractor shall replace any material that is damaged or defective.
- b. The loading and unloading of all pipe, valves, and other accessories shall be in accordance with the manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material.
- c. The contractor shall locate and provide the necessary storage areas for materials and equipment. If private property is being used for storage areas, then the contractor must have the written consent from the owner. Without this written consent, all material and equipment shall be stored within the existing rights-of-way and easements of the project. Pipe may not be prestrung along job site; it must be delivered to and removed from job site each day. In extenuating circumstances when the inspector authorizes pipe to remain on the project from one day to the next, the ends of the pipe must be sealed.
- d. All materials, once on the job site, shall be stored in accordance with the manufacturer's recommendations.
- e. All pipes shall be kept free of dirt and other debris. Any damage relating to the coating of the various materials for reuse mains shall be repaired in a manner approved by the City.
- f. The contractor shall be responsible for safeguarding and protecting all material and equipment stored on the job site. The contractor shall be responsible for the storage of materials in a safe and workmanlike manner to prevent injuries, during and after working hours, until the project is complete.

4. BARRICADES, SIGNS AND STREET PROVISIONS

- a. Signs, barricades, warning lights, guard rails, and flaggers shall be employed as necessary when construction endangers either vehicular or pedestrian traffic. These devices shall remain in place until the traffic may proceed normally again. The contractor shall hold the City harmless for any damages or injuries caused by the construction of reuse mains.
- b. Detours and all traffic control measures shall be setup and maintained by the contractor under the direction of the City of Raleigh Department of Transportation and the North

Carolina Department of Transportation. Notice must be given a week in advance of the detour so that necessary notification of the traveling public may be made. The contractor will furnish all barricades, signs, lights, and other safety devices to protect his/her construction. The contractor is in no way relieved of liability for providing this protection because others approve the detour.

- c. Construction work zone signs and signing procedures shall conform to the Manual of Uniform Traffic Control Devices (MUTCD) and supplements and to all applicable federal, state and local codes. The contractor shall be responsible for securing the necessary permits from the City's and the State's Department of Transportation and Inspections for all work to be performed in the public rights-of-way.

5. PROPERTY PROTECTION

Trees, fences, poles, and all other property shall be protected unless their removal is authorized, and any property not authorized for removal, but damaged by the contractor, shall be restored by the contractor to the owner's satisfaction.

6. GENERAL CONSTRUCTION SAFETY

- a. The contractor and any subcontractors shall be responsible for the total compliance with all federal, state, and local ordinances, laws and regulations as related to safe construction practices, and to protecting the employees and the public's health and safety.
- b. The contractor shall ensure that all Occupational Safety and Health Administration (OSHA) regulations and standards are followed during all phases of the construction project.
- c. The City shall not be responsible for the contractor's adherence to OSHA regulations and standards. However, the City may report known violations or unsafe practices to the appropriate enforcement agency.
- d. The contractor shall be required to furnish safety equipment necessary to inspect the work including, but not limited to, ladders, gas detectors/oxygen sensors, blowers, etc.

7. ENCROACHMENT CONTRACTS AND PERMITS

- a. Prior to actual construction, the contractor shall acquire the necessary encroachments from North Carolina Department of Transportation when working within the rights-of-way of state system roads or highways. The encroachment permit shall be kept on the job site at all times.
- b. The contractor shall be responsible for securing all other local, state, and federal permits required for the utility construction.
- c. The contractor must have an approved set of permitted construction plans onsite at all times.
- d. Reuse Water shall not be utilized without an operational permit from the Reuse Division of the Public Utilities Department. **Please see Appendix C for permit applications and permit process flow charts.**

8. PAVEMENT REMOVAL AND REPLACEMENT

- a. All pavements to be removed shall be cut along straight lines with the appropriate saw cut machine. The removal and replacement of the pavement shall conform to the information shown in Reuse Details R-1 and R-2.
- b. All cuts of City streets must be patched the same day with a temporary or permanent patch. Once work has been completed, all temporary patches shall be replaced with permanent ones. All work from patching shall be cleaned up at the same time of patching.
- c. The City of Raleigh shall perform density tests as needed to determine contractor's compactive efforts. See Note 2 and 3 of Reuse detail R-2
- d. Pavement cuts shall be confined to a maximum trench bottom width as shown in Details Reuse Details R-1 through R-3b, plus 12 inches on either side.
- e. Asphalt compaction shall be done with a gasoline or diesel powered smooth drum asphaltic roller.
- f. Pavement cuts within NCDOT Right of Way shall not be performed without the proper encroachment permits on site. All patching of NCDOT pavements shall conform to the approved on site encroachment permit.

9. VALVE OPERATIONS

- a. No valve in the existing system shall be operated without following the procedure outlined below. Failure to comply with these requirements shall be grounds for suspension of pipe-laying operations until written assurance can be obtained from a company official that such noncompliance will not occur again. The contractor should be aware that the City regards violations of these requirements as justifying punitive measures.
- b. Notification procedures are as follows:
 - 1) The contractor shall notify the Public Utilities Department's Reuse Division at (919) 996-3700 in order to request the operation of any valves. **At least twenty-four hours notice must be given to the Public Utilities Department, and at least twenty-four hours notice must be given to each customer affected by a reuse or potable water cut-off. The contractor is responsible for notifying the affected customers.** All valve operations shall be done by a Public Utilities Department personnel or by the City's inspector for a particular project. It is illegal for anyone other than a City of Raleigh employee to operate existing potable water or reuse main valve, unless accompanied by a City of Raleigh employee.
 - 2) The contractor shall provide the following information when calling the Reuse Division for valve operation:
 - a) Name of person calling
 - b) Name of company
 - c) Telephone number of company
 - d) Location of valve and map number, if available
 - e) Reason for requesting operating and whether to be closed or open

- f) Time valve to be opened or closed
 - g) Approximate time potable water or reuse line to be out of service
- c. Each time a contractor needs a valve operated, he/she shall again secure permission, following the steps outlined above.
- d. System valves shall be defined as any valve that has main pressure against either gate face. Newly installed tapping valves and control valves to networks not yet accepted for service are considered system valves. Valves within a network still under construction are not considered as system valves.

10. CONSTRUCTION WATER

Please see "construction water" in the Policies and Procedures section.

- l. In all cases where potable water is used to temporarily charge a reuse water system, there shall be an approved above-ground reduced pressure principle backflow preventer or air gap separation between the potable water system and the reuse water system.

Note: Individuals caught using water unmetered and/or unauthorized by the Public Utilities Department will be prosecuted to the fullest extent of the law.

11. EXCAVATION

- a. Prior to any excavation or construction, the contractor shall locate all existing utilities in the field. If help is needed in locating utilities operated by the Public Utilities Department, the contractor should contact the Operations Division at (919) 996-2737.
- b. Trench width shall be a minimum of six inches plus outside diameter of pipe and a maximum of twenty-four inches plus outside diameter of pipe, unless OSHA requires additional trench width. Trench width shall be measured between the faces of the cut at the top elevation of the pipe bell as shown in Standard Reuse Detail R-3a and R-3b.
- c. Trench bottom conformation, where no special bedding is required, may be that referred to herein as flat bottom where the trench bottom is excavated slightly above grade and cut down to pipe grade by hand in the fine-grading operation. Where the trench bottom is inadvertently cut below grade, it shall be filled to grade with an approved material and thoroughly tamped compacted to 95% or use #67 stone to bring to grade.
- d. The maximum length of open trench shall be no more than three hundred feet, unless approval is obtained from the Public Utilities Director.
- e. The contractor shall, at his/her own expense, keep all trenches free from water during the excavation for construction of foundations, masonry, and reuse mains. The water shall be pumped out of the trench or build check dams to keep it out of the ditch in such a manner as not to cause injury to the public health, private property, or the work in progress. Erosion control measures shall be taken during this pumping.
- f. In trenches where water is present or dewatering is required, the trench shall be stabilized with #67 stone. When the contractor encounters material during trench excavation, at the opinion of the inspector or Public Utilities Director, that is unsuitable (i.e. "muck"), this material shall be replaced with material that is considered suitable prior to the pipe-laying

operations. In this case, construction fabrics may be required to prevent the migration of side support away from the pipe.

- g. Safety and convenience of the public necessitate that all work, including excavation, be done in such a manner as to cause minimum traffic interruption, both pedestrian and vehicular. Utilities such as fire hydrants, valves, etc., shall be accessible at all times. Gutters and drains shall be left open and clear at all times, and the contractor shall be responsible for all drainage around his work. Unless specifically waived by the Transportation Director, provisions shall be made to maintain vehicular traffic on all streets in which work is in progress, and suitable walkways shall be maintained for pedestrian travel.
- h. Sheeting or bracing shall be used wherever necessary to prevent failure of the trench banks. All sheeting shall conform to AASHTO and OSHA safety standards. The decision of the Public Utilities Director or Engineer relative to bracing for the protection of property of the City shall be binding upon the contractor. The removal of sheeting shall be done in such a manner as to minimize the loss of friction between the backfill and trench walls.

12. ROCK EXCAVATION

- a. Rock shall be defined as that solid material that cannot be excavated, in the opinion of the Public Utilities Director or Engineer, by any means other than drilling and blasting, drilling and wedging, or boulders and broken concrete exceeding ½ cubic yard in volume. Rock shall be excavated to the same limits as earth excavation except that the trench shall be made six inches lower than the outer bottom of the pipe, and this six inches shall be refilled with six inches of #67 stone and thoroughly compacted to the sub-grade level. All blasting shall be done under the supervision of the City Inspector or Engineer and subject to all applicable regulations. The City reserves the right to require the removal of rock by means other than blasting where any pipe or conduit is either too close to or so situated with respect to the blasting as to make blasting hazardous. Rock taken from the ditch shall immediately be hauled away and disposed of by the contractor.
- b. Blasting procedures shall conform to all applicable local, state and federal laws and ordinances. A blasting permit shall be obtained from the City of Raleigh Fire Marshal's Office, prior to any blasting. The application shall be obtained 24-hours before any blasting takes place, and the Fire Marshal may specify the hours of blasting. The contractor shall take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or overburden. The contractor shall keep explosive materials that are on the job site in special constructed boxes provided with locks. Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting takes place within five-hundred feet of a utility, structure or property which could be damaged by vibration, concussion or falling rock, the contractor shall be required to take seismograph readings and to keep a blasting log containing the following information for each and every shot.
 - 1) Date of shot
 - 2) Time of shot
 - 3) Crew Supervisor
 - 4) Number and depth of holes

- 5) Approximate depth of overburden
 - 6) Amount and type of explosive used in each hole
 - 7) Type of caps used (instant or delay)
 - 8) The weather
 - 9) Seismograph instrument and readings
- c. This blasting log shall be made available to the Public Utilities Director or Engineer upon request and shall be kept in an orderly manner. It shall be the contractor's responsibility to have adequate insurance to cover any damages resulting from blasting so to hold the City of Raleigh harmless from any claims.

13. TRENCH PREPARATION

- a. Trench excavation shall conform to the line and depth shown on the plans. The trench shall be properly braced and drained so that workers may work therein safely and efficiently. When water is being pumped from the trench, the pump discharge shall follow natural drainage channels, drains or storm sewers. In discharging trench water, it will be necessary to follow standard erosion control measures so as to minimize erosion and sedimentation. In no case may trench water or groundwater be pumped into or allowed to enter the sanitary sewer system.
- b. The width of the trench may vary with the depth of cut and other conditions the trench shall be in accordance with the dimensions set forth by OSHA and other information shown on **Standard Reuse Detail R-3a and R-3b.**
- c. The foundations for ductile iron shall be a firm and stable flat bottom (Type 1) trench with bell holes so that the pipe rests uniformly on the entire barrel length. **See Standard Reuse Detail R-3a and R-3b.**
- d. Pipe clearance in rock shall be a minimum of six inches below and on each side of the pipe for sizes sixteen inches and less in diameter. For sizes larger than sixteen inches in diameter, the minimum clearance shall be nine inches below and on each side.

14. PIPE INSTALLATION

- a. Ductile iron pipe shall be installed in accordance with the requirements of the latest AWWA Standard C-600. PVC pipe shall be installed in accordance with AWWA C605.
- b. Reuse pipe shall be laid to the line and grade shown on the plans with all valves and hydrants located as shown on the plans.
- c. Protection shall be afforded to all underground and surface structures using methods acceptable to the Public Utilities Director or Engineer. This protection shall be furnished by the contractor at the contractors' own expense.
- d. Deviation from line and grade may be made only on revised plans upon approval by Public Utilities Department and identified on "as built" when such deviations arise from grade or line conflicts with existing utilities, structures or other sources of conflict.
- e. Subsurface explorations shall be made by the contractor at the direction of the Public Utilities Director or Engineer where it is necessary to determine the location of existing pipes, valves or other underground structures.

- f. Depth of pipe cover, unless shown otherwise on the plans shall be four feet. Depth of cover shall be measured from the established street grade or the surface of the permanent improvement to the top of the barrel of the pipe.
- g. After the foundation has been properly graded, bedded when applicable, and the bell holes dug, the pipe and accessories shall be carefully lowered into the trench by approved methods. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. All damaged pipe and accessories shall be removed from the job.
- h. Pipe shall be swabbed clean with sodium hypochlorite solution before it is laid, and any pipe which cannot be cleaned with a swab shall be removed and cleaned with suitable apparatus. Any pipe showing evidence of oil, tar or grease shall be permanently marked and removed from the job.
- i. Pipe installation and jointing of pipe shall be done according to manufacturer's recommendation with care being taken to provide uniform bearing for the pipe. Bell and spigot of pipe shall be cleaned and properly lubricated where a mechanical joint of a "push on" type joint is employed. No chlorine powder or tablets shall be put in the lines during installation. The Public Utilities Director reserves the right to require restrained joint pipe in new construction.
- j. Open ends of pipe shall be plugged with a standard plug or cap at all times when pipe laying is not in progress. Trench water shall not be permitted to enter pipe.
- k. Pipe cutting for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner in accordance with the manufacturer's recommendations and without damage to the pipe.
- l. Bell ends will face the direction of installation unless otherwise directed by the Public Utilities Director or Engineer. For lines on an appreciable slope, the Public Utilities Director or Engineer may also require that bell ends face upgrade.

Maximum horizontal deflections for ductile iron pipe shall be as follows for an eighteen foot joint of pipe:

MAXIMUM DEFLECTION IN INCHES

| <u>Size Pipe</u> | <u>MJ</u> | <u>Push-on-Joint</u> |
|------------------|-----------|----------------------|
| 4 | 31 | 19 |
| 6 | 27 | 19 |
| 8 | 20 | 19 |
| 10 | 20 | 19 |
| 12 | 20 | 19 |
| 14 | 13 | 11 |
| 16 | 13 | 11 |
| 18 | 11 | 11 |
| 20 | 11 | 11 |
| 24 | 9 | 11 |
| 30 | 9 | 11 |
| 36 | 8 | 11 |
| 42 | 7 | 7 |
| 48 | 7 | 7 |

- n. When installing a reuse main, the horizontal separation from any water main shall be ten feet. If this separation cannot be maintained due to existing conditions, the variation allowed is the water main in a separate trench with the elevation of the water main at least 18 inches above the top of the reuse and must be approved by the Public Utilities Director. All distances are measured from the outside diameter to outside diameter. Where it is impossible to obtain proper separation, or anytime a reuse main passes over a water main, DIP materials or steel encasement extended 10' on each side of crossing must be specified & installed to waterline specifications.
- o. Maintain 24" min. vertical separation at all reuse & storm drain crossings. Where adequate separations cannot be achieved, specify DIP materials & a concrete cradle having 6" min. clearance (per COR PUD detail S-49)
- p. All other underground utilities shall cross water, sewer and reuse facilities with 18" min. vertical separation required
- q. Where practical, water, reuse, and sewer mains shall be located in order of descending quality from the ground surface.
- r. The following minimum horizontal separations shall be maintained:
 - i. Reclaimed water distribution lines shall be located 10' horizontally from and 18" below any water line where practicable. Where these separation distances cannot be met, the piping and integrity testing procedures shall be to water main standards in accordance with 15A NCAC 18C. (Ductile Iron pipe with joints equivalent to water mains standards for 10' each side of the point of crossing)
 - i. 100 feet from any private or public water supply source, including wells, WS-1 waters or Class I or Class II impounded reservoirs used as a source of drinking water (except as noted below)
 - ii. 50 feet from any waters (from normal high water) classified WS-II, WS-III, B, SA, ORW, HQW or SB (except as noted below)
 - iii. 10 feet from any other stream, lake, or impoundment (except as noted below)
 - iv. 25 feet from private wells (with no exceptions)
 - v. 50 feet from sources of public water supply (with no exceptions)
 - vi. Reuse shall be 18" vertically above sewer mains at crossings or a minimum of 2' horizontally as per 15A NCAC 02T .0305.**

Where the required minimum separations cannot be obtained, ductile iron sanitary sewer pipe with joints equivalent to potable water main standards shall be used.
- s. Railroad crossings shall be made following all precautionary construction measures required by the railroad officials.

- t. All reuse crossings under the state system roads shall be made in accordance with the requirements of the NC DOT as defined in their encroachment permits.
- u. Where conditions are, in the opinion of the City Inspector, unsuitable for laying pipe because of weather or trench conditions, the contractor shall be required to cease work until permission is given by the City Inspector for work to commence again, providing such conditions have been corrected.
- v. All reuse piping, valves, outlets and other appurtenances shall be color-coded, taped, or otherwise marked to identify the source of the water as being reuse water, as described in the Reuse Materials Section of these specifications.
- w. Tracer wire to be installed on all PVC reuse pipe. Tracer wire to be laid in the same ditch to the side of the pipe no more than one foot from the pipe, secured to the pipe every 25 feet, and with a minimum cover of two foot deep. Tracer stations shall be installed at intervals no less than 300 feet a part or from other above ground conductive appurtenances (hydrants, blow-offs). PVC pipe installed at depths greater than 12 feet shall have tracer stations spaced no more than 300 feet or as directed by the Public Utilities Director. Tracer stations will consist of a valve box with lids stamped "TS" and painted Pantone 522C. The #12 copper wire shall be fastened to the inside of valve box with three feet of excess wire in the box for connectivity. Tracer wire installed in steel encasement situations shall be inspected during installation to ensure that wire or insulation has not been damaged.

15. REACTION BLOCKING

- a. All fittings or components subject to hydrostatic thrust shall be securely anchored by the use of concrete thrust blocks poured in place, unless otherwise directed by the engineer. The reaction areas required for these thrust blocks shall be given to the contractor by the inspector, and the contractor shall install the blocks according to directions provided by the inspector. Where concrete must be reinforced, the contractor shall furnish such reinforcing as is required.
- b. Required reaction bearing areas will be taken from the schedule herein. See Standard Reuse Details R-4a through R-9. Areas given are vertical plans measured in solid material normal to the thrust line of the fitting.
- c. Material for reaction blocking shall be transit-mixed concrete. This concrete shall have a minimum twenty-eight day compressive strength of 2500 psi. Any metal used to resist thrust that is not encased in concrete shall be galvanized or otherwise treated for corrosion resistance or shall be painted as directed by the engineer.
- d. Valves on ductile iron lines shall be anchored with thrust collars as shown in Standard Reuse Details R-4a through R-5.

16. BACKFILLING PIPE

- a. The backfilling of the trench after the pipe installation and testing shall be in accordance with Reuse Details R-R-3b for ductile iron and Reuse Detail R-3a for PVC.

- b. PVC pipe shall be installed in accordance with AWWA C605. At a minimum, all PVC pipe shall be installed at a Type 3 laying condition as specified by AWWA C605 for depth of installation from 4-ft to 10-ft measured from the top of the pipe. The Type 3 laying condition requires the pipe to be bedded on a minimum of 4-inches of select granular material that will conform to the bottom of the pipe. Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a 0.075 mm (No. 200) mesh sieve and no less than 95 percent by weight passing the 25 mm (1 inch) sieve. Pipe laying on a flat bottom trench is unacceptable.

Embedment material shall be compacted to the top of the pipe. When using mechanical compactors, avoid contact with the pipe. When compacting over the pipe crown, a minimum cover of at least 8-inches or more in conformance with the manufacturer's requirements shall be maintained over the top of the pipe prior to compacting. The maximum embedment sizing shall be limited to materials passing a 3/4-inch sieve for angular materials or 1-1/2-inches for rounded rock. Embedment materials consisting of select material or native soils shall be well drained, granular, free of rocks and other foreign materials and shall be selected and placed to prevent gouges, crimping, or puncture of pipe, joints or appurtenances.

- c. Ductile iron pipe shall be backfilled with suitable native material. No rocks, boulders, or stone four inches or larger shall be included in the backfill for at least two feet above the top of the pipe.
- d. All backfill shall be compacted in six-inch lifts measured from the pipe foundation upward. Backfill for roadway shall be compacted to at least 95% of maximum soil density in those areas where the supporting capacity of the soil is of prime consideration. Laboratory determination of maximum soil density will follow the procedure of AASHTO T99-86. Field determination of the density of the soil in place shall follow the procedure of AASHTO T191-86 or T204-86. The result of any one test may be a minimum of 90% of maximum density, but the average of any three tests in an area shall be 95% of maximum density. All tests shall be conducted at the direction of the City Inspector, and the cost of such tests will be borne by the contractor with the provision that the City will test an area two times only where both tests fail. The contractor shall then be required to submit satisfactory evidence that his ditch compaction meets the specifications.
- e. Deficiency of backfill material shall be supplied by the contractor where this deficiency results from any cause other than rejection of unsuitable backfill material (other than rock) by the City Inspector. In cases where the City Inspector directs, the contractor shall dispose of unsuitable backfill material and provide suitable backfill material.

Where excavated material has been rendered unsuitable, either before or after excavation, by inclement weather or type of material, the contractor must correct the moisture or furnish replacement backfill material.

- f. Backfilling shall not be allowed, except with permission of the City Inspector. When a ditch is flooded or the weather is unsuitable, the contractor shall not backfill unless permission is given by the City Inspector. No backfilling with frozen material shall be allowed.

17. SETTING VALVES AND VALVE BOXES

- a. Valves shall be set at locations shown on the plans with care being taken to support the valve properly and to accurately position the valve box over the operating nut of the valve. Where pavement is existing, the box shall be adjusted to finished street grade as shown in **Standard Reuse Detail R-14**. When valves are located in street rights-of-way, but out of pavement, the boxes shall be adjusted to finished grade and a concrete pad two-feet square and six-inches thick shall be poured around the box one-half inch from the top. When valves are located outside of street rights-of-way, the boxes shall be at finish grade, and a concrete block two-feet square and six-inches thick shall be poured around the box at grade line. Valve locations out of street rights-of-way shall be marked with a metal post having a minimum diameter of two inches and a minimum bury of three feet with a minimum of three feet exposed. The exposed portion shall be painted purple and shall be placed so that a valve operating tool has free operation.
- b. When a tapping sleeve and valve are being used, the valve, sleeve, and machine assembly shall be air tested to hold at 150 psi for a five-minute duration in the presence of the inspector prior to drilling or tapping the main. The valve shall be in the closed position during the testing. High pressure reuse transmission mains [greater than 150 psi operating pressure] may require more stringent testing, as recommended by the manufacture and required by the Public Utilities Director.

18. SETTING FITTINGS

Fittings shall be set at locations shown on the plans with care being taken to properly "bell-up" joints and support the body of the fitting. All dead-end lines shall be plugged with mechanical joint plugs or caps and anchored by using thrust collars and blocking as shown on **Standard Reuse Details R-4a through R-5**

19. SETTING BLOW-OFFS AND RELEASE VALVES

- a. Blow-offs and drainage branches shall not be submerged in any stream or be installed in any other manner that will permit back siphonage into the reuse distribution system.
- b. All blow-offs shall be installed as shown on **Standard Reuse Details R-19 and R-20** to divert flow to the sewer collection system. Blow-offs shall not be installed to allow drainage to any area other than a sewer manhole.
- c. **Drainage of air release valves shall be not be directed to the sanitary sewer system. See detail R-16**

20. SURFACE RESTORATION

- a. All disturbed surfaces and property thereon, shall be restored to a condition equal to that existing before construction began, and the contractor shall maintain and be responsible for all ditches in paved streets, curbs, gutters, or sidewalks until the contractor repaves the trench cuts. The contractor, with permission of the inspector, may place temporary or permanent asphaltic material in the cut. Asphalt compaction shall be done with a gasoline or diesel powered smooth drum asphaltic roller.
- b. All easements will be seeded with grass and left so they can be mowed by conventional mowers, unless approved by the Public Utilities Department for rip-rap or other specified

material. In remote areas, easements will be seeded with a quality fescue grass. In residential areas, easements will be seeded with either falcon or rebel fescue or leaf mulch at the request of property owner. The contractor shall guarantee a good uniform stand of grass and shall reseed any bare or thin spots. The contractor will be responsible for a one-year warranty on materials and workmanship.

21. EROSION CONTROL

Erosion control measures shall be performed by the contractor, conforming to the requirements of, and in accordance with, plans approved by the State of North Carolina Department of Environment and Natural Resources, North Carolina Sedimentation Control Commission, and City of Raleigh Inspections Department Erosion Control Division, and as per the erosion control plan portion of the construction drawings and these specifications. The sedimentation and erosion control plan and permit shall remain onsite at all times. The contractor shall not allow mud and debris to accumulate in the streets. Should the contractor pump water from trenches during construction, appropriate siltation preventative measures shall be taken prior to the entry into any storm drain or stream. All measures must be taken so that stormwater runoff does not go to the pipes or manholes of the utility system. All materials used for erosion control shall be approved by the Engineer prior to installation by the contractor.

- a. Temporary and permanent erosion control measures shall be shown on the plans. Temporary and permanent erosion control work shall be coordinated throughout the project to provide effective and continuous erosion control throughout construction and post construction, which minimizes siltation of streams, lakes, reservoirs, other water impoundments, ground surface, or other property. Seeding and mulching shall be carried out immediately behind construction.
- b. Temporary erosion control measures shall include, but not be limited to, swaled easements, silt fences, crushed stone check dam devices, silt basins (sedimentation traps), mulching, earth berms, and rip-rap.
- c. Permanent erosion control measures shall include, but not be limited to, swaled easements, rip rap, and seeding of disturbed areas.
- d. Erosion and siltation shall be controlled on projects by using swales to control run-off and convey run-off to controlled discharge points, by silt fences, rip-rap, crushed stone, and earth berms to contain silt, with pipe culverts where major access or haul roads cross drainage ditches or streams, silt basins where pipe lines cross drainage ditches or streams, and seeding and mulching will be performed as soon after pipe installation as possible. When temporary measures are removed after completion of the project the disturbed area must be stabilized, if necessary.

22. MAINTAINING SERVICE

When replacing or extending reuse mains, the contractor shall maintain existing reuse services.

23. GUARANTEE

The contractor shall guarantee all material, equipment, and workmanship for a period of at least one year after final acceptance by the City. The Public Works Departments Construction Inspection Division is responsible for the issuance of final acceptance letters by the City.

24. WETLAND/STREAM BUFFERS

Conditions of 401/404 permits shall be strictly followed to the satisfaction of Corps of Engineers. All Neuse Riparian buffers shall be maintained as required by the North Carolina Division of Water Quality.

25. GENERAL REUSE MAIN TESTING SEQUENCE

Reuse mains shall be tested in the following general sequence:

- a. "Pigging" main (mains with gate valves)
- b. Flush the main (flush water shall be routed to the sanitary sewer system)
- c. Perform the hydrostatic tests
- d. Introduce the appropriate amount of chlorine by tapping the main
- e. Hold the chlorine solution in the main for at least twenty-four hours and no more than seventy-two hours
- f. Flush the main (flush water shall be routed to the sanitary sewer system)

26. PIGGING

All new mains with gate valves must be pigged with a polyethylene "pig", 5#/cubic foot density, at the conclusion of installation.

The pig must be blown at the end of the main by means of the following:

- a. 4" main - 4" blow-off
- b. 6" main - 6" blow-off
- c. 8" and 12" main - blow-off assembly as shown on **Standard Reuse Detail R-19**
- c. 16" – 24" main – To be determined by the field inspector

The contractor installing the line shall write the name of the company and street name in which the work is taking place on the pig in a manner in which it will not rub off.

27. HYDROSTATIC TESTS

- a. All main installations, including private distribution lines to the buildings, shall be pressure tested between each main line valve in accordance with the latest AWWA Standard C-600-87. The test shall be performed using a suitable pump and an accurate pressure gauge. Immediately upon completion of a section of main, 150 psi (\pm 5 psi) of pressure shall be applied and held for two hours. The acceptable leakage rate shall not exceed 0.092 gallons per inch of pipe diameter per 1,000 feet of pipe per hour.

Failure of the reuse main to comply with the above acceptable leakage rate shall require the contractor to replace any defective materials to insure a watertight installation. If it is deemed that the existing blow-off valve is the cause of failure, the party responsible for the water main extension shall also be responsible for adding a valve at that location and abandoning the existing valve. After any inadequacies have been corrected, the leakage

rate will again be tested. This test shall be repeated until that portion of main is brought to compliance with the permissible leakage rate. High pressure reuse transmission mains [greater than 150 psi operating pressure] may require more stringent testing, as recommended by the manufacture and required by the Public Utilities Director.

- b. Prerequisite conditions for inspection prior to testing shall be as follows:
 - 1) Valves shall be properly located, operable, and at correct elevation. Valve boxes or manholes shall be centered over operating nuts, and the top of the box or manhole shall be at proper elevation.
 - 2) Lines shall be properly vented where entrapped air is a consideration.

28. CHLORINATION

- a. All additions or replacements to the reuse system, including backflow prevention devices, shall be chlorinated before being placed in service. Such chlorination must take place under the supervision of an inspector.
- b. Pipe subjected to contaminating materials shall be treated as directed by the Public Utilities Department or Engineer. Should such treatment fail to cleanse the pipe, replacement shall be required. The City shall bear no portion of any cost sustained by the contractor in meeting this specification.
- c. Chlorination of a completed line shall be carried out after completing the pressure test and in the following manner.
 - 1) Taps will be made at the control valve at the upstream end of the line and at all extremities of the line including valves. These taps shall be located in such a manner as to allow HTH solution to be fed into all parts of the line.
 - 2) A solution of potable water containing high test hypochlorite (70%) available chlorine or chlorine gas solution shall be introduced into the line by regulated pumping at the control valve tap. The solution shall be of such a concentration that the line shall have a uniform concentration of 50 ppm total chlorine immediately after chlorination. The table below shows the required quantity of 70% HTH compound to be contained in solution in each 1000-foot section of line to produce the desired concentration of 50 ppm.

| <u>Pipe Size</u> | <u>Pounds High Test Hypochlorite (70%) Per 1000 Feet of Line</u> |
|------------------|--|
| 4" | 0.40 |
| 6" | 0.88 |
| 8" | 1.56 |
| 10" | 2.42 |
| 12" | 3.50 |
| 14" | 4.76 |
| 16" | 6.22 |
| 20" | 9.76 |
| 24" | 14.00 |
| 30" | 21.00 |
| 36" | 31.50 |
| 48" | 56.00 |

- 3) The HTH solution shall be circulated in the main opening the control valve and systematically manipulating taps at the line extremities. The HTH solution must be pumped in at a constant rate for each discharge rate in order that a uniform concentration will be produced in the mains.
 - 4) Services shall be sterilized by methods acceptable to the Public Utilities Director or Engineer, and the contractor shall have the same responsibility for laterals as for mains in regard to bearing full cost of any corrective measures needed to comply with bacteriological or other requirements.
 - 5) HTH solution shall remain in lines for no less than twenty-four hours, unless otherwise directed by the Public Utilities Director or Engineer.
 - 6) Extreme care will be exercised at all times to prevent the HTH solution from entering existing mains.
- d. Free residual chlorine after twenty-four hours shall be at least 10 ppm, or the Public Utilities Department or Engineer will require that the lines be re-chlorinated.
- e. Mains will be flushed with potable water with a blow-off assembly of sufficient size to effectively clean the main. See Standard Reuse Detail R-19. The flushing connection shall include cross connection control measures, including an appropriately sized reduced pressure principle backflow preventer, and shall be approved by the Public Utilities Department. In cases where a connection to the potable water system is not practical and flushing with reuse water is proposed, written authorization from the Public Utilities Department will be required prior to proceeding with flushing operations. The party making the written request to flush with reuse shall prepare a flushing plan for review and approval by the Public Utilities Department. . Flushing of lines may proceed after twenty-four hours, provided the free residual chlorine analysis is satisfactory. Flushing shall be continued until chlorine returns to normal level. During times of water shortages or distribution main problems, the flushing operation may be delayed. The Public Utilities Department shall determine when flushing is allowable. The contractor shall advise the inspector prior to the chlorination and flushing so that the inspector can advise the Public Utilities Department of the construction location, size, and length of mains. All tests will be done in the presence of an inspector. Flushing will be for short duration. Sufficient

precautions must be taken to the satisfaction of the inspector to ensure that the impact of the water is absorbed and the water is conveyed without erosion or property drainage. All flush water shall be de-chlorinated using methods acceptable to the City of Raleigh Public Utilities Department.

30. SERVICE CONNECTIONS

- a. Taps shall be made only on a line under pressure and after the main has been tested and chlorinated. No taps on dry lines shall be allowed, unless specific authorization from the engineer is obtained.
- b. Taps shall be at an angle of forty-five degrees to a perpendicular plane through the center line of the pipe as shown is in **Standard** Reuse Detail R-18.
- c. The maximum size of direct taps shall be as follows:

| <u>Main Size</u> | <u>Maximum Size</u> |
|------------------|---------------------|
| 4" | 1" |
| 6" | 1" |
| 8" | 1 1/4" |
| 10" | 1 1/2" |
| 12" and larger | 2" |

On 4-inch through 10-inch mains, larger size taps may be made by using a service saddle.

- d. Services larger than two inches shall be made by using a tapping sleeve and valve. The service line from the main shall be:

4-inch D.I. for 4-inch services;
6-inch D.I. for 6-inch services; and
8-inch D.I. for 8-inch services.

The typical tapping sleeve and valve is shown in Standard Reuse Detail R-11.

- e. No taps or services shall be made on the 16-inch or larger transmission mains unless approved by the Public Utilities Director.
- f. Before any reuse services are installed, the main shall be thoroughly flushed using a flow velocity sufficient to scour the pipe interior. All flush water originating from a reuse main or other reuse water source shall be discharged to the sanitary sewer system.
- g. Each meter yoke shall be flushed before the installation crew proceeds to the next service installation.

REUSE MAIN AND SERVICE ABANDONMENT

Reuse services to be abandoned must remove the corporation cock and insert a plug in the main. When plugging the line is not available, the corporation cock may be turned off, capped, and surrounded with 1 ft³ of concrete. All remaining portions of the service shall be removed from the main to the right of way line and shall be disposed of properly. Water main abandonment must be

performed in accordance with a plan approved by the Public Utilities Department. Service and main abandonment require inspection by the Public Works Department at 919-996-3030.

Additional Information

Raleigh Public Utilities 919-996-4540 (Includes meter division, public utilities inspections and water and sewer construction plan review)

Raleigh Public Works Engineering Inspections 919-996-3030 (Raleigh only)

Raleigh Customer Service Center 919-996-2495 (Plan submittal all areas/ permits for Raleigh residents only)

Merger Communities local permitting agencies

Town of Garner 919-772-4688

Town of Knightdale 919-217-2241

Town of Rolesville 919-556-3506

Town of Wake Forest 919-435-9400

Town of Wendell 919-365-4450

Town of Zebulon 919-269-7455