

# WATER DISTRIBUTION SYSTEM

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## *NASH COUNTY NORTH CAROLINA*

### STANDARD SPECIFICATIONS AND DETAILS

September 8, 2003

## 1.01 Water System Extensions

### A. General

1. All new developments proposing to construct water system improvements for ownership and maintenance by Nash County shall conform to these Standard Specifications and Details, as well as to the requirements of the North Carolina (NC) Department of Environment and Natural Resources.
2. Plans and specifications for water line extensions must be prepared and submitted by the developer's engineer, licensed to practice in NC, and must be approved prior to beginning construction.
3. Copies of all engineering design data, assumptions, calculations, etc., shall be submitted to the County Public Utilities Department at the time the plans are submitted. Copies of all permits shall also be submitted at this time.
4. Applications for approval of all water line extensions shall be made by the developer's engineer to the NC Department of Environment and Natural Resources and other applicable agencies which may be impacted by the proposed work.
5. Sufficient data shall be shown so as to accurately locate the facilities in the field.
6. When applicable, the developer will be responsible for preparing a soil erosion sedimentation control plan. This plan, along with appropriate fees, shall be submitted to the Land Quality Section of the NC Department of Environment and Natural Resources, Raleigh Regional Office, for approval.
7. No work is to begin until the Plans and Specifications have been approved by the Public Utilities Department and the appropriate state agencies and all required permits have been obtained.
8. The developer will be responsible for securing all required easements and rights-of-way needed for the construction and maintenance of the water lines. Easements shall be transferred to the County prior to final acceptance of the water lines.
9. Where applicable, the developer shall obtain appropriate encroachment approvals from the NC Department of Transportation.
10. If the County determines that the timely completion of the proposed improvements are critical to the overall integrity of the water distribution system or that they are vital to the health and well-being of its citizens, it may require the developer to provide a bond or letter of credit, in an amount equal to 150% of the estimated cost of the proposed improvements, which guarantees the completion and satisfactory operation of the improvements. This bond or letter of credit shall be posted with the County prior to the County issuing approval to begin construction and shall remain in effect through the warranty period.
11. All contractors performing any construction activity involving Nash County

water system shall be licensed to practice general contracting in the State of North Carolina. The contractor shall be licensed in the appropriate area of classification for the type of construction to be performed and shall not perform construction activity which exceeds the limitations of the designated contractor's license.

12. During construction the contractor shall be responsible for all project safety requirements. Additionally, the contractor shall adhere to all state and local Health Department regulations as they pertain to their employees.
13. The developer's engineer shall be responsible for certifying to the NC Department of Environment and Natural Resources (DENR) that the water line has been installed in accordance with the approved plans and specifications. A copy of this certification, and NC DENR's response, shall also be sent to the County Public Utilities Department.
14. After the installation of all improvements, the developer or designee shall contact the County Public Utilities Department and schedule a Completion (pre-final) Inspection. The Public Utilities Department will accept the improvements or respond with a punch list within 30 days of the request. The developer or designee must complete all items indicated on the punch list, and any additional items noted, within 60 days or the punch list will be void. The developer or designee must then request a Final Inspection. At this time the developer must provide the Public Utilities Department with 2 complete sets of record drawings that accurately reflect the improvements as they were installed, including but not limited to the location of all services, valves, blow-offs, fire hydrants, etc.
15. No water service will be provided by the County Public Utilities Department until the construction certification has been forwarded to the NC Department of Environment and Natural Resources and the record drawings have been delivered to the County Public Utilities Department.
16. Upon the acceptable completion of all punch list items, the developer or designee will receive an acceptance letter from the County Public Utilities Department. This acceptance begins a warranty for materials and workmanship including pavement repairs for 1 year from the date of the County Acceptance Letter. The warranty will be to the County Public Utilities Department from the developer or designee.
17. The Public Utilities Department will perform routine maintenance during the warranty period but all materials and workmanship are the responsibility of the developer. If repairs resulting from faulty materials and/or workmanship are needed during the warranty period, the developer or designee shall be notified by the Public Utilities Department. If the repairs are not made in a timely fashion or if the repairs are of an emergency nature, the Public Utilities Department may choose to make the repairs and bill the developer for the total cost of the repairs.
18. Upon completion of, or just prior to the end of, the warranty period, the developer or designee shall request a Final Warranty Inspection from the Public Utilities Department. The Public Utilities Department will respond with final acceptance or a punch list on workmanship or materials within 30 days of the

request. The developer or designee must complete all items indicated on the punch list, and any additional items noted within 60 days or the punch list will be void. The developer or designee must then request another Final Warranty Inspection.

19. Upon the acceptable completion of all punch list items, the developer or designee will receive a Letter of Final Acceptance from the Public Utilities Department. The Public Utilities Department will assume all responsibility of the system as of the date of the Letter of Final Acceptance.

## **1.02 Water Distribution Pipe**

### **A. Design**

#### **1. Location**

- a. All public water mains shall be located within dedicated rights-of-way or easements having a minimum width of 20 feet.
- b. To the extent possible, water mains shall be located outside of paved surfaces.
- c. Main extensions to a lot shall terminate at the furthestmost property line from the direction of approach.
- d. Water mains shall be buried to a depth sufficient to provide a minimum of 36 inches of cover.
- e. Water mains shall be at least 10 feet laterally from existing and proposed sewers. Where existing conditions prevent a 10 foot lateral separation, the following shall be followed with approval of the County Public Utilities Department.
  - i) Lay water main in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
  - ii) Lay water main in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
- f. When it is necessary for a water main to cross over a sewer, the bottom of the water main shall be at least 18 inches above the top of the sewer. Where existing conditions prevent an 18 inch vertical separation, construct both the water main and sewer of ferrous materials with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.
- g. When it is necessary for a water main to cross under a sewer, construct both the water main and the sewer of ferrous materials with joints

equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A full joint of water main pipe shall be centered at the point of crossing.

2. Sizing

a. Residential Areas

- i) Mains shall be a minimum of 6 inches in diameter. Larger lines may be required if an adequate, interconnected grid cannot be established within the proposed development. The developer's engineer shall provide documentation which shows that the proposed water system provides adequate flows and pressures.
- ii) In residential areas, 2-inch diameter water mains may be permitted at the discretion of the County if no more than 20, or the equivalent of 20, residences are to be connected to the line, unless the line is looped or otherwise supplied from 2 connections with mains of adequate capacities.
- iii) A looped 2 inch diameter main shall serve no more than 40 residences or the equivalent water demand of 40 residences. A 2 inch main shall not exceed 500 feet in length.

b. Business, Commercial, Industrial Areas

Water mains in business, commercial and industrial areas shall be 8-inch and 12-inch minimum diameters. An 8-inch main shall be used only when it completes an adequate grid. The maximum length of 8-inch lines without connection to a larger feeder main is 1,200 feet unless special approval for deviation from this requirement is granted by the County Public Utilities Department. In all cases, water mains shall be of such size as to maintain minimum residual pressure acceptable to the County.

B. Material

1. Polyvinyl Chloride (PVC) Pressure Pipe – PVC – SDR 21

a. General

- i) PVC materials shall comply with ASTM D1784 with a cell classification of 12454-B.
- ii) Pipe shall be tested and certified for potable water distribution products by the NSF Standard No. 14 or 61 and bear the NSF seal on each section of pipe.

b. PVC - SDR 21

- i) Pressure Rated (PR) PVC pipe 2-inch to 8-inch shall conform to ASTM D2241.

- ii) Pipe shall be pressure rated 200 with a standard dimension ratio of SDR 21.
- iii) Pipe shall have an integral elastomeric-gasket bell end. The joints and gaskets shall comply with ASTM D3139 and ASTM F477.
- iv) Fittings for pipe 3-inch and larger shall conform to AWWA C110, or C153 and have mechanical joints with transition gaskets as required for the pipe outside diameter. Fittings shall be made of gray-iron or ductile-iron. Interior of fittings shall be cement-mortar lined with seal coat in accordance with AWWA C104.

2. Polyvinyl Chloride (PVC) Pressure Pipe – PVC – C900

a. General

- i) PVC materials shall comply with ASTM D1784 with a cell classification of 12454-B.
- ii) Pipe shall be tested and certified for potable water distribution products by the NSF Standard No. 14 or 61 and bear the NSF seal on each section of pipe.

b. PVC - C900

- i) PVC - C900 pipe (6" TO 12") shall conform to AWWA C900.
- ii) Pipe shall be pressure class 150 with a standard dimension ratio (SDR) of 14.
- iii) Outside diameter shall conform to ductile iron pipe.
- iv) Pipe shall have plain end and integral elastomeric - gasket bell ends.

3. Ductile Iron Pipe

a. Pipe and fittings: 3" and larger

- i) Suitable for a system working pressure of 150 psi at the depth indicated on the Drawings with a type 2 laying condition.
- ii) Pipe with interior lining to be used in a drinking water system shall be certified and listed in accordance with NSF 61.
- iii) Interior shall be lined with cement-mortar with seal coat in accordance with AWWA C104.

b. DIP for below ground service

- i) Joints shall be of the push-on type as per AWWA C151.

- ii) Provide mechanical joint fittings.
- c. DIP for above ground service
  - i) Joints shall be of the flanged type as per AWWA C115.
  - ii) Ductile iron shall be Grade 60-42-10.
  - iii) Pipes to be painted shall have only a shop primer on the outside by the manufacturer. Verify that proposed manufacturer's primer is compatible with proposed paint system.

4. High Density Polyethylene Pipe (HDPE)

- a. The use of High Density Polyethylene Pipe (HDPE) shall be restricted to those installations where Horizontal Directional Drilling (HDD) has been approved by the County Public Utilities Department.
- b. Pipe shall be polyethylene Type III, Class C, Category 5 and Grade P34 as described by ASTM D-1248 and shall conform to ANSI/AWWA C-906-90.
- c. HDPE pipe shall be pressure rated at 200 psi with a minimum standard dimension ratio equal to 9 (SDR 9) for both the barrel and molded flange adapters.
- d. Pipe shall be jointed by means of heat fusion.

C. Excavation

1. General

- a. All construction relating to the utility improvements must be performed by contractors licensed by the State of North Carolina to perform the proposed activity.
- b. The developer and the contractor shall be responsible for project safety.
- c. All work shall be performed in accordance with applicable State and Federal safety regulations including, but not limited to the following:
  - i) NC Safety and Health Standards for the Construction Industry (29CFR 1926 Subpart P).
  - ii) NC OSHA Industry Guide No. 14 - Excavations.
  - iii) NC OSHA Industry Guide No. 20 - Crane Safety.
- d. The contractor shall provide barriers, warning lights and other protective devices at excavations as necessary for safety of workers and the public.

- e. The contractor shall provide the sloping of a bank, shoring, sheeting, or other means of maintaining the stability of the trench in accordance with the requirements of the Associated Contractor's Manual of Accident Prevention OSHA, Part 1926.P.
- f. Should it be necessary to close or partially close a street, the contractor shall notify the Public Utilities Department and all other applicable emergency response agencies at least 24 hours prior to closing the street.

## 2. Definitions

- a. Backfill: A specified material used in filling the excavated trench and placed at a specified degree of compaction.
  - i) Materials: Materials listed herein include processed materials plus the soil classifications listed under the Unified Soil Classification System, (USCS) (Method D2487 and Practice D2488). The soil materials are grouped into five broad categories according to their suitability for this application.
    - aa. Class I: Angular, 6 to 40-mm (¼- to 1½-inch), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone and crushed shell.
    - bb. Class II: Coarse sands and gravels with maximum particle size of 40 mm (1½ inch), including various graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW and SP are included in this class.
    - cc. Class III: Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil Types GM, GC, SM and SC are included in this class.
    - dd. 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 shall not be used for bedding, haunching or initial backfill.
    - ee. Class V: This class includes the organic soils OL, OH, and PT, as well as, soils containing frozen earth, debris, rock larger than 40 mm (1-2 in.) in diameter, and other foreign materials. These materials shall not be used for bedding, haunching, or initial backfill.
- b. Backfill Zones: Each backfill zone shall extend the full width of the trench bottom.

- i) Foundation: Extending down the specified amount from 4 inches below the pipe bottom.
  - ii) Pipe Embedment
    - aa. Bedding: Extending from 4 inches below the pipe bottom to the pipe bottom.
    - bb. Haunching: Extending from the bedding (bottom of the pipe) to the pipe spring line.
    - cc. Initial Backfill: Extending from the haunching (pipe spring line) to 1 foot above the top of the pipe.
  - iii) Final Backfill: Extending from 1 foot above the top of the pipe to the finish ground elevation.
- c. Compaction: Process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. A Degree of compaction  $\cong$  shall be expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D698 (Standard Proctor).
  - d. Excavation: The removal of soil, or rock to obtain a specified depth or elevation.
  - e. Hard Material: Solid, homogeneous material which are not included in the definition of a rock but which usually require the use of heavy excavation equipment with ripper teeth or the use of jack hammers for removal. Amount must exceed 1 cubic yard in volume. Material having a standard penetration resistance as determined by ASTM D1586 and 150 blows per foot is defined as hard material.
  - f. Lift: Layer of soil placed on top of a previously prepared or placed soil.
  - g. Rock: Solid, homogeneous material which cannot be removed without the systematic drilling and blasting exceeding 1 cubic yard in volume. Material having a standard penetration resistance as determined by ASTM D1586 greater than 150 blows per foot is defined as a rock. Removal of a hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.
  - h. Topsoil: Natural, friable soil, representative of productive soils in the vicinity of the site. Topsoil shall be free from roots, stones larger than 1 inch, objectionable weed seeds, toxic substances, and materials that hinder grading, planting, and maintenance operations.

### 3. Water Control

- a. Prevent surface water from entering the trench.

- b. When trench bottom is below the existing ground water table, install a dewatering system to maintain water table approximately 1 foot below trench bottom. Provide a man experienced in dewatering work at the job site.
  - c. Maintain dewatering until backfilling has proceeded above the existing ground water level.
  - d. Dispose of water from dewatering operations in accordance with the NC Sedimentation Pollution Control Act.
4. Use of Explosives
- a. Obtain required permits for blasting from the Public Utilities Department and other applicable agencies.
  - b. Store, handle, and use explosives in accordance with local and state regulations or in the absence of such, in accordance with the provisions of the Manual of Accident Prevention and Construction of the Associated General Contractors of America, Inc.
  - c. Conduct survey and document existing conditions of facilities prior to blasting. Provide seismographic monitoring during progress of blasting operations.
  - d. Use explosives in such a way to minimize vibration to existing utilities and structures.
  - e. Provide only experienced individuals for blasting in accordance with accepted practices. Project Foreman shall have a minimum of 2 years experience in the type of blasting activity being proposed.
  - f. The contractor is responsible for safety of life and damage to property resulting from the use of explosives.
5. Excavating
- a. Excavation shall be by open cut, unless otherwise indicated on the Drawings or specified herein. Short sections of trench may be tunneled or direct bored with the approval of the Public Utilities Department.
  - b. Stockpile excavated material in such a manner that it will not obstruct the flow of runoff, streams, endanger work, impair the use or appearance of existing facilities, or be detrimental to the completed work.
  - c. Trench dimensions shall be as follows:
    - i) Minimum width: Pipe outside diameter plus 18 inches.
    - ii) Maximum width: Pipe outside diameter plus 24 inches.

- iii) Sides shall be vertical to a minimum of one foot above the top of pipe.
- d. Shape trench bedding to provide uniform bearing for the full pipe length. Bottom shall be free of protrusions which could cause point loading on pipe. Provide bell holes as required for properly making pipe joint.
- e. Do not over excavate. Excavation below grade without approval of the County shall be backfilled with Class I material.
- f. Undercut soils that become unsatisfactory by construction activity or by being left exposed to the weather and backfill with Class I material.
- g. Remove shoring, bracing, and sheeting, unless otherwise noted, as the trench is backfilled. The County shall have the authority to require that the sheeting be left in place.
- h. Excavation of trench shall not advance more than 200 feet ahead of the completed utility installation. In no case should the excavation extend beyond that which can be backfilled by the end of the work day.
- i. Correct unstable soil conditions encountered at trench foundation.
- j. Excavate rock and hard material to a minimum depth of 4 inches below the pipe for pipes smaller than 30 inches and 6 inches for pipes 30 inches and larger.
- k. Pressure Lines:
  - i) Provide a minimum 3 feet of cover, unless indicated otherwise on the drawings.
  - ii) Excavate trenches to provide vertical curve chords which will not exceed the pipe manufacturer's recommended joint deflection.
  - iii) Provide concrete thrust blocks having a compressive strength of 3,000 psi at 28 days at change in horizontal and vertical direction and reduction in the pipe size. Cut trench sides vertical and square to receive concrete. Provide bearing area against trench wall as indicated on the Drawings. Restrained pipe joints may be used when they are designed by a licensed Engineer.
- l. Gravity Lines: Excavate trench to the alignment and grade indicated on the Drawings.
- m. Utility Structures: Excavate a minimum of six (6) inches below subgrade and backfill with Class I material compacted to 95 percent maximum density. If the soil conditions are found to be unsuitable for structural stability of the manhole, Engineer may require additional depth of Class I material.

6. Boring and Jacking

a. General

- i) The crossing of a highway by means other than open cut shall be made by installing an encasement pipe beneath the roadway by dry boring and jacking. All such installations shall be made in accordance with the NC Department of transportation's "Policies and Procedures for Accommodating Utilities on Highway Rights-of-Way".
- ii) Railroad crossings shall be made in accordance with Part 5.3 of the American Railway Engineering Association's (AREA) "Specifications for Pipelines Conveying Non-Flammable Substances".

b. Materials

- i) Encasement Pipe: Encasement pipe shall be uncoated spiral welded steel meeting ASTM A-139, Grade B, with a minimum yield strength of 35,000 psi. Pipe length and size shall be as indicated on the Drawings. The minimum wall thickness shall be as follows:

<u>Pipe Size (O.D.-inches)</u>	<u>Wall Thickness (inches)</u>
4 – 12¾	0.188
16 – 24	0.250

- ii) Carrier Pipe: Carrier pipe shall be of the type, size, and joints as indicated on the Drawings and specified herein.
- iii) Pipe Support: Provide pipe supports designed and manufactured for the support of the carrier pipe size and material to be used for the Project within the encasement size indicated on the Drawings. Supports shall be designed to carry the pipe at the support spacing specified and meet the following minimum requirements:
  - aa. Band Width: 8 inches for pipes 14 inches and under and 12 inches for pipes 16 inches and over.
  - bb. Pipe position within casing: Centered and Restrained.
  - cc. Support Spacing: Provide a support within one foot on each side of joints and 6 foot maximum spacing along pipe. Provide a support within one foot of each end of casing.

- dd. Supports shall be as manufactured by Advance Products and Systems, Inc., Pipeline Seal and Insulator, Inc, or equal.
  - iv) Casing End Seal: Provide casing seal designed and manufactured for sealing around the casing and carrier pipe. The seal may be a wrap-around or a pull-on. Seal shall be made of 1/8-inch thick synthetic rubber. Seal shall be secured with stainless steel banding straps with worm gear tightening device.
- c. Installation
- i) Verify the subsurface conditions at each boring site. Payment will not be made for encasement pipe installed but not usable.
  - ii) Stabilize and maintain bore pit bottom to provide proper equipment support and maintain pipe alignment. Dewater as necessary for site. Excavate bore pit in accordance with OSHA regulations. Provide adequate barricades, railings, and warning lights throughout the boring operation. Conduct operation in such a manner so as not to create a hazard to nor impede the flow of traffic.
  - iii) Install encasement pipe by dry boring and jacking.
  - iv) Boring auger diameter shall not be greater than the outside diameter of the encasement pipe and shall not extend more than 6-inches ahead of the cutting edge of the encasement pipe. Fill voids that are formed during the operation with a 1:3 portland cement grout pumped at 50 psi to ensure that there will be no settlement of the roadway.
  - v) As the boring operation progresses, butt weld each new section of the encasement pipe to the section previously jacked into place. Maintain proper alignment. Confirm the grade of the encasement pipe as the Work progresses.
  - vi) If an obstruction is encountered during the boring operation efforts should be made to remove the obstruction. If obstruction cannot be removed, withdraw the encasement pipe and fill the void with 1:3 portland cement grout at 50 psi. If the encasement pipe cannot be withdrawn, seal ends before moving to another bore site.
  - vii) Provide seals at each end of encasement pipe.
  - viii) Carrier Pipe: Install carrier pipe in the encasement pipe using manufactured pipe supports. Supports shall prevent movement of the carrier pipe within the encasement. Space supports in accordance with pipe manufacturer.

D. Installation

1. General

- a. Lay pipe in the presence of a representative of the County Public Utilities Department, unless specifically approved otherwise.
- b. Handle pipe and accessories in accordance with manufacturer's recommendations. Care shall be taken to not damage pipe coatings.
- c. Carefully inspect pipe immediately prior to laying. Do not use defective pipe. Replace pipe damaged during construction.
- d. Lay pipe to grade and alignment indicated on the approved Drawings.
- e. Provide proper equipment for lowering pipe into trench.
- f. Provide tight closure pipe ends when work is not in progress.
- g. Keep pipe interior free of foreign materials.
- h. Do not lay pipe in water or when the trench or weather conditions are unsuitable for the work.
- i. Clean bell and spigots before joining. Make joints and lubricate gasket in accordance with pipe manufacturer recommendation.
- j. Block fittings in pressure lines with concrete, or restrain as indicated on Standard Detail Nos. 1.04, 1.05, and 1.06 or as required to prevent movement.
- k. Disinfection of pipe during installation:
  - i) Soak gaskets for minimum of 1 hour in a 50-100 ppm hypochlorite solution prior to installation.
  - ii) Mop bells and spigots of pipe, fittings, and valves with a 50-100 ppm hypochlorite solution immediately prior to making joints.
- l. A 12-gauge insulated solid wire shall be taped to the top of all PVC and HDPE water mains and attached to all valves. The tracer wire color shall be blue.
- m. Warning and Identification Tape
  - i) Tape shall be a minimum 3 inch wide polyethylene plastic tape manufactured specifically for identification of buried utilities with means of enabling detection by a metal detector to a minimum depth of 3 feet. Tape color shall be blue it shall be continuously imprinted with warning and identification markings in bold black letters to read "CAUTION - BURIED WATER

LINE BELOW." Color and printing shall be permanent and unaffected by moisture or soil.

- ii) Tape shall be by Blackburn Manufacturing, Joseph G. Pollard Co., or Reef Industries, Inc., or an approved equal.

2. PVC Pressure Pipe

- a. Install PVC pipe in conformance with AWWA C605.
- b. Solvent Weld: Field cut ends shall be sanded to roughen the surface. Joints shall be cleaned of foreign material. Solvent shall be applied to the joint and joint made as recommended by the manufacturer. Excess solvent shall be wiped off. The joint should not be moved until sufficiently set up.
- c. 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. The joint shall be made as recommended by the manufacturer.

3. Ductile Iron Pipe: Install pipe in conformance with AWWA C600 and the following:

- a. For laying pipe in a vertical or horizontal curve, each full length pipe may be deflected by the following maximum offset distance:
  - i. Push-on joint
    - aa. 3 to 12-inch pipe: 14-inch offset
    - bb. 14 to 36-inch pipe: 8-inch offset
  - ii. Mechanical joint
    - aa. 3 to 6-inch pipe: 20-inch offset
    - bb. 8 to 12-inch pipe: 15-inch offset
    - cc. 14 to 20-inch pipe: 8-inch offset
    - dd. 24 to 36-inch pipe: 6-inch offset

4. High Density Polyethylene Pipe (HDPE)

- a. HDPE pipe shall be installed only by the horizontal directional boring method with fluid assistance in accordance with the current best industry practice.
- b. The contractor performing the horizontal directional bore shall provide evidence, satisfactory to the County Public Utilities Department, which clearly demonstrates the contractor's experience and ability to complete

the directional bore.

5. Copper Pipe and Tubing

- a. Copper pipe shall conform to Type K4 soft copper.
- b. Soldered joint fittings shall conform to NSI B-16.22. Fittings are to be of same manufacturer as pipe.
- c. Screw joint fittings to be provided where required and indicated.
- d. Screw joint unions shall be provided at each in-line valve, pressure regulator, pressure reducer and/or where indicated.

6. Polyethylene Pressure Pipe and Tubing: Polyethylene pressure pipe and tubing, ½-inch through 3-inch, shall conform to AWWA 901 and the following requirements:

- a. Line shall be the size indicated on the drawings and shall be polyethylene tubing.
- b. Line shall be made from material having standard CTS PE code designation PE 3406.
- c. Line shall have a minimum pressure class of 160 psi with a dimension ratio (DR) of DR-9.
- d. Direct bury #12 THNN wire with polyethylene pipe for tracing and locating service lines.

E. Backfilling and Compaction

1. Weather Limitations: Proceed with backfill operations based on the following weather conditions:

- a. Temperature must be above freezing and rising.
- b. In windy, hot, or arid conditions with a high rate of evaporation, add moisture to the material to maintain optimum moisture content.
- c. Do not proceed in rain or on saturated subgrades.
- d. Do not place material on surfaces that are muddy, frozen, or contains frost.

2. General

- a. Maintain backfill operation within 200 feet from pipe laying operation.
- b. Backfill trench to existing ground surface with select excavated material

at the specified compaction.

- c. If excavated material is unsuitable to obtain specified compaction, provide suitable off-site borrow material for backfill.
- d. Re-excavate trenches improperly compacted. Backfill and compact as specified.
- e. Provide appropriate tamping equipment and water controlling equipment to obtain proper moisture content, to achieve specified compaction of backfill.
- f. Conduct operation of heavy equipment above pipe installation so as to prevent damage to pipe.
- g. Install warning / identification tape over utilities. Bury tape a maximum of three (3) feet below grade and a minimum of one (1) foot above the utility.
- h. Install tracer wire for PVC water mains. Bury tracer wire with pipe. Wire shall be looped into valve boxes to allow access for direct contact location.

### 3. Backfill in Pipe Embedment Zone

- a. Backfill with material as specified below. Material shall be free from objects larger than 2 inches in any dimension.
- b. Where unstable material has been excavated below the pipe bottom, the entire Pipe Embedment Zone shall be backfilled with Class I material.
- c. Place backfill material to assure adequate placement and compaction of material under pipe haunches.
- d. No movement of the pipe shall occur during placement and compacting of material.
- e. Place pipe zone backfill in 6 inch maximum layers.
- f. When excavating in Class I, Class II, Class III and stable Class IV soils suitable for bedding, the bedding surface shall provide a firm foundation of uniform density. Backfill with select excavated material to pipe spring line and compact to 90 percent.
- g. When excavating in Class V, unstable Class IV soils, running water, and other unstable soil conditions, excavate a minimum of 4 inches below pipe bottom and provide Class I material for bedding and haunch zone.

### 4. Final Backfill

- a. Backfill with materials free of stones and debris larger than 6 inches in

any dimension. Place backfill in layers not exceeding the thickness and compacted to the minimum density specified below.

b. Trench backfilled with noncohesive materials may be compacted with water flooding; except under roadways, shoulders of roadways, and other areas subject to vehicular movement, provided the method of compaction is approved by the County Public Utilities Department and provides the degree of compaction required.

c. Lifts and Density:

i) Undeveloped areas (i.e., forest, fields, and crop lands): Trench may be filled with bulldozer blade provided material fall will not damage pipe. Mound soil over the trench area sufficiently to settle level over time. Degree of compaction shall be 85 percent density as per ASTM D698.

ii) Lawns: Backfill in 12 inch layers and compact to 90 percent. Top 12 inches shall be free of material with dimension over 2 inches.

iii) Roads (including Right-of-way), drives, parking areas (including areas within 20 feet), and areas adjacent to existing utilities: Backfill in 6 inch layers compacted to 95 percent.

iv) Within 20 feet of foundations: Backfill in 6 inch layers compacted to 95 percent.

5. Utility Structures: Bring backfill to grade in even lifts on all sides. Lift depths and compaction densities shall be as specified according to area of installation for pipe above. Backfill against cast-in-place concrete structure only after concrete has attained the specified 28 day compressive strength.

#### F. Soil Testing

1. Compaction tests may be made at the option of the County. Tests will be performed by an independent testing laboratory. Owner will pay for cost of the initial tests.

2. For each test that fails the compaction requirements, two additional tests shall be made by the testing firm at the direction of the County.

3. Correct deficiencies in compaction.

#### G. Pavement Replacement

1. Repair damaged pavement structures as specified herein.

2. Cut existing pavements for utility installation in straight lines generally parallel to the utility. Properly dispose of removed pavement structure.

3. Extend pavement patch 1 foot beyond each side of trench on firm subgrade.
4. Flexible Pavements: Replace flexible pavements with a pavement structure equal to existing but no less than as shown on Standard Detail No. 1.16.
5. Rigid Pavements: Surface replacement shall match existing surfacing except where otherwise indicated.
6. Curbs, Gutters, and Sidewalks: Replace curb and gutters, and sidewalks removed or damaged with similar sections to match the existing. Remove to nearest existing joint. Include cost of work in the unit price for the utility.
7. Private Drives: Repair private driveways with the same pavement structure as the existing, but no less than 6 inches of ABC stone and 2 inches of I-2. Grade shall match and tie into the existing driveway.
8. Approval of Other Authorities: Pavements under the jurisdiction of the NC Division of Highways shall be subject to the approval of representative of that Division.

### **1.03 Fire Hydrants**

#### **A. Location**

1. All hydrants to be installed only on 6" mains or larger.
2. Hydrants shall be located within the street rights-of-way at the side property line between lots. In no case shall a fire hydrant be located at or near the middle of a lot's roadway frontage.
3. Positive drainage away from the fire hydrant shall be provided in such a manner so as to prevent damage to the adjoining lots and/or structures when hydrants are being flushed.
4. The number and final location of fire hydrants will be determined by the County Public Utilities Department on a project by project basis.

#### **B. Specifications: Hydrants shall conform to AWWA C502 and to the following requirements:**

1. Nozzles: 2 2½ inch hose and 1 4½ inch pumper connections.
2. Nozzle threads shall conform to National Standards or to the County requirements.
3. Main valve diameter: 4½ inch.
4. Minimum depth of bury: 42 inches.
5. Inlet connections: 6 inch mechanical joint

6. Operating nut shall be pentagon shaped and shall open counter clockwise.
  7. Close with water pressure
  8. "O" ring seals.
  9. Traffic model with frangible sections near the ground line designed to break on impact.
  10. Provide extension for hydrant standpipe as required to set center line of hydrant nozzle a minimum of 15 inches and a maximum of 24 inches above ground line.
  11. Remove chains and paint with Rustoleum #964 Federal Safety Red. Nozzle caps and bonnet shall receive a coating of Alert Series 1440 Silver White by Ferro, Inc.
  12. Oil and grease as recommended by manufacturer after installation.
  13. Hydrants shall be American Darling B-50-B, Kennedy Guardian in 4½, Mueller Centurion A421, or Waterous Trend 100.
  14. Hydrant tees are required and shall be mechanical joint anchoring tees number F-1217 as manufactured by Clow Corporation, Number 10180 as manufactured by American Ductile Iron Pipe Company, or equal.
- C. Installation: Hydrants shall be installed in accordance with Public Utilities Department's Standard Detail No. 1.01.

#### **1.04 Backflow Prevention Assemblies**

- A. The use and type of backflow preventers shall meet the requirements of the NC Guidelines for Cross Connection Control in Water Distribution Systems as adopted by the NC Department of Environment and Natural Resources.
- B. Backflow prevention assemblies shall conform to USC Foundation for Cross Connection Control and Hydraulic Research and to the following requirements:
  1. Double Check Valve (DCV) in conformance with AWWA C510 and ASSE 1015.
  2. Reduced Pressure Zone (RPZ) in conformance with AWWA C511 and ASSE 1013.
  3. Service shall be for cold water.
  4. Assembly shut-off valves shall be:
    - a. 2-inch and under: ¼ turn, full port, resilient seated, bronze ball valve.
    - b. Over 2-inch: OSandY resilient seated gate valves.

5. Valves shall be internally epoxy coated in accordance with AWWA C550.
- C. Enclosures for backflow preventers shall meet the following requirements:
1. Aluminum or fiberglass reinforced construction sized to totally enclose “wet” portion of BFP.
  2. Provide access through lockable doors or hinged lid for testing of BFP.
  3. Shall be totally removable for maintenance of BFP.
  4. Lined with unicellular, non-wicking, insulation.
  5. Provide thermostatically controlled heat source within enclosure to provide freeze protection to minus 30 degrees F.
  6. For enclosure of reduced pressure zone BFP, provide drain openings at each end to accommodate full port discharge form device. Openings shall be protected against intrusion of wind, debris, and animals.
  7. Provide means of permanent anchor to concrete pdd.

## 1.05 Valves and Appurtenances

- A. Location
1. Valves shall be installed on all branches from feeder mains and on hydrant branches according to the following:
    - a. 3 valves at cross intersections
    - b. 2 valves at tee intersections
    - c. 1 valve on hydrant branches
  2. Main line valves on straight runs between intersections shall be spaced at intervals distances not exceeding the following:

<u>Main Size</u>	<u>Maximum Spacing</u>
2"	400'
4"	600'
6"	800'
8"	1,000'
12"	1,400'
16"	1,800'

3. Ductile iron, mechanical joint gate valves shall be used for water mains through 12 inch in diameter. For mains 16 inch and larger, butterfly valves may be used.
4. A valve location post, as per Standard Detail No. 1.17 shall be installed for each

main line underground valve of 4" nominal size and larger.

B. Specifications

1. General: Valves shall conform to AWWA C800 and to the following requirements:
  - a. Size shall be as required for the pipe size and material as indicated on the Drawings and specified herein.
  - b. Open by counterclockwise rotation.
  - c. Provide an interior protective epoxy coating in accordance with AWWA C550 on ferrous surfaces in contact with the liquid.
  - d. Components in contact with the liquid shall be in compliance with NSF 61.
  - e. Standard system working pressure of 150 psi.
  - f. Equip valves with a suitable means of operation.
  - g. For buried valves over 5 feet deep, provide extension stems of cold rolled steel to bring the operating nut to within 30 inches of the ground surface. Extension stems shall also be provided as required for floor stands and to floor valve box.
  - h. Provide valve accessories as required for proper valve operation for valve locations as indicated on the Drawings and as recommended by valve manufacturer.
  - i. Similar valve types shall be of one manufacturer.
2. Gate valves: 3" and larger
  - a. Valves shall conform to AWWA C509 for resilient-seated gate valves.
  - b. O-ring stem seal on non-rising stem (NRS) valves.
  - c. Valve shall be designed for 150 psi working pressure.
  - d. Ends shall be mechanical joint for underground locations and flanged joint for above ground locations.
  - e. Valves shall be non-rising stem (NRS) with wrench nut for underground locations and Outside Screw and Yoke (OS and Y) with handwheel for above ground locations.
3. Butterfly Valves: 3" and larger
  - a. Butterfly valves shall conform to AWWA C504 for potable water.

- b. Valve body shall be cast or ductile iron mechanical-joint for underground location.
- c. Valves shall be class 150B.
- d. Rubber seats shall mate with stainless steel or nickel-copper alloy seat surfaces.
- e. Valve shafts shall consist of one-piece unit extending completely through the valve disc for valves under 12-inches. Above this size, shaft shall be one piece or the stub-shaft type. Shafts shall be type 304 stainless steel.
- f. Valve discs shall be cast iron, ductile iron, or stainless steel.

4. Tapping Valves

- a. Tapping valves shall conform to the specifications for gate valves, and shall be specifically modified for the passage and clearance of the tapping machine cutter.
- b. The mating end to the tapping sleeve shall be raised male surface to provide true alignment to the sleeve and tapping machine.
- c. Valves shall be of the same manufacturer as the tapping sleeve.

5. Valve Boxes

- a. Box shall be high strength cast iron of the screw or telescopic type. Box shall consist of a flare base section, center extension as required, and a top section with the word "WATER" cast in the cover. Length of box shall be such that full extension of box is not required at the depth of water main cover.
- b. Valve operation nut shall be within 30 inches of the top of the box. Provide stem extension if necessary to bring operating nut to within 30 inches of the top of box.
- c. Extension stem (if necessary) shall be sized so as to transmit full torque from the operating mechanism to the valve stem without binding, twisting, or bending. Stem shall be made from heavy steel pipe. Stem shall be complete with couplings for connection to valve and floor stand where required. When valve extension kits are used they must be as recommended by the valve manufacturer.
- d. Set a valve box over each buried valve. Support box so that no stress shall be transmitted to the valve or pipe line. Install box plumb and set top flush with finished grade. Operating nut shall be centered in box. Provide a 24-inch by 24-inch wide by 6-inch thick concrete pad at the top of valve boxes in paved areas.

6. Blow-Off Assemblies
  - a. Blow-off assemblies, as shown in Standard Detail No. 1.03, shall be installed at all dead-ends and at distinct low points.
  - b. A blow-off location post, as per Standard Detail No. 1.17, shall be installed for each blow-off assembly.
  - c. Fire hydrants shall be used as a blow-off for lines greater than 6-inch in diameter.
  
7. Fittings
  - a. Fittings for pipe 3-inch and larger shall conform to AWWA C110, or C153 and have mechanical joints with transition gaskets as required for the pipe outside diameter. Fittings shall be made of gray-iron or ductile iron.
  - b. Interior of fittings shall be cement-mortar lined with a bituminous seal coat in accordance with AWWA C104.
  - c. 2-inch and smaller fittings shall be brass or as approved by the Public Utilities Department.
  - d. All fittings shall be rated for the same operating pressure as the pipe for which they are to be used.
  - e. Fittings for HDPE pipe shall be limited to HDPE molded flange adapters for the exclusive use to mechanically join HDPE pipe and ductile iron fittings. Fittings shall have the same pressure rating as the HDPE pipe.
  
8. Tapping sleeves shall be the two piece type, 304 stainless steel, gray cast or ductile iron with mechanical joint to the main line and flanged to the tapping valve. Tapping sleeve shall be of the same manufacturer as the tapping valve. Side flange seals shall be of the O-ring or 360 degree gasket type. Sleeve shall be designed for a system working pressure of 150 psi.
  
9. Air Release Valves: If the design engineer or the County Public Utilities Department determine that air release valves are needed, they shall conform to the following requirements:
  - a. Air release valves (1/2" to 16") shall meet or exceed the requirements of AWWA C512.
  - b. Valve shall be of the single housing, short body style that combines the operation of both an air/vacuum and air release valve.
  - c. Provide threaded inlet.
  - d. Valve shall be manufactured for a 150 psig working pressure.

- e. Provide stainless steel ball float and internal trim.
- f. Provide isolating bronze ball valve for connection to main line.

10. Check Valves

- a. Check valves shall be swing-check type conforming to AWWA C508 and to the following requirements:
  - i) Provide lever and weight for swing check control.
  - ii) Metal to metal or resilient material to metal seat construction.
  - iii) Ends shall be flanged.
- b. All check valves four (4) inches and larger shall be the horizontal, lever and weight swing type check valves. Check valves smaller than four (4) inches shall be swing type with screen in cap and renewable composition disc.
- c. Valves shall be manufactured by Mueller, Clow, Dresser or approved equal.

11. Reaction Blocking

- a. All fittings or components subject to hydrostatic thrust shall be securely anchored by the use of poured in place concrete thrust blocks.
- b. Concrete shall be placed so as to not interfere with the removal of the fitting or components.
- c. Concrete for reaction blocking shall be 3,000 psi or greater.
- d. Alternative restraining methods may be approved by the Public Utilities Department.

C. Installation

- 1. Valves shall be installed on a firm foundation of concrete. Bolted connections shall be protected from the concrete and not embedded. Connection to the pipe shall be such that there shall be no stress at the joint caused by misalignment.
- 2. Maximum depth of valve nut shall be 30 inches. When extension kits are used, they must be manufactured by the same company which manufactured the valve.
- 3. Where valves are located in paved areas, the valve box shall be adjusted to the finished street grade. A 2'x2'x6" concrete pad shall be placed around the box below the asphalt surface.
- 4. Valves located outside of paved areas shall have a pre-cast concrete collar placed

around the box.

5. Valve boxes shall be centered over the wrench nut and seated on compacted fill without touching the valve assembly.
6. Air release valves shall be installed in a manhole as per Standard Detail No. 1.15.
7. Tapping valves and sleeves shall be installed in strict compliance with the manufacturer's recommendation. All bolts shall be properly torqued.

## **1.06 Water Services**

### **A. General**

1. A service tap shall be made for each platted lot by the contractor prior to pressure testing of the water main. In lieu of this, the taps may be made after testing, while the line is under pressure and being observed for leakage by a County representative.
2. Water meters for all services shall be purchased from Nash County or another supplier approved by Nash County. Meters purchased by Nash County that are 2 inches and smaller shall be delivered to the Public Utilities Department and will be installed by the Public Utilities Department or an approved contractor as services are activated. Meters larger than 2 inches shall be installed by the developer under the supervision of the Public Utilities Department. No meters shall be installed or placed into service until there is an inspection certificate completed by Nash County Inspections Department.
3. Service saddles shall be provided for service pipe connection to main pipe material. Saddles shall meet the following requirements:
  - a. Bronze or iron body to conform to the outside dimension of the main.
  - b. O-ring, Buna N rubber gasket to provide watertight connection.
  - c. Hinged, double bottom strap design.
  - d. Threaded outlet to match threads on corporation valve.
4. The maximum size of direct taps without a fitting, tapping sleeve or saddle for ductile iron water main shall be as follows:
  - a. 6" main - 1" tap
  - b. 8" main - 1 1/4" tap
  - c. 10" main - 1 1/2" tap
  - d. 12" main - 2" tap
5. Unless otherwise directed by the Public Utilities Department, meters shall be

located at the right-of-way line.

6. Taps shall be located at 10:00 or 2:00 on the circumference of the pipe. Taps shall be staggered alternating from one side of the water main to the other and at least 12 inches apart. Taps must be a minimum of 24 inches apart, if they are on the same side of the pipe.
7. The water meter shall be sized based on water demand. Water meter size can generally be determined from the following table.

Water Meter Sizing

Supply Systems Predominately for Flush Tanks

<u>Meter Size (Inches)</u>	<u>Load Range (Number of Fixtures)</u>	<u>Flow Range (GPM)</u>
5/8" PD	1 - 22	0 - 20
1" PD	22 - 140	20 - 50
1½ " PD	140 - 450	50 - 100
2" PD	450 - 1000	100 - 200
3" T or C	1000 - 2500	200 - 400
4" T or C	2500 - 5000	400 - 600

Supply Systems Predominately for Flush Valves

<u>Meter Size (Inches)</u>	<u>Load Range (Number of Fixtures)</u>	<u>Flow Range (GPM)</u>
5/8" PD	1 - 8	0 - 20
1" PD	8 - 50	20 - 50
1½ " PD	50 - 275	50 - 100
2" PD	275 - 1000	100 - 200
3" T or C	1000 - 2500	200 - 400
4" T or C	2500 - 5000	400 - 600

PD = Positive Displacement  
 T = Turbine  
 C = Compound (must be sized on a case by case basis)

8. A 12-gauge insulated wire shall be taped to the service line and extended from the locator wire on the main into the meter box. The tracer wire color shall be blue.

B. Materials

1. Corporation Stops

- a. The size of the stop shall be the same as indicated for the service line on the drawings.
- b. The inlet thread shall conform to the requirement of AWWA C800.

- c. The outlet thread shall be as required for the pipe material specified.
- 2. Service saddles shall be provided for service pipe connection to main pipe material. Saddles shall meet the following requirements:
  - a. Bronze or iron body to conform to the outside dimension of the main.
  - b. O-ring, Buna N rubber gasket to provide watertight connection.
  - c. Hinged, double bottom strap design.
  - d. Threaded outlet to match threads on corporation valve.
- 3. Service Tubing
  - a. Service lines ½-inch through 3-inch shall be polyethylene (PE) tubing. PE pipe shall be pressure rated 160 psi, SDR 9 and shall meet the requirement of AWWA C901.
  - b. Line shall be made from material having standard CTS PE code designation PE 3406.
  - c. Direct bury #12 THNN wire with polyethylene pipe for tracing and locating service lines.
- 4. Meter Boxes/Setters/Vaults
  - a. Meter boxes and covers shall be cast iron and sized for required water meter. Lid shall be made for touch read with a 1¾ inch hole for transmitter.
  - b. Box shall be Russell MBX1 or approved equal.
  - c. Setter shall be made of copper and compatible with the meter and other fittings to be supplied.
  - d. Setter shall have a curb stop on the public side of the meter. Curb stop shall be O-ring sealed and capable of being locked in the closed position. Setter shall have a dual check valve on the private side of the meter.
  - e. Setter shall be Ford LSAVHH21-233W for K4 copper or Ford LSAVHH41-233W CTS plastic or approved equal.
  - f. Meter boxes for 1½-inch and 2-inch services shall be lightweight polymer concrete as shown in Standard Detail No. 1.09.
  - g. Meter boxes shall be set on standard bricks supported on a minimum of 6-inch of crush stone. Top of box shall be set flush with the ground.
- 5. Meters

- a. Compound meters shall conform to AWWA C702 and to the following requirements:
  - i) Meter size shall be as indicated on the Drawings.
  - ii) Meter ends shall match pipe fittings.
  - iii) Provide magnetic drive with sealed gear housing.
  - iv) Main casing shall be cast iron.
  - v) Indicator/Totalizer shall have:
    - 1. 4-inch combination dial reading in gallons per minute (gpm) and gallons
    - 2. Rate of flow indicator with a range of 0-15,000 gpm
    - 3. 6-digit totalizer
    - 4. Circular test dial
  - vi) Meters shall be purchased from Nash County.
- b. Install meter boxes and water service components so top of meter will be within 6 inches of the surface.

6. Meter Valves

- a. Meter valves shall be as required for installation with the type of service pipe provided and the water meter used and shall be suitable for an operating pressure of 150 psi.
- b. Valves shall be of brass and bronze construction with O-ring seals.
- c. Valves shall be straight cascading dual check valves as manufactured by Ford or equal.

7. Pressure Reducing Valve

- a. The valve shall maintain a constant downstream pressure regardless of the varying inlet pressure.
- b. The valve shall meet Federal Specification, MIL-V-18146, Type II.

**1.07 Testing and Inspection**

A. General

- 1. Prior to installation, all materials used must have a preliminary inspection by the County Public Utilities Department.
- 2. The contractor shall furnish all materials, labor and equipment to perform all testing and inspections to the satisfaction of the Public Utilities Department.

3. The Public Utilities Department will provide water for the testing of water mains up to 3 times the volume of the main to be tested. If additional water is required, the contractor will be responsible for the additional cost.
4. Clean and flush all pipes of foreign matter prior to testing. If required by the County Public Utilities Department, 8 inch and larger mains shall be cleaned and flushed by using the cleaning device with the commercial name "Pigs".
5. No valve on the existing system shall be operated without authorization from the County Public Utilities Department.
6. Notify the County Public Utilities Department 48 hours prior to conducting any test.

B. Pressure Testing

1. Pressure test in accordance with AWWA C600 for ductile iron pipe and AWWA C605 and M23 for PVC pipe and as specified herein.
2. General:
  - a. The source, quality, and method of disposal of water to be used in test procedures shall be approved by the County Public Utilities Department.
  - b. Obtain County permission 48 hours prior to filling or flushing of pipe system with water from owner's water system. County shall operate valves connected to the existing water system. Where large quantities of water may be required for flushing, County reserves the right to require that flushing be done at periods of low demand.
  - c. Clean and flush pipe system of foreign matter prior to testing.
  - d. Provide air vents at high points in the line section to be tested for releasing of air during filling. Service corporation stops may be used for air vent when located at a high point. Include cost of air vents in price of testing. Leave corporation stops in place after testing and note locations on Record Drawings.
  - e. Allow concrete blocking to reach design strength prior to pressure testing.
  - f. Test main prior to installation of service taps.
  - g. Repair defects in the pipe system. Make repairs to the same standard as specified for the pipe system.
  - h. Retest repaired sections until acceptance.
  - i. Repair visible leaks regardless of the test results.

j. Pipe sections shall not be accepted and placed into service until specified test limits have been met.

3. Testing:

a. Notify the County a minimum of 48 hours prior to testing.

b. Perform tests in the presence of the County.

c. Length of line to be tested at one time shall be subject to approval of the County. Make pressure tests between valves. Furnish suitable test plugs where line ends in "free flow."

d. Upon completing a section of pipe between valves, test pipe by maintaining for a two hour period a hydrostatic pressure of 150 psi.

e. Test pressure shall not vary by more than +/- 5 psi for the duration of the test.

f. Allowable leakage shall be less than 10 gallons per inch of diameter per mile of pipe per 24 hours.

C. Disinfection:

1. After satisfactory completion of the pressure test, disinfect new potable water mains and existing mains that have required repair in accordance with AWWA C651 and as specified herein. Disinfect water mains in a maximum length per day of 2,000 feet.

2. General:

a. Provide a superintendent experienced in the required procedures for disinfecting with chlorine.

b. Obtain County permission 48 hours prior to filling, flushing, and chlorinating of the water mains. County shall operate valves connected to the existing water system.

c. Do not allow highly chlorinated water into the existing distribution system.

d. If there is any question that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to neutralize the residual chlorine. Federal, state, or local environmental regulations may require special provisions or permits prior to disposal of highly chlorinated water.

e. Perform disinfection and testing in presence of the County.

3. Connection to Existing System: Notify the County 48 hours prior to making connections to the existing system. Thoroughly clean the existing water main

exterior prior to the installation of tapping sleeves and corporation stops. Lightly dust with calcium hypochlorite powder the water main exterior and the interior surface of the tapping sleeve, and corporation stops.

4. After satisfactory flushing of the main, disinfect by the injection of a chlorine solution. Induce chlorine in sufficient quantity to maintain a chlorine residual of at least 50 ppm throughout the system to be tested. Maintain the chlorine solution in the system for at least 24 hours.
5. Valves and Fire Hydrants: Open and close valves on the mains being disinfected a minimum of three (3) times during the chlorine contact period and a minimum of three (3) times during flushing. Fire hydrants and other appurtenances should receive special attention to insure proper disinfection.
6. For Cut-In Construction: Use the following procedures for disinfecting of the new installation and the existing main at the cut-in point in accordance with AWWA C651, Section 9:
  - a. Apply liberal quantities of hypochlorite, in the form of tablets, to the open trench.
  - b. Interior of new pipe and fittings and the ends of the existing mains shall be swabbed or sprayed with a 1 percent hypochlorite solution before installation.
  - c. Install a 2-inch tap downstream of the work area. The tap shall be used for blowing off the main. Or, use the next fire hydrant downstream of the work area for blowing off the main.
  - d. Install a 2-inch tap just upstream of the new installation. Control water from the existing system so as to flow slowly into the work area during the application of chlorine. After the line is thoroughly flushed, add chlorine solution at a concentration of 100 ppm by the continuous feed method and hold in the main for 1 hour.
7. Prior to flushing, the free chlorine residual shall be a minimum of 25 ppm. Flushing of the lines shall proceed until the lines contain the normal chlorine residual of the system.
8. Bacteriological and Chlorine Residual Sampling and Testing:
  - a. Test for free chlorine residual at required bacteriological test locations immediately after induction of highly chlorinated water and again after 24 hours, prior to flushing of the highly chlorinated water from the potable water system.
  - b. Obtain two samples at each location specified after the chlorination procedure is completed, and prior to placing the system in service. Take the first sample immediately after flushing of the chlorinated water and again in 24 and 48 hours. A set of samples shall be taken as a minimum at the following locations:

- i) Every 1,200 lf.
    - ii) End of each main.
    - iii) A minimum of one from each branch.
    - iv) Mains at cut-in locations: Each side of work area. Time between samples to be determined by engineer in the field.
  - c. Recommended additional samples. During the required sampling of water from the new system, it is recommended that samples be taken from the existing potable water source to determine if coliforms are present.
  - d. Care in sampling. No hose or fire hydrant shall be used for the collection of samples. Take samples from an approved sample tap consisting of a corporation stop installed in the main with a copper tube gooseneck assembly. Operation shall be such as to ensure that the sample collected is actually from water that has been in the new system.
  - e. Test samples for the presence of coliform organisms in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater. Testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique.
  - f. Testing shall be performed by a laboratory certified for the required testing by the State of NC.
  - g. Test for odor. The water in the new system should also be tested to assure that no offensive odor exists due to chlorine reactions or excess chlorine residual.
  - h. If samples show the presence of coliform, one of the procedures described below shall be followed, with the approval of the County, before placing the unit or facility in service:
    - i) Take repeat samples at least 24 hours apart until consecutive samples do not show the presence of coliform.
    - ii) Again subject the system to chlorination and sampling as described in this section.
  - i. If samples are free of coliform, and with the approval of the County Public Utilities Department, the potable water system may be placed in service.
9. Contamination: If, in the opinion of the County Public Utilities Department, possible contaminants have entered the existing water system, or water samples show the water in the existing system to be

unsafe on completion of the work, the existing water system shall be disinfected as specified herein and shall include all contaminated components. Disinfection of the existing system shall be coordinated with the Public Utilities Department.

# WATER DISTRIBUTION SYSTEM

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## INDEX

### WATER DISTRIBUTION SYSTEM

		<u>PAGE #</u>	
SECTION	1.01	Water System Extensions	1 - 3
SECTION	1.02	Water Distribution Pipe	3 - 18
SECTION	1.03	Fire Hydrants	18 - 19
SECTION	1.04	Backflow Prevention Assemblies	19 - 20
SECTION	1.05	Valves And Appurtenances	20 - 25
SECTION	1.06	Water Services	25 - 28
SECTION	1.07	Testing And Inspection	28 - 33

### STANDARD DETAILS

1.01	TYPICAL FIRE HYDRANT DETAIL
1.02	TYPICAL VALVE BOX INSTALLATION
1.03	STANDARD 2" BLOW-OFF ASSEMBLY
1.04	THRUST BLOCK FOR HORIZONTAL PIPE BENDS
1.05	VERTICAL THRUST BLOCK DETAIL
1.06	STANDARD THRUST COLLAR INSTALLATION
1.07	STANDARD CAPPING DETAIL
1.08	WATER SERVICE ASSEMBLY
1.09	STANDARD 1 ½" & 2" METER INSTALLATION & VAULT
1.10	STANDARD 3" & 4" METER INSTALLATION & VAULT
1.11	BORE CROSSING DETAIL
1.12	WATER LINE STEEL ENCASEMENT
1.13	INSTALLATION OF PIPELINE AT CULVERT DETAIL
1.14	PIPELINE RESTRAINT AT HDPE/DI CONNECTIONS DETAIL
1.15	COMBINATION AIR VALVE MANHOLE (FOR WATER MAINS)
1.16	PAVEMENT REPLACEMENT DETAIL
1.17	4' x 4" x 4" WITNESS POST