

WATER DISTRIBUTION SYSTEM

STANDARDS & SPECIFICATIONS MANUAL



MOORE COUNTY PUBLIC WORKS DEPARTMENT

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PREFACE

This Manual is for the Moore County Public Utilities and the East Moore Water District water and sewer systems, all of which are operated by the Moore County Public Works Department (MCPW).

These standards are for design and construction of water distribution facilities which will come under the jurisdiction of MCPW. **These standards alone do not constitute a complete set of construction documents. The owner's or developer's Professional Engineer is responsible for design and compilation of complete construction and contract documents.** These standards are set forth as the minimal requirements to achieve a suitable quality level for utilities which will become the property of MCPW.

The standards do not include a complete commentary on methods of installation and detailed information or quality of workmanship in place. The owner's or developer's Professional Engineer must include detailed information on methods of construction and should expand on the testing and any of the special requirements to the engineer's satisfaction, subject to the approval of MCPW.

From time to time, these standards will be amended and/or expanded at the request of the MCPW Engineering Division with approval of the Director. It will be the responsibility of the owner or developer to contact the MCPW to obtain updated standards.

There may be circumstances whereby the design engineer may wish to propose changes or modifications to these standards, when this occurs permission from the County Engineer shall be obtained prior to submission to the North Carolina Department of Environmental Quality (NCDEQ).

Disclaimer

To the best of its ability, the County has ensured that the material presented in this manual is accurate and reliable. However, the design of engineered facilities requires considerable judgment on the part of the designer. It is the responsibility of the design professional to ensure that techniques utilized are appropriate for a given situation. Therefore, neither the County of Moore nor any officer, employee, or agent of the County accepts any responsibility for improper design, loss, damage, or injury as a result of the use of this manual.

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STANDARD & SPECIFICATIONS MANUAL - WATER DISTRIBUTION SYSTEM

1.0 DESIGN

A. General

Moore County Public Works (MCPW) distribution system design and construction shall be in accordance with the requirements of Title 15A 18C, .0900 “Distribution System” of the North Carolina Administrative Code, Department of Environmental Quality.

B. Size of Mains

Water mains shall be sized to provide a minimum system pressure of 20 psi and minimum residual pressure of 20 psi at all points of the distribution system during a fire flow condition with peak system demands a minimum 30 psi at all points under Average Daily Demand conditions. If higher pressures are required, it is the responsibility of the water customer to provide the necessary booster pumping equipment and facilities at their expense. If booster pumps are required on the fire suppression system, the designer shall contact the County Engineer to determine the additional requirements (back-flow, etc.) that will apply. The booster pumps should be clearly noted on the construction plans if they are required. If lower pressures are required, it is the responsibility of the water customer to provide the necessary pressure reducer at their expense.

- (1) The C-factor to be used shall be $C = 120$ for DIP, 130 for HDPE and 130 for PVC. Pipe Flow velocities shall be limited to a maximum of 10 fps under design flow conditions. The County Engineer may require design conditions to be met with higher pipe velocities and/or pipe segment head losses on a case-by-case basis.
- (2) The design shall include:
 - a. Fire Flow Demand.
 - b. Any other background flow that will contribute to demand on the main.
- (3) For projects designed with more than one phase, the design analysis shall check each phase to ensure that these guidelines are satisfied during each phase of construction as well as after final completion of all phases.
- (4) The size of main to be installed shall be based on the existing and future needs of the County’s water system.
- (5) The length of mains, developed in streets, subdivisions, commercial or industrial complex, shall be based on the following principles:

- a. The terminal point of extension shall be the last user's property line to be served by the extension;
- b. The extension shall include all services connections required to cover users to be served by the extension;
- c. If the last user is adjacent to a roadway or easement that contains a water main, the water line shall be connected to that line to increase water pressure and improve water quality.

Note: Additional easements may be required by the County Engineer to provide a loop system with existing proposed extensions to future proposed water lines.

C. Fire Flow

Refer to the MCPW Development Policy for fire flow requirements. In all cases, the required fire flow shall not be less than the amounts listed below with greater amounts where required by the ISO equation and the State of North Carolina Fire Code tables unless otherwise modified by the Fire Marshal.

<u>DISTANCE BETWEEN BUILDINGS</u>	<u>NEEDED FIRE FLOW</u>
More than 31 feet	750 gpm
11 feet to 30 feet	1,000 gpm
10 feet or less	1,500 gpm

The calculated (required) fire flow shall be reviewed by the County Engineer and Fire Marshal and the flows may be adjusted as determined appropriate by the Fire Marshal for site specific conditions.

2.0 UTILITIES LOCATION

A. Easements

See the County's Water and Wastewater Systems Development Policy, Section II.E.

B. Sewer Main Separation

- (1) Parallel Installation: Water mains shall be installed at least 10 feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a 10 feet lateral separation, in which case:
 - a. The water main is installed in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or
 - b. The water main is laid in the same trench as the sewer with the water main located at one side of 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.

- (2) Water Main over a Sewer: The water main shall be laid at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer, unless local conditions or barriers prevent an 18 inch vertical separation—in which case both the water main and sewer shall be constructed of ferrous materials and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.
- (3) Water Main under a Sewer: This type of installation shall be approved by the County Engineer prior to installation. The water main shall be laid at such an elevation that the top of the water main is at least 18 inches below the bottom of the sewer. Both the water main and the sewer shall be constructed of ductile iron pipe and with joints equivalent to water main standards for a distance of 10 feet each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

C. Storm Sewer and Gas Main Separation

- (1) Water Main over Storm and Gas: Water mains shall be of Ductile Iron Pipe at all areas where 24" clearance above the storm or gas line cannot be obtained. (See STD. NO. PW-1)

Water Main under Storm and Gas: This type of installation must be approved by the County Engineer prior to installation. Water mains shall be of Ductile Iron Pipe at all areas where 24 inches clearance below the storm or gas line cannot be obtained. Install at least one joint of DIP centered under the storm sewer line and backfill to 24 inches above the water main with suitable backfill. (See STD. NO. PW-1)

- (2) Parallel lines shall have a 10 feet separation from storm sewer only. Gas main separation shall be approved by County Engineer.

D. NCDOT Right-of-Way

- (1) Utilities to be constructed within NCDOT right-of-way will require a NC DOT Encroachment Permit.
- (2) All distribution systems within NCDOT right-of-way shall be designed as outlined in NCDOT manual "Policies and Procedures for Accommodating Utilities on Highway Right-of-ways".
- (3) Crossings under ditch to be 24 inches below bottom of ditch to top of pipe. Crossings under roadways to be 3 feet below top of roadway to top of pipe or encasement pipe.

E. Railroad Right-of-Way

- (1) Utilities to be constructed within Railroad right-of-way will require an Encroachment Permit from the Railway management.
- (2) Railroad crossings shall be perpendicular, ductile iron pipe and encased.
- (3) Crossing from top of rail to top of encasement pipe shall meet the Railroad standard.

3.0 EROSION CONTROL

All water main construction plans, regardless of project size shall include measures and/or devices to prevent soil erosion and to prevent sedimentation of streams and drainage ways. This requirement is waived for water mains in subdivision projects where the project erosion control plans includes water main construction and where enforcement of erosion control requirements is not under MCPW control. Design of Erosion and Sediment Control devices shall be in accordance with MCPW "General Construction Standards and Specifications" Section: "Seeding/Turfing and Erosion Control" and North Carolina "Sediment Control Planning and Design Manual".

4.0 PIPE MATERIAL

A. Pipe Size & Type

<u>Pipe Type</u>	<u>Pipe Size</u>
DIP Ductile Iron Pipe, 250 psi	18" & larger
DIP Ductile Iron Pipe, 350 psi	12" & smaller
PVC C-900, 235 psi, DR 18	4" to 12"
PVC C-900, Fusible, 200 psi, DR 18	4" to 12"
PVC C-905, 200 psi, DR 21	14" to 36"
PVC SDR-21, 200 psi (Water Main)	2" to 10"
PEP Tubing, 200 psi (Water Service)	1"
Sch. 40 PVC, 200 psi (Water Service)	2"
SP Steel Pipe, 35,000 psi (Encasement)	all sizes
HDPE, 250 psi, DR 9	all sizes

- a. Encasement is required for all main and service crossing on Interstate Standards roads.
- b. Encasement is required for all mains crossing under non Interstate Standards roads.
- c. Encasement is not required for roads with 2,000 vpd or less.
- d. Encasement is required for all Railroad crossings.

B. Ductile Iron Pipe

All ductile iron pipes shall be designed as per ANSI/AWWA C151/A21.50. Pipe wall thickness shall conform to ANSI/AWWA C150/A21.50. Pipe up to and including 12 inch diameter pipe shall be Pressure Class 350 (min.), while pipe greater than 12 inch diameter shall be at least Pressure Class 250. The County Engineer may require heavier class pipe on a case-by-case bases.

Pipe joints shall be of the push-on type with rubber gaskets as per ANSI/AWWA C111/A21.11. Mechanical or special joints may be used as project requirements dictate or as required by the Engineer. Pipe lining shall be cement-mortar, on the interior, with an external coat of bituminous material, all in accordance with ANSI/AWWA C104/A21.4. All mechanical joints shall be restrained by Mega-Lugs or Grip Rings.

The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.

Ductile iron pipe shall be manufactured by U.S. Pipe, American, or Clow, and shall be furnished in 20 foot and 18 foot lengths.

C. PVC Pipe (C-900 & C-905)

PVC pipe shall be rigid polyvinyl chloride with integrally formed, factory fabricated bell with "slip" joints rubber gaskets conforming to AWWA C-111. It shall be suitable for all conditions imposed by Plan locations and for a maximum working pressure of 200 psi. Pipe shall be Type 1, Grade 1, made from clear virgin material and shall conform to the requirements of ANSI/AWWA C-900 & C-905. All pipes shall bear the National Sanitation Foundation Seal of Approval for potable water, the manufacturer's name, and class of pipe.

Provision must be made for expansion and contraction at each joint, through the rubber gasket and pipe bell. All mechanical joints shall be restrained by Mega-Lugs or Grip Rings.

Contractor shall not use pipe that is brittle or sun bleached which shall compromise its use.

Pipe to conform to ANSI/AWWA C-900 for C-900, DR-18 or C-905, DR-21 pipe within municipal boundaries and extra-territorial jurisdiction, and within residential subdivisions, shopping centers and industrial complexes within rural areas, for all new construction.

D. PVC Pipe (Sch. 40)

All PVC Schedule 40 pipe shall be manufactured from virgin rigid PVC (polyvinyl chloride) vinyl compounds with a cell class of 12454 as identified in ASTM D 1784. Pipe shall be Iron Pipe Size (IPS) conforming to ASTM D 1785. Pipe shall be manufactured as a system and be the product of one manufacturer. Pipe shall be manufactured in the United States. Pipe shall conform to NSF International Standard 61 or the health-effects portion of NSF Standard 14.

E. PVC Pipe (SDR-21)

All PVC SDR21 pipe shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound per ASTM D1784. The pipe shall be manufactured in strict compliance with ASTM D2241, consistently meeting and/or exceeding the Quality Assurance test requirements of this standard with regard to pressure rating, material, workmanship, burst pressure, flattening, impact resistance, and extrusion quality. The pipe shall be manufactured in the USA, using domestic materials. All pipes shall be stored indoors after production at the manufacturing site until shipped from factory. This pipe shall carry the National Sanitation Foundation (NSF) seal of approval for potable water applications.

Use SDR-21 pipe for 10 inches and less in rural areas which are less populated and C-900 pipe for 12 inches and less in urban areas unless special needs require other type as approved by the County Engineer. All mechanical joints shall be restrained by Mega-Lugs or Grip Rings.

F. HDPE - High Density Polyethylene Pipe

HDPE pipe for directional drilling shall be DR-9, 250 psi, and sized to have the minimum inside diameter the same as the connecting Force Main. Connection of HDPE to Ductile Iron pipe shall be horizontal and made to prevent binding of HDPE. All pipes shall be labeled ANSI/AWWA C906 or C901. Pipe material is to conform to ASTM D2737. Design of pipeline shall meet *PPI Handbook of Polyethylene Pipe* on Performance Pipe website. Maximum bending radius shall meet the *PPI Handbook* requirements, which is 20 times the pipe diameter for DR 9 pipe. Installation of HDPE pipe shall meet ASTM D-2774 *Standard Practice for Underground Installation of Thermoplastic Pressure Pipe*.

After directional drilling, HDPE pipe shall be allowed to retract(release) for 30 days after which connection shall be made to three joints of DIP with restrained mechanical joints, gate valves and reducers. A valve shall be placed between the first and second joint of DIP at each end of the HDPE. Alternately, if less retraction time is desired, the Design Engineer may submit calculations and data referenced in the *PPI Manual*, including Pulling-in calculations, pullout prevention technique, horizontal drilling records, and allowable tensile load calculations for the County Engineer's review.

G. Steel Encasement Pipe

Encasement pipe for installation under highways and railroads shall be 35,000 psi pipe conforming to ASTM A139. Encasement pipe shall conform to NCDOT specifications for pipe laying for highway crossings and specifications for railroad crossings. The pipe shall be furnished with a bituminous coating on the outside.

(1) Carrier Pipe – DIP

(2) Spacers – Steel, epoxy coated “spiders” shall be provided. Provide one spacer in the center of pipe and one spacer on each end of the same pipe stick.

(3) Carrier Pipe shall be installed using boltless restraining gaskets. Boltless restraining gaskets shall be “Field-Lok”, “Fast-Grip”, “Gripper Gasket” or approved equal.

5.0 FITTINGS

A. Ductile Cast Iron Fittings

Ductile cast iron fittings shall conform to the requirements of ASTM A21.10, with mechanical joint ends conforming to ASTM A21.11, except that material and manufacturer shall conform to ASTM A339, Grade 80-60-3. All fittings shall be bituminous coated and cement lined as required for pipe. Where flanged ends may be required, flanges shall conform to applicable requirements of ANSI B16.1 and ANSI B16b. Minimum class shall be Pressure Class 350 pipe. No push on joint ends will be allowed.

Ductile Iron Pipe must be used in areas where pipe length is less than 4 feet, between fittings, etc.

B. Gaskets

Gaskets for pipe and fittings shall be continuous ring of rubber material compounded to resist deterioration and of a texture to assure a permanent and watertight seal. They shall have smooth surfaces, free from pitting, blisters, porosity or any other defects. Gaskets shall conform to the requirements of ANSI/AWWA C111/A21.11.

Gasket lubricant shall be a potable hydrogenated vegetable oil, insoluble in cold water, non-toxic, shall not support the growth of bacteria, and shall not impart taste or odor to the water. It shall not contain detergent soaps, organic solvents or other deleterious ingredients and shall have no deteriorating effects on the gaskets. The lubricant shall be semi-paste, easily applicable, readily adherent to the inside of the bell and shall remain in a usable state throughout the range of temperature in which pipe is normally installed.

C. Iron Fittings

Iron fittings shall be manufactured in accordance with ANSI/AWWA C-110/A21.10, latest revision and addendum. The fittings shall be tested and the manufacturer shall provide certified test results upon request by the Engineer. This testing shall include hydrostatic proof testing of the fittings.

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 25,000 psi. Iron fittings shall be all-bell mechanical joint conforming to ANSI/AWWA C-115/A21.15-05. On all fittings Mega-Lugs or Grip Rings shall be used. Male compression restrained joints to be used on 2 inch PVC.

All fitting interiors shall be cement mortar lined, with bituminous seal cast in accordance with ANSI/AWWA C-104/A21.4 and the outside shall be bituminous coated.

6.0 VALVES

A. Valve Location

Valves shall be installed on all branches from mains and on hydrant branches according to the following schedule:

- 3 valves at cross intersections
- 2 valves at tee intersections
- 4 valves at cross intersections near water towers
- 3 valves at tee intersections near water towers
- 1 valve on hydrant branches
- 1 valve at "stub outs" for future extensions
- 1 valve at change in pipe size
- 1 valve at each end of directional bore line
- Additional valves may be required as needed

Main line valves should coincide with fire hydrants. Valves deeper than 4 feet should have operation nut extended to 4 feet from surface. See STD. NO. PW 3 for detail. Main line valves on straight runs between intersections shall be spaced at interval distances not to exceed the following:

For Urban Areas	
<u>Main Size</u>	<u>Maximum Spacing</u>
6 inches	600 feet
8 inches	800 feet
12 inches	1,200 feet
16 inches	1,600 feet

For Rural Areas

<u>Main Size</u>	<u>Maximum Spacing</u>
4 inches	1,000 feet
6 inches	2,000 feet
8 inches	2,000 feet
12 inches	3,000 feet
16 inches	3,000 feet

B. Gate Valve

12 inch and Smaller:

Gate valves 12 inch and smaller shall be of the resilient wedge type conforming to ANSI/AWWA Standard C-515. They shall be designed for a working pressure of 200 psi. The valves shall be open-left (counter clockwise), non-rising stem ductile iron body, with O-ring seals and a 2 inch square operating nut. Extension stems shall be furnished when depth of bury places operating nut is in excess of four feet below finished grade.

16 inch and Larger:

Gate valves 16 inch and larger, may be the horizontal gate type or butterfly type and shall be used for all main line in sizes 16 inches through 24 inches. Type of valve used shall be approved by County Engineer.

C. Tapping Valve

All tapping valves shall conform to the Standard Specification for gate valves, 12 inches and smaller, as noted above, except that the inlet end shall be flanged, faced and drilled per ANSI B16.1 for 125 lb. standard. The outlet end shall be of the mechanical joint type capable of receiving a standard tapping machine.

Resilient Wedge Gate Valves to conform to ANSI/AWWA C-505 and shall be Clow, Mueller or Kennedy.

D. Butterfly Valve

Butterfly valves shall be used for water mains 16 inches or greater, unless pressure dictates a gate valve is needed for higher pressure. Type of valve used shall be approved by County Engineer.

Butterfly valves shall meet or exceed ANSI/AWWA C-504 for disc seat type valves. Iron valve bodies shall conform to ASTM A-126. Valve disc shall be cast bronze or ductile iron with bronze or stainless steel seating surfaces. The disc shall have adjustable stops preset by the factory and the seals shall be natural rubber. Butterfly valves installed in vaults shall be furnished with service actuators with 2" square

operating nuts and open by turning counter clockwise, if required by the County Engineer. Extension stems shall be furnished when the depth of the operating nut is in excess of four (4) feet below finished grade. Butterfly valves shall have mechanical joint ends conforming to ANSI/AWWA C111/A21.11. Butterfly valves shall have a design working water pressure of 200 psi and be hydrostatically tested to 300 psi. Valves shall be Mueller, Kennedy, Pratt, or equal.

E. Valve Marker

Valve Markers are to be installed in rural areas, near the right-of-way line, to better identify their location. All in-line valves shall have a valve marker. Fire hydrant valves shall not have a valve marker.

In urban areas, valve markers are to be installed only as recommended by the County Engineer.

Valve markers shall be placed 1 foot inside right-of-way line or property easement. Markers must have distance to valve stamped on top with arrow pointing in the right direction. See STD. NO. PW 4 for detail.

F. Valve Box

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. Valve boxes shall be set on brick for stability and not sit directly on the valve or water main. Where located within paved areas, the box shall be adjusted to finished street grade. When valves are located in street right-of-way, but out of pavement, the boxes shall be adjusted to finish grade and a concrete protector ring shall be placed around the box one inch above the street right-of-way grade. See STD. NO. PW 6 for detail.

All valve boxes shall be of the adjustable type. Valve boxes shall be cast from close-grained gray iron, in three pieces consisting of a lower base piece, upper part and cover. The lower base piece shall be flanged at the bottom to fit around the valve and shall also be flanged on the lower end and of such size as to telescope over the lower part with upper end cast on the upper surface in raised letters the word "WATER". Valve box covers shall be painted a blue after installation. Valve boxes shall be painted prior to shipment with a coat of protecting asphaltic paint.

For Valve Box Cover protection provide a concrete protector ring. See STD. NO. PW 5 for detail.

G. Air Release and Combination Air Valve

Combination Air Valves shall be provided at high points on all 12 inch and larger water mains where the change in vertical grade crest to sag is 2 feet or greater. An Air Release

Valve shall be provided at high points on 2 inch to 8 inch water mains where air cannot be adequately released from the main through service connections.

On pumped lines or in any other application where the potential for water column separation exists, the County Engineer shall evaluate the need for Combination Air Valves and shall recommend specific valve configurations for approval.

Air release valves shall be contained within a (5 feet minimum diameter) Doghouse Manhole with grave bottom and no drain to ensure that the vacuum relief port cannot allow outside water to enter the waterline. The manhole cover shall have "WATER" stamped on the cover with raised letters.

Air release valves shall be equivalent to ARI, ClaVal or approved equal and conform to ANSI/AWWA C-512. See STD. NO. PW 7 for detail.

H. Blow-Off Assembly

All transmission mains 12 inches and larger must be designed such that they can be dewatered completely within four hours through blow off assembly or fire hydrants. Dead end lines 4 inch and less shall be terminated with a 2 inch blow off valve and lines 6 inch and larger are to be terminated with a fire hydrant. Flushing sites shall have adequate drainage areas. See STD No. PW- 8 for detail.

I. Insertion Valve

Insertion valves shall be used when a main line needs to be isolated, enabling in-line, under pressure repair of all moving parts. Insertion valves shall be resilient wedge gate valves with a rated working pressure of 250 psig minimum and meet ANSI/AWWA C515 material standards. Insertion valves shall be TEAM Industrial Services InsertValve or approved equal.

7.0 HYDRANTS

A. Hydrant Installation

Hydrants shall be set plumb, properly located with the pumper nozzle facing the closest curb of a fire lane or street, but not a parking space. Hydrant tees shall be used. Restraining couplings are to be installed. A minimum of 8 cubic feet of #57 stone shall be placed around the drains. The backfill around the hydrants shall be thoroughly compacted. Hydrants shall be placed 1 foot inside the back of right-of-way or property line. Fine grade shall be to the bury line. See STD. No PW- 9 for detail.

No one except MCPW personnel authorized agents of MCPW and qualified Fire Department personnel are authorized to operate any of the distribution system fire hydrants.

B. Hydrant Types

Fire hydrants shall be of the compression type meeting ANSI/AWWA C502 standards, designed for a minimum working pressure of 200 psi and a hydrostatic test pressure of 300 psi with the valve in both the open and closed positions.

All hydrants shall be equipped with two 2 1/2 inch nozzles and one 4 1/2 inch pumper nozzle. Each nozzle shall be bronze with cast iron caps secured thereto with a suitable steel chain. Nozzles shall have National Standard Threads.

The hydrants shall be open-left and equipped with a pentagon-type operating nut (National Standard) measuring 1 1/2 inches from point to flat. Hydrants shall be of the “dry top” type with the upper rod threads completely enclosed in a sealed grease or oil chamber, equipped with “O” ring seals and Teflon thrust bearing.

The hydrants shall have a 6 inch shoe or boot, mechanical joint. Hydrants shall have bronze to bronze threads provided between the hydrant seat or seat ring and the seat attaching assembly. The hydrant shall be of the “safety” type so that, if the upper barrel is broken off, the hydrant valve will remain closed and reasonable tight. All hydrants shall be furnished with barrel and stem extensions as required by the final field location to provide a nominal minimum bury of 3 feet and 6 inches, or greater, if indicated on the drawings.

All hydrants shall have a thrust block behind the hydrant, below the weep holes allowing the weep holes to still be operational.

Hydrants connected to 12 inches and larger water mains shall have 5 1/4 inch barrel diameter or as approved by the County Engineer.

Hydrants shall be Mueller “Super Centurion”, Clow “Medallion” or equal.

Hydrants color shall be red and factory painted (Field Painting will not be Allowed)

All hydrants shall have permanent 5 inch, rigid, male National Standard threads STORZ connections installed on the 4 1/2 inch pumper nozzle with a lockable cap. All STORZ connections shall be manufactured out of 6061-T6 Aluminum with a hard coat anodized to Mil-A-8625f, Type 3, and dark gray finish. All STORZ connections shall comply with NFPA 1963 (Corrosion Resistance), UL listed and FM approved. MCPW shall not be responsible for any cost associated with the STORZ connections.

8.0 TAPPING EXISTING WATER MAINS

A. Tapping Sleeve

Tapping sleeves shall be used on all taps greater than 4 inches. Tapping sleeves shall be a two piece type, stainless steel suitable for bolting and air testing. The body is to

consist of a gasket of Virgin SBR rubber compound. Tapping sleeves as manufactured by Mueller, Romac, JCM and Smith-Blair are acceptable. See STD. NO. PW 10 & 11 for detail.

Tapping Sleeves shall meet the appropriate length listed in the table below:

<u>Main and Tap (inches nominal)</u>	<u>Length (along run)</u>
6x6, 6x3, 6x4, 6x2	18 inches
8x2, 8x3, 8x4, 8x6	19 inches
8x8	21 inches
10x2, 10x3, 10x4, 10x6	19 inches
10x8, 10x10	23 inches
12x2, 12x3, 12x5, 12x6	19 inches
12x8	21 inches
12x10, 12x12	25 inches

Sleeves shall meet all the requirements of ASNI/AWWA C110/A21.10 and C111/A21.11. Tapping sleeves shall have a full circumferential gasket. For tapping sleeves with an outlet diameter greater than 12 inches, the sleeve shall have an outlet seal gasket. Lubricate pipe and face of gasket with water or soap-water. Do not use petroleum based products such as grease or pipe lubricant.

When installing, the existing main shall be carefully and completely cleaned prior to installing the tapping sleeve or saddle. All surfaces of the existing main encompassed by the sleeve, along with the inside of the sleeve and the inside of the tapping valve, shall be disinfected during installation by swabbing with a chlorine solution or dusting with calcium hypochlorite (HTH) powder. Once these surfaces are disinfected, the Contractor shall not allow dirt, mud, trench water or any other contaminants to come in contact with these surfaces.

Once the tapping sleeve and valve are installed on the main, a pressure test shall be performed by applying 100 psi compressed air to the test port for a period of at least 15 minutes, with no drop. During this period, all joints shall be mopped with a soap-water solution to locate leaks. This test shall be performed in the presence of the County Engineer or his representative.

Upon satisfactory completion of the installation and pressure testing of the tapping sleeve and valve, the existing main shall then be tapped using a tapping device equipped with a pilot drill and shell type cutter which retains the pipe coupon. Once the tap is complete and the tapping machine removed, the tapping valve shall be cleaned of any cuttings and then kept plugged until the water main is installed. A thrust block shall be placed behind the wet tap with plastic wrap between the pipe and thrust block.

B. Corporation Stop

Corporation stops shall be designed and manufactured in accordance with ANSI/AWWA C-800 latest revision. Corporation stops shall be equipped with an AWWA standard tapered thread on the inlet end and a compression connector on the outlet end for connection of polyethylene pipe. The stops shall be fully shop tested for leaks with air pressure under water. The stop shall have a minimum rated working pressure of at least 300 psi, with a safety factor of at least 2 times the rated working pressure. No 'ground key' corporations shall be used. The corporation stops shall be as manufactured by Mueller, Ford or equal.

C. Service Tubing

Service Tubing shall be Polyethylene SIDR 7 and meet ANSI/AWWA C-901 and be clearly marked with nominal size, rated operating pressure at 73.4 degrees F, type of pipe, material designation code, date code (month, year, day), manufacturer's brand name, National Sanitation Foundation logo indicating approval for potable water usage and compliance with ASTM specifications, plant location code and ASTM D-2239 approval.

D. Water Meter

Moore County has standardized on Badger radio read water meters. Two-inch and smaller water meters will be furnished and installed by Moore County. Two-inch services shall have a meter setter. See STD. NO. PW 12 & 13 for $\frac{3}{4}$ and 1 inch meter service. See Detail STD. NO. PW 14 for 2 inch meter service.

Three-inch and larger water meters shall be furnished and installed by the Contractor. See Detail STD. NO. PW 15 for 3-inch and larger Water Meter Service and Vault. Shop drawings must be submitted for approval before the meter is ordered. Moore County staff must be present at the time of installation of water meters.

Contractor shall provide and install a Lockseal Assembly for all meters. Both the stud and Lockseal head shall be case hardened steel with plating for corrosion protection. The Lockseal Assembly shall be installed per manufacturers recommendations, and shall be manufactured by Highfield or equal.

Multiple occupancy building may be master metered or the individual units metered separately. Where "gang" meters are installed, permanent placards shall be provided inside the meter box to indicate the unit served by each meter. The only exception to this metering requirement shall be in the case of building fire sprinkler systems, where such services shall be equipped with a detector meter on the backflow prevention device. Where other service connections are requested a separate meter shall be installed.

E. Master Meter

Master meters may be permitted to serve single ownership, single lot properties in the following categories:

- i. Apartments/Condominiums
- ii. Hotels/Motels
- iii. Hospitals
- iv. Warehouses/Industrial Buildings
- v. Schools
- vi. Mobile Home Parks
- vii. Shopping Centers
- viii. Churches
- ix. Rest Homes

Plans for these properties shall meet all building and fire code requirements. All water mains, valves, and fire hydrants shall meet the County's standards and specifications. Master meters shall be installed in vaults that have positive drainage provided from bottom (preferred) or sump pump.

2 inch and larger Domestic Services Meters and Irrigation Meters shall be Compound Type unless approved otherwise by the County Engineer.

F. Check Valve

3/4 inch and 2 inch check valves shall be incorporated into the meter. 3 inch and larger check valves shall be ClaVal or approved equal.

G. Meter Box

For 3/4 inch meter water services with a single meter and 3/4 inch meter water services with double meters, the meter box shall be rectangular with minimum nominal dimensions in inches of 21-3/8x14-7/8x12" (l-w-d). Lids shall plastic and be labeled "WATER METER", containing a cast iron reader lid with no holes. Boxes may be plastic except for traffic bearing installations, which shall be traffic rated and approved by the County Engineer. Meter boxes shall have at least a 3 feet allowance from any obstructions. All meter boxes shall have at least 4 inches of washed stone installed to allow for proper drainage. Meter Box with Lid provided by NDS, DFW or equal. See STD. NO. PW 16 for detail.

H. Service Saddle

Service Saddles shall be wide body style for PVC water mains (Ford S-70, Mueller H-134 or equal) or double strap style for ductile iron water mains (Ford S-90, Mueller BR2B or equal). Body shall be stainless steel, bronze or brass with O-ring seal,

manufactured to meet AWWA C800. Saddles shall be used for 1" and 2" service outlet diameter types. See STD. NO. PW 11 for detail.

I. Dual Branch Assembly

The County Engineer shall determine if dual or single assembly is needed. See STD. No. PW 13 for detail.

L. Lockable Valve for Irrigations

Lockable Valves shall be installed on all irrigation services that are allowed to connect to the domestic water service (see NCGS 143-355.4 (a)). Lockable Valves shall be brass and conform to AWWA Standard C800. The letters "NL" shall be cast into the main body for lead-free identification and certified to NSF/ANSI Standard 61 and NSF/ANSI Standard 372 where applicable. Valve shall be non-directional and watertight with flow in either direction. Ends shall be integral or secured with adhesive to prevent unintentional disassemble. Hole shall be provided for attaching curb box rod or handle in tee-head. Valve shall be rated for 300 PSI working pressure and have a padlock wing for locking valve in closed position. See STD. No. PW 17 for detail.

K. Services Across Roads Wider Than Two (2) Lanes

Services across roads wider than two (2) lanes shall have a casing installed by the customer, in addition to the Tap Fee, in order for Moore County to install the service tubing inside the casing across the road. The casing shall be installed by Bore & Jack or Directional Drilling and shall meet the standards in the General Construction section of these specifications and extend from R/W to R/W.

9.0 ABANDONMENT OF EXISTING MAINS AND SERVICES

All water mains AND SERVICES shall be abandoned as per below.

- A. Water Services: All water services shall be demolished and disposed of that are within the R/W back to the existing corporation stop and the corporation stop shall be shut off.
- B. Water Main: All water mains shall be demolished and disposed of that are within the R/W back to the supplying water main connection and capped at the tee. If a gate valve is located on the abandoned water main at the tee, it shall be removed and delivered to Moore County or disposed of (decided by Moore County). Any active water main isolation shall be coordinated with Moore County.

10.0 METER VAULT

Meter Vaults are used for the primary purpose of housing Pressure Reducers, Flexible Connections, Water Meters and Strainers. The vault can contain supplementary items such as bottom drain to daylight (preferred), 1/2 HP Stainless Steel Submersible Sump Pumps, two 4 inch "goose neck" vent pipes, Aluminum Door(s) AASHTO H-20 wheel load, JD-AL-H2O, Bilco or equal all contained in or on a 4,000 psi reinforced concrete box. The hatch needs to have the capability of draining to daylight. See STD. NO. PW 15 for detail.

The vault shall have a valve at each outside end of the vault to shut off the meters and for maintenance. A by-pass line parallel to the vault shall be installed with a valve to close if the meters are in use and to open if meters are not in use. The top of the vault should be approximately 8 inches above the natural ground surface and should be coated on the underground outside surface with exterior water proofing.

11.0 TRENCH EXCAVATION

Water main trenches shall be excavated to such depth that the pipe will have a minimum cover of at least 3 feet as measured from final, finished grade, based on the approved typical sections and/or grading plans to the crown of the installed pipe. In general, installation depth shall be limited to a maximum of 5 feet in depth unless it conflicts with other subsurface structures. See STD. NO. PW 26 for detail.

Trench width shall be a minimum of 16 inches plus the outside diameter of pipe barrel up to 10" and a maximum of 24 inches plus the outside diameter of pipe barrel from 12 inches and larger, unless trenching is approved.

Where water main trench excavation is in rock, the rock shall be excavated to a minimum depth of 6 inches below the bottom of the pipe. This space shall be filled with selective material approved by the Engineer.

In trenches where water is present or where dewatering is required, the trench bottom shall be stabilized with selective material approved by the Engineer. When material of poor supporting value (i.e. "muck") is encountered in the trench, it shall be removed and replaced with selective material approved by the Engineer.

All water main trenches shall be protected from entrance of surface water. Any water observed in the trench shall be promptly removed by pumping, or other means, provided that water disposal is directed to suitable erosion control devices to prevent deposition of sediment into nearby streams, ponds, etc. The Contractor shall use all means necessary to prevent the entrance of water, including the construction of temporary berms or dikes.

12.0 PIPE INSTALLATION

A. General

All water main pipes shall be clean before installation. Any dirty pipe shall be thoroughly swabbed by the Contractor. Pipe showing evidence of oil or grease contamination shall not be used.

Pipe laying and jointing shall be accomplished in strict accordance with the recommendations of the pipe manufacturer. Care shall be taken during pipe installation so as not to exceed the maximum joint deflection.

Open ends of the pipe shall be plugged at all times that pipe installation is not in progress.

Bell ends shall generally face the direction of flow source. Where water mains are installed on an appreciable slope, the Engineer may require that the bell ends face upgrade.

The barrel of the pipe shall bear the pressure uniformly upon a firm and stable flat bottom trench at all times. The trench bottom will be excavated for the bell ends such that the pipe rest uniformly on its entire barrel length.

B. Tracer Wire and Tape

Tracer wire shall be installed along the top of water main pipe and services and secured (i.e. Duct tape) to the pipe every 10 feet. Tracer wire shall be number 12 gauge, color blue, rated for underground installation with a minimum breaking strength of 450 lbs. and a coating of 15 mils. After installation, the Contractor is responsible for the testing of the tracer wire in the presence of the County Engineer or a designee after the roadway has been installed. During testing, the water main shall be located so the County Engineer or a designee can see the spacing between the water main and the Edge of Pavement to make sure it meets the spacing requirement.

All spliced or repaired wire connections in the tracer wire system shall be made using a Wing Nut Wire Connector (for two to four number ten wires), or approved equivalent, and made waterproof using an approved buried service wire closure. The buried service wire closure shall be Frame Gel Closure or equivalent.

Detectable Warning Tape shall be installed from 18 inches to 24 inches above the pipe line. See STD. NO. PW 26 for detail.

C. Thrust Restraint

Thrust restraint for water mains shall be provided at all tees, bends and plugs. Restraints shall be restrained type mechanical joint and concrete blocking. Concrete thrust blocking shall be poured in place. The bearing area for thrust blocks shall be based on the required test pressure of 200 psi and a field determination of the load bearing capacity of the soil.

Conservative estimates of soil load bearing capacities by experienced and qualified inspectors are normally allowed. However, analysis may be required by the County Engineer. See STD. NO. PW 27 for detail.

For lines that end with a valve for future extension, there shall be added to the valve one full pipe stick, plug and concrete blocking.

D. Unfinished Streets

Where main extensions are laid in unfinished streets, the developer shall be fully responsible for damages to the main and all fixtures and appurtenances, such as hydrants, gate valve boxes, blow-off boxes, etc., including the location thereof. If, after the mains are installed, the surface grade is lowered with the result that the required minimum cover of the mains, fixtures, or appurtenances is not maintained, then the developer shall pay for cost of lowering the mains to the structural level required to correct this deficiency. This responsibility shall remain in force until such time as the street is structurally complete.

13.0 BACKFILLING

A. General

Backfilling shall be completed as soon as possible, so as to minimize the length of time that the trench or any part thereof is left open. Material classification for backfill materials, as may be noted hereinafter, shall conform to the Engineer's requirement.

B. Backfilling

All trash, forms, debris and other foreign material shall be cleared from around all pipes and structures before backfilling. The pipe shall be backfilled with suitable materials. The initial backfill to a point 12 inches above top of the pipe shall be placed in shallow 6 inch layers, individually compacted, with emphases on the “hunching” area (up to the spring-line of the pipe). See STD. No. PW 26 for detail.

C. Final Backfill

The remaining or final backfill for all pipe materials shall be suitable material. No rocks, boulders, or stones shall be included in the backfill material for at least 2 feet above the top of the pipe. In non-traffic areas, the backfill shall be placed in lifts not exceeding 12 inches and compacted to 90% of maximum dry density per AASHTO T-99. In traffic areas the final backfill shall be placed and compacted in 6 inch layers, and compacted to 95% of maximum dry density per AASHTO T-99 to a point 12 inches below subgrade. The top 12 inches shall be compacted to 100% of maximum dry density (AASHTO T-99).

Where deemed necessary, the Engineer may require compaction test on any or all lifts of backfill placed in trenches under roadways. The cost for such test shall be borne by the Contractor.

14.0 PRELIMINARY FILLING AND FLUSHING

No valve shall be operated without giving a minimum 24 hour notice to the MCPW. No Contractor or other non-MCPW personnel shall at any time operate any valve. MCPW must be contacted for information on purchasing water, account setup for construction water, and for approved hydrant meter arrangements.

The Contractor, first, shall pump dry and dispose of all extraneous ground water and sand, gravel and foreign objects within the water main. The new or empty water mains now shall be slowly filled with water at a rate that will allow complete evacuation of air from the line.

Each valve section of the completed main shall be flushed prior to chlorination as thoroughly as possible with water pressure and outlets available. If no hydrant is provided at the end of the main section, a tap shall be installed at the main section extremity, large enough to develop a velocity in the main of at least 2 fps. The flushing operations shall be done after the pressure test has been made. Each valve section of the newly laid pipe shall be flushed separately. Flushing sites shall have adequate drainage and shall be approved by the Engineer. The Contractor shall provide hoses, pipe, etc. to divert water from flushing operations into drainage ways to avoid damage to yards and erosion.

Disposal of flushed water shall meet the requirements of NCDEQ. Provide dechlorination as required.

Pigging is to be at the discretion of the County Engineer.

15.0 HYDROSTATIC TESTING

No valve in the existing water system shall be operated by any party other than MCPW employees.

The line shall be tested to a pressure of 200 psi for a duration of 24 hours. The pressure gauge used in the hydrostatic test shall be calibrated in increments of 5 psi or less. At the end of the test period, the leakage shall be measured with an accurate water meter, supplied by the contractor.

No pressure pipe installation will be accepted until leakage is less than the number of gallons per hour for each section tested, as determined by the following formula:

$$Q = \frac{LD\sqrt{P}}{148,000}$$

Q = Allowable leakage, in gallons per hour

L = Length of pipe tested, in feet

D = Nominal diameter of the pipe, in inches

P = Testing Pressure, in pounds per square inch

All visible leaks at pipe joints, services, and at any appurtenances are to be repaired regardless of the amount of leakage. After testing, remove service line from testing point.

Pressure testing is the responsibility of the Contractor. All pressure tests must be witnessed by the Engineer, or designee, for approval.

Water for testing and blow-off may be obtained from existing water main. The contractor is responsible for any cost of water used during testing. Air testing is not allowed.

16.0 DISINFECTION

All new, cleaned or repaired water mains shall be disinfected, by the Continuous Feed method, in accordance with AWWA Standard C651.

Chlorination of a completed line shall be carried out 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. The taps shall be strategically located so as to allow High-Test Hypochlorite (HTH) solution to be fed into all parts of the line.
- (2) A solution of water containing HTH (65%) available chlorine shall be introduced into the line by regulated pumping at the control valve tap. The solution shall be of such concentration that the line shall have a uniform concentration of 50 ppm free chlorine immediately after chlorination. The chart below shows the required quantity of 65% HTH compound contained in solution in each 1,000 feet of line to produce the desired concentration of 50 ppm.

POUNDS OF HIGH TEST HYPOCHLORITE (65%)	
<u>PIPE SIZE (inches)</u>	<u>PER 1,000 FEET OF LINE FOR 50 ppm</u>
2	0.10
4	0.42
6	0.94
8	1.68
10	2.62
12	3.77
16	6.70

- (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 mains.
- (4) If at any time, during the first three hours, the hypochlorite solution drops below 50 ppm, the flow shall be stopped; chlorination equipment shall be relocated at the head of the slug; and, as flow resumes, chlorine shall be applied to restore the free chlorine to not less than 50 ppm.
- (5) As the chlorinated water flows past fittings and valves, related valves and hydrants shall be operated so as to disinfect appurtenances and pipe branches.
- (6) After the applicable retention period, heavily chlorinated water should not remain in prolonged contact with pipe. In order to prevent damage to the pipe lining or to prevent corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed, by the Contractor, from the main fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than 2 ppm. Chlorine residual must be verified using an EPA approved method utilizing the chemical DPD, by the Contractor, in the presence of the Engineer or representative.

17.0 BACTERIOLOGICAL SAMPLING

Flushing of lines may proceed after 24 hours, provided the free residual chlorine analysis is satisfactory. Flushing shall be continued until a check, by the Contractor with an EPA approved method utilizing the chemical DPD, shows that the lines contain only the normal chlorine residual of 2 ppm. Chlorine residual shall be checked in the presence of the Engineer or representative before bacteriological samples are taken. The flushing operation shall be monitored at all times by the Contractor.

Within 24 hours after flushing is complete, the contractor shall collect samples in the presence of the Engineer, or designee, for bacteriological analysis testing by an independent laboratory approved by the NC Department of Environmental Quality. The sampling points shall be identified on the Record Drawings and the sample ID indicate. Samples shall be taken every 2,000 feet, at the end of the line and on each branch. The Engineer or representative shall observe the collection of samples. Copies of the results shall be mailed directly to the County Engineer.

In the event that three successive bacteriological tests fail, that section of the main shall be re-chlorinated by the Contractor and new test performed prior to moving to the next section of the main.

No new water lines may be placed into service until such time as final approval to place into service has been granted by the County. Services will not be granted until all of the following items are completed and approved: construction punch list items, record

drawings, required certifications testing, final inspection, Deed of Dedication and Releases of Liens and Wavers.

18.0 OPERATION OF EXISTING VALVES

No valve shall be operated by any party other than MCPW. This includes the operation of tapping valves installed as part of the improvements.

New water mains valves shall remain off unless filling or flushing operations are under way. No more than one valve shall be opened at any time between the new and existing mains. Valves shall be closed immediately upon completion of filling and flushing operations and shall remain closed until the new mains have been accepted by MCPW.

19.0 WATER USE DURING CONSTRUCTION

The Contractor shall make arrangements with the MCPW for water to be used for the filling, testing, flushing, etc. of newly installed water mains. All work requiring water shall be carried out in a manner which will minimize the volume of water required. MCPW will furnish water equal to two times the water main volume. If lines have to be filled three or more times the Contractor will purchase the water at bulk prices.