HOKE COUNTY

WATER SYSTEM SPECIFICATIONS

NOTE: These standards list several AWWA/ANSI/ASTM standards for water system materials, methods, etc. which may have had revisions since the time these specifications were compiled. The Contractor and Manufacturer shall use the most current version of the AWWA/ANSI/ASTM standards. Any revised AWWA/ANSI/ASTM standards shall supersede any standard described in these specifications. The Contractor shall contact the Engineer of Record to ensure the most current standards are being used.

WATER MAIN CONSTRUCTION

1. SCOPE: This section shall include the furnishing of all labor, tools, materials, and all other incidentals required for a complete system as shown on the drawings and specified herein.

2. MATERIALS:

2.1. General: All materials used on this project shall conform, as a minimum, to the specifications contained in this section. Should the contractor desire to use other materials not listed in these specifications, written permission must be obtained from the Owner's engineer.

All material shall be free from defects impairing strength and durability and be of the best commercial quality for the purposes specified. It shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

2.2. Pipe:

2.2.1. Ductile Iron: ASTM Specification A339-55, latest revision, Gr. 60-42-10, and in conformance with ANSI Stand. A21.51-1991 (AWWA C151-91), as approved by Sect. Comm. A21, American National Standards Association. Pipe dimensions shall conform to Federal Specifications WW-P-421c, Type II, push-on joints; Type III, mechanical joints. Each pipe shall be conspicuously marked on the outside of the barrel to readily identify it from cast iron. Pressure class shall be as required by ANSI A21.50-1991 latest revision, assuming Type 1 laying conditions. The minimum pressure class for each size pipe shall be Pressure Class 200.

2.2.1.1. Joints:

(1). Push-On Joints: Shall be a single rubber gasket joint and comply with ANSI/AWWA C11/A21.11.

(2). Mechanical Joint: Shall be a bolted joint of the stuffing-box type and shall comply with ANSI/AWWA C11/A21.11.

(3). Restrained Push-On Joints and Restrained:

(4). Mechanical Joints: Shall comply with the applicable sections of ANSI/AWWA C11/A21.11 and shall be TR Flex or equivalent. Restrained joint ductile iron pipe shall be provided at fittings and bends in the lengths and sizes as indicated on the contract drawings. Restrained

push-on joint pipe and fittings shall be capable of being deflected after assembly.

2.2.1.2. Lining and Coating: Shall be a cement mortar lining of standard thickness with a seal coat of asphaltic material and shall comply with ANSI/AWWA C104/A21.4-80.

2.2.1.3. Exterior Coating: Shall be an asphaltic coating in accordance with ANSI/AWWA C151/A21.51-81.

2.2.1.4. Flanged Ductile Iron Pipe with Threaded Flanges: Shall be ductile iron with a maximum working pressure of at east 250 psi and shall meet the requirements of ANSI/AWWA C115/A21.15-83. Flanges shall be ANSI B16.1 Class 125 or Class 250 as necessary to match the flanges of the attached valve or fitting, or adaptors may be used to mate the Class 125 flange to a Class 250 flanged fitting or valve.

2.2.1.5. Steel: Galvanized, standard weight, screwed pipe, ASTM Standard A120-62T. Galvanized steel pipe shall not be used for distribution system or water service lines without the written approval of the Owner.

Joints: Malleable iron couplings, Type II, Zinc coated, federal specification WW-P-521d(1).

2.2.1.6. Wrought Iron: Class A, Standard weight, zinc coated, Federal Specification WW-P-441b(1). Use only where indicated on the drawings or with the written approval of the Owner.

Joints: Wrought iron couplings, Type II, zinc coated, Federal Specification WW-P-521d(1).

2.2.1.7. Copper: Federal specification WW-T-799, Type K.

Joints: Flared, or where otherwise indicated, wiped joints.

2.2.1.8. PVC: PVC Pipe shall be SDR21 or C900 as indicated on the drawings. The pipe shall be plainly marked with the following information: manufacturer's name, size, material (PVC) type and grade or compound, NSF Seal, pressure rating and reference to appropriate product standards.

PVC pipe used for construction shall comply with the following standards:

(1)	Standard Dimensions Ratio 200 psi, SDR 21	ASTM-D-2241
(2)	AWWA C900	AWWA C900
(3)	Grade 1 OVC Compound Material 1254-B	ASTM-D-1784
(4)	Bubber Coupling Rings	ASTM-D-1869
(5)	Burst Pressure Test 200 psi, SDR-21-minimum quick burst pressure 800 psi	ASTM-D-1599
(6)	Impact Strength	ASTM-D-2444
(7)	Schedule 40 Fittings	ASTM-D-2466
(8)	Schedule 80 Fittings	ASTM-D-2467

Joints: Push on joints utilizing elastomeric ring gaskets complying with ASTM-D-3139.

Pipe that conforms with ASTM-F1483 for Molecular Oriented Pipe (MOP), with a Hydrostatic design basis (HDB) of 7100 psi and pressure rating of 200 psi with an IPS OD is an acceptable alternative to SDR21 pipe.

2.3. Fittings:

2.3.1. Ductile Iron: Ductile iron fittings shall be mechanical joint or slip joint in accordance with the requirements of ANSI/AWWA C153/A21.53. The fitting shall be made of ductile iron complying with ASTM A536 and the working pressure shall be 350 PSI. The joints shall conform to ANSI/AWWA C111/A21.11. Bolts and nuts shall be low alloy steel.

Linings and coatings shall be as required in the specifications for ductile iron pipe.

2.3.2. Flanged Pipe: ASA Specification B16.l, Class 125, flanged. Gaskets shall be one-sixteenth inch thick ring gaskets of red sheet rubber.

2.3.3. Steel Pipe: Malleable iron, zinc coated, Federal Specification WW-P-521d(1), Type II, where approved for use.

2.3.4. Copper Pipe: Brass or bronze fittings for flared copper pipe, or wiped joint fittings where indicated or required.

2.3.5. Wrought Iron Pipe: Wrought iron, zinc coated, Federal Specification WW-P-52l(d), Type II, where approved for use.

2.4. Certificate of Inspection: Submit to the engineer a certificate of inspection from the pipe manufacturer that the pipe supplied has been inspected at the plant and meets the requirements of these specifications.

2.5. Valves: Valves supplied shall be of the designations and description indicated on the plans or described herein. The contractor shall insure himself that all valves supplied are produced in accordance with any references to codes or standards.

2.5.1. Gate Valves: Gate valves shall be designed and manufactured in accordance with the requirements of the latest revision of AWWA C-509. All valves shall be of iron body, bronze mounted, resilient seat type with non-rising stems and a 2" square operating nut.

Valves shall be manufactured with "0" Ring stem seals. Valves 16" and larger shall have a by-pass to equalize pressure on both of the valves to facilitate opening. All valves 24" and larger shall be equipped with gearing and asbestos packing.

Valve ends shall be of the size and type required for connections to the type service line used. Standard connections shall be push-on w/gaskets for PVC pipe, or M.J. for CI or DI pipe.

Pressure ratings for the valves shall be as follows:

SIZE	WORKING PRESSURE	HYDEOSTATIC TEST PRESSURE (SHELL)
2"-12"	200 psi	400 psi
14"-24"	150 psi	300 psi

Mueller, American-Darling, Kennedy, American, U.S. Pipe, M&H or approved equal will be accepted.

2.6. Valve Boxes: Adjustable valve boxes shall be of equal quality and workmanship to those manufactured by Mueller Company, or Resselaer Valve Company. Valve boxes shall be of close- grained gray cast iron. The valve boxes shall be the two-piece screw type and the cover or cap shall have cast on the upper surface in raised letters the word "Water". Valve boxes shall be painted with a coat of protective asphaltum paint before being shipped from the factory.

2.7. Hydrants: All hydrants shall comply with AWWA Standard C502, the latest revisions thereof, and the following design standards.

2.7.1. Fire hydrants shall be of the compression type, closing with the line pressure, with a 4 1/2" valve opening.

2.7.2. Hydrants shall have a minimum of 3'-6" bury and shall stand approximately 30" above surface elevation.

2.7.3. Hydrants shall be furnished with a sealed oil or grease reservoir located in the bonnet, so that all threaded and bearing surfaces are automatically lubricated. Teflon washers shall be used for ease of operation.

2.7.4. Hydrants shall be furnished with a breakable feature that will break cleanly upon impact. This shall consist of a two-part breakable safety flange. The seat ring shall be bronze and thread into a bronze drain ring located between the lower barrel and shoe.

2.7.5. All hydrants will be cast marked or outside design shall be such that visible identification can be made as to type and design.

2.7.6. Hose and pumper nozzles shall be threaded or leaded-in nozzles with caps and chains supplied.

2.7.7. Paint: All hydrants shall receive two exterior shop coats of fire hydrant red paint as specified by AWWA C502. In addition, one finish exterior coat of fire hydrant red paint shall be applied after construction operations are complete. The paint schedule shall comply with the following:

2.7.7.1. Preparation: Steel structures painting council - SP1-63 and SP2-63. Solvent and tool cleaned. Lightly sand existing coatings. Spot prime all damage areas of existing coating.

MANUFACTURER	SPOT PRIMER	FINISH COAT
Tnemec	37-77	Tneme-Gloss
Koppers	622	Glamortex
Pratt and Lambert	40.90	Vitralite Gloss

2.7.8. Hydrants shall be equipped with one (1) 4 1/2" pumper connection and two (2) 2 1/2" fire hose coupling connections. Outlet nozzle caps shall be provided for all outlets.

2.7.9. Hose gauge will be national standard, operating nut will be 1 1/2" pent. open counter clockwise.

2.7.10. Hydrants shall be Mueller Centurion, American Darling Mark 73 or approved equal.

2.8. Services: ¾" to 2"

2.8.1. Tapping Saddles: Tapping saddles shall provide full support around the circumference of the pipe with a designed in safeguard against overtightening to prevent deforming the pipe. All parts of the saddle shall be constructed of corrosive resistant bronze or galvanized malleable iron including bolt and nuts required to assemble. Only saddles designed specifically for the type water main pipe used shall be allowed. Threads shall be AWWA standard cc tapered. Dresser 194, Rockwell 395, Ford S70, Mueller H-13000 Series, or approved equal will be accepted.

2.8.2. Corporation Stops: Corporation stops are to be of bronze construction and a minimum size of 3/4" (inlet and outlet). Inlet threads will be AWWA Standard Taper cc. Outlets will be IP threads with a brass compression-fitting adapter for the appropriate water service pipe size. Ford, Mueller, Hayes or approved equal will be accepted.

2.8.3. Pipe for Service Lines:

2.8.3.1. Type – Polyethylene

2.8.3.2. General: All polyethylene pipe shall conform to all applicable requirements in the latest revisions of the following standards:

(1). AWWA C901-78 - Standard for polyethylene (PE) pressure pipe 1/2" through 3" for water materials.

(2). ASTM-1248 - Standard for polyethylene molding and extrusion

(3). ASTM-2239 - Standard for polyethylene (PE) Plastic pipe (SDR-PR). (IPS-I.D.)

2.8.3.3. Material - Polyethylene extrusion compound from which the polyethylene pipe is extruded shall comply with the applicable requirements for PE-3406 high density, ultra-high molecular weight polyethylene material as described in ASTM D-1248 (latest revision). The PE pipe shall be rated for use with water at 73.4° F at a hydrostatic design stress of 800 psi and a maximum working pressure of 200 psi.

2.8.3.4. Dimensions and tolerances shall comply with ASTM D-2239 (Iron pipe size [SDR-7]). installed:

2.8.3.5. Marking: The following data shall be clearly marked on all service pipe

(1). Nominal size

(2). Operating pressure @ 73.4° F

(3). Type of pipe, i.e., "water service pipe"

(4). Material designation code, "PE-3406"

(5). Date code: Month, year and day

(6). Manufacturer's brand name

(7). National sanitation foundation logo (indicating approval for potable water and compliance with ASTM specifications)

(8). ASTM Specification - "ASTM D-2239"

(9). Plant location code

NOTE: Typical house service shall be 3/4" "IPS" as shown on plans.

2.8.3.6. Meter Yoke: Meter yoke shall consist of copper and have a height of seven inches. Yoke shall have an inverted key type valve with lockwing on the riser and an angle check valve with dual independently acting check valves located at the outlet of the meter. The check valve shall have spring-assisted seating, and the seat shall be of Buna-N Rubber. All other valve parts shall be red brass or stainless steel. Inlets will have a brass adapter as required for a compression fitting to "IPS" water service pipe. Outlet shall be Ford Double Purpose coupling, Mueller 14222, or approved equal. The yoke shall have a brace pipe eye for support. Supplier shall provide certification that meter yokes meet all requirements of AWWA C-800-84 or latest revision. Yoke shall be Ford 170 series Coppersetter or approved equal.

2.8.3.7. Compression Fittings: Compression fittings shall be Ford, "Pack-joint", Mueller, "110 Compression", Hayes, "Hayes-Tite" or approved equal. A stainless steel insert will be required with any fitting that compresses the outside of the pipe to hold the pipe in place.

2.8.3.8. Meter Boxes: Meter boxes shall be supplied with each service connection. Boxes may be constructed of either cast iron, concrete, non-corrosive high-density polyethylene, or PVC. Box shall have an inside lip for support of the lid where the Owner can place an identification number.

(1). Cast Iron Boxes will be made in two pieces, i.e., box and cover. The box

shall be a minimum of 12 inches deep by 17 inches long by ten inches wide. Boxes shall be manufactured by Dewey Brothers, Ford Meter Box Company, Opelike Foundry Company or equal.

(2). Concrete Boxes shall not be less than 12 inches in depth by 17 inches long by 10 inches wide, and shall be cast from Class "A" concrete. The cover shall be made of either reinforced concrete and cast separately from the box with a cast iron reading lid, or the lid may be of all cast iron construction.

(3). Plastic Boxes: High-density polyethylene material used in the boxes shall meet or exceed the following physical properties:

a. Flexural modulus - 90,000 PSI

b. Compression strength 10% deflection, PSI - 1,100

c. Heat distortion, 66 PSI - 170°

d. Specific gravity - .6

e. Hardness, Shore D – 58

f. Impact strength, 1016, falling dirt - 160 in-lb.

g. Total load at center of top - 2,800+ lbs. Boxes shall not be less than 12" deep, by 17" long by 10" wide. The box cover may be either plastic with a cast iron reader lid or of all cast iron construction.

(4). PVC Boxes: PVC boxes shall be made of an extrusion grade PVC material with a wall thickness of at least .300' and a minimum diameter of 15". The lid shall be cast iron with a rim extending 1/2" below the base to fit inside the box.

2.8.3.9. Teflon Tape: Teflon tape will be used on all threaded connections to reduce the possibility of leaking joints.

2.9. Tapping Sleeves: Tapping sleeves shall consist of two sections of heavy welded steel which bolt together on the pipe and seal against a concave wedge gasket around the tap opening. The outlet shall have a flat-faced flange that is recessed to mate with standard tapping valves per MSS SP60 up through 12-inch size on size. Finish shall be a fusion-bonded epoxy coated to an average of 12 mil thickness. Bolts and nuts shall be stainless steel. Tapping sleeve shall be Rockwell 622 or approved equal.

2.10. Air Release Valves: The air release valves shall automatically function to release to atmosphere entrained air that may accumulate in the pipeline. Once the accumulated air is exhausted, the valve shall seat tightly to prevent water leakage. The valve shall operate through a compounded lever system. The valve body and cover shall be of cast iron; float of stainless steel; levers of brass; and with a resilient seat. The valves shall be sized and installed as shown on the contract drawings. Valves shall have 250 lb. flanged inlet. Valves shall be capable of operating from 0 to 100 psi. The air valve body shall be rated for a system pressure of at least 250 psi. Valves shall be Crispin Model P32 or approved equal.

Note that the isolation valve for the air release valve installation must have a rated working pressure of at least 200 psi and be provided with 250# flanges or have a flange adapter.

3. CONSTRUCTION METHODS:

3.1. General: All pipe shall be laid when and as directed by the Engineer. The work shall be discontinued to the least degree possible.

3.2. Trenching: The trench shall be dug to the required alignment and depth as shown on the plans or directed by the Engineer, and only so far in advance of the pipe laying as the Engineer shall permit. The width of the trench shall be kept at a minimum. The depth of the trench shall generally be sufficient to allow a minimum of three feet of cover over the top of the pipe. The bottom of the trench shall be shaped by hand and shall support the pipe for the entire length.

It shall be the responsibility of the contractor to provide adequate bearing for all pipe lines laid in uncertain soil conditions. If the trench bottom should be softened by flooding, rain or other causes, the unsuitable material shall be removed and replaced with suitable material properly shaped and tamped to grade.

The use of timber or other material to support the pipe shall not be used.

3.3. Pipe Laying: All water pipe shall be laid by experienced workmen with straight lines, even grades, and all joints shall be perfectly fitted. All pipe fittings, valves, hydrants, and accessories shall be carefully lowered into the trench with suitable equipment in a manner that will prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. Pipe and accessories shall be inspected for defects prior to their being lowered into the trench. Any defective, damaged or unsound material shall be repaired or replaced as directed by the Engineer. All foreign matter or dirt shall be removed from the interior and machined ends of pipe and accessories before it is lowered into position

in the trench. Pipe shall be kept clean by means approved by the Engineer during and after laying.

3.4. Joining Mechanical Joint Pipe:

3.4.1. Joining Existing Bell and Spigot to New Mechanical Joint: Due to the difficulty that may be encountered in attempts to make such a connection of this type, an adapter having a fitting bell and a M.J. socket may be used by the contractor.

3.4.2. Cleaning and Assembling Joints: Clean last 8" outside the spigot, and the inside of the bell of mechanical joint pipe to remove oil, grit, tar (other than standard coating) and other foreign matter from the joint and then paint clean area with an approved soap solution. The cast iron gland shall then be slipped on the spigot end of the pipe with the extension of the gland toward the socket or bell end. The rubber gasket shall be painted with the soap solution and placed on the spigot end with thick edge toward the gland.

3.4.3. Bolting of Joints: Push entire section of pipe forward to seat spigot end in the bell. Press gasket into place within the bell, being careful to have the gasket evenly located around the entire joint. Move C.I. gland along the pipe into position for bolting, insert all bolts, and screw nuts up tightly with fingers. Tighten all nuts with a suitable (preferably torque-limiting) wrench. Tighten nuts that are spaced 180 degrees apart alternately in order to produce equal pressure on all parts of the gland.

3.5. Joining Rubber Gasket Pipe (Bell Tite, Tyton, or Equivalent):

3.5.1. Cleaning Joint and Gasket: Clean gasket and spigot and inside of bell thoroughly to remove all dirt and other foreign matter.

3.5.2. Inserting Gasket: Insert gasket furnished by the pipe manufacturer into the gasket seat in the bell. Gasket shall be properly seated in the grooves provided in the pipe bell.

3.5.3. Lubricating Gasket and Pipe Spigot: Using a non-toxic vegetable soap, apply a film by hand to the inside surface of the gasket that comes into contact with the entering pipe and to the first l" of the spigot end of the entering pipe. Use only lubricant specified by the pipe manufacturer.

3.5.4. Final Assembling of Joint: Align entering pipe with the bell to which it is to be joined. Enter the spigot end into the bell until it just makes contact with the gasket. Apply sufficient pressure to force the spigot end past the gasket up to solid contact with the bell.

3.5.5. Field Cutting Pipe: Rubber gasket pipe - when it is necessary to field cut rubber gasket pipe, chamfer the cut end 1/8 inch x 30ø before inserting into a rubber gasket bell.

3.6. Joining Plastic Pipe: Plastic pipe shall be joined in strict accordance with the manufacturer's recommendations.

3.7. Testing: The contractor shall provide a suitable pump for applying pressure and an accurate gauge for measuring the pressure. Immediately upon completing a portion of the line between two valves, the pipe shall be tested by applying one hundred fifty (150) pounds per square inch hydrostatic pressure.

This pressure shall be maintained for two hours. Hydrostatic testing shall conform to all applicable requirements of ANSI/AWWA C600-82, Section 4. Leakage shall not exceed 10 gallons per inch of pipe diameter per mile of pipe per 24 hours.

3.8. Disinfection: After pipes are laid, and before cutting into the existing system, they shall be disinfected in a manner acceptable to the Engineer, and to his complete satisfaction, such disinfection to meet the requirements of the North Carolina Department of Environmental Quality, Division of Environmental Health, and all applicable requirements of AWWA C651, and shall be accomplished by filling the pipe with a solution of 50 parts per million residual chlorine. This solution shall remain in the pipe for 24 hours.

After a section of pipe has been tested and disinfected, the pipe shall be flushed to remove excess chlorine. Water samples shall then be taken by the contractor at each fire hydrant, as directed by the Engineer, for biological testing. The Contractor shall have these tests run by a state certified testing laboratory. No portion of the system shall be placed in operation until the tests are approved. If the presence of coliform bacteria is detected in the water samples, the section of pipe shall be disinfected again and additional samples shall be taken. The expense of disinfecting again shall be borne by the Contractor with no additional expense to the Owner.

3.9. Connections to Existing Mains: No connection shall be made by the contractor to any section of the existing water system unless the Resident Inspector, Field Engineer, or Water Plant Superintendent is present at the site. No valve or hydrant shall be opened or closed unless one of the above-listed persons is present at the site.

In making connections to the old distribution system, valves shall be set as shown on the plans, or at such designated place as the Engineer may direct. If, due to unforeseen conditions, these locations have to be changed or additional valves or fittings added, the

Contractor shall install the valves or fittings at the new locations.

3.10. Valves: All valves set by the Contractor shall include a valve box set to grade as directed by the Engineer. Valves shall not be set under pavement.

3.11. Fittings: Fittings shall be installed where and as shown on the plans or as directed by the Engineer. All bends (1/16 to 1/4), y-branches, plugs and all other fittings requiring such shall be sufficiently backed, blocked, or braced to preclude the possibility of their blowing off the main.

3.12. Hydrants: Final location of each hydrant shall be determined in the field by the Owner and the Engineer. Locations shall be approximately where indicated on the plans. The hydrants shall be set upon a bed of compacted crushed stone at least thirty (30) inches square by ten (10) inches in depth.

Extreme care shall be taken in excavating a vertical bank on the back side of the hydrant in order to leave a firm bank of earth against which to block or brace the hydrant. The hydrant shall be blocked or braced by placing concrete behind the back of the hydrant to keep the hydrant from being forced off of the end of the pipe by water pressure in the main. There shall be furnished and installed an approved strapping assembly to securely anchor the hydrant to the main line.

When the hydrant is backfilled, crushed stone or gravel shall be placed around the hydrant to a point just above the drain holes of the hydrant.

3.13. Blocking: All turns, fittings, etc., that induce pressure which would cause separation of the pipe, breakage, etc., shall be blocked with 3,000 lb. concrete. Blocking shall be formed and placed in such a manner that the pressure to be exerted at the point of blocking shall be transferred to firm, undisturbed earth at a maximum load of 2,000 lbs. per square foot. The Contractor shall insure that blocking at all tees, bends, plugs, etc., shall be sufficient to contain all pressure exerted by the pipe up to a pressure of 150 lbs. per square inch hydraulic pressure within the pipe, i.e., pressure at plug = 150# ÷(area of pipe in inches). The Contractor shall also be responsible for any damage or repairs caused by blowouts of any insufficiently blocked pipe.

When gray cast or ductile iron fittings are used with SDR 21 pipe, restrained joints may be provided in lieu of concrete blocking in the following cases:

JOINTS TO BE RESTRAINED

Direction Change (bends & offsets)	inlet and outlet
Size Change (reducers)	inlet and outlet
Branches (tees, crosses & wyes)	branch(es) only
Dead Ends (caps & valves)	all joints

The contractor shall use Uni-Flange 1300-S PVC pipe restrainers by Ford Meter Box Company or equivalent to achieve restraint from pipe to mechanical joint connection. These restrainers shall be a two piece clamping ring and incorporate serrations on the I.D. for 360 degrees contact and support of pipe. The restrainers shall not be used as a combination mechanical joint gland and restrainer.

All restrainers used shall have Factory Mutual approval for use on the type of pipe on which the restrainer is to be installed.

In addition to the above, a sufficient length of restrained pipe shall be proved before and after these joints where needed. To restrain the bell and spigot ends, use the Uni-Flange 1350-S restrainer or equal. The length to be restrained shall be determined from the following schedule:

NOM. PIPE SIZE	L - MINIMUM LENGTH TO BE RESTRAINED ON EACH SIDE OF FITTING (ft)							
	ELBOWS (deg)				VALVES, DEAD ENDS, TEES			
	11 1/4	22 1/2	45	90				
2		2	4	6	11		9	
4		4	6	11	17		13	
6		4	7	13	21		15	
8		5	10	16	26		18	
12		7	14	24	39		27	
14		8	16	28	44		41	
16		9	18	31	50		46	
18		10	20	34	55		50	
24		12	26	40	65		60	

3.14. Borings:

3.14.1. Boring Under Paved Roads and Highways:

3.14.1.1. Standards: Procedures for boring shall be in accordance with the best accepted methods of the construction and as shown on the plans and specified in these specifications.

3.14.1.2. General: Lines installed under highways shall be bored as shown on the detailed drawings. Casings will be installed of the type, size, and thickness as specified herein or on the detailed drawings. The contractor shall be responsible for notifying the Department of Transportation at least five days prior to any contemplated work and for securing any required permits for performing the work. All work shall be accomplished under the supervision of the Engineer and the District Engineer of the Department of Transportation or his authorized representative.

3.14.1.3. Carrier Pipe: Carrier pipe used under highways shall be of an approved material and installed to the satisfaction of the District Engineer of the Department of Transportation.

3.14.1.4. Casing Pipe: The inside diameter of the casing pipe shall not be less than two inches greater than the largest outside diameter of the joints and couplings for carrier pipe less than 6" o.d., and 4" greater for carrier pipe 6" and larger. It shall, in all cases, be great enough to easily remove carrier pipe without disturbing the casing pipe.

(1). Pipe Size 8" & Smaller: Schedule 40 wrought steel or wrought iron pipe having a wall thickness as shown below may be used for casing pipe 8" and smaller.

DIA OF PIPE (inches)	WROUGHT STEEL WALL THICKNESS (inches)	WROUGHT IRON WALL THICKNESS (inches)
2 1/2	0.203	0.208
3	0.216	0.221
3 1/2	0.226	0.231
4	0.237	0.242
5	0.258	0.263
6	0.280	0.286
8	0.322	0.329

(2). Pipe Sizes 10" and Larger: Steel pipe for casings 10" and larger shall be manufactured from steel having a minimum yield strength of 35,000 psi with the minimum wall thickness as shown below:

DIA. OF PIPE (inches)	MIN. WALL THICKNESS (inches)
10	0.188
12	0.188
16	0.250
18	0.250
20	0.250
24	0.250
30	0.312
36	0.375

3.14.1.5. Installation: The minimum depth from the roadway surface to the top of the casing pipe at its closest point shall be three feet. Casing pipe shall be filled with sand as shown on plans and the ends shall be sealed. Contractor may use casing spacers in lieu of filling with sand with prior approval of Engineers.

Contractors shall be required to provide shoring of boring pits and trenches more than six feet deep in accordance with the North Carolina Department of Transportation and Federal Occupational Health and Safety Act.

3.14.2. Boring Under Railroads:

3.14.2.1. Standards: Procedures for boring shall be in accordance with the best accepted methods of the construction and as shown on the plans and specified in these specifications.

3.14.2.2. General: All work on-railroad rights of way shall be done under the supervision of the Chief Engineer of the railroad, or his authorized representative, who shall be notified at least 15 days before construction is begun. In addition, this work shall only be done in the presence of the authorized representative of the Chief Engineer, and no methods shall be used that, in the opinion of the representative, could be hazardous to the railway.

3.14.2.3. Carrier Pipe: Carrier line pipe and joints shall be of the material shown on the details of the railroad encroachment agreements or as approved by the Chief Engineer or his authorized representative.

3.14.2.4. Casing Pipe: The inside diameter of the casing pipe shall not be less than two inches greater than the largest outside diameter of the joints and couplings for the carrier pipe less than 6" o.d., and 4" greater for carrier pipe 6" and larger. It shall, in all cases, be great enough to easily remove carrier pipe without disturbing the casing pipe.

Steel pipe manufactured from steel having a minimum yield strength of 35,000 psi and having a minimum permissible wall thickness as listed below shall be used as casing pipe.

DIA. OF PIPE (inches)	MIN. WALL THICKNESS (inches)
10	0.188
12	0.251
16	0.312
18	0.313
20	0.375
24	0.407
30	0.469
36	0.532

3.14.2.5. Installation: The depth from the base of the railway rail to the top of the casing at the closest point shall not be less than 6 feet. Also, there should not be less than 3 feet from the bottom of the side ditches to the top of the casing pipe. Casing pipe shall be filled with sand as shown on plans and the ends shall be sealed. Contractor may use casing spacers in lieu of filling with sand with prior approval of Engineers.

Contractors shall be required to shore all pits used for boring if it is over six feet deep.

3.14.2.6. Stream Crossings: Streams, creeks or rivers will be crossed by one of the following methods as detailed on the plans:

(1). D.I.-Ball Joint Pipe laid 18" (minimum) below bottom of stream creek, or river.

(2). D.I.-Push on joint pipe encased in concrete laid 18" (minimum) below bottom of stream, creek, or river.

(3). D.I.-M.J. pipe laid 18" (minimum) below bottom of stream, creek, or river.

(4). D.I.-M.J. pipe encased in concrete and laid under stream bottom.

(5). Steel casing pipe laid under stream, creek or river bottom with a carrier pipe placed inside.

(6). D.I.-M.J. pipe attached to bridge by anchor bolts.

(7). Span crossing with welded steel pipe.

(8). D.I. - R.J. pipe laid 18" (minimum) below bottom of stream, creek or river.

The contractor shall construct each crossing as detailed and as directed by the Engineer. Construction will only be undertaken when the Engineer's representative is present.

3.15 Valve and Meter Vaults:

3.15.1 General: The contractor shall supply all specified material, labor, tools, equipment, and perform all work and services necessary for or incidental to the furnishing and installation of all valve and meter vaults as shown on the plans. The meter and strainer will be supplied by others. However, installation will be the responsibility of the contractor under this item. Although such work may not be specifically shown or specified, all supplementary or miscellaneous items, devices or appurtenances incidental to or necessary for a sound, secure, complete and compatible installation shall be furnished and installed as part of this work.

3.15.2 Submittals: The contractor shall submit complete shop drawings showing locations and dimensions of equipment proposed to be used in the construction.

3.15.3 Location: Valve and meter vaults will be located, as much as possible, within the rights of way of the N.C. Department of Transportation or public roads where the pipe lines to be connected are located. The contractor will construct the vaults in such a manner as to protect the existing structures, i.e., road surfaces, drainage piping, or road shoulders that exist close to the proposed vault locations.

3.15.4 Materials and Equipment:

3.15.4.1 Vault: The enclosing vault shall be constructed of formed and poured

in place concrete as shown on the detailed drawings. The contractor may use as an equal a pre-cast vault if dimensions and design strength are adequate.

If a pre-cast vault is proposed, detailed drawings and design data shall be submitted to the Engineer for approval prior to beginning construction. Any pre-cast vault used must be on the N.C. Department of Transportation approved list of manholes and vaults.

3.15.4.2 Valves:

Gate Valves: Gate valves supplied shall be as specified in Section 2.5.1 of these specifications. All gate valves supplied for vault installation shall have ends as shown on the detailed drawings.

Check Valves: Check valves supplied shall be iron body, fully bronze mounted swing type, gravity operated with lever and weight with 125# flanged ends as manufactured by Mueller Co., American Darling, Kennedy, American, or an approved equal.