Section 4 - Water Distribution

Overview

This section includes specifications regarding all material, equipment, and labor required to install water piping, fittings, valves, and appurtenances as specified, as shown on the Plans, and as directed by the Engineer.

The Contractor shall construct the water lines, valves, fire hydrants, and appurtenances as shown on the Plans and as specified in this section. Clearing, grubbing, trench excavation, shoring, backfill, restoration and other related items shall be as specified in Section 2: Trench Excavation and Backfilling. Pipe and accessories shall be new as specified in this section or as specifically approved by the Engineer. All pipes, fittings, packing, joint materials, valves and fire hydrants shall conform to the latest edition Section C of the American Water Works Association (AWWA) Standards as a minimum. Other standards referenced in this specification (e.g.; ASTM) are applicable as far as the material or installation conforms to AWWA Section C. All materials/products that contact potable water must be third party certified as meeting the specifications of ANSI/NSF Standard 61, *Drinking Water System Components-Health Effects*. The certifying party shall be accredited by the American National Standards Institute. There shall be no connection between the water distribution system and any pipe, pumps, tanks vessels, hydrants or any other structure whereby unsafe water or other contaminated materials may be discharged or drawn into the water system.

Chapter 1 – Pipe Materials

The following pipe materials are approved for use within the City of North Augusta water system. All water lines 12-inches in diameter and larger shall be ductile iron pipe.

All pipe material shall be as shown on the Plans or as directed by the Engineer. The pressure rating, pressure class, pipe weight, length of pipe specification reference, and name of manufacturer shall be clearly marked on each length of pipe.

All pipe material, solder, and flux shall be lead free (less than 0.2% led solder and flux less than 8.0% lead in pipe and fittings).

Section 1.0 – Ductile Iron Pipe

Ductile Iron (DI) Pipe shall conform to the requirements of ANSI A-21.50 (AWWA C150 & C-151) and ANSI A-21.10 (AWWA C-100). Ductile iron pipe shall be coated and lined as specified in AWWA C-104.

1.00 Ductile Iron Pipe 12-Inch in diameter and smaller shall be pressure Class 350. Unless otherwise shown on the plans or directed by the City Engineer.

1.01 Ductile Iron Pipe 16-Inch in diameter and larger shall be pressure Class 250. Unless otherwise shown on the plans or directed by the City Engineer.

1.02 Ductile Iron Pipe shall have a cement lining meeting the requirements of ANSI 21.4 (AWWA C-104).

1.03 A minimum of 1 mil thick bituminous coating shall be on the outside surface of all ductile iron pipe.

1.04 Pipe shall be clearly marked with manufacturer's name, D.I. or ductile, weight, and class.

1.05 Joints shall be either push-on or mechanical joint configuration.

1.06 Ductile Iron Pipe materials shall be new. Pipe that has been previously used for conveying potable water is prohibited.

1.07 Ductile Iron Pipe shall be used for any water line section where bedrock is encountered.

Section 1.1 – Polyvinyl Chloride (PVC) Pipe

Polyvinyl Chloride (PVC) Pipe shall conform to requirements of AWWA C-900 and ASTM D2241. All PVC Pipe shall be pressure Class 200.

1.10 PVC Pipe that is 4-inch through 12-inch in diameter shall be AWWA C-900, pressure Class 200. Solvent-weld PVC pipe and fittings shall not be used in water mains 4-inch in diameter and larger.

1.11 PVC Pipe that is 2-inch in diameter shall comply with ASTM D-2241, and shall be pressure Class 200.

1.12 PVC with a diameter larger than 12-inch shall be prohibited for use in the water system. Ductile Iron shall be used for 12-inch and larger diameter waterlines. See Section 1.0 for Ductile Iron Pipe specifications.

1.13 PVC Pipe material shall be new. Pipe that has been previously used for conveying potable water is prohibited.

1.14 The storing and handling of the pipe shall be done in a manner acceptable to North Augusta Utilities. All pipe shall be supported within 5' of each end; in between the end supports, there shall be another additional support. The pipe shall be stored away from heat or direct sunlight.

1.15 Pipe shall be clearly marked with nominal size, type of material, SDR or Class, manufacturer's name, NSF Seal of Approval.

Section 1.2 – Steel Pipe

When installed as approved by the City Engineer, steel pipe shall conform to AWWA C-200 and either ASTM A53 or ASTM A120 (Black and hot-dipped Zinc Coated).

Section 1.3 – Non-Approved Materials

The following materials are not allowed in any installation within the City of North Augusta Water System:

1.30 Asbestos Cement Pipe

1.31 Thermoplastic Pipe

1.32 Natural rubber or other material which will support microbiological growth; this includes material that may be used for gaskets, O-rings, or other products for jointing pipes, setting meters or valves, or other appurtenances and which may be exposed to water.

1.33 Slip-on joint lubricant which will support microbiological growth; this includes the use of vegetable shortening.

1.34 The installation of used materials of any type is not permitted.

Chapter 2 – Pipe Jointing

Section 2.1 – Push-On Joints

Push-on type joints shall be assembled by inserting a continuous, molded, synthetic rubber compound ring gasket in an annular recess in the pipe socket and forcing the spigot end of the entering pipe into the socket, thereby compressing the gasket radically to the pipe to form a positive seal.

The design and shape of the gasket and the annular recess shall be such that the gasket is locked in place against displacement as the join is assembled. Details of the joint design shall be in accordance with the manufacturer's standard practice.

The size and shape of the gasket shall be suitable to provide adequate compressive force between the spigot and the socket after assembly to affect a positive seal under all combinations of joints and gasket tolerances.

Ductile iron push-on joints shall conform to AWWA C-111. PVC push-on joints shall conform to AWWA C-900 for 6, 8, and 12-inch pipe and to ASTM D-3139 for 2-inch PVC pipe. Gaskets shall conform to AWWA C-151 and AWWA C-111.

Lubricant for push-on joints shall be non-toxic, shall not support bacteria growth, and shall have no deteriorating effect on the gasket material.

Section 2.2 – Mechanical Joints

Mechanical Joints shall conform to AWWA C-111 and AWWA C-153. Mechanical joints shall have gaskets smooth and free from any porosity or imperfections. Gaskets shall be made of vulcanized synthetic rubber. Bolts for mechanical joints shall be standard, high strength, heat-treated cast iron tee-head bolts and hexagon nuts meeting the requirements of AWWA C-111.

2.20 The last 8 inches of the spigot and inside of the bell of mechanical joint pipe shall be thoroughly cleaned and approved lubricant shall be applied.

2.21 The cast-iron gland shall then be slipped on the spigot end of the pipe. The rubber gasket shall be placed on the spigot end with the thick edge toward the gland.

2.22 The entire section of the pipe shall be pushed forward to seat the spigot end in the bell. The gasket shall then be pressed into place within the bell, and the gasket shall be evenly positioned around the entire joint.

2.23 The cast-iron gland shall be moved into position for bolting, all bolts inserted, with the nuts finger tight. Bolts shall be tightened alternately to

produce an equal pressure on all parts of the gland. A suitable torque-limiting wrench shall be used with maximum torque as recommended by the manufacturer.

Section 2.3 – Restrained Joints

2.30 Bolts, nuts, and all-thread rod shall be made of either high-strength cast iron containing a minimum of 0.50 percent copper, or medium carbon steel ASTM A 449 specifications for carbon steel externally threaded standard fasteners, Grade B, having minimum yield strength of 74,000 psi.

2.31 Stainless steel materials shall be Type 316 stainless or better.

2.32 Materials shall be clean, and coated with a rust resistant lubricant.

2.33 Threads shall be in accordance with ANSI B1.1.

2.34 Threads shall conform to the coarse thread series with Class 2A internal threads, and Class 2B external threads.

2.35 Bolts three-quarter inch (3/4”) and smaller shall be furnished with heavy hex heads conforming to ANSI B18.2.1.

2.36 Bolts three-quarter inch (3/4”) may have either standard or heavy hex heads conforming to ANSI B18.2.1.

Chapter 3 – Pipe Joint Fittings

3.00 All ductile iron and grey cast iron fittings shall conform to the requirements of ANSI A21.10 and AWWA C100 *Ductile-iron and Gray-iron Fittings*. Standard mechanical joint fittings shall be used. The gaskets shall be the proper kind for attachment with the type of pipe being used.

3.01 All ductile iron and gray cast iron fittings shall be given an outside bituminous coating, as stipulated in ANSI A21.10 and shall be coated with the pipe manufacturer's standard (10 to 20 mils dry film thickness) outside coating, coal tar, or asphalt base material per AWWA C151 or fusion-bonded epoxy in accordance with ANSI A21.16/AWWA C116).

3.02 Fittings shall be lined with enameling or a thin cement lining in accordance with ANSI A21.4/AWWA C104 *Cement-mortaring for Ductile Iron Pipe and Fittings*. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately 1 mil thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard or ANSI A21.4/AWWA C104.

3.03 Underground piping shall have mechanical or push-on joints. Above ground an interior piping shall have flanged joints.

Chapter 4 – Pipe Installation

Section 4.0 – Inspection of Materials

A careful field inspection shall be made of all material before installation. Materials and accessories shall be handled with care to insure delivery and installation in a sound, undamaged condition. All materials should comply with AWWA C600 and AWWA C605. Particular care shall be taken to protect the linings and coatings from damage. Pipe and accessories shall be examined for defects and tapped with a light hammer to detect cracks prior to installation. All damaged, defective or unsound materials as determined by the Engineer shall be removed from the job site.

Section 4.1 – Alignment and Grade

4.10 All pipes shall be laid and maintained to the required lines and grades. Fittings, valves, and hydrants shall be at the required locations and with joints centered and all valves, hydrant, and stems plumb.

4.11 Temporary support and adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work shall be furnished by the contractor.

4.12 Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipes, branch connections to mains, or main drains, the obstruction shall be permanently supported, relocated, removed, or reconstructed by the contractor in cooperation with the owners of such utility structures.

4.13 All pipe shall be laid to the depth shown on the contract drawings or as required by the Engineer in writing. The depth shall be measured from the established street grade or the surface of the permanent improvement to the top of the pipe. See Detail 4.11 for minimum cover requirements.

Section 4.2 – Excavation of Trench

4.20 The trench shall be dug to the required alignment and depth shown on the drawings and/or as specified above only so far in advance of the pipe laying as North Augusta Utilities shall permit. The trench shall be braced and drained when necessary so that workers may work therein safely and efficiently.

4.21 The trench width at the ground surface may vary with and depend upon its depth and the nature of the ground encountered. The minimum clear width of the un-sheeted or sheeted trench measured at the horizontal

diameter of the pipe shall be eighteen inches (18”), or one foot (1’) greater than the outside diameter of the barrel of the pipe, whichever is greater. The maximum clear width of the trench at the top of the pipe shall be not more than the outside diameter of the pipe plus two feet (2’).

4.22 The pipe shall be laid on firm soil, cut true and even to afford bearing for the full length of the barrel of the pipe, or on earthen mounds.

4.23 Any part of the trench excavated below grade shall be corrected with thoroughly compacted material approved by the City of North Augusta Engineering Department.

4.24 When an unstable subgrade condition is encountered, an additional depth shall be excavated and refilled to pipe foundation grade with crushed stone or other suitable material as required to achieve a satisfactory trench bottom.

4.25 Ledge rock, boulders, and large stones shall be removed to provide clearance to each side of, and below, all pipe and accessories. This clearance for pipe and accessories shall be six inches (6”).

4.26 Excavations below subgrade in rock or in boulders shall be refilled to subgrade with material approved and thoroughly compacted.

4.27 Wherever necessary to prevent caving, trench excavations in soils such as sand, gravel, and sandy soil shall be adequately sheeted and braced. Where sheeting and bracing are used, the trench width shall not be less than that specified in section 4.21 above. As backfill is placed, if sheeting is to be withdrawn, it shall be withdrawn in increments not to exceed one foot (1’), and the void left by the withdrawn sheeting shall be filled and compacted.

4.28 All excavated materials shall be piled in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other provisions made for street drainage.

4.29 The use of trench digging machinery will be permitted except where its operations will cause damage to trees, buildings, or existing structures above or below ground. At such locations, methods by hand shall be employed to avoid such damage.

4.29.1 To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, warning lights, and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for traffic use. Whenever required, watchmen

shall be provided to prevent accidents. Rules and regulations of the local authorities regarding safety provisions shall be observed.

4.29.2 Excavations for pipe laying operations shall be conducted to cause the least interruption to traffic. Hydrants under pressure, valve-pit covers, valve boxes, curb-stop boxes, fire or police call boxes, or other utility controls shall be unobstructed and accessible during the construction period.

4.29.3 Adequate provisions shall be made for the flow in sewers, drains, and water courses encountered during construction. The structures which may have been disturbed shall be satisfactorily restored.

Section 4.3 – Preparation of Trench Bottom

Pipe shall be laid directly on a trench bottom containing coupling holes so as to provide continuous contact with the pipe between coupling holes.

4.30 Coupling Holes: Prior to lowering the pipe into the trench, a coupling hole shall be dug in the trench bottom having a length, width, and depth to allow assembly and to maintain a minimum clearance of two inches (2”) between coupling and undisturbed trench bottom.

4.31 Shaping Trench Bottom: Prior to lowering pipe into the trench, the trench bottom between coupling holes hall be made flat and cut true and even to grade so as to proved continuous contact of the trench bottom with the pipe.

Section 4.4 – Lowering Pipe and Accessories into Trench

4.40 All pipe, fittings, valves, hydrants, and accessories shall be carefully lowered into the trench using suitable equipment in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

4.41 The pipe and accessories shall be inspected for defects prior to lowering into the trench. Any defective, damaged, or unsound material shall be repaired or replaced.

4.42 All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean.

Section 4.5 – Installation of Pipe

Installation of water mains and appurtenances shall be conducted in accordance with Section C of the American Water Works Association (AWWA) Standards and/or manufacturers recommended installation procedures.

4.50 Continuous, uniform bedding shall be provided in the trench for all buried pipe. After a length of pipe has been placed in the trench with the spigot end forced home in the bell of the adjacent pipe, it shall be brought to the correct line and grade, and secured in place by tamping in layers to a sufficient height above the pipe to adequately support and protect the pipe. Backfill must be of an approved material. Stones other than crushed bedding shall not come into contact with the pipe and shall not be within six inches (6") of the pipe.

4.51 Whenever pipe laying is not in progress, the open ends of pipe shall be closed either with a watertight plug or by other approved means. If there is water in a trench, this seal shall be left in place until the trench has been pumped completely dry.

4.52 The pipe shall be cut so that valves, fittings, or closure pieces can be inserted in a neat and workmanlike manner and without any damage to the pipe. After cutting, all burrs and sharp edges shall be removed and the exterior of the spigot end suitably beveled to facilitate assembly.

4.53 Properly restrained bends shall be used for all major alignment changes. Joint deflections shall only be used for minor alignment changes necessary to avoid obstructions. Long radius curves by joint deflection shall only be used if approved by the Engineer. Joint deflectors hall not exceed manufacturer's recommendations, or that necessary for the joint to be satisfactorily made.

4.54 All pipe shall be joined in the exact manner specified by the manufacturer of the pipe and jointing materials.

4.55 Pipe shall be laid with the bell facing in the direction of laying. No blocking of the pipe barrel above the trench bottom will be permitted.

4.56 All mains shall be detectable within three and a half feet (3.5') with electronic locating equipment. When PVC pipe is used, locating wire shall be laid above the pipe per Detail 4.04.

4.57 Where the minimum cover of thirty-six inches (36") cannot be provided, the pipe shall be ductile iron or other approved material and method approved by SCDHEC, and, when necessary, insulated to prevent freezing. See Detail 4.11.

4.58 All water mains shall be located out of all contaminated areas. If the main must run through a contaminated site, the main material must protect the water system from being contaminated (e.g. Ductile Iron Pipe with chemical resistant gaskets). Rerouting of the water line is recommended, if possible.

Chapter 5 – Separation of Water Mains and Sewers

5.00 Water Mains and Sewers shall be separated in accordance with South Carolina Department of Health and Environmental Control's State Primary Drinking Water Regulation R.61-58.4.D.(12) (a)–(f).

5.01 Water lines will be permitted to cross perpendicular over sanitary sewer lines when a vertical separation of 18 inches (18") can be maintained and the water line will be located above the sewer line. Where a water line crosses over a sanitary sewer, a full length of pipe shall be used with its joints straddling the sewer. See Detail 4.05.

5.02 Where a water line is to be parallel to a sanitary or storm sewer, it shall be laid at least ten feet (10') from the sewer. Where approved when supported by date from the design engineer, water lines may be permitted closer than this on a case-by-case basis, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on the one side of the sewer. The elevation of the bottom of the water main must be at least 18 inches (18") above the top of the sewer.

5.03 When it is impossible to obtain the distances specified in Section 5.10 (State Primary Drinking Water Regulation), the City may allow an alternative design. Any alternative design shall:

i. Maximize distances between the water main and sewer line and the joints of each;
ii. Use materials which meet the requirements of R.61-58.4(D)(1) for the sewer line; and,
iii. Allow enough distance to make repairs to one of the lines without damaging the other.

5.04 Potable water lines shall not be laid less than twenty-five feet (25') horizontally from any portion of a wastewater tile-filed or spray-field, or shall be otherwise protected by an acceptable method approved by SCDHEC.

5.05 No water pipe shall pass through or come in contact with any part of a sewer manhole. Water lines may come in contact with storm sewers or catch basins if there is no other practical alternative, provided that ductile iron pipe is used, no joints of the water line are within the storm sewer or catch basin and the joints are located as far as possible from the storm sewer or catch basin.

5.06 There shall be at least a ten foot (10') horizontal separation between water mains and sanitary sewer force mains. There shall be an eighteen inch (18") vertical separation at crossing in all cases whether the water

main is either above or below the sewer line. Whenever possible, the water main shall be located above the sewer line.

5.07 Chamber pits, or manholes containing valves, blow-offs, meters, air relief valves, or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer.

Chapter 6 – Surface Water Crossings

6.00 A minimum cover of two feet (2') shall be provided over the pipe in for underwater crossings. When crossing water courses which are greater than fifteen feet (15') in width, the following shall be provided:

6.01 The pipe shall be protected from damage, freezing, anchored, supported and accessible for repairs or replacement.

6.02 The pipe material and joints shall be designed appropriately.

6.03 Valves shall be located so that the section can be isolated for testing or repair; the valves shall be easily accessible, and not subject to flooding.

6.04 A blow-off shall be provided on the side opposite the supply service, sized in accordance with R.61-58.4(D)(7) *SCDHEC State Primary Drinking Water Regulations*. Blow-offs shall not be directed toward creeks or other water bodies without proper precaution being taken to de-chlorinate prior to discharge.

6.05 The pipe material shall be ductile iron mechanical joint and designed appropriately. See Detail 4.18.

Chapter 7 – Installing Pipe by Jacking and Boring

Where water mains are to be installed within paved streets, roadways, sidewalks, etc., and it is undesirable to install pipe under this surface by means of an open cut trench, the contractor will install this pipe by jacking and boring.

Section 7.1 – Steel Casing for Highway Crossings

7.00 Only ASTM A 139, Grade B steel pipes, recently primed and coated with hot coal tar enamel to dry film thickness of a minimum 100 mils shall be used.

7.01 The casing pipe shall have a minimum inside diameter and a minimum wall thickness as specified by the Engineer. The Engineer shall be responsible for determining if the minimum sizes and thickness shown on the approved drawings are adequate for placing the casing under the highway and for installing the carrier pipe.

7.02 Only ductile iron pipe shall be used inside steel casings unless specifically approved otherwise by the City of North Augusta Engineering Department.

7.03 Ductile Iron pipe shall be supported by 360° stainless steel carrier spacers.

Chapter 8 – Identification Tape and Detection Wire

8.00 A twelve-gauge copper wire or metallic identification tape shall be installed over the pipe and within one foot of finished grade.

8.01 The wire or tape shall be stubbed up at each valve location and left accessible inside the valve box. The wire shall form a continuous loop in the water system. Insulation shall be stripped from each wire where spliced together. Bare copper wires shall be covered with a water proofing tape to prevent corrosion.

8.02 See Detail 4.04 for further illustration.

Chapter 9 – Valves

Valves shall be furnished and installed as shown on the plans, as specified, or as directed by the Engineer. Unless otherwise noted, valves shall be furnished with mechanical join connections for buried service and flanged joints for non-buried service. All valves shall be opened by turning counterclockwise and shall have an arrow cast into the metal of the operating nut, or in the handle, to indicate direction of opening. Each valve shall have the manufacturer's name, year made, and pressure rating cast on the body.

Section 9.0 – Gate Valves

9.00 Gate valves shall have a full opening equal to the size of the pipe on which they are installed and shall open by turning counterclockwise.

9.01 Gate valves shall be iron body, bronze mounted, double disc parallel seat valves with hub, mechanical joint, or flanged ends, as called for on the plans or in the proposal form. Mechanical joints shall be used unless other configuration specified in the plans.

9.02 All valves installed below ground shall be non-rising stem type with a two inch (2") square operating nut, marked to indicate the direction of opening. All valves installed above ground shall be outside stem and yoke (OS&Y) type, equipped with hand wheel for manual operation, marked to indicate the direction of opening.

9.03 Gate valves shall meet the requirements of AWWA C509, specifications for gate valves for ordinary water service. Valves shall be tested at a minimum pressure of 300 pounds per square inch hydrostatic pressure for working pressures up to 150 pounds per square inch, and 400 pounds per square inch hydrostatic pressure for working pressures greater than 150 pounds per square inch.

9.04 Valves shall be furnished with double "O" ring seal, and stuffing boxes shall be bronze brushed, providing complete bronze sealing surface for "O" rings. Valves shall be M&H Valves or Mueller No. A02370-20 or approved equal. Two inch (2") gate valves shall be Mueller No. A2360-8 or equal with square operating nut.

Section 9.1 – Tapping Valves

Tapping valves and mechanical joint sleeves shall be furnished and installed at the locations shown on the plans. The tapping valve shall conform in all respects to Chapter 9 of these specifications. The Contractor shall verify the material and size of the pipeline to be tapped. Valves and sleeves shall be manufactured by the Mueller Company, or approved equal.

Section 9.2 – Butterfly Valves

Butterfly valves shall conform to AWWA Standard C504 for Class 150B, unless otherwise specified.

9.20 Suitable for two-way flow.

9.21 Valve body to be cast iron ASTM A126, Class B or cast iron ASTM A48, Class 40 or ductile iron ASTM A536, Grade 65-44-12.

9.22 Body ends to be flanged, ANSI B16.1, Class 125, for all exposed locations and all valves larger than 48 inch (48”).

9.23 Provide mechanical joint ends, in accordance with AWWA C-111, for buried valves 48 inches (48”) and smaller.

9.24 Furnish disc of Ni-Resist (ASTM A436 Type I) or ductile iron (ASTM A536). Disc to be offset design, providing 360° uninterrupted seating, with 90° operations from full closed to full open position.

9.25 Resilient seats to be synthetic rubber (BUNA-N). Seat may be located in the valve body or attached to the disc. Matting material for resilient seat to be 18-8 Type 304 stainless steel. Seats to be field adjustable around the full 360° circumference and field replaceable.

9.26 Shafts to be turned, ground, and polished, constructed of 18-8 Type 304 stainless steel. Shafts may be of one piece or two-piece stub design.

9.27 Valve bearings shall be of Teflon or other self-lubricating material designed for a bearing pressure not to exceed 1/5 of the compressive strength of the bearing material.

Section 9.3 – Air Relief Valves

Air relief valves shall be provided in accordance with sound engineering practices at high points in water mains as required.

9.30 Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur.

9.31 The open end of an air relief valve from automatic valves or from a manually operated valve shall be extended to the top of the pit and provided with a screened downward facing elbow.

9.32 See Detail 4.15 for further illustration.

Section 9.4 – Valve Boxes

All underground valves shall be installed with cast iron valve boxes having a suitable base and shaft extension sections to cover and protect the valve and permit easy access and operation. Box assemblies shall be Clow F-2450, Grinnell, Mueller, or an approved equal.

9.40 Extension sections shall be furnished with the boxes when required for valves installed at depth below the minimum required depth for main installation.

9.41 The word “WATER” shall be cast on covers for valve boxes on potable water lines only. A 24” x 24” x 4” concrete donut shall be placed around all valve boxes not located in paved areas.

9.42 See Detail 4.02 for further illustration.

Section 9.5 – Valve and Box Installation

9.50 Valves and valve boxes shall be installed throughout the water system as shown on the plans or as directed by the Engineer.

9.51 Valves and valve boxes shall be plumb and valve boxes shall be centered directly over the valve operating nut.

9.52 Earth fill shall be carefully tamped around the valve box to three feet (3’) on all sides or to the undisturbed face of the trench, if less than three feet (3’).

9.53 Stuffing boxes shall be tightened and the valve shall be inspected in both opened and closed positions to see that all parts are working.

9.54 All piping and valves shall be properly and adequately supported to prevent movement or undue strain on the piping and equipment.

Chapter 10 – Fire Hydrants

All fire hydrants shall be Mueller Centurion 200, Red in color. The contractor shall be responsible for furnishing and installing all fire hydrants as shown on the plans or as directed by the Engineer. Fire hydrants shall be three-way, cast iron body, of the dry head, breakable traffic type with breakable safety flange at the ground line, and shall beet AWWA C502 *Specifications for Fire Hydrants*, or latest revision. Rated working pressure for fire hydrants shall be 250 psi. See Detail 4.01 for schematic drawing of installation.

Section 10.1 – Setting Fire Hydrants

10.00 The interior of the hydrant shall be thoroughly cleaned of all foreign matter prior to installation. Hydrant drains shall not be connected to or located within ten feet (10') of sanitary sewers.

10.01 Hydrants shall be jointed to the main with a six inch (6") pipe branch controlled by an independent six inch (6") gate valve.

10.02 Hydrants shall be set plumb with the bury line at the ground surface and at such elevations that the connecting pipe shall have at least forty-two inches (42") of cover over the pipe. Furnish and install hydrant extensions as necessary to ensure proper elevation.

10.03 Whenever hydrants are set in soil classified as impervious, a drainage pit two feet (2') in diameter and two feet (2') deep shall be excavated below each hydrant. The pit shall be filled compactly with course gravel or broken stone mixed with course sand, under and around the bowl of the hydrant to a level six inches (6") above the waste opening. No hydrant drainage pit shall be connected to a sewer.

10.04 Earth suitable for backfill shall be carefully placed in six inch (6") layers and carefully tamped.

10.05 A reaction or thrust backing shall be provided at the bowl of each hydrant and shall be so placed as not to obstruct the drainage outlet of the hydrant, or the bowl of the hydrant.

10.06 Where conditions are such that the bearing value of the trench wall will not provide satisfactory support, the Contractor will be required to furnish and install mechanical joint restraint or tie rod harnesses to hold the fittings and pipe line in place.

10.07 Not less than seven cubic feet (7') of crushed or broken stone shall be placed around the base of the hydrant to insure drainage.

10.08 All hydrants shall be fit with a metal Storz Permanent Hydrant Adapter or integral Storz connection. The fitting shall have a five inch (5”) Storz connection.

10.09 After installation, each hydrant and valve shall be inspected in both opened and closed positions to assure that all parts are in satisfactory working condition.

10.010 Immediately following installation, all fire hydrants shall be securely covered with a polyethylene bag bearing the words “Hydrant Out of Service”, or some other indication that the fire hydrant is not active. Plastic “garbage” bags are not acceptable. The hydrant bag shall remain in place until a SCDHEC Permit to Operate is issued.

Chapter 11 – Service Connections

A separate tap shall be made for each residence and/or business. The tap to the main shall be made with a tapping saddle of cast-iron or double stainless steel strapping construction. Unless otherwise noted on drawings, all taps, fittings, and service tubing shall be three quarter inch (3/4") diameter. See Detail 4.10 for further illustration.

11.00 All tapping of mains shall be done in the upper half of the pipe and approximately at a 45° angle from the vertical.

11.01 Tapping saddles shall be of cast-iron or double stainless steel strapping construction.

11.02 Service tubing shall be Type K copper, in accordance with ASTM B-88 specifications. Tubing shall be sized the same as with compression fittings installed by properly bending and not crimping the tube. Tubing shall be continuous without splices, unless the required length exceeds one hundred feet (100'). No polyethylene, plastic, steel, or any other tubing material is allowed.

11.03 Corporation stops and curb stops shall be three quarter inch (3/4") Ford, Ford angle meter valve #KV43332W compression fitting with locking wing, or approved equal. All curb stops and angle valves shall be made of brass.

11.04 All services shall be located at the center of the lot or unit unless otherwise noted in drawings. The concrete curb shall be stamped with a "W" while the concrete is wet, to designate the tap location. The stamp shall be provided by the City of North Augusta Engineering Department.

Chapter 12 – Meter Boxes and Vaults

Meter boxes shall be either concrete or cast-iron of the proper and necessary dimensions to accommodate the particular size meter to be housed. The box shall be large enough so that the particular size meter housed by it can be removed without disturbing the box. See Detail 4.10 for further illustration.

12.00 The cover for the box shall be of cast iron Brooks or equal and such that it can be easily removed by one person for purposes of providing easy access to the complete meter assembly and cut off.

12.01 Service connections three quarter inch (3/4”) to one inch (1”) shall have meter box bases made of heavy gage polybutylene plastic.

12.02 Service connections one and a half inch (1 ½”) through two inches (2”) shall have meter box bases made of cast-iron.

12.03 Service connections three inches (3”) and larger shall have meter box bases made of concrete and the lid shall be made of stainless steel cast into the concrete.

12.04 All meter boxes shall have a depth of not less than fifteen inches (15”).

12.05 Meter boxes, pits, vaults, or manholes containing valves, blow-offs, meters, air release valves, or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer system.

Chapter 13 – Reaction Support

All ductile iron and cast-iron material associated with the installation of all below-grade hydrant barrels and risers, valves, fittings, restraining couplings and pipe shall be poly-wrapped in accordance with ANSI A21.5 (AWWA C105) *National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.* The thickness of this wrapping shall be 8 mils. See Detail 4.08 for further illustration.

13.00 Concrete mix used for thrust blocking shall have a 28-day compressive strength of no less than 3,000 pounds per square inch.

13.01 Blocking shall be placed between the undisturbed ground and the fitting to be anchored. Place the blocking so that the pipe and fitting joints will be accessible for repairs, unless otherwise shown.

13.02 Thrust blocking is required on all water lines greater than two and a half inches (2.5”) in diameter.

13.03 Thrust blocking must also be installed on all lines two and a half inches (2.5”) and smaller if the joints are of the slip-joint type.

13.04 Sufficient thrust block bearing shall be installed to distribute the thrust onto undisturbed earth at a rate not exceeding the allowable soil bearing value.

13.05 Where conditions are such that the bearing value of the trench wall will not provide satisfactory support, the Contractor will be required to furnish and install mechanical joint restraint and/or tie rod harnesses to hold the fittings and pipe line in place.

13.06 Megalug retainer glands or equivalent shall be used for all mechanical joints three inches (3”) and larger. Where appropriate and as designated by the City Engineer, Megalug retainer glands shall be used in combination with blocking.

13.07 See Detail 4.08 for reaction support schematics.

Chapter 14 – Cross-Connection Control Devices

14.00 All fire lines for sprinkler systems, except those in the high hazard category, as well as irrigation lines shall be protected by an approved testable double check valve. Facilities involved with medical treatment or flood processing, for example, will also require a backflow prevention device. Any water supply project involving the use of a reduced pressure backflow prevention device or double check valve assembly will not be given final approval for operation until the backflow prevention devices have been tested by a SCDHEC certified tester and test results have been submitted to the City of North Augusta Building Standards Division. Backflow prevention devices must be on the SCDHEC approved list. The person testing the backflow prevention devices must be a SCDHEC certified tester.

14.01 No piping systems which bypass an installed backflow prevention device (or preventer) shall be allowed under any circumstances, unless the bypass is also equipped with an equal, approved backflow prevention device.

14.02 High hazard category cross-connections shall require an air gap separation or an approved reduced pressure backflow preventer.

14.03 Reduced pressure principal backflow prevention assemblies may not be installed in any location subject to possible flooding. This includes pits or vaults, which are not provided with a gravity drain to the ground's surface that is capable of exceeding the discharge rate of the relief valve. Generally, if installed in a pit, the drain line shall be two times the size (2x) of the line entering the backflow prevention device. The drain cannot empty into any type of ditch, storm drain, or sewer, which could flood water back into the pit.

14.04 All piping up to the inlet of the backflow prevention device must be suitable for potable water. The pipe must be AWWA or NSF approved. Black steel pipe cannot be used on the inlet side of the device.

14.05 Backflow preventers must be on the SCDHEC list of approved backflow prevention devices, and shall be installed in a manner approved by the City of North Augusta and in accordance with local plumbing codes and all applicable requirements of the SCDHEC State Primary Drinking Water Regulations R.61-58.

14.06 Testing of backflow preventers is required immediately after installation, repairs, or replacement.

14.07 For residential protection, the Utilities Division will install Residential Dual Check Valves for the customer. The customer shall be aware that the installations of a residential dual check valve results in potentially closed plumbing system within the residence. As such, the owner may need to provide for thermal expansion within their closed system, i.e., pressure relief valves and/or the installation of thermal expansion devices.

14.08 There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contamination materials may be discharged or drawn into the system.

Chapter 15 – Blow-Offs

15.00 Blow-offs shall be located in a box or structure that facilitates proper use. The orifice shall be provided on fixed piping, in the valve box.

15.01 Blow-offs shall not be directed towards roads or so that the water will flow into a creek, or any natural water source. At stream crossings, direct the blow-off away from streams, over ground.

15.02 No flushing device shall be directly connected to any sewer.

15.03 See Detail 4.12 for further illustration.

Table 1 – Blow-Off Orifice Sizes

Pipe Diameter (inches)	Minimum Flow Required (GPM)	Orifice Size
2	25	0.75”
2.5	40	1”
3	60	1.25”
4	100	1.5”
6	220	2”
8	400	2.5”
10	612	Fire Hydrant
12	882	Special Blow-Off
14	1,200	Special Blow-Off
16	1,570	Special Blow-Off

Chapter 16 – Testing

Section 16.0 – General

16.00 The contractor shall provide all necessary equipment, gauges, labor, tools, and services, and shall perform all work required in connection with testing water mains, laterals, and service lines. An official of the City of North Augusta must be present to witness the tests.

16.01 Each valve section of water main shall be slowly filled with water, with care being taken to expel all air from pipes. If hydrants or blow-offs are not available at high points in the main, the pipe shall be tapped at thigh points to vent the air, and shall be plugged at completion of tests.

16.02 Each valve shall be tested in the closed position during the water line tests.

16.03 Any leaks found shall be immediately repaired.

Section 16.1 – Pressure Test

The Contractor shall conduct a hydrostatic pressure test on all piping, and valves. The test shall be conducted at 150% of the working pressure of the line, but not less than 150 psi. The test shall be carried out in accordance with AWWA C-600, hereinafter specified and as directed by the Engineer. The leakage test can be carried out at the same time as the pressure test in some cases.

16.10 The duration of the test shall be a minimum of two hours.

16.11 All exposed pipes, fittings, valves, and hydrants shall be carefully examined during the test. Any cracked or defective pipes, fittings, valves, or hydrants discovered during the test shall be removed and replaced with sound material in the manner specified. Repeat the test until results are satisfactory.

Section 16.2 – Leakage Test

Leakages tests shall be conducted in accordance with AWWA Standard C-651. The leakage test shall be conducted by measuring the amount of water which enters the test section under test pressures for a minimum of two hours. All measuring devices shall be furnished by the Contractor.

16.20 During the test, the main shall be subjected to a pressure of 150 psi.

16.21 No pressure pipe installation will be accepted until the leakage test passes. Allowable leakage is determined by the following formulas:

P.V.C Pipe		Ductile Iron Pipe
$L = \frac{N*D*\sqrt{P}}{7{,}400}$	or	$L = \frac{S*D*\sqrt{P}}{133{,}200}$

L = Allowable leakage (gallons per hour)
N = Number of joints
S = Length of pipe being tested (feet)
D = Nominal diameter of pipe (inches)
P = Average test pressure (psi)

16.22 Should any test of pipe lade disclose leakage greater than that specified, the defective joints shall be located and repaired until the leakage is within the specified allowance.

Chapter 17 – Disinfection Procedures for Completed Water Distribution Systems

17.00 After water lines have been tested per Chapter 16 of these specifications, all newly installed water mains and repaired portions of or extensions to existing water mains shall be thoroughly flushed, disinfected, and subjected to bacteriological tests. Disinfection shall comply with AWWA C-651 *Disinfection of Water Mains.* In general, one approved method known as the "continuous feed" method is as follows:

1. Water from the existing distribution system or other source of supply shall be controlled so as to flow slowly into the newly laid pipeline during the application of chlorine.

2. The solution shall be retained in the pipeline for a minimum of twenty-four (24) hours and then flushed thoroughly with a potable water of satisfactory bacteriological quality before starting the sampling program.

17.01 The newly laid main shall be thoroughly flushed with water from the existing distribution system or another source approved by the City of North Augusta Engineering Department. Flushing shall be at a sufficient rate to produce a minimum velocity of two and a half feet per second (2.5 fps) in the main. After thorough flushing has been completed, chlorine for disinfection shall be applied and maintained at a minimum of 50 mg/L available chlorine. To ensure that this concentration is maintained, the chlorine residual shall be measured at regular intervals.

17.02 Chlorine may be applied using one of the two following ways:

1. As chlorine gas-water mixture. The chlorine solution shall be applied by means of a solution feed chlorinating device.

2. As a solution of calcium hypochlorite powder in water. Calcium hypochlorite shall be the commercial product known as H.T.H., Perchloren, or Maxochlor, or approved equal. The solution consisting of five percent (5%) powder and ninety-five percent (95%) water by weight shall be prepared.

17.03 The amount of chlorine needed for each one hundred feet (100') of line is shown in Table 2 for pipes of various diameters. A one percent (1%) chlorine solution may be prepared either with one pound (1 lb) of calcium hypochlorite for each eight and a half (8.5) gallons of water or with sodium hypochlorite.

Table 2 - Chlorine required to produce a 50 mg/L concentration in 100 feet of pipe

Pipe Size (in)	100% Chlorine (lbs)	1% Chlorine Solution (gal)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88
14	0.328	3.96
16	0.428	5.12
18	0.540	6.48
20	0.68	8.00
24	0.98	11.52

17.04 The chlorinating agent shall be applied at the beginning of the section adjacent to the feeder connection, and shall be injected through a corporation cock or other connection insuring treatment to the entire line. The chlorinating agent shall be fed into the new line slowly.

17.05 While the chlorine is being applied, the valves shall be manipulated so that the treatment dosage will not flow back into the line that is supplying the water. The application of chlorine shall be continued until the entire line being treated is filled with the chlorine solution. Then the chlorinated water shall be retained in the line for at least twenty-four (24) hours, during which time all valves and hydrants in the line being treated shall be operated so that appurtenances can also be disinfected. After twenty-four (24) hours, the treated water shall have a chlorine concentration of at least 25 mg/L throughout the line.

17.06 After the application retention period, the heavily chlorinated water shall be flushed from the line until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system. Such flushing shall be performed only at sites where there is adequate drainage.

17.07 The velocity of the water used to flush a line shall be a minimum of two and a half feet per second (2.5 fps).

17.08 Once the line has been flushed, tests shall be performed to make certain that the rendered chlorine in the water is within acceptable limits.

17.09 Flushing shall not be considered a substitute for taking preventative measures before and during the laying of water lines.

Chapter 18 – Bacteriological Tests

18.00 After a potable water line has undergone final flushing, following the disinfection but before it is placed into service, a sample shall be collected for bacteriological testing from the end of that line. In the case of extremely long lines, additional samples shall be taken at the City of North Augusta Engineering Department request.

18.01 The contractor or owner shall collect a minimum of two (2) samples from each sampling site for total coliform analysis. The number of sites depends on the amount of new construction but must include all dead-end lines, and be representative of the water in the newly constructed mains, and shall be collected a minimum of every twelve hundred linear feet (1,200 LF).

18.02 Prior to sampling the chlorine residual must be reduced to normal system residual levels or be non-detectable in those systems not chlorinating.

18.03 These samples must be collected at least twenty-four (24) hours apart and must show the water line to be absent of total coliform bacteria. The chlorine residual must also be measured and reported.

18.04 If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must also be reported. If the non-coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated.

18.05 All samples must be analyzed by a State certified laboratory.

Appendix A – Design Criteria for Public Water Supply Systems

All water supply systems shall be designed in accordance with South Carolina DHEC *"State Primary Drinking Water Regulation: R.61-58*" and the following requirements.

Design of Water Supply: Any proposed addition of to the City of North Augusta municipal water supply should address the following items with design data and design calculations which include.

1. Maximum instantaneous flows, based on type of development. Refer to tables 1, 2, and 3, herein.

2. Number and types of proposed service connections.

3. Fire flow requirements: 500 GPM + 1/5 (or 20%) of the maximum instantaneous flows.

4. Flow tests conducted from a location near the tie-on site must be submitted. Each test must include the following: static and residual pressures using a flow greater than the proposed demand for this project: the distance, pipe size(s), and pipe material(s) from the test point to the tie-on site; elevation at the test point; and the date, time, and duration of each test. Design calculation shall be based upon flow test(s) conducted within the last twelve (12) months.

5. Design head loss calculations, including elevation changes shall show 25 psi minimum residual when either instantaneous demand occurs or when flushing flow in excess of peak hourly flow occurs, whichever is greater. The normal working pressure in the system shall not be less than 35 psi.

6. No line extension shall be made of an existing line when the existing line does not meet the minimum pressure and flow requirements.

7. Avoid dead-end lines if possible. Check lines less than 200 feet to ensure that they may avoid stagnant water in the lines in addition to maintaining chlorine residual. Include a plan to extend these lines within one year of acceptance by the City.

8. Blow-offs required where changing pipe size, unless design engineer can demonstrate that there is adequate pressure to flush the lines. Plans should specify size of blow-off. Dead end lines shall be provided with a fire hydrant if flow and pressure are sufficient, or with a blow-off valve in a box for flushing purposes (See Detail 4.12). Lines 200 ft or less in length will not require blow-offs, unless specifically required by the City.

9. Post-type hydrants are not used in the City and therefore are not an adequate design flushing means. Standard fire hydrants are required on lines 6-inch in diameter and greater.

10. Lines 10 inches in diameter and larger require flows in excess of 500 GPM to achieve a 2.5 ft /second (FPS) scouring velocity. This requires a standard fire hydrant or other approved blow-off, for flushing designed to provide at least 500 GPM in excess of peak hourly flow and a minimum residual pressure of 25 psi.

11. No flushing device shall be directly connected to any sewer.

12. Sufficient valves shall be provided on water mains so that customer inconvenience and sanitary hazards will be minimized during repairs.

13. Valves required at all intersections and loops per Detail 4.13.

14. Use DIP with mechanical joints for any lines being installed in rock.

15. Water mains smaller than six (6) inches may be installed in residential areas providing that all of the following conditions are met:

    Note: These water lines are not designed to provide fire protection, however, in addition to the above requirements, these lines must meet the following conditions:

    a. No public water line or main may be smaller than two (2) inches.

    b. Lines shall also be designed to provide a minimum residual pressure of not less than 25 psi under maximum instantaneous demand conditions as given in the tables below, Tables 1, 2, 3.

    c. All residences must be within 500 feet of fire protection.

    d. Dead end lines smaller than 6” shall not exceed 200 feet unless a properly sized blow-off is installed.

    e. Where dead end mains occur they shall be provided with an approved fire hydrant or blow-off.

    f. Blow-offs shall be sized to provide a minimum velocity of 2.5 ft/sec. in the main line and maintain a residual pressure of 25 psi.

16. Water mains six (6) inches or larger must meet the following additional requirements for fire protection purposes:

a. The minimum size of water main providing fire protection and serving fire hydrants shall be six (6) inches.

b. All residences must be within 500 feet of fire protection.

c. Lines shall be designed to maintain a minimum residual pressure of not less than 20 psi when fire flows are provided in excess of peak hourly demand.

d. Peak hourly demand (flow) = 2.7 times average demand or 1/5 (one-fifth) of maximum instantaneous demand.

e. In the absence of historical data, a value of 100 gal/person/day may be used for average daily demand.

f. Fire flow required shall be based on ISO requirements, but not less than 500 GPM.

g. Lines shall also be designed to provide a minimum residual pressure of not less than 25 psi under maximum instantaneous demand conditions as given in the tables below, Tables 1, 2, and 3.

h. Dead ends shall be minimized by looping of all mains whenever practical.

i. Where dead end mains occur they shall be provided with a fire hydrant if flow and pressure are sufficient, or with an approved flushing hydrant or blow-off.

j. No Post Hydrants are used in the City of North Augusta. All lines six (6) inches and greater will only have standard fire hydrants installed to be also used for flushing.

k. Blow-off shall be sized to provide a minimum velocity of 2.5 ft/sec. in the main line and maintain a residual pressure of 25 psi.

Table 1 : Maximum Instantaneous Flows for Residential Areas			
Number of Residences Served	Flow Per Residence in GPM	Number of Residences Served	Flow Per Residence in GPM
1 (First)	15.0	91-100	2.0
2-10*	5.0	101-125	1.8
11-20**	4.0	126-150	1.6
21-30	3.8	151-176	1.4
31-40	3.4	176-200	1.3
41-50	3.2	201-300	1.2
51-60	2.7	301-400	1.0
61-70	2.5	401-500	0.8
71-80	2.2	501-750	0.7
81-90	2.1	751-1000	0.5

*Second, third, etc., through tenth residence served
**Eleventh, twelfth, etc., through twentieth residence served

Example: What is the maximum instantaneous flow for a residential area with 13 residences?

Residence 1 = 15 GPM, Residences 2-10 = 5 GPM, Residences 11-13 = 4 GPM.

15+(5*9)+(4*3) = 72 GPM.

Table 2. Maximum Instantaneous Flows for Commercial Areas	
Type of Business	GPM on Basis Shown
Barber Shop	3.0 gpm per chair
Beauty Shop	3.0 gpm per chair
Dentist Office	4.0 gpm per chair
Department Store*	1.0-3.0 gpm per employee
Drug Store	5.0 gpm
Industrial Plants**	4.0 gpm plus 1.0 gpm per employee
Laundry	30.0 gpm per 1,000 pounds clothes
Launderette	8.0 gpm per unit
Meat Market, Super Market	6.0 gpm per 2,500 sq. ft. floor area
Motel, Hotel	4.0 gpm per unit
Office Building	0.5 gpm per 100 sq. ft. Floor area Or 2.0 gpm per employee
Physician's Office	3.0 per examining room
Restaurant	2.0 gpm per seat
Drive-in	2.0 – 7.0 gpm
Service Station	10.0 gpm per wash rack
Theatre	0.2 gpm per seat
Drive-in	0.2 gpm per car space
Other Establishments	Estimate at 4.0 gpm each

*Including customer service
**Not including process water
***Non-water using establishments

Table 3. Maximum Instantaneous Flows for Institutions			
Type of Institution		Basis of Flow, GPM	
Boarding Schools, Colleges Churches Clubs: Country, Civic Nursing Homes Prisons Rooming Houses		2.0 gpm per student 0.4 gpm per member 0.6 gpm per member 4.0 gpm per bed 2.0 gpm per bed 3.0 gpm per inmate Same as Residential*	
Schools: Day, Elementary, Junior, Senior High			
Number of Students	GPM Per Student	Number of Students	GPM Per Student
0-50	2.0	800	1.38
100	1.90	900	1.32
200	1.88	1,000	1.20
300	1.80	1,200	1.04
400	1.72	1,400	0.86
500	1.64	1,600	0.70
600	1.56	1,800	0.54
700	1.44	2,000	0.40

*****Each unit of an apartment building should be considered as an individual residence