STANDARDS

AND

SPECIFICATIONS

FOR CONSTRUCTION

City of North Augusta
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North Augusta
South Carolina's Riverfront

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Section 1 – Site Work

Overview

This section includes specifications regarding all material, equipment, and labor required for clearing, grubbing, excavation, filling, and grading the site as specified, as shown on the Plans, and as directed by the Engineer.

Chapter 1 – Protection of Existing Improvements

1.00 Streets, sidewalks, driveways, power/ cable/telephone lines, gas lines, water lines, sewers, storm drains and other existing improvements shall be maintained and protected from damage. Any aerial, surface or subsurface improvements damaged during the course of the work shall be repaired to the satisfaction of the Engineer. Satisfactory provisions shall be made for the maintenance of traffic on streets, driveways, and walkways.

Prior to any excavation, the Contractor shall notify all utilities and utility locating services to provide locations for buried utilities. The contractor shall obtain all necessary permits (grading, building, water, sewer, encroachment, etc.) prior to beginning work.

Chapter 2 – Clearing and Grubbing

Section 2.0 – Clearing

Clearing shall consist of the felling and cutting up, or the trimming of trees, and the satisfactory disposal of the trees and other vegetation together with the timber, snags, brush and rubbish occurring within the construction area. Individual trees and groups of trees designated to be left standing within cleared areas shall be trimmed of all branches to such heights and in such manner as may be necessary to prevent interference with the construction operations. All limbs and branches required to be trimmed shall be neatly cut close to the trunk of the tree or to main branches, and the cuts thus made shall be painted with an approved tree-wound paint. Individual trees, groups of trees, and other vegetation to be left standing, shall be protected from damage as necessary. Clearing operations shall be carefully conducted to prevent damage to trees left standing, existing structures and improvements, and to provide for the safety of employees the public and adjoining properties.

Section 2.1 – Grubbing

Grubbing shall consist of the removal and disposal of all stumps and roots from the site as indicated on the drawings. In foundation and sub-base areas, stumps, roots, logs, timber, and other debris not suitable for foundation or sub-base purposes shall be excavated to a depth not less than 18 inches below any subgrade, shoulder or slope. All depressions excavated below the original ground surface for the removal of stumps and roots shall be refilled with suitable material and compacted to make the surface conform to the surrounding ground.

All timber, logs, stumps, roots, brush, rotten wood and other refuse from the clearing and grubbing operation shall be removed from the site and disposed of as approved by the Engineer.

Chapter 3 – Grading

Site grading shall consist of excavating, backfilling, and compacting soils to the final elevations and contours as shown on the drawings, including subgrade preparation for roads and parking areas.

Fill material shall be as specified on the drawings or per Section 2 – Trench Excavation and Backfill and shall be free of roots, trash and any other deleterious material.

Topsoil shall be stripped from all areas prior to grading and shall be stored for use during restoration. Topsoil shall consist of a natural material that occurs in surface deposits of limited depth and shall be free of stones larger than two inches (2") in diameter, roots, excessive vegetation, rubbish or other deleterious matter. Topsoil shall be approved by the Engineer before use.

Section 3.0 – Fill Placement

Suitable material removed from excavation shall be used, where feasible, in the formation of embankments, fills, subgrades, shoulders, backfills, and site grading. Excess material from excavations, not suitable for such uses, shall be wasted on site or removed from the site as required. If a waste area is not designated, the material shall be hauled from the site and disposed of in a manner acceptable to the Engineer. Wetting, drying, hauling, scarifying, mixing, shaping, rolling, tamping, de-watering or other operation shall be performed by the Contractor as approved by the Engineer. Such operations shall be considered incidental to the site work and shall be performed at no additional expense to the Owner.

Embankments, fills and excavations shall be properly shaped and drained to prevent water from running into the excavations. Any water which accumulates in excavations shall be removed promptly and the saturated soil shall be removed and replaced with approved fill material.

Section 3.1 – Compaction

All backfill and embankments shall be constructed with approved fill material consisting of sand, clay, gravel, or a combination thereof. No organic or silty materials shall be utilized. Approved material shall be placed in horizontal layers of loose material not to exceed eight inches (8") in depth. Each layer shall then be compacted utilizing sheepsfoot, vibrator, or mechanical rollers. Compaction shall be made to the percent of maximum dry density as shown in Table 1.

The Engineer, at his discretion, may order tests and inspections to be performed during the progress of the work, or at the completion of any individual unit of work, or at the time of final inspection of the entire project. Maximum dry density shall be as determined by ASTM D698, *Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort*, or AASHTO T-99 Method, *Standard*

Method of Test for Moisture–Density Relations of Soils, Standard Proctor, for the material being utilized.

Table 1 - Compaction Requirements

Location	Percent Compaction Required
Structure footings and foundations, Road Subgrade (top 8”), Utility trench in roadway (top 8”)	100%
Road Subgrade (below 8”) Roadway Shoulders Utility trench in roadway (below 8”) Utility trench outside roadway	95%

Density of embankment, fill, backfill or subgrade shall be measured utilizing the sand-cone method or nuclear moisture/density gauge. These tests will be performed by an independent soil testing laboratory holding AASHTO certification. The costs of these tests shall be borne by the Contractor. All fills not meeting the compaction requirements shall be removed and re-compacted until the desired compaction is achieved.

Section 3.2 – Finish Grading

Except as otherwise specified herein, all disturbed areas on the site shall be finished off to a uniformly smooth surface, free from abrupt, irregular surface changes. The finished surface shall be not more than one tenth of a foot above or below (±0.1’) the established grade. There shall be no roots, waste building materials, trash or other unsightly matter projecting through or visible at the surface.
After all embankments and fills have been completed to grade, and after all structures and pipe lines requiring the use of heavy equipment have been completed, excavation necessary for the construction of walkways and steps may be performed. Excavation shall be accurately cut to line and grade; sufficient width for the accurate placement and adequate support of the forms shall be allowed. After the forms are removed, the backfill shall be replaced and re-compacted around the walks and steps. Care shall be taken to avoid damage to the walks and steps.
Topsoil shall be evenly spread over the entire area to receive vegetation cover. The compacted subgrade shall be scarified to a depth of two inches (2”) for the bonding of topsoil with the subsoil. Topsoil shall then be evenly spread, compacted and graded to a uniform thickness of not less than three inches (3”), and the surface shall conform to the requirements of site grading, ditches, embankments, or other features, as applicable.

Ditches shall be cut accurately to line, grade, and cross-section. Any excessive ditch excavation shall be backfilled to grade with material approved by the Engineer. The degree of smoothness shall be that usually obtainable with string line or hand raking methods; the finished surface of ditch slopes shall not be more than one tenth of a foot above or below (±0.1’ the appropriate elevations. Random spot checks of elevations and slopes shall be conducted by ordinary differential level and profile methods.

Section 3.3 – Rock

Rock will not be classified as such for additional payment. The contractor shall make appropriate site investigations to satisfy himself as to rock and other materials which may be encountered on the project.

Chapter 4 – Erosion and Sedimentation Control

Section 4.0 – Standards

No development shall be undertaken that directly or indirectly increases the erosion of land or its potential for erosion. All land disturbing activities shall be in accordance with the *South Carolina Stormwater Management and Sediment Reduction* regulations.
Siltation and soil erosion shall be controlled by the Contractor using the appropriate erosion control devices contained in the Best Management Practices (BMP's) section of the City of North Augusta Sediment and Erosion Control Manual. Erosion control structures shall be maintained until permanent grassing has been established and shall be removed when directed by the Engineer.

4.00 To help retain sediment generated by land-disturbing development activities within the boundaries of the development tract, the developer shall plant or otherwise provide a permanent ground cover sufficient to restrain erosion within fourteen (14) calendar days of completion of final grading.

4.01 No land disturbing activity shall be permitted in proximity to a water body unless a vegetated strip is provided along the margin of the watercourse of sufficient width to prevent sediment from leaving the site and entering the watercourse.

Section 4.1 – Permits

No land disturbing activity shall be performed by the contractor until a grading permit has been obtained from the City of North Augusta. Additionally, prior to land disturbing activity, a Stormwater Management Plan and/or Sediment Reduction Plan shall be submitted to the City of North Augusta Stormwater Management Department. Land disturbing activity cannot begin until those plans are reviewed and approved by the Stormwater Department

Section 2 – Trench Excavation and Backfill

Overview

This section includes specifications regarding all material, equipment, and labor required to excavate and backfill the trench for the installation of water, sanitary sewer, and storm drainage pipelines as specified, as shown on the Plans, and as directed by the Engineer.

Chapter 1 – Protection of Existing Improvements

1.01 Streets, sidewalks, driveways, power/ cable/telephone lines, gas lines, water lines, sewers, storm drains and other existing improvements shall be maintained and protected from damage. Any aerial, surface or subsurface improvements damaged during the course of the work shall be repaired to the satisfaction of the Engineer. Satisfactory provisions shall be made for the maintenance of traffic on streets, driveways, and walkways.

Prior to any excavation, the Contractor shall notify all utilities and utility locating services to provide locations for buried utilities. The contractor shall obtain all necessary permits (grading, building, water, sewer, encroachment, etc.) prior to beginning work.

1.02 Care shall be exercised to protect trees to be left standing. Within the branch spread of such trees, all trenching shall be performed with extra care. The trench shall be opened when the work can be installed immediately. Injured roots shall be pruned cleanly and backfill placed as soon as possible.

1.03 The Contractor shall restore all property and facilities to a condition equal to or better than the condition found prior to beginning construction. Such restoration shall include but not be limited to re-grassing with seed or sod, replacing trees/shrubs/flowers, replacing pavement, replacing sidewalks/driveways, and replacing fences.

Chapter 2 – Excavation

Section 2.0 – General Excavation

Trench excavations shall be made by the open cut method to the depths indicated on the drawings or as otherwise specified. All excavated materials not suitable for backfill shall be wasted on site or removed from the site as directed.

The excavated trench shall be at least twelve inches (12”) wider but not more than sixteen inches (16”) wider than the outside diameter of the pipe being installed. The trench shall be excavated true to line to provide six to eight inches (6”-8”) clearance on each side of the pipe. The bottom of the trench shall be accurately graded to provide uniform bearing and support along the pipe barrel. Bell holes shall be excavated to allow sufficient space to make the joint and to insure that the pipe will rest evenly on the bottom of the trench. Bell hole dimensions shall be as recommended by the pipe manufacturer. Excavations for structures and other accessories shall be sufficient to provide at least twelve inches (12”) clearance between the structure and the trench wall. If rock is encountered, the trench shall be excavated to a minimum depth six inches (6”) below the pipe. The trench shall then be backfilled with select material, compacted in place, to the depth required for pipe installation. Wet or other unsuitable material encountered in the trench bottom shall be removed to a depth required to gain sufficient bearing strength as directed by the Engineer. The trench shall then be backfilled with select material, compacted in place, to the depth required for pipe installation. If rock or other unsuitable material is encountered in the excavation for structures, the excavated area below the structure shall be backfilled with stone or concrete as directed by the Engineer.

Section 2.1 – Stockpiling of Excavated Material

Material excavated from the trench that is suitable for backfill shall be stockpiled a safe distance away from the excavation to allow room for adequate angle of repose and to protect the excavation. No material may be placed within three feet of the nearest edge of the trench. Material unsuitable for backfilling, as determined by the Engineer, shall be wasted on site or removed from the site and disposed of by the Contractor, as approved by the Engineer.

Section 2.2 – Shoring and Sheeting

All shoring, sheeting, and bracing required to perform and protect the excavation and to safeguard employees and the public shall be performed. Whenever sheeting is driven to depth below the elevation of the top of the pipe, that portion of the sheeting below the elevation for the top of the pipe shall not be disturbed or removed. Sheeting left in place shall be cut off not less than 1 foot below finished grade. No sheeting shall be removed until the excavation is substantially backfilled as specified in Chapter 3 of this section.

Section 2.3 – Water Removal

The Contractor shall be required to control groundwater and prevent the accumulation of water within excavations. Water shall be removed via well pointing, pumping, or other methods shall be as approved by the Engineer. The Contractor shall also control surface water runoff to prevent the accumulation of water in excavated trenches. Water shall not be allowed to rise in open excavations after pipe or structures have been placed. No work shall be performed within the trench until the Contractor demonstrates that groundwater and surface water runoff is controlled. If water accumulates within an excavation, the Contractor will be required to remove the water and saturated materials and backfill with approved material. Water removed from excavations shall be discharged at points where it will not damage adjacent property or facilities.

Section 2.4 – Blasting

Explosives are to be used only within legal limitations. Before explosives are used, all necessary permits for this work shall be secured and all precautions taken in the blasting operations to prevent damage to property, persons, or facilities. The Contractor shall assume full liability for any damage that may occur during the use of explosives. No blast shall be set off within fifty feet (50') of existing pipe or pipe already installed in the trench.

Chapter 3 – Backfilling

Trenches and other excavations shall not be backfilled until all required tests are performed and the work has been approved by the Engineer. The trenches shall then be carefully backfilled with approved excavated materials or other material approved by the Engineer. Backfill shall not contain organic material, blasted rock, broken concrete or pavement, construction debris, frozen earth, etc.

For backfill up to a level one foot (1') over the top of pressure pipelines and two feet (2') above the top of gravity pipelines, only selected materials shall be used. Select materials shall be finely divided material free from debris, organic material and rock, and may be suitable job excavated material or shall be provided by the Contractor from other sources. The backfill shall be placed in uniform layers not exceeding 6 inches in depth. Each layer shall be moistened and carefully and uniformly tamped with mechanical tampers or other suitable tools to ninety-five percent (95%) standard proctor compaction. Each layer shall be placed and tamped under the pipe haunches with care and thoroughness so as to eliminate the possibility of voids or lateral displacement.

The remainder of the backfill material shall then be placed and compacted above the level specified above. In areas not subject to traffic, the backfill shall be placed in twelve inch (12") layers, and each layer moistened and compacted to a density approximating that of the surrounding earth. Under roadways, driveways, paved areas, parking lots, along roadway shoulders and other areas subject to traffic, the backfill shall be placed in six inch (6") layers and each layer moistened and compacted to ninety-five percent (95%) standard proctor compaction. Any trenches which are improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and compaction. Along all portions of the trenches not located in roadways, the ground shall be graded to a reasonable uniformity and the mounding over the trenches left in a neat condition satisfactory to the Engineer. All compaction shall be verified by nuclear density gauge on a random basis as specified by the Engineer in the field. Compaction tests shall be paid for by the contractor and conducted by an approved independent testing laboratory that is certified by AASHTO.

Sheeting not specified to be left in place shall be removed as the backfilling progresses. Sheeting shall be removed in such a manner as to avoid caving the trench. Voids left by the removal of sheeting and shoring shall be carefully filled and compacted. Where, in the opinion of the Engineer, damage is liable to result from withdrawing sheeting, the sheeting will be ordered to be left in place.

Chapter 4 – Pavement Replacement

The Contractor shall replace or repair all road/street/highway pavement and sidewalks that are damaged by this construction as specified herein and/or as required by the SCDOT Highway Encroachment Permit.

Pavement repairs shall be made by saw-cutting the existing pavement outside the damaged area to provide eight inches of bearing on undisturbed soil on each side of the excavation. The existing asphalt and/or concrete and/or base materials shall be removed to the depth required to place the patch. The following requirements are minimum thickness and in all cases the patch shall not be less than the existing pavement thickness.

4.00 Replace concrete street pavement with eight inch (8”) thick concrete that is rated at three thousand pounds per square inch (3,000 psi).

4.01 Replace asphalt pavement with two inches (2”) thick asphalt concrete (SCDOT Type III) surface course. The backfill of the trench the asphalt is placed over shall be as follows.

4.01.0 Eight inch (8”) thick concrete that is rated at three thousand pounds per square inch (3,000 psi).

4.01.1 Controlled Density Fill (“Flowable Fill”) poured into the entire depth of the trench.

4.01.2 Compacted fill subgrade compacted to ninety-five percent (95%) Modified Proctor in the entire depth of the trench.

4.02 Replace asphalt pavement edges, parking lots, and driveways with two inch (2”) thick asphalt concrete (SCDOT Type III) surface course.

4.03 Replace concrete driveways with six inch (6”) thick concrete that is rated at three thousand pounds per square inch (3,000 psi).

4.04 Replace concrete sidewalks with five inch (5”) thick concrete that is rated at three thousand pounds per square inch (3,000 psi).

Section 3 – Restoration

Overview

This section includes specifications regarding all material, equipment, and labor required to properly restore areas disturbed by this construction as specified, as shown on the Plans, and as directed by the Engineer.
Restoration shall include replacing fences, driveways, sidewalks, mailboxes, landscaping, and other surface features in addition to cultivating the soil, fertilizing, seeding, and mulching grass on all disturbed areas. The specified procedures may be adjusted as approved by the Engineer to meet varying weather and soil conditions. All eroded areas shall be filled and grassed. A stand of grass with complete coverage shall be established prior to acceptance by the Engineer.

Chapter 1 – Fertilizing and Grassing

Section 1.0 – Material

All materials for fertilizing and grassing must be approved by the Engineer prior to use.

1.00 Fertilizer shall be an acceptable commercial fertilizer known as 4-12-12, or equivalent.

1.01 Limestone shall be agricultural limestone containing at least 34% magnesium carbonate, and crushed especially for agricultural purposes.

1.02 Seed shall have at least 90% purity and 80% germination. In residential areas the type of grass seed shall match grass in adjacent areas and shall be determined by the Engineer. In highway right-of-ways, drainage ditches or other non-residential areas, the type of seed and application rates shall be in accordance with Table 1.

Table 2 - Grassing Schedule for Non-Residential Areas

Schedule Number	Common Name of Seed	Rate of Application (lbs/ac)	Planting Date
1	Common Bermuda (Hulled)	60	March 1 – August 14
	Love Grass	50	
2	Common Bermuda (Un-hulled)	90	August 15 – February 28
	Love Grass	80	
	Annual Rye Grass	15	

1.03 Sod shall be installed as required by the Engineer. The type of sod shall match grass in adjacent areas and shall be determined by the Engineer.

Section 1.1 – Planting

All preparation, fertilizing, planting and watering shall be done in an acceptable manner by competent personnel.

1.10 Area to be seeded or sodded shall be loosened or pulverized to a depth three to four inches (3” – 4”) by disc harrowing, with all clods broken up and all sticks and other debris removed. Fertilizer shall be distributed over the area at a minimum rate of one thousand pounds per acre (1,000 lb/ac), and limestone at a minimum rate of two thousand pounds per acre (2,000 lb/ac).

1.11 Seed shall be distributed on the prepared area by the use of a commercial applicator that will provide even distribution. For grassing in residential areas, minimum application rates shall be as specified below; heavier applications shall be made where necessary to provide an acceptable cover.

1.11.0 Fescue shall be applied at two hundred pounds per acre (200 lb/ac).

1.11.1 Bermuda, Centipede, and Zoysia shall be applied at fifty pounds per acre (50 lb/ac).

1.12 Seed shall then be raked into the ground and lightly covered. After the seed is covered, the area shall be rolled and dressed smooth by a cultipacker or other means acceptable to the Engineer. Immediately after seeding, the area shall be covered with a mulch of ripe native hay or other acceptable material.

1.13 Sod shall be rolled out or placed in straight rows. The ends of rolls or squares shell be staggered at least one foot (1'). All edges shall be pulled tightly together. After sodding is complete, the sod shall be set in place using a hand-pushed drum roller.

1.14 After planting is completed, the planted areas shall be sufficiently watered. Watering shall be continued as necessary until an acceptable grass cover is obtained.

Section 1.2 – Temporary Cover

If grading is completed and ready for seeding at a time inappropriate for establishing the permanent grass cover, temporary coverage shall be provided for erosion control as specified below. Contractor shall return to the site and provide the permanent cover, in the manner specified above, at such time as may be suitable.

1.20 Surface area to be seeded shall be prepared as for permanent cover except that fertilizer shall be applied at one half (1/2) the rate specified therefor.

1.21 Area to be grassed shall be planted according to Table 2. Seed shall be applied in the manner specified in Section 1.1.

Table 3 - Grassing Schedule for Temporary Cover

Schedule Number	Common Name of Seed	Rate of Application (lbs/ac)	Planting Date
1	Annual Sudan Grass (Sweet or Tift)	40	April 1 – August 15
2	Brown Top Millet	50	April 1 – August 15
3	Rye Grain	55	August 16 – March 31
	Annual Rye Grass	15	

1.22 After temporary planting is completed, the planted areas shall be watered as specified in Section 1.2.

Chapter 2 – Maintenance

During the maintenance guarantee period, the Contractor shall maintain all grassed areas and repair all damage due to erosion, drought, etc. A stand of grass having complete coverage shall be in place at the end of the guarantee period.

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 lass 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

1.04 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.

1.05 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).

1.06 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.

1.07 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 SCDES, 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 SCDES.

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) *SCDES 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

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

10.01 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.

10.02 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

11.00 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.

11.01 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.

11.02 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.

11.03 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.

11.04 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 SCDES 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.

14.00 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.

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

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

14.03 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.

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

14.05 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.

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

15.01 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.

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

15.03 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.

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

15.05 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.

15.06 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.

15.07 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 SCDES certified tester and test results have been submitted to the City of North Augusta Building Standards Division. Backflow prevention devices must be on the SCDES approved list. The person testing the backflow prevention devices must be a SCDES 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 SCDES 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 SCDES 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 4 – 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)
S = Length of pipe being tested (feet)
N = Number of joints
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 5 - 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 DES *"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

Section 5 – Sanitary Sewer

Overview

This section includes specifications regarding all material, equipment, and labor required to install sewer lines, sewer service laterals, manholes, and appurtenances as specified, as shown on the Plans, and as directed by the Engineer.

The Contractor shall construct the sewer lines, sewer service laterals, manholes, 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 and unused materials as specified herein or as specifically approved by the Engineer.

Chapter 1 – Organization of Work

The Contractor shall so organize his work that backfilling and cleanup shall closely follow pipe laying operations and manhole construction.

In general, not more than one block of a street or roadway shall be closed for construction at any one time. Before proceeding with trenching operation in a succeeding block, the preceding section shall be backfilled, cleanup completed and the street opened to traffic.

For work outside the streets and roadways, not more than five hundred (500') feet of trench shall remain open at any one time.

Failure on the part of the Contractor to comply with the above provisions in a reasonable manner, as determined by the Engineer, shall be sufficient cause for the Engineer to order a temporary shut-down of further trenching and pipe laying operations until the provisions have been met.

The Owner reserves the right to accept and use portions of work when it is considered to be in the public's interest to do so; the Engineer shall have the authority to establish the order in which the lines shall be worked.

Chapter 2 – Location and Grade

The line and grade of the sewer, and the position of manholes and other structures shall be as shown on the plans or as directed by the Engineer. The price for trenching shall include trench excavation to the depth necessary to lay the sewer to the grade shown, but measurements for payment will be made only to the grade line indicated.

All lines and grades shall be laid out by the Contractor from the controlling lines and bench marks established by the Engineer, or from measurements shown. All line and grades shall be subject to checking by the Engineer, but that checking shall in no way relieve the Contractor from responsibility for their correctness. The Contractor shall provide such stakes, materials, labor and assistance as the Engineer may require in laying-out work, establishing bench marks and checking and measuring the work.

Chapter 3 – Unloading, Handling, and Storing of Materials

Equipment and facilities for unloading, hauling, and distributing and storing materials shall be furnished by the Contractor. Delays and/or charges for unloading materials shall be at the expense of the Contractor.

Pipe, fittings and other materials shall be carefully handled so as to prevent breakage and/or damage. Pipe may not be unloaded by rolling or dropping off of trucks or cars. Preferred unloading is in units using mechanical equipment, such as fork lifts, cherry pickers, or front-end loaders with forks. If fork lift equipment is not available units may be unloaded with use of spreader bar on top and nylon strips or cables (cushioned with rubber hose sleeve) looped under the unit.

Materials shall be distributed and placed where they will not interfere with traffic. No street or roadway may be closed without first obtaining permission of the proper authorities. The Contractor shall furnish and maintain proper warning signs and lights for the protection of traffic along highways, streets and roadways upon which material is distributed. No distributed materials shall be placed in drainage ditches.

3.00 All pipe, fittings and other materials which cannot be distributed along the route of the work shall be stored for subsequent use when needed. The Contractor shall make his own arrangements for the use of storage areas; except that, with permission, they may make reasonable use of the Owner's storage yards.

3.01.0 Concrete and ductile iron pipe must be stockpiled on level ground. Timbers must be placed under the pipe for a base and to prevent dirt and debris from washing into the pipe.

3.01.1 PVC pipe must be stockpiled on level ground. If pipe is unloaded individually by hand the same as factory load, with stop blocks nailed at either end. Stockpile must be built up the same manner as it was stocked for shipment. Individual lengths of pipe shall not be stacked in piles any higher than five feet (5').

If pipe is unloaded in units, the units must be place on level ground and shall not be stacked more than two (2) units high. Units must be protected while loaded on the truck or car. Supports shall be sufficient to carry the weight of all units loaded above.

If pipe is to be stored outside and exposed to sunlight for more than thirty days, the pipe must be protected by covering with a canvas or other opaque material. The cover shall be loose

enough to allow for air circulation around the pipe. The use of clear plastic sheets will not be permitted.

Chapter 4 – Pipe Materials

The following pipe materials are approved for use within the City of North Augusta. All pipe material shall be as shown on the Plans or as directed by the Engineer. The specification reference, and name of manufacturer shall be clearly marked on each length of pipe.

All work done and materials furnished shall be subject to inspection by the Engineer or his authorized representative. Improper work shall be reconstructed and materials which do not conform to the requirements of this section shall be removed from the work upon notice being received from the Engineer of the rejection of those materials. The Engineer shall have the right to mark rejected materials and/or the Contractor shall segregate said materials to distinguish them as such.

Section 4.0 – Quality and Inspection

Latitudes in workmanship and finish allowed by ASTM notwithstanding, all pipe shall have smooth exterior and interior surfaces; be first quality, be free from cracks, blisters, and other imperfections, and be true to theoretical shapes and forms throughout each length. Pipe shall be subject to inspection by the Engineer at the pipe plant, trench, and other points of delivery for the purpose of culling and rejecting pipe, independent to laboratory tests, which does not conform to the requirements of this Section. Pipe which does not conform will be so marked by the Engineer, and shall not be used in the work. On-the-job repairing of rejected pipe will not be permitted.

Section 4.1 – Experience of Manufacturers

The pipe manufacturer shall submit evidence, if requested by the Engineer, of having consistently produced pipe and joints of the quality specified herein, and which have exhibited satisfactory performance results in service over a period of not fewer than two years. The pipe manufacturer and the pipe manufacturing process shall be subject to approval by the Engineer.

Section 4.2 – Concrete Pipe

Concrete sewer pipe shall be bell and spigot and shall conform to ASTM C76 *Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe*, as amended to date.

4.00 Concrete reinforced pipe shall comply with ASTM C76, Table 3, 4 or 5 and be Class III, IV or V.

4.01 All pipe size eighteen inches (18”) and larger shall be reinforced. Pipe shall be of the class dictated by the depth of bury and bedding as shown in Table 7. Pipe shall be furnished in lengths of at least eight feet (8’).

4.02 Cement shall be Type II, or approved equal and coarse aggregate shall be crushed limestone.

4.03 Wire reinforcement used in the pipe shall conform to the standard specifications, with the following exceptions:

i. Elliptical steel reinforcement will not be permitted.

ii. Longitudinal wires for pipe made on packer head type machines shall be at least seven (7) gauge and in no case shall spacing thereof be in excess of four inches (4").

4.04 Steam curing of concrete pipe shall conform to the standard specifications, with the following exception:

i. When temperatures fall below an average of 40° F, curing shall be continuous for a 24-hour period, except for the interval when forms and/or rings are removed.

4.05 All pipe, when tested by the three-edge bearing method, in accordance with ASTM C497, *Standard Test Methods for Concrete Pipe*, shall have a minimum crushing strength of not less than the values provided in Table 1. Minimum crushing strength is defined as the load to produce a 0.01-inch crack for reinforced pipe.

Table 6 - Minimum Strengths for Reinforced Concrete Pipe

Pipe Size	Class III	Class IV	Class V
18 inches	2,025 plf	3,000 plf	4,500 plf
21 inches	2,360 plf	3,500 plf	5,250 plf
24 inches	2,700 plf	4,000 plf	6,000 plf
30 inches	3,375 plf	5,000 plf	7,500 plf

4.06 Absorption shall not exceed six percent (6%) when determined in accordance with ASTM C497.

4.07 All pipe shall have O-ring rubber gasket type joints conforming with the applicable provisions of ASTM C443, *Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets*. A rectangular groove shall be provided in the spigot end of the pipe to receive the circular rubber gasket and it shall be so formed that when the joint is complete the gasket will be deformed to the shape of the groove and confined on all four sides. Bell and spigot surfaces shall be accurately formed and smooth to provide a close sliding fit with a nominal

clearance not to exceed one sixteenth inch (1/16”) between the outside surface of the spigot and the inside surface of the bell.

4.08 Repaired and patched pipe will not be acceptable unless each individual pipe so repaired or patched shall have first been inspected and approved by the Engineer, for repair and patching at the pipe plant. Repairs to, and patching of gasket groves and shoulders will not be permitted if damage is of a nature which, in the opinion of the Engineer, would impair the water tightness of the completed joint.

4.09 Made-up gasketed joints shall be tested for shear loading at a total load of one hundred pounds per inch (100 lb/in) of diameter, including the weight of the pipe, water, and test apparatus. The load shall be uniformly applied to the spigot and over an arc of not less than one hundred and twenty degrees (120°) for a longitudinal distance of twelve inches (12”) immediately adjacent to the bell, with the pipe supported on blocks behind the bells during the test procedure. There shall be no visible leakage when tested with an internal water pressure of one hundred pounds per square inch (100 psi) for a period of ten minutes. At least one shear loading test shall be conducted for each size of pipe to be delivered to the jobsite.

Section 4.3 – Polyvinyl Chloride (PVC) Sewer Pipe

Polyvinyl Chloride (PVC) Sewer Pipe shall be bell and spigot in lengths not exceeding twenty feet (20’) laying lengths and shall have minimum wall thickness conforming to ASTM D3034, *Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings*, under the classification for SDR 35 pipe, as amended to date, or ASTM 789-85.

PVC sewer pipe fittings shall be bell and spigot or bell and plain end and shall conform to ASTM D3034, as amended to date.

4.30 PVC pipe shall be marked at intervals of five feet (5’) or less with the following information: Manufacturer's Name or trade Mark, Plant code, Date of manufacture, Nominal Pipe Size, PVC Cell Classification, the legend "Type PSM DR 35 PVC Sewer Pipe", and ASTM designation D3034.

Fittings shall be marked with the following information, Manufacturer's Name or Trade Mark, Nominal Size, Designation PVC and PSM and ASTM designation D3034.

All markings shall remain legible during normal handling, storage and installation.

4.31 The Contractor shall furnish the Engineer with a written statement from the manufacturer that all pipe and fittings furnished have been sampled, tested and inspected in accordance with ASTM D 3034, as amended to date. Each certification so furnished shall be signed by an authorized agent of manufacturer.

4.32 All pipe shall have elastomeric joints with an integral bell gasket coupler. Rubber gaskets shall comply with the physical requirements specified in the latest revision of ASTM F477, *Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe,* as amended to date. Joints shall meet the requirements specified in ASTM D3212, *Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals*, as amended to date.

Section 4.4 – Ductile Iron Pipe

Pipe shall be centrifugally cast and shall conform to ANSI Specifications A21.10, A21.50 and A21.51, as amended to date, with mechanical or push-on joints and laying lengths of at least eighteen feet (18') with Class 51 wall thickness for size three inch (3") and four inch (4") pipe and Class 50 wall thickness for pipe six inch (6") in size and above unless indicated otherwise herein and/or on the drawings.

4.40 Fittings shall be cast from gray or ductile iron and shall conform to ANSI Specifications A21.10 (AWWA C 110), as amended to date. All fittings shall have standard mechanical joints. Fittings for size three inch (3") through twelve inch (12") shall be Class 250 for Gray Iron and Class 350 for Ductile Iron. Fittings for size fourteen inch (14") through forty-eight inch (48") shall be Class 150 for Gray Iron and Class 250 for Ductile Iron. Either Gray Iron or Ductile Iron fittings will be permissible unless otherwise specified or shown on the Drawings.

4.41 Pipe and Fittings shall be cement-lined (standard thickness) inside and bituminous coated outside, in accordance with the applicable provisions of ANSI Specification A 21.4 (AWWA C 104) and, ANSI A 21.51 (AWWA C 151), as amended to date. The inside cement lining shall be treated with a bituminous seal coat.

4.42 Weights of pipe and fittings shall conform strictly to the requirements of ANSI Specifications. The class designations for the various classes of pipe and fittings shall be cast onto fittings in raised numerals, and cast or stamped on the outside of each joint of pipe. Weights shall be plainly and conspicuously painted in white on the outside of each joint of pipe and each fitting after the exterior coating has hardened.

4.43 The manufacturer of iron pipe and fittings shall furnish both the Engineer and the Owner with a certified letter stating that inspection and specified

tests have been made and that the results thereof comply with the applicable ANSI Specifications for each.

Chapter 5 – Trench Width

Section 5.0 – Concrete Pipe

Table 7 - Maximum Trench Widths and Depths for Concrete Pipe

Pipe Size	Maximum Trench Width	Class of Pipe	Class C Bedding		Class B Bedding		Class A Bedding	
			(1)	(2)	(1)	(2)	(1)	(2)
18"	3'-4"	III	8	8	11	9	24	15
		IV	15	12	24	15	*	22
		V	*	18	*	22	*	*
21"	3'-8"	III	8	8	11	9	24	16
		IV	15	12	24	16	*	22
		V	*	18	*	23	*	*
24"	4'-0"	III	9	9	13	11	24	16
		IV	16	12	24	16	*	22
		V	*	19	*	24	*	*
30"	4'-8"	III	10	10	14	12	25	17
		IV	17	14	25	17	*	24
		V	*	20	*	24	*	*

(1) Maximum Trench Depth for Maximum Trench Width
(2) Limit of Trench Depth if Maximum Trench Width is exceeded.
* Up to and including thirty feet (30') of depth.
Note: If trenches are excavated to widths in excess of the maximum trench width or if trench wall collapses, sewers shall be laid with the class of bedding required for the trench depth shown in column (2) above at the expense of the Contractor. See Chapter 6 for Pipe Bedding.

Section 5.1 – Polyvinyl Chloride (PVC) Pipe

5.10 The maximum clear trench width at the top of the pipe shall not exceed a width equal to the normal pipe diameter plus eighteen inches (18"). If this width is exceeded or the pipe is installed in a compacted embankment, pipe embedment shall be compacted to a point at least two and a half (2½) pipe diameters from the pipe on both sides of the pipe or to the trench walls, whichever is less.

5.11 For PVC pipe sizes six inch (6") to twenty-one inch (21") the maximum height of cover shall be thirty feet (30') and pipe shall be bedded in Class I Bedding and compacted at ninety-five percent (95%) of proctor density.

5.12 If the 95% proctor density compaction cannot be obtained with materials from trench excavation, the Contractor will be required to obtain them elsewhere.

Section 5.2 – Payment

The cost of special bedding and tamping shall be included in the prices bid for sewers at various depths, except that the Engineer may authorize payment for concrete bedding or the use of crushed stone bedding where poor soil conditions are encountered, each in accordance with unit prices bid. The cost of furnishing extra strength sewer pipe shall be included in the prices bid for sewers at various depths.

Chapter 6 – Pipe Bedding

All pipe shall be laid on foundations prepared in accordance with the following specifications.

Section 6.0 – Concrete Pipe

Concrete pipe shall be laid as specified using the following classes of bedding required by the trench width and trench depth for the various sizes of pipe to be installed.

6.00 Class A bedding shall be either a concrete cradle (Type 1) or a concrete arch (Type 2).

Where the Type 1 method is used, the trench shall be excavated not less than six inches (6") below the barrel of the pipe or a minimum of two inches (2") below the pipe bell (whichever is greater) and the pipe laid to line and grade on concrete blocking or equal. Class "B" concrete shall then be placed to the full width of the trench, but in no case less than four inches (4") from the pipe bell on either side of the trench, and to a height of at least one-fourth the outside diameter of the pipe. No backfill shall be placed in the trench for a period of at least twenty-four (24) hours after the concrete has been placed. The backfill shall then be completed with selected backfill, had placed and tamped, to the limits shown on Detail 5.08 – Pipe Embedment.

Where concrete arch (Type 2) method is used, the trench shall first be excavated not less than six inches (6") below the barrel of the pipe bell (whichever is greater). The trench shall then be brought to grade with compacted crushed stone, placed the full width of the trench, as excavated, up to one-half the outside diameter of the pipe. the backfill shall then be complete with Class "B" concrete placed for the full width of the trench, as excavated, and to a point at least four inches (4") above the barrel of the pipe or one-fourth the inside diameter of the pipe (whichever is greater).

6.01 Class B bedding shall be performed by first undercutting the trench not less than six inches (6") below the barrel of the pipe or a minimum of two inches (2") below the pipe bell (which is greater). The trench shall then be brought to grade with compacted crushed stone, the pipe laid to line and grade and backfilled with compacted crushed stone placed the full width of the trench, as excavated, up to one-half the outside diameter of the pipe. The backfill shall then be completed with selected backfill, hand placed and tamped, to the limits shown on Detail 5.08 – Pipe Embedment.

6.02 Class C bedding shall be performed by first undercutting the trench not less than six inches (6") below the barrel of the pipe or a minimum of two inches (2") below the pipe bell (whichever is greater). The trench shall then be brought to grade with compacted crushed stone, the pipe laid out to line and grade and backfill of compacted crushed stone placed and grade and backfill of compacted crushed stone placed the full width of the trench, as excavated, up to one-fourth the outside diameter of the pipe. The backfill shall then be completed with selected backfill, hand placed and tamped, to the limits shown on Detail 5.08 – Pipe Embedment.

6.03 Bell Holes shall be provided in all classes of bedding so as to relieve pipe bells of all load, but small enough to ensure that support is provided throughout the length of pipe barrel.

6.04 Crushed stone bedding material shall conform to the latest revision of ASTM C 33, *Standard Specification for Concrete Aggregates*, as amended to date, gradation of #57 (ASTM #57), varying in sizes ¼" through 1". Bedding material shall be placed in the trench and thoroughly compacted to grade by tamping. Compacted bedding materials shall be carried up the sides of the pipe to the heights shown for the various classes of bedding.

6.05 If trenches are excavated to widths in excess of those specified in Table 7 or if trench walls collapse, pipe shall be laid down with the class of bedding required for the trench depth shown in column (2) of the Table at the expense of the Contractor.

Section 6.1 – Polyvinyl Chloride (PVC) Pipe

PVC pipe shall be laid as specified using the following classes of bedding required for the various type soils and conditions encountered. Bedding for PVC pipe shall be in accordance with ASTM D2321, *Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications*, as amended to date, the manufacturers recommendations and these specifications.

6.10 Class IA or IB Materials shall be used for bedding and haunching in all conditions. Class II, Class III, Class IVA, Class IVB and Class V materials will not be permitted for bedding and haunching under any condition.

6.11 Trench shall be undercut to allow for a minimum of six inches (6") of bedding material. Bell holes shall be excavated in the bedding material to allow for unobstructed assembly of the joint but care shall be taken to assure that bell hole is no larger than necessary to accomplish proper joint assembly. After joint assembly, material shall be placed under and

around the entire length of pipe and compacted. Compaction up to one-half the outside diameter of the pipe and the full width of the ditch shall be of the same material used in the bedding. Backfilling shall then be carried to a point six inches (6") above the top of pipe, using hand tools for tamping. If the remaining backfill material contains large particles which could damage the pipe from impact during placement the initial backfill shall be increased to twelve inches (12") above the top of the pipe. Puddling will not be allowed as a method of compaction. The remaining backfill shall be as specified in Section 2: Trench Excavation and Backfilling. Pipe shall have at least thirty-six inches (36") of cover before wheel loading and at least forty-eight inches (48") of cover before using heavy duty tamping equipment.

6.12 Class IA, IB, II, III, IVA, IVB, and V materials are defined in Table 8. Their recommended uses are given in Table 9.

Table 8 - Classes of Embedment and Backfill Materials

Class	Type	Soil Group Symbol D 2487	Description	Percentage Passing Sieve Sizes			Atterberg Limits		Coefficients	
				1 1/2 in. (40 mm)	No. 4 (4.75 mm)	No. 200 (0.075 mm)	LL	PL	Cu	Cc
IA	Manufactured Aggregates: open-graded, clean.	None	Angular, crushed stone or rock, crushed gravel, broken coral, crushed slag, cinders or shells; large void content, contain little or no fines.	100%	</=10%	<5%	Non-Plastic			
IB	Manufactured, Processed Aggregates; dense-Graded, clean.	None	Angular, crushed stone (or other Class IA materials) and stone/sand mixtures with gradations selected to minimize migration of adja-cent soils; contain little or no fines.	100%	</=50%	<5%	Non-Plastic			
II	Coarse-Grained Soils, clean	GW	Well-graded gravels and gravel-sand mixtures; little or no fines.	100%	<50% of "Coarse Fraction"	<5%	Non-Plastic		>4	1 to 3
		GP	Poorly-graded gravels and gravel-sand mixtures; little or no fines.						<4	<1 or >3
		SW	Well-graded sands and gravelly sands; little or no fines.		>50% of "Coarse Fraction"				>6	1 to 3
		SP	Poorly-graded sands and gravelly sands; little or no fines.						<6	<1 or >3
	Coarse-Grained Soils, borderline clean to w/fines	e.g. GW-GC SP-SM	Sands and gravels which are borderline between clean and with fines.	100%	Varies	5% to 12%	Non-Plastic		Same as for GW, GP, SW and SP	
III	Coarse-Grained Soils With Fines	GM	Silty gravels, gravel-sand-silt mixtures.	100%	<50% of "Coarse Fraction"	12% to 50%		<4 or <"A" Line		
		GC	Clayey gravels, gravel-sand-clay mixtures.					<7 and >"A" Line		
		SM	Silty sands, sand-silt mixtures.		>50% of "Coarse Fraction"			>4 or <"A" Line		
		SC	Clayey sands, sand-clay mixtures.					>7 and >"A" Line		

Class	Type	Soil Group Symbol D 2487	Description	Percentage Passing Sieve Sizes			Atterberg Limits		Coefficients	
				1 1/2 in. (40 mm)	No. 4 (4.75 mm)	No. 200 (0.075 mm)	LL	PL	Cu	Cc
IVA	Fine-Grained Soils (inorganic)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, silts with slight plasticity.	100%	100%	>50%	<50	<4 or <"A" Line		
		CL	Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays.					>7 and >"A" Line		
IVB	Fine-Grained Soils (inorganic)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	100%	100%	>50%	>50	<"A" Line		
		CH	Inorganic clays of high plasticity, fat clays.					>"A" Line		
V	Organic Soils	OL	Organic silts and organic silty clays of low plasticity.	100%	100%	>50%	<50	<4 or <"A" Line		
		OH	Organic clays of medium to high plasticity, organic silts.				>50	<"A" Line		
	Highly Organic	PT	Peat and other high organic soils.							

Table 9 - Recommendations for installation and Use of Soils and Aggregates for Foundation, Embedment, and Backfill

Soil Class (See Table 3, above)					
	Class IA	**Class IB**	**Class II**	**Class III**	**Class IV-A**
General Recommendations and Restrictions	Do not use where conditions may cause migration of fines from adjacent soil and loss of pipe support. Suitable for use as a drainage blanket and underdrain in rock cuts where adjacent material is suitably graded.	Process materials as required to obtain gradation which will minimize migration of adjacent materials. Suitable for use as a drainage blanket and underdrain.	Where hydraulic gradient exists check gradation to minimize migration. "Clean" groups suitable for use as drainage blanket and underdrain.	Do not use where water conditions in trench may cause instability.	Obtain geotechnical evaluation of proposed material. May not be suitable under high earth fills, surface applied wheel loads, and under heavy vibratory compactors and tampers. Do not use where water conditions in trench may cause in-stability.
Foundation	Suitable as foundation and for replacing over-excavated and unstable trench bottom as restricted above. Install and compact in 6 in. maximum layers.	Suitable as foundation and for replacing over-excavated and unstable trench bottom. Install and compact in 6 in. max-maximum layers.	Suitable as foundation and for replacing over-excavated and unstable trench bottom as restricted above. Install and compact in 6 in. maximum layers.	Suitable as foundation and for replacing over-excavated trench bottom as restricted above. Do not use in thicknesses greater than 12 in. total. In-stall and compact in 6 in. maximum layers.	Suitable only in undisturbed condition and where trench is dry. Remove all loose material and provide firm, uniform trench bottom before bedding is placed.

Soil Class (See Table 3, above)					
	Class IA	**Class IB**	**Class II**	**Class III**	**Class IV-A**
Bedding	Suitable as restricted above. Install in 6 in. maximum layers. Level final grade by hand. Minimum depth 4 in. (6 in. in rock cuts).	Install and compact in 6 in. maximum layers. Level final grade by hand. Minimum depth 4 in. (6 in. in rock cuts).	Suitable as restricted above. Install and compact in 6 in. maximum layers. Level final grade by hand. Minimum depth 4 in. (6 in. in rock cuts).	Suitable only in dry trench conditions. Install and compact in 6 in. maximum layers. Level final grade by hand. Minimum depth 4 in. (6 in.in rock cuts).	Suitable only in dry trench conditions and when optimum placement and compaction control is maintained. Install and compact in 6 in. maximum layers. Level final grade by hand. Minimum depth 4 in. (6 in. in rock cuts).
Haunching	Suitable as restricted above. Install in 6 in. maximum layers. Work in around pipe by hand to provide uniform support.	Install and compact in 6 in. maximum layers. Work in around pipe By hand to provide uniform support.	Suitable as restricted above. Install and compact in 6 in. maximum layers. Work in around pipe by hand to provide uniform support.	Suitable as restricted above. Install and compact in 6 in. maximum layers. Work in around pipe by hand to provide uniform support.	Suitable only in dry trench conditions and when optimum placement and compaction control is maintained. Install and compact in 6 in. maximum layers. Work in around pipe by hand to provide uniform support.
Initial Backfill	Suitable as restricted above. Install to a minimum of 6 in. above pipe crown.	Install and compact to a minimum of 6 in. above pipe crown.	Suitable as restricted above. Install and compact to a minimum of 6 in. above pipe crown.	Suitable as restricted above. Install and compact to a minimum of 6 in. above pipe crown.	Suitable as restricted above. Install and compact to a minimum of 6 in. above
Embedment Compaction**	Place and work by hand to insure all excavated voids and haunch areas are filled. For high densities use vibratory compactors.	Minimum density 85%. *** Use hand tampers or vibratory compactors.	Minimum density 85%. *** Use hand tampers or vibratory compactors.	Minimum density 90% Std. Proctor. *** Use hand tampers or vibratory compactors. Maintain moisture content near optimum to minimize compactive effort.	Minimum density 95% Std. Proctor. *** Use hand tampers or impact tampers. Maintain moisture content near optimum to minimize compactive effort.
Final Backfill	Compact as required by the engineer.	Compact as required By the engineer.	Compact as required by the engineer.	Compact as required by the engineer.	Suitable as restricted above. Compact as required by the engineer.

***Class IV-B (MH-CH) and Class V (OL, OH, PT) materials are unsuitable as embedment. They may be used as final backfill as permitted by the Engineer.**

****When using mechanical compactors avoid contact with pipe. When compacting over pipe crown maintain a minimum of 6" cover when using mechanical compactors. When using larger compactors maintain minimum clearances as required by the Engineer.**

*****The minimum densities given in the table are intended as the compaction requirements for obtaining satisfactory embedment stiffness in most installation conditions.**

Section 6.2 – Ductile Iron Pipe

Ductile iron pipe for gravity sewer shall be laid as specified using the following type of bedding required for the depth of cover for the various sizes of pipe to be installed.

6.20 For pipe with a flat bottom trench on undisturbed earth, backfill shall be as specified in Section 2: Trench Excavation and Backfilling.

6.21 For pipe bedded in 4 inches (4”) of select materials, backfill shall be as specified in Section 2: Trench Excavation and Backfilling. Select materials may be excavated material if free from rocks, foreign material, and frozen earth.

6.22 Maximum depth of cover for ductile iron pipe of various classes and sizes to be installed are as shown in Table 5.

Table 10 - Maximum Depths of Cover Over Ductile Iron Pipe

			Maximum Depth of Cover (ft)	
Pipe Size (in.)	Thickness Class	Normal Thickness (in.)	Flat Bottom Trench (ft)	Selected Material (ft)
10	50	0.29	38	55
	51	0.32	49	66
	52	0.35	59	79
12	50	0.31	36	52
	51	0.34	43	60
	52	0.37	53	71
16	50	0.34	30	47
	51	0.37	34	51
	52	0.40	40	57
18	50	0.35	29	42
	51	0.38	32	49
	52	0.41	36	53
20	50	0.36	27	38
	51	0.39	30	44
	52	0.42	34	50
24	50	0.38	23	31
	51	0.41	27	36
	52	0.44	30	41
30	50	0.39	18	25
	51	0.43	21	29
	52	0.47	24	33

Chapter 7 – Laying Gravity Sewer Pipe

All sewer pipe shall be laid upgrade, spigots shall point downgrade. The pipe shall be laid in the trench so that, after the sewer is completed, the invert fixed or given by the Engineer. The interior of all pipes shall be carefully freed of all dirt and superfluous material of every description, as pipe laying proceeds. Defective joints discovered after laying shall be repaired and made tight. Defective pipe shall be removed and proper replacement made.

Section 7.0 – Concrete Pipe with Rubber Gasket Joints

The surfaces of the pipe joints as well as the rubber gaskets, shall be thoroughly cleaned and wiped free of dust, dirt, and other foreign material. After the surfaces have been thoroughly cleaned, the mating surfaces of the joints and gaskets shall be lubricated with proper type of lubricant supplied by and applied in accordance with the recommendations of the pipe manufacturer. The gasketed spigot end of the pipe shall then be centered on a grade into the bell of the preceding pipe, shoved home, and properly seated by applying a moderate force with a pry or lever device. Pipe joints shall have the ability to joint up with relative ease and shall resist backing out from the seated position so that when the joint is made, it will need no restraint to keep it tight. Immediately after joining the pipes, the last pipe shall be brought to final alignment and grade. After each joint is made, the gasket shall be checked for proper position in its groove. Care shall be taken to prevent pinching and cutting of the gasket during installation. If the gasket is out of position, or has been damaged in any way the pipe shall be removed and re-laid with a new gasket. Every pipe shall be filled around immediately after being properly placed to prevent the moving of joints.

Section 7.1 – Polyvinyl Chloride (PVC) Pipe with Elastomeric Joints

Proper implements, tool and equipment shall be used for placement of the pipe in the trench to prevent damage. Under no circumstances may the pipe be dropped into the trench. In subfreezing temperatures, caution shall be exercised in handling pipe to prevent impact damage. All pipe shall be carefully examined for cracks, blisters, nicks, gouges, severe scratches, voids inclusions, and other defects before laying. If any pipe is discovered to be defective after having being laid, it shall be removed and replaced with sound material at the expense of the Contractor.

7.10 The assembly of the gasketed joint shall be performed as recommended by the pipe manufacturer. The elastomeric gaskets may be supplied separately in cartons or pre-positioned in the bell joint or coupling at the factory. When gaskets are color-coded, the Contractor shall consult the pipe manufacturer or his literature for the significance. In all cases, the gasket, the bell or coupling interior, especially the groove area (except when the gasket is permanently installed) and the spigot area shall be cleaned with a rag, brush, paper towel to remove any dirt or foreign material before the assembling. The gasket pipe spigot bevel, gasket

groove, and sealing surfaces shall be inspected for damage of deformation. When gaskets are separate, only gaskets which are designed for and supplied with the pipe shall be used. They shall be inserted as recommended by the manufacturer.

7.11 Lubricant used shall be supplied by the pipe manufacturer and shall be applied as specified by the pipe manufacturer.

After lubrication, the pipe is ready to be joined. Good alignment of the pipe is essential for ease of assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Do not swing or "stab" the joint, that is, do not suspend the pipe and swing it into the bell. The spigot end of the pipe is marked by the manufacturer to indicate the proper depth of insertion.

If undue resistance to insertion of the pipe end is encountered, or the reference mark does not position properly, the joint shall be assembled and the position of the gasket checked. If it is twisted or pushed out of its seat ("fish mouthed"), the Contractor shall inspect components, and repeat the assembly steps. Both pipe lengths concentric alignments. If the gasket was not out of position, the Contractor shall verify proper location of the reference mark. The reference mark shall be relocated if it is out of position.

7.12 Field cut pipe to be joined shall be square cut using a hacksaw, handsaw or power saw with a steel blade or abrasive disc. The pipe shall be marked around its entire circumference prior to cutting to assure a square cut. A factory-finished beveled end shall be used as a guide for proper bevel angle, and depth of bevel plus the distance to the insertion reference mark. The end may be beveled using a pipe taper. A portable sander or abrasive disc may be used to bevel the pipe end. Any sharp edged on the leading edge of the bevel must be rounded off with a pocket knife or a file.

7.13 The maximum deflection in the installed PVC pipeline shall not exceed 5% of the pipe original internal diameter. Deflection testing will be required using either a deflectometer or a "GO-NO-GO" mandrel. The Engineer shall randomly select portions of the project to be deflection tested. Such portions shall consist of not less than 5% of the total reaches. (Reach being lengths of pipe between two manholes in the project excluding house leads).

Where deflection is found to be excess of 5% of the original pipe diameter, the Contractor shall excavate to the point of excess deflection and carefully compact around the point where excess deflection was found. However, should after the initial testing, the deflected pipe fail to

return to the original size (inside diameter) the line shall be replaced.

In the event that deflection occurs beyond the 5% limit in any section of 5% or more of the reached tested, the entire system shall be tested.

Section 7.2 – Ductile Iron Pipe with Mechanical or Push-On Joints

Proper and suitable tools and equipment shall be used for the safe and convenient handling and laying of ductile iron pipe. Care shall be taken to prevent damage to the exterior coating and interior cement lining. All pipe shall be carefully examined for crack and other defects before laying. If any pipe or fitting is discovered to be defective after having being laid, it shall be removed and replaced with sound material at the expense of the Contractor. Whenever pipe is required to be cut, the cutting shall be done by skilled workmen using an abrasive wheel cutter. Use of a cold chisel or oxyacetylene torch will not be permitted.

7.20 Mechanical joints shall be made only by experienced mechanics. Sockets and spigots shall be washed with soapy water before slipping the gland and gasket over the spigot end of the pipe.

The spigot shall be inserted into the socket full depth, then backed off one quarter inch (1/4”) to provide clearance for expansion. The gasket shall be brushed with soapy water and shall be pushed into position making sure that it is evenly seated in the socket. The gland shall then be moved into position for compressing the gasket. All bolts and nuts shall be made "finger-tight."

For joints made in trenches, the bolts shall be tightened to a uniform tightness, using a torque wrench for tightening. Bolts shall be tightened alternately one hundred and eighty degrees (180°) apart.

7.21 Push on joints shall be assembled as follows.

The groove and bell socket shall be thoroughly cleaned and lubricated before the gasket is inserted. Before inserting the gasket, it shall be thoroughly lubricated and manufacturer’s instructions shall be followed for proper facing and seating of a gasket. After the gasket is in place and just prior to joint assembly, a generous coating of lubricant shall be applied to the exposed gasket surface. The lubricant used shall be a lubricant supplied by the pipe manufacturer.

The plain end shall be inspected and any sharp edges which might damage the gasket shall be removed by mean of a file or a power grinder. Pipe that is cut in the field must be ground and beveled before assembly. Prior to inserting the plain end of the pipe into the bell socket lubricant shall be applied to the beveled nose of the pipe.

Small pipe may be pushed home with a long bar but large pipe may require additional power such as a jack, lever, or back hoe. A timber header shall be used between the bell and bar or other power to avoid damage to the pipe.

During assembly of the pipe the joint must be kept straight while pushing. Pipe may be deflected if desired but only after the assembly is complete.

7.22 Mechanical or Push-on Joint pipe may be used on piers in gravity sewer lines. Pipes shall be laid with one quarter inch (1/4”) clearance in each joint to provide for expansion. Jointing of pipe shall be as described above. On mechanical joint pipe the bolts shall be tightened alternately one hundred and eighty degrees (180°) apart, but be left "finger-tight" until the sewage is diverted into the sewers; then the bolts shall be further tightened a sufficient amount which will prevent slippage which may occur because of temperature stress.

Section 7.3 – Closing Pipe

When the work of pipe-laying is suspended for the night, and at other times, the end of the sewer shall be closed with a tight cover. The Contractor shall be responsible for keeping the sewer free from obstruction.

Chapter 8 – Laying Force Main Pipe

All force mains shall be a minimum of four-inch (4”) diameter and construction of PVC pipe and/or ductile iron pipe in accordance with these specifications. The minimum depth of force mains within the lift station yard shall be three feet (3’) deep. The minimum depth of force mains outside of the lift station yard shall be four feet (4’) deep.

Section 8.0 – Piping Materials

8.00 All PVC pipe for force mains shall be in accordance with AWWA C900, Class 200. All PVC pipe used for force mains shall be underground installation only and green in color. PVC force main pipe shall have metallic locating wire installed.

8.01 All force main piping shall have a minimum cover of four feet (4’). All locations with less than four feet of cover shall require epoxy lined ductile iron pipe (EDIP).

8.02 All other PVC force main piping requirements including testing shall be in accordance with the PVC pipe specifications and testing requirements of Section 4 of these specifications.

8.03 All underground and above ground ductile iron force main piping shall be Class 350 and in accordance with the piping and fitting requirements of Section 4 of these specifications.

Section 8.1 – Force Main Installation

All force main installation for PVC and DIP, fittings, valves, and manholes shall be in accordance with Section 4 and Section 5 of these specifications per pipe type unless otherwise specified.

8.10 Locating wire shall be installed when PVC pipe is used. The wire shall be a continuous run and include mylar marking tape indicating “Caution Buried Sewer Line” from the valve vault within the lift station yard to the connection of the gravity system manhole. The wire shall be attached to all fittings and valve boxes to ensure ease of location and attachment for locating purposes. The wire shall be brought to within two feet (2’) below finish grade at one hundred-foot (100’) intervals along the installation. The locating wire shall extend up to the surface at the valve vault or manhole and be attached to the top of the concrete structure. Wire shall be extended to the top of in line valve boxes.

8.11 Pressure testing of force mains shall require a temporary plug properly restrained and/or thrust collared to prevent a blow out or damage to the

existing sanitary sewer. The testing pressure shall be a minimum of one hundred and fifty pounds per square inch (150 psi).

8.12 Filling the force main with water for pressure testing shall be done by filling the we well with potable water via the yard hydrant and running the pumps to pressurize the force main. An additional testing pump may be required to pump the piping to the required test pressure. A temporary cross connection to the potable water system is not permitted to fill the force main.

Section 8.2 – Force Main Valves

Section 8.2.1 – Isolation Valves

8.2.1.0 All isolation valves for force mains shall be plug valves.

8.2.1.1 All plug valves shall be of the non-lubricated eccentric type with resilient faced plugs.

8.2.1.2 The pipe connections shall be flanged or mechanical joint as required.

8.2.1.2.0 Flanged valves shall be in accordance with ANSI 16.1, Class 125.

8.2.1.2.1 Mechanical joint valves shall be in accordance with ANSI A21.1 or AWWA C111.

8.2.1.3 All buried valves shall have mechanical joint ends.

8.2.1.4 Valve working pressures shall be as designed by a professional engineer and shall have a minimum working pressure of one hundred and fifty pounds per square inch (150 psi).

8.2.1.5 The port area for four-inch (4”) through six-inch (6”) valves shall be a minimum of eighty-seven percent (87%) of the full pipe area.

8.2.1.6 The body of the valve shall be constructed of cast iron ASTM A126 class B body and plug. The seat shall be constructed of nickel, raised, and welded to the body.

8.2.1.7 The actuator shall be quarter turn with a two inch (2”) square nut.

8.2.1.8 Plug valves shall be as manufactured by Dezurik Water Controls #PEC Eccentric plug valve or approved equal.

Section 8.2.2 – Check Valves

8.2.2.0 All check valves shall be swing check with an external swing indicator arm. Ball check valves are not permitted.

8.2.2.1 Check valves shall be all iron body, bronze mounted, full opening swing type.

8.2.2.2 All check valves shall be flanged in accordance with ANSI 16.1 Class 125.

8.2.2.3 Check valves shall be installed a vault or pit.

8.2.2.4 The valve disc shall sing completely clear of the waterway when valve is fully open, permitting full flow. The disc shall be cast iron, and rubber faced.

8.2.2.5 Hinge pins shall be 18-8 stainless steel.

8.2.2.6 Check valves shall be as manufactured by Crispin Multiplex Manufacturing Company model #SWL or approved equal.

Section 8.2.3 – Air Release Valves (ARV)

8.2.3.0 All air release valves shall be combination air/vacuum valves in order to aid in the stabilization and elimination of air within the pipeline.

8.2.3.1 Air release valves shall have a body and cover manufactured from ductile iron in accordance with ASTM A536 Grade 65-42-12. The exterior coating for the body and cover of the ARV shall be fusion bonded epoxy.

8.2.3.2 The ARV shall be supplied with a backwash accessory and an isolation valve.

8.2.3.2.1 Isolation valves shall be a bronze full flow ball valve sized equal to the port required.

8.2.3.3 Air release valves shall be connected to the force main piping using a double stainless-steel strap and reducing plug sized specifically for the ARV application.

Section 8.2.4 – Installation of Valves

8.2.4.0 All check valves and plug valves installed within a pit or vault shall have flanged joints, and require a restrained flange adapter (RFA). All air release valves shall be installed within a manhole.

8.2.4.1 All check valves shall be installed within a pit or vault.

8.2.4.2 Plug valves shall be installed within a pit, vault, or standard underground installation. Above ground applications shall be flange joint and below ground shall be mechanical joint, and restrained as required. Restrained joint requirements shall be in accordance with these specifications.

8.2.4.3 All air release valves shall be installed within a manhole. ARVs shall be bed per Standard Detail 4.15.

8.2.4.4 Any operating wrenches required shall be turned over to the City of North Augusta at the time of lift station startup.

8.2.4.5 All buried plug valves shall be installed plumb and have a standard cast iron valve box and concrete ring protector in accordance with Section 4 of these specifications. However the cast iron cover shall read S/"Sewer".

Chapter 9 – Pump Stations

All equipment supplied pursuant to this Specification shall be new, unused, current production models equipped as described in the specifications. The equipment specified herein shall be equipped with those items normally supplied. Item(s) not specifically mentioned shall not be interpreted as not requested. Specifications are intended to set minimum levels of quality and/or suitability.

Section 9.0 – System Description

9.00 The principal items of equipment shall include two horizontal or vertical mounted, self- priming, centrifugal non-clog sewage pumps, motors, piping, valves, motor control panel, full enclosure, automatic liquid level control system and integral wiring, Auto-Start standby motorized engine to provide pumping service during power failure.

9.01 Manufacturer shall furnish and provide detailed installation instructions to the Owner for a factory built, automatic lift station. The pump system shall be complete with all equipment specified herein, factory assembled on fabricated steel baseplate.

9.02 All major castings of the pump shall be domestically made.

9.03 Enclosures shall be manufacture red standard resistant to weathering, ultra violet radiation, yellowing, chalking, mold, mildew, fungus, and corrosive sewer gases. The enclosure shall include the following:

9.03.0 Thermostat operated ventilation blower.

9.03.1 Adjustable thermostat controlled electric heater

9.03.2 LED lighting.

Section 9.1 – Pump Design and Performance

Pumps must be designed to handle raw, unscreened, domestic sanitary sewage. Pumps shall have 4” suction and discharge connections. Each pump shall be selected to perform under the operating conditions specified by the design engineer. Each pump shall be self-priming and designed specifically for handling raw, unscreened, domestic sanitary sewage. The discharge port shall be capable of being rotated to allow for multiple pipe connections. A motorized standby pump shall be included that is capable of pumping the average design flow of the development. The City’s preferred pump station and manufacturer is Gorman Rupp’s “Reliasource” lift station.

Section 9.2 – Submittals

9.20 Submittal shall include shop drawings of layout of mechanical equipment and anchor bolt locations for pumps. Piping connections and station access clearances shall be dimensioned relative to the station centerline. The electrical ladder logic drawings shall illustrate motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.

9.21 Installation shall be in accordance with written instructions provided by the pump supplier. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping, and valves, but lack experience on exact equipment supplied.

9.22 Documentation shall be specific to the pump system supplied. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the system manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:

9.22.0 Functional description of each major component, complete with operating instructions.

9.22.1 Instructions for operating pumps and pump controls in all modes of operation.

9.22.2 Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.

9.22.3 Support data for commercially available components not produced by the system manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.

9.22.4 Electrical schematic diagram of the pump system circuits. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits including interconnections.

Section 9.3 – Serviceability

All pumps are to be supplied with a drain kit for ease of maintenance. The kit shall contain ten feet (10') of length of reinforced plastic hose with a female quick connect fitting at one end and factory installed drain fittings in each pump. All pumps shall be equipped with an anti-ragging system to prevent pump clogging.

Section 9.4 – Valves and Piping

9.4.0 Each pump shall be equipped with a full flow type check valve, with flanged ends and be fitted with an external lever and spring. The valve shall swing completely clear of the waterway when the valve is full open. The seating shall be by a resilient field replaceable ring on the valve disc contacting a bronze or stainless-steel ring in the valve body. Valves shall be equipped with removable cover plates to permit entry or for complete removal of internal components without removing the valve from the line.

9.4.1 A two-way plug valve must allow pump(s) to be isolated from the force main. The valve body shall have flanged end connections.

9.4.2 An automatic air release valve shall be furnished for each pump to permit the escape of air to the atmosphere during initial priming or unattended re-priming cycles.

9.4.3 All valve parts exposed to sewage shall be constructed of corrosion resistant materials.

9.4.4 A cleanout port shall be provided for ease of inspection, cleanout, and service.

9.4.5 A pressure gauge shall be supplied for each pump. Suction pressure must be monitored by a glycerin-filled compound gauge and discharge pressure by a glycerin-filled pressure gauge.

Section 9.5 – Drive Unit

Pump motors shall have copper windings, induction type, with normal starting torque and low starting current characteristics, suitable for continuous service. The motors shall not overload at the design condition or at any head in the operating range specified.

Section 9.6 – Electrical and Level Control

9.6.0 Electrical control equipment shall be mounted within a free standing NEMA 4X stainless-steel enclosure. The door shall be hinged and sealed with a neoprene gasket and equipped with captive closing hardware.

9.6.1 A properly sized heavy-duty circuit breaker shall be furnished for each pump motor. The circuit breakers shall have NEMA Class 10, ambient compensated overload protection and individual phase failure protection.

9.6.2 Motor starter: A reduced voltage, Variable Frequency Drives (VFDs) shall be furnished for each pump motor. The power section shall consist of back-to-back Silicon Controlled Rectifiers (SCRs) which shall be rated to accommodate the designed pump station.

9.6.3 The starting modes shall be operated by VFDs.

9.6.4 When the start ramp time is complete, the starter shall energize an integral bypass contactor. When in bypass mode, the bypass contactor shall carry the motor load to minimize internal heating in the electrical enclosure.

9.6.5 The starter shall include the following protective features: communication fault, control temperature, excess starts/hour, stall, jam, line fault, open gate, overload, overvoltage, phase reversal, power loss, underload, under voltage, shorted SCR, open bypass and voltage unbalance.

9.6.6 The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motors from damage caused by phase reversal, phase loss, low voltage, and voltage unbalance. An integral time delay shall be provided to minimize nuisance trips. The motors shall automatically restart when power conditions return to normal.

9.6.7 The control panel shall also be equipped with a field adjustable failure time delay for each pump. Controls shall be provided to start the lag pump at the lead pump start level if the lead pump fails or if the lead pump selector switch is placed in the off position. If a pump fails, the remaining functional pump shall only be called to operate at the lag pump operating level. Normal pump alternation shall resume when the failure condition is corrected and the pump has been reset.

9.6.8 The lift station shall be equipped with a three phase KVA step-down transformer to supply one hundred and fifteen (115) volt, AC, single phase power for the control and auxiliary equipment. The primary and secondary side of the transformer is to be protected by a thermal magnetic circuit breaker, sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door and a padlock able operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in the “OFF” position.

9.6.9 An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.

9.6.10 Duplex electrical control equipment shall include but not be limited to the following: hand-off automatic selector switches for each pump, a green pump running indicator light, a red failure pilot light, a red seal failure indicator light, a red high-water alarm pilot light, a common exterior alarm light, a “normal-test-silence” selector switch for a panel mounted audible alarm, a remote mounted red-light alarm, pump run time meters, and a six hundred fifty (650) volt lightning/surge arrestor. Pilot lights shall be provided for each level input.

9.6.10.1 The red high-water alarm pilot light and common exterior alarm lights shall be red with a Lexan lens. The exterior alarm shall burn dimly during normal conditions to indicate power on and the lamp good, and shall flash brightly during high water level, pump failure, or seal failure. A normal open common alarm output contact shall be energized by these alarm conditions.

9.6.11 The design of the pump station shall include level inputs for: stop, lead pump start, lag pump start, and high-water alarm. The power applied to the level sensors shall be a maximum of twenty-four volts alternating current (24 VAC) with a current of less than thirty milliamps (30 Ma) for intrinsic safety and shall be optically isolated.

9.6.11.1 The wet well level shall be controlled by four sealed mercury tube float switches. All floats shall be provided with twenty-five foot (25’) of Type SJO flexible cord and shall be attached to a stainless-steel bracket mounted at the top of the wet well. The panel shall also be equipped with a non-reset elapse hour meter and a twenty (20) amp, one hundred fifteen (115) volt convenience duplex outlet mounted in the panel.

9.6.12 The panel shall include an alternative relay to reverse the lead pump selected on each successive start and an override circuit to start both pumps if the wet well level rises to the “lag” start elevation.

9.6.13 A terminal strip shall be provided for easy connection of cords from the pumps and float switches. To insure proper connections, a schematic wiring diagram shall be posted inside the panel door.

9.6.14 The panel shall include a soft stop feature to require the pumps to stop three (3) seconds apart during the condition that both pumps are running when signaled to stop in order to prevent water hammer. In conditions where the lead and lag pumps are called for simultaneously, the soft start feature shall ensure that they start three (3) seconds apart.

9.6.15 An individual filed adjustable time control shall be used to delay starting each pump in the automatic mode after power failure or during initial startup.

9.6.16 When the pumps are in automatic mode, and the controller receives a seal failure condition, the controller shall automatically alternate to the other pump and the failed pump shall be made the lag pump on future cycles until the seal failure condition is corrected.

9.6.17 The panel shall be equipped with a Mission Communications Legacy M110 Monitoring Unit.

9.6.18 The panel shall be provided with a manual operated transfer switch and receptacle compatible with voltage and horsepower requirements for stand-by power capability.

Section 9.7 – Pump Station Sites

The pump station site shall be paved with either asphalt or concrete. The site shall also have a six-foot (6’) tall security fence enclosure with a twelve-foot (12’) gate.

A yard hydrant shall be installed at each lift station site. All yard hydrants shall be fitted with a screwed joint inlet connection, a single two and a half inch (2 ½“) hose nozzle, and have a minimum main valve opening size of two and a quarter inch (2 ¼“) diameter. The minimum bury depth shall be two and a half feet (2’ 6”). Yard hydrants shall be primarily operated by a two inch (2”) square nut gate valve installed at the hydrant.

For further illustration see Detail 5.14 - Pump Station Site.

Section 9.8 – Testing

The Contractor shall conduct testing of the pump station once it is fully installed and prior to the pump station is put into operation. The Contractor shall notify the Public Services Department and the Public Works Department forty-eight (48) hours in advance of planned testing. Representatives from Public Services and Public Works shall witness the testing and testing services shall be provided at no cost to the City.

The testing process shall include but not be limited to:

9.8.0 Contractor to fill wet well with water. Place operating switch in manual position and demonstrate operation of lead pump and lag pump both sequentially and in tandem.

9.8.1 Wet well to be lowered to below the shut-off point and then the selector switch shall be placed to automatic position. The wet well shall then be filled slowly to observe lead pump run and lag pump run functionality. Pumps shall then be allowed to run to observe pump shut-off functionality.

9.8.2 Power shall be disconnected to the pumps and wet well shall be filled to observe alarm functionality.

9.8.3 Generator provided shall be put into operation and pumps shall be observed operating to empty the wet well from alarm level.

9.8.4 Level controller shall be disconnected and the float switches shall be check to ensure that each pump is turned on and off by the appropriate switch.

9.8.5 The wet well shall be filled with water to the level of the invert influent pipe. The water shall remain for a minimum of two hours. If the level has dropped at the end of two hours, the Contractor shall locate and repair the leak to the satisfaction of the City. Repeat test as needed to ensure the absence of leaks.

If during the above testing procedure, any test shows that any component of the system is not operating as intended, the Contractor shall make necessary adjustments and/or repairs and repeat the testing procedure.

The contractor and electrical panel supplier shall provide a certification letter prior to the acceptance of the pump station by the City. The letter shall certify that the panel has been inspected at the jobsite, after complete installation. The letter shall also certify that the panel components match approved shop drawings and are in compliance with the plans and specifications. Finally, the letter shall certify that the panel and its

components have not been modified or changed in any way and are safe to energize and operate.

Section 9.9 – Warranty

The pump supplier shall warrant all equipment to be of quality construction, free of defects in material and workmanship. Each pump shall be, warranted for sixty (60) months to be resistant to rust, corrosion, corrosive soils, effects of airborne contamination or physical failures occurring in normal service for the period of the pump station warranty. All other equipment, apparatus, and parts furnished shall be warranted for twelve (12) months, excepting only those items that are normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, etc. The pump supplier shall be solely responsible for warranty of the pump system and all components furnished.

Chapter 10 – Precast Concrete Manholes

Precast concrete manholes shall consist of precast reinforced concrete riser sections, concentric top section and a base section conforming to Detail 5.01 – Standard Manhole. Precast manhole sections shall be manufactured in accordance with ASTM C478, *Standard Specification for Circular Precast Reinforced Concrete Manhole Sections*, as amended to date, and these specifications. Concrete shall have a minimum compressive strength of four thousand pounds per square inch (4,000 psi) when tested in accordance with ASTM C39, *Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens*, as amended to date. Steel reinforcement shall be as specified in ASTM C478, as amended to date. Wall and bottom section shall have a minimum thickness of five inches (5"). Absorption shall not exceed nine percent (9%) when determined in accordance with ASTM C497, as amended to date.

10.00 Base sections for precast concrete manholes shall have a bottom poured monolithically with the walls. Base sections shall be furnished with inside diameters of four, five, or six feet as required. Base sections shall be furnished with a minimum height of twenty-four inches (24”) for pipes having a diameter of eight, ten, or twelve inches and a minimum height of thirty-six inches (36”) for pipes having a diameter of fifteen or eighteen inches. Minimum height for 5- or 6-feet diameter base sections shall be forty-eight inches (48”) regardless of pipe size. Base sections with five or six foot inside diameter shall be reduced to four foot inside diameter by means of an adapter ring or transition top.

The openings in the base section for the accommodation of the pipe shall be cast to closely conform to job conditions and shall provide a minimum clearance of three inches (3") between the inside bottom of the base and outside bottom of the pipe barrel.

10.01 Riser sections shall be furnished in a minimum of six inch (6”) increments and shall be four feet (4') in diameter with, either tongue and groove joint to be sealed with approved butyl rubber or bitumastic material, similar to "Ram Nek" as manufactured by K. T. Snyder Co., Inc. or O-ring gasket type joint conforming to ASTM C443, as amended to date. The gasket joint shall be thoroughly cleaned of all loose materials and brushed with an approved Epoxy to give a smooth surface free of any honeycomb.

10.02 In the event that the manhole has to be altered after delivery to job site the Contractor may, with permission of the Engineer, connect the pipe to the manhole with a collar of mortar and brick. The opening between the pipe and manhole shall have a minimum clearance of one inch (1”) and shall be filled from the inside of the manhole with a non-shrink grout.

10.03 Repaired and Patched sections will not be acceptable unless each individual section so repaired and patched shall have first been inspected and approved by the Engineer, for repair and patching at the manhole plant. Repairs to the patching of O-Ring grooves and shoulders will not be permitted.

10.04 Manhole brick for grade adjustment shall be whole hard burned common brick conforming to ASTM C32, *Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale)*, Grade MS, as amended to date. A maximum of three courses shall be used.

Chapter 11 – Placing Precast Manholes

Precast concrete manholes shall be placed or constructed where shown and/or directed by the Engineer. Manholes shall be four, five, and six feet in diameter as determined from the schedule of pipe sizes and line deflections or as shown.

The top of manholes outside of roads, streets, and highways shall be built to grades twelve inches (12") above ground surface unless otherwise shown on the Drawings. Manholes in roads, etc. shall be built to grade designated by the Engineer. Vented manholes shall be constructed to elevations as shown on the Drawings.

Section 11.0 – Precast Concrete Manholes

Precast concrete manholes shall be bedded on not less than six inches (6") of compacted crushed stone at Contractor's expense. The crushed stone shall extend to not less than six inches (6") outside the walls of the manhole, and shall be compacted under entire length of pipe within manhole excavation.

11.00 Connections of pipe to manholes shall be made with a flexible joint system. The joint system shall be a neoprene or synthetic rubber boot or sleeve, either cast or core drilled into the wall of manhole. The boot or sleeve shall be clamped and seated to the pipe with a stainless-steel band. The boot or sleeve, system shall be "Lock Joint Flexible Manhole Sleeves" as manufactured by Interpace Corporation or "Kor-N-Seal" as manufactured by National Pollution Control System, Inc. or equal. connections of pipe to manhole shall have a minimum clearance of one inch (1") and shall be filled from the inside of the manhole with a non-shrink grout.

11.01 The top of the concentric top section shall have a minimum wall thickness of eight inches (8") to accommodate brick courses for height adjustment. A maximum of three (3) brick courses will be allowed for adjustment of manhole to required grade.

Section 11.1 – Drop Connections

Drop connections will be required, wherever there is a difference in elevation between the inlet and outlet inverts of two feet (2') or more or wherever called for on the Drawings. Drop pipe shall be the same size as the sewer which they serve. Openings in the walls of precast concrete manholes for drop connections shall not be made at joints. Drop connection fittings and riser pipe shall be encased in formed Class "C" concrete. Drop connections shall conform with Detail 5.03 – Drop Manhole, Detail 5.04 – Inside Drop Manhole, or as shown on the Drawings. Drop connections shall be carefully backfilled to prevent dangerous side pressure.

Section 11.2 – Manhole Inverts

Manhole inverts shall be carefully constructed with cement grout, Class "B" concrete, or cement mortar brickwork; special care shall be taken to lay the channel and adjacent pipes to grade. Cement mortar shall be made of one (1) part cement and two (2) parts clean sharp sand. Channels shall be properly formed, rounded, and troweled smooth. The connections of the sewer with the wall and channel of the manhole shall be tight and smooth.

Section 11.3 – Manhole Steps

Manhole steps shall conform to Detail 5.01 – Standard Manhole. Steps for precast concrete manholes shall be installed along a vertical centerline, on approximately fourteen to sixteen inches (14" to 16") centers.

Section 11.4 – Future Sewer Connections

Where shown, a twelve inch (12") long pipe stub for future sewers, of such size as any be designated, shall be laid to proper grade and alignment and plugged with a factory plug with same type joint as used on the sewer pipe.

Section 11.5 – Manhole Frames and Covers

Manhole frames and covers shall be as shown on Detail 5.05 – Manhole Frame & Cover and as called for in the proposal and shall include setting to finished grade as required, and grouting in place.

Section 11.6 – Manhole Inflow Seal

A manhole inflow seal made of High-Density Polyethylene Copolymers shall be installed on all sanitary sewer manholes.

Section 11.7 – Frames and Chimney Seal

An internal frame and manhole chimney seal shall be installed on all manholes installed in areas that have potential for water infiltration through the frame and chimney section. The seal shall be removable and flexible see FlexRib by NPT, Inc or approved equal.

Chapter 12 – Connections to Existing Sewers

At location where new sewers are shown to be connected to existing sewers at a new manhole, the Contractor shall first expose the existing sewer and install a supporting timber beam with suitable straps around the pipe so as to bridge the excavation for the new manhole. The manhole shall then be constructed complete with invert and frame and cover. Under special conditions the Contractor may temporarily block and/or divert sewer flows to facilitate the construction operations. Actual physical connection of the sewer will be made at a later date, as directed. See Detail 5.13 – Doghouse Manhole for schematic drawing of installation.

Chapter 13 – Iron Castings

Castings shall be of gray-iron conforming to ASTM A48, *Standard Specification for Gray Iron Castings*, as amended to date. Manhole and step castings shall be as shown on Detail 5.01 – Standard Manhole unless otherwise specified. Castings shall be tough, close-grained and smooth, free from blow holes, blisters, shrinkage stains, cracks, cold shots and like defects. No plugging of defective castings will be permitted. Castings shall be made accurately to dimensions shown on the Drawings or ordered and shall be planned or ground where necessary, whether marked or not, to secure perfectly flat bearing surfaces. Allowance shall be made in the patterns so that the specified thickness or metal will not be reduced. No casting will be accepted, the weight of which is less than the theoretical weight, based on required dimensions, by more than five percent (5%).

Chapter 14 – Highway Crossings

The Contractor shall install pipe lines across highways in accordance with the applicable regulations of the State Highway Department and as shown on the Drawings. Permits for highway crossings will be obtained by the Owner. A copy of the permit shall be submitted to the City prior to construction.

Section 14.0 – Steel Pipe Casing

Steel pipe casing shall be manufactured from Steel conforming to ASTM A252 *Standard Specification for Welded and Seamless Steel Pipe* Grade 2, as amended to date, with a minimum yield strength of 35,000 psi before cold forming. Pipe may be straight seam or spiral weld. A protective coating will not be required. The diameter and wall thickness of steel pipe casing shall be as shown on the Drawings.

Section 14.1 – Installation of Steel Pipe Casing by Boring Method

Installation of steel pipe casing shall be by the dry boring method at locations shown on the Drawings. Installations of steel pipe casing shall be in accordance with the applicable regulations of the State Highway Department; the Detail Drawings and these Specifications. All excavation for pit and bore shall be unclassified.

14.00 The boring pit shall be solid sheeted, braced and shored as necessary to provide a safe operation. The Contractor shall take all precautions, and shall comply with all requirements as may be necessary to protect private or public property.

14.01 The Contractor shall set the boring rig so that, after the casing is completed and the sewer carrier pipe installed, the invert surface of the sewer shall conform accurately to the grades and alignment fixed or given by the Engineer.

14.02 The hole shall be bored and cased through the soil by a cutting head on a continuous auger mounted inside the casing pipe. The boring of the howl and installation of the casing pipe; shall be simultaneous. Lengths of casing pipe shall be fully welded to the prodding section in accordance with AWS recommended procedures.

14.03 After installation of the casing pipe is complete, the sewer carrier pipe shall be installed through the casing pipe as shown on the Detail Drawings.

Section 14.2 – Concrete Piers

Concrete piers for ductile iron pipe shall be constructed of Class "A" concrete, and shall be constructed as shown on Details 5.09.1-5.09.5 – Aerial Crossings. If rock is encountered, piers supporting pipe lines across streams shall be anchored into the rock, so as not to resist overturning during periods of flood stages in the stream. Holes not smaller than two and one-half inches (2½") in diameter by two feet (2') deep shall be drilled into the rock after excavation for the footing is complete; No. 6 reinforcing bars shall be embedded in grout made with high-early strength cement poured into the holes. In wet holes, grout shall be deposited with a tremie. Straight bars shall be used, and shall be bent over for anchorage after the concrete has attained its full strength. Where unusually poor soil conditions are encountered, the Engineer may direct that spread footings of concrete be constructed, or that pin piles be driven for support for piers.

Chapter 15 – Testing and Cleaning

Before acceptance of any sewer or systems of sewers, lines shall be cleaned and tested in accordance with these Specifications. Where any obstruction is met, the Contractor will be required to clean the sewers by means of rods, swabs, or other instruments. Lines and manholes shall be clean before final inspection. Pipe lines shall be straight and show a uniform grade between manholes. The Contractor shall be required to correct any variations therefrom which may be disclosed during the inspection.

Section 15.0 – Leakage Tests

All sewer lines, including in house service lines, shall be tested for leakage, in the presence of the Engineer or his representative, before being placed into service. Tests shall be conducted by one or a combination of the three methods listed herein.

15.00 Infiltration Test

Where natural ground water levels stand a minimum of two feet (2') above the top of the pipe, the amount of leakage may be determined form measurements made at the lower end of the sewer section under test. Sewers above the test section shall be closed before testing by the installation of suitable watertight bulkheads. The length of the test section shall be determined by the Engineer. The average of six readings at five-minute intervals will be used to determine the rate of infiltration for any one test section.

Table 11 - Allowable Infiltration

Size of Sewer	Gallons Per 24 Hours Per Foot of Sewer
8"	0.30
10"	0.38
12"	0.45
15"	0.57
18"	0.68
21"	0.80
24"	0.91
30"	1.14

15.01 Exfiltration Test

Where natural ground water levels do not stand two feet (2') above the top of the pipe, an exfiltration test shall be conducted on each section of sewer. The test shall be performed up to an average maximum hydrostatic head of ten feet (10'). The test shall be conducted in the following manner.

The ends of the pipe in the test section shall be closed with suitable watertight bulkheads. Inserted into each bulkhead at the top of the sewer pipe shall be a two-inch (2”) pipe nipple with an elbow. At the upper end of the test section a riser pipe shall be installed. The test section of the pipe shall be filled through the pipe connection in the lower

bulkhead which shall be fitted with a tight valve, until all air is exhausted and until water overflows the riser pipe at the upper end. Water may be introduced into the pipe twenty-four (24) hours prior to the test period to allow complete saturation. House service line, if installed, shall also be fitted with suitable bulkheads having provisions for the release of air while the test section is being filled with water.

During the test period, which shall extend over a period of thirty (30) minutes, water shall be introduced into the riser pipe from measured containers at such intervals as are necessary to maintain the water at the top of the riser pipe. The total volume of water added during the thirty (30) minute test period shall not exceed that shown for infiltration in Table 6.

15.02 Low-Pressure Air Test

Where sewer grades are such that preclude performance of the exfiltration test or at the Contractor's option, a low-pressure air test shall be conducted on each section of sewer after completion and before acceptance.

Prior to air testing, the section of sewer between manholes shall be thoroughly cleaned and wetted. Immediately after cleaning or while the pipe is water soaked, the sewer shall be tested with low-pressure air. At the Contractor's option sewers may be tested in lengths between manholes or in short sections (twenty-five feet (25') or less) using Air-Lock balls pulled through the line from manhole to manhole. Air shall be slowly supplied to the plugged sewer sections until internal air pressure reaches approximately four pounds per square inch (4.0 psig). After the pressure of 4.0 psig is obtained, regular the air supply so that the pressure is maintained between 3.5 and 4.0 psig for at least two minutes. If a drop of 1.0 psi or greater occurs in less than the minimum allowed time, the line has failed the test, and the Contractor will be required to locate the failure, make necessary repairs and re-test the line. Minimum test time for various pipe sizes, in accordance with ASTM F1417, *Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air*, as amended to date, is shown in Table 7.

Table 12 - Minimum Time for a 1.0 psig Pressure Drop for Size and Length of Pipe for Q=0.0015

Pipe Diameter (in)	Minimum Time (min:s)	Length for Minimum Time (ft)	Time for Longer Length (s)
8	7:34	298	1.52 * L
10	9:26	239	2.374 * L
12	11:20	199	3.418 * L
15	14:10	159	5.342 * L
18	17:00	133	7.692 * L
21	19:50	114	10.47 * L
24	22:40	99	13.674 * L

Required test equipment includes Air-Lock balls, braces, air hose, air source, timer, rotometer as applicable, cut-off valves, pressure reducing valve, 0-15 pressure gauge, 0-5 pressure gauge with gradations in 0.1 psi and accuracy of + 2%.

The Contractor shall keep records of all tests made. Copy of such records will be given to the Engineer or the Owner. Such records shall show date, line number and stations, operator and such other pertinent information as required by the Engineer.

The Contractor is cautioned to observe proper safety precautions in performance of the air testing. It is imperative that plugs be properly secured and that care be exercised in their removal. Every precaution shall be taken to avoid the possibility of over pressurizing the sewer line.

15.03 Repairs

All visible leaks shall be repaired regardless of whether infiltration, exfiltration or air test is within allowable limits. No sewer will be accepted until leakage tests demonstrate compliance with one of the above leakage test methods.

Section 15.1 – Manhole Vacuum Test

All new wastewater manholes shall be vacuum tested according to ASTM C1244-93 *Standard Test Methods for Concrete Sewer Manholes by the Negative Pressure (Vacuum) Test* after backfilling operations. The general procedure shall be as outlined in this section.

15.10 Manholes shall be prepared by plugging all lift holes and pipes entering the manhole. Care should be taken to securely brace all pipes and plugs to prevent being pulled into the manhole during the test.

15.11 The test head shall be placed on top of the manhole according to manufacture specifications and 10 inches of mercury be drawn down on the manhole.

15.12 The valve on the vacuum line shall be closed and valve pump shut off.

15.13 The inspector shall record the time that that it takes for the vacuum to drop to nine inches (9“) of mercury. The manhole will pass if the time required to drop from ten inches (10”) to nine inches (9”) of mercury exceeds the time shown in Table 8, adapted from ASTM C1244, *Standard Test Methods for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test*. If the drop occurs faster than the time below the manhole shall be repaired using approved methods and retested until a passing time is obtained.

Table 13 - Minimum Test times for Manhole Vacuum Test

Depth of Manhole (Feet)	Diameter of Manhole (Feet)			
	4	5	6	Time (Seconds)
0-8	20	26	33	
10	25	33	41	
12	30	39	49	
14	35	46	57	
16	40	52	67	
18	45	59	73	
20	50	65	81	
22	55	72	89	
24	59	78	97	
26	64	85	105	
28	69	91	121	
30	74	98	121	

Section 15.2 – Cleaning Up

Before the work is considered complete, all material not used, and rubbish of every character must be removed from the project. All streets, sidewalks, curbs, fences and other private or public facilities and structures disturbed must be in essentially as good condition as existed before the work was done. Any subsequent settlement of backfill or payment over trenches shall be replaced by the Contractor and the surfaces brought to grade.

Section 15.3 – Acceptance of Work

Sewer lines and appurtenances will not be considered ready for acceptance until all provisions of the Specifications have been complied with, until all tests have been satisfactorily completed, and until inspection of the lines has been made by the Engineer, and permission granted therefor.

Section 6 – Storm Drainage

Overview

This section includes specifications regarding all material, equipment, and labor required to install storm drainage facilities as specified, as shown on the Plans, and as directed by the Engineer. The contractor shall furnish all material, equipment, and labor required to install storm drainage facilities as specified, as shown on the Plans, and as directed by the Engineer.

The Contractor shall construct the storm drainage pipelines true to line and grade including all manholes, drainage structures, and other appurtenances shown on the Plans and specified below. Clearing, grubbing, trench excavating, sheeting, shoring, backfilling, restoration, and related items shall be as specified in Section 2: Trench Excavation and Backfilling. All materials shall be furnished new and shall be as shown on the Plans and as specified below.

Chapter 1 – Pipe Materials

The following pipe materials are approved for use within the City of North Augusta. All pipeline materials shall comply with SCDOT *Standard Specifications for Highway Construction* (latest edition). Specific exceptions are as follows*:*

- The minimum pipe diameter for storm drainage pipelines to be maintained by the City shall be eighteen inches (18”).

- No metal pipe *(*CMP, DIP, BCMP*,* aluminized or galvanized CMP) shall be installed or approved for use in construction.

- All storm drainage pipelines installed within road rights-of-way shall be reinforced concrete pipe (RCP).

Pipeline materials shall be as shown on the Plans and as directed by the Engineer.

1.00 Reinforced Concrete Pipe (RCP) shall conform to requirements of AASHTO M 170, *Standard Specification for Reinforced Concrete Culver, Storm Drain, and Sewer Pipe*. Circular, Class III RCP shall be used unless otherwise specified or shown on the Plans. Elliptical RCP may only be used on a case by case basis as approved by the Engineer.

1.01 Corrugated Plastic Pipe shall be allowed only outside of road rights-of-way. All corrugated plastic pipe shall be of the high-performance polypropylene type. Pipe shall be in conformance with AASHTO M330, *Standard Specification for Polypropylene Pipe, 300 to 1500 mm (12 to 60 in) Diameter*, and ASTM F2881 *Standard Specification for 12 to 60 in. [300 to 1500 mm] Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications*. Joints shall be either water tight (WT) or soil tight (ST) as specified. Joint gaskets shall be in conformance with ASTM F477, *Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe*, when applicable.

Chapter 2 – Pipe Installation

All pipe shall be inspected and approved by the Engineer prior to installation. The pipe shall be free from functional defects (cracks, broken ends, spalls, etc.) as determined by visual inspection. The Contractor shall remove all defective pipe from the site.

The pipe trench shall be prepared as specified in Section 2: Trench Excavation and Backfilling and pipe installation shall proceed upgrade with the bell end upgrade. Pipe shall be carefully lowered into the trench using pipe slings or cable. Pipe shall not be rolled or dropped into the trench. Each pipe shall be laid true to the line and grade as shown on the Plans to form a close concentric joint to ensure a uniform flow line. A minimum grade of one (1%) percent is required for all storm drainage pipelines unless otherwise shown on the Plans or directed by the Engineer. Pipe shall be installed in a straight alignment to allow visual inspection by looking from both ends of the completed installation. Unless specifically approved by the Engineer, pipe shall not be laid on a curve.

Concrete pipe joints shall be made with flexible water-tight gaskets in conformance with AASHTO C 990, *Standard Specification for Joins for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants*. The pipe ends shall be thoroughly cleaned and dry prior to applying the gasket. In lieu of gasket joints, the Contractor may make concrete pipe joints with cement mortar fully packed in the annular space finished smooth and flush inside and an excess mortar bead outside the pipe joint.

Corrugated Plastic Pipe shall be installed in conformance with ASTM D2321, *Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications*. Bedding shall be in conformance with Detail 6.16 – Pipe Bedding.

Chapter 3 – Structure Materials

All drainage boxes, wing traps, head walls, junction boxes, weir inlets, manholes, outlet structures, and energy dissipation structures shall be built as shown on the Plans and standard detail drawings. Structures shall be precast concrete or constructed in place with brick, block, or concrete as specified herein and as shown on the standard details. **No knockout boxes are allowed** unless specifically approved by the City Engineer.

3.00 All precast concrete manholes and drainage structures shall conform to ASTM C 478, *Standard Specification for Circular Precast Reinforced Concrete Manhole Sections*. Cast in place concrete shall be SCDOT Class A (3000 psi) unless otherwise specified. The concrete mix design must be approved by the Engineer.

3.01 Clay or shale brick used in the construction of manholes, catch basins and other drainage structures shall conform to the requirements of ASTM C32, *Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale)*, Grade MM. Concrete brick shall conform to ASTM C55, *Standard Specification for Concrete Building Brick,* Grade S-II. Concrete block shall be Grade A, Hollow Load Bearing Concrete Masonry Units in conformance with ASTM C90, *Standard Specification for Loadbearing Concrete Masonry Units*. Mortar materials shall meet SCDOT requirements.

3.02 Trap weir inlet frame must be U.S. Foundry USF 1258, cover type "BD". Manhole frame and must be U.S. Foundry USF 668, cover type KL.

3.03 Rip-rap stones shall be hard quarry or field stone and shall be of such quality that they will not disintegrate on exposure to water or weathering. Stone for hand placing to thickness of twelve inches (12”) shall vary in size with no pieces weighing more than one hundred and fifty (150 lbs). At least twenty percent (20%) of the stone pieces, excluding spalls, shall weigh more than sixty pounds (60 lbs), and no more than twenty percent (20%) of the stone pieces, excluding spalls shall weigh less than twenty-five pounds (25 lbs). Stone for hand placing to a thickness of six inches (6”) must be no less than three inches (3”) in one dimension and six inches (6”) in another dimension.

Chapter 4 – Structure Installation

Drainage structures shall be installed where shown on the Plans and as directed by the Engineer. Excavation shall proceed as specified in Section 2: Trench Excavation and Backfilling to prepare a firm foundation on native material capable of supporting the weight of the structure. Water shall not be present in the foundation area. If native materials are not capable of providing a firm foundation, the foundation area shall be excavated and suitable material placed and compacted to provide the necessary bearing strength.

4.00 All masonry structures shall be installed on reinforced concrete footings or foundations as shown on the Plans and Standard Details. Brick and block shall be laid to line in courses in full and close joints of mortar which shall be not less than one quarter inch (1/4”) and not more than one half inch (1/2”) in thickness, and the thickness shall be uniform throughout. Adjoining courses shall break joints one half a brick (block) as nearly as practicable. Courses shall be level except where otherwise necessary. All joints shall be finished properly as the work progresses and, on exposed faces, they shall be neatly struck. Broken or chipped brick (block) will not be allowed in the faces of the structure. In making closures, no piece of the brick (block) less than the width of a whole shall be used and wherever practicable in making such closures, whole brick (block) shall be laid with the long side at right angles to the face of the structure. The exposed surface of the masonry structure shall be thoroughly cleaned of mortar stains, and pointed satisfactorily. When Reinforced Masonry is specified, care shall be taken to ensure the proper placement of the reinforcing steel as specified in the plans.

4.01 All precast concrete structures shall be set plumb and to the elevations shown on the plans. Pipe connections shall be made by stubbing the pipe end inside the structure and rebuilding the structure wall around the pipe with brick and mortar. In lieu of brick and mortar, concrete collars may be poured around the pipe on the outside structure wall, overlapping the structure wall a minimum of six inches (6”) in all directions.

4.02 All cast-in-place concrete structures shall be constructed in accordance with the design requirements and details shown on the Plans and as specified elsewhere herein. Concrete shall be placed and compacted to form a structure of maximum density and impermeability and of uniform texture exhibiting a smooth surface when the forms are removed. Concrete shall not be placed until the foundation, steel placement, and formwork has been approved by the Engineer. Defective concrete, as determined by the Engineer, shall be removed and/or repaired by the contractor.

4.03 The Contractor shall place rip-rap as shown on the plans, or a minimum of ten square yards (10 sy) at all discharge points of ditches and pipe outlets/inlets. Rip-rap shall be placed by machine and/or by hand to the designated slope, thickness, length, and depth, taking care to avoid damage to pipes and structures. The Contractor shall grout loose rip-rap as indicated on the Plans and as directed by the Engineer.

Chapter 5 – Inspection and Testing

Upon completion of pipe installation, the pipeline shall be cleaned to remove all construction debris, dirt, mud, mortar, etc. Existing downstream piping shall be inspected by the Engineer and cleaned by the Contractor if necessary. All new storm drainage piping and appurtenances will be subject to final inspection by the Engineer. All deficiencies noted shall be corrected to the satisfaction of the Engineer prior to acceptance. All required testing such as concrete strength, soil compaction, etc., as specified in Section 2: Trench Excavation and Backfilling and as directed by the Engineer shall be conducted by an approved independent laboratory hired by the Contractor. Test results shall be submitted directly to the Engineer.

Chapter 6 – As-Built Drawings

As the work progresses, a record shall be made on all changes to and deviations from the Plans. As-Built drawings shall be furnished to the City before acceptance of all storm drainage systems.

Section 7 – Roadway Construction

Overview

This section includes specifications regarding all material, equipment, and labor required for road construction, including subgrade, base, asphalt surface, and shoulders as specified, as shown on the Plans, and as directed by the Engineer. All work shall be in accordance with SCDOT, Standard Specifications for Highway Construction, except as modified below. This specification shall also be applied to parking lots, driveways, and other paved areas as applicable.

These specifications are based on minimum subgrade, base course, and surface course requirements. Road designs may vary from these minimum requirements based on site conditions, road type, traffic volume, etc. The design for each road will specify additional subgrade, base and surface course requirements if necessary. These material and thickness requirements will be shown on the Plans.

Chapter 1 – Subgrade

The subgrade shall be prepared for the subsequent installation of base course, pavement, sidewalk, curb and gutter, and shoulders. Prior to the completion of the subgrade, all cuts/fills, sewers, drains, water lines, and structures shall be substantially complete. The compacted subgrade shall conform to the lines, grades and cross sections as specified, as shown on the Plans, and as directed by the Engineer.

1.00 The entire surface of the in-place subgrade shall be plowed, harrowed and thoroughly mixed to a depth of at least twelve inches (12"). After the material is mixed, the subgrade shall be compacted to final line and grade (one hundred percent (100%) of maximum density for the top eight inches (8”) and ninety-five percent (95%) of maximum density below the top eight inches (8”)). Maximum densities will be determined by either AASHTO T99, *Standard Method of Test for Moisture–Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop*, SC T-25, *Field Method of Determining Moisture-Density Relations of Soils,* or SC T-29, *Field Determination of Maximum Dry Density and Optimum Moisture Content of Soils by the One-Point Method*.

1.01 Finished Grading shall be completed as described below.

1.01.0 The surface of the complete subgrade shall be bladed to a smooth and uniform texture. The center line profile shall conform to the established elevations with an acceptable tolerance of ± one tenth of a foot (±0.10’).

1.01.1 The full width between the back of the curb and right-of-way shall be finished, graded to a uniformly smooth surface, free from any abrupt irregularities, and sloping at a ratio not to exceed one half inch (1/2") per foot nor less than one quarter inch (1/4") per foot. The finished grade shall not exceed ± one quarter foot (±0.25’) from the plan cross-section.

1.01.2 No base or curb and gutter shall be placed before the subgrade is inspected, tested, and approved by the Engineer.

1.02 Testing shall be done on all portions of the subgrade underlying the base and curb and gutter, plus an 18-inch width behind each curb.

1.02.0 The contractor will provide the roller with a minimum axle load of fifteen thousand pounds (15,000 lbs or 7-1/2 tons) per rear axle; generally, a fully loaded water distributor, asphalt distributor, loaded twenty-yard truck, or similar approved equipment.

1.02.0.0 Test rolling shall be done parallel to the center line, with the forward speed of the roller between two and three miles per hour (2-3 mph).

1.02.0.1 Test rolling under the curb and gutter shall be done prior to placement of curb and gutter. The surface shall be in a finished condition ready for the placement of curb and gutter.

1.02.0.2 Test rolling under the base material shall be done prior to placement of the base material. The surface shall be in a finished condition ready for the placement of base material. Test rolling of the area under the base material shall be done over the quarter parts of the road, with additional passes at the discretion of the Engineer.

1.02.1 Compaction testing shall be as specified in Section 1.00 of this Chapter.

1.02.1.0 The Contractor shall arrange for an approved, independent testing laboratory, that is certified by AASHTO, to conduct the necessary compaction tests at his own expense. Test results shall be submitted directly from the lab to the Engineer.

1.02.1.1 Test locations will be determined by the Engineer and in no case, will be less than one test per four hundred and fifty feet (450 ft) of road bed.

1.03 Areas that exhibit pumping, soft spots, and low compaction shall be repaired or replaced and re-tested as directed by the Engineer. The repairs may consist of re-mixing in-place material, additional compaction effort, removal of unsatisfactory material and replacement with satisfactory material, or by the strengthening or stabilizing of the material in place.

1.04 Upon submission of passing compaction test results and satisfactory test roll, the Engineer will approve the subgrade for the installation of road base and curb and gutter. However, subgrade approval may be rescinded if significant time passes or inclement weather deteriorates the subgrade. The Contractor will be required to repair and/or replace any subgrade deterioration and seek re-approval from the Engineer.

Chapter 2 – Base Course

Upon approval of the subgrade, the base course shall be installed to the lines, grades and cross sections as specified, as shown on the Plans, and as directed by the Engineer.

Materials listed below are recommended for use as a base course. Alternate materials may be submitted to the City Engineer for review.

Section 2.0 – Aggregate Base Course

2.00 Aggregate base course shall consist of a mixture of crushed stone, gravel, sand, soil, or approved similar material. The mixture shall be in conformance with SCDOT Type 1 or Type 2 Stabilized Aggregate Base Course.

2.00.0 Aggregate base course shall consist of a six inch (6”) minimum compacted thickness, as shown on the Plans, or as directed by the Engineer.

2.00.1 The material shall be free from lumps or balls of clay, weeds, roots, or other objectionable matter.

2.00.2 No in-place mixing of aggregate base course will be permitted.

2.01 The base material shall be spread evenly on the approved subgrade and brought to line, grade, and cross-section as shown on the Plans or as directed by the Engineer. The material shall then be bladed, wetted, and rolled to achieve a dense, smooth, unyielding, well bonded base course compacted to one hundred percent (100%) maximum density.

2.02 The Contractor shall finish the base course to a smooth and uniform surface, free from abrupt changes, and sloping to the edges at a rate of one quarter inch (1/4") per foot. The surface shall vary from profile and cross section at any given point by no more than ±one half inch (±1/2”). There shall be no roots, organic matter, trash or any other deleterious material on or protruding from the surface.

Section 2.1 – Asphalt Base Course

2.10 Asphalt base course shall be in conformance with SCDOT Hot-Mix Asphalt Aggregate Base Course or other asphalt mix approved by the Engineer.

2.11 The base material shall be spread by a mechanical spreader on the approved subgrade, struck to the line, grade, and cross-section as shown on the Plans or as directed by the Engineer, then compacted by rolling to

achieve a dense, smooth, uniform surface. A tack coat shall be applied to the asphalt base prior to laying the asphalt surface course.

2.12 The Contractor shall finish the base course to a smooth and uniform surface, free from abrupt changes, and sloping to the edges at a rate of one quarter inch (1/4") per foot. The surface shall vary from profile and cross section at any given point by no more than ±one half inch (±1/2”). There shall be no roots, organic matter, trash or any other deleterious material on or protruding from the surface.

Section 2.2 – Testing and Maintenance

Testing on the base course shall conform to the testing requirements outlined in Section 1.02, in Chapter 1 of these specifications.

The base course shall be maintained by repeated machining throughout its entire length for such length of time as necessary to provide an adequate base course conforming to the required cross section, grade, thickness and proper compaction. Maintenance shall also include the correction of any defects which may develop due to traffic, erosion, or other cause; and shall include watering, machining, rolling, and other operations necessary to condition and preserve the base course. Any lack of uniformity in the base course mixture, unevenness in the surface, or other irregularities shall be corrected by adding or replacing base materials and re-mixing, reshaping, and re-compacting as necessary and as required. The base shall be properly drained at all times.

Chapter 3 – Bituminous Pavement

The prime coat and hot laid asphalt concrete surface course shall be installed on the approved base course to the lines, grades, and cross-sections as specified, as shown on the Plans, and as directed by the Engineer.

3.00 All bituminous mixtures shall not be produced or placed during rainy weather, when the subgrade or base course is frozen or shows any evidence of excess moisture, when the moisture on the surface to be paved would prevent proper bond, or when the air temperature is less than forty degrees Fahrenheit (40°F) in the shade away from artificial heat. In addition, hot laid asphalt concrete surface courses, which are to be placed at a rate of one hundred pounds per square yard or less, shall not be placed when the air temperature measured in the shade, away from artificial heat, is less than fifty degrees Fahrenheit (50ºF).

3.01 When a prime coat is required, it shall be uniformly applied to the base course by use of the distributor spray bars at the rate of 0.25 to 0.28 gallons per square yard. The prime coat shall be applied when the atmospheric temperature is above fifty-five degrees Fahrenheit (55°F). The material for the prime coat shall be one of the following:

3.01.0 Cutback Asphalt (Rapid Curing Type) material shall be grade RC-30 and shall conform to the requirements of the SCDOT Standard Specifications. RC-30 shall be sprayed between fifty degrees (50°) and one hundred twenty degrees Fahrenheit (120°F).

3.01.1 Cutback Asphalt (Medium Curing Type) material shall be Grade MC-30 and shall conform to the requirements of AASHTO M 82, *Standard Specification for Cutback Asphalt (Medium-Curing Type)*, except that the penetration of the residue shall be 80-250. The Saybolt-Furol viscosity shall apply. MC-30 shall be sprayed between fifty degrees (50°) and one hundred twenty degrees Fahrenheit (120°F).

3.01.2 Anionic emulsified asphalt shall be Grade EA-P and shall meet the requirements of AASHTO M 140, *Standard Specification for Emulsified Asphalt*. EA-P shall be sprayed between fifty degrees (50°) and one hundred sixty degrees Fahrenheit (160°F).

3.02 The following shall be required of surface course.

3.02.0 Asphalt concrete mixture shall be composed of mineral aggregate and asphalt cement, mixed in an approved plant

and shall conform to SCDOT Standard Specifications for Highway Construction for the type specified on the plans or elsewhere in these specifications. The job mix shall be approved by the Engineer prior to installation.

3.02.1 The mixture shall be transported from the mixing plant to the point of use in approved vehicles. Loads shall not be of such size or weight as to interfere with the efficient operation of the spreader. Loads shall not be sent out so late in the day as to prevent the completion of spreading and completion of the mixture during daylight, unless artificial light is provided. The mixture shall be delivered at a temperature between two hundred and fifty degrees (250°) and three hundred twenty-five degrees Fahrenheit (325°F) and within ± twenty degrees Fahrenheit (±20°F) of the temperature set at the mixing plant.

3.02.2 Upon arrival at the point of dumping, the mixture shall be dumped into the spreader and immediately spread true to line, grade and cross section specified and to the loose depth that will secure a minimum compacted thickness of as specified on the plans. The hot mixture shall be free from lumps and shall be spread while it is in a workable condition.

After the mixture has been spread and before roller compaction is started, the surface shall be checked, all fat spots and irregular areas removed and replaced with satisfactory material. All irregularities in alignment and grade along the outside edge shall also be corrected by the addition or removal of mixture before the edge is rolled.

Immediately after the asphalt mixture is placed and struck off and surface irregularities are corrected, the mixture shall be thoroughly and uniformly compacted by rolling.

During compaction of asphalt concrete asphalt, the roller shall not pass over the end of freshly placed material except when a construction joint is to be formed. Edges shall be finished true and uniform.

The surface shall be rolled when the mixture is in the proper condition. Rolling shall not cause undue displacement, cracking, or shoving.

The number, weight, and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. The sequence of rolling operations

and the selection of roller types shall provide the specified pavement density.

Immediately after the hot mixture is placed, it shall be sealed with rollers. Thereafter, rolling shall be a continuous process, insofar as practicable, and all parts of the pavement shall receive uniform compaction.

Rolling shall begin at the sides and proceed longitudinally parallel to the center of the pavement, each trip overlapping at least ½ the roller width, gradually progressing to the crown of the pavement. When abutting a previously placed lane, the longitudinal joint shall be rolled first, followed by the regular rolling procedure. On superelevated curves, rolling shall begin at the low side and progress to the high side by overlapping of longitudinal trips parallel to the centerline.

Displacements occurring as a result of reversing the direction of a roller, or from other causes, shall be corrected at once by the use of rakes or lutes and addition of fresh mixture when required. Care shall be taken in rolling not to displace the line and grade of the edges of the asphalt mixture. All roller marks shall be eliminated.

To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with a very small quantity of detergent or other approved material. Excess liquid will not be permitted.

Along forms, curbs, headers, walls, and other places not accessible to rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or mechanical tampers. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.

Edges of asphalt pavement surfaces shall be true curves or tangents. Irregularities shall be corrected.

The surface of the compacted course shall be protected until the material has cooled sufficiently to support normal traffic without marring.

3.02.3 The newly finished pavement shall be protected from vehicular traffic of any kind until the pavement has cooled and hardened and for a minimum of six hours.

3.02.4 The surface will be tested by using a ten-foot (10') straightedge. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall not be more than one quarter inch (1/4"). Humps and depressions exceeding the specified tolerance shall be corrected, or the defective work shall be removed and replaced with new material.

3.03 The above work will be subject to thickness and compaction tests as deemed necessary by the Engineer. Such tests will be at the expense of the Contractor.

Chapter 4 – Protection of Existing Improvements

Streets, sidewalks, driveways, power/ cable/telephone lines, gas lines, water lines, sewers, storm drains and other existing improvements shall be maintained and protected from damage. Any aerial, surface or subsurface improvements damaged during the course of the work shall be repaired to the satisfaction of the Engineer. Satisfactory provisions shall be made for the maintenance of traffic on streets, driveways, and walkways.

Prior to any excavation, the Contractor shall notify all utilities and utility locating services to provide locations for buried utilities. The contractor shall obtain all necessary permits (grading, building, water, sewer, encroachment, etc.) prior to beginning work.

Section 4.0 – Restoration of Property

The Contractor shall restore all property and facilities disturbed by this construction as specified in Section 3 - Restoration of these specifications.

Section 4.1 – Adjustment of Existing Facilities

All manholes, valve boxes, catch basins, traps, fire hydrants, etc. shall be adjusted flush to the finished pavement surface or grade along the road shoulder. The Contractor will be required to raise, lower, and/or reconstruct such facilities at his expense. Adjustments may be made as specified elsewhere herein with brick/mortar, concrete, manhole riser sections, or other materials as required. Manhole adjustment rings shall be submitted for approval to the Engineer prior to use.

Section 4.2 – Maintenance

Unless otherwise specifically noted, the contractor shall maintain the roadway throughout the warranty period.

Section 8 – Concrete Construction

Overview

This section includes specifications regarding all material, equipment, and labor required for concrete construction, including manholes, headwalls, footings, foundations, piers, drainage structures, curb and gutter, sidewalk, etc. as specified, as shown on the Plans and as directed by the Engineer.

Concrete strength and mix design shall be as specified for each type of facility, as shown on the Plans, and as directed by the Engineer. Concrete shall conform to SCDOT requirements for Class A concrete (3,000 psi 28-day compressive strength) or Class B concrete (2,500 psi 28-day compressive strength) as indicated. Mixing shall be accomplished at an approved central mix plant in accordance with ASTM C94, *Standard Specification for Ready-Mixed Concrete*. Unless specifically approved by the Engineer, job site mixing will not be allowed. Mix designs shall be submitted to the Engineer for approval prior to placement.

Chapter 1 – Concrete Cylinders

Concrete Cylinders for testing purposes shall be made in accordance with ASTM C 31, *Standard Practice for Making and Curing Concrete Test Specimens in the Field*. Testing shall be done by a laboratory approved by the Engineer. Each test shall consist of at least four (4) specimens; two (2) for field control and (2) two for laboratory control. One (1) initial test will be required and then on (1) test for each one hundred (100) yards thereafter. All testing will be performed at the discretion of the Engineer at the Contractors expense.

Chapter 2 – Placing of Concrete

Placing of concrete shall be in daylight hours and no concrete shall be placed when the atmospheric temperature is below thirty-five degrees Fahrenheit (35 °F). Concrete mixed at a central plant shall be transported to the job site as per ASTM C94, *Standard Specification for Ready-Mixed Concrete*. Concrete shall be compacted with mechanical, internal-vibrating equipment and/or with hand spading with a slicing rod. Earth fill shall not be placed on fresh concrete until it has been allowed to set twenty-four (24) hours.

Section 2.0 – Form Work

2.00 Form work shall be built to conform to the shape, lines and dimensions of the concrete work as shown. Forms shall be set to line and grade, and shall be braced, tied, and secured in a manner which will withstand placing of the concrete and which will maintain shape and position. Forms shall be tight and be substantially assembled to prevent bulging and the leaking of concrete. Joints may be arranged vertically or horizontally as required. Temporary openings shall be arranged, where required, at the bottoms of wall forms and elsewhere, to facilitate cleaning and inspecting. Used formwork shall have nails removed and surfaces in contact with concrete thoroughly cleaned before reuse. Wall sleeves, inserts, and openings required in concrete work shall be securely set to alignment and elevation. Chamfer strips shall be placed in forms for all exterior corners.

2.01 Under normal conditions, the time elapsing before the forms may be stripped shall not be less than the following:

2.01.0 Slabs – fourteen (14) days

2.01.1 Piers – seven (7) days

2.01.2 Walls – two (2) days

Section 2.1 – Finishing

All exposed concrete surfaces shall be kept wetted with water, and shall be rubbed with a carborundum stone of medium fineness, or other equal abrasive, to bring the surface to a smooth texture and to remove all form and other marks. The paste formed by the rubbing may be rubbed down by floating with a canvass, carpet-faced, or cork float, or may be rubbed down with dry burlap.

Chapter 3 – Expansion Jointing

Section 3.0 – Materials

Material used for expansion joint shall be preformed joint filler of either sponge rubber (Type I) or polyurethane-bonded recycled rubber (Type IV) material that meets AASHTO M 153 (*Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction)* or semi-rigid, closed-cell polypropylene foam that meets ASTM D8139 (*Standard Specification for Semi-Rigid, Closed-Cell Polypropylene Foam, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction)*. Other materials such as polyvinyl chloride (PVC) may be used, if the PVC meets the recovery, compression, and extrusion requirements in either of the above referenced specifications. Do not use non-extruding and resilient bituminous (AASHTO M 213) types of preformed joint filler.

Section 3.1 – Location

Expansion joints shall be installed as specified on the plans and at the following locations:

- Where sidewalk is constructed between an adjoining substantial structure on one side and curbing on the other side, from an expansion joint adjacent to the curbing.
- Place an expansion joint between the sidewalk and the radius curbing at street intersections.
- Where concrete sidewalks or medians are constructed adjacent to existing or new concrete pavement structure, place a transverse expansion joint in the sidewalk or median opposite such joints in the concrete pavement or structure.
- Where existing structures such as light standards, poles, fire hydrants, etc., are within the limits of the sidewalk or median area, surround the structures with an expansion joint.
- Place transverse expansion joints at intervals of not more than fifty (50) feet in concrete sidewalk.
- Place transverse expansion joints at intervals of not more than one hundred (100) feet in concrete curbing.

Chapter 4 – Reinforcing Steel

Reinforcing steel, structural steel, miscellaneous iron, and steel and iron castings shall be as specified, as shown on the Plans, and as called for in the work to which they pertain.

4.00 The Contractor shall furnish to the Engineer for review six (6) copies of bending and placing details for steel bar reinforcing which show bar size, spacing, bending, and tagging identification.

4.01 Bar reinforcement and wire mesh shall be furnished by domestic steel mills. Steel bar reinforcement shall conform to the requirements of ASTM A615, Standard *Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement*, (Grade 60), and shall be of an approved deformed type. Bars shall be cold bent to the dimensions indicated on the drawings. Bending shall be done in the shop unless otherwise specified and shall conform to the requirements of ACI Building Code (ACI-318). Bars shall be furnished full lengths unless otherwise indicated on the drawings, or approved by the Engineer. Bars shall be placed in the locations shown on the drawings and held securely in place during the placing of concrete. Bars shall be spaced the proper distance from the face of the wall by the use of approved precast concrete mortar blocks and/or steel chairs with plastic coated legs or plastic tips or stainless steel chairs.

Wire mesh reinforcement shall conform to the requirements of ASTM A185, *Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete,* and unless otherwise indicated on the Drawings, shall be four-inch by four-inch (4” x 4”) mesh, of six (6) gauge wire. Wire mesh shall be secured in position by space bars and chairs or pre-cast concrete mortar blocks.

4.02 Miscellaneous iron and steel for straps, brackets and related items shall conform to ASTM A36, *Standard Specification for Carbon Structural Steel*, with a minimum yield strength of thirty-six thousand pounds per square inch (36,000 psi) and shall be as shown on the Plans.

Carbon steel bolts and nuts shall conform to ASTM A307, *Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength*, unless otherwise shown on Drawings. Bolts and nuts in general shall be United States standard dimension. All anchor bolts exposed to the weather shall be of stainless steel Type 316, unless otherwise specified. Anchor bolts in general shall be placed in forms prior to pouring concrete. When concrete anchors must be used, they shall be Phillips "Red Head", Rawl "Saber Tooth" self-drilling anchors, or equal.

Welding under these Specifications may be done by the MIG, TIG, or "Electrode" method in accordance with AWS-ASTM E 6012, (Electrode Method only).

Section 9 – Sediment and Erosion Control

Overview

No development shall be undertaken that directly or indirectly increases the erosion of land or its potential for erosion. All land disturbing activities shall be in accordance with the South Carolina Stormwater Management and Sediment Reduction regulations.

1.00 Developers shall take all reasonable measures to reduce soil loss and contain sediment during construction. To help retain sediment generated by land-disturbing development activities within the boundaries of the development tract, the developer shall plant or otherwise provide a permanent ground cover sufficient to restrain erosion within ten (10) calendar days of completion of final grading. Best Management Practices (BMP's) contained in the City of North Augusta Sediment and Erosion Control Manual shall be used.

1.01 No land disturbing activity shall be permitted in proximity to a water body unless a vegetated strip is provided along the margin of the watercourse of sufficient width to prevent sediment from leaving the site and entering the watercourse.

1.02 No land disturbing activity shall be performed by the contractor until a Grading Permit has been obtained from the City of North Augusta.

1.03 No land disturbing activity shall be performed by the contractor until a stormwater management plan and sediment reduction plan has been submitted to the City of North Augusta Stormwater Management Department and the required Stormwater Permit has been obtained. Permits can be obtained from:

City of North Augusta
Stormwater Management Department
100 Georgia Avenue
2nd Floor
North Augusta, SC 29841-3843
(803) 441-4246