

## 02630 – STORM DRAINAGE

(Last revised 7/24/06)

### SELECTED LINKS TO SECTIONS WITHIN THIS SPECIFICATION

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## **PART 1 – GENERAL**

### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this specification.
- B. [Section 02275 – Trenching, Backfilling, and Compaction of Utilities](#)
- C. [Section 02530 – Sanitary Sewer](#)
- D. [Division 02920 – Seeding, Sodding, and Groundcover](#)

### **1.2 SUMMARY**

This section includes all equipment, labor, material, appurtenances, and services required for complete installation of storm drainage piping, ditches, structures, and specialties for municipal drainage systems.

### **1.3 DEFINITIONS**

#### A. General

For the purposes of this specification, the following definitions refer to storm water drainage systems and structures that come under the authority of the City of Jacksonville, North Carolina as specified within this section and other sections of this manual.

**Public Storm Drainage System:** Drainage systems and their appurtenances required for the conveyance of public storm water from and across publicly maintained streets, roads, highways, and other public property and located within public rights-of-way and/or easements.

#### B. The following are industry abbreviations for various pipe materials.

- 1) **CAP:** Corrugated Aluminum (Alloy) Pipe

- 2) **PCP:** Plain Concrete Pipe
- 3) **RCP:** Reinforced Concrete Pipe
- 4) **HDPE:** High Density Polyethylene

#### 1.4 SUBMITTALS

- A. Submit shop drawings on all non-standard products/materials.
- B. Submit product data and shop drawings for the following.
  - 1) Drop/curb inlets
  - 2) Frame and covers
  - 3) Head/end walls
  - 4) Inlet grates
  - 5) Concrete pipe and piping specialties
  - 6) Precast concrete manhole castings
  - 7) Corrugated Aluminum Pipe
  - 8) HDPE fittings

#### 1.5 QUALITY ASSURANCE

- A. Materials and operations shall comply with the latest revision of all applicable Codes and Standards.
- B. Piping materials shall be marked clearly and legibly.
  - 1) Reinforced Concrete Pipe shall be marked as follows:
    - a. Pipe Class,
    - b. Manufacturer
  - 2) Plain Concrete Pipe shall be marked as follows:
    - a. Pipe Class,
    - b. Manufacturer
  - 3) Corrugated Aluminum Pipe shall show identification marks on pipe as follows:
    - a. Manufacturer's Name or Trade Mark,
    - b. Nominal thickness and type of aluminum
    - c. Specification Designation
    - d. Plant Designation Code
    - e. Date of Manufacture
  - 4) Double walled corrugated HDPE pipe, end sections, tees, elbows and accessories shall be marked as follows:
    - a. AASHTO Designation
    - b. The date of manufacture
    - c. Name or trademark of the manufacturer

## 1.6 STANDARD ABBREVIATIONS

<b>AASHTO</b>	American Association of State Highway Transportation Officials.
<b>ACI</b>	American Concrete Institute
<b>ACPA</b>	American Concrete Pipe Association
<b>AISI</b>	American Iron and Steel Institute
<b>ANSI</b>	American National Standards Institute
<b>AREA</b>	American Railway Engineers Association
<b>ASCE</b>	American Society of Civil Engineers
<b>ASTM</b>	American Society for Testing and Materials
<b>CRSI</b>	Concrete Reinforcing Steel Institute
<b>FS</b>	Federal Specifications
<b>MSDS</b>	Material Safety Data Sheets
<b>NCMA</b>	National Concrete Masonry Association
<b>NCSPA</b>	National Corrugated Steel Pipe Association
<b>OSHA</b>	Occupational Safety and Health Administration
<b>NCDOT</b>	North Carolina Department of Transportation

## 1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

### A. Pipe Condition/Pipe Examination:

- 1) **New Pipe Inspection – All pipe:** Inspect materials thoroughly upon arrival. Examine materials for damage. Remove damaged or rejected materials from site. Pipe shall be protected during handling against impact shocks and free fall. Pipe shall be kept clean at all times, and no pipe shall be used in the work that does not conform to the appropriate ASTM Specifications.
  - a. **Concrete Pipe:** Check bells and spigots closely for smoothness, roundness, and honeycombing (concrete pipe), which may be a source of infiltration. Check for cracks, chips, etc. on both ends. Reject any pipe that will not provide watertight seal or is otherwise structurally deficient.
  - b. **Corrugated Aluminum Pipe, Coupler Bands, Terminal Sloped End Section and other Special Fittings:** All corrugated aluminum pipe, fittings and coupler bands shall be unloaded and handled with reasonable care. Pipe and fittings shall not be dragged over gravel or rock and shall be prevented from striking rock or other hard objects

during placement on bedding. Pipe with protective coatings shall be handled with special care to avoid damage. Pipe on which such coatings have been damaged shall, unless repaired to the satisfaction of the Public Services Director, be rejected at the site of the work regardless of previous approvals. Pipe having any localized bends in excess of 5 percent of the specified pipe diameter or any dent in excess of ½ inch shall be rejected. Rejected damaged pipe may be used if repaired to the satisfaction of the Public Services Director. Repair may be made by jacking or by any other method meeting the approval of the Public Services Director.

- 2) **Pre-Installation Inspection:** Prior to being installed, each section of the pipe shall be carefully examined for damage and conformity with these specifications. All pipes damaged or deemed not to conform to these specifications shall be rejected and removed from site.
  - a. **Concrete Pipe:** All concrete pipes in which the spigots and bells cannot be made to fit properly, or pipe, which has chipped bells or spigots, will be rejected. The faces of all spigots ends and of all shoulders on the bells of rigid pipe must be true.
  - b. **Corrugated Aluminum Pipe:** All aluminum pipes in which the pipe and bands cannot be made to fit properly shall be repaired as directed by the Public Services Director, and if it cannot, it will be rejected. Protect pipe coating during handling using methods recommended by the manufacturer. Use of bare cables, chains, hooks, metal bars, or narrow skids in contact with coated pipe is not permitted.
  - c. **Double Walled HDPE Pipe:** All double walled corrugated HDPE pipe in which the pipe and fittings cannot be made to fit properly shall be rejected. Protect pipe during handling using methods recommended by the manufacturer.
- B. Observe manufacturer's directions for delivery and storage of materials and accessories.
- C. Protect stored piping from entry of water or dirt into pipe. Protect bells and flanges of special fittings from entry of moisture and dirt.
- D. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

## 1.8 PROJECT CONDITIONS

**Storm Drainage Manholes** – no water mains shall pass through or come in contact with any part of a storm drainage manhole. A minimum of 3 feet of horizontal separation shall be maintained between water mains and storm drainage manholes unless otherwise approved by the Public Services Director. Interference/conflict manholes will not be permitted unless otherwise approved by the Public Services Director and NCDOT where applicable.

## 1.9 LOCATING SERVICES

Contact the City of Jacksonville Public Services Department to coordinate interruption of water or sewer services, operation of water valves, line cut-ins etc. that are the result of storm drainage construction. If interruption is necessary, the interruption shall be arranged to occur at such a time to cause the least disruption and minimize loss of service. At the direction of the Public Services Director, temporary water or sewer service may be required to be provided. To all citizens affected, provide a minimum of 48 hours written notice of the proposed water or sewer utility interruption or necessary operation of water valves.

### 1.10 COORDINATION

- A. Coordinate tie-in to municipal drainage systems with the Public Services Director.
- B. Contact **“NC One Call”** 1-800-632.4949 or current locator service before digging. Call the City of Jacksonville Public Services Department at 910-938-5249 for water/sewer location services. Notify NCDOT prior to performing any work within ½ mile of any traffic signal.

## **PART 2 – PRODUCTS**

### 2.1 PIPE & FITTINGS

#### 2.1.1 CORRUGATED ALUMINUM ALLOY PIPE

##### A. CORRUGATED ALUMINUM ALLOY PIPE

Corrugated aluminum alloy pipe must meet the requirements of AASHTO M196 except that Type IA pipe will not be permitted. The pipe sizes, gauges, and corrugations shall be as shown on the plans. Handling and assembly shall be in accordance with NCSPA's (National Corrugated Steel Pipe Association) recommendations.

##### B. JOINTS & FITTINGS IN CORRUGATED ALUMINUM ALLOY PIPE

Corrugated aluminum alloy pipe end sections and other fittings shall meet the requirements of AASHTO M196.

#### 2.1.2 CONCRETE PIPE

##### A. PLAIN CONCRETE PIPE (NOT PERMITTED)

##### B. REINFORCED CONCRETE PIPE

RCP shall be a minimum of Class III, Wall B and meet the applicable requirements of AASHTO M170. Concrete pipe joints shall be tongue and groove type unless otherwise specified. RCP shall conform to the requirements of applicable sections of the latest revision of the NCDOT *Standard Specifications for Roads and Structures*.

RCP Class III or IV shall also meet ASTM C76, *Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe*.

Gasketed joints in concrete pipe shall meet the requirements of paragraph [2.2.9, \*Performed Plastic Gaskets\*](#). Mortar joints shall meet the requirements of [paragraph 3.1.1 E 1\), \*Mortar Joints\*](#).

### **2.1.3 HDPE CORRUGATED POLYETHYLENE PIPE**

Pipe shall be high-density polyethylene corrugated exterior/smooth interior pipe. 15-inch through 36-inch diameters shall meet all the requirements of AASHTO M294, Type S *Specification for Corrugated Polyethylene Pip, 12 to 36 inch diameter*. 42 inch and 48 inch diameters shall have minimum pipe stiffness of 20 and 17 psi, respectively, at 5% deflection; and shall meet all other requirements of AASHTO M294.

Pipe coupling bands, end treatments, pipe tees, and elbows shall conform to AASHTO M294.

### **2.1.4 CORRUGATED METAL PIPE (NOT PERMITTED)**

## **2.2 MISCELLANEOUS APPURTENANCES**

### **2.2.1 BEDDING**

See [Section 02275, \*Trenching, Backfilling, and Compaction of Utilities\*](#).

### **2.2.2 BRICK**

Brick shall be hard clay, grade SM, ASTM C 32, *Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale)* and AASHTO M91.

### **2.2.3 CONCRETE BLOCK**

Concrete block shall conform to the requirements of ASTM C139, *Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes*.

### **2.2.4 CONCRETE FLARED END SECTIONS**

Concrete flared end sections shall meet all applicable requirements of AASHTO M170 except those pertaining to design. All concrete flared end sections shall be reinforced. The concrete used in flared end sections shall be air entrained and shall attain strength of 3500 psi when tested in accordance with AASHTO T22. 3:1 slopes are required on flared ends.

### **2.2.5 GEOTEXTILE FABRIC:**

Geotextile fabric shall be protected from mud, dirt, dust, sunlight, and debris during transport and storage. Material shall be inert to commonly encountered chemicals; resistant to mildew, rot, insects, and rodents; and biologically and thermally stable. Geotextile fabric for subsurface installation shall not be exposed to direct sunlight for more than 24 hours before or during installation.

- A. **Filter Fabric for Rip Rap:** Filter Fabric for Rip Rap and Rip Rap Beddings shall conform to Section 1056 – *Engineering Fabrics* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision for Type 2 engineering fabric.
- B. **Fabric for Subsurface Drains:** Non-woven needle-punched fabric for subsurface drains shall conform to Section 1056 – *Engineering Fabrics* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision for Type 1 engineering fabric.

## 2.2.6 MORTAR FOR CONCRETE BLOCK & BRICK

Mortar shall be type M, ASTM C 270, *Standard Specification for Mortar for Unit Masonry* and ASTM C 144, *Standard Specification for Aggregate for Masonry Mortar*. Mortar shall be prepared from cement in perfect condition and shall be prepared in boxes for that purpose. No mortar that has stood beyond 45 minutes shall be used. Proportion by volume for the different types of application shall be as follows:

Brick masonry = 1 part cement to 2 parts sand

Pointing = 1 part cement to 1 part sand

When specified by the Public Services Director, grout for cellular fill of block or voids shall be comprised of 3000-psi ready mix concrete with pea gravel aggregate. Do not provide air entrainment unless specified by the Public Services Director.

## 2.2.7 MISCELLANEOUS CONCRETE

Concrete Classes (NCDOT) to Design Compressive Strength at 28 days (f'c):

Class AA	General	4,500-psi
Class A	General	3,000-psi
Class B	Massive or Lightly Reinforced	2,500-psi

Ready mixed concrete shall comply with ASTM C94, *Standard Specification for Ready-Mixed Concrete*. All exposed concrete shall be air entrained. Concrete strength shall be as specified on standard details and drawings. Unless otherwise specified, all concrete shall be Class A, minimum.

## 2.2.8 PORTLAND CEMENT

Type I, CSA normal, ASTM C150 *Standard Specification for Portland Cement*.

## 2.2.9 PRECAST REINFORCED CONCRETE MANHOLES

- A. Precast reinforced concrete manholes shall be designed and manufactured in accordance with ASTM C478, *Standard Specification for Precast Reinforced Concrete Manhole Sections*, latest revision and AASHTO M199. Either an “O” ring joint conforming to the requirements of AASHTO M198 and ASTM C443 *Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets* or joints conforming to AASHTO M199 and ASTM C990

*Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants* may be used.

Type of Concrete used in the construction of the manholes shall have a minimum 28-day compressive strength of 4000-psi air entrained (with 4 to 6 percent air) conforming to ASTM C33 *Standard Specification for Concrete Aggregates* and ASTM C94 *Standard Specification for Ready-Mixed Concrete*. Manholes shall have monolithic base and eccentric cone flattop as applicable. Structures are to have steps. Manholes shall have extended bases with appropriate reinforcing. Acceptable manufacturers are: Carolina Precast Concrete, Inc., Oldcastle Precast, N. C. Products Concrete Corporation, Stay-Right Tank, or Tindall Precast Concrete Products, Inc.

### **2.2.10 PRECAST UNDERGROUND CONCRETE UTILITY STRUCTURES**

Structures of precast reinforced concrete shall be designed and manufactured in accordance with ASTM C858, *Standard Specification for Underground Precast Concrete Utility Structures*, latest revision with preformed butyl rubber joint sealant meeting ASTM C990, *Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed flexible Joint Sealants*, latest revision. Type Concrete used in the construction of the Utility Structures shall have a minimum 28-day compressive strength of 4000-psi air entrained (with 4 to 6 percent air) conforming to ASTM C33 *Standard Specification for Concrete Aggregates* and ASTM C94 *Standard Specification for Ready-Mixed Concrete*. Unless shown otherwise on the drawings, structures are to have steps. Steel reinforcing shall conform to the requirements of ASTM C857, *Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures*, latest revision. Structures shall be designed for an H20-44 loading in traffic areas. Acceptable manufacturers are: Carolina Precast Concrete, Inc., Oldcastle Precast, N. C. Products Concrete Corporation, Stay-Right Tank, or Tindall Precast Concrete Products, Inc.

### **2.2.11 PREFORMED PLASTIC GASKETS (JOINT SEALER)**

Preformed plastic gaskets shall meet federal specification SS-S-00210. Sag or flow resistance and Chemical resistance shall meet ASTM C990. Preformed butyl gaskets shall be used with structures meeting ASTM C478, ASTM C990 and AASHTO M199. Preformed plastic gaskets shall equal or exceed “Ram-Nek” as manufactured by the Henry Company, Sealants Division, Houston, TX.

### **2.2.12 MANHOLE FRAMES AND COVERS**

**Standard Frames and Covers:** Manhole frames and covers shall be meet ASTM A48 *Standard Specification for Gray Iron Castings*, Class 35B, traffic frame and cover as manufactured by Capitol Foundry, US foundry or East Jordan Iron Works. Standard manhole frames and covers shall be manufactured to the dimensions and configurations shown on [standard detail C06.01](#) and shall have a minimum of four 1-inch diameter holes in the flange of the frame. Minimum inside diameter of the opening shall be 23 1/2 inches. Manholes castings may be either bituminous coated or plain. The bearing surface of the frames and covers shall be machined and the cover shall seat firmly into the frame without rocking. Weights shall not vary more than 5% +/- of the weight shown on [standard detail C06.01](#).



**Cast-in-Place Frames and Covers:** Manhole frames and covers shall meet ASTM A48 *Standard Specification for Gray Iron Castings*, Class 35B, traffic frame and cover as manufactured by Capitol Foundry, US foundry or East Jordan Iron Works. Cast-in-place manhole frames and covers shall conform to the dimensions and configurations as shown on [standard detail C06.05](#) and shall have a minimum inside opening diameter of 24 inches. Frames shall be plain un-coated. Manholes covers may be either bituminous coated or plain. The bearing surface of the frames and covers shall be machined and the cover shall seat firmly into the frame without rocking.

Covers are to be embossed along the perimeter with the words “Storm” and “Drains to Waterway.”

Acceptable Manufacturers and models are:

<b>Standard Frames &amp; Covers</b>		
<b>Manufacturer</b>	<b>Standard</b>	<b>Detail</b>
Capitol Foundry	-	-
US Foundry	<b>700-KL</b>	<b>C06.01</b>
East Jordan Iron Works	-	-
<b>Cast-in-place Frames &amp; Covers</b>		
East Jordan Iron Works	<b>V-1890</b>	<b>C06.05</b>

### 2.2.13 MISCELLANEOUS GRAY IRON CASTINGS

**Catch basin frames and grates:** Supply gray iron castings meeting the requirements of ASTM A48 *Standard Specification for Gray Iron Castings*, Class 35B as manufactured by Capitol Foundry, US foundry or East Jordan Iron Works. Boldly fillet castings at angles, and provide arrises that are sharp and perfect. No sharp, unfilleted angles or corners are permitted. Provide castings that are true to pattern in form and dimension, free from pouring faults, sponginess, cracks, blowholes, and other defects affecting their strength and value for the service intended. Welding is not allowed for the purpose of making a casting structurally sound. Welding for cosmetic or other purposes is not allowed without approval of the Public Services Director.

### 2.2.14 DROP INLETS

- A. Drop inlet tops and bases shall be precast and shall conform to the requirements of [paragraph 2.2.8, Precast Underground Concrete Utility Structures](#), as well as all applicable sections of the latest revision of the *NCDOT Standard Specifications for Roads and Structures*. Refer to [standard details 633.01 through 634.02](#).
- B. Drop inlet bases may be either precast reinforced concrete or concrete block.
- C. Inlet grates shall conform to the requirements of [paragraph 2.2.11, Miscellaneous Gray Iron Castings](#), and the applicable sections of the latest revision of the *NCDOT Standard Specifications for Roads and Structures*.

### 2.2.15 REINFORCING STEEL

Reinforcing steel shall conform to ASTM A615 *Specification for Deformed Billet-Steel Bars for Concrete Reinforcement*, Grade 60.

### 2.2.16 RIP RAP AND RIP RAP BEDDING

Rip Rap and Rip Rap Bedding shall conform to Section 1042 – *Rip Rap Material* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision for Class A, B, 1 and 2 rip rap.

### 2.2.17 SUBSURFACE DRAINAGE

Subsurface drains shall conform to Section 1044 – *Subsurface Drainage Materials* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision.

### 2.2.18 MISCELLANEOUS STORMWATER APPURTENANCES

All miscellaneous stormwater appurtenances including but not limited to Endwalls, Headwalls, and Flared end sections shall conform to all applicable sections of the latest revision of the NCDOT *Standard Specifications for Roads and Structures*.

## **PART 3 – EXECUTION**

### 3.1 PIPE INSTALLATION - GENERAL

#### 3.1.1 CONSTRUCTION – ALL PIPE

- A. **Trench Width:** Trench width shall be per [Standard Detail 631.01](#).
- B. **Pipe Laying Direction:** Place piping beginning at low point and progress uphill. Place on grade, with unbroken continuity in invert, horizontally and vertically, and on alignment as indicated on plans. Place bell or groove ends of piping facing upstream. Install gaskets, seals, sleeve, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements. Place non-woven Geotextile fabric around joints as specified in [paragraph F3, Wrapping Pipe Joints](#).
- C. **Directional changes in gravity lines:** Use manholes for changes in direction of gravity lines. The Public Services Director may permit horizontal curves in pipe alignment for pipe greater than 48 inches in diameter where pipe has been manufactured with a beveled end.
- D. **Stringing out Pipe:** When pipe is strung out during unloading, it shall be set on high ground and in a position to prevent silt deposits, storm water, or other matter from entering the pipe prior to its placement in the trench.
- E. **OSHA Trench Protection:** Adhere to all OSHA requirements for trench slope protection, particularly Subpart P, *Excavations*, of 29 CFR 1926, latest revision. Trench walls may have vertical sides up to a maximum height of 5 feet above subgrade elevation. Beyond this depth, the entire sides must be laid back or a trench box, certified for the depths being used, must be used. Contractor is responsible for determining the proper and applicable slope based on type soil in

order to meet Subpart P, *Excavations*, latest requirements. Laying back slopes also applies for areas where the top of the trench box is lower than the top of the bank. Contractor shall employ the services of a Geotechnical engineer for direction and guidance if unstable or difficult soils are encountered. In any event, the Contractor shall hold the City of Jacksonville harmless for injuries and/or damages resulting from failure to properly adhere to trench protection regulations/requirements in force at the time of a failure or mishap.

- F. **Pipe Laying:** Pipe shall be bedded per [Section 02275 – Trenching, Backfilling and Compaction of Utilities](#). The pipe and fittings shall be laid in the trench so that its interior surface shall conform to the grade and alignment as shown on the plans. Pipe laying shall be done in such a way as to disturb as little as possible the pipe that has already been laid. The alignment and grade of the storm main may be field adjusted whenever, in the opinion of the Public Services Director, it is necessary, so long as the changes are consistent with the City of Jacksonville policy in affect at the time of the change. Changes in either grade or alignment may only occur at manholes. Where necessary, the invert grade shall be cambered by an amount sufficient to prevent the development of sag or back slope in the flow line. The developer's engineer will determine the amount of camber used. Where bell and spigot pipe is used, recesses shall be excavated to receive the pipe bells.

Before laying, the bell and spigot will be wiped free from any dirt or other foreign matter. All surfaces of the portion of the pipe to be joined, and the factory-made jointing material, shall be clean and dry. Jointing material shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing material or factory-fabricated joints shall then be placed, fitted, and adjusted in such skillful manner as to obtain the degrees of water tightness required. Each joint shall be completely wrapped in geo-fabric overlapping itself and the joint at least 18". Lifting holes shall be plugged according to the manufacturer's recommendations. A sheet of geo-fabric shall be placed over the plugged lifting hole and pipe extending 18" from either side of the hole.

Trenches shall be kept as dry as possible during bedding, laying and jointing and for as long a period as required until the trench is backfilled. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to offset conditions that might tend to move the pipe off line or grade. The greatest care shall be used to secure water tightness and to prevent damage to or disturbing of the joints during the backfilling process, or at any other time.

After the trench foundation has been properly graded to receive the pipe, the pipe shall be carefully lowered into the trench with approved methods. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. All damaged pipe shall be replaced at the Contractor's expense.

All joints shall be left exposed for inspection purposes during the working day and a suitable ladder affording easy and safe access for such inspection shall be furnished.

The Contractor at his own expense shall make any defects due to settlement good.

- 1) **Mortar Joints:** The mortar in the joints shall be composed of 1 part Portland cement and two parts clean sharp sand with 15% hydrated lime, by volume, added to the mixture. The pipe shall be clean and moist when mortar is applied. The lower portion of the bell or groove shall be filled with mortar sufficient to bring the inner surface flush and even when the next joint is fitted into place. The remainder of the joint shall then be filled with mortar and a bead or ring of mortar formed around the outside of the joint. The application of mortar to the inside of joints may be delayed until fill in is completed where the pipe is in excess of 30 inches in diameter. The inside of all mortar joints shall be clean and smooth upon completion of the work. Completed mortar joints shall be cured and protected by permanently wrapping the exposed outside of the mortar joint with a layer of 30# roofing felt or a nonwoven Geotextile fabric.
  - 2) **Flexible Plastic Joint:** Flexible joints meeting the requirements of paragraph [2.2.9. Preformed Plastic Gaskets](#) may be used in lieu of mortar joints. However, the outside of the pipe must still be wrapped in fabric.
  - 3) **Wrapping Joints:** Wrap each storm drainage pipe joint with a non-woven Geotextile fabric. Fabric is to be placed a minimum of 18 inches on each side of the joint and shall lap itself a minimum of 18 inches.
- G. **Laying Flexible Pipe:** Installation shall be in accordance with AASHTO *Standard Specifications for Highway Bridges*, Section 26, Division II or ASTM A 798 and in conformance with the project plans and specifications. If there are any inconsistencies or conflicts, the Contractor must bring them to the attention of the Public Services Director. Flexible pipe shall be carefully placed on the foundation/bedding at the downstream end with the inside circumferential laps pointing downstream and with the longitudinal laps at the side or quarter points.
- Aluminum alloy pipe and paved invert pipe shall be handled with special care to avoid damage to pipe and/or coatings. When paved inverts are specified, paved invert pipe shall be installed with the paved invert centered on the bottom.
- The pipe sections shall be joined with coupling bands, fully bolted. Coupling bands for annular and helical corrugated aluminum pipe shall provide circumferential and longitudinal strength sufficient to preserve the alignment, prevent separation of the sections, and prevent infiltration.
- H. **Temporary Suspension of Work:** When the trench is left for the night or if pipe laying is suspended, all exposed ends of the pipe shall be plugged to keep out dirt, water, animals and other foreign matter or substances. This plugs shall be kept in the ends of the pipeline at all times when laying is not in actual progress.
  - I. **Cutting or Fitting Pipe:** Whenever a pipe requires cutting to bring a pipe to the required location, the work shall be done in a satisfactory manner with an approved cutting tool or tools, that will leave a smooth end at right angles to the axis of the pipe and not otherwise damage the pipe. The method of cutting pipe shall be in accordance with manufacturer's recommendations. Such cuts shall be made by the Contractor without extra compensation.
  - J. **Joining pipe of different materials: the Public Services Director shall approve all in-line connections joining pipes of different materials.**

**K. Joining pipe of different sizes:**

- 1) Connections shall be made in a skillful manner without damage to the main conduit and lateral lines shall not be allowed to protrude beyond the inner wall of the conduit. These joints shall be neatly and tightly made with Portland cement mortar. Taps are not to be made to the line unless approved by the Public Services Director.
- 2) **New pipe reducer fittings:** Provide reducer fittings from the larger to the smaller pipe that are manufactured for that purpose and approved by the City Public Services Director.
- 3) **Existing pipe reducer fittings:** Where pipes of different materials as well as different sizes are joined, the reducer fitting material shall match the material of the larger pipe and approved by the Public Services Director.

**3.1.2 REINFORCED CONCRETE PIPE**

- A. Pipe support for pipe shall provide uniform bearing for the pipe barrel along its entire length. The pipe shall be carefully laid on the prepared foundation/bedding, groove end upgrade with the tongue fully inserted and each joint checked for alignment and grade as the work proceeds.
- B. Minimum pipe bedding class: See [Section 02275, Trenching, Backfilling, and Compaction of Utilities, paragraph 3.3.2](#) for minimum bedding requirements.
- C. Pipe with varying wall class must not be mixed between manholes or boxes.
- D. **Bury Limitations:** [Table 26.1](#) shall govern as the maximum allowable bury for concrete storm pipe:

<b>Table 26.1</b>				
<b>Bury Limitations on RCP (15 through 60 inches)</b>				
<b>Pipe Class</b>	<b>Maximum Depth of Bury<sup>a</sup></b>			<b>Max Trench Width (feet)</b>
	<b>Class III (feet)</b>	<b>Class IV (feet)</b>	<b>Class V (feet)</b>	
15-inch	9.5	14.5	23	4.0
18-inch	9.5	15.0	32.5	4.0
24-inch	11.5	23.0	50	4.0
30-inch	11.0	19.5	44.5	5.0
36-inch	10.5	18.0	35	6.0
42-inch	11.0	19.0	36.5	6.5
48-inch	11.5	19.5	37.5	7.0
54-inch	12.0	20.0	38.5	7.5
60-inch	12.0	20.5	38.5	8.0

<sup>a</sup> Based on saturated clay weighing 120 pcf, trench width as specified, class C stone bedding, 1350 plf per ft of internal diameter for class III and 2000 plf per ft of internal diameter for class IV, 3000 plf per ft of internal diameter for class V, D-0.01 crack

- E. Join concrete pipe using either mortar or bitumastic material to seal joint.

- F. Each joint shall be wrapped in a non-woven geo-fabric overlapping the joint and itself by at least 18". Geo-fabric shall also be placed over lifting pinholes after they have been properly plugged in accordance with the manufacturers' recommendations.
- G. As each joint is laid, visually inspect to be certain that no jointing compound gasket, or trash is protruding from the joint or lying inside the pipe.

### 3.1.3 PLAIN CONCRETE PIPE

- A. Plain Concrete Pipe is approved for storm uses in non-traffic bearing situations only. The pipe shall be carefully laid on the prepared foundation/bedding, bell end up grade with the spigot fully inserted and each joint checked for alignment and grade as the work proceeds.
- B. Pipe support for pipe shall provide uniform bearing for the pipe barrel along its entire length.
- C. Minimum pipe bedding class: see [3.1.2. paragraph B](#), above.
- D. Pipe with varying wall class must not be mixed between manholes or boxes.
- E. Bury Limitations: See [Table 26.2](#), below.

Pipe Diameter	Maximum Depth of Bury Non Reinforced (feet)
15-inch	9.5
18-inch	10.5
21-inch	11
24-inch	11.5

- F. Join concrete pipe using either mortared or bitumastic material, such as Ram-Nek, to seal joints. Each joint shall be wrapped in a non-woven geo-fabric overlapping the joint and itself by at least 18". Geo-fabric shall also be placed over lifting pinholes after they have been properly plugged in accordance with the manufacturers' recommendations.
- G. As each joint is laid, visually inspect to be certain that no jointing compound, gasket, or trash is protruding from the joint or lying inside the pipe.

### 3.1.4 DOUBLE WALLED CORRUGATED HDPE PIPE:

- A. Pipe support shall provide uniform bearing for the pipe barrel along its entire length. The pipe shall be carefully laid on the prepared foundation/bedding and each joint checked for alignment and grade as the work proceeds. Each joint

shall be wrapped in a non-woven geo-fabric overlapping the joint and itself by at least 18”.

- B. Installation of double walled corrugated exterior/smooth interior HDPE pipe shall be in accordance with ASTM D2321, *Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe, latest revision* and as directed by the Public Services Director.
- C. Minimum pipe bedding class: See Division 02275, *Trenching, Backfilling, and Compaction of Utilities*, paragraph 3.3.2 for minimum bedding requirements.
- D. Backfill and compaction shall conform to the applicable provisions of Division 02275, *Trenching, Backfilling, and Compaction of Utilities*. To prevent displacement of pipe, backfill shall be brought up evenly on both sides of the pipe. Backfill shall be suitable material such as free-draining sands and gravel conforming to ASTM D2321, Class I, II or III (see also Division 02275, *Trenching, Backfilling, and Compaction of Utilities*, paragraph 2.1.1 for F for satisfactory soils). Lift thickness and compaction requirements for backfill shall conform to the requirement of Division 02275, *Trenching, Backfilling, and Compaction of Utilities*, Tables 2275.3 and 2275.4.
- E. **Bury Limitations:** Minimum cover over pipe shall be 18 inches in a quality backfill envelope and where subject to traffic loads. Non-traffic areas shall also have a minimum of 18 inches of fill in a quality backfill envelope. Maximum cover over pipe shall be limited to 10 feet. At the discretion of the Public Services Director, deeper bury may be permitted provided calculations are submitted and sealed by a NC Professional Engineer for the proposed application.
- F. Leakage testing: Leakage rates of pipe shall not exceed 50 gallons/inch diameter/mile/day.

### 3.2 MANHOLE CONSTRUCTION FOR STANDARD MANHOLES AND DROP INLET BASES

- A. **Standard Manholes and Drop Inlet Bases:** Manholes shall be constructed in accordance with [standard details 633.01 through 634.02](#) with the following exceptions:

Flexible boots and precast concrete inverts will not be required.

Joints will be as specified in the product section of this specification.

The pipe opening in precast units shall be at least 4 but not more than 8 inches larger than the outside diameter of the pipe. Pipe openings shall be formed, drilled, or neatly cut as approved by the Engineer.

The Contractor may use brick and masonry block or concrete pipe cutoffs in conjunction with mortar to fill the void between pipe culverts and precast structures. Such materials shall be thoroughly wetted and bonded with mortar. The remaining exterior and interior void shall be filled and sealed/slicked with mortar to the contour of the precast structure.

The standard joint shall be sealed on the interior of the structure, after installation, with a non-shrink hydraulic cement mortar.

Plug all weep holes with mortar.

Pour concrete inverts in all structures. Concrete shall be in compliance with products section for miscellaneous concrete of these specifications. Shape manhole channel with a smooth semicircular bottom matching inside diameter of the connecting pipe/pipes. Change directions of flow with a smooth curve of as large a radius as the manhole size will permit. Change size and grade of channels gradually and evenly. Shape the shelf to provide a slope between 1 and 2 inches per foot towards the invert.

Manholes shall be installed plumb.

- B. **Adjustments:** The Contractor shall exercise care in the ordering of structures so that the use of brick for leveling and adjustments can be minimized. Where adjustment of a manhole is required, grade rings shall not be used unless otherwise approved by the Public Services Director. Where adjustment of the inlet is required, the use of bricks is approved, provided that the entire void between the flat-top and inlet is also filled with brick and mortar to uniformly distribute loading of the inlet. The depth of bricks shall not exceed 12 inches before removal of the cone or flat-top is necessary for adjustment (see [standard detail C06.03](#)).

On all storm manholes, a mastic joint material shall be placed between the frame and cover and the cone or grade ring.

When applicable, during the installation of manholes, if frame and cover is near or within wheel path in roadway, turn cone to place the frame out of wheel path.

- C. **Replacement/Rehabilitation of Existing Manholes:**

When a new manhole is necessary, the old manhole must be completely removed and a new precast manhole set in its place. Where the old manhole is of satisfactory quality, the Contractor will make connection thereto as directed by the Public Services Director at no additional cost even if it is necessary to modify the bottom of the manhole to meet the new grade. Such extras are considered incidental to the manhole connection cost.

### 3.3 CONSTRUCTION OF MISCELLANEOUS APPURTENANCES

End walls and other miscellaneous storm drainage items shall be constructed in accordance with the latest edition of the NCDOT *Standard Specifications For Roads and Structures*.

### 3.4 ABANDONING STORM DRAINAGE LINES & MANHOLES

- A. **Storm lines:** Unless directed otherwise by the Public Services Director, when an existing storm drainage line is designated to be abandoned in place, the low end of the line is to be plugged and lean concrete grout (flowable fill) pumped into the line until line is completely filled.



- B. **Manholes:** When an existing manhole, either partially or wholly, is designated to be abandoned and the storm lines, either entering or exiting the manhole, have been abandoned according to the preceding paragraph, the upper portion of the manhole shall be removed to a minimum of 18 inches below the proposed finished grade, or as determined by the Public Services Director, NCDOT #57 stone dumped into the manhole, and the stone vibrated to effect consolidation of the stone. The remainder of the fill between the top of the manhole and the finished subgrade is to be backfilled as follows. Where the manhole is located within a roadway right of way, backfill with NCDOT # 57 Stone and consolidate. Outside roadway right of ways, filter fabric shall be placed over the stone, suitable material of a compactable nature shall be placed over the top of the manhole, and the material tamped.

### 3.5 SLOPE ANCHORS

All lines on slopes equal to or greater than 20% slope shall have concrete anchors placed around the pipe directly below the bell end of the line. The anchors shall be spaced every other joint unless otherwise shown on the plans and constructed to the dimensions shown on the construction.

### 3.6 EXCAVATION OF DRAINAGE CHANNELS

- A. Open storm drainage channels and ditches shall be graded and shaped in accordance with the elevations, slopes, widths, and lengths indicated on the plans except that the side slopes shall be 3:1 or flatter. The outfall elevation of the new channels and ditches shall be graded to match the flow elevations of all existing or natural channels, unless indicated or specified otherwise.
- B. The drainage channels shaped with fill materials shall be compacted within the limits and in accordance with the related backfill work specified elsewhere.
- C. The drainage channels shall be prepared, seeded, and mulched in accordance with the related work specified elsewhere. Where indicated on the drawings, specified, or otherwise directed by the Public Services Director, erosions control measures, such as temporary liners, rip rap, concrete liners, etc., shall be provided.

### 3.7 PLACEMENT OF RIP RAP AND RIP RAP BEDDING

Placement of Rip Rap and fabric shall conform to Section 876 – *Rip Rap* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision.

### 3.8 SUBSURFACE DRAINAGE

Installation of subsurface drainage systems shall conform to the requirements of Section 815 – *Subsurface Drainage* of the NCDOT *Standard Specifications for Roadways and Structures*, latest revision using non-woven needle-punched fabric.

### 3.9 INSPECTION

At any time during construction up to and including completion of entire pipe installation, the Public Services Director may inspect the work in part or as a whole in order to satisfy himself/herself that every portion of the project has been faithfully carried out in accordance with the plans, specifications, and standard details, as applicable.

If, in the opinion of the Public Services Director, a defect exists in the pipeline or its appurtenances, in some place not accessible except by uncovering, the Public Services Director may order the line to be uncovered. If it is found that after the pipe has been uncovered at the order of the Public Services Director, no defect exists or that the defects were not the fault of the Contractor, then the expense so incurred by the Contractor shall be borne by the City.

Flush all sand, dirt, and debris from the lines prior to inspection. Provide lights and mirrors and inspect lines in the presence of the City's representative.

Inspect the system for conformance with line and grades shown on the plans and provide record drawing measurements on record drawings.

**Visual Inspection:** All lines and manholes shall be visually inspected by the City of Jacksonville from every manhole by use of mirrors. At the direction of the Public Services Director, areas of questionable construction may be inspected by the City using television cameras. The lines shall exhibit a fully circular pattern when viewed from one manhole to the next. Lines, which do not exhibit a true and correct line and grade, have obstruction or structural defects, shall be corrected to meet these specifications and the barrel left clean for its entire length.

**Laying Tolerance:** Place pipe to the grades and alignment shown on the plans and within a tolerance of 1:1000 vertical and 1:500 horizontal, unless otherwise directed by the Public Services Director.

### 3.10 MAINTENANCE

The developer shall maintain all pipe installations in such a condition that they will function continuously from the time the pipe is installed until the development/project is accepted for maintenance by the City. Furthermore, soil erosion and sedimentation control measures shall be installed wherever necessary, including at curb inlets for example, and maintained for the duration of the development until the project is fully stabilized. Once permanent groundcover has been established, temporary erosion control measures shall be removed and the disturbed areas landscaped and seeded.

### 3.11 MEASUREMENT & PAYMENT

See Section 1.4 of 00950, *Measurement and Payment*.

**END OF SECTION 02630**

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