SECTION 5 - MATERIALS

5.01 INTRODUCTION

The following Section provides a description of materials acceptable for the construction of gravity sanitary sewers, force mains, manholes and their appurtenances within Fall Creek Regional Waste District. Use of other materials not specified herein will be allowed only with the written approval and authorization of the General Manager of Fall Creek Regional Waste District.

5.02 GRAVITY SANITARY SEWERS

A. GENERAL

The Fall Creek Regional Waste District currently allows the use of the following pipe materials meeting or exceeding the minimum requirements/specifications set forth herein for the construction of gravity sanitary sewers:

- Polyvinyl Chloride Pipe (PVC)
- Ductile Iron Pipe (DIP)
- Truss Pipe
- High Density Polyethylene Pipe (HDPE)

VITRIFIED CLAY PIPE (VCP) is not an approved material for the construction of sanitary sewers within Fall Creek Regional Waste District.

In general, all gravity sanitary sewer pipe shall be the bell and spigot type with elastomeric seal joints and smooth interior walls meeting or exceeding all requirements set forth in the latest ASTM Standard referenced herein.

THE DISTRICT DOES NOT ALLOW THE USE OF SOLVENT CEMENT JOINT FOR GRAVITY SANITARY SEWERS.

Each length of pipe shall be marked per the requirements of the respective ASTM Standard.

Upon request, the Contractor at his own expense shall furnish the District with copies of all material tests required by applicable ASTM Standards.

B. GRAVITY SANITARY SEWER MATERIALS

Each pipe material acceptable for gravity sanitary sewer construction is separated into its own subsection for ease of revision and/or updating as follows:

1. POLYVINYL CHLORIDE PIPE

a. Pipe: Polyvinyl chloride (PVC) gravity sanitary sewer pipe shall be the integral wall bell and spigot type with elasto-meric seal joints and smooth inner walls meeting or exceeding all of the requirements set forth in ASTM D-3034 for pipe diameters 15-inches or less and meeting or exceeding all of the requirements set forth in ASTM F-679 for pipe diameters greater than 15-inches.

For diameters 15-inches or less, the pipe shall have a minimum cell classification of 12454-B or 12454-C and for diameters greater than 15-inches, the pipe shall have a minimum cell classification of 12454-C; with all pipe having a minimum tensile strength of 34.50 MPA as defined in ASTM D-1784.

PVC sanitary sewer pipe shall have a minimum pipe stiffness of 46 psi for each diameter when measured at 5% vertical ring deflection and tested in accordance with ASTM D-2412.

b. Joints: Flexible gasketed joints shall be compression type so that when assembled, the gasket inside the bell will be compressed radially on the pipe spigot to form a water tight seal. The assembly of joints shall be in accordance with the pipe manufacturer's recommendations and ASTM D-3212. The gaskets sealing the joint shall be made of rubber of special composition having a texture to assure a watertight and permanent seal and shall be the product of a manufacturer having at least five (5) years experience in the manufacture of rubber gaskets for pipe joints. The gasket shall be a continuous ring of flexible joint rubber of a composition and texture which is resistant to common ingredients of sewage, industrial wastes and groundwater, and which will endure permanently under the conditions likely to be imposed by this service.

The gasket shall conform to the requirements of ASTM F-477.

All field-cutting of pipe shall be done in a neat, trim manner using a hand or power saw, and the cut end shall be beveled using a file or wheel to produce a smooth bevel of approximately 15 degrees and be a minimum depth of one-third the pipe wall thickness. Field cut pipe will only be allowed to be installed at manholes, at prefabricated tees and wyes, and at the connection of new sanitary sewer to existing sanitary sewer.

NO SOLVENT CEMENT JOINTS SHALL BE ALLOWED.

NOTE: Only smooth exterior pipe shall be used at manhole connections.

c. Fittings: only manufactured fittings made of PVC plastic having a cell classification of 12545-B or 12545-C as defined in ASTM D-1784 shall be used.

SADDLE CONNECTIONS SHALL NOT BE ALLOWED FOR NEW CONSTRUCTION.

d. Design: The minimum wall thickness for PVC sewer pipe greater than 15-inches in diameter shall conform to T-1 as specified in ASTM F-679

e. Marking: The date of manufacture, class of pipe, specification designation, size of pipe, name or trademark of manufacturer, and identification of plant/location shall be legibly marked on the outside of each pipe section in accordance with the ASTM D-3034.

f. Certification: The Contractor shall upon request furnish the District with manufacturer's certification stating that the pipe supplied meets or exceed all requirements of the applicable ASTM standards and these Standards.

g. Any pipe and fittings installed deeper than 15 feet shall be SDR-26.

2. REINFORCED CONCRETE PIPE

REINFORCED CONCRETE PIPE (RCP) IS PERMITTED FOR THE CONSTRUCTION OF GRAVITY SANITARY SEWERS OF ALL SIZES.

a. Material: All reinforced concrete pipe shall be Class III, IV or V in accordance with ASTM C-76, latest edition; wall thickness "B" or "C" per site conditions and be manufactured from Portland Cement and aggregate as specified herein.

Reinforced Concrete Low-Head Pressure Pipe in accordance with ASTM C-361 shall be allowed for gravity sanitary sewer construction.

b. Portland Cement: Portland Cement for manufacture of concrete pipe and fittings shall be Type I or Type III and shall conform to ASTM C-150. Upon request by the District, the Contractor shall furnish manufacturer's certificate stating the type of cement used in the manufacturer of the pipe furnished.

c. Aggregate: The aggregate for manufacture of concrete pipe and fittings shall conform to ASTM C-33 except that the requirement for gradation shall not apply. Upon request by the District, the Contractor shall furnish manufacturer's certificate stating the type of aggregate used in the manufacture of the pipe furnished.

d. Steel Reinforcement: Steel reinforcement shall be in accordance with requirements of the applicable table in ASTM C-76. Reinforcement shall extend full into bell or spigot ends for pipes 36" and larger and shall extend full into the bell of rubber gasketed pipes 12" and larger. Elliptical reinforcement shall not be permitted. Longitudinal reinforcement shall be continuous and all reinforcement shall have a minimum concrete cover of 1 inch.

e. Lift Holes: Lift Holes shall not be permitted.

f. Joints: Concrete pipe shall be furnished with joints using either concrete bell and spigot or zinc coated steel bell and spigot rings or rubber seal and rings (Anderson Seal or an approved equal). All types of joints shall have a groove on the spigot for a rubber "O" ring gasket.

Pipe joints using concrete bell and spigot or zinc coated steel bell and spigot rings shall conform to ASTM C-361 except that the gaskets shall be as specified hereinafter. Pipe joints using rubber gaskets shall conform to ASTM C-443. The steel shall be sealed with a rubber gasket conforming to ASTM C-443 so that the joint will remain watertight under all conditions of service. The steel skirt (minimum 5 3/4 inches in

length and fabricated from 16 gage metal) shall be continuously welded in the inside face of the steel spigot ring and to the longitudinal reinforcement.

Profile gasket type joints using a self-lubricated gasket (Forsheda Style 138 or approved equal) on a single offset spigot and formed bell are acceptable. Joints shall be sealed with a profile rubber gasket conforming to ASTM C-443 so that the joint will remain watertight under all conditions of service.

Only one style of joint system will be permitted between a manhole run of pipe.

g. Absorption Limit: Absorption of the reinforced concrete pipe shall not exceed 6% of the dry weight.

h. Marking: The date of manufacture, class of pipe and specification designation, size of pipe, name or trademark of the manufacturer, and identification of plant shall be legibly marked on the outside of each section of pipe per the ASTM requirement.

i Specials: Specials shall conform to the specifications for straight pipe insofar as applicable. Special design or construction necessary for specials shall be subject to approval by the District on a case-by-case basis.

j. Gaskets: The gaskets sealing the joint shall be made of rubber of special composition having a texture to assure a watertight and permanent seal and shall be the product of a manufacturer having at least five (5) years experience in the manufacture of rubber gaskets for pipe joints. The gasket shall be a continuous ring of flexible joint rubber of a composition and texture which is resistant to common ingredients of sewage, industrial wastes and groundwater, and which will endure permanently under the conditions likely to be imposed by this service. The gasket shall conform to the requirements of ASTM C-443.

k. Sanitary Sewer Lateral Connections: Connections to the RCP sewer shall be subject to District approval. Where lateral connections must be made to the RCP sewer, a rubber connector with stainless steel clamp (KOR-N-SEAL) shall be used. The connector shall be the sole element relied on to assure a flexible watertight seal of the pipe.

The rubber for the connector shall comply with ASTM C-923 and shall be resistant to ozone, weather elements, chemicals including acids and alkalis, animal and vegetable fats, oils, and petroleum products from spills.

The stainless steel elements of the connecter shall be totally non-magnetic Series 305 stainless steel. The stainless steel clamp shall be capable of sustaining applied torque in excess of eighty (80) inch-pounds. It shall be the responsibility of the Contractor to submit details of the proposed connection to the District for approval. Connections not

approved by the District shall be subject to removal and replacement with an approved adaptor.

l. Certification: The contractor shall upon request furnish to the District manufacturers' certification stating that all pipe materials and pipe appurtenances supplied meet or exceed the applicable requirements of the ASTM standards and these Standards.

3. DUCTILE IRON PIPE ***SEE SHEET C8.10 FOR POLY-LINED SPECIFICATIONS FOR DUCTILE IRON PIPE.**

a. Material: Ductile Iron Pipe in diameters from eight (8) inches through thirty-six (36) inches shall be centrifugally cast and shall conform to ANSI Specifications A21.51 and AWWA C-151, latest revision. Ductile Iron Pipe shall be Class 50, 51, 52 or 54 wall thickness dependent upon site conditions and provided in minimum laying lengths of eighteen (18) feet. Ductile Iron Pipe larger than thirty-six (36) inches in diameter shall be approved on a case-by-case basis by the District.

b. Fittings: Fittings shall be standardized for the type of pipe and joint specified and shall comply with ANSI A-21.10, AWWA C-110.

c. Joints: Mechanical joints, slip or flanged joints shall be provided.

Mechanical joints and accessories shall conform to AWWA Standard C-111, ANSI A-21.11. The bolts and nuts shall be corrosion resistant high strength alloy steel.

The o-ring gaskets sealing the slip joint shall be made of rubber of special composition having a texture to assure a watertight and permanent seal and shall be the product of a manufacturer having at least five (5) years experience in the manufacture of rubber gaskets for pipe joints. The gasket shall be a continuous ring of flexible joint rubber of a composition and texture which is resistant to common ingredients of sewage, industrial wastes and groundwater, and which will endure permanently under the conditions likely to be imposed by this service. The gasket shall conform to the requirements of AWWA C-111 (ANSI A-2111).

Flanged joints shall be manufactured with laying dimensions, facing and flange detailed in accordance with AWWA Standard C-115 (ANSI A21.15) Class 125.

d. Weights and Marking: Weights of pipe 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 numbers, 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.

e. Certification: The Contractor shall upon request furnish the District with certified reports stating that inspection and specified tests have been

made and that the results thereof comply with the applicable ANSI Specifications and these Standards for each.

4. HIGH DENSITY POLYETHYLENE PIPE

a. Pipe and fittings: HDPE pipe shall be the wall bell and spigot type with elastomeric seal joints and smooth interior walls. Pipe and fittings shall be made from high molecular weight high density polyethylene material meeting the requirements of ASTM D-3350 Cell Class PE 334433C. All material shall be virgin resin.

Only manufactured wyes, tees, adaptors of the bell and spigot type shall be used. NO SADDLE CONNECTORS SHALL BE USED.

b. Joints: Flexible gasketed joints shall be compression type so that when assembled, the gasket inside the machined groove on the pipe spigot will be compressed radially in the pipe bell to form a watertight seal. Joints shall meet the requirements of ASTM D-3212.

c. Gaskets: The gaskets shall be made of a rubber of special composition having a texture to assure a watertight and permanent seal and shall be the product of a manufacturer having at least five (5) years experience in the manufacture of rubber gaskets for pipe joints. The gasket shall be a continuous ring of flexible joint rubber of a composition and texture which is resistant to common ingredients of sewage, industrial wastes and groundwater, and which will endure permanently under the conditions likely to be imposed by this service. The gasket shall conform to all requirements of ASTM F-477.

d. Nominal ring stiffness: ALL HDPE PIPE SHALL HAVE A MINIMUM PIPE STIFFNESS OF 46 PSI WHEN MEASURED IN COMPLETE ACCORDANCE WITH ASTM D-2412. The Ring Stiffness Constant (RSC) classification value for the pipe between bell and spigot shall comply with the minimum value of 57 lb/ft.

Installation: The installation shall be in conformance with specifications for installation of flexible pipe as per all applicable ASTM requirements including F-412, D-2321, D-2412, D-3212, and D-3350

e. Certification: Upon request the contractor shall furnish a certificate of conformance to the required ASTM Standards, these Standards and other conformance certifications in the form of affidavits of conformance, test results and/or copies of test reports.

f. Markings: Each length of HDPE sanitary sewer shall be clearly marked with the Manufacturer's Name, Tradename or Trademark, Nominal pipe size, Pipe Stiffness, production Code/Extrusion Code Material Cell Class Designation and ASTM number.

5. COMPOSITE WALL/TRUSS PIPE

a. Material: PVC Truss Pipe shall be the wall bell and spigot type with elastomeric seal joints and smooth inner walls meeting or exceeding all

of the requirements set forth in ASTM D-2680 for pipe diameters eight (8) inches to fifteen (15) inches.

PVC Truss Pipe shall have a minimum pipe stiffness of 200 psi for each diameter when measured at 5% vertical ring deflection and tested in accordance with ASTM D-2412.

The fill material shall be Portland Cement, Perlite Concrete or other inert fill material exhibiting the same degree of performance.

b. Joints: Flexible gasketed joints shall be compression type so that when assembled, the gasket inside the bell will be compressed radially on the pipe spigot to form a watertight seal. The gaskets sealing the joints shall be made of rubber of special composition having a texture to assure a watertight and permanent seal and shall be the product of a manufacturer having at least five (5) years experience in the manufacture of rubber gaskets for pipe joints. The gasket shall be a continuous ring of flexible joint rubber of a composition and texture which is resistant to common ingredients of sewage, industrial wastes and groundwater, and which will endure permanently under the conditions likely to be imposed by the requirements of ASTM F-477.

NO SOLVENT CEMENT JOINTS SHALL BE ALLOWED.

All field-cutting of pipe shall be done in a neat, trim manner using a hand saw per manufacturer's recommendations. Care shall be taken to protect the filler material. All field cuts shall be sealed according to manufacturer's recommendations.

c. Fittings: Only manufactured fittings shall be used.

d. Certification: Upon request the contractor shall furnish to the District a copy of the manufacturer's test report or a statement by the manufacturer that the material has been sampled, tested, and inspected in accordance with ASTM d-2680 and these Standards. Each certification shall be signed by an authorized agent of the manufacturer or seller.

e. Markings: The pipe barrel shall be marked at five (5) foot intervals per ASTM D-2680 with the following:

1. Manufacturer's name, tradename or trademark;
2. ASTM D-2680;
3. PVC Composite pipe;
4. Extrusion code, including date and location of manufacture; and
5. Nominal pipe size.

5.03 SANITARY SEWER FORCE MAINS

A. GENERAL

The Fall Creek Regional Waste District allows the use of the following pipe materials meeting or exceeding the minimum requirements set forth herein, for the construction of sanitary sewer force mains.

- Polyvinyl Chloride Pipe
- High Density Polyethylene Pipe (HDPE)

Each pipe segment shall be clearly marked per the requirement of the respective ASTM, AWWA and/or ANSI Standard.

B. ANCHORAGE

Force mains shall be anchored to resist thrusts that develop at bends, angles, tees, etc. in the force main pipe. The magnitude of the forces to be resisted shall be calculated and provided as part of the Engineer's design submittal. The required anchorage shall be attained by installing restrained pipe joints, concrete thrust blocks or anchor blocks based upon sound engineering practices. Anchorage design at force main fittings shall be based on pipeline pressures of at least 25 percent greater than the maximum pump design shut off head plus a water hammer allowance with an appropriate factor of safety.

C. AIR/VACUUM RELIEF VALVES

Sanitary sewer force mains shall be designed to avoid the need for air or vacuum release lines. If possible, force mains shall be designed without high points and with the top of the force main below the hydraulic grade line at the minimum pumping rate so that relief valves will not be needed.

If high points in the force main cannot be eliminated, an A.R.I. air release valve or approved equal shall be installed at each significant high point where air could become trapped. The air release valve shall be installed in a manhole structure in accordance with the requirements of section 5.04, and provisions shall be required for draining the structure. A high point shall be considered significant if it is 2 feet or more above the minimum hydraulic gradeline, or when pumping is intermittent above the static head line.

D. FORCE MAIN MATERIALS

Each pipe material acceptable for force main construction is described in the following individual subsections for ease of discussion and revisions:

1. POLYVINYL CHLORIDE (PVC) FORCE MAIN

a. PIPES:

PVC force main pipe shall conform to ASTM Specification D-2441, Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe (SDRPR). The material used shall conform to ASTM Specification D-1784, Standard Specification of Rigid Polyvinyl Chloride and Chlorinated Polyvinyl Chloride compounds, Class 12454-B (PVC 1120). The minimum pressure class/SDR rating acceptable shall be Class 200/SDR 21.

The pipe fittings shall be pressure rated in accordance with recommendations of the plastic pipe institute. Pressure class and standard dimension ratios (SDR) shall be as follows:

Class 200:	SDR 21
Class 250:	SDR 17
Class 315:	SDR 13.5

All plastic pipe and couplings shall bear identification markings in accordance with Sections 2.5.2 and 2.5.3 of AWWA C-900-75, which shall include the National Sanitation Foundation (NSF) seal of approval. In addition, the plain end of each pipe length shall have two (2) rings, one (1) inch apart, painted around the pipe at the proper location to allow field checking of the correct setting depth of the pipe in the bell or coupling.

b. JOINTS:

Joints shall be bell end or coupling push-on type. No glue allowed. The push-on joint and joint components shall meet the requirements for ASTM Specification D-3139, Joint for the Plastic Pressure Pipe, using Flexible Elastomeric Seals. The joint shall be designed so as to provide for the thermal expansion and contraction experienced with a total temperuasu change of seventy-five (75) degrees F in each joint of pipe. Details of the joint design and assembly shall be in accordance with joint manufacturer's standard practice.

The lubricant shall have no deteriorating effects on the gasket or the pipe. The lubricant containers shall be labeled with manufacturer's name.

Gaskets shall meet all applicable requirements of ANSI Standard A-21.11.

c. FITTINGS:

Fittings shall be of the same material and class as the pipe with joints and gaskets to properly fit the PVC pipe.

d. INSTALLATION:

The installation shall conform to the requirements of the manufacturer, the AWWA Standard and as indicated on the plans and specified herein.

e. MARKING AND CERTIFICATION:

Marking and certification requirements - see Section 5.02 b.1 e and f

2. HIGH DENSITY POLYETHYLENE PIPE (HDPE) FORCE MAIN

a. Pipe dimensions shall conform to the IPS dimensions associated with HDPE pipe unless otherwise noted.

b. Pipe and fittings: HPDE force main pipe shall conform to ASTM Specification D-3350, Standard Specification for Polyethylene (PVC) Plastic Pipe and fittings materials. All material shall be virgin resin. Pressure class and dimension ratios (DR) shall be as follows:

Class 100:	DR 17
Class 128:	DR 13.5
Class 160:	DR 11
Class 200:	DR 9

Fittings for the polyethylene pipe line shall be molded or fabricated from the same material as specified for hereinbefore for the HDPE pipe. All run-of-the-pipe fittings shall be fusion welded into the pipeline. Wye branches shall be true wyes.

c. Joints: All HDPE is to be joined by leakproof, thermal, butt fusion joints. All fusion must be done by certified personnel. Threaded or solvent cement joints and connections are NOT permitted.

d. Nominal ring stiffness: ALL HDPE PIPE SHALL HAVE A MINIMUM PIPE STIFFNESS OF 46 PSI WHEN MEASURED IN COMPLETE ACCORDANCE WITH ASTM D-2412. The Ring Stiffness Constant (RSC) classification value for the pipe between bell and spigot shall comply with the minimum value of 57 lb/ft.

Installation: The installation shall be in conformance with specifications for installation of flexible pipe as per all applicable ASTM requirements including F-412, D-2321, D-2412, D-3212, and D-3350

e. Certification: Upon request the contractor shall furnish a certificate of conformance to the required ASTM Standards, these Standards and other conformance certifications in the form of affidavits of conformance, test results and/or copies of test reports.

f. Markings: Each length of HDPE sanitary sewer shall be clearly marked with the Manufacturer's Name, Tradename or Trademark, Nominal pipe size, Pipe Stiffness, production Code/Extrusion Code Material Cell Class Designation and ASTM number.

5.04 SANITARY SEWER MANHOLES

A. GENERAL

Sanitary sewer manholes shall be installed at the end of each line segment; at all changes in grade, size, materials and/or alignment; at all intersections; and at distances not greater than 400 feet. Cleanouts shall not be substituted for manholes.

In unpaved/grassy areas manholes shall be designed and installed such that they extend a minimum of three (3) inches above finished grade to prevent water ponding. Positive drainage away from the manhole shall be provided. Manholes are not to be buried. All manholes are to be constructed a minimum of 1' above USGS 100 year flood plain.

B. TYPES OF MANHOLE CONSTRUCTION

The District will allow either Monolithic (Cast-in-Place) or Precast manholes conforming to the specifications herein.

C. MONOLITHIC (CAST-IN-PLACE) MANHOLES

Should a Contractor elect to build monolithic manholes, shop drawings showing at a minimum the concrete mix, steel reinforcement details, pipe connections and manhole dimensions shall be submitted to the District for approval of each structure to be built. The shop drawings shall have been reviewed and certified by a registered Professional Engineer prior to submittal to the District.

D. PRECAST MANHOLES (SEE FIGURES 5-1 THRU 5-3)

Precast reinforced concrete manholes including bases, risers/barrels, cones and flat slabs shall be constructed of either wet or dry cast Class A concrete meeting or exceeding the requirements of ASTM C-478, latest revision.

Precast reinforced concrete manholes shall be manufactured, tested and marked in accordance with ASTM C-478. Precast manholes shall be constructed with the base and the first riser section as one complete precast unit. Where used, precast manhole cones shall be the eccentric cone type.

"See Through" lift holes shall not be allowed on precast concrete manholes 48 inches in diameter or less. "See Through" lift holes are allowed on manholes greater than 48 inches in diameter. All lift holes shall be thoroughly wetted and completely filled with non-shrink mortar or epoxy grout; then smoothed and covered, both inside and out, with a trowelable grade butyl rubber base backplaster material to ensure water tightness. All joints between precast manhole elements shall be made with an approved rubber gasket in accordance with ASTM C-443, latest edition, and a 1/2-inch diameter non-asphaltic mastic (Kent Seal or equal as approved by F.C.R.W.D, conforming to AASHTO M-198 and Federal Specifications SS-521-A.

All manhole sections shall be steam or heat-and-water-mist cured and shall not be installed until at least five (5) days after having been cast. All cuts in manholes shall be core drilled.

E. MANHOLE BASES, INVERTS AND FLOW CHANNELS/BENCH WALLS

Monolithic or Precast manhole bases shall be of 6" minimum thickness for 4' diameter and 8" minimum thickness for larger diameters, and shall be constructed of Class A concrete having a minimum compressive strength of 4,000 psi. The bottom invert of all pipe entering a manhole shall be at least three (3) inches above the top of the base slab so that the finished sewer channel may be installed and shaped. The installation of the final sewer channel may be done at the point of fabrication of the precast base or cast-in-place.

The flow channels within manholes shall be an integral part of the precast base. The channels shall be shaped and formed for a clean transition with proper hydraulics to allow the smooth conveyance of flow through the manhole. The Bench wall shall be formed to the crown of the inlet and outlet pipes to form a "U" shaped channel as shown in Figures 5-1 and 5-2. The bench wall shall slope back from the crown at minimum 1/2-inch per

foot to the manhole wall. The outlet invert elevation of the manhole is to be 1/10th foot below the lowest inlet invert elevation(s). For connections to existing manholes, manholes shall be core drilled and flow channels shall be required and shaped as if it were a new manhole. Figure 5-6 provides generalized standards for the construction/layout of flow channels for manholes with numerous connections.

F. ADJUSTING RINGS

NO BRICK OR BLOCK SHALL BE USED IN THE CONSTRUCTION OF A MANHOLE OR TO ADJUST THE ELEVATION OF THE FRAME AND COVER.

Where one (1) solid riser or barrel section cannot be used, final adjustments in elevation of the frame and cover shall only be accomplished by the use of precast concrete adjusting rings per the detail as shown in Figure 5-4 or 5-4 B and conforming to ASTM C-478. Riser rings other than that shown in Figure 5-4 A or 5-4 B may be accepted based upon written aneed approval of the District. PVC adjusting rings are acceptable upon review by the District.

Rings shall be of a nominal thickness of not less than two (2) inches and not more than twelve (12) inches total of adjusting rings shall be allowed for adjustment of the manhole frame and cover to required elevation.

A watertight seal shall be provided between the cone and riser ring, each adjoining riser ring, and riser ring and casting by the use of two (2) rows of 1/2-inch extrudable preformed gasket material. The extrudable gasket material shall be placed as shown in Figure 5-4 A or 5-4 B. As an alternative to adjusting rings, a cast-in-place section as detailed in Figure 5-5 may be used.

G. CASTING, FRAME AND COVER

The type of frame and cover to be used shall be Neenah R-1772 AVH with Type B concealed pickhole lid or East Jordan Model 1022-1AGSMD manufactured by East Jordan Iron Works, per the detail shown on Figure 5-7. All castings shall conform to the requirements of ASTM and the dimensions as shown on Figures 5-1 thru 5-4 A or 5-4 B, and the following:

1. Casting shall be of uniform quality, free from blow holes, porosity, hard spots, shrinkage, distortion or other defects. They shall be smooth and well-cleaned by shot blasting or other approved method.
2. All castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Round frames and covers shall be of non-rocking design or shall have machined horizontal and vertical bearing surfaces to prevent rocking and rattling under traffic. All castings shall be fully interchangeable.
3. All weights shall not deviate from the tolerances permitted by ASTM Standards (i.e. ASTM A48-83 "Standard Specifications for Gray iron Castings").
4. No open pick holes shall be allowed.
5. Sanitary sewer manhole covers shall have the words "sanitary sewer" cast in the cover in letters two (2) inches in height.

H. EXTRUDABLE PREFORMED GASKET MATERIAL

A nominal 1/2-inch size butyl rubber base gasket material, conforming to AASHTO M-198 and Federal specification SS-S-210A shall be used for adjusting ring grooves; between adjusting ring and cone; between adjusting ring and casting; and in joints of precast manhole sections. The gasket material shall be as manufactured by Hamilton Kent-Seal, RUB'R-NEK-L-T-M by K.T. Snyder Company or an approved equal. A compatible primer or solvent as recommended by manufacturer to butyl base material shall be used to prepare surfaces prior to application of butyl base material.

I. TROWELABLE BUTYL RUBBER BACKPLASTER

Per Figures 5-1 thru 5-3, the exterior of the manhole from two (2) inches below the bottom riser ring on the cone section to and covering the base of the casting, including the voids on the outside joints of the riser rings shall be sealed with a trowelable grade butyl rubber base exterior backplaster material, 1/4 inch minimum thickness when dry.

Installation shall be as detailed in the figures attached.

J. SPECIAL TYPES OF MANHOLES

1. Outside drop connection

No inside drop manhole connections shall be allowed for new sewer construction. Inside drop connections to existing manholes shall only be allowed upon written approval of the District. Where a sanitary sewer or sanitary sewer lateral enters a manhole 24 inches or more above the invert of the outgoing sewer, the incoming sewer shall be connected to the manhole by means of an outside drop connection per Figure 5-8. Outside drop connections may be either precast or monolithically poured.

Base for Manhole with outside Drop Connection - The footing for the portion of the manhole under the drop shall be monolithically poured at the same time as the rest of the manhole footing. A minimum of three (3) 1/2 inch diameter reinforcing rods shall be placed on dowels into the footing. these rods shall be tied to the reinforcements. The rods shall be tied to the reinforcement as specified in ACI Building Code Requirements. The rods shall be extended as the vertical part of the drop is constructed. In addition, the drop shall be tied into each joint to precast concrete manhole with a minimum 1/4 inch rod to prevent any separation of the drop from the precast manhole.

Detailed drawings shall be submitted for approval for all field fabricated drop connections.

2. Special flood protected manholes

In areas susceptible to flooding, the top of the manhole shall be above the 100 year flood elevation. The Engineer shall identify the flood elevation on the plans and design the manhole to preclude the submergence of the manhole. No alternatives may be used without approval of the District.

K. MANHOLE DIAMETERS

The following are minimum manhole diameters for sanitary sewers entering/exiting a manhole at the following range of angles:

MANHOLE DIAMETERS		
	PIPES ENTERING / LEAVING AT	PIPES ENTERING / LEAVING AT
PIPE SIZE	0 – 45 BEND	45 – 90 BEND
8" – 21"	48"	48"
24"	38"	60"
27" – 30"	60"	60"
33" – 36"	60"*	72"

Pipes greater than 36 inches and up to 48 inches in diameter shall be per Figure 5-2.

Pipes greater than 48 inches in diameter shall be per Figure 5-3.

L. STEPS

Manhole steps shall be furnished.

M. SEWER PIPE TO MANHOLE CONNECTIONS

To connect a sanitary sewer to a manhole, either a flexible boot KOR-N-SEAL 1 or 2, flexible connector, cast-in-place Dura-Seal gasket, "A"-lock gasket or an approved equal shall be used. Connections to an existing manhole shall be a flexible boot KOR-N-SEAL or approved equal.

If the flexible boot connection is used, it shall be placed in the reinforced concrete manhole base and secured to the pipe by a stainless steel clamp. Flexible connectors shall conform to ASTM C-923.

The cast-in-place inflatable gasket shall conform to ASTM C-923.

All connections shall provide for a watertight seal between the pipe and manhole. The connector shall be the sole element relied upon to assure a flexible watertight seal of the pipe to the manhole.

*NOTE: 72" if the "A"-lock connector is used.

The rubber for the connector shall comply with ASTM C-923 and shall be resistant to ozone, weather elements, chemicals, including acids and alkalis, animal and vegetable fats, oils and petroleum products.

The stainless steel elements of the connector shall be totally non-magnetic Series 305 stainless steel. The stainless steel clamp shall be capable of sustaining applied torque in excess of eighty (80) inch-pounds. It shall be the responsibility of the Contractor to submit details of the proposed connection to the District for approval. Connections not

approved by the District shall be subject to removal and replacement with an approved adaptor.

All pipe connections to manholes and pump station wetwells need to address "boot inversion" at the sewer pipe to manhole connection point due to the potential for excessive hydrostatic pressure on the boot. In these situations the pipe connection and boot shall be encased with a quick set grout on the inside and a No. 4 slump concrete mix on the outside to prevent the boot from inverting.

N. REJECTION OF PRECAST MANHOLE SECTION

Precast reinforced concrete manholes, risers and tops shall be subject to rejection for failure to conform to any of the following specification requirements:

1. Fractures or cracks passing through the shell, except for a single end crack that does not exceed the depth of the joint;
2. Defects that indicate imperfect proportioning, mixing and molding;
3. Surface defects indicating honeycombed or open texture;
4. Damaged ends, where such damage would prevent making a satisfactory joint;
5. Infiltration into manhole;
6. The internal diameter of the manhole section shall not vary more than one (1) percent from the nominal diameter;
7. Not installed in conformance with Section 7;
8. Not clearly marked date of manufacturer, trade name, size designation part number, and ASTM number;
9. Having a deviation more than 1/4" from the straight edge at any point across the top of manhole cone section or riser ring; and/or
10. Having any visible steel bars along inside of outside surface of the manhole except for reinforcement stirrups or spacers used to position the cage during manufacture.

5.05 BUILDING SEWERS

Building sewers shall be either SDR 35, Schedule 80 or Schedule 40 PVC pipe conforming to ASTM D2241. Joints shall be flexible gasket push-on compression type.

VITRIFIED CLAY PIPE(VCP) SHALL NOT BE PERMITTED FOR BUILDING SEWER CONSTRUCTION.

END OF SECTION 5

REVISIONS

DATE	DESCRIPTION	BY

HWC ENGINEERING

INDIANAPOLIS - TERRE HAUTE
LAFAYETTE - MUNCIE - NEW ALBANY
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SPRINGBROOK ON 1A
SECTION 1

SANITARY SPECIFICATIONS

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REGISTERED
No. 10200309
STATE OF INDIANA
PROFESSIONAL ENGINEER

Sean M. Downey

DRAWN BY	
SMD	
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SMD	
DATE	
NOVEMBER 8, 2018	
SCALE	
N/A	
SHEET	

JOB NUMBER 2017-271-A

C8.7

SANITARY SPECIFICATIONS