

SECTION 6  
SANITARY SEWER SYSTEMS

6.1 GENERAL

This Section sets forth the general requirements for design, installation, and testing of sanitary sewer gravity collection and pressure transmission systems and pump stations. Additional information can be found in Section 4 (General Conditions), Section 9 (Standard Drawings), and Section 10 (Standard Plan Notes) and Section 13 (Technical Specifications).

6.2 SEWER COLLECTION SYSTEM DESIGN

The Engineer shall comply with the design and installation requirements as specified by Lee County Utilities, the Florida Department of Environmental Protection (FDEP), Lee County Department of Transportation (LCDOT), Florida Department of Transportation (FDOT) and any other relevant State and Local regulatory agencies.

A. Flow Demands

Flow demands for design shall be calculated on the basis of full development as known or projected. For phased developments, the design shall be based on total build out conditions for the development, or the anticipated service area of the proposed pump station.

**Average Day Flow** - The average daily flow for domestic use shall be calculated at the minimum rate as follows:

- Single-Family (SF) Residence = 100 gpd per capita, 2.5 persons per residence for a flow of 250 gpd per SF residence.
- Multi-Family (MF) Residence = 100 gpd per capita, 2.0 persons per residence for a flow of 200 gpd per MF residence.
- Mobile Home Park (MHP) Unit = 100 gpd per capita, 2.0 persons per unit for a flow of 200 gpd per MHP unit.
- RV Unit = 50 gpd per capita, 2 persons per unit; for a flow of 100) gpd per RV unit.
- Flow demands for commercial, industrial, and special-type developments shall be established from Florida Administrative Code FAC 64E-6 guidelines, existing records of the last year maximum three-month average, or by using the best available data.

An Equivalent Residential Unit (ERU) is defined as 250 gpd.

**Peak Hour Flow** - Sanitary sewer systems shall be sized to provide ample capacity for the required peak flow rates. The maximum required capacity shall be the product of the peak factor shown below times the cumulative average daily flow of the total service area:

	<u>Flow (ADF)</u>		<u>Peak Factor</u>
0 m <sup>3</sup> /d to 189 m <sup>3</sup> /d	(0 to 0.05 MGD)	(0 to 35 gpm)	3.5
>189 m <sup>3</sup> /d to 946 m <sup>3</sup> /d	(>0.05 to 0.25 MGD)	(>35 to 174 gpm)	3.0
>946 m <sup>3</sup> /d to 7572 m <sup>3</sup> /d	(>0.25 to 2.00 MGD)	(>174 to 1389 gpm)	2.5

B. Gravity Sewer Size Computation

Sanitary sewer pipes shall be sized to provide ample capacity for the required peak flow rates. The minimum allowable size for any gravity sewer, other than service connections, shall be 20 cm (8") in diameter. All gravity sewers pipes shall be designed at slopes providing minimum velocities of not less than 61 cm/s (2 fps) when flowing full, based on Manning's formula. The following minimum slopes shall be used as a design guideline:

<u>SANITARY SEWER PIPE DIAMETER</u>		<u>MINIMUM SLOPE cm/meter (Feet per 100 Feet)</u>
cm	<u>Inches</u>	
20.3	8"	0.40
25.4	10"	0.28
30.5	12"	0.22
38.1	15"	0.15
45.7	18"	0.12
53.3	21"	0.10
61.0	24"	0.08
76.2	30"	0.058
91.4	36"	0.046

Minimum slopes less than those indicated will be considered only with justification and will require special approval by Lee County Utilities.

C. Design Considerations

1. Sanitary gravity sewers shall be installed with straight alignment and grade between manholes with manhole spacing not to exceed 152 meters (500 feet).
2. Manholes shall be constructed at all changes in size, direction or termination of sanitary sewers. A master manhole must be provided within 25 feet of the wetwell at all new pump stations unless otherwise approved by Lee County Utilities.
4. Sanitary gravity sewer line size changes shall occur only at manholes.
3. Flow direction changes greater than 90 degrees shall not be allowed without special

approval unless a 6 ft diameter manhole is constructed. For flow direction changes greater than or equal to 45 degrees at a manhole, a minimum line drop of 3 cm (0.1 feet) shall be provided across the manhole.

5. Corrosion protection of existing sewer mains and manholes shall be provided when design velocities greater than 1.8 m/s (6 fps) are anticipated or attained.
6. Special attention shall be given to gravity lines which receive flow from sanitary sewer force mains. Care shall be taken in these areas to ensure excessive flow rates do not create surcharge conditions downstream. Drop pipes must be installed to reduce odors emitted due turbulent discharge conditions (see details in Section 9).
7. Service connections shall be installed at the locations shown in the approved drawings and per the standard details shown in Section 9. A minimum of one (1) service connection shall be installed to service every property fronting a gravity sewer line and can be accomplished by a single service lateral for a lot or by a double service lateral serving two (2) adjoining lots. Service connections shall be a minimum of 10 cm (4") diameter for single family residential and 15.25 cm (6") diameter for double service residential and commercial facilities. Service connections shall be made into the gravity sewer lines only.
8. Gravity sewer pipes shall have a minimum 4 ft of cover to the top of the pipe.
9. All service laterals shall have a cleanout located at the easement or at the R-O-W line
10. The materials allowed for buried sewer pipes are polyvinyl chloride (PVC), or high density polyethylene (HDPE), or fiberglass. Use of ductile iron pipe (DIP) and fittings are not allowed without the specific approval of Lee County Utilities.
11. Protection of Water Supplies – Wastewater sewers proposed in the vicinity of any water supply facilities, shall meet the following requirements from the 10-States Standards (“Recommended Standards for Wastewater Facilities” 1997 or latest edition, Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers)

- a. Horizontal and Vertical Separation

Sewers shall be laid at least 10 feet (3 m) horizontally from any existing or proposed water main. The distance shall be measured from outside pipe wall of the sewer pipe to outside pipe wall of the water main. In cases where it is not practical to maintain a 10 foot (3 m) separation, Lee County Utilities may allow deviation on a case-by-case basis, if supported by data from the design engineer and approved by FDEP.

Such deviation may allow installation of the sewer closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the water main is at least

18 inches (460) mm) above the top of the sewer.

If it is impossible to obtain proper horizontal and vertical separation as described above, both the water main and sewer must be constructed of slip-on or mechanical joint pipe complying with Lee County Utilities design standards and be pressure tested to 150 psi (1034 kPa) to assure watertightness before backfilling. This alternate must be accepted by the Department of Health and Rehabilitation Services.

b. Crossings

Sewers crossing water mains shall be laid to provide a minimum vertical distance of 18 inches (460 mm) between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. The sewer pipe shall cross under the water main unless otherwise approved by Lee County Utilities. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer to maintain line and grade.

When it is impossible to obtain proper horizontal and vertical separation as stipulated above, one of the following methods must be specified:

- a. The sewer shall be designed and constructed equal to the requirements water pipe design, and shall be pressure tested at 150 psi (1034 kPa) to assure water tightness prior to backfilling.
- b. The sewer line shall be encased in a watertight carrier pipe, which extends 10 feet (3 m) on both sides of the crossing, measured perpendicular to the water main. The carrier pipe shall be of materials meeting the requirements described in later sections.

The points of beginning and ending of pipe encasement shall be not more than 15.25 cm (6") from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

D. Connection To Existing System

Any private wastewater system desiring to connect to Lee County's sanitary sewer shall be constructed to Lee County Utilities standards and the ownership turned over to Lee County Utilities in its entirety. Prior to acceptance by Lee County Utilities, this wastewater system shall be tested and inspected by Lee County Utilities or its representatives, to assure compliance with Lee County Utilities' standards. In no case shall substandard private systems generating excessive inflow/infiltration as determined by Lee County Utilities, be allowed to connect into the County's

system. Any cost associated with this connection must be paid for by the private system owner and the connection coordinated with Lee County Utilities or its representatives.

### 6.3 GRAVITY SEWER COLLECTION SYSTEM MATERIALS

The following pipe shall be acceptable for sanitary sewer gravity line construction:

#### A. Fiberglass Pipe

The pipes shall be manufactured in accordance with ASTM D-3262 with a minimum stiffness class of  $F/y = 32.34 \text{ Kg/cm}^2$  (46 psi). The stiffness is to be measured in accordance with ASTM D-2412. The pipe shall be as manufactured by Price Brothers Composite Pipe or approved equal.

The pipe shall be manufactured by the centrifugal casting process resulting in a dense, non-porous, corrosion resistant, consistent composite structure.

Stiffening ribs or rings shall not be used.

#### 1. Couplings

Unless otherwise specified, the pipe shall be field connected with filament wound fiberglass exterior sleeve couplings that utilize elastomeric sealing rings as the sole means to maintain joint water-tightness. The joints must meet the performance requirements of ASTM D-4161.

#### 2. Fittings

Flanges, elbows, reducers, tees, wyes, and other fittings shall, when installed, be capable of withstanding specified operating conditions. They may be contact molded or manufactured from mitered sections of pipe joined by glass fiber reinforced overlays. Field taps shall be made using "inserta-Tee" as manufactured by Fowler Manufacturing Company, or equal.

All fittings and accessories shall be furnished by the pipe supplier and shall have bell and/or spigot configuration compatible with the pipe.

#### 3. Manhole Connections

Provide a water stop flange boot or gasket for connection of the fiberglass pipe to the manholes.

B. Polyvinyl Chloride Pipe

All polyvinyl chloride pipe (PVC) shall be of the integral bell and spigot joint type which meets or exceeds requirements set forth in ASTM D3034. Minimum wall thickness shall conform to SDR 26. Fittings shall be made of PVC plastic as defined in ASTM D1784. Flexible gasketed joints shall be elastomeric compression types conforming to ASTM F1336, ASTM D3201 and ASTM F477.

C. Manholes

1. Manholes shall conform to the requirements of ASTM Designation C478, with reinforcement of Grade 40 bars and the following modifications:
2. The minimum wall thickness shall be 20.3 cm (8").
3. The design of the structure shall include a precast base of not less than 20.3 cm (8") in thickness poured monolithically with the bottom section of the manhole walls.
4. Manhole tops shall terminate at such elevations as will permit laying up grade rings under the manhole frame to make allowances for future street grade adjustments.
5. Drop connections, where required on precast manholes, shall be manufactured with the manhole elements at the casting yard. Drop manholes shall be constructed per the standard drawings in Section 9.
6. Unless otherwise approved by Lee County Utilities, all manholes, shall be protected internally from deterioration by either of the following:
  - a. GU manhole liner, as manufactured by GU Industries, Inc. or
  - b. AGRU, Suregrip polypropylene (PP-R) protective liner system, or
  - c. IET Coating system – surface preparation shall include pressure washing at 5,000 psi, abrasive blasting with black beauty steel slag and application of the IET coat at three (3) three different intervals to a total thickness of 125 mils.

The liner or coating system must be installed per manufacturer's recommendation and completely protect the structure from corrosion. The liner or coating system must extend and seal onto manhole ring, seal onto and around pipe openings, and any other protrusions, completely cover the bench and flow invert. Provide a five (5) year unlimited warranty on all workmanship and products. The work which includes the surface preparation and application of the coating or liner system, shall protect the structure for at least five (5) years from all

leaks, and from failure due to corrosion from exposure to corrosive gases such as hydrogen sulfide.

All manhole, wetwell, and valve vault exteriors shall be coated with two (2) coats coal tar epoxy to a minimum thickness of 18 mils. Where no corrosive conditions are expected in a wetwell or manhole, with Lee County Utilities specific written approval, the interior of the manhole may be coated with two (2) coats coal tar epoxy to a minimum thickness of 18 mils.

D. Manhole Frames and Covers

Castings for manhole frames, covers and other items shall conform to the ASTM Designation A48, Class 30. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength, or otherwise make them unfit for the service intended. The seating surfaces between frames and covers shall be machined to fit true so the frames and covers do not shift under traffic conditions or permit entry of storm water from flooding. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. The words SANITARY SEWER, as well as LEE COUNTY shall be cast in all manhole covers. All manhole frames and covers shall be traffic bearing unless otherwise specified and conform to U.S. Foundry Casting Specification 240-B. Frames and covers shall be fully bedded in mortar to the correct finish grade elevation with adjustment brick courses or concrete grade rings installed in conformance with the standard drawings in Section 9.

Inflow protectors shall be provided for all manholes. Plastic or 304 stainless steel inflow protectors shall be provided for manholes located in non-traffic bearing locations. 304 stainless steel inflow protectors with 304 stainless steel handles and rubber gasketed rims shall be provided for manholes located in traffic bearing locations.

Care must be take to avoid inflow of stormwater into the sewer system. In conditions where high stormwater inflow conditions are expected and there is a possibility of unauthorized removal of the manhole cover to drain stormwater into the sewer system, Lee County Utilities may require the use of US Foundry 240B-BWT bolted water tight manhole frame which has four (4) stainless steel bolts and a flat gasket.

6.4 SEWAGE FORCE MAINS DESIGN

This Section includes the general requirements for design and installation of force main systems serving sewage pumping stations. Additional information can be found in Section 4 (General Information), Section 9 (Standard Drawings), and Section 10 (Standard Plan Notes) and Technical Specifications.

A. Design Standards

1. System Capacity

Force main systems shall be of adequate size 10 cm (4") minimum to efficiently transmit the total ultimate peak operational flow to the effluent point. Consideration shall be given to possible future connecting pumping stations and this probability shall be reviewed with Lee County Utilities. Capacity computations shall be coordinated with the proposed pumping system and future flow requirements, if applicable. In order to provide adequate pipeline cleansing, force main flow velocity shall not be less than 0.61 m/s (2 fps) at minimum pumping capacity, nor greater than 1.8 m/s (6 fps) at ultimate maximum design pumping capacity. However, with multiple pumping station systems or phase development, this minimum velocity requirement may not be possible and the system design shall receive special attention regarding hydrogen sulfide formation and control, and cleaning maintenance such as installation of pressure clean outs.

2. Operational Cost Consideration

In addition to initial capital expenditure, long-term pumping station operational costs shall also receive consideration when sizing force main systems. Should a pipe size option be available within the design limits, the cost of sewage pumps and motors, force main system and pump operating power (computed for design average daily flow rate for ten (10) years at existing electricity cost), shall be compared to like amounts for the alternate designs. The final force main size selection shall be based on the least long range capital and operational cost. Said cost analysis shall be subject to review and approval by Lee County Utilities.

3. Connection at Conflict Structures

Where pipes are to extend into or through structures, flexible, watertight joints shall be provided at the wall face. Pipes shall be encased throughout the inside of the structure, and there shall be no interior joints.

4. Corrosion Protection

The allowed force main pipe materials are polyvinyl chloride (PVC) or high density polyethylene (HDPE) or fiberglass. Use of ductile iron pipe (DIP) and DIP fittings are not allowed without the specific approval of Lee County Utilities. Where a force main is expected to flow full pipe at all times, DIP may be used after specific approval by Lee County Utilities. The DIP pipe will be required to have a fusion bonded epoxy coating to a minimum of 20 mil thickness.

If specifically approved by Lee County Utilities for use, exterior protection shall be provided for underground ductile iron pipe and fittings within areas of severe corrosive

conditions. This shall be accomplished by the installation of polyethylene encasement through the area of concern. The soil test evaluation to determine the necessity for extra protection in suspect areas shall be those set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, ductile iron pipe crossing said utility shall be protected for a distance of 6.1 meters (20 feet) to each side.

If ductile iron pipe is to be installed parallel to and within 3.1 meters (10 feet) of cathodically protected pipe, then protection shall be provided for the entire length. Steel pipe shall not be installed in severe corrosion areas.

5. Air Venting

Where the force main profile is such that air pockets or entrapment could occur, provisions for air release shall be provided. Automatic air release assemblies shall be installed on all force mains at profile break points, such as tops of hills, where free flow will occur during operation or after pumping stops. Air release valves shall be suitably housed in a properly vented underground vault or casting.

6. Valve Locations

Unless otherwise approved by Lee County Utilities, for force mains with diameters larger than 12", valves shall be installed in the force main runs a minimum of every 305 meters (1,000 feet). Valves shall be installed on all subsidiary force mains at the point of connection to the major main in order to isolate said pipeline for maintenance. Where force mains are to be extended, valves shall be placed at the future connection point to preclude line shutdown at the time of extension. At future connection branches or ends, the valves shall be followed by 2 lengths of pipe and capped and shall be restrained by methods other than thrust blocking in order to facilitate said connection without system shut-down.

7. Clean-Out Connections

Should force mains appear to be susceptible to sedimentation clogging created by depressed crossings or extended low flow and low velocity periods, suitable clean-out connections shall be provided. Said clean-outs, such as plugged wye or tee fittings, shall be located to facilitate the subject maintenance operation.

8. Terminal Discharge

To minimize turbulence and release of sewer gases, force mains shall enter the terminal facility (gravity sewer manhole or pumping station wet well) at a point just below the operational water level of said receiving unit. At manholes, the point of force main entry shall be in the same direction as the flow line. Any deviation must first be approved by Lee County Utilities. Should an elevation drop be required to obtain the outlet connection, the

prior down slope of the force main shall not exceed 45 degrees and adequate air venting shall be provided at the profile breakpoint. Force main profile shall be designed so pipe upstream from the breakpoint remains full at all times (see details in Section 9).

For new force main connections to existing manholes or pump station wetwells, the developer must install a Lee County Utilities approved liner/coating system for corrosion protection of the manhole structure. Additionally, for discharge of new force main flow into an existing Lee County Utilities pump station wetwell, the developer must install a new inline master manhole unless one already exists.

9. Identification

To preclude possible domestic water tapping, all underground gravity sewers and force main pipes shall be green and marked with 7.6 cm (3") detectable marking tape for "sanitary sewer" per standards outlined in the Utility Location and Coordinating Council's Uniform Color Code and placed along the entire pipe length. In all cases, the marking detectable tape shall be installed a minimum of 30.5 cm (12") to 46 cm (18") below finished grade during backfill operations and in accordance with the tape manufacturer's specification.

A location tracing wire shall also be installed with all PVC, HDPE and fiberglass pipe and shall be a continuous No. 12 insulated copper tracing wire laid in the trench on top of the pipe and attached to the pipe at ten (10) foot intervals. This continuous tracing wire shall run along the entire pipe and be stubbed out at valves, pressure clean-outs and air release valves.

10. Depth

Sanitary sewer force mains shall be designed to have 76 cm (30") minimum cover except under pavement where 91 cm (36") shall be the minimum depth.

B. Materials

1. Pipe

The following pipe materials shall be acceptable for force main construction:

**Polyvinyl Chloride (PVC)** - PVC sanitary sewer force mains shall meet the following AWWA specifications:

PVC Pipe Not Installed Under Roadway Pavement

- AWWA C900, DR 18 for pipe diameters 10 cm (4") through 30.5 cm (12")
- AWWA C905, DR 18 for pipe diameters 36 cm (14") through 61 cm (24")

- AWWA C905 DR 25 for pipe diameters greater than 61 cm (24").

#### PVC Pipe Installed Under Roadway Pavement By Direct Burial

- AWWA C900, DR 14 for pipe diameters 10 cm (4") through 30.5 cm (12")
- AWWA C905, DR 18 for pipe diameters 36 cm (14") through 61 cm (24")
- AWWA C905 DR 25 for pipe diameters greater than 61 cm (24").

PVC pipe must not be used in areas with petroleum contamination.

**High Density Polyethylene (HDPE)** – Lee County Utilities has the option of approving the use of HDPE sanitary sewer force mains. HDPE force mains shall have the equivalent internal diameter and equivalent pressure class rating as the corresponding PVC pipe, unless otherwise approved by Lee County Utilities. HDPE pipe must have at least three equally spaced horizontal green marking stripes.

Air piping and fitting used for transmission of sewer gases in odor control system must be either Schedule 40 PVC, fiberglass or HDPE material. DIP pipe and fittings will not be allowed for air piping of sewer gases.

All aboveground PVC or fiberglass pipes must be painted with UV-resistant paint.

## 2. Pipe Joints

PVC pipe shall have provisions for expansion and contraction provided in the joints. All joints shall be designed for push-on make-up connections. Push-on joint may be a coupling manufactured as an integral part of the pipe barrel consisting of a thickened section with an expanded bell with a groove to retain a rubber sealing ring of uniform cross section, similar and equal to John's Mannville ring-type and Ethyl Bell Ring or may be made with a separate twin gasketed coupling similar and equal to Certainteed Fluid-Type.

Gaskets shall be elastomeric and conform to AWWA Standards and ASTM F-477. Gaskets shall have clean tips unless otherwise specified. If petroleum contamination is found or suspected, Buna N (nitrile) gaskets must be used.

## 3. Inspection of Material

The Contractor shall obtain from the pipe manufacturers a certificate of inspection to the effect that the pipe and fittings supplied have been inspected at the plant and that they meet the requirements of these specifications. All pipe and fittings shall be subjected to visual inspection at time of delivery and also just before they are lowered into the trench to be laid, and pipe joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor. The entire product of any plant may be rejected when, in the opinion of the Owner, the methods of manufacture fail to secure

uniform results, or where the materials used are such as to produce inferior pipe or fittings.

4. Fittings (See Technical Specifications for more details)

All underground fittings shall be HDPE fittings or AWWA C900 or C905 PVC push on joint, with the minimum pressure rating of 1,724 kPa (250 psi). DIP fittings must not be used unless specifically approved by Lee County Utilities. If approved, DIP fittings must have a factory applied internal fusion bonded epoxy coating to a minimum of 20 mil thickness.

All above-ground fittings in direct contact with wastewater shall be HDPE or ductile iron flange-joint type with the minimum pressure rating of 1,724 kPa (250 psi) and shall conform to the requirements of ANSI Standard A21.10. Above ground DIP fittings must have an internal fusion bonded epoxy coating to a minimum of 20 mil thickness. All above ground fittings must have a factory applied exterior epoxy coating in accordance with AWWA C550.

PVC fittings 4 inches and larger in diameter shall meet the requirements of applicable AWWA C900 and C905 specifications. Fittings shall be manufactured entirely of PVC meeting ASTM D1784, shall be formed by a thermal-form process and be of one-piece construction. PVC fittings must be able to withstand 755 psi quick burst pressure-tested in accordance with ASTM D1599 and withstand 500 psi for a minimum of 1,000 hours tested in accordance with ASTM D1598. Bells shall be gasketed push on type conforming to ASTM D3139 with gaskets conforming to ASTM F477. Fittings shall be as manufactured by the Harrington Corporation, or approved equal. Ductile iron fittings with mechanical or push on joints conforming to AWWA C153 or C110 may be approved as alternative when PVC pressure fittings of the required sizes are not available. If approved, DIP fittings must have a factory applied internal a fusion bonded epoxy coating to a minimum of 20 mil thickness.

5. Valves

a. Eccentric Plug Valves (See Technical Specifications)

Only eccentric plug valves are approved for use in sewage applications. The only exception is when wet taps are used to connect to existing force mains.

b. Swing Check Valves (See Technical Specifications)

c. Pinch Check Valves (See Technical Specifications)

6. Valve Boxes (See Technical Specifications)

Cast iron valve boxes shall be provided for all valves installed underground which do not have extended operators such as is required by the plug valves. The valve boxes shall be adjustable to fit the designated depth of each cover over the valve and shall be designed so as to prevent the transmission of surface loads directly to the valve or piping. Valve boxes shall have an interior diameter of not less than 12.7 cm (5"). The valve boxes shall be provided with covers marked with the word "SEWER". The covers shall be so constructed as to prevent tipping or rattling. Valve boxes shall be manufactured by OPELIKA FOUNDRY COMPANY, Opelika, Alabama or TYLER PIPE DIVISION, Tyler, Texas or approved equal.

7. Air Release Valves (See Technical Specifications)

8. Restraining Devices (See Technical Specifications)

Restraining joints shall be placed at all bends, tees, plugs, reducers, and other fittings to provide lateral support, and shall conform to the details shown on the drawings in Section 9. Concrete thrust blocks may be utilized as additional restraint if approved by Lee County Utilities.

Joint restraining systems shall be designed for the maximum pressure condition and the safe bearing load for horizontal and vertical thrust. At a minimum, the thrust restraining system shall have a working pressure equal to or greater than the pipe material maximum pressure rating.

A reasonable safety factor shall be determined by the Design Engineer in specifying all restraining devices. All restrained fittings and joints shall be shown on the plan and profile and must be included on the record drawings. Refer to Section 9 for the minimum restraint schedule required by Lee County Utilities.

A joint restraining schedule shall be the responsibility of the Design Engineer and shall be included in the design package. The restraining schedule shall be an integral part of the package submitted for approval to the Department of Lee County Utilities and the permit agencies.

## 6.5 EXCAVATION, TRENCHING, BACKFILLING, AND RESTORATION

### A. General

The provisions set forth in this Section shall be applicable to all underground sewer piping installations regardless of location. Special design considerations shall require approval from Lee County Utilities.

B. Materials (See Technical Specifications)

1. Sheeting and Bracing (See Technical Specifications)
2. Concrete (See Technical Specifications)

C. Workmanship (See Technical Specifications)

1. Trench Dimensions (See Technical Specifications)
2. Trench Grade (See Technical Specifications)
3. Utility Bedding (See Technical Specifications)
4. Unsuitable Material Below Trench Grade (See Technical Specifications)
5. Extra Utility Bedding Material (See Technical Specifications)
6. Excavated Material (See Technical Specifications)
7. Material Disposal (See Technical Specifications)
8. Borrow (See Technical Specifications)
9. Rock Excavation (See Technical Specifications)
10. Dewatering (See Technical Specifications)
11. Obstructions (See Technical Specifications)
12. Backfill (See Technical Specifications)
13. Protective Concrete Slab  
  
Refer to Section 9 for Details.
14. Restoration (See Technical Specifications)
15. Protection and Restoration of Property (See Technical Specifications)
16. Cleanup (See Technical Specifications)
17. Excavation Site Safety (See Technical Specifications)

## 6.6 ADDITIONAL INSTALLATION REQUIREMENTS (See Technical Specifications)

### A. Pipe

1. Inspection of Material (See Technical Specifications)
2. Pipe Cleanliness (See Technical Specifications)
3. Pipe Gradient (See Technical Specifications)
4. Identification (See Technical Specifications)
  - a. Identification Tape (See Technical Specifications)
  - b. Locating Wire (See Technical Specifications)
5. Pipe Joint Deflection (See Technical Specifications)
6. Rejects (See Technical Specifications)
7. Polyvinyl Chloride Pipe (See Technical Specifications)
8. Anchors (See Technical Specifications)
9. Joints (See Technical Specifications)

### B. Installing Valves and Boxes (See Technical Specifications)

### C. Manholes (See Technical Specifications)

### D. Concrete Encasement

Concrete encasement shall be constructed in accordance with details as shown in Section 9.

### E. Flush Out Connections

Flush out connections shall be installed at the locations and in accordance with the details shown in Section 9.

### F. Casing Installations

#### 1. General

The provisions of this section shall represent the minimum standards for the installation of

casing pipe for sewer force main pipeline.

Sewer force mains to be placed under all Lee County Department of Transportation & Engineering roadways shall be installed in a casing. The steel casing procedures shall conform to the requirements of Lee County DOT as outlined in "Administrative Code AC-11-12" and any supplements thereto. All work and materials shall be subject to inspection by DOT. The Department's property and surface conditions shall be restored to the original condition in keeping with the Department's specifications and standards.

In general, all underground sewer force mains crossing all existing Lee County roadways, Florida State Highways and railroads shall be installed under these traffic ways within steel casing pipe. Specific crossing requirements shall be obtained in advance from the authority having jurisdiction.

It shall be the responsibility of the Contractor to submit the necessary permit documents and data to the appropriate authority and receive approval thereof. The Contractor shall maintain traffic on the roadway and shall keep all workmen and equipment clear of the travelway during the work. All safety regulations of the Department and any permit(s) shall be complied with.

## 2. Casing Pipe Material and Installation

Casing pipes crossing under County roadways shall be located at suitable approved alignments in order to eliminate possible conflict with existing or future utilities and structures with a minimum 91 cm (36") depth of cover between the top of the casing pipe and the surface of the roadway. Casings shall be new prime steel pipe conforming to the requirements of ASTM Designation A-139. The minimum casing pipe size and wall thickness shall be as shown in the following table, for the sewer carrier pipe size indicated.

For sizes not included therein, or for special design considerations, approval shall be obtained from Lee County Utilities.

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### For PVC Pressure Carrier Pipes

<u>Carrier Pipe</u>		<u>Casing Pipe</u>		<u>Wall Thickness</u>	
<u>Nominal Size</u>		<u>Nominal Diameter</u>			
<u>cm</u>	<u>Inches</u>	<u>cm</u>	<u>Inches</u>	<u>cm</u>	<u>Inches</u>
10.16	4	30.48	12	0.64	0.250
15.25	6	40.64	16	0.64	0.250
20.32	8	45.72	18	0.64	0.250
25.40	10	50.80	20	0.64	0.250
30.48	12	60.96	24	0.79	0.312
35.56	14	71.12	28	0.79	0.312
40.64	16	76.20	30	0.79	0.312

45.72	18	76.20	30	0.79	0.312
50.80	20	91.44	36	0.95	0.375
60.96	24	106.68	42	1.27	0.500

**For Gravity Sewer Carrier Pipes**

<u>Carrier Pipe Nominal Size</u>		<u>Casing Pipe Nominal Diameter</u>		<u>Wall Thickness</u>	
<u>cm</u>	<u>Inches</u>	<u>cm</u>	<u>Inches</u>	<u>cm</u>	<u>Inches</u>
20.32	8	35.56	14	0.64	0.250
25.40	10	40.64	16	0.64	0.250
30.48	12	50.80	20	0.64	0.250
38.10	15	60.96	24	0.79	0.312
45.72	18	66.04	26	0.79	0.312
53.34	21	76.20	30	0.79	0.312
60.96	24	81.28	32	0.95	0.375
68.58	27	91.44	36	0.95	0.375

**HDPE Carrier Pipe**

HDPE may be used as the carrier pipe and casing pipe with approval from Lee County Utilities. The HDPE casing shall be SDR 11 and there shall be a minimum of 4” clearance between the interior of the casing pipe and the outside of the carrier pipe, unless otherwise approved by the County.

- 
- a. For casing pipe crossings under roadways, railroads, or other installations not within the jurisdiction of Lee County, the Contractor shall comply with the regulations of said authority in regard to design, specifications and construction. State Highway casing installations shall be as specified in the FDOT, "Utility Accommodation Guide", and for railroads, the American Railway Engineering Association, Part 5, Section 5.2, "Specifications for Pipelines Conveying Nonflammable Substances", shall be applicable. However, in no case shall the minimum casing pipe diameter and wall thickness, for a specific carrier pipe size, be less than that specified above.

3. Carrier Pipe

Sewer Force Mains installed within casing pipes shall utilize joint restraining for the entire pipe length inside the casing. Special supporting of the carrier pipe within the casing shall be required with a design approved by Lee County Utilities.

Cascade stainless steel carriers with ultra high molecular weight polyethylene polymer skids, being on center and restrained can be used for installing the carrier pipe. Skids shall be installed 2.1 meters (7 feet), or less, on center. After the carrier pipe has been tested for leakage, the casing shall have the ends blocked with either a 20 cm (8") wall of brick masonry with a weep hole installed near the bottom of each wall or Cascade Model CCES End Seals with stainless steel bands.

High density polyethylene Raci casing spacers or approved equal, can be used for installed all size PVC carrier pipes. The spacers shall be of a projection type with a minimum number of projections around the circumference totaling the number of carrier pipe diameter inches. Casing spacers shall be spaced per manufacturer's recommendation with double spacers on each end of the casing. The casing spacers shall provide a minimum safety factor of 2 to 1 to support the service load.

G. Testing

All new sewer lines installed shall be tested for leakage. The test used will be Hydrostatic Testing for force mains and Low Pressure Air Testing for gravity lines. Tests to be performed will be indicated by the Engineer and witnessed by the Engineer and the Lee County Utilities representatives.

1. Flushing

All mains shall be flushed to remove all sand and other foreign matter. The velocity of the flushing water shall be at least 4 fps. Flushing shall be terminated at the direction of the Engineer. The Contractor shall dispose of the flushing water without causing a nuisance or property damage.

2. Hydrostatic Testing

The Contractor shall perform hydrostatic testing of the system as set forth in the following, and shall conduct said tests in the presence of representatives from the County and other authorized agencies, with 48 hours advance notice provided.

Piping and appurtenances to be tested shall be within sections between valves unless alternate methods have received prior approval from the County. Testing shall not proceed until concrete thrust blocks are in place and cured, or other restraining devices installed.

All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter. While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section, with additional release cocks provided if required.

Hydrostatic testing shall be performed with a sustained pressure for a minimum of two (2)

hours at 1,034 kPa (150 psi) pressure or 2-1/2 times working pressure, whichever is higher, unless otherwise approved by Lee County Utilities, for a period of not less than two (2) hours. Testing shall be in accordance with the applicable

provisions as set forth in the most recent edition of AWWA Standard C600. The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formula:

$$L = \frac{SD(P)^{0.5}}{133,200}$$

Where,

L = Allowable leakage in gallons per hour;

S = Length of pipe tested in feet;

D = Nominal diameter of the pipe in inches;

P = Average test pressure maintained during the leakage test in pounds per square inch

For 1,034 kPa (150 psi),  $L = (9.195 \text{ EE-}5)SD$

The testing procedure shall include the continued application of the specified pressure to the test system, for the one hour period, by way of a pump taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container.

Should the test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until results are within the established limits. The Contractor shall furnish the necessary labor, water, pumps, and gauges at specified location(s) and all other items required to conduct the required water distribution system testing and perform necessary repairs.

### 3. Low Pressure Air Testing of Gravity Sewers

#### General

It is imperative that all sanitary sewers and associated service lines be constructed watertight to prevent infiltration and/or exfiltration. To that end, all new gravity sanitary sewer systems will be subject to low pressure air testing.

### Low Pressure Air Test

After completing backfill of a section of gravity sewer line, the Contractor shall, at his expense, conduct a Line Acceptance Test using low pressure air. The test shall be performed using the below stated equipment, according to state procedures and under the supervision of the Engineer and in the presence of a Lee County Utilities representative, with 48 hours advanced notice provided.

#### a. Equipment

1. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
2. Pneumatic plugs shall resist internal bracing or blocking.
3. All air used shall pass through a single control panel.
4. Three individual hoses shall be used for the following connections:
  - a. From control panel to pneumatic plugs for inflation.
  - b. From control panel to sealed line for introducing the low pressure air.
  - c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

#### b. Procedures

All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 172 kPa (25 psig). The sealed pipe shall be pressurized to 34.5 kPa (5 psig). The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

After a manhole to manhole reach of pipe has been backfilled and cleaned and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 172 kPa (25 psi). Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 27.6 kPa (4 psi) greater than the average back pressure of any ground water that may be over the pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period 24 kPa [3.5 psi] minimum pressure in the pipe), the air

hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "Acceptable", if the time required in minutes for the pressure to decrease from 24 kPa to 17.2 kPa (3.5 to 2.5 psi) (greater than the average back pressure of any ground water that may be over the pipe) shall not be less

than the time shown for the given diameters in the following table:

Pipe Diameter		<u>Minutes</u>
<u>In Inches</u>		
<u>cm</u>	<u>Inches</u>	
20.3	8	4.0
25.4	10	5.0
30.5	12	5.5
40.6	16	7.5
45.7	18	8.5
61.0	24	11.5

Time in minutes = 0.472 D

D = Diameter of pipe in inches.

In areas where ground water is known to exist, the Contractor shall install capped vertical pipe adjacent to the top of one of the sewer lines. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the ground water shall be determined by removing the pipe cap, and a measurement of the height in feet of water over the invert of the pipe shall be taken. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 3.5 meters (11-1/2 feet), then the added pressure will be 34.5 kPa (5 psi). This increases the 24 kPa (3.5 psi) to 58.5 kPa (8.5 psi), and the 17.2 kPa (2.5 psi) to 51.7 kPa (7.5 psi). The allowable drop of one pound and the timing remain the same).

If the installation fails to meet this requirement, the Contractor shall, at his own expense, determine the source of leakage. He shall then repair or replace all defective materials and/or workmanship.

H. Deflection Testing For Gravity Sewers

All polyvinyl chloride and fiberglass sewer pipe shall be subject to deflection testing assuring that the maximum deflection of 5% has not been exceeded. Any pipe failing this test is subject to removal and replacement at the Contractor's expense.

I. Televiewing

All sanitary sewer gravity lines shall be televieued at the Builder, Developer or Contractor's expense; and a videotape of the subject mains provided prior to acceptance by Lee County Utilities. Televieuing may only occur after the stabilized subgrade has been installed and satisfactory density tests has been submitted to Lee County Utilities. A Lee County Utilities representative must be present during the televieuing. The sewer video inspection shall include rotating the camera lens to inspect the interior of each sewer lateral. Additionally, the Builder, Developer, or Contractor shall provide by tabular form utilizing "Remote Televieuing Form" (see Section 11), all information regarding gravity system indicated on the "Remote Televieuing Form".

J. Pipe Rounders

The use of pipe rounders is strictly prohibited.

6.7 PUMP STATION SYSTEM DESIGN

The Engineer shall comply with the design and installation requirements as specified by Lee County Utilities and the Department of Environmental Protection.

A. General

For pumping stations with a design peak hour flow of 136 m<sup>3</sup>/d (1500 g.p.m.) or less, a minimum of two pump units shall be provided. Where the peak hour design flow exceeds 136 m<sup>3</sup>/d (1500 g.p.m.), three (3) or more units shall be provided. All pump stations shall be designed such that the design peak hour flow can be pumped with the largest pump out of service. The selected sewage pump system shall be capable of pumping the design peak hour flow at the maximum computed system total head requirements. Additionally, final selection shall be based upon optimum operational costs.

B. Hydraulic Computations

Head-Capacity curves shall be prepared for the proposed pumping system in order to determine the various operational conditions. A hard copy of the hydraulic computations and if a computerized hydraulic model is used, a diskette of the corresponding electronic input and output files shall be submitted to Lee County Utilities for approval. Hydraulic computations shall be in accordance with standard engineering formulas with pipe friction loss calculated by Hazen-William's Formula, using a conservative coefficient of friction factor ( C ) of 110 for all pipes. The following values for "K" coefficients shall be used for minor head loss calculations:

<u>Fitting</u>	<u>Coefficient, K</u>
Plug Valves (Fully Opened)	0.77
Swing Check Valves (Fully Opened)	2.50
90 <sup>0</sup> Bends	0.80

45° Bends	0.20
Tees (Straight Run)	0.35
Tees (Branch Run)	1.28
Wyes (Straight Run)	0.30
Wyes (Branch Run)	0.50
Expansion Sudden D2/D1 = 0.75	0.19
Pipe Exit	1.00

WaterCAD is the computerized hydraulic model preferred by Lee County Utilities. Other acceptable hydraulic models are KYPIPE, Cybernet, and H2ONet. Use of other hydraulic models may be approved by Lee County Utilities on a case by case basis.

The effect of the proposed pump station on the hydraulic capacity of the existing sewer system must be evaluated prior to Lee County Utilities approval for connection of the proposed pump station. A hydraulic analysis must be performed to demonstrate that the increase in wastewater flow from the proposed pump station (1) must not surcharge any existing gravity sewers and (2) must not reduce the design pumping capacity of all manifolded existing pump stations and (3) must not cause the receiving pump station to exceed its design capacity.

For a force main system with only one pump station, the system's head capacity shall be calculated under peak hour flow conditions utilizing one pump running, all pumps running, and other combinations, if applicable.

For a force main system with multiple pumping stations manifolded together, the system head capacity shall be calculated under the maximum static head, i.e. wetwell level of the proposed pump station set at the pump off elevation and under peak hour flow conditions, as follows:

- a. Design pump station is only station on system running, therefore, utilizing above-stated conditions.
- b. All pump stations running with one pump running at each station.
- c. With one pump running in the proposed pump station together with a pump running at each of the following number of largest flowing pump stations:

<u>Number of Pump Stations Manifolded on the same Force main System</u>	<u>Number of Largest Flowing Pump Stations Running Simultaneously</u>
2	2
3	2
4	3
Greater than 4	Sufficient number of pump stations running

to pump at least 60% of the total flow when all pump stations are running.

C. Wet Well Design

Wet wells shall provide sufficient space for equipment, required suction pipe submergence and the wetwell inside diameter shall not be less than 1.8 meters (6 feet), or 1.2 meters (4 feet) for grinder pump stations .

Low water levels shall be set to provide adequate submergence of pumps and facilities to preclude inlet vortexing and air-binding. In general, the normal operational water level shall provide positive suction head for the pumps. High water alarm shall not exceed an elevation that is 15.25 cm (6") below invert elevation of the lowest influent gravity sewer. There shall be a minimum distance of 1.83 meter (6.0 feet) from influent invert to wet well bottom.

In designing the wetwells, the following three limitations must be observed:

1. One pump running in a duplex pump station must have the capacity to pump the peak hour flow.
2. Under average daily flow conditions, it is desirable to set the pump cycle time to pump out the wetwell every 6 to 15 minutes to prevent septic conditions. Pump cycle time is defined as the time required to fill the storage volume in the wetwell from the pump "Off" level to the Lead Pump "On" level plus the time required to pump down the wetwell to the Pump "Off" level. The maximum number of cycles per hour shall be 10 cycles per hour or 6 minutes per cycle. For a duplex pump station, the number of pump starts will be one half of the calculated cycles per hour as a result of pump alternation.
3. Since starting current produces heat, it is recommended that each motor be started no more than 10 times per hour.

Under average daily flow conditions, the time for one pump cycle is given by the equation:

$$T_{Avg} = \frac{V_{ww}}{(Q_{DP} - Q_{AI})} + \frac{V_{ww}}{Q_{AI}}$$

- Where:  $T_{Avg}$  = Time for one pump cycle under average flow conditions (in minutes)  
 $V_{ww}$  = Storage volume in the wetwell from Lead Pump "On" level to Pump "Off" level (in gallons)  
 $Q_{DP}$  = Design pumping rate (gpm)  
 $Q_{AI}$  = Average flow into wetwell (gpm)

Under peak hourly flow conditions, the time for one pump cycle is calculated as the pump down rate with zero inflow and then refilling of the wetwell at peak hourly flow

conditions immediately after the pump shuts off. This will result in maximum cycles per hour for the pump station by the equation:

The time for one pump cycle under peak hourly flow conditions is given by the equation:

$$T_{\text{Peak}} = \frac{V_{\text{ww}}}{(Q_{\text{DP}})} + \frac{V_{\text{ww}}}{Q_{\text{PI}}}$$

- Where:
- $T_{\text{Peak}}$  = Time for one pump cycle under peak hour flow (in minutes)
  - $V_{\text{ww}}$  = Storage volume in the wetwell from Lead Pump “On” level to Pump “Off” level (in gallons)
  - $Q_{\text{DP}}$  = Design pumping rate (gpm)
  - $Q_{\text{PI}}$  = Peak hourly flow into wetwell (gpm)

#### D. Piping Design

Each sewage pump shall have individual piping and, for nonsubmersible-type pumps, suction through a down-turned bell mouth fitting located within the wetwell to preclude turbulence and a shutoff valve prior to the pump. Each individual pump discharge pipe shall be equipped with an air release valve, a check valve, followed by a shut-off eccentric plug valve prior to connecting into the station header and force main. All pipes discharging into the wetwell shall be designed for submerged discharge below the lead pump “pump-off” level (see Section 9 detailed drawings). This may be accomplished using a drop pipe connection. The intake pipe shall be designed to prevent pump damage by cavitation at possible extreme pumping rates.

### 6.8 PUMP STATION GENERAL REQUIREMENTS

#### A. Site

Pumping Stations shall be installed outside of any road right-of-way and be readily accessible sites, unless otherwise approved by Lee County Utilities and shall have adequate area provided for operation and maintenance of facility. A site approximately 6 m x 9.1 m (20' by 30') is generally adequate for duplex submersible pump station facilities. The site shall meet the setback requirements per Lee County Development Code. The site shall be well drained and, unless otherwise approved by Lee County Utilities, the wetwell top slab and electrical panel must be set at or above the elevation designated by the Federal Insurance Administration as the 100-year FEMA flood water surface elevation. For maintenance purposes, the top of the wetwell shall be easily accessible by Lee County Utilities vehicles.

Site preparation including pavement and walkways for good all-weather operations, and all required site fencing and landscaping shall be provided in accordance with Lee County Land Development Code standards.

B. Structures

Where buildings and/or structures are constructed, the provisions of Section 8 shall apply with special design consideration for the following:

1. Combined wetwell/drywell pumping station structures shall provide complete separation between wet and dry wells, including their superstructures and chlorine storage rooms. Separation by common-wall construction is acceptable, provided that interconnecting pipes and ducts are designed to preclude co-mingling of fluids or gases.
2. Pumping station structures shall be of adequate size to allow easy access to all operating equipment for service and maintenance.
3. Structural openings shall be provided to facilitate equipment removal including pumps and motors, standby generators, communitors or bar screens and other large items.
4. Well designed stairways shall be provided for dry well access and to the service landings for wet wells when regular inspection or maintenance is required therein.
5. All floor and stairway surfaces within drywell shall be sloped and the pump room floor shall be provided with a small channel against the divider wall leading to a sump containing a submersible sump pump.
6. All access openings, stair wells or other abrupt drops in traffic areas shall be covered or protected by gratings, checkered plate, handrails or other applicable safety devices.
7. Building design shall provide adequate ceiling height and structural considerations and include the installation of initial and future hoisting equipment.
8. A master manhole shall be required when constructing a pump station. This manhole shall have only one effluent pipe to the pump station.

C. Ventilation and Odor Control Facilities

Forced draft mechanical ventilation shall be provided for all below ground dry wells and wet wells where free access is required for operating equipment maintenance and/or inspection. Wet wells for submersible installations or others without free access shall be ventilated with not less than one 10 cm (4") diameter open vent pipe. All vents shall be at least 61 cm (2 feet) above flood levels in flood zones set by FEMA or other competent authority. Ventilation for dry wells may be

intermittent at a minimum of 30 complete air changes per hour or continuous at six (6) changes per hour minimum, with additional capacity for equipment heat dissipation if required. In all cases of intermittent ventilation, the blower(s) shall operate when lights are turned on or temperature reaches a preset level. Wet and dry well ventilation systems shall be independent and shall in no case allow cross-connection between these areas.

Ventilating fans or blowers, ductwork and other appurtenances shall be installed in accordance with the recommendations of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook on "Heating, Ventilating, and Air-Conditioning Systems and Applications, 1987 or latest edition. Ducts shall be fiberglass or Schedule 40 PVC with white or grey painted coating and labeled with air flow direction arrows.

Odor control equipment shall be required for all wetwell air concentrations with expected hydrogen sulfide air concentrations exceeding 10 ppm on the average. Proposed odor control equipment and methods shall be reviewed and approved by Lee County Utilities.

Drop pipes as shown in the detailed drawings in Section 9, shall be installed to minimize turbulence and release of sewer gases.

D. Piping Systems

1. Pump Station Piping

Pump station sanitary sewer piping shall have the same requirements as those for sewage force mains outlined in Section 6, except that PVC pipe or HDPE pipe shall be utilized within the wetwell structure. Above ground HDPE discharge piping with associated above ground plug valves and check valves are allowed as an option to buried valve vaults.

2. Potable Water Service

Galvanized steel or PVC pipe and fittings with appropriate gate valves and backflow prevention devices shall be required at pump station facilities.

E. Connections At Structures, Wall Pipes and Sleeves

Where pipes are to extend into or through structures from the exterior, flexible connections (mechanical or push-on type joints) shall be provided at the exterior wall face.

For pipes passing through structural walls, wall pipes with water stops shall be installed where the location is below the surface of the ground or at any point where fluid levels will exceed that elevation. Neoprene sleeves with watertight caulking and 316 Series SS stainless steel clamps

will be suitable at other locations.

F. Wetwell Liners and Coatings

The wetwell liners or coatings will be required on all concrete wetwells. The following wetwell liners or coatings are Lee County Utilities approved:

- GU Liner
- Agru Liner
- IET Coating System

The wetwell liners or coatings must be installed, tested and inspected after installation per manufacturer's recommendation. The liner or coating system must extend and seal onto wetwell hatch frame, around pipe openings and any other protrusions, to prevent contact of wetwell structure from corrosive sewer gases. Where no corrosive conditions are expected in a wetwell or manhole, with Lee County Utilities specific written approval, the interior of the manhole or wetwell may be coated with two (2) coats coal tar epoxy to a minimum thickness of 18 mils.

G. Piping Flexibility

In order to provide for expansion and contraction, differential settlement, or expedite installation and maintenance, flexible connections (flanged coupling adapters, expansion joints, couplings, etc.) shall be provided within flanged piping systems.

H. Supports And Restraining

Special consideration shall be given to the support and restraining for piping systems. This requirement shall also apply to both interior and exterior systems with restraining of flanged pressure piping required where flexible connections are used.

I. Station Water System

All sewage pumping stations shall be provided with a station water system with adequate capacity and pressure for wash-down utilization. Said installation shall include all meters, taps, connections. All fees required shall be paid by the developer/contractor prior to placing the pump station in operation. Said supply shall be completely separated from the potable supply by use of Lee County Utilities approved reduced pressure-type back-flow prevention device. Hose bibs and hose shall be standard commercial sizes and provided at convenient locations to facilitate maintenance with special large capacity units installed for wet well wash down. In-line curb stop with lock wings or lockable spigot must be installed on the water service.

J. Flow Meters

Indicating, totalizing and recording flow meters shall be provided for all sewage pumping stations with ultimate ratings greater than 136 m<sup>3</sup>/d (1500 g.p.m.) or as directed by Lee County Utilities. Meters shall be of the magnetic type with Teflon lining, stainless steel electrodes and ultrasonic cleaning, or the universal venturi type with flanged cast or ductile iron body and bronze throat. Flow meters shall be designed to record both the peak pumping station capacity and anticipated minimum flows with equally high accuracy. The meters shall be direct reading in gallons per minute, totalizing in million gallons per day and recording on 30.5 cm (12") diameter, 24-hour linear charts in gallons per minute. All meters shall also be tied to the Radio Telemetry SCADA System. The flow metering system shall be installed within the pumping station structure, if space is available, or in an exterior protected and drained pit. In all cases, meter by-pass valves and piping shall be provided.

K. Sump Pump

A minimum of two (2) sump pumps shall be provided in dry pit chambers and shall be of the heavy duty submersible type capable of passing 9.5 mm (3/8-inch) solids. The pumps shall provide capacity for expected structure infiltration, sewage pump drainage and wash-down flow. The pump shall be controlled automatically by a built-in, field-adjustable, liquid-level control. The sump pits shall provide sufficient capacity to preclude sump pump short cycling. The pump shall discharge to the wet well at a point well above any maximum water level and through a discharge pipe equipped with double check valves and a shut-off gate valve at the pump. Sump pumps shall be tied into the SCADA System and indicate ON alarm, number of starts and run time.

L. Lighting

Sufficient lighting shall be provided for night time emergency work at the pump station site. Provide a 10 foot tall aluminum light pole with 250 watt halogen lamp with a manually controlled on/off switch located inside the pump control panel.

M. Emergency Pump Connections

For sewage pumping stations not equipped with stationary standby power generators, connections shall be provided for emergency auxiliary pumping. Said connection shall be in accordance with details in Section 9.

N. Sewage Pumps And Motors

1. General

Sewage pumping units shall be capable of handling raw, unscreened sewage and shall be capable of passing a sphere of at least 7.6 cm (3") in diameter. Pumps shall be electric

motor driven and of a proven design that has been in sewage service under similar conditions for at least five years. Pumps shall provide the required peak design performance requirements and be suitable for operation within the total hydraulic range of operation without overloading the motors.

2. Submersible Pumps

The pump design shall provide easy removal and replacement for inspection or maintenance purposes without bolts or other fastening to be removed or personnel to enter the wet well.

The units shall be non-clog, mechanical seal, submersible sewage pumps as manufactured by Flygt Corporation or ABS Pumps, Inc. Certified pump curves shall be furnished with the pumps.

- a. Pump Design (See Technical Specifications)
- b. Pump Construction (See Technical Specifications)
- c. Pump Test (See Technical Specifications)
- d. Pump Warranty (See Technical Specifications)

3. Dry Pit Pumps (See Technical Specifications)

O. Pump Motors (See Technical Specifications)

P. Pump Controls (See Technical Specifications)

Each pumping station control system shall include a liquid level controller which shall sense the sewage level in the wet well and provide appropriate signals to the logic circuits to produce the required mode of operation for the pumping facilities. The standard level controls shall be five (5) non-mercury Rotofloats as manufactured by Anchor Scientific Inc. Long Lake, MN, or approved equal. At pump stations where there is a possibility of massive accumulation of floatables, oil and grease that may interfere with the proper operation of the floats, Lee County Utilities may required the installation of a bubbler type liquid level control system as manufactured by Digital Control Corporation or Lee County Utilities approved equal. All pump stations serving commercial and industrial facilities will be required to have a bubbler type liquid level control system unless specifically approved by Lee County Utilities.

Any alternative levels sensing and control system must be approved by Lee County Utilities. The bubbler type liquid level control system and any alternative levels sensing and control system shall include a high float and a low level float as a back-up system.

Q. Variable Speed Pump Control Systems See Technical Specifications

R. Telemetry System (See Technical Specifications)

All sewage pumping stations shall be equipped with and connected to radio telemetry SCADA equipment. Remote Telemetry Unit (RTU) at the pump stations in the original Lee County Utilities service area shall be Motorola MOSCAD-L. New RTUs in the former Florida Cities Water Company (FCWC) service areas (now acquired by Lee County Utilities) must be of equipment that match the RTUs already existing in that FCWC service area.

S. Emergency Generators (See Technical Specifications)

Standby emergency generators shall be installed at all Master Pumping Stations repumping three or more pump stations, unless otherwise approved or directed by Lee County Utilities. Standby emergency generators shall also be required if the pump station location results in more than 30 minutes of response time from a maintenance crew.

Said installation shall be an engine-generator of adequate size to automatically start and operate the pumps required for design flow conditions, lights, controls and other critical items. The engine-generator installation shall be in accordance with all applicable manufacturer's requirements. In order to minimize the noise levels, especially in residential, commercial and industrial areas, the generator system must be equipped with a noise reduction package that must first be approved by Lee County Utilities. The approved generator systems are as manufactured by Caterpillar and Onan-Cummins.

Pump stations not supplied with emergency generators on site shall have service generator receptacle type and size of sufficient capacity to operate all necessary equipment and connect to power via Lee County Utilities existing portable generators

T. Power Disconnect Switch

Pump stations shall be provided with a separate power disconnect switch located in line immediately after the power meter and before the control panel. The switch shall be NEMA 4X, aluminum or stainless steel, housing fitted with locking hoop and padlocks, master keyed to County Standard.

U. Power Meter

Power meter shall be supplied in a NEMA 4X enclosure.

## 6.9 TYPES OF PUMPING STATION CONSTRUCTION

### A. Submersible Facilities

Sewage pumping stations of the submersible type shall include the removable pump units previously specified, aluminum access frame and cover, 316 Series stainless steel pipe pump guide bars. Pump discharge pipes shall extend from each pump to an accessible well protected and drained pit in which the control and check valve, and pressure sensors shall be installed. The submersible pumping system and accessories shall be as manufactured by Flygt Corporation, or ABS Pumps. For flows in excess of 63 l/s (1,000 g.p.m.), three (3) or more pumps may be required.

### B. Built-In-Place Facilities

Structural built-in-place sewage pumping stations shall be constructed where the peak design flow exceeds 126 l/s (2000 g.p.m.) or as directed by Lee County Utilities. Additionally, where the peak flow requirement is more than 126 l/s (2000 g.p.m.), the facility shall be designed for three (3) or more pumping units. Said facilities shall be constructed in accordance with all applicable provisions of this standard.

### C. Wet Wells and Valve Vaults

The structure may be of circular or rectangular and shall be constructed of poured-in-place or precast, Type II concrete sections (ASTM C-478) placed on a poured bottom foundation base. Fiberglass wetwells may be approved by Lee County Utilities on a case by case basis. The top slab shall be suitable for (AASHTO H20) traffic loading, and care shall be taken to prevent flotation. All structures shall be constructed level and plumb. Wetwell shall not be out of plumb by more than 5 cm (2") per 3 m (10') or 1.66%. All wetwells shall be protected from deterioration as specified in previous sections.

The top slab of the wetwell and valve vault must be set at an elevation equal to or greater than the 100 year flood elevation. If above ground pump discharge pumping from the wetwell is used instead of the valve vault design (see details in Section 9), a protective fencing may be required by Lee County Utilities.

## 6.10 PUMP STATION ELECTRIC PANELS

Electric panels shall be of the type recommended by the pump manufacturer and shall be compatible with the requirements of the pumping operation. All panels shall include provisions for turning pumps on and off, manually and automatically, alternating lead pump with each pump cycle or manually, indications for operation and alarm conditions, testing and indication of all operational features, and terminal strip wired and indicated for all telemetry contacts. Spare a minimum of 8 terminal strip contacts shall be provided to allow for expansion, repair or alterations.

For all pump stations operating on 480 V, install appropriately sized transformer to step down the voltage to 120V to provide a minimum of 20 amp circuit in the receptacle.

A waterproof wiring schematic showing the color coded wiring and corresponding descriptions shall be affixed to the inside of the pump control panel door.

Include a lighting arrestor, GE or equivalent, sized for voltage, current and phase for particular installation as approved by a licensed electrical engineer and mounted on the outside bottom of the disconnect box.

All wiring shall be color coded and numbered as shown in Section 9.