

SECTION 3

SANITARY SEWER SYSTEMS

3.1 GENERAL

This section sets forth the general requirements for design, materials, installation, and testing of sanitary sewer gravity collection system components including gravity mains, gravity manholes, sewage force mains and pump stations.

3.2 SYSTEM DESIGN

Gravity collection systems shall be designed by a Florida Registered Professional Engineer (Engineer of Record) and constructed in accordance with the design and installation requirements as specified by Lee County Utilities (LCU), the Florida Department of Environmental Protection (FDEP), the Lee County Department of Transportation (LCDOT), the Florida Department of Transportation (FDOT) and any other relevant state and local regulatory agencies as well as with the requirements established by the Lee County Land Development Code (LDC) as amended from time to time.

A. Flow Demands

1. Flow demands for design shall be calculated on the basis of full development as known or projected.
 - a) 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.
2. The average daily flow for domestic use shall be calculated at the minimum rate as follows:
 - a) Single-Family (SF) Residence = 100 gpd per capita, 2.5 persons per residence for a flow of 250 gpd per SF residence.
 - b) Multi-Family (MF) Residence = 100 gpd per capita, 2.0 persons per residence for a flow of 200 gpd per MF residence.
 - c) Mobile Home Park (MHP) Unit = 100 gpd per capita, 2.0 persons per unit for a flow of 200 gpd per MHP unit.
 - d) Recreational Vehicle Park (RVP) Unit = 50 gpd per capita, 2 persons per unit; for a flow of 100 gpd per RVP unit.

A. Flow Demands - continued

- e) Commercial, Industrial and special-type developments shall be established based on Chapter 64E-6 of the Florida Administrative Code guidelines &/or historical flow data for similar establishments.
 - (1) In order to use historical flow data; a minimum of the most recent 12 months of billing histories for at least six (6) similar establishments must be provided.
 - (2) Similarities must be demonstrated including but not limited to; size, hours of operation, number of employees, etc.
- 3. Gravity collection 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>
a) 0 to 0.05 MGD (0 to 35 gpm)	3.5
b) >0.05 to 0.25 MGD (35 to 174 gpm)	3.0
c) >0.25 to 2.00 MGD (174 to 1389 gpm)	2.5
- 4. Minimum Peak Factor is 2.5
- 5. An Equivalent Residential Unit (ERU) is defined as 250 gpd.

*Per 10-State Standards

B. Hydraulic Computations

- 1. Hydraulic computations also known as 'Head-Capacity Curves' will be required as follows:
 - a) For all developments connecting to a pressurized collection system,
 - b) For developments with contributor flow greater than 5,000 gallons per day connecting to low pressurized collection systems, and/or
 - c) When deemed necessary by LCU.
- 2. Hydraulic calculations shall be prepared for proposed gravity collection systems in order to determine the various operational conditions as follows:
 - a) Hydraulic computations shall be done in accordance with standard engineering formulas.
 - b) Pipe friction loss shall be calculated using the Hazen-William's Formula,
 - c) A conservative coefficient of friction factor (C) of 110 shall be used for all pipes.

B. Hydraulic Computations – continued

- d) 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 ⁰ Bends	0.80
45 ⁰ 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

3. Computerized Hydraulic Modeling Software approved by LCU are as follows:
- Innovyze InfoWater (preferred by LCU)
 - KYPIPE,
 - Cybernet,
 - H2ONet,
 - WaterCAD
 - Use of other hydraulic models may be approved by LCU on a case by case basis.
4. The effect of the proposed pump station on the hydraulic capacity of the existing sewer system must be evaluated prior to LCU 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:
 - Must not surcharge any existing gravity sewers,
 - Must not reduce the design pumping capacity of all manifolded existing pump stations, and
 - Must not cause the receiving pump station to exceed its design capacity.

B. Hydraulic Computations – continued

5. For a force main system with only one pump station, the system's head capacity shall be calculated under peak hour flow conditions utilizing:
 - a) one pump running,
 - b) all pumps running and
 - c) other combinations, if applicable.
6. System head capacity for force main systems with multiple pumping stations manifolded together shall be calculated under the maximum static head, i.e. wet well level of the proposed pump station set at the pump off elevation and under peak hour flow conditions, as follows:
 - a) The design pump station is the only station on the system 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 flowing pump stations:

Number of Pump stations Manifolded on the same Force Main System	Number of Flowing Pump stations Running Simultaneously
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.

7. A hard copy of the hydraulic computations and a CD of the corresponding electronic input and output files of the computerized hydraulic model shall be submitted to LCU for approval.

C. Horizontal and Vertical Separation for Mains

1. Sanitary sewer mains and related appurtenance shall be installed at least 10 feet horizontally from any existing or proposed water main.
 - a) The distance shall be measured from outside pipe wall of the sewer pipe to outside pipe wall of the water main.
 - b) In cases where it is not practical to maintain a 10 foot separation, LCU may allow deviation on a case-by-case basis. Such deviations may be approved if:
 - (1) Supported by data provided by the Engineer of Record,
 - (2) Approved by FDEP, and
 - (3) The water main is at an elevation so the bottom of the water main is at least 18 inches above the top of the sewer main.
2. Sewer mains crossing water mains shall be installed to provide a minimum vertical separation of 18 inches.
 - a) The distance shall be measured from the outside pipe wall of the sewer main to the outside pipe wall of the water main.
 - (1) This shall be the case regardless of whether the water main is above or below the sewer main.
 - b) The sewer main shall cross under the water main unless otherwise approved by LCU.
 - c) The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints.
3. When it is impossible to obtain proper horizontal and vertical separation as indicated above, the following shall apply:
 - a) The sewer pipe shall be designed and constructed equal to the requirements of water pipe design, and shall be pressure tested at 150 psi to assure water tightness prior to backfilling.
 - b) The sewer line shall be encased in a watertight casing pipe, which extends 10 feet on both sides of the crossing, measured perpendicular to the water main. This alternate must be approved by LCU and the LCDOH.
4. Additional separation requirements for sewer mains and related appurtenances shall be as follows unless otherwise approved by LCU:
 - a) A minimum of ten (10) feet horizontal separation is also required between other public and/or private utilities, structure(s), building(s), wall(s), fountain(s), fence(s) and LCU infrastructure unless specifically approved by LCU.

C. Horizontal and Vertical Separation for Mains – continued

- b) Drainage inlets shall be located no closer than (5) feet from proposed or existing LCU owned and maintained pipe or facility. When the 5' separation cannot be achieved for new mains, LCU requires one joint of C900 DR-14 PVC pipe to be centered on said inlet with 3' of separation.
- c) All new light pole foundations shall be a minimum of five (5) feet from any existing or proposed LCU owned and maintained pipeline or facility unless approved by LCU.
- d) The root ball of palm trees shall be a minimum of five (5) feet and the root ball of shade trees shall be a minimum of ten (10) feet from any existing or proposed LCU owned and maintained pipe or facility.
- e) TV cable, telephone, gas, electric power, and irrigation lines may cross under LCU facilities with a minimum of eighteen (18) inches of vertical clearance.

D. Inspection of Materials

- 1. The contactor shall obtain a Certificate of Inspection from the pipe manufacturer indicating that the pipe and fittings supplied have been inspected at the plant and that they meet LCU requirements and specifications.
- 2. Any and all materials received from a given plant may be rejected if:
 - a) the methods of manufacturing fail to produce uniform results and/or
 - b) the materials used are such that produce inferior pipe and/or fittings.
- 3. All materials shall be subjected to visual inspection at time of delivery as well as just before they are to be lowered into the trench.
- 4. Any materials; pipe, fittings or other appurtenances that do not conform to LCU requirements and specifications will be rejected.
- 5. The contractor must remove any rejected materials immediately.

3.3 GRAVITY MAIN DESIGN

This sub-section sets forth the general requirements for design and installation of sanitary sewer gravity mains, gravity manholes and service laterals.

A. Gravity Main Size Computation

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

Pipe Diameter	Minimum Slope
8"	0.40%
10"	0.28%
12"	0.22%
15"	0.15%
18"	0.12%
21"	0.10%
24"	0.08%
30"	0.058%
36"	0.046%

- b) Projects are to be constructed at the slopes shown on the approved construction plans unless otherwise approved by LCU.
- c) Slopes more or less than those indicated above will be considered only with justification and will require approval by LCU.
- d) Changes in slope shall only occur at manholes.

B. Location and Depth

1. Gravity mains shall be installed with straight alignment and grade between manholes.
2. Manholes are to be located in the center of the roadway unless otherwise approved by LCU.
3. Manhole spacing may not exceed 500 feet.

B. Location and Depth – continued

4. Gravity mains are not to be installed through planting islands and/or cul de sacs unless otherwise approved by LCU.
5. Gravity mains shall have a minimum 4 ft of cover to the top of the pipe unless otherwise approved by LCU.
 - a) In all cases where 4 ft of cover cannot be achieved, the complete run between manholes shall be constructed of C-900 DR 18.

C. Design Considerations

1. Manholes shall be constructed at all changes in size, direction and/or termination of gravity mains.
2. Flow direction changes greater than or equal to 45 degrees at a manhole require a minimum line drop of 0.1 feet to be provided across the manhole.
3. All master manholes are to be six (6) ft in diameter and must be provided as follows:
 - a) Within 25 feet of the wet well at all new pump stations unless otherwise approved by LCU and
 - b) At all flow direction changes greater than 90 degrees unless otherwise approved by LCU.
4. Corrosion protection of existing sewer mains and manholes shall be provided when design velocities greater than 6 fps are anticipated or attained.
5. Care shall be taken in these areas to ensure excessive flow rates do not create surcharge conditions downstream.
6. Service connections shall be installed at the locations shown in the approved drawings and per the LCU Standard Details.
 - a) Service connections shall be made into gravity mains only unless otherwise approved by LCU.
 - b) Service wyes shall be a minimum of 5 ft from either upstream or downstream manholes.
 - c) A minimum of one (1) service connection shall be installed to service every property fronting a gravity sewer main.
 - (1) LCU prefers one (1) double service lateral for serving two (2) adjoining lots.
 - (2) If double service laterals are unfeasible, single service laterals for each lot may be designed and must be approved by LCU

C. Design Considerations – continued

- d) Service connections shall be a minimum of:
 - (1) 4" diameter for single family residential,
 - (2) 6" diameter for double residential services and
 - (3) 6" diameter for commercial/industrial facilities.
- e) All service laterals shall have a traffic bearing water-tight cleanout per LCU Standard Detail located at the easement or at the R-O-W line.

D. Acceptable Pipe Materials

- 1. The following pipe shall be acceptable for gravity main construction:
 - a) Polyvinyl Chloride Pipe (PVC)
 - (1) All PVC pipe shall be of the integral bell and spigot joint type which meets or exceeds requirements set forth in ASTM D3034.
 - (2) Minimum wall thickness shall conform to SDR 26.
 - (3) Fittings shall be made of PVC plastic as defined in ASTM D1784.
 - (4) Flexible gasketed joints shall be elastomeric compression types conforming to ASTM F1336, ASTM D3201 and ASTM F477.

Please see Conditions Requiring Casing Section for roadway crossings.

E. Manholes

- 1. Manholes shall conform to the requirements of ASTM Designation C478, with reinforcement of Grade 40 bars and the following modifications:
 - a) The minimum wall thickness shall be 8".
 - b) The design of the structure shall include a precast base of not less than 8" in thickness poured monolithically with the bottom section of the manhole walls.
 - c) 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 LCU Standard Details.
 - d) Sections are to be installed in true alignment, with a 1/4 inch maximum tolerance per section.
- 2. Unless otherwise approved by LCU; all manholes, shall be protected internally from deterioration.

E. Manholes - continued

- a) A liner or coating system must be installed per manufacturer's recommendation and must:
 - (1) Completely protect the structure from corrosion,
 - (2) extend and seal onto manhole ring,
 - (3) seal onto and around pipe openings, and any other protrusions, and
 - (4) completely cover the bench and flow invert.
3. The exteriors of all manholes, wet wells, and valve vaults shall be coated with two (2) coats of coal tar epoxy to a minimum thickness of 18 mils.
4. A five (5) year unlimited warranty is required on all workmanship and products.
 - a) This warranty shall include the surface preparation and application of the coating or liner system intended to protect the structure from all leaks.
 - b) This warranty shall also include failure due to corrosion from exposure to corrosive gases such as hydrogen sulfide.

Please refer to the 'Approved Materials List' for additional information.

F. Manhole Frames and Covers

1. Castings for manhole frames, covers and other items shall conform to the ASTM Designation A48, Class 30.
 - a) 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.
 - b) 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.
2. Lifting or "pick" holes shall be provided, but shall not penetrate the cover.
3. For systems that will be owned and maintained by LCU, the words SANITARY SEWER, and LEE COUNTY shall be cast in all manhole covers.
4. All manhole frames and covers shall conform to U.S. Foundry Casting Specification 240-B.
 - a) Frames and covers must be traffic bearing unless otherwise specified,
 - b) Shall be fully bedded in mortar to the correct finish grade elevation, and

F. Manhole Frames and Covers – continued

- c) Are to include adjustment brick courses or concrete grade rings installed in conformance with LCU Standard Details.
- 5. Care must be taken to avoid inflow of stormwater into the sewer system.
 - a) Inflow protectors shall be provided for all manholes.
 - (1) HDPE inflow protectors shall be provided for manholes located in non-traffic bearing locations.
 - (2) 304 stainless steel inflow protectors with 304 stainless steel handles and rubber gasketed rims shall be provided for manholes located in traffic bearing locations.
 - b) In conditions where high stormwater inflow is expected and/or there is a possibility of unauthorized removal of the manhole cover to drain stormwater into the sewer system, LCU 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.

G. New Connections to Existing System

- 1. Any private wastewater system desiring to connect to Lee County's sanitary sewer system must be turned over to LCU in its entirety unless otherwise approved by LCU.
 - a) Prior to acceptance by LCU, this wastewater system shall be tested and inspected by LCU.
- 2. In no case shall substandard private systems or systems generating excessive inflow/infiltration as determined by LCU be allowed to connect into the County's system.
- 3. Any cost associated with this connection must be paid for by the private system owner and the connection must be approved by LCU.
- 4. Connections to existing LCU manholes shall be as follows:
 - a) Core bore and seal manhole with rubber boot and stainless steel strap.
 - b) Coordinate with LCU to verify the condition of the existing manhole's coating and re-coat if necessary.

3.4 GRAVITY MAIN TESTING

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 mains will be subject to the following testing:

A. Cleaning and Flushing

1. Cleaning and flushing of all mains is required to remove all sand and foreign matter.
2. The Contractor shall dispose of the flushing water without causing a nuisance or property damage.

B. Density Tests

1. Density Tests must be performed after stabilized sub-grade has been installed to determine if required compaction has been achieved.
 - a) Density Tests are to be performed by an independent testing lab.
 - b) Test results are to be certified by a Florida Register Engineer at the expense of the developer or contractor.
2. Test locations shall be determined by the engineer however, they shall be spaced no more than 100 feet apart where the trench cut is continuous.
3. If any of the tests are unsatisfactory, the contractor shall re-excavate and re-compact the backfill at his expense until required density is obtained.
4. Copies of all density test results are to be provided to LCU by the engineer.
 - a) Failure to furnish these results will result in the project not being recommended for acceptance by Lee County.

C. Low Pressure Air Testing

1. Low pressure air testing may occur only after the stabilized subgrade has been installed and satisfactory density tests have been submitted to LCU.
 - a) 48 hours advanced notice is to be provided.
 - b) Tests are to be performed according to state procedures.
 - c) Tests are to be under the supervision of the Engineer of Record and witnessed by an LCU representative.
2. Testing Equipment
 - a) All air used shall pass through a single pressure gauge.

C. Low Pressure Air Testing - continued

- b) Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
- c) Pneumatic plugs shall resist internal bracing or blocking.

3. Procedures

- a) All pneumatic plugs shall be seal tested before being used in the actual test installation as follows:
 - (1) One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked.
 - (2) Air shall be introduced into the plugs to 25 psig.
 - (3) The sealed pipe shall be pressurized to 5 psig.
 - (4) The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
- b) Once each manhole to manhole run of pipe has been backfilled and cleaned, it shall be tested as follows:
 - (1) The pneumatic plugs shall be placed in the line at each manhole and inflated.
 - (2) Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psi greater than the average back pressure of any ground water that may be over the pipe.
 - a. At least two (2) minutes shall be allowed for the air pressure to stabilize.
 - (3) After the stabilization period, with 3.5 psi minimum pressure in the pipe, the air hose from the compressor to the air supply shall be disconnected.
 - (4) The portion of line being tested shall be termed "Acceptable", if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psi shall not be less than the time shown for the given diameters in the following table:

Pipe Diameter	Minutes
8"	4.0
10"	5.0
12"	5.5
16"	7.5
18"	8.5
24"	11.5

C. Low Pressure Air Testing - continued

$$\text{Time in minutes} = 0.472 D$$

D = Diameter of pipe in inches

- c) When gravity mains are installed in areas where ground water is known to exist; its depth (in feet) shall be divided by 2.3 to establish the pounds of pressure. The result will be added to all readings. For example, if the depth of water is 11-1/2 feet, then the added pressure will be 5 psi. This increases the 3.5 psi to 8.5 psi, and the 2.5 psi to 7.5 psi.
 - (1) The allowable drop of one pound and the timing remain the same.
- d) Test Failure
 - (1) If the installation fails to meet testing requirements, the Contractor shall, at his own expense, determine the source of leakage.
 - (2) Contractor shall then repair or replace all defective materials and/or workmanship.

D. Deflection Testing For Gravity Sewers

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

E. Televiewing

- 1. All sanitary sewer gravity mains shall be televiewed at the Builder, Developer or Contractor's expense.
 - a) Televiewing may occur only after the stabilized subgrade has been installed and satisfactory density tests have been submitted to LCU.
 - b) An LCU representative must be present during the televiewing.
 - c) Televiewing shall include rotating the camera lens to inspect the interior of each sewer lateral.
 - d) LCU reserves the right to request laterals be televised should staining or foreign material be detected during the main line inspection.
 - (1) An LCU approved depth gauge and 5% mandril must be pulled in full view of the camera in all cases.
 - (2) The maximum allowable depression for 8" diameter pipe is 1"

E. Televiwing - continued

- (3) The maximum allowable depression for 10" diameter pipe is 1 ¼".
2. Prior to acceptance of the gravity main by LCU; the Builder, Developer, or Contractor shall provide LCU with a "Remote Televiwing Form" (see 'Forms' Section) containing all information obtained during the televiwing of the subject main(s) along with a DVD of the actual televiwing.

F. Pipe Rounders

1. The use of pipe rounders is strictly prohibited.

3.5 SEWAGE FORCE MAIN DESIGN

This Section includes the general requirements for design and installation of pressurized sewage force mains.

A. Force Main Sizing

1. Force mains shall be of adequate size to efficiently transmit the total ultimate peak operational flow.
 - a) Force mains shall be 4" minimum diameter unless approved by LCU

B. System Capacity

1. Consideration shall be given to possible future connecting pumping stations and this probability shall be reviewed with LCU.
2. Capacity computations shall be coordinated with the proposed pumping system and future flow requirements, if applicable.
3. In order to provide adequate pipeline cleansing, force main flow velocity shall not be less than 2 feet per second (fps) at minimum pumping capacity, nor greater than 6 fps at ultimate maximum design pumping capacity.
 - a) With multiple pumping station systems or phased development, this minimum velocity requirement may not be possible.
 - (1) These system designs shall receive special attention regarding hydrogen sulfide formation and control, and cleaning maintenance such as installation of pressure clean outs.

C. Operational Cost Consideration

1. In addition to initial capital expenditure, long-term pumping station operational costs shall receive consideration when sizing force main systems.
 - a) 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.
 - b) The final force main size selection shall be based on the least long range capital and operational cost.
 - c) Said cost analysis shall be subject to review and approval by LCU.

D. Location and Depth

1. Sanitary sewer force mains shall be installed at the edge of the road right-of-way or within an LCU Easement abutting the road right-of-way opposite of potable water mains unless otherwise approved by LCU.
2. Sanitary sewer force mains shall be designed to have 30" minimum cover except under pavement where 36" shall be required.

See Section 3.2 C for addition vertical and horizontal separation requirements.

E. Design Considerations

1. All piping shall be installed in accordance with the pipe manufacturer's recommendations and approved shop drawings.
 - a) Where pipe deflections are used, they are not to exceed 80 percent of the maximum deflections limits shown in AWWA C600.
2. Connection at Conflict Structures
 - a) Where pipes are to extend into or through structures, flexible, watertight joints shall be provided at the wall face.
 - b) Pipes shall be installed within steel casing using bell restraints and casing spacers.
3. Corrosion Protection
 - a) Installation within areas of severe corrosive conditions must be specifically approved by LCU.
 - b) If approved for use, exterior protection shall be provided for underground ductile iron pipe and fittings.
 - (1) Polyethylene encasement shall be installed through the area of concern.
 - c) A soil test evaluation as set forth in ANSI Standard A21.5 shall be conducted in suspect to determine the necessity for extra protection.
 - d) Where other existing utilities are known to be cathodically protected, ductile iron pipe crossing said utility shall be protected for a distance of 20 feet to each side.
 - e) If ductile iron pipe is to be installed parallel to and within 10 feet of cathodically protected pipe, protection shall be provided for the entire length.
 - f) Steel pipe shall not be installed in severe corrosion areas.

E. Design Considerations - continued

4. Air Venting

- a) Where the force main profile is such that air pockets or entrapment could occur, provisions for air release shall be provided.
- b) 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.
 - (1) Air release valves shall be suitably housed in a properly vented underground vault or casting.

5. Valve Locations

- a) Plug valves shall be installed in force main runs a minimum of every 1,000 feet unless otherwise approved by LCU.
- b) 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.
- c) At future connection branches or ends, valves shall be followed by 2 lengths of pipe which is to be capped.
 - (1) Unless otherwise approved by LCU, these branches are to be restrained by methods other than thrust blocking in order to facilitate said connection without system shut-down

6. Pressure Clean-Out Connections

- a) 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 every 400 feet.
 - (1) Said clean-outs, such as plugged wye or tee fittings, shall be located to facilitate maintenance.

7. Terminal Discharge

- a) 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.
- b) At manholes, the point of force main entry shall be in the same direction as the flow line.
 - (1) The last 20' of pipe into the manhole shall be upsized 2 diameter inches.

E. Design Considerations - continued

- c) For new force main connections to existing manholes or pump station wet wells, the developer must install an LCU approved liner/coating system for corrosion protection of the manhole structure.
- d) For discharge of new force main flow into an existing LCU pump station wet well, the developer must install a new inline master manhole unless one already exists.
- e) Any deviation from these above requirements must first be approved by LCU.

F. Valves

- 1. 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.

G. Valve Boxes

- 1. Cast iron valve boxes shall be provided for all valves installed underground which do not have extended operators such as is required for plug valves.
- 2. Valve boxes shall:
 - a) Have an interior diameter of not less than 5",
 - b) Be adjustable to fit the designated depth of each cover over the valve,
 - c) Be designed to prevent the transmission of surface loads directly to the valve or piping, and
 - d) Be provided with covers marked with the word "SEWER".
 - (1) The covers shall be so constructed as to prevent tipping or rattling.

H. Restraining Devices

- 1. Restraining joints shall be placed at all bends, tees, plugs, reducers, and other fittings to provide lateral support.
- 2. Restraining joints shall conform to applicable LCU Standard Details.
- 3. If approved by the Engineer of Record and LCU, concrete thrust blocks may be utilized as additional restraint.
- 4. Joint restraining systems shall be designed for the maximum pressure condition and the safe bearing load for horizontal and vertical thrust.
- 5. At a minimum, the thrust restraining system shall have a working pressure equal to or greater than the pipe material maximum pressure rating.

H. Restraining Devices - continued

6. A reasonable safety factor shall be determined by the Engineer of Record in specifying all restraining devices.
7. All restrained fittings and joints shall be shown on the plan and profile and must be included on the record drawings. Refer to LCU Standard Details for the minimum restraint schedule required.
8. A joint restraining schedule shall be the responsibility of the Engineer of Record and shall be an integral part of the design package submitted to LCU and the permit agencies for approval.

I. Identification

1. To preclude possible domestic water tapping, all force mains shall be green and marked with 3" detectable marking tape for "sanitary sewer".
 - a) Detectable marking tape shall be per standards outlined in the Utility Location and Coordinating Council's Uniform Color Code.
 - b) It shall be placed along the entire pipe length.
 - c) In all cases, the detectable marking tape shall be installed in accordance with the tape manufacturer's specification.
 - d) It shall be a minimum of 12" to 18" below finished grade during backfill operations.
2. A continuous location tracing wire shall also be installed with all PVC and HDPE force mains.
 - a) The tracing wire is to be 12-gauge double insulated copper.
 - b) It shall be laid in the trench on top of the pipe and attached at ten (10) foot intervals along the entire length of the pipe.
 - c) It shall be stubbed out at valves, pressure clean-outs and air release valves.

J. Acceptable Pipe Materials

1. Ductile Iron (DIP) is not to be used for force mains.
2. Polyvinyl Chloride (PVC)
 - a) PVC sanitary sewer force mains shall meet the following AWWA specifications:
 - (1) PVC Pipe Not Installed Under Roadway Pavement:
 - a. AWWA C900, DR 18 for pipe diameters 4" through 14"
 - b. AWWA C905, DR 25 for pipe diameters 16" and greater

J. Acceptable Pipe Materials - continued

(2) PVC Pipe Installed Under Roadway Pavement By Direct Bury and All Vertical Deflections:

- a. AWWA C900, DR 14 for pipe diameters 4" through 14"
- b. AWWA C905, DR 25 for pipe diameters 16" and greater

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

3. High Density Polyethylene (HDPE)

a) LCU has the option of approving the use of HDPE sanitary sewer force mains.

(1) HDPE force mains shall have the equivalent internal diameter and equivalent pressure class rating as the corresponding PVC pipe, unless otherwise approved by LCU.

(2) HDPE pipe must have at least three equally spaced horizontal green marking stripes.

(3) All aboveground force mains shall be constructed of HDPE DR 11 unless otherwise approved by LCU.

Please see Conditions Requiring Casing Section for additional information.

3.6 CASING INSTALLATION

The provisions of this section shall represent the minimum standards for the installation of casing pipe for force mains as well as conditions requiring casing.

A. General

1. For force mains to be placed under all Lee County Department of Transportation (LCDOT) roadways, the casing and procedures shall conform to the requirements of LCDOT as outlined in Administrative Code "AC-11-12" and any supplements thereto.
2. All work and materials shall be subject to inspection by LCDOT.
3. Specific crossing requirements of the authority having jurisdiction shall be obtained in advance and complied with for all underground force mains crossing Lee County roadways, Florida State Highways, and railroads.
4. Casing requirements for private roadways within LCU service areas shall be the same as those for LCDOT roadways.
5. It shall be the responsibility of the engineer to prepare and complete design loading calculations for the force main casing to determine if the proper material requirements are greater than those minimums specified here.
6. Casings shall be installed in accordance with permit conditions of the authority having jurisdiction.

B. Conditions Requiring Casing

1. When new roadways, turn lanes, acceleration lanes, deceleration lanes, or driveways are proposed; split steel casing pipe with bell restraints and casing spacers shall be installed on any existing PVC main.
 - a) Relocation or replacement of existing PVC pipe lines is an option to installation of split steel casing, if approved by LCU.
2. LCU reserves the right to require split steel casing on existing LCU mains under any other conditions deemed necessary.

B. Conditions Requiring Casing - continued

3. New carrier pipe conditions which will require a casing are as follows:

Location	Carrier Pipe Material		
	PVC DR 18	PVC DR 14	HDPE DR 11
All Rights-of-Way, not under traveled way	none	none	none
Local Roadways and Collectors no more than 2 lanes			
Under Primary Travel Lane ¹	steel casing ³	steel casing ³	none
Under Secondary Travel Lane ²	steel casing ³	steel casing ³	none
Collector More than 2 lanes or Arterial Roadway			
Under Primary Travel Lane ¹	steel casing ³	steel casing ³	HDPE casing ⁴
Under Secondary Travel Lane ²	steel casing ³	steel casing ³	none
Controlled Access, Expressway, and Freeway			
Under Primary Travel Lane ¹	steel casing ³	steel casing ³	HDPE casing ⁴
Under Secondary Travel Lane ²	steel casing ³	steel casing ³	HDPE casing ⁴
Railroads	steel casing ³	steel casing ³	HDPE casing ⁴
Driveway or Access Drive			
For Institutional sites (schools, hospital, etc)	steel casing ³	steel casing ³	none
For all others	none	none	none

Notes:

1. Includes condition where the carrier pipe crosses under both Primary and Secondary Travel Lanes together.
2. Condition where the carrier pipe is only under a Secondary Travel Lane.
3. Steel casing shall conform to the requirements of the Steel Casing Section of this Chapter.
4. HDPE casing shall conform to the requirements of the HDPE Casing Section of this Chapter.

4. In addition to the above; LCU reserves the right to require casings for new mains if conditions warrant &/or if deemed necessary.

C. Casing Pipe Installation

1. 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.
2. There shall be a minimum 36" depth of cover between the top of the casing pipe and the surface of the roadway.
3. 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.
4. Casing requirements for private roadways within LCU service areas shall be the same as those for LCDOT roadways.
5. State Highway casing installations shall be as specified in the FDOT, "Utility Accommodation Guide".

C. Casing Pipe Installation - continued

6. Railroads crossings shall be as specified in the ‘American Railway Engineering Association, Part 5, Section 5.2, "Specifications for Pipelines Conveying Nonflammable Substances".
7. In no case shall the minimum casing pipe diameter and wall thickness, for a specific carrier pipe size, be less than that specified herein.

D. Casing Pipe Material

1. Steel Casing
 - a) Steel casings shall be prime steel pipe conforming to the requirements of ASTM Designation A-139.
 - b) Unless otherwise approved by Lee County Utilities, the minimum casing pipe size and wall thickness shall be as shown in the following table, for the force carrier pipe size indicated.

Carrier Pipe Normal Size Inches	Casing Pipe Nominal Diameter Inches	Casing Pipe Wall Thickness Inches
4	10	0.250
6	12	0.250
8	16	0.250
10	20	0.250
12	24	0.312
14	28	0.312
16	30	0.312
20	36	0.375
24	42	0.500

- c) For sizes not included herein, or for special design considerations, approval shall be obtained from Lee County Utilities.
2. HDPE Casing
 - a) HDPE casings shall be a minimum DR 11 for carrier pipes less than 16” diameter.
 - b) HDPE casings for carrier pipes 16” diameter and larger shall be DR 17.
 - c) There shall be a minimum of 4” annular clearance between the interior of the casing pipe and the outside of the carrier pipe, unless otherwise approved by the LCU.
 - d) HDPE casing pipe shall be manufactured from PE 3408 polyethylene meeting AWWA C906 standards.

D. Casing Pipe Material – continued

- e) Unless otherwise approved by LCU, the minimum casing pipe size and wall thickness shall be as shown in the table below, for the carrier pipe size indicated.

Carrier Pipe Normal Size Inches	Carrier Pipe Wall Thickness Dimension Ratio	Casing Pipe Nominal Diameter Inches	Casing Pipe Wall Thickness Dimension Ratio
4	11	10	11
6	11	14	11
8	11	16	11
10	11	18	11
12	11	20	11
14	11	24	11
16	11	24	17
18	11	30	17
20	11	30	17
24	11	30	17

E. Carrier Pipe

1. Pipe and fittings shall comply with the applicable provisions of these Standards.
2. PVC force main carrier pipes to be installed within steel casings shall be Restrained Joint with casing spacers in accordance with Section 2 and the requirements of LCU Standard Details.
 - a) Stainless steel carriers with Teflon skids, being on center and restrained shall be the preferred method for installing the carrier pipe in steel casing.
 - b) High-density polyethylene Raci casing spacers or approved equal can be used for all size PVC pipes and on DIP pipe with diameters 12” or less.
 - c) 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.
 - d) Spacers shall be installed every 7 feet, or less, on center.
 - e) The casing spacers shall provide a minimum safety factor of 2 to 1 to support the service load.
3. HDPE force main carrier pipes are to be installed within HDPE casings.
 - a) Spacers and bell restraints shall not require.
4. Special supporting of the carrier pipe within the casing shall be required with a design approved by Lee County Utilities.
5. After the carrier pipe has been tested for leakage, the casing shall have the ends blocked with an 8" wall of brick masonry with a weep hole installed near the bottom of each wall.

3.7 FORCE MAIN TESTING

All new sewer force mains installed shall undergo Hydrostatic Testing for leakage. The tests to be performed will be indicated by the Engineer of Record and witnessed by LCU representatives.

A. Flushing

1. All mains shall be flushed to remove all sand and other foreign matter.
2. Flushing shall be terminated at the direction of the LCU Inspection Staff
3. The Contractor shall dispose of the flushing water without causing a nuisance or property damage, and shall meet all regulatory requirements for the protection of the environment.

B. Hydrostatic Testing

1. The Contractor shall furnish the necessary labor, water, pumps, and gauges at specified location and number and all other items required to conduct the required force main testing.
2. The Contractor shall perform hydrostatic testing of the system as set forth in the following:
 - a) 48 hours advance notice must be provided to LCU before all testing.
 - b) Testing is to be conducted in the presence of representatives from LCU and other authorized agencies.
 - (1) It is the underground contractor's responsibility to pre-pressure test prior to scheduling the official test with LCU and the Engineer of Record.
 - c) Piping and appurtenances to be tested shall be within sections between valves unless alternate methods have received prior approval from the LCU.
 - d) Testing shall not proceed until restraining devices have been installed.
 - e) All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter.
 - f) While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities to be tested.
 - g) Hydrostatic testing shall be performed with a sustained pressure for a minimum of two (2) hours at 150 psi pressure or 2-1/2 times working pressure, whichever is higher, unless otherwise approved by LCU,
 - h) Testing and passing results shall be in accordance with the applicable provisions as set forth in the most recent edition of AWWA Standard C600.

B. Hydrostatic Testing - continued

- i) The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formula:

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

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), $L = (9.195 \text{ EE-}5)SD$

3. The testing procedure shall include the continued application of the specified pressure to the test system, for the two (2) hour period, by way of a pump taking supply from a container suitable for measuring water loss.
 - a) The amount of loss shall be determined by measuring the volume displaced from said container.
4. Should the test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until results are within the established limits.

Please see 'Technical Specifications' Section for additional information on flushing, and hydrostatic testing requirements.

Please see the 'Approved Materials List' for additional information on the following:

- | | |
|--------------------------|--------------------------|
| 1. Pipe | 10. Restraining Devices |
| 2. Casing | 11. Anchors |
| 3. Fittings/Joints | 11. Manholes |
| 4. Gaskets | 12. Corrosion Protection |
| 5. Eccentric Plug Valves | 13. Pressure Clean-outs |
| 6. Swing Check Valves | 14. Backflow Devices |
| 7. Pinch Check Valves | 15. Sand |
| 8. Valve Boxes | 16. Concrete |
| 9. Air Release Valves | |

3.8 EXCAVATION, TRENCHING, BACKFILLING, AND RESTORATION

Please see the 'LCU Technical Specifications' for additional information on the following:

- | | |
|---|--|
| 1. Sheeting and Bracing | 11. Rock Excavation |
| 2. Concrete | 12. Borrow |
| 3. Workmanship | 13. Excavation Site Safety |
| 4. Trench Dimensions | 14. Dewatering |
| 5. Trench Grade | 15. Obstructions |
| 6. Unsuitable Material Below Trench Grade | 16. Backfill |
| 7. Utility Bedding | 17. Restoration |
| 8. Extra Utility Bedding Material | 18. Protection and Restoration of Property |
| 9. Excavated Material | 19. Cleanup |
| 10. Material Disposal | 20. Protective Concrete Slab |

3.9 ADDITIONAL INSTALLATION REQUIREMENTS

Please see the 'LCU Technical Specifications' for additional information on the following:

- | | |
|----------------------------|---------------------------------|
| 1. Inspection of Material | 9. Polyvinyl Chloride Pipe |
| 2. Pipe Cleanliness | 10. Anchors |
| 3. Pipe Gradient | 11. Joints |
| 4. Pipeline Identification | 12. Installing Valves and Boxes |
| 5. Identification Tape | 13. Manholes |
| 6. Locating Wire | 14. Concrete Encasement |
| 7. Pipe Joint Deflection | 15. Flush Out Connections |
| 8. Rejects | |

3.10 PUMP STATION DESIGN

The Engineer shall comply with the design and installation requirements as specified by LCU and the Florida Department of Environmental Protection (FDEP).

A. General

1. Pumping stations with a design peak hour flow of 1500 gpm or less shall include a minimum of two (2) pumps.
2. Pumping stations where the peak hour design flow exceeds 1500 gpm, three (3) or more pumps shall be provided.
3. Proposed projects with three (3) or more pump stations, must provide a 'Master' pump station.
 - a) All master pump stations are to be equipped with adequately sized odor control units.
 - b) All master pump stations are to be equipped with adequately sized standby emergency generators.
4. The force main exiting the master pump station shall be the only connection to LCU's existing facilities.
5. All pump stations shall be designed such that the design peak hour flow can be pumped with the largest pump out of service.
6. The selected sewage pump system shall be capable of pumping the design peak hour flow at the maximum computed system total head requirements.
7. Final pump selection shall be based upon optimum operational costs.
8. LCU reserves the right to request that proposed sewage pump stations intended to serve a single building or tract of land and that do not provide a regional benefit be constructed as privately owned and maintained pump stations.

B. Wet Well Design

1. The wet well shall be circular and constructed of precast, Type II concrete sections.
2. All structures shall be constructed level and plumb.
 - a) Sections are to be installed in true alignment, with a ¼ inch maximum tolerance per section.
3. In all cases, the top elevation of the wet well shall be no lower than 6 inches above the master manhole rim elevation.

B. Wet Well Design - continued

4. Wet wells shall provide sufficient space for equipment and required suction pipe submergence.
 - a) The inside diameter of the wet well shall not be less than 8 feet, unless otherwise approved by LCU.
 - b) 6 foot diameter wet wells will be acceptable for grinder stations only.
5. Wet Well Liners and Coatings
 - a) To prevent contact of wet well structure from corrosive sewer gases, all wet wells will require liners or coatings installed, tested and inspected per manufacturer's recommendation.
 - b) The liners/coatings must extend and seal:
 - (1) onto wet well hatch frame,
 - (2) around pipe openings and
 - (3) around any other protrusions.
 - c) Where no corrosive conditions are expected in a wet well, the interior may be coated with two (2) coats of coal tar epoxy to a minimum thickness of 18 mils.
 - (1) With specific written LCU approval.
 - d) Please refer to 'Technical Specifications' for additional information regarding wet well liners and coatings.
6. In general, the normal operational water level shall provide positive suction head for the pumps.
7. Low water levels shall be set to provide adequate submergence of pumps and facilities to preclude pump cavitation.
8. High water alarm shall not exceed an elevation that is 6" below invert elevation of the lowest influent gravity sewer.
9. There shall be a minimum distance of 6.0 feet from influent invert to the wet well bottom.
10. In designing wet wells, the following three limitations must be observed:
 - a) One pump running in a duplex pump station must have the capacity to pump the peak hour flow.
 - b) Under average daily flow conditions, it is desirable to set the pump cycle time to pump out the wet well every 6 to 15 minutes to prevent septic conditions.

B. Wet Well Design – continued

- (1) Pump cycle time is defined as the time required to:
 - a. Fill the storage volume in the wet well from the pump “Off” level to the Lead Pump “On” level plus
 - b. The time required to pump down the wet well to the Pump “Off” level.
 - (2) The maximum number of cycles per hour shall be 10 or 6 minutes per cycle.
 - (3) 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.
- c) Since starting current produces heat, it is recommended that each motor be started no more than 10 times per hour.

d) Pump Cycles

- (1) 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 wet well from Lead Pump “On” level to Pump “Off” level (in gallons)

Q_{DP} = Design pumping rate (gpm)

Q_{AI} = Average flow into wet well (gpm)

- (2) 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 wet well at peak hourly flow conditions immediately after the pump shuts off. This will result in maximum cycles per hour for the pump station.

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

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

Where:

T_{Peak} = Time for one pump cycle under peak hour flow (in minutes)

V_{ww} = Storage volume in the wet well from Lead Pump “On” level to Pump “Off” level (in gallons)

Q_{DP} = Design pumping rate (gpm)

Q_{PI} = Peak hourly flow into wet well (gpm)

C. Pumps And Motors

1. Pumps shall be designed to facilitate easy removal and replacement for inspection or maintenance purposes.
 - a) There shall be no bolts or other fastening to be removed.
 - b) Without LCU personnel needing to enter the wet well.
2. Pumps shall be:
 - a) non-clog,
 - b) mechanical seal,
 - c) capable of handling raw, unscreened sewage and passing a sphere of at least 3" in diameter.
3. Pumps shall provide the required peak design performance.
 - a) They shall be suitable for operation within the total hydraulic range of operation without overloading the motors.

D. Piping Design

1. Pump station piping shall have the same requirements as those for force mains except that PVC or HDPE shall be utilized within the wet well structure.
2. Pump station piping shall be above ground unless otherwise approved by LCU.
3. Each sewage pump shall have individual piping.
4. For non-submersible type pumps there shall be:
 - a) Suction through a down-turned bell mouth fitting located within the wet well to preclude turbulence, and
 - b) A shutoff valve prior to the pump.
5. Each individual pump discharge pipe shall be equipped with:
 - a) An air release valve,
 - b) A check valve, and
 - c) An eccentric plug valve.
 - (1) The eccentric plug valve shall follow the check valve to facilitate shut-off.
 - (2) It is to be located prior to the connection into the station header and force main.
6. All pipes discharging into the wet well shall be designed for submerged discharge below the lead pump "pump-off" level.
 - a) This may be accomplished using a drop pipe connection.
7. The intake pipe shall be designed to prevent pump damage by cavitation at possible extreme pumping rates.

D. Piping Design - continued

8. 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.
 - a) For pipes passing through structural walls, wall pipes with water stops shall be installed:
 - (1) where the location is below the surface of the ground and
 - (2) at any point where fluid levels will exceed that elevation.
 - b) Neoprene sleeves with watertight caulking and 316 Series SS stainless steel clamps will be suitable at other locations.
9. Flexible connections such as flanged coupling adapters, expansion joints and couplings, etc., shall be provided within flanged piping systems in order to provide for:
 - a) expansion and contraction,
 - b) differential settlement,
 - c) and/or to expedite installation and maintenance.
10. Special consideration shall be given to the support and restraining of piping systems where flexible connections are used.
 - a) This requirement shall apply to both interior and exterior systems.

3.11 PUMP STATION GENERAL REQUIREMENTS

A. Site

1. Pump Stations shall be installed outside of any road right-of-way.
2. The site shall meet the setback requirements per Lee County Land Development Code.
3. Pump station sites shall have adequate area provided for operation and maintenance of facility.
 - a) At a minimum 20' by 30'.
4. A master manhole must be provided within 25 feet of the wet well
 - a) This manhole shall have only one effluent pipe to the pump station.
5. Pump station sites are to be well drained.
 - a) The wet well top slab must be set at or above the elevation designated by the Federal Insurance Administration 25-year 3-day FEMA flood water surface elevation.
 - b) The bottom of the 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.
6. For operation and maintenance purposes, pump station sites are to be readily accessible by LCU vehicles and shall include:
 - a) A 10' wide paved or concrete driveway with no more than a 2% slope in either direction.
 - (1) Driveway is to be designed to drain water away from the pump station site.
 - b) A 10' wide cantilevered gate,
 - c) 6' tall chain link fence with dark green vinyl coating
 - (1) Dark green vinyl coating is preferred however, black is also acceptable.
 - d) Geotechnical fabric with 4" of compacted #57 stone.
7. Sufficient lighting shall be provided for night time emergency work as follows:
 - a) Provide a 10 foot tall aluminum light pole.
 - b) The lamp shall be a 250 watt halogen lamp.
 - c) There is to be a manually controlled on/off switch located inside the pump control panel.
8. All sewage pump stations shall be provided with a potable water service and reduced pressure cross connection assembly.
 - a) All applicable LCU fees for this service shall be paid by the developer/contractor prior to placing the pump station in operation.

A. Site – continued

- b) Installation shall include meter box, tap, and connection.
 - (1) Please refer to LCU Standard Details for specific LCU installation requirements.
- c) The location of meter and assembly must be shown in the site plan on the pump station detail sheet.
 - (1) LCU prefers the meter box to be located within the LCU Pump Station Easement, on the outside of the fence with the assembly located just inside the fence but within 2' of the meter box.
- d) A conveniently located brass or copper hose bib shall be provided to facilitate wet well wash down.
 - (1) The hose bib is to be mounted on a 4" x4" precast concrete post secured by stainless steel straps located adjacent to the cross connection assembly.

B. Emergency Pump Connections

- 1. All pump stations not equipped with stationary standby power generators shall be equipped for emergency auxiliary pumping per LCU Standard Details.

C. Pump Station Power

- 1. An Electric Meter shall be supplied by the company providing power to the station.
- 2. A separate Power Disconnect Switch shall be provided at each pump station.
 - a) The Disconnect Switch is to be located in line immediately after the power meter and before the control panel.
 - b) The switch shall be NEMA 4X, aluminum or stainless steel housing fitted with locking hoop and padlocks, master keyed to County Standards.
 - c) See Technical Specification for additional information.
- 3. Electric Panels
 - a) Electric Panels shall be of the type recommended by the pump manufacturer and shall be compatible with the requirements of the pumping operation.
 - b) Each shall include provisions for:
 - (1) Turning pumps on and off, manually and automatically,
 - (2) Alternating lead pump with each pump cycle or manually,
 - (3) Indications for operation and alarm conditions,
 - (4) Testing and indication of all operational features,
 - (5) Terminal strip wired and indicated for all Scada contacts,

C. Pump Station Power - continued

- (6) Spare a minimum of 8 terminal strip contacts to allow for expansion, repair &/or alterations.
- c) All pump stations operating on 480 V, shall include appropriately sized transformer to step down the voltage to 120V to accommodate a minimum of 20 amp circuit in the receptacle.
- d) All wiring shall be color coded and numbered as shown in the LCU Standard Details.
- e) A waterproof wiring schematic showing the color coded wiring and corresponding descriptions shall be affixed to the inside of the pump control panel door.
- f) A lightning arrestor is to be provided sized for voltage, current and phase for particular installation as approved by a licensed electrical engineer.
 - (1) The lightning arrestor is to be mounted on the outside bottom of the disconnect box.
- g) Pump stations not supplied with emergency generators on site shall include a service generator receptacle of the type and size sufficient to operate all necessary equipment and connect to power via LCU portable generators.
 - (1) Emergency Generators will be required at all Master Pump Stations as well as any pump station whose location results in more than 30 minutes response time from a maintenance crew.
 - (2) See Master Pump Station Section below for additional information.

3.12 MASTER PUMP STATIONS - ADDITIONAL REQUIREMENTS

Master pump stations shall include all components required for typical pump stations however, they shall also include the following:

A. Ventilation and Odor Control Facilities

1. Forced draft mechanical ventilation shall be provided for all wet wells where free access is required for operating equipment maintenance and/or inspection.
 - a) Wet wells without free access shall be ventilated with a minimum of one 4" diameter open vent pipe.
2. All vents shall be a minimum of 2 feet above flood levels in flood zones set by FEMA or other competent authority.
3. 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.
4. Ducts shall be fiberglass or Schedule 40 PVC with white or grey painted coating and labeled with air flow direction arrows.
 - a) Air piping and fittings used for transmission of sewer gases in odor control systems must be:
 - (1) Schedule 40 PVC or HDPE.
 - (2) DIP pipe and fittings will not be allowed.
5. Odor control equipment shall be required for all wet well air concentrations with expected hydrogen sulfide air concentrations exceeding 10 ppm on the average.
6. Proposed odor control equipment and methods shall be reviewed and approved by LCU.

B. Emergency Generators

1. Emergency generators are to be engine type of adequate size to automatically start and operate the pumps required for design flow conditions, lights, controls and other critical items.
2. The generator installation shall be in accordance with all applicable manufacturers' requirements.
3. In order to minimize noise levels, the generator must also be equipped with a noise reduction package that must first be approved by LCU .

Please see the 'LCU Technical Specifications' for additional information on the following:

1. Pump Design
2. Pump Construction
3. Pump Test
4. Pump Warranty
5. Dry Pit Pumps
6. Pump Motors
7. Pump Controls
8. Variable Speed Pump Control Systems
9. Telemetry System
10. Emergency Generators
11. Power Disconnect Switch
12. Flow Meters
13. Sump Pump
14. Sewage Pumps And Motors