

## SECTION IV-2 - CIVIL DESIGN CRITERIA

### 2.1 Wastewater Flow Calculations

#### A. Wastewater Flow Projections

Projected wastewater inflow to a lift station shall be calculated using the procedure outlined in the Fort Worth Water Department's Policy and Procedure for Processing Water and Wastewater Projects for Design and Construction dated April 1999. In order to accurately perform the wastewater inflow calculations, the following information, as a minimum, shall be determined by the design engineer:

1. Total acreage in lift station watershed
2. Total population and acreage of existing developments to be served by lift station.
3. Total population and acreage of proposed developments to be served by lift station.
5. Harmon's peaking factor
6. Average day and maximum day inflows to lift station

#### B. Lift Station Design Pumping Capacity

The firm pumping capacity of the lift station shall be equal to or greater than the peak wastewater inflow. Firm pumping capacity is defined as the maximum lift station pumping capacity with the largest pump out of service.

### 2.2 Site Considerations

#### A. Lift Station Site Survey

A site survey shall be submitted with the lift stations plans containing the lift station site boundary lines described by bearing and distance. All adjoining properties shall be labeled on the survey plat. Whenever possible, the City of Fort Worth shall be granted fee title ownership of the lift station site upon final acceptance.

#### B. Access

The lift station shall be accessed via a minimum 12' wide concrete driveway located in a dedicated right-of-way or permanent easement. The site layout shall provide means for Water Department maintenance vehicles to access the lift station site in order to provide routine and emergency maintenance for all equipment.

C. Water Service

Water service shall be provided to the lift station site. Water service shall consist of a 1” copper service and hose bib located at the property line.

D. Lift Station Fence and Gate

The lift station, including mechanical and electrical equipment, shall be protected from access by the general public. The lift station shall be enclosed within an intruder resistant fence or located within a lockable structure. An intruder resistant fence shall consist of a minimum of a chain link fence six feet in height with a 1 foot section above consisting of three strands of barbed wire. Fencing requirements may be upgraded as desired by the design engineer.

An entrance with two eight foot wide gates across the access road with removable center pole shall be provided. Gates may be required to be upgraded as necessary depending on the size of the lift station and the equipment located on site. The gate entrance shall be set back at least twenty feet from the road in order to allow vehicles to pull off the road before opening the gate.

E. Storm Water Provisions

The lift station shall be protected from the 100 year flood and shall be accessible to maintenance personnel during a 25 year flood. Where applicable, the 100 year base flood elevation (BFE) and/or floodplain delineation shall be shown on the engineering drawings. All lift station electrical controls and vent pipe outlet must be elevated above the 100 year BFE.

The site shall be graded generally to drain away from the lift station wetwell, and to remove storm water runoff from the site in a non-erosive manner. Where the lift station is susceptible to localized flooding, a drainage study, signed and sealed by a licensed engineer, shall be submitted to the City showing the 25 and 100 year storm flows and proposed storm water conveyance structures.

2.3 Wetwells

A. Wetwell Size

The required volume of wetwell storage occurs when the flow into the wetwell is one half the maximum inflow. Storage volume calculations shall be confined to the volume in the wetwell only and should not include the volume within the collection system. In order to calculate this volume, the minimum cycle time between pump motor starts shall meet the following requirements:

<u>Pump Motor Size (HP)</u>	<u>Minimum Cycle Time (min)</u>
Less than 20 HP	15 minutes
20 HP to 100 HP	20 minutes
Over 100 HP	25 minutes

The formula used to calculate the minimum wetwell volume is as follows:

$$V = TQ/4$$

Where

V	=	Wetwell volume in gallons
Q	=	Pump capacity in gallons per minute
T	=	Minimum cycle time in minutes

In addition to this requirement, the design engineer shall investigate electrical service outage records at the lift station location per 30 TAC 317.3. If power reliability is deemed to be inadequate by the TNRCC, the TNRCC may require one or more of the following:

1. A diesel generator with automatic transfer switch permanently located at the lift station site.
2. Emergency flow equalization storage be provided in wetwell and/or collection system
3. Electrical service from two independent feeder lines or substations of the same electric utility, provided automatic switch over capabilities are in effect.

#### B. Wetwell Coatings

The interior of the lift station wetwell shall be coated or lined using an approved Fort Worth Water Department coating or lining material, to the thickness required.

#### C. Wetwell Finished Floor

The finished floor of the lift station wetwell shall have a minimum slope of ten (10) percent to the pump intakes and shall have a smooth finish to prevent solids deposition. Coordinate finished floor requirements with pump manufacturer's recommendations.

#### D. Baffle Walls

The engineer shall coordinate with the pump manufacturers to determine if anti-vortexing baffle walls, located within the wetwell, are required.

#### E. Hydrostatic Test

Prior to backfilling wetwell, a hydrostatic test shall be performed on the wetwell structure, performed in accordance with ACI 350 – “Environmental Engineering Concrete Structures”.

#### 2.4 Valve Vaults

In general, the minimum vertical distance from the valve vault top slab or grate walking surface to the valve vault finished floor shall be 6'-8". The overall length and width of the valve vault must provide at least 24" of horizontal clearance between the outside edge of the check valves and the valve vault walls. Valve vault floors shall be sloped to the sump. Variances to this requirement for small lift stations shall be approved on a case by case basis.

### **2.5 Ventilation and Odor Control**

#### A. Wetwell

The ventilation for the wetwell shall be designed as a passive gravity ventilation system where the air volume in the wetwell is either increased or decreased as the wastewater level fluctuates due to inflow and outflow. The passive ventilation shall be sized to vent at a rate equal to the maximum pumping rate of the station, not to exceed a maximum permissible design airflow through vent pipe of 600 feet per minute (fpm). Passive “gooseneck” vents shall be turned down so that the opening faces the top slab of the wetwell. The minimum allowable passive vent diameter shall be 6". Stainless steel screens shall be required to prevent birds and/or insects entry into the wetwell.

#### B. Valve Vault

A valve vault with a grated top shall normally not require mechanical ventilation. Mechanical ventilation shall be required where grated valve tops are not utilized. Mechanical ventilation systems under intermittent operation shall be designed to provide a minimum of 30 air changes per hour. Mechanical ventilation systems under continuous operation shall be designed to provide a minimum of six air changes per hour.

#### C. Odor Control

The Water Department may require the design engineer to incorporate odor control facilities into the project, depending on the odor potential of the site. The design engineer shall coordinate with Water Department in order to determine odor control requirements.

#### 2.6 Force Mains

A. Alignment

Force mains shall be aligned vertically in such a way as to minimize peaks and valleys which require combination air/vacuum valves.

B. Hydraulic Design Considerations

The minimum allowable velocity within a force main shall be 2.5 fps and the maximum allowable velocity shall be 8 fps. High velocities within force mains are discouraged due to the associated high surge pressures and excessive friction head.

C. Surge Pressure Design Considerations

The engineer shall calculate the surge pressures expected within the force main during pump operation. Where applicable, surge valves shall be placed downstream of the check valve and shall preferably discharge back into the wetwell.

D. Hydrostatic Test

A hydrostatic test of the force main at two times the maximum anticipated operating head or 150 psi, whichever is greater, shall be completed prior to acceptance. The purpose of the hydrostatic test is to establish that the section of pipe to be field tested, including all joints, fittings, and other appurtenances, will not leak, or that leakage is within the allowable limits. The test shall be conducted for a period of not less than two hours, after which, if the pressure has dropped from the initial reading, the system shall be re-pressurized to the initial pressure. The amount of water required to re-pressurize the system shall be accurately measured. Leakage shall be defined as the quantity of water that must be supplied in to the pipe in order to achieve and maintain test pressure. Allowable leakage shall be defined as any leakage amount below the following allowance:

$$L = SD\sqrt{P} / 133,200$$

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 during the leakage test, in psig

If repairs are required, the hydrostatic field test shall be repeated until the pipe installation conforms to the requirements.

2.7 Receiving Gravity Sewer

A. Hydraulics

The receiving gravity sewer system shall be designed to convey the maximum pump discharge without surcharge plus all flows to be conveyed by the service area of the gravity sewer.

B. Location

Due to odor considerations, the manhole at the transition from the force main to gravity main shall be located as far away from existing or proposed houses as possible and in city right of way.

C. Corrosion Resistance

A sanitary sewer manhole with approved Fort Worth Water Department corrosion resistant coating shall be placed at the transition between the wastewater force main and the receiving gravity main.