2.0 ENGINEERING REPORT

All pump station plans shall be accompanied by an engineering report. The following information shall be included in the report:

2.1 TITLE PAGE - Title page should include the project name, date, developer/owner's name and engineering firm preparing plans.

2.2 SEWER SYSTEM INFORMATION

A. Introduction

1. Type, location and size of development

2. Number of and range in size of lots or buildings to be serviced

B. Existing Sewer System

1. Location and type of gravity system the force main will discharge into.

2. Future of sanitary sewer service

3. State whether the entire development will be serviced by the proposed phase or if several phases will be involved.

4. State the number of lots this phase will encompass initially and finally if future phases are to be constructed.

2.3 PUMP STATION AND FORCE MAIN DESIGN CALCULATIONS

A. Nb = Number of specified types of buildings
Np = Number of persons per unit
Pe = Nb x Np

B. Average Daily Flow (ADF)

1. Average Daily Flow (GPD) = Pe x 100 gal/person/day

2. Average Daily Flow (GPM) = Flow (GPD) / 1440 (Min/Day)

C. Peak Daily Flow (PDF)

1. $$\text{Peaking Factor} = \left(18 + \sqrt{\frac{PE}{1000}}\right) \div \left(4 + \sqrt{\frac{PE}{1000}}\right)$$

2. Peak Daily Flow (GPD) = PF X ADF (GPD)

3. Peak Daily Flow (GPM) = PF X ADF (GPM)

D. Total Dynamic Head (TDH)

1. Static Head (Hs)
   Eh = Maximum force main elevation
   E1 = Wet well low water elevation
   Es = Eh - E1

2. Loss (Lf) due to friction in force main
   Length = Total equivalent length of force main and piping within pump station
   Lf = Length x Friction Factor

   - Hazen-Williams C-factor of 120 shall be used for computation of friction losses.

3. TDH = Hs + Lf

E. Force Main

1. Volume of Storage (Vs)

2. Velocity Produced in Force Main

3. Maximum Operating Pressure

   (a) Size air release valves (if applicable)

   (b) Retention time of force main (at initial flows and at design flows)

F. Storage Requirements

1. Volume of storage (Vs)
   Vs = ADF (GPD) x (hours of storage required / 24 hours per day)

2. Dimensions of storage facility.

G. Buoyancy Checks - A buoyancy check shall be performed for the pump station wet well and the retention chamber.

2.4 CYCLE TIMES

A. Volume (Vr) of water in wet well needed to turn primary pump on

1. Elevation difference (E5) between primary pump on elevation (E3) and pump off elevation (E4)
   E5 = E3 - E4

2. Volume (Vpf) of water per vertical foot in the wet well
   A = the inside area of the wet well
   Vpf = A x 7.481 gal/ft3

3. Vr = E5 x Vpf

B. Cycle Time for ADF

1. Time (Tf) required for volume in wet well to reach Vr
   Tf = Vr/ADF (GPM)

2. Time (Tp) required for pump to return water level to the pump off elevation

3. Total Cycle Time
   Pump ON for Tp
   Pump OFF for (2) Tf + Tp

C. Cycle Time for PDF

1. Time (Tf) required for volume in wet well to reach Vr
   Tf = Vr/PDF (GPM)

2. Time (Tp) required for pump to return water level to the pump off elevation Tp = Vr/(CSR - PDF (GPM)

3. The pump is on for one pumping cycle of Tp and off for 2 storage cycles of Tf plus one pumping cycle of Tp because pumps alternate

D. Total Cycle Time:
Pump ON for Tp
Pump OFF for (2) Tf + Tp

2.5 LISTING OF RESULTS FROM THE DESIGN CALCULATIONS TO BE PRESENTED IN THE FOLLOWING ORDER:

A. Number of Lots or Buildings

B. Population Equivalent

C. Average Daily Flow in GPM

D. Peak Daily Flow in GPM

E. The Volume of the Retention Chamber (8-hour minimum, may require 24 hours in some cases)

F. Static Head

G. Total Dynamic Head

H. The Pump Selected (including type manufacturer, model number, size, Hp, RPM, phase and GPM)

I. Total Cycle Time for Average Daily Flow
Number of Minutes ON (Pumping Time)
Number of Minutes OFF (Fill Time)

J. Total Cycle Time for Peak Daily Flow
Number of Minutes ON (Pumping Time)
Number of Minutes OFF (Fill Time)

K. Size and Length of Force Main

L. Velocity Maintained in Force Main

M. Force Main Retention Time (at initial flows and at design flows)

N. Air Release Valve Sizing Calculations (if applicable)

O. Maximum Force Main Operating Pressure

2.6 COST EFFECTIVE ANALYSIS

Consultant shall perform a cost effective analysis for all proposed pump stations and expansions of existing City-owned pump stations. Cost analysis shall compare the construction, operation and maintenance costs and any applicable salvage values over a 20-year period between

proposed pump station and a reasonable gravity sewer alternative. Operation and maintenance costs that must be considered include: labor, electrical, equipment replacement and routine maintenance.

Pump stations will only be considered a viable option if the cost analysis clearly shows that the gravity sewers are not economically feasible.

2.7 Pump performance curves shall be included with the engineering report.