Wastewater Lift Station No. 50 Improvements Project

PRELIMINARY DESIGN REPORT

Prepared For:

**City of Riviera Beach
Utility District**

Prepared By:

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April 2011

CITY OF RIVIERA BEACH UTILITY DISTRICT
WASTEWATER LIFT STATION NO. 50 IMPROVEMENTS PROJECT

TABLE OF CONTENTS

CITY OF RIVIERA BEACH UTILITY DISTRICT
WASTEWATER LIFT STATION NO. 50 IMPROVEMENTS PROJECT

TABLE OF CONTENTS

CITY OF RIVIERA BEACH UTILITY DISTRICT
WASTEWATER LIFT STATION NO. 50 IMPROVEMENTS PROJECT

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

SECTION 1
INTRODUCTION

1.1 Purpose

The purpose of this Preliminary Design Report is to provide preliminary design criteria regarding the design and construction associated with the City of Riviera Beach Utility District's (RBUD) Wastewater Lift Station No. 50 Improvements Project. The design parameters presented in this Preliminary Design Report are based on review of existing site conditions, a review of as-built drawings of the original Lift Station No. 50 construction drawings and subsequent modifications to Lift Station No. 50, and discussions with RBUD Staff. This Preliminary Design Report provides a description of existing and proposed conditions including preliminary design drawings, a summary of design criteria, and a summary of the associated requirements for electrical, instrumentation and controls, site civil, and permitting.

1.2 Background

RBUD has identified Wastewater Lift Station No. 50 as a facility requiring rehabilitation or replacement to improve safety and reliability, and reduce operation and maintenance costs. Lift Station 50 is located in the central southern area of RBUD's Wastewater Service Area at 909 Avenue U (adjacent to RBUD's Water Booster Facility). Refer to **Figure 1-1** for a location map.

1.3 Project Description

Lift Station 50 serves as the master lift station for the City of Riviera Beach's entire wastewater service area east of Canal C-17 (including Singer Island) and a major portion of the wastewater service area west of Canal C-17. The existing lift station, constructed in the 1960s, is set up in a wet pit-dry pit configuration and contains mountings for four shaft driven pumps. The lift station has reached beyond its expected service life. Access to the wet and dry pits is sub-standard and does not meet all of the OSHA 1910.146 permit-required confined space entry requirements. The pumps and piping in the dry pit are heavily corroded. The pumps and much of the associated equipment are now obsolete and replacement parts are no longer available. Therefore, currently only one of the four pumps is operable. This lift station is in need of total replacement. The proposed improvements associated with this project are summarized below:

- New submersible quadraplex lift station and associated yard piping on RBUD property adjacent to the existing lift station.
- Electrical and instrumentation system within an air-conditioned electrical building.
- Standby electrical power generator and fuel storage tank.
- Biological odor control system.
- Concrete pads, driveways, perimeter walls, access gate, and minor landscaping.
- Existing force main re-routing to the proposed lift station.

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Wastewater Lift Station 50 Improvements

LOCATION MAP

FIGURE
1-1

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SECTION 2
EXISTING CONDITIONS

2.1 Lift Station No. 50

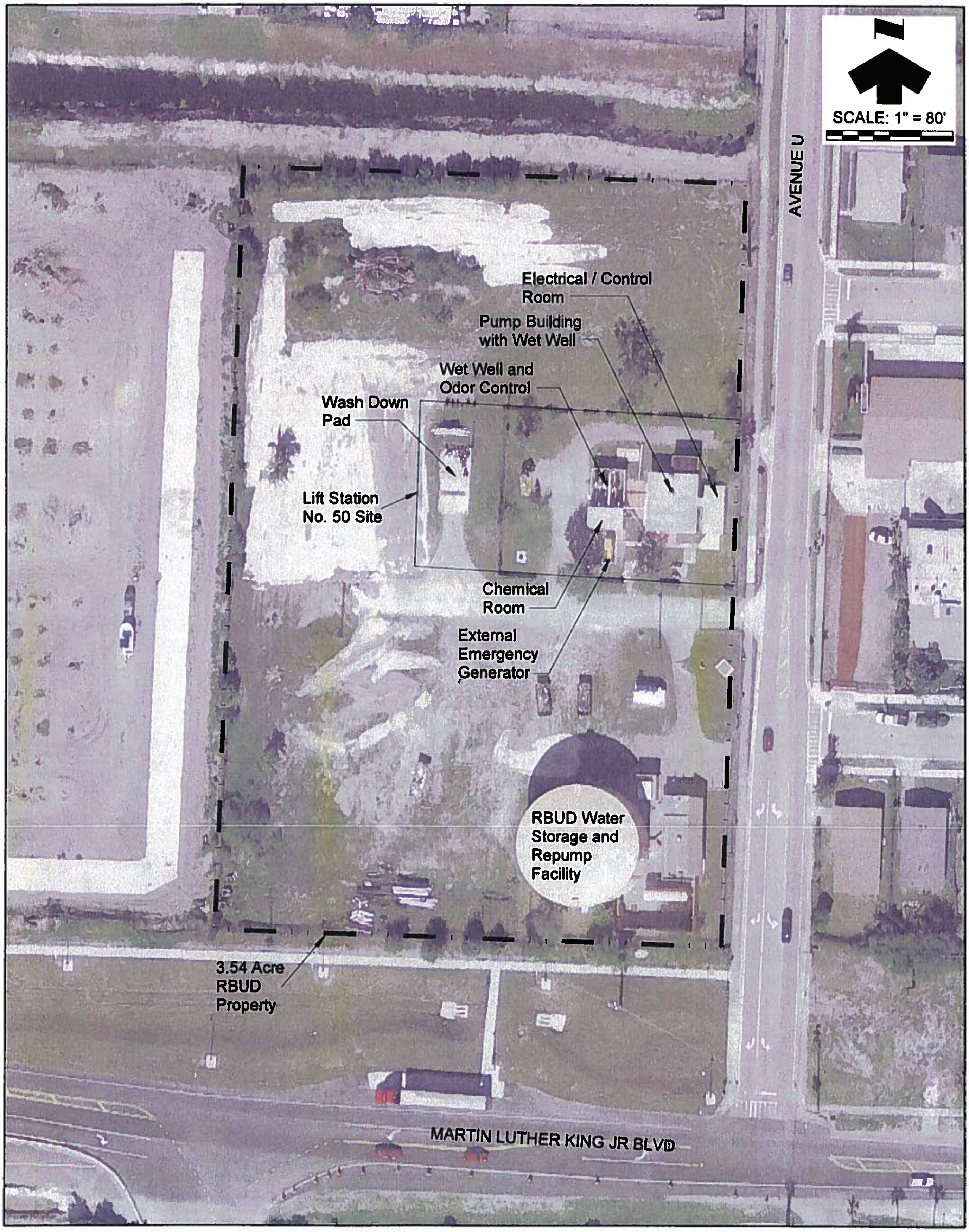
Lift Station No. 50 is located at 909 Avenue U, Riviera Beach, Florida on a 3.54-acre site owned by the City of Riviera Beach Utility District and located within the municipal boundaries of the City of Riviera Beach. The site was apparently once the location of a wastewater treatment plant. The lift station, which occupies only a small portion of the overall site, fronts Avenue U and is immediately surrounded by vacant property; however, there is an existing RBUD water storage and repump facility located south of Lift Station No. 50 on the same parcel. The existing site is shown in **Figure 2-1**.

The lift station is set up in a wet pit-dry pit configuration. The existing facility consists of four vertically mounted shaft-driven 150 HP centrifugal pumps, two of which are variable speed drive and two of which are constant speed pumps. Pump No. 1 and Pump No. 2 are variable speed pumps while Pump No. 3 and Pump No. 4 are constant speed pumps. Based on our review of the pump station activity report provided by RBUD, it appears that the two variable speed pumps have been out of service since at least January 2008. It also appears that only one pump (Pump No. 3) has been operating at the facility from February 2010 to at least September 2010 (the end of the record in the activity report).

The facility is comprised of several buildings. There is a grade level single-story air-conditioned electrical/control room connected to a two-story pump building by an internal doorway. At grade level, the pump building contains the four pump motors and an obsolete 525 KW diesel powered emergency electrical generator (which has been replaced with an external 220 KW diesel powered emergency electrical generator with integral fuel tank). There is a single flight of stairs that lead down to a suspended catwalk in the pump room below. This catwalk then leads down another flight of stairs to the base of the pump room where the four pumps are mounted on floor pedestals. The pump room shares the western wall and the floor elevation with an adjacent below-grade wet well.

Beside the pump building, there is another below-grade wet well piped to the first wet well through three valved 30-inch pipes. The top of this wet well contains two small adjacent rooms: one an obsolete bleach storage room, and the other an obsolete caustic storage/feed pump room. The remainder of the wet well is topped by an odor control system and associated piping which is enclosed behind a concrete masonry wall. Outside, to the north off the pump building there is an obsolete 2,500-gallon underground diesel fuel tank that once fueled the obsolete electrical generator in the pump building.

Approximately 100 feet west of the pump station facility is a concrete wash-down pad, which is used by RBUD to empty sewage vacuum trucks. The perimeter of the concrete wash-down pad is surrounded on three sides by a six-inch high concrete curb. The pad is sloped to drain to a ductile iron trench gate that is connected to an 18-inch PVC gravity drain line leading to the lift station wet well.



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Wastewater Lift Station 50 Improvements

EXISTING SITE

FIGURE 2-1

Lift Station 50 serves as the master lift station for the City of Riviera Beach's entire wastewater service area east of Canal C-17 (including Singer Island) and a major portion of the wastewater service area west of Canal C-17. The lift station receives wastewater flows pumped by 28 RBUD owned lift stations and 8 privately owned lift stations via a number of force mains.

Lift Station No. 50 receives wastewater flows from the north via 14-inch and 16-inch force mains; from the north-east via an 18-inch force main; from the west via a 16-inch force main; and from the east via a 6-inch force main. The lift station discharges directly into a 30-inch force main that directs the flow to the East Central Regional Wastewater Reclamation Facility (ECRWRF) for treatment. There is a 30-inch magnetic flow meter located in line on the 30-inch force main inside a concrete vault just south of the lift station building. The 16-inch force main and the 18-inch force main are piped and valved in such a way that they can either discharge into the lift station or they can by-pass the lift station and discharge directly into the 30-inch force main. We understand that currently both these force mains are directed into the lift station as long as two pumps are operable and the force mains are reset to by-pass the lift station when only one of the pumps is operable.

From review of record drawings provided by RBUD we have determined Lift Station No. 50 was apparently first constructed in approximately 1966. The facility was then rehabilitated in 1992, and further rehabilitated in 2000. The 1992 rehabilitation consisted of building the electrical/control room and installing two VFD drives; replacing the existing pumps and motors; constructing the second wet well, storage rooms and odor control system (since removed and replaced by a more temporary system); replacing the 2,500-gallon underground diesel fuel tank; constructing pavement improvements; and constructing numerous yard piping improvements. The 2000 rehabilitation consisted of constructing the new 30-inch magnetic flow meter on the 30-inch discharge pipe south of the lift station building, and replacing some valves and piping on the discharge side of the pumps in the pump room. In 2006, valving and by-pass piping were installed in the existing 16-inch and 18-inch force mains outside the lift station to allow these two force mains to by-pass the lift station and discharge into the 30-inch force main. In addition, RBUD recently installed the external 220 KW diesel powered electrical generator with integral fuel tank.

Existing pump data obtained from RBUD and from site review is summarized in **Table 2-1**:

Table 2-1
Lift Station No. 50 Existing Facilities

Item	Description
Station Type	Wet pit-dry pit configuration
Wetwell No. 1 Dimensions	34.7' L x 8.7' W x 11' H
Wetwell No. 2 Dimensions	32.7' L x 17.7' W x 14.7' H
Pumps:	
Quantity	4 pumps
Operation	2 VFD, 2 constant speed
Capacity	3,700 gpm (each)
TDH	85 ft
Horsepower	150 HP (each)
Manufacturer/Model	Allis/Chalmers Model NSWV 250

SECTION 3

WASTEWATER FLOW PROJECTIONS

3.1 General

The proposed Lift Station No. 50 will be sized to serve the current Lift Station No. 50 service area. The lift station will also be sized to accommodate any increase in wastewater flow due to expected population growth in the lift station service area over the next 20 years.

3.2 Historical Wastewater Flows

At the time of our evaluation of Lift Station 50, the 30-inch magnetic flow meter was not operating and the 30-inch magnetic flow meter is not integrated into the SCADA system to document the average daily wastewater flows pumped by Lift Station 50. Therefore, in order to determine the wastewater flows the current Lift Station No. 50 pumps, it is necessary to review the historical start times and run times for the lift station.

RBUD automatically records the lift station pump start times and run times on a daily basis and the data is stored as an "Activity Report" in the station computer. The start and run times for the lift station pumps can be used to determine the average daily flow being pumped from the lift station by multiplying the number of pump starts per day by the fixed working volume of wastewater stored and pumped from the dual wet wells on every pump start. For example, the fixed working volume in the dual wet wells is 30,700 gallons (calculated by measuring the dimensions of the dual wet wells and the operational levels provided in the Lift Station record drawings). If on a given day the lift station pumps start 40 times, then the average daily wastewater flow pumped by the station on that day would be 30,700 gallons multiplied by 40, which equals 1,228,000 gallons.

We reviewed the daily pump station Activity Reports for almost a 3-year period from January 1, 2008 through September 23, 2010 and calculated the average daily wastewater flows (in gallons per day) pumped by Lift Station No. 50. Our calculations, based on the run time data, yielded a pump capacity in the range of approximately 3,500 to 4,000 gallons per minute. This closely matches the reported operating flow (3,700 gpm at 85 TDH) for the station. (In addition, on a field visit to Lift Station 50 on February 8, 2011, we found out the 30-inch flow meter had been repaired only a few days earlier. We observed that Pump 3 operated at approximately 4,000 to 4,200 gpm during its pump cycle).

The Activity Reports for the 3-year time period indicated that since the beginning date, only the two constant speed pumps had been operational and since February 2010, only one of the constant speed pumps were operational. It is our understanding that when RBUD was operating Lift Station 50 on only one pump, the 16-inch and 18-inch by-pass force main pipes were open, and some undeterminable volume of the total daily flow was by-passed around Lift Station 50. This means the data provided for the period of February 2010 to September 2010 cannot be used to calculate Lift Station 50's historical flows. Therefore, our estimate of the historical average daily wastewater flows (gpd) passing through Lift Station 50 are as presented in **Table 3-1**:

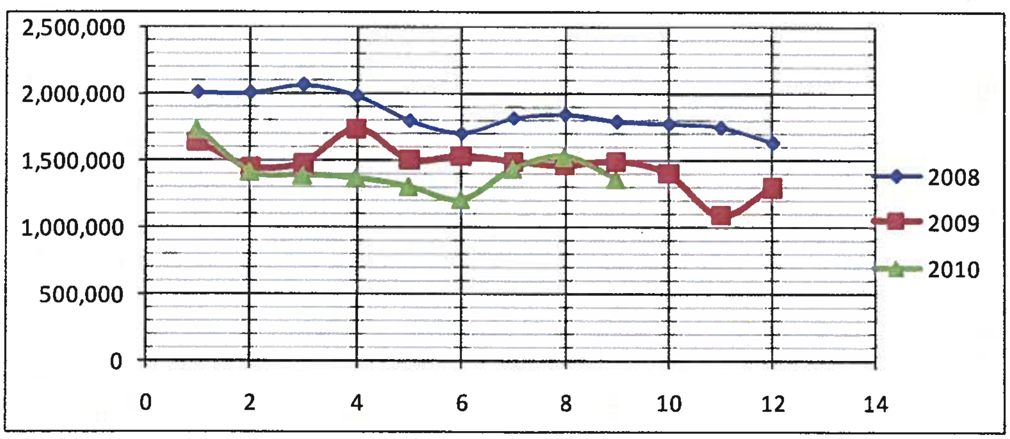
Table 3-1
Average Daily Wastewater Flows Pumped by Lift Station No. 50 (gpd)

Month	2008	2009	2010
January	1,999,461	1,636,013	1,736,035
February	1,997,617	1,449,479	*1,416,586
March	2,054,919	1,477,561	*1,390,413
April	1,972,987	1,729,433	*1,369,220
May	1,788,523	1,500,339	*1,306,235
June	1,695,633	1,528,860	*1,210,603
July	1,808,329	1,487,465	*1,439,929
August	1,835,068	1,455,774	*1,530,048
September	1,782,647	1,488,950	*1,362,813
October	1,765,745	1,399,326	
November	1,740,690	1,086,780	
December	1,626,110	1,296,332	
Average	1,838,980	1,461,359	

*Note: Not representative of Total Average Daily Flow through LS 50, because 16-inch and 18-inch by-pass force main pipes were open.

There was some anomalous run-time data in several months within the overall data set. Those months are April 2009, November 2009, December 2009, June 2010, and July 2010. However, discounting the anomalies, the data seems to somewhat trend from month to month and be relatively consistent and reliable. The data also indicates there has been a reduction in wastewater flows in 2009 and 2010 as compared to 2008. The historical average daily wastewater flow data passing through Lift Station 50 plots as presented in **Figure 3-1**:

Figure 3-1
Plots of Average Daily Wastewater Flows Pumped by Lift Station No. 50 (gpd)



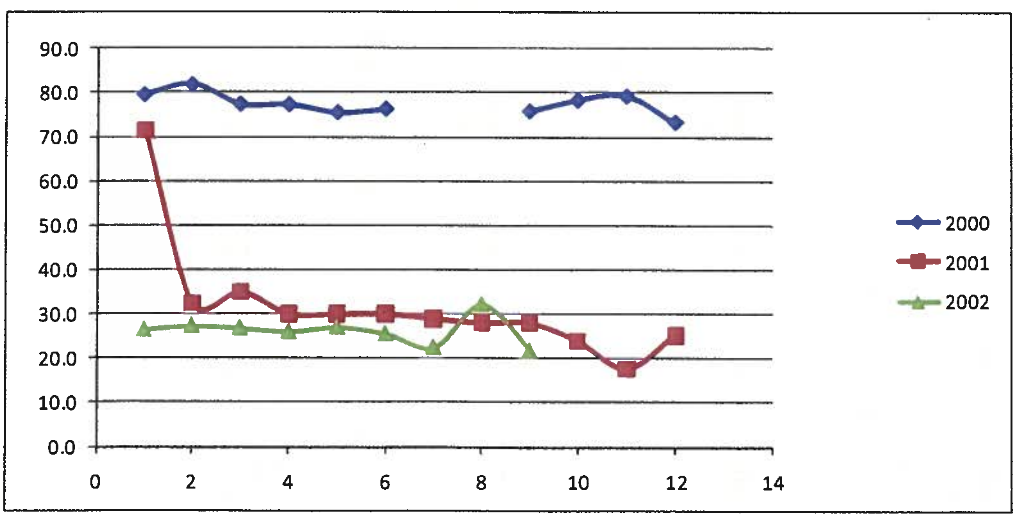
RBUD also provided a box of daily circular flow charts for Lift Station 50, which we carefully reviewed. The data in the box ranged from June 1992 to January 2006. We reviewed and attempted to evaluate the flow data for the years 2001 and 2002 because we thought it would be the most accurate time frame of the data provided considering the 30-inch magnetic flow meter was installed in December 2000. We also reviewed the flow data for the year 2000 to determine if there is a trend in the three years of data.

Unfortunately, the data presents a difficulty because it is plotted on the circular charts in a scale range from 0 to 100. We are unable to convert this 0 – 100 scale to a flow rate measured in gallons per minute; however, we did chart (**Table 3-2**) and plot (**Figure 3-2**) the average monthly unit-less information, the results of which follow:

Table 3-2
Unit-less Average Daily Wastewater Flows Pumped by Lift Station No. 50

Month	2000	2001	2002
January	79.6	71.6	26.5
February	81.9	32.4	27.3
March	77.4	35.0	26.8
April	77.3	30.0	26.0
May	75.5	30.0	27.0
June	76.3	30.0	25.5
July		29.0	22.5
August		28.0	32.3
September	75.8	28.0	21.7
October	78.3	24.0	
November	79.3	17.8	
December	73.3	25.3	

Figure 3-2
Unit-less plots of Average Daily Wastewater Flows Pumped by Lift Station No. 50



Note that data for July 2000, August 2000, October 2002, November 2002, and December 2002 were missing. The year 2000 data was recorded from the original flow meter. We believe that the large data drop between January and February of 2001 represents when the new 30-inch flow meter took over from the original flow meter. The two flow meters both used daily charts with a range of 0 – 100; however, they must have been calibrated very differently. Otherwise, the data seems to broadly trend from month to month.

3.3 Population Projections

In order to project the additional wastewater flows that will occur in the Lift Station No. 50 service area due to expected population growth over the next 20 years (to the year 2030), it is first necessary to project the population growth over the same time-period. Population projections for the area of Riviera Beach served by Lift Station No. 50 were developed based on 2009 Palm Beach County population projections, which incorporate future land use, adopted redevelopment plans, new development approvals, and local planning forecasts from individual local governments within Palm Beach County.

The Palm Beach County population projections are derived from the 2009 Population Allocation Model prepared by the Palm Beach County Planning Division. The 2009 Population Allocation Model is based on the Bureau of Economic and Business Research (BEBR) 2009 projections for Palm Beach County. Planning level projections required by local municipalities for public services planning such as water and wastewater supply necessitate the allocation of countywide projections to smaller geographic areas. The methodology utilized by the Population Allocation Model allows for the distribution of BEBR projections to traffic analysis zones (TAZ).

To project the population of the Lift Station No. 50 service area, we overlaid the service area boundary and the TAZ data on a GIS map of the City of Riviera Beach. Keeping in mind the total 2010 population for the City of Riviera Beach is approximately 37,000, we then extracted only the population data for the Lift Station No. 50 service area for the years 2010 through 2030.

Table 3-3
Lift Station No. 50 Service Area Population Projections

Year	Population	% Increase	Year	Population	% Increase
2010	24,840		2021	27,569	1.6
2011	25,099	1.0	2022	27,998	1.6
2012	25,478	1.5	2023	28,454	1.6
2013	25,719	0.9	2024	28,957	1.8
2014	25,878	0.6	2025	29,331	1.3
2015	25,970	0.4	2026	29,804	1.6
2016	26,113	0.6	2027	30,286	1.6
2017	26,246	0.5	2028	30,772	1.6
2018	26,502	1.0	2029	31,256	1.6
2019	26,802	1.1	2030	31,770	1.6
2020	27,138	1.3			

3.4 Wastewater Flow Projections

Future average daily wastewater flows can be projected by multiplying the above projected Lift Station No. 50 service area population projections by an acceptable daily per capita wastewater flow. Currently, the City of Riviera Beach uses a daily per capita wastewater Level of Service of at least 135 gallons per person per day as prescribed in the City's *2010 Comprehensive Plan, Objective 1.5 – Level of Service, Policy 1.5.1.* Similarly, the City currently utilizes a daily per capita water Level of Service of at least 195 gallons per person per day as prescribed in the Comprehensive Plan. The wastewater to water use ratio of these two numbers is 0.69. We understand these levels of service values were first derived and utilized in a 1989 Comprehensive Plan. Recent evaluations performed by BFA on the City's historical 5-year water usage rates provide us the opportunity to update these values.

In a Technical Memorandum prepared by BFA entitled *Population Projections and Water Demand Analysis* dated December 28, 2010, we determined the City's historical finished water per capita use rate, calculated based on the 5-year average (from 2005 through 2009) of total annual finished water billed to customers was 164 gallons per person per day. Applying the wastewater to water use ratio of 0.69 to this more updated water use value, the updated wastewater use value should be 113 gallons per day per person. We will project the future wastewater flows for Lift Station 50 utilizing this updated value.

The proposed Lift Station No. 50 design should be based on the projected 2030 wastewater flows. However, the design pumping capability of the lift station should be sized based on the peak design flow, which is calculated by multiplying the average daily wastewater flow by an acceptable Peaking Factor. A widely accepted suitable Peaking Factor for a lift station with average daily flows in excess of 1.0 million gallons per day is 2.5. **Table 3-4** tabulates the average daily wastewater flows and the peak design flows for Lift Station No. 50 from 2010 to 2030.

Table 3-4
Lift Station No. 50 Service Area Wastewater Flow Projections

Year	Average Daily Flow (gpd)	Average Daily Flow (gpm)	Peak Design Flow (gpd)	Peak Design Flow (gpm)
2008	2,836,187	1,970	7,090,468	4,924
2009	2,820,028	1,958	7,050,070	4,896
2010	2,806,920	1,949	7,017,300	4,873
2011	2,836,187	1,970	7,090,468	4,924
2012	2,879,014	1,999	7,197,535	4,998
2013	2,906,247	2,018	7,265,618	5,046
2014	2,924,214	2,031	7,310,535	5,077
2015	2,934,610	2,038	7,336,525	5,095
2016	2,950,769	2,049	7,376,923	5,123
2017	2,965,798	2,060	7,414,495	5,149
2018	2,994,726	2,080	7,486,815	5,199
2019	3,028,626	2,103	7,571,565	5,258
2020	3,066,594	2,130	7,666,485	5,324
2021	3,115,297	2,163	7,788,243	5,409
2022	3,163,774	2,197	7,909,435	5,493
2023	3,215,302	2,233	8,038,255	5,582
2024	3,272,141	2,272	8,180,353	5,681
2025	3,314,403	2,302	8,286,008	5,754
2026	3,367,852	2,339	8,419,630	5,847
2027	3,422,318	2,377	8,555,795	5,942
2028	3,477,236	2,415	8,693,090	6,037
2029	3,531,928	2,453	8,829,820	6,132
2030	3,590,010	2,493	8,975,025	6,233

Projecting the future wastewater flows in this manner has presented a problem. The projected Average Daily Flows for the years 2008 and 2009 in **Table 3-4** above are 2,836,187 gpd and 2,820,028 gpd respectively. However, the actual estimated average daily wastewater flows presented in **Table 3-1** indicate the average daily flow for 2008 was 1,838,980 gpd and the average daily flow for 2009 was 1,461,359 gpd. Essentially the actual 2008 and 2009 flows are approximately half of the projected 2008 and 2009 flows. Ideally, the actual and projected 2008 and 2009 flows would be reasonably similar and would indicate that the flow projection method was well calibrated. The most likely problem is the estimated per capita wastewater Level of Service of 113 gallons per person per day being higher than actual. However, for a master wastewater lift station as critical to the City of Riviera Beach as Lift Station 50, it is more prudent to be conservative when estimating projected wastewater flows so we will size the proposed lift station based on the 2030 projected wastewater Peak Design Flow of 8,975,025 gallons per day which equates to 6,233 gallons per minute.

3.5 Proposed System Curves

FDEP design criteria requires the proposed lift station to be able to pump the design peak flow of 6,233 gallons per minute with the largest pump out of service, therefore each pump in the station should be designed with a pumping capacity of 2,077 gpm. We performed basic hydraulic modeling of the force main between the proposed Lift Station No. 50 and the ECRWRF.

The force main is comprised of approximately 700 feet of 24-inch pipe, 14,800 feet of 30-inch pipe, and 7,550 feet of 36-inch pipe. The force main receives additional downstream wastewater flow from the Mangonia Park connection and from the Lift Station No. 47 connection before discharging at the ECRWRF. We have estimated the 2030 peak flow contribution from Mangonia Park into this force main to be approximately 942 gpm, and we have estimated the 2030 peak flow contribution from Lift Station No. 47 to be approximately 5,533 gpm. The total head conditions in the force main will vary from a "best case" to a "worst case" scenario depending on what flows are concurrently contributing to the main. We modeled both these scenarios to examine the range of conditions that Lift Station No. 50 will be required to operate under, and plotted a high head system curve and a low head system curve. The high head system curve is based on the proposed Lift Station 50 pumping design peak flow from a low wet well level while Mangonia Park and Lift Station No. 47 are contributing peak flows into the force main at the same time. The low head system curve is based on the proposed Lift Station 50 operating only one pump (2,077 gpm) from a high wet well level while no flows are pumping into the force main from Mangonia Park and Lift Station No. 47. We have included a plot of the low head system curve and the high head system curve in **Appendix A**.

3.6 Proposed Pump Curves

We have selected four identical pumps for the proposed Lift Station No. 50 (with four variable frequency drives). We will base our design on Flygt 10-inch NP3301/636 model pumps rated at 70 HP at 1185 rpm at top speed. The combination of these pumps operating through a range of conditions from a single pump operating at variable speed through all three pumps operating at full speed have the ability to meet the range of conditions which Lift Station No. 50 will be required to operate under. That is, the ability to pump approximately 2,077 gpm using one pump at 80% speed to satisfy the requirements of the low head system curve conditions through the ability to pump approximately 6,233 gpm using three pumps at full speed to satisfy the high head system curve conditions. **Appendix A** includes a plot of the low and high system curves in conjunction with multiple pump curves including a single pump running a variable speeds; and one, two and three pumps running at full speed. This Appendix also contains the manufacture's pump curve and dimensional cut sheet for the selected Flygt 10-inch NP3301/636 model pumps.

SECTION 4

REGULATORY DESIGN REQUIREMENTS

4.1 General

Design of the proposed RBUD Wastewater Lift Station No. 50 Improvements must take into consideration existing City, County, State, and Federal regulations that govern the design, construction, operation, and maintenance of the facility. The Palm Beach County Health Department, the Florida Department of Environmental Protection, and the City of Riviera Beach Building Division maintain regulatory jurisdiction over the project. The requirements of these agencies for permitting and construction of the proposed facility are summarized in the following sections.

4.2 Palm Beach County Health Department

The Florida Department of Environmental Protection (FDEP), through Section 403.021(2) of the Florida Air and Water Pollution Control Act, has established standards and requirements for Florida wastewater facilities. In turn, the Palm Beach County Health Department (PBCHD) has been delegated as a local program by the FDEP to perform several functions in the domestic waste program including issuance and enforcement of construction permits for proposed domestic wastewater collection systems including wastewater lift stations. The primary chapter of the Florida Administrative Code (F.A.C.) under which FDEP, through PBCHD, regulates wastewater collection systems and transmission facilities in the State of Florida is Chapter 62-604.

Chapter 62-604 establishes the requirements for permitting, construction, operation, and maintenance of wastewater lift stations. This chapter also incorporates by reference certain outside design related standards such as Recommended Standards for Wastewater Facilities, 1997 Edition, published by Health Education Services, Inc., Health Education Services Division, also known as "Ten States Standards". The following will summarize the permit and design requirements for permitting a wastewater lift station.

4.2.1 Permit Requirements

Prior to construction of the proposed wastewater lift station, RBUD shall make application to the PBCHD for either a general or individual permit. For Lift Station No. 50, the appropriate permit is "general" based on the following information provided in Chapter 62-604.600 (6):

(a)...a general permit is hereby granted to any person for the construction of a wastewater collection/ transmission system that has been designed in accordance with the standards and criteria set forth in subsections 62-604.400(1) and (2), F.A.C., provided that:

1. Notice to the Department under subsection 62-4-530(1), F.A.C. is submitted on Form 62-604.300(8)(a) at least 30 days prior to initiating construction; and
2. The wastewater facility to which the system will be connected:

a. Has the capacity to receive the wastewater generated by the proposed collection system;

b. Is in compliance with the capacity analysis requirements of Rule 62-600.405, F.A.C.;

c. Is not under a Department Order associated with effluent violations or the ability to treat wastewater adequately; and

d. Will provide necessary treatment and disposal as required by Chapter 403, F.S. and applicable Department rules.

4.2.2 Design/Performance Considerations

Regulatory requirements related to design and performance considerations and applicable to Lift Station No. 50 are contained in numerous subsections of Chapter 62-604.400 and are summarized below.

4.2.2.1 Site Layout: Pump stations shall be designed and located on the site so as to minimize adverse affects resulting from odors, noise and lighting.

4.2.2.2 Flood Protection: The electrical and mechanical equipment must be protected from physical damage by the 100-year flood and must remain fully operational and accessible during the 25-year flood.

4.2.2.3 Security: New pumping stations must be enclosed with a fence or otherwise designed with appropriate features that discourage the entry of animals and unauthorized persons.

4.2.2.4 Standby Power: Pump stations that receive flow from one or more pump stations through a force main or pump stations discharging through pipes 12-inches or larger shall provide for uninterrupted pumping capabilities including an in-place emergency generator. The emergency system shall have sufficient capacity to start up and maintain the total rated running capacity of the station.

4.2.2.5 Lighting Protection: Pump stations shall be protected from lighting and transient voltage surges. As a minimum, stations shall be equipped with lightning arrestors, surge capacitors or other similar protection devices, and phase protection.

4.2.2.6 Force Mains: Branches of intersecting force mains shall be provided with appropriate valves such that one branch may be shut down for maintenance and repair without interrupting the flow of other branches.

4.3 Environmental Resource Permit Program

The Environmental Resource Permit (ERP) Program regulates activities involving the alteration of surface water flows including site grading, and stormwater containment and treatment. ERP permit applications are processed by FDEP or by the SFWMD. In the case of construction of stormwater systems such as retention ponds specifically for water or wastewater facilities, the responsibility is delegated to FDEP. The necessary permit application form is FDEP Form No. 62-343.900(1), entitled *Joint Environmental Resource Permit.*

4.4 National Pollutant Discharge Elimination System Permit

It is expected that the construction of the proposed Lift Station No. 50 and the subsequent demolition of the existing Lift Station No. 50, if combined as one project, will temporarily disturb more than one (1) acre. If a construction project disturbs more than one (1) acre, the entity that owns or operates the project must obtain a National Pollutant Discharge Elimination System (NPDES) stormwater permit and implement appropriate pollution prevention techniques to minimize erosion and sedimentation and properly manage stormwater during construction. FDEP is the jurisdictional agency responsible for this program. The necessary permit application form is FDEP Form No. 62-621.300(4)(a), entitled *Generic Permit for Stormwater Discharge from Large and Small Construction Activities,* also known as a CGP.

The CGP application requires the submittal of a CGP Notice of Intent (NOI) on DEP Form 62-321.300(4)(b), and the preparation and submittal of a Stormwater Pollution Prevention Plan (SWPPP) prior to commencing construction activities. In addition, a Notice of Termination (NOT) on Form 62-621.300(6) must be submitted to FDEP to upon completion of construction activities.

4.5 City of Riviera Beach Building Permit

Lift Station 50 is located within the corporate limits of the City of Riviera Beach and construction and subsequent demolition is therefore subject to a City Building Permit. The City Building Division enforces construction related codes, reviews development plans and all building related permit issues. The City Building Division also is responsible for the issuance of Certificates of Occupancy while performing mechanical, electrical, plumbing, and building inspections.

Additionally, the City's guidelines on setback and maximum height ordinances, fire protection requirements, and landscaping requirements should be taken into account for the design of the new wastewater lift station.

SECTION 5

CIVIL AND MECHANICAL BASIS OF DESIGN

5.1 Site Location

The proposed Lift Station No. 50 facility site is located adjacent to and north of the existing Lift Station 50 site on property owned by the City of Riviera Beach Utility District. The site is located within Section 31, Township 42 S., Range 43 E., and occupies approximately 0.50 acres. The coordinates of the center of the site are approximately 26^0 46' 16" N, 80^0 05' 95" W. The site and other property surrounding the existing Lift Station 50 site were apparently once the location of a wastewater treatment plant.

5.2 Flood Hazard

The site is at approximately 17 feet above sea level. Based on the National Flood Insurance Program FIRM Map Community-Panel No. 125142 0002 D, dated 09/30/1982, the facility site is not located within the 100-year flood zone or any other special hazard zone.

5.3 Lift Station Facility Layout

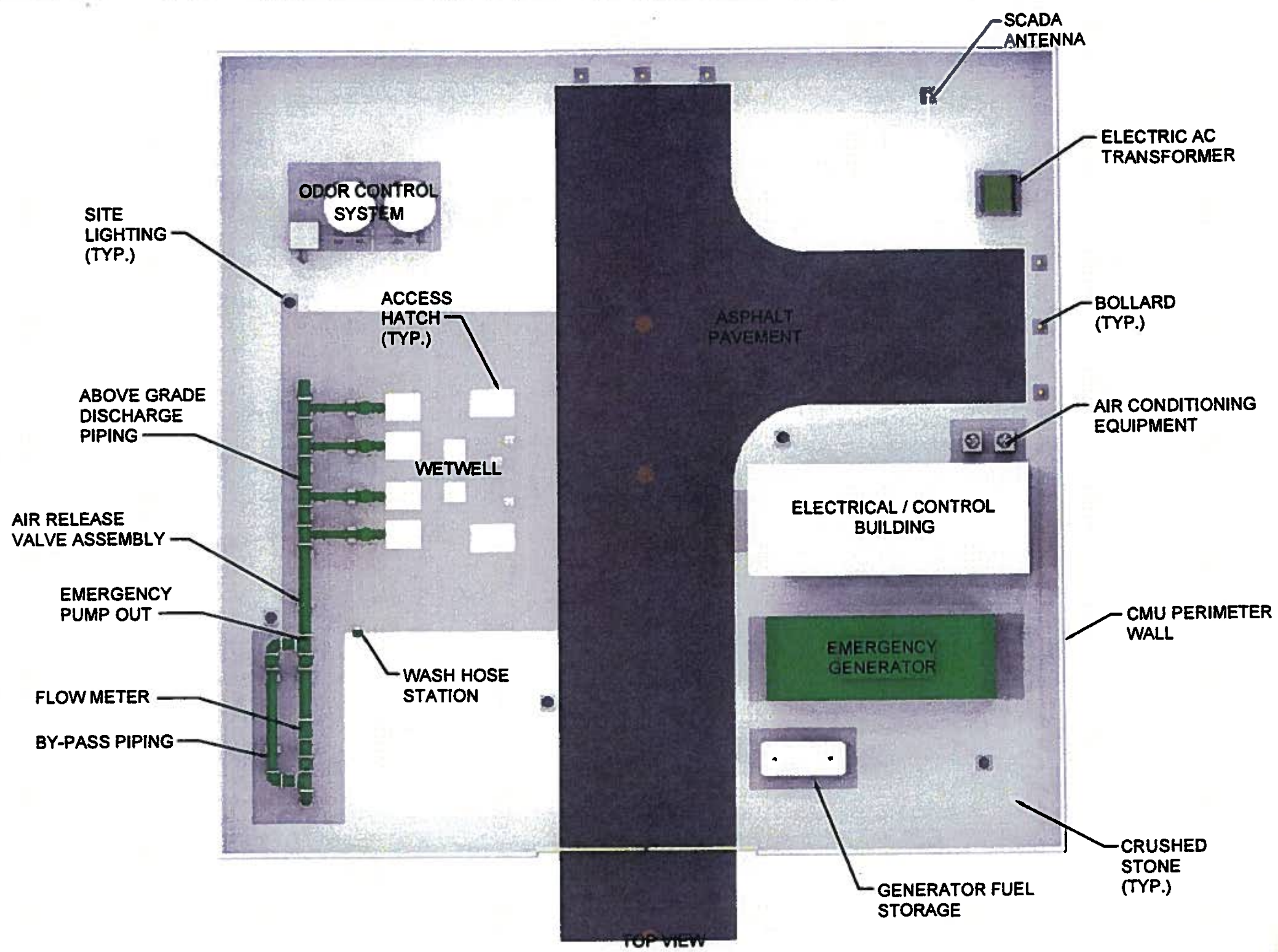
5.3.1 General:

The proposed lift station facility has been laid out and sited to address specifically the visual and audible impact on the neighborhood, the need to keep the existing lift station in service during construction, access to the facility for normal operation and maintenance, clearance from property lines and the efficient use of available property, and site security. Refer to **Figure 5-1** for the proposed site plan.

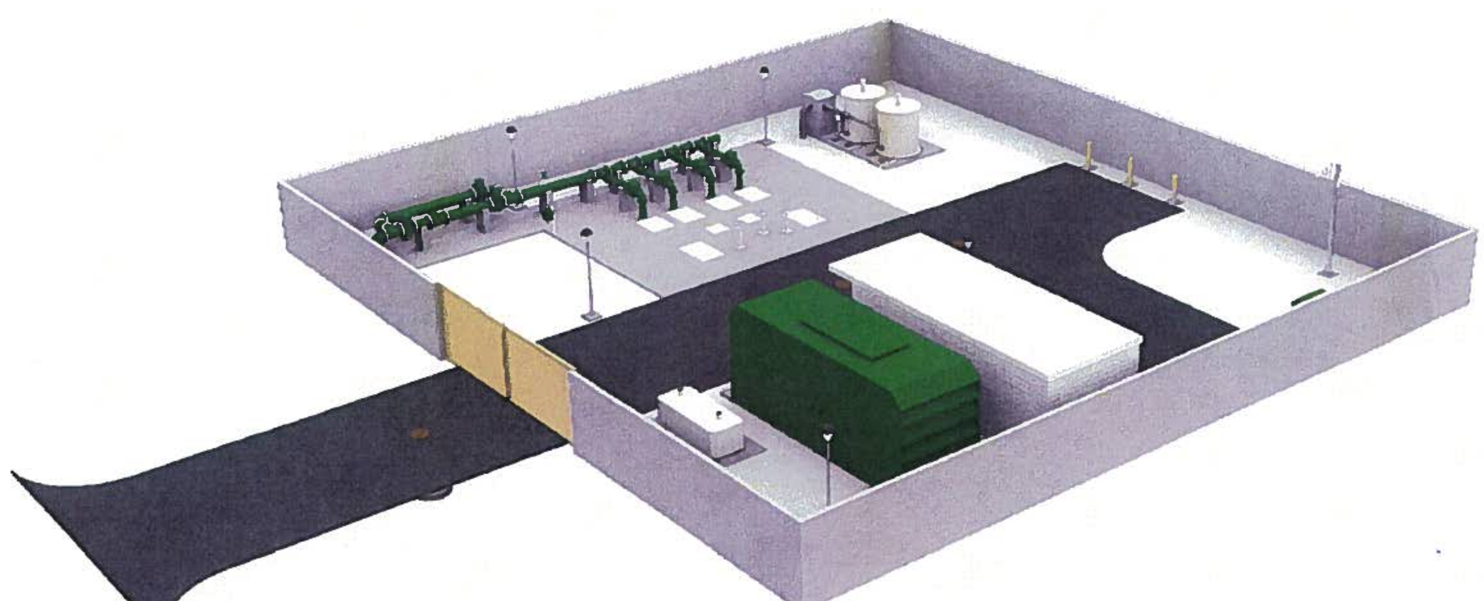
The facility will be enclosed on all sides with an 8-foot high concrete masonry unit wall with an 18-foot wide ornamental aluminum rolling gate secured with a chain and padlock. The masonry wall will be finished and painted to match the aesthetics of the existing Avenue U Water Booster Station Facility wall, which is located on the south side of the existing Lift Station 50. The masonry wall will not only secure the site; it will serve to attenuate sources of sound from equipment within the facility such as the standby power generator and odor control fans.

5.3.2 Operation and Maintenance Considerations:

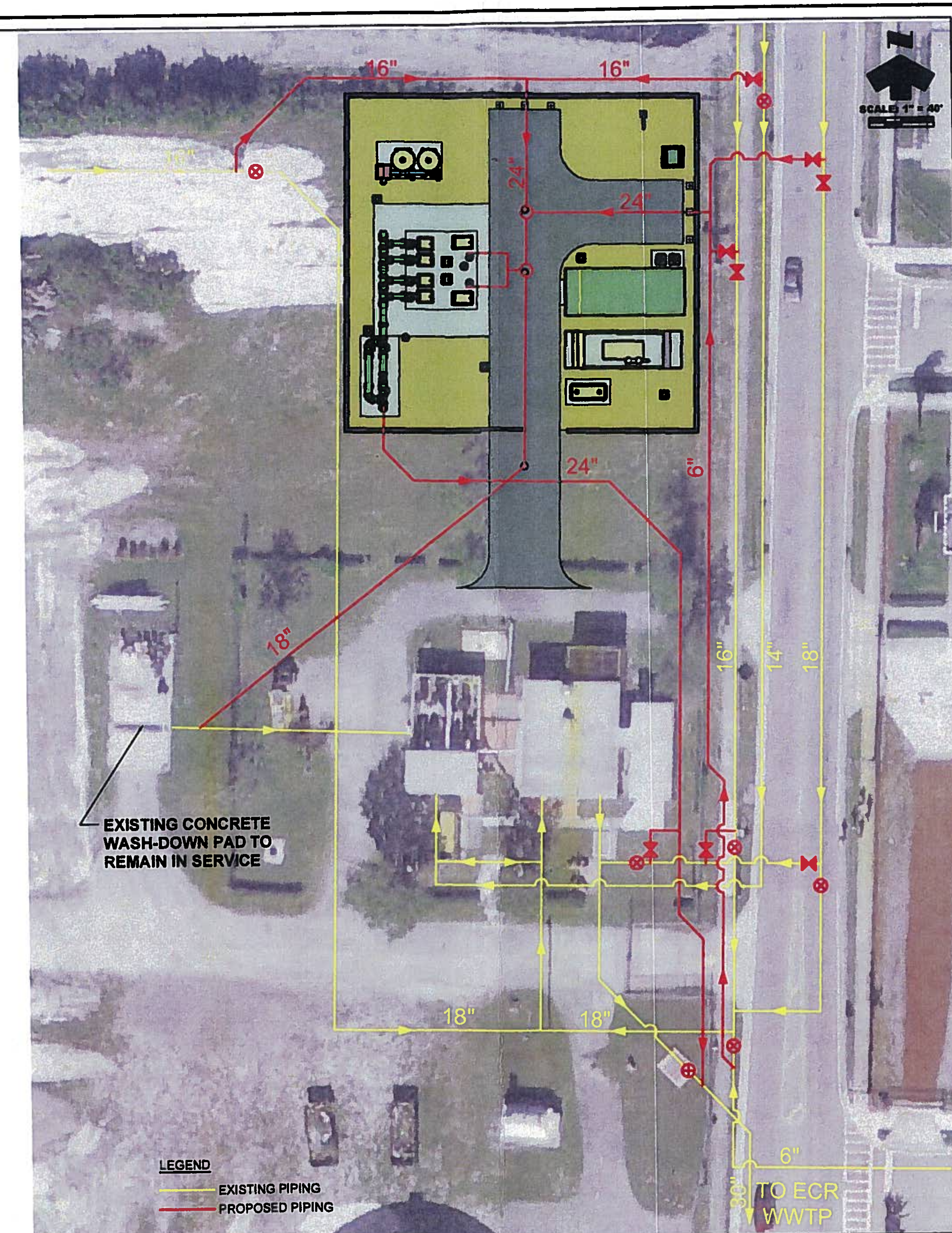
The proposed lift station facility will be accessed via an existing asphalt driveway and gated entrance off Avenue U, which it will share with the existing lift station. New access pavement and pavement within the facility walls will be asphalt and will be 18-feet wide. The asphalt pavement within the facility has been laid out to provide full access to all lift station equipment, including submersible pumps, odor control system, yard piping, electrical building, standby power generator, and fuel tank by trucks and/or cranes. Pipe bollards have been placed within the facility where necessary to protect equipment from vehicles. The existing concrete wash-down pad, which is used by RBUD to empty sewage vacuum trucks, will be gravity piped to the proposed wet well.



TOP VIEW
PROPOSED PUMP STATION
N.T.S.



ORTHOGRAPHIC VIEW
PROPOSED PUMP STATION
N.T.S.



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BFA Environmental Consultants
Barnes, Ferland and Associates, Inc.
Engineering Buisness No. 6899

Wastewater Lift Station 50 Improvements

PROPOSED LIFT STATION 50 SITE PLAN

FIGURE 5-1

5.3.3 Site Grading and Drainage:

All equipment and aboveground yard piping within the facility walls will be placed on concrete base slabs set several inches above the grade of the access pavement. To minimize maintenance, the remaining area inside the perimeter walls will be covered with 4-inches of crushed 57 stone with an underlying layer of geotextile fabric. The facility will be graded such that surface water runs off equipment and equipment slabs and into the stone in the yard. All unpaved disturbed areas outside the perimeter wall will be sodded or seeded and mulched. The following site grading criteria will be used where applicable:

- The site will be graded to promote runoff. The minimum longitudinal grade that will be provided for all the dry swales (except during runoff conditions) is 0.1 percent;
- A minimum longitudinal slope of 100 horizontal (h): 1 vertical (v) or 1.0 percent for access pavement will be established;
- A minimum road cross slope of ¼-inch per foot (approximately 2 percent) for access pavement will be established; and
- Minimum elevations of new access pavement will be established to match existing pavements.

5.4 Lift Station Configuration

5.4.1 General:

The proposed lift station is configured in a quadraplex submersible style using rail-mounted pumps with permanently mounted pump base and discharge piping. Two pumps will be constant speed drives and two pumps will be variable frequency drives. The facility includes above-grade discharge piping with flow meter and emergency pump out connection, an odor control system, an electrical building, a standby power generator with above grade fuel tank, and a SCADA tower.

5.4.2 Pumps:

The submersible pumps shall be able to "run dry", that is with liquid in the wet well only deep enough to submerge the bottom half of the pump's volute. Pump motors shall be explosion proof. Sufficient electrical/ control cable shall be attached to the pump such that no splicing is required between the pump and a junction box. A seal shall be supplied between a junction box and any panel or disconnect and between the wet well and junction box to isolate the junction box from the moisture and corrosive gases in the wet well. All pump spacings and related clearances in the wet well shall be in accordance with the manufacturer's recommendations and Hydraulic Institute standards for proper pump operation.

Dual-type 316 stainless steel guide rail systems with type 316 stainless steel lifting chains shall be used for guiding submersible pumps to and from their anchorage/hydraulic connection points. Guide rail supports shall be installed not more than 10 feet on center in accordance with the manufacturer's recommendations.

The selected pumps are based on a pump station capacity designed to provide a design peak flow of 8.975 MGD (6,233 gpm) with three pumps operating. The fourth pump will provide stand-by capacity in conformance with FDEP reliability criteria. The design will be based on four Flygt 10-inch NP3301/636 model pumps (with four variable frequency drives) rated at 70 HP at 1185 rpm at top speed.

5.4.3 Wet Well:

The wet well shall have a rectangular configuration with two compartments (containing two variable speed pumps per compartment). The compartments essentially divide the wet well into two separate isolatable chambers. These compartments allow maintenance or cleaning of the wet wells, submersible pump base flange repair, or the replacement of guide rails or guide cables without bypassing the lift station.

A manually operated fabricated stainless steel slide gate is to be located in the dividing wall for hydraulically balancing when the wet well is compartmentalized. The dividing wall between wet well compartments shall extend to the top of the wet well, so that when the slide gate is closed, the wet well being dewatered and potentially accessed is maintained dry and not subject to gases from the adjacent wet well.

A common influent chamber is provided within the wet well. All influent piping flows into this common chamber and the flow will split from there through manually operated fabricated stainless steel slide gates to the two wet well compartments. In addition, the wet well entrance includes a baffle wall to minimize turbulence, air entrainment, and potential hydrogen sulfide gas.

Concrete fillets are provided per the Hydraulic Institute Standards to prevent solids build up in the influent chamber and around the pumps. The compartment floor bottoms are sloped toward the pump inlets to minimize grit accumulation. In addition, a depressed sump is provided in each wet well chamber for final compartment dewatering.

The wet well shall be designed to withstand external horizontal loads imposed by saturated lateral earth pressures with ground water at finished grad while empty, and internal hydrostatic loads while the wet well is full of water with no external earth pressures. Lateral earth pressures shall provide for surcharge due to adjacent truck or crane load. The common wall between the wet well compartments shall be designed for full hydrostatic load on one side while the other chamber is empty. The top slab of the wet well shall be designed to support the dead load of the slab, plus a uniform live load of 250 psf. The top slab shall also be capable of supporting a concentrated live load at any location equal to the weight of the single largest submersible pump to be installed in the wet well.

The interior walls, ceiling, and pipe openings in the wet well shall be lined with an 80-mil thick high-density polyethylene (HDPE). The HDPE embedment sheeting shall be mechanically bonded to the concrete by integral studs.

Access hatches to the wet well shall be gasketed to prevent rainwater from entering and odors from escaping. The frames and cover plates shall be designed for a uniform load of 250 psf and shall be fabricated from extruded aluminum trough flange with continuous anchor flange around the perimeter and aluminum checker plate respectively. All aluminum embedded in concrete shall be coated with a bituminous paint. The frames and cover plates shall be equipped with all Type 316 stainless steel hardware and accessories, including lift assist mechanisms. The access hatches shall be provided with a hasp and recessed, keyed padlock locking system. Pump access hatches shall be sized to provide the manufacturer's recommended clearance on all sides of the pump as it is being removed. Sizing and placement of the hatches shall be in accordance with the pump manufacturer's minimum recommendations. The inside dimensions of the rectangular wet well will be approximately 19.5 feet long by 18 feet wide by 18 feet deep.

5.4.4 Submersible Mixers:

Each of the two wet well compartments shall be fitted with a submersible mixer. The mixers shall be capable of handling raw sewage and shall be able to be raised and lowered and easily removed for inspection or service using integral sliding guide brackets without the need for personnel to enter the wet well compartments. The entire weight of each mixer unit shall be guided by a single bracket that will be capable of handling the thrust created by the mixer. Each mixer shall be of the integral gear, close coupled, submersible type. All components of the mixer including motor and gearbox shall be capable of continuous underwater operation. In addition, the mixer shall be capable of operation in air, completely unsubmerged for two hours. The design will be based on two ITT 4630 model mixers with 14.57-inch stainless steel propellers rated at 2.55 HP at 855 rpm.

5.4.5 Discharge Piping:

The wet well discharge piping and fittings from each of the pump connections to outside the wet well shall be Type 316 Schedule 40 stainless steel with flanged joints and BUNA gaskets. The remaining lift station discharge piping, including check valves with hydraulic cushion and closing speed control, isolation non-lubricated eccentric plug valves, dual header piping (one leg of which contains the electromagnetic flow meter), air release valve, and emergency pump out connection shall all be located above grade.

All above grade piping and fittings shall be flanged ductile iron up to the point of tie-in to the force main (outside the wall). The ductile iron pipe shall meet the requirements of AWWA C150 and C151. Flanges shall be in accordance with AWWA C115 (faced and drilled per ANSI B16.1 Class 125). Gaskets shall be specially designed combination ring and full face NSF Standard 61 Certified SBR black rubber per AWWA C111. Ductile iron pipe shall be pressure class 350, the exterior shall be painted with industrial grade alkyd enamel, and the interior shall be epoxy-ceramic lined. Hardware for wet well piping, above grade piping and valves shall be stainless steel. Above-grade piping and valves shall be supported by concrete pipe supports.

The buried force main piping (outside the lift station wall) shall be AWWA C905 PVC DR 25 bell and spigot pipe with elastomeric gaskets and with restrained mechanical joint ductile iron fittings.

All fittings shall be ductile iron and shall be lined with an epoxy-ceramic interior. Above-grade fittings shall be flanged, pressure rated to 250 psi, and meet the requirements of AWWA C110. All buried fittings shall be compact fittings meeting the requirements of AWWA C153. Buried fitting sizes up to 24-inch shall be pressure rated to 350 psi. Buried fittings larger than 24-inch shall be pressure rated to 250 psi. Above-grade ductile iron fittings shall be flanged in accordance with AWWA C110, and faced and drilled to match ANSI B16.1 Class 125. Gaskets shall be specially designed combination ring and full face NSF Standard 61 Certified SBR black rubber per AWWA C111. The exterior of the above ground fittings shall be painted with an industrial grade alkyd enamel (to match above grade piping). Buried ductile iron fittings shall be restrained mechanical joint fittings with elastomeric gaskets in accordance with AWWA C111.

5.4.6 Valves:

Plug valves shall be non-lubricated full port eccentric style with elastomeric-coated plug in accordance with AWWA C504. The valve body, cover, plug, and seat ring shall be cast iron. The eccentric plug shaft shall be installed horizontally, with the plug stored in the top position when the valve is open to minimize potential for grit accumulation in the valve seat or shaft bearing. Aboveground valves shall be flanged (ANSI B16.1 125lb. standard) and shall be gear actuated hand wheel operated. Underground valves shall have restrained mechanical joints and gear actuated 2-inch square operating nuts. Plug valves shall have a minimum pressure rating of 150 psi.

Check valves shall be outside lever and weight swing check style in accordance with AWWA C508 and have cast iron body with stainless steel or bronze body seat, stainless steel hinge shaft and cast iron disc with renewable rubber disc seat.

Gate Valves (used for tapping valves at force main connection points) shall be resilient wedge valve in accordance with AWWA C515 and have a ductile iron body, bonnet, and wedge with a high strength bronze stem and nut. The wedge shall be rubber encapsulated and the valve body and bonnet shall be fusion-bonded epoxy coated inside and out. The valve shall be pressure rated to 250 psi and have 100% leak-tight closure.

Sewage-type air release valve shall have a cast iron body and cover with stainless steel float and trim. The valve shall directly tapped to the high point in the above grade piping and a full flow ball valve shall be installed under the air release valve for isolation and maintenance.

A reduced pressure system backflow preventer shall be installed on a 1½ potable water service connection to provide wash water through a hose bib at the wet well, and to provide water to the odor control system. The backflow preventer will be installed in an above grade horizontal piping assembly that will include two isolation gate valves and test cocks for periodic inspection and maintenance of the device.

5.4.7 Odor Control System:

The lift station facility design includes the installation of a modular biofiltration system for odor and hydrogen sulfide control. The biofiltration system utilizes naturally occurring microorganisms to treat air containing hydrogen sulfide and other reduced sulfur compounds, and volatile organic compounds (VOC's). The system is composed of a control panel, blower, humidification chamber, and biofilter vessel. The components are housed inside a fiberglass reinforced plastic cover.

Air from the wet well is drawn through above grade fiberglass reinforced duct piping to the system blower. The air is passed through the bottom of the humidification chamber where the air is saturated with water. The saturated air passes through the biofilter media bed where it is treated and released to the atmosphere. Weep hoses are provided at various heights along the filter be to provide substantial moisture control. Water is drained from the bottom of the reactor. A portion of the water is wasted to a drain pipe and redirected back into the wet well, while the remainder is combined with fresh water and recycled back into the filter bed. This recycling of the wasted water provides nutrient return to the system and minimizes wastewater generation. The design will be based on an Envirogen Dual H-120 modular odor control system and will be sized for a 99% removal of hydrogen sulfide (H_2S) with an average removal of 50 parts per million (ppm) and a peak removal of 100 ppm at six air changes per hour.

5.4.8 Electromagnetic Flow Meter:

The meter shall be a velocity sensing electromagnetic type, microprocessor based signal converter, sealed housing, flanged tube meter. The meter tube shall be fabricated of stainless steel pipe and use 150 lb. AWWA Class D flat face steel flanges. The interior and exterior of the meter tube shall be lined with 40 mils of NSF approved fusion bonded epoxy coating. The meter shall have a digital indicator having a range of 0 gpm to 10,000 gpm and shall be accurate to within 0.5% of true flow. The meter assembly shall have a velocity range of 0.2 fps to 49 fps. The signal converter shall be mounted with the meter and provide a digital display of rate of flow in addition to total volume. The signal converter shall also send a 4-20 mA signal to the programmable logic controller in the electrical room. The design will be based on a McCrometer Model UM06 Ultramag electronic flow meter.

5.4.9 Slide Gates:

The slide gates located within the wet well shall be fabricated stainless steel gates conforming to the requirements of AWWA C561. The frames, slides, yoke, stem and stem guides shall be manufactured of ASTM A-240 Type 316 L stainless steel. The guides, side seals, and top seals shall be manufactured of ultra high molecular weight polyethylene. The bottom seal shall be flush and manufactured of resilient neoprene. The slide gate frames shall be directly mounted to the walls of the wet well using stainless steel anchor bolts and backed by EPDM gaskets. The slide gate stems shall be fitted with pedestal mounted manually operated geared actuators. The design will be based on a Fontaine Series 20 Model 204 Frame and Stem configuration.

SECTION 6

STRUCTURAL BASIS OF DESIGN

6.1 Electrical Building

The lift station facility design includes the installation of an electrical building to house the motor control centers (MCCs), VFDs, and instrumentation and control systems for operation of the lift station. The electrical building will also include a desk with a computer, where the overall RBUD wastewater system can be monitored and controlled remotely.

6.1.1 General Building Considerations:

Exterior treatment will match the aesthetics of the perimeter concrete masonry wall.

In consideration of security, exterior windows will not be installed.

The electrical room and the operator's room will both be air conditioned, but not heated.

Minimum interior height clearance of the building shall be 10 feet.

Housekeeping pads (6" minimum) shall be placed under all floor-mounted equipment.

6.1.2 Codes and Regulations:

The design of the electrical building shall be in accordance with the following codes and regulations:

- 2004 Florida Building Code with latest revisions
- 2004 Florida Fire Prevention Code with latest revisions
- Florida Accessibility Code for Building Construction
- Americans with Disabilities Act Accessibility Guidelines
- Occupational Safety and Health Administration Regulations
- The American Society for Testing and Materials
- National Fire Codes

6.1.3 Building Wall Construction:

The building walls shall be concrete masonry unit (CMU) bearing wall construction. The CMUs shall be foam filled with insulation. Interior and exterior walls (and ceiling) shall be primed with a single 5 mil water repellent coating and finished with two 5 mil coats. Interior walls (and ceiling) shall be painted with semi gloss enamel for increased light reflectance. The interior floor shall be coated with one 8 mil coat of slip resistant epoxy primer and sealer.

6.1.4 Roof Construction:

The roof of the building shall be constructed of 8-inch pre-cast concrete hollow core slabs topped with 2-inches of 3,000-psi concrete and a 6 x 6 10/10 welded wire fabric. The edge of the roof shall be fitted with aluminum facia edging and the entire roof encapsulated with a fully adhered thermoplastic roofing membrane system.

6.1.5 Doors and Hardware:

The electrical room shall be accessed via a set of out-swinging exterior double doors. The double door opening shall be 7'-0" wide by 7'-10" high. The doors shall be aluminum with aluminum frames and shall have 6" by 25" glass viewing panels. The doors shall be fully weather stripped, provided with thresholds, equipped with closers and doorstops. Door hinges shall be ball bearing, extra heavy-duty weight, stainless steel finish and shall have non-removable hinge pins. Door locks and latches shall be lever-handled mortise locks with stainless steel lock case and finish.

SECTION 7

ELECTRICAL AND INSTRUMENTATION BASIS OF DESIGN

7.1 Electrical System

As outlined in section 1 of this report, Lift Station No. 50 has been determined to require rehabilitation or replacement of all lift station components. This includes the electrical, emergency power systems and instrumentation components of this facility. The following provides an overview of the intended designs for the important project components.

7.2 FPL Service

The existing FPL service heads west along W. 10th St., crosses overhead at Stozier Street, and then terminates at a dead end pole location. From this location, FPL runs 13 KV underground to the existing pump station's external vault. It will be necessary for this existing FPL service to remain energized and in service until the new station is completely operational.

The final location of the new FPL service point will be coordinated during the final design of this project. The proposed electrical building will be served from a new FPL pad mounted transformer that will be utilized to step the 13 KV distribution voltage down to the facility utilization voltage of 480 volts.

7.3 Proposed Power Distribution

The electrical system for lift station no. 50 will be designed per EPA-430-99-74-001 "Design Criteria for Mechanical, Electric and Fluid System and Component Reliability", NFPA 820 "Standard for Fire Protection in Wastewater Treatment and Collection Facilities" and the current edition of the National Electric Code (NEC).

The loads associated with the proposed Lift Station 50 treatment facility will be served from a common power distribution system. The combined loads will total approximately 345 KVA of electrical loads. This loading represents the ultimate loading that will be connected at this facility and, as such, will be used as the basis for sizing the normal and emergency power services for this facility.

Per EPA guidelines, *the electrical distribution design criteria should include considerations for reliability, maintainability and safety. To provide for a reliable distribution, the system should be designed with two independent sources of power and protection from common mode failure. These sources are generally two totally independent utility sources or a utility service and sufficient standby power to allow complete operation of the plant in order to meet discharge permit requirements...The internal power distribution system shall be designed such that no single fault or loss of a power source will result in disruption of the electric service..."*

It is proposed that two (2) 600 amp, 480 volt service entrance rated transformers will serve two (2) independent motor control centers (MCCs). These MCCs will house all VFDs, starters, breakers, etc. required and will be interlocked together such that either of the service entrance rated ATS' can serve both MCCs. In the event that normal power is lost at either ATS, the emergency generator will be automatically started and brought on line to serve all plant components. The new electrical distribution equipment will be located in the proposed electrical/control building.

The following provides an overview of the connected load for the new Lift Station No. 50.

Proposed Load Tabulation

Description		**Load**						**Amps**	
Wastewater Pumps		4	@	70		Hp	=	336	
Panel L1		1	@	20		kVA	=	24	
Misc Motors				45		kVA	=	54	
		Connected Load:						414	Amps
Minimum Service Entrance Capacity	=	414	+	.25	x	84	=	435	Amps

7.4 Distribution System Protection

The following types of protective devices shall be used for the low voltage distribution systems: 480-volt Switchboards – 100% rated insulated case circuit breaker with solid-state trip for mains and feeders 400A and larger. Smaller feeders will be accommodated via local 480 volt panelboards.

- 480-volt Motor Control Centers – Main breakers shall be 100% rated molded case with solid-state trip.
- 480-volt feeder circuit breakers in Motor Control Centers and Panelboards, 400A and larger – Shall be 100% rated, molded case with solid-state trip.
- 480-volt feeder circuit breakers in Motor Control Centers and Panelboards, smaller than 400A (other than for combination motor starters) – Shall be molded case, thermal magnetic type.

All electrical equipment shall have adequate momentary and interrupting capacity to withstand fault currents that may occur at the point in the system where the equipment shall be applied. Ground fault protection on main breakers and feeder breakers shall be equipped with time delay setting and restraint systems, unless indicated otherwise on the design drawings.

7.5 Panelboards

Lighting panels shall be surface-mounted, 208Y/120-volt, three-phase, four-wire type, with the main circuit breaker sized to match the lighting transformer capacity. Transformers to supply 208Y/120 volt requirements shall be dry type and suitable for the area in which they are to be located. Separate panelboards shall be provided to supply power to instruments and control panels where the equipment to be supplied requires a conditioned power supply. Each panelboard will be provided with a minimum of 20% spare breakers with spaces, bus work, and terminations to complete the standard size panel. Panelboard schedules shall show the circuit description, protective device trip rating, and number of poles, rating of main lugs or main circuit breaker. Where multiple instruments are connected to a single-branch circuit, a toggle switch shall be provided at each tap to allow each individual instrument to be disconnected from the branch circuit.

7.6 Raceways

Specific types of raceway shall be chosen for use in various locations in the facility, based on moisture, temperature, exposure to damage, corrosion, voltage and cost.

- Exterior, exposed conduit shall be aluminum.
- In corrosive areas, PVC-coated rigid steel shall be used.
- Exterior, underground, direct-buried conduit shall be schedule 80 PVC.
- Exterior, underground, concrete-encased conduit shall be schedule 40 PVC.
- Interior, exposed conduit in dry areas shall be aluminum.
- EMT shall be allowed from 5' above finished floor and higher with exposed conduits feeding lighting circuits.
- Interior, exposed conduit in corrosive areas shall be PVC schedule 80.
- Interior, concealed conduit shall be schedule 40 PVC.
- PVC conduit runs shall use PVC coated galvanized steel elbows.
- The minimum diameter of conduit shall be ¾-inch.

7.7 Wire and Cable

Copper conductors shall be used throughout. Solid conductors shall be permitted for lighting and receptacle circuits. All other applications shall employ stranded conductors. The current-carrying capacity of conductors shall be based on 75°C insulation ratings. Conductors No. 6 AWG and smaller shall have THHN/THWN insulation, while larger conductors shall have XHHW insulation. Individual No. 14 AWG conductors shall be used for discrete control circuits, unless it is practical to use multi-conductor cables to group control circuits. Twisted, shielded pair control cable No. 16 AWG with an aluminum Mylar tape shield shall be used for analog signals.

7.8 Grounding

Load centers shall be bonded to a grounding electrode, which may consist of a building steel column that is bonded to the underground rebar, or a made electrode system (triad or connection to ground loop around the building) and the nearest available effectively grounded metal water pipe. In addition, ground rods shall be driven outside the building to supplement the ground electrode. Grounding electrodes of ground mats or embedded rods and cables shall have a maximum resistance to ground of 5 ohms.

The parts of all electrical equipment, devices, panelboards, and metallic raceways that do not carry current shall be connected to the ground conductors. The transformer neutrals of wye-connected transformers shall be solidly grounded through a grounding conductor connected to the grounding system. A ground wire shall be installed in all raceways that contain power conductors of any voltage.

7.9 Lightning Protection

A lightning protection system shall be provided and installed for the proposed Blower Building, and for all structures greater than 5 feet above grade level. They system shall be in compliance with provisions of Code for Lightning Protection Systems as adopted by the National Fire Protection Association and Lightning Protection Institute.

Lightning protection cable shall be Class I copper. Grounding counterpoise shall be as shown. Fittings and straps shall be cast copper. Air terminals shall be copper as required to match roof conductors, have proper base support for surface on which they are attached, and be securely anchored to this surface. Terminals shall project a minimum of 10 inches above the top of the object to which it is attached.

Roof conductors shall consist of copper that complies with the weight and construction requirements of the Code, and be coursed to interconnect with air terminals and, in general, provide a two-way minimum path to ground. Down conductors shall be copper, and concealed within the structure.

Ground connections shall be made in accordance with requirements of all applicable codes. Ground rods shall be placed in a minimum of 2 feet from building foundations. In addition to above artificial grounds, one down conductor of each two-path system shall be connected to a water piping system with approved water pipe type strap connector. All ground rods shall be 5/8-inches in diameter, with a minimum length of 20 feet copper weld type.

7.10 Plant Monitoring and Control System

The design for plant monitoring and control will be directed towards providing the most reliable, operationally efficient system possible. In general terms, this will involve the following:

- Parameters required for automated control of the process or for operational reporting purposes will be monitored using transmitters that include local indication. This allows operations and maintenance personnel to observe the value while at the process location.

- Local manual controls will be provided for each process to allow process control independent of the Plant Control System; albeit with reduced functionality. This facilitates commissioning of the process equipment and subsequent maintenance activities.
- The Process Control System will use Programmable Logic Controllers (PLCs). These will contain control strategies applicable exclusively to the local process. This facilitates equipment commissioning and maintenance by allowing each process to be controlled independently. The PLC will also interface with all Variable Frequency Drives.
- Chemical feed rates will be flow paced with analytical trim wherever appropriate. This ensures minimum chemicals are used while still achieving the desired result.
- Human Machine Interface (HMI) devices will be located at each major operating location, the master control room, and selected supervisor's offices. These devices will be interconnected with the plant PLC and the Plant Control System server. This allows operations staff to observe, in real time, conditions throughout the plant without having to return to the control room.
- Remote monitoring of the facility will be handled by the Data Flow RTU system.

7.11 Standby Power System

While the availability of power from FPL is desirable and provides a level of reliability, a standby diesel generator will be included in the design. The generator will provide power to the new facility during those occasions when FPL power is unavailable.

On-site power generation would provide an additional level of redundancy to the FPL electrical service brought to the proposed plant.

The diesel generator would be connected to the switchgear thru an automated generator breaker. It is proposed to be sized at 275 KW and will operate only if the FPL feeder has failed.

A 1500-gallon fuel tank will be provided for the new generator. This will provide approximately 48 hours of fuel at fuel load with 33% spare capacity. The fuel tank will be stored in a separately mounted concrete encased steel tank. **See Table 7-1** for tank sizing criteria.

TABLE 7-1
Riviera Beach Lift Station No. 50
Palm Beach County, Florida
Fuel Tank Calculations
DATE: March 28, 2011

Description:

The following provides the basis for and design of the fuel tank system for the above referenced facility.

A. Engine/Generator Data:

Make:	Cummins
Engine:	Model DQHAA
Size:	275KW/344KVA

B. Fuel Consumption:

Load:	100%
kW:	275 KW
Consumption (gal/hour):	21.81

C. Time Period (per NFPA 110):

# of hours	48

D. Minimum gallon requirement (with 133% spare capacity):

1392.35 gallons

E. Fuel Tank Selected

1500 gallons

Notes: 1 As per NFPA 110 Table 2-2.3, minimum time, in hours for which the emergency power system is designed to operate at its rated load without being refueled.

2 As per NFPA 110 3-4, 2.3 – The main fuel reservoir shall have a minimum capacity of at least 133% of that specified in Table 2-3.

SECTION 8

CONSTRUCTION

8.1 Construction Techniques and Sequences

It is anticipated construction of the proposed Lift Station No. 50 Facility, including wet well construction, concrete work, wall and building construction, pump mechanical and electrical equipment, odor control, standby power generator and fuel tank, yard piping, force mains and connections, and other related site improvements, will be performed using standard means and methods, and construction techniques. The existing Lift Station No. 50 will remain in service during construction of the proposed Lift Station No. 50 Facility. However, scheduled service shut downs will be required at several phases of the construction to make connections to existing force mains and to transfer electrical power to the new facility.

Typical erosion and sedimentation control methods outlined by the Florida Department of Environmental Protection will be used to control siltation and erosion at the project site. During construction, soil disturbance will be minimized to control siltation and erosion. At a minimum, silt fencing will be installed around the perimeter of the construction site and storm water inlet and grates will be protected by synthetic hay bales. As required, temporary seeding and mulching will be performed periodically to prevent erosion. The contractor will also be required to mow the entire facility property routinely during his occupation of the site.

Noise due to construction cannot be eliminated but will be controlled by limiting the contractor's daily and weekly work schedule (start and stop times and days of the week). In addition, noise will be abated in so far as possible by enforcement of maximum decibel levels on all construction equipment and machinery.

While it is impractical to eliminate all dust and debris created on a construction site, efforts will be taken to contain the dust to the limits of the facility site. Areas that have been cleared will be watered down during times of infrequent rain to keep dust down. During construction of the wet well and concrete work, electrical building and walls, masonry operations will be monitored, and if concrete cutting creates excessive dust that is blown beyond the facility site, "wet-cutting" measures will be taken. A centralized trash and debris collection area will be established using dumpsters where necessary to promote cleanliness on the work site. Additionally, trucks leaving the site will be monitored and a means of reasonable cleaning of the street or installing a truck wash at the facility entrance will be provided so that excessive dirt is not carried onto the local roadways.

It is not anticipated that adverse odors will affect the surrounding areas as a result of construction operations. Fuel for and exhaust from equipment, some paints, and some coatings may have odors, but those odors should not be adverse beyond the limits of the construction site.

The Contractor will first be required to establish and on-site field office in addition to providing a field office for RBUD Construction Inspection Staff. A field office area and material storage yard may likely be established at the end of the existing asphalt driveway, directly west of the existing Lift Station 50 Facility. This location would not interfere with any planned construction or demolition work. Following the clearing and grubbing of the project area on the north side of the existing Lift Station 50 facility, the construction of the wet well and the installation of the underground influent and discharge yard piping will begin first. The wet well is too large to be delivered to the site as a precast concrete structure, so the wet well location will be excavated to the required elevation and the floor and walls of the structure will be formed and poured in place. Once the walls of the wet well are formed and cured, the influent yard piping and manholes will be installed and tested. In addition, the underground electrical conduits from the wet well, odor control system, flow meter, standby power generator, and fuel tank will be installed. The entire area can then be backfilled and compacted to grade level.

Once this underground work is completed, the wet well top slab can be installed, the footers for the perimeter wall and electrical building can be constructed (including the concrete floor), and the concrete masonry unit perimeter walls and electrical building walls can begin construction. Meanwhile, at the same time, the concrete grade slabs for the odor control system, above grade discharge piping and flow meter, the standby power generator and fuel tank will be constructed.

Following the construction of the concrete-grade slabs and during the construction of the perimeter masonry walls and the masonry electrical building, numerous mechanical components and systems of the lift station facility may be constructed concurrently. The slide gates, submersible pumps, rails, and associated mechanical and electrical hardware will be installed within the wet well. The above grade discharge piping, check valves and plug valves will be installed, and the odor control system will be installed in addition to the emergency generator and fuel tank. Similarly, much of the proposed force main outside the yard will be constructed and connections to existing force mains will be made.

Once the electrical building is completed and the interior, including the air conditioning system, has been finished and painted, wiring for all the electrical power and components will be pulled to the building, and the electrical panels and equipment will be installed. At this point in construction, electrical power will be provided to the wet well components, the odor control system, the flow meter, the standby power generator, and fuel tank for testing and troubleshooting.

Meanwhile, the Contractor will complete the perimeter masonry wall, and paint the wall and electrical building exterior. He will also lay the asphalt driveway, place gravel in the yard and install the access gate. Outside the wall, he will grade the site, sod the immediate perimeter of the wall and the storm water retention swales, and seed and mulch the remaining construction area. The new facility will at this point be able to be started-up and fully tested in order to reach a level of Substantial Completion. Once the new facility has been accepted by RBUD as substantially complete, the existing facility will be placed out of service in preparation for its demolition.

Overall, the final completion of the proposed Lift Station No. 50 is estimated to require 28 weeks of actual construction with an additional 16 weeks required in advance of construction for mobilization, field engineering, shop drawing approval, and material and equipment procurement and delivery.

SECTION 9

OPINION OF PROBABLE CONSTRUCTION COST

9.1 Planning Cost Estimate

The purpose of this section of the Preliminary Design Report is to provide a preliminary opinion of probable construction cost associated with the construction of the proposed Lift Station No. 50 and the subsequent demolition of the existing Lift Station No. 50.

A summary of the planning level costs, including construction cost, general conditions (bonds, permits, insurance, etc.) costs, project contingency, and related technical services is presented in **Table 9-1** for the construction of the proposed Lift Station No. 50. All construction and demolition costs are in December 2010 dollars. The total estimated construction cost for the proposed Lift Station No. 50 is approximately $2,737,300, which includes a 10% construction contingency. These cost estimates are based upon:

- Recent bid prices for similar projects;
- Planning level vendor quotes for proposed equipment;
- Recent cost estimates for similar projects in Florida;
- Standard cost data from industry publications as contained in Means publications; and
- Standard allowances for items such as electrical, instrumentation, yard piping, and site work.

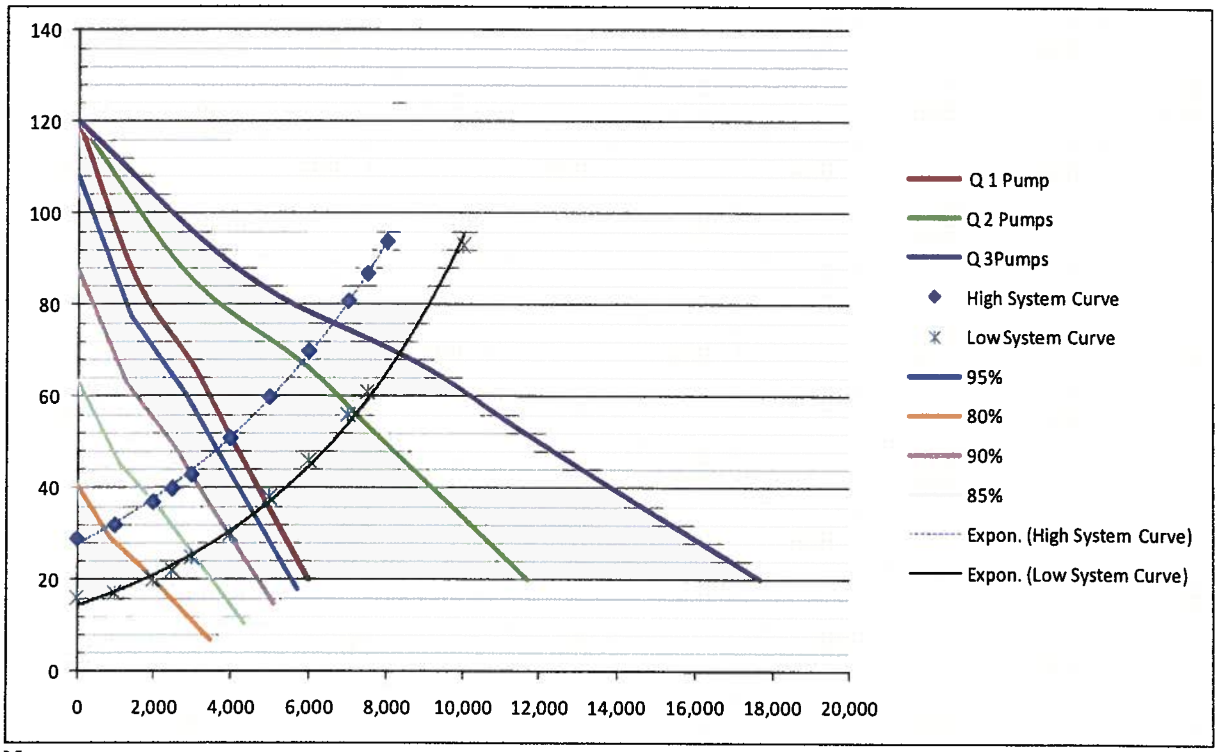
TABLE 9-1
Proposed Lift Station No. 50 Construction Cost Estimate

Item No.	Description	Estimated Cost
1	Mobilization/ Demobilization	$100,000
2	General Requirements	$18,000
3	Site Survey, Field Engineering and Record Drawings	$12,000
4	Clearing and Grubbing	$3,000
5	Earthwork, Grading and Finish Grading	$9,400
6	Concrete Wet Well Construction	$286,000
7	Submersible Pumps, Mixers and Accessories	$260,000
8	Odor Control System	$112,745
9	Emergency Generator, Fuel Tank and Piping	$225,000
10	Magnetic Flow Meter with Transmitter	$39,000
11	Electrical Materials and Installation	$455,000
12	Instrumentation and Controls	$145,000
13	Yard Piping, Valves and Fittings	$635,247
14	Yard Concrete	$29,226
15	Electrical Building	$68,000
16	Perimeter Masonry Wall and Gate	$57,986
17	Asphalt Pavement	$20,025
18	Yard Stone with Geofabric	$8,125
19	Bollards	$2,000
20	Sodding	$630
21	Seed and Mulch	$850
22	Erosion and Sedimentation Control	$1,200
	Subtotal	**$2,488,434**
	Construction Contingency (10%)	**$248,843**
	Total Project Cost	**2,737,277**

Appendix A

Proposed Lift Station 50 System Curves and Pump Curve Information

We have selected four identical pumps for the proposed Lift Station No. 50 (with four variable frequency drives): Flygt 10-inch NP3301/636 model pumps rated at 70 HP at 1185 rpm at top speed. The combination of these pumps operating through a range of conditions from a single pump operating at variable speed through three pumps operating at full speed have the ability to meet the range of conditions which Lift Station No. 50 will be required to operate under. That is, the ability pump approximately 2,077 gpm using one pump at 80% speed to satisfy the requirements of the low head system curve conditions through the ability to pump approximately 6,233 gpm using three pumps at full speed to satisfy the high head system curve conditions. The following plot is of the low and high system curves in conjunction with multiple pump curves including a single pump running a variable speeds; and one, two and three pumps running at full speed:



Notes:

- Q1 represents one pump running, Q2 represents two pumps running and Q3 represents three pumps running.
- The pump curves shown below Q1 (one pump running) indicate the performance of a variable frequency drive pump at various percentages of full speed (i.e.: 95%, 90%, 85% and 80%).

The following two pages contain the manufacturer's pump curve and dimensional cut sheet for the selected Flygt 10-inch NP3301/636 model pumps:

PERFORMANCE CURVE

PRODUCT	TYPE
NP3301.180	MT

DATE	PROJECT	CURVE NO	ISSUE
2009-03-23		63-636-00-2130	2

	1/1-LOAD	3/4-LOAD	1/2-LOAD
POWER FACTOR	0.80	0.75	0.64
EFFICIENCY	91.0 %	91.5 %	91.5 %
MOTOR DATA	—	—	—

RATED POWER	70	hp
STARTING CURRENT	560	A
RATED CURRENT	89	A
RATED SPEED	1185	rpm
TOT.MOM.OF INERTIA	1.1	kgm2
NO. OF BLADES	2	

COMMENTS

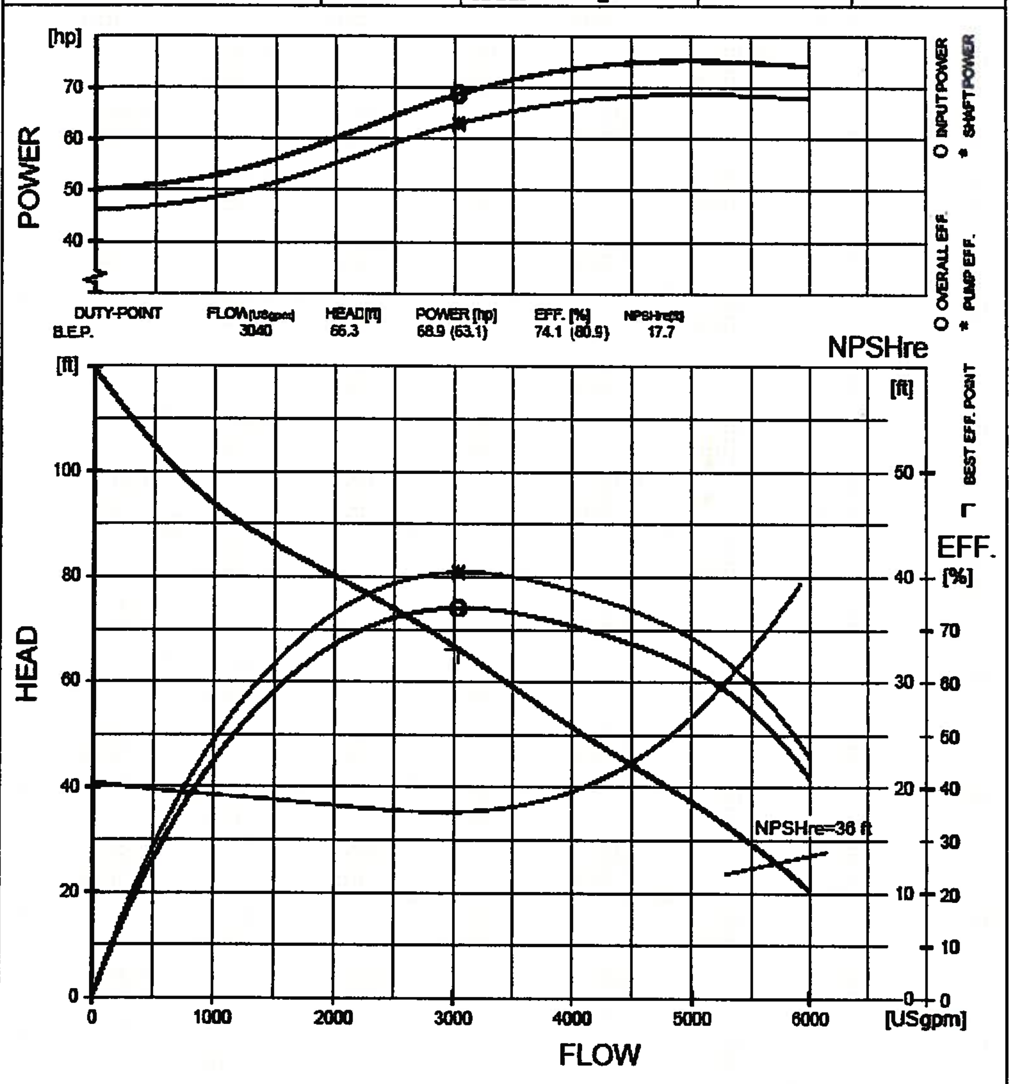
INLET/OUTLET	IMP. THROUGHLET
-/ 10 inch	—

IMPELLER DIAMETER: 384 mm

MOTOR #	STATOR	REV
35-25-6AA	01D	11

FREQ.	PHASES	VOLTAGE	POLES
60 Hz	3	460 V	6

GEARTYPE	RATIO
—	—

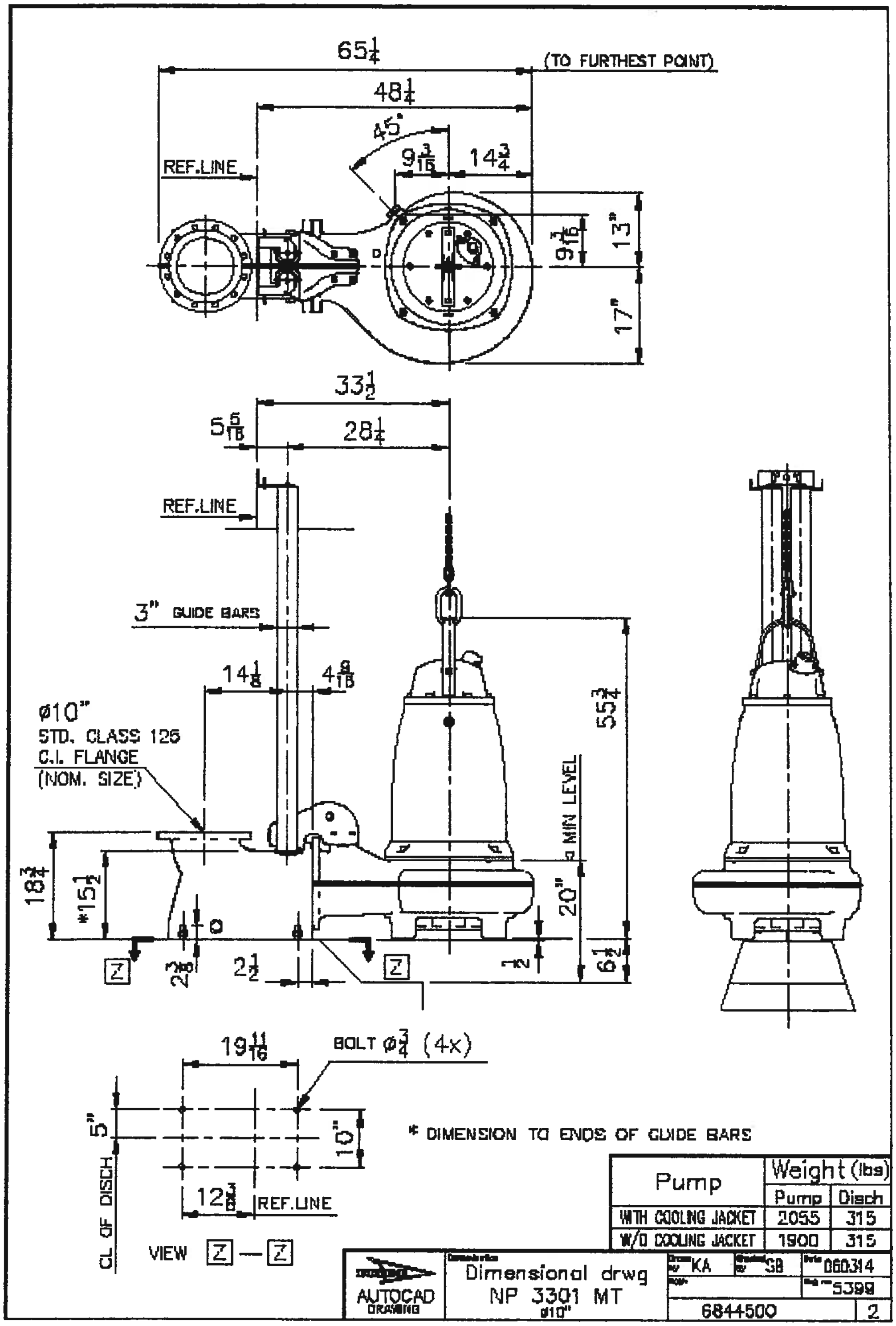


FLYPS3.1.6.3 (20060531)

NPSHre = NPSH3% + min. operational margin

Performance with clear water and ambient temp 40 °C

HI B Curve



Pump	Weight (lbs) Pump	Weight (lbs) Disch
WITH COOLING JACKET	2055	315
W/O COOLING JACKET	1900	315