Northlake Lift Station & Forcemain Project

Prepared For:
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PROJECT BACKGROUND

Utility Engineering Group, PLLC (UEG), was contracted by Colliers Engineering & Design (CED) for the proposed Northlake Lift Station & Forcemain Project. The lift station will follow the required design criteria, specifications, and will be in accordance with both San Antonio Water System (SAWS), and the Texas Commission of Environmental Quality (TCEQ).

The proposed lift station will collect sewage from the Northlake Subdivision, located within the proposed lift station service area boundary as described in the SAWS Utility Service Agreement No. 28154. The proposed developed flows from the subject area will be further discussed later in this report. The routing and design of the gravity sewer system that will bring flow to the proposed lift station will be completed by CED and will follow proposed and future right-of-way and easements, terminating at a manhole located within the lift station site. A vicinity map is included in Appendix A and shows the Northlake development in relation to the proposed lift station site.

PROJECT AREA

The proposed lift station is located within the Extraterritorial Jurisdiction of the City of San Antonio, just west of Gardner Road and north of Calaveras Lake. The proposed lift station site will be located within a dedicated parcel, platted with the development, and dedicated to SAWS. The proposed lift station site will utilize approximately 0.31 AC out of the total 0.37 AC lift station lot and will incorporate the wet well, valve pad, electrical components, and all associated appurtenances which are included in the attached Site Location Map and associated construction plans. The existing site conditions consist of relatively flat topography with soil profiles ranging from clayey sands to sandstone and fat clay with trees and significant vegetation located throughout the lift station site as well as the rest of the proposed development area.

FORCE MAIN SYSTEM ALIGNMENT

The Northlake wastewater collection system, designed by CED, will collect and deliver wastewater flows to the proposed lift station site. The associated off-site forcemain was designed by UEG, in coordination with the routing and tie-in locations provided by CED. Utility Engineering Group has coordinated with CED and SAWS on the force main design and alignment in order to size the lift station pumps and yard piping, as well as avoid any other utility conflicts inside and outside of the proposed development. The proposed wastewater flows will be pumped by the proposed lift station through a proposed 12-inch HDPE Ductile Iron Pipe System (DIPS) force main approximately 14,815 feet to the north of the site. Due to the length of the proposed line, a dual-forcemain system will be utilized for redundancy. The lines will be identical and parallel HDPE pipe systems. After reaching the highest proposed elevation of approximately 591 ft MSL, the force main terminates at the existing manhole located southwest of New Sulphur Springs Road.

DEVELOPMENT OF WASTEWATER FLOWS

1. Equivalent Dwelling Units (EDU's)

The determination of the wastewater flows for the proposed lift station are calculated based on the Equivalent Dwelling Units, (EDU's) and land use. An EDU is the standardized measure of consumption, use, generation or discharge of water or wastewater attributable to a single-family residence. UEG has confirmed with CED the number of allotted EDU's for the Northlake Subdivision that will contribute to the proposed lift station.

Based on the project Utility Service Agreement and SAWS Lift Station Design Criteria, the proposed lift station wet well is sized for a total of 2,450 EDU's, which will only include the proposed Northlake Subdivision. See Table 1 below for a breakdown of the projected EDU's.

Table 1: Equivalent Dwelling Units for the Northlake Trails Lift Station.

Land Uses	EDU's/ AC	Allotted EDU's
Northlake Subdivision	**5.47**	**2,450**
Total:		**2,450**

2. Wastewater Flow Projections

The proposed Sunshine Trails lift station projected wastewater flows were determined based on SAWS Lift Station Design Criteria which utilizes a proposed wastewater flow design value of 200 gpd/EDU, 600 gallons per acre for Infiltration/Inflow (I/I), and a Peaking Factor of 2.5. Each of the calculations shown below were used to develop the proposed flow conditions for the design of the lift station.

A. Average Dry Weather Flow (ADF)

In accordance with the San Antonio Water System Lift Station Design Guidelines, the Average Dry Weather Flow is calculated using the formula:

ADF = Total EDU * 200 gpd/EDU

A total of 340.3 gpm (490,000 gpd) was calculated for the proposed land plan uses detailed above. Table 2 below provides the calculated ADF for each of the proposed development areas.

B. Peak Dry Weather Flow (PDWF)

The Peak Dry Weather Flow (PDWF) of 850.7 gpm (1,225,000 gpd) was determined using the SAWS Guidelines. The formula provided below was used to calculate the PDWF:

PDWF = Total EDU * 2.5 gpd/EDU

Table 2 below provides the calculated PDWF for each of the proposed development units.

C. Peak Wet Weather Flow (PWWF)

The Peak Wet Weather Flow (PWWF) of 1037.3 gpm (1,493,764 gpd) was determined using the SAWS Lift Station Design Guidelines. The formula provided below was used to calculate the PWWF:

PWWF = PDWF + I/I

The overall proposed conditions and wastewater flow projection is provided in Table 2 below.

Table 2: Equivalent Dwelling Units for the Northlake Lift Station Service Area

Landplan Uses	Average Dry Weather Flow (gpd)	Peaking Factor Dry Weather Flow	Peak Dry Weather Flow (gpd)	Infiltration/ Inflow (gpd)	Peak Wet Weather Flow (gpm)
Northlake Subdivision	340.3	2.5	1,225,000	268,764	1037.3
Totals	**340.3**	**2.5**	**1,225,000**	**268,764**	**1037.3**

Lift Station Design Analysis

The Northlake Lift Station has been designed based on the Texas Administrative Code, Chapter 217 - Design Criteria for Domestic Wastewater Systems, as well as the San Antonio Water System Lift Station Design & Construction Guidelines. The design is based on multiple factors including projected force main sizing, the calculated peak wet weather flow from the proposed development areas, and buildout of the proposed lift station service area. Additionally, the capacity of the wet well will also depend on various factors. These factors will be further summarized later in the report.

1. *Northlake Lift Station Wet Well Capacity*

The Northlake Lift Station wet well capacity was determined based on the flow contributing from each of the identified development units. Based on the contributing PWWF from the development, the overall influent design flow of 1037.3 gpm (1,493,764 gpd) has been utilized for the proposed lift station wet well design. The lift station has been designed utilizing a 14-

foot fiberglass wet well layout, approximately 31-feet in depth. The buoyancy will be also included with our calculations to verify our design. Appendix B of the report provides the full analysis of the wet well design for the lift station.

2. *Selection of Force Main Size*

The selected pipe material, length, and inside diameter are all factors in the calculation of the force main losses. Additionally, the number and type of bends and valves in the force main system are also evaluated to determine the Total Dynamic Head (TDH). According to SAWS Lift Station and Construction Guidelines, "*All pipe material shall consist of fusion-welded HDPE, and both engineering report and plans must indicate either Ductile Iron Pipe Size (DIPS) or Iron Pipe Size (IPS)*". Per SAWS criteria, UEG has selected a High-Density Polyethylene (HDPE) DIPS pipe material. Referring to SAWS design criteria, a minimum 150-psi pressure rating pipe must be considered. A 12-inch (11.127 I.D.) 160-psi DR13.5 would be suitable when considering a HDPE DIPS pipe material selection. Due to the length of the forcemain being almost 3 miles long (14,815 LF), dual 12" force mains will be provided.

(a) HDPE Ductile Iron Pipe System (DIPS)

Selecting an HDPE DIPS material with a lift station firm pumping capacity flow of 1092 gpm, a velocity of 3.60 fps is expected. Using a factor of Using a factor of C=150, the TDH would approximately be 168-ft. Utilizing a C=150 value, the expected water hammer pressure would be approximately 115.1-psi, which is below proposed DIPS 160-psi rated pipe.

3. *Selection of Pump, Motors, and Impellers*

Based on the analysis, the selected pumps are Flygt model NP 3202 SH

3~275 at a frequency of 60 Hz which provides a pumping capacity of **720** gpm with 1-pump running, and a total firm pumping capacity of **1092** with 2 pumps running and one on standby. Each of the pumps will alternate accordingly, prolonging the life expectancy of the pumps.

The selected Flygt pumps produce approximately 168-feet of total head based on the minimum and maximum elevations depicted within the lift station design. The overall pump efficiency for each of the pumps will vary depending on the total dynamic head conditions, however at the station design point, the selected pumps will have an overall efficiency of 58.4%. The impeller chosen for the lift station design will consist of a hard-iron impeller and the selected pump motors are Flygt model NP3202 SH~3 275 (50hp) with a rated speed of 3,555 rotations per minute (RPM). The selected Flygt pumps are shown to be efficient with the given parameters and with the selected motor and impeller. Appendix C provides additional detail of the selected pumps.

4. *Detention of Effluent & Total Cycle Times:*

The detention time, calculated with the wet well design, is utilized to determine the amount of storage and cycle times expected for the inflows to fill the wet well when reaching its maximum capacity. The PWWF detention time can be calculated by using the equation provided in the SAWS Lift Station Design and Construction Guidelines. The following equation is utilized to find the detention time in the wet well design:

$$\mathbf{T_d = T_f + T_e}$$

In this scenario, the summation of the time to fill ($\mathbf{T_f}$) plus the time to empty ($\mathbf{T_e}$) equates to 89.37 minutes of total detention time for lift station. Odor control is required if the total detention time is greater than 180 minutes, in this case, no odor control is required for the lift station. An aerator system, Wet Well Wizard, shall be placed to normalize and eliminate hydrogen sulfide due to the septic conditions and dissolve fats, oils and related

odors within the wet well.

The total cycle time for the proposed lift station was also determined using the design criteria. The method is shown below for reference:

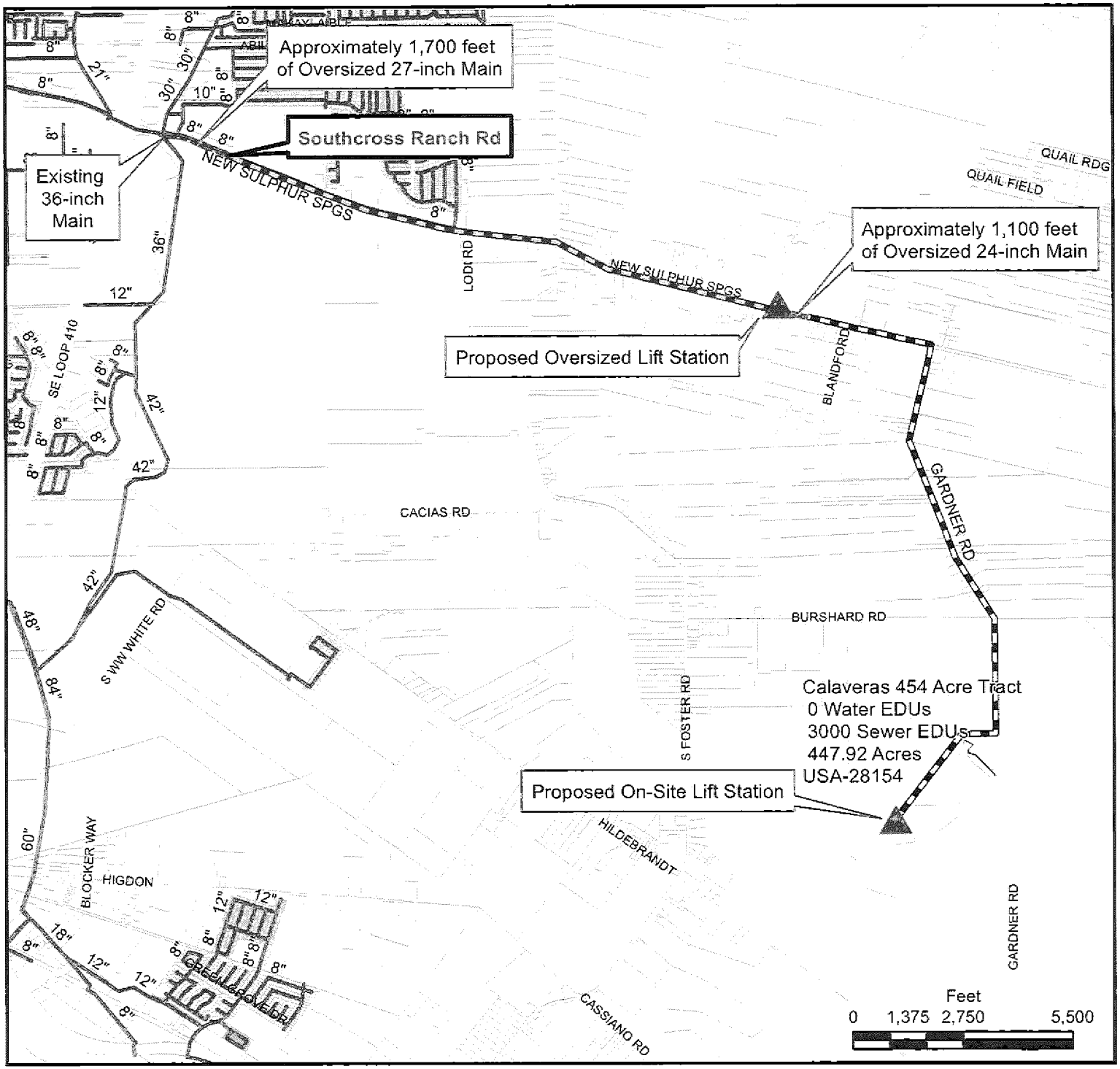
$$\textbf{Cycle Time (min)} = T_e + 2T_d$$

This formula assumes on the pump being on for one pumping cycle of T_e and for two storage cycles of T_f due to alternating pumps. The total cycle times for the project are provided in the table below:

Table 3: Total Cycle Times (Ultimate Capacity with Selected Pumps)

Detention Time & Total Cycle Time	**T_e Total Time to Empty (Min.)**	**T_f Total Time to Fill (Min.)**	**T_d Total Detention Time (Min.)**
ADF	6.17	13.64	**19.81**
MDWF	4.65	49.78	**54.43**
PWWF	84.90	4.47	**89.37**
PDWF	19.23	5.46	**24.69**

Appendix A : Site Location



Attachment III:
USA-28154
"Calaveras 454-Acre" Tract
Proposed Water Infrastructure Map
447.92 Acres

San Antonio Water System

Legend

- USA Tract
- Parcel
- Existing Sewer Main
- Proposed Lift Station
- Proposed Oversized 24-inch Main
- Proposed Oversized 27-inch Main
- Proposed Force Main
- Proposed Oversized Force Main

Project Location

Appendix B: Wet Well Analysis

Northlake LS Wastewater Planning

Wastewater Planning Factors:

[1] Wastewater Flow = 200 gpd/LUE

[1] Infiltration/Inflow = 600 gpd/acre

Contributing Areas - SAWS Northlake LS Wastewater System

Landplan Uses	Living Unit Equivalent (LUE) per Acre	LUE's [2]	Area (acres) [2]	Average Dry Weather Flow (gpd)	Average Dry Weather Flow (gpm)	Minimum Flow (gpd)	Minimum Flow (gpm)	Peaking Factor Dry Weather Flow [1]	Peak Dry Weather Flow (gpd)	Peak Dry Weather Flow (gpm)	Infiltration /Inflow (gpd)	Peak Wet Weather Flow (gpd)	Peak Wet Weather Flow (gpm)
Total Flow Contributing to the Northlake Lift Station	**5.47**	2450	447.94	490,000	340.3	134,241	93.2	2.50	1,225,000	850.7	268,764.0	1,493,764	1037.3
Total for the Entire Northlake LS System		2450	447.94	490,000	340.3	134,241	93.2	2.50	1,225,000	850.7	268,764.0	1,493,764	1037.3

Notes:

[1] Information based on SAWS Design Standards

[2] Based on information provided by KFW Engineers and Surveying Utility Serivce Agreement

*Acreage from Lot Layout dated March 2024

*LUE's from Lot Layout dated March 2024

Northlake Wastewater Lift Station Design - Pump Requirements

Static Head (Hs)

Max. Force Main Elevation:	591.00
Wet Well Low Level Elevation:	474.27
Hs:	116.73 ft

Pipe Friction and Minor Losses

Pipe Length:	14,815
Pipe Material:	12" HDPE DIPS DR13.5

Pipe Information			
Pipe Size	Pipe I.D. (in.)	Area (in^2)	Area (ft^2)
12	11.127	97.240	0.675

Pipe Friction = [(10.44) x (L) x (Q^1.85)]/[(C^1.85) x (d^4.8655)]
Hazen Williams Equation

Minor Losses = K x (V^2/(2 x g)) **g =** **32.2**

Force Main Minor Losses

Description	Number	K	Total K	
4" - 45° Bend	2	0.27	0.54	
4" - 90° Bend	1	0.45	0.45	
4" Check Valve	2	0.9	1.80	
4" Gate Valve	2	0.14	0.28	
4"X6" 45° Reducer Bend	1	0.05	0.05	..
6" Wye Branch	1	0.42	0.42	
6" Gate Valve	2	0.11	0.22	
6"x8" 45° Reducer Bend	1	0.24	0.24	
8"x12" Reducer	1	0.05	0.05	
12" Plug Valves	10	0.23	2.30	
12" - 11.25° Bend	4	0.06	0.24	Total K
12"- 22.5° Bend	2	0.11	0.22	
12"- 45° Bend	13	0.22	2.86	**9.67**

HDPE DIPS DR13.5

C= 150

Q (gpm)	Velocity (fps)	Pipe Friction (ft)	Minor Losses (ft)	Total Losses (ft)	TDH (ft)	
50	0.16	0.16	0.00	0.17	116.90	
100	0.33	0.59	0.02	0.61	117.34	
150	0.49	1.25	0.04	1.29	118.02	
200	0.66	2.13	0.07	2.20	118.93	
250	0.82	3.23	0.10	3.33	120.06	
300	0.99	4.52	0.15	4.67	121.40	
350	1.15	6.01	0.20	6.21	122.94	
400	1.32	7.70	0.26	7.96	124.69	
450	1.48	9.57	0.33	9.90	126.63	
500	1.65	11.63	0.41	12.04	128.77	
550	1.81	13.87	0.49	14.37	131.10	
600	1.98	16.30	0.59	16.88	133.61	
650	2.14	18.90	0.69	19.59	136.32	
700	2.31	21.67	0.80	22.47	139.20	
750	2.47	24.62	0.92	25.54	142.27	
800	2.64	27.75	1.05	28.79	145.52	
850	2.80	31.04	1.18	32.22	148.95	
900	2.97	34.50	1.32	35.82	152.55	
950	3.13	38.13	1.48	39.61	156.34	
1000	3.30	41.93	1.63	43.56	160.29	
1037	3.42	44.84	1.76	46.60	163.33	Design Capacity
1050	3.46	45.89	1.80	47.69	164.42	
1092	3.60	49.34	1.95	51.29	168.02	Pump Capacity
1100	3.63	50.01	1.98	51.99	168.72	
1150	3.79	54.30	2.16	56.46	173.19	
1200	3.96	58.74	2.35	61.10	177.83	
1250	4.12	63.35	2.55	65.91	182.64	
1300	4.29	68.12	2.76	70.88	187.61	
1350	4.45	73.05	2.98	76.03	192.76	

Northlake Wastewater Lift Station Design - Wet Well Storage Requirements

Net Positive Suction Head (NPSH)

NPSHr = 26 Net Positive Suction Head Required (ft)

NPSHa = Pb + Hs -Pv -H_{fs}

Pb =	29.5	Barometric Pressure (ft) - San Antonio Area
Hs =	0.5	Min Static Suction Head (ft)
Pv =	1.4	Vapor Pressure of Liquid (ft) - San Antonio Area
Hfs =	0	Friction Loss in Suction Pipe (ft)

28.6 Net Positive Suction Head Available (ft)

OK

Velocity Produced in Force Main (V_{fm})

Maximum - Two Pumps Running ~ Stand-By

V_{fm} = 0.4087099 * (Q/d2)

Q =	1092	Discharge Flow for Pump (gpm)
d =	11.127	Inner Pipe Diameter (in)

V_{fm} = 3.60 *fps*

Water Hammer Calculations

$$a = \frac{4660}{\sqrt{\frac{Ew*Di}{Ep*tp}}} \qquad P = \frac{a*V}{2.31*g} + Operating\ Pressure$$

Ew =	300,000	Bulk Modulus of Water (psi)
Di =	11.127	Inside Diameter of Pipe (in)
Ep =	120,000	Young's Modulus of Pipe (psi)(HDPE DIPS DR13.5 Pipe)
tp =	0.978	Pipe Wall Thickness (in)
g =	32.2	Acceleration of Gravity (ft/s^2)
V =	3.60	Velocity in Pipe (fps)
	168.02	Max Operating Head in Pipe (ft)
	72.77	Max Operating Press. In Pipe (psi)

a =	**873.7683**	Pressure Velocity Factor
P =	**115.11**	Water Hammer Pressure (psi)

160 HDPE DIPS DR13.5

Surge Control Measures are NOT REQUIRED

TCEQ Min. Lift Station Wet Well Storage Requirements

Motor HP	Min. Cycle Time in Minutes (Using Average Daily Flow)	
Less Than 50	6	(TCEQ Min.)
50-100	10	
Over 100	15	

Total Pump Capacity Required:	1037	gpm
Lead Pump Capacity:	720	gpm
Total Firm Pump Capacity:	1092	gpm
Pump Horsepower:	50	hp
Min. Cycle Time:	17	min.

SAWS Lift Station Wet Well Storage Requirements

Motor HP	Min. Cycle Time in Minutes (Using Average Daily Flow)	Fill Time (min.)	Empty Time (min.)	
Less Than 50	10	7	3	(San Antontio Water System)
50-100	17	12	5	
Over 100	25	18	7	

Wet Well Cycling Time (TCEQ):

1). $T_{cy} = T_F + T_E$

T_{cy}= 28.9

2). $T_F = \frac{V}{Q_i}$

T_f= 15.2

3). $T_E = \frac{V}{Q_o - Q_i}$

T_e = 13.6

T_F= Wet Well Fill Time (mins.) (All pumps off to Lead Pump On)
T_E= Wet Well Empty Time (mins.)
T_{cy}= Wet Well Cycling Time (mins.)
V= Wet Well Active Volume (gallons). Internal Cross Section and Lead Pump on and All Pumps off Level
Q_i= Average Daily Flow (gpm)
Q_o= Pump flow with one pump running (gpm)

Required Wet Well Volume:

V_R = (Min. Cycle Time x Pump Capacity)
V_R= 4,641.00 (gallons)
V_R= 620.41 (ft^3)

Minimum Required Working Depth:

Basin Dia. 14 (ft)
Volume/1ft: 153.938 (ft^3)
Volume/1ft: 1151.534 (gallons)

Minimum Required Working Depth = 4.03 (ft)

Actual Working Depth = 4.50 (ft)
Actual Wet Well Volume = 5181.90 (gallons)

High Level Alarm On:	480.94	480.94
High Level Alarm Reset	480.44	480.44
Lag Pump On	479.94	479.94
Lead Pump On	479.44	479.44
All Pumps Off	474.94	474.94
Low Level Alarm Reset	474.44	474.44
Low Level Alarm On	473.94	473.94

Wet Well Design:

Basin Area 153.93804 (ft)
Basin Depth 31.00 (ft)
Volume 4772.08 (ft^3)
Volume 35697.54 (gallons)
Design Flow 1092 gpm

	Elevation	Distance From Wet Well Floor
High Level Alarm On:	480.94	8.50
High Level Alarm Reset	480.44	8.00
Lag Pump On	479.94	7.50
Lead Pump On	479.44	7.00
All Pumps Off	474.94	2.50
Low Level Alarm Reset	474.44	2.00
Low Level Alarm On	473.94	1.50

WW Flow Line In Elev.: 480.94
Top of Wet Well Slab Elev.: 503.44
Bottom of Wet Well Slab Elev.: 472.44

Overall Wetwell Depth 31.00

Volume of Storage:

V_S = Average Daily Flow (gpd) x (1 Hr. Min. / 2 Hr. Max. Storage) / 24 Hr.
Average Daily flow: 490,000 (gpd) (2 Hr. Max Storage)
V_S= 40,833 (gallons)
V_S= 5,458.64 (ft^3)
Average Daily flow: 490,000 (gpd) (1 Hr. Min. Storage)
V_S= 20,417 (gallons)
V_S= 2,729.32 (ft^3)

V_S = Peak Wet Weather Flow (gpd) x (20-min Min. / 40-min Max Storage)
PWWF: 1,493,764 (gpd) (40-min. Max Storage)
V_S= 41,493 (gallons)
V_S= 5,546.88 (ft^3)
PWWF: 1,493,764 (gpd) (20-min. Min. Storage)
V_S= 20,747 (gallons)
V_S= 2,773.44 (ft^3) *EMERGENCY STORAGE REQUIREMENTS MET*

Lowest MH Top Elev. Or WW Top Elev. (Use Lowest): 503.44 (ft)
Lead Pump Elev: 479.44 (ft)
Lowest MH Elev. - Lead Pump Elev. 24 (ft)
Total Volume: 3694.513 (ft^3)
Total Gallons: 27636.8 (gallons)

Wet Well Vent Sizing:

Total Firm Pumping Capacity: 1092 gpm 145.98 cfm
TCEQ Max. Vent Air Flow Rate: 600 fpm

Min. Vent Size Based on TCEQ Max. Flow Rate: 6.68 in

Vent Size Selected: 8 in
Max. Vent Air Flow Rate Based on Vent Size Selected: 418.20 fpm *VENT SIZE MEETS TCEQ REQUIREMENTS*

Northlake Wastewater Lift Station - Wet Well Detention Times & Force Main Flush Times

Wet Well Detention Times

Peak Wet Weather Flows:

$T_d = T_f + T_e$

*Q_{in} = 1037.34 Peak Wet Weather (gpm)

Q_{out} = 1092 Pump Capacity (gpm)

Time to Fill (T_f) = 4.47 (min.)

Time to Empty (T_e) = 84.90 (min.)

T_d = **89.37** Detention Time (min.)

Less than 180 min. NO ODOR CONTROL REQUIRED

Total Cycle Time = 178.75 (min.)

Peak Dry Weather Flows:

$T_d = T_f + T_e$

Q_{in} = 850.69 Peak Dry Weather (gpm)

Q_{out} = 1092 Pump Capacity (gpm)

Time to Fill (T_f) = 5.46 (min.)

Time to Empty (T_e) = 19.23 (min.)

T_d = **24.69** Detention Time (min.)

Less than 180 min. NO ODOR CONTROL REQUIRED

Total Cycle Time = 49.38 (min.)

Average Dry Weather Flows:

Td = tf + te

Q_{in} = 340.28 Average Daily Flow (gpm)

Q_{out} = 1092 Q-ADF (gpm)

Time to Fill (T_f) = 13.64 (min.)

Time to Empty (T_e) = 6.17 (min.)

T_d = **19.81** Detention Time (min.)

Less than 180 min. NO ODOR CONTROL REQUIRED

Total Cycle Time = 39.63 (min.)

Minimum Dry Weather Flows:

$T_d = T_f + T_e$

Q_{in} = 93.22 Minimum Dry Weather (gpm)

Q_{out} = 1092 Pump Capacity (gpm)

Time to Fill (T_f) = 49.78 (min.)

Time to Empty (T_e) = 4.65 (min.)

T_d = **54.43** Detention Time (min.)

Less than 180 min. NO ODOR CONTROL REQUIRED

Total Cycle Time = 108.86 (min.)

Interim Storage Requirements

Vr = 4641 Gal / 620.37 ft^3

Vs = 40,833.33 Gal / 5,458.27 ft^3

1092 Pump GPM (gpm)

17 Min. Cycle Time (min)

Average Force Main Flush Time

$$WWFT = \frac{7.481\pi D^2(\Delta h_{on-off})}{4Q_i}$$

D =	14	*ft*
Δh_{on-off}	4.50	*ft*
Qi =	340.28	*gpm*

Avg. Wet Well Filling Time (WWFT) = **15.23** min.

$$PRT = \frac{7.481\pi D^2(\Delta h_{on-off})}{4(Q_o - Q_i)}$$

Qo =	1092	*gpm*

Avg. Pump Running Time (PRT) = **6.89** min.

WWDT = WWFT + PRT

Avg. Wet Well Detention Time(WWDT) = **22.12** min.

$$FC = \frac{L}{60V_{FM}(PRT))}$$

V_{fm} =	3.60	ft/s
L =	14815	ft

Avg. Flushing Cycle (FC) = **9.9359** cycles

$$FT = (FC_W)(WWDT) + (FC_D)(PRT)$$

FC_W =	9.0
FC_D =	0.9359

Average Force Main Flush Time (FT) = **205.56** min.

Northlake Wastewater Lift Station Design - Pipe Sizing

From Pump Suction to Valve Vault

Flow Rate =	**720.00**	gpm	1 pump
Qin =	1.60	cfs	

Pipe Size (in.)	Pipe I.D. (in.)	Velocity (fps)	
6	5.817	8.69	HDPE DIPS DR13.5
8	7.63	5.05	
10	9.375	3.35	
12	11.127	2.38	

Pump Rate =	**1092**	gpm	2 pumps
Qin =	2.43	cfs	

Pipe Size (in.)	Pipe I.D. (in.)	Velocity (fps)
6	5.817	13.18
8	7.63	7.66
10	9.375	5.08
12	11.127	3.60

Winter Engineering
1202 Hurst Hollow
Austin, TX 78734
(512) 431-8724

JOB Northlake Lift Station
SHEET NO. 1 OF
CALCULATED BY VW DATE
CHECKED BY DATE
SCALE

Wet Well Design - 14'-0" I.D. x 31'-0" deep Fiberglass

I Hydrostatic Pressure - assume water table @ grade w/ S.F. = 1.1 for buoyancy

∴ Hydrostatic pressure = (65 psf)(31' + 1'$_{cap}$ + 1.5'$_{mat}$) = 2180 psf
× 1.1 = 2400 psf

II Gravity Loads - note: while cap slab is isolated, it still contributes to overburden.

∴ D.L. mat = (0.15 kcf)(1.5')(9.0')²(π) = 57 K
D.L. cap = [(0.15)(1.0')(18')(24') = 65 K
D.L. backfill = [(0.15)(1.5') + (.09)(30')](9'² - 7.5'²)(π) = 231 K
353 K

III P_{uplift} = (2.4 ksf)(π)(9.0')² = 611 K (includes S.F.)
∴ Check contribution from soil/backfill wedge:
wedge width @ top = (29.5')(sin 10°) = 5.1' ⇒ Try 26'ϕ

∴ $P_{DL\ wedge}$ = (.09 kcf)(29.5')(13² - 9²)(½)(π) = 367 K
720 K Buoyancy Resistance OK

IV Mat Design - Empty Wet Well
w uplift = (2.18 ksf)(1.2) = 2.62 ksf - (1.5')(.15 ksf) = 2.4 kcf ↑
(see above) L.F.

check shear w/ 18" thick mat; fc' = 4000 psi; V_c = 2(.75)√4000 (12)(14)
= 15.94 kcf

V_u = (π(6.5')²(2.62 ksf)/π(13') = 8.5 kcf OK

Check outside perimeter:
$P_{backfill}$ = 611 K - (57 K
= 554 K (1.2)/π(9.5² - 7.5')
= 6.22 ksf × 1.5'
∴ V_u = 9.34 kcf OK

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02/15/25

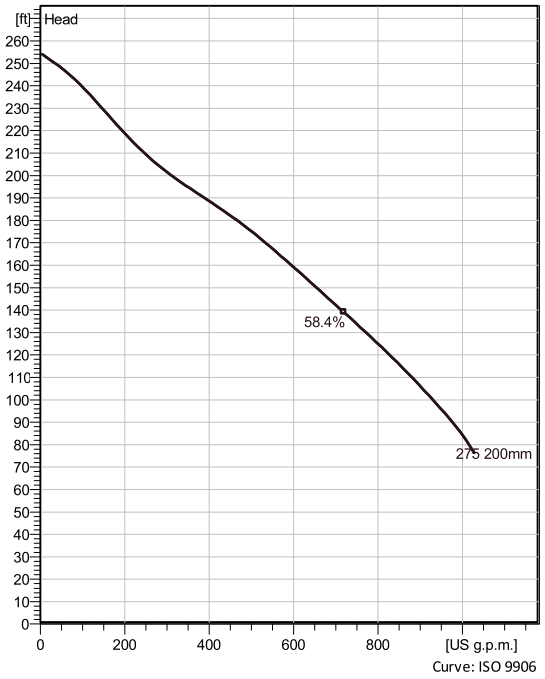
Appendix C: Flygt Pumps, Impeller, & Motor

NP 3202 SH 3~ 275

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

Technical specification

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3202.185 30-19-2AA-W 50hp

Installation type
P - Semi permanent, Wet

Impeller diameter
200 mm

Discharge diameter
4 inch

Pump information

Impeller diameter
200 mm

Discharge diameter
4 inch

Inlet diameter
150 mm

Maximum operating speed
3555 rpm

Number of blades
2

Max. fluid temperature
40 °C

Material

Impeller
Hard-Iron ™

Project	Northlake LS	**Created by**	Garry Montgomery		
Block	0	**Created on**	2/6/2025	**Last update**	2/6/2025

NP 3202 SH 3~ 275

Technical specification

Motor - General

Motor number N3202.185 30-19-2AA-W 50hp	**Phases** 3~	**Rated speed** 3555 rpm	**Rated power** 50 hp
ATEX approved No	**Number of poles** 2	**Rated current** 56 A	**Stator variant** 38
Frequency 60 Hz	**Rated voltage** 460 V	**Insulation class** H	**Type of Duty** S1
Version code 185			

Motor - Technical

Power factor - 1/1 Load 0.92	**Motor efficiency - 1/1 Load** 90.2 %	**Total moment of inertia** 3.54 lb ft²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.90	**Motor efficiency - 3/4 Load** 89.8 %	**Starting current, direct starting** 480 A	
Power factor - 1/2 Load 0.85	**Motor efficiency - 1/2 Load** 87.9 %	**Starting current, star-delta** 160 A	

Project	Northlake LS	**Created by**	Garry Montgomery		
Block	0	**Created on**	2/6/2025	**Last update**	2/6/2025

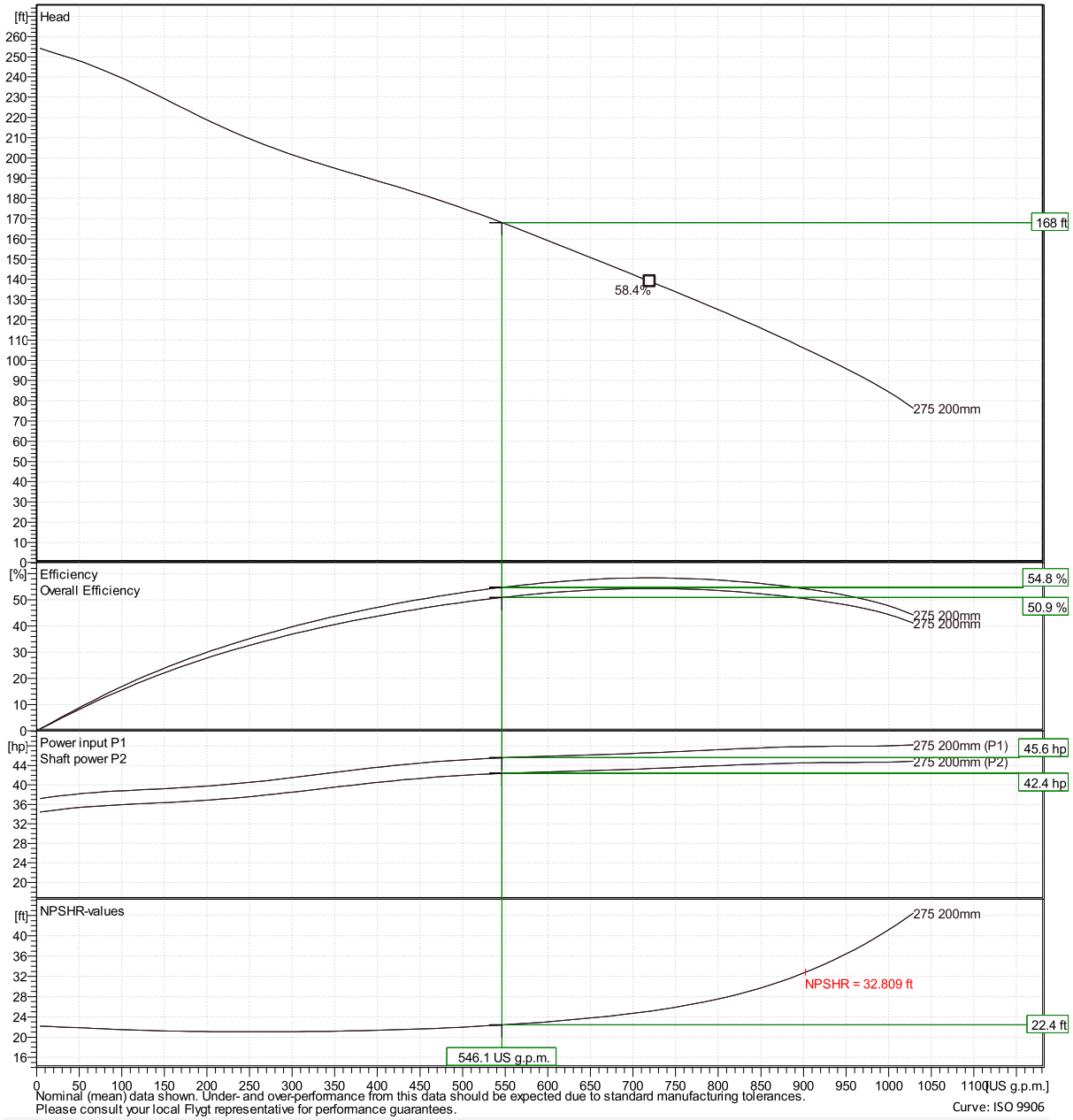
NP 3202 SH 3~ 275

Performance curve

Duty point

Flow	Head
546 US g.p.m.	168 ft

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

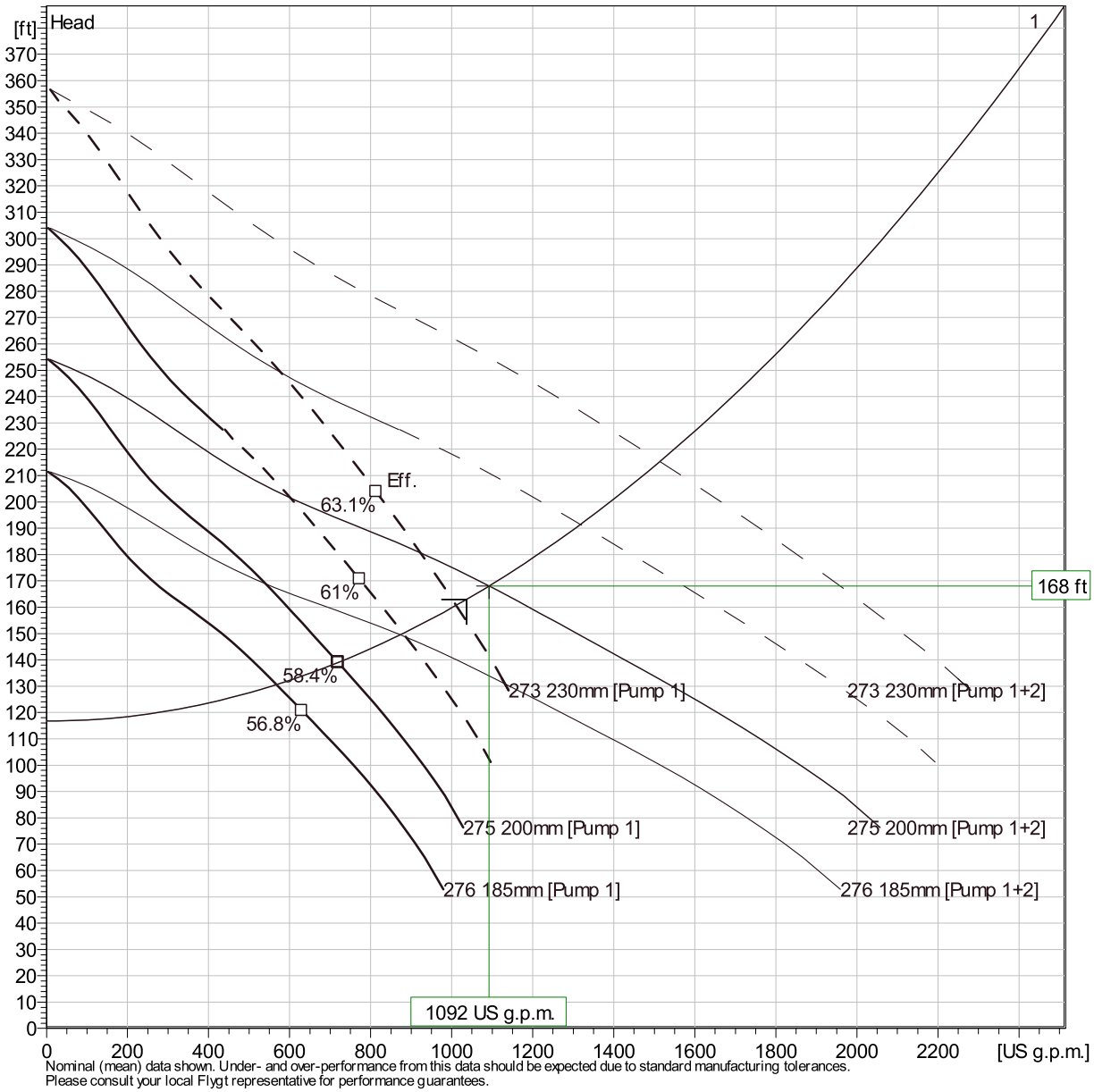
Curve: ISO 9906

Northlake LS			Garry Montgomery		
0		**Created on**	2/6/2025	**Last update**	2/6/2025

NP 3202 SH 3~ 275

Duty Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.42lb/ft³; 1.6891E-5ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
2 / 1	546	168	42.4	1090	168	84.8	54.8 %	1040	22.4
1 / 1	720	139	43.4	720	139	43.4	58.4 %	805	25.1

Project		**Created by**	Garry Montgomery		
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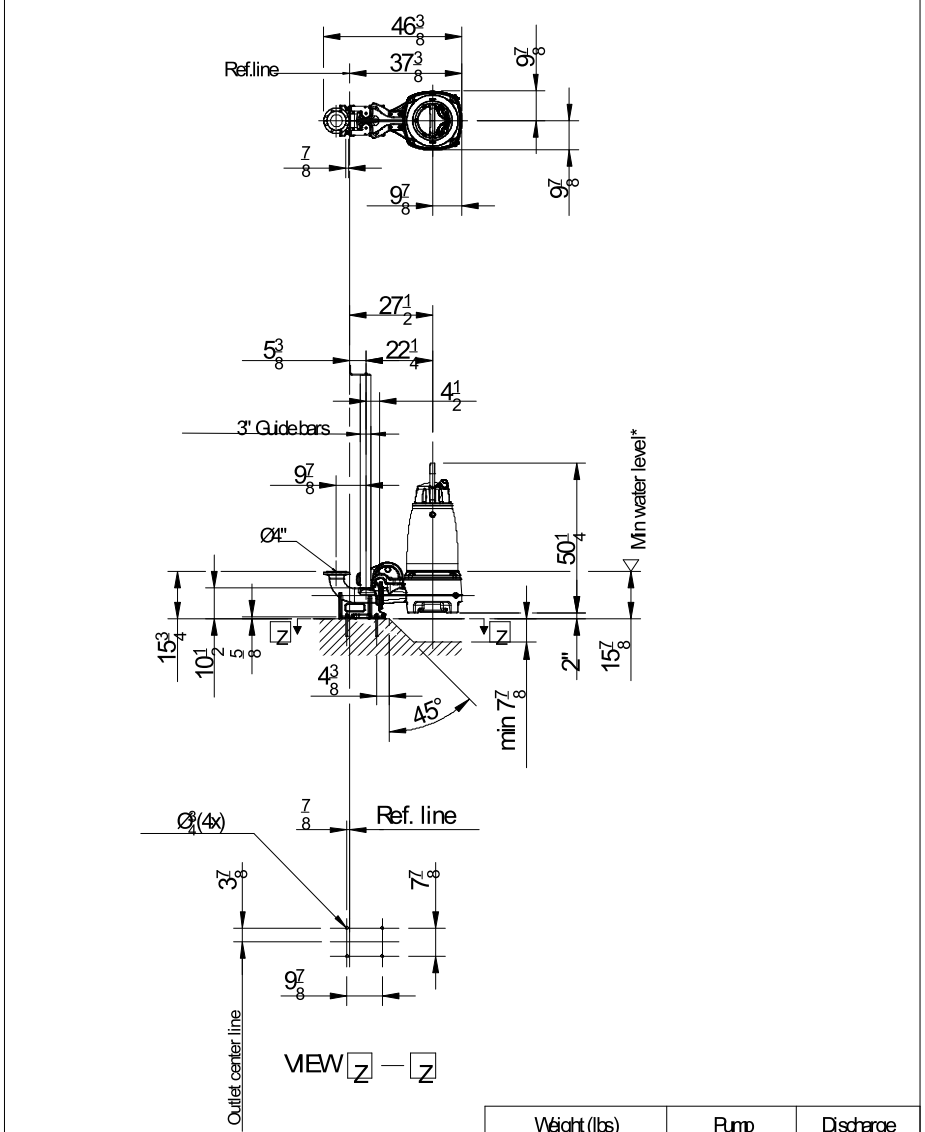
NP 3202 SH 3~ 275

Dimensional drawing



Weight (lbs)	Pump	Discharge
with cooling jacket	1215	95
without cooling jacket	1105	95

* Only applicable for intermittent duty.
Consult the IOM for more info.

FLYGT	FP	3202	SH	Discharge outlet Ø4"	Scale 1:40	Date 220921
095,185,350,390,660,670				Pump outlet Ø4"		
				Pump inlet	Drawing number 7632100	Revision 5
				Suction inlet		

Project	Northlake LS	**Created by**	Garry Montgomery
Block	0	**Created on**	2/6/2025 **Last update** 2/6/2025