

LIFT STATION CALCULATIONS

FOR

VILLA RICHEY

ADDRESS: 4210 Madison Street; New Port Richey, FL

PROPERTY ID: 16-26-16-0010-06100-0010

PREPARED FOR:

Villa Richey, LLC

PREPARED BY:



5048 POINTE EMERALD LANE; BOCA RATON, FL
(p) 561.465.5949 | (e) nbarnett@bardezco.com
FL CERTIFICATE OF AUTHORIZATION NO.: 32223

PREPARED UNDER THE SUPERVISION OF:



Digitally signed

by NOEL

BARNETT

Date:

2024.03.26

16:01:50 -04'00'

This item has been digitally signed and sealed by Noel A. Barnett, PE on the date adjacent to the seal.

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Noel Barnett, PE, LEED^{AP}

FL Professional Engineer No.: 72006

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1. Calculate Average Daily and Peak Inflow Rates:

A. Sanitary Sewer Service Area:

Villa Richey Equivalent Residential Units (ERUs):

73.0	ERUs
------	------

Compute Average Daily Flow = 73 Multi-Family (Non-Retirement) ERUs x 170 gal/day per ERU (Table B-2)

12,410	gal/day
0.012	MGD

Compute Average Inflow, gpm = 12,410 gal/day / 24 hr/day x 60 min/hr

8.62	gpm
------	-----

Compute Peak Design Daily Flow = 0.012 MGD x 3.0 (Table B-3)

0.037	MGD
37,230	gal/day

Compute Peak Design Inflow, gpm = 37,230 gal/day / 24 hr/day x 60 min/hr

25.85	gpm
-------	-----

2. Dynamic Head Computations:

A. Compute Head Loss Through Pipes:
$$H_L = \frac{10.67 L Q^{1.852}}{C^{1.852} D^{4.87}}$$

where:

L = Length of Pipe (feet)

Q = Volumetric Flow Rate (gpm)

C = Coefficient of Roughness

D = Pipe Diameter (inches)

Average Daily Inflow:	8.62	gpm	(Includes 23' between pump intake and aboveground valving)
Peak Inflow:	25.85	gpm	
Pipe Diameter:	2.00	inches	
Length of Pipe, L_{ACTUAL} =	105.0	feet	

Account for Minor Losses:

$L_{ML} = 105 * 0.15$ feet (Assumes 15% Minor Losses)

$L_{ML} =$

5.3	feet
-----	------



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Account for Head Loss Through Bends/Fittings:

$$\text{Equivalent Length} = \text{L/D Ratio} \times \text{Pipe Diameter} \times (1' / 12")$$

Fitting	No.	L/D Ratio	Equiv. Length
45 Bend	0	16	0
90 Bend	2	30	20
22.5 + 11.25 Bends	0	9	0
Cross/Tee	1	60	20
Gate Valve	2	8	5
Total Fittings/Bends Length, L_{FITTINGS} :			45.3

Compute Total Equivalent Pipe Length:

$$L_{\text{TOTAL}} = L_{\text{ACTUAL}} + L_{\text{ML}} + L_{\text{FITTINGS}}$$

$$L_{\text{TOTAL}} = 105 + 5.3 + 45.3$$

$$L_{\text{TOTAL}} = \boxed{155.6 \text{ feet}}$$

Compute Head Loss Through Pipes:

$$H_L \text{ (Avg Daily)} = \boxed{0.61 \text{ feet}}$$

$$H_L \text{ (Peak)} = \boxed{4.64 \text{ feet}}$$

B. Compute Static Head:

$$\text{Static Head} = \text{Ground Elevation} + 18" - \text{Pump 'ON' Elevation}$$

$$= 43.35 + 1.5 - 31.18$$

$$= \boxed{13.7 \text{ feet}}$$

3. Compute Minimum Operational Wet Well Volume:

$$V_{\text{min}} = (\theta_{\text{min}} * Q_{\text{out}}) / 4$$

where:

V_{MIN} = Minimum operational wet well volume

θ_{min} = Minimum number of minutes between successive starts

Q_{OUT} = Design pumping rate at build-out of all contributing flows

θ_{min} = Minimum 10 starts/hour

θ_{min} = 6 minutes

Q_{OUT} = Maximum one pump capacity

$Q_{\text{OUT}} = 64.1 \text{ gpm}$

$$V_{\text{MIN}} = (6 \text{ minutes} \times 64.1 \text{ gpm}) / 4$$

$$V_{\text{MIN}} = \boxed{96.2 \text{ gallons}}$$

$$\text{Min. On/Off Dist.} = V_{\text{MIN}} / \text{Wet Well Cross-Sectional Area}$$

$$= 96.2 \text{ gal} / 28.27 \text{ sf} \times 7.48 \text{ (gal/cf)}$$

$$\text{Min. On/Off Dist.} = 0.45 \text{ feet (*)}$$

(*) Use minimum allowable dist = 2.0 feet



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4. Design Input for Proposed Forcemain/Lift Station:

Wet Well Diameter:	6.0	feet
Top Slab/Ground Elevation:	43.35	NAVD
Influent Invert Elevation:	32.18	NAVD
Elevation of High Water Alarm:	32.15	NAVD
Both Pumps ON Elevation:	31.65	NAVD
Duty Pump ON Elevation:	31.15	NAVD
Both Pumps OFF Elevation:	29.15	NAVD
Top of Bottom Slab Elevation:	27.15	NAVD
Coefficient of Roughness (Hazen-Williams):	100.0	



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5. Compute System Head Curves:

A. Max. Pressure Reading at Madison Forcemain = 7.40 psi (17.1 FT-HEAD)

LENGTH (ft)	SIZE (inch)	MATERIAL	C-VALUE	FLOW (gpm)	FLOW CFS	PIPE LOSS (ft)	STATIC HEAD (ft)	VELOCITY (fps)	PRESSURE PSI	PRESSURE (ft)	TOTAL HEAD (ft)
155.6	2	PVC	100	0.0	0.00	0.00	13.7	0.00	7.40	17.1	30.8
155.6	2	PVC	100	10.0	0.02	0.80	13.7	1.02	7.40	17.1	31.6
155.6	2	PVC	100	20.0	0.04	2.88	13.7	2.04	7.40	17.1	33.7
155.6	2	PVC	100	30.0	0.07	6.11	13.7	3.06	7.40	17.1	36.9
155.6	2	PVC	100	40.0	0.09	10.40	13.7	4.08	7.40	17.1	41.2
155.6	2	PVC	100	50.0	0.11	15.73	13.7	5.11	7.40	17.1	46.5
155.6	2	PVC	100	60.0	0.13	22.04	13.7	6.13	7.40	17.1	52.8
155.6	2	PVC	100	70.0	0.16	29.32	13.7	7.15	7.40	17.1	60.1
155.6	2	PVC	100	80.0	0.18	37.55	13.7	8.17	7.40	17.1	68.3

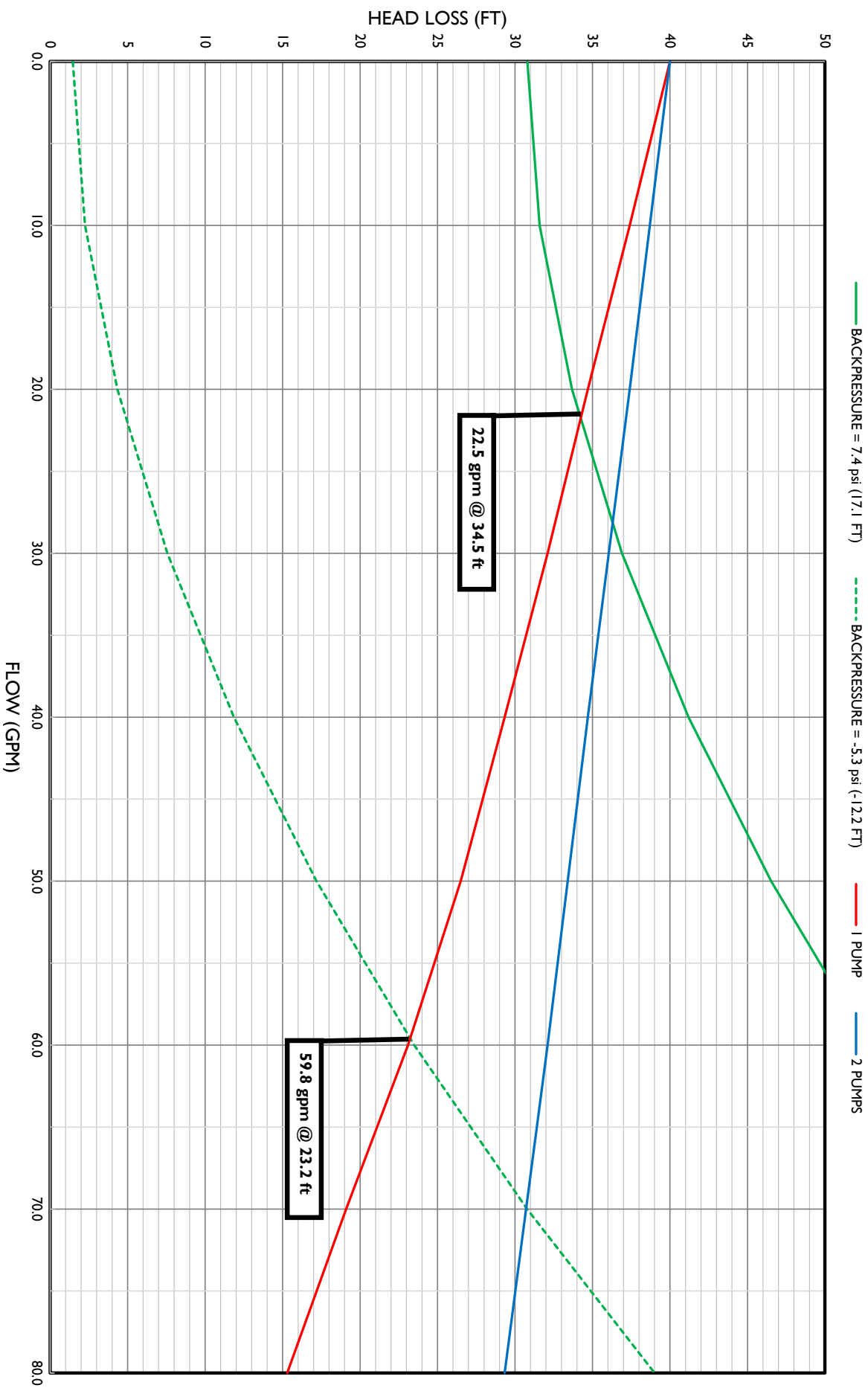
B. Min. Pressure Reading at Madison Forcemain = -5.3 psi (-12.2 FT-HEAD)

LENGTH (ft)	SIZE (inch)	MATERIAL	C-VALUE	FLOW (gpm)	FLOW CFS	PIPE LOSS (ft)	STATIC HEAD (ft)	VELOCITY (fps)	PRESSURE PSI	PRESSURE (ft)	TOTAL HEAD (ft)
155.6	2	PVC	100	0.0	0.00	0.00	13.7	0.00	-5.30	-12.2	1.5
155.6	2	PVC	100	10.0	0.02	0.80	13.7	1.02	-5.30	-12.2	2.3
155.6	2	PVC	100	20.0	0.04	2.88	13.7	2.04	-5.30	-12.2	4.3
155.6	2	PVC	100	30.0	0.07	6.11	13.7	3.06	-5.30	-12.2	7.6
155.6	2	PVC	100	40.0	0.09	10.40	13.7	4.08	-5.30	-12.2	11.9
155.6	2	PVC	100	50.0	0.11	15.73	13.7	5.11	-5.30	-12.2	17.2
155.6	2	PVC	100	60.0	0.13	22.04	13.7	6.13	-5.30	-12.2	23.5
155.6	2	PVC	100	70.0	0.16	29.32	13.7	7.15	-5.30	-12.2	30.8
155.6	2	PVC	100	80.0	0.18	37.55	13.7	8.17	-5.30	-12.2	39.0



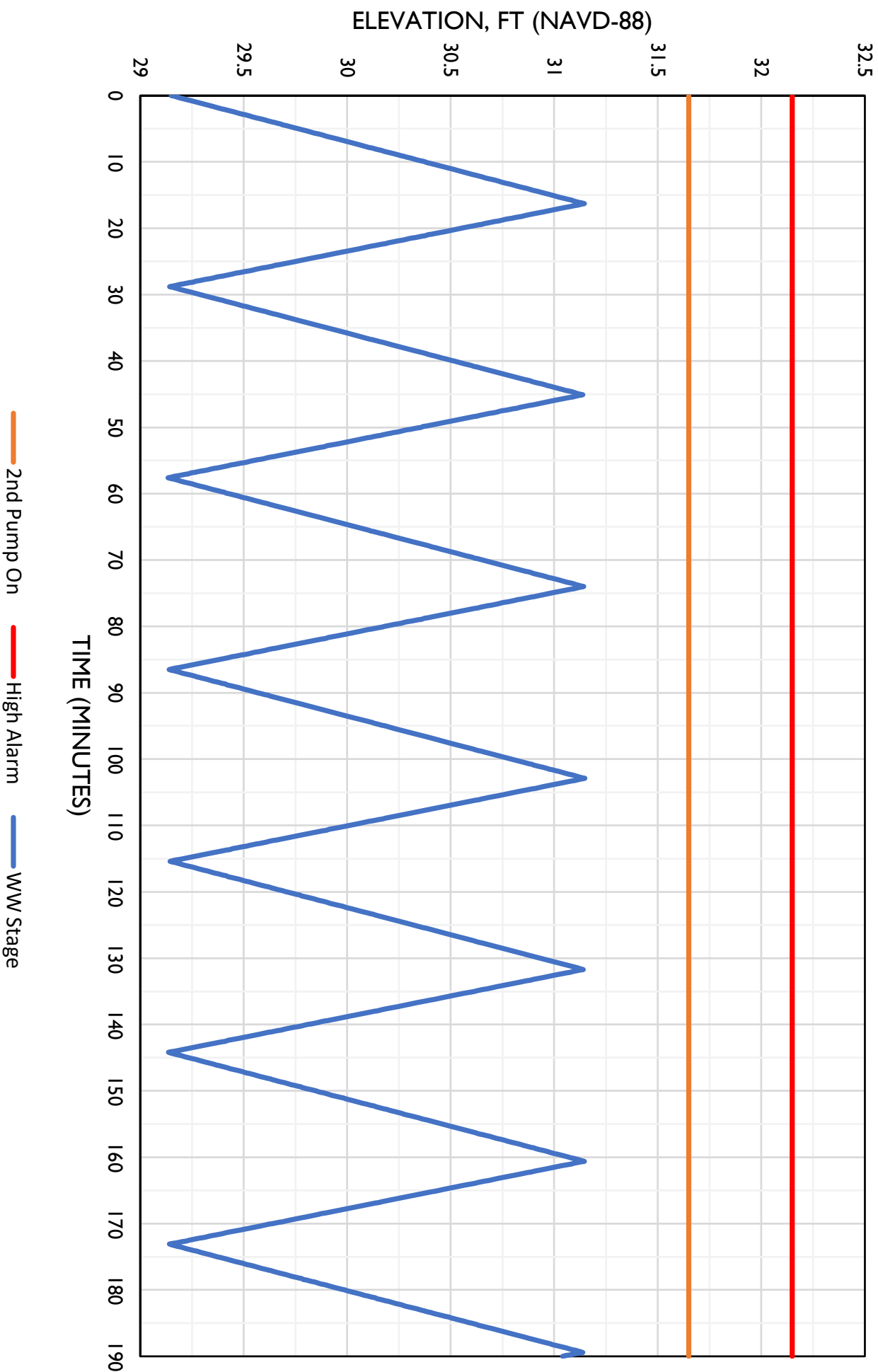
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SYSTEM HEAD CURVE



VILLA RICHEY

Barnes 2SEV1022DS, IHP | 31.15 On, 29.15 Off
Peak Inflow = 25.9 gpm





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6. Buoyancy Calculations

Wall Thickness:	8.0	inches
Top Slab:	6.0	inches
Top Slab Diameter:	7.33	feet
Bottom Slab:	12.0	inches
Bottom Slab Diameter:	9.33	feet
Concrete Density:	150.0	lbs/cf
Soil Density:	90.0	lbs/cf

Wet Well Bottom Slab Cross-Sectional Area:	68.42	ft ²	
Wet Well Outer Wall Cross-Sectional Area:	42.24	ft ²	
Wet Well Inside Wall Cross-Sectional Area:	28.27	ft ²	
Top Slab Opening Cross-Sectional Area:	13.50	ft ²	
Top Slab Remainder Cross-Sectional Area:	14.77	ft ²	= Wet Well Inside Wall Area - Top Slab Opening Area

A. Compute Sub-Grade Wet Well Volumes:

Top Slab:	43.35	NAVD
Ground Elevation:	43.35	NAVD
Bottom Slab:	27.15	NAVD

Distance from Grade to Top of Bottom Slab:	16.20	feet
Distance from Grade to Bottom of Bottom Slab:	17.20	feet

Volume of Bottom Slab =	68.4	ft ³
Volume @ Bottom of Bottom Slab =	1,176.8	ft ³
Volume @ Top of Bottom Slab @ Outer Wall =	684.2	ft ³
Volume @ Top of Bottom Slab @ Inner Wall =	458.0	ft ³

B. Compute Upward Buoyancy Force:

$$= (\text{Volume of Bottom Slab} + \text{Volume @ Outer Wall}) \times 62.4 \text{ lbs/ft}^3$$
$$= 46,965.7 \text{ lbs}$$

C. Compute Downward Force:

Weight of Bottom Slab =	10,262.5	lbs	
Weight of Wetwell Walls =	33,929.2	lbs	
Weight of Wetwell Top Slab (Inside Walls) =	1,108.1	lbs	
Weight of Saturated Soil on Flange =	11,705.6	lbs	= (Bottom Slab Area - Outer Wall Area) x Wall Height x (Soil Density - Water Density)
Total Downward Force =	57,005.3	lbs	

D. Compute Factor of Safety:

$$= \text{Downward Force} / \text{Upward Force}$$
$$= 1.21$$

APPENDIX 'A'

Pressure Test Results

Summary

File:

Channel Summary

Chan	Chan Tag	Chan Type	Eng Units	Max	Min	Total Samples	Average	MKT	Start Time	Stop Time
Chan 1		Pressure	PSI	7.4	-5.3	42952	-3.1		07/06/2023 14:27:08	07/07/2023 14:18:50
Chan 2		Temperature	Deg F	103.0	76.7	42952	89.1	90.4	07/06/2023 14:27:08	07/07/2023 14:18:50

APPENDIX 'B'

Pump Data

Barnes Submersible, No. 2SEV1022DS

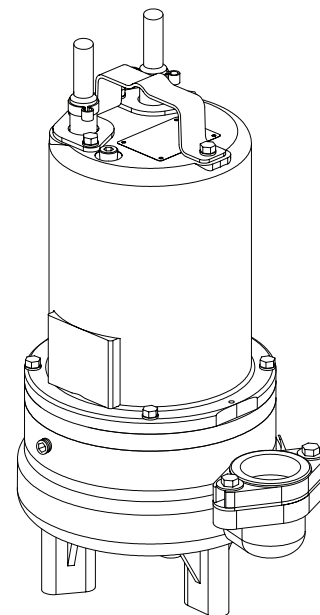
I&O Manual

2" Discharge

DISCHARGE	2" NPT, Female, Vertical, Bolt-on Flange
LIQUID TEMPERATURE	104°F (40°C) Continuous
VOLUTE	Cast Iron ASTM A-48, Class 30
MOTOR HOUSING	Cast Iron ASTM A-48, Class 30
SEAL PLATE	Cast Iron ASTM A-48, Class 30
IMPELLER: Design	Vortex, open, with pump out vanes on back side. Dynamically balanced, ISO G6.3
Material	Cast Iron ASTM A-48, Class 30
SHAFT	416 Stainless Steel
SQUARE RINGS	Buna-N
HARDWARE	300 Series Stainless Steel
PAINT	Air Dry Enamel
SEAL:	
<i>Design</i>	Tandem Mechanical, Oil filled reservoir
<i>Material</i>	Carbon/Ceramic/Buna-N
	Hardware -300 Series Stainless
CORD ENTRY	20 ft. (6.1m) Cord with plug on 120 volt & .5HP, 240 volt, 1 phase. Quick connect custom molded for sealing and strain relief
SPEED	1750 & 3450RPM (Nominal)
UPPER BEARING	Single Row, Ball, Oil lubricated
<i>Load</i>	Radial
LOWER BEARING	Single Row, Ball, Oil lubricated
<i>Load</i>	Radial & Thrust
MOTOR: Design	NEMA L -Single Phase, NEMA B -Three phase Torque Curve, Oil Filled, Squirrel Cage Induction
<i>Insulation</i>	Class B
SINGLE PHASE	Permanent Split Capacitor (PSC) Includes Overload Protection in Motor
THREE PHASE	200-240/480 is Tri-Voltage. 600V. Requires Overload Protection to be included in control panel
OPTIONAL EQUIPMENT	Seal Material, Impeller Trims, Additional cord, Normally Closed Temperature Sensors with cord for 3 phase pumps (Requires relay in control panel), Normally Open Moisture sensor with cord for DS pumps (Requires relay in control panel).

RECOMMENDED:

Accessories	Break Away Fitting (BAF) Check Valve Control Panel
Seal Kit PN	130176
Service Kit PN	130172



Series: 2SEV-DS 0.5, 0.75, 1.0HP, 1750 & 3450RPM, 60Hz



Sample Specification

DESCRIPTION:

SUBMERSIBLE NON-CLOG SEWAGE PUMP
DESIGNED FOR TYPICAL RAW SEWAGE
APPLICATIONS

Series 2SEV-DS

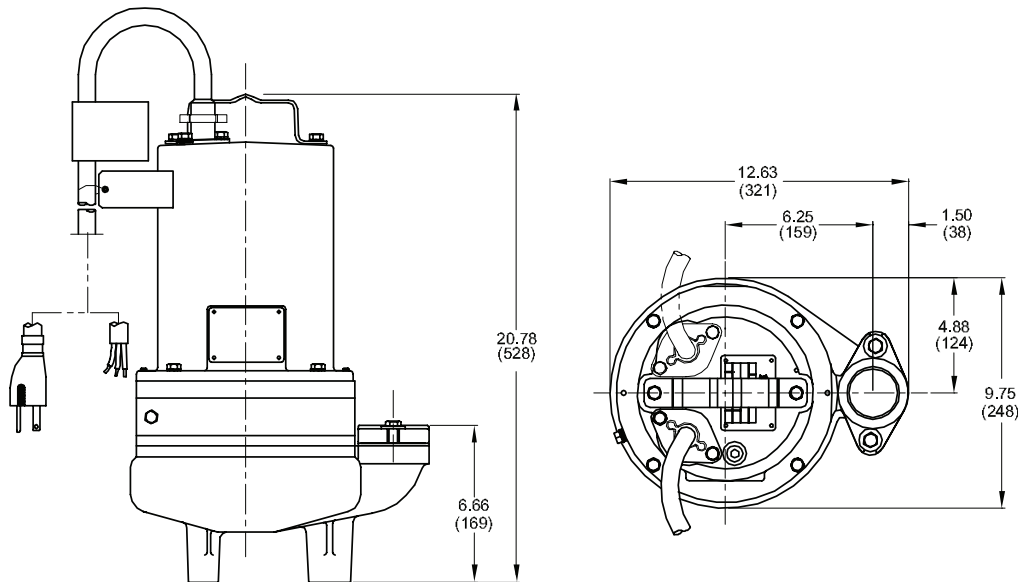
2" Spherical Solids Handling
Vortex, Double Seal

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2" Discharge

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MODEL NO	PART NO	HP	VOLT/PH	Hz	RPM (Nom)	NEMA START CODE	FULL LOAD AMPS	LOCKED ROTOR AMPS	CORD SIZE	CORD TYPE	CORD O.D. inch (mm)
2SEV514DS	104923	0.5	120/1	60	1750	F	12.0	21.3	14/3	SJTOW	0.375 (9.5)
2SEV524DS	104924	0.5	240/1	60	1750	J	6.3	14.9	14/3	SOW	0.530 (13.5)
2SEV594DS	104925	0.5	200-240/3	60	1750	H/L	3.7/3.8	9.8/11.0	14/4	SOW	0.570 (14.5)
2SEV544DS	104926	0.5	480/3	60	1750	K	1.9	5.3	14/4	SOW	0.570 (14.5)
2SEV554DS	104927	0.5	600/3	60	1750	H	1.4	3.4	14/4	SOW	0.570 (14.5)
2SEV724DS	104932	0.75	240/1	60	1750	K	7.1	25.8	14/3	SOW	0.530 (13.5)
2SEV794DS	104933	0.75	200-240/3	60	1750	H/K	4.8/4.6	13.7/15.4	14/4	SOW	0.570 (14.5)
2SEV744DS	104934	0.75	480/3	60	1750	K	2.3	7.7	14/4	SOW	0.570 (14.5)
2SEV754DS	104935	0.75	600/3	60	1750	L	1.6	7.2	14/4	SOW	0.570 (14.5)
2SEV1024DS	104940	1.0	240/1	60	1750	G	8.5	25.8	14/3	SOW	0.530 (13.5)
2SEV1094DS	104941	1.0	200-240/3	60	1750	E/H	5.3/5.1	13.7/15.4	14/3	SOW	0.570 (14.5)
2SEV1044DS	104942	1.0	480/3	60	1750	H	2.5	7.7	14/4	SOW	0.570 (14.5)
2SEV1054DS	104943	1.0	600/3	60	1750	J	2.2	7.2	14/4	SOW	0.570 (14.5)
2SEV512DS*	104976	0.5	120/1	60	3450	G	12.6	24.6	14/3	SJTOW	0.375 (9.5)
2SEV522DS	104977	0.5	240/1	60	3450	E	6.0	10.2	14/3	SOW	0.530 (13.5)
2SEV592DS	104978	0.5	200/240/3	60	3450	P/R	5.8/5.3	19.9/18.4	14/3	SOW	0.570 (14.5)
2SEV542DS	104980	0.5	480/3	60	3450	R	2.6	9.1	14/3	SOW	0.570 (14.5)
2SEV552DS	104981	0.5	600/3	60	3450	T	2.1	8.7	14/3	SOW	0.570 (14.5)
2SEV1022DS	104987	1.0	240/1	60	3450	F	10.7	21.8	14/3	SOW	0.530 (13.5)
2SEV1092DS	104988	1.0	200-240/3	60	3450	H/J	7.9/7.5	19.9/18.4	14/4	SOW	0.570 (14.5)
2SEV1042DS	104990	1.0	480/3	60	3450	J	3.7	9.1	14/4	SOW	0.570 (14.5)
2SEV1052DS	104991	1.0	600/3	60	3450	L	2.9	8.7	14/4	SOW	0.570 (14.5)

OPTIONAL - Temperature sensor cord for 3 phase models is 14/3 SOW, 0.530 (13.5mm) O.D.

OPTIONAL - Moisture sensor cord is 18/5 SOW, 0.470 (11.9mm) O.D.

OPTIONAL - Moisture & Temperature sensor cord for 3 phase models is 18/5 SOW, 0.470 (11.9mm) O.D.

(*) Pump is CSA listed **ONLY**.

IMPORTANT !

- 1.) PUMP MAY BE OPERATED "DRY" FOR EXTENDED PERIODS WITHOUT DAMAGE TO MOTOR AND/OR SEALS.
- 2.) THIS PUMP IS NOT APPROPRIATE FOR THOSE APPLICATIONS SPECIFIED AS CLASS I DIVISION I HAZARDOUS LOCATIONS.
- 3.) INSTALLATIONS SUCH AS DECORATIVE FOUNTAINS OR WATER FEATURES PROVIDED FOR VISUAL ENJOYMENT MUST BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE ANSI/NFPA 70 AND/OR THE AUTHORITY HAVING JURISDICTION. THIS PUMP IS NOT INTENDED FOR USE IN SWIMMING POOLS, RECREATIONAL WATER PARKS, OR INSTALLATIONS IN WHICH HUMAN CONTACT WITH PUMPED MEDIA IS A COMMON OCCURRENCE.

SECTION 1B
PAGE 28
DATE 6/13

CRANE®

A Crane Co. Company

PUMPS & SYSTEMS

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Series 2SEV-DS

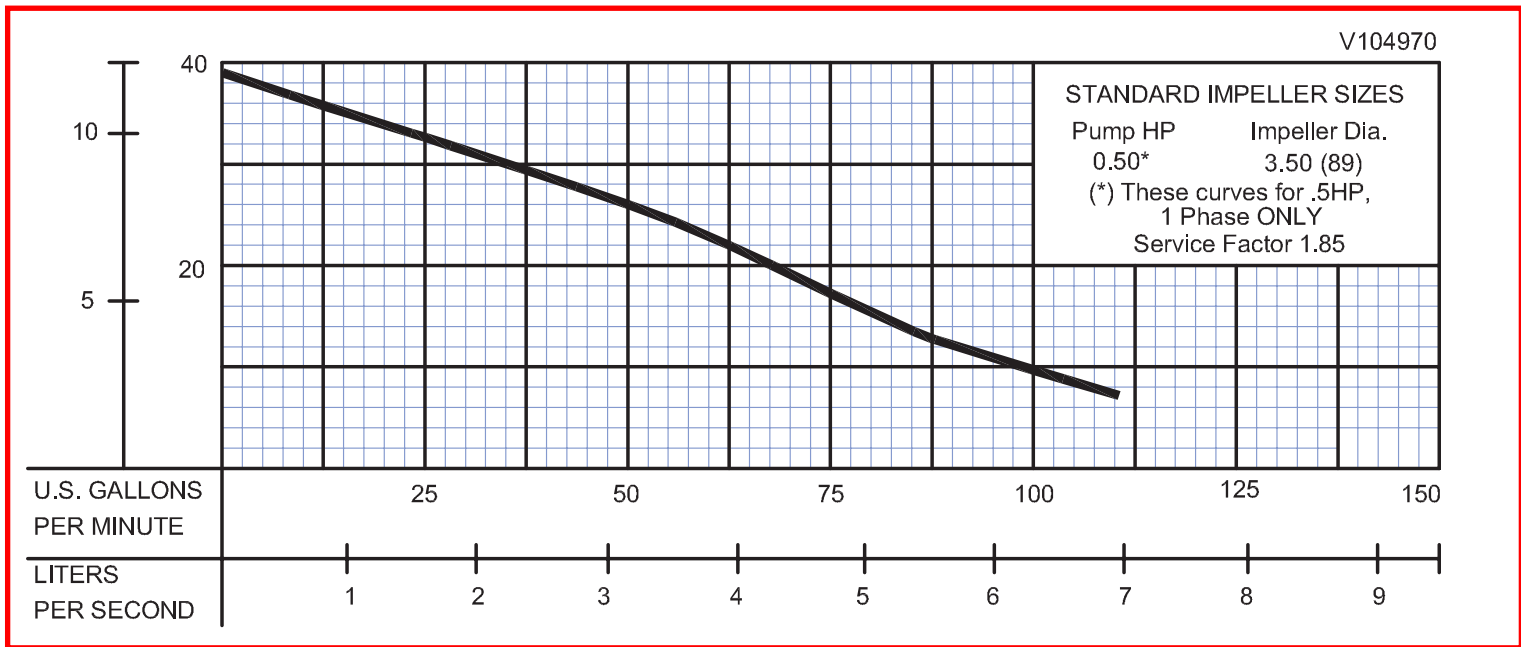
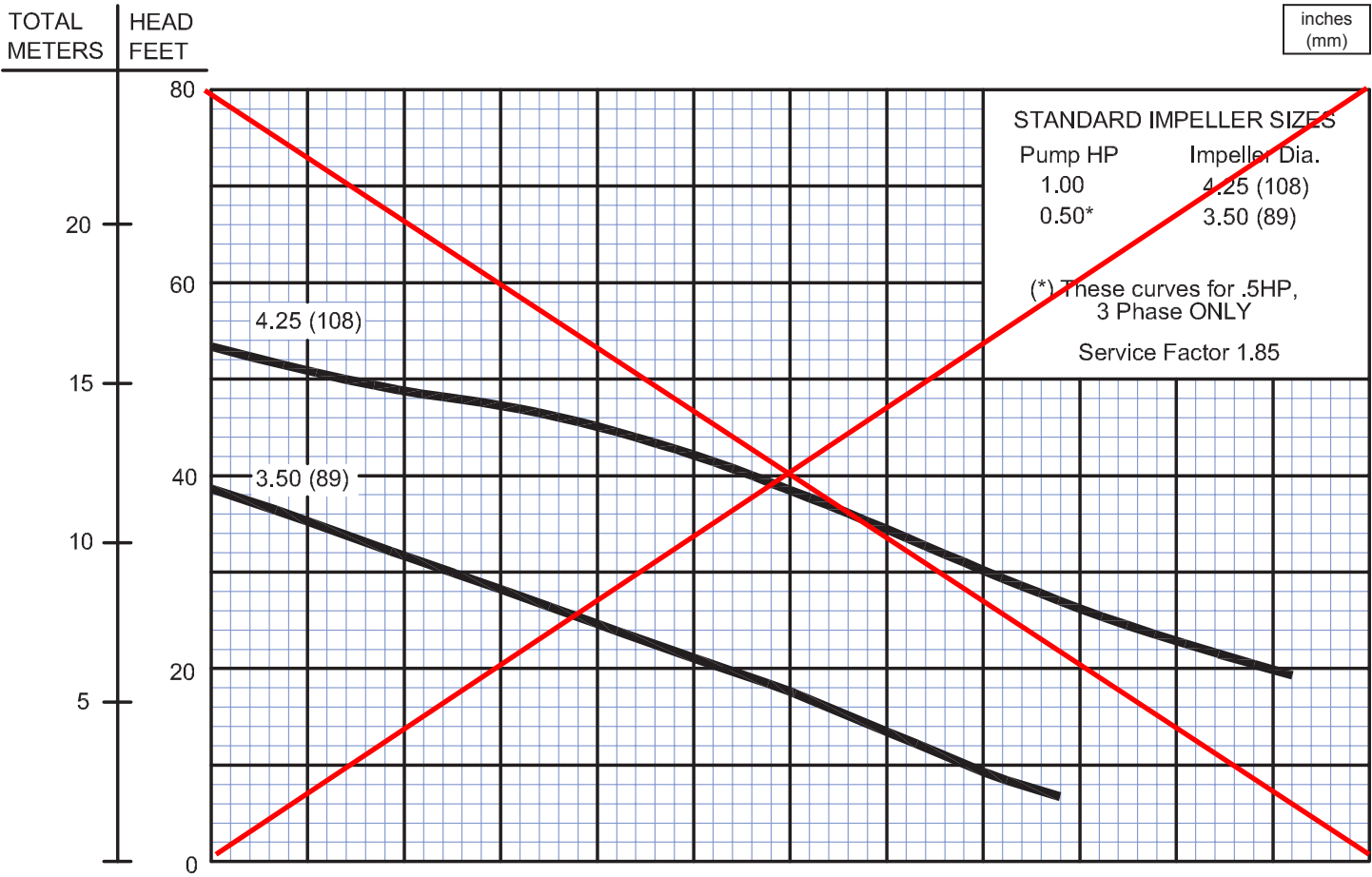
Performance Curve
.5HP & 1HP, 3450RPM, 60Hz



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2" Discharge

I&O Manual



Testing is performed with water, specific gravity 1.0 @ 68° F @ (20°C), other fluids may vary performance

I&O Manual

2" Discharge

