BARGHAUSEN

SANITARY SEWER PUMP AND FORCE MAIN CALCULATIONS

Freeman Logistics
22nd Ave NW and 82nd Ave E
Puyallup, WA

Prepared for:
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Our Job No. 21585

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1.0 INTRODUCTION/GENERAL INFORMATION

The following pages of this report delineate the criteria followed and the methodology used for sizing the sewer grinder pump and force main servicing the Freeman Logistics project.

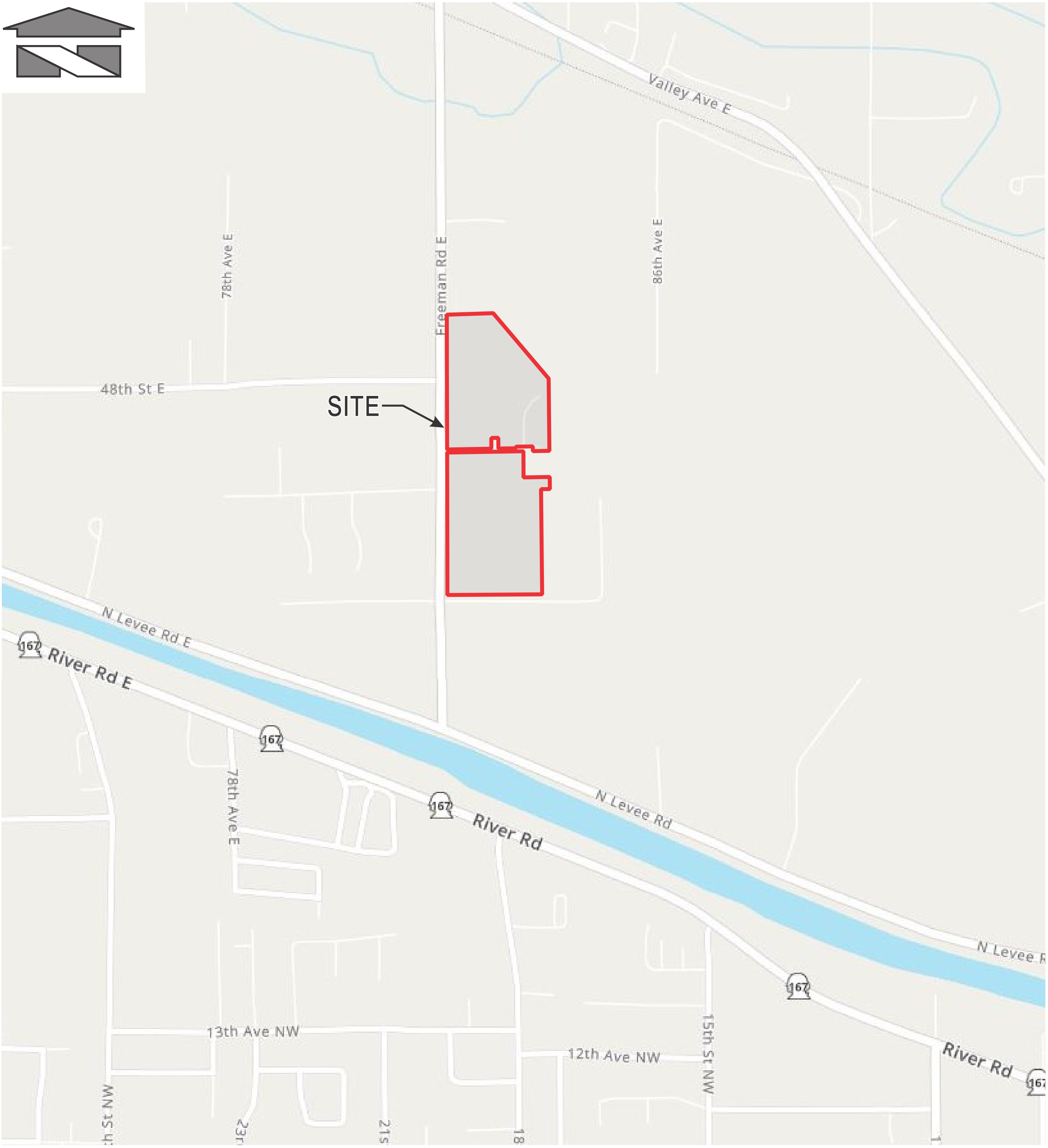
The project includes 2 warehouse buildings. The expected, maximum daily population is expected to be approximately 1,136 people. Water use of 15 gallons per person per day is anticipated.

The onsite system is designed with a private gravity main which collects and conveys flows from each building to a single pump station designed at the southwest corner of the site. Approximately 2,855 linear feet of new force main will be constructed between the pump station and the connection to the gravity system along Industrial Parkway.

Emergency standby power is proposed using a generator (natural gas or approved alternative). 24-hour storage volume will not be provided.

This report also includes buoyancy calculations for the pump manhole due to the shallow seasonal high groundwater elevation on the site.

Figure 1
Vicinity Map



REFERENCE: MapQuest (2022)

Scale: Horizontal: N.T.S. Vertical: N/A	For: Freeman Road Logistics Fife, Washington	Job Number 21585
Barghausen Consulting Engineers, Inc. 18215 72nd Avenue South Kent, WA 98032 425.251.6222 barghausen.com	Title: VICINITY MAP	DATE: 09/01/22

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Appendix A
Pump Design

SANITARY SEWER PUMP DESIGN

<u>Pump Criteria</u>:

- Design for peak sewer flow
    - Onsite flow: (DOE Orange book table G2-2 has “factories” at 15-35 gpd per person per 8-hr shift)
        - Offsite flow: For commercial zoning, use contribution factor of 1,000 gallons per day per acre of tributary area. Offsite contributions: Approximately 1.86 acres of commercial buildings on adjacent Schenk’s properties.

        - Potential development on parcel 042020-1114, limited due to critical areas. Assumed 2.5 acres of tributary area.

The proposed project proposes 491,323 sf or 11.28 acres of building area. Offsite contributions total approximately 4.36 acres of tributary building area.

Onsite Flow = 17,040 gallons per day (15 gpd X 1,136 people) = 710 gallons per hour (17,040 gpd/24 hr)

Assume peaking factor of 4 (from DOE "Orange Book")
Peak flow = 2,840 gallons per hour (710 x 4) = 47.33 gallons per minute (2,840 gph/60 min/hr)

Offsite Flow = 4,360 gallons per day (1,000 gallons per day per acre x 4.36 acres) = 182 gallons per hour

Assume peaking factor of 4 (from DOE “Orange Book”)

Peak flow = 728 gallons per hour (182x4) = 12.13 gallons per minute (728 gph/60 min/hr)

Total peak flow = 59 gallons per minute (onsite + offsite peak flows)

- Provide a submersible duplex pump system capable of pumping sewage without plugging

- **Minimum Pump size = 60 gpm at 50-feet TDH**

<u>Pump Cycles</u>

- Wet well storage = Pump On - Pump Off x 118.96 gallons per linear feet of MH = 13.0 – 10.5 x 118.96 = 297.4 gallons
- Cycle time = 297.4 gal / 60 gpm = 4.96 minutes
- Cycles per hour = 12.1

Appendix B
Force Main Sizing

SANITARY SEWER FORCE MAIN DESIGN

<u>Pump System</u>

Force main design for proposed force main:

- Design flow in the force main = 60 gpm (based on suggested pump size)

- Use 3 inch force main
  - Velocity = 0.1337 cfs/0.049 sf = 2.73 fps
  - 2 fps < 2.73 fps < 8 fps

Static Head = Invert at downstream end of force main - Pump Off Elevation

Invert elevation (Ex. manhole Industrial Parkway) = 34.00 (est)

Pump off elevation = 10.00

Static Head = 34.00 – 10.00 = 24.00 feet

Total Dynamic Head = based on pump configuration and force main (to be verified by pump manufacturer)

Force Main is HDPE (Sch. 40 Pipe)

New 3" Force Main Pipe Length = 2,855 feet

Friction loss in 3" main at 60 gpm = 2,855/100 x 0.9 = 25.7 feet

Fitting losses in equivalent length of 3" straight pipe (From Friction Loss chart)

Elbows and valves: 90 deg = 7.7
45 deg = 4.1
Gate valve = 2.0

Head loss = ((6)(7.7)+(7)(4.1)+(2)(2.0))/100 x 0.9 = 0.71 feet

Total Head = Static Head + Friction Loss = 24 + 26 + 1 = 51 feet

Minimum pump size = 60 GPM @ 50 feet TDH

Suggested pump (Weil 2516 - 1hp Grinder) = 60 GPM @ ±60 feet

Pump System

Pump Station Control Panel Specification

Primary power shall be from the proposed building. Contractor is to verify available power source and sizing prior to ordering the pump station. Each pump system shall have its own control panel.

The control panel for each sanitary pump station shall include:

- Control for a duplex pump system (controls to be hard wired)
- Enclosure for installation outside (installation to be near the pump station)
- Visual alarm – flashing light
- Display at control panel to monitor station performance
- 12-hour battery backup for control panel
- Manual and remote reset for alarms
- Alarms for:
    - Pump failure
    - Seal failure
    - High temperature
    - Low water
    - High water
    - Low battery
    - Power failure
- Duplex cycle counter
- Duplex elapsed run time meter
- Surge protection
- Dial up to 8 phone numbers during an alarm condition
- Minimum 1 year warranty

Appendix C
Buoyancy Calculations

FREEMAN SEWER BUOYANCY CALCULATIONS

- **SSMH No. 5, Type 2 - 54 inches**

  Rim: 32.33
  Inside Bottom = 10.50
  Outside Bottom = 9.83

- **Weight of Manhole**

  Top Slab = ~2,600 lbs
  Barrell = 1,100 lb/lf x (32.33 -0.67-15.50) = 17,776 lbs
  Bottom 5' base = 7,600 lbs
  Total (manhole) = 27,976 lbs
  $P_{Manhole}$ = 28.0 Kip↓

- **Water Weight**

  Max groundwater height (~5' bge) = 27.00 feet
  Manhole displacement = (27.00 – 9.83) x π r^2 = 17.17 π $(2.625)^2$ = 371.5 CF
  Water unit weight = 62.4 lb/ft^3
  P_{Water} = 372.5 x 62.4 = 23,200 lb = 23.2 Kip↑

- **Buoyancy**

  $\sum_F = P_{Manhole} - P_{Buoyancy}$ = 28.0K↓ - 23.2K↑ = 4.8K↓

  $FS = \frac{28.0}{23.2}$ = 1.21

Appendix D
Pump Specifications

WEIL 2-Inch Submersible Grinder Pump 2516

Submersible Wastewater Pump Association SWPA MEMBER

Heavy duty pump for commercial and industrial applications.
Solids are reduced to 3/8 diameter or less.

Pump Type	Grinder
Disch. Size	2 Inch
Disch. Type	ANSI
Mounting Style	2613 Removal

Pump
- Case - Cast Iron
- Impeller - Cast Iron
- Rotating Cutter - 440C Stainless Steel Rockwell 58C
- Shredder Ring - 440C Stainless Steel Rockwell 58C
- Stainless Steel Hardware

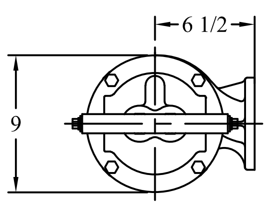
Options
- Bronze Impeller
- 316 SS Impeller
- CUL/UL Explosion Proof Motor
- 575 Volt 60 Hz 3 Phase Motor
- Moisture Sensor and Temperature Limiter
- Additional Power Cable Lengths
- Stainless Steel Lifting Cable

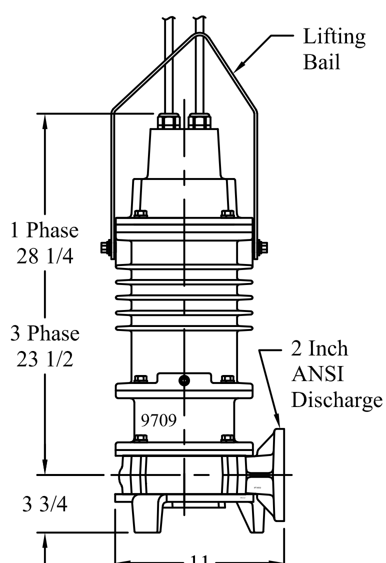
Capacities - Wet Wells		
Dia or Side Inches	Gallons per Foot of Depth	
	Round	Square
24	24	30
30	37	47
36	53	67
48	94	120
60	147	187
72	212	269

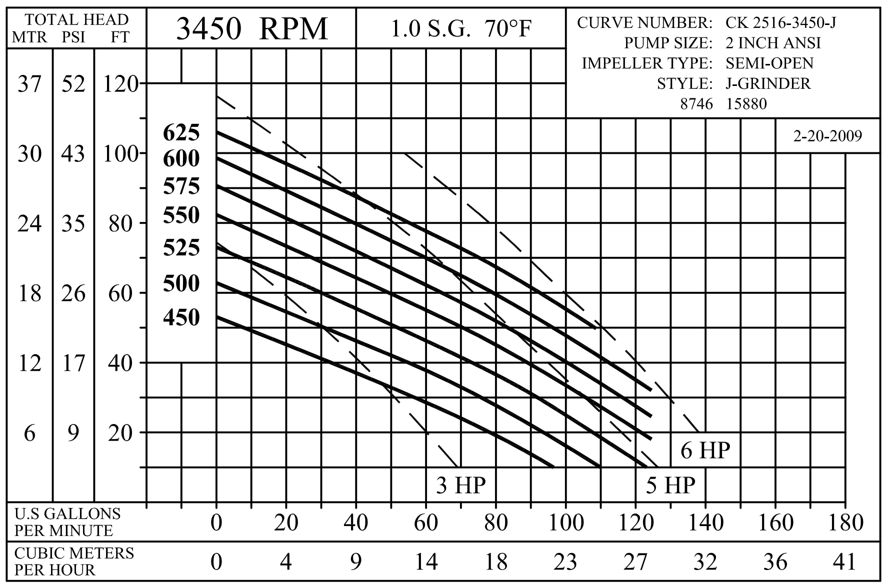
Motor
- **Double Seal - Tandem**
  - Upper - Carbon against Ceramic
  - Lower - Silicon Carbide against Silicon Carbide
- **Air-Filled Hermetically Sealed**
- **Shaft - Stainless Steel Series 300**
- Motor Shell - Cast Iron
- Insulation - Class F
- Ball Bearings - 2 - Double Sealed
- Power Cable Length - 25 ft
- Three-phase motor
  - 1750 RPM and 3450 RPM
  - 60 Hz, 208-230 or 460 volts
- Single-phase capacitor start motor
  - 1750 RPM
  - 60 Hz, 115 or 208-230 volts
  - Automatic reset thermal and overload protection

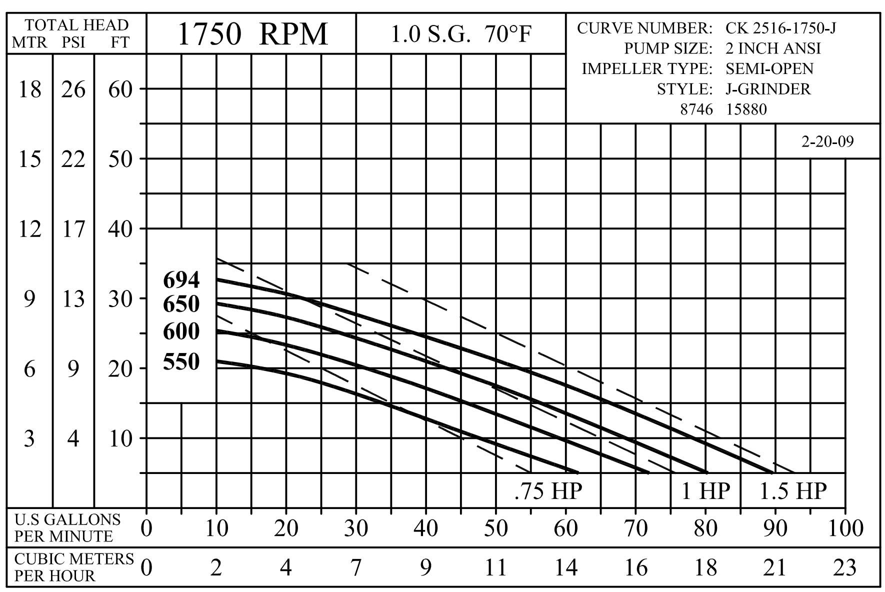
Flow - To prevent solids from settling out	
Discharge Pipe Size Dia Inches	Minimum Flow GPM
1 1/2	15
2	25
3	50

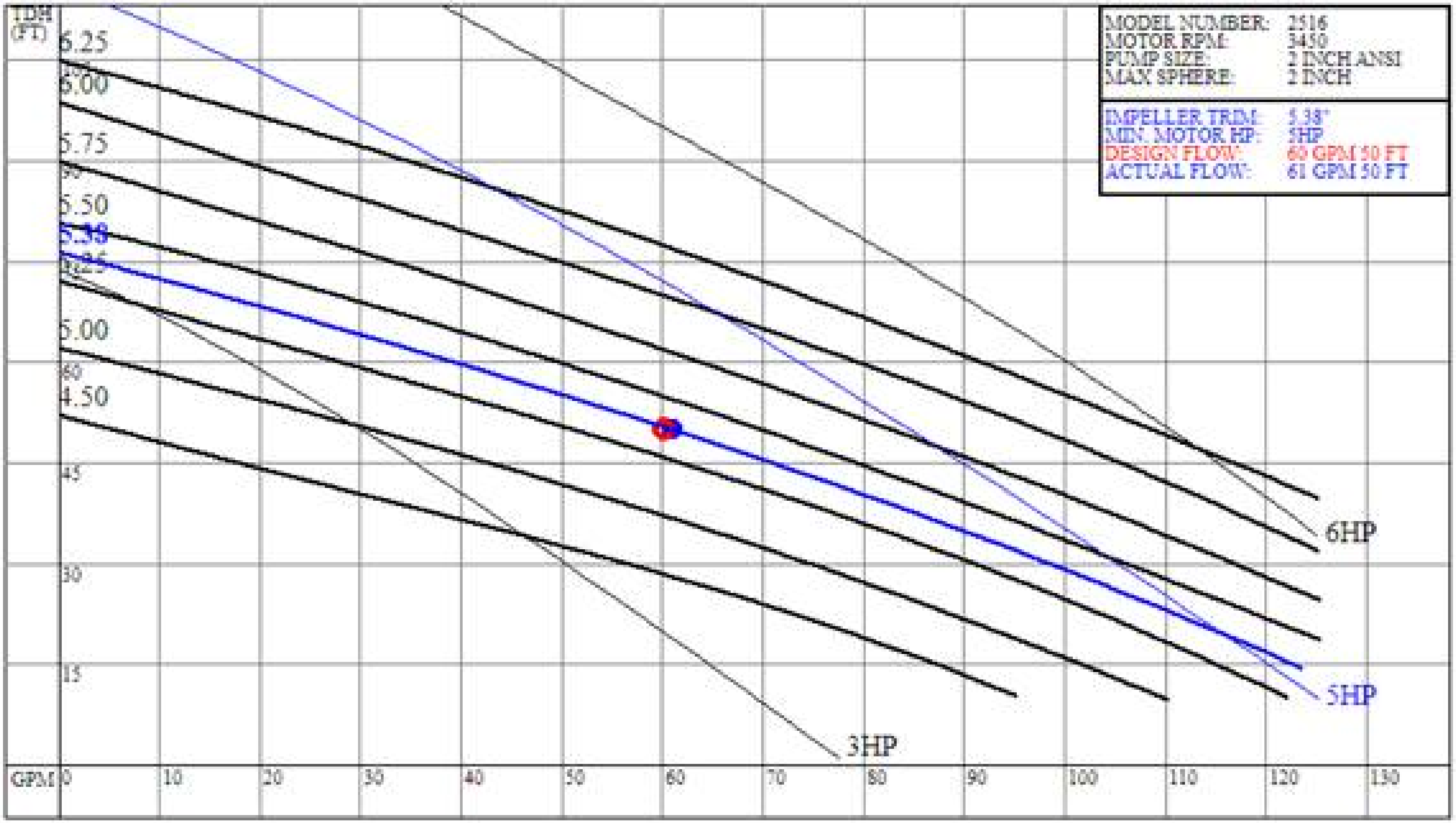
Good wet well design
Maximum 10 starts per hour.
Minimum run time - 1 1/2 minutes.











MODEL NUMBER: 2516
MOTOR RPM: 3450
PUMP SIZE: 2 INCH ANSI
MAX SPHERE: 2 INCH
IMPELLER TRIM: 5.38"
MIN. MOTOR HP: 5HP
DESIGN FLOW: 60 GPM 50 FT
ACTUAL FLOW: 61 GPM 50 FT
TDH (FT)
6.25
6.00
5.75
5.50
5.38
5.25
5.00
4.50
90
60
45
30
15
GPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
6HP
5HP
3HP