FEB Anoxic Reactor Effluent Pump Station

PUMP/LIFT STATION INFORMATION			
Ownership ☐ Public ☒Private	Type of Wastewater ☐ Residential ☐ Commercial ☒Industrial ☐ Other?		If Other, list below
Pump Station Flows (gallons/day) Design 12.0 MGD	Average 9.0 MGD	Peak 14.0 MGD	Peak Factor 1.5
Basis of Design 12.0 MGD		Pump Type Self-Priming	
Will peak flows be accommodated if largest unit fails? ☒Yes ☐ No	Pump calc's and pump curves attached? ☒Yes ☐ No	Cycle Time (minutes) NA	Wet Well Detention Time (minutes)
Check valves provided on discharge line? ☒ Yes ☐ No		Gate valves provided on discharge line? ☒ Yes ☐ No	
If not, explain alternate procedure:			
Ventilation provided in wet well? ☐ Yes ☒No	Dry Well? ☐ Yes ☒No	Is an alarm system included? ☒ Yes ☐ No	Alternate source of power? ☒ Yes ☐ No
What other provisions for emergency operations? Pumps have automatic variable speed drives for normal continuous operation and flow rate control.			
Height of Influent Above Pump (suction head) (ft) Suction lift	Height of Effluent Above Pump (discharge head) (ft) 5.0 ft.	Friction Loss (ft) 65 (two pumps on @ 2,100 gpm each - Ph 1) 48 (four pumps on @ 2,500 gpm each -Ph 2)	

Pump Design Point	Pump Operating Point	Static Head (ft)	Total Head (ft)	Required Motor Horsepower (hp)
2,100 gpm/pump-Ph1 2,500 gpm/pump-Ph2	2,100 gpm (per pump)	27.5	93 (Ph 1) 75 (Ph 2)	75 (x4 pumps)

FORCE MAIN INFORMATION			
Type of Pipe DIP and C900 PVC		Length (ft) 1030	Diameter (in) 10", 12" and 20"
Hazen-Williams "C" Design Factor 120	Type of Joints Mechanical	Velocity Under Design Conditions (ft/sec) 12 (in Ex. 12 - Ph 1) 10 (in new 20 - Ph 2)	Minimum Pipe Cover (ft) 2.0 ft.
Air relief valves specified? ☐ Yes ☒No	Clean-outs provided? ☐ Yes ☒No	Maximum distance between clean-outs (ft) NA	
Minimum ten foot (10') horizontal & eighteen inch (18") vertical separation from water lines maintained? ☒Yes ☐ No	If not, explain provisions to prevent cross-contamination:		
Comments Mixed liquor pumped from FEB Reactors #1A and #1B and an approximate constant rate 24 hours/day into downstream Nitrification Reactor #2A.			

PROJECT: Allen Harim
SUBJECT: FEB Anoxic #1B Eff PS to Reactor #2A (through Existing Anoxic PS FM)
DATE: 12-Aug-2015
PUMP:

CONDITION: 2 **Pump On**

Design Flow = 2100 GPM
Flow Calculation Increment = 250 GPM
Miscellaneous Losses = 0 Feet

Static Lift = **27.5 Feet**

DESCRIPTION	Suction														
					Diameter =	10 Inches		Length =		50 Equivalent Length =			90 Total Length =		140
						Flow Multiplier 1			gpm						
Flow (gpm)	600	850	1100	1350	1600	1850	**2100**	2350	2600	2850	3100	3350	3600	3850	4100
Flow (cfs)	1.34	1.89	2.45	3.01	3.57	4.12	**4.68**	5.24	5.79	6.35	6.91	7.46	8.02	8.58	9.14
Diam. (in) =	10	10	10	10	10	10	**10**	10	10	10	10	10	10	10	10
Diam. (ft) =	0.83	0.83	0.83	0.83	0.83	0.83	**0.83**	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Total Length (ft) =	140.0	140.0	140.0	140.0	140.0	140.0	**140.0**	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0
Wetted Perimeter (ft)	2.62	2.62	2.62	2.62	2.62	2.62	**2.62**	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62
Pipe Area (sf)	0.55	0.55	0.55	0.55	0.55	0.55	**0.55**	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
R_H	0.21	0.21	0.21	0.21	0.21	0.21	**0.21**	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
C =	120	120	120	120	120	120	**120**	120	120	120	120	120	120	120	120
Vel. (fps)	2.5	3.5	4.5	5.5	6.5	7.6	**8.6**	9.6	10.6	11.6	12.7	13.7	14.7	15.7	16.7
Friction Loss (ft)	0.39	0.75	1.21	1.76	2.42	3.16	**4.00**	4.92	5.93	7.03	8.22	9.48	10.83	12.27	13.78
Entrance Loss (ft)	0.05	0.09	0.16	0.24	0.33	0.44	**0.57**	0.72	0.88	1.05	1.25	1.45	1.68	1.92	2.18
Headloss (ft)	0.44	0.84	1.37	2.00	2.75	3.60	**4.57**	5.64	6.81	8.08	9.46	10.94	12.51	14.19	15.96

DESCRIPTION	Discharge #1														
					Diameter =	14 Inches		Length =		10 Equivalent Length =			214 Total Length =		224
						Flow Multiplier 1									
Flow (gpm)	600	850	1100	1350	1600	1850	**2100**	2350	2600	2850	3100	3350	3600	3850	4100
Flow (cfs)	1.34	1.89	2.45	3.01	3.57	4.12	**4.68**	5.24	5.79	6.35	6.91	7.46	8.02	8.58	9.14
Diam. (in) =	14	14	14	14	14	14	**14**	14	14	14	14	14	14	14	14
Diam. (ft) =	1.17	1.17	1.17	1.17	1.17	1.17	**1.17**	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
Total Length (ft) =	224.0	224.0	224.0	224.0	224.0	224.0	**224.0**	224.0	224.0	224.0	224.0	224.0	224.0	224.0	224.0
Wetted Perimeter (ft)	3.67	3.67	3.67	3.67	3.67	3.67	**3.67**	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
Pipe Area (sf)	1.07	1.07	1.07	1.07	1.07	1.07	**1.07**	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
R_H	0.29	0.29	0.29	0.29	0.29	0.29	**0.29**	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
C =	120	120	120	120	120	120	**120**	120	120	120	120	120	120	120	120
Vel. (fps)	1.3	1.8	2.3	2.8	3.3	3.9	**4.4**	4.9	5.4	5.9	6.5	7.0	7.5	8.0	8.5
Friction Loss (ft)	0.12	0.23	0.38	0.55	0.75	0.98	**1.24**	1.53	1.84	2.19	2.55	2.95	3.37	3.81	4.28
Headloss (ft)	0.12	0.23	0.38	0.55	0.75	0.98	**1.24**	1.53	1.84	2.19	2.55	2.95	3.37	3.81	4.28

DESCRIPTION	Discharge#2 PS														
					Diameter =	14 Inches		Length =		50 Equivalent Length =			233 Total Length =		283
						Flow Multiplier 1									
Flow (gpm)	600	850	1100	1350	1600	1850	**2100**	2350	2600	2850	3100	3350	3600	3850	4100
Flow (cfs)	1.34	1.89	2.45	3.01	3.57	4.12	**4.68**	5.24	5.79	6.35	6.91	7.46	8.02	8.58	9.14
Diam. (in) =	14	14	14	14	14	14	**14**	14	14	14	14	14	14	14	14
Diam. (ft) =	1.17	1.17	1.17	1.17	1.17	1.17	**1.17**	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
Total Length (ft) =	283.0	283.0	283.0	283.0	283.0	283.0	**283.0**	283.0	283.0	283.0	283.0	283.0	283.0	283.0	283.0
Wetted Perimeter (ft)	3.67	3.67	3.67	3.67	3.67	3.67	**3.67**	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
Pipe Area (sf)	1.07	1.07	1.07	1.07	1.07	1.07	**1.07**	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
R_H	0.29	0.29	0.29	0.29	0.29	0.29	**0.29**	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
C =	120	120	120	120	120	120	**120**	120	120	120	120	120	120	120	120
Vel. (fps)	1.3	1.8	2.3	2.8	3.3	3.9	**4.4**	4.9	5.4	5.9	6.5	7.0	7.5	8.0	8.5
Friction Loss (ft)	0.15	0.29	0.47	0.69	0.95	1.24	**1.57**	1.93	2.33	2.76	3.23	3.72	4.25	4.82	5.41
Headloss (ft)	0.15	0.29	0.47	0.69	0.95	1.24	**1.57**	1.93	2.33	2.76	3.23	3.72	4.25	4.82	5.41

DESCRIPTION	Discharge #2														
					Diameter =	20 Inches		Length =		350 Equivalent Length =			375 Total Length =		725
						Flow Multiplier 2									
Flow (gpm)	1200	1700	2200	2700	3200	3700	**4200**	4700	5200	5700	6200	6700	7200	7700	8200
Flow (cfs)	2.67	3.79	4.90	6.02	7.13	8.24	**9.36**	10.47	11.59	12.70	13.81	14.93	16.04	17.16	18.27
Diam. (in) =	20	20	20	20	20	20	**20**	20	20	20	20	20	20	20	20
Diam. (ft) =	1.67	1.67	1.67	1.67	1.67	1.67	**1.67**	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67
Total Length (ft) =	725.0	725.0	725.0	725.0	725.0	725.0	**725.0**	725.0	725.0	725.0	725.0	725.0	725.0	725.0	725.0
Wetted Perimeter (ft)	5.24	5.24	5.24	5.24	5.24	5.24	**5.24**	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24
Pipe Area (sf)	2.18	2.18	2.18	2.18	2.18	2.18	**2.18**	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18
R_H	0.42	0.42	0.42	0.42	0.42	0.42	**0.42**	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
C =	120	120	120	120	120	120	**120**	120	120	120	120	120	120	120	120
Vel. (fps)	1.2	1.7	2.2	2.8	3.3	3.8	**4.3**	4.8	5.3	5.8	6.3	6.8	7.4	7.9	8.4
Friction Loss (ft)	0.25	0.48	0.77	1.13	1.54	2.02	**2.55**	3.14	3.79	4.49	5.24	6.05	6.92	7.83	8.80
Headloss (ft)	0.25	0.48	0.77	1.13	1.54	2.02	**2.55**	3.14	3.79	4.49	5.24	6.05	6.92	7.83	8.80

DESCRIPTION	Force Main Seg 1														
					Diameter =	12 Inches		Length =		560 Equivalent Length =			66 Total Length =		626
						Flow Multiplier 2									
Flow (gpm)	1200	1700	2200	2700	3200	3700	**4200**	4700	5200	5700	6200	6700	7200	7700	8200
Flow (cfs)	2.67	3.79	4.90	6.02	7.13	8.24	**9.36**	10.47	11.59	12.70	13.81	14.93	16.04	17.16	18.27
Diam. (in) =	12	12	12	12	12	12	**12**	12	12	12	12	12	12	12	12
Diam. (ft) =	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total Length (ft) =	626.0	626.0	626.0	626.0	626.0	626.0	**626.0**	626.0	626.0	626.0	626.0	626.0	626.0	626.0	626.0
Wetted Perimeter (ft)	3.14	3.14	3.14	3.14	3.14	3.14	**3.14**	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14
Pipe Area (sf)	0.79	0.79	0.79	0.79	0.79	0.79	**0.79**	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
R_H	0.25	0.25	0.25	0.25	0.25	0.25	**0.25**	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
C =	120	120	120	120	120	120	**120**	120	120	120	120	120	120	120	120
Vel. (fps)	3.4	4.8	6.2	7.7	9.1	10.5	**11.9**	13.3	14.8	16.2	17.6	19.0	20.4	21.8	23.3
Friction Loss (ft)	2.61	4.97	8.02	11.71	16.03	20.97	**26.51**	32.65	39.36	46.65	54.50	62.90	71.86	81.37	91.41
Headloss (ft)	2.61	4.97	8.02	11.71	16.03	20.97	**26.51**	32.65	39.36	46.65	54.50	62.90	71.86	81.37	91.41

DESCRIPTION	Force Main Seg 2														
					Diameter =	10 Inches		Length =		120 Equivalent Length =			114 Total Length =		234
						Flow Multiplier 2									
Flow (gpm)	1200	1700	2200	2700	3200	3700	**4200**	4700	5200	5700	6200	6700	7200	7700	8200
Flow (cfs)	2.67	3.79	4.90	6.02	7.13	8.24	**9.36**	10.47	11.59	12.70	13.81	14.93	16.04	17.16	18.27
Diam. (in) =	10	10	10	10	10	10	**10**	10	10	10	10	10	10	10	10
Diam. (ft) =	0.83	0.83	0.83	0.83	0.83	0.83	**0.83**	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Total Length (ft) =	234.0	234.0	234.0	234.0	234.0	234.0	**234.0**	234.0	234.0	234.0	234.0	234.0	234.0	234.0	234.0
Wetted Perimeter (ft)	2.62	2.62	2.62	2.62	2.62	2.62	**2.62**	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62
Pipe Area (sf)	0.55	0.55	0.55	0.55	0.55	0.55	**0.55**	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
R_H	0.21	0.21	0.21	0.21	0.21	0.21	**0.21**	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
C =	120	120	120	120	120	120	**120**	120	120	120	120	120	120	120	120
Vel. (fps)	4.9	6.9	9.0	11.0	13.1	15.1	**17.2**	19.2	21.2	23.3	25.3	27.4	29.4	31.5	33.5
Friction Loss (ft)	2.37	4.52	7.28	10.63	14.56	19.05	**24.08**	29.65	35.75	42.37	49.50	57.14	65.28	73.91	83.03
Exit Loss (ft)	0.37	0.75	1.25	1.89	2.65	3.55	**4.57**	5.72	7.01	8.42	9.96	11.63	13.43	15.37	17.43
Headloss (ft)	2.75	5.27	8.54	12.52	17.22	22.60	**28.65**	35.38	42.76	50.79	59.46	68.77	78.71	89.28	100.46
Static Head (ft)	27.5	27.5	27.5	27.5	27.5	27.5	**27.5**	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5
Friction Loss (ft)	6.3	12.1	19.5	28.6	39.2	51.4	**65.1**	80.3	96.9	115.0	134.4	155.3	177.6	201.3	226.3
TDH (ft)	33.8	39.6	47.0	56.1	66.7	78.9	**92.6**	107.8	124.4	142.5	161.9	182.8	205.1	228.8	253.8

PROJECT: Allen Harlm
SUBJECT: FEB Anoxic #1B Eff PS to Reactor #2A (New 20" FM)
DATE: 12-Aug-2015
PUMP: **CONDITION:** 4 Pump On

Design Flow = 2500 GPM
Flow Calculation Increment = 250 GPM
Miscellaneous Losses = 0 Feet

Static Lift = 27.5 Feet

DESCRIPTION Suction — Diameter = 10 Inches — Length = 50 — Equivalent Length = 90 — Total Length = 140
Flow Multiplier 1 gpm

Flow (gpm)	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500
Flow (cfs)	2.23	2.79	3.34	3.90	4.46	5.01	5.57	6.13	6.68	7.24	7.80	8.36	8.91	9.47	10.03
Diam. (in) =	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Diam. (ft) =	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Total Length (ft) =	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0
Wetted Perimeter (ft)	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62
Pipe Area (sf)	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
R_H	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
C =	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Vel. (fps)	4.1	5.1	6.1	7.1	8.2	9.2	10.2	11.2	12.3	13.3	14.3	15.3	16.3	17.4	18.4
Friction Loss (ft)	1.01	1.53	2.14	2.85	3.65	4.54	5.52	6.58	7.73	8.97	10.28	11.68	13.16	14.73	16.37
Entrance Loss (ft)	0.13	0.20	0.29	0.40	0.52	0.66	0.81	0.98	1.17	1.37	1.59	1.82	2.07	2.34	2.62
Headloss (ft)	1.14	1.73	2.44	3.25	4.17	5.20	6.33	7.56	8.90	10.33	11.87	13.51	15.24	17.07	18.99

DESCRIPTION Discharge #1 — Diameter = 14 Inches — Length = 10 — Equivalent Length = 214 — Total Length = 224
Flow Multiplier 1

Flow (gpm)	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500
Flow (cfs)	2.23	2.79	3.34	3.90	4.46	5.01	5.57	6.13	6.68	7.24	7.80	8.36	8.91	9.47	10.03
Diam. (in) =	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Diam. (ft) =	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
Total Length (ft) =	224.0	224.0	224.0	224.0	224.0	224.0	224.0	224.0	224.0	224.0	224.0	224.0	224.0	224.0	224.0
Wetted Perimeter (ft)	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
Pipe Area (sf)	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
R_H	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
C =	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Vel. (fps)	2.1	2.6	3.1	3.6	4.2	4.7	5.2	5.7	6.3	6.8	7.3	7.8	8.3	8.9	9.4
Friction Loss (ft)	0.31	0.48	0.67	0.89	1.13	1.41	1.72	2.05	2.40	2.79	3.20	3.63	4.09	4.58	5.09
Headloss (ft)	0.31	0.48	0.67	0.89	1.13	1.41	1.72	2.05	2.40	2.79	3.20	3.63	4.09	4.58	5.09

DESCRIPTION Discharge#2 PS — Diameter = 14 Inches — Length = 50 — Equivalent Length = 233 — Total Length = 283
Flow Multiplier 1

Flow (gpm)	3500	3750	4000	4250	4500	4750	5000	5250	5500	5750	6000	6250	6500	6750	7000
Flow (cfs)	7.80	8.36	8.91	9.47	10.03	10.58	11.14	11.70	12.25	12.81	13.37	13.93	14.48	15.04	15.60
Diam. (in) =	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Diam. (ft) =	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
Total Length (ft) =	283.0	283.0	283.0	283.0	283.0	283.0	283.0	283.0	283.0	283.0	283.0	283.0	283.0	283.0	283.0
Wetted Perimeter (ft)	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
Pipe Area (sf)	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
R_H	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
C =	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Vel. (fps)	7.3	7.8	8.3	8.9	9.4	9.9	10.4	10.9	11.5	12.0	12.5	13.0	13.5	14.1	14.6
Friction Loss (ft)	4.04	4.59	5.17	5.78	6.43	7.10	7.81	8.55	9.32	10.12	10.94	11.80	12.69	13.61	14.56
Headloss (ft)	4.04	4.59	5.17	5.78	6.43	7.10	7.81	8.55	9.32	10.12	10.94	11.80	12.69	13.61	14.56

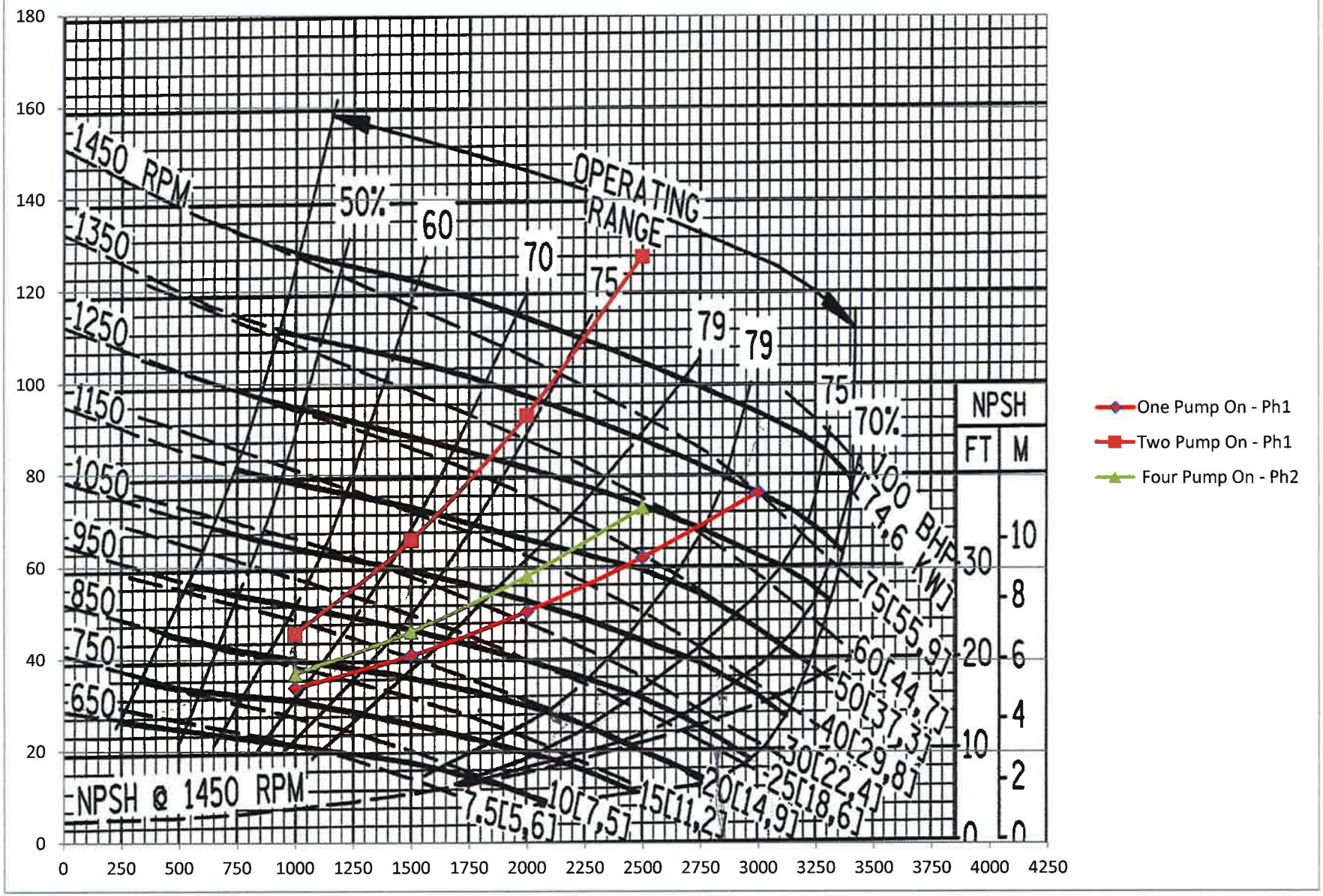
DESCRIPTION Discharge #2 — Diameter = 20 Inches — Length = 350 — Equivalent Length = 375 — Total Length = 725
Flow Multiplier 4

Flow (gpm)	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000	16000	17000	18000
Flow (cfs)	8.91	11.14	13.37	15.60	17.83	20.05	22.28	24.51	26.74	28.97	31.19	33.42	35.65	37.88	40.11
Diam. (in) =	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Diam. (ft) =	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67
Total Length (ft) =	725.0	725.0	725.0	725.0	725.0	725.0	725.0	725.0	725.0	725.0	725.0	725.0	725.0	725.0	725.0
Wetted Perimeter (ft)	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24
Pipe Area (sf)	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18
R_H	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
C =	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Vel. (fps)	4.1	5.1	6.1	7.1	8.2	9.2	10.2	11.2	12.3	13.3	14.3	15.3	16.3	17.4	18.4
Friction Loss (ft)	2.33	3.52	4.94	6.56	8.40	10.45	12.70	15.15	17.79	20.63	23.67	26.89	30.30	33.89	37.68
Headloss (ft)	2.33	3.52	4.94	6.56	8.40	10.45	12.70	15.15	17.79	20.63	23.67	26.89	30.30	33.89	37.68

DESCRIPTION Force Main Seg 1 — Diameter = 20 Inches — Length = 560 — Equivalent Length = 110 — Total Length = 670
Flow Multiplier 4

Flow (gpm)	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000	16000	17000	18000
Flow (cfs)	8.91	11.14	13.37	15.60	17.83	20.05	22.28	24.51	26.74	28.97	31.19	33.42	35.65	37.88	40.11
Diam. (in) =	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Diam. (ft) =	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67
Total Length (ft) =	670.0	670.0	670.0	670.0	670.0	670.0	670.0	670.0	670.0	670.0	670.0	670.0	670.0	670.0	670.0
Wetted Perimeter (ft)	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24
Pipe Area (sf)	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18
R_H	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
C =	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Vel. (fps)	4.1	5.1	6.1	7.1	8.2	9.2	10.2	11.2	12.3	13.3	14.3	15.3	16.3	17.4	18.4
Friction Loss (ft)	2.15	3.26	4.56	6.07	7.77	9.66	11.74	14.00	16.44	19.07	21.87	24.85	28.00	31.32	34.82
Headloss (ft)	2.15	3.26	4.56	6.07	7.77	9.66	11.74	14.00	16.44	19.07	21.87	24.85	28.00	31.32	34.82

DESCRIPTION Force Main Seg 2 — Diameter = 20 Inches — Length = 120 — Equivalent Length = 220 — Total Length = 340
Flow Multiplier 4

Flow (gpm)	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000	16000	17000	18000
Flow (cfs)	8.91	11.14	13.37	15.60	17.83	20.05	22.28	24.51	26.74	28.97	31.19	33.42	35.65	37.88	40.11
Diam. (in) =	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Diam. (ft) =	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67
Total Length (ft) =	340.0	340.0	340.0	340.0	340.0	340.0	340.0	340.0	340.0	340.0	340.0	340.0	340.0	340.0	340.0
Wetted Perimeter (ft)	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24	5.24
Pipe Area (sf)	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18
R_H	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
C =	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Vel. (fps)	4.1	5.1	6.1	7.1	8.2	9.2	10.2	11.2	12.3	13.3	14.3	15.3	16.3	17.4	18.4
Friction Loss (ft)	1.09	1.65	2.31	3.08	3.94	4.90	5.96	7.10	8.35	9.68	11.10	12.61	14.21	15.90	17.67
Exit Loss (ft)	0.26	0.40	0.58	0.79	1.04	1.31	1.62	1.96	2.33	2.74	3.17	3.64	4.15	4.68	5.25
Headloss (ft)	1.35	2.06	2.90	3.87	4.98	6.21	7.58	9.06	10.68	12.41	14.27	16.25	18.36	20.58	22.92
Static Head (ft)	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5
Friction Loss (ft)	11.3	15.6	20.7	26.4	32.9	40.0	47.9	56.4	65.5	75.4	85.8	96.9	108.7	121.0	134.0
TDH (ft)	38.8	43.1	48.2	53.9	60.4	67.5	75.4	83.9	93.0	102.9	113.3	124.4	136.2	148.5	161.5

FEB Anoxic Reactor #1 Effluent PS