APPENDIX B

2020 Sanitary Sewer Analysis

Midway Village

Sanitary Sewer Analyses

Technical Memorandum

Daly City, California

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A. Introduction

The Midway Village area is being proposed for redevelopment as part of the Midway Village Redevelopment Project (proposed project). Currently the Midway Village area contains 150 residential units, 223 parking spaces, a child-care facility, open space, an existing street system, and office space for the San Mateo County Housing Authority (SMCHA). Additionally, an existing park, David R. Rowe/Bayshore Park (Bayshore Park), is currently located directly north and east of the Midway Village area.

The proposed project area is located within Daly City, California in San Mateo County (See Figure A, Vicinity Map). Specifically, the project site is bound by Schwerin Street to the West and Martin Street to the South, with Midway Drive running directly through the center of the project area. The project site is approximately 15 acres and is comprised of 39 San Mateo County parcels.

The proposed project involves redevelopment of this site and include mixed-use development consisting of 555 residential units, 725 parking spaces, a child-care facility, a community center, office space for property management and other ancillary services, a revised street system, and recreation facilities. Additionally, Bayshore Park will be relocated and redeveloped as part of the proposed project. SMCHA currently administers the Public Housing Program throughout San Mateo County, which includes the existing Midway Village area. These homes are restricted for low and very low-income households and would remain as such under the proposed project. Other improvements as part of the proposed project include landscaping, water and wastewater line improvements, and pedestrian walkways.

B. Project Background

The Midway Village area is listed as an active cleanup site on the state “Cortese” list pursuant to Government Code Section 65962.5. A Phase I Environmental Site Assessment (ESA) was prepared for the project site. The site history from this Phase I ESA is summarized below:

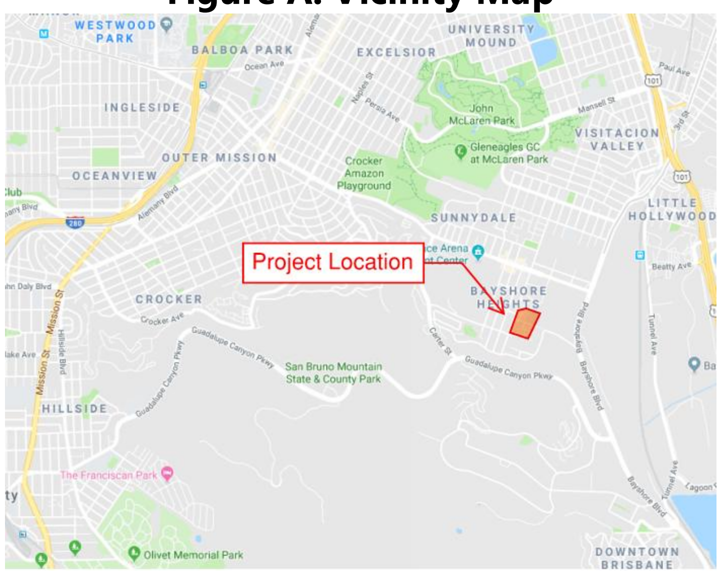
From approximately 1906 to 1916 a manufactured gas plan (MGP) operated on what is today the Pacific Gas and Electric Company (PG&E) Martin Service Center property, located directly north of project site. This plant used crude oil to create gas used for lighting. This process produced a waste material called lampblack containing polycyclic aromatic hydrocarbon (PAH) which impacted soils where the plant existed. In 1944, the Federal Government obtained parts of the PG&E property, including the project site, to build Navy housing. When land for this housing was graded, contaminated soils containing PAHs were unknowingly used to fill low-lying areas prior to construction of the housing. The volume of PAH-containing fill material used in this manner has been estimated at approximately 20,000 cubic yards (CY).

In 1976, the Navy housing was demolished, and the Midway Village Housing Complex was built and a year later (Midway Village area), in 1977, the City of Daly City created Bayshore Park on the property immediately adjacent to and northeast of the Midway Village area. It wasn’t until 1990 that the Department of Toxic Substance Control (DTSC) became aware of the contamination in and around the Midway Village area, as well as the Bayshore Park area, and the childcare facility.

Various site investigations including testing of the soils and groundwater in and around the Midway Village area occurred in the early 90s. In 1993 the DTSC approved a cleanup and Remedial Action Plan (RAP) for the Midway Village area which included soil removal of the top two to five feet of soils in select areas (approximately 2,983 CY of material) followed by capping of these areas with two to five feet of clean soil, concrete patios, asphalt, or walkways. This work was completed by 1994. Then in 1998, DTSC approved a similar plan for Bayshore Park.

Currently, the Bayshore Park area has land use restrictions which are limited by a "Covenant to Restrict Use of Property" made between the City of Daly City and the DTSC. A Deed Restriction was filed with San Mateo County Clerk on October 17, 2002, which was developed to prevent exposure of humans or biota to the potential contaminants on the site. Any development of the Bayshore Park area would be required to comply with the Deed Restriction, which may need to be modified or lifted to allow for residential use on the site. This is further discussed in Section 2.5.2, Approvals of this SCEA (SCS Engineers 2017).

Figure A: Vicinity Map



C. Existing Sanitary Sewer System

The sanitary sewer collection system that serves the Project site is owned and operated by the Bayshore Sanitary District (District). Sewer flow generated on the project site is conveyed through a series of gravity collection mains to the Carlyle Pump Station. Treatment of the District's wastewater is provided by the San Francisco Public Utilities Commission (SFPUC) at their Southeast Wastewater Treatment Plant.

Carlyle Pump Station (CPS)

The Project site sewer is conveyed to the Carlyle Pump Station, located at 96 Industrial Way. The CPS is fed by an 18-inch gravity sewer line located beneath Midway Drive that runs from the intersection of Schwerin Street and Midway Drive to the CPS on Industrial Way. Several sewer laterals connect the surrounding buildings to this sewer main on Midway Drive.

The existing pump station has four pumps each rated 30 horsepower (hp) in a 10' x 27'-2" wet-well below ground. The Bayshore Sanitary District 2018 Master Plan indicates that the capacity of the CPS with a single pump running is 1,750 gpm, with two pumps running simultaneously is 2,550 gpm, with three pumps running simultaneously is approximately 2,950 gpm, and with four pumps running simultaneously is approximately 3,200 gpm (at the fourth pump on level). These pumps are not variable speed pumps, rather they cycle on and off and are controlled by floats. If one pump will not keep up with the inflow, then additional pumps will turn on. The 14-inch asbestos cement line (AC) that is 3,320 feet long discharges into a City and County of San Francisco (CCSF) manhole at elevation 7.76.

D. Criteria

The design calculations of the proposed system are based on the District's design parameters indicated in Section B of the District's Standard Specifications. Peak flow from the proposed project entering the gravity line cannot reach 100% of the existing line capacity, i.e., depth of flow cannot be greater than or equal to the pipe diameter. Should this occur, additional measures or upsizing of pipes would be needed.

If the project peak flow exceeds the pumping capacity (flow and head) of any existing lift station then additional improvements would be needed to mitigate the project's impact. The project should also mitigate if the velocity in the existing asbestos cement pipe is greater than 10 feet per second which is unlikely to occur in the force main downstream of the lift station.

All pipes must be sized to flow at 2 feet per second at half full in order to achieve cleaning velocities. In order to meet this criteria, the existing pipes must meet the following minimum slope requirements before and after settlement:

- 12-inch = 0.2%
- 15-inch = 0.15%
- 18-inch = 0.12%
- 24-inch = under 0.1%

E. Approach / Methodology

The approach used to evaluate the proposed Project impacts on the existing system included:

1) Using GIS parcel data and the Master Plan Table 2-6 (History of District Customers by Type), BKF identified the number of parcels/units tributary to each of the manholes at the upstream ends of the model. See Table 1 in the Attachments for a breakdown of parcels/units by manhole.

2) BKF then calculated the number of dwelling units tributary to the existing sewer line through the project (MH-34, MH-35 and MH-14A). A majority of the parcels to these manholes include detached single family residential units. As a result, a 1:1 ratio was applied to calculate the number of dwelling units in each parcel. BKF then applied the 200 gpd/residential dwelling unit to calculate flow to these manholes.

3) The total average dry weather flow to CPS, provided by the District (262,874 gpd), was used to calculate the balance of dry weather flow from all other residential and non-residential parcels. The remaining flow was distributed uniformly based on number of parcels tributary to the remaining model inflow manholes (MH-5, MH-17 and MH-24).

4) A peaking factor of 2 was used to estimate the peak dry weather flow to each manhole.

5) To estimate infiltration and inflow, Master Plan Table 6-1 (I/I in Individual Flow Monitoring Basins) was used to estimate average infiltration/inflow flow based on mile-inches of pipe for each model inflow manhole.

6) BKF used the highest infiltration/inflow recorded at CPS (during the 2017 storm event cited in the Master Plan) and the previously determined infiltration/inflow factor derived above to calculate the corresponding flow rate to each manhole. After reviewing the January 10th, 2017 storm against historical rainfall data from the National Oceanic and Atmospheric Administration (NOAA), the rain event corresponds to a 40-year design storm which is higher than the typical design storm used for determining infiltration/inflow (5 or a 10-year design storm).

7) From the corresponding CPS pumped flow recordings (Master Plan Figure 2-4), 2,835gpm (i.e., max pumped flow of 3,200 gpm – peak dry weather flow of 365 gpm) was used to calculate the storm event infiltration/inflow at each manhole.

8) To calculate the infiltration/inflow from the proposed project, BKF calculated the infiltration/inflow for existing pipes on project site and substituted the infiltration/inflow from the proposed project pipelines. The I/I from the proposed project pipes is calculated using the design infiltration rate of 0.2 gpm per inch-diameter per 1000 ft.

9) The resulting net increase in peak wet-weather flow with the proposed project is only 26 gpm. Without any reduction for a new pipe system, the increase in peak wet weather flow is 136 gpm.

10) The CPS pump station performance was reviewed in accordance with the peak flow increases. With either increase in flow, the pump station/forcemain is adequate to serve the project.

F. Projected Sewer Flow

The daily average sewer generation for each building is calculated using the occupancy of the existing or proposed building using sewer demand factors designated in the 2018 Master Plan and supplemented by industry standard demand factors. The sewer flows are estimated using the dwelling units and occupancies, provided by DB Architects in September of 2019, to equate a flow based on the demand factors and occupancies. BKF validated the standard demand factors using historical flow monitoring data at the CPS.

Residential demand estimates were estimated using a generation rate of 200 gallons per day per unit per the Bayshore Sanitary District standards. Office, community, and day care demand estimates are based on a demand factor of 10 gallons per day per person. Park bathroom demand is accounted for using 488 gallons per restroom per day.

Table A below shows the existing, proposed, and the increase (proposed minus existing use) in wastewater generated by the project.

Table A: Post-Project Increases in Wastewater Generation

Project Characteristic	Demand Factor (1) (2)		Existing Consumption (3) (gallons/day)	Proposed Consumption (3) (gallons/day)	Increase in Use
Residential	200	gallons/du/day	30,000	111,000	81,000
Office/Community Center	10	gallons/person/day	70	900	830
Day Care	10	gallons/student/day	1,090	1,250	160
Bayshore Park Restrooms (4)	488	gallons/restroom/day	0	976	976
			Total For Project	**114,126**	**82,966**

Sources:
1. Residential demand is based on Bayshore Sanitary District 2018 Master Plan wastewater design criteria of 200 gallons per day per dwelling unit.
2. Office/Community Center and day care demand factor is based on City of Oakland Sewer flow rate of 10 gallons per day per person.
3. Existing and proposed employees/students counts for office/community center and daycare are provided by DB Architects.
   - Daycare: 109 Existing & 125 Proposed students
   - Office/Community Center: 7 Existing & 90 Proposed students
4. Assumes 20 fixtures per restroom.

The average daily values estimated were then multiplied by a peaking factor of 2 to account for fluctuations in water usage during the day to calculate peak dry weather flow. Table 2 presents the demand factors used and the peak dry weather flows for each building.

G. Additional Inflow & Infiltration (I/I)

The District's collection system is significantly impacted by additional Rainfall-Derived I/I (RDII) spikes during and shortly following rainfall events. Appendix 2 summarizes historical peak daily flows at the inflow pipe to the Carlyle Pump Station during the period 1993 to 2017 provided in the 2018 District Master Plan. I/I derivation is summarized in Tables 1 and 2.

Calculation of RDII

Historical peak daily flows provided in the District's Master Plan were used to estimate the I/I flows in the existing collection system. The largest recorded I/I occurred on January 10, 2017. Approximately 1.4 inches of rainfall occurred over 2 hours, corresponding to a 40-year storm per NOAA Atlas 14. The largest amount of rainfall recorded over a 24-hour period occurred on February 26, 2008 with approximately 3.25 inches of rainfall, corresponding to a 5-year storm. The infiltration and inflow rates for these two storms were applied to model nodes using the basin-specific generation rates noted in Table 6-1 of the 2018 District Master Plan. The 5-year storm was applied to establish a design storm I/I while the 40-year storm was used to evaluate the system during extreme events.

Reduction in I/I Rates

Infiltration and inflow to the project site will be reduced with the removal of the existing pipes. For the 5-year storm, the I/I reduction was calculated using the corresponding generation rate of the existing collection system (length and pipe diameter). Per District standards, I/I rates for the proposed sections of pipe were calculated using the generation rates of 0.2 gpm per inch-diameter per 1,000 feet of pipe.

For the purposes of this analysis, no reduction in I/I was included for the 40-year storm. Although the infiltration and inflow will be reduced, this is a conservative approach for the evaluation during extreme rain events.

Model Scenarios

The calculated peak wet weather conditions reflect the maximum I/I rates and the peak dry weather flows for the proposed collection system. The model was run for both the 5-year flows and the 40-year flows. During the 5-year storm, the main inflow line runs partially full. During the 40-year storm, the sewer flows will still be contained below the existing ground.

H. Hydraulic Analyses

A hydraulic model was setup to, a) analyze the capacity of the existing gravity sewer collection system, and b) to identify improvements necessary to support the Project. The sanitary sewer collection system was analyzed using a computer-modeling software, SewerCAD by Haestad Methods. SewerCAD is a collection system analysis program that evaluates gravity and pressurized sanitary sewer collection systems using Manning's equation. Refer to Figure 1 for Sewer System Model Layout.

<u>Model Setup</u>

The existing gravity sewer system pipe sizes, inverts and rim elevations needed to analyze system capacity were gathered from several sources. These include field survey data, City block-maps, construction drawings, and as-built information. Because gravity sewer lines generally operate under open channel flow conditions, the slope of the line is critical in estimating capacity. The model was built primarily using field survey data. Field survey data from structures immediately upstream of the Carlyle Pump Station (presented in the 2015 Sewer System Management Plan) was supplemented by field survey for the purposes of this analysis. The two field surveys include all structures and pipes downstream of the project to the Carlyle Pump Station. As-builts and City block maps were used to supplement any field survey data that is missing for the remaining lateral structures.

<u>Results</u>

The analyses showed that the depth of flow in the existing gravity sewer system is less than 75-percent of the pipe diameter for all pipe segments from the project site to the Carlyle Pump Station under peak wet weather flow. The existing 18-inch main line is shown to be adequately sized to convey Project sewer flows. See Table 3 in the Attachments for the peak wet weather hydraulic results.

With the highest infiltration and inflow ever recorded (40-year storm event), the existing gravity sewer system can convey peak sewer flows with freeboard throughout the modeled system. No reduction for I/I is considered during this scenario. During this extreme event, the boundary condition is set at the pump station wet well water elevation needed to convey the peak flows (to be discussed in the following section). See Table 4 in the Attachments for the corresponding hydraulic results.

I. Impacts, Mitigations, and Recommendations

The proposed Project will increase peak flow and volume to the existing downstream sanitary sewer collection system, which is made up of two main components, 1) the gravity pipe collection system, and 2) the Carlyle Pump Station.

<u>Gravity System</u>
The analyses showed that the existing gravity collection system is able to convey the increase in sewer flow from the proposed Project and still meet the criteria.

- Impacts and Mitigation – There are no impacts to the gravity system as a result of the proposed Project. As such, the Project is not required to implement mitigation measures.

<u>Carlyle Pump Station</u>
The existing Carlyle Pump Station, to where the proposed Project ultimately discharges to, has four pump. The pumps turn on successively as the water level raises in the wet-well. When the water level reaches elevation of (-)2.5 feet, the fourth pump turns on and the combined flow pumped at this point with all four pumps running simultaneously is 3,200 gpm.

With the proposed project, the peak wet-weather flow is estimated to be 3,336gpm. Since this flow rate is higher than 3,200 gpm pumped at wet-well water level elevation of (-)2.5 feet, the water level raises in the wet-well, which in turn reduces the static head allowing all four pumps to discharge at a higher rate than 3,200gpm. So, the wet-well elevation at which all four pumps can match the inflow of 3,336gpm is 2.3 feet. This increased wet-well elevation of 2.3 feet was used as starting water surface elevation for the gravity pipe system capacity analyses.

Under these conditions and without any reduction in infiltration and inflow from the proposed project, the pump station water level will not exceed elevation 2.3 with all four pumps running and no overflows will occur in the upstream gravity system. Refer to Figure 2 for the Carlyle SSPS Curve.

J. Conclusion

The proposed Project will increase peak flow and volume to the existing sanitary sewer collection. The analyses found that the existing conveyance and pump systems are able to handle the increase in flow without any modifications. As such, there are no impacts as a result of the Project.

Attachments

Table 1: Wastewater Generated
Table 2: Wastewater Generated – Project
Table 3: Peak Wet Weather Flows
Table 4: Peak Wet Weather Flows, Highest Recorded I/I

Figure 1: Sewer System/Model Layout
Figure 2: Carlyle SSPS Curve

Appendices

Appendix 1: Flow Monitoring Basins
Appendix 2: I/I Flow Rates – Historical Data
Appendix 3: Carlyle Pump Station Information

References

i) Bayshore Sanitary District Master Plan, August, 2018.
ii) Bayshore Sanitary District Standard Specifications for Design and Construction of Sanitary Sewer Collection and Conveyance Facilities (rev. 3), March 2018.
iii) California Building Standards Commission, 2010 California Fire Code, January 2011.
iv) City of Oakland Sanitary Sewer Design Standards, August 2008.

ATTACHMENTS

Table 1A - Wastewater Generated: Existing Conditions

Model Node	Existing Sewer Flows				
	Existing Dwelling Units [1]	Average Dry Weather Flow [2][3] (gpd)	Peak Dry Weather Flow [4] (gpm)	Highest Recorded I/I [5] (gpm)	Highest Recorded Peak Wet Weather Flow [5] (gpm)
MH-34	798	159,600	222	1,286	1,508
MH-35 (Project Flows)	150	30,000	42	429	471
MH-14A	136	27,200	38	389	427
MH-5	486	44,874	62	585	647
MH-17	1	92	0	27	27
MH-24	12	1,108	2	118	120
Total	**1,583**	**262,874**	**365**	**2,835**	**3,200**

Notes:
1. There are 1,742 dwelling units in the entire sewer district according to the 2018 Master Plan. 159 parcels, in predominantly residential zoning areas, do not discharge to the Carlyle Pump Station. BKF has conservatively assumed that 159 dwelling units are not conveyed to the Carlyle Pump Station.
2. Average Dry Weather Flow (ADWF) for residential use is estimated using a demand factor of 200 gallons per day per dwelling unit (per District standards).
3. The total ADWF corresponds to the measured baseline flow at the Carlyle Pump Station (262,874 gallons per day).
4. Peak Dry Weather Flow (PDWF) is calculated using a peaking factor of 2. Flow monitoring at the pump station on 11/03/16 shows a peaking factor of approximately 1.4.
5. On January 11th, 2017, approximately 1.4 inches of rainfall occurred over 2 hours (corresponding to about a 40 year storm). All four pumps were activated with a recorded discharge of 3,200 gallons per minute. The corresponding infiltration and inflow is 2,835 gallons per minute. Infiltration and inflow rates are applied (using length and pipe diameter) to model nodes using the basin specific generation rates noted in Table 6-1 of the 2018 Master Plan. These generation rates (that assess a smaller storm event) are applied using a universal factor to adjust to the highest recorded infiltration and inflow rate to the pump station.

Table 1B - Wastewater Generated: Proposed Conditions

Model Node	Proposed Sewer Flows						
	Proposed Dwelling Units [1]	Average Dry Weather Flow [2] (gpm)	Peak Dry Weather Flow [2] (gpm)	I/I with Proposed Project [3] (gpm)	Peak Wet Weather Flow with Highest Recorded I/I [3] (gpm)	**Peak Wet Weather Flow (gpm) without I/I Reduction**	**Peak Wet Weather Flow [4] (gpm)**
MH-34	798	159,600	222	1,286	1,508	**1,508**	**723**
MH-35 (Project Flows)	555	114,126	159	319	478	**588**	**286**
MH-14A	206	41,200	57	389	446	**446**	**209**
MH-5	486	44,874	62	585	647	**647**	**290**
MH-17	1	92	0	27	27	**27**	**11**
MH-24	12	1,108	2	118	120	**120**	**48**
	2,058	**361,000**	**501**	**2,725**	**3,226**	**3,336**	**1,566**

Notes:
1. An additional 71 units is routed to Node MH-14A for the Robertson School Site.
2. See Table 2 for project flows.
3. Infiltration and inflow from the project site will be reduced with the removal of existing pipes. The reduction is assessed using the corresponding generation rate (using length and pipe diameter) for the pipes to be removed. Infiltration and inflow for proposed pipes is assessed using the generation rate of 0.2 gpm per inch-diameter per 1,000 feet (per District standards).
4. On February 26th, 2008, approximately 3.25 inches of rainfall occurred over 24 hours (corresponding to a 5 year storm) and generated the second highest daily flow recorded. The infiltration and inflow rates for this event are applied (using length and pipe diameter) to model nodes using the basin specific generation rates noted in Table 6-1 of the 2018 Master Plan. These generation rates (that assess a smaller storm event) are applied using a universal factor to adjust to the infiltration and inflow rate for the 5-year, 24-hour storm to the pump station.

Table 2 - Wastewater Generated - Project

Project Characteristic	Demand Factor [1][2]	Proposed Occupancy [3]	Average Dry Weather Flow (gpd)	Peak Dry Weather Flow [4] (gpm)
Residential	200 gallons/du/day	555 du	111,000	154
Office/Community Center	10 gallons/person/day	90 persons	900	1
Day Care	10 gallons/student/day	125 persons	1,250	2
Bayshore Park Restrooms [4]	488 gallons/restroom/day	*N/A*	976	1
		Total For Project	**114,126**	**159**

Notes:
1. Residential demand is based on Bayshore Sanitary District 2018 Master Plan wastewater design criteria of 200 gallons per day per dwelling unit.
2. Office/Community Center and day care demand factor is based on City of Oakland Sewer flow rate of 10 gallons per day per person.
3. Existing and proposed employees/students counts for office/community center and daycare are provided by DBarchitects.
   - Daycare: 109 Existing & 125 Proposed students
   - Office/Community Center: 7 Existing & 90 Proposed students
4. Assumes 20 fixtures per restroom.
5. Peak Dry Weather Flow (PDWF) is calculated using a peaking factor of 2. Flow monitoring at the pump station on 11/03/16 shows a peaking factor of approximately 1.4.

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TABLE 3
SANITARY SEWER FLOW HYDRAULICS, PEAK WET WEATHER FLOW, MODEL OUTPUT
(Analysis performed using Bentley SewerCAD v8i)

Pipe[4] #	Upstream Node	Downstream Node	Total Discharge (gpm)[1]	Capacity @ Constructed Slope (gpm)	Pipe Size[5] (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Manning's n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL[3] Elevation Upstream	HGL[3] Elevation Downstream	**Upstream Freeboard[2] (feet)**	Upstream Cover (feet)	**Velocity (ft/s)**	**Depth/Diameter Ratio d/D**
P-LL01-3	MH-17	MH-18	**11**	713.8	8.0	23.1	0.017	0.013	2.60	2.20	9.83	9.83	2.67	2.30	**7.2**	6.6	**1.7**	
P-LL01-2	MH-18	MH-19	**11**	360.6	8.0	316.7	0.004	0.013	2.20	.80	9.83	13.63	2.28	1.84	**7.6**	7.0	**1.0**	
P-LL01-1	MH-19	MH-20	**11**	191.7	8.0	80.1	-0.001	0.013	.80	.90	13.63	11.97	1.84	1.84	**11.8**	12.2	**0.1**	
P-L02-4	MH-6	MH-5	**290**	488.6	12.0	321.4	0.001	0.013	5.30	5.60	10.52	10.89	6.30	6.18	**4.2**	4.2	**1.5**	
P-L02-3	MH-6	MH-7	**290**	275.8	12.0	336.2	0.000	0.013	5.30	5.20	10.52	15.92	6.18	6.08	**4.3**	4.2	**0.9**	
P-L02-2	MH-7	MH-8	**290**	0.0	12.0	24.7	0.000	0.013	5.20	5.20	15.92	15.86	5.93	5.92	**10.0**	9.7	**0.8**	
P-L02-1	MH-8	MH-9	**290**	866.8	12.0	81.7	0.003	0.013	5.20	4.96	15.86	18.01	5.90	5.88	**10.0**	9.7	**2.2**	
P-L01-3	MH-23	MH-24	**48**	215.0	6.0	301.7	0.007	0.013	4.50	6.70	9.64	11.77	6.86	4.72	**2.8**	4.6	**2.0**	
P-L01-2	MH-21	MH-23	**48**	178.6	6.0	159.1	0.005	0.013	3.70	4.50	12.51	9.64	4.68	3.92	**7.8**	8.3	**1.7**	
P-L01-1	MH-21	MH-20	**48**	1004.5	8.0	81.6	0.034	0.013	3.70	.90	12.51	11.97	3.85	1.84	**8.7**	8.1	**3.3**	
P-09	MH-34	MH-35	**723**	2517.2	18.0	333.2	0.003	0.013	15.01	14.06	39.09	27.51	15.56	14.69	**23.5**	22.6	**2.7**	**0.37**
P-08	MH-35	MH-36	**1009**	3841.8	18.0	218.3	0.007	0.013	13.91	12.46	27.51	23.92	14.48	13.04	**13.0**	12.1	**4.1**	**0.38**
P-07	MH-36	MH-37	**1009**	2634.1	18.0	92.9	0.003	0.013	12.30	12.01	23.92	25.06	12.94	12.65	**11.0**	10.1	**3.1**	**0.43**
P-06	MH-37	MH-14A	**1009**	3614.1	18.0	388	0.006	0.013	11.76	9.48	25.06	26.50	12.33	10.32	**12.7**	11.8	**3.9**	**0.38**
P-05	MH-14A	MH-15	**1218**	3777.1	18.0	370.8	0.006	0.013	9.45	7.07	26.50	16.97	10.07	7.96	**16.4**	15.6	**4.3**	**0.41**
P-04	MH-15	MH-16	**1218**	2311.9	18.0	299.4	0.002	0.013	7.07	6.35	16.97	16.35	7.85	7.42	**9.1**	8.4	**3.0**	**0.52**
P-03	MH-16	MH-9	**1218**	1509.4	18.0	331.7	0.001	0.013	6.35	6.01	16.35	18.01	7.37	7.03	**9.0**	8.5	**2.1**	**0.68**
P-02	MH-9	MH-20	**1508**	17389.0	24.0	136.7	0.029	0.013	4.91	.90	18.01	11.97	5.55	1.79	**12.5**	11.1	**7.6**	**0.32**
P-01	MH-20	O-1	**1567**	29951.8	24.0	47.7	0.087	0.013	.90	- 3.25	11.97	11.00	1.55	- 2.94	**10.4**	9.1	**11.2**	**0.33**

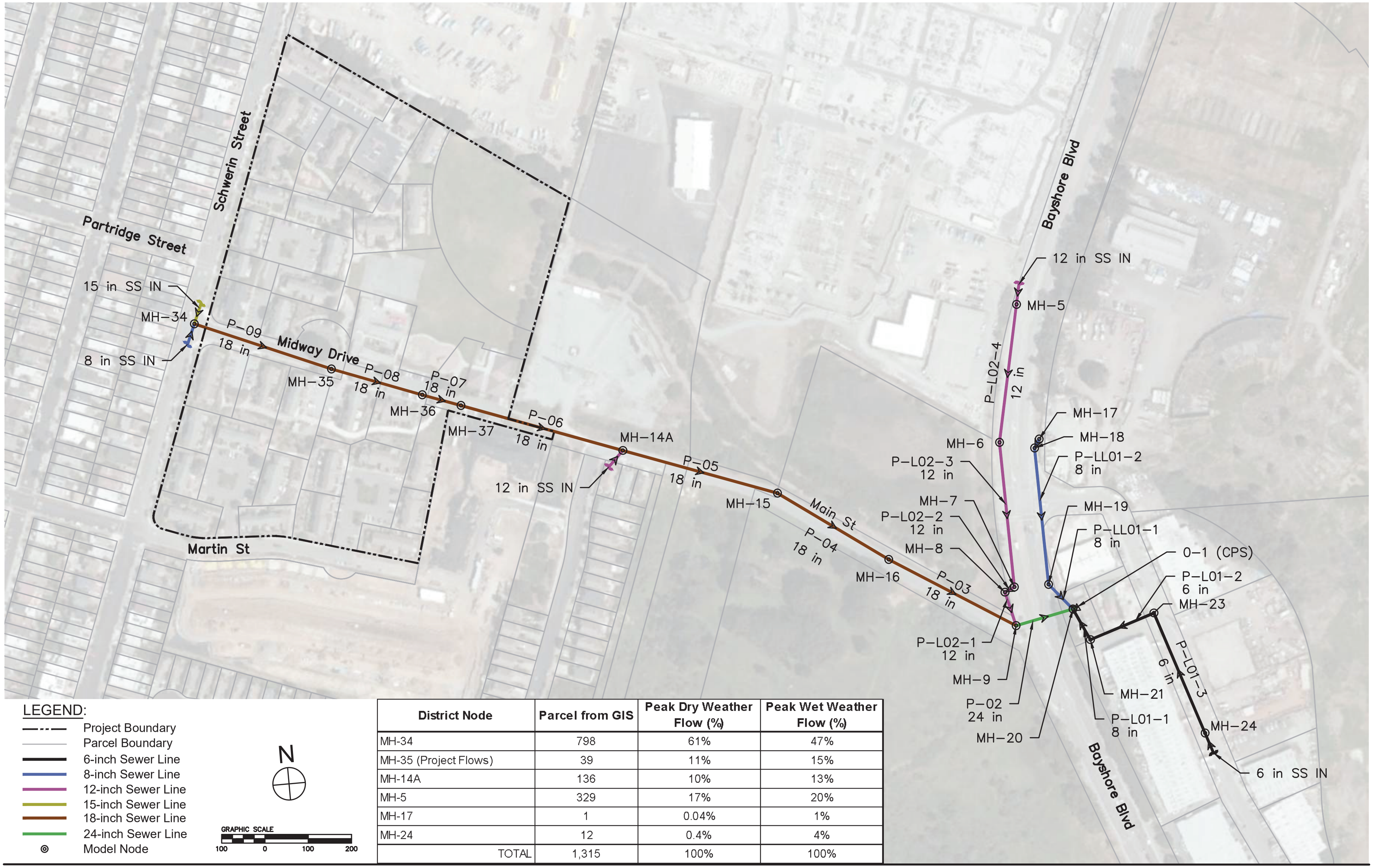
Notes
(1) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(2) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(3) Outfall discharges to the Carlyle Pump Station. Outfall tailwater condition is set to the second pump on (elevation -4.0).
(4) See Figure 1 for SewerCAD schematic
(5) Nominal pipe size is assumed to be the inside diameter

MIDWAY VILLAGE
SANITARY SEWER SYSTEM REPORT
January 2020

TABLE 4
SANITARY SEWER FLOW HYDRAULICS, PEAK WET WEATHER FLOW, HIGHEST RECORDED I/I, MODEL OUTPUT
(Analysis performed using Bentley SewerCAD v8i)

Pipe(4) #	Upstream Node	Downstream Node	Total Discharge (gpm) (1)	Capacity @ Constructed Slope (gpm)	Pipe Size (5) (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Manning's n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL(3) Elevation Upstream	HGL(3) Elevation Downstream	**Upstream Freeboard (2) (feet)**	Upstream Cover (feet)	**Velocity (ft/s)**	**Depth/Diameter Ratio d/D**
P-LL01-3	MH-17	MH-18	**27**	713.8	8.0	23.1	0.017	0.013	2.60	2.20	9.83	9.83	2.71	2.48	**7.1**	6.6	**2.2**	
P-LL01-2	MH-18	MH-19	**27**	360.6	8.0	316.7	0.004	0.013	2.20	.80	9.83	13.63	2.48	2.47	**7.4**	7.0	**1.4**	
P-LL01-1	MH-19	MH-20	**27**	191.7	8.0	80.1	-0.001	0.013	.80	.90	13.63	11.97	2.47	2.47	**11.2**	12.2	**0.2**	
P-L02-4	MH-6	MH-5	**647**	488.6	12.0	321.4	0.001	0.013	5.30	5.60	10.52	10.89	7.72	7.20	**2.8**	4.2	**1.8**	
P-L02-3	MH-6	MH-7	**647**	275.8	12.0	336.2	0.000	0.013	5.30	5.20	10.52	15.92	7.17	6.62	**3.4**	4.2	**1.8**	
P-L02-2	MH-7	MH-8	**647**	0.0	12.0	24.7	0.000	0.013	5.20	5.20	15.92	15.86	6.57	6.53	**9.4**	9.7	**1.8**	
P-L02-1	MH-8	MH-9	**647**	866.8	12.0	81.7	0.003	0.013	5.20	4.96	15.86	18.01	6.48	6.34	**9.4**	9.7	**1.8**	
P-L01-3	MH-23	MH-24	**120**	215.0	6.0	301.7	0.007	0.013	4.50	6.70	9.64	11.77	6.97	4.86	**2.7**	4.6	**2.5**	
P-L01-2	MH-21	MH-23	**120**	178.6	6.0	159.1	0.005	0.013	3.70	4.50	12.51	9.64	4.80	4.05	**7.7**	8.3	**2.2**	
P-L01-1	MH-21	MH-20	**120**	1004.5	8.0	81.6	0.034	0.013	3.70	.90	12.51	11.97	3.94	2.47	**8.6**	8.1	**4.3**	
P-09	MH-34	MH-35	**1508**	2517.2	18.0	333.2	0.003	0.013	15.01	14.06	39.09	27.51	15.85	15.11	**23.2**	22.6	**3.3**	**0.56**
P-08	MH-35	MH-36	**2096**	3841.8	18.0	218.3	0.007	0.013	13.91	12.46	27.51	23.92	14.74	13.46	**12.8**	12.1	**5.0**	**0.55**
P-07	MH-36	MH-37	**2096**	2634.1	18.0	92.9	0.003	0.013	12.30	12.01	23.92	25.06	13.31	13.02	**10.6**	10.1	**3.7**	**0.67**
P-06	MH-37	MH-14A	**2096**	3614.1	18.0	388	0.006	0.013	11.76	9.48	25.06	26.50	12.59	10.81	**12.5**	11.8	**4.7**	**0.55**
P-05	MH-14A	MH-15	**2542**	3777.1	18.0	370.8	0.006	0.013	9.45	7.07	26.50	16.97	10.37	9.19	**16.1**	15.6	**5.1**	**0.61**
P-04	MH-15	MH-16	**2542**	2311.9	18.0	299.4	0.002	0.013	7.07	6.35	16.97	16.35	9.10	8.23	**7.9**	8.4	**3.2**	**1.35**
P-03	MH-16	MH-9	**2542**	1509.4	18.0	331.7	0.001	0.013	6.35	6.01	16.35	18.01	8.13	6.93	**8.2**	8.5	**3.2**	**1.19**
P-02	MH-9	MH-20	**3189**	17389.0	24.0	136.7	0.029	0.013	4.91	.90	18.01	11.97	5.86	2.40	**12.2**	11.1	**9.4**	**0.48**
P-01	MH-20	O-1	**3336**	29951.8	24.0	47.7	0.087	0.013	.90	- 3.25	11.97	11.00	2.28	2.30	**9.7**	9.1	**14.0**	**0.69**

Notes
(1) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(2) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(3) Outfall discharges to the Carlyle Pump Station. Outfall tailwater condition is set to elevation 2.3 which corresponds to the head required for the four pumps to convey the project peak flow in addition to the pump capacity. See Figure 2 for the corresponding pump curves. This pump station analysis does not include any reduction in infiltration and inflow from the project.
(4) See Figure 1 for SewerCAD schematic
(5) Nominal pipe size is assumed to be the inside diameter



LEGEND:

- Project Boundary
- Parcel Boundary
- 6-inch Sewer Line
- 8-inch Sewer Line
- 12-inch Sewer Line
- 15-inch Sewer Line
- 18-inch Sewer Line
- 24-inch Sewer Line
- Model Node

District Node	Parcel from GIS	Peak Dry Weather Flow (%)	Peak Wet Weather Flow (%)
MH-34	798	61%	47%
MH-35 (Project Flows)	39	11%	15%
MH-14A	136	10%	13%
MH-5	329	17%	20%
MH-17	1	0.04%	1%
MH-24	12	0.4%	4%
TOTAL	1,315	100%	100%

FIGURE 1: EXISTING SEWER SYSTEM / MODEL
MIDWAY VILLAGE DEVELOPMENT

DRAWING NAME: \\Bkf-sj\vol4\2018\181024_Midway_Village\DOCS\06-Design\G-Wastewater_System\Report\Figures\Figure 1_System_Layout.dwg
PLOT DATE: 11-27-19 PLOTTED BY: TAYL

BKF 100+ YEARS
ENGINEERS . SURVEYORS . PLANNERS

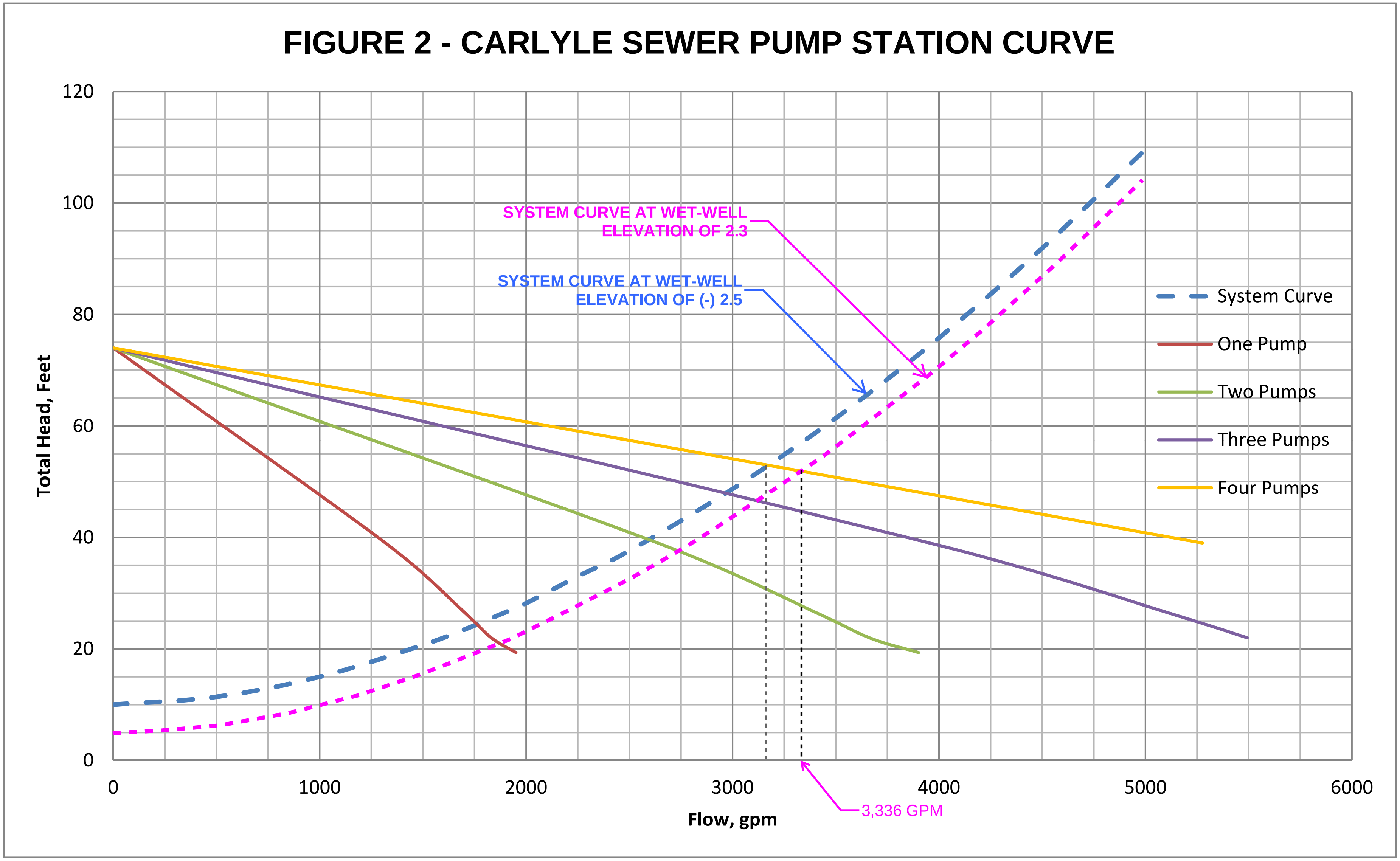


FIGURE 2 - CARLYLE SEWER PUMP STATION CURVE
Total Head, Feet
Flow, gpm
0
20
40
60
80
100
120
1000
2000
3000
4000
5000
6000
SYSTEM CURVE AT WET-WELL ELEVATION OF 2.3
SYSTEM CURVE AT WET-WELL ELEVATION OF (-) 2.5
3,336 GPM
System Curve
One Pump
Two Pumps
Three Pumps
Four Pumps

APPENDICES

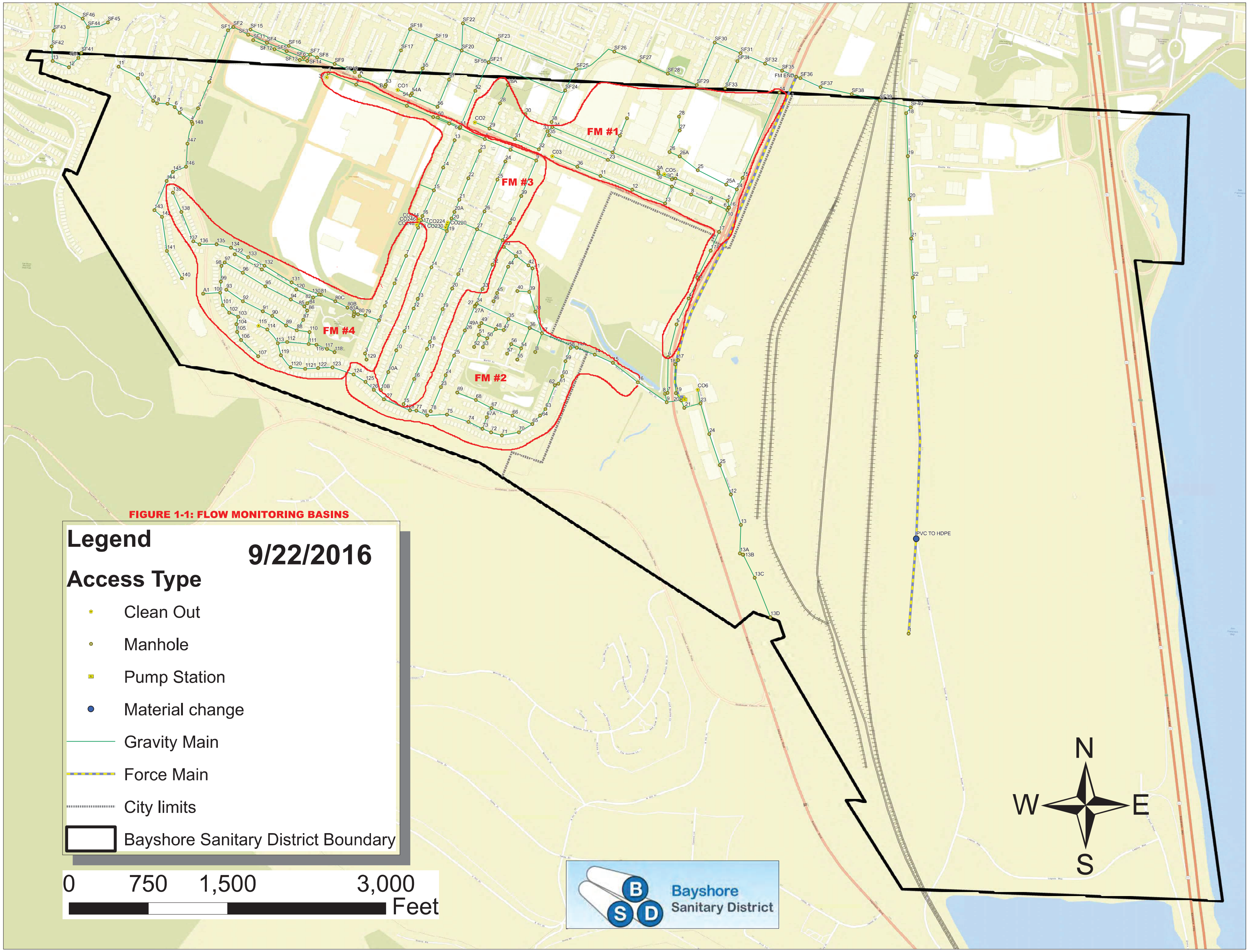


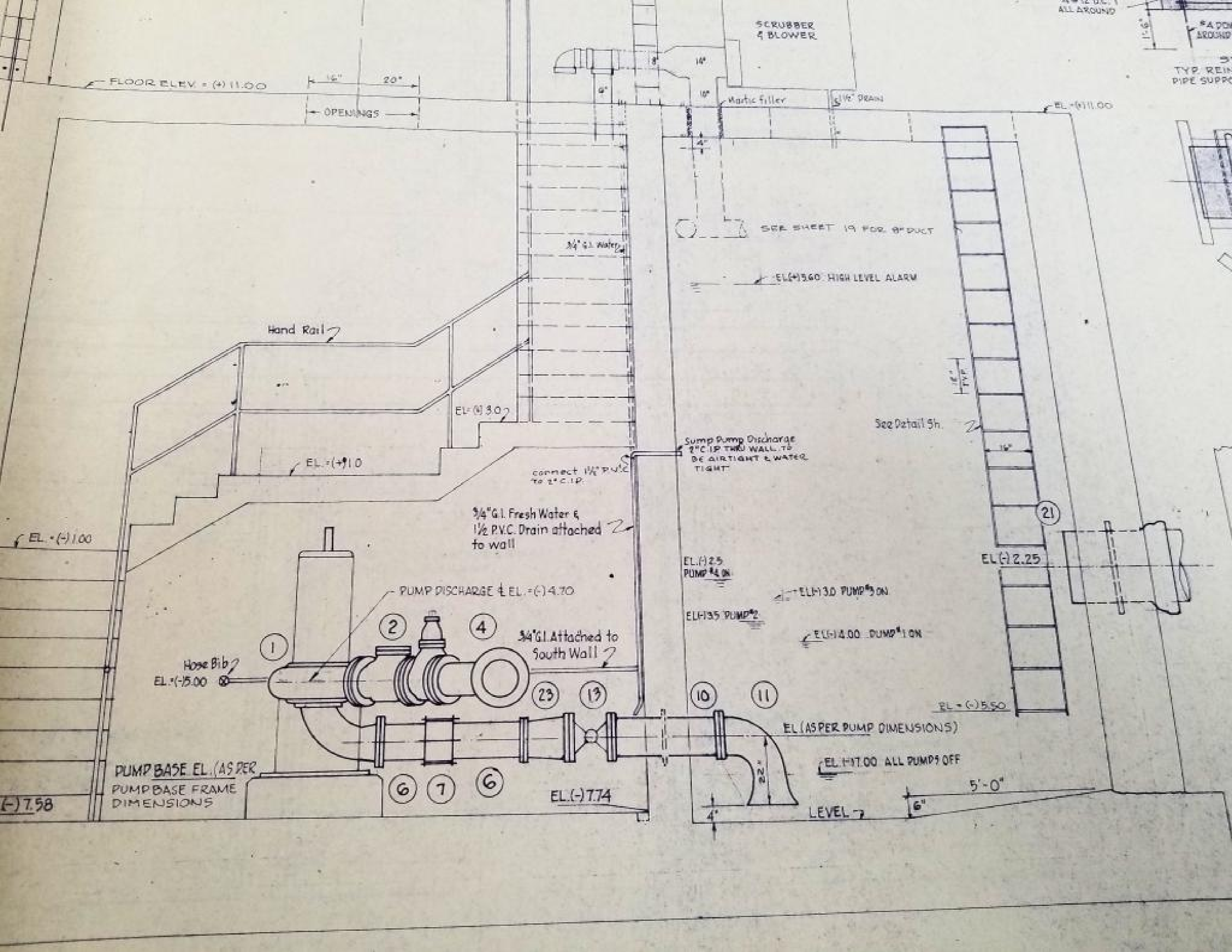
FIGURE 1-1: FLOW MONITORING BASINS

Table 4-2:
Summarized Historical I/I

YEAR	MONTH	DATE	RAIN	FLOW	EST DRY FLOW	EST I/I
2017	Feb.	10	1.10	921,000	262,800	658,200
		11	0.40	1,042,000	262,800	779,200
		12	0.20	748,000	262,800	485,200
		13	0.80	1,040,000	262,800	777,200
	Jan.	4	1.10	655,000	262,800	392,200
		10	0.75	847,000	262,800	584,200
		11	1.40	1,571,000	262,800	1,308,200
		19	1.00	633,000	262,800	370,200
		20	1.00	644,000	262,800	381,200
2016	Jan.	5	0.85	423,000	262,800	160,200
		6	1.25	698,000	262,800	435,200
		19	0.65	683,000	262,800	420,200
		20	0.60	859,000	262,800	596,200
	Dec.	8	1.64	675,000	262,800	412,200
		9	0.50	640,000	262,800	377,200
		16	1.50	979,000	262,800	716,200
2015	Dec.	22	2.60	1,030,000	262,800	767,200
2014	Dec.	3	1.75	1,075,000	262,800	812,200
		4	1.00	795,000	262,800	532,200
		12	1.90	2,247,000	262,800	1,984,200
2012	Mar.	14	1.00	426,000	262,800	163,200
		15	1.50	958,000	262,800	695,200
		28	0.75	536,000	262,800	273,200
	Apr.	10	0.75	460,000	262,800	197,200
	Dec.	5	0.90	445,000	262,800	182,200
2011	Feb.	16	1.00	578,000	262,800	315,200
		25	0.51	462,000	262,800	199,200
	Mar.	23	0.75	530,000	262,800	267,200
		24	0.49	562,000	262,800	299,200
		25	1.49	1,124,000	262,800	861,200
2010	Jan.	19	1.75	780,000	262,800	517,200
		20	1.25	949,000	262,800	686,200
		21	1.00	1,003,000	262,800	740,200
		22	0.75	831,000	262,800	568,200
		26	0.50	523,000	262,800	260,200
	Feb.	24	1.25	671,000	262,800	408,200

YEAR	MONTH	DATE	RAIN	FLOW	EST DRY FLOW	EST I/I
2008	Jan.	22	0.55	457,000	262,800	194,200
	Feb.	13	0.75	408,000	262,800	145,200
		20	0.85	469,000	262,800	206,200
		25	0.40	450,000	262,800	187,200
		26	3.25	1,854,000	262,800	1,591,200
2007	Feb.	24	0.75	427,000	262,800	164,200
		27	0.75	585,000	262,800	322,200
		28	0.65	564,000	262,800	301,200
2006	Feb.	2	0.60	711,000	262,800	448,200
	Mar.	2	0.40	619,600	262,800	356,800
		3	1.00	871,700	262,800	608,900
		14	0.50	560,800	262,800	298,000
		15	0.60	697,100	262,800	434,300
		21	0.75	712,000	262,800	449,200
1995	Jan.	10	2.00	1,087,000	200,000	887,000
		13	0.75	680,200	200,000	480,200
		24	0.75	684,900	200,000	484,900
		27	1.15	757,200	200,000	557,200
1994	Feb.	8	0.40	503,100	200,000	303,100
		17	0.50	396,500	200,000	196,500
		18	0.75	436,000	200,000	236,000
1993	Jan.	7	2.30	1,074,900	200,000	874,900
		8	0.55	680,400	200,000	480,400
		13	2.40	1,048,000	200,000	848,000
		14	1.35	1,110,000	200,000	910,000
		21	1.10	740,600	200,000	540,600

Days with total flow greater than 1MGD highlighted in yellow


SCRUBBER & BLOWER
FLOOR ELEV. = (+) 11.00
OPENINGS
Mastic filler
1½" DRAIN
EL = (+) 11.00
TYP. REIN. PIPE SUPPO
SEE SHEET 19 FOR 8" DUCT
EL(+)5.60 HIGH LEVEL ALARM
¾" G.I. Water
Hand Rail
EL = (+) 3.0
EL. = (+) 1.0
See Detail Sh.
Sump Pump Discharge 2" C.I.P. THRU WALL TO BE AIRTIGHT & WATER TIGHT
connect 1½" P.V.C to 2" C.I.P.
¾" G.I. Fresh Water & 1½ P.V.C. Drain attached to wall
EL. = (-) 1.00
EL.(-)2.5 PUMP #4 ON
EL(-)3.0 PUMP #3 ON
EL(-)3.5 PUMP #2
EL(-)4.00 PUMP #1 ON
EL(-)2.25
PUMP DISCHARGE ℄ EL. = (-) 4.70
¾" G.I. Attached to South Wall
Hose Bib
EL. = (-)5.00
EL = (-) 5.50
EL (AS PER PUMP DIMENSIONS)
EL (-)7.00 ALL PUMPS OFF
PUMP BASE EL. (AS PER PUMP BASE FRAME DIMENSIONS
(-) 7.58
EL.(-) 7.74
5'-0"
LEVEL
6"
4"
16"
20"
14"
10"
8"
18" TYP.

Gmail

Tom Yeager <teyeagerpe@gmail.com>

pump start levels

Rich <csms1984@aol.com>
To: teyeagerpe@gmail.com

Tue, Nov 12, 2019 at 8:20 AM

Tom,

first pump on level======= 39.28 "
second pump ========== 48.39 "
third pump ============ 52.08 "
fourth pump =========== 68.09 "