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Technical Memorandum

To: Manfred Wong – SFPUC
Bessie Tam – SFPUC

Thru: Wallis Lee – DPW Hydraulic Section

From: Bassam Aldhafari – DPW Hydraulic Section

Date: February 3, 2015

Subject: Mariposa Pump Station (MPS) Dry Weather Flow Hydraulic Analysis

Executive Summary:

In coordination with the SFPUC Waste Water Enterprise we have reviewed historical and current studies of the Mariposa drainage system to determine the impacts of existing and future developments within the area. An analysis was needed to determine the following: A) Existing hydraulic capacity at Mariposa PS (sanitary only) and needed upgrades to meet immediate inflows resulting from UCSF Medical Center and flows from the existing sewer network and B) An estimate of projected inflows resulting from the entire Mariposa tributary under full development conditions (Approximately 240 acres in size), which includes the proposed Warriors Development in blocks 29-32. As a result of the sanitary flow analysis, the following tasks were conducted:

1. Assess current sanitary drainage conditions for the Mariposa tributary. Under existing conditions, the Mariposa Dry Weather Pump Station is capable of pumping a peak flow rate of 1.2 MGD, with average daily pumping of 0.6 MGD and a total sump volume of approximately 1,800 gallons.
2. Determine immediate improvements to maintain the hydraulic performance of MPS to collect and convey approximately 2.0 MGD peak flow resulting from UCSF Medical Center (Activated February 2015) and the tributary south of Mariposa St. The interim solution is to accommodate additional flows from the UCSF Hospital within Mission Bay and consists of connecting the existing 10-inch sanitary force main to the 20-inch wet weather force main which increases the peak pumping capacity to approximately 3.5 MGD (see Attachment 3 for resulting pump curves). This will allow the 20-inch force main to be used for dry weather flow conveyance for the interim project only.
3. Summarize long-term (full build out) user projected sanitary flows to convey 1.7 MGD average and 4.8 MGD peak flow (as of 1/27/2015). See Table 1 below for breakdown of estimated full development flow projected to contribute to Mariposa Sanitary PS. These projections are intended to summarize expected inflows based on available information but do not account for flows that can contribute from other tributary areas or unforeseen development.

Table 1: Summary of Average and Peak Flow to MPS by Block

Peak Sanitary Flow Projections to Mariposa Sanitary Pump Station by User			
Sanitary Flow Contribution from Combined Sewer System			
Tributary Area (Basin "B" from Attachment 2)	180 Acres		
Contributing Area	Average (MGD)	Peak Flow (MGD)	Notes
Flow from South of Mariposa St Combined Sewer System	0.6	1	Assuming total Basin "B" contributes to MPS.
Sanitary Flow Contribution from Mission Bay Development at Full Build out			
Tributary Area (Basin "A" from Attachment 2)	60 Acres		
Block Number/User	Average (gpm)	Peak Flow (gpm)	Notes
24: Genentech and Bayers Hall	80	240	Combines lots 24a, 24b, and 24c*.
25: Academic Office Building	71	213	From UCSF LRDP*
29-32: Warriors Stadium**	114	746	Total contribution from blocks 29, 30, 31, 32**
33-34: UCSF	63	190	From UCSF LRDP*
36-39 & X3: UCSF Medical Center 1	90	474	Phase 1 289 beds
40: Commercial	40	118	From Mission Bay Sanitary Master Plan
UCSF Medical Center 2	77	405	Phase 2 550 beds total
Remaining Blocks	17	50	Blocks P23,P26, X4. Mission Bay Sanitary Master Plan
Total Average (MGD)	1.4		
Total Peak (MGD)		3.5	
Estimated (I&I) based on Metcalf and Eddy (Wastewater Engineering, 1972)	0.3		Assuming an infiltration rate of 30000 gpd/mile (total length of sewer appreciated at 9.4 miles)
Total Average Flow (Basin "A" + Basin "B") + I&I (MGD)	2.3		Equivalent to 3.5 CFS
Total Peak Flow (Basin "A" + Basin "B") + I&I (MGD)		4.8	Equivalent to 7.4 CFS
* Refer to Mission Bay UCSF LRDP Sanitary Sewer Exhibit (Attachment 5)			
** Refer to Warriors Stadium Sanitary Sewer Exhibit (Attachment 6)			

The long term improvements will include an upgrade of existing drainage infrastructure to accommodate full development inflows. Downstream conveyance capacity will need to be assessed as part of the long term improvements to determine the ability of sewers to convey full development flows from MPS. The projections summarized above are based on available information but do not account for flows that can contribute from other tributary areas or unforeseen development, therefore final design flow should be reassessed to account for future development within the area that may contribute to MPS.

Enclosed Attachments:

Attachment 1: Schematic of Mariposa Drainage System

Attachment 2: Tributary Area and Existing Sewer Network Map

Attachment 3: Pump Curves for Interim Force Main Interconnect Project

Attachment 4: Pipe Calculations for Sewer Sizing Along Mariposa St

Attachment 5: Peak Sanitary Flow Projection Exhibit from UCSF LRDP

Attachment 6: Peak Sanitary Flow Projection Exhibit from Golden State Warriors

Background:

To assess Mariposa Dry Weather current flow conditions, a number of previous hydraulic studies of the area were compiled and reviewed to develop a baseline of existing conditions. Currently the Mariposa Pump Station serves a dual purpose of collecting, storing, and discharging (through force mains) sanitary and combined storm water flows from surrounding tributaries to the South East Pollution Control Treatment Plant (SEP). Refer to Attachment 1 for a schematic of the Mariposa Drainage System (Dry Weather).

The Mariposa watershed is comprised of two main basins (240 acres) that are divided north and south of Mariposa St. A portion of Mission Bay (400 ft north of 16th St and southward to Mariposa St), approximately 60 acres in size, historically discharged sanitary and storm water flows to the Mariposa watershed (Shown as sub-watershed "A" in Attachment 2). The second watershed discharges sanitary and storm flows north from Potrero Hill to the Mariposa Drainage System (Shown as sub-watershed "B" in Attachment 2), and is approximately 180 acres in size. The Mariposa watershed is comprised of sanitary and storm sewer systems (Mission Bay will be an MS4 area, whereas south of Mariposa St Tributary will remain as a combined sewer system). The sanitary system collects all sanitary flow from basin A and B and pumps the flow through a 10-inch force main to a 27-inch gravity sewer at the intersection of Illinois St/21st St. The storm system collects combined flows which are being stored in a 0.7 MG transport storage box on Mariposa St between Terry Francois Blvd and 3rd St and pumped through a 20-inch force main to the previously mentioned gravity sewer. The flow then gravitates to SEP. Combined (sanitary and storm) flow that exceeds the wet weather pumping and storage capacity overflows into the San Francisco Bay (see Attached "Drainage Schematic" of the Mariposa drainage system). Due to the separation of sanitary and storm sewers within the Mission Bay area, wet weather flows from Mission Bay South will be redirected to a new wet weather pump station currently under construction and will no longer contribute

to the Mariposa Wet Weather System. A separate analysis is need to assess wet weather impacts as a result of new development on the Mariposa System and is not included as part of the analysis.

Existing Conditions of Sanitary Flow Drainage for Mariposa Tributary:

The existing flow rate that enters the Mariposa sanitary pump station is approximately 0.6 MGD average with a peak flow rate of 1 MGD, not including flows from basin “A”. Based on pump tests conducted by the SFPUC the peak pumping rate of the Mariposa sanitary pump station is approximately 1.2 MGD. Current peak flow estimates into the Mariposa station pump station fluctuate between 0.8 to 1.0 MGD under existing flow conditions, prior to UCSF occupancy. Anticipated flow from UCSF Hospital (estimated by F&L at 570 GPM, see Attachment 5 from UCSF LRDP) will exceed the existing peak pumping capacity of the Mariposa sanitary pump station, which triggered an interim solution to be developed as part of this analysis.

Flow Meter Installation:

In order to verify the inflow to the box structure, SFPUC Waster Water Enterprise collected sanitary flow data from November and December 2014 at four monitoring locations and at the Mariposa Sanitary Pump Station to determine inflows and outflows of the Mariposa System. The average total inflow from all the flow meters was estimated to be 1.02 MGD (Using DCS data from Mariposa PS). The flow capacity from the DCS data of the dry weather (single pump) is approximately 1.06 MGD. Flow data from all meters are summarized in Figures 1-5 below with measured average and peak flow for each site.

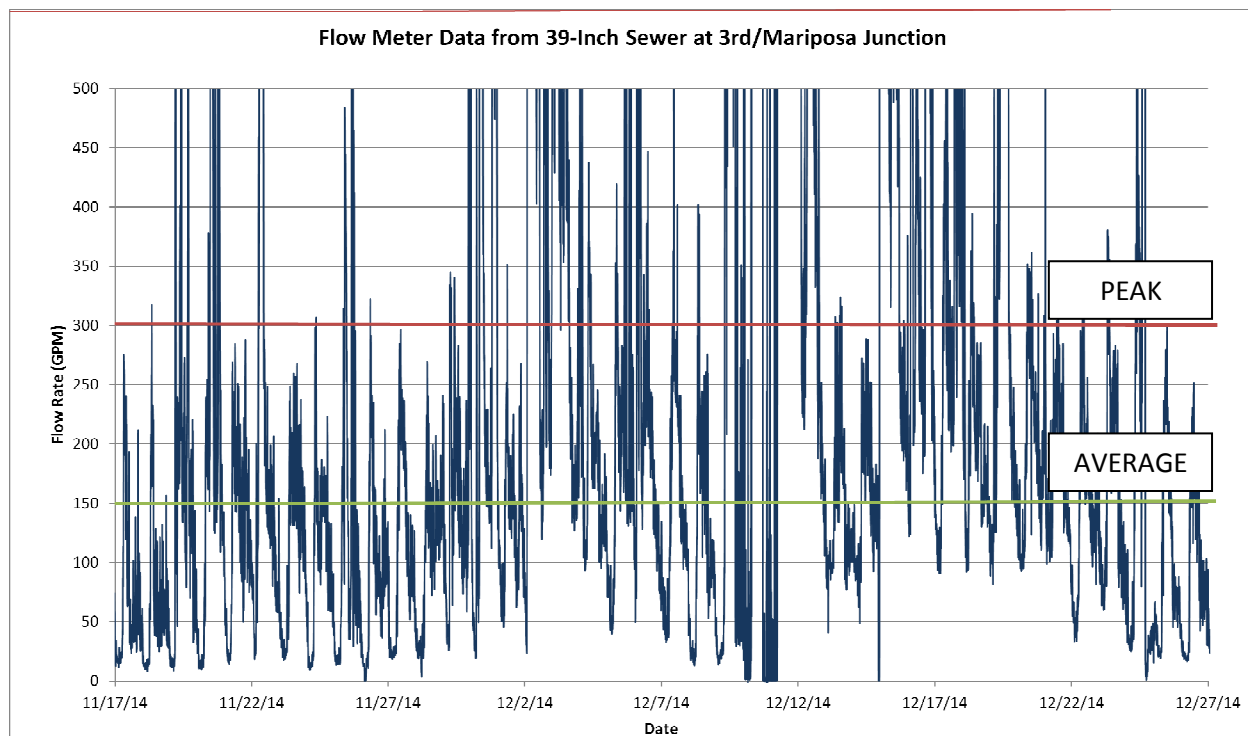


Figure 1: Flow Meter Data for 39-Inch Sewer at 3rd/Mariposa

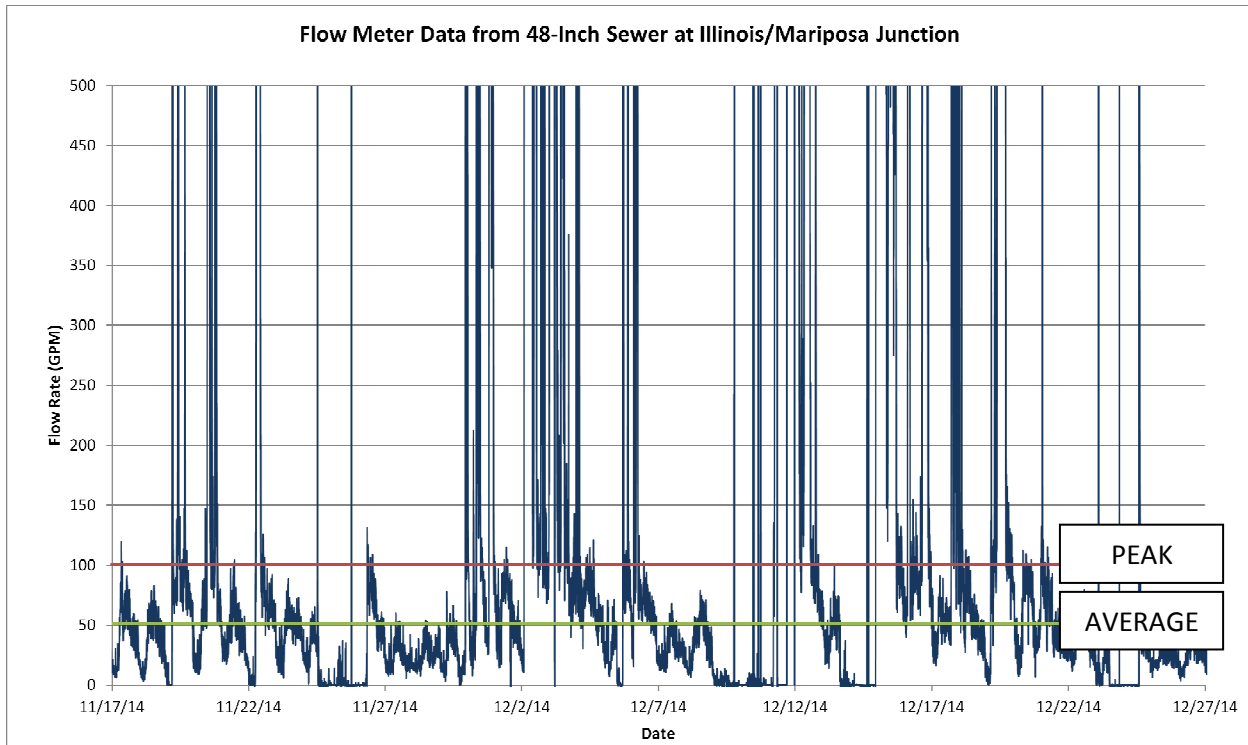


Figure 2: Flow Meter Data for 48-Inch Sewer at Illinois/Mariposa

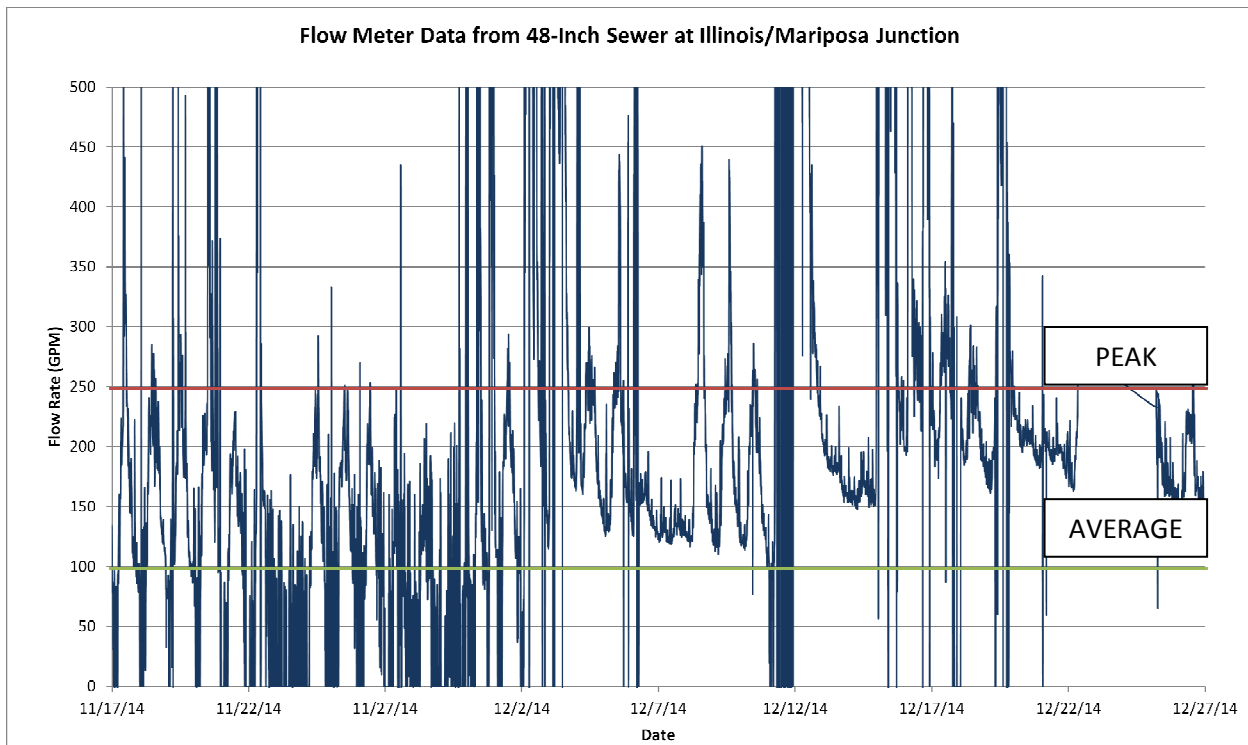


Figure 3: Flow Meter Data for 48-Inch Sewer at Illinois/Mariposa

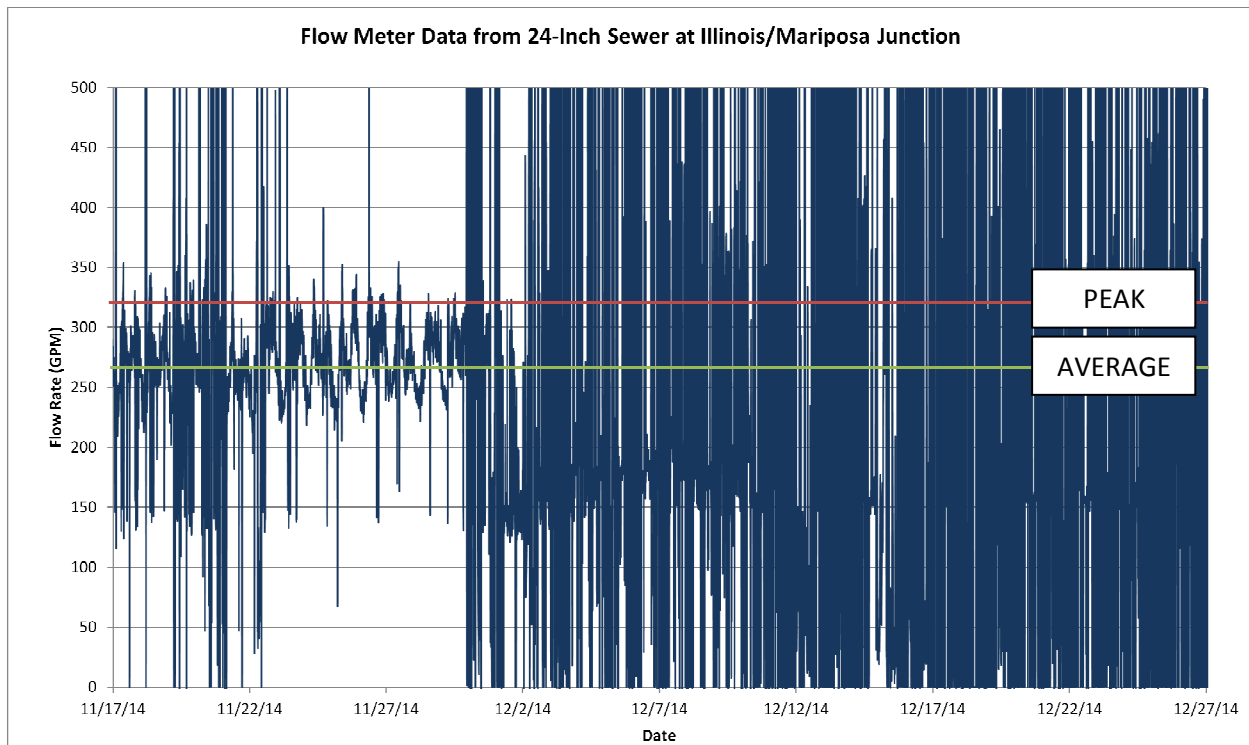


Figure 4: Flow Meter Data for 24-Inch Sewer at Illinois/Mariposa

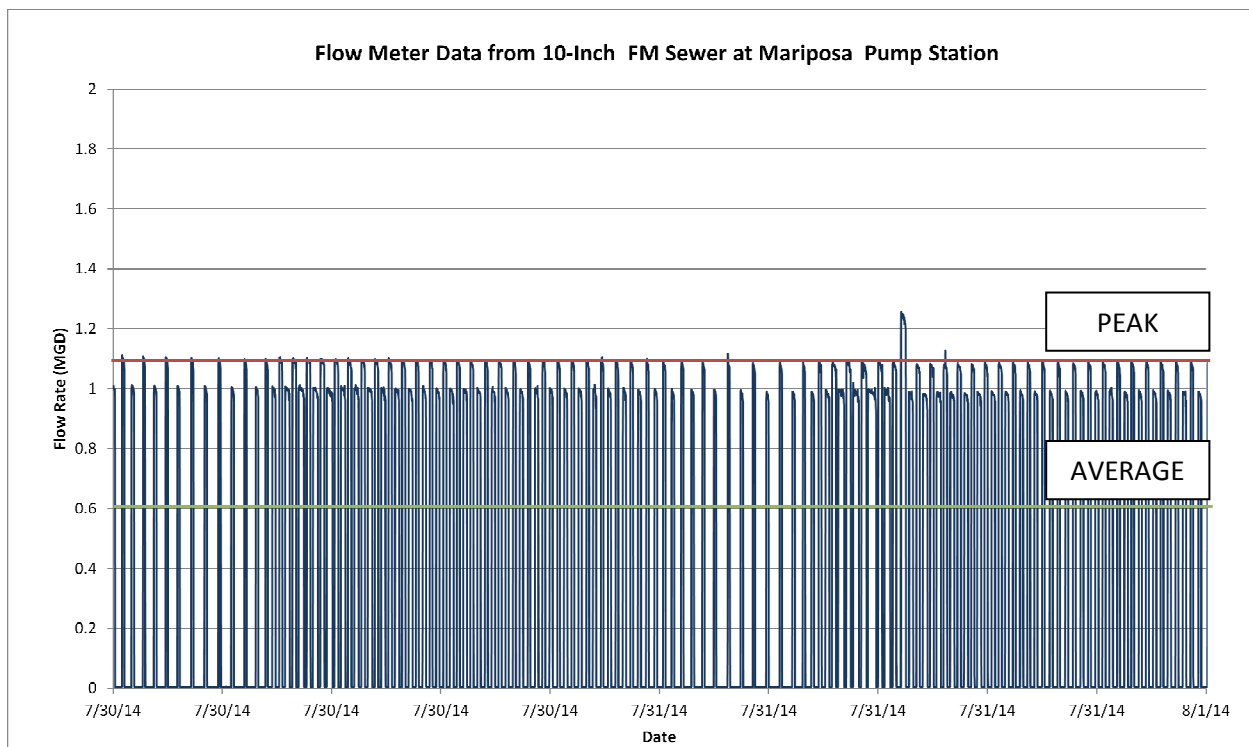


Figure 5: Flow Meter Data from DCS for 10-Inch Force Main at Mariposa PS

Summary of Previous Hydraulic Reports:

This section contains a detailed breakdown of flows for each historical study received by EHY. References to studies will be provided. Studies on record with Hydraulic Section are chronologically ordered and summarized in Table 2 below:

Table 2: Summary of Projected Average and Peak Flows from Mission Bay Development to MPS

Report Date	Report Title	Completed By	Projected Average Sanitary Flow from Mission Bay (Total)	Projected Peak Sanitary Flow from Mission Bay (Total)
March 1989	Mariposa Facilities Hydraulic Model	HCE	No mention of average sanitary flow to MPS	Mentions a peak 2 MGD pumping rate
December 1997	Mission Bay Sanitary Sewer Flows	KCA	Average flow to Mariposa is stated as 0.532 MGD	Memo states only average flows to Mariposa not peak
December 2000	Mission Bay Project Separated Sanitary Sewers	Olivia Chen Consultants	2.61 MGD total (0.48 MGD from UCSF and 1.43 MGD from other users). MPS average is 0.61 MGD	7.83 MGD total (1.44 MGD from UCSF and 4.29 MGD from other users). Mariposa Peak is 1.83 MGD
December 2011	Mission Bay Interim Development (Draft)	HCE	Not clear if stated value is average or peak flow from draft report	Not clear if stated value is average or peak flow from draft report
November 2013	Bayside Operations Study	SSIP PMC	Existing 0.5 MGD total average flow for MPS. No projection given.	No projection given for peak flow.
May 2014	UCSF Long Range Development Plan (EIR)	Freyer and Laureta	Average is calculated as 0.7 MGD based on an assumed peaking factor of 3.	Projected peak flow of 1445 GPM to MPS from Mission Bay, equivalent to 2.1 MGD (Revised in latest EIR). Does not include Warriors Stadium.
January 2014	Mariposa/Mission Bay Flow Analysis	GHD (Revised in May 2014)	1.0 MGD from supporting table	2.81 MGD from full build out to Mariposa system.
May 2014	Mariposa/Mission Bay Flow Analysis	GHD	1.63 MGD from supporting table	2.82 MGD from full build out to Mariposa system.
January 2015	Water and Sewer Analysis for Golden State Warriors Arena @ Mission Bay Blocks 29-32	BKF	0.16 MGD (114 GPM) from new development in blocks 29-32	1.1 MGD (746 GPM) from new development in blocks 29-32

Process to Determine Needed Interim Improvements:

The proposed interim and long-term improvements to the Mariposa Pump Station are based on projected flows from contributing areas. The following procedure was used in this analysis:

- Determine tributary area and existing sanitary flow and pump operation.
- Estimate future sanitary and peak flow rates from user's part of the tributary area contributing to the Mariposa pump station.
- Propose adequate gravity sewer size to convey projected peak sanitary flows to existing dry weather sump.
- Determine size and location for new sewer connection to utilize existing transport storage box in event of sanitary flow exceeding the pump capacity or as a dry weather flow diversion during future construction/maintenance of the sanitary sump/pumps or force main.
- Summarize Waste Water Enterprise interim improvements to the pump station and force mains to accommodate interim flows resulting from the UCSF Medical Center.

Defined Design Constraints:

- Required static head of 35.5 ft to lift sanitary flow from existing dry weather sump at MPS to the discharged manhole at intersection of 21st St/Illinois St. The existing pump set point upstream in the dry weather sump is set to -11.5 ft and the invert of the discharge pipe is set to 24.0 ft relative to City datum.
- Minimum flow velocity of 3 ft/s needed to flush debris from proposed force main.
- Flow velocity not to exceed 8 ft/s to protect force main from abrasion/scour.

Summary of Findings/Recommendations for Interim Improvements:

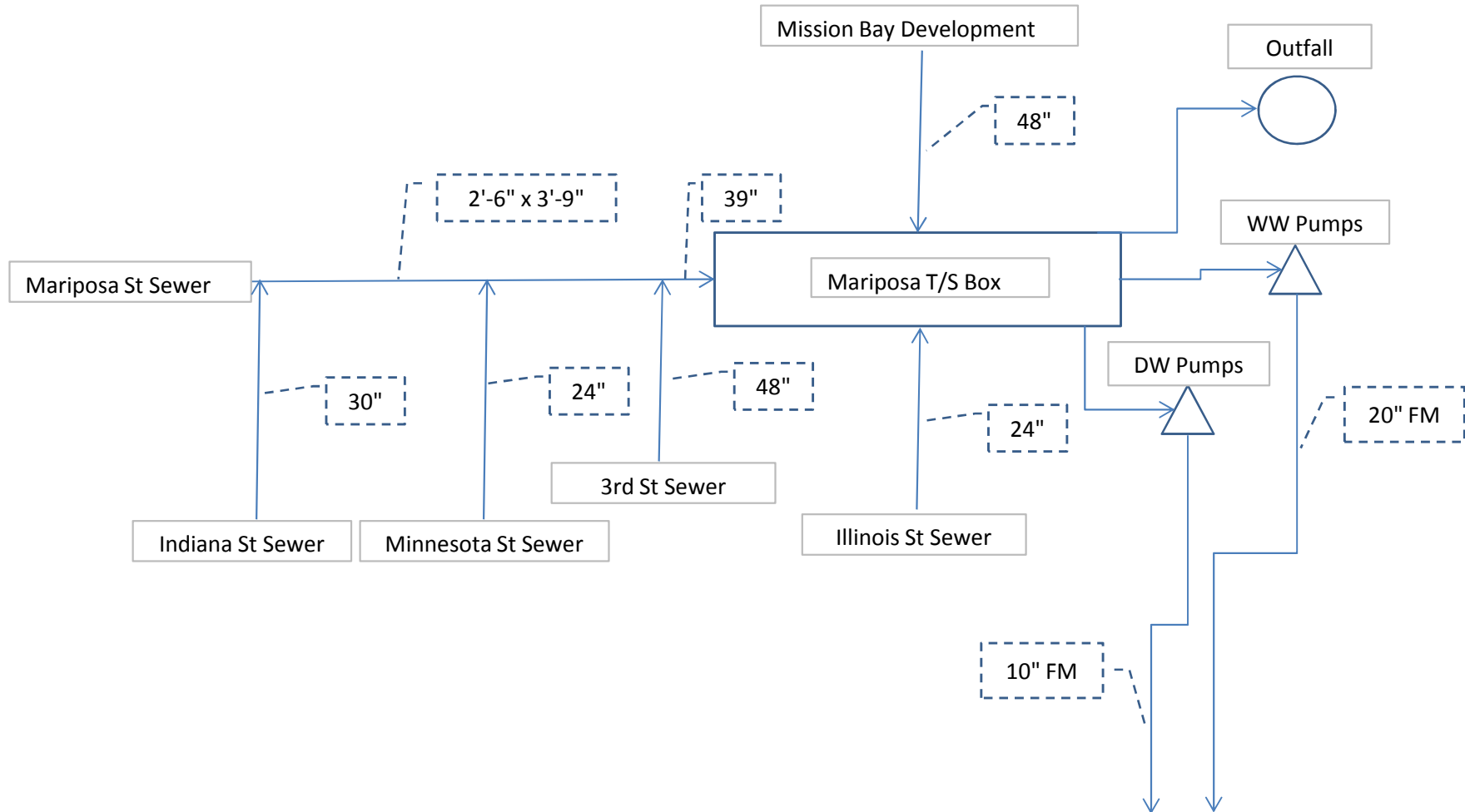
- The interim option to accommodate additional flows from the UCSF hospital is to connect the existing 10-inch sanitary force main to the 20-inch wet weather force main. This will enable the MPS DW pumping capacity of the existing sanitary pumps from approximately 1.2 MGD to approximately 3.5 MGD (see Attachment 3 for pump curves provided by SFPUC WWE-Mechanical Section). This solution will only be able to accommodate a small number of future users that will connect to the sewer system. A long-term improvement plan will need to be analyzed and may consider a number of alternates that will convey full development flow to SEP.
- Current flow meter data within the contributing tributary and sanitary pump station confirms the existing inflows are reaching dry weather pumping capacity at Mariposa PS.
- The estimated total Mariposa PS dry weather peak flow is 4.8 MGD (This peak value is based on the map provided by F&L consultant of UCSF) discharge after full development of Mission Bay to the Mariposa DW Pump Station in addition to calculations reviewed by DPW-Hydraulics to estimate peak flows from lots owned by the Warriors (see Attachment 3).

- The existing 12-inch sewer main on Mariposa St between 3rd St and the Mariposa PS dry weather sump will need to be enlarged to 24-inch HDPE to accommodate full development flows (See Attachment 4 for detailed calculations).
- Hydraulic capacity of the downstream gravity sewers which discharge to the South East Treatment Plant will need to be assessed under full development conditions and will be conducted as part of the long term improvement study.
- Future study will include recommendations for long term improvements (pumped or gravity) to account for full Mission Bay development.


Note: This analysis excludes the aspect of solid/grit handling and odor control. Flow calculations are subject to change as a result of new development in the Mariposa watershed.

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 SFPUC: Tony Flores George Engel Michael Tran Brian Carlomagno Ed Ho Marla Jurosek
 Lori Regler Leslie Webster

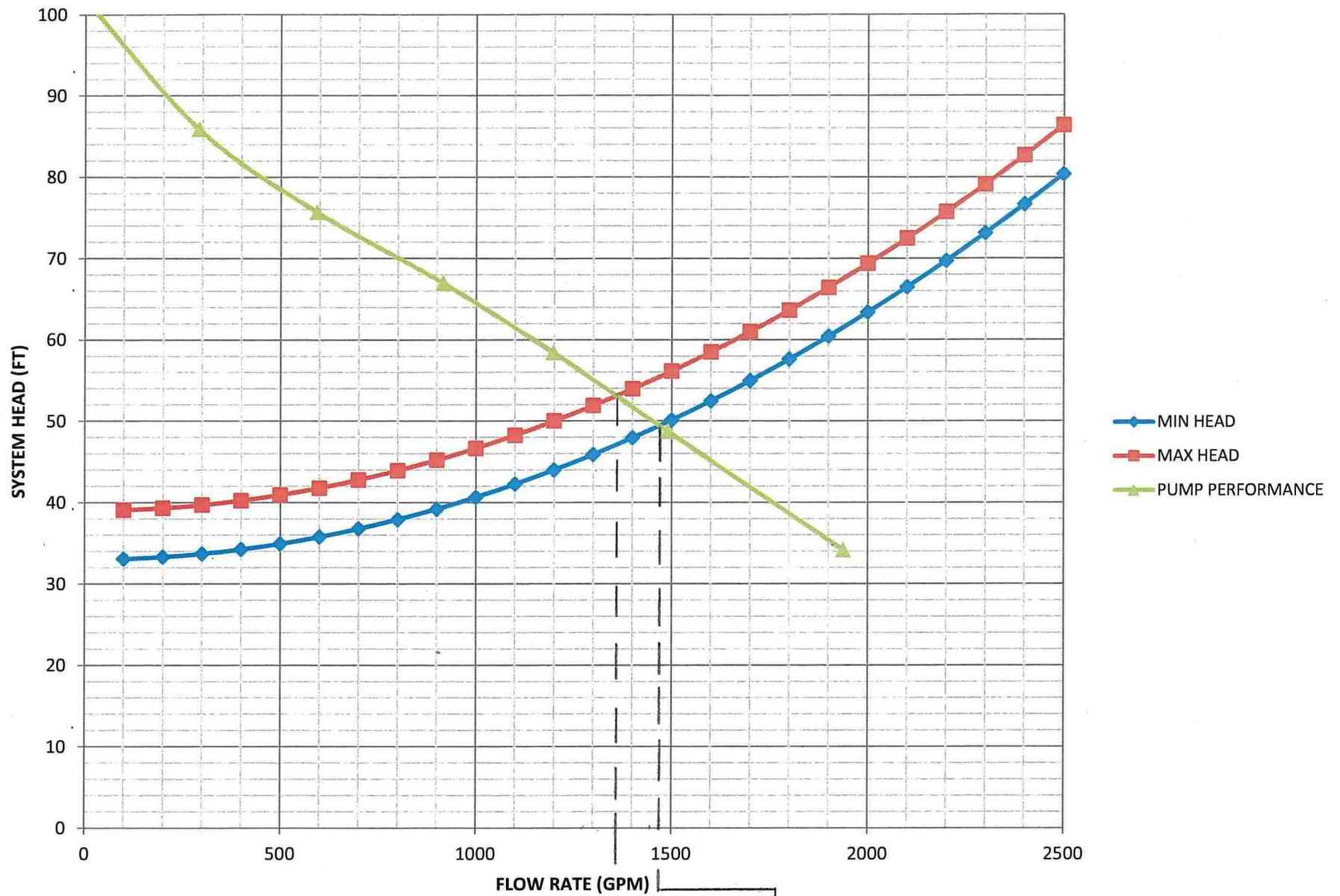
Mariposa Drainage System Schematic





<div><div>●</div>Manhole</div> <div><div><div></div><div></div></div>Existing Network</div> <div><div></div>Catchment</div>		HYDRAULIC STUDY: MISSION BAY/MARIPOSA PS SANITARY FLOW ANALYSIS		STUDY BY: BA	APPROVED BY: WL	HYD JO: 2508J
		TRIBUTARY AREA (SANITARY) AND EXISTING NETWORK MAP		ATTACHMENT 2		

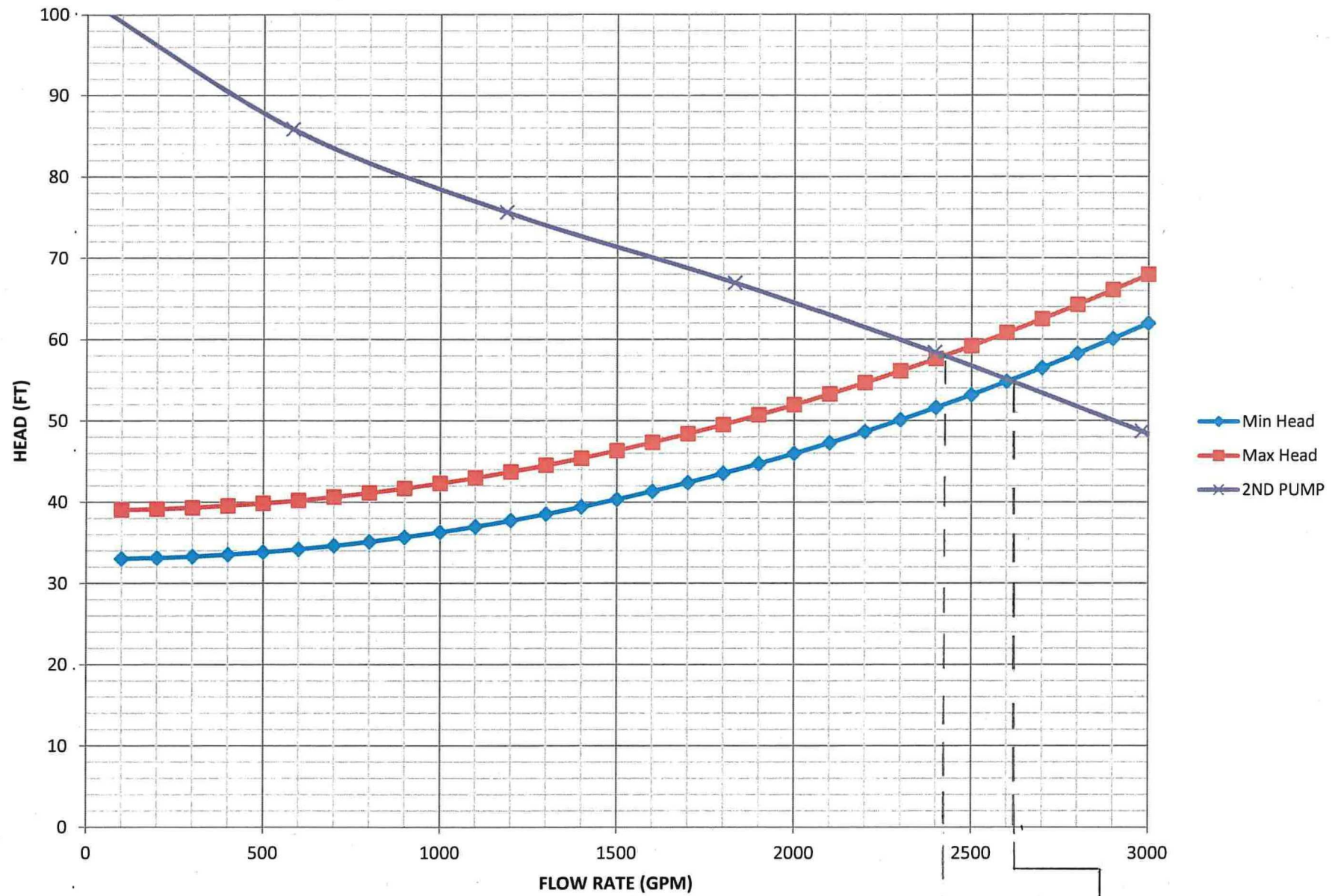
Single Pump System Curve



1360 GPM
(1.9 MGD)

1465 GPM
(2.1 MGD)

Two Pump System Curve

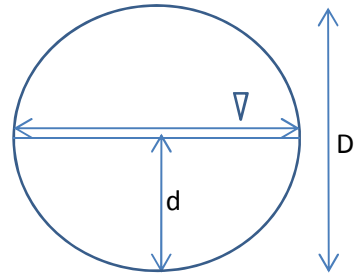


2420 GPM (3.5 MGD) 2620 GPM (3.8 MGD)

Hydraulic Capacity Calculation For Existing 24-inch Mariposa St Sewer Main

Parameters

Pipe Diameter (D)	24	inches
Pipe Radius (R)	12	inches
Slope (So)	0.004	ft/ft
Depth of Flow (d)	f(Q)	ft
Manning's (n)	0.01	--
Design Flow Rate Q _d	4871.7	gpm
Flow Area (A)	f(Q)	sq. ft
Wetted Perimeter (P)	f(Q)	ft
Hydraulic Radius (R)	(A/P)	ft
Flow Rate (Q)	AxV	gpm (cfs)
English Unit Conversion	1.49	--
Unit Conversion	1 cfs =	448.8 gpm



$$V = (K_u/n) R^{2/3} S^{1/2}$$

Manning's Equation Used for Velocity Calculation

	Flow Depth < D/2	Flow Depth > D/2
Circular Segment Height (H)	H=d	H=D-d
Central Angle (θ)	$\theta = 2\arccos[(r-H)/r]$	$\theta = 2\arccos[(r-H)/r]$
Circular Segement Area (K)	$K = r^2(\theta - \sin\theta)/2$	$K = r^2(\theta - \sin\theta)/2$
Arc Leng (s)	$s = r \times \theta$	$s = r \times \theta$
Flow Area (A)	$A = K$	$A = \pi r^2 - K$
Wetter Perimeter (P)	$P = s$	$P = 2\pi r - s$
Hydraulic Radius (R)	$R = A/P$	$R = A/P$

[illegible]

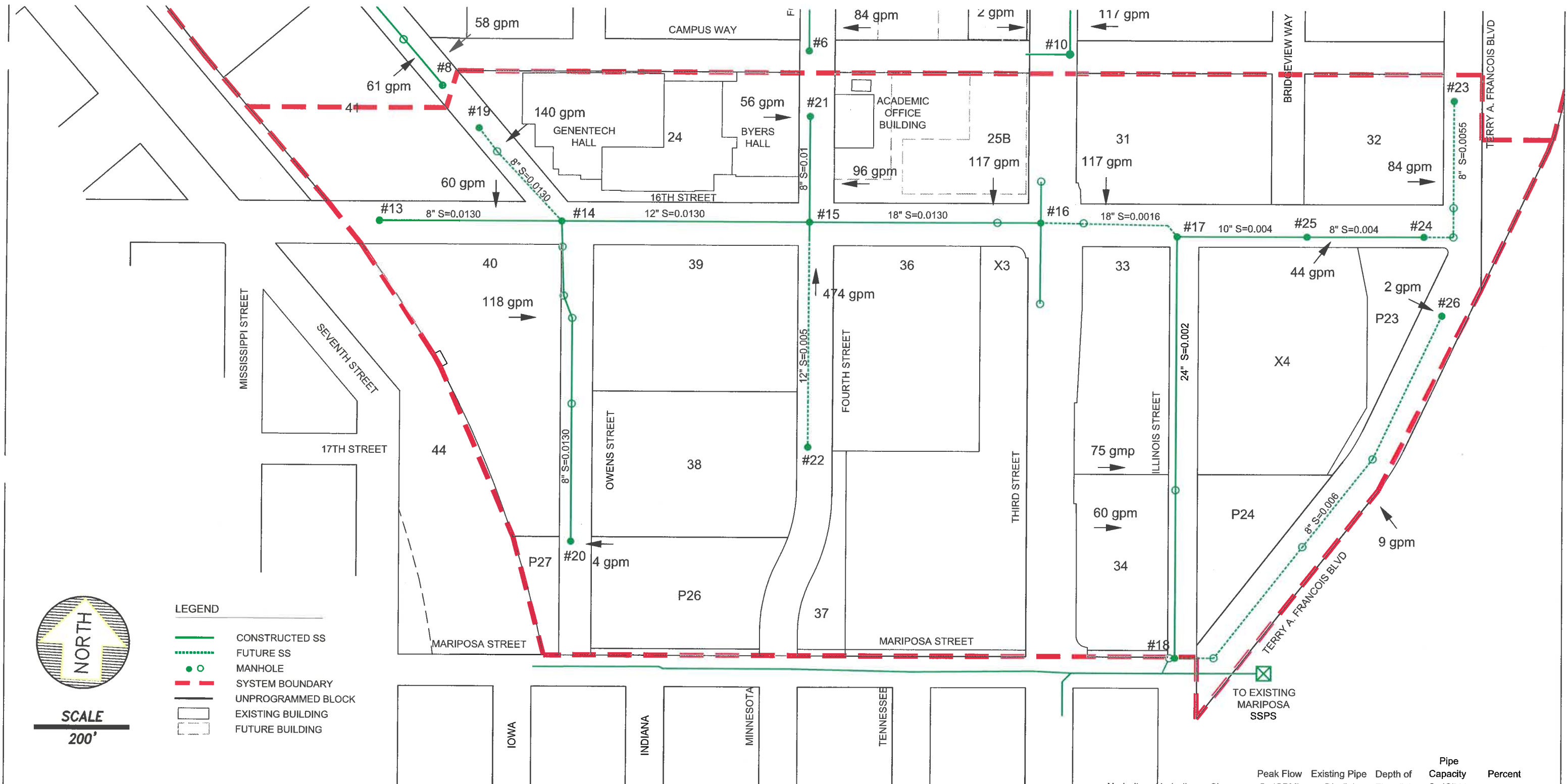


EXHIBIT 3
MISSION BAY UCSF LRDP
BLOCKS 15, 16, 18, 23, 25
SANITARY SEWER EXHIBIT



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Node #	Node #	Slope	Peak Flow Q=(GPM)	Existing Pipe Dia (in)	Depth of Flow (in)	Pipe Capacity Q=(GPM)	Percent Full
13	14	0.0130	143	8	1 5/8	628	21%
14	15	0.0130	322	12	3 3/8	1,822	28%
15	16	0.0130	1065	18	5 3/8	5,376	30%
16	17	0.0016	1182	18	10 3/8	1,885	57%
17	18	0.0020	1445	24	9 3/8	4,542	39%
19	14	0.0130	140	8	2 5/8	628	33%
20	14	0.0130	122	8	2 3/8	628	30%
21	15	0.0100	152	8	2 7/8	547	36%
22	15	0.0050	474	12	5 3/8	1,131	45%
23	24	0.0055	84	8	2 1/2	408	32%
24	25	0.0040	128	8	3 3/8	345	42%
25	17	0.0040	128	10	3 1/8	614	21%

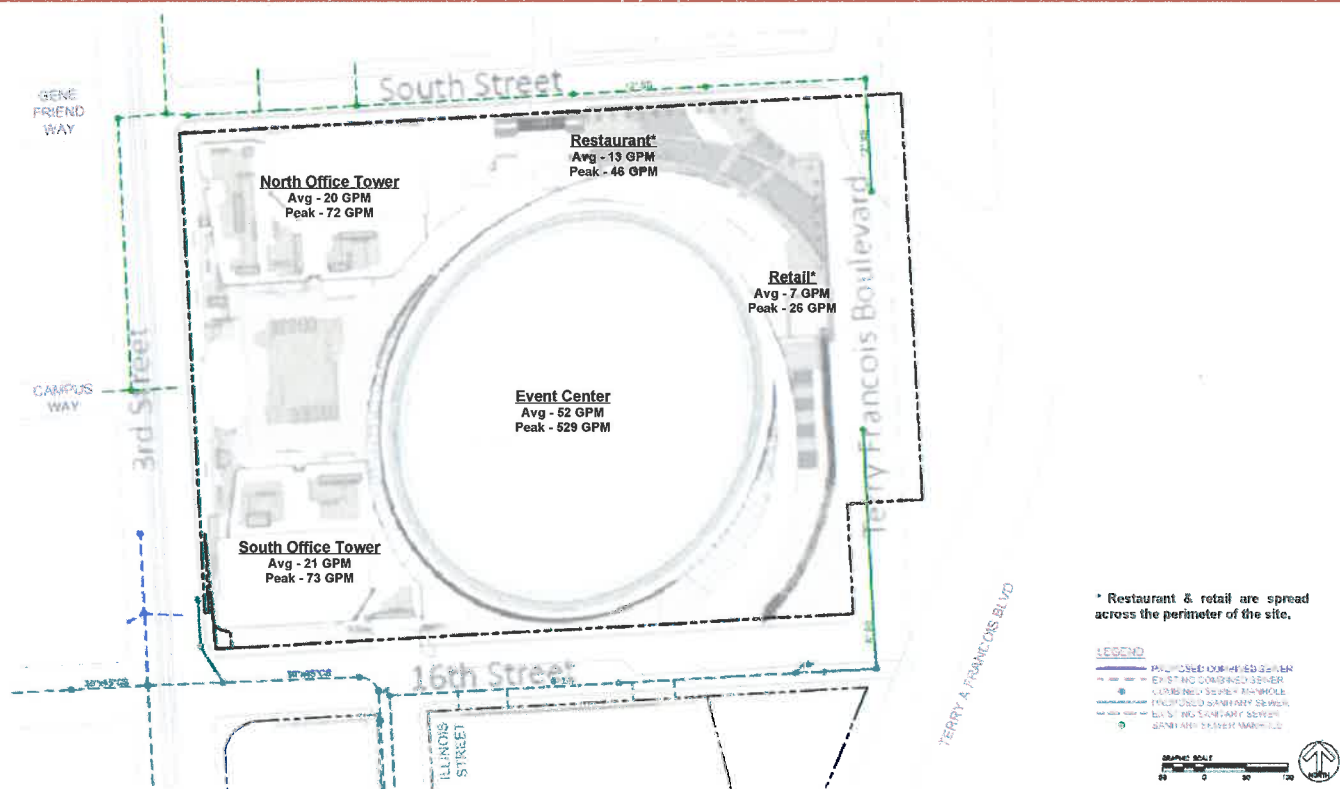
UCSF Flows Tributary to the Mariposa Pump Station

8/4/2014

Block	Peak Flow (see note 1) (GPM)	Projected Peak Flow (GPM)	Master Plan Peak Flow (GPM)	Net Peak Flow Difference (GPM)
24a/b	213		116	97
24c	27		42	-15
25a		96	42	54
25b		117	70	47
33/34		190	135	55
Hospital		474	429	45
			Net:	283

- Notes:
- 1) Peak Flows from Blocks 24a/b and 24c are from water purchased (90%) multiplied by peaking factor of 3.
 - 2) Hospital Blocks encompass Blocks 36, 37, 38, 39, X3.
 - 3) Projected Peak Flows are from UCSF Planned Development.
 - 4) Net increase of 283 GPM Peak Flow (94 GPM average flow)

SANITARY SEWER EXHIBIT



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