CASTRO VALLEY SANITARY DISTRICT

Wastewater Collection System Master Plan Update

MARCH 2016

WEST YOST ASSOCIATES

Wastewater Collection System Master Plan Update

Prepared for

Castro Valley Sanitation District

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1.0 INTRODUCTION

The purpose of this Wastewater Collection System Master Plan Update (this report) is to validate the Castro Valley Sanitary District (CVSan) hydraulic capacity upgrade projects identified in the previous master planning documents using recently-collected flow monitoring data, and to update the CVSan capital improvement plan (CIP) with the resulting hydraulic capacity upgrade projects.

This report is intended to serve in parallel with the 2015 CVSan Gravity Sewer Asset Management Plan. That report addresses issues related to maintaining and improving collection system facilities based on condition assessment information, whereas this report is primarily intended to address system capacity concerns.

This report is organized to address the key topics covered in previous master planning documents. Accordingly, this report consists of the following sections:

- Background Information
- Wastewater Flows
- Hydraulic Model Updates
- Capacity Analysis
- Updated Capital Improvement Recommendations

2.0 BACKGROUND INFORMATION

This section discusses key background information including sources of information, an existing system description, and previous CVSan master plans.

2.1 Sources of Information

The following documents and information were provided by CVSan and are used in this analysis:

- Castro Valley Sanitary District Wastewater Collection System Master Plan by Brown and Caldwell, dated June 2, 2006 (2006 Master Plan)
- Collection System Master Plan Update Phase 1 by Castro Valley Sanitary District, dated December 19, 2011 (Phase 1 – Preliminary Design Report)
- Collection System Master Plan Update Phase 2 by Castro Valley Sanitary District, dated November 26, 2012 (Phase 2 – Alternatives Analysis)
- CVSan Graphic Information Systems wastewater asset layers, provided by CVSan staff on December 17, 2015
- Castro Valley Sanitary District Sewer Flow Monitoring And Inflow / Infiltration Study (2015 Flow Monitoring Study), dated June 2015

2.2 Existing System Description

CVSan is a Special District whose purpose is to manage the collection system facilities in the unincorporated community of Castro Valley, located in Alameda County. CVSan's collection system conveys approximately 3.2 million gallons per day (mgd) of wastewater average daily dry weather flow (ADWF) from a population of 61,388, based on the 2010 census. The conveyed wastewater is ultimately treated by the Castro Valley/Oro Loma Sanitary District Wastewater Treatment Plant in San Lorenzo. The CVSan collection system consists of approximately 148 miles of gravity sewer pipe, the majority of which is vitrified clay pipe (VCP), as shown in Table 1, plus 1.8 miles of force main and eight pump stations. The existing system is depicted in Figure 1.

Table 1. CVSan Collection System Pipe Lengths and Materials

Material Type	Length of Pipe (LF)	% of System
Ductile Iron Pipe	17,276	2.2
Vitrified Clay Pipe	737,278	94.3
Other Materials	19,986	2.6
Unknown	7,647	1.0
Total	**782,187 (148 miles)**	**100**

2.3 Previous Master Plans

This section describes the key previous CVSan master planning documents, which include:

- 2006 Master Plan
- Master Plan Update Phase 1 – Preliminary Design Report
- Master Plan Update Phase 2 – Alternatives Analysis

2.3.1 2006 Master Plan

The 2006 Master Plan used the following methodologies to evaluate the capacity and condition deficiencies of the system:

1. Peak wet weather flow (PWWF) was projected using a 10-year, 24-hour design storm based on Alameda County rainfall data.
2. Flow monitoring data were collected in 2005/2006 District-wide from various sub-basins to calibrate a hydraulic model that simulated the performance of the collection system under average dry weather and peak wet weather conditions. The Data from the existing CVSan flume that measures flows at the downstream end of the system were also used in the analysis.
3. Minor surcharging was considered to be allowable during the 10-year, 24-hour design storm. Gravity pipes were considered deficient if surcharging occurred 0.5 feet above the crown of shallow sewers (i.e., with less than five feet of cover) and 2.0 feet above the crown of deeper sewers (i.e., with greater than five feet of cover).

N

0 0.2 0.4

Miles

Symbology

- Gravity Main
- Pump Station
- Force Main
- District Boundary

REDWOOD RD

LAKE CHABOT RD

SEVEN HILLS RD

STANTON AV

FOREST AV

CASTRO VALLEY BL

E CASTRO VALLEY BL

CROWN CANYON RD

VILLAREAL DR

GROVE WY

580

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Figure 1

Existing Collection System

Castro Valley Sanitary District
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Last Saved: 1/5/2016 1:55:51 PM \\Wos-FS01\Walnut Creek\Clients\455 Castro Valley Sanitary District\06-13-03 Dist Engineer\GIS\Figures\Master plan Update\Figure1 Existing Collection System.mxd - nshojai

4. Pump stations were considered deficient if the PWWF during the 10-year, 24-hour design storm exceed the pump station firm capacity (i.e., with one pump out of service). Force mains were considered deficient if the maximum velocity of 7 feet per second (fps) is exceeded during PWWF conditions.
5. Condition assessment data of 69 percent of the system collected by CVSan between 1997 and 2006 was used to prioritize condition improvements. Prior to 2007, CVSan used a proprietary VHS-based CCTV data collection software that integrated with Hansen, CVSan's CMMS software. A review of the condition data revealed significant discrepancies in the database due to miscoding and a lack of quality control in CCTV data collected prior to 2007. Since 2007, CVSan has implemented the uniform, industry-standard NASSCO condition assessment rating system, and currently has NASSCO-certified CCTV operators that provide CVSan with more uniform, higher-quality condition data.

The 2006 Master Plan projected a PWWF of approximately 35 mgd at the downstream end of the system during the 10-year, 24-hour design storm. That report also identified capital improvement projects that were prioritized into five categories based on the potential for SSOs and other considerations.

2.3.2 Master Plan Updates Phase 1 – Preliminary Design Report

Phase 1 of the Master Plan Update served as a preliminary design report for the repair projects identified in the 2006 Master Plan. Because of missing or inadequate video records for the majority of the repair projects specified in the 2006 Master Plan, 36 percent of those projects were reviewed, with the result that 51 pipe segments were confirmed as needing repair or replacement.

2.3.3 Master Plan Update Phase 2 – Alternatives Evaluation

Phase 2 of the Master Plan Update serves as an Alternatives Evaluation that revisited the methodologies and results from the 2006 Master Plan, and concluded that unit costs for system improvements were significantly underestimated, but that the recommended repairs were likely more extensive than needed. The Phase 2 Master Plan Update presented options for further consideration and analysis, including collecting additional flow monitoring data, conducting infiltration and inflow (I/I) reduction pilot studies, performing benchmarking studies, and also included updated costs for the CIP.

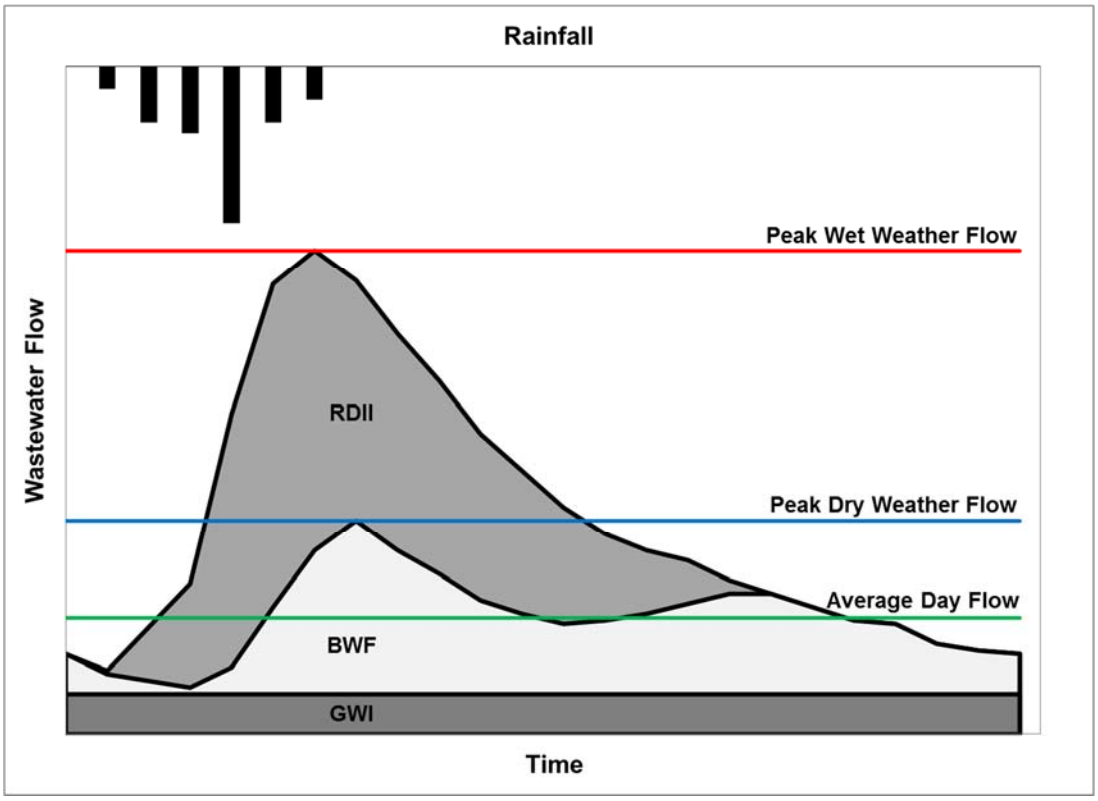
3.0 WASTEWATER FLOWS

This section discusses wastewater flow components, the 2015 Flow Monitoring Study, and outfall flume flows related to wastewater flows within the CVSan collection system.

3.1 Wastewater Flow Components

PWWF is significantly greater than peak dry weather flow (PDWF) because of the presence of I/I. The various components of I/I are depicted in Figure 2. I/I is considered to have two major components: Rainfall-dependent I/I (RDII) and groundwater infiltration (GWI).

Figure 2. Wastewater Components for Typical PWWF Conditions



RDII consists of a combination of inflow and rainfall-dependent infiltration. Inflow is defined as storm water runoff directly entering a wastewater collection system though system leaks/openings (such as perforated manhole covers) and improper/illicit storm water connections (such as catch basins, roof leaders, cleanouts, foundation drains, drainage sump pumps, and area drains). Infiltration is defined as water traveling through the ground and entering the collection system through defective pipes, pipe joints, damaged lateral connections, and porous manhole walls. Non-rainfall-dependent GWI occurs when portions of a wastewater collection system are below the groundwater table for extended periods of time, even during dry weather periods. Rainfall-dependent infiltration occurs when groundwater levels briefly rise during storms to submerge portions of the wastewater collection system.

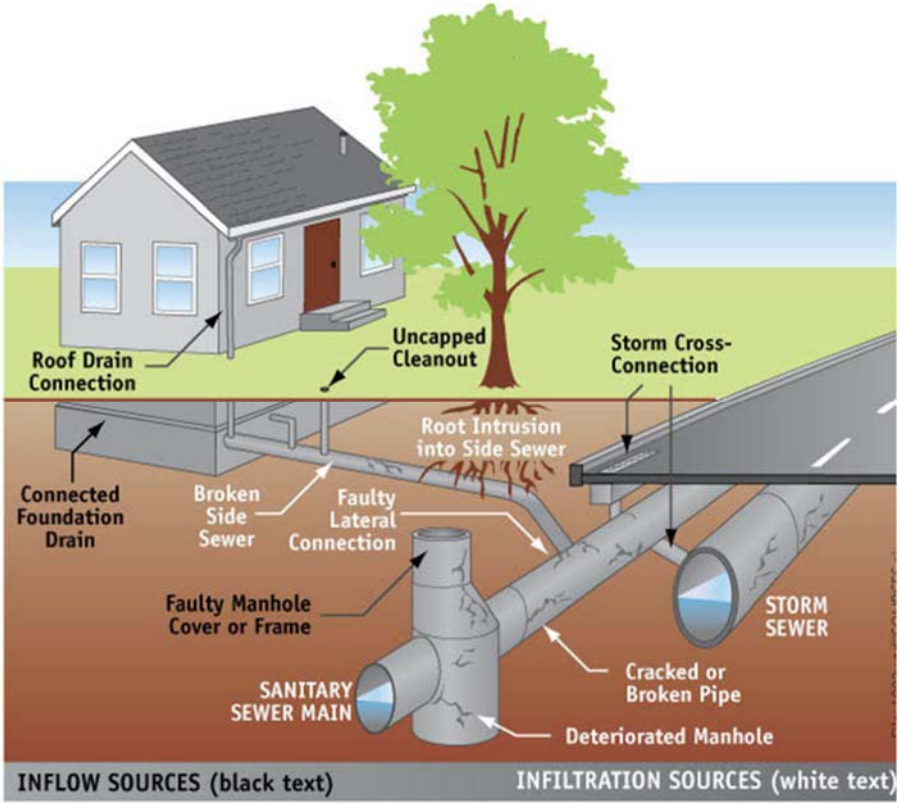
3.1.1 CVSan RDII Levels

CVSan is considered to have severe levels of inflow and infiltration (I/I) according to industry standards. Nationally, a typical PWWF-to-ADWF ratio above 3.5 is considered high. In the San Francisco Bay, collection systems with PWWF-to-ADWF ratios above 5 are common, and ratios above 8 or 9 are considered very high. It has been demonstrated in earlier Master Plans that CVSan has a PWWF-to-ADWF ratio of over 10 during design storm events (the 10-year, 24-hour storm). Moreover, these high ratios are short-term in nature, thus indicating a severe level of rainfall-dependent I/I. Therefore, the need exists to provide CVSan with a better understanding of the I/I occurring within the collection system in order to confirm the need for several of CVSan's currently-planned hydraulic capacity upgrade projects.

3.1.2 Sources of RDII

Typical sources of RDII into wastewater collection systems are shown in Figure 3. In addition to direct and illicit connections, aging and damaged sewer laterals are also commonly found in the San Francisco Bay Area to be a major contributor of RDII, since laterals are typically located on private property, poorly maintained, buried at shallow depths, and subject to tree root intrusions.

Figure 3. Typical Sources of RDII



3.1.3 Inflow Indicators

The first indicator of inflow is the fast response of collection system flow rates, where storm water rapidly flows into the collection system and causes a sharp increase in flows directly after rainfall begins. However, a similar collection system response can also occur due to rainfall-dependent infiltration entering defective shallow laterals, which often act as French drains for yard and driveway areas.

Smoke testing is a commonly-used method for locating individual inflow sources, although it is also generally understood that this procedure does not identify all sources of inflow. Smoke testing involves charging the collection system with non-toxic smoke, which fills the airspace of mains, manholes, and laterals. Once the system is charged, inspectors look for the emergence of smoke from building roof vents (indicating a legal connection of a building sewer lateral) and from illicit/improper connections such as:

- Storm drain cross-connections
- Area drains
- Roof drain/downspouts
- Basement/foundation drains
- Uncapped or loosely-capped cleanouts

Smoke will not pass through P-traps, surcharged pipes, sump pumps connected from basement drains, or moisture-saturated soil. In dry summer months, smoke can sometimes be observed emerging from the dry ground surface on private property, indicating poor private service lateral condition. It is for this reason that the mid- to late dry season tends to be the best time to perform such testing, when soil moisture is likely to be at a minimum. Smoke testing is typically contracted based on linear footage of main sewer line. Costs vary from $1.00 to $1.50 per linear foot, and testing of 7,000 to 10,000 feet per day is typically achievable.[1]

3.1.4 Infiltration Indicators

Infiltration can occur into any portion of the collection system that is not hydrostatically sealed. Typically, pipe material and age provides an indication of sewers likely to be deteriorated or subject to poor construction methods/techniques that were common in earlier eras.

Condition assessment data can also be used to identify possible infiltration sources. CCTV inspections are a common means of assessing the condition of pipelines and the potential for infiltration. Although CCTV inspections do not typically identify active points of RDII (because inspections are generally not practical during major storm events), some CCTV inspection observations can indicate potential infiltration problems. These include:

- Observed points of infiltration
- Pipe cracks/holes; broken pipe
- Offset/separated joints
- Root intrusion
- Defective lateral tap connections

The proximity of deteriorated sewer mains to a concentrated source of storm water such as creeks, drainage facilities, or areas of frequent street flooding can also indicate a higher likelihood of greater infiltration rates.

The Focused Electrode Leak Locator (FELL) technology detects the leak potential of a pipe by measuring the electrical resistivity of the pipe wall. Like water, electricity follows a path of least resistance, so a sewer that allows water to penetrate or leak can also allow electrical current to escape. Each defect is rated either “small,” “medium,” or “large,” based on a sonde current

[1] Sterling, Raymond L., et. al., Water Environment Research Foundation (WERF), *Methods for Cost-Effective Rehabilitation of Private Lateral Sewers*, 2006.

"threshold" established from comparison studies between previous data and joint pressure tests. The results can prioritize sewers for follow-up inspections and I/I reduction projects.

3.2 2015 Flow Monitoring Study

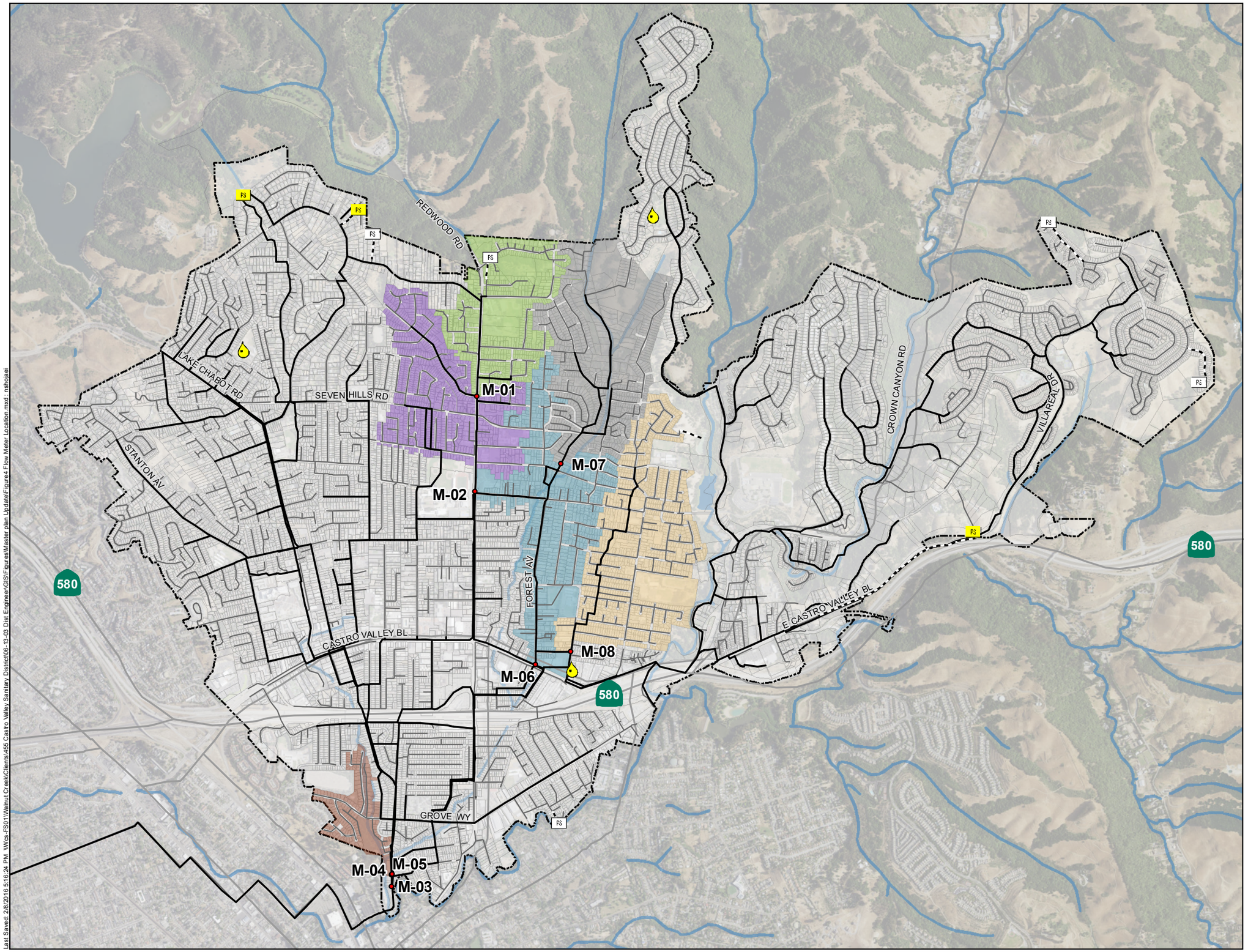
The 2015 Flow Monitoring Study (noted above) provided an assessment of baseline flows, peak flows, and peak I/I conditions from the 2014/2015 wet season. Key elements of that study that are discussed in this section include: 1) flow metering sites, 2) rainfall results, and 3) flow metering results.

3.2.1 Flow Metering Sites

The geographic configuration of flow metering sites and rain gauges used in the study are depicted in Figure 4 and summarized in Table 2. Figure 4 also shows the six collection system tributary basins of interest. The five basins north of Interstate-580 are defined by the fact that they are the primary areas contributing to trunk lines that are suspected of being undersized. A total of ten flow meters at eight distinct locations (designated as Sites M-1 through M-8), and two rain gauge sites (designated as RG-A and RG-B), were used in the study. These sites were selected either to capture flows from the five tributary basins of interest (Sites M-1, M-2, M-6, M-7, and M-8), or to represent the entire service area (Sites M-3, M-4, and M-5). Monitoring was performed over a period of approximately four months from November 18, 2014 to March 29, 2015.

Table 2. 2014/2015 Flow Monitoring Locations

Site No.	Description	Manhole No.	Diameter	Location	Purpose
M-1	Redwood Road (upstream reach)	27-69	8"	Redwood Rd. and Joseph Dr.	Validate Upper Redwood Road Capacity Project
M-2	Redwood Road (downstream reach)	MH310	6"	Redwood Rd. north and Heyer Ave.	Validate Upper Redwood Road Capacity Project
M-3N	Upstream of flume	24-15	15"	3rd St. south of Crescent Ave.	Verify flume accuracy; capture trunk flow splits to validate South of I-580 Capacity Project
M-3E	Upstream of flume	24-15	8"	3rd St. south of Crescent Ave.	Verify flume accuracy; capture trunk flow splits to validate South of I-580 Capacity Project
M-3W	Upstream of flume	24-15	8"	3rd St. south of Crescent Ave.	Verify flume accuracy; capture trunk flow splits to validate South of I-580 Capacity Project
M-4	Upstream of flume	24-3	33"	3rd St. at Crescent Ave.	Verify flume accuracy; capture trunk flow splits to validate South of I-580 Capacity Project
M-5	Upstream of flume	24-2	24"	3rd St. at Crescent Ave.	Verify flume accuracy; capture trunk flow splits to validate South of I-580 Capacity Project
M-6	Forest Avenue	30-54	15"	Forest Ave. at Castro Valley Blvd.	Validate Forest Avenue Capacity Project
M-7	Sandy Road	28-94	8"	Sandy Rd. north of James Ave.	Validate Sandy Road Capacity Project
M-8	Marshall Street	30-40	10"	Marshall St., north of Greenacre Rd.	Validate Marshall Street Capacity Project



N

0 0.2 0.4

Miles

Symbology

- Rain Gauge
- Flow Monitoring Site

2014/15 Flow Monitoring Basin

- 1
- 2
- 3-W
- 6
- 7
- 8
- Modeled Gravity Main
- Unmodeled Gravity Main
- Modeled Pump Station
- Unmodeled Pump Station
- Force Main
- District Boundary

Notes:
1. Metering sites 3,4, and 5 collectively represent flows from the entire system.
2. Metering site 3 includes meters 3-W, 3-N, and 3-E.

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Figure 4

2014/15 Flow Meter Locations

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The Site M-3 metering location has a 15-inch inlet from the north, an 8-inch inlet from the east, an 8-inch inlet from the west, and a 15-inch outlet to the south. In 2013/2014, flow was measured on the outlet pipe, but due to flow turbulence associated with three lines coming together, hydraulic conditions were not ideal. For the 2014/15 season, all three inlet lines were monitored separately to capture the total flow. These lines are designated at Site M-3N, Site M-3E, and Site M-3W.

3.2.2 Rainfall Results

The five largest storm periods captured in the 2015 Flow Monitoring Study span the following dates:

- November 19–22, 2014
- November 29–December 7, 2014
- December 11, 2014
- December 15–21, 2014
- February 6–9, 2015

Table 3 summarizes the rainfall totals at each rain gauge and peak rainfall intensity at rain gauge B for each of these storm periods. As indicated in the table, the December 11, 2014 storm was the most significant in terms of rainfall volume and rainfall intensity.

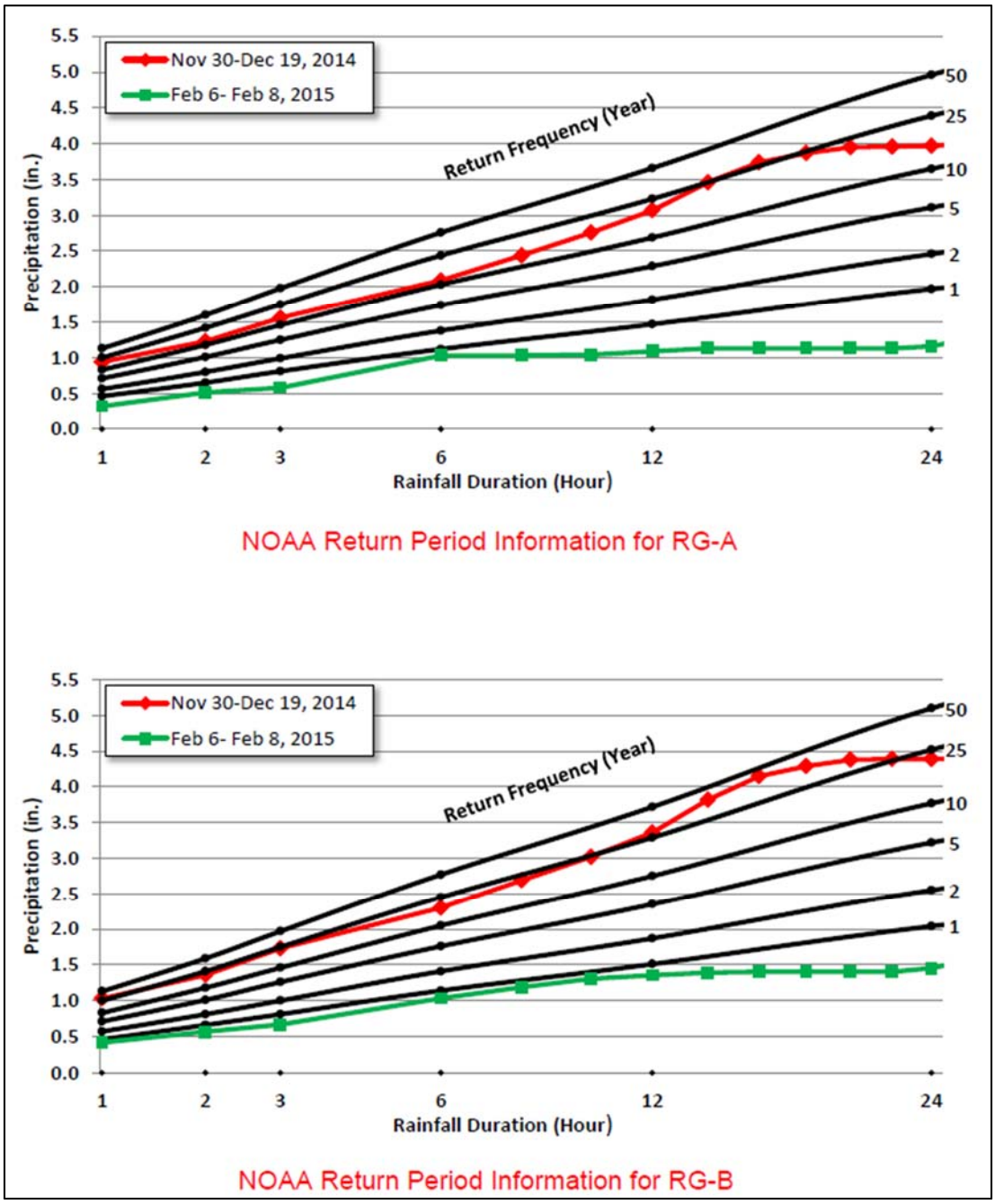
Table 3. Storm Period Rainfall Totals

Storm Period	RG-A Rainfall, in	RG-B Rainfall, in	RG-B Peak Rainfall Intensity (in/hr)
November 19–22, 2014	1.65	2.13	0.34
November 29–December 7, 2014	3.48	4.07	0.37
December 11, 2014	4.09	4.49	1.03
December 15–21, 2014	3.03	3.19	0.34
February 6–9, 2015	2.38	2.88	0.41

Based on existing long-term rainfall records, it is possible to put these storm periods into a historical context using historical rainfall information provided by the National Oceanic and Atmospheric Administration (NOAA) to derive long-term storm frequency and magnitude characteristics. These historical storm characteristics are defined in terms of return period and storm duration. For example, a 24-hour storm with a 10-year return period represents the peak 24-hour rainfall total for a given event that is expected to happen once every ten years, on average.

The monitored storm periods from the 2014/15 monitoring season are compared to historical storm characteristics for the Castro Valley area in Figure 5. As indicated in the figure, the February 3–6, 2015 storm period was not a historically significant event. However, rainfall during the December 11, 2014 storm (shown in the figure as covering the period from November 30 to December 19, 2014) had a return frequency of between 10 and 25 years for rainfall durations of 6-hours to 24 hours.

Figure 5. Storm Event Classification at RG-A and RG-B



Source: Castro Valley Sanitary District Sewer Flow Monitoring and Inflow/Infiltration Study, V&A, June 2015 (2015 Flow Monitoring Study).

3.2.3 Flow Metering Results

The flow metering results for the monitoring period are summarized in Table 4. As indicated in the table, all of the sites had peaking factors greater than 4.0, and most had peaking factors greater than 10.0. As noted above, these results are considered high according to industry standards and comparative San Francisco Bay Area agencies.

Table 4. Capacity Analysis Summary

Site	Pipe Diameter, in	ADWF, mgd	Peak Measured Flow, mgd	Peaking Factor	Peak Measured Depth, in	Surcharge Above Pipe Crown, ft
M-1	8	0.082	1.747	21.2	110.9	8.6
M-2	8	0.170	1.385	8.1	6.8	–
M-3N	15	0.306	1.823	6.0	9.2	–
M-3E	8	0.042	0.173	4.1	13.0	0.4
M-3W	8	0.009	0.471	50.9	10.0	0.2
M-4	33	1.471	18.784	12.8	25.0	–
M-5	24	0.825	9.331	11.3	21.7	–
M-6	15	0.206	2.85	13.8	8.7	–
M-7	8	0.128	1.811	14.1	9.6	0.1
M-8	10	0.157	1.669	10.6	8.5	–

3.3 Flume Flows

Flow data collected on 15-minute intervals at the existing CVSan outfall flume were available for the period of November 2014 through early January 2015. Flow metering sites M-3N, M-3E, M-3W, M-4, and M-5, when taken in aggregate, should approximate the flow measured at the flume (within the level of error of each flow meter). A comparison of the 15-minute data for the period of overlap of the two data sets (flume versus 5-site aggregate) is shown in Figure 6. Average daily flows for the period of comparison are shown in Figure 7. Some key conclusions of these comparisons include the following:

1. The two data sets generally track very closely for most of the period of comparison.
2. Beginning around December 19th, the flume drops suddenly and stays well below the 5-site aggregate for several days until slowly tracking back upward and reconverging around January 1st. Based on the prior data, it appears that the 5-site aggregate is more reliable during this period.
3. The flume tends to report slightly lower than the 5-site aggregate at low-flow conditions, and higher than the 5-site aggregate at high-flow conditions.

4.0 HYDRAULIC MODEL UPDATES

An H2OMapSewer model of the CVSan collection system was originally developed and used as part of the 2006 Master Plan. Since that time, collection system improvements have been constructed, the GIS data describing the system configuration has been updated, and additional collection system flow data have become available. Accordingly, this section summarizes the model network updates and dry and wet weather model calibrations.

Due to the built-out nature of the CVSan tributary area, land uses have remained largely unchanged since the 2006 Master Plan. As a result, no significant land use updates were needed.

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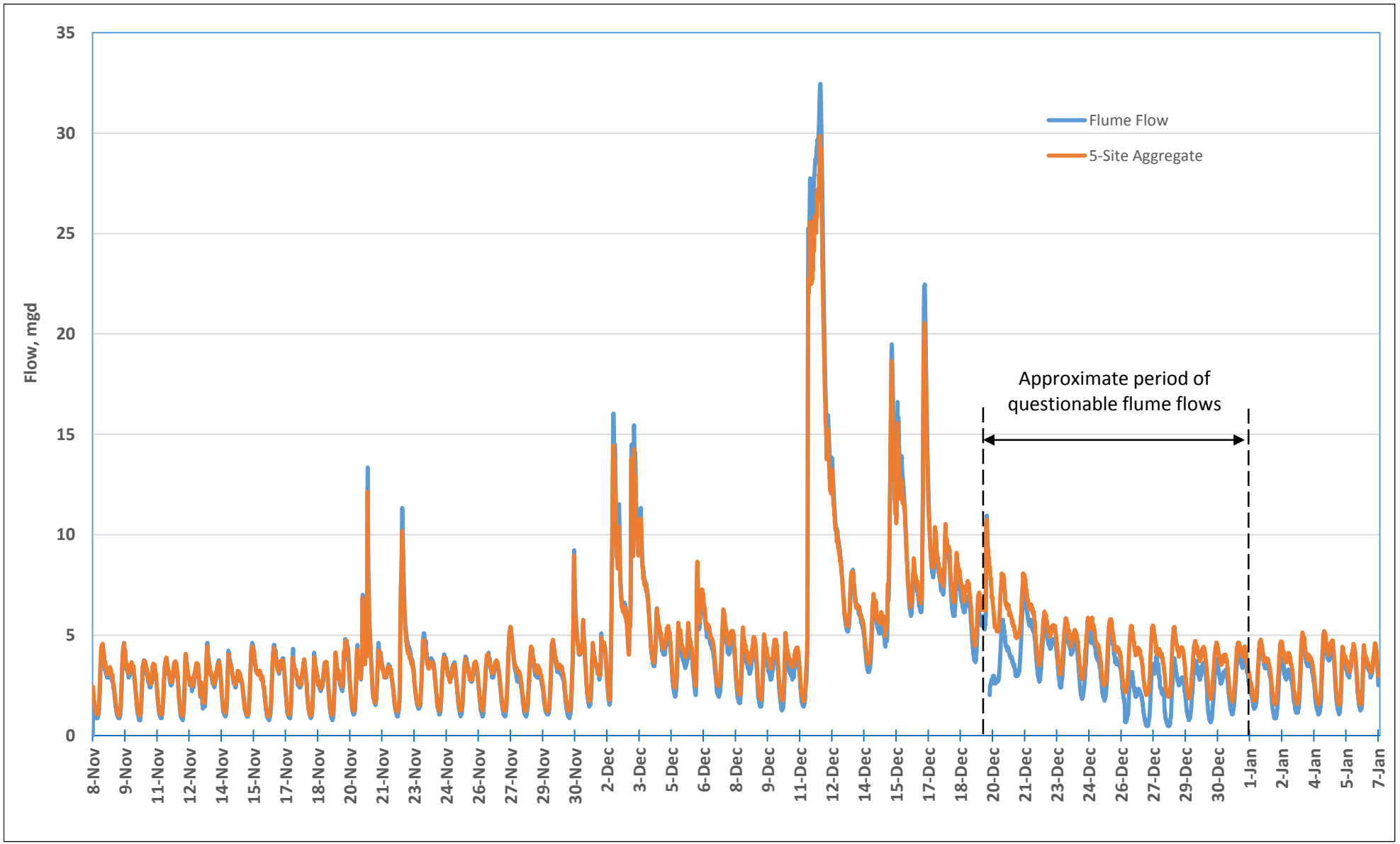

Figure 6

CVSan Flume versus 5-Site Aggregate Flows, 15-Minute Data

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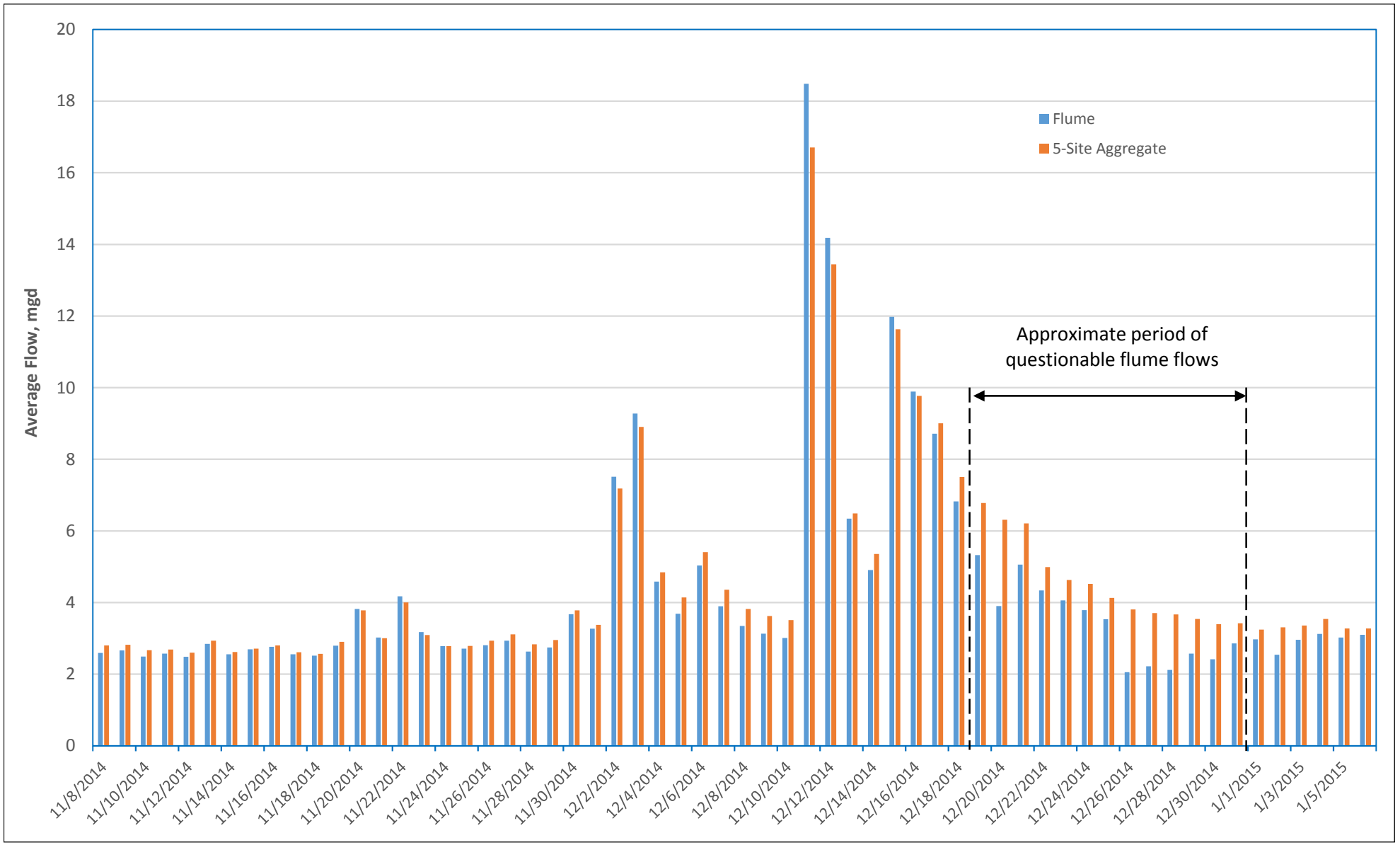

Figure 7

Daily Average Flows:
Flume versus 5-Site Aggregate

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In addition, the same pump stations that were modeled in the 2006 Master Plan are included in the current model. Specifically, the modeled stations include Pump Stations 3 and 5 located near the northern boundary of the system between Redwood Road and Lake Chabot Road, and Pump Station 7 on Villareal Drive, serving the northeastern corner of the system.

4.1 Model Network Updates

Pipe reaches that have been modified from the 2006 Master Plan model are also indicated in Figure 8, which shows the following distinctions between model elements:

1. Modeled facilities that remain unchanged from the 2006 Master Plan.
2. Revised model elements based on structural improvements that have occurred since the time of the 2006 Master Plan.
3. Revised model elements based on updated system information where no actual physical changes to the system have occurred.

4.1.1 System Improvements

System improvements that have been completed since the 2006 Master Plan are indicated in Figure 8 and include the following:

- The Lake Chabot Road improvements in the northwest area of the collection system.
- The Streetscape project that extends primarily along Redwood Road and Castro Valley Boulevard in the central area of the collection system.

4.1.2 Asset Registry Updates

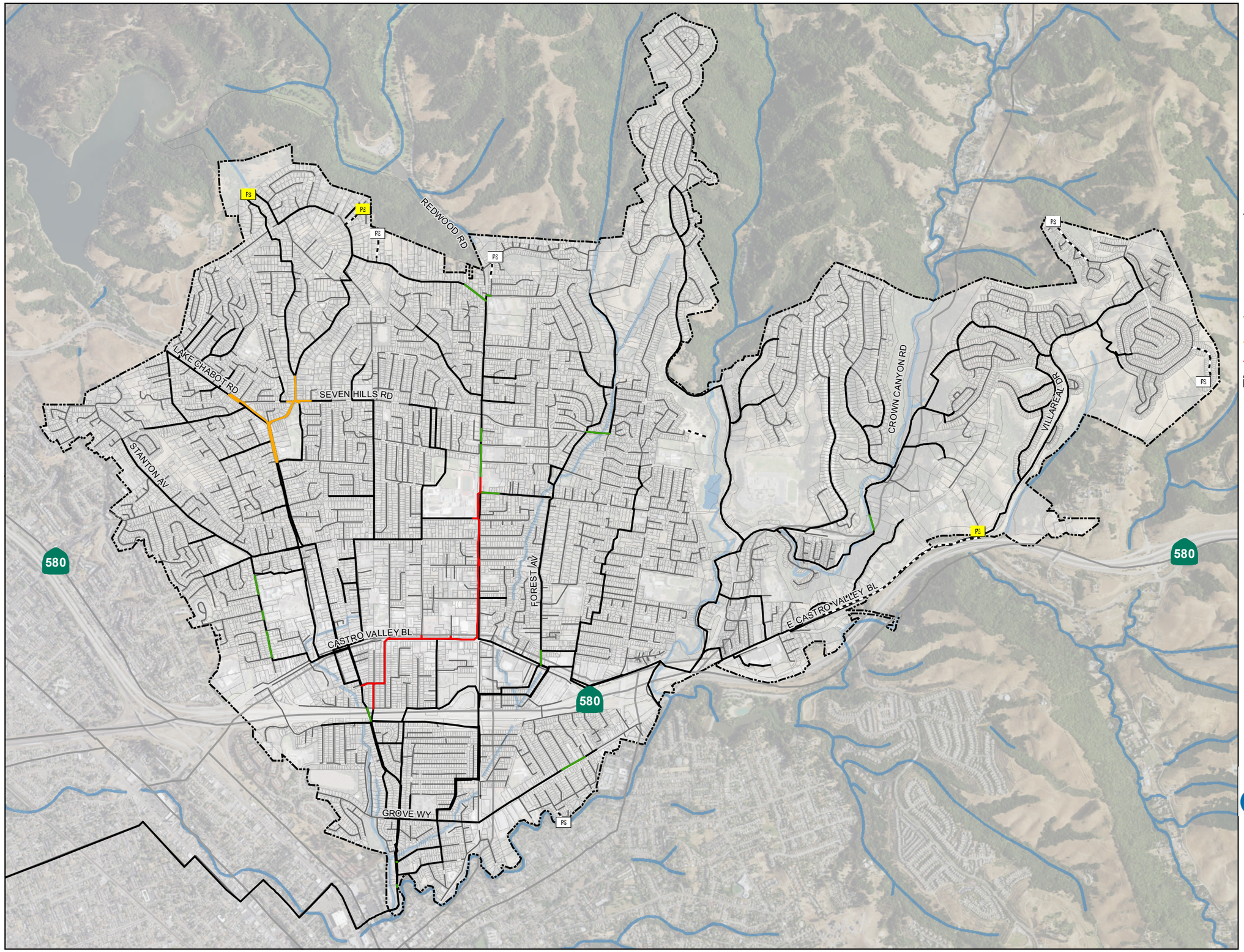
Asset registry updates refer to system information updates based on ArcGIS and Lucity data that have been updated since the time of the 2006 Master Plan. Several model segments were revised based on updated GIS information and are indicated in green in Figure 8.

4.1.3 Flow Splits

CVSan staff have provided detailed information on portions of the system where ambiguity previously existed regarding collection system hydraulics and sewer configuration. Documentation of system connectivity as obtained from discussions with and field verifications made by CVSan staff is presented in Appendix A.

4.2 Dry Weather Model Calibration

Dry weather calibration results for each metering site are summarized in Table 5. Detailed comparisons of measured and modeled diurnal dry weather flow conditions at each flow monitoring site are presented in Appendix B. The comparison of system-wide measured versus modeled diurnal dry weather flow is presented in Figure 9. As indicated in Table 5, for the system as a whole, the modeled ADWF is within 3.5 percent of the metered ADWF, while the modeled PDWF is within 7.1 percent of the metered PDWF.



Symbology

- Modeled Gravity Main
- Unmodeled Gravity Main
- Modeled Pump Station
- Unmodeled Pump Station
- Force Main
- Diameter Change Based on 2015 GIS
- Lake Chabot Road Improvement
- Streetscape Project
- District Boundary

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Figure 8

Model Network Updates

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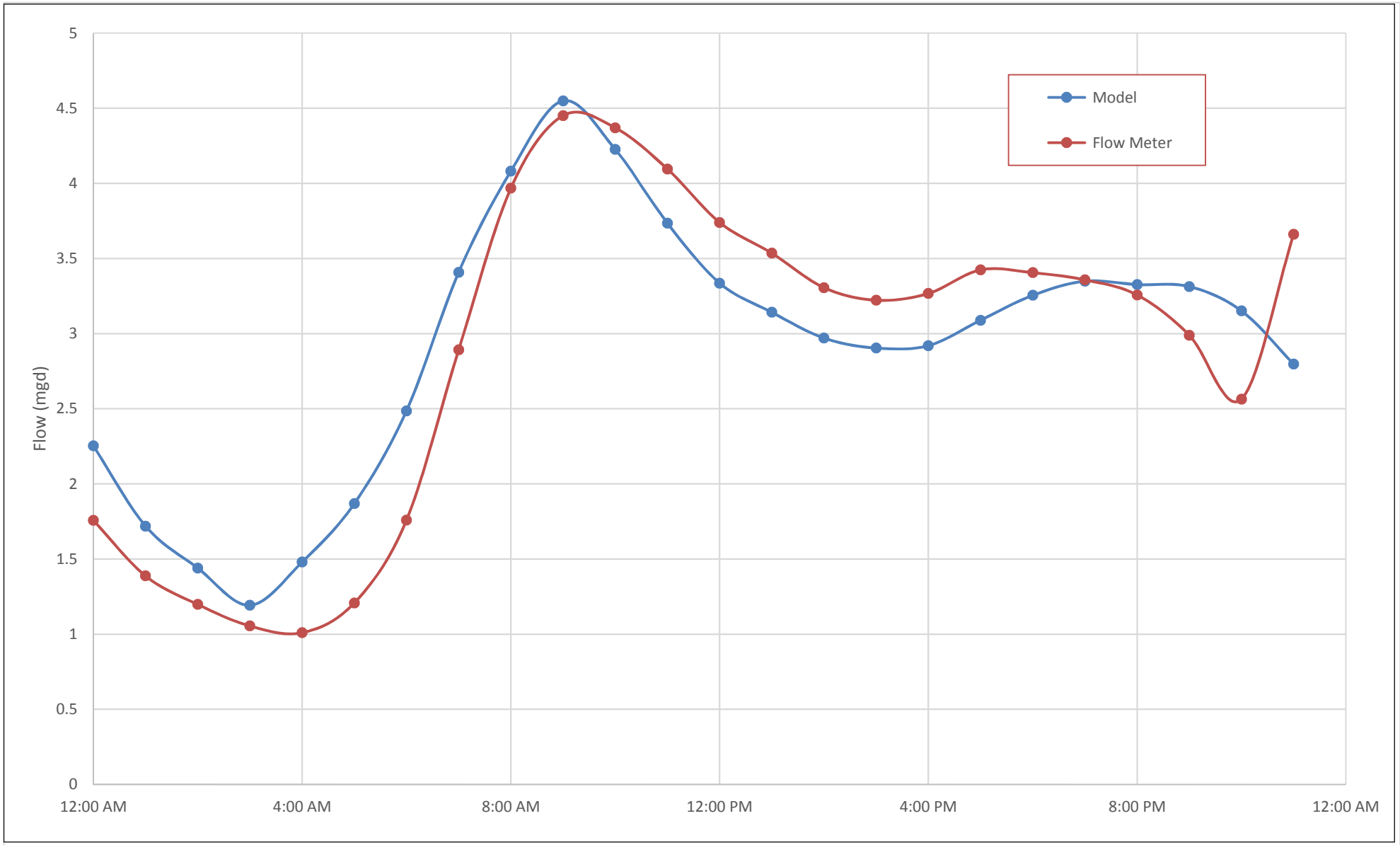

Figure 9

ADWF Comparison:
Metered versus Modeled Flow

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Table 5. Dry Weather Calibration Results

Meter	Meter Peak Dry Weather Flow, mgd	Model Peak Dry Weather Flow, mgd	Percent Difference	Meter Average Dry Weather Flow, mgd	Model Average Dry Weather Flow, mgd	Percent Difference
1	0.096	0.095	-1.0%	0.15	0.15	0.5%
2	0.18	0.18	-0.2%	0.29	0.29	1.5%
3-N[(a)]	0.31	0.32	2.3%	0.47	0.43	-7.1%
4	1.58	1.59	0.5%	2.52	2.58	2.5%
5	0.92	0.91	-0.2%	1.43	1.41	-1.2%
6	0.22	0.23	3.5%	0.34	0.35	3.0%
7	0.13	0.14	2.2%	0.19	0.20	0.7%
8	0.17	0.17	0.3%	0.30	0.29	-2.3%
System-wide	2.87	2.92	1.6%	4.45	4.55	2.2%

(a) The tributary areas to meters 3-E and 3-W were not specifically modeled, but instead the flow information from those meters were used in the calculation of system-wide flows.

Flow meters used to collect flow data typically have a margin of error of approximately two percent in velocity readings and ± 0.1" in depth readings, which combines to approximately ± 5 percent. Hydraulic models are considered to be calibrated well if flow projections are within ten percent of metered flows.

The ADWF calibration involves adjustment of the land use flow factors that were established in the 2006 Master Plan. Due to limited data, not all of the factors could be calibrated; however, many of the land use categories are relatively trivial in terms of flow generation. Therefore, for this analysis, ADWF calibration was limited to residential categories only. Moreover, the calibration involved a single adjustment factor applied to all of the residential categories. This assumption is considered reasonable given that the typical flow-generating behavior is not expected to vary widely from one residential land use category to the next.

The calibrated dry weather land use flow factors are compared to the factors from the 2006 Master Plan in Table 6. The results of the land use flow factor calibration are that all residential land use factors were reduced by 11.5 percent, and then appropriately rounded off.

Table 6. Land Use Flow Factors

Land Use Designation	Unit	Flow Factor	
		2006 Master Plan	Current Analysis
Single-Family Residential	gpd per parcel	170	150
Duplex to Quadplex	gpd per parcel	250	220
Multi-Family 1 (10 – 19.9 dwelling units per acre)	gpd per acre	2100	1900
Multi-Family 2 (29 dwelling units per acre)	gpd per acre	3800	3400
Multi-Family 3 (60 dwelling units per acre)	gpd per acre	7800	6900
Commercial	gpd per acre	1250	1250
Industrial	gpd per acre	500	500
Institutional	gpd per acre	350	350
Mixed Use	gpd per acre	3350	3350
Open Space/Vacant	gpd per acre	0	0

It should be noted that the baseline dry weather flows that were measured in 2014, and which serve as the basis for the dry weather flow calibration, reflect lower than normal wastewater flow generation rates due to the ongoing drought. As a result, the use of the newly-calibrated factors shown in Table 6 will be less conservative than the use of the previous factors, which may reflect more typical non-drought period wastewater flow generation rates. Therefore, the capacity analysis (discussed in Section 5.0) is performed using two separate simulations: one based on the newly-calibrated land use flow factors, and one based on the factors from the 2006 Master Plan.

4.3 Wet Weather Model Calibration

The wet weather calibration of the model involves the application of an R-T-K analysis to quantify the following three factors at each flow metering location in which peak wet weather flows were measured:

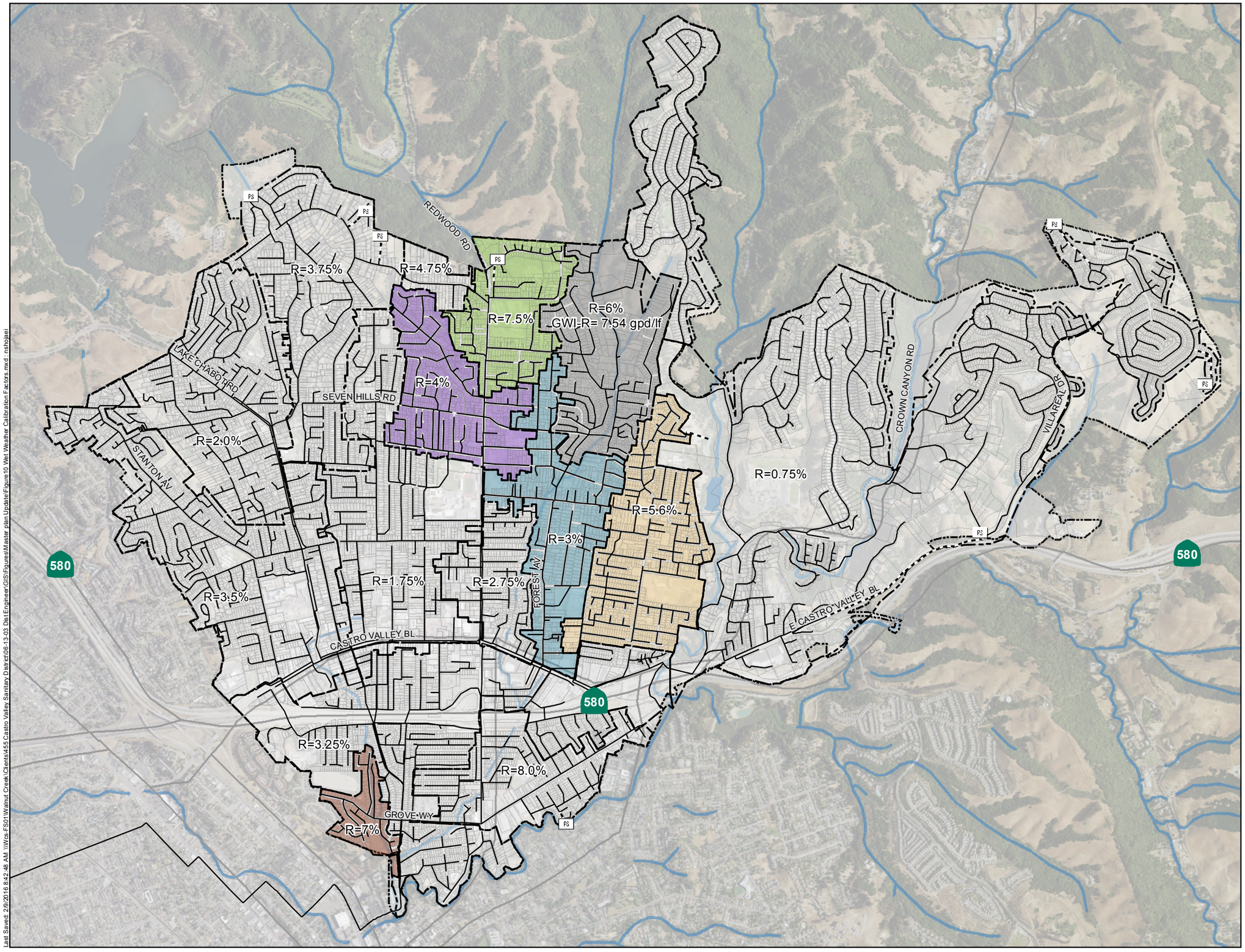
R-factor: The percentage of rainfall that enters the system in the form of I/I.

T-factor: The time from the storm onset to the runoff peak.

K-factor: A constant used in defining the shape of the hydrograph.

Of these, the R-factor has the clearest intuitive meaning, and also has the largest influence on the magnitude of the peak wet weather flow of any of the R-T-K factors. The resultant R-factors used in this study are shown on Figure 10. Because the number of flow monitors in the 2015 Flow Monitoring Study was significantly reduced from those deployed for the 2006 Master Plan, the R-T-K factors for areas not directly monitored in 2014/2015 were retained from the 2006 Master Plan.

The December 11, 2014 storm served as the basis for the PWWF calibration. Comparisons of measured and modeled diurnal peak wet weather flow conditions are presented in Appendix C. The comparison of system-wide measured versus modeled diurnal peak wet weather flow is presented in Figure 11.



Symbology

- Gravity Main
- Pump Station
- Force Main
- District Boundary
- Area with Unique R-Value

2014/15 Flow Monitoring Basin

- 1
- 2
- 3-W
- 6
- 7
- 8

Notes:
1. R: The Total Effective Rainfall Volume (%)
2. GWI-R: Ground Water Infiltration Rate (gpd/lft)
3. R-values taken from 2006 SSMP, except for areas with colored hatching.

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Figure 10

Calibrated R-Factors for PWWF Conditions

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WWCS Master Plan Update

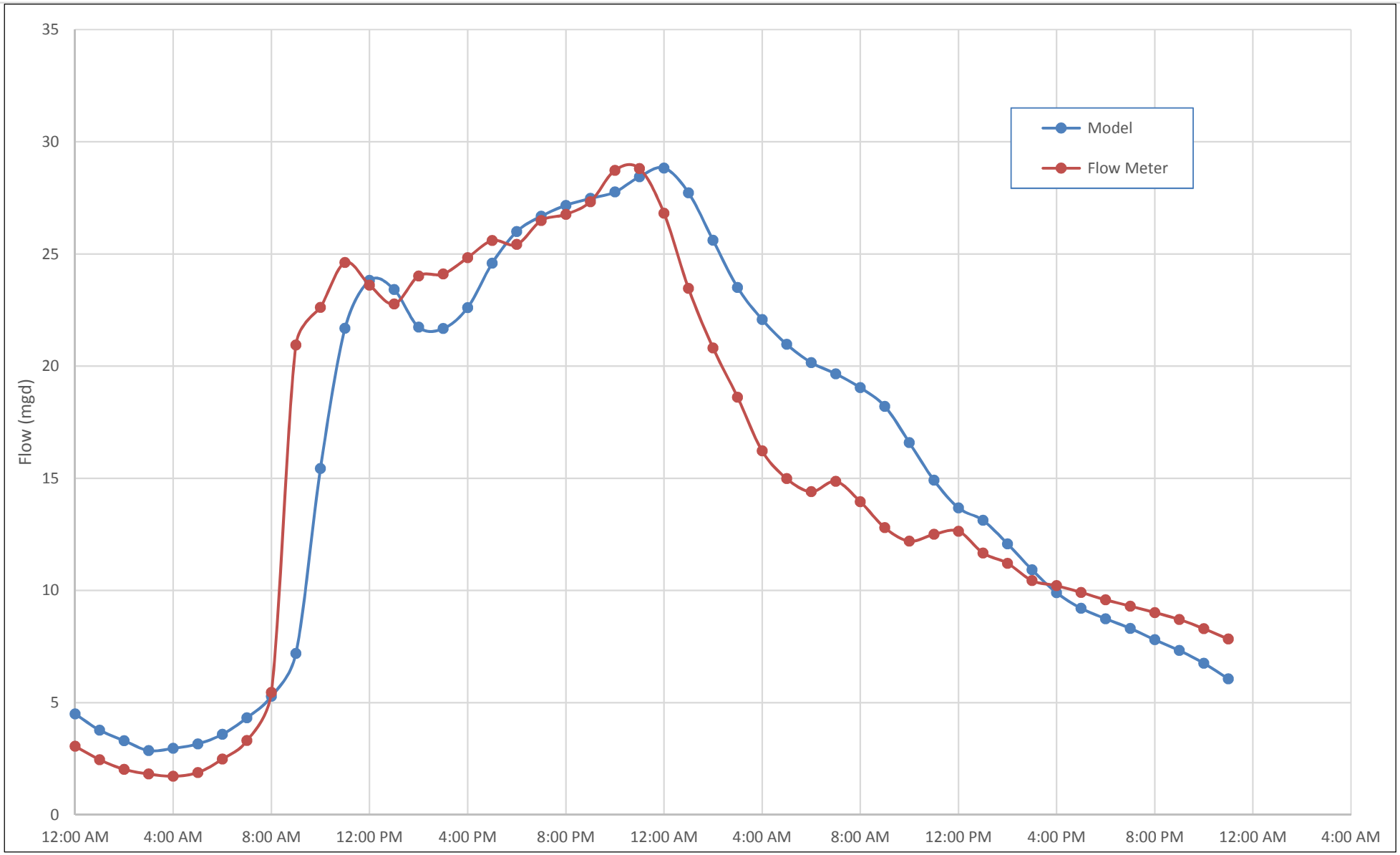


Figure 11

PWWF Comparison:
Metered versus Modeled Flow

Castro Valley Sanitary District
Wastewater Collection System Master Plan Update

At the outfall flume structure, the ADF is 4.6 (mgd), the PWWF peaking factor is 5.28, and the PWWF is 24.0 (mgd) during a 10 year, 24 hour design storm event.

5.0 CAPACITY ANALYSIS

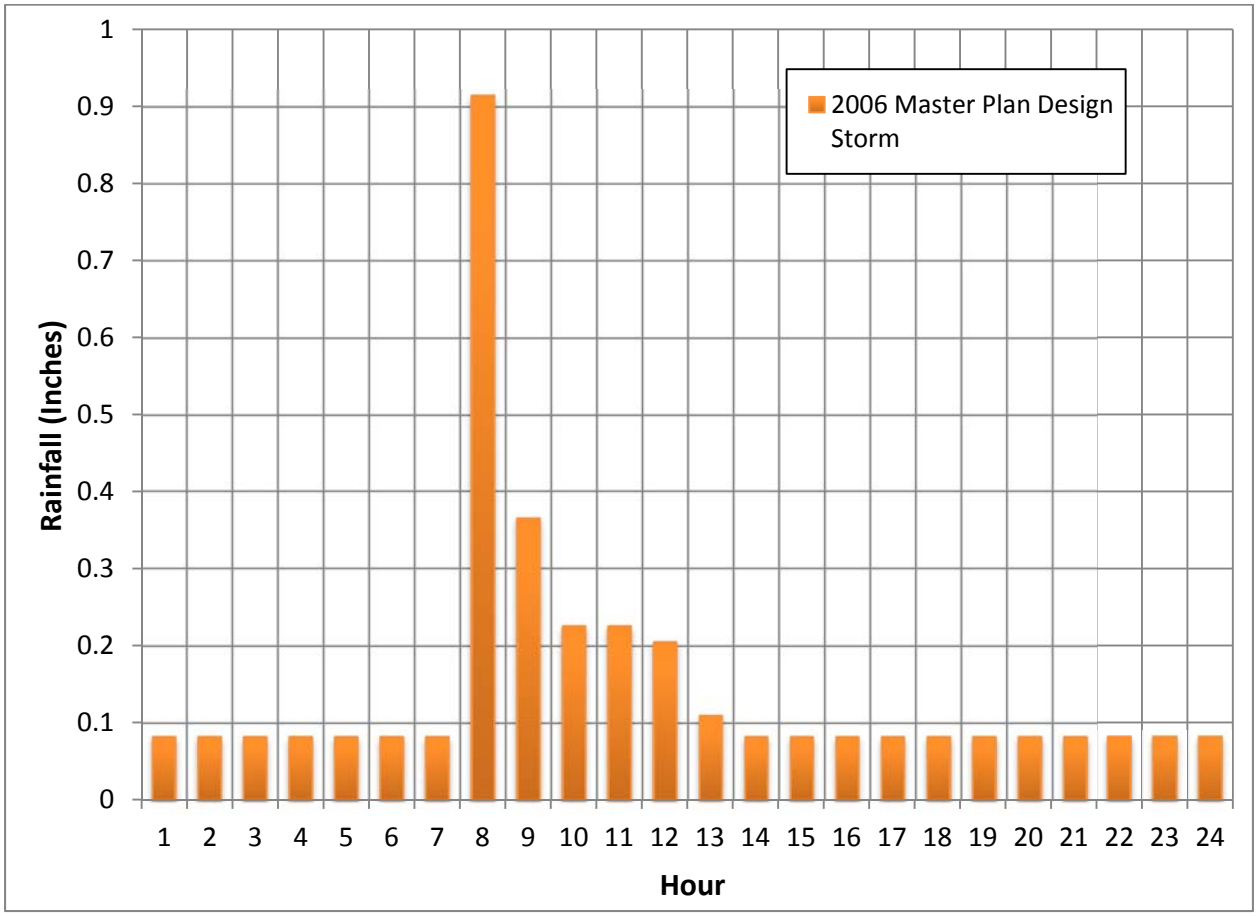
The CVSan collection system capacity analysis involves the following elements:

- Design Storm
- Dry Weather Performance
- Wet Weather Performance

5.1 Design Storm

The design storm used in this analysis is the 10-year, 24-hour storm shown in Figure 12, which is consistent with the design storm used in the 2006 Master Plan.

Figure 12. Design Storm Distribution



5.2 Dry Weather Performance

The assessment of dry weather performance involves the determination of which gravity lines surcharge or approach a surcharging condition during dry weather flow conditions. Accordingly, each gravity sewer was evaluated to determine which of the following categories it falls into for modeled PDWF conditions. The categories are defined in terms of the depth of flow (d) at PDWF conditions divided by the pipe diameter (D) and are displayed on Figure 13:

- d/D: 0 to 0.25
- d/D: 0.25 to 0.50
- d/D: 0.50 to 0.75
- d/D: 0.75 to 1.0
- d/D: >1.0

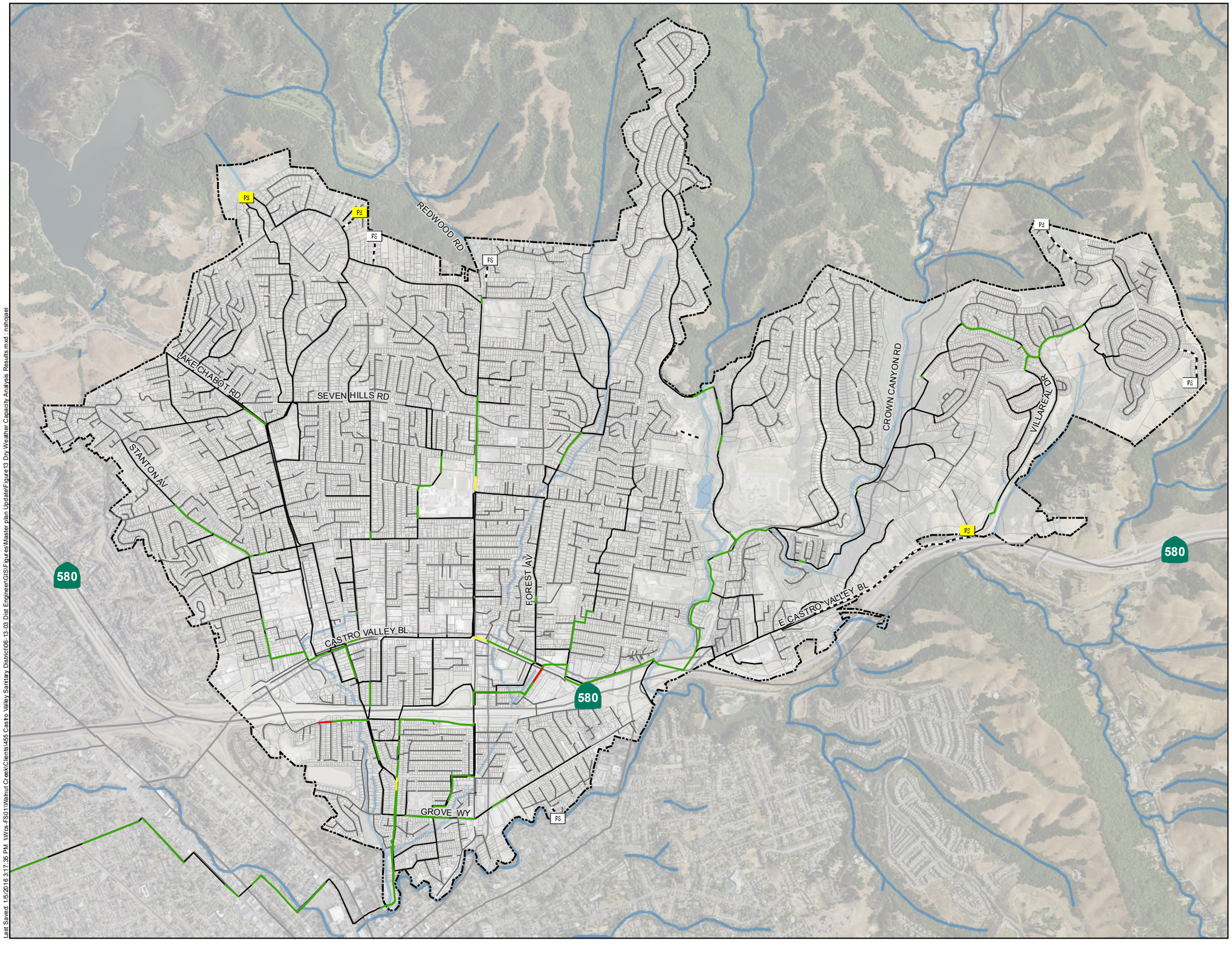
As indicated in Figure 13, there are two places in the system where d/D exceeds 0.75, both of which exceed 1.0 (full pipe capacity). The first of these is located on Aspen Avenue in a sewer that is undersized to handle design PWWF conditions (discussed in Section 5.3). The other is located along Strobridge Avenue in a segment where the GIS data indicates a substandard pipe slope. However, the flows are not especially high and the pipe is relatively deep, so this surcharging has a low impact. The pipe slope along the segment in question should be confirmed. There is some possibility that this sewer could pose maintenance issues associated with stagnant flow in the line, but overall, line capacity does not appear to be a concern.

5.3 Wet Weather Performance

The assessment of peak wet weather performance involves the determination of which gravity lines surcharge or outflow during design peak wet weather flow conditions. Accordingly, each gravity sewer was evaluated to determine which of the following categories it falls into for modeled PWWF conditions, which were chosen for this analysis because they are consistent with the categories used in the 2006 Master Plan:

- No Surcharging
- Surcharging 0 to 2 feet above pipe crown
- Surcharging >2 feet above pipe crown
- Manhole outflows

In general, the latter two categories are considered severe enough to trigger system improvements to correct the identified capacity issues. Areas where there is surcharging in the 0 to 2-foot range are considered to be watch-list areas that justify periodic monitoring.



Last Saved: 1/5/2016 3:17:35 PM M:\Wcs-FS01\Walnut Creek\Clients\455 Castro Valley Sanitary District\06-13-03 Dist Engineer\GIS\Figures\Master plan Update\Figure13 Dry Weather Capacity Analysis Results.mxd - rshojaei

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Figure 13

Dry Weather Capacity Analysis Results

Castro Valley Sanitary District
WWCS Master Plan Update

The results of the analysis are indicated in Figure 14. Key areas of concern include:

- The existing 6- and 8-inch diameter Redwood Hills Road sewer extending south from Seven Hills Road
- The existing 8-inch diameter Sandy Road sewer extending south from Seven Hills Road
- The existing 10-inch diameter sewer along Marshall Street, extending from Normandy Court to Greenacre Road
- The existing 10, 12, and 15-inch diameter sewer along Aspen Avenue and Pine Street extending south and west from Castro Valley Boulevard
- Various locations south of Interstate-580 near the outlet of the CVSan collection system

Various locations along and tributary to the Stanton Avenue and Lake Chabot Road trunk lines in the western portion of the collection system are considered watch-list areas for which future monitoring is recommended (see below).

6.0 UPDATED CAPITAL IMPROVEMENT RECOMMENDATIONS

Based on the results presented above, a capital improvement program has been developed to address system deficiencies. Key topics covered in this section include:

- Recommended Capital Improvement Program
- Other Recommendations

6.1 Recommended Capital Improvement Program

The recommended CIP consists of the sewer capacity improvement projects summarized in Table 7 and shown on Figure 15. The total capital cost of the improvements is estimated to be $7.6 million. Detailed project sheets for each recommended improvement are provided in Appendix D. The major recommended CIP projects address the areas of concern shown in Figure 14, and are summarized below. Hydraulic profiles of each CIP project (showing the existing hydraulic deficiencies and the post-improvement hydraulic profile) are located in Appendix E.

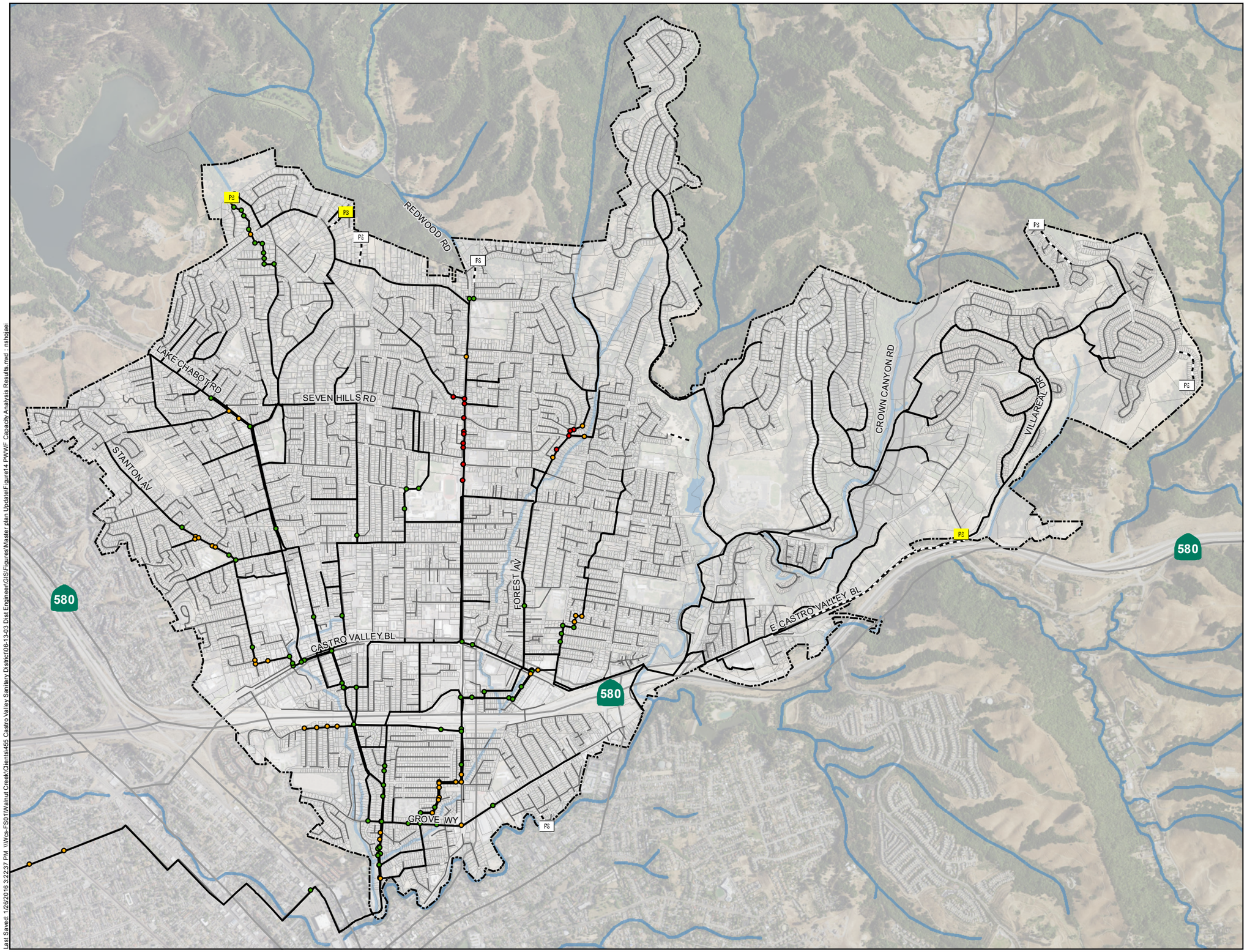
Redwood Road Trunk Sewer. From Seven Hills Road to Heyer Avenue. This project is significantly shorter than estimated by the 2006 Master Plan because of the additional data provided by the 2015 Flow Monitoring Study for M-1 and M-2. In 2014/15, these two meters were placed directly downstream of the confluence of a smaller tributary basin and downstream of the planned hydraulic project to refine the project scope.

Sandy Road Trunk Sewer. From Seven Hills Road to north of James Avenue. This study uses improved flow monitoring data directly upstream of this project to refine the size a scope of the 2006 Master Plan.

Marshall Street Trunk Sewer. From Normandy Court to Greenacre Road. This basin calibrated remarkably well, and the use of the December 11, 2014 storm, which was very close to the 10-year, 24-hour design storm allowed the R-factors and PWWFs to be refined.

Table 7. Recommended Capacity Improvement Projects

Project Name	Risk Level	Location	Description	Flow Conditions	Fiscal Year	Cost, 2015 Dollars
Redwood Road Trunk Sewer	High	Redwood Road between Seven Hills Road and Heyer Avenue	• Upsize 1,058-LF sewer to 10-inch diameter VCP • Upsize 675-LF sewer to 12-inch diameter VCP	Existing Capacity: 0.93 mgd Design PWWF: 1.73 mgd	2016/17	855,000
Marshall Street Trunk Sewer	High	Marshall Street between Greenacre Road and Veronica Avenue and Normandy Court	• Upsize 1,328-LF sewer to 12 inch diameter VCP	Existing Capacity: 1.05 mgd Design PWWF: 1.67 mgd	2017/18	727,000
Sandy Road Trunk Sewer	Medium	Sandy Road south of Seven Hills Road	• Upsize 848-LF sewer to 10-inch diameter VCP	Existing Capacity: 0.88 mgd Design PWWF: 1.50 mgd	2017/18	259,000
Aspen and Pine Trunk Sewer	Medium	Aspen Avenue and Pine Street between Castro Valley Boulevard and Elm Street	• Upsize 809-LF sewer to 18-inch diameter VCP • Upsize 626-LF sewer to 21-inch diameter VCP	Existing Capacity: 1.17 mgd Design PWWF: 2.51 mgd	2017/18	1,264,000
South of I-580 Relief Sewer	High	South of Interstate-580 from Redwood Road to North 3rd Street	• Construct 3,874-LF of 21-inch diameter VCP • Construct 1,110-LF of 24-inch diameter VCP	Inadequate capacity on multiple alignments Design PWWF: 4.17 mgd	2018/19	4,457,000
					Total	**$7,562,000**



0 0.2 0.4
Miles

Symbology

Surcharge Condition

- No Surcharge (not shown)
- >0' and ≤2'
- >2 (no outflows)
- Outflows
- Modeled Gravity Main
- Unmodeled Gravity Main
- Modeled Pump Station
- Unmodeled Pump Station
- Force Main
- District Boundary

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Figure 14

PWWF Capacity Analysis Results

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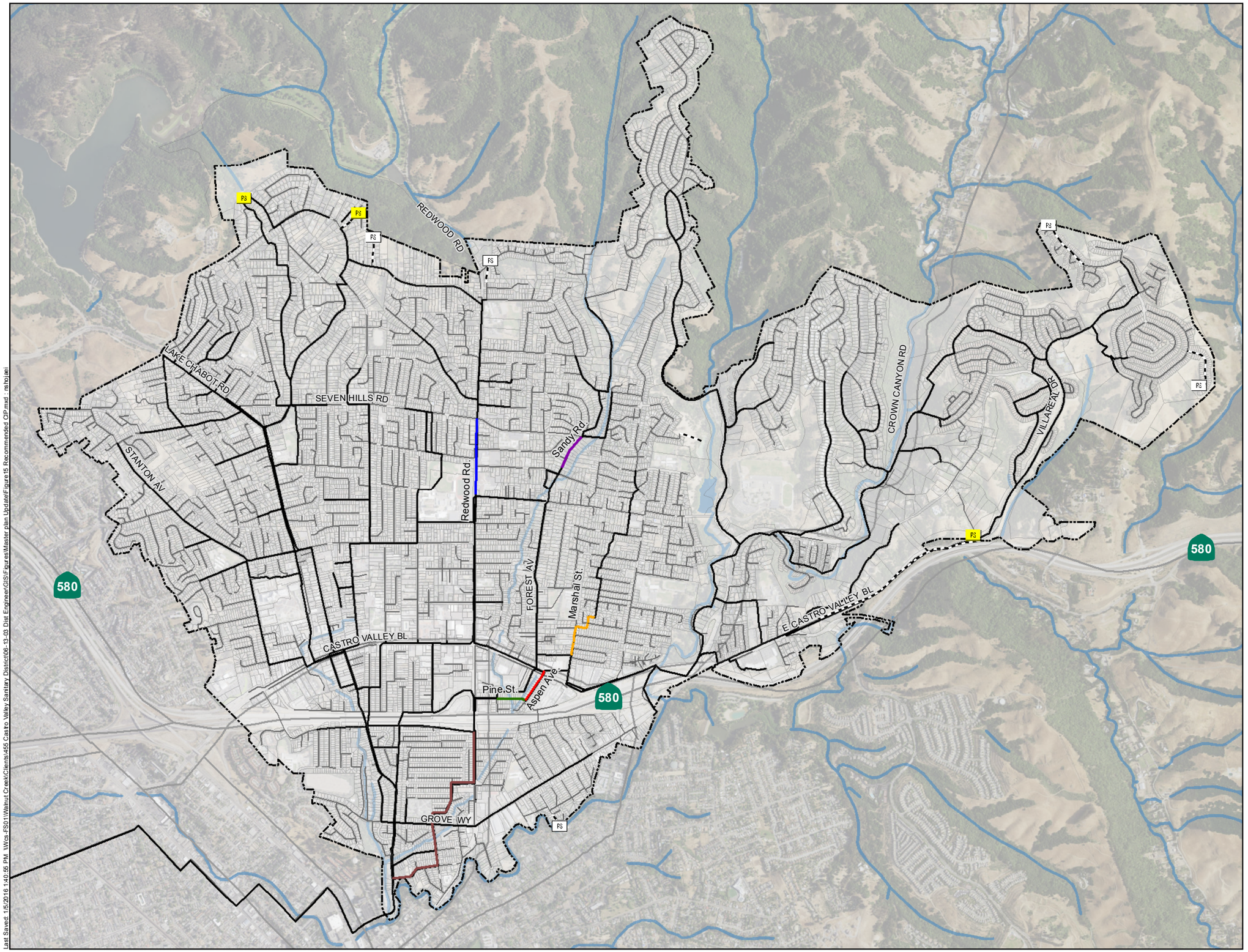
Last Saved: 1/26/2016 3:22:37 PM \\Wcs-FS01\Walnut Creek\Clients\455 Castro Valley Sanitary District\06-13-03 Dist Engineer\GIS\Figures\Master plan Update\Figure14 PWWF Capacity Analysis Results.mxd - nehojaei



N

0 0.2 0.4

Miles

Symbology

- Modeled Gravity Main
- Unmodeled Gravity Main
- Force Main
- Modeled Pump Station
- Unmodeled Pump Station
- District Boundary

CIP Projects

- Aspen Ave.
- Marshal St.
- Pine St.
- Redwood Rd.
- Sandy Rd.
- South of Highway 580

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Figure 15

Recommended Capital Improvement Projects

Castro Valley Sanitary District
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Last Saved: 1/5/2016 1:40:55 PM \\Wes-FS01\Walnut Creek\Clients\455 Castro Valley Sanitary District\06-13-03 Dist Engineer\GIS\Figures\Master plan Update\Figure15 Recommended CIP.mxd - rschrojenei

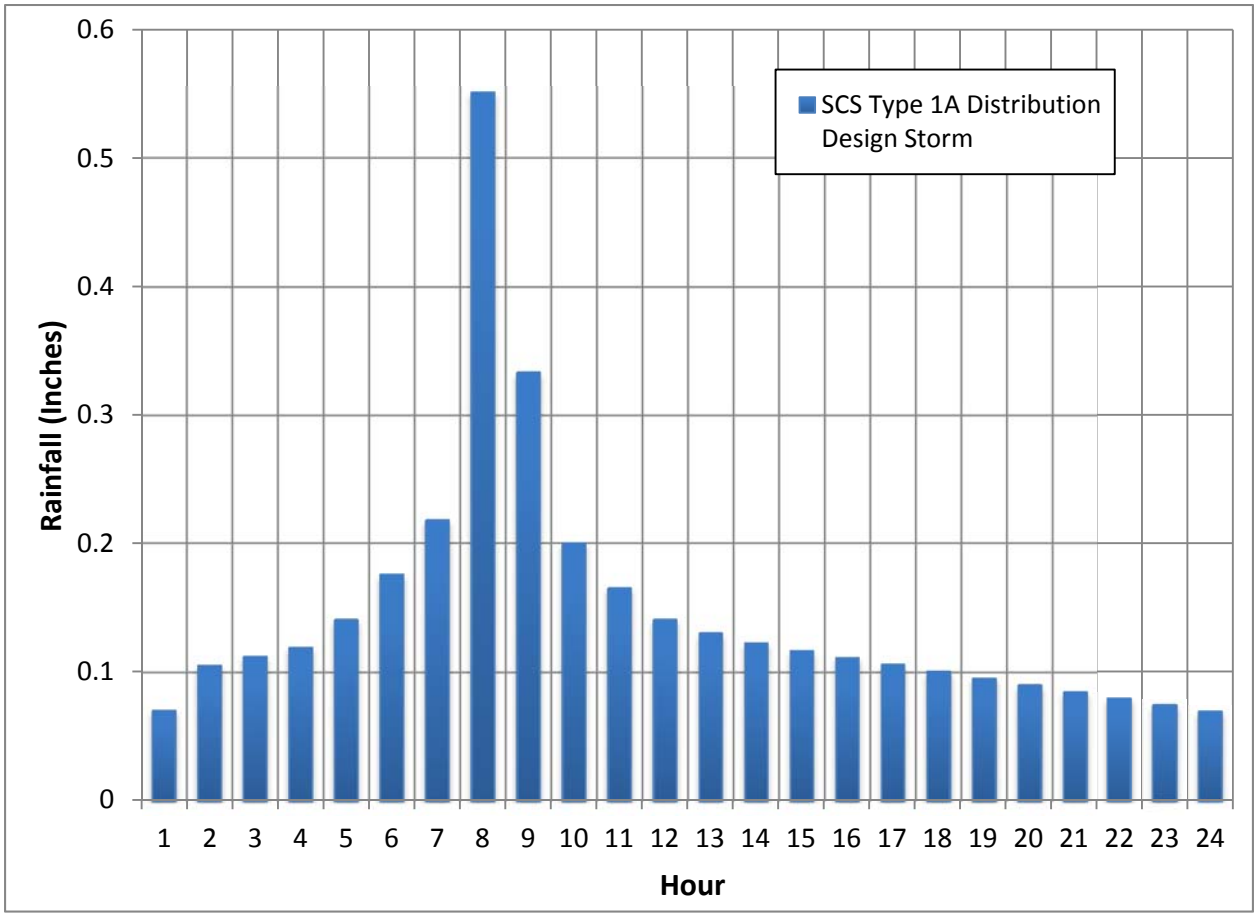
Aspen and Pine Trunk Sewer. From Castro Valley Boulevard to Elm Street. New flow splits and upstream flow monitoring data refined this project size from the 2006 Master Plan.

South of I-580 Relief Sewer. From Redwood Road to North 3rd Street. This sewer remains necessary to relieve surcharging. However, project validation flow monitoring is recommended to refine newly-discovered flow splits in the model in order to refine the project size.

6.2 Sensitivity Analysis

In order to determine how sensitive the CIP projects are to the design storm distribution used, a sensitivity analysis was performed using the 10-year, 24-hour storm defined as the Soil Conservation Service Type 1A storm distribution, as shown in Figure 16. This storm distribution has a less severe peak than the design storm used in this Master Plan Update and in the 2006 Master Plan, but is consistent with the methodologies required under typical San Francisco Baykeeper third-party lawsuits, which is becoming a San Francisco Bay industry standard. It should be noted that both design storm distributions shown in Figure 12 and 16 have equal 10-year, 24-hour rainfall volumes over the 24-hour period - but differ in rainfall distribution over time.

Figure 16. SCS Type 1A Design Storm Distribution



The results of the sensitivity analysis are that while several of the CIP projects would be one or two pipe segments shorter, or of one-size smaller pipe diameter, none of the CIP projects are eliminated by the use of the alternate design storm distribution shown in Figure 16. For the purposes of providing adequate capacity, this minor sensitivity to the design storm distribution was acknowledged by CVSan, but capacity will be provided for the design storm distribution shown in Figure 12, which is slightly more conservative, but very similar in peak to the actual storm metered on December 12, 2015.

6.3 Other Recommendations

Other recommendations developed during the course of this analysis include the following:

- Ongoing Monitoring
- Inflow Reduction Program
- Private Lateral Rehabilitation Program
- Hydraulic Model Update

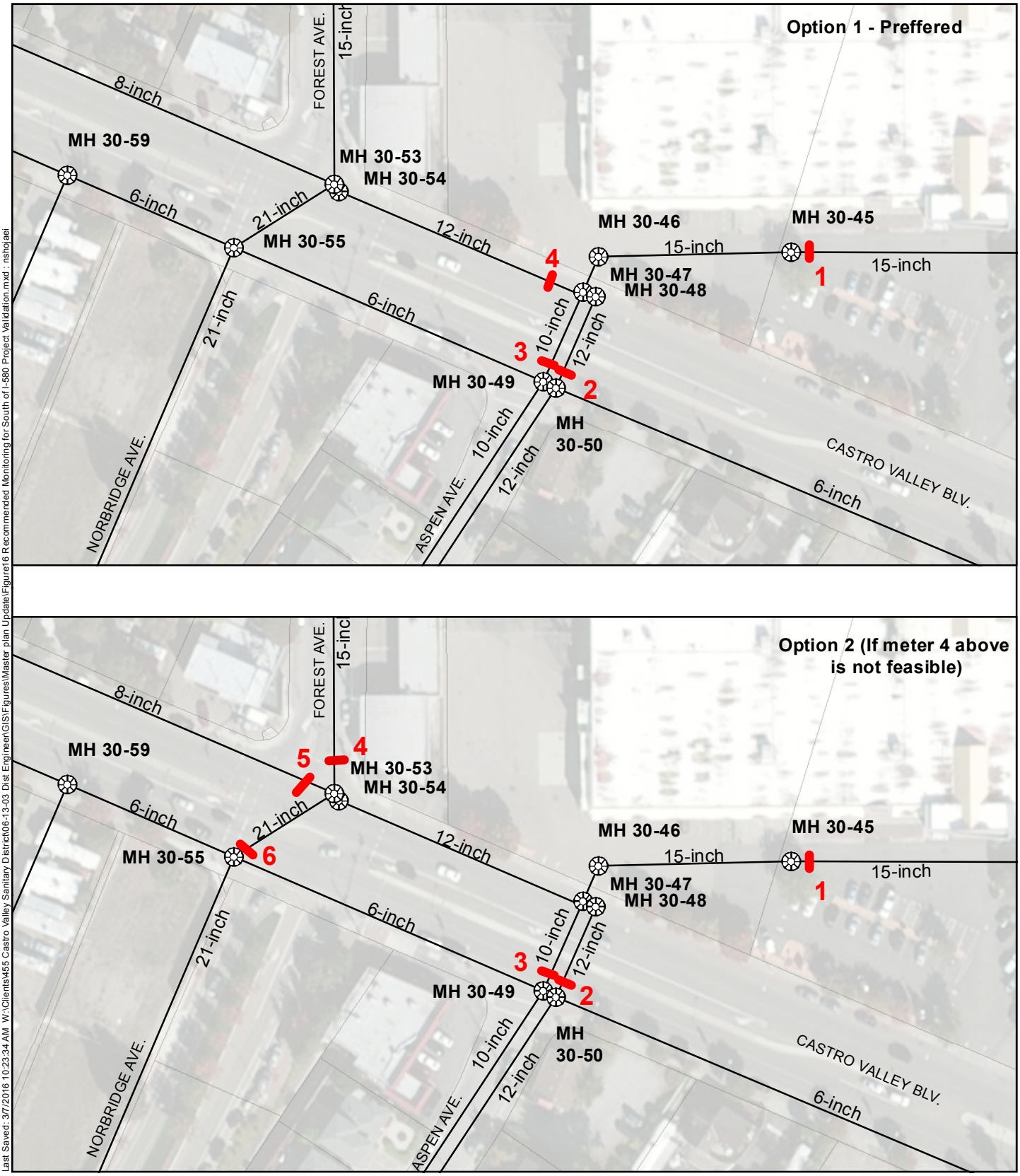
6.3.1 Ongoing Monitoring

The hydraulic model results indicate some uncertainty about the flow path in the portion of the system where the trunk lines flowing south down Forest Avenue and west along Castro Valley Boulevard. Before the implementation of the South of I-580 Relief Sewer project, additional flow monitoring is recommended at points 1 through 4 indicated on Figure 17 in order to confirm the size and scope of this project. If hydraulically impractical, then points 5 through 7 would serve as an acceptable alternative.

In addition, monitoring is recommended on the Stanton Avenue and Lake Chabot Road trunk lines to verify that the surcharging indicated by PWWF modeling is not severe enough to justify capital improvements. The specific flow monitoring locations can be determined at a later time.

6.3.2 Inflow Reduction Program

As shown in Table 4, metered flows from M-3W revealed that for a small tributary area, flows increased 50-times during wet weather – producing 0.46 in I/I from this small area, indicating the presence of a significant I/I source (see Figure 18).



Last Saved: 3/7/2016 10:23:34 AM W:\Clients\455 Castro Valley Sanitary District\06-13-03 Dist Engineer\GIS\Figures\Master plan Update\Figure16 Recommended Monitoring for South of I-580 Project Validation.mxd : nshojaei

Symbology

- Monitoring Location
- Manhole
- Gravity Main
- Force Main

N

0 50 100

Scale in Feet

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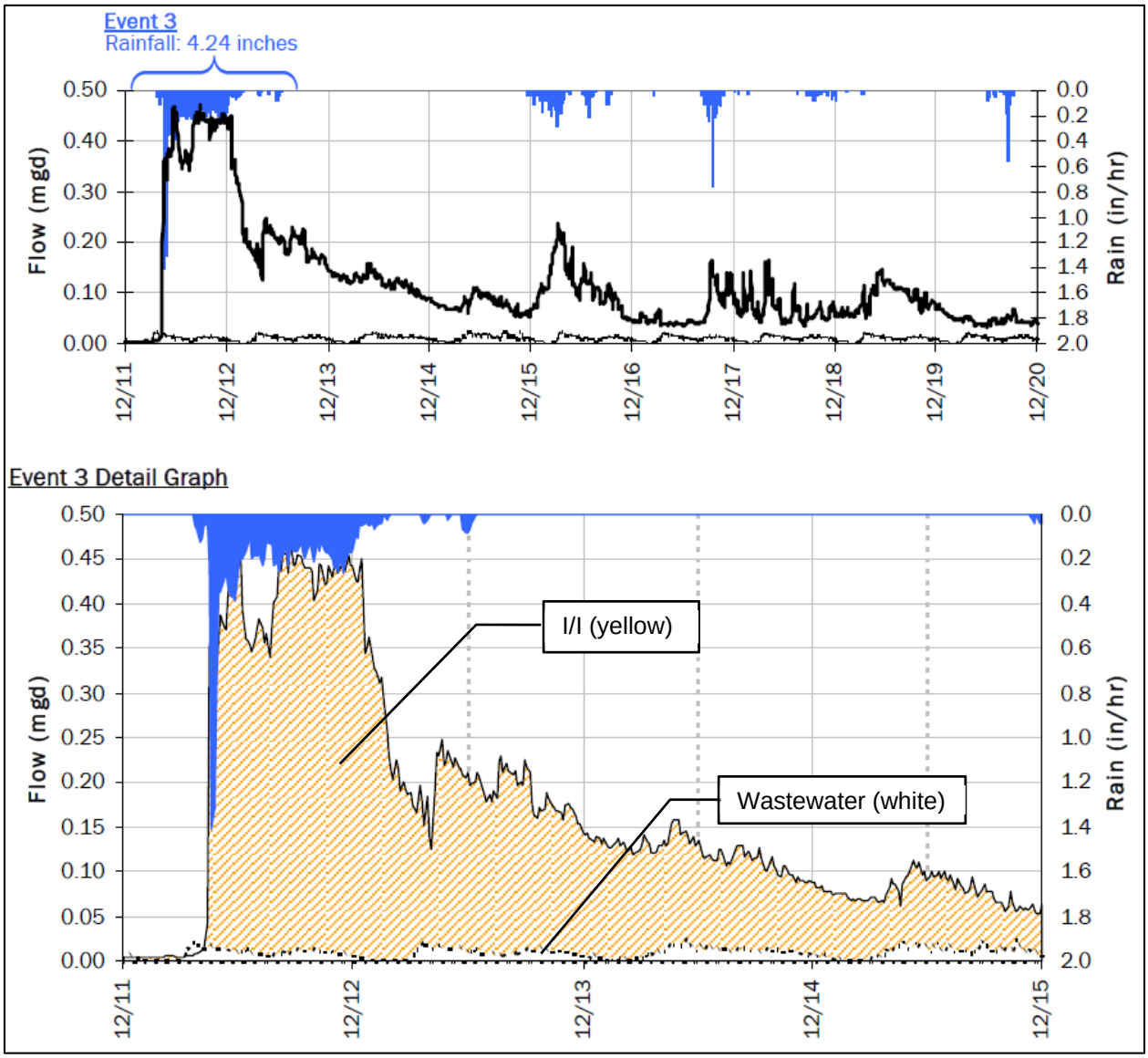
Figure17

Recommended Monitoring for South of I-580 Project Validation

Castro Valley Sanitary District
WWCS Master Plan Update

Figure 18. I/I Identified by Sub-basin Flow Monitoring at M-3W



Source: Castro Valley Sanitary District Sewer Flow Monitoring and Inflow/Infiltration Study, V&A, June 2015 (2015 Flow Monitoring Study).

In a tributary area this small, it is highly unlikely that this magnitude of I/I is coming simply from deteriorated sewer mains or laterals. Rather, it is likely that there is a direct creek or storm drain inflow source or potentially neighborhood-wide downspout connections. It is highly recommended that CVSan conduct smoke testing in Basin 3W in an attempt to identify the source of I/I here so that it can be removed. Appendix F includes a Smoke Testing Work Plan to facilitate these investigations.

Additionally, the Phase 2 Alternative Analysis included a summary of CVSan's past smoke testing activities – which identified several possible direct storm drain connections. Appendix G includes details on the defects identified in 2012 by smoke testing. It is highly recommended that CVSan investigate the possible storm drain cross connections immediately to prevent 2016 El Niño storm impacts, and follow up in 2016/17 with permanent disconnections.

As a part of CVSan's ongoing I/I reduction program, CVSan's should develop an Inflow Reduction Program to:

- Continue to identify sources of I/I including conducting sub-basin flow monitoring and smoke testing
- Address known storm drain cross connections
- Enforce inflow source repairs and/or disconnections on private property
- Identify and prioritize other I/I identification and reduction methods such as FELL investigations in known problem basins

6.3.3 Private Lateral Rehabilitation Program

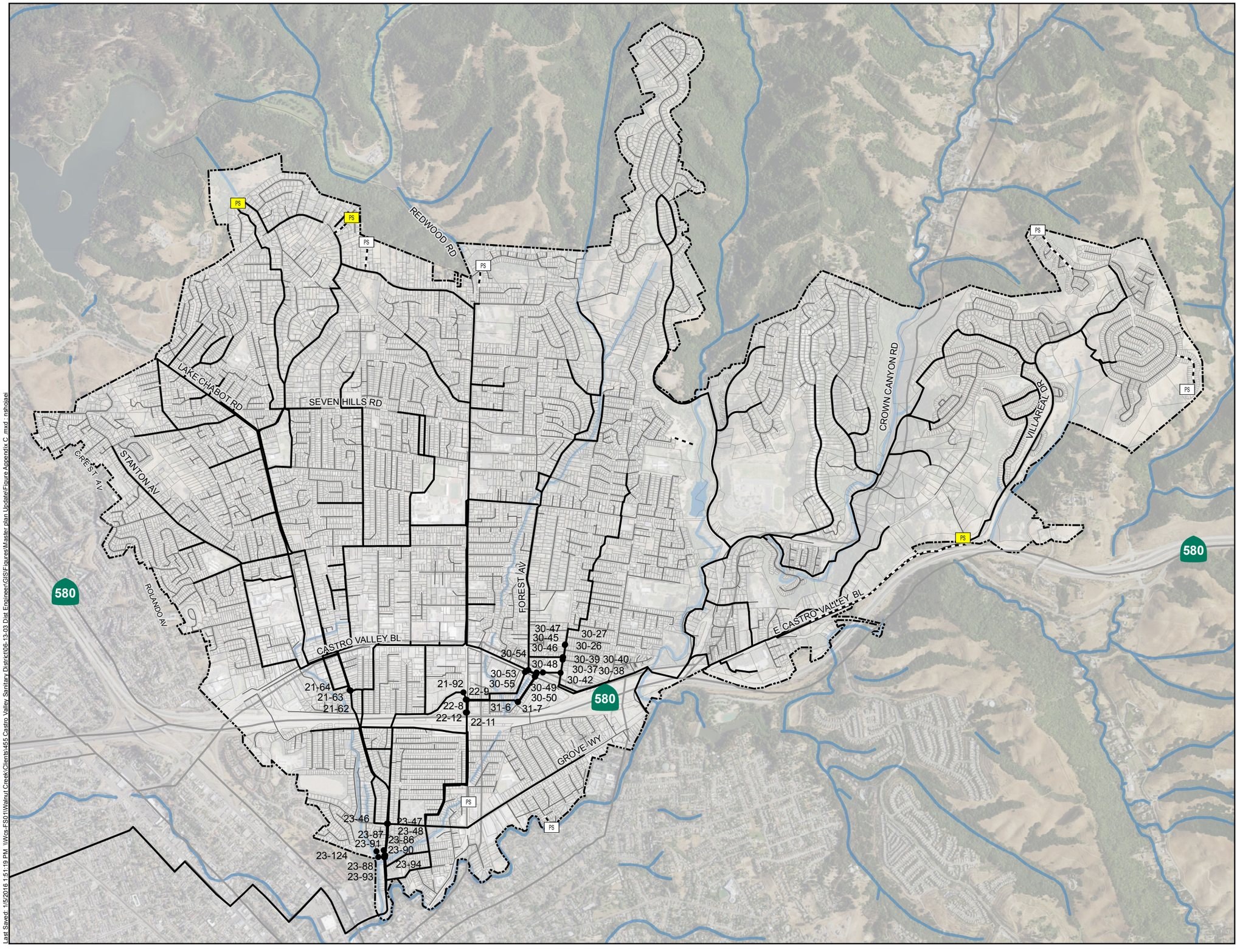
CVSan has a proactive Private Lateral Grant Program that has been extremely successful in past years. In fact, annual grant funds are at times depleted within only a few months of the annual funding date. It is recommended that CVSan increase its efforts to control and reduce RDII by expanding the funds provided for private lateral inspection and rehab. RDII from private laterals has been found to account for approximately 50 percent of the total RDII in several Bay Area cities. This program to inspect and rehabilitate private service laterals provides on-going RDII control at low cost to CVSan.

6.3.4 Hydraulic Model Update

The existing hydraulic model should be updated periodically to reflect changes in the collection system, including sewer rehabilitation and construction of gravity sewer capacity upgrades.

APPENDIX A

Flow Split Documentation



N

0 0.2 0.4

Miles

Symbology

- Updated Flow Split Manhole
- Modeled Gravity Main
- Unmodeled Gravity Main
- Modeled Pump Station
- Unmodeled Pump Station
- Force Main
- District Boundary

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Manholes with Updated Flow Split Information

Castro Valley Sanitary District
WWCS Master Plan Update

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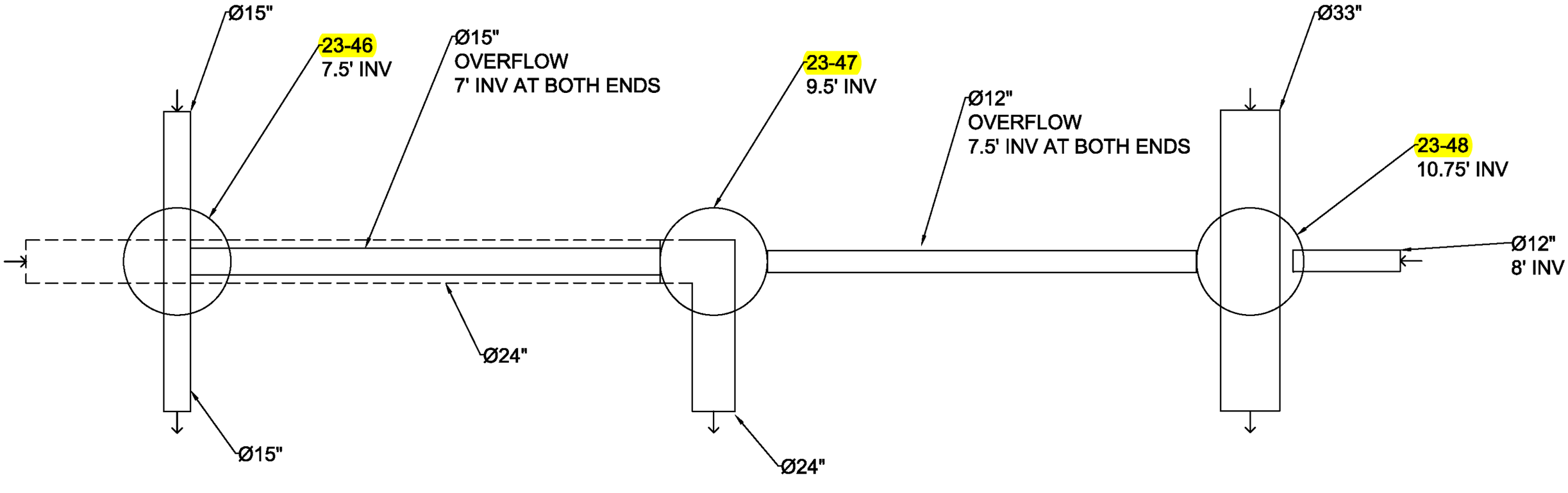
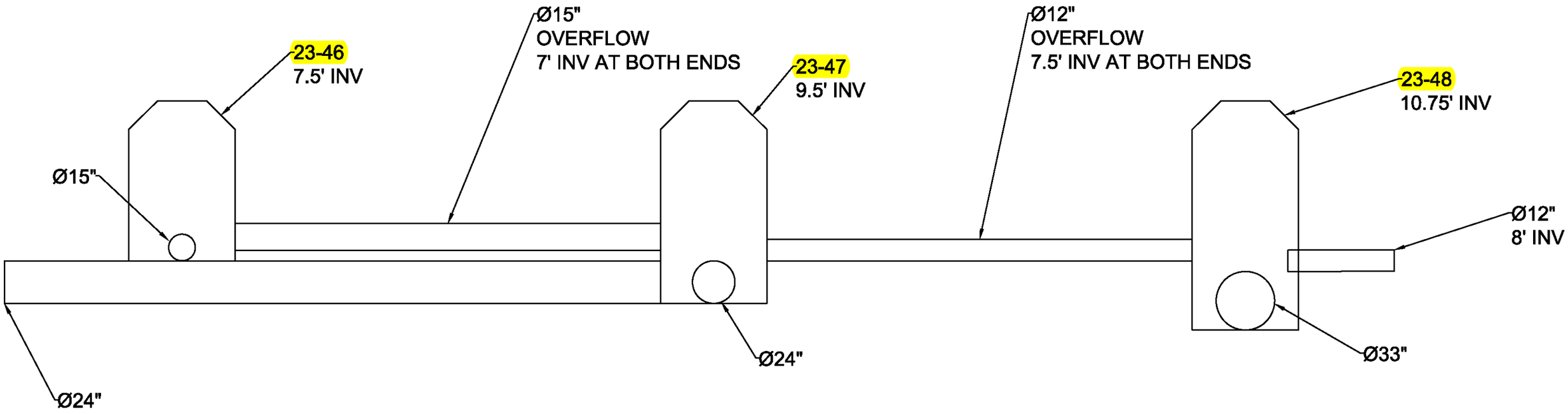

Ø15"
23-46
7.5' INV
Ø15"
OVERFLOW
7' INV AT BOTH ENDS
23-47
9.5' INV
Ø12"
OVERFLOW
7.5' INV AT BOTH ENDS
Ø33"
23-48
10.75' INV
Ø12"
8' INV
Ø24"
Ø15"
Ø24"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OVERFLOW
7.5' INV AT BOTH ENDS
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8' INV
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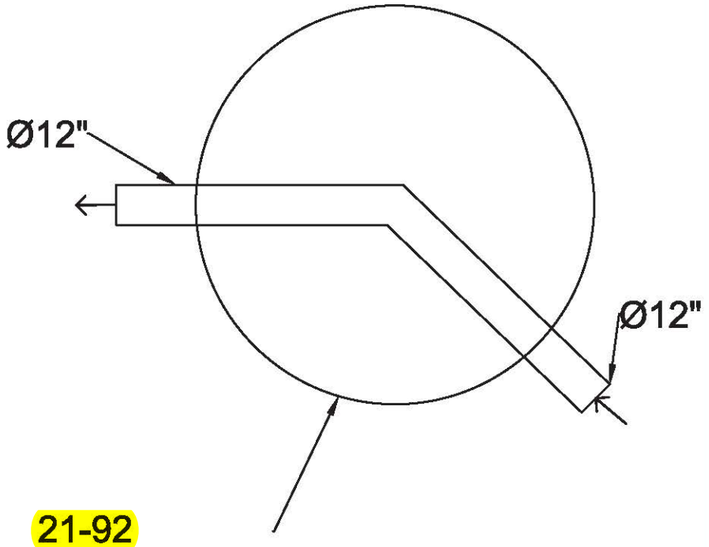
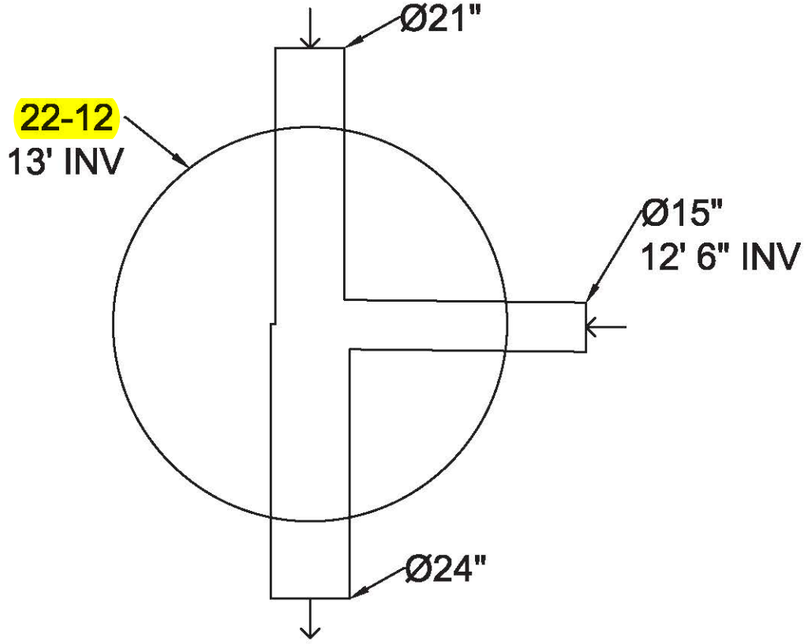
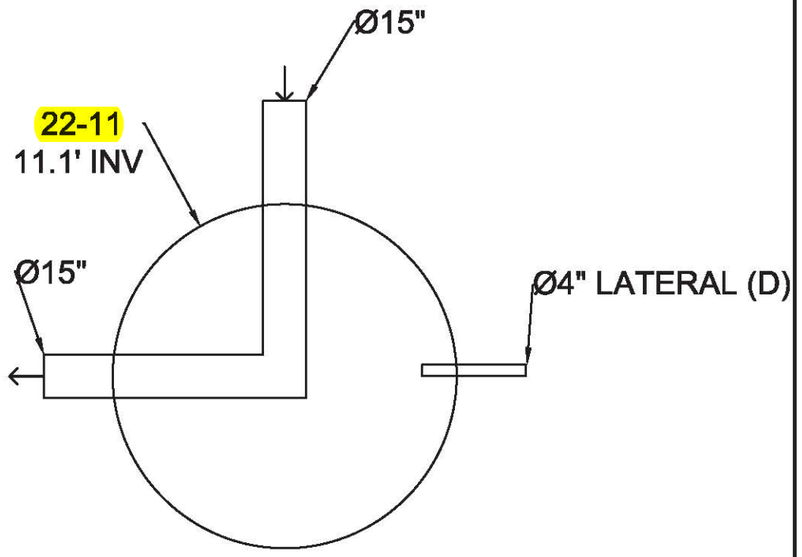
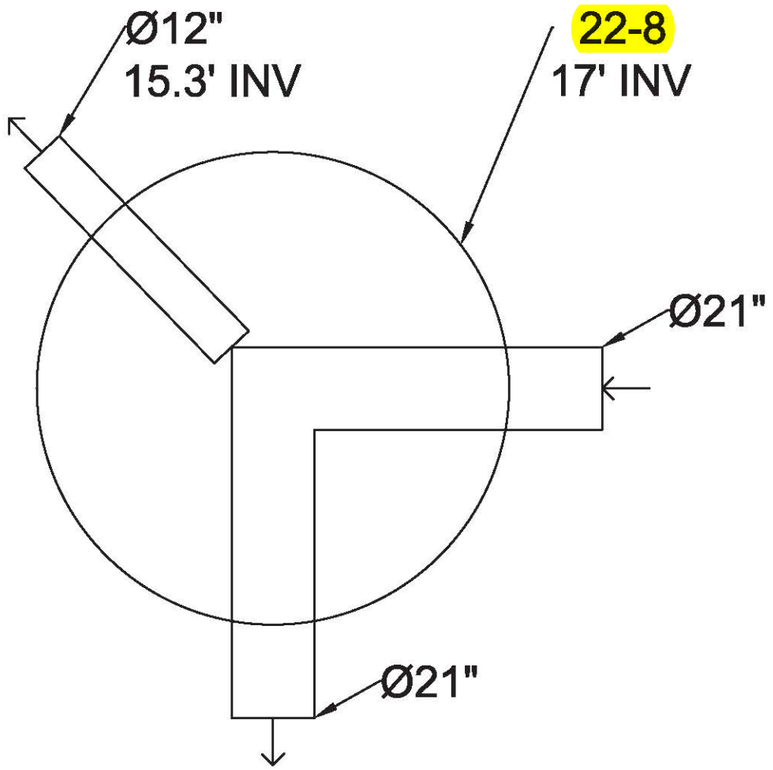
Ø24"
Ø33"

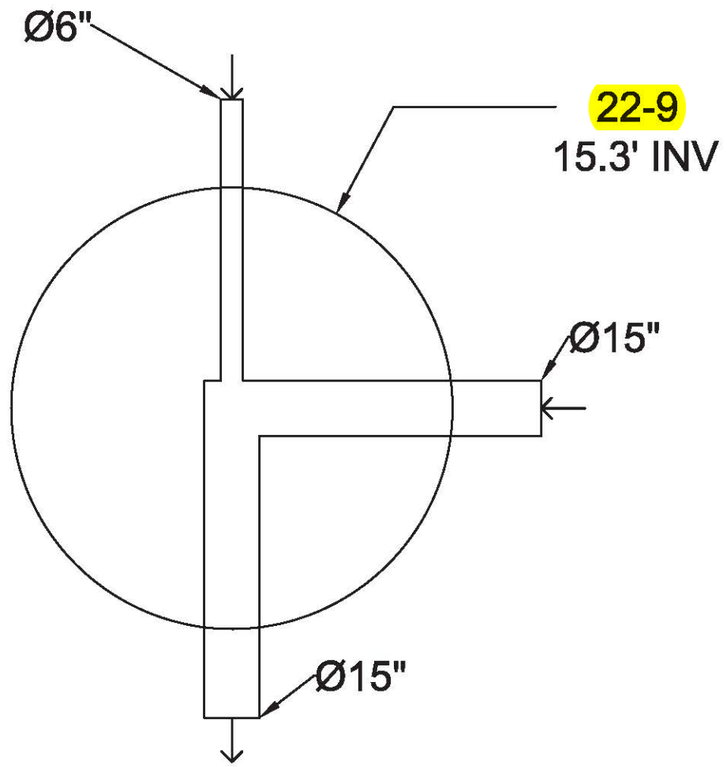


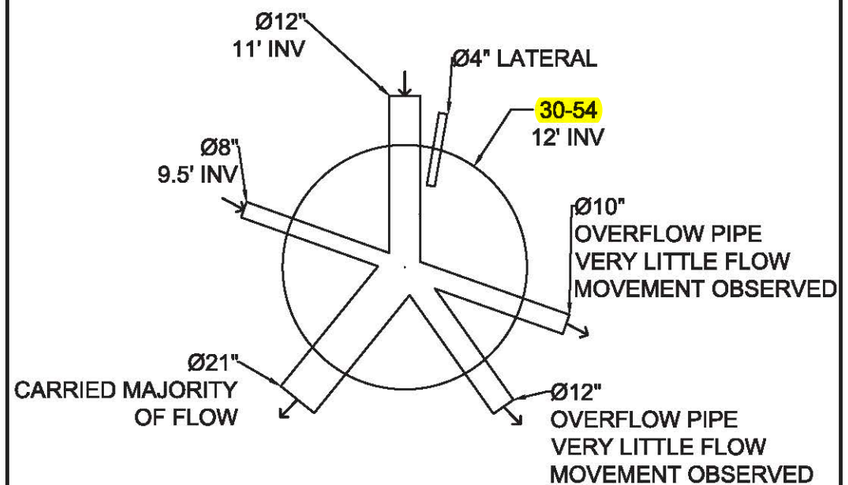
21-92
16.3' INV
FLOW DIRECTIONS
ASSUMED, DRY PIPE

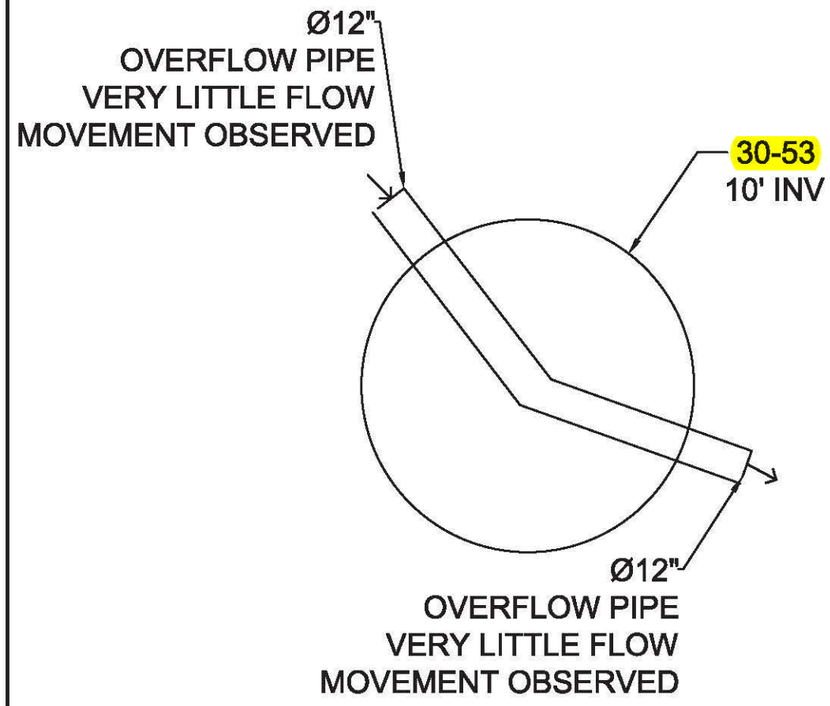


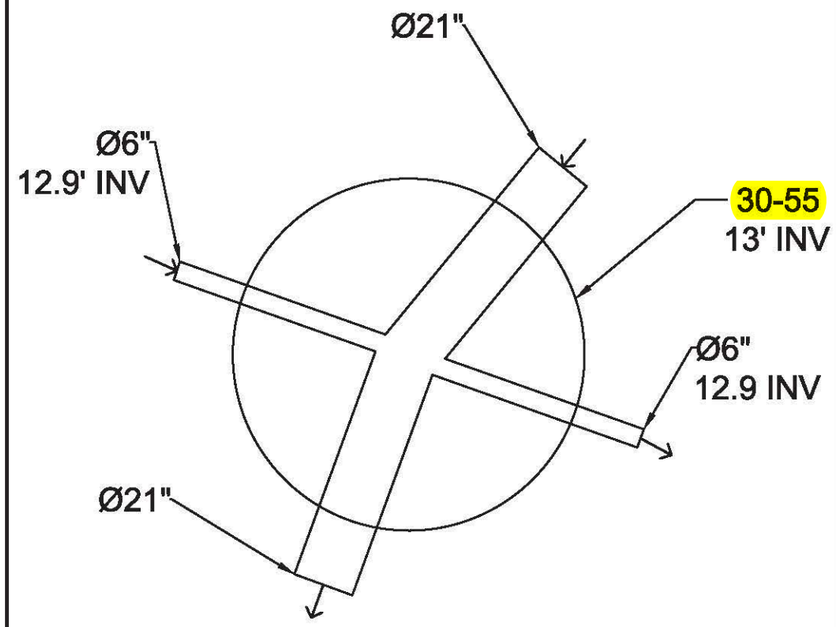









Ø12"
OVERFLOW PIPE
VERY LITTLE FLOW
MOVEMENT OBSERVED
30-53
10' INV
Ø12"
OVERFLOW PIPE
VERY LITTLE FLOW
MOVEMENT OBSERVED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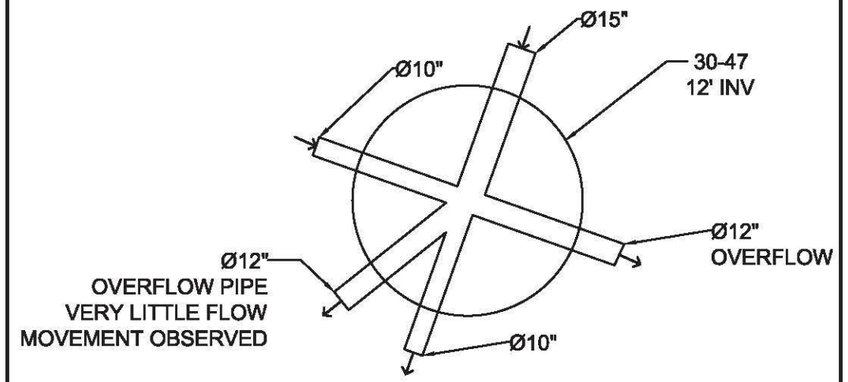
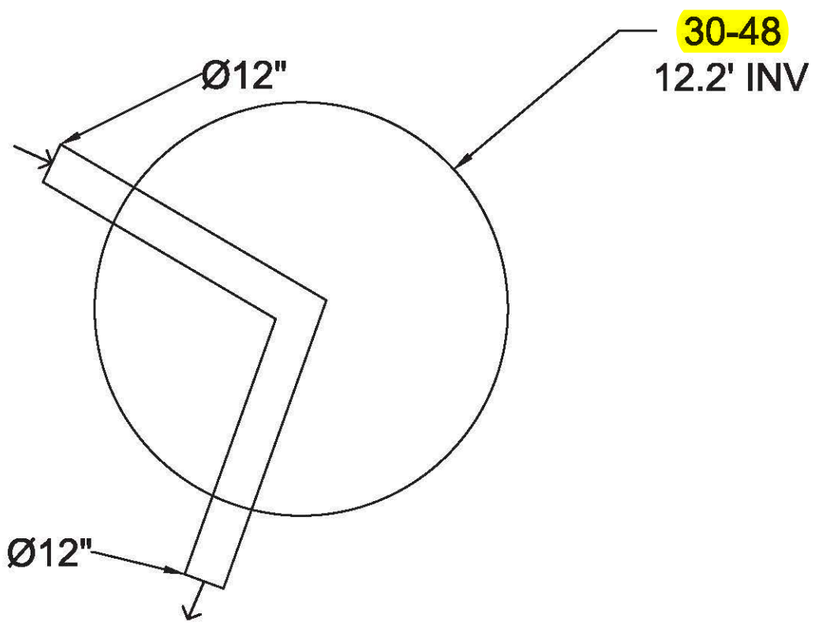
12.9' INV
30-55
13' INV
Ø6"
12.9 INV
Ø21"


Ø15"
Ø10"
30-47
12' INV
Ø12"
OVERFLOW
Ø12"
OVERFLOW PIPE
VERY LITTLE FLOW
MOVEMENT OBSERVED
Ø10"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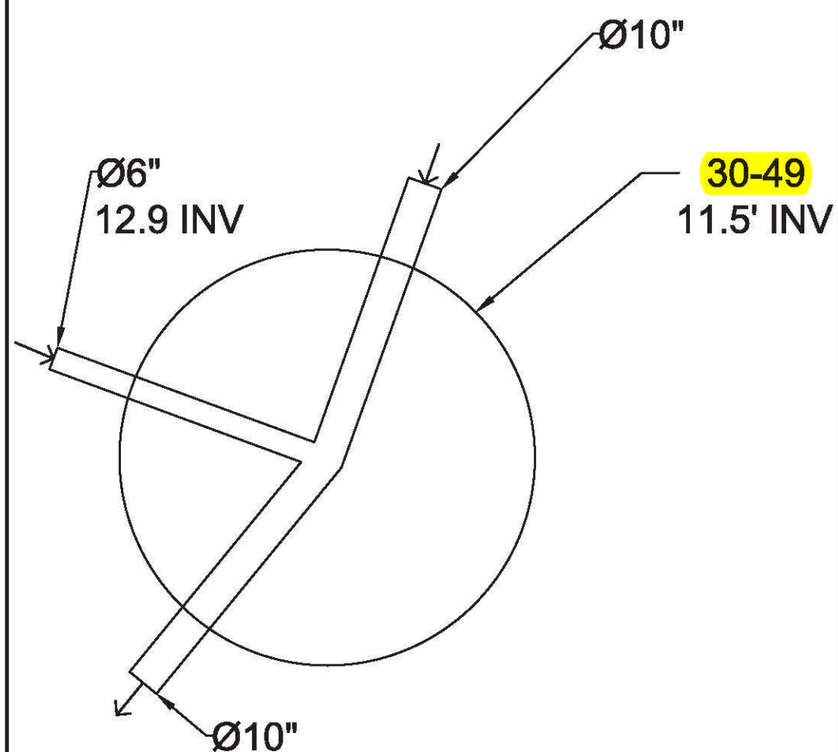
Ø12"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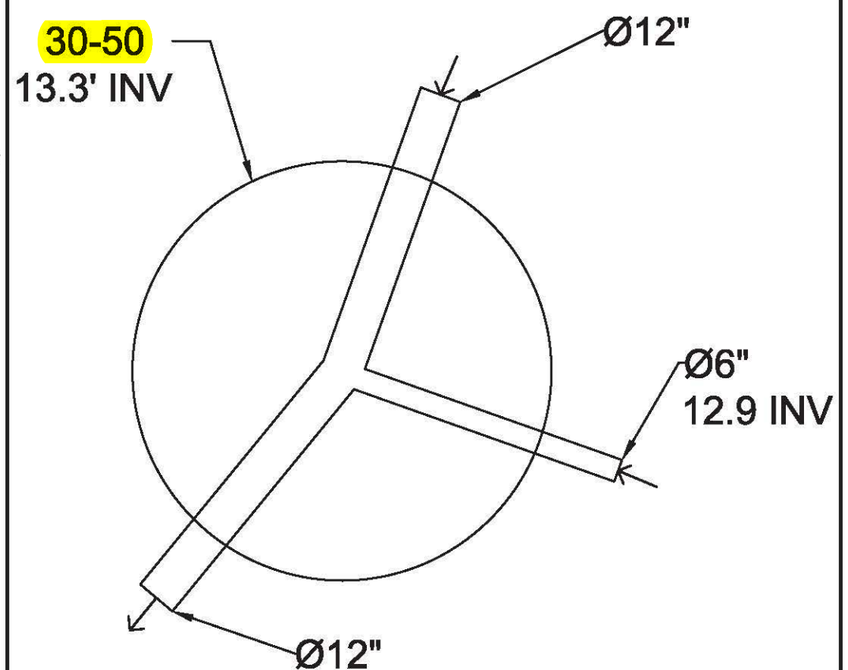
Ø10"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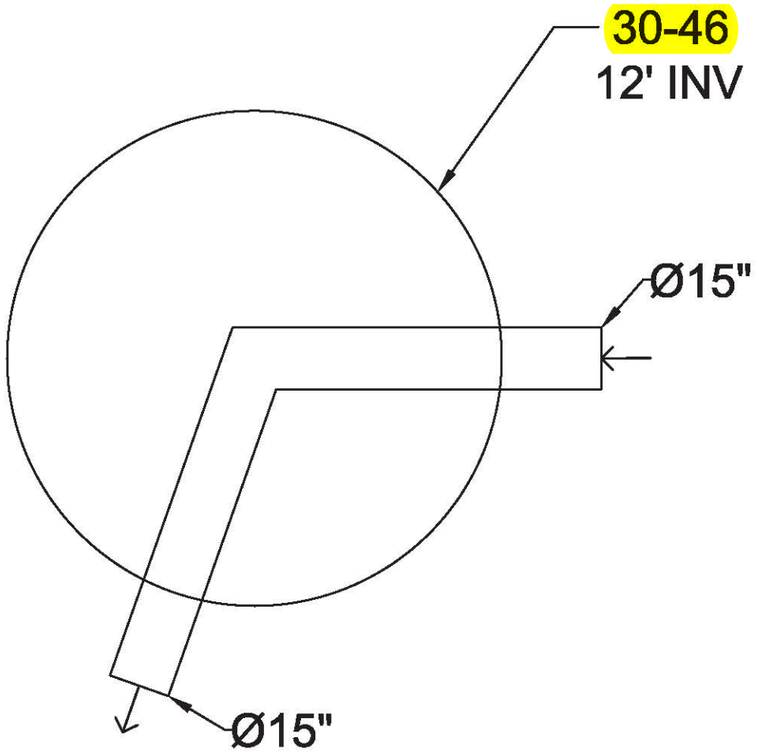
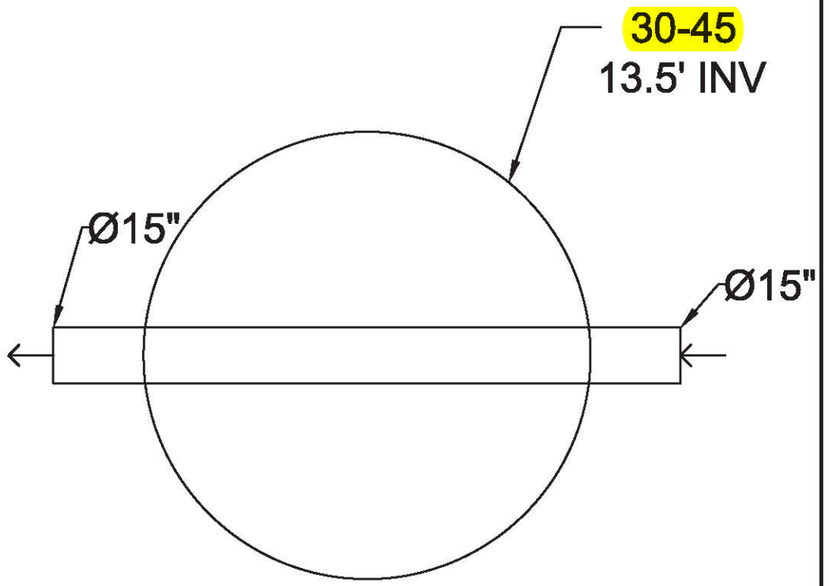
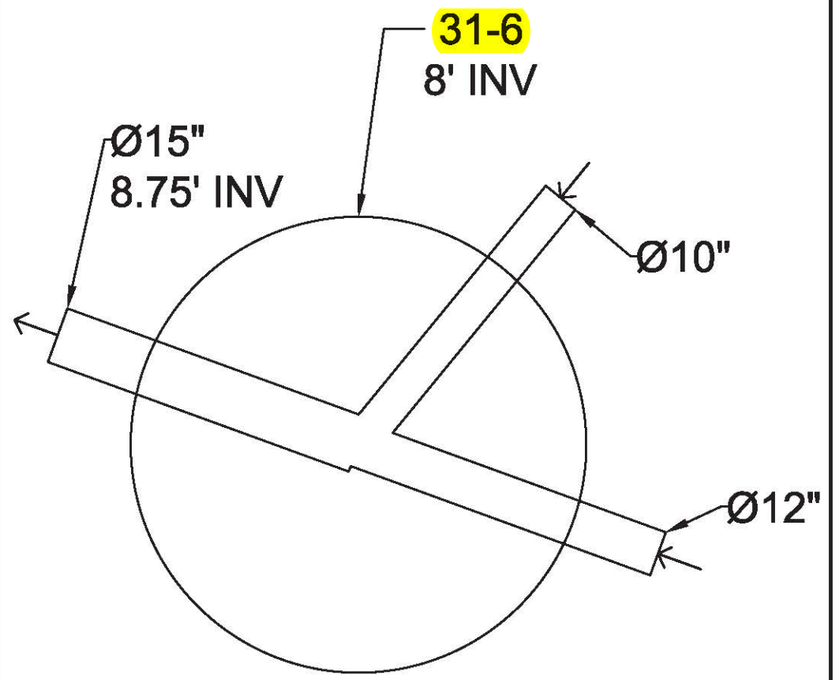
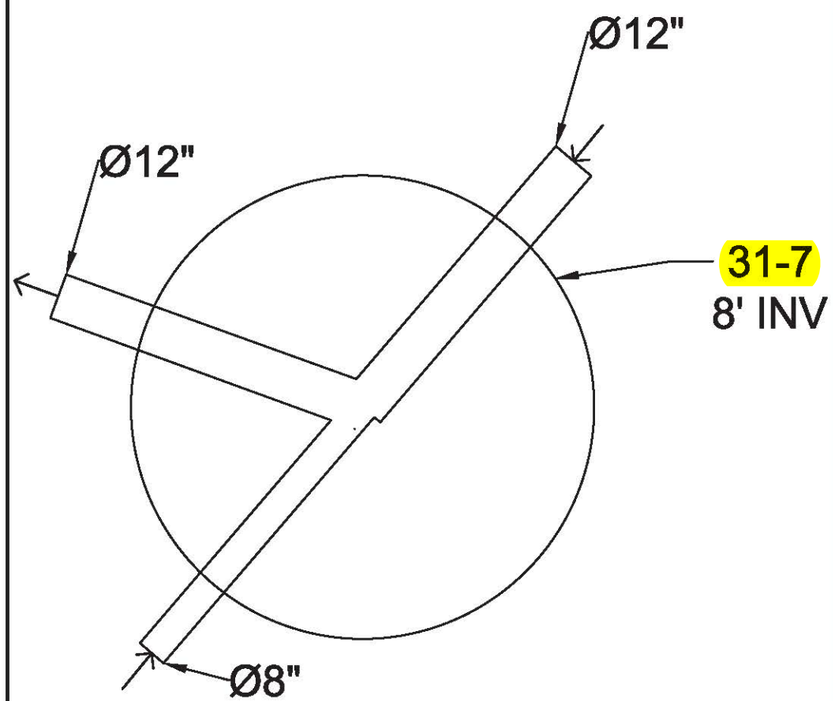
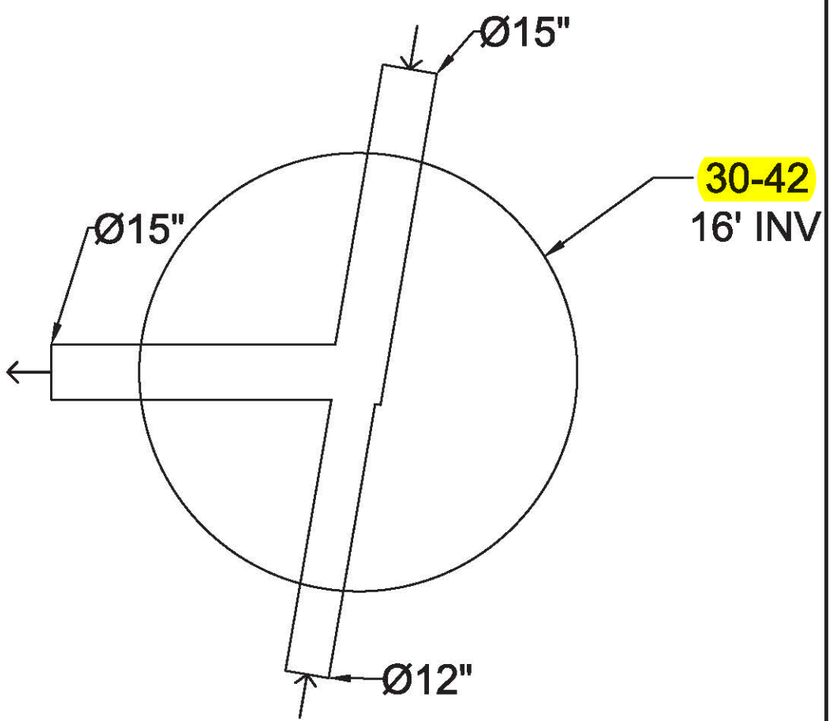
13.3' INV
Ø12"
Ø6"
12.9 INV
Ø12"

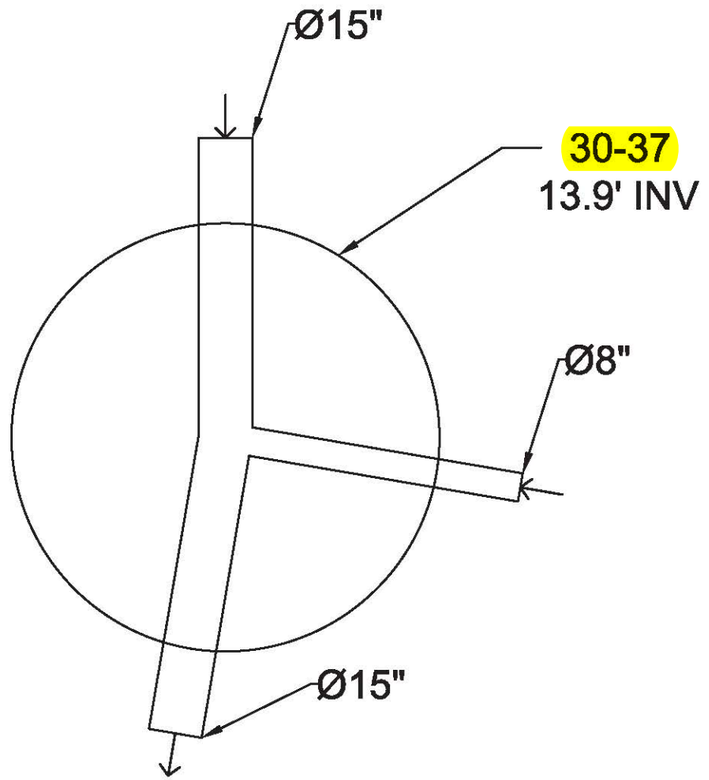

30-46
12' INV
Ø15"
Ø15"

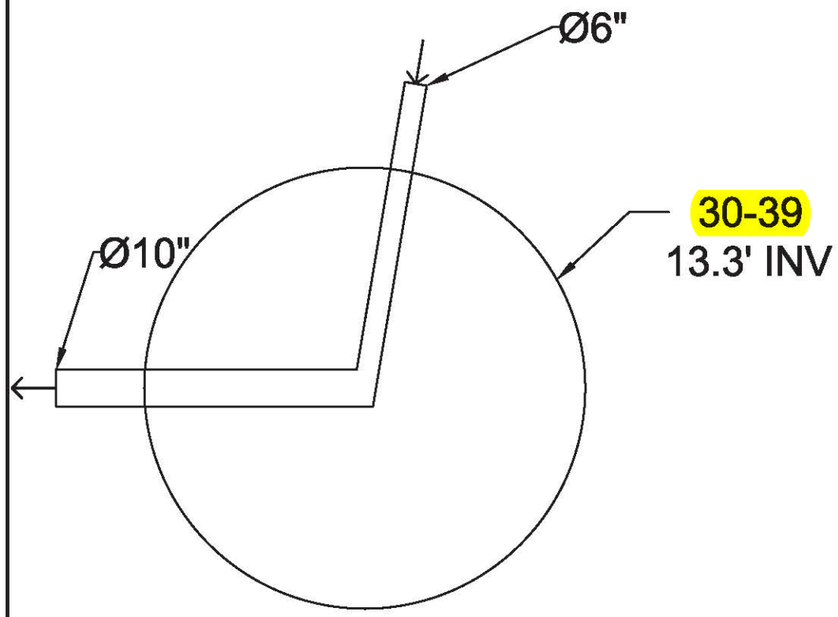

30-45
13.5' INV
Ø15"
Ø15"

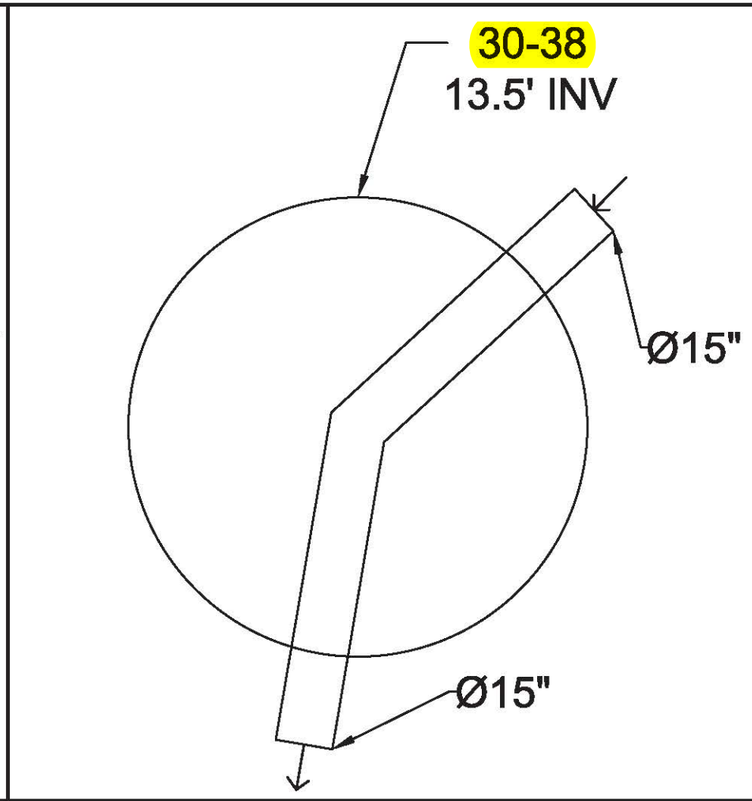

31-6
8' INV
Ø15"
8.75' INV
Ø10"
Ø12"

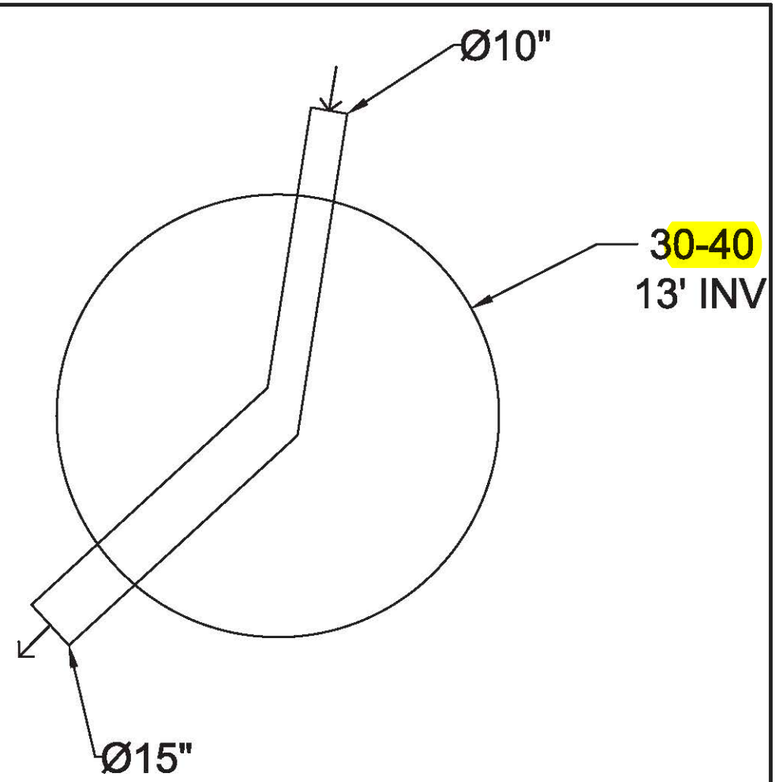

Ø12"
Ø12"
31-7
8' INV
Ø8"

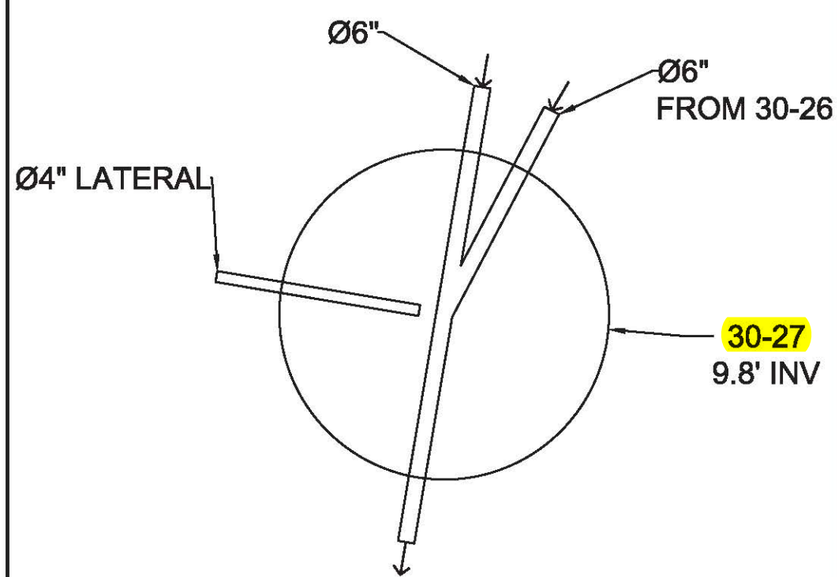

Ø15"
30-42
16' INV
Ø15"
Ø12"

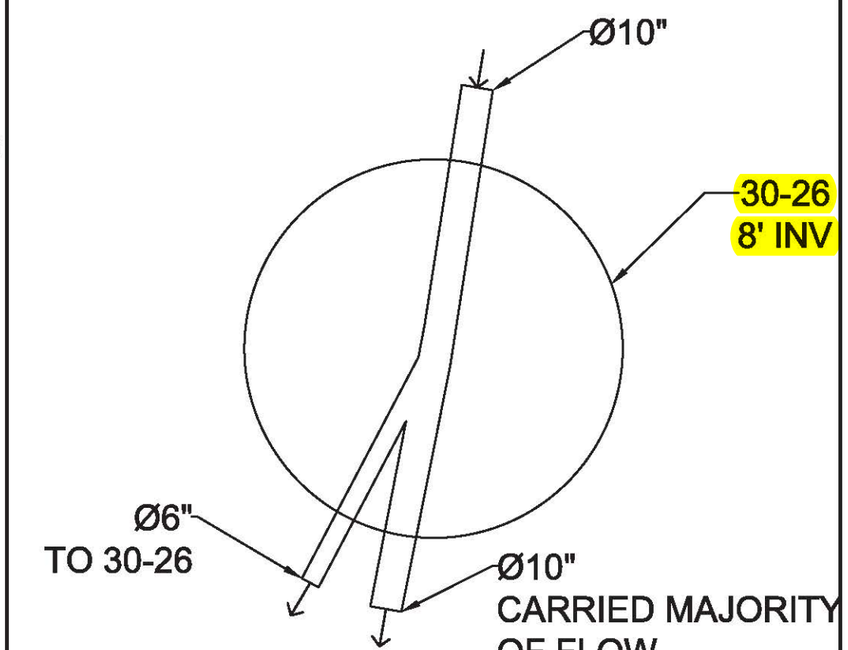

Ø15"
30-37
13.9' INV
Ø8"
Ø15"

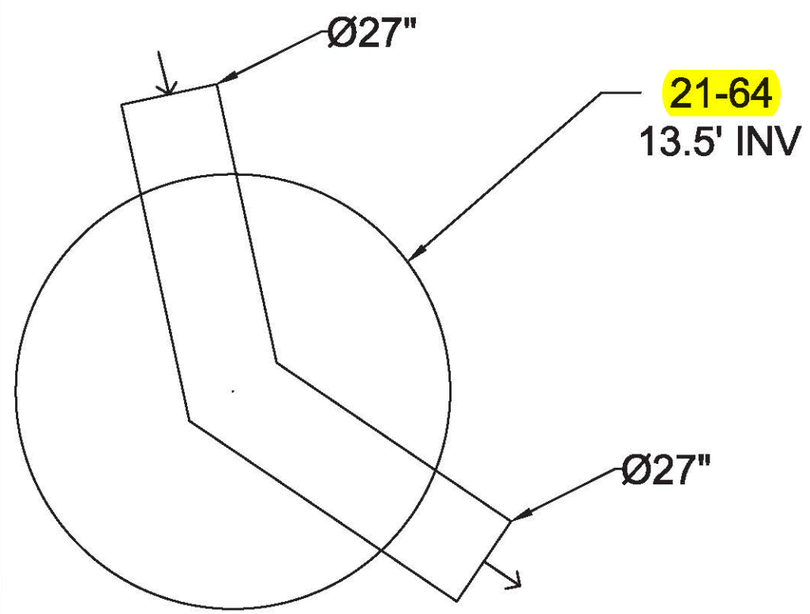

Ø6"
Ø10"
30-39
13.3' INV

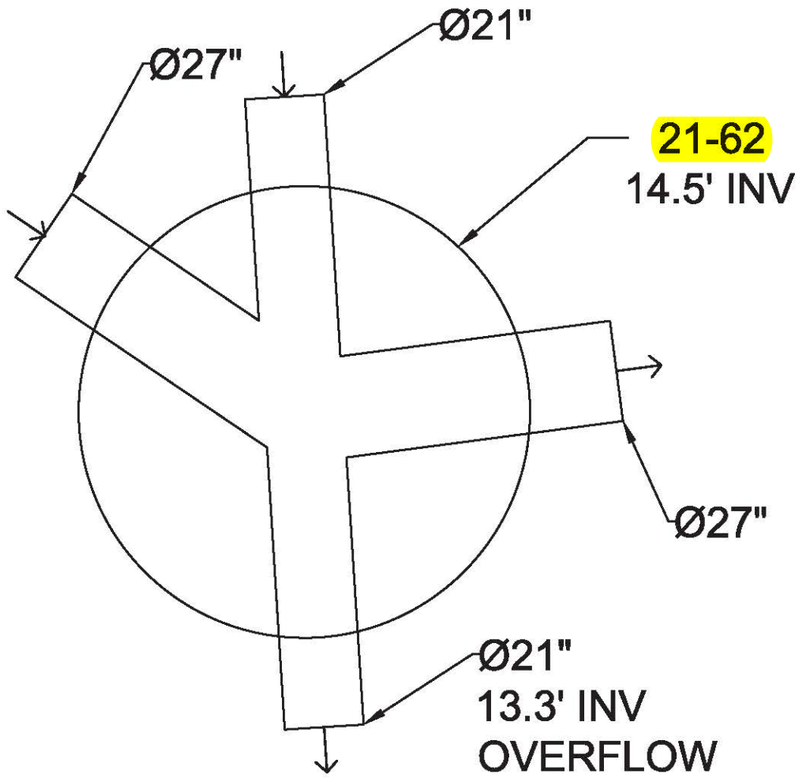

30-38
13.5' INV
Ø15"
Ø15"

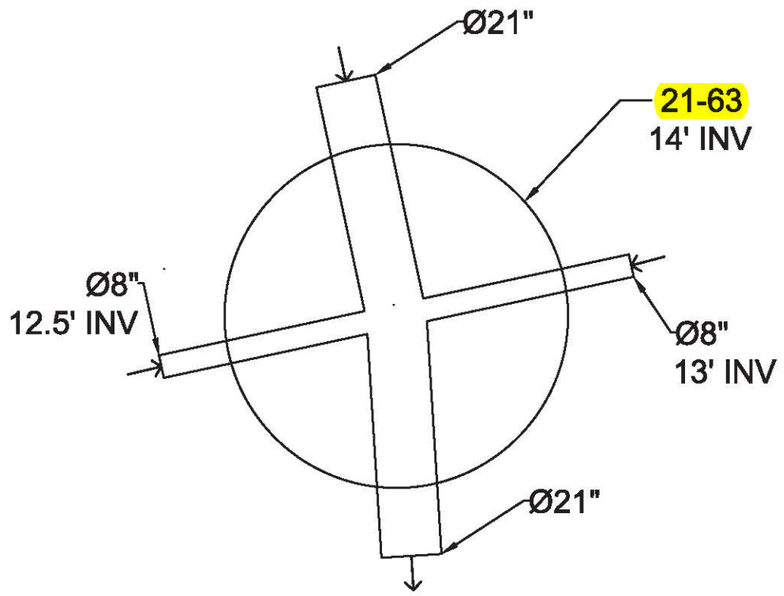

Ø10"
30-40
13' INV
Ø15"

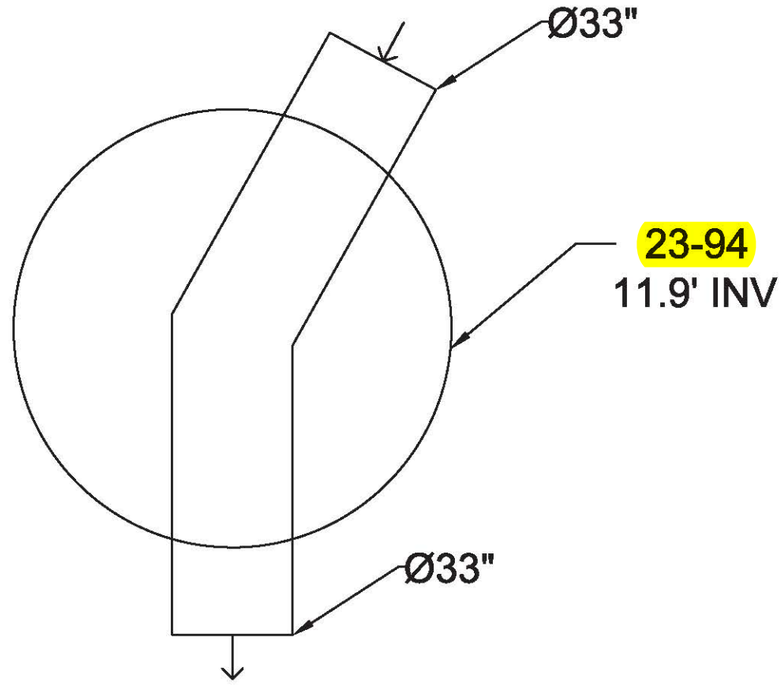

Ø6"
Ø6"
FROM 30-26
Ø4" LATERAL
30-27
9.8' INV

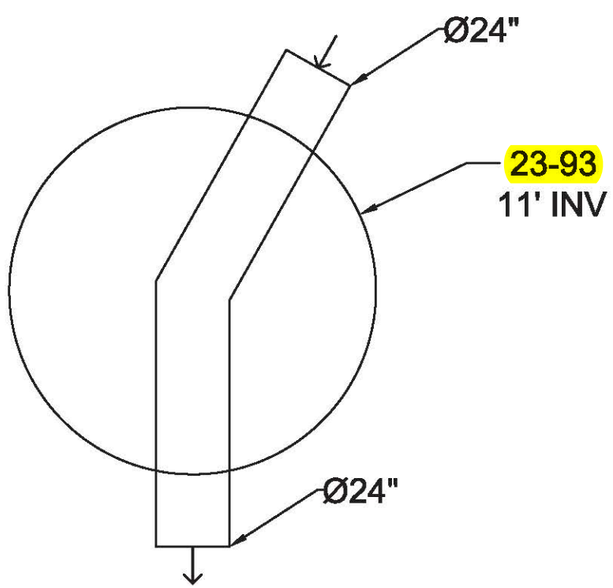

Ø10"
30-26
8' INV
Ø6"
TO 30-26
Ø10"
CARRIED MAJORITY
OF FLOW


Ø27"
21-64
13.5' INV
Ø27"

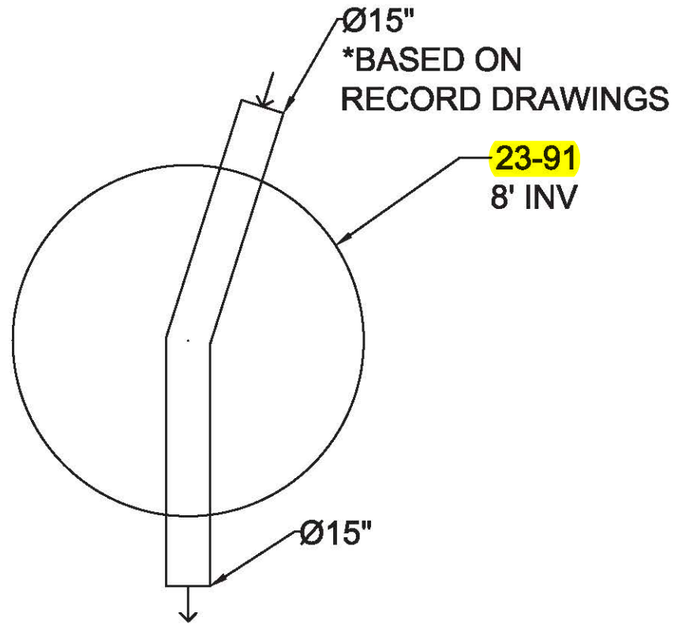




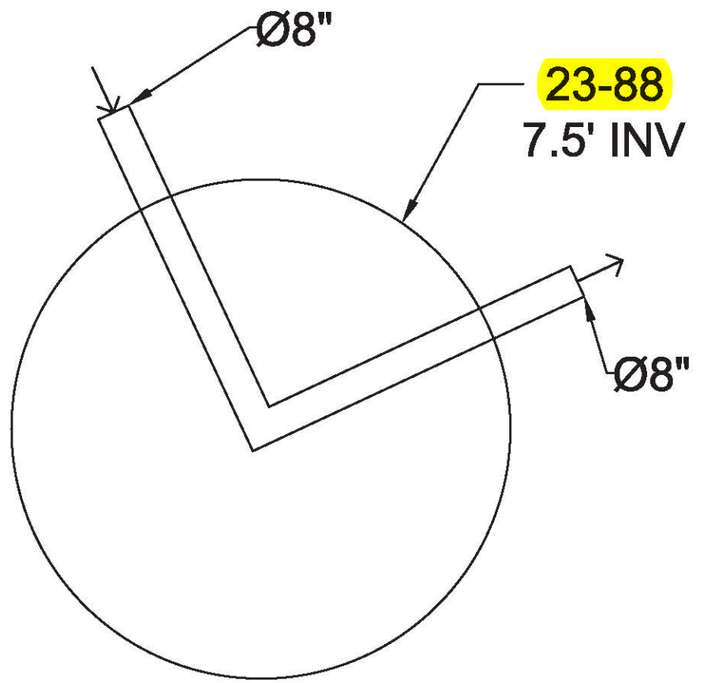


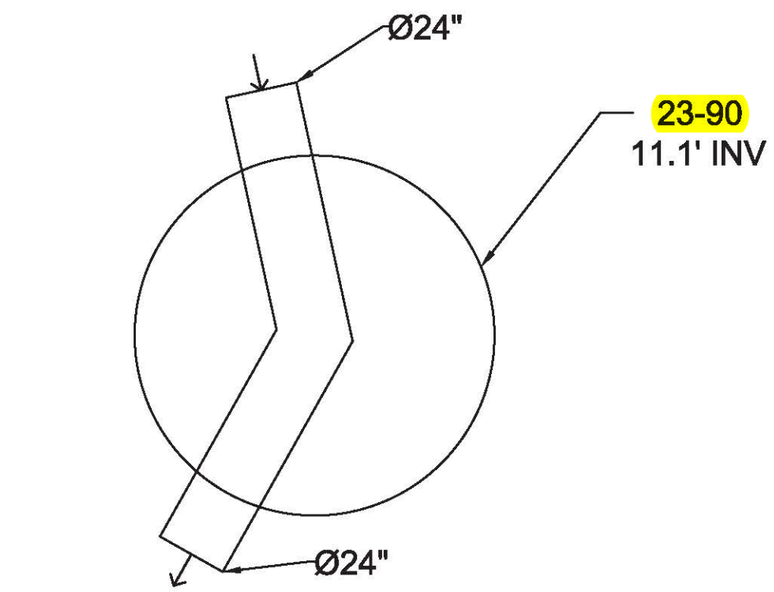


RECORD DRAWINGS DO NOT INDICATE 23-91_23-93 WAS EVER CONSTRUCTED.
SITE VISITS REVEALED PIPES AS SHOWN.
23-90_23-93 CCTV INSPECTION CONFIRMS 23-91_23-93 DOES NOT EXIST. NO CCTV INSPECTION TO VERIFY 23-90_23-91.
.

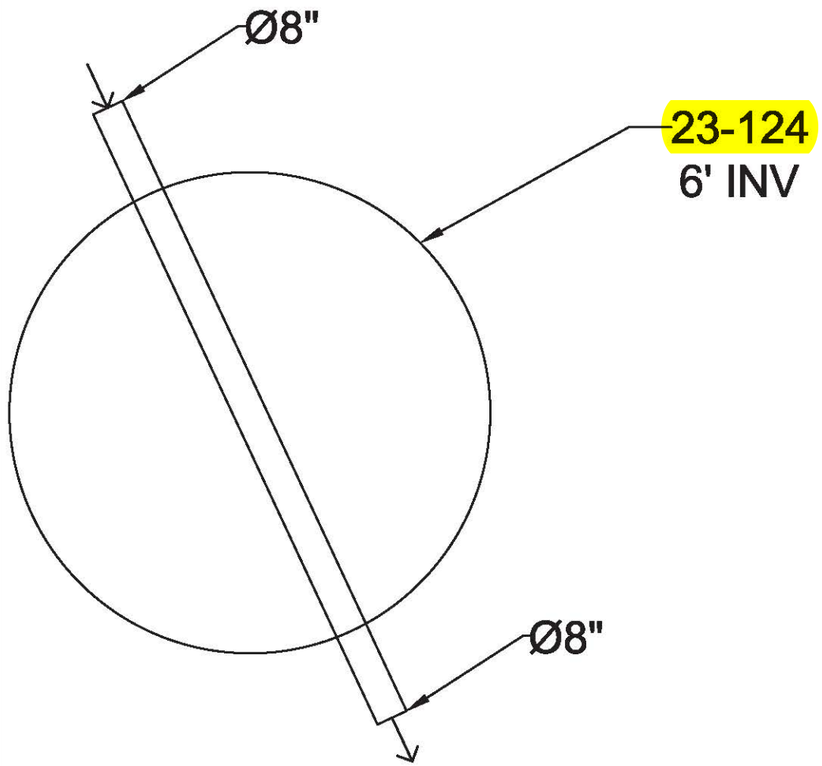


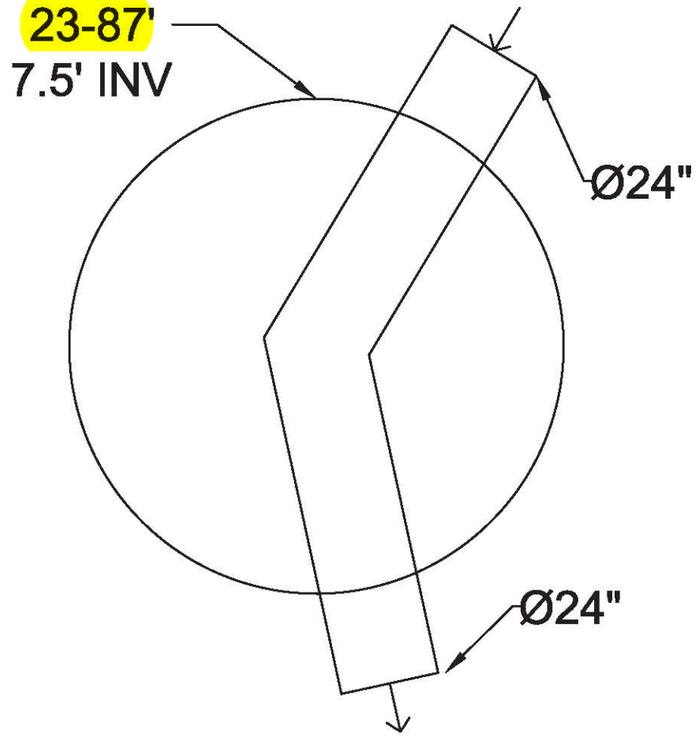
RECORD DRAWINGS DO NOT INDICATE 23-90_23-91 & 23-91_23-93 WERE EVER CONSTRUCTED.
SITE VISITS REVEALED PIPES AS SHOWN.
23-90_23-93 CCTV INSPECTION CONFIRMS 23-91_23-93 DOES NOT EXIST. NO CCTV INSPECTION TO VERIFY 23-90_23-91.

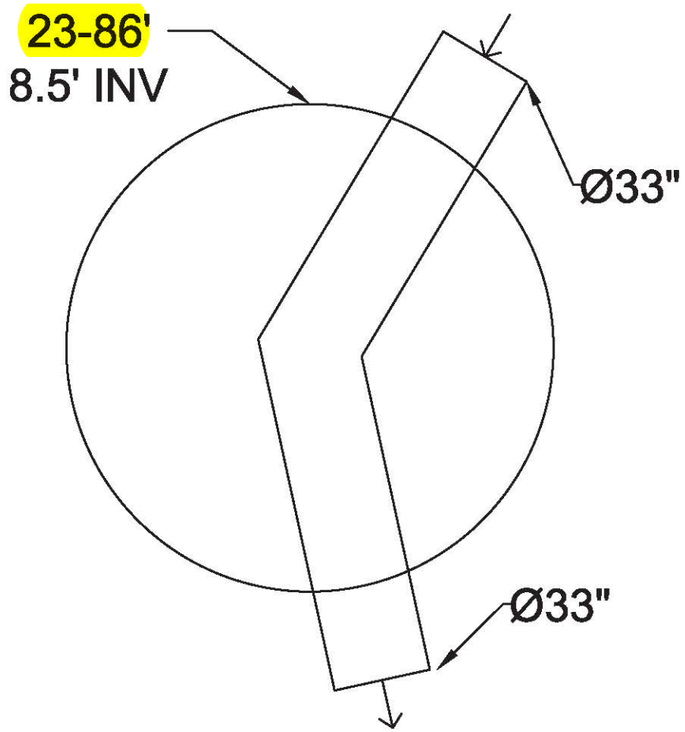


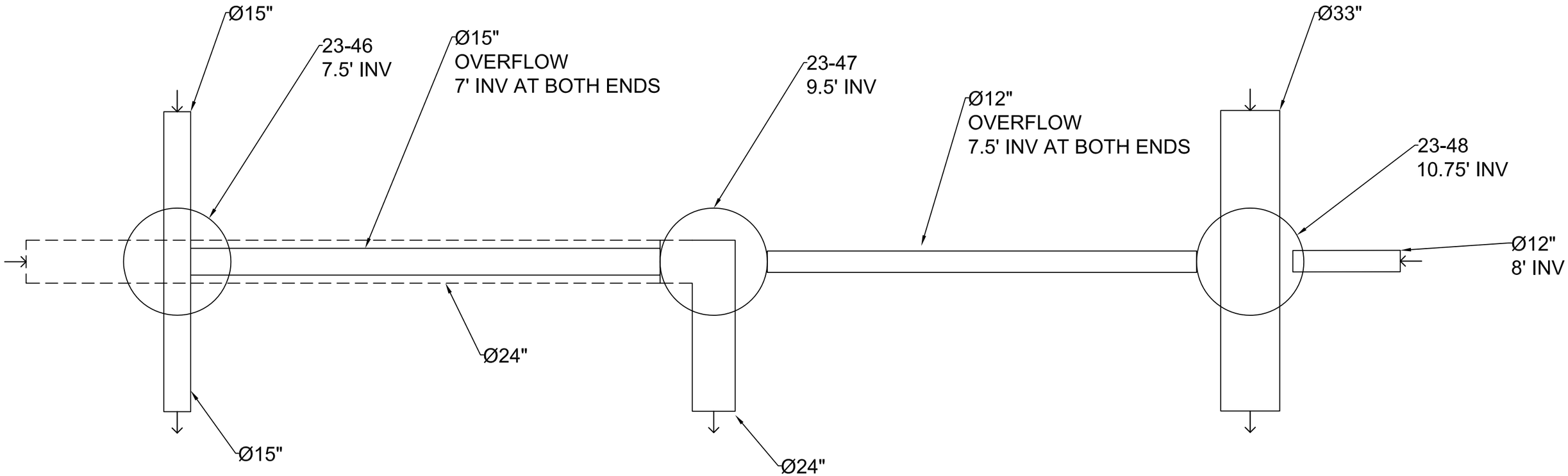


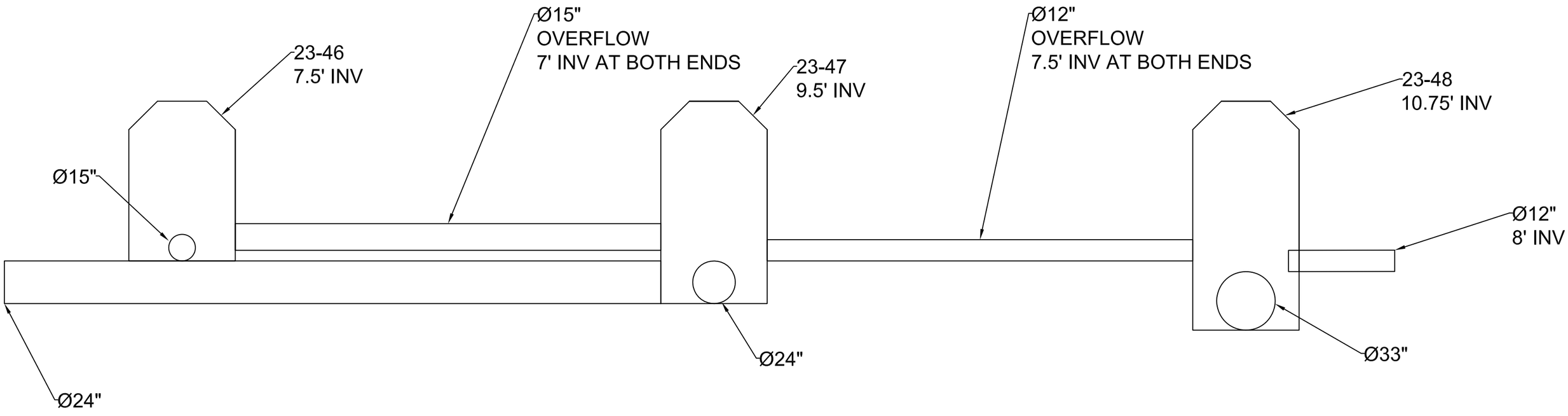
RECORD DRAWINGS DO NOT INDICATE
23-90_23-91 WAS EVER CONSTRUCTED.
SITE VISITS REVEALED PIPES AS SHOWN.
NO CCTV TO VERIFY.

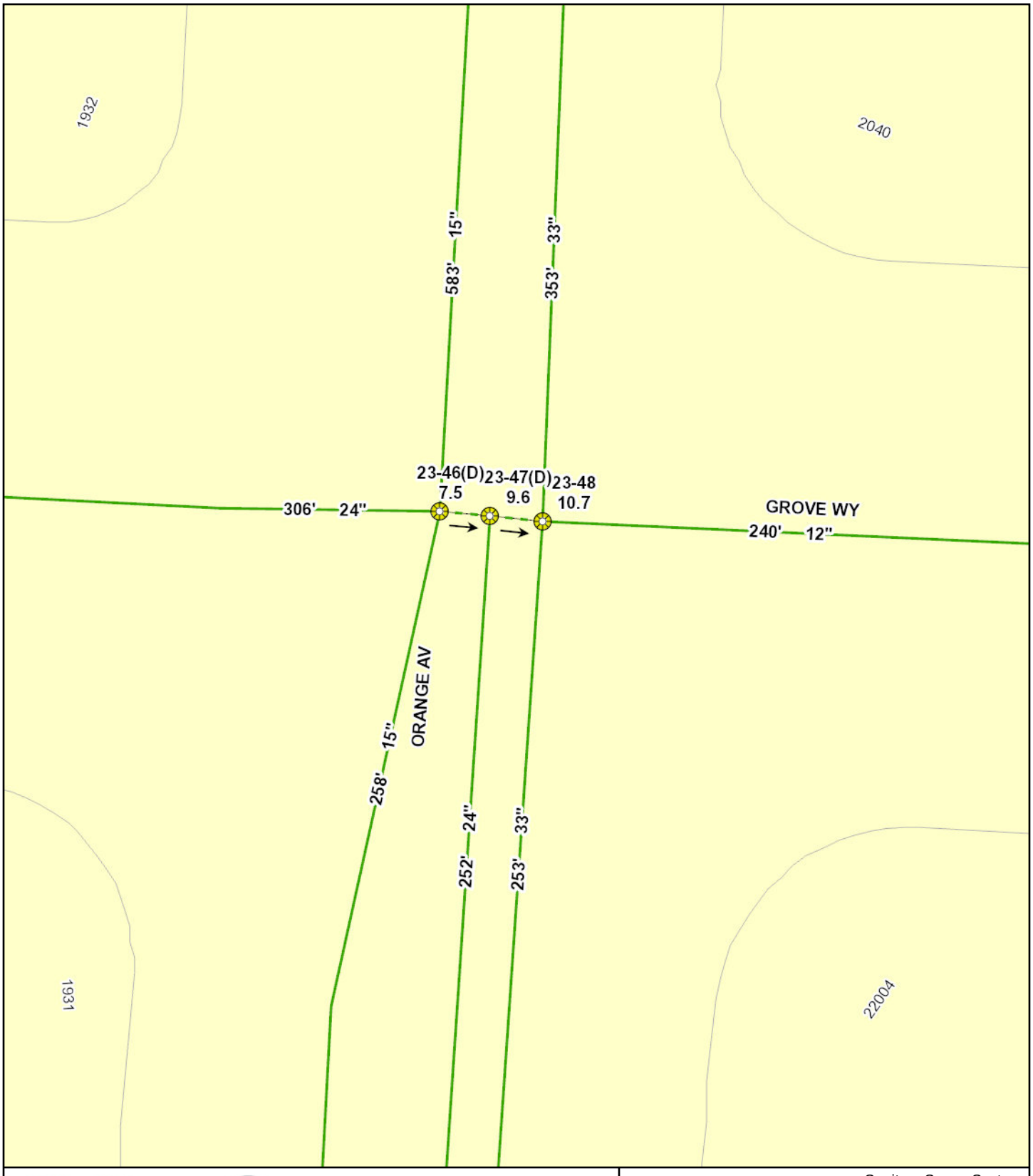







Ø15"
23-46
7.5' INV
Ø15"
OVERFLOW
7' INV AT BOTH ENDS
23-47
9.5' INV
Ø12"
OVERFLOW
7.5' INV AT BOTH ENDS
Ø33"
23-48
10.75' INV
Ø12"
8' INV
Ø24"
Ø15"
Ø24"


Ø15"
23-46
7.5' INV
Ø15"
OVERFLOW
7' INV AT BOTH ENDS
23-47
9.5' INV
Ø12"
OVERFLOW
7.5' INV AT BOTH ENDS
23-48
10.75' INV
Ø12"
8' INV
Ø24"
Ø24"
Ø33"



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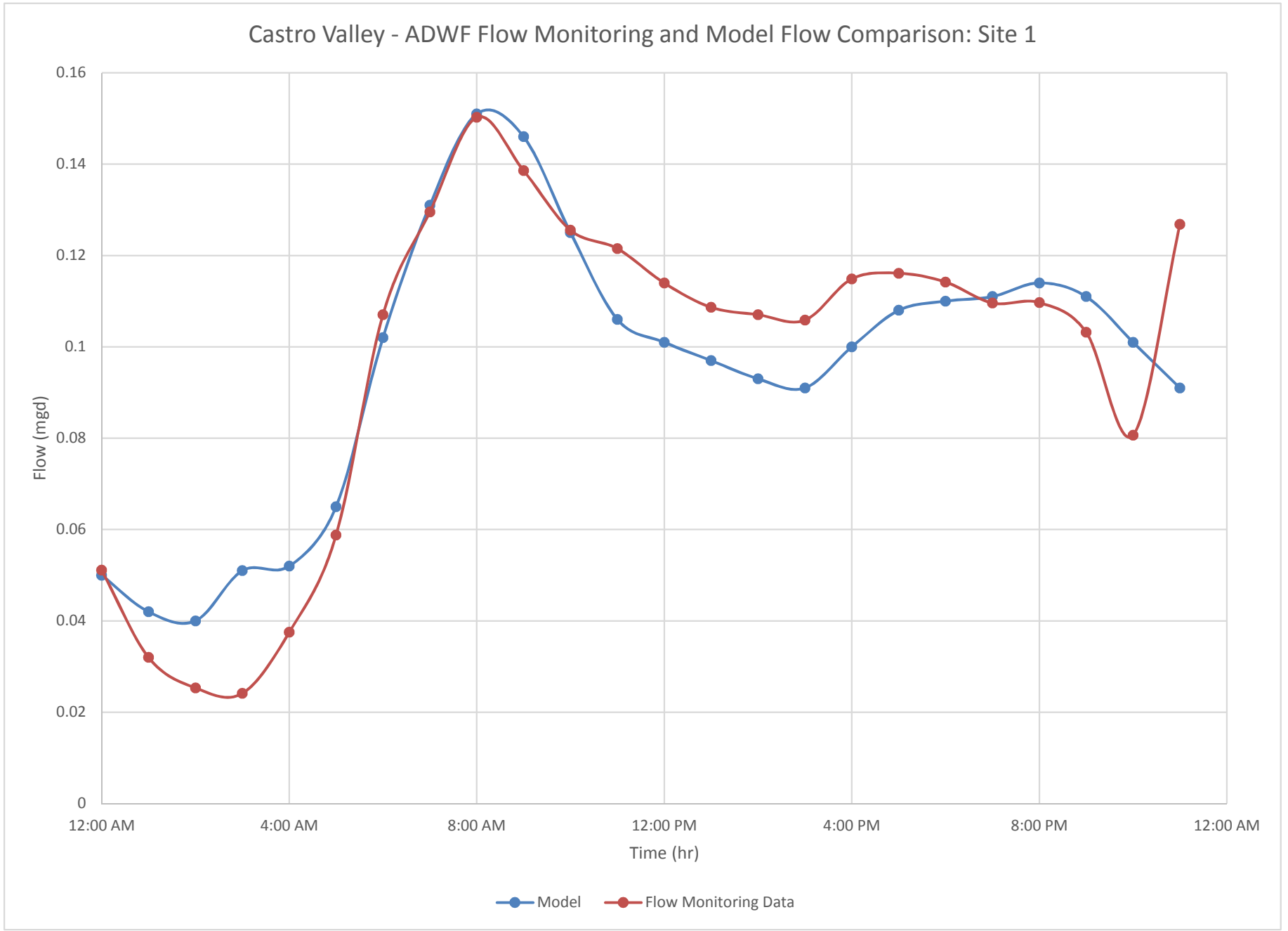
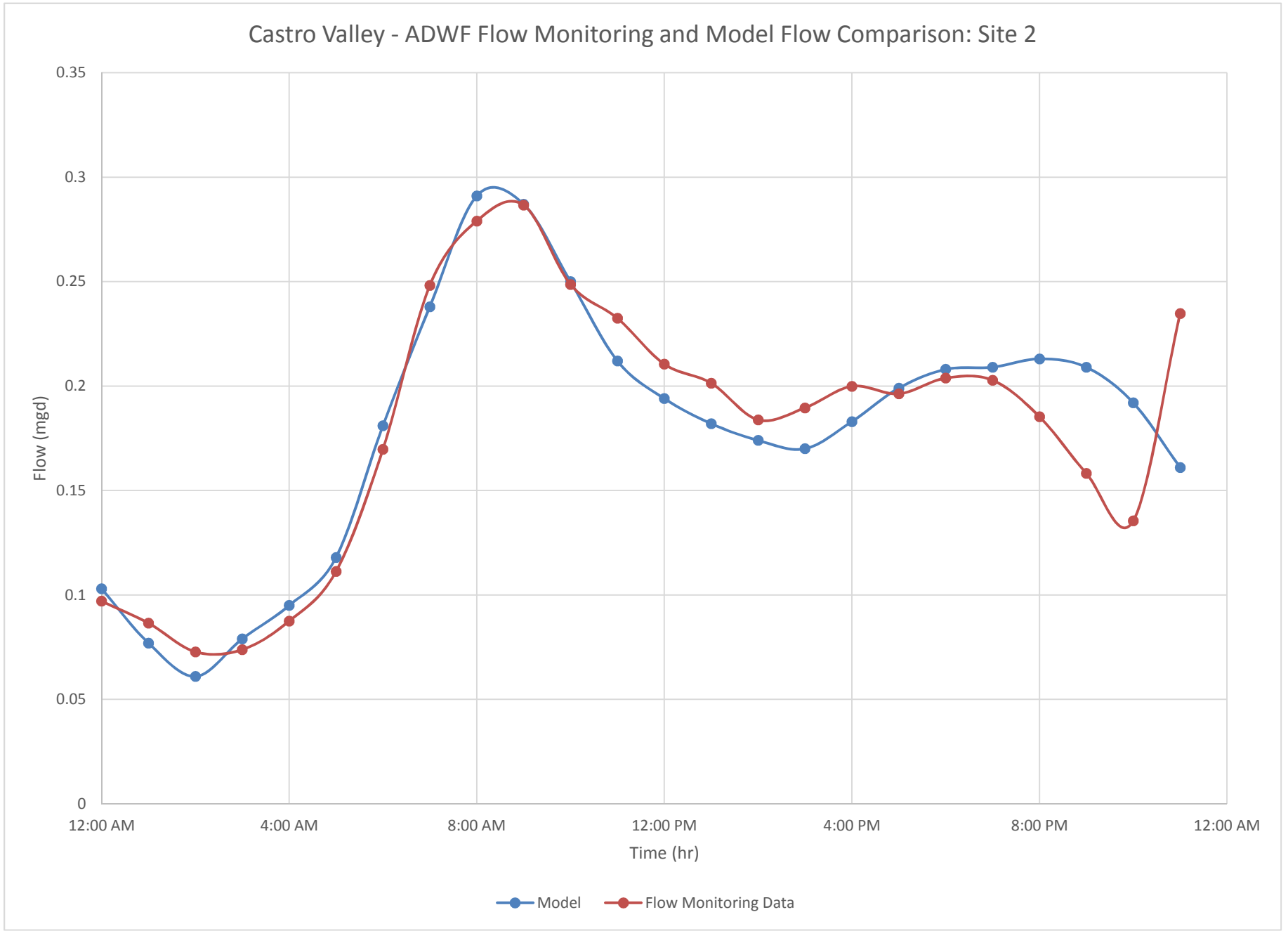
Sanitary Sewer System
Castro Valley, California

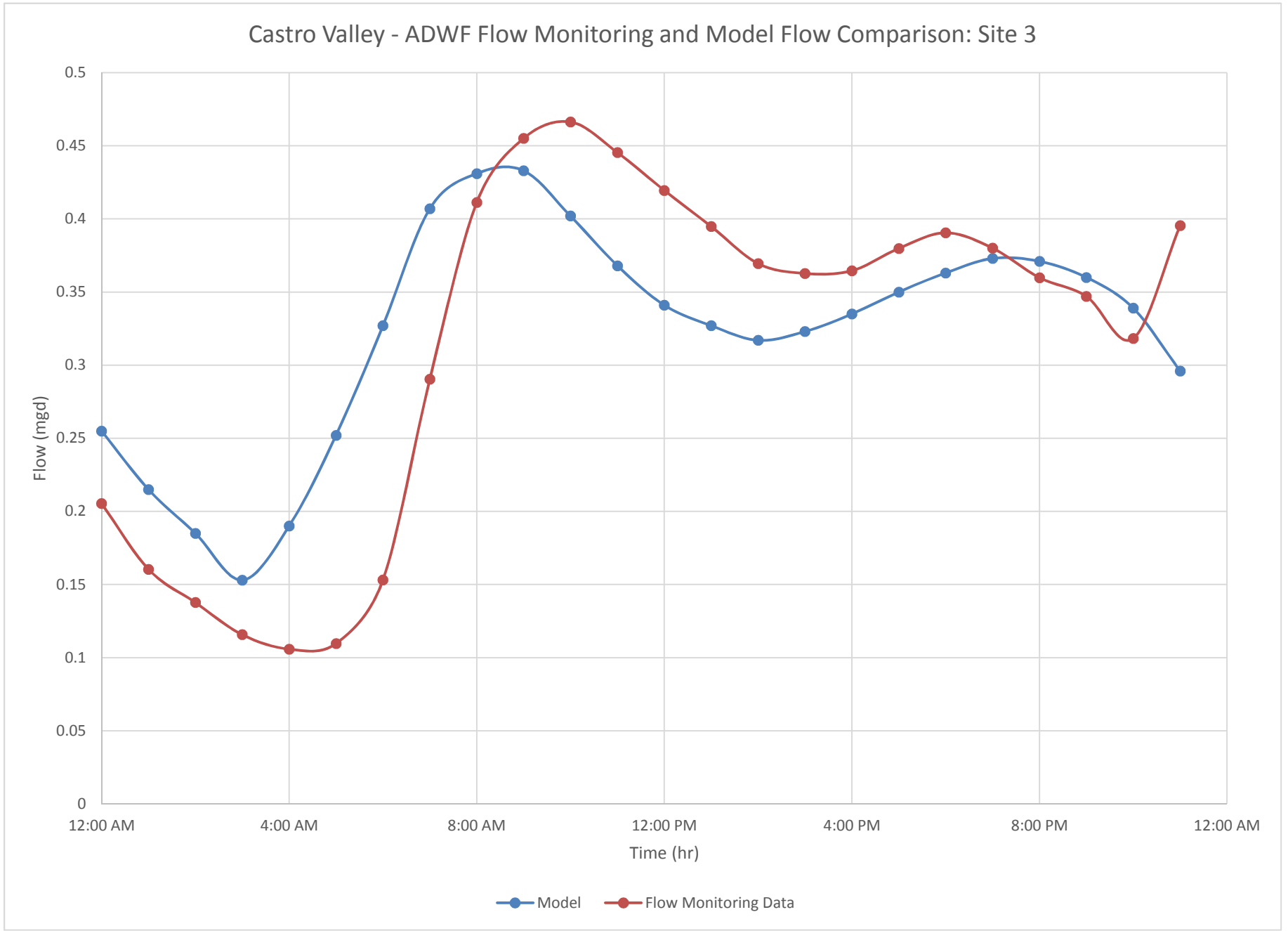
10/19/2015

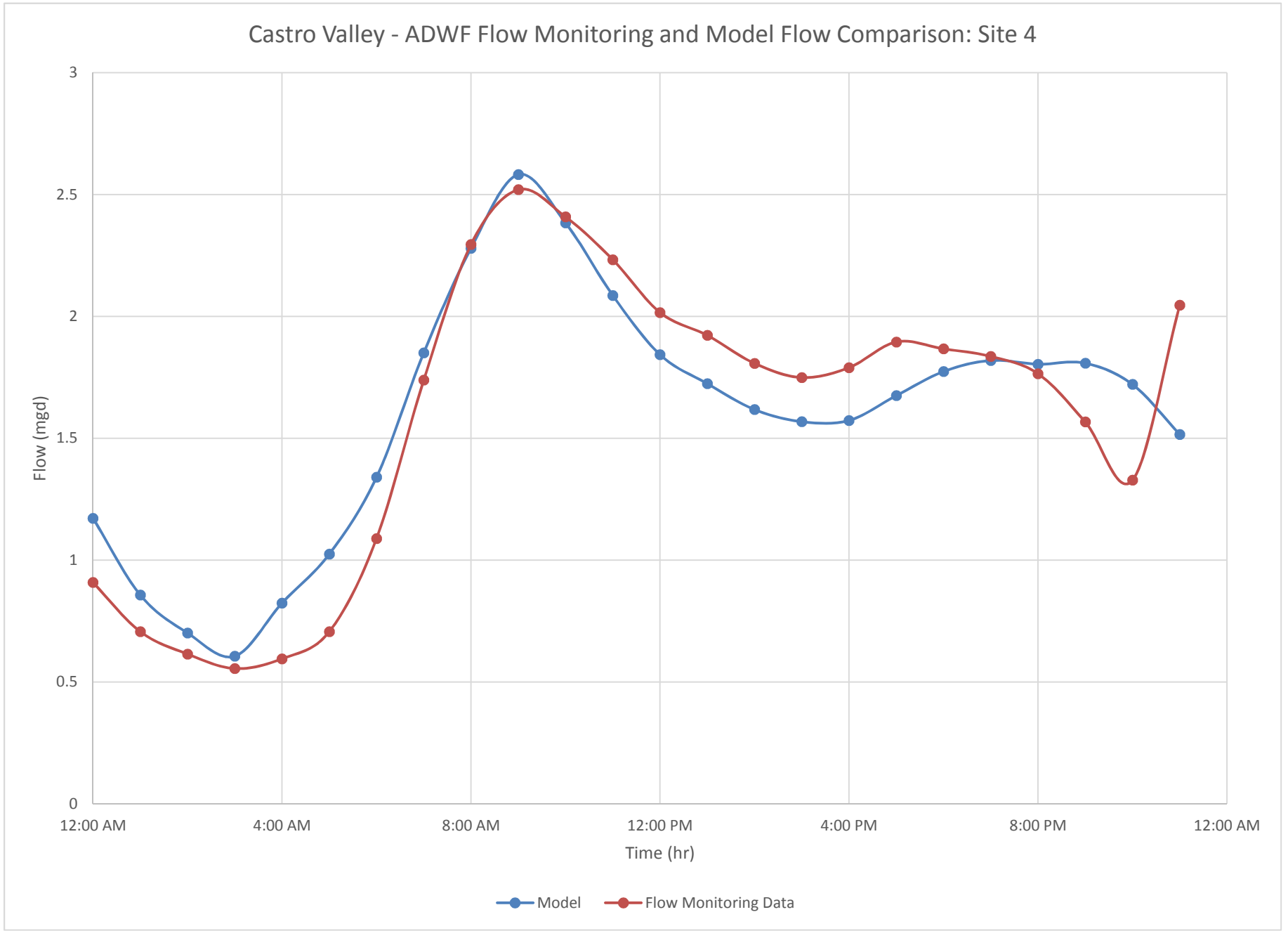
APPENDIX B

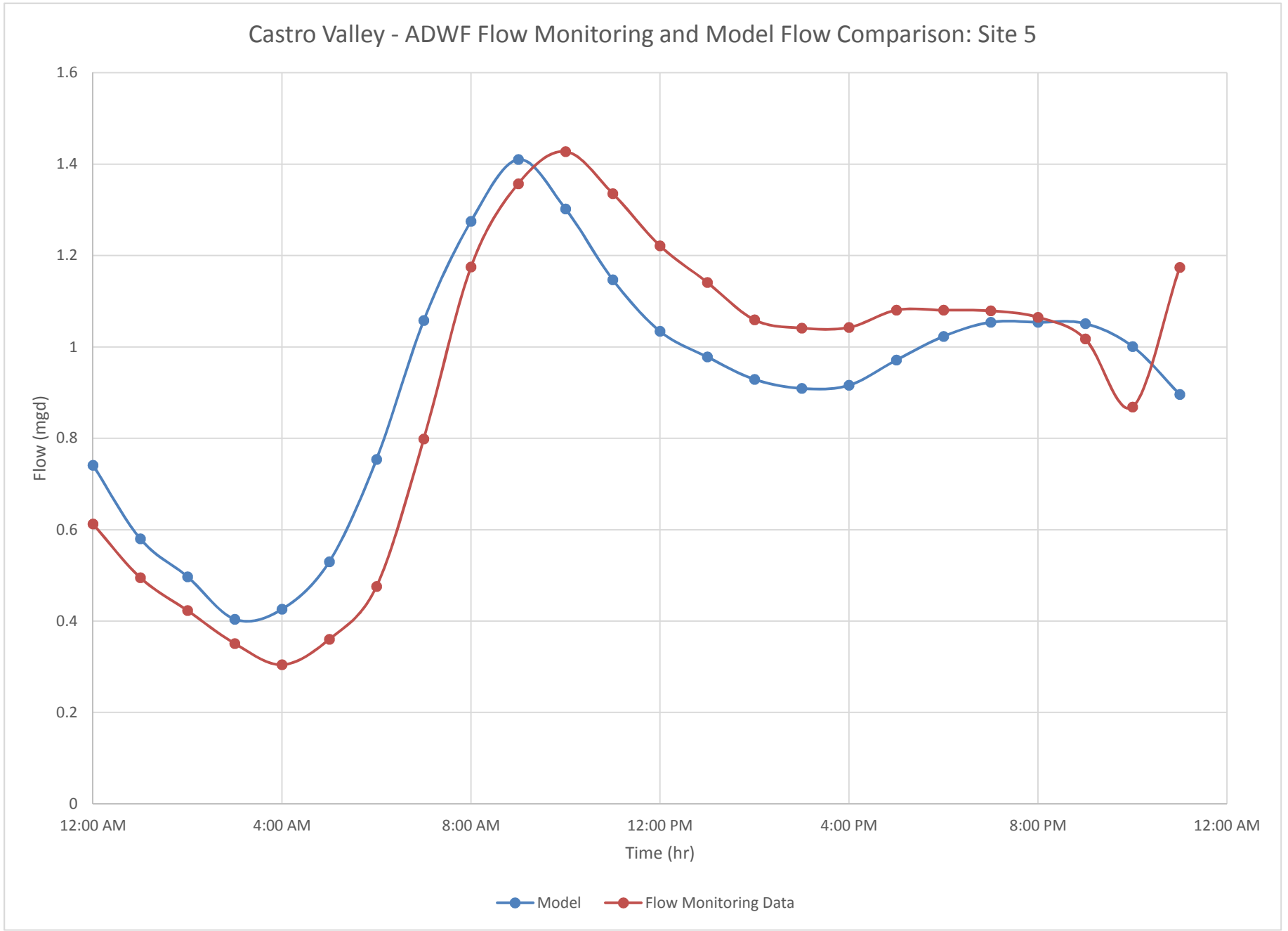
Dry Weather Calibration Plots

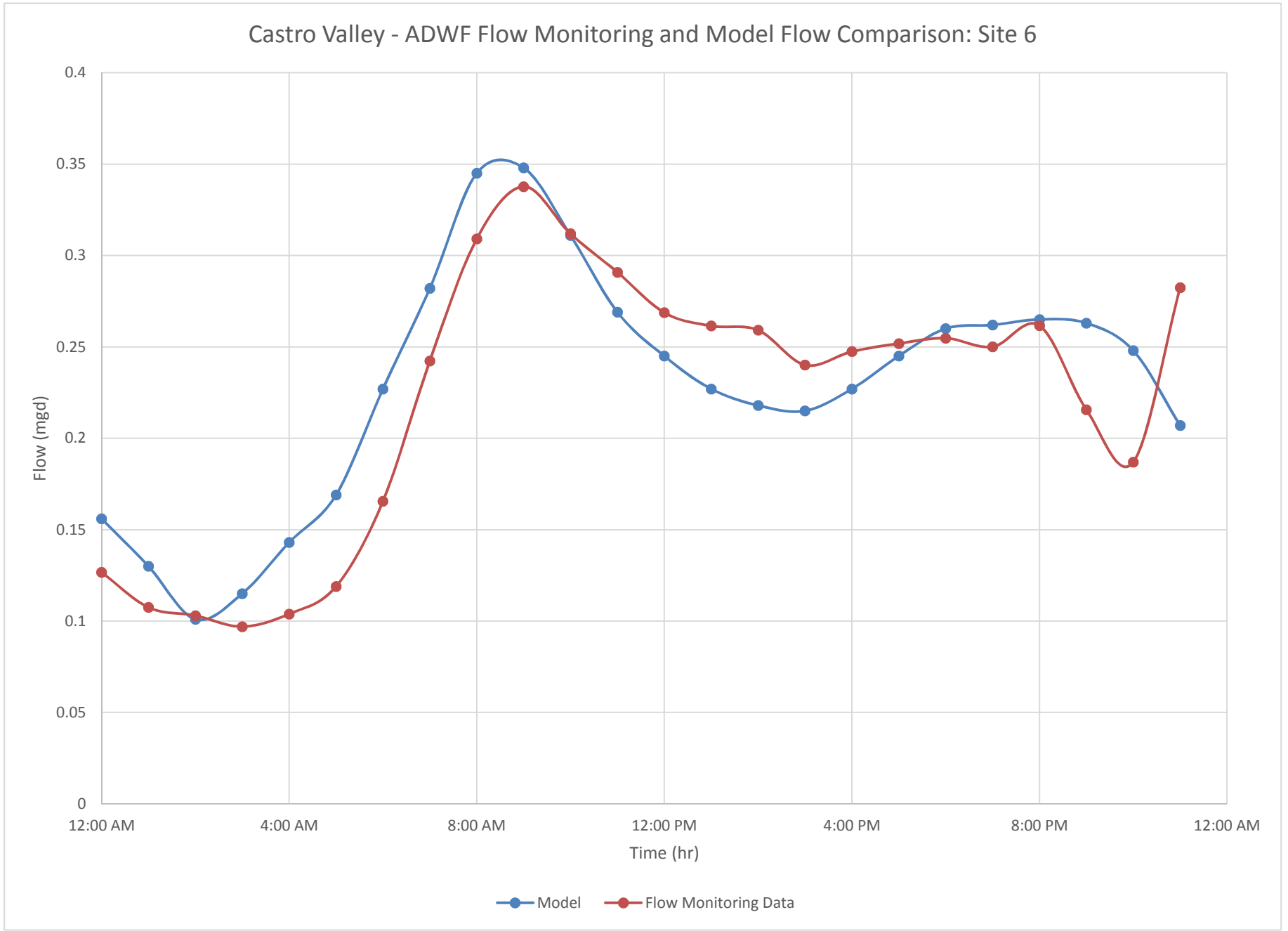

Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 1
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Flow (mgd)
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data

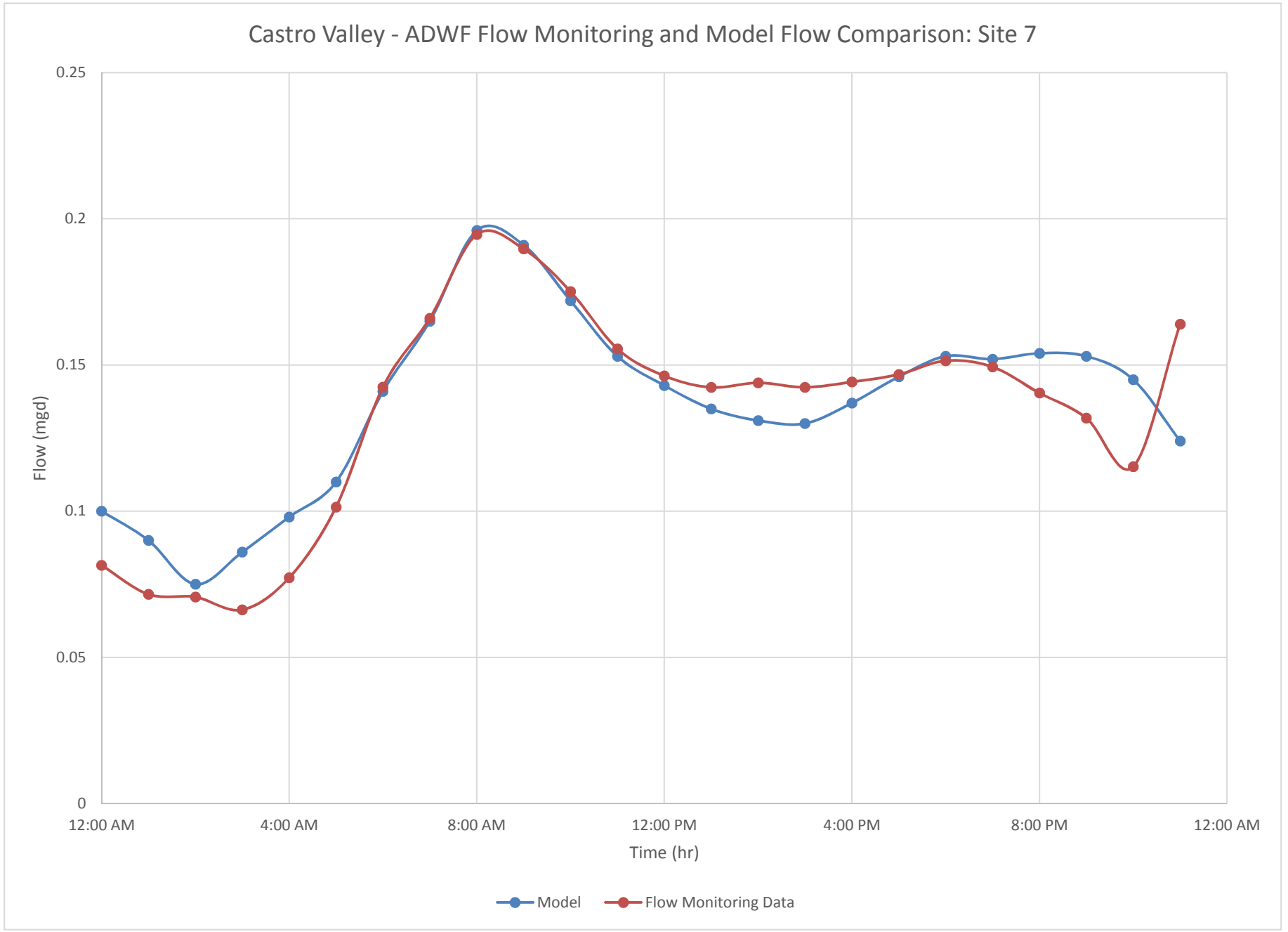

Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 2
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Flow (mgd)
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data

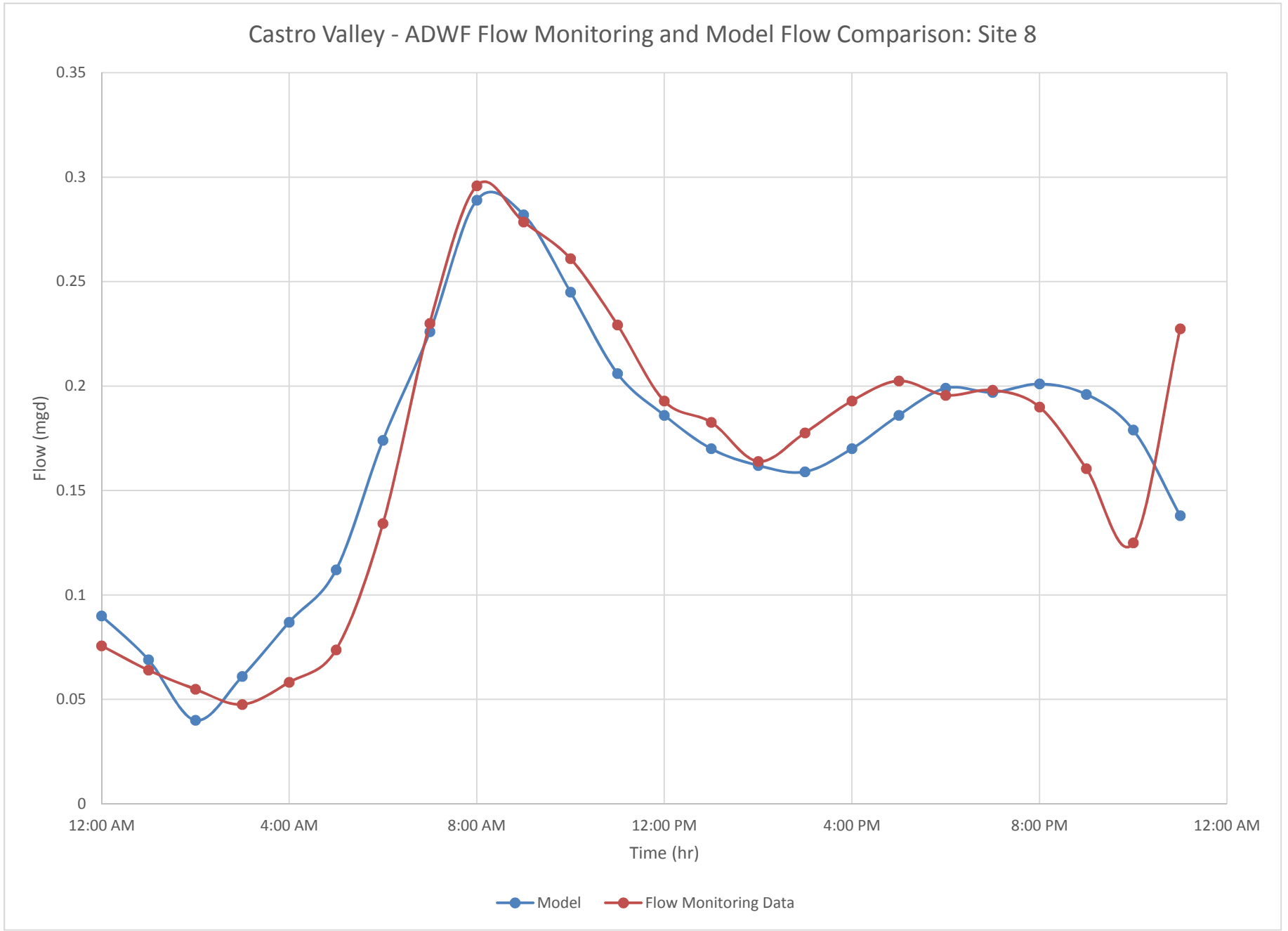

Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 3
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Flow (mgd)
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data

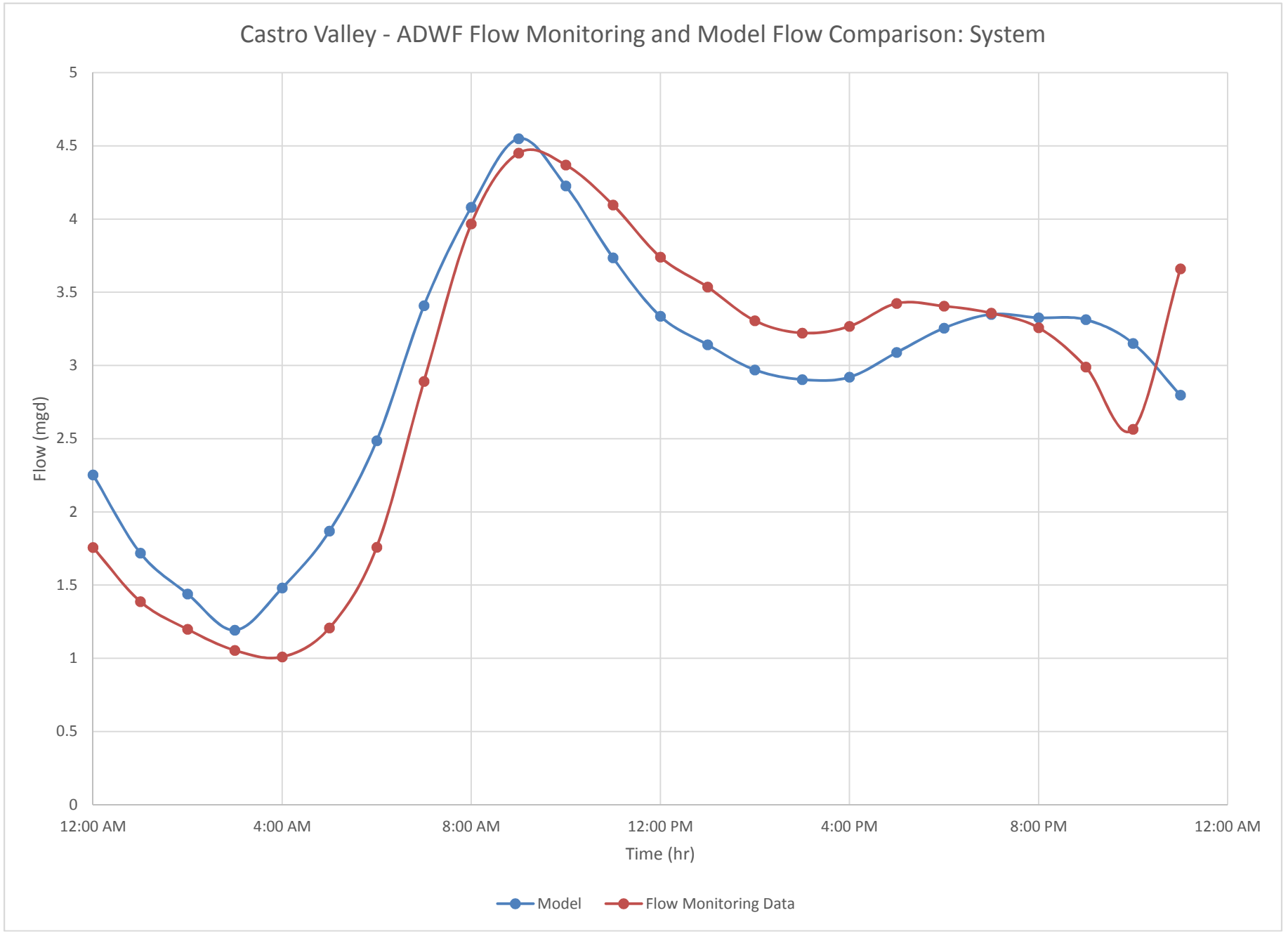

Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 4
Flow (mgd)
3
2.5
2
1.5
1
0.5
0
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data


Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 5
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Flow (mgd)
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data


Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 6
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Flow (mgd)
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data

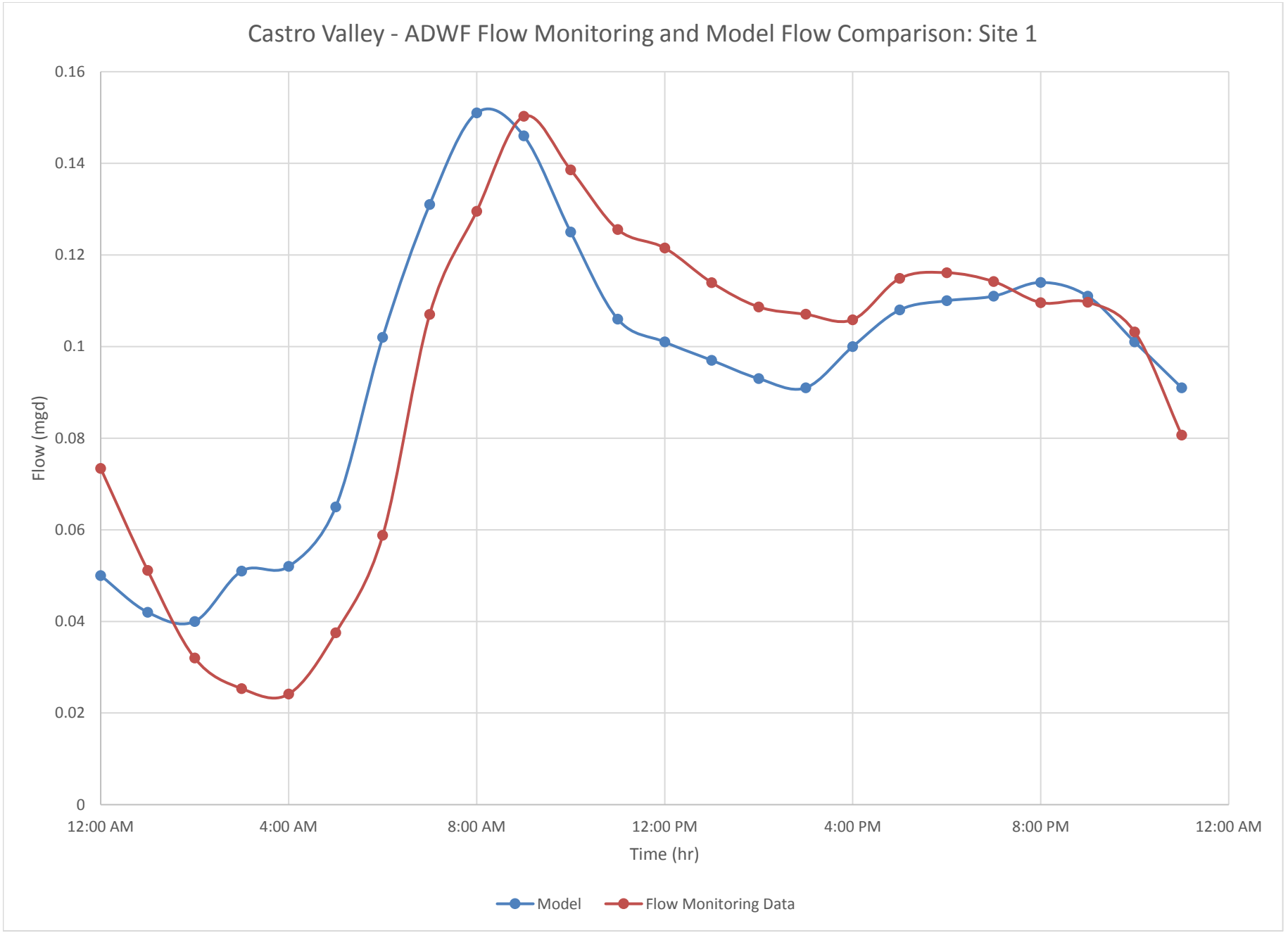

Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 7
0.25
0.2
0.15
0.1
0.05
0
Flow (mgd)
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data

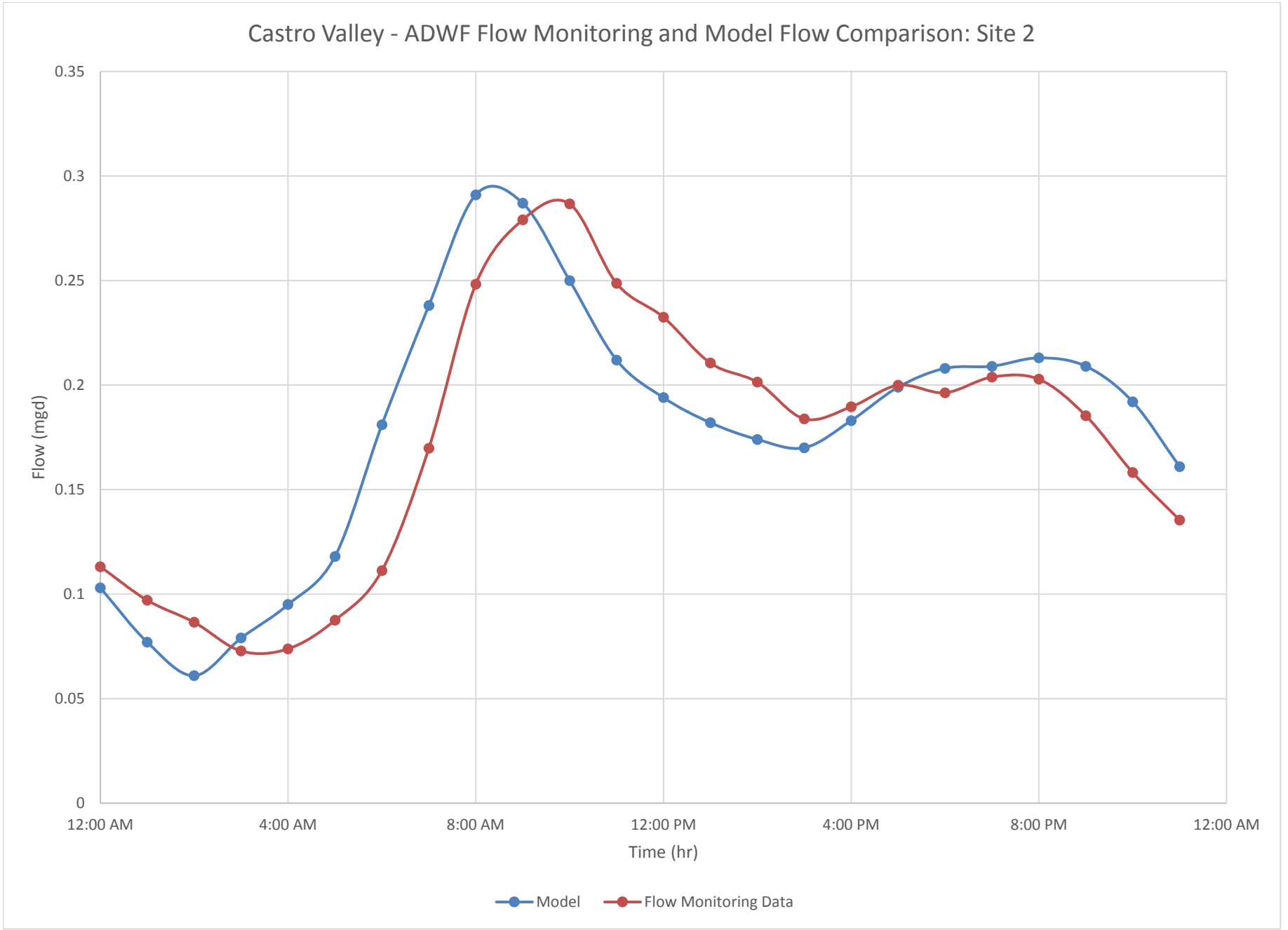

Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 8
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Flow (mgd)
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data

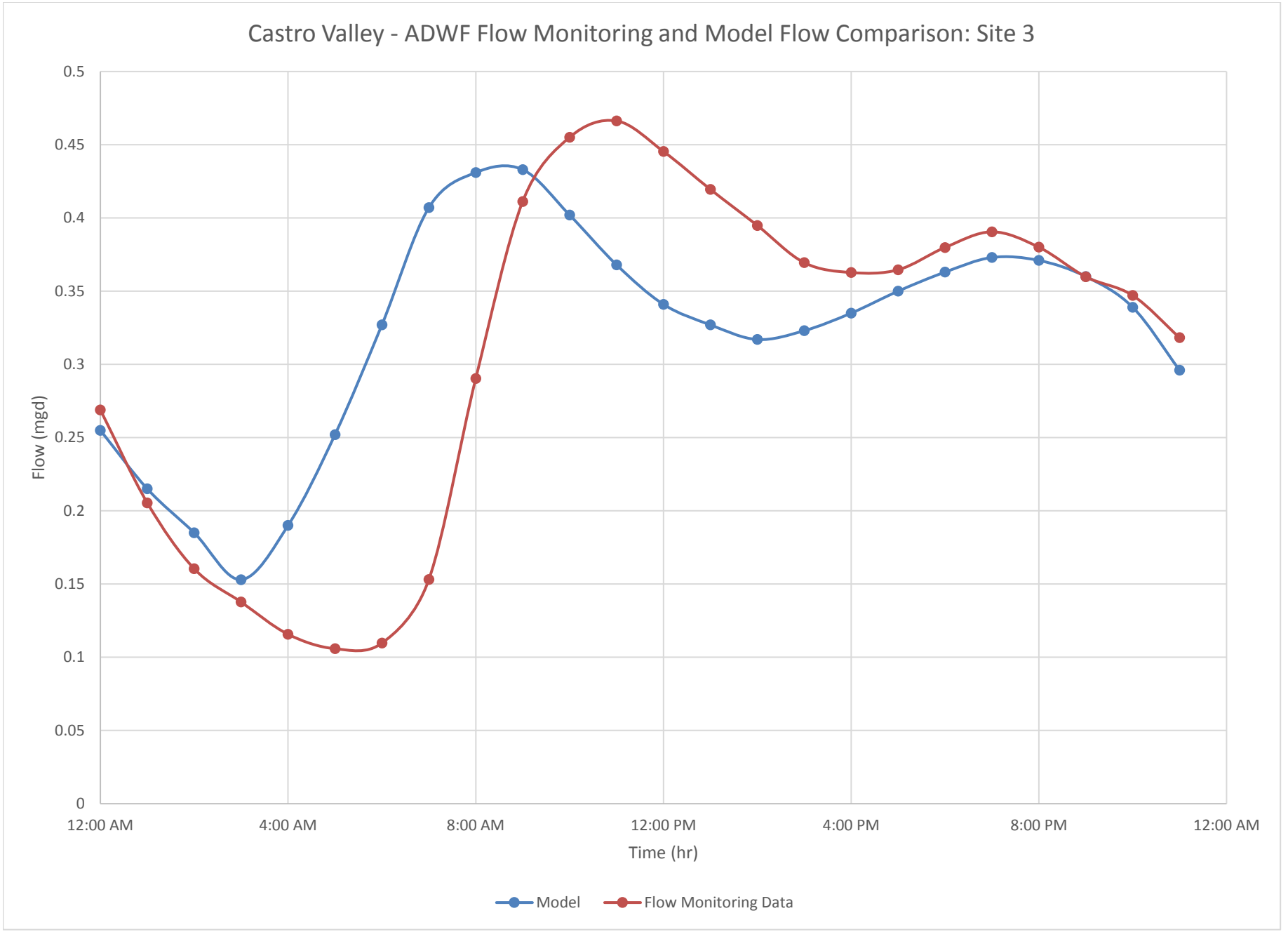

Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: System
Flow (mgd)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data

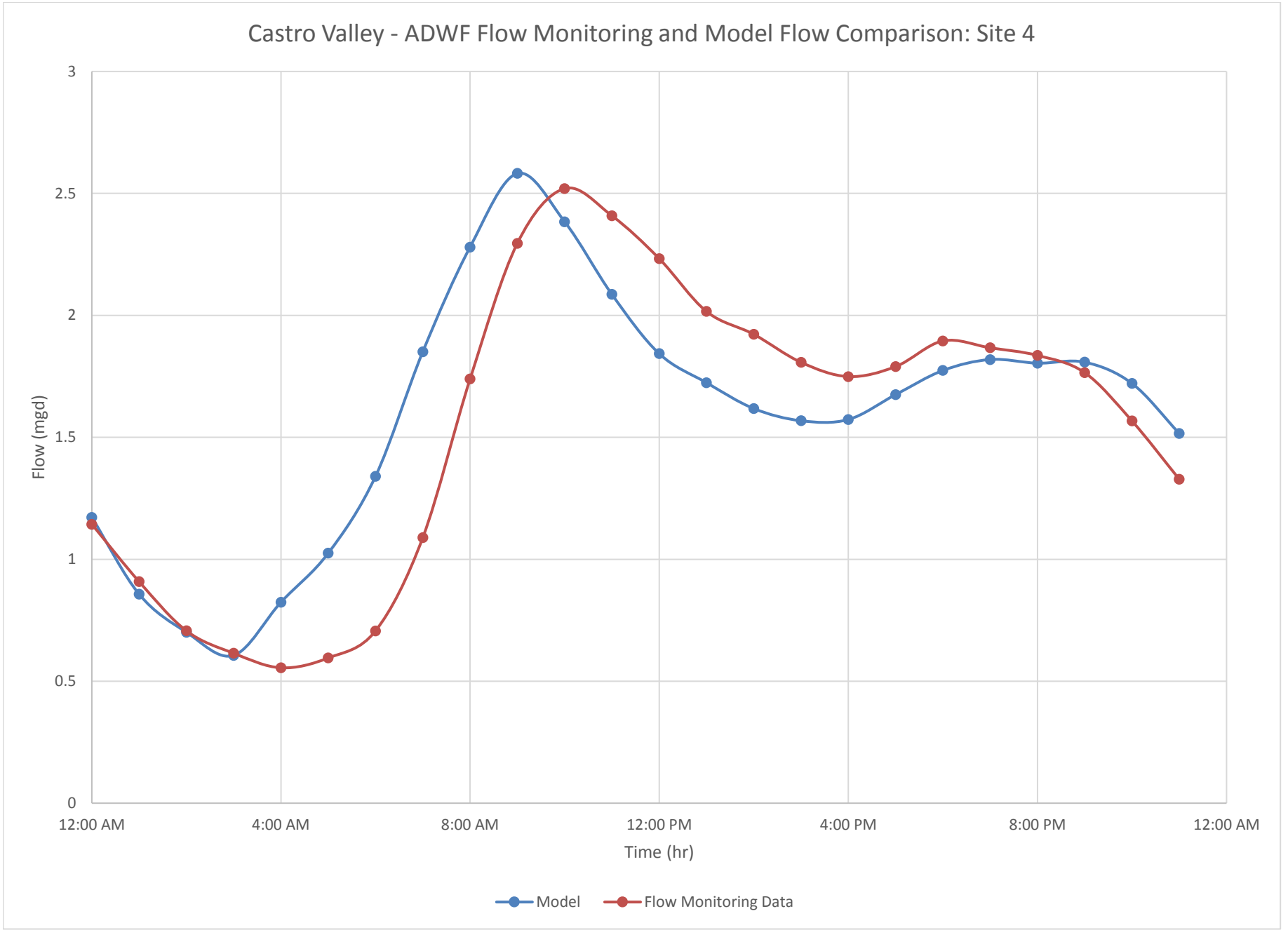
APPENDIX C

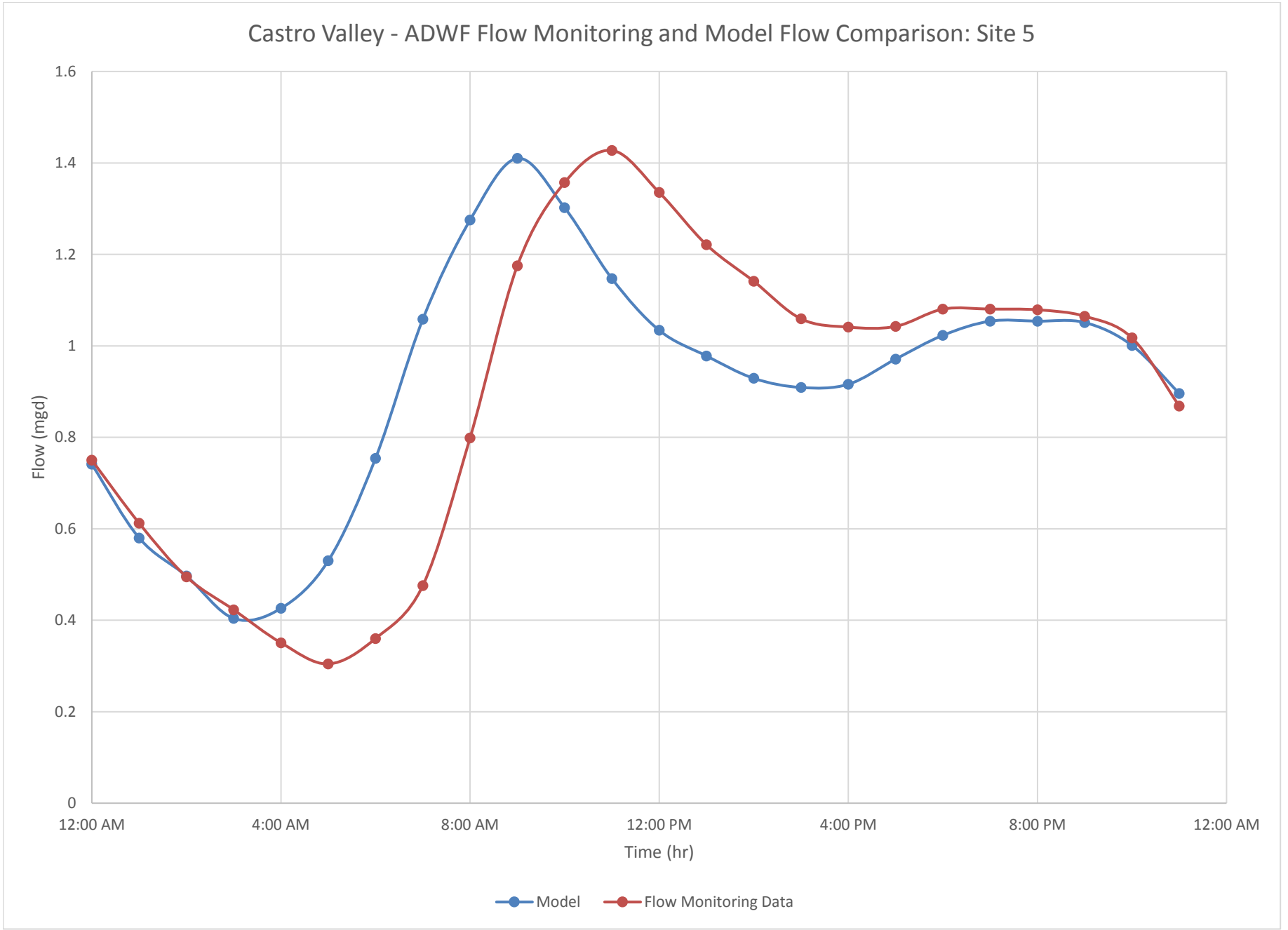
Wet Weather Calibration Plots

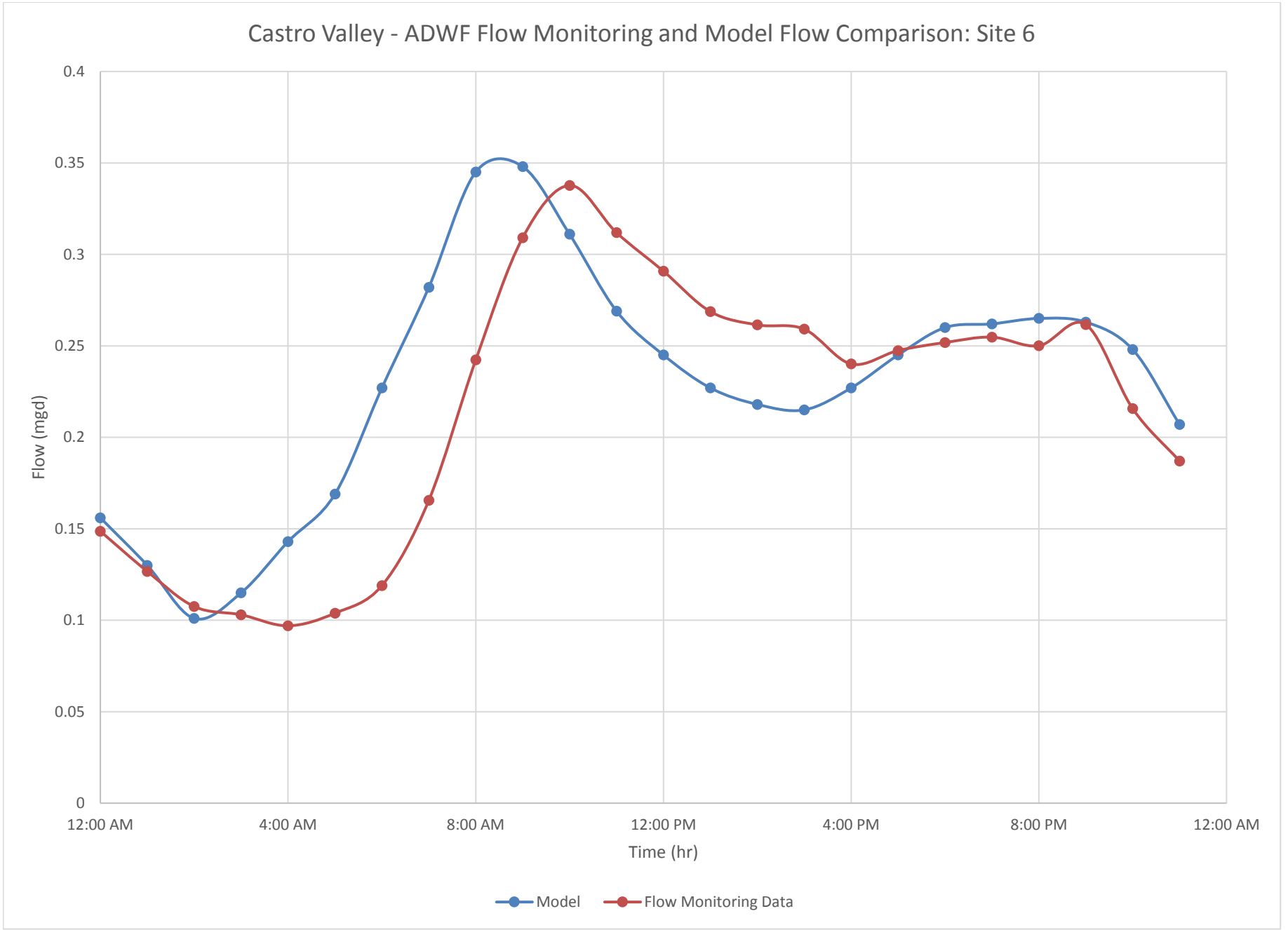

Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 1
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Flow (mgd)
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data

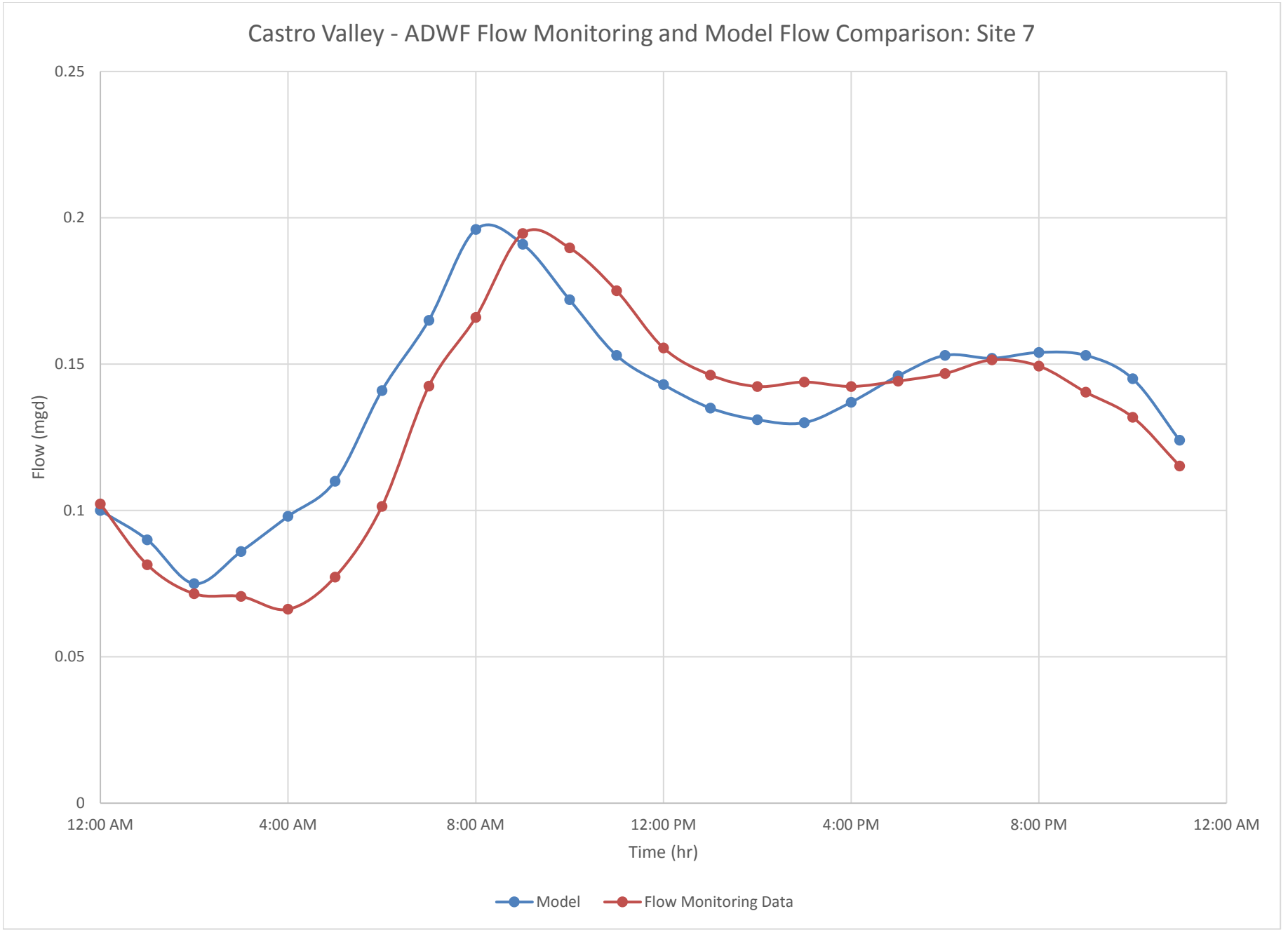

Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 2
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Flow (mgd)
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data

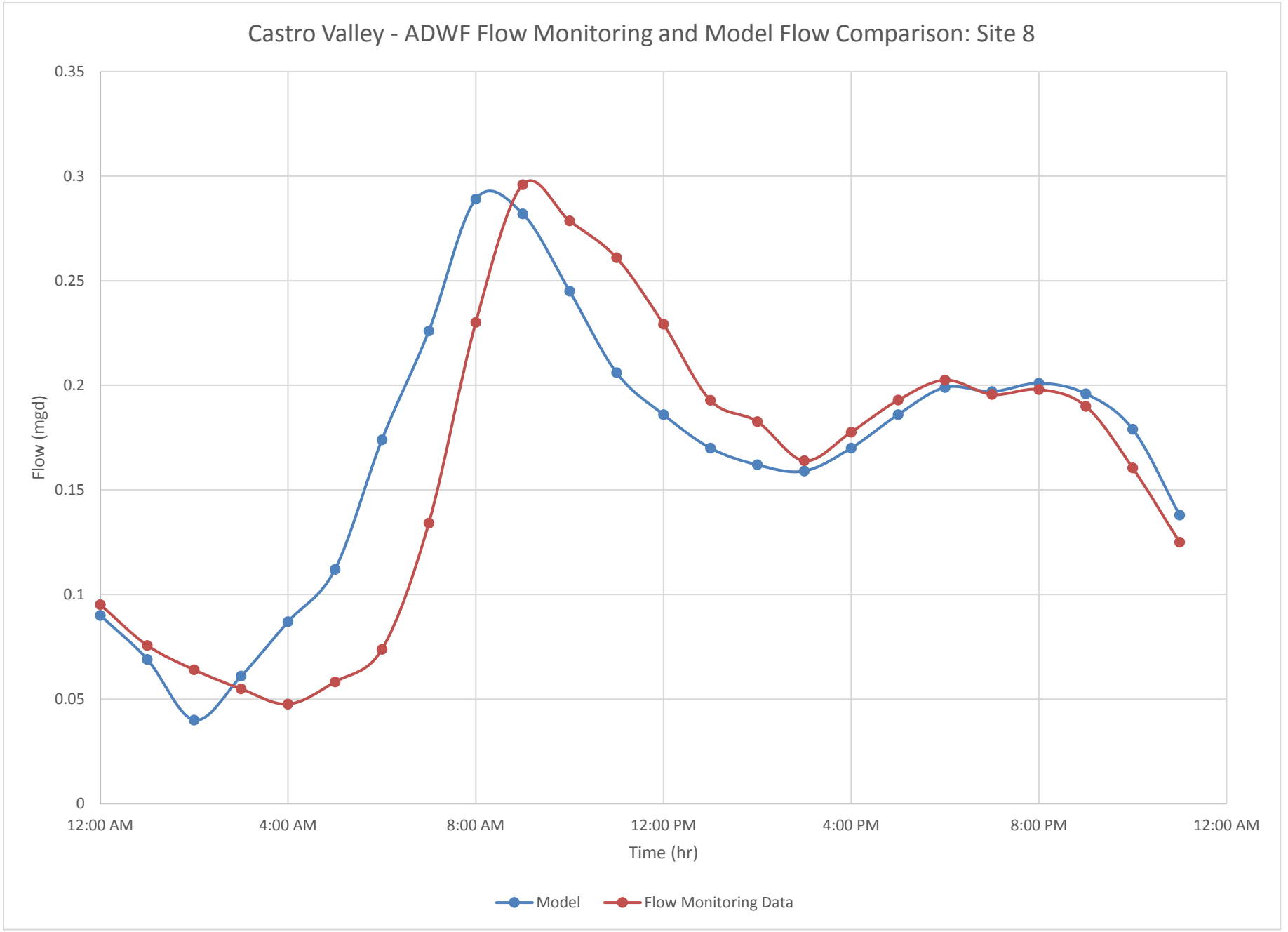

Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 3
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Flow (mgd)
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data


Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 4
Flow (mgd)
3
2.5
2
1.5
1
0.5
0
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data


Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 5
Flow (mgd)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data


Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 6
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Flow (mgd)
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data


Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 7
0.25
0.2
0.15
0.1
0.05
0
Flow (mgd)
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data


Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: Site 8
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0.3
0.25
0.2
0.15
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0.05
0
Flow (mgd)
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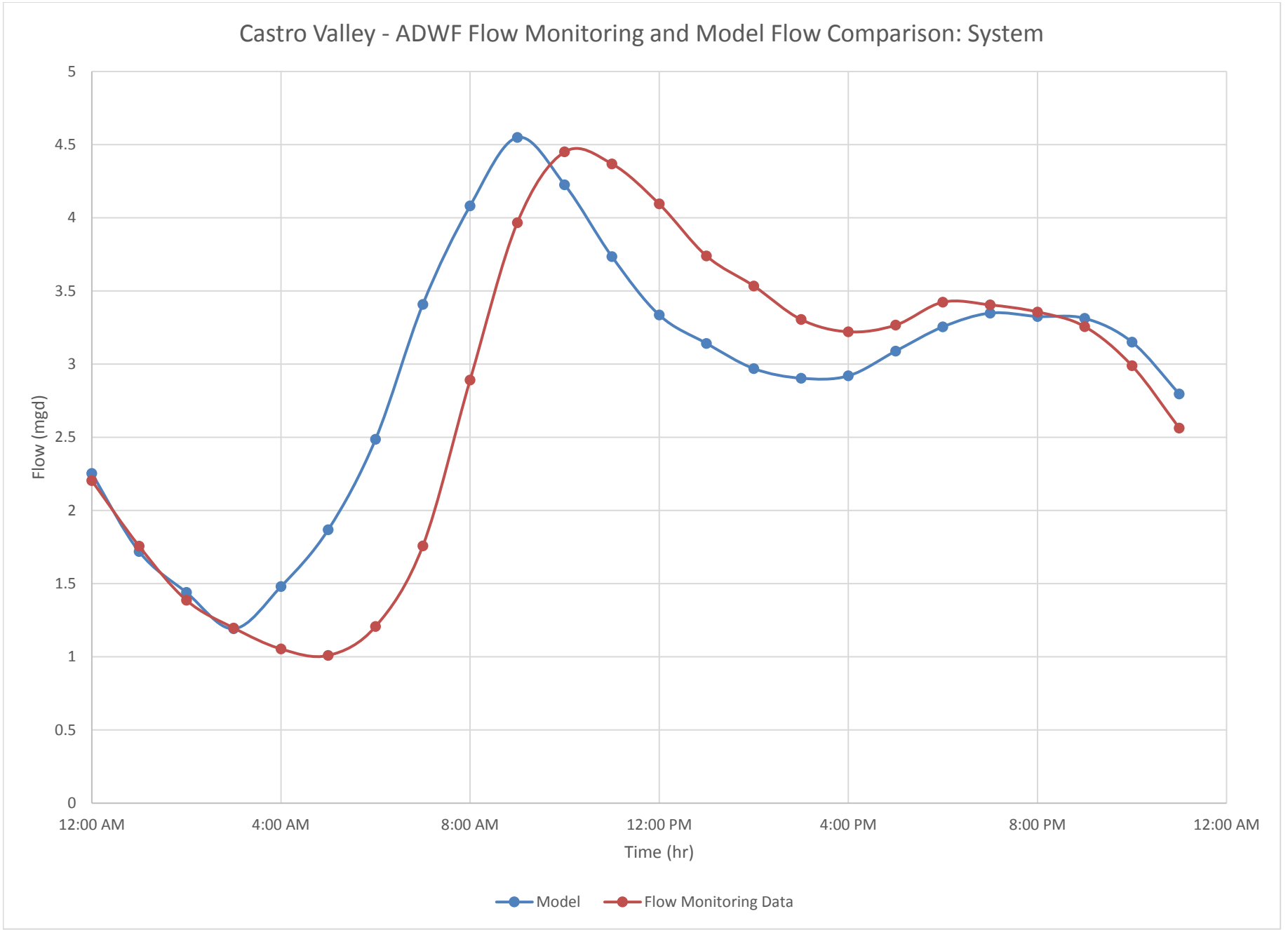
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data


Castro Valley - ADWF Flow Monitoring and Model Flow Comparison: System
Flow (mgd)
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4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time (hr)
Model
Flow Monitoring Data

APPENDIX D

Capital Improvement Project Sheets

PROJECT: Redwood Road Trunk Sewer

Priority/Fiscal Year: Priority A: FY 2016/17

Risk Level: High Risk

Project Purpose: Upsize gravity sewer to accommodate PWWF and relieve wet weather surcharging on Redwood Road and points upstream

Project Location: Redwood Road between Seven Hills Road and Heyer Avenue

Existing Conditions:

- 6-inch and 8-inch VCP
- Existing capacity = 0.93 mgd
- 2006 ADWF: 0.23 mgd
- 2015 ADWF: 0.20 mgd

Design PWWF: 1.73 mgd (10-year, 24-hour design storm)

Model Reference: MH 27-66 to MH 19-110

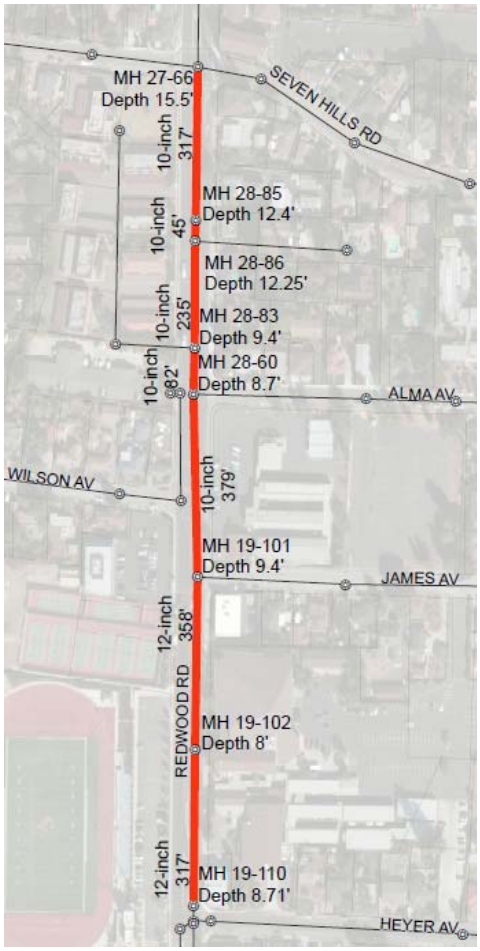
Recommendations:

- Upsize 1,058 LF of sanitary sewer to 10-inch VCP by open-cut replacement
- Upsize 675 LF of sanitary sewer to 12-inch VCP by open-cut replacement

Estimated Project Costs

Item	Unit	$/Unit	Quantity	Total
10-inch Remove & Replace	LF	$270	1,058	$286,000
12-inch Remove & Replace	LF	$324	675	$219,000
Project Subtotal				***$505,000***
30% Contingency				$152,000
Construction Cost Subtotal				***$657,000***
Engineering, Legal, Admin., etc. @ 30%				$198,000
Total Capital Cost				**$855,000**

PROJECT LOCATION MAP



PROJECT PHOTO

Redwood Road at Heyer Avenue looking North

PROJECT TRIGGERS

EXISTING CAPACITY DEFICIENCY:

Pipe is currently undersized for PWWF conditions, and overflows at multiple locations during wet weather.

CVSan

WASTEWATER COLLECTION SYSTEM MASTER PLAN UPDATE

REDWOOD ROAD TRUNK SEWER PROJECT SHEET

WEST YOST ASSOCIATES

PROJECT: Marshall Street Trunk Sewer

Priority/Fiscal Year: Priority B: FY 2017/18

Risk Level: High Risk

Project Purpose: Upsize gravity sewer to accommodate PWWF and relieve wet weather surcharging on Marshall Street and points upstream

Project Location: Marshall Street between Normandy Court and Greenacre Road

Existing Conditions:
- 10-inch VCP
- Existing capacity = 1.05 mgd
- 2006 ADWF: 0.19 mgd
- 2015 ADWF: 0.17 mgd

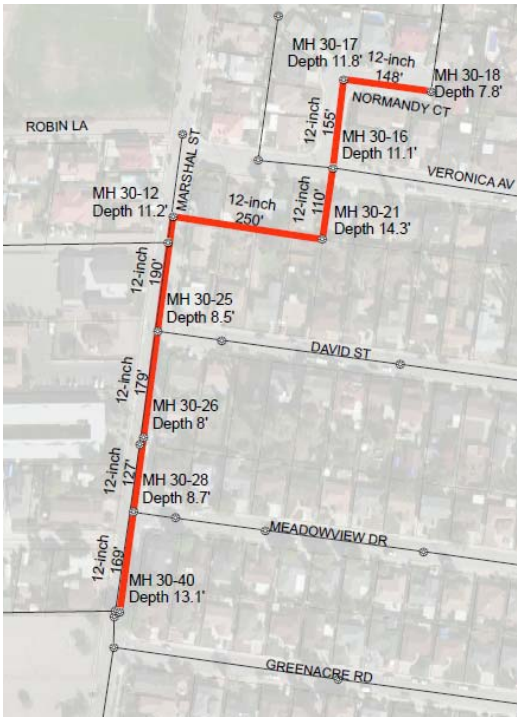
Model Reference: MH 30-18 to MH 30-40

Design PWWF: 1.67 mgd (10-year, 24-hour design storm)

Recommendations:
- Upsize 1328 LF of sanitary sewer to 12-inch VCP by open-cut replacement

Estimated Project Costs				
Item	Unit	$/Unit	Quantity	Total
12-inch Remove & Replace	LF	324	1,328 LF	$430,000
Project Subtotal				***$430,000***
30% Contingency				$129,000
Construction Cost Subtotal				***$559,000***
Engineering, Legal, Admin., etc. @ 30%				$168,000
Total Capital Cost				**$727,000**

PROJECT LOCATION MAP



PROJECT PHOTOS

Marshal Street at Greenacre Road looking North

PROJECT TRIGGERS

EXISTING CAPACITY DEFICIENCY:

Pipe is currently undersized for existing PWWF conditions, and surcharges more than two feet at multiple locations during wet weather.

CVSan

WASTEWATER COLLECTION SYSTEM MASTER PLAN UPDATE

MARSHAL STREET TRUNK SEWER PROJECT SHEET

WEST YOST ASSOCIATES

PROJECT: Sandy Road Trunk Sewer

Priority/Fiscal Year: Priority B: FY 2017/18

Risk Level: Medium Risk

Project Purpose: Upsize gravity sewer to accommodate PWWF and relieve wet weather surcharging on Sandy Road and points upstream

Project Location: Sandy Road south of Seven Hills Road

Existing Conditions:
- 8-inch VCP
- Existing capacity = 0.88 mgd
- 2006 ADWF: 0.14 mgd
- 2015 ADWF: 0.17 mgd

Model Reference: MH 28-9 to MH 28-94

Ultimate PWWF: 1.50 mgd (10-year, 24-hour design storm)

Recommendations:
- Upsize 848 LF of sanitary sewer to 10-inch VCP by open-cut replacement

Estimated Project Costs				
Item	Unit	$/Unit	Quantity	Total
10-inch Remove & Replace	LF	180	848 LF	$153,000
Project Subtotal				***$153,000***
30% Contingency				$46,000
Construction Cost Subtotal				***$199,000***
Engineering, Legal, Admin., etc. @ 30%				$60,000
Total Capital Cost				**$259,000**

PROJECT LOCATION MAP

PROJECT PHOTO

Sandy Road at Seven Hills Road looking South

PROJECT TRIGGERS

EXISTING CAPACITY DEFICIENCY:

Pipe is currently undersized for existing PWWF conditions, and surcharges more than 2 feet at multiple locations during wet weather.

CVSan

WASTEWATER COLLECTION SYSTEM MASTER PLAN UPDATE

SANDY ROAD TRUNK SEWER PROJECT SHEET

WEST YOST ASSOCIATES

PROJECT: Aspen and Pine Trunk Sewer

Priority/Fiscal Year: Priority B: FY 2017/18

Risk Level: Medium Risk

Project Purpose: Upsize gravity sewer to accommodate PWWF and relieve wet weather surcharging

Project Location: Aspen Avenue and Pine Street between Castro Valley Boulevard and Elm Street

Existing Conditions:

- 10-inch, 12-inch and 15-inch VCP
- Existing capacity = 1.17 mgd
- 2006 ADWF: 0.79 mgd
- 2015 ADWF: 0.70 mgd

Design PWWF: 2.51 mgd (10-year, 24-hour design storm)

Model Reference: MH 30-46 to MH 31-4

Recommendations:

- Upsize 809 LF of sanitary sewer to 18-inch VCP by open-cut replacement
- Upsize 626 LF of sanitary sewer to 21-inch VCP by open-cut replacement

Estimated Project Costs				
Item	Unit	$/Unit	Quantity	Total
18-inch Remove & Replace	LF	$486	809 LF	$393,000
21-inch Remove & Replace	LF	$567	626 LF	$355,000
Project Subtotal				***$748,000***
30% Contingency				$224,000
Construction Cost Subtotal				***$972,000***
Engineering, Legal, Admin., etc. @ 30%				$292,000
Total Capital Cost				**$1,264,000**

PROJECT PHOTO

Intersection of Aspen Avenue and Pine Street looking West along Pine Street

PROJECT TRIGGERS

EXISTING CAPACITY DEFICIENCY:

Trunk sewers are currently undersized for existing PWWF conditions and surcharges more than two feet at multiple locations during wet weather.

PROJECT LOCATION MAP

CVSan

WASTEWATER COLLECTION SYSTEM MASTER PLAN UPDATE

ASPEN AND PINE TRUNK SEWER PROJECT SHEET

WEST YOST ASSOCIATES

PROJECT: South of I-580 Relief Sewer

Priority/Fiscal Year: Priority C: FY 2018/19

Risk Level: High Risk

Project Purpose: New relief sewer to relieve surcharging in Orange Avenue and several locations along the proposed parallel relief sewer alignment

Project Location: South of Interstate-580 from Redwood Road to North Third Street

Existing Conditions: Inadequate capacity in multiple trunk sewers

Design PWWF: 4.17 mgd (10-year, 24-hour design storm)

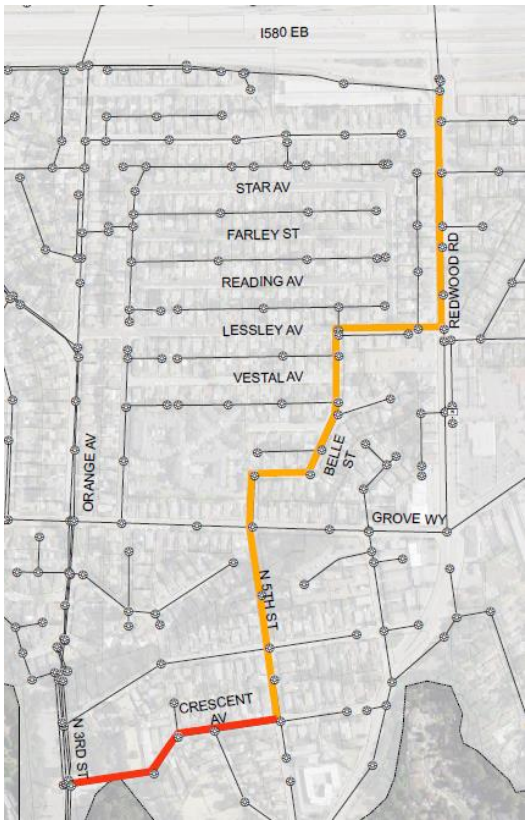
Model Reference: MH 30-18 to MH 30-40

Recommendations:

- Construct 3,874 LF of 21-inch VCP and 1,110 LF of 24-inch VCP by open-cut

Estimated Project Costs				
Item	Unit	$/Unit	Quantity	Total
21-inch New Pipeline	LF	$567	3,874	$2,197,000
24-inch New Pipeline	LF	$648	1,110	$719,000
Creek Crossing Cost	LF	$600	600	$360,000
Project Subtotal				***$3,276,000***
30% Contingency				$983,000
Construction Cost Subtotal				***$4,259,000***
Engineering, Legal, Admin., etc. @ 30%				$198,000
Total Capital Cost				**$4,457,000**

PROJECT LOCATION MAP



PROJECT PHOTO

Redwood Road looking south from the I-580 undercrossing

PROJECT TRIGGERS

EXISTING CAPACITY DEFICIENCY:

Existing mains are currently undersized for PWWF conditions, and surcharge at multiple locations during wet weather

CVSan

WASTEWATER COLLECTION SYSTEM MASTER PLAN UPDATE

SOUTH OF I-580 RELIEF SEWER PROJECT SHEET

WEST YOST ASSOCIATES

APPENDIX E

CIP Project Hydraulic Profiles

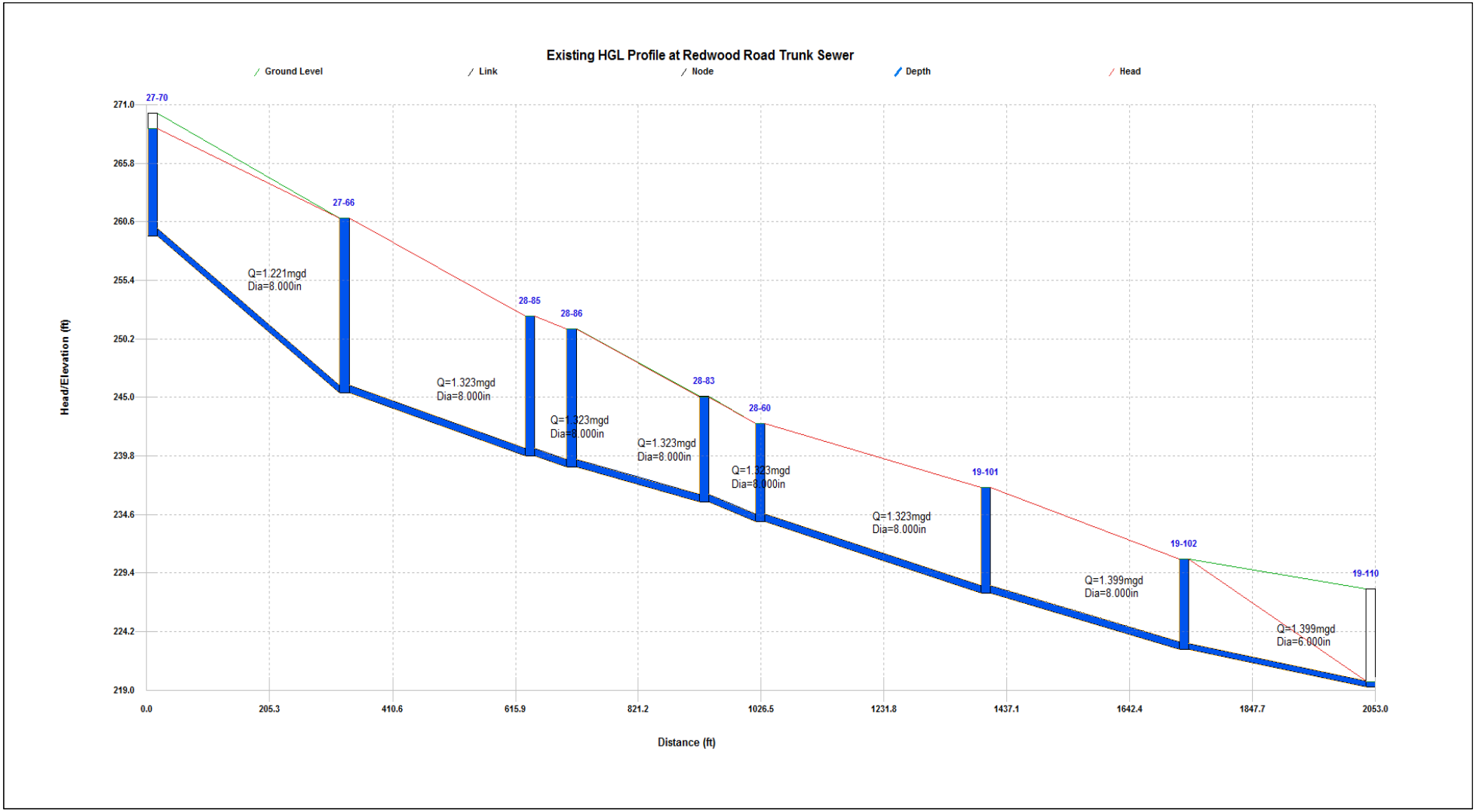


Figure E-1

Existing HGL Profile at Redwood Road Trunk Sewer

Castro Valley Sanitary District
WWCS Master Plan Update

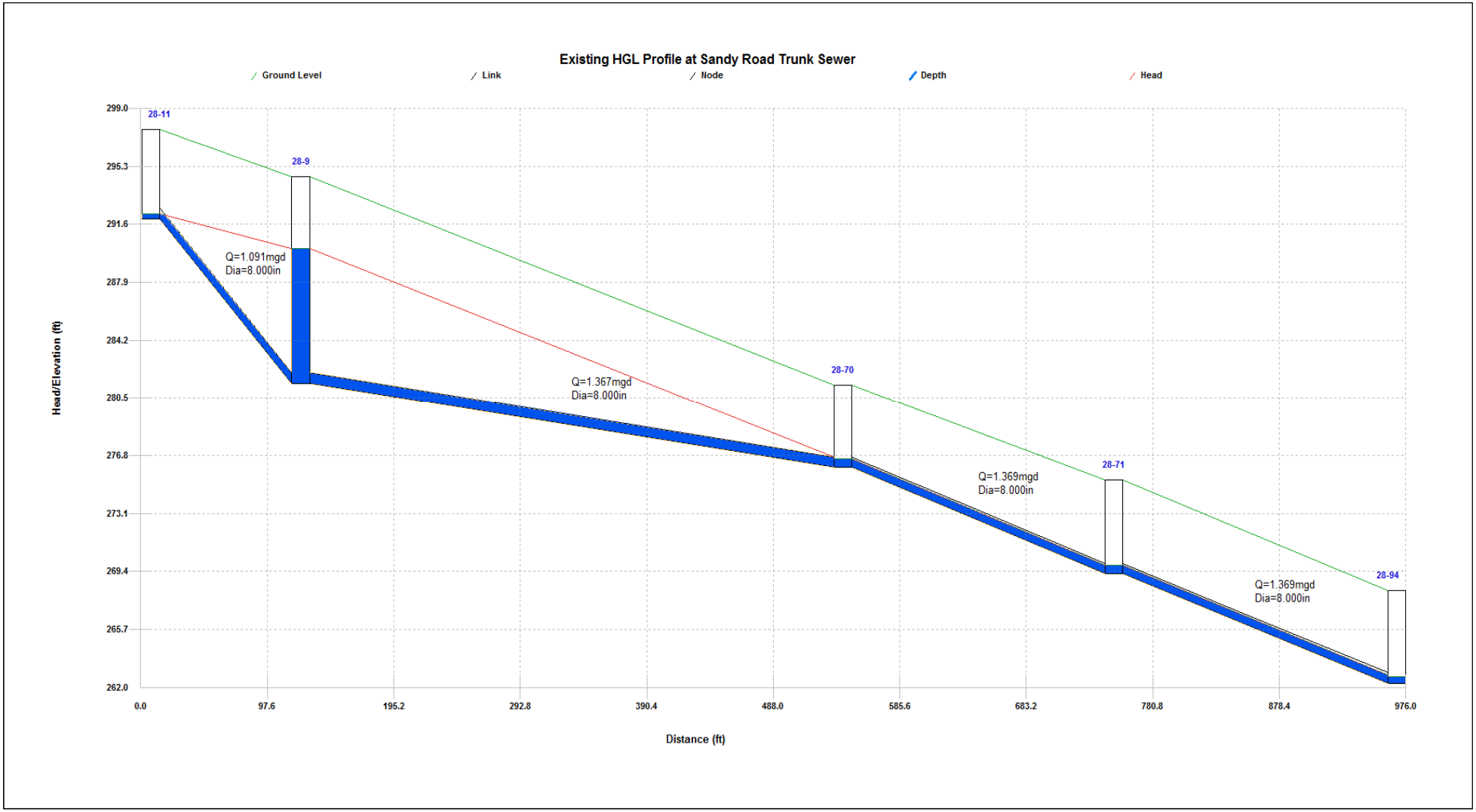


Figure E-2

Existing HGL Profile at Sandy Road Trunk Sewer

Castro Valley Sanitary District
WWCS Master Plan Update

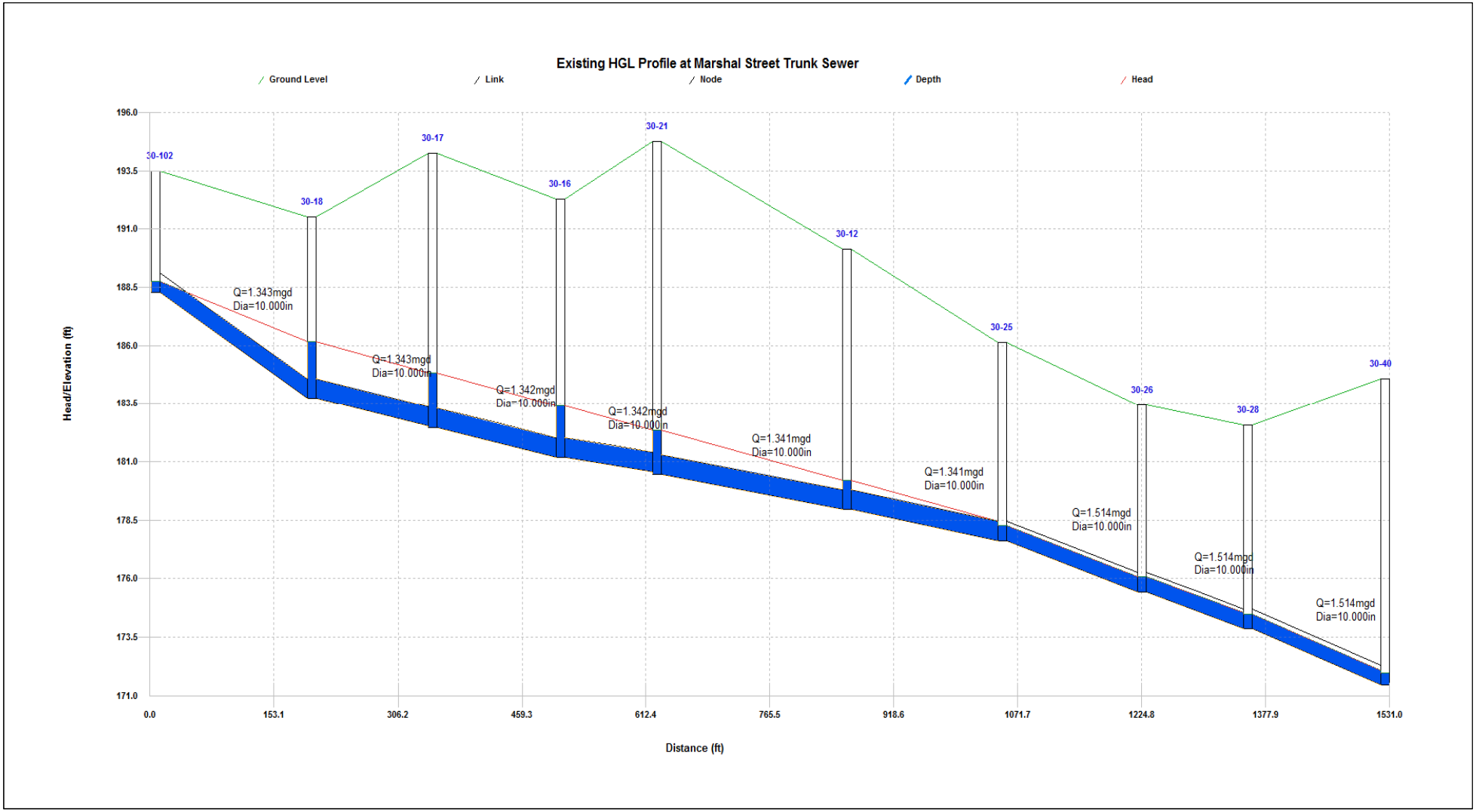


Figure E-3

Existing HGL Profile at Marshal StreetTrunk Sewer

Castro Valley Sanitary District
WWCS Master Plan Update

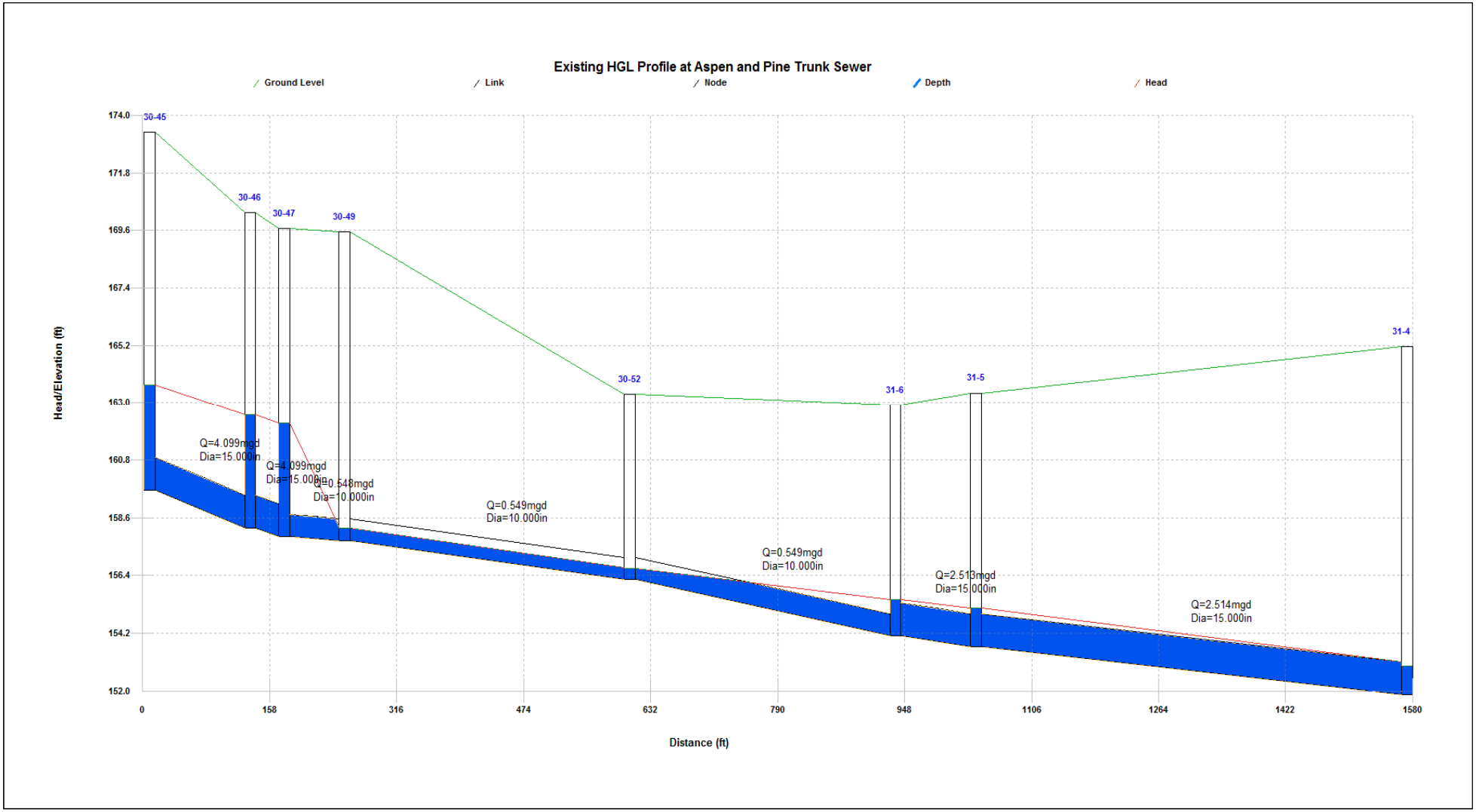


Figure E-4

Existing HGL Profile at Aspen and PineTrunk Sewer

Castro Valley Sanitary District
WWCS Master Plan Update

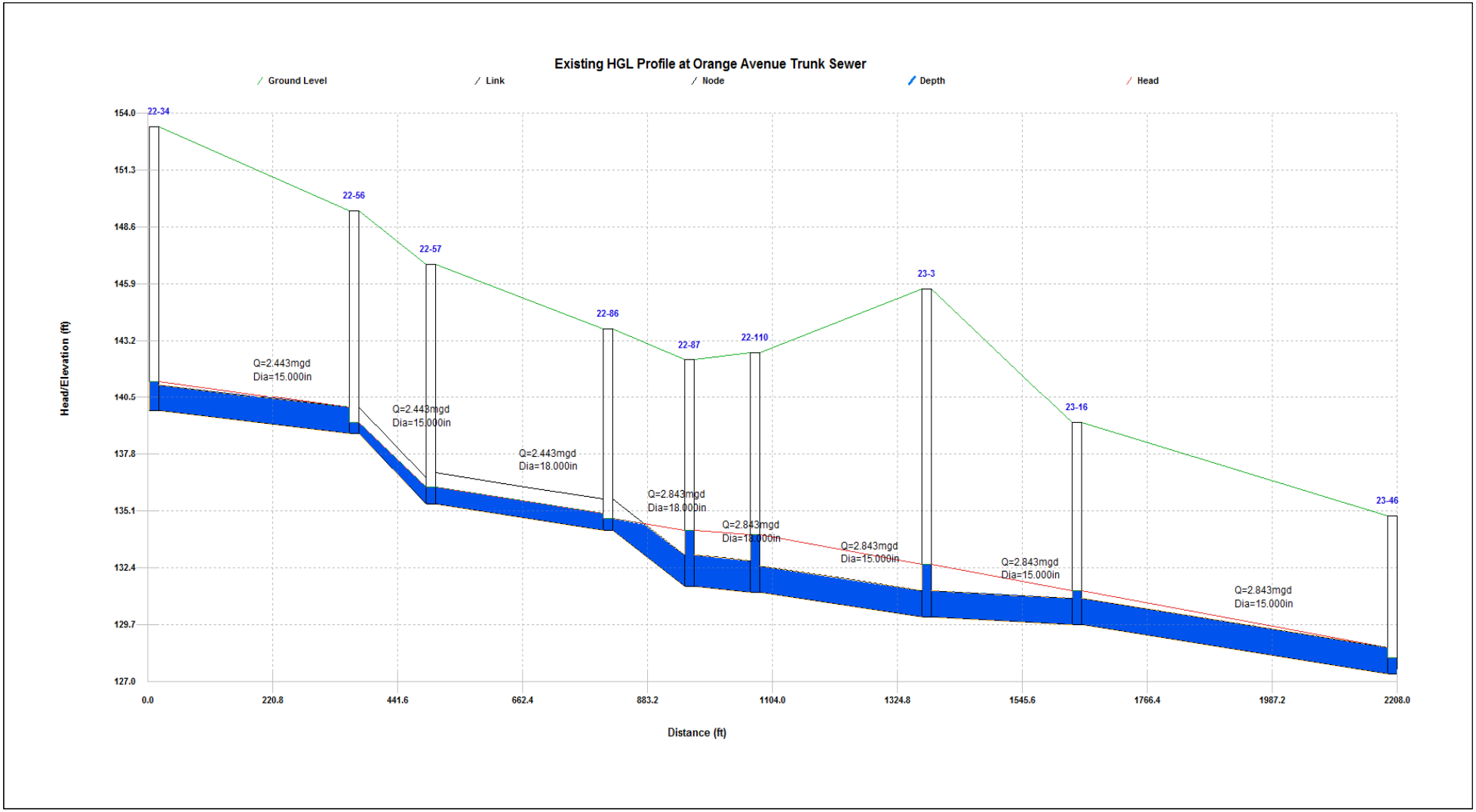


Figure E-5

Existing HGL Profile at Orange Avenue Trunk Sewer

Castro Valley Sanitary District
WWCS Master Plan Update

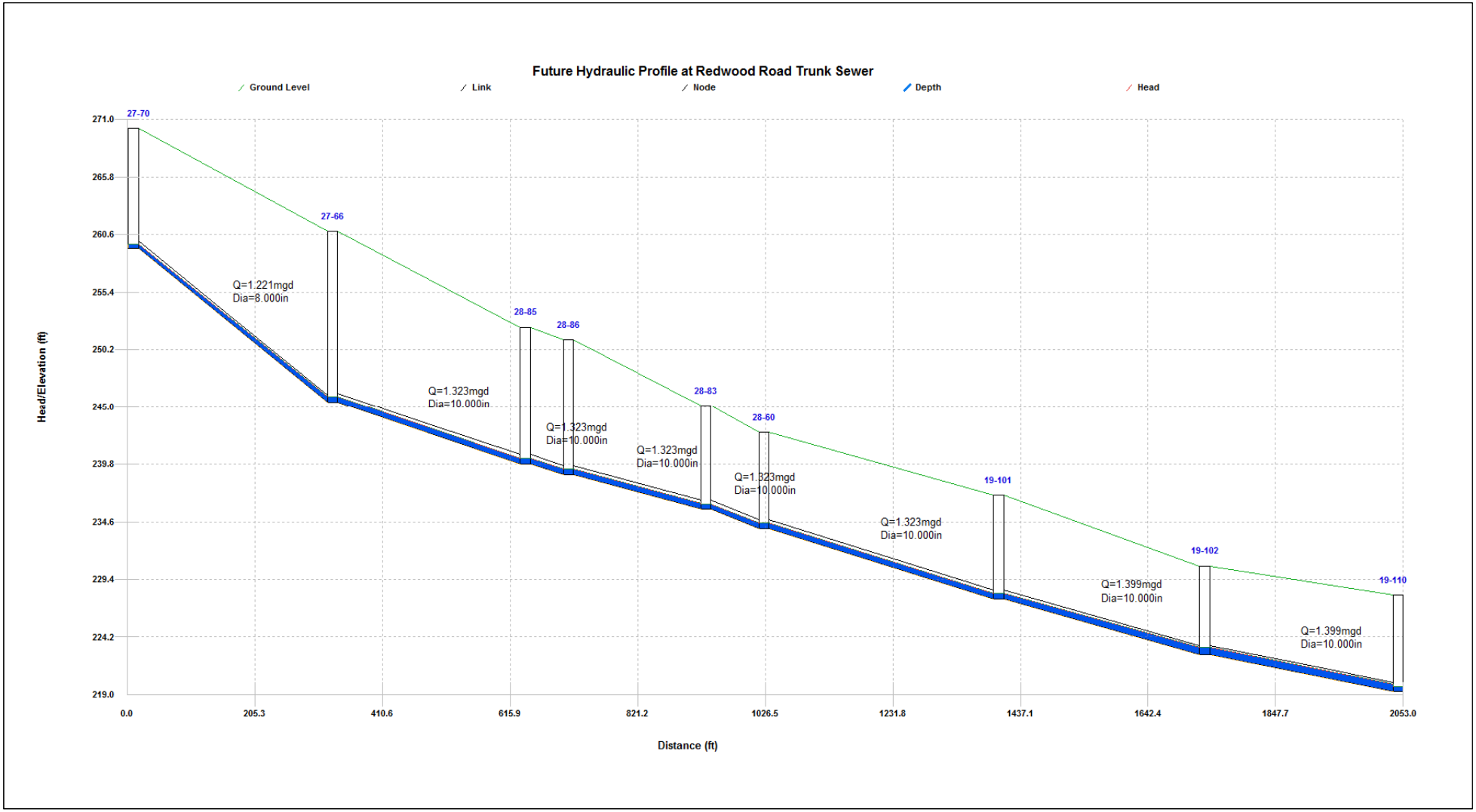


Figure E-6

Future Hydraulic Profile at Redwood Road Trunk Sewer

Castro Valley Sanitary District
WWCS Master Plan Update

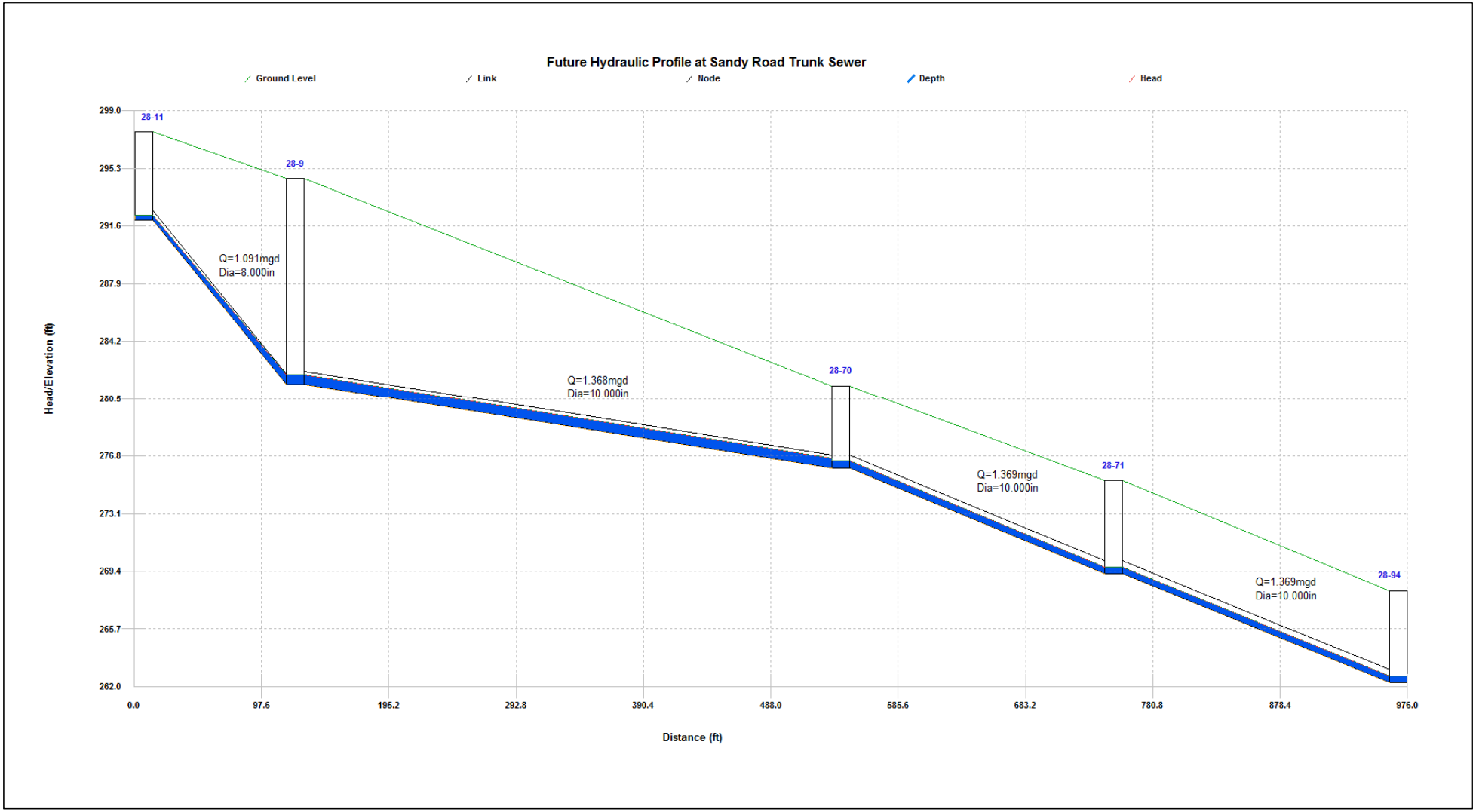


Figure E-7

Future Hydraulic Profile at Sandy Road Trunk Sewer

Castro Valley Sanitary District
WWCS Master Plan Update

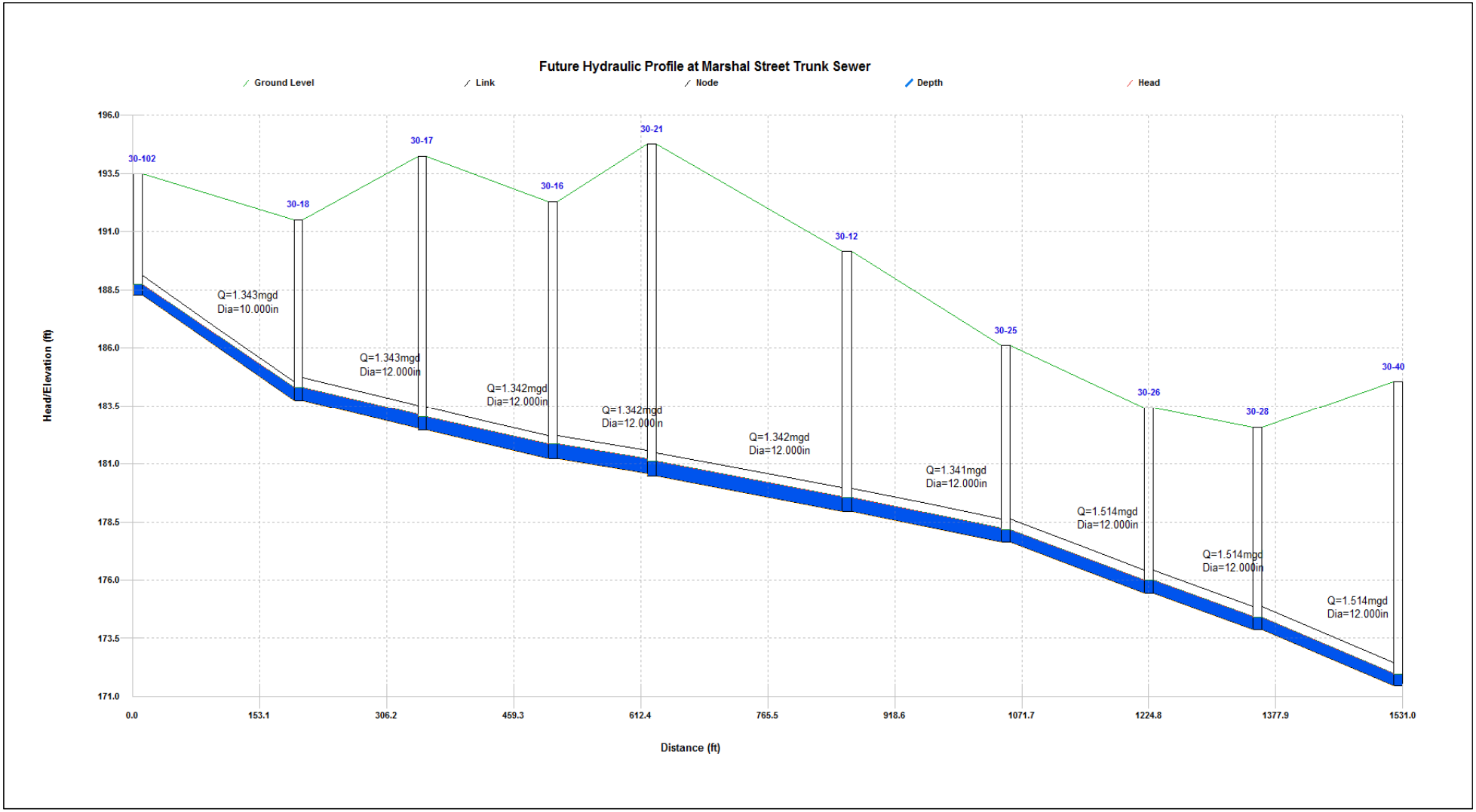


Figure E-8

Future Hydraulic Profile at Marshal Street Trunk Sewer

Castro Valley Sanitary District
WWCS Master Plan Update

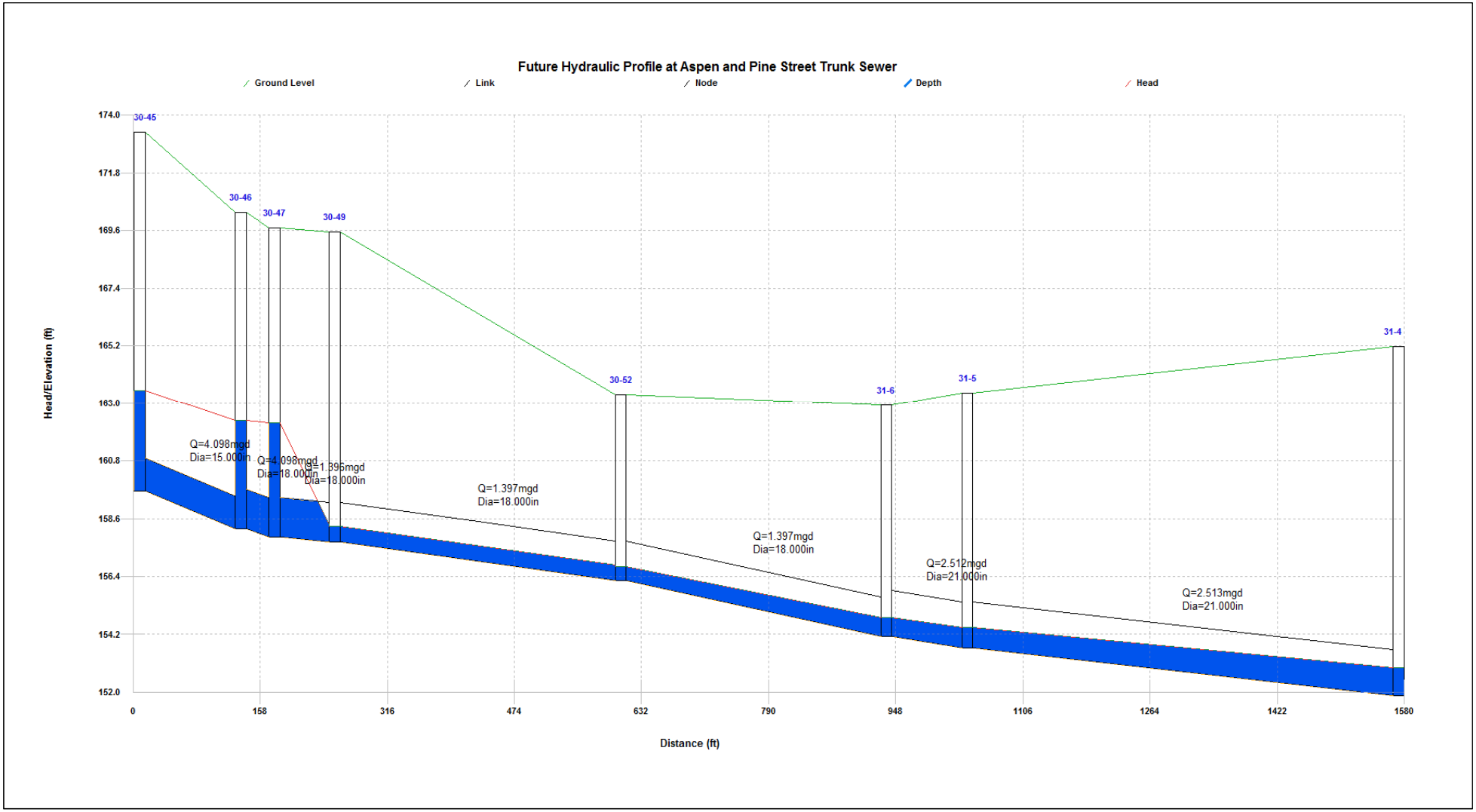


Figure E-9

Future Hydraulic Profile at Aspen and Pine Street Trunk Sewer

Castro Valley Sanitary District
WWCS Master Plan Update

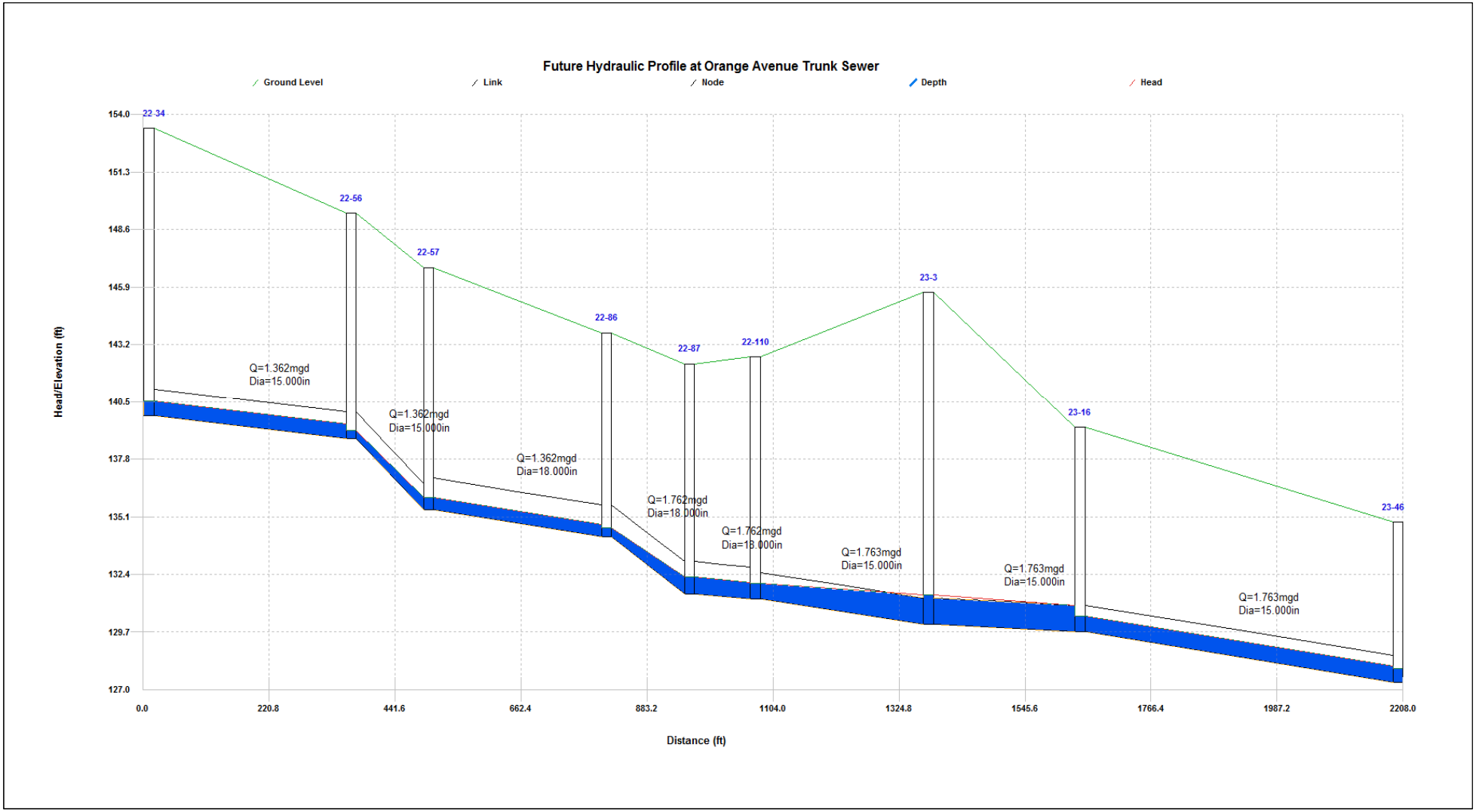


Figure E-10

Future Hydraulic Profile at Orange Avenue Trunk Sewer

Castro Valley Sanitary District
WWCS Master Plan Update

APPENDIX F

2015 Smoke Testing Work Plan

WEST YOST ASSOCIATES 25 YEARS 1990–2015

TECHNICAL MEMORANDUM

DATE: November 5, 2015 Project No.: 455-20-15-06

TO: Landon Lochrie, Castro Valley Sanitary District

CC: Roland Williams, Castro Valley Sanitary District
Tyree Jackson, Castro Valley Sanitary District
Paul Loving, SFE Global

FROM: Lani Good, P.E., R.C.E. #73677

SUBJECT: 2015 Smoke Testing Work Plan

INTRODUCTION

During the recent update of the Castro Valley Sanitary District's (CVSan's) hydraulic model update (using flow monitoring data collected during the 2014/15 wet weather season), West Yost Associates (West Yost) discovered a new sub-basin (see Figure 1) with abnormally high inflow and infiltration (I/I) rates, and validated the previously-known high I/I area (see Figure 2). As a part of CVSan's ongoing I/I reduction efforts, West Yost recommends that CVSan engage SFE Global (see Attachment A for SFE Global proposal) to conduct smoke testing in these areas of the CVSan wastewater collection system.

The objective of smoke testing is to gather evidence of the presence of indirect sources of infiltration (such as broken sewer pipes, offset joints, and other sewer defects) and to confirm locations of direct inflow such as connections from roof leaders, stairwells, yard drains, driveways, patios, area drains, foundation drains, broken or un-capped clean-outs, defective manholes, and abandoned building sewers. This Technical Memorandum (TM) outlines a work plan for the smoke testing work on this project.

PRE-WORK ACTIVITIES

This section describes the pre-testing activities that will be accomplished prior to commencing any field work.

Public Notification

Residents, institutions, and businesses in the area to be smoke tested shall be notified prior to initiation of smoke testing. Various methods shall be used to notify residents and businesses including door hangers, signs, and verbal discussions where feasible. Notifications will be performed as follows:

1. CVSan shall distribute an initial letter notifying property owners and residents of smoke testing activities at least one week prior to smoke testing (see Attachment B for a draft notice).
2. SFE Global crews (crews) shall distribute pre-approved advance notice door hangers (see Attachment C for a draft notice) 48 to 72 hours before smoke testing. If smoke testing is delayed, crews shall re-distribute door hangers 48 to 72 hours prior to the rescheduled time of smoke testing.
3. Prior to testing each day, crews shall meet daily with CVSan staff at the CVSan Engineering Office at 20211 Patio Drive, Suite 200 in Castro Valley in order to inform CVSan staff of where testing will occur that day. CVSan staff shall notify Fire and Police Departments via fax of a map of the areas to be tested that day. Delivery methods may change during the project at the request of the Fire or Police Chief (e.g., email, hand-delivery).
4. Prior to the test, crews shall make personal contact with a responsible person at schools, hospitals, nursing homes, and all other institution/public facilities in the immediate area of the smoke testing.

All notifications shall direct residents to call the CVSan Main Office at (510) 537-0757 with questions and concerns. Field crews shall refer all concerned residents to Landon Lochrie in the CVSan Engineering Department.

Permits

Work within CVSan easements and right-of-way does not require a permit. No work will be performed in State and/or County right-of-ways.

Weather, Ground, and Ground Water Condition Requirements

Smoke testing shall not be performed on rainy days or when saturated soil conditions exist. Additionally, smoke testing shall only be performed when the groundwater level is low enough to provide accurate smoke testing results. Testing shall be closely monitored on windy days. If smoke coming out of the ground is blown away so quickly as to escape accurate detection and/or photo documentation, testing shall cease until such time that weather conditions permit an accurate record of smoke testing results. Previously notified residents, businesses, and institutions shall be re-notified if smoke test date ranges have expired before completion.

Flow Control

Smoke testing shall normally be accomplished without the need for bypass pumping. Crews shall set up temporary plugs or flow barriers as required to contain an adequate volume of smoke within the section of sewer being tested. Crews shall monitor the resulting surcharged sewer at the manhole upstream of the section of sewer being tested, and prevent overflow conditions from occurring by removing the flow barriers in a timely manner.

FIELD WORK

This section describes the field work for smoke testing portions of CVSan's collection system.

Field Work Sequencing

Approximately 3.6 miles of pipeline will be inspected with efforts concentrated within five of the City's collection system basins, as summarized in Table 1 and shown on Figures 1 through 5. Smoke testing rates vary widely depending on the number of defects found, but testing rates range from 2,000-4,000 linear feet of mainline sewers per day on average. Field work will begin on Monday, October 13, 2014 beginning in Basin 7. The work sequence for subsequent basins is shown in Table 1.

Table 1. Smoke Testing Field Work Sequence

Work Sequence	Basin Number	Total Pipe Length		Pipe Diameter Range, inch	Number of Manholes	Average Pipe Segment Length, feet
		feet	miles			
1	3 West	9,929	1.9	6 to 8	49	207
2	7	8,976	1.7	6 to 8	45	204
	Total	**18,905**	**3.6**	-	**94**	

Field Work Hours

Work is not permitted to begin earlier than 7 a.m. or extend past 6 p.m. Smoke testing field work is not permitted to occur on weekends, as CVSan personnel will not be available to answer resident calls or assist the field crews. Notices may be distributed to residents on weekends, as necessary to keep the work on schedule.

Communication Protocol

1. Before beginning work each morning, smoke testing field crew will meet with CVSan staff at the CVSan Engineering Office located at 20211 Patio Drive, Suite 200, Castro Valley. The field crew will meet with CVSan staff at approximately 7:30 am inside the Engineering office (Suite 200) so that the crew can be mobilized and ready to begin work at 8 am.
2. CVSan staff will not be present during all smoke testing activities, but can be contacted if abnormal issues arise. Smoke testing crews should call Landon Lochrie at (510) 506-3597 if major defects such as storm drain cross connections or illegal connections are found.
3. All other maintenance issues can be directed to the CVSan main office at (510) 537-0757 during work hours, or the wastewater emergency response hotline at (510) 506-5821 after hours.

Field Activities

Safety. Field work safety shall be according to SFE Global's Field Work Safety Plan (see Attachment D) and according to State and Federal law.

System Evacuation/Preparation. When crews open a manhole cover during the smoke testing procedures, prior to placing any smoke into the manhole – crews shall check gas levels and evacuate the manhole as necessary.

Site Security. The work site shall be secured by placing traffic control signs and safety devices at the boundary of the work site.

Confined Space Entry. Crews shall minimize the physical entry of personnel into the sewer facilities. If required, manhole entry shall be performed in accordance with Federal, State, and local laws, regulations, policies, requirements, and standards especially those promulgated by OSHA.

DATA MANAGEMENT PROCEDURES

Smoke testing data will be recorded in the field using SFE Global's customized MS Access database. Data will be processed by SFE Global and submitted in a MS Access database with any associated image files. Crews shall record data on the SFE Global Smoke Testing Report Form and enter codes into the SFE database (using Microsoft Access). At the completion of the project, SFE Global will submit the database and images to CVSan to ensure data type compatibility with CVSan's Lucity computerized maintenance management system. Smoke testing data collected includes, but is not limited to:

- Date and time of the test, weather conditions, and testing personnel.
- Location, including reference to the relevant manhole (upstream and downstream manholes ID numbers) and the nearest street address.
- Area and type of surface drained at the location of the smoke leak.
- Defect source type and description of the smoke leak, including intensity of smoke code and amount.
- Digital color photographs of the results of each test.
- Crews shall draft out a schematic layout of the manholes and sewer mains under testing including address and location, manhole ID numbers, photo number and direction taken, defect source type, accurate location of defect within the test area and type of surface drained. (Note geographical orientation relative to north.)
- All smoke exit locations shall be surveyed using a GPS or conventional survey methods if GPS survey is not feasible.
- A separate Smoke Test Report shall be submitted for each sewer main segment tested regardless if a defect is found or not.
- Main line defects and service lateral defects will be carefully scrutinized to ensure that a conservative determination of public vs. private side defects is made.

FIGURES

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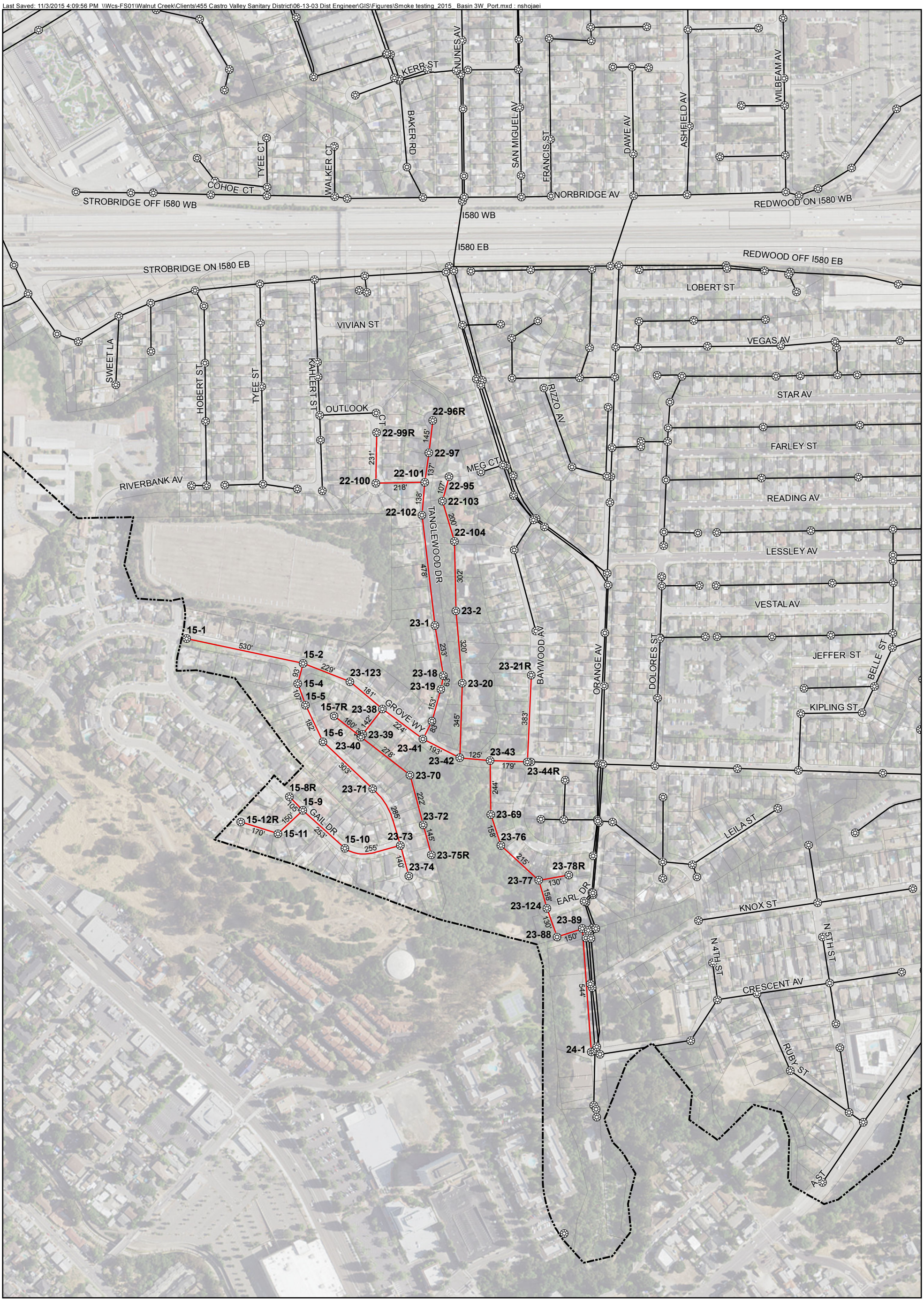

Symbology

- Manhole
- PS Pump Station
- 2015 Smoke Testing
- Sanitary Sewer
- Force Main
- District Boundary

N

0 200 400

Scale in Feet

Figure 1

2015 Smoke Testing

Castro Valley Sanitary District
District Engineering

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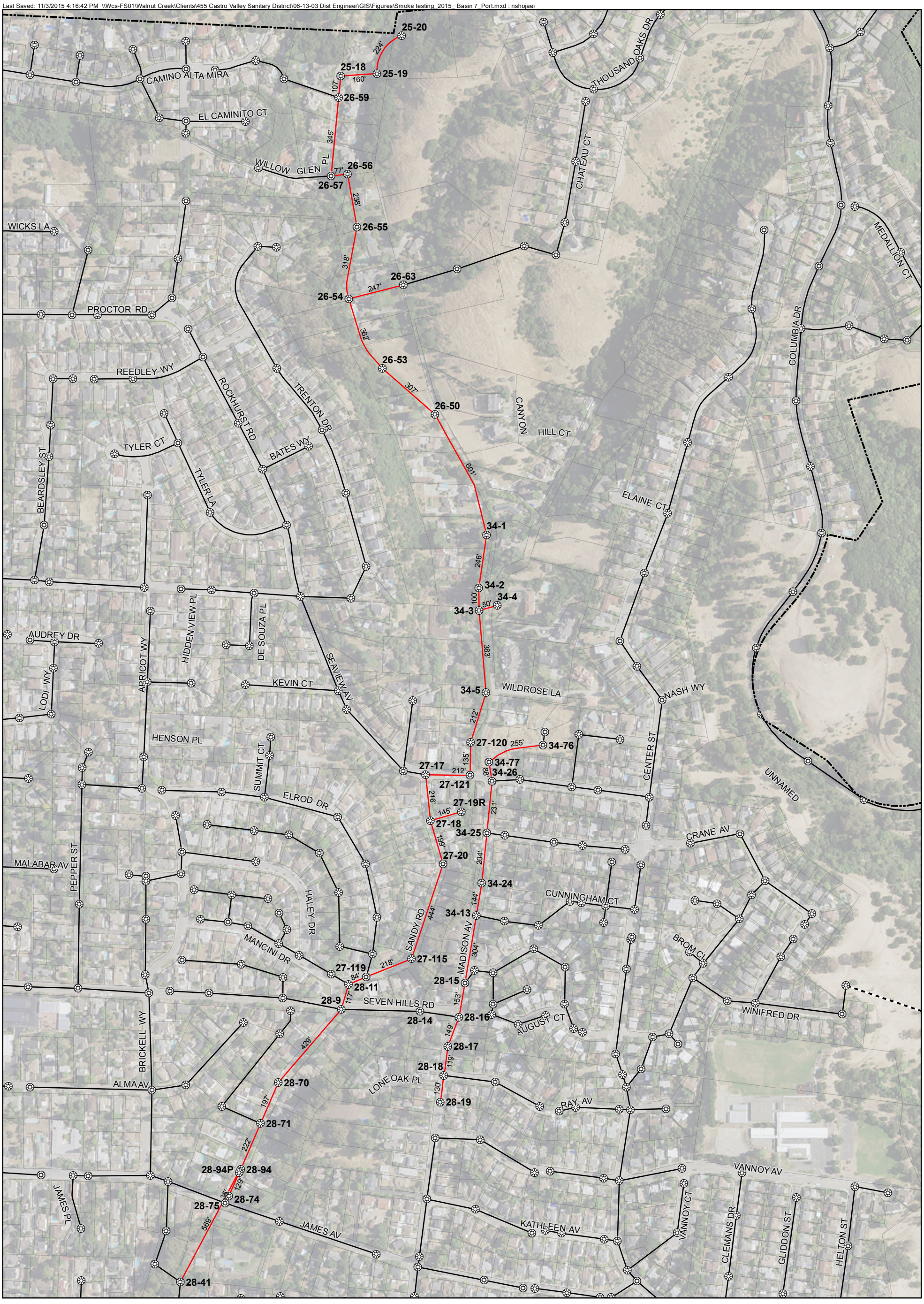


Symbology

- Manhole
- Pump Station
- Force Main
- 2015 Smoke Testing
- Sanitary Sewer
- District Boundary

N

0 200 400

Scale in Feet

Figure 2

2015 Smoke Testing

Castro Valley Sanitary District
District Engineering

WEST YOST ASSOCIATES

ATTACHMENT A

SFE Global CVSan Sanitary Sewer Smoke Testing Proposal

SFE Global - Washington
1313 E Maple Street, Suite 201-408
Bellingham, WA 98225
Toll Free: 1-866-332-9876

SFE Global - California
1104 Corporate Way
Sacramento, CA 95831
Toll Free: 1-866-332-9876

November 3, 2015

Ms. Lani Good, PE

WEST YOST ASSOCIATES
1777 Botelho Drive, Suite 240
Walnut Creek CA, 94596

SUBJECT: CASTRO VALLEY SANITARY DISTRICT - SANITARY SEWER SMOKE TESTING

Dear Ms. Good:

Thank you for the opportunity to submit this proposal for sanitary sewer smoke testing services with the Castro Valley Sanitary District. Services and reporting supplied by SFE Global, along with estimated fees, are described below.

SFE GLOBAL

SFE GLOBAL (SFE) is a municipal and industrial service company specializing in underground infrastructure assessment and monitoring. SFE has been conducting services of this nature for Municipal, Governmental and Industrial clients since 1991.

SFE has five (5) offices between the United States and Canada (Bellingham, Sacramento, Vancouver, Edmonton, Winnipeg,) with a total of 30 employees. We have excellent references with a track record for delivering project objectives on time and on budget.

SFE Services Include:

- All Applications of Flow Monitoring and Water Quality Monitoring - Sanitary Sewers, Storm Sewers, Creeks, Culverts, Landfills, Industrial Effluent, Billing Stations, Temporary and Permanent Installations, LID (Low Impact Development) Performance Monitoring, and Complete Hydrologic Gauging Stations.

- GoData Web-Based Data Management Platform – Versatile web-based data management system for all data types. Organize, Graph, Alarm, and Analyze various types of monitored infrastructure data

- Meteorological Monitoring – Supply, Installation, and Monitoring of Complete Weather Stations

- Rhodamine WT Dye Calibrations of Flow Monitoring Stations. Verify and Improve the Accuracy of your Existing Flow Monitoring Station. Regulatory Agency Compliance

- Sewer Smoke Testing and Dye Testing. Reduce I&I and Illegal Sanitary Connections

- 3D Mapping of underground pipelines

- Manhole Inspection Programs. Data Base Catalogued Inventory Complete with Condition Assessments.

- Unidirectional Water Main Flushing.

- Reservoir Cleaning, Disinfection, and Inspection.

- Domestic Water Flow testing and Data Logging Services for Water Model Calibration

- Pipeline Pigging - Cleaning of Domestic Water Mains, Sewer Force Mains, Siphon Mains, and Industrial Product Pipelines. Renew Pipelines and Reduce Pumping Costs.

SEWER SMOKE TESTING OVERVIEW

Smoke Testing Services along with subsequent reports supplied by SFE are directly related to the investigation of storm water cross connections and system deficiencies within the sanitary and/or storm sewer systems. The objective of a typical smoke testing project is to investigate and itemize various storm water inflow sources and report on all findings. A sewer smoke testing program is an extremely effective method of immediately determining storm water cross connections that are contributing to inflow and infiltration to a sewer system.

A typical smoke testing system is illustrated here. A large fan or blower is placed over a centrally located manhole pushing non-toxic smoke-filled air through a sewer line. SFE utilizes only industry leading Hurco brand smoke machines and liquid smoke for all projects as it is non-toxic and leaves no residue.

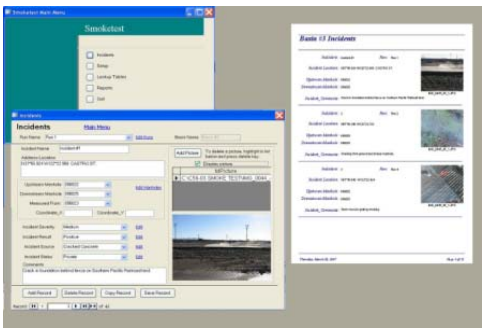
The smoke travels under low pressure and will fill the main line plus any connections; then quickly follows the path of any system defects including cracks and direct cross connections to the ground surface. After placing the blower and filling the lines with smoke, SFE staff will perform a visual inspection of the area being tested. This inspection includes GPS locations of the incidents, photograph documentation, along with standard field incident forms being filled out.

As indicated, SFE Global uses only Hurco brand smoke testing equipment. We own and operate all equipment to be utilized for this project. SFE will have two working smoke testing units available at all times should one become damaged or fail. Sufficient liquid smoke to complete the entire project will be on hand from the beginning. All incident logs and cameras are kept in good working order and image files are uploaded to a secure backup drive on a regular basis throughout the day. SFE owns and maintains all service vehicles used on the project. Each vehicle is equipped with necessary safety gear, lights, cones, signage, tools, and all necessary equipment / consumables required to complete the project.

Once the smoke machine is set in place at the first manhole of each respective run and adjacent or end manholes have had the air void blocked with custom rubber matting (set in place from the surface), the smoke run is now ready to start. Upon starting the smoke machine with liquid smoke injection, SFE staff then walk the street in search of visible smoke, or in the case of roof vents, an incident may be written up if no smoke is observed. (Indicating there may be a cross connection) SFE checks each property carefully; paying special attention to clean-outs and roof leaders. It is not unusual for smoke to be seen coming up from grass, wooded areas, and cracks in the concrete or asphalt. All incidents are recorded on the field sheet template and at the end of each day are passed along to our Operations Manager for input into the database. All image files are also transferred and archived on a daily basis.

Weather can play an important role in the quality of your smoke testing results. Best results are seen when the water table is low and on dry days, due to the fact that water is an excellent vapor barrier. Smoke testing should also be avoided on very windy days as it becomes possible that even a light breeze can disperse smoke before it becomes visible.

SFE utilizes an in-house designed custom smoke testing database for all reporting. This software and database system was developed to maximize efficiency in reporting smoke test results in a clear, precise manner. Standard reports include executive summaries, all test procedures, daily event logs, pictures, and defect codes with pinpoint locations. All fields can be altered to suit the needs of our client and with the MS Access database, importing into various public works management software is very straight forward. In addition, if our client has their own smoke test log form, we're happy to utilize this as means of delivering all pertinent incident reports. Our goal is to have our clients obtain useful information in a format that suits their needs.



PLANNING AND PERSONNEL

Sewer smoke testing, although a simple concept, requires careful planning and an experienced Project Manager / Team to execute a successful assignment. Planning tasks will include the following items:

- ✓ A pre-project meeting with the City to better understand their needs and priorities. At this time, SFE expects to thoroughly review each party's respective responsibilities and will draft a working document outlining all deliverables.

- ✓ Notifications for website, Fire Dept, Police, local newspaper, and all residential/commercial notices will be reviewed and approved by the City prior to being distributed. Hand delivered door hanger notices are a standard for SFE Global.

- ✓ Each basin's runs are to be prioritized and SFE to draft a smoke test run plan for the first basin, to be approved by the City. Any subsequent basin planning to be completed on an on-going basis, giving the City Project Manager sufficient time to review and approve prior to new notifications being delivered.

- ✓ SFE will work with the City in identifying any residential, commercial, or industrial properties that may need a more comprehensive notification program, such as hospitals or schools.

- ✓ SFE understands the need to be polite and courteous with the public in all the services we provide. Our field technicians and Project Managers are all experienced in this matter. We appreciate that smoke entering one's residence can be extremely alarming. Our technicians are all well versed in explaining the situation to distraught residents.

Key Personnel for this Project are:

Paul Loving – SFE Operations Manager - Mr. Loving will be the lead responsible for the success of this project; serving as a liaison between project team members and overseeing all SFE activities. Paul will be responsible for day to day reporting along with QA/QC of all field data collected. Mr. Loving brings 25 years of management experience to this project along with over 12-years of smoke testing experience.

Adrian Marshall – SFE Project Manager. Mr. Marshall has been with SFE for over ten years and routinely takes the technical lead on many projects. An invaluable asset to our team, not only is Adrian very familiar with all aspects of a smoke testing project, but he also maintains our fleet of data loggers, flow meters, and small engine equipment. Mr. Marshall's role on this assignment will be to support the Operations Manager through a key role in identifying smoke and system defects; and reporting on them appropriately.

Dylan Carvin – SFE Technician and Safety Officer. Mr. Carvin has been with SFE for a little over 3-years. Much of his work to date has been involving our sewer flow monitoring services, pipeline pigging services and potable water reservoir cleaning and disinfection services. Dylan's role on this project will be to use his safety training and knowledge of our corporate safety manual to draft a hazard assessment for review prior to the project start date. In addition, Dylan will execute and document daily toolbox meetings and act as support to the team through photo documentation of visual smoke.

REFERENCE PROJECTS

In recent years, SFE Global has completed many smoke and dye testing projects. Please see below for just a few of our references.

1. **City of Folsom / West Yost Associates - 281,000lf of Notification Delivery, Sanitary Sewer Smoke Testing, and Incident Reporting**

- Roger Kohne, P.E.
  Senior Civil Engineer
  City of Folsom
  50 Natoma Street
  Folsom, CA 95630
  P: (916) 351-3455

2. **City of Dundee / Kennedy Jenks Consultants – 35,000lf of Notification Delivery, Sanitary Sewer Smoke Testing, and Incident Reporting**

- Dana Devin-Clarke, P.E.
  Kennedy/Jenks Consultants
  200 S.W. Market Street, Suite 500, Portland, Oregon, 97201
  P: (503) 423-4000

3. **City of Pacifica – 185,000lf of Notification Delivery, Sanitary Sewer Smoke Testing, and Incident Reporting**

- Ms. Maria P. Aguilar, P.E.
  City of Pacifica
  Engineering Department
  700 Coast Highway
  Pacifica, CA 94044
  P: (650) 738-4664

4. **City of Richmond, CA and Lake Berryessa, CA – 60,000lf of Notification Delivery, Sanitary Sewer Smoke Testing, and Incident Reporting**

- Mr. Animesh Irkulla
  Manager, Asset Management
  Veolia Water North America
  2300 Contra Costa Blvd., Suite 350
  Pleasant Hill, CA 94523
  P: (408) 621.8721

SCHEDULE

At this time we've assumed a work schedule of Monday-Friday, 8:00am-5:00pm. We are able to mobilize for a planning meeting with the City immediately upon being issued an Intent to Contract letter or PO#, and can fully mobilize to complete the project within 1-week of the execution of a contract.

FEES

Type of Work	Specific Details	Fees
Sanitary Sewer Smoke Testing	• Scope as detailed in the aforementioned approach. • Fee based on a 18,900lf of sewer to be tested • Fee includes door to door notice delivery	$21,950

Terms & Conditions:

- ***Fees exclude any applicable taxes.*** *All invoices require payment within thirty (30) days.*
- *Quotation is valid for 60 days.*
- *Delays or disruptions through no fault of SFE and causing project interruption may result in a crew and equipment standby rate of $425/hour.*
- *Should there be a requirement for third party traffic control (i.e. Traffic Control Company for lane closures or high traffic areas) at any location, and should this be the responsibility of SFE, our fees will be invoiced at cost plus 10%.*
- *Any reports required will be submitted to our client in a digital format (.pdf)*

Thank you again for the opportunity. We are looking forward to working with you on this assignment. If you have any questions or require any further information please do not hesitate to contact me directly.

Sincerely,
SFE Global

Mike Lemmen
Director - Business Development
SFE File#U15-141P2ML

ATTACHMENT B

Draft Smoke Testing 1 to 2 Week Notice

Notice of Smoke Testing

In approximately one or two weeks during the morning and afternoon, the Castro Valley Sanitary District will be smoke testing the sanitary sewer lines in your area. Work will occur Monday through Friday between the hours of 8:00 am and 3:00 pm. Notification will occur again one to two days before the test.

The Castro Valley Sanitary District (CVSan) will be doing smoke testing to the sanitary sewer lines in your area. These tests involve blowing harmless smoke into parts of the sewer system to find damage, improper connections, and where unwanted water may be entering CVSan's sewer system. As a result, smoke may be seen coming from roof vents, building foundations, catch basins, clean-outs, down spouts, sewer laterals or manhole covers. The smoke will not enter your home or business if it is properly plumbed, vented, and the water traps contain water.

Caution to residents:
Water can evaporate from unused plumbing fixtures. If you have a bathroom or plumbing fixture that is not used or is seldom used, traps should be filled by running water in the fixtures the day before scheduled smoke testing and on a monthly basis thereafter in order to prevent sewer gas from entering the home or office.

The smoke used is a non-toxic substance that is harmless to humans, pets, food, and material items. If smoke does enter the building, it will clear in a few minutes with proper ventilation. Please advise a representative of the smoke testing crew if any leakage occurs in your home or business. Additionally, if you have any questions about the test, health issues or any other concerns, feel free to ask a crew member, or contact CVSan at (510) 537-0757.

Your presence is not required during the tests, and all public safety authorities have been notified of this event. We would appreciate it if you would mention this notice to your neighbors in case they have not received a notice.

Additional information may be found on CVSan's website: http://www.cvsan.org/

Thank you for your cooperation.

ATTACHMENT C

Draft Smoke Testing Door Hanger Notice

Notice of Smoke Testing

The Castro Valley Sanitary District will be testing sewer lines in your area from 8:00 am to 3:00 pm on

xx-xx-2015 through xx-xx-2015

The Castro Valley Sanitary District (CVSan) will be doing smoke testing to the sanitary sewer lines in your area. These tests involve blowing harmless smoke into parts of the sewer system to find damage, improper connections, and where unwanted water may be entering CVSan's sewer system. As a result, smoke may be seen coming from roof vents, building foundations, catch basins, clean-outs, down spouts, sewer laterals or manhole covers. The smoke will not enter your home or business if it is properly plumbed, vented, and the water traps contain water.

Caution to residents:
Water can evaporate from unused plumbing fixtures. If you have a bathroom or plumbing fixture that is not used or is seldom used, traps should be filled by running water in the fixtures the day before scheduled smoke testing and on a monthly basis thereafter in order to prevent sewer gas from entering the home or office.

The smoke used is a non-toxic substance that is harmless to humans, pets, food, and material items. If smoke does enter the building, it will clear in a few minutes with proper ventilation. Please advise a representative of the smoke testing crew if any leakage occurs in your home or business. Additionally, if you have any questions about the test, health issues or any other concerns, feel free to ask a crew member, or contact CVSan at (510) 537-0757.

Your presence is not required during the tests, and all public safety authorities have been notified of this event. We would appreciate it if you would mention this notice to your neighbors in case they have not received a notice.

Additional information may be found on CVSan's website: http://www.cvsan.org/

Thank you for your cooperation.

ATTACHMENT D

SFE Global California Standard Safety Manual

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ID2
Cap Cleanout

ID29
Cap Cleanout

ID35
Repair Lateral

ID41
Repair Lateral

ID40
Cap Cleanout or Repair Lateral

ID6
Review SD Drawings
Perform CCTV SD.
And Disconnect SD from SS

ID7
Disconnect Area Drain from SS

ID33
CCTV SD. And Disconnect SD from SS

ID36
Repair Lateral

ID38
Repair Lateral

ID39
Repair Lateral

ID37
Repair Lateral

ID22
Repair Lateral

ID30
Disconnect vault drain from SS

ID19
Repair Lateral

ID20
Cap Cleanout or Repair Lateral

N

0 200 400
Feet

Symbology

2012 Smoke Testing Defects

- Light
- Moderate
- Severe
- Manhole
- Pump Station
- Force Main
- Gravity Main
- District Boundary

CVSan

WEST YOST ASSOCIATES

Figure 1

2012 Smoke Testing Defects

Castro Valley Sanitary District
Wastewater Collection System
Master Plan Update

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N

0 200 400

Feet

Symbology

2012 Smoke Testing Defects

- Light
- Moderate
- Severe
- Manhole
- Pump Station
- Force Main
- Gravity Main
- District Boundary

CVSan

WEST YOST ASSOCIATES

Figure 2

2012 Smoke Testing Defects

Castro Valley Sanitary District
Wastewater Collection System
Master Plan Update

ID 24
Cap
Cleanout

ID 23
Cap
Cleanout

ID 34
Cap
Cleanout

ID 21
Repair
Lateral

ID 9
Disconnect Area
Drain from SS

ID 1
Cap
Cleanout

ID 8
Repair
Lateral

ID 10
Cap Cleanout

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Disconnect
vault drain from SS

ID 31
Disconnect Area
Drain from SS

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Retest

ID 16
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ID 32
Cap
Cleanout

ID 15
Repair
Lateral

ID 18
Repair Lateral

ALMA AV
BRICKELL WY
SANDY RD
LONE OAK PL
RAHLVES DR
UNNAMED
RAY AV
MADISON AV
VANNOY AV
JAMES AV
JAMES PL
LEMAS PL
KATHLEEN AV
REDWOOD RD
HOLLAND PL
COREY WY
HEYER LA
HEYER AV
MERRILL PL
HEYER
GLIDDON ST
HELTON ST
HELTON CT
XENIE CT
REDWOOD GLEN
HELEN PL
FOREST CT
BEVERLY PL
HEYER HEIGHTS
HEYER PL
MABEL AV
MABEL PL
KINNEY CT
SALEM RD
SOMERSET AV
FOREST GLEN PL
BERDINA RD
GREGORY ST
JAYDINE ST
MEL LA
CENTER ST
PARKVIEW RD
SARGENT AV
ALANA RD
NEWHAVEN WY
EDWARDS LA
ROXY WY
NICHANDROS ST
LORENA AV
STEVENS ST
FOREST AV
FERN WY
GYEN ST
SHAMROCK WY
PARADISE KNOLLS
CIRCLE AV
TODDIKA LA
OMEGA AV
MODESTO ST
MEADOWLARK DR
MARSHALL ST
GEM AV
GEM CT
JAMISON WY

N

0 200 400
Feet

Symbology

2012 Smoke Testing Defects

- Light
- Moderate
- Severe
- Manhole
- Pump Station
- Force Main
- Gravity Main
- District Boundary

CVSan

WEST YOST ASSOCIATES

Figure 3

2012 Smoke Testing Defects

Castro Valley Sanitary District
Wastewater Collection System
Master Plan Update

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Feet

Symbology

2012 Smoke Testing Defects

- Light
- Moderate
- Severe
- Manhole
- Pump Station
- Force Main
- Gravity Main
- District Boundary

CVSan

WEST YOST ASSOCIATES

Figure 4

2012 Smoke Testing Defects

Castro Valley Sanitary District
Wastewater Collection System
Master Plan Update

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Table 1. 2012 Smoke Testing Defects

ID	Longitude	Latitude	Address	Return type	Severity	Apx B Page No	MH	Notes	Ownership	Recommendation	SFE Scope
1.00	-122.07	37.70	19532 Alana Road	Cleanout	Light	86.00	1331.00	Smoke from cleanout with cap missing in front of house on Alana Road.	Private	Cap Cleanout	Confirm
2.00	-122.07	37.69	3765 Castro Valley Boulevard	Cleanout	Moderate	68.00	1417.00	Smoke from cleanout with cap missing at the Tra-Tel Trailer Park on Castro Valley Boulevard.	Private	Cap Cleanout	Confirm
3.00	-122.07	37.69	3765 Castro Valley Boulevard	Area Drain	Moderate	13.00	1417.00	Smoke coming out of multiple area drains and old bathroom lines at the Tra-Tel Trailer Park on Castro Valley Boulevard.	Private	Disconnect Area Drain from SS and Cap and Abandon lateral connection per CV Sanitary Standards.	Smoke Test
4.00	-122.07	37.69	20999 Cato Court	Ground Surface	Moderate	30.00	1418.00	Ground surface smoke behind building at the back of Cato Court.	Private	Repair Lateral	
5.00	-122.07	37.70	4117 David Street	Cleanout	Light	82.00	1388.00	Smoke from cleanout with cap missing in front of house on David Street.	Private	Cap Cleanout	Confirm
6.00	-122.08	37.69	21635 Dolores Street	Storm Drain	Moderate	10.00	2950.00	Smoke coming out of storm drain located on Dolores Street, near intersection with Farley Street.	Public- County Flood Control	Review SD Drawings, Perform CCTV SD. And Disconnect SD from SS	Smoke Test
7.00	-122.08	37.69	21654 Dolores Street	Area Drain	Light	17.00	2951.00	Smoke coming out of area drain in backyard of house on Dolores Avenue.	Private	Disconnect Area Drain from SS	Confirm
8.00	-122.07	37.70	19603 Fern Way	Foundation	Light	63.00	1352.00	Foundation smoke from underneath house on Fern Way.	Private	Repair Lateral	
9.00	-122.07	37.70	19610 Forest Avenue	Area Drain	Light	19.00	2668.00	Smoke coming out of area drain in front yard of house on Forest Avenue.	Private	Disconnect Area Drain from SS	Smoke Test
10.00	-122.07	37.70	19897 Forest Avenue	Cleanout	Light	72.00	1358.00	Smoke from cleanout with missing cap in condo complex on Forest Avenue.	Private	Cap Cleanout	Confirm
11.00	-122.07	37.70	19983 Forest Avenue	Vault/Valve	Light	27.00	3324.00	Smoke coming out of valve vault marked water, next to parking lot in housing complex on Forest Avenue.	Public- EBMUD	Disconnect vault drain from SS	
12.00	-122.07	37.70	20228 Forest Avenue	Roof Leader	Severe	22.00	1362.00	Smoke from downspouts of multiple buildings on parcel.	Private	Disconnect downspouts from SS	Confirm
13.00	-122.07	37.70	20551 Forest Avenue	Area Drain	Moderate	15.00	3351.00	Smoke coming out of area drain at condo complex off of Forest Avenue.	Private	Disconnect Area Drain from SS	Smoke Test
14.00	-122.07	37.70	20551 Forest Avenue	Ground Surface	Moderate	52.00	3351.00	Ground surface smoke from curb in front of house on Forest Avenue.	Private	Repair Lateral	
15.00	-122.06	37.70	4277 Gem Avenue	Ground Surface	Moderate	34.00	1843.00	Ground surface smoke from lawn on Gem Avenue.	Private	Repair Lateral	
16.00	-122.06	37.70	4250 Gem Avenue	Ground Surface	Light	54.00	1371.00	Probably a cleanout. Ground surface smoke from planter box of house on Gem Avenue.	Private	Cap Cleanout or Repair Lateral	Confirm
17.00	-122.06	37.70	4225 Gem Avenue	Other	N/A	89.00	1349.00	No smoke coming out of 3-4 houses on Gem Avenue.		Retest	Smoke Test
18.00	-122.06	37.70	20019 Gem Avenue	Ground Surface	Moderate	36.00	1848.00	Ground surface smoke from joint in lawn / driveway on Gem Avenue.	Private	Repair Lateral	
19.00	-122.08	37.68	2180 Grove Way	Ground Surface	Light	60.00	1018.00	Ground surface smoke from lawn in front of house on Grove Way.	Private	Repair Lateral	
20.00	-122.08	37.68	2264 Grove Way	Ground Surface	Light	58.00	1020.00	Ground surface smoke from below grade on edge of sidewalk and outside edge of vault, by lawn in front of house on Grove Way	Private	Cap Cleanout or Repair Lateral	Confirm
21.00	-122.06	37.70	4662 Heyer Avenue	Foundation	Light	65.00	1777.00	Foundation smoke from underneath house on Heyer Avenue.	Private	Repair Lateral	
22.00	-122.07	37.69	2664 & 2670 Jones Street	Ground Surface	Moderate	44.00	1508.00	Ground surface smoke from grass lawn between the houses 2664 and 2670 Jones Street.	Private	Repair Lateral	
23.00	-122.06	37.71	4828 Kathleen Avenue	Cleanout	Light	78.00	1734.00	Smoke from cleanout in front of house on Kathleen Avenue.	Private	Cap Cleanout	Confirm
24.00	-122.06	37.71	18937 Madison Avenue	Cleanout	Light	76.00	1245.00	Smoke from cleanout with cover and cap missing, just behind gate of house on Madison Avenue.	Private	Cap Cleanout	Confirm
25.00	-122.10	37.72	17108 Mayflower Drive	Ground Surface	Moderate	50.00	3122.00	Ground surface smoke from sidewalk on Mayflower Drive, just uphill from smoke return at storm drain.	Public	Review SD Drawings to Confirm Lateral or Storm Drain	Smoke Test
26.00	-122.10	37.72	17214 Mayflower Drive	Storm Drain	Severe	8.00	125.00	Smoke coming out of storm drain located on Mayflower Drive hill, just up from September Court.	Public- County Flood Control	Review SD Drawings, Perform CCTV SD. And Disconnect SD from SS	Smoke Test
27.00	-122.07	37.70	4003 Meadowview Drive	Cleanout	Light	74.00	1393.00	Smoke from cleanout with missing cap in front of house on Meadowview Drive.	Private	Cap Cleanout	Confirm
28.00	-122.07	37.70	4004 Meadowview Drive	Storm Drain	Severe	2.00	1393.00	Smoke coming out of storm drain located at the intersection of Marshal Street and Meadowview Drive.	Public- County Flood Control	CCTV SD. And Disconnect SD from SS	Smoke Test
29.00	-122.07	37.69	21675 Redwood Road	Cleanout	Light	80.00	1067.00	Smoke from cleanout with cap missing in front of eye center on Redwood Avenue.	Private	Cap Cleanout	Confirm
30.00	-122.07	37.69	22151 Redwood Road	Vault/Valve	Moderate	25.00	3065.00	Smoke coming out of EBMUD Vault behind building on Redwood Boulevard.	Public- EBMUD	Disconnect vault drain from SS	
31.00	-122.07	37.70	4131 Toddika Lane	Storm Drain	Severe	6.00	2656.00	Smoke coming out of storm drain located on Toddika Lane, along the entrance to the apartment complex. Probably a direct connection.	Private	Disconnect Area Drain from SS	Smoke Test
32.00	-122.06	37.70	20057 Topaz Court	Cleanout	Light	84.00	3353.00	Smoke from cleanout with cap missing in front of house on Topaz Court.	Private	Cap Cleanout	Confirm
33.00	-122.07	37.69	2662 Totten Street	Storm Drain	Severe	4.00	1511.00	Smoke coming out of storm drain located on the right side of the end of Totten Street.	Public- County Flood Control	CCTV SD. And Disconnect SD from SS	Smoke Test
34.00	-122.06	37.71	5027 Vannoy Avenue	Cleanout	Moderate	70.00	3395.00	Smoke from cleanout with cover and cap missing in front of house on Vannoy Avenue.	Private	Cap Cleanout	Confirm
35.00	-122.07	37.69	2681 Vegas Avenue	Ground Surface	Moderate	38.00	2511.00	Ground surface smoke from rock landscaping on side of house on Vegas Avenue.	Private	Repair Lateral	
36.00	-122.07	37.69	22049 Vergil Street	Ground Surface	Moderate	40.00	1506.00	Ground surface smoke from gravel near side yard fence of house on Vergil Street.	Private	Repair Lateral	
37.00	-122.07	37.69	22089 Vergil Street	Ground Surface	Moderate	46.00	3364.00	Ground surface smoke from right corner of front yard (when facing house) of house on Vergil Street.	Private	Repair Lateral	
38.00	-122.07	37.69	22053 & 22057 Vergil Street	Ground Surface	Moderate	42.00	3365.00	Ground surface smoke from side yard area between houses 22053 and 22057 Vergil Street.	Private	Repair Lateral	
39.00	-122.07	37.69	22073 & 22077 Vergil Street	Ground Surface	Moderate	48.00	1507.00	Ground surface smoke from side yard area between 22073 and 22077 Vergil Street	Private	Repair Lateral	
40.00	-122.07	37.69	2655 Watson Street	Ground Surface	Light	56.00	1515.00	Ground surface smoke from under planting pot/barrel of house on Watson Street, probably a cleanout.	Private	Cap Cleanout or Repair Lateral	Confirm
41.00	-122.07	37.69	2678 Watson Street	Ground Surface	Moderate	32.00	1514.00	Ground surface smoke from house lateral on Watson Street.	Private	Repair Lateral	

WEST YOST ASSOCIATES