RESOLUTION NO. 25-9514

A RESOLUTION OF THE CITY OF SANTA CLARA, CALIFORNIA, APPROVING THE SANITARY SEWER MASTER PLAN UPDATE REPORT

WHEREAS, the San Francisco Regional Water Quality Control Board and the California State Water Resources Control Board have both independently mandated that all sanitary sewer system operators within the San Francisco region and within the State of California, respectively, prepare and implement Sanitary Sewer Management Plans ("SSMP");

WHEREAS, the City operates and maintains a sanitary sewer collection system within the city limits and the City Council of the City of Santa Clara is the governing body of the City's sewer utility;

WHEREAS, the State Water Resources Control Board requires that the SSMP be updated every 6 years and adopted by the City Council at a regular or special meeting to ensure that the City Council is aware of the scope of the SSMP and its potential impacts;

WHEREAS, the City Council most recently approved a 2025 Update to the SSMP on July 15, 2025 (Resolution 25-9470);

WHEREAS, a system evaluation and capacity assurance plan is a required element of a SSMP;

WHEREAS, the Department of Public Works has prepared a report entitled "Sanitary Sewer Master Plan Update 2025" (the "Report") to guide the ongoing and future sanitary sewer system capacity improvements and to fulfill the SSMP requirement for a system evaluation and capacity assurance plan;

WHEREAS, the system evaluation and capacity assurance plans contained in the 2025 Update to the SSMP included the 2007 Assessment, 2016 Master Plan, and preliminary draft of the Sanitary Sewer Master Plan Update 2025 Report;

WHEREAS, the Report which is attached is on file in the Office of the City Clerk, available for public inspection, and incorporated herein by this reference;

//

WHEREAS, the Report was made available for public inspection at least ten days before the public hearing by placing the data on file with the City Clerk's office on November 5, 2025 in accordance with Government Code 66016; and,

WHEREAS, the City Council now desires to approve the Report.

NOW THEREFORE, BE IT RESOLVED BY THE CITY OF SANTA CLARA AS FOLLOWS:

1. That the City Council hereby finds that the above Recitals are true and correct and by this reference makes them a part hereof.

2. That said Report, as duly revised and corrected if necessary, is hereby approved.

3. Effective date. This resolution shall become effective immediately.

I HEREBY CERTIFY THE FOREGOING TO BE A TRUE COPY OF A RESOLUTION PASSED AND ADOPTED BY THE CITY OF SANTA CLARA, CALIFORNIA, AT A REGULAR MEETING THEREOF HELD ON THE 9TH DAY OF DECEMBER, 2025, BY THE FOLLOWING VOTE:

AYES:	COUNCILORS:	Chahal, Cox, Gonzalez, Hardy, Jain, and Park, and Mayor Gillmor
NOES:	COUNCILORS:	None
ABSENT:	COUNCILORS:	None
ABSTAINED:	COUNCILORS:	None

ATTEST: _____
NORA PIMENTEL, MMC
ASSISTANT CITY CLERK
CITY OF SANTA CLARA

Attachments incorporated by reference:
1. Sanitary Sewer Master Plan Update – August 2025

Sanitary Sewer Master Plan Update

Final Report

DRAFT

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City of Santa Clara

August 2025

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LIST OF ACRONYMS AND ABBREVIATIONS

ADWF	Average Dry Weather Flow
APN	Assessor Parcel Number
BWF	Base Wastewater Flow
CCTV	Closed-Circuit Television
CIP	Capital Improvement Program or Capital Improvement Plan
CIPP	Cured-in-Place Pipe
City	City of Santa Clara
CMC	Chromite-Machado-Cabrillo
County	Santa Clara County
CSJ	City of San Jose
CuSD	Cupertino Sanitary District
d/D	Depth to Diameter Ratio
DDF	Depth, Duration, Frequency
DIP	Ductile Iron Pipe
DTM	Digital Terrain Model
DU	Dwelling Unit
DWF	Dry Weather Flow
EL	Existing Loads
ENR CCI	Engineering News Record Construction Cost Index
FAR	Floor-area-ratio
FM	Flow Meter
fps	Feet per second

GAP	Great America Parkway
GIS	Geographic Information System
GP	General Plan
gpd	Gallons per day
gpcd	Gallons per capita per day
GWI	Groundwater Infiltration
I/I	Infiltration and Inflow
ICM	InfoWorks ICM™
IDF	Intensity, Duration, Frequency
LiDAR	Light Detection and Ranging
LF	Linear Feet
LMN	Lined Model Network (Future)
LTFL	Long-Term Future Loads
MAP	Mean Annual Precipitation
mgd	Million gallons per day
MH	Sanitary Sewer Manhole
MP	Master Plan
NAICS	North American Industry Classification System
NAVD	North American Vertical Datum of 1988
NGVD	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NTFL	Near-Term Future Loads
PDWF	Peak Dry Weather Flow
PHD	Patrick Henry Drive
PS	Pump Station
PVC	Polyvinyl Chloride (Pipe)
PWWF	Peak Wet Weather Flow
RCP	Reinforced Concrete Pipe
RDI/I	Rainfall-Dependent Infiltration and Inflow
SCADA	Supervisory Control and Data Acquisition
SCS	Soil Conservation Service
SD	Specific Development
SF	Square Feet
SJ/SC RWF	San Jose / Santa Clara Regional Wastewater Facility
SMH	Sanitary Sewer Manhole
SSO	Sanitary Sewer Overflow
UMN	Unlined Model Network (Current)
USDA	United States Department of Agriculture
V&A	V&A Consulting Engineers, Inc.
VCP	Vitrified Clay Pipe
VFD	Variable Frequency Drive
W&C	Woodard & Curran
WWF	Wet Weather Flow

EXECUTIVE SUMMARY

This report summarizes the results and recommendations of the Sanitary Sewer Master Plan Update (Master Plan Update) for the City of Santa Clara (City or Santa Clara). Woodard & Curran prepared the Master Plan Update in close coordination with City staff. The Master Plan Update will be used to guide improvements to the City's sewer system to accommodate current and future development and to help the City continue to provide a high level of service to its customers.

The overall objectives of this Master Plan Update were to develop wastewater flow projections for the City's sewer service area using up-to-date development and land use information and flow monitoring data; update and expand its existing hydraulic model of the sanitary sewer system; use the model to identify existing capacity deficiencies and future capacity requirements; and develop a phased Capital Improvement Program (CIP), including cost estimates, for implementing the required capacity improvements to the sewer system.

This Executive Summary provides a concise summary of the Master Plan Update report, highlighting critical information including objectives, findings, conclusions, and recommendations. It is presented in three parts:

1) **Introduction to the City's Existing Sewer System and Service Area** (**Section ES-1**) discusses the City of Santa Clara's existing sewer system infrastructure and service area.
2) **Description of How the Capacity Analysis was Prepared** (**Section ES-2**) describes the scope and methodologies of the planning effort, including the key planning and technical assumptions incorporated into the sewer system capacity analysis.
3) **Recommended Capital Improvement Program** (**Section ES-3**) presents the recommended CIP, including capacity improvement projects, phasing, and estimated costs. In addition, recommendations are presented for implementing the proposed CIP.

ES-1 Introduction to the City's Existing Sewer System and Service Area

Santa Clara is located in central Santa Clara County adjacent to the cities of San Jose, Cupertino, and Sunnyvale and covers approximately 18 square miles. The City has a population of approximately 130,000 and is served by a wastewater system comprising approximately 288 miles of sewer pipelines generally ranging from 4 to 48 inches in diameter (including approximately 12 miles of sewer pipelines not owned by the City, excluding laterals) and seven (7) sewage pump stations.

The City collects wastewater generated within the City's service area from approximately 25,000 City customers (connections). Based on the City's billing database, roughly 90% of the City's existing customers are residential users and the remaining 10% are non-residential users, including commercial, municipal, and industrial users. In addition to collecting wastewater flows from customers within its service area, the City also has an agreement to convey wastewater flows from a major portion of the Cupertino Sanitary District (CuSD) via a connection at Homestead Road and Swallow Drive.

Wastewater flows collected are generally conveyed eastward and northward. A portion of the City's flow continues eastward to the Trimble Trunk and conveyed to the City of San Jose's interceptor sewers on Zanker Road. The remainder of the City's flow and all the CuSD flow travels northward to the City's Northside and Rabello Pump Stations, where the flow is pumped to the San Jose/Santa Clara Regional Wastewater Facility (SJ/SC RWF) for treatment and disposal. The City's sewer system and service area are shown in **Figure ES-1**. A summary of the City's sanitary sewer system infrastructure is presented in **Table ES-1**.

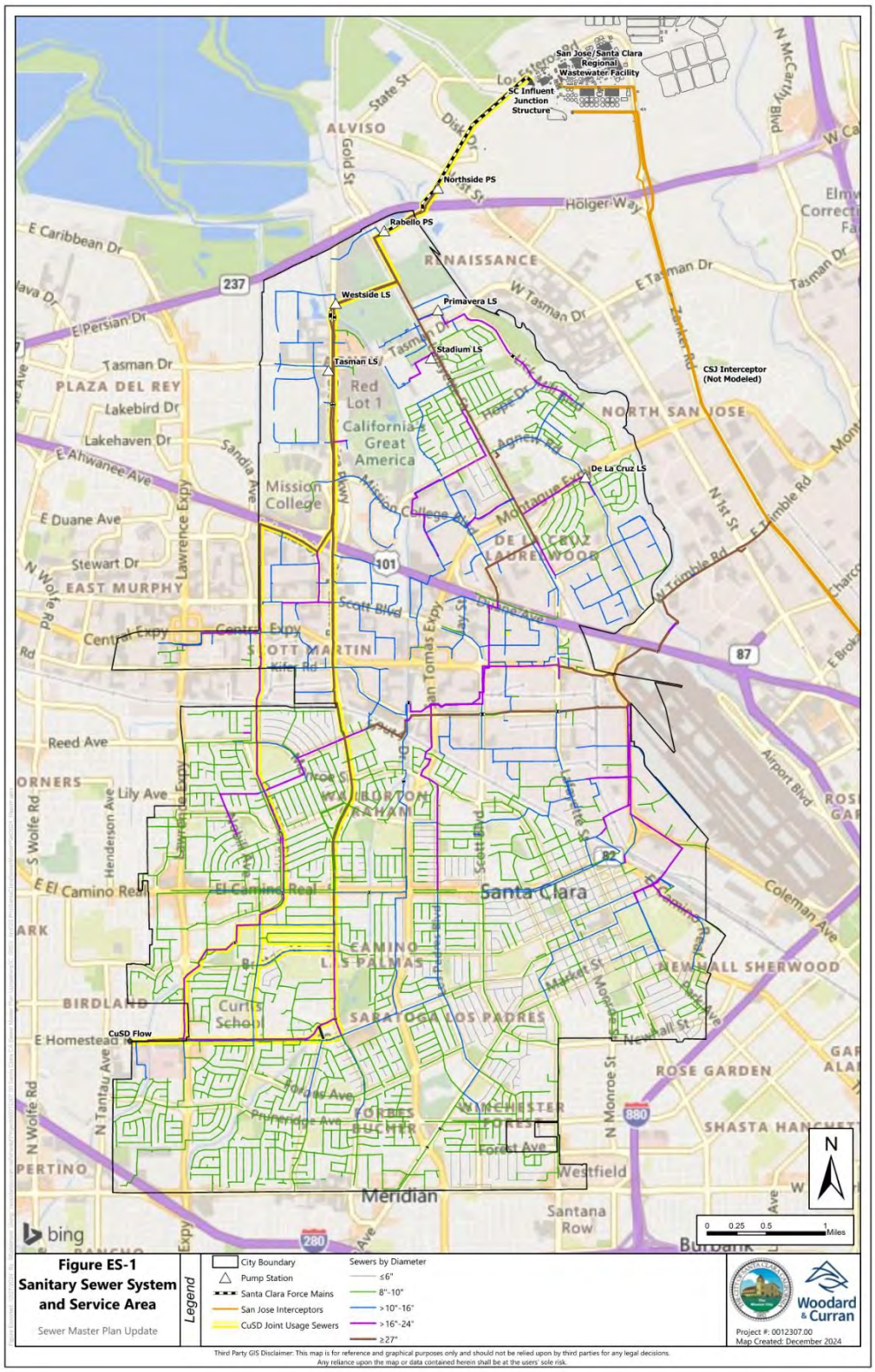
TABLE ES-1: SUMMARY OF SANITARY SEWER SYSTEM INFRASTRUCTURE

Infrastructure	Quantity	Unit
Sewer Mains (Pipes)	1,456,400[1] / 276	Feet / Miles
Manholes	5,500	-
Siphons	34 (59 barrels[2])	-
Pump Stations	7	-

[1]Total length is rounded to the nearest one hundred feet.

[2]Some siphons have multiple barrels: Three (3) siphons have three (3) barrels, 19 siphons have two (2) barrels, and the remaining 12 siphons have a single barrel.

FIGURE ES-1: SANTA CLARA SANITARY SEWER SYSTEM AND SERVICE AREA



ES-2 Description of How the Capacity Analysis was Prepared

This study is intended to provide a comprehensive update of the City's Sanitary Sewer Master Plan to reflect the most current and accurate information on wastewater flows, projected growth, and system performance. To accomplish this, the City recognizes the need to update the hydraulic model of its sewer system, which is used to assess system performance and identify system capacity needs for both existing and projected future wastewater flows. This section describes how the capacity analysis was prepared and discusses the wastewater flow assumptions, hydraulic model development and calibration, design and performance criteria, and capacity analysis scenarios and results.

Wastewater Flow Assumptions

Wastewater flow assumptions are required to develop a hydraulic model that is an accurate representation of reality. The Santa Clara model includes both existing and future projected wastewater flow scenarios. Existing base wastewater flow (BWF) was estimated for each parcel within the City's service area based on recent customer water usage records obtained from the City's water billing database.

Future BWF projections were estimated by incorporating the most current development information that was available for the City's service area, which included development projects in review, specific plans, General Plan, and entitlements. Based on the timing and type of development, the future base wastewater flows were assigned to one of two scenarios: near-term future or long-term future. The long-term future scenario included all development assumptions applied to the near-term future scenario plus development assumptions associated with the City's General Plan and entitlements. The City's billing database records show that many entitlement holders have historically discharged less than their flow entitlements; however, considering the City is required to provide capacity to these users should they have the need to increase their discharges, the long-term future BWF scenario conservatively assumes that all entitlement holders would make use of their full discharge allowances.

Table ES-2 summarizes the average BWF assumptions applied to the hydraulic model for the City's service area.

TABLE ES-2: AVERAGE BASE WASTEWATER FLOW ASSUMPTIONS FOR SANTA CLARA[1]

Land Use	Residential	Non-Residential	Total
Flow Scenario	(mgd)	(mgd)	(mgd)
Existing	6.72	4.50	11.22
Near-Term Future	10.11	6.09	16.20
Long-Term Future[2]	13.58	15.48	29.06

[1]Does not include sewer flows from the Cupertino Sanitary District (CuSD). Refer to **Table ES-3**.

[2]Includes 5.09 mgd assumed for entitlements, mostly for non-residential land uses.

The Santa Clara hydraulic model includes flow scenarios that represent both dry weather (non-rainfall) and wet weather (rainfall) conditions. In dry weather conditions, the base wastewater flows presented above account for the vast majority of total discharges to the sewer system. During wet weather conditions, total discharges to the sanitary sewer system increase due to the introduction of storm water inflow and infiltration, which enters the sanitary sewer system in direct response to rainfall events through holes in manhole covers, defects in sewer pipelines and service laterals, or illegally connected storm drainage infrastructure. If groundwater levels are high enough, some infiltration can also occur during dry weather conditions as it infiltrates into sewer infrastructure from below through defects. Wet weather flows are generated by simulating a design storm rainfall event in the hydraulic model.

Because CuSD discharges to Santa Clara's sanitary sewer system, the existing and future projected wastewater flow scenarios in the hydraulic model also include wastewater flow assumptions for CuSD for both dry and wet weather conditions. CuSD flows were incorporated into the hydraulic model as inflow hydrographs, which define the rate of wastewater flow entering a specific point (i.e., manhole) in the network during a simulation. CuSD flows for existing dry weather conditions were based on flow monitoring data. CuSD flows for existing wet weather conditions, near-term future dry and wet weather conditions, and long-term future dry and wet weather conditions were based on flows from CuSD's hydraulic model, which was most recently re-calibrated in 2023 by AKEL Engineering. For these flow scenarios, Woodard & Curran created inflow hydrographs based on the results that were exported from CuSD's re-calibrated model; the magnitude of flows was maintained but the timing was slightly shifted to match the diurnal usage pattern observed in the flow monitoring data and to align the peak wet weather response where applicable. For the long-term future wet weather flow scenario only, the peak flow was conservatively scaled up (from a predicted flow of 11.5 mgd) to match the contractual limit (13.8 mgd) defined in Santa Clara's agreement with CuSD.

Table ES-3 summarizes CuSD's average BWF assumptions applied to the hydraulic model for the City's service area.

TABLE ES-3: WASTEWATER FLOW ASSUMPTIONS FOR CUSD[1]

Flow Scenario	Average Dry (mgd)	Peak Dry (mgd)	Average Wet (mgd)	Peak Wet (mgd)
Existing	3.7	5.6	4.1	10.7
Near-Term Future	4.2	6.3	4.6	11.3
Long-Term Future	4.6	6.7	5.9	13.8[2]

[1]Based on CuSD's hydraulic model results for a seven (7) day period.

[2]Assumed to be contractual limit defined in agreement between Santa Clara and CuSD.

Hydraulic Model Network Development

A hydraulic model of the City's sewer system was developed for this study. The model includes all City-owned pipes and manholes within the sanitary sewer system, excluding approximately 12 miles of privately-owned sewer mains. Therefore, the model network consists of about 276 miles of sewers, including 2.7 miles of force mains and 1.7 miles of siphons, or roughly 96% of the total 288 miles of sewer pipeline within the City's system. The model also includes all seven sewage pumping stations. The model is a significant expansion of the model used for the 2016 Master Plan, which was developed to represent the trunk or "backbone" of the sewer system and as such contained approximately 34% (or 94 miles) of the total length of the City's sewers. Since 2016, Woodard & Curran has maintained and updated the City's model as sewer improvement projects were implemented, development reviews were requested, or when new network data became available, and this Master Plan Update builds on that work by significantly expanding the model network to include all City-owned sewer pipelines.

The model was used to assess how the system would perform under various planning and flow scenarios and to identify pipes or pump stations that may not have sufficient capacity to convey the predicted flows under existing or future conditions.

Hydraulic Model Calibration

Before the hydraulic model can be used for the capacity analysis performance evaluation, it must be calibrated to confirm that it is an accurate representation of the flows and hydraulic conditions in the City's sanitary sewer system. Model calibration is the process of comparing model-simulated flows to observed

flows and adjusting the model assumptions and parameters as needed until a reasonably good match is achieved. Generally, the model calibrator attempts to match flow volumes and peak flows between the model-simulated and observed data.

Model calibration is first performed for dry weather flows to achieve an accurate prediction of the base wastewater flows and baseline groundwater infiltration if present during non-rainfall conditions. Wet weather calibration is then performed to achieve an accurate prediction of the storm water inflow and infiltration that discharges to the sanitary sewer system during rainfall events.

A temporary flow monitoring program (shown in **Figure ES-2**) was conducted as part of this study to facilitate model calibration. The program obtained flow depth and velocity data (used to compute flow rate) at 31 strategically identified locations throughout Santa Clara's sanitary sewer system during both dry weather and wet weather conditions and rainfall data at three distinct locations. The observed data were compared to the model-simulated flows during the calibration process to confirm actual flows and system routing and characterize infiltration and inflow into the sewers within each distinct flow meter (FM) basin.

The model calibration process also included reviewing key flow splits in the City's sewer system to confirm flow routing, refining diurnal flow patterns to accurately represent the typical variation of flows throughout the day, and reviewing the City's largest dischargers and their discharge locations.

Table ES-4 summarizes the final model calibration results for the overall system based on discharge location by comparing model-simulated to observed flows during both dry weather and wet weather conditions for the downstream most flow meters. It was determined that a reasonably good match was achieved for the overall system considering the observed average dry weather flows and peak wet weather flows were within 10% of the model-simulated flows at both discharge locations. The period used for the dry weather calibration was the seven (7) day dry period from December 17 through December 23, 2022. Wet weather calibration was performed for the full 2022-2023 season because the flow monitoring program captured several rainfall events. The January 13-16, 2023 rainfall event produced the largest flow response and was used as the primary basis for calibrating the model to match observed peak wet weather flows. Several storms occurred within a short amount of time during the flow monitoring period, so there were likely cumulative impacts that increased the inflow and infiltration response during the subsequent storms. Additionally, the calibration focused on selecting parameters to conservatively match peak flows observed during the mid-January event which occurred later in the season after significant rainfall had already fallen and soils were generally saturated. As a result, the modeled and metered peak flows and volumes typically matched better for the later season rainfall events.

TABLE ES-4: SUMMARY OF HYDRAULIC MODEL CALIBRATION RESULTS[1]

	Average Dry Weather Flows (mgd)			Peak Wet Weather Flows (mgd)		
Discharge Location	**Observed**	**Modeled**	**Difference[2]**	**Observed**	**Modeled**	**Difference[2]**
Santa Clara Northside and Rabello Pump Stations[3]	10.54	10.09	-4.3%	23.03	24.22	+5.2%
Trimble Trunk	4.65	4.46	-4.1%	13.65	13.93	+2.1%

[1]Model results are compared to the 2022-2023 flow monitoring data.

[2]Difference is reported as modeled minus observed flow.

[3]Includes flows from CuSD.

The infiltration and inflow response to rainfall, which is referred to as rainfall-dependent infiltration and inflow (RDI/I), was quantified within each flow meter basin through the wet weather calibration process.

Figure ES-3 presents a visual representation of the wet weather calibration model results in terms of the total RDI/I rate that was applied to the model for each meter basin to match model-simulated and observed flows. The total RDI/I rate (or "Total R") is a percentage that represents the total amount of rainfall that becomes runoff and eventually enters the sanitary sewer system as RDI/I. As shown in the figure, half of the City's flow meter basins had RDI/I rates of less than 5%. In contrast, flow meter basins concentrated within the central western portion of Santa Clara's system displayed very high RDI/I rates of greater than 80%. These flow meter basins are located within the Chromite-Machado-Cabrillo (CMC) tributary area and the adjacent Agate Drive tributary area. The flow monitoring data showed that the nature of the RDI/I responses to rainfall in these areas were indicative of significant infiltration, as the response was generally slower and took a long time to recede (i.e., several weeks following rainfall). Moreover, because consecutive rainfall events occurred within a short period of time during the flow monitoring period, the infiltration response did not fully recede before another rainfall event occurred. The flow monitoring results were consistent with the findings of other field investigations completed recently in the CMC basin, which concluded that rainfall-dependent infiltration appeared to be the most significant contributor to the wet weather response, possibly from defects in tributary sewer laterals and mains.

During the dry weather calibration process, a total of 0.158 mgd of additional GWI flow was applied to the system uniformly throughout two (2) of the 31 flow meter areas (i.e., FM 26 and FM 31), which were located in the CMC and Agate Drive tributary areas, respectively. GWI represents a seasonal increase in wastewater flows due to infiltration into the sewers during non-rainfall conditions, typically in low-lying areas or areas close to creeks or other water bodies. The need to add GWI to these flow meter basins to calibrate for dry weather conditions further suggests that significant infiltration is occurring, likely through defects in tributary sewer laterals and mains.

FIGURE ES-2: FLOW MONITORING PROGRAM

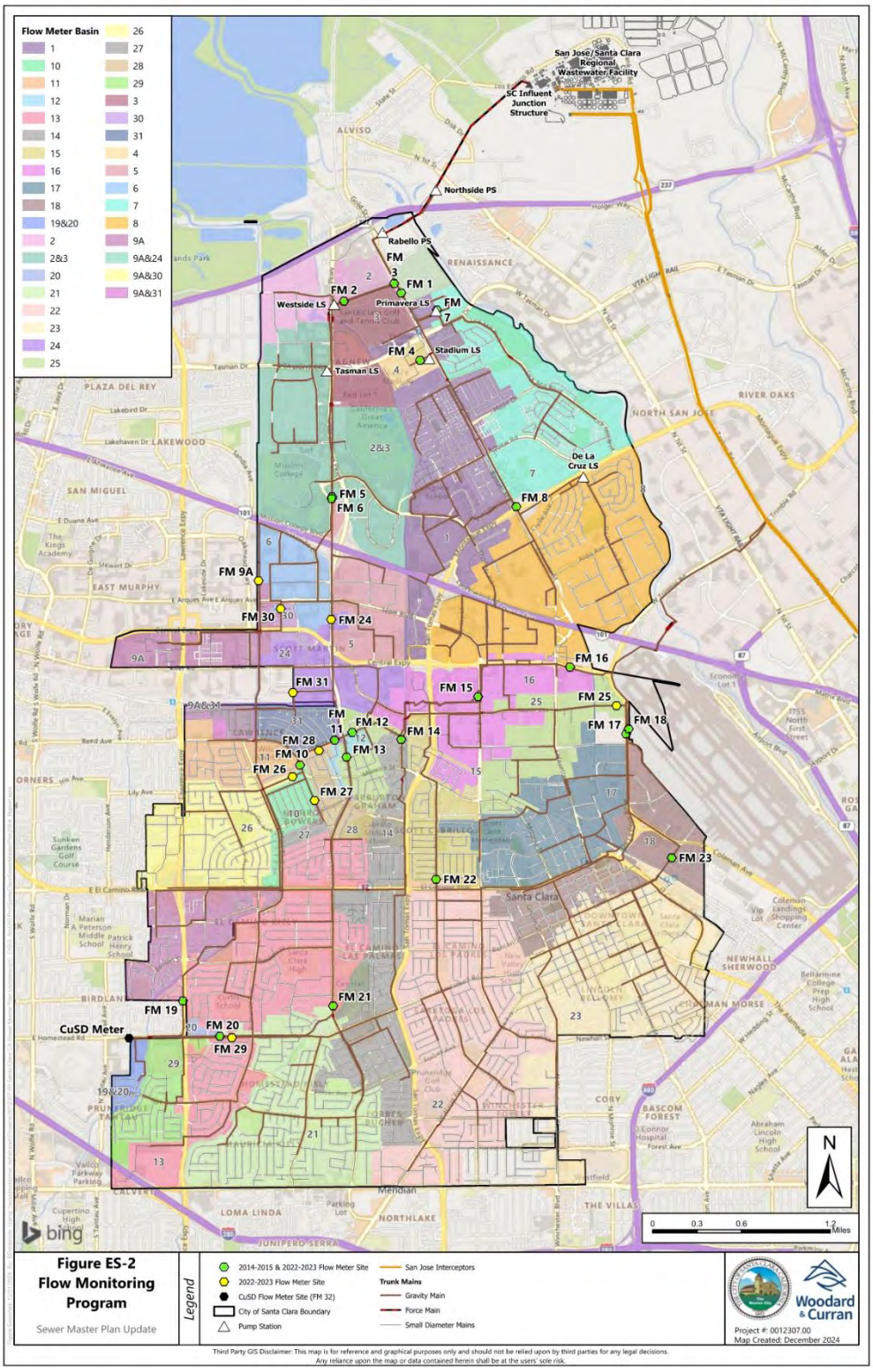
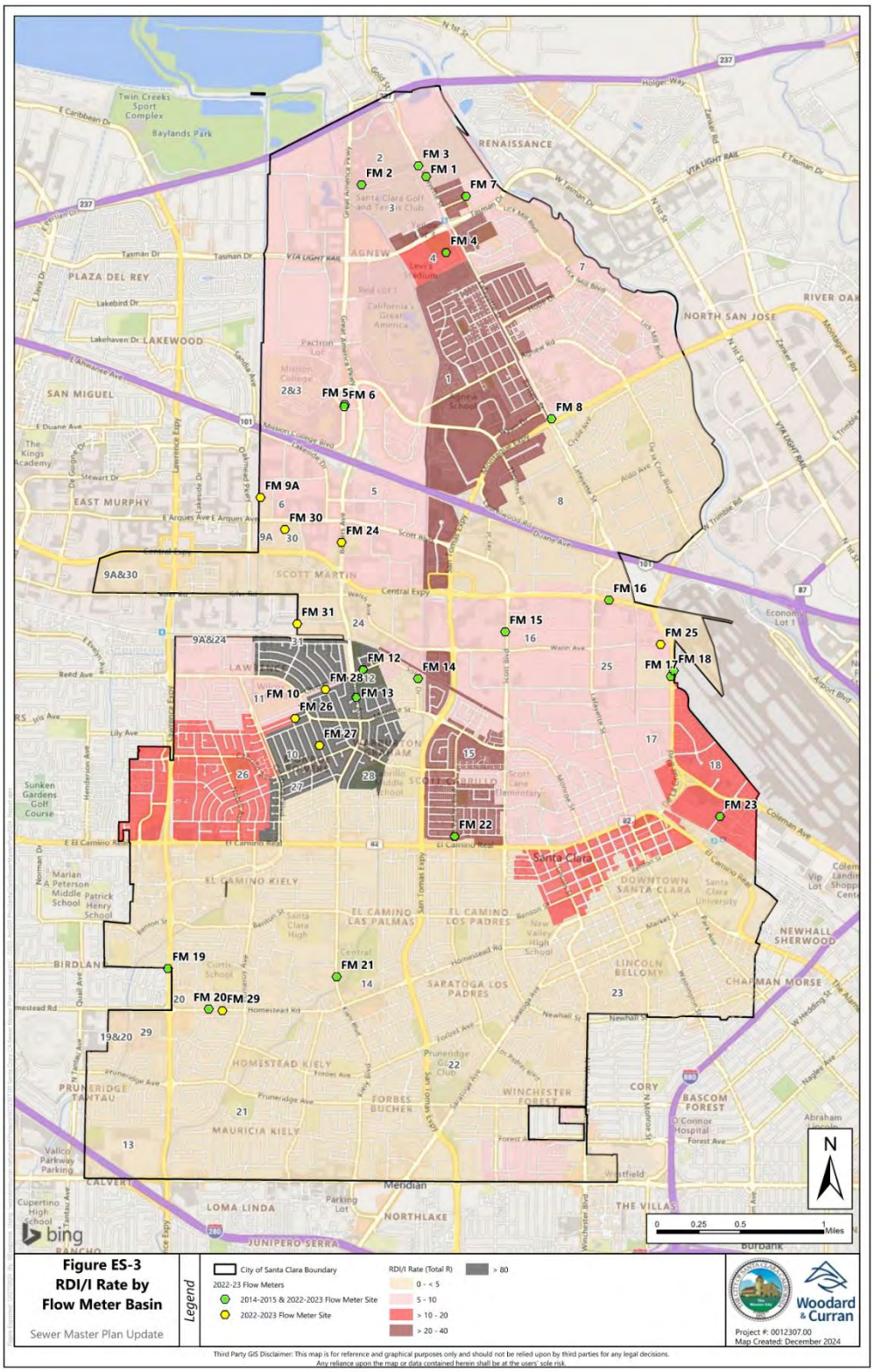


FIGURE ES-3: RDI/I RATE BY FLOW METER BASIN



Design and Performance Criteria

The capacity analysis requires selection of design and performance criteria, which are applied so that the hydraulic model can be used to determine if sewer facilities would have adequate capacity under the flow scenarios developed or if the capacity would be exceeded, requiring system improvements. **Table ES-5** presents and describes the design and performance criteria that were selected for this Master Plan Update.

TABLE ES-5: SUMMARY OF DESIGN AND PERFORMANCE CRITERIA

Criterion	Purpose	Selected
Design Storm Rainfall	Single event rainfall assumed to produce peak flows generated from a rainfall event of a desired return period to assess system capacity during wet weather conditions.	• Return Period: 10 years • Duration: 24 hours • Rainfall Depth and Temporal Distribution: Based on Santa Clara County Drainage Manual (developed from historical rainfall event in December 1955) • Storm Timing: Peak-on-peak[1] (weekday) • Antecedent Conditions: Wet, saturated soils • Spatial Distribution: Lowest intensity north and highest intensity southwest
Performance (Capacity Deficiency)	Used to determine if the capacity of an existing sewer facility is inadequate to the extent that a capacity improvement project would be needed.	• Gravity Sewers: Flow depth exceeds full pipe (d/D[2] > 1) during either dry weather or design storm wet weather conditions (i.e., no surcharge is allowed). • Pump Stations: Firm capacity[3] greater than the peak wet weather flow during the design storm. • Force Mains: Velocity exceeds 8 feet per second (fps).
Design	Used for the purpose of sizing new or relief facilities based on the City's desired level of service and are generally more conservative than the performance criteria because new facilities should be designed to a higher standard.	Gravity Sewers: • d/D < 0.75 under future peak wet weather flows • Minimum Velocity = 2 fps for daily dry weather • Maximum Velocity = 10 fps at peak design flow • Minimum Pipe Diameter = 8 inches • Minimum Cover = 6 feet (ground to pipe crown) Pump Stations: Firm capacity greater than the peak wet weather flow during the design storm. Force Mains: • Minimum/Maximum Velocity: 3 fps /8 fps • Minimum Cover = 6 feet (ground to pipe crown)

[1]Peak RDI/I occurs at approximately the same time as peak BWF for most areas of the sewer system.

[2]d/D = Depth-to-Diameter Ratio representing the depth of flow within the pipe.

[3]Capacity of the pump station assuming that the largest pump is out of service.

The design and performance criteria selected for sewer master planning efforts vary by agency and are reflective of the level of risk that is acceptable to each agency. Common criteria for several agencies both inside and outside of California were reviewed during the process of selecting the City's criteria. Ultimately, Santa Clara elected to apply relatively conservative criteria in order to identify all potential projects, recognizing that conditions may change in the future due to variable factors such as sewer condition, additional development, and climate change. However, engineering judgment was used when applying the

performance criteria to avoid identifying capacity deficiencies where gravity sewers showed only minor criteria violations.

Capacity Analysis Scenarios and Results

The capacity analysis is performed using the calibrated hydraulic model to identify sewer facilities that may not have sufficient capacity to convey the predicted flows based on the selected performance criteria. A total of 12 model scenarios were developed to assess system performance and were a combination of the wastewater flow scenario (existing, near-term future, or long-term future), design flow (dry or wet weather), and physical network assumptions (with or without assumed lining of City-identified reinforced concrete sewers likely to be in poor condition) listed in **Table ES-6**.

TABLE ES-6: SUMMARY OF CAPACITY ANALYSIS MODEL SCENARIOS

Wastewater Flow	Design Flow	Physical Network
Existing	Dry Weather	Unlined: Current system with no future lining assumed
Near-Term Future	Wet Weather	Lined: Assumes future lining of City-identified RCP trunks in poor condition
Long-Term Future		

The capacity analysis identified a total of 16 gravity sewer deficiencies, the locations of which are shown in **Figure ES-4**. In the figure, pipes shown in pink are predicted to surcharge due to "throttle" conditions, indicating that the full capacity of the pipe is less than the predicted peak flow. Pipes shown in purple are predicted to surcharge due to backwater from a downstream throttle condition. A total of 15 capacity improvement projects were developed to relieve the gravity sewer capacity deficiencies identified through the capacity analysis. The project locations and extents are shown in **Figure ES-5**. Most projects were developed to either replace the existing, capacity-deficient pipe with a larger pipe or to re-direct a portion of flows to other existing sewers with adequate available capacity. Replacement pipes were sized based on the selected design criteria to convey flow for the most conservative model scenario (i.e., long-term future wastewater flow, wet weather design flow, and lined physical network). The number of projects developed (15) is less than the number of capacity deficiencies identified (16) because model runs showed that the Agate Drive deficiency would be relieved once the Calabazas Trunk project was implemented.

The capacity analysis did not identify any pump station or force main capacity deficiencies. The firm and total capacities of each of the City's seven sewer pump stations were estimated based on basic information, pump settings, pump curves, and system curves provided by the City. Those theoretical capacities were then compared to the model-predicted peak wet weather flows generated from the design storm rainfall event. Because the theoretical firm capacity of each station did not exceed the model-predicted flow into the station, it was assumed that each station had adequate capacity to convey flows during the most conservative condition evaluated based on the City's performance criteria. Model-predicted force main velocities were also within the specified performance criteria (i.e., less than 10 fps) during the most conservative condition evaluated, and similarly, no capacity deficiencies were identified. Although the capacity analysis did not identify any pump station capacity deficiencies, the model-predicted peak design flows to the Rabello and Northside Pump Stations during long-term future wet weather conditions (44.8 mgd) are close to the combined firm capacities of these two stations (45.2 mgd). Based on discussions with the City's Water and Sewer Department, the diversion box upstream of these two pump stations contains a wet well with weir slots that the City has the ability to adjust by dropping in weir boards to control the flow. Under dry weather conditions and normal settings, approximately 80% of flows go to the Rabello PS and the remaining 20% go to the Northside PS. City staff had not observed flows overtopping the weir boards towards Northside PS, but suspects there may be a gap underneath the weir boards considering SCADA

confirms that flows go to both pump stations. The City should continue to monitor influent flows to these two pump stations as future developments come online and adjust the diversion box weir settings as needed to maximize the available capacity.

FIGURE ES-4: OVERVIEW OF CAPACITY DEFICIENCIES

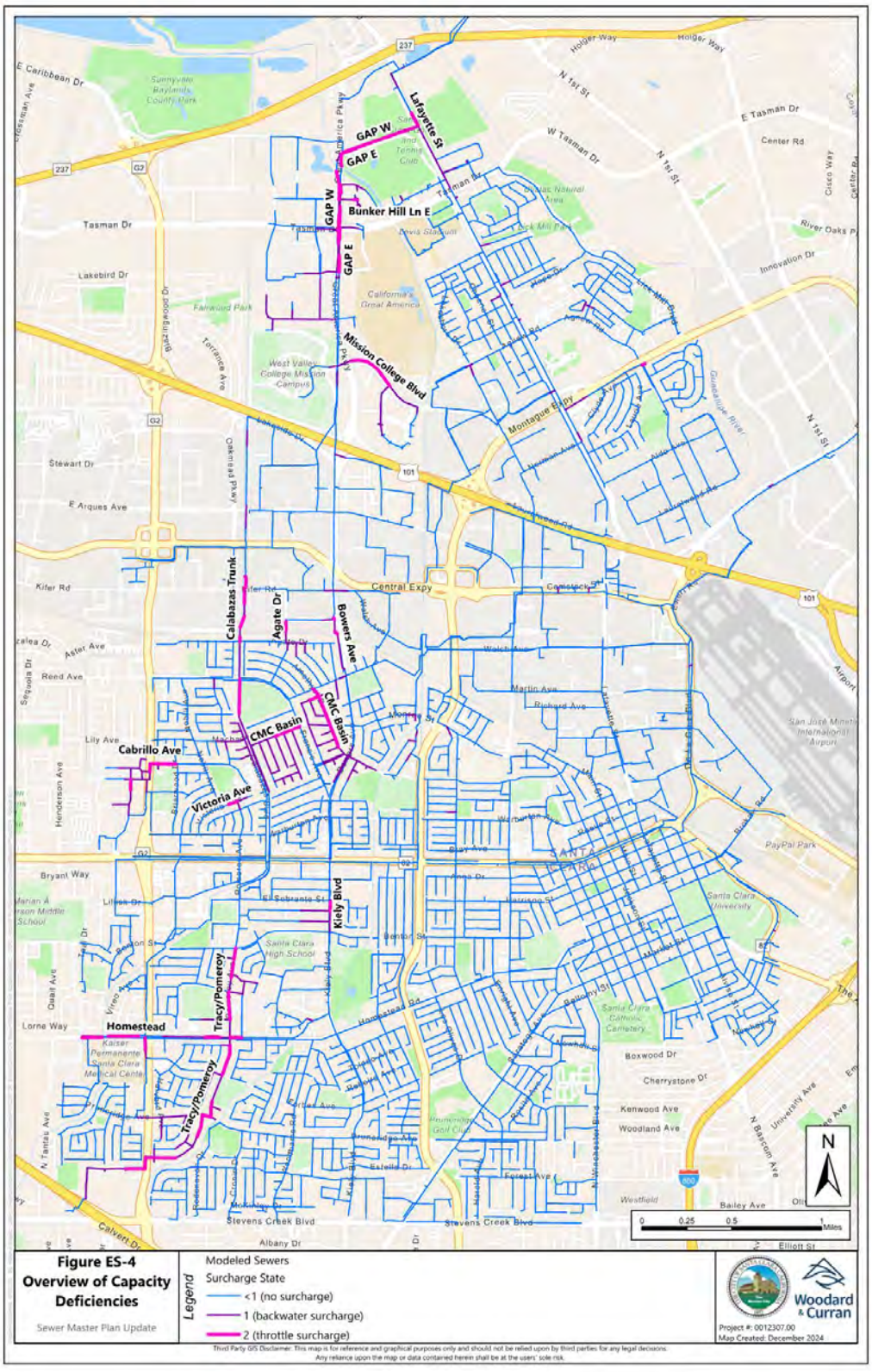
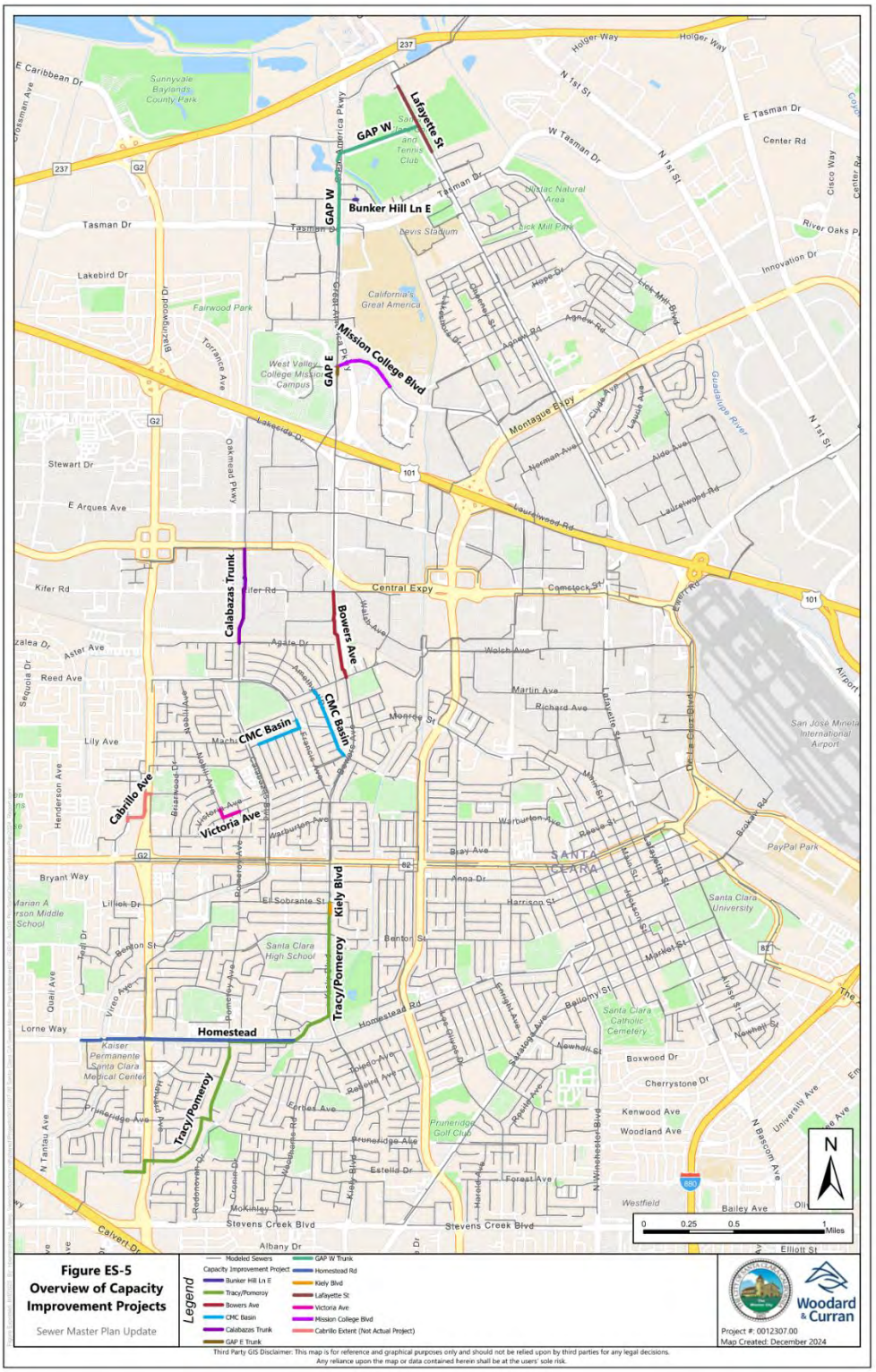


FIGURE ES-5: OVERVIEW OF CAPACITY IMPROVEMENT PROJECTS



ES-3 Recommended Sewer Capacity Capital Improvement Plan

The Sewer Capacity CIP recommended in this study is designed as guidance for the City to provide adequate sewer system capacity for the City's existing and anticipated future development. **Table ES-7** and **Table ES-8** provide a summary and detail of the recommended capacity improvement projects, respectively. The wastewater flow, design flow, and physical network triggers listed next to each project in **Table ES-8** represent the least conservative condition (i.e., lowest flow and available capacity) that first caused the deficiency to occur. Relative priorities of "1" (highest priority) to "7" (lowest priority) were assigned to each project based on a combination of factors including the wastewater flow trigger, design flow trigger, and physical network trigger, and assumed structural condition. Therefore, projects that address existing deficiencies without future lining assumptions in place were assigned the highest priority because they pose the greatest risk of a sanitary sewer overflow (SSO). Those projects were subsequently scheduled for earlier implementation, assuming a start date in 2025. The remaining projects, which would be triggered by future loading conditions, were assigned an implementation start date of 2035. Projects were also assigned a flow confidence level from "1" (highest confidence) to "5" (lowest confidence) to reflect the level of confidence in the data that were used to calibrate the hydraulic model, forecast flows, and identify deficiencies. Projects which were assigned a confidence level "4" or "5" had no reliable confirmation of model flows; thus, conducting flow monitoring on these project reaches prior to design would provide a greater level of confidence in modeled flows.

The total estimated capital cost of the Sewer Capacity CIP is approximately $100.6 million in 2024 dollars. These costs include baseline construction costs for new sewer mains and sewer structures using open-cut methods; and cost allowances for project mobilization/demobilization, traffic control, and bypass pumping as needed. The total estimated construction costs also include a 30% allowance for contingencies for unknown conditions, and the total estimated capital cost includes an allowance of 25% of construction cost for engineering, administration, construction management, and legal costs. Costs for lining City-identified RCP trunks are not included in the Sewer Capacity CIP as these are condition-related maintenance costs. The estimated costs are planning or conceptual level estimates to be used for budgeting purposes only and are considered to have an estimated accuracy range of -30% to +50%. Note that the Sewer Capacity CIP does not include costs for two of the specific developer-driven capacity improvement projects, Patrick Henry Drive (PHD) and Tasman/GAP, as the developers will fund those improvements. Additionally, it is assumed that the City's overall sewer system CIP will also include costs for condition-related improvements; however, these projects are not addressed in this Master Plan Update report.

TABLE ES-7: SUMMARY OF RECOMMENDED SEWER CAPACITY CIP

Description	Quantity	Notes
Number of Projects	13	3 to be implemented in 2025; 10 after 2035
Total Length of New Sewers	38,100 LF	Approximately 7.2 miles
Range of New Sewer Diameters	8" – 48"	Standard pipe sizes only (inside diameters)
Number of New Weirs	4	Used to modify flow routing
Total Estimated CIP Cost[1]	$100.6M	Based on August 2024 dollars
Total Other Costs[2]	$75K annually $950K every 7-8 years $25K annually	Hydraulic Model Maintenance and Support; Future Master Plan updates (next in 2032-2033); Technical Analyses for Model Verification

[1]Designed to reflect costs derived directly from construction of the capacity improvement projects only.

[2]Other costs associated with improvement of flow conveyance in the system.

TABLE ES-8: CAPACITY IMPROVEMENT PROJECT DETAILS

Project No.[1]	Project ID	Project Location	Pre-Project Pipe Diameter(s)[2]	Project Description	Priority[3]	Flow Confidence Level[4]	Wastewater Flow Trigger[5]	Design Flow Trigger[5]	Physical Network Trigger[5]	Project Cost[6]
1	**Tracy/Pomeroy/Homestead /Kiely**	Tracy Dr, Pomeroy Ave, Homestead Rd (S Trunk), Kiely Blvd	10 to 22.8-inch	12,313 LF of 15 to 27-inch diameter pipe	7	N/A	LTFL (entitlement)	DWF	UMN	**$26,942,000**
2	**Homestead Road**	N Homestead Trunk from Swallow Wy to Saratoga Creek	18 to 30-inch	6,407 LF of 24 to 33-inch diameter pipe	3	3	LTFL	WWF	UMN	**$17,156,000**
3	**Kiely Boulevard**	Orthello Wy to S of El Sobrante St	8-inch	266 LF of 10-inch diameter pipe	6	4	LTFL	WWF	UMN	**$513,000**
4	**Victoria Avenue**	Fowler Ave & Pomeroy Ave to Nobili Ave & Victoria Ave	8-inch	764 LF of 10-inch diameter pipe	6	3	LTFL	WWF	UMN	**$1,337,000**
5	**Cabrillo Avenue**	Halford Ave & Buckley St; St. Lawrence Dr, W of Lawrence Expwy	8-inch	Flow Diversion Weirs only. No pipe replacement.	1	3	EL	WWF	UMN	**$154,000**
6	**CMC Basin**	Santa Maria Ave & Francis Ave; Amethyst Dr	8 to 12-inch	3655 LF of 12 to 15-inch diameter pipe	1	1 & 2	EL	WWF	UMN	**$7,263,000**
7	**Bowers Avenue**	Bowers Ave from Chromite Dr to Walsh Ave	25.7-inch	2605 LF of 30-inch diameter pipe	4	5	LTFL	WWF	LMN	**$8,047,000**
8	**Calabazas Trunk**	Calabazas Creek from S of Agate Dr to Central Expwy	22.8 to 27-inch	2791 LF of 18 to 27-inch diameter pipe	2	5	EL	WWF	LMN	**$8,731,000**
9	**Mission College Boulevard**	Mission College Blvd from Freedom Cir to west of Great America Pkwy	12 to 15-inch	1886 LF of 15-inch diameter pipe	5	N/A	LTFL (specific development)	DWF	UMN	**$3,830,000**
12	**GAP West Trunk**	S of West Tasman Dr to Lafayette St	28.5 to 35.7-inch	4810 LF of 36 to 42-inch diameter pipe	3	2	LTFL	WWF	UMN	**$17,781,000**
13	**GAP East Trunk**	Old Glory Ln to S of Bunker Hill Ln; Stars and Stripes Dr	31.4-inch	231 LF of 39-inch diameter pipe	4	2	LTFL	WWF	LMN	**$1,002,000**
14	**Bunker Hill Lane East**	E of Great America Pkwy	6-inch	107 LF of 8-inch diameter pipe	7	N/A	LTFL (entitlement)	WWF	UMN	**$301,000**
15	**Lafayette Street**	N of Calle del Mundo to S of Great America Wy	34.2 to 40.3-inch	2290 LF of 42 to 48-inch diameter pipe	3	2	LTFL	WWF	UMN	**$7,515,000**
TOTAL ESTIMATED COST	**$100,572,000**									

[1]Projects are numbered from upstream to downstream. Table does not include Project Nos. 10 (Patrick Henry Drive) and 11 (Tasman/GAP) because project costs will be paid for by the developers.

[2]Pre-project pipe diameters include future lining assumptions.

[3]Projects are prioritized based on wastewater flow, design flow, and physical network triggers as well as assumed structural condition.

[4]Rating assigned to validate the need for the project through review of flow monitoring data and reported surcharging and operational issues, and compatibility between flow meter data and the model. Descriptions of the flow confidence levels are as follows: N/A = Not assigned because project would be triggered by entitlement flow or specific development; 1 = Flow meter on or very near to the project reach surcharged during metered storm; 2 = Flow meter on or very near to the project reach confirms flow, but did not surcharge during metered storm; 3 = Flow meter near the project reach (upstream or downstream) confirms flow; 4 = No flow meter near the project reach to confirm flow; 5 = Conflicting flow between meter and model.

[5]EL = Existing Loads; LTFL = Long-Term Future Loads; DWF = Dry Weather Flow; WWF = Wet Weather Flow; UMN = Unlined Model Network; LMN = Lined Model Network.

[6]Costs are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area and are Class 5 estimates (planning level).

Implementation Recommendations

The City should begin implementation of the Capital Improvement Program recommended in this Master Plan Update, starting with projects needed to address existing system capacity deficiencies. The following items should be considered in project scheduling and design, and in future updates of the Master Plan:

- The City should consider conducting additional flow monitoring or observation to document flow levels during large storm events at locations in the system where the model predicts significant surcharge or where there is a significant difference between previous flow monitoring conducted and the model results. Flow levels during large storm events should be compared to the water levels simulated by the hydraulic model to verify if the modeling predictions for the design storm seem reasonable, and to confirm the need for and, if necessary, refine project sizing.
- The alignments and sizes of all recommended projects should be verified with detailed pre-design analyses, including topographic surveys, geotechnical investigations, utility research, and constructability reviews. Detailed pre-design analyses should consider feasibility of trenchless construction methods including pipe-bursting and Pilot Tube Guided Auger Boring (PTGAB), especially at major roadway, railway, and creek crossings.
- The decision to parallel or replace existing sewers should consider the physical condition and remaining useful life of the existing pipelines and laterals; the availability of pipeline corridors for new sewer construction; and operation and maintenance concerns.
- Capacity improvement projects triggered by long-term future flow assumptions associated with entitlements would not need to be implemented until the entitled parcel(s) provide notice to the City of their intent to increase their discharge up to their entitled flow.
- The hydraulic model has been developed to assist the City in performing capacity analyses and updating the Master Plan in the future. The model should be kept up to date with any changes to existing sewer connections, development plans, and sewer system facilities.

This Master Plan Update report is intended to be a working document to be refined and updated as additional data and new planning information become available. The capacity assessment should be updated whenever there are major changes in planning assumptions or, at a minimum, every five to ten years.

1. INTRODUCTION

This introductory section identifies the background and study objectives for the Master Plan Update, briefly describes the City's sanitary sewer system and service area and presents an overview of the report's organization by summarizing the content discussed within each section.

1.1 Background and Study Objectives

Prior to this study, the City last conducted a comprehensive assessment of its wastewater system in its 2016 Sanitary Sewer Master Plan Update[1] (2016 Master Plan). Of the seven (7) capacity improvement projects recommended in the 2016 Master Plan, three (3) projects were implemented: two (2) of which were operational adjustments to the set points for the Westside and Tasman Pump Stations to eliminate unnecessary backups in the influent gravity sewers, and the third was a capital project to upsize approximately 1,800 feet of 24-inch sewers along the Calabazas Creek trunk between Kifer Road and Scott Boulevard to 27-inch sewers. The City has also implemented all projects recommended in the 2007 Master Plan, such as the Walsh Ave (West-to-East trunk), Monroe St, Machado Ave, Chromite Dr, Nobili Ave, Scott Blvd, and Park Ave improvements.

Since 2016, in addition to completing a few sewer improvement projects, the City has experienced a significant amount of new development, necessitating an update to the 2016 Master Plan that includes an evaluation of the capacity of the sanitary sewer system to handle existing and future wastewater flows. Several development reviews have also been completed since the 2016 Master Plan. These development reviews are conducted using the City's hydraulic model to assess if the sanitary sewer system has enough available system capacity for the individual development to connect to the system.

Thus, the purpose of this study is to build an updated, comprehensive hydraulic model of the City's sewer system, calibrate the model to current flow monitoring data, and identify needed capacity improvements based on existing and projected future flows. Multiple data sets provided by the City were used to execute the tasks to meet each of the objectives of this study. Each section provides a discussion of the available data, and a summary of the existing information provided by the City is presented in **Appendix A**. This Master Plan Update summarizes the basis of the sewer flow estimates and the hydraulic model development and calibration process, presents the criteria used for the capacity analysis and the deficiencies identified, and describes the proposed projects to address identified capacity deficiencies. Due to the relatively high rates of I/I in specific areas of the system, this assessment also included identifying areas of higher I/I appropriate for further investigation.

1.2 Sanitary Sewer System and Service Area

Santa Clara is a city of approximately 130,000 people located in central Santa Clara County adjacent to the cities of San Jose, Cupertino, and Sunnyvale and covers approximately 18 square miles. The City's wastewater system serves approximately 25,000 City customers in its service area (primarily residential users) through approximately 288 miles of sewer pipelines generally ranging from 4 to 48 inches in diameter (including 12 miles of private sewer pipelines) and seven (7) sewage pump stations. The City also has an agreement to convey wastewater flows from a major portion of the Cupertino Sanitary District (CuSD) via a connection at Homestead Road and Swallow Drive. Wastewater flows collected are generally conveyed eastward and northward. A portion of the City's flow continues eastward to the Trimble Trunk and is conveyed to the City of San Jose's interceptor sewers on Zanker Road. The remainder of the City's flow and

[1] City of Santa Clara, Sanitary Sewer Master Plan Update, RMC Water and Environment, April 2016.

all the CuSD flow travels northward to the City's Northside and Rabello Pump Stations, where the flow is pumped to the San Jose/Santa Clara Regional Wastewater Facility (SJ/SC RWF) for treatment and disposal. A summary of the City's sanitary sewer system infrastructure is presented in **Table ES-1**. The City's sewer system and service area are shown in **Figure ES-1**.

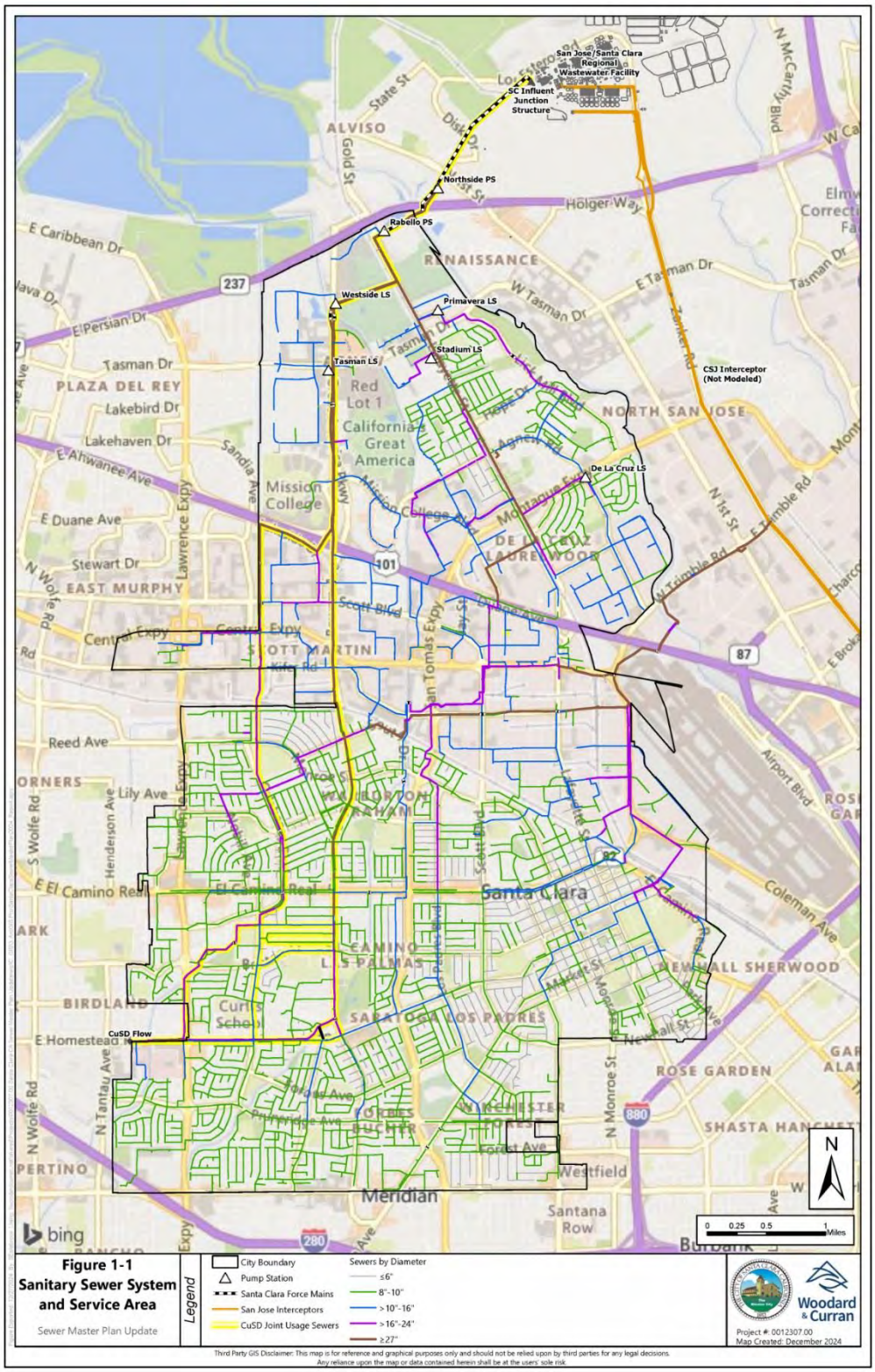
TABLE 1-1: SUMMARY OF SANITARY SEWER SYSTEM INFRASTRUCTURE

Infrastructure	Quantity	Unit
Sewer Mains (Pipes)	1,456,400[1] / 276	Feet / Miles
Manholes	5,500	-
Siphons	34 (59 barrels[2])	-
Pump Stations	7	-

[1]Total length is rounded to the nearest one hundred feet.

[2]Some siphons have multiple barrels: Three (3) siphons have three (3) barrels, 19 siphons have two (2) barrels, and the remaining 12 siphons have a single barrel.

FIGURE 1-1: SANTA CLARA SANITARY SEWER SYSTEM AND SERVICE AREA



1.3 Report Organization

The contents of each of the sections and appendices of this Master Plan Update report are described below.

- **Section 1 – Introduction**: This introductory section provides background information on the objectives and scope of the Master Plan Update, the City's sanitary sewer system and service area, and the contents and organization of this report.
- **Section 2 – Wastewater Flow Assumptions**: This section describes the flow monitoring program and basis for estimating model flows for existing conditions and future conditions with projected development.
- **Section 3 – Hydraulic Model Development and Validation**: This section describes the modeled sanitary sewer system, development of the hydraulic model network, and the calibration of the hydraulic model for dry and wet weather flow conditions.
- **Section 4 – System Capacity Analysis**: This section defines the basis for the capacity assessment of the system, including the selected design storm and performance criteria used to identify deficiencies, and presents the capacity deficiencies identified based on the model results. The section also identifies areas of the system with high I/I and recommends additional investigations to isolate potential direct inflow sources in those areas.
- **Section 5 – Recommended Capital Improvement Plan**: This section presents the recommended capacity improvement projects based on the results of the system capacity analysis using the calibrated hydraulic model. Each recommended project is documented with a general description, planning level capital cost estimate, relative priority rating, and flow confidence level.
- **Appendices**: The appendices to the report provide additional detailed information to support the findings and recommendations presented in the report sections, including a summary of data available for the project, plots of flow monitoring and rainfall data and model calibrations, future land use assumptions, and detailed project descriptions, the Sewer Performance and Design Criteria technical memorandum, cost estimates, and figures for capacity improvement projects.

2. WASTEWATER FLOW ASSUMPTIONS

This section describes the flow monitoring program and basis for estimating model flows for existing conditions and future conditions with projected development.

2.1 Flow Monitoring Program

To support the development of the hydraulic model and Master Plan Update, a temporary flow monitoring program was conducted as part of this study. The purpose of the flow monitoring program was to obtain data to quantify actual flows and characterize infiltration and inflow (I/I) within the sewer system, and to calibrate the hydraulic model for both dry and wet weather conditions.

2.1.1 Flow Monitoring and Rain Gauge Sites

One critical purpose of a flow monitoring program is to aid in the calibration of the model, which is discussed further in **Section 3.3**. Considerations for flow meter (FM) placement to support model calibration generally include:

- Isolate areas to characterize flows for model calibration;
- Select sites on downstream trunks for flow confirmation;
- Align the location with flow meters previously used;
- Further divide tributary areas with suspected high I/I based on previous flow monitoring data to further isolate I/I;
- Prioritize preferred hydraulic conditions (i.e., manholes on a straight line preferred over manholes on bends or with multiple incoming pipes); and
- Consider ease of access and safety.

Santa Clara has conducted citywide flow monitoring programs in 2006 and 2015 as part of the City's sewer system capacity assessment study and sewer master plan, respectively. The City also conducted additional selective flow monitoring in the Chromite-Machado-Cabrillo (CMC) tributary area (an area with suspected high I/I based on previous monitoring programs) as detailed in a September 2020 report[1].

The 2022-2023 flow monitoring program for this Master Plan Update included 31 temporary gravity flow meters. Prioritizing the placement of the flow meters in the same locations used for previous monitoring programs is beneficial because it allows for comparison to the previously monitored flows to identify changes over time (e.g., increase in I/I). Therefore, the 2022-2023 program included placement of flow meters in all the same locations as in 2015 except for FM2, which was moved three manholes upstream due to safety concerns, and FM9, which was moved farther downstream to be north of Scott Blvd. The 2022-2023 program also included installation of 8 additional flow meters that were not part of the 2015 program, including a flow meter along Uranium Drive south of Mead Avenue which the City added onto the initial program. Four (4) rain gauges were also installed during the 2022-2023 program, all in the same locations as the rain gauges installed during 2015 and placed to capture spatial variability of rainfall within the City.

V&A Consulting Engineers (V&A), under sub-contract to Woodard & Curran, installed the flow meters and rain gauges and conducted the monitoring program. The flow meters and rain gauges were installed and

[1] Sewer Flow Monitoring and Inflow/Infiltration Study prepared by V&A in September 2020 included flow monitoring at 20 sites conducted during two phases.

operational from December 13, 2022 to February 13, 2023 (approximately 9 weeks). The flow meters collected flow depth and velocity data which were used to compute flow rate.

In addition to the 31 temporary flow meter sites, CuSD also maintains a permanent flow meter at the CuSD's and City's sewer connection point to monitor CuSD flows discharging to the City's sewer system. CuSD provided V&A with flow data recorded by the permanent meter for the duration of the flow monitoring period.

The location of the flow monitoring sites and rain gauges are shown in **Figure 2-1**. The figure also shows the associated tributary area (basin) for each flow meter. Note that some meters were located downstream of other meters. In those cases, the meter tributary areas are "incremental" (areas between the flow meter and tributary basins of the upstream flow meters). **Table 2-1** lists the flow meter locations and pipe diameters, and notes if the meter is incremental (i.e., has upstream flow meters). A schematic of the City's trunk sewer system including the temporary flow meters, pump stations, flow split manholes, and diversion structures is presented as **Figure 2-2**. Plots of the flow monitoring data, including flow, velocity, and level, are provided as **Appendix B**.

During the flow monitoring period, V&A visited all the temporary flow monitoring sites approximately monthly to check meter operation and site conditions, obtain field calibration measurements, and download collected data. Field calibration involves taking manual depth measurements and flow velocity measurements using a portable velocity meter. These calibration measurements were compared to and used to adjust monitor-recorded depth and velocity, if needed. Calibration measurements were taken at different times of day to obtain calibration points for the full range of typical diurnal flows.

TABLE 2-1: FLOW METER SITES

FM ID	Site Location	MH ID[1]	Upstream Meter ID(s)	Pipe Size (in)[2]
1	Lafayette St. north of Calle de Mundo	S104-28	4, 7-8, 10-12, 14-15, 19-22, 26-29	36
2	Parking Lot east of Great America Pkwy and north of Stars and Stripes Dr	S104-26	6, 9, 19-20, 29-30	33
3	Lafayette St. north of Calle de Mundo	S104-30	5-6, 9-13, 19-21, 24, 26-31	42
4	Parking lot of Levis Stadium	S94-35	--	24
5	Mission College Blvd. north of Our Lady's Wy.	S83-21	10, 11, 12, 13, 20, 21, 24, 26, 27, 28, 29, 30, 31	33
6	Mission College Blvd. north of Our Lady's Wy.	S83-22	9, 19-20, 29-30	30
7	Upstream of Primavera Lift Station.	S105-34	--	24
8	Lafayette St. north of Montague Expwy.	S86-12	11-15, 20-22, 26-29	30
9	Calabazas Creek north of Scott Blvd.	S72-17	19, 20, 29	30
10	San Juan Ave. and Monroe St.	S52-79	26-27	24
11	Chromite Dr. and Pilot Knob Dr.	S53-40	10, 26-28	24
12	Chromite Dr. and Alhambra Dr.	S53-23	10-11, 26-28	24
13	Bowers Ave. just north of Bonnie Dr.	S53-54	20-21, 29	30
14	South Dr. south of Loma Vista Ln.	S54-16	20-21, 29	15

FM ID	Site Location	MH ID[1]	Upstream Meter ID(s)	Pipe Size (in)[2]
15	Nvidia Parking lot, west off of Scott Blvd. south of Central Expwy.	S65-50	22	18
16	Central Expwy west of UPRR	S67-13	10-12, 14, 20-22, 26-29	27
17	De La Cruz Blvd. north of Martin Ave. (western sewer)	S58-9	22	24
18	De La Cruz Blvd. north of Martin Ave. (eastern sewer)	S58-8	22-23	24
19	North of intersection of Wren Ave. at Kent Avenue	S21-18	--	24
20	Homestead Rd. west of Cherry Orchard Place	S21-47	--	18
21	Kiely Blvd. north of Hearth Pl. and south of Kaiser Dr.	S23-6	20, 29	24
22	Los Padres Blvd. at Bray Ave.	S45-80	--	18
23	Brokaw Rd. northeast of UPRR	S48-31	--	18
24	Bowers Ave. (southbound) north of Central Expwy.	S63-1	10-13, 20-21, 26-29, 31	33
25	West of De La Cruz Blvd. (southbound) and east of Walsh Ave.	S57-56	10-12, 26- 28	30
26	Machado Ave. east of Santa Cruz Ave.	S52-87	--	21
27	Francis Ave. north of Cabrillo Ave.	S43-2	--	10
28	Amethyst Dr. south of Chromite Dr. and north of Kearney Ave.	S53-46	--	8
29	Homestead Rd. west of Bond Pl. and east of Cherry Orchard Pl.	S21-55	--	15
30	Parking lot south of Scott Blvd, north of Central Expwy., west of Oakmead Village Dr.	S72-33	--	15
31	Uranium Dr. south of Mead Ave.	S65-50	--	10
32	CuSD FM at Homestead Rd. and Swallow Dr.	S20-9	--	15

[1] Flow meters were placed on the downstream end of the influent pipe.

[2] GIS pipe diameter. Actual diameter as measured by V&A may be slightly different. When manholes have multiple incoming manholes, the largest pipe was monitored.

FIGURE 2-1: FLOW MONITORING PROGRAM

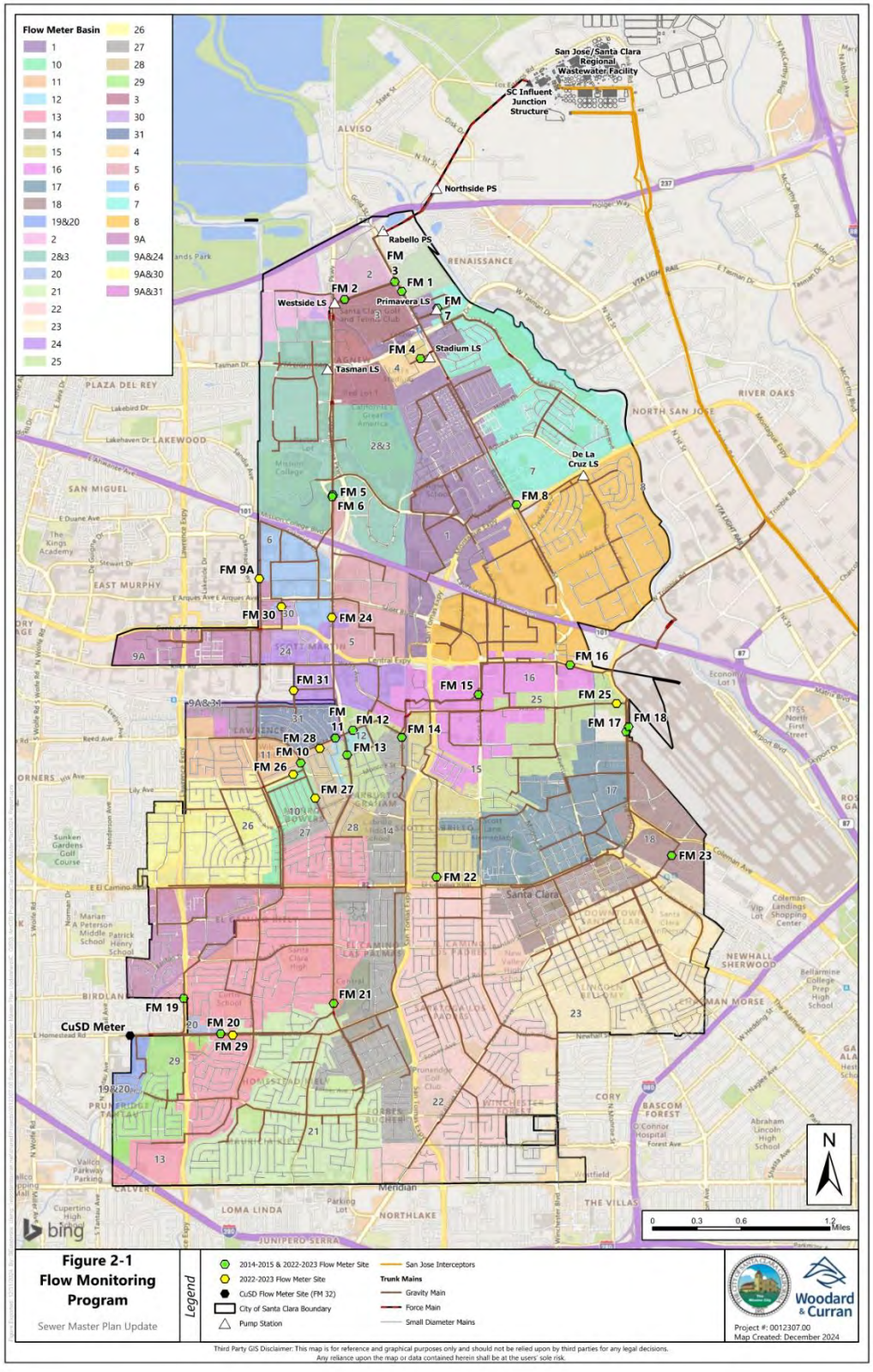
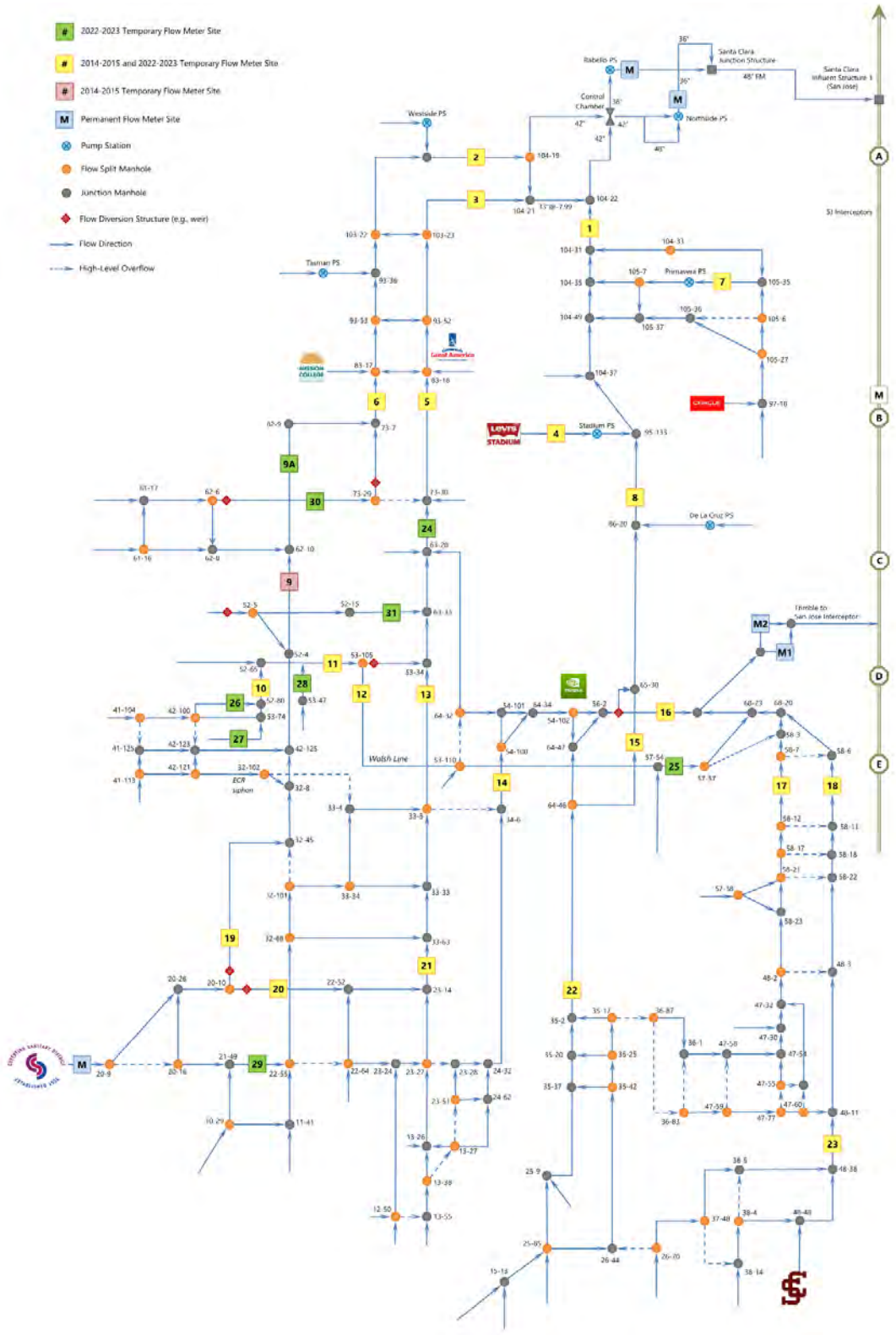


FIGURE 2-2: TRUNK SEWER SYSTEM SCHEMATIC



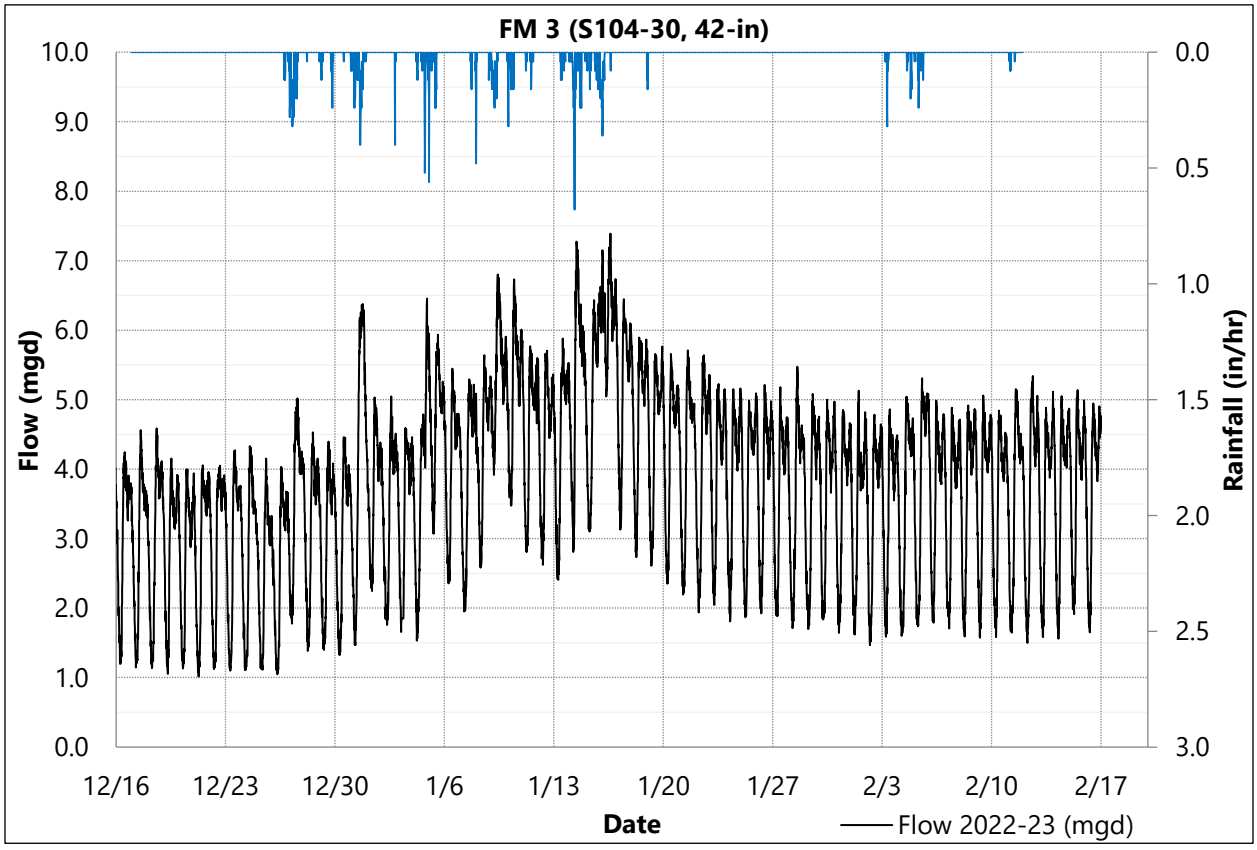
2.1.2 Flow Monitoring Data

During the flow monitoring program, V&A routinely inspected the flow meters as discussed above, and temporary flow meter data was uploaded on a regular basis to an online portal (Claros). Claros generates tabular reports and graphs of recorded level and velocity, as well as scattergraphs of level versus velocity. In addition to V&A's internal data review and quality analysis procedures, Woodard & Curran staff periodically reviewed the preliminary flow meter data over the course of the monitoring program to inspect for changes in flow indicating potential problems with the flow meter (e.g., debris buildup on the sensor), change in system operation, or customer discharges, or response to wet weather events. V&A provided "final" (quality controlled and adjusted data) after the conclusion of the program.

Two (2) of the temporary flow meters in the Chromite Drive and Machado Avenue area (FMs 11 and 28) experienced data loss during the flow monitoring period that coincided with wet weather events. Although the data loss occurred during periods with significant rainfall, there were still data available at these sites from other rainfall events that occurred during the flow monitoring period. V&A used the available data to recreate data for the missing periods.

Figure 2-3 shows typical plots of measured flow and rainfall for one flow meter for the flow monitoring period between December 2022 and February 2023. Plots of the flow monitoring data, including flow, velocity, and level, are provided for all meters as **Appendix B**.

FIGURE 2-3: PLOT OF TYPICAL FLOW DATA FOR 2022-2023 FLOW MONITORING PERIOD



2.1.3 Additional Monitoring for Dry Weather Flow Verification

In addition to the systemwide flow monitoring program conducted during the winter of 2022-2023, V&A also performed selective monitoring per direction from the City and Woodard & Curran as described below.

Review of the flow monitoring data versus model dry weather flows revealed that FM 12 was placed in the incorrect location during the initial winter 2022-2023 flow monitoring program. To remedy this, Woodard & Curran and the City requested that V&A collect one week of dry weather flow data at the correct location over the summer to enable confirmation of model dry weather flows.

Per the City's request, additional dry weather flow monitoring was also performed by V&A at eight (8) FM sites during a 7-day dry period from December 9-15, 2023. The purpose of the additional flow monitoring was to confirm if the sewer system's routing of dry weather flows was in alignment with the City's normal operating conditions. The City's desire for confirmation was due to discrepancies observed during the winter 2022-2023 flow monitoring program and the previous flow monitoring program conducted during the winter of 2014-2015, which were identified during the model calibration process and are discussed further in **Section 3.3**.

2.2 Basis of Hydraulic Model's Wastewater Flow Estimates

This section presents the basis of wastewater flow estimates for the City's sanitary sewer system. It describes the wastewater flow components used in the hydraulic model and the existing and projected future land uses for the City, which form the basis for generating base wastewater flows that are applied to the model. Design flow estimates are based on criteria developed for three major flow components discussed below and confirmed through model calibration as described in **Section 3.3**.

2.2.1 Wastewater Flow Components

Wastewater flows include three components: base wastewater flow (BWF), groundwater infiltration (GWI), and rainfall-dependent infiltration/inflow (RDI/I), as illustrated conceptually in **Figure 2-4**.

Base Wastewater Flow (BWF)

BWF represents the sanitary and process flow contributions from residential, commercial, institutional, and industrial users of the system. BWF varies throughout the day, but typically follows predictable diurnal patterns depending on the type of land use. (Note: the hydraulic modeling software refers to BWF as "foul flow.")

Groundwater Infiltration (GWI)

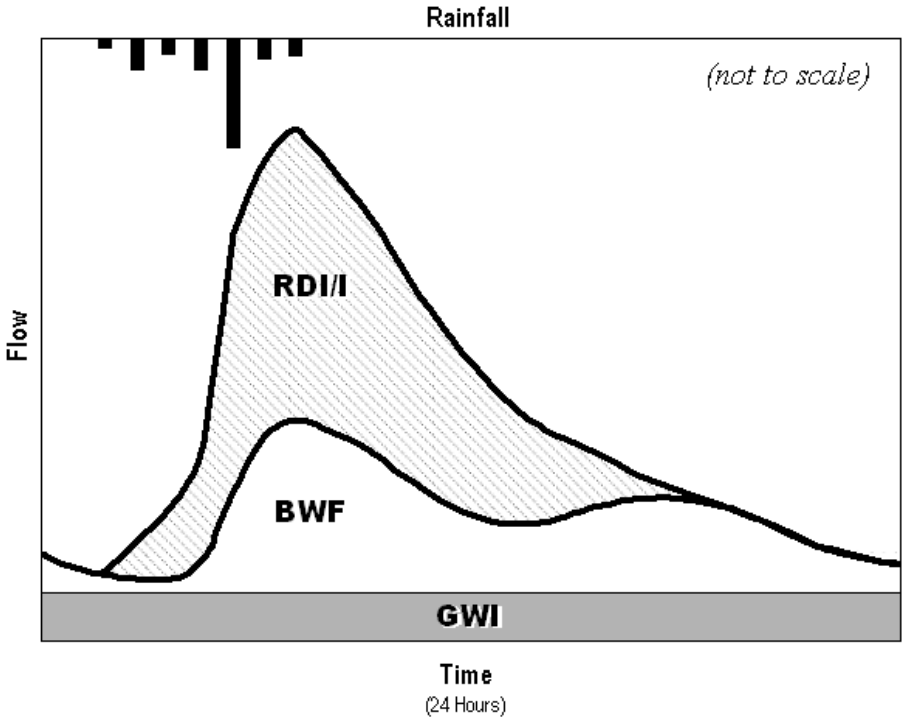
GWI is groundwater that infiltrates into defects in sewer pipes and manholes, particularly in winter and springtime in low-lying areas. GWI is typically seasonal in nature and remains relatively constant during specific periods of the year. However, rainfall typically has long-term impacts on GWI rates, as evidenced by measurable increases in GWI after prolonged periods of rainfall. (Note: the hydraulic modeling software refers to GWI as "baseflow.")

Rainfall-Dependent Infiltration and Inflow (RDI/I)

RDI/I is storm water inflow and infiltration that enter the system in direct response to rainfall events, either through direct connections such as holes in manhole covers or illegally connected roof leaders or area drains, or, more commonly, through defects in sewer pipes, manholes, and service laterals. RDI/I typically result in short term peak flows that recede relatively quickly after the rainfall ends. The magnitude of RDI/I

flows are related to the intensity and duration of the rainfall, the relative soil moisture at the time of the rainfall event, and the condition of the sewers.

FIGURE 2-4: WASTEWATER FLOW COMPONENTS



2.2.2 Base Wastewater Flow Estimates

For the City's Master Plan Update, BWF loads were developed for existing conditions, near-term future development conditions, and long-term future development conditions. Existing loads were developed based on average winter water use data from the City's customer billing records, and future loads were based mainly on specific, known development and redevelopment projects combined with the City's 2035 General Plan (GP) development forecast. The loading methodology for existing conditions and projected near-term and long-term future BWF are discussed further in the following subsections. A summary of the BWF loads associated with both existing and future land use conditions is presented in **Table 2-2**.

TABLE 2-2: SUMMARY OF BWF LOADS FOR EXISTING, NEAR-TERM, AND FUTURE CONDITIONS[1]

	Existing Conditions	Future Conditions	
Flow Component	Existing Load (mgd)[2]	Near-Term Load (mgd)	Long-Term Load (mgd)[3]
Residential BWF	6.72	10.11	13.58
Non-Residential BWF	4.49	6.09	15.48
Total Average BWF	11.21	16.20	29.06

[1]Does not include loads from CuSD, which are discussed in subsequent subsections.
[2]Estimated existing BWF calculated from winter water use data.
[3]Includes 5.09 mgd assumed for entitlement agreements, mostly for non-residential land uses.

2.2.2.1 Existing BWF Loads

Existing BWF was estimated based on actual water billing records exported from the City's customer billing database. The City's Information Technology (IT) group used the Esri ArcGIS software (GIS) to add location identifier fields to the raw billing data, including the assessor parcel number (APN) and service address.

Raw billing data were first processed to exclude non-wastewater generating accounts, which consisted of selecting only the billing data records with field "utility_type" equal to "S" for sewer. By isolating the sewer accounts, the metered potable water and recycled water accounts that do not generate sewer discharges (e.g., meters that serve fire, construction, or irrigation uses) were removed. The City also has customers who use domestic wells and/or recycled water; however, the BWF for these customers were assumed to be included in the sewer billing data per conversations with the City's finance department.

Each account's BWF was estimated based on the average water use for three winter periods (December through March) between December 2019 and March 2022. Metered water use during the winter months most closely approximates wastewater generation because outdoor water use is at a minimum. Each user was also assigned one of two land use types (i.e., residential or non-residential) according to the account's use category designation as shown in **Table 2-3**.

TABLE 2-3: LAND USE CLASSIFICATIONS AND EXISTING BWFS BY USE CATEGORY

Assigned Land Use	Use Category[1]	Use Category Description	Existing BWF (mgd)
Residential	SF	Single-family residential	3.20
	MF	Multi-family residential	3.52[2]
Non-Residential	CI	Commercial industrial	3.78[2]
	MU	Municipal	0.46
	MJ	Major sewer users	0.25
		Total	**11.21**

[1]Based on billing data field "CustomerType_Category".

[2]A portion of the customers assigned to the "CI" use category in the City's billing database were re-assigned to the "MF" use category for the purpose of estimating BWFs because they represented water use from multi-family residential buildings. Detailed land use descriptions based on the North American Industry Classification System (NAICS) were used to identify these customers.

The billing data were further processed in GIS for the purpose of associating each billing data point with its physical service location. Most water billing records were geocoded according to the APN from the City's land parcels dataset. Where parcel APN did not match between the parcel shapefile and the water billing data, billing records were geocoded according to service address. A visual assessment of the City's water meter locations and parcels using GIS confirmed that the data were available for most significantly developed parcels within the City. **Figure 2-5** shows the geocoded water billing data by customer type.

The procedure used to determine the loading point of each parcel is discussed in **Section 3.2.3**.

Existing Flow from Cupertino Sanitary District (CuSD)

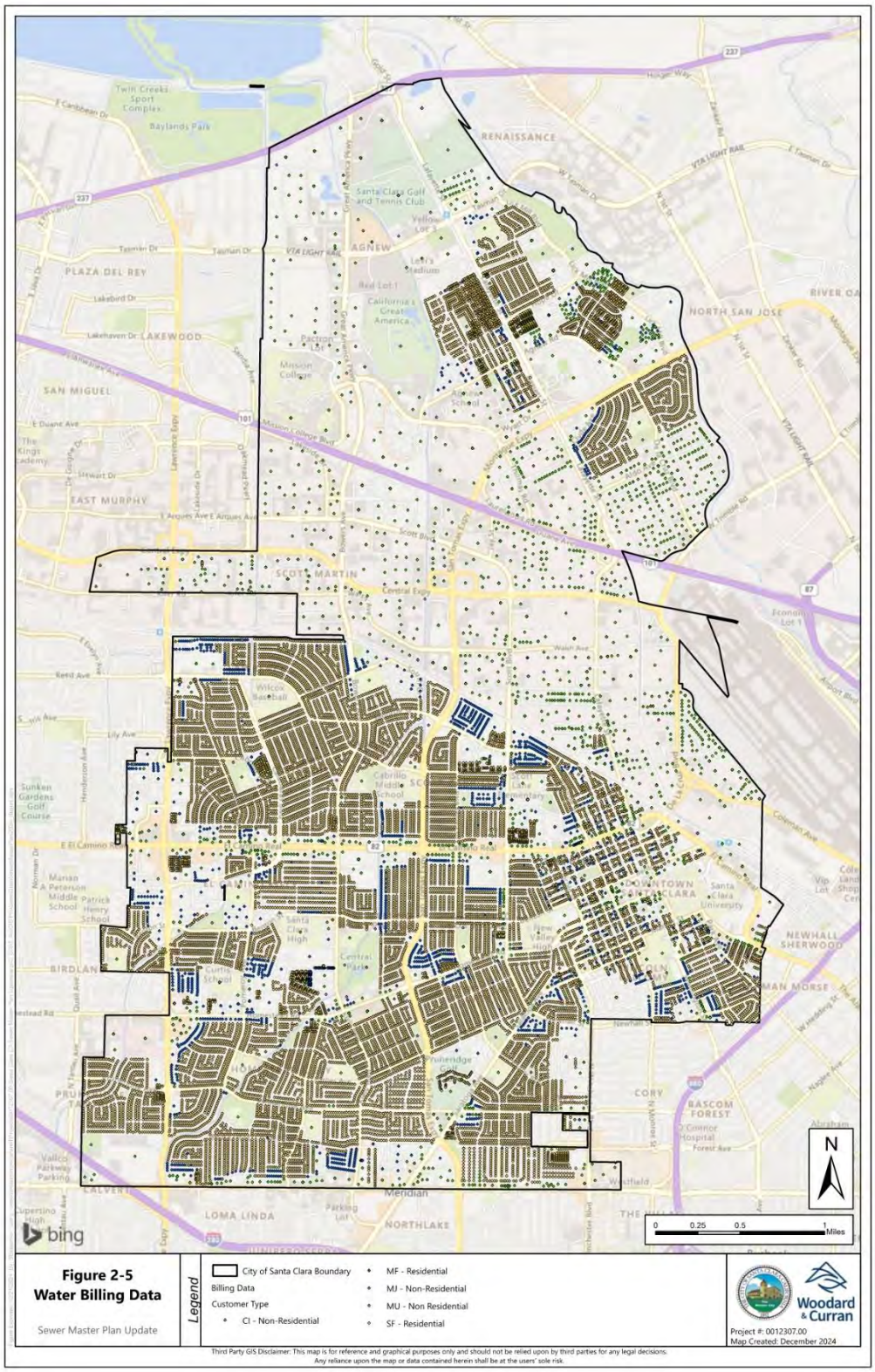
CuSD provides sewer services for the majority of City of Cupertino, portions of the City of Saratoga, and several unincorporated areas within Santa Clara County adjacent to San Jose. Most of the flow is discharged into the Santa Clara system via a 27-inch sewer line in Homestead Road; the rest is discharged into the City of San Jose (CSJ) system at various other connection points.

CuSD maintains a permanent flow meter at its discharge point in Homestead Road. Meter data between December 2022 and February 2023 were reviewed and analyzed; based on the raw data, monitored average

dry weather flow (ADWF) and peak dry weather flow (PDWF), based on the period from December 17-23, 2022, were about 3.6 and 5.7 mgd, respectively. Similar to the declining trend observed for the City, CuSD's ADWF has also declined over 20% compared to the 2007 estimate of 4.9 mgd but increased slightly compared to the 2015 estimate of 3.5 mgd. The initial reduction can likely be explained by increased water conservation activities in response to drought and increased efficiency of water fixtures over time as new homes are built or existing homes are remodeled.

For the purposes of model calibration (discussed further in **Section 3.3**), the monitored flows were used as the BWF loads from CuSD in the model and were applied to the model network as inflow hydrographs. However, the raw CuSD flow data were adjusted (i.e., reduced by approximately 5% by volume, resulting in a revised ADWF closer to 3.45 mgd) when applied to the model because it was suspected that the CuSD flow meter was recording higher than actual flows. The CuSD flow meter was not calibrated prior to or during the City's flow monitoring period, whereas the temporary meters installed throughout the City were calibrated by V&A several times. Moreover, the summation of flow data recorded at FMs 19, 20, and 29 (downstream of CuSD) was less than the CuSD recorded flows prior to the adjustment.

FIGURE 2-5: WATER BILLING DATA



2.2.2.2 Future BWF Loads

Future loads, for both near-term and long-term projected land use conditions, were estimated based on development information tracked by Woodard & Curran, additional development information provided by the City, and unit flow factors developed for the 2016 Master Plan. The development of future load estimates, including the assumed unit flow factors, is discussed further in the following subsections.

Unit Flow Factors for Projected Future Development

Unit flow factors, which are representative of the typical per unit wastewater usage associated with a specific land use type, were referenced for the future load calculations. All unit flow factors used for the calculation are from the 2016 Master Plan and the San José-Santa Clara Regional Wastewater Facility (RWF) sewage coefficient table and are presented in **Table 2-4**, which also shows the associated density and floor-area-ratio (FAR) assumptions where applicable (i.e., for parcels associated with the City's 2035 General Plan). Unit flow factors were also calculated based on the recent billing data that were used to develop existing BWF loads. The multi-family residential unit flow factors calculated using the recent billing data were around 165 gallons per day per dwelling unit (gpd/DU) on average, which is comparable to the 2016 Master Plan unit flow factor values (i.e., 154 gpd/DU for apartments and 175 gpd/DU for condos and townhomes). However, the single-family residential unit flow factor calculated using the recent billing data (i.e., approximately 175 gpd/DU) was significantly lower compared to the 2016 Master Plan unit flow factor of 245 gpd/DU. The reduction observed in per unit water use consumption for single-family dwellings is reasonable considering that outdoor water use is higher for single-family residential customers and several water use restrictions have targeted outdoor water use and irrigation in response to prolonged drought conditions in California. However, for the purpose of this Master Plan Update effort, the City elected to use the single-family residential unit flow factor from the 2016 Master Plan, given that this is a planning exercise, and it is a more conservative assumption.

TABLE 2-4: UNIT FLOW FACTORS USED TO ESTIMATE FUTURE BWF LOADS

Land Use Category Description	Unit Flow Factor[2]	Density/FAR Assumed[3]
Very High Density Residential	121 gpd/DU	-
Apartments	154 gpd/DU	-
Corridor Mixed Use and Community Commercial (Residential)	154 gpd/DU	25 DU/acre
Regional Commercial Mixed (Residential)	154 gpd/DU	40 DU/acre
Condos and Townhomes	175 gpd/DU	-
Corridor Residential	175 gpd/DU	-
Single Family Residential	245 gpd/DU	-
Office (Low Density)	0.1 gpd/SF	-
Agricultural Open Space	0 gpd/SF	-
Retail	0.1 gpd/SF	-
Community	0.1 gpd/SF	-
Amenity	0.1 gpd/SF	-
Research and Development (R&D) Office and High-Density Office	0.15 gpd/SF	-
Daycare	0.183 gpd/SF	-

Land Use Category Description	Unit Flow Factor[2]	Density/FAR Assumed[3]
Police	0.21 gpd/SF	-
Swim center	0.3 gpd/SF	-
Retail Mixed or High-Density Retail	0.3 gpd/SF	-
Corridor Mixed Use (Non-Residential)[1]	0.335 gpd/SF	-
Regional Commercial Mixed (Non-Residential)[1]	0.335 gpd/SF	-
Fitness	0.42 gpd/SF	-
Beauty Parlor	0.47 gpd/SF	-
Hotel	0.48 gpd/SF or 100 gpd/room	-
Medical Office	0.51 gpd/SF	-
Restaurant (Small Food Service)	0.9 gpd/SF	-
Restaurant (Full Service)	1.04 gpd/SF	-
Public (Educational Facilities)	15 gpd/student or 0.21/SF	0.2
Theater	5 gpd/seat	-
Assisted Living Facility	77 gpd/bed	-
University Residences	70 gpd/bed	-
Medium Density Residential	154 gpd/DU	25 DU/acre
High Density Residential	154 gpd/DU	40 DU/acre
Low Density Residential	245 gpd/DU	25 DU/acre
Neighborhood Commercial (Residential)	154 gpd/DU	25 DU/acre
Parks/Recreation	0 gpd/SF	0.2
Neighborhood Commercial (Non-Residential)	0.1 gpd/SF	0.3
Community Commercial (Non-Residential)	0.1 gpd/SF	0.4
Regional Commercial (Non-Residential)	0.1 gpd/SF	0.5
Heavy Industrial	0.15 gpd/SF	1.25
Light Industrial	0.15 gpd/SF	0.85

[1] Unit Flow factor assumes 25% of full-service restaurants and 75% commercial.

[2] gpd = gallons per day. DU = dwelling unit. SF = square foot.

[3] Only used for the GP Phase 3 developments. For specific developments, the square footage was provided by the City or the developer.

BWF Loads for Near-Term Future Projected Development

A list of the near-term future development parcels as well as a figure depicting their locations are provided in **Appendix C**. Near-term future development parcels were identified based on a development tracking spreadsheet that Woodard & Curran created and updated regularly as part of the on-call hydraulic modeling services provided to the City, including near-term future load projections and several development reviews. In January 2023, the City Planning Department reviewed the spreadsheet and

updated the project development assumptions, including project status and timeline, number of units for projects with residential development and development square footage for projects with non-residential development, where applicable. If the City indicated that a specific development was "approved" or "under construction" as of January 2023, it was assumed to be a near-term future development. City Planning indicated a phased approach would be applied to some of the larger development projects associated with specific plans (e.g., Patrick Henry Drive), in which case a portion of the development was included in the near-term future loading scenario and the remainder was applied to the long-term future development scenario. The land use assumptions (e.g., number of units, office square footage) associated with development projects identified as near-term in the updated tracking spreadsheet were multiplied by the appropriate unit flow factors presented in **Table 2-4** to calculate the BWF loads. For near-term specific developments that were also associated with development reviews, the development reviews were referenced to confirm the calculated BWF loads.

When applying the near-term future BWF loads to the model, it was assumed that the existing BWF loads associated with the parcels identified as near-term developments would be replaced.

BWF Loads for Long-Term Future Projected Development

A list of the long-term future development parcels as well as a figure depicting their locations are provided in **Appendix C**. Long-term future development parcels were identified based on Woodard & Curran's development tracking spreadsheet discussed above and the City's 2035 General Plan assumptions. Some of the specific developments in the development tracking spreadsheet were assumed to be long-term future rather than near-term future, mostly in cases where projects were associated with specific plans (e.g., Patrick Henry Drive) and City Planning indicated a phased approach would be applied as discussed in the previous section. Like the near-term BWF loads, the BWF loads associated with the long-term future specific development projects were calculated based on the specific project's development assumptions and the corresponding unit flow factors. Parcels identified as Phase 3 developments in the City's 2035 General Plan were also identified as long-term future developments. Some parcels were removed from the original Phase 3 General Plan development parcels dataset, including parcels that were already associated with specific developments and parcels that had been removed from the General Plan based on feedback provided by City Planning. The General Plan designation field (GPLANCRT) of the General Plan parcels shapefile (*GeneralPlanParcels_Shapefile.shp*) provided by the City was used to assign the appropriate unit flow factors, density, and FAR assumptions to the Phase 3 parcels based on the corresponding land use. The long-term future BWF loads for the Phase 3 parcels were then calculated by applying those assumptions to the square footage (SF) of the parcel. For example, BWF loads for a parcel associated with a GPLANCRT of "Office (High Density)" were calculated by multiplying the area of the parcel by the unit flow factor (0.15 gpd/SF per **Table 2-4**) and the FAR (1.25 per **Table 2-4**).

BWFs for the long-term future development scenario also included flow assumptions for entitlement holders that discharge to the City's sewers. The City is obligated to provide sewer system capacity for entitlement holders up to the flows specified in the entitlement agreements. The City's billing database records show that many entitlement holders have historically discharged less than their flow entitlements; however, considering the City is required to provide capacity to these users should they have the need to increase their discharges, the long-term future BWF scenario conservatively assumes that all entitlement holders would make use of their full discharge allowances. Flow assumptions for entitlement holders were also included in the City's 2016 Master Plan. The City reviewed the entitlement flow assumptions that were included in the 2016 Master Plan and updated those assumptions for this Master Plan Update based on available information. The long-term future BWF scenario includes flow assumptions for entitlement holders totaling approximately 5.09 mgd, the vast majority of which is allocated to non-residential land users. In

limited cases where entitlement flow assumptions were applied to the same parcels with planned future development, the higher flow was applied. Therefore, where entitlement flows were assumed to be less than future flows, the more conservative future flows were used in the model for the long-term future scenario. The entitlement flow assumptions are documented in **Appendix C**.

When applying the long-term future BWF loads to the model, it was assumed that the existing BWF loads associated with the parcels identified as long-term developments would be replaced.

Future Projected Flow from Cupertino Sanitary District

Future projected load assumptions for CuSD were incorporated into Santa Clara's Master Plan Update based on the latest information available from CuSD's hydraulic model, which was most recently re-calibrated in 2023 by AKEL Engineering. CuSD exported the results from its re-calibrated hydraulic model and provided the flow hydrographs to Woodard & Curran for both near-term and long-term future development projections during both dry weather and wet weather flow conditions. Woodard & Curran created inflow hydrographs based on the results that were exported from CuSD's re-calibrated model; the magnitude of flows were maintained but the timing was slightly shifted to match the diurnal usage pattern observed in the flow monitoring data and to align the peak wet weather response where applicable. **Table 4-6** summarizes the wastewater flow assumptions applied to Santa Clara's hydraulic model to represent the future projected inflows from CuSD. Note that for the long-term future wet weather flow scenario only, the peak flow was conservatively scaled up to match the contractual limit defined in Santa Clara's agreement with CuSD which is equal to 13.8 million gallons per day (mgd).

TABLE 2-5: WASTEWATER FLOW ASSUMPTIONS FOR CUSD[1]

Flow Scenario	Average Dry (mgd)	Peak Dry (mgd)	Average Wet (mgd)	Peak Wet (mgd)
Near-Term Future	4.2	6.3	4.6	11.3
Long-Term Future	4.6	6.7	5.9	13.8[2]

[1]Based on CuSD's hydraulic model results for a seven (7) day period.

[2]Assumed to be contractual limit defined in agreement between Santa Clara and CuSD.

2.2.3 Groundwater Infiltration

GWI represents a seasonal increase in wastewater flows due to infiltration into the sewers, typically in low-lying areas or areas close to creeks or other water bodies. In the context of design flow criteria, GWI represents the incremental groundwater infiltration that occurs during the wet weather season which is in addition to the "baseline" groundwater level during the driest months of the year.

GWI is applied in the model as a constant flow in addition to the BWF. The amount of GWI in any particular area of the sewer system is determined during model calibration by comparing the modeled flows to the actual observed dry weather (non-rainfall period) flows at points in the system where flow data are available (e.g., at flow meter sites). Where modeled BWF is noticeably less than monitored dry weather flow by a constant value throughout the day, the difference is assumed to represent GWI. Note that because GWI is seasonal in nature, the modeled GWI is intended to represent a typical GWI rate during the wet weather season (wintertime) rather than a dry season (summertime) GWI. Typical wintertime GWI rates may range from about 100 to 1,000 gallons per acre per day (gpad).

The GWI determined at the monitoring location is then distributed to the upstream meter tributary area on a weighted per-contributing drainage area basis. For Santa Clara, contributing areas for most parcels were set equal to the total area of those parcels. For parcels identified as open space or parks, the contributing

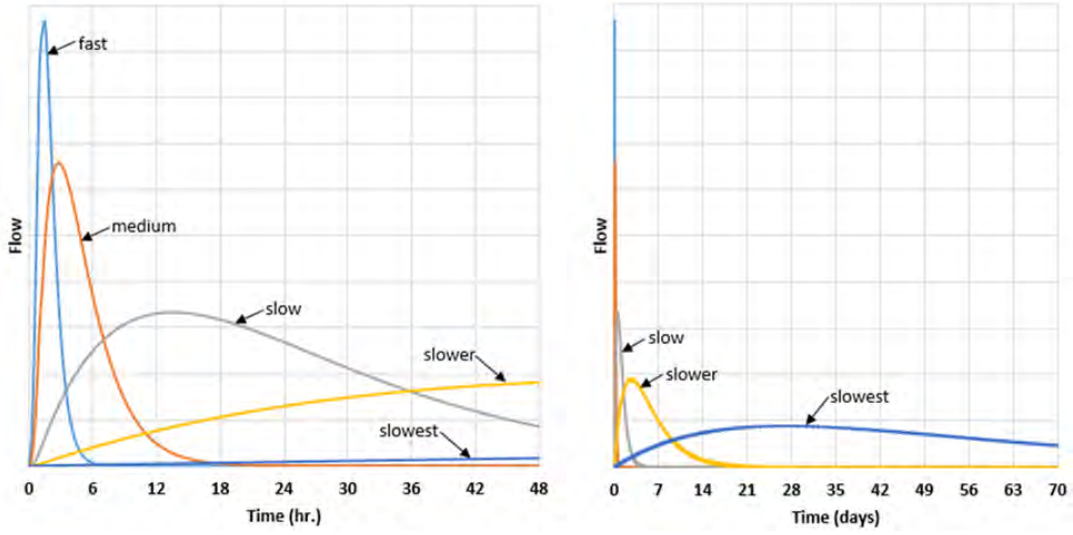
area was set equal to 0. For parcels identified as schools, the contributing area was assumed to be half of the total area to exclude grass sports fields from the contributing area calculation. All parcels with total areas greater than 5 acres were visually inspected, and the contributing area was zeroed out or reduced if it was determined that significant areas within those parcels did not contribute sewer flows.

2.3 Rainfall-Dependent I/I

RDI/I flows result from rainfall events that produce infiltration and inflow of storm water runoff into the sanitary sewer system. RDI/I can be quantified as the difference between the total flow during and immediately following a storm event and the non-rainfall "base flow" (BWF plus GWI) that is estimated to have occurred during the storm period. RDI/I varies depending on many factors including the magnitude and intensity of the storm event, area topography, type of soil and the degree of soil saturation (due to antecedent rainfall) prior to the storm event, and the condition of the sewers, manholes, and service laterals. RDI/I is usually expressed as a volume or a percentage of the rainfall volume (termed the "R value") entering the sewer system from subcatchment contributing areas for each of several flow components representing different response patterns to rainfall events (e.g., fast, medium, slow).

For this modeling effort, five RDI/I response components were used, with each component identified by a percentage of the total RDI/I volume and other parameters that reflect the timing of the flow response, as illustrated conceptually in **Figure 2-6**. The "fast" component of the hydrograph has the largest impact on the magnitude of the peak wet weather flow response, while the slower components can contribute significantly to the total volume of the RDI/I response. The slowest response component can extend out many days or weeks after the rainfall (alternately, this component could be represented as an increase in GWI). Summing all of the component hydrographs for the duration of the rainfall events results in the total RDI/I hydrograph for that area. R values and hydrograph parameters are determined through the process of wet weather model calibration, discussed in **Section 3.5** of this report, in which actual observed rainfall events are simulated in the hydraulic model, and the resulting model hydrographs are compared to the measured flows at the flow meter locations. The RDI/I parameters are adjusted as needed to achieve the best match of modeled to monitored flows. The same calibrated parameters are generally applied to all subcatchments within each meter area. Once calibrated, the model RDI/I parameters can be applied to a design storm to simulate wet weather flows for a design event.

FIGURE 2-6: RDI/I HYDROGRAPH COMPONENTS



3. HYDRAULIC MODEL DEVELOPMENT AND VALIDATION

This section provides an overview of the hydraulic modeling software and modeling terminology and describes the hydraulic model development and validation process, which includes discussion of the modeled sewer network and facilities as well as the methodology and results associated with calibration of the hydraulic model.

3.1 Hydraulic Modeling Software and Modeling Terminology

The modeling software used for development of the Master Plan Update hydraulic model was InfoWorks ICM™ by Autodesk (InfoWorks or ICM), a fully dynamic hydraulic model that was used for Santa Clara's 2016 Master Plan and the development reviews completed since as well as for many other wastewater systems in the Bay Area, including San Jose and Sunnyvale. InfoWorks uses the implicit method to solve fully dynamic equations of motion (St. Venant equations) for all pipe segments simultaneously at each time step. Detailed information regarding the model software and hydraulic theory (i.e., solution model, equation system, solver, and modeling features) can be found on Autodesk's help webpage[1]. Implicit solvers tend to be more stable than explicit solvers with pumping situations and perform better than explicit solvers when dealing with short pipes and loops in the network. Woodard & Curran used its own InfoWorks licenses for this work.

Key hydraulic modeling terms are defined below.

- **Network** refers to the representation of the physical facilities being modeled. Modeled network components include pipes, manholes, pump stations, etc.
- **Nodes** are primarily manholes, but also include pump station wet wells and outfalls (discharge points from the modeled system). Key data associated with nodes include manhole ground elevations and pump station wet well elevations and cross-sectional areas.
- **Pipes** or **conduits** are connections between nodes and include both gravity sewers and force mains. Key data associated with pipes are upstream and downstream node IDs, pipe length, diameter, roughness and headloss factors, and upstream and downstream invert elevations.
- **Pumps** are modeled individually, connecting pump station wet wells with the upstream node of associated force mains. Data associated with pumps include type (e.g., fixed or variable speed), on and off levels, pump capacities, and pump discharge curves.
- **Subcatchments** (also called **sewersheds** or **subbasins**) are areas that contribute flow to the modeled sewer network. Data associated with subcatchments include sanitary flow (computed based on population, water use, or other available data), type of diurnal sanitary flow profile (which is a function of land use), infiltration/inflow (I/I) parameters, and the node at which the flow from the subcatchment enters the modeled system.
- **Model loads** are the flows entering the modeled sewer system from each subcatchment. Model loads include residential and commercial sanitary or BWF, GWI, and RDI/I. As a sum, they represent the total sewer system flow applied to the model. Development of model loads is discussed in **Section 2.2**.

[1] Autodesk Help Menu Documentation on Hydraulic Model Theory, available online at: https://help.autodesk.com/view/IWICMS/2025/ENU/?guid=GUID-3AF862EF-FC9D-4632-BACD-06CC4BC0431C.

- **Models** are the combination of a modeled network, its associated subcatchments and loads, and other data (e.g., rainfall, diurnal profiles, inflows from other areas, etc.) that comprise a specific model scenario.

3.2 Hydraulic Model Network Development

The hydraulic model network includes the pipes, manholes, and other physical facilities that comprise the modeled sewer system. This section describes the modeled system, including how the sewer facilities are represented in the model, the data attributes that describe the facilities, and the processes for validating those data.

3.2.1 Modeled System

The hydraulic model network developed for this Master Plan Update includes all City-owned pipes within the sanitary sewer system based on the City's GIS data layers. Approximately 12 miles of privately-owned sewer mains were excluded from the model network; therefore, the network consists of about 276 miles of sewers, including 2.7 miles of force mains, or roughly 96% of the total 288 miles of sewer pipeline within the City's system. The hydraulic model also includes all seven sewage pumping stations. The 2016 Master Plan model was developed to represent the trunk or "backbone" of the sewer system and as such contained approximately 34% (or 94 miles) of the total length of the City's sewers. Woodard & Curran has maintained and updated the model as sewer improvement projects were implemented, development reviews were requested, or when new network data became available, and this Master Plan Update built on that work by significantly expanding the model network to include all City-owned sewer pipelines. A summary of the pipes and other facilities included in the hydraulic model network is presented in **Table 3-1**.

TABLE 3-1: SEWER SYSTEM MODEL PIPE SUMMARY

Pipe Diameter (in)	Total Length[1] (ft)
4-6	199,600
8-10	757,800
11-12	222,000
14-16	63,800
17-21	60,100
22-24	48,200
27-29	16,200
30	26,600
>30	47,700
Force Main	14,400
Total Length (feet)	1,456,400
Total Length (miles)	276
Approx. No. of Manholes	5,500
No. of Siphons	34 (59 barrels[2])

[1]Rounded to the nearest hundred feet.

[2]Some siphons have multiple barrels: Three (3) siphons have three (3) barrels, 19 siphons have two (2) barrels, and the remaining 12 siphons have a single barrel.

3.2.2 Model Network Construction and Validation

The updated and expanded model network was constructed using the City's current GIS files of the sewer system, network data from the previous trunk model, 2020 LiDAR ground elevation data, invert data obtained during previous master planning efforts on the small diameter pipes in the system, review of selected record drawings, and limited field investigations.

The GIS shapefiles were used to spatially define the model network, as well as to initially populate asset properties of pipe diameter, pipe length, and pipe material. Invert and rim elevation data were not included in the City's GIS data but are essential for the model. Therefore, elevation data were obtained from a combination of data sources.

For manhole rims, elevations were assigned based on LiDAR ground elevation data as obtained from the County of Santa Clara[1]. Elevations were adjusted from NAVD 88 to NGVD 29 by -2.69 feet based on the National Geodetic Survey Coordinate Conversion and Transformation Tool[2]. The same datum adjustment was used for the 2016 Master Plan and ongoing modeling studies.

For sewer pipe inverts, elevations were populated using the trunk model that was developed for previous master plan efforts (updated on an ongoing basis), small-diameter pipe invert elevations obtained during previous master planning efforts, and depth data from the City's current GIS (invert estimated by subtracting the depth from the inferred manhole rim), in order of priority. For areas with missing data or in areas where more information was needed to construct the model, additional as-built drawings and field investigations were requested and incorporated.

For sewer pipe diameters, diameters of trunk sewer pipes were assigned based on the trunk model that was developed for previous master plan efforts (updated on an ongoing basis). In select cases where as-builts from specific pipeline lining projects were available (e.g., along the Calabazas trunk near Kifer Road), diameters for lined pipes in the trunk system were updated to reflect their internal diameters. Nominal diameters were assumed for all other pipes. Diameters of small-diameter pipes (not included in the trunk model) were populated from the City's current GIS.

Several model construction and validation processes were applied to review the initial data that were imported into the model network. The goal of the review was to resolve potential connectivity and data entry errors associated with the GIS data. The result of the model construction and validation process was a fully connected, all-pipe model network representing the City's physical sewer infrastructure (i.e., pipes, manholes, and special structures) and sewer system inflows from individual parcels throughout the City (i.e., subcatchments).

Model construction and network validation processes included the following:

- The model network was checked for connectivity, i.e., verifying that correct upstream/downstream manholes were identified for each pipe and that there were no missing links in the network.
- Model special structures, such as siphons, sluice gates, weirs, orifices, and pumps were added as described in **Section 3.2.4**. As-built drawings and field data were used to develop details for

[1] Elevation data (2-foot resolution, hydro flattened digital terrain model (DTM) developed based on LiDAR) were published by the County of Santa Clara. The data are available for download here: https://www.arcgis.com/home/item.html?id=44a391b570a14d4687591fa2e89ebb11 (last updated October 2022).
[2] Tool used to determine height adjustments between vertical datums at specific locations of interest. Available online at: https://geodesy.noaa.gov/NCAT/.

the modeled pump stations, such as wet well elevations and dimensions, number of pumps, pump types, on/off levels, and discharge curves.

- Flow splits (manholes with more than one outlet pipe) were identified, and field verification and/or as-built drawings were requested as needed for further verification of outlet pipe elevations and/or the existence of weirs or other flow diversion structures (refer to **Section 3.2.4**).
- Manhole and pipeline network data, including rim and invert elevations and pipeline sizes, were assigned based on the following:
    - In select locations, record drawings for several pipelines were provided by the City and were used to refine elevation, size, and connectivity information. User text fields within the model were used to document the title of the referenced record drawing.
    - Where invert elevation data were missing or inconsistent with nearby elevations, and not determined through as-built information, interpolated values between known values were used as appropriate or pipe slope was used to infer invert elevations at the upstream ends of the system.
    - Elevation data in the as-builts were adjusted as needed to the NGVD 29 datum.
- Based on the data provided by the sources above, SQL scripts were created and run in order to identify missing or suspect data in the modeled network. Profiles were plotted for each series of pipe segments identified by the scripts to visually check for missing rim or invert elevations, negative or reverse pipe slopes, or abrupt steps up or down in pipe inverts. Where data indicated a discrepancy, an approach to resolve the discrepancy was identified and data were either interpolated or verified through field investigations conducted by the City or as-built drawings. Profiles were also plotted for major trunk sewers and a random subset of sewers within the system to check for missing or suspect data.
- The sources of model data (e.g., GIS, as-built/record drawings, survey/field investigation) were documented using "flags" in the model database.
- All gravity pipelines were modeled assuming a Manning's n of 0.013.
- Headloss coefficients for pipelines were inferred using InfoWorks ICM's "Inference Data Editor" tool, which infers the upstream and downstream headloss coefficients for a pipe based on the planar intersection angle at manholes or other model nodes. Larger intersection angles correspond to higher headloss coefficients.
- Model subcatchments were created to represent parcels and their wastewater discharges as discussed in **Section 3.2.3**.

3.2.3 Subcatchments

Model subcatchments define areas tributary to the modeled pipe network. For this new all-pipe model, each subcatchment represents a single assessor parcel within the City and "loads" to a pipe or pipes in the modeled network to define where flow from that parcel enters the sewer system. The model includes approximately 23,300 subcatchments, ranging in size from less than 1 acre to 110 acres.

To assign the load pipes to subcatchments, the laterals shapefile from the City's GIS was used. Load pipes were assigned to subcatchments based on proximity to the closest lateral and were defined as the sewer

pipe intersecting with the closest lateral. This process assigned a loading pipe to each of the parcels. A visual inspection complemented the process where parcels either did not have a lateral nearby or had multiple laterals. The load pipes are then refined as needed as part of the calibration process (discussed in **Section 3.3**). Additional discussion of model load development and allocation is provided in **Section 2.2**.

3.2.4 Special Structures and Flow Splits

Special structures discussed in this section include siphons, gates, weirs, and pumps. Some of these structures were not included in the GIS database of pipes and manholes and therefore were manually added to the model network based on their location. In most cases, the trunk model data were referenced when manually adding these special structures to the model network because most of the special structures were already included in the trunk model used for development reviews. The information specific to each structure that was extracted from the existing trunk network was complemented with information from as-built drawings and/or other information provided by the City where available. Overall, the trunk network included 26 weirs, three (3) gates (at two (2) manholes), and one (1) orifice. The all-pipe model network includes the same number of gates and orifices but two (2) additional weirs, so 28 weirs in total.

3.2.5 Pump Stations

All seven (7) of the City's sewage pumping stations are included in the model network. Pump data summary sheets provided by the City and available record drawings for the lift stations were used to configure the pump stations in the model. Pump on/off levels (converted to elevations) were based on the on/off wet well levels indicated in the pump station summary sheets and as-builts received as part of the 2016 Master Plan and updates received since. Firm capacity (i.e., capacity with the largest pump out of service) and total capacity for each pump station were estimated based on basic information, pump settings, pump curves, and system curves provided by the City. City staff confirmed that none of the pump stations are equipped with variable frequency drives (VFDs). **Table 3-2** presents a summary of modeled pump stations, including their estimated firm and total capacities; the calculations for which are provided in **Appendix D**. The locations of the City's pump stations are shown in **Figure 1-1**.

TABLE 3-2: SEWER SYSTEM MODEL PUMP STATION SUMMARY

No.	Pump Station Name	No. of Pumps	Firm Capacity (mgd)[1]	Total Capacity (mgd)
1	Westside	2	1.55[2]	2.53[2]
2	Tasman	2	1.61[2]	2.34[2]
3	De La Cruz	2	1.61[2]	2.52[2]
4	Primavera	6	5.72[2]	6.39[2]
5	Stadium	6	2.56[2]	2.68[2]
6	Rabello	8	25.4[3]	27.9[4]
7	Northside	4	19.8[3]	21.3[4]

[1] Firm capacity is defined as the capacity with the largest pump out of service.

[2] Theoretical firm and total capacities were estimated for Westside, Tasman, De La Cruz, Primavera, and Stadium Pump Stations based on basic information, pump settings, pump curves, and system curves provided by the City. Refer to **Appendix D** for detailed calculations for each pump station.

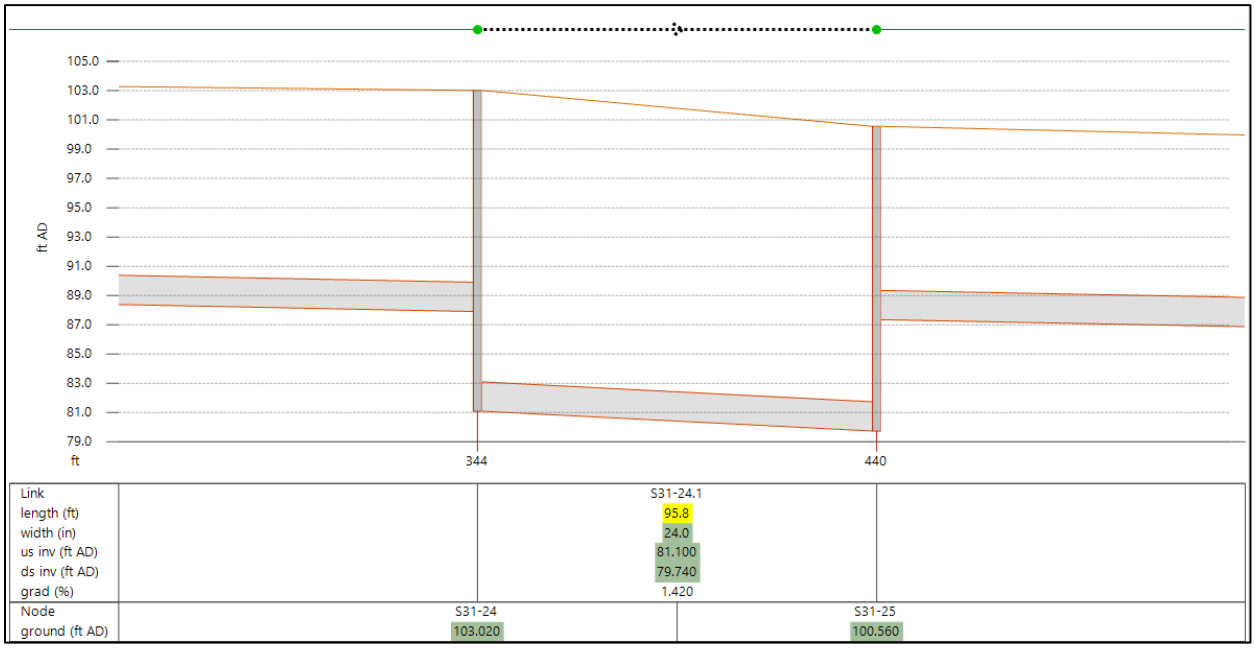
[3] Theoretical firm capacities for Rabello and Northside Pump Stations were estimated by Schaaf & Wheeler Consulting Civil Engineers (S&W) as reported in a memorandum titled "Northside and Rabello Pump Station Firm Capacity Evaluation", dated July 5, 2022.

[4] Theoretical total capacities for Rabello and Northside Pump Stations were estimated using excel spreadsheet tools developed by Schaaf & Wheeler as part of the firm capacity study (refer to footnote 3). System curves for total capacities were estimated based on inferred data because Schaaf & Wheeler did not collect test points with all pumps running.

3.2.5.1 Siphons

The model includes 59 inverted siphons ranging in diameter from 6 to 24 inches; 12 of these are single-barrel siphons, 38 are part of double-barrel siphons (i.e., at 19 locations), and 9 are triple-barrel siphons (i.e., at 3 locations). Siphons were added to the model as pipes with lengths that reflect actual siphon geometry as obtained from record drawings (sum of downslope, horizontal, and upslope portions). A sample siphon profile is shown in **Figure 3-1**.

FIGURE 3-1: SAMPLE SIPHON PROFILE



Siphons include downslope, horizontal, and upslope portions, but can be modeled appropriately without the downslope and upslope segments as shown in **Figure 3-1**. Record drawing information incorporated into the model includes siphon size, invert elevations, segment lengths and locations of the angle points. Where record drawings were not available, GIS data and/or other information provided by the City was referenced. The following rules were applied in the modeling of siphons:

- Siphons with two or more barrels were represented as separate pipes connecting to the same upstream and downstream nodes with diameter and elevations specified for each pipe.
- The friction factor (Manning's "n") was set to the same value (0.013) as those specified for gravity pipes elsewhere in the modeled system.

All siphons were assumed to operate under self-cleansing conditions preventing any major sediment build-up. Therefore, no sediment was included in the model siphons.

A list of the siphons included in the hydraulic model and the corresponding assumptions is provided in **Appendix H**.

3.2.5.2 Flow Splits

Flow splits, or diversions, are nodes in the system with two or more downstream pipes. The City collected survey information at key flow split locations that Woodard & Curran identified to confirm invert elevations, rim elevations, and flow conditions. The field-collected survey information (data sheets included as **Appendix E**) was used to update the model attribute information.

Examples of key connections, flow splits, and diversion structures include the following:

- Connection at Homestead Rd. and Swallow Dr. that sends CuSD's sewer flows to Santa Clara's system via a 27-inch sewer line.
- Diversion structure modeled to divert part of the flow going to Northside PS and to Rabello PS.
- Flume structure modeled to split the flow to the sewer going north on Lawrence Expwy and the sewer going east on Homestead Rd. (refer to **Figure 3-2**).

FIGURE 3-2: FLUME DIVERSION STRUCTURE TO HOMESTEAD RD. OR LAWRENCE EXPWY.

3.3 Model Calibration Process and Results

This section discusses the model calibration methodology and results. Model calibration is the process of comparing model-simulated flows to monitored (observed) flows and adjusting model parameters until a reasonably good match is achieved. It is not expected that the calibration results in an exact match between modeled and observed flows at every meter at all times; however, modeled flows at most meters should reasonably match the flow volumes and peak flows in the observed data. Model calibration was achieved first through comparing modeled versus metered flows during a dry weather (non-rainfall) period to achieve an accurate prediction of BWF and GWI, and then during a wet weather period to estimate the RDI/I response.

3.4 Dry Weather Flow Calibration

This section discusses the methodology and procedures used to calibrate the model for dry weather flow conditions and presents the results of the dry weather calibration.

3.4.1 Dry Weather Flow Calibration Methodology

The goal of dry weather calibration is to confirm that the modeled flows and hydraulic conditions are reasonable compared to the metered flows during non-rainfall periods. Dry weather calibration is an iterative process; if legitimate differences are found between modeled and metered flows, these differences are investigated, and adjustments would be made to the modeled flows as appropriate.

The general approach to dry weather flow calibration was as follows:

1) **Confirm overall model loads match metered flows**. Compare total model flows to metered flows at the most downstream flow meters (FM1, FM2, FM3). If significant discrepancies are identified, review the model loads and billing data for major issues. Investigate and resolve issues.
2) **Compare modeled and metered average flows to identify major discrepancies**. Starting at the upstream ends of the system and continuing downstream until the model outfall, identify any flow meters where the difference between average modeled and metered flows is greater than 30%. If discrepancies are identified at a meter, review the tributary model loads and associated billing for major issues and/or flow routing at flow splits and diversion structures. Investigate and resolve issues.
3) **Compare modeled and metered average flows to identify modest discrepancies**. Starting at the upstream ends of the system and continuing downstream until the model outfall, identify any flow meters where the difference between average modeled and metered flows is between 10% and 30%. If discrepancies are identified at a meter, review parcel loading assignments, major dischargers, or need to use a return factor or discharge cap for selected residential customers. Some modest discrepancies in average flows could be due to the need to add GWI, which are considered in conjunction with review of diurnal patterns. Investigate and resolve issues.
4) **Compare modeled average flows to pump station SCADA**. If hourly pump station SCADA are available, compare the data to modeled flows.
5) **Review diurnal patterns**. Balance adjustment of diurnal patterns with the need to add constant GWI. Adjust patterns as needed or as available information allows for large users (customers with average water use above 50,000 gpd), permitted industrial dischargers (particularly those with batch discharges), and event venues with highly variable use (e.g., Levi Stadium).
6) **Review flow monitoring and model surcharge status**. If the model predicts any surcharge during DWF, those locations should be reviewed for potential network data errors.

For meters that are downstream of multiple other meters, a flow balance was performed to confirm that the total upstream metered flow is less than or equal to the downstream metered flow (e.g., if FM 3 is downstream of FM 1 and FM 2, then FM 1 flows + FM 2 flows should be ≤ FM 3 flows).

3.4.1.1 Review of Largest Water Users

A total of 22 accounts with average winter water use of over 50,000 gpd were identified based on the billing data, which are summarized in **Table 3-3** and shown in **Figure 3-3**. During calibration, average flows from these large users were reviewed. Only base flows from the account located at 444 Saratoga Avenue were adjusted from the initial water consumption value presented below to better match modeled and metered flows; base flows were reduced by approximately 20% because an 80% return factor was applied to the FM 22 tributary area as discussed in **Section 3.4.2**. This adjustment was reasonable given that it is a very large multi-family residential property with a significant amount of irrigated landscape surrounding the 468 units. Several of these large users were assigned distinct diurnal patterns as discussed in **Section 3.4.1.2**.

TABLE 3-3: CITY'S LARGEST WATER USERS (WATER USE GREATER THAN 50,000 GPD)

Account Holder	Account No.	Address	APN	Customer Type[2]	NAICS Class Description[3]	Avg Water Use (gpd)[4]
ELEC DEPT	72271	850 Duane Ave	224-08-153	MU	Other General Government Support (Power Plant)	345,810
CALIFORNIA PAPERBOARD	63199	525 Mathew St	230-03-090	MJ	Paperboard Mills	239,508
INTEL CORPORATION	64334	3065 Bowers Ave	216-46-015	CI	Semiconductor & Related Device Manufacturing	137,542
THE IRVINE COMPANY LLC	82043	3355 Octavius Dr	216-45-058	CI	Lessors of Nonresid. Build. excpt Miniwarehou	125,548
SUMMERHILL LAWRENCE LLC[1]	81664	3494 Toomey Pl	216-60-025	CI	New MF Housing Const Excpt Operative Builders	119,422
CORESITE CORONADO STENDER LLC	62292	3035 Stender Wy	216-29-084	CI	Bare Printed Circuit Board Manufacturing	115,565
ELEC DEPT	64922	524 Robert Ave	230-03-067	MU	Other General Government Support (Power Plant)	115,177
KAISER PERMANENTE	68692	702 Lawrence Expy	316-09-046	CI	General Medical and Surgical Hospitals	109,415
SUMMERWOOD AT SARATOGA CA INC	64126	444 Saratoga Ave	294-04-000	MF	Lessors of Residential Buildings and Dwelling	101,166
APPLIED MATERIALS	64284	3300 Scott Blvd	216-49-024	CI	Semiconductor & Related Device Manufacturing	100,189
INTEL CORPORATION	64352	2150 Mission College Blvd	104-48-010	CI	Semiconductor & Related Device Manufacturing	89,168
3515-3585 MONROE STREET LLC[1]	76100	3555 Monroe St	216-25-008	CI	New MF Housing Const Excpt Operative Builders	83,570
VANTAGE DATA CENTERS LLC	64337	2880 Northwestern Pkwy	216-28-133	CI	Semiconductor & Related Device Manufacturing	83,110
STREAMLINE CIRCUITS CORP	62970	1415 Richard Ave	224-06-170	CI	Bare Printed Circuit Board Manufacturing	73,936

Account Holder	Account No.	Address	APN	Customer Type[2]	NAICS Class Description[3]	Avg Water Use (gpd)[4]
APPLE INC	76270	3250 Scott Blvd	216-29-117	CI	All Other Business Support Services	63,907
CYXTERA DATA CENTERS INC	61293	4650 Old Ironsides Dr	104-04-077	CI	Data Processing, Hosting, & Related Services	61,571
WOODSBOROUGH HOMES ASSOC	64115	950 Kiely Blvd	290-62-000	MF	Othr Orgs (HOA, TOA, Tennant Assoc&Similar)	59,979
DIGITAL REALTY TRUST LP TOTALZ	78636	2220 De La Cruz Blvd	230-03-108	CI	Data Processing, Hosting, & Related Services	59,632
SANTA CLARA UNIVERSITY	64018	500 Lafayette St	269-38-090	CI	Rooming and Boarding Houses	57,109
FUJIFILM DIAMATIX INC	82985	2230 Martin Ave	224-10-126	CI	R&D in Physical, Engineering & Life Sciences	53,903
PROMETHEUS REAL ESTATE MS #2	61640	4101 Lick Mill Blvd	097-08-100	MF	Lessors of Residential Buildings and Dwelling	53,215
APCT INC	61520	3495 De La Cruz Blvd	101-15-033	CI	Radio&TV Broadcast&Wireless Comm Equip Manuf	51,944

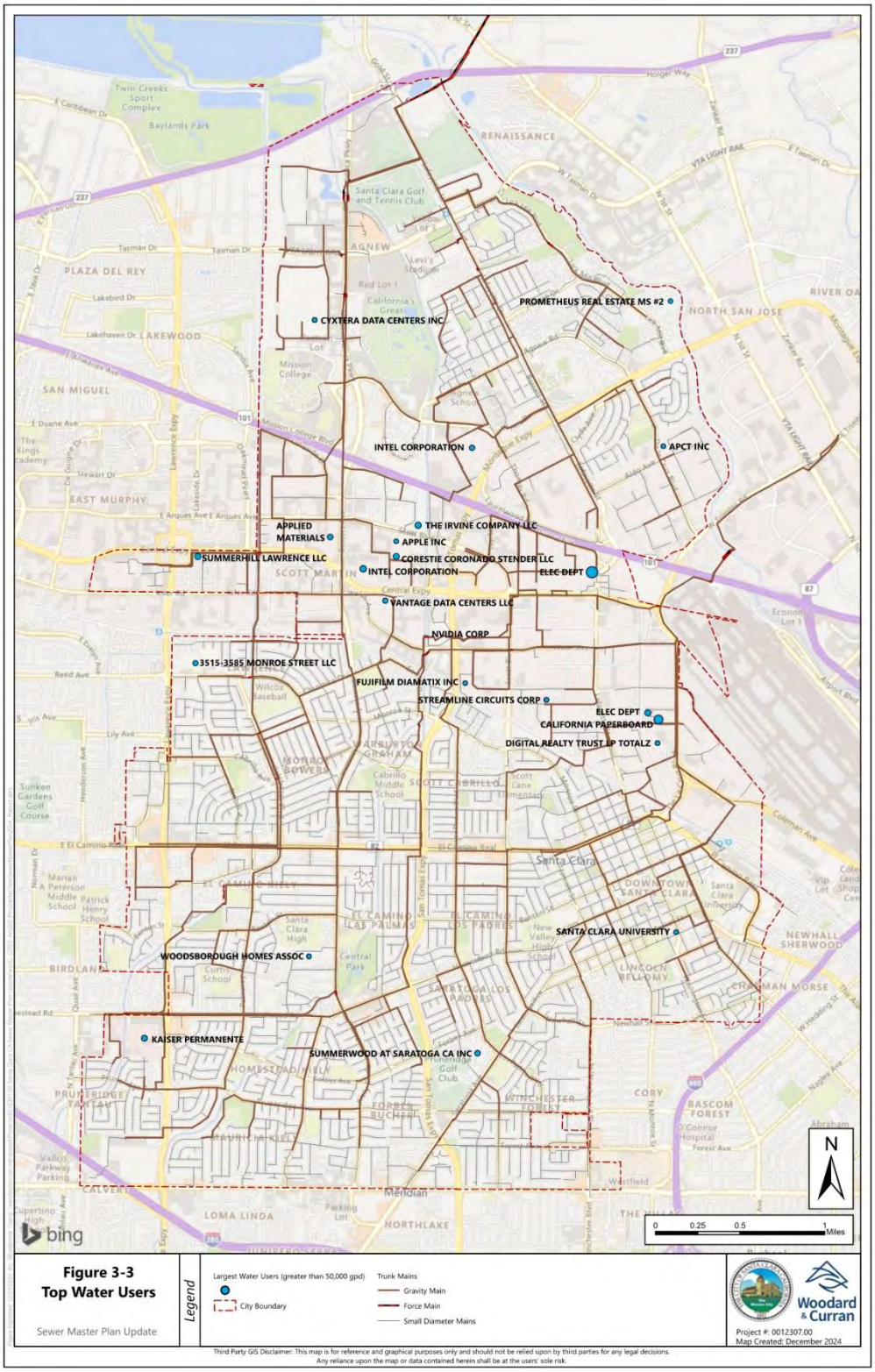
[1]Recent new construction.

[2]MU = Municipal; MJ = Major User; CI = Commercial Industrial; MF = Multi-Family Residential.

[3]NAICS = North American Industry Classification System. Federal standard used to classify businesses by type.

[4]Estimated based on winter water use billing data ("utility_type" = sewer records from December 2021 - March 2022). May not correspond directly with the largest sewer dischargers, especially in cases where large volumes of water may be used onsite and therefore not discharge to the sewer system (e.g., data centers). Sewer flows from large users are reviewed and updated as appropriate during the dry weather calibration procedure.

FIGURE 3-3: CITY'S TOP WATER USERS (WATER USE GREATER THAN 50,000 GPD)

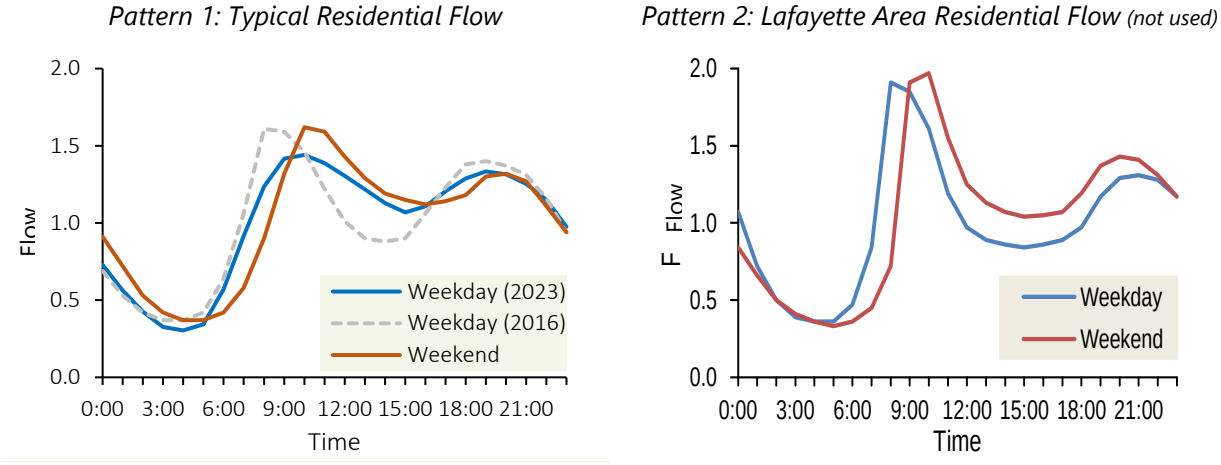


3.4.1.2 Diurnal Pattern Development and Refinement

In most sewer systems, BWF typically exhibits distinctive diurnal patterns depending on the land use, usually categorized as residential and non-residential. BWF varies throughout the day in a typical way, generally peaking early in the morning in most predominantly residential areas. Typical hourly peaks from residential areas tend to be about twice the average flow. Higher peaks can occur on atypical days of the year (e.g., on major holidays such as Thanksgiving or at halftime on Super Bowl Sunday). For Santa Clara's sewer model, typical diurnal patterns were developed for residential and commercial/industrial (i.e., non-residential) wastewater flows for both weekend and weekday conditions. Additional non-residential patterns were also developed for specific large users. The patterns were applied to the subcatchment BWF in the model based on the subcatchment's land use and location.

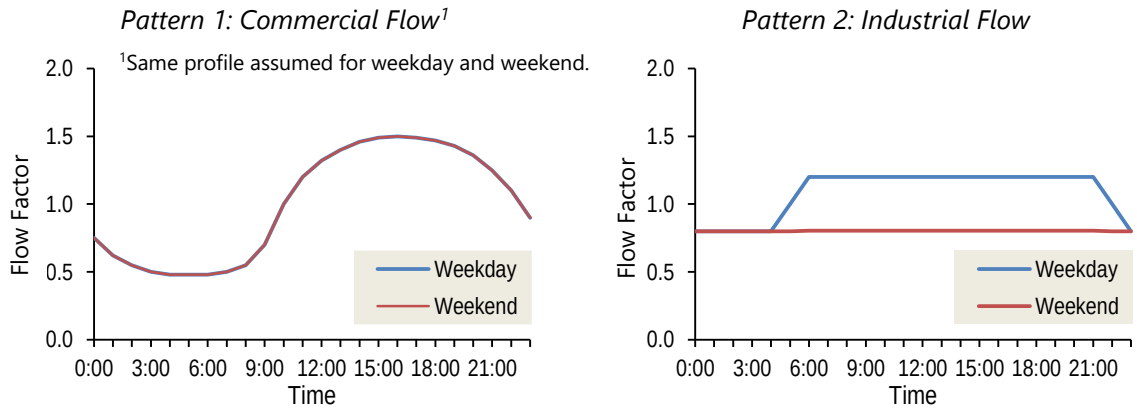
During the dry weather calibration process, the typical residential and non-residential diurnal patterns developed were reviewed and updated accordingly based on a comparison of modeled versus metered flow data. The typical residential diurnal pattern developed for the 2016 Master Plan (shown in **Figure 3-4**) was adjusted to better match the more recent flow meter data, which showed a later and less peaky residential morning peak that can likely be explained by lifestyle changes associated with the COVID-19 pandemic including work-from-home trends. Diurnal patterns exhibited at specific meters that receive predominantly residential flows (e.g., FM 22) were reviewed to refine the residential diurnal curve. The residential diurnal curve that was developed for the Lafayette Area (northeastern part of the City in the vicinity of Lafayette St. and Montague Expwy.) during the 2016 Master Plan (shown in **Figure 3-4**) was also reviewed and compared to the flow monitoring data. Based on the comparison, it was not evident that this distinct, peakier pattern was still an appropriate representation of base flows from this area, so it was removed from the model.

FIGURE 3-4: RESIDENTIAL DIURNAL PATTERNS



Similarly, typical non-residential diurnal patterns developed for the 2016 Master Plan (shown in **Figure 3-5**) were reviewed based on a comparison between modeled versus metered flow data. Specifically, diurnal patterns exhibited at meters that receive predominantly non-residential flows (e.g., FM 17) were reviewed to determine if refinement of existing and/or development of alternate non-residential diurnal curves was warranted. Based on the review, it was determined that the non-residential curves used for the 2016 Master Plan were still an appropriate representation of the typical base flows, so no adjustments were made.

FIGURE 3-5: NON-RESIDENTIAL DIURNAL PROFILES



Operational information regarding sewer discharge patterns for permitted industrial dischargers within the City was obtained during the 2016 Master Plan and was used to create individual non-residential diurnal curves for specific dischargers at that time based on batch discharge information indicated on their wastewater discharge permits or surveys. Individual diurnal patterns developed during the 2016 Master Plan were applied to the following specific non-residential dischargers: Levis Stadium (assuming a 1:00 pm home game), Great America Waterpark, Agilent, Digital LLC, Oracle, City Electric Department (power plants), Applied Material, Owens Corning, APCT Inc., Marvell Semiconductor, Intel, and Streamline Circuits. Woodard & Curran attempted to obtain more recent batch discharge information for permitted industrial dischargers from the City of San Jose but was unsuccessful. However, based on review of the modeled versus metered flow data, the individual patterns obtained for the 2016 Master Plan and applied to specific non-residential dischargers in the model reasonably represented their base flows.

3.4.2 Base Flow Adjustments and Addition of GWI

To better match the modeled and metered flows, some base flow adjustments were applied during the dry weather calibration process. Existing base loads from residential customers, both single-family and multi-family, were capped at a maximum of 300 gpd/dwelling unit. Even though the loads were developed using winter water use billing data (typically the season with the lowest outdoor irrigation), it is likely that some outdoor irrigation is still occurring, so this cap on residential water use was applied to reduce the impacts of excessive outdoor irrigation. Additionally, a return factor, which represents the proportion of water used that is returned to the wastewater system, was considered for the basins where modeled base flows were significantly higher than observed flows. A return factor of 80% was applied to the base flows from upstream basins that primarily collect sewer flows from single-family residential properties (FMs 21, 22, and 23) also to try to remove outdoor irrigation from the water use data to better match modeled and metered flows. A similar return factor was applied to these upstream basins during the 2016 Master Plan effort.

After the base flows adjustments described above were applied, GWI was then added when the observed (metered) dry weather hydrographs were greater than the model-simulated hydrographs by a relatively constant value throughout the day. A total of 0.158 mgd of additional GWI flow was applied to the system uniformly throughout 2 of the 32 flow meter areas at a rate of 250 gpad for FM 26 and 1,800 gpad for FM 31. It should be noted that it may be difficult to assess the actual amount of GWI in any given area, as the relative accuracy of the flow monitoring data, water consumption data, and other model assumptions may affect the amount of flow attributed to GWI. However, this methodology is considered adequate for modeling purposes. It should be noted that this estimate is representative of early-season GWI; however, GWI typically increases throughout the wet weather season as the soil progressively becomes saturated as

more rainfall occurs. Late-season GWI or extended rainfall-dependent infiltration is accounted for during wet weather calibration.

3.4.3 Dry Weather Flow Calibration Results

The seven (7) day dry period from December 17 through December 23, 2022 was used as the primary dry weather calibration period for comparing flow data from the 2022-2023 flow monitoring program to the model results. The primary focus of the dry weather calibration was to confirm that the calculated average BWF based on winter water consumption was consistent with the measured flows at the meter locations. The other objectives of the dry weather calibration were to confirm the flow routing in the system, particularly in areas where flow can be diverted in more than one direction (flow splits), as well as to confirm the diurnal profiles used to represent the hourly variations in BWF. The diurnal curves shown in **Figure 3-4** and **Figure 3-5** were developed and/or confirmed based on the calibration.

Table 3-4 compares the model versus meter average dry weather flows at the downstream most flow meters, **Table 3-5** and **Table 3-6**, respectively, compare the model versus 2022-2023 and 2014-2015 meter average dry weather flow at each meter location, and **Figure 3-6, Figure 3-7**, and **Figure 3-8** show plots of model versus metered dry weather flow for the total flow at the downstream-most meters (FM 1, FM 2, and FM 3, respectively). In these graphs, the green line represents the monitored (observed) flow, and the red line represents the model-simulated flow. Dry weather calibration plots of model-predicted versus metered flows at all flow meter locations for both 2022-2023 and 2014-2015 are provided as **Appendix F**.

As indicated in **Table 3-5**, the dry weather model calibration resulted in a reasonably good match of modeled to metered flow (within 10% at the downstream most flow meters). A comparison of 10% is considered a good match due to fluctuations in flows typically observed over time, as well as potential errors inherent in metering flows in a field environment. At meters with very low flows, small differences between modeled and metered flows can result in a relatively large percent difference; therefore, at these meters (e.g., FM 30), modeled flows within 0.1 mgd of the meter data were also considered a good match.

However, it should also be noted that review of the 2022-2023 flow meter data and comparison to the 2014-2015 data collected for the 2016 Master Plan revealed significant differences that, upon further investigation, were determined to be caused by temporary system conditions that were not representative of typical operations. The initial calibration showed significant, unexpected differences between modeled and metered flows along the Calabazas and Bowers trunks downstream of the Lawrence/Homestead gate structure (pictured in **Figure 3-2**). Through additional review of flow data collected for the 2016 Master Plan; system data and potential flow split locations; and field investigation by City staff, it was determined that the likely cause of the differences was two-fold. First, the Lawrence/Homestead gate structure was likely clogged with rags during the flow monitoring period, causing more flow than expected to be routed to the Calabazas trunk. Second, it was surmised that some issue in the Calabazas trunk (possibly a temporary blockage) caused significant surcharging, enough to reach the level that would route flows away from the Calabazas trunk and into the Bowers trunk through a higher-level split at El Sobrante. Moreover, this second condition seemed to change over time, with significant shifts in metered flows observed at FM 9A, with corresponding shifts at FM 13. These temporary, atypical system conditions that were present during the 2022-2023 flow monitoring period are discussed further in **Section 3.4.3.1**.

The dry weather calibration results presented in **Table 3-5** are based on a model run that attempted to replicate the first difference (clog at the Lawrence/Homestead gate structure), but the second difference (Calabazas trunk backup into Bowers trunk) could not be replicated in the model because although a blockage was suspected based on the data, it was not identified or confirmed at a specific location. Given that the dry weather calibration should be performed assuming normal operating conditions, the 2014-

2015 flow meter data was also compared to the dry weather model calibration results (with the Lawrence/Homestead gate structure settings back to normal) for the locations affected by the two issues discussed above. **Table 3-6** presents the results of that comparison.

TABLE 3-4: DRY WEATHER FLOW CALIBRATION RESULTS SUMMARY[1]

FM IDs	Discharge Location	Meter ADWF (mgd)	Model ADWF (mgd)	Difference (mgd)[2]	Difference (%)[2]
1+2+3	Lafayette and GAP[3] Trunks (FM 1+FM 2+FM3)	10.54	10.09	-0.45	-4.3%
16+17+18+25	Trimble Trunk (FM16+FM17 + FM18 + FM25)	4.65	4.46	-0.19	-4.1%

[1]Model results are compared to the 2022-2023 flow monitoring data.
[2] Difference is reported as model flow minus meter flow.
[3] GAP = Great America Parkway.

TABLE 3-5: DRY WEATHER FLOW CALIBRATION RESULTS VS. 2022-2023 FLOW MONITORING DATA[1]

FM ID	GWI (gpad)	Return Factor Applied (%)[2]	Meter ADWF (mgd)	Model ADWF (mgd)	Difference (mgd)[3]	Difference (%)
1	-	-	2.91	2.91	<-0.01	0.1%
2	-	-	4.71	4.57	-0.14	-3.0%
3	-	-	2.92	2.61	-0.31	-10.6%
4[4]	-	-	0.03	0.04	0.01	33.3%
5	-	-	2.93	3.11	0.18	6.1%
6	-	-	2.75	3.69	0.94	34.2%
7[5]	-	-	1.10	0.83	-0.27	-25%
8	-	-	1.46	1.51	0.05	3.3%
9A	-	-	2.24	3.52	1.28	57.1%
10	-	-	0.65	0.65	<0.01	0.2%
11	-	-	0.77	0.89	0.11	15%
12	-	-	0.83	0.90	0.07	8.3%
13	-	-	2.10	2.05	-0.05	-2.5%
14	-	-	0.41	0.46	0.05	12%
15	-	-	0.23	0.24	0.01	5.8%
16	-	-	1.46	1.35	-0.11	-7.5%
17	-	-	0.77	0.92	0.14	19%
18	-	-	1.18	0.97	-0.21	-18%
19	-	-	2.65	2.78	0.13	4.7%
20	-	-	0.42	0.50	0.08	19%
21	-	80%	0.89	0.95	0.06	6.5%
22	-	80%	0.82	0.87	0.04	5.4%
23	-	80%	0.59	0.66	0.07	12%

FM ID	GWI (gpad)	Return Factor Applied (%)[2]	Meter ADWF (mgd)	Model ADWF (mgd)	Difference (mgd)[3]	Difference (%)
24	-	-	2.39	2.58	0.19	8.2%
25	-	-	1.24	1.22	-0.02	-1.9%
26	250	-	0.55	0.55	<-0.01	0.4%
27	-	-	0.02	0.02	<-0.01	-6.6%
28	-	-	0.08	0.06	-0.02	-22%
29	-	-	0.20	0.23	0.03	15%
30	-	-	0.04	0.05	0.01	25%
31	1,800	-	0.24	0.23	-0.01	-6.3%
32 (CuSD)[6]	-	-	3.63	3.45	-0.18	-5.0%

[1] Model results are compared to the 2022-2023 flow monitoring data and assume a blockage at the Lawrence/Homestead gate structure.
[2] Return factors applied are based on incremental areas (i.e., do not include flows that are upstream of the tributary area).
[3] Difference is reported as model flow minus meter flow. Rounded to nearest 0.01 mgd.
[4] Flow data were highly variable due to impact from Levi's Stadium events.
[5] Flow data were likely impacted by backwater influence from the Primavera Pump Station. Raw data showed frequent spikes in flow.
[6] Raw flow data from CuSD's permanent flow meter were reduced by approximately 5% when applied to the model as discussed in **Section 2.2.2.1**.

TABLE 3-6: DRY WEATHER FLOW CALIBRATION RESULTS VS. SELECT 2014-2015 FLOW MONITORING DATA[1]

FM ID	GWI (gpad)	Return Factor Applied (%)[2]	Meter ADWF (mgd)	Model ADWF (mgd)	Difference (mgd)[3]	Difference (%)
2	-	-	4.05	4.72	0.67	16.5%
3	-	-	2.98	2.79	-0.19	6.4%
5	-	-	3.94	4.13	0.19	4.8%
6	-	-	2.65	3.00	0.35	13.2%
7	-	-	0.88	0.82	-0.06	-6.8%
9[4]	-	-	2.00	2.66	-0.66	33.0%
13	-	-	3.50	3.07	-0.43	-12.3%

[1] Model results are compared to the 2014-2015 flow monitoring data and assume normal settings (no blockages) at the Lawrence/Homestead gate structure.
[2] Model BWF values and return factors applied are based on incremental areas (i.e., do not include flows that are upstream of the tributary area).
[3] Difference is reported as model flow minus meter flow. Rounded to nearest 0.01 mgd.
[4] Located upstream of FM 9A but still along the Calabazas trunk and downstream of El Sobrante overflow connection.

FIGURE 3-6: DRY WEATHER CALIBRATION GRAPH (FM 1)

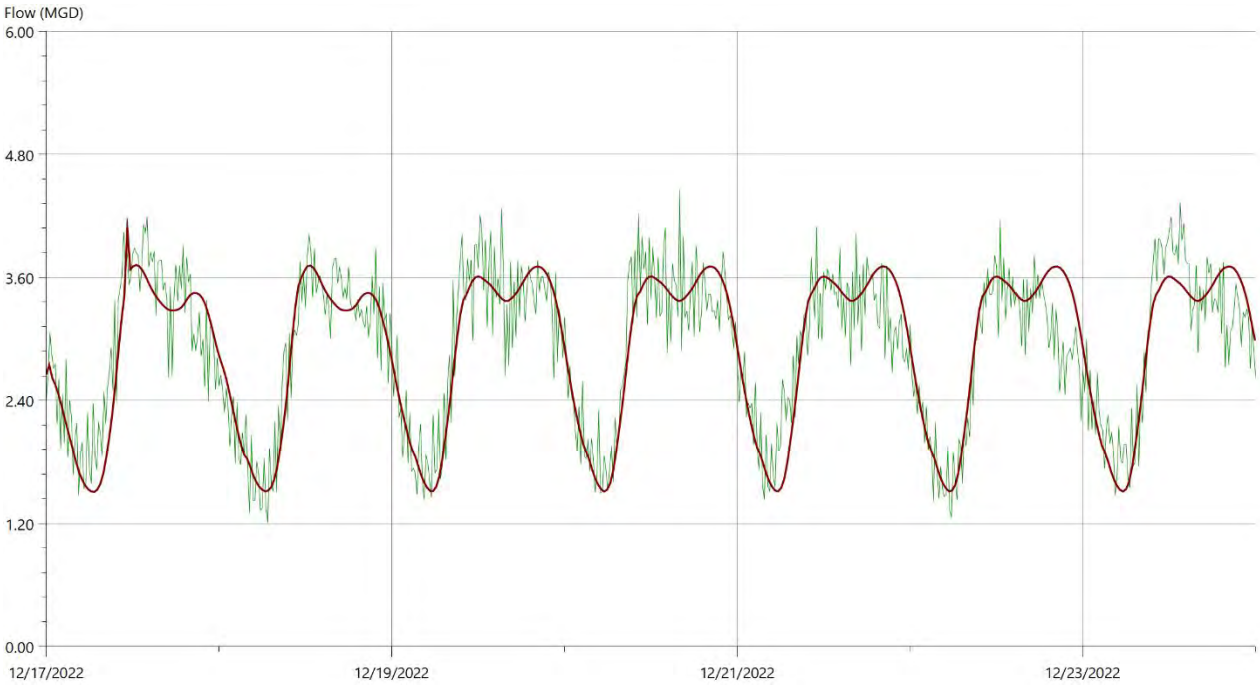


FIGURE 3-7: DRY WEATHER CALIBRATION GRAPH (FM 2)

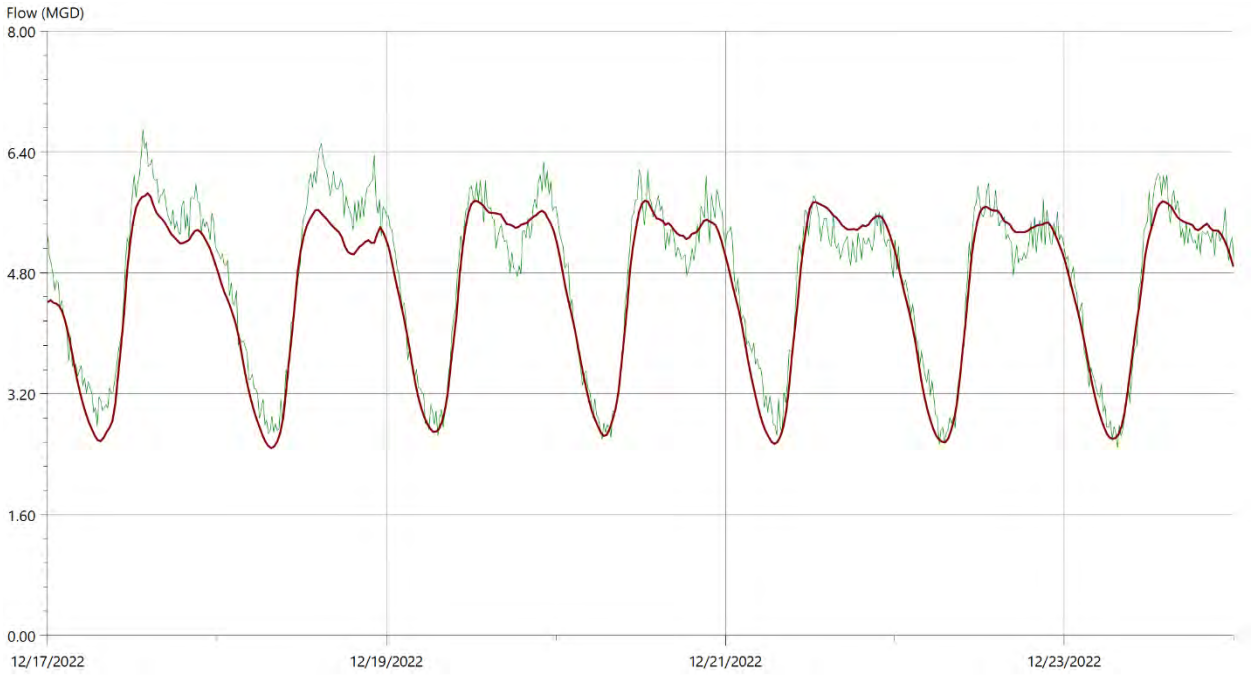


FIGURE 3-8: DRY WEATHER CALIBRATION GRAPH (FM 3)

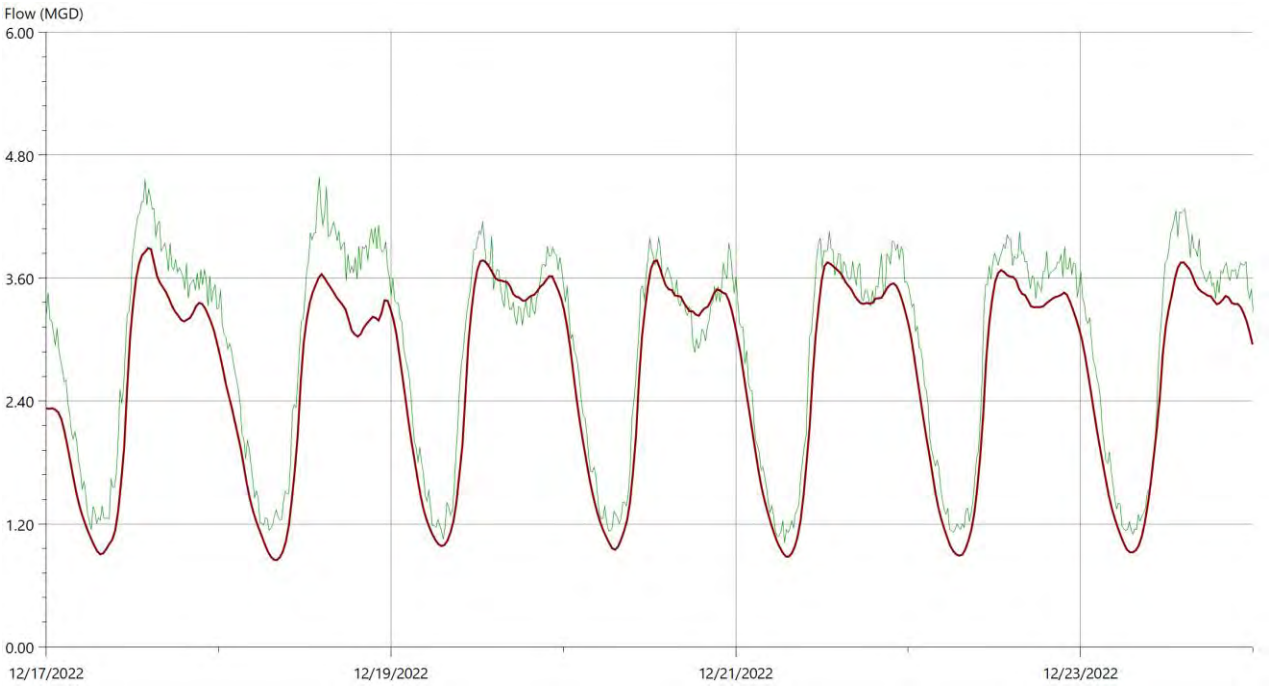


Table 3-7 summarizes the total estimated dry weather flow (DWF) within Santa Clara's sewer system based on the model calibration and the existing loads described previously.

TABLE 3-7: DRY WEATHER FLOW SUMMARY (EXISTING CONDITIONS)

Flow Component	Flow (mgd)
City Residential BWF	5.69
City Non-Residential BWF	5.53
CuSD Total BWF[1]	3.45
Total Average BWF	**14.67**
Estimated GWI[2]	0.16
Total Average DWF	**14.83**

[1]Average modeled daily dry weather flow from CuSD based on dry weather calibration period from **Table 3-5**.
[2]Calculated based on difference between metered non-rainfall period flows and estimated BWF calculated from winter water use data.

3.4.3.1 Differences Between 2022-2023 & 2014-2015 Flow Monitoring Data

During the dry weather calibration and review of the flow monitoring data, Woodard & Curran identified significant differences between the 2022-2023 and 2014-2015 flow monitoring data at the following meters:

- **FMs 19 & 20**: Based on the 2014-2015 flow monitoring data and field inspections recorded by the City, the diversion structure located at Homestead Road and Lawrence Expressway (shown in **Figure 3-2**) splits flows roughly evenly, routing approximately 50% of the flow to the trunk on Homestead and the remaining 50% to the trunk on Lawrence. The model replicated this expected split based on field measurements of gate openings at that time. However, the 2022-2023 flow monitoring data showed that approximately 80% of flow was being routed to the trunk on Lawrence and the remaining 20% was being routed to the trunk on Homestead. The City's Water and Sewer Department staff performed a field inspection to investigate the discrepancy in August 2023 and discovered that rags had built up on the center divider and were impacting the distribution of flow. After City staff removed the rags, they reported that both gates were fully open, and flows appeared to be evenly split. Staff also confirmed that gate settings had not been changed since 2015.
- **FMs 9A & 13**: The 2022-2023 flow monitoring data showed that flows in the Calabazas trunk at FM 9A were significantly lower than flows recorded at FM 9 in 2014-2015, which is located upstream of FM 9A. Additionally, the 2022-2023 flows at FM 19, which is located considerably upstream of FMs 9A and 9, were higher than the flows recorded at FM 9A. These data suggested that flows were being diverted away from the Calabazas trunk somewhere between FM 19 and FM 9A, which was not evident in the 2014-2015 flow monitoring data. Further investigation by Woodard & Curran and additional field surveys conducted by the City revealed that surcharged conditions were observed in the Calabazas line at manhole S32-101 located at the Pomeroy Avenue and El Sobrante Street intersection in March 2023 during dry weather conditions. The invert of the overflow pipeline on El Sobrante is significantly higher compared to that of the Calabazas line (+2.9 ft per the survey data), so it would take a substantial increase in hydraulic grade line for flows to back up into El Sobrante (away from FM 9A and into FM 13). When the same location was surveyed in August 2023, no surcharging was discovered, and flows appeared to have returned to normal. Woodard & Curran was unable to replicate the surcharging observed in March 2023 dry weather conditions in the model. Therefore, in addition to flows in the Calabazas trunk being higher than normal due to rag build up at the Homestead/Lawrence diversion structure (discussed above), it is suspected that there was a temporary downstream blockage in the Calabazas trunk somewhere downstream of the El Sobrante connection that forced flows to backup into the overflow pipe. Flows to El Sobrante are routed to FM 13. Other downstream flow meters affected by the atypical flow routing include FMs 2, 3, 5, 6, and 24. The reported flow differences are greater at FMs 5 and 6 compared to FMs 2 and 3 because there are interconnectors between the two GAP trunks downstream of FMs 5 and 6 but upstream of FMs 2 and 3.
- **FM 7**: The 2022-2023 flow monitoring data were likely affected by backwater influence from the pump station. Numerous spikes were observed in the raw flow data, which were not present in the 2014-2015 flow data. As shown in **Table 3-6**, the modeled dry weather flows were only 6.8% lower by volume than the 2014-2015 recorded flows; moreover, V&A installed the 2022-2023 flow meter one manhole upstream of the 2014-2015 flow meter due to the pump station backwater influence observed at the original location during the site investigations.

Per the City's request, additional dry weather flow monitoring was performed for a week in early December 2023 as described in **Section 2.1.3** to further investigate the major discrepancies which are summarized below.

Summary of Major Discrepancies Identified

It was determined that the likely cause of the differences between the 2022-2023 and 2014-2015 flow monitoring data was two-fold:

1) *Lawrence/Homestead Gate Structure Flow Split*: The Lawrence/Homestead gate structure was likely clogged with rags during the initial flow monitoring period, causing more flow than expected to be routed to the Calabazas trunk.

2) *Calabazas Trunk Line Temporary Blockage*: It was surmised that some issue in the Calabazas trunk (possibly a temporary blockage) caused significant surcharging, enough to reach the level that would route flows away from the Calabazas trunk and into the Bowers trunk through a higher-level split at El Sobrante. Moreover, this second condition seemed to change over time, with significant shifts in metered flows observed at FM 9A (located on the Calabazas trunk), with corresponding shifts at FM 13 (located on the Bowers trunk).

Conclusions from Additional DWF Monitoring Investigations

Metered ADWFs for the 7-day dry period between December 9-15, 2023 were compared to the winter 2022-2023 and winter 2014-2015 metered ADWFs at the same locations as well as model-predicted ADWFs. Graphs of metered versus modeled ADWFs are included in **Appendix F**. Based on a comparison of the results, Woodard & Curran suspects that the two major differences identified above (1. Lawrence/Homestead Gate Structure Flow Split; 2. Calabazas Trunk Line Temporary Blockage) had been resolved as of the December 2023 flow monitoring period and that the City's Calabazas and Bowers trunk lines were operating closer to normal and as intended. To prevent future clogs that could affect sewer flow routing, it is recommended that the City periodically inspect and clean the Lawrence/Homestead gate structure as well as other structures or locations prone to rags or blockages.

Key findings based on the flow monitoring data were as follows:

- During the December 2023 flow monitoring period, the flow split at the Lawrence/Homestead gate structure (FM 19 along Lawrence Expwy, and FM 20 along Homestead Rd) was operating much closer to the approximately 50/50 flow split that the City considers to be "normal" conditions. Based on the flow monitoring data, metered flows at the split were as follows:
    - *December 9-15, 2023 ADWFs*: ~39% to Lawrence Expwy / Calabazas trunk line (FM 19) vs. ~61% to Homestead Rd / Bowers trunk line (FM 20). It should be noted that this split was used in the model and is reflected in the Model Flow results shown on the attached graphs.
    - *December 17-23, 2022 ADWFs*: ~86% to Lawrence Expwy / Calabazas trunk line (FM 19) vs. ~14% to Homestead Rd / Bowers trunk line (FM 20).

- The December 2023 flow monitoring results at FM 21 (along Kifer Rd downstream of FM 20) also confirmed that flows along Homestead Rd continued through to the Bowers trunk line. The December 2023 ADWFs were similar to the winter 2014-2015 metered ADWFs.

- New flow meter sites (FM 33 along El Sobrante St and FM 34 along El Camino Real) were added to check if flows were leaving the Calabazas trunk line at these locations. The December 2023 flow monitoring results confirmed that during the monitoring period flows were retained within the

Calabazas trunk line and did not discharge to the sewers along El Sobrante St or El Camino Real. Additionally, FM 30 (east of Calabazas trunk line between E Arques Ave and Central Expwy) was repeated to confirm flows from the Calabazas trunk line were not discharging to Central Expwy. The December 2023 flow monitoring results were consistent with the 2022 data at this site, showing very low flows through FM 30.

- Shifts in ADWFs that were apparent in the winter 2022-2023 flow monitoring data at FM 9A (along the Calabazas trunk line north of E Arques Ave) and FM 13 (along Bowers Ave on the Bowers trunk line between Chromite Dr and Monroe St) were not present during the one week of December 2023 flow monitoring.

- As evident on the graphs included in **Appendix F**, the model overpredicts flows at both FM 9A and FM 13. In reviewing the collected data, however, no changes to the model flows were incorporated. Total metered flows at FM 19 and FM 20 were very similar between the 2015, 2022, and 2023 flow monitoring periods. Likewise, total metered flows at the downstream meters FM 2 and FM 3 were very similar between 2015 and 2022. The model matches overall flows at these locations well. Conversely, the total metered flows between FM 9A and FM 13 in 2023 and 2022 were 24% and 27% lower than the 2015 metered flows (at FM 9 and FM 13). However, attempting to adjust the model to replicate these lower flows would adversely affect the calibration of downstream meters.

3.5 Wet Weather Flow Calibration

This section discusses the methodology and procedures used to calibrate the model for wet weather flow conditions and presents the results of the wet weather calibration.

3.5.1 Wet Weather Flow Calibration Methodology

Wet weather calibration builds on the dry weather calibration procedure. The goal of wet weather calibration is to match modeled and metered flows during the rainfall events observed during the flow monitoring period. Specifically, the model calibrator strives to achieve a reasonably good match between the modeled and metered peak flows and volumes observed during and before and after the rainfall event. Like dry weather calibration, wet weather calibration is also an iterative process during which adjustments are made to GWI (if needed to match pre-rainfall conditions) and to model parameters governing the volume and response time of RDI/I.

To define the RDI/I parameters, actual rainfall events observed during the flow monitoring period were simulated in the hydraulic model, and the resulting model hydrographs were compared to the measured flows at the flow meter locations. The RDI/I parameters were adjusted as needed to achieve a reasonable match of modeled to monitored flows. The same calibrated parameters were applied to all subcatchments within each meter basin.

3.5.2 Wet Weather Flow Calibration Results

During wet weather calibration, the percentage volume of each of five RDI/I components representing a range of response times (pictured conceptually in **Figure 2-6**) were adjusted to simulate the volume and timing of RDI/I for monitored storm events in order to best match the overall wet weather hydrograph shape and magnitude of peak flows. To simulate a rainfall event in the model, the rainfall was assigned to subcatchments using observed data from the closest available rain gauge. The model-predicted wet weather response, which is based on the assigned rainfall intensity and RDI/I components, was then compared to the observed flow monitoring data.

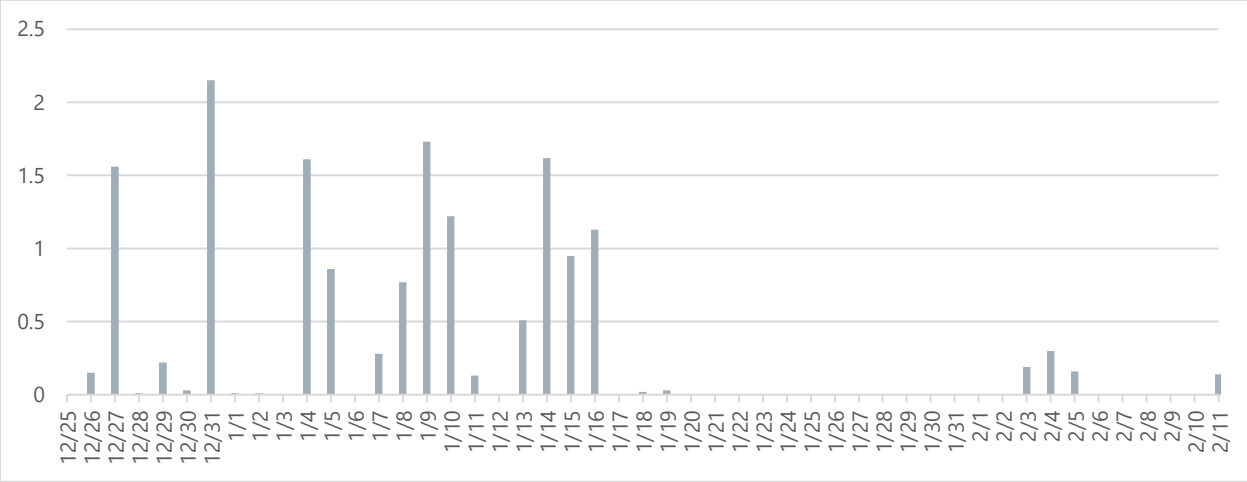
The flow monitoring program conducted in winter of 2022-2023 as part of this Master Plan Update (refer to **Section 2.1**) captured several rainfall events for the wet weather calibration effort. Rainfall for key events referenced for the wet weather calibration is summarized in **Table 3-8**. For comparison (based on the County Drainage Manual and an assumed MAP of 14.5 inches), the 10-year, 24-hour rainfall volume for central Santa Clara is approximately 2.92 inches with a peak hour intensity of 0.65 in/hr and the 5-year, 24-hour rainfall volume for central Santa Clara is approximately 2.45 inches with a peak hour intensity of 0.54 in/hr. Therefore, based on the statistics reported in **Table 3-8**, all the rainfall events observed during the flow monitoring period were individually less than a 10-year return period for the 24-hour duration and the January 4-5, 2023 storm was close to a 5-year return period. However, several of the storms occurred within a short amount of time so there were likely cumulative impacts that increased the inflow and infiltration response during subsequent storms. For example, the January 13-16, 2023 storm event was close to a 10-year storm based on NOAA statistics for the 2-day and 4-day durations. **Figure 3-9** graphically depicts the daily rainfall recorded during the temporary flow monitoring period, in inches.

TABLE 3-8: RAINFALL EVENTS REFERENCED FOR WET WEATHER CALIBRATION[1]

Date of Event	Min 24-Hour Rainfall (in)	Max 24-Hour Rainfall (in)	Min Peak 1-Hour Intensity (in/hr)[2]	Max Peak 1-Hour Intensity (in/hr)[2]
Dec 27, 2022	1.52	1.89	0.28	0.37
Dec 31, 2022	1.55	2.15	0.28	0.36
Jan 4-5, 2023	1.29	2.34	0.36	0.59
Jan 8-10, 2023	1.11	2.08	0.23	0.39
Jan 13-16, 2023	1.62	2.06	0.29	0.42

[1]Rainfall totals based on temporary rain gauge data from gauges 1-4. Minimum rainfall totals are generally from rain gauge 1 located in the northern portion of the City and maximum rainfall totals are generally from rain gauge 3 located in the southern portion of the City. [2]Intensity is reported as an hourly average of 15-minute rainfall data.

FIGURE 3-9: DAILY RAINFALL OBSERVED DURING 2022-2023 FLOW MONITORING PERIOD (IN)[1]



[1]Rainfall totals are from rain gauge 3 located in the southern portion of the City.

Table 3-9 compares the model versus meter peak wet weather flows discharged to the City's GAP and Trimble trunks, **Table 3-10** and **Table 3-11**, respectively, compare the model versus 2022-2023 and 2014-2015 meter wet weather flows at each meter location, and **Figure 3-10**, **Figure 3-11**, and **Figure 3-12**, show plots of model versus metered wet weather flow at the downstream-most meters (FM 1, FM 2, and FM 3,

respectively). In these graphs, the green line represents the monitored (observed) flow, and the red line represents the model-simulated flow. Wet weather calibration plots of model-predicted versus metered flows at all flow meter locations for both 2022-2023 and 2014-2015 are provided as **Appendix F**.

As indicated in **Table 3-10**, the wet weather model calibration resulted in a reasonably good match of modeled to metered volumes and peak flows (within 15% at most locations). However, because it was determined that temporary system conditions that were not representative of typical operations were present during the 2022-2023 flow monitoring period (discussed in **Section 3.4.3.1**), the 2014-2015 flow monitoring data were also compared to the model results at select, affected locations as shown in **Table 3-11**. As part of the wet weather calibration process, Woodard & Curran still reviewed data from both the 2014/2015 and 2022/2023 seasons to confirm that the model was at least reasonable for both conditions at all flow meter locations. The 2014/2015 wet weather season had one very large early season rainfall event, which differed from the 2022/2023 wet weather season in which several, smaller individual storms occurred in a short amount of time.

As evident in the wet weather calibration plots included in **Appendix F**, the modeled and metered peak flows and volumes typically matched better for the later season rainfall events. This is because the full 2022-2023 season was reviewed as the wet weather calibration period; the volume and peak flows associated with the early-season rainfall events are typically overestimated because the same RDI/I parameters were applied across all rainfall events. The RDI/I response typically increases throughout the wet weather season as the soil progressively becomes saturated as more rainfall occurs. Therefore, the wet weather calibration was performed to conservatively match the observed volume and peak flows resulting from higher RDI/I responses during late-season wet weather events.

FIGURE 3-10: WET WEATHER CALIBRATION RESULTS AT FM 1

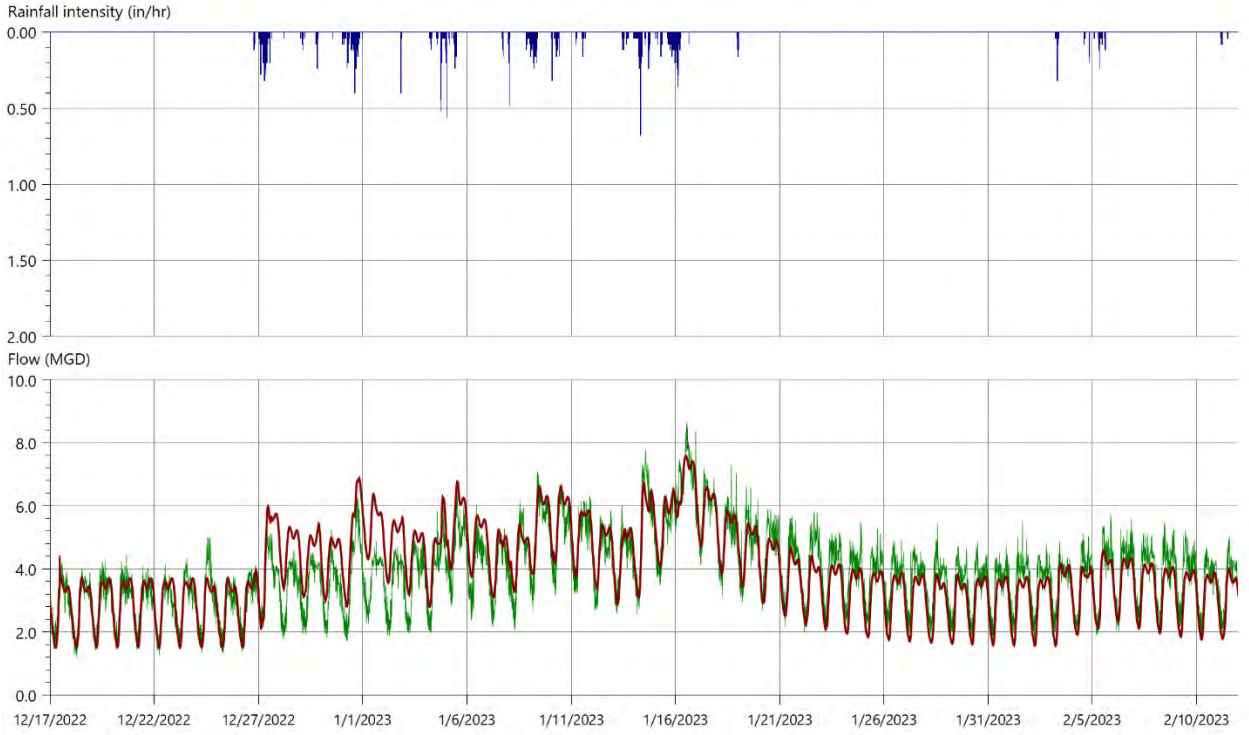


FIGURE 3-11: WET WEATHER CALIBRATION RESULTS AT FM 2

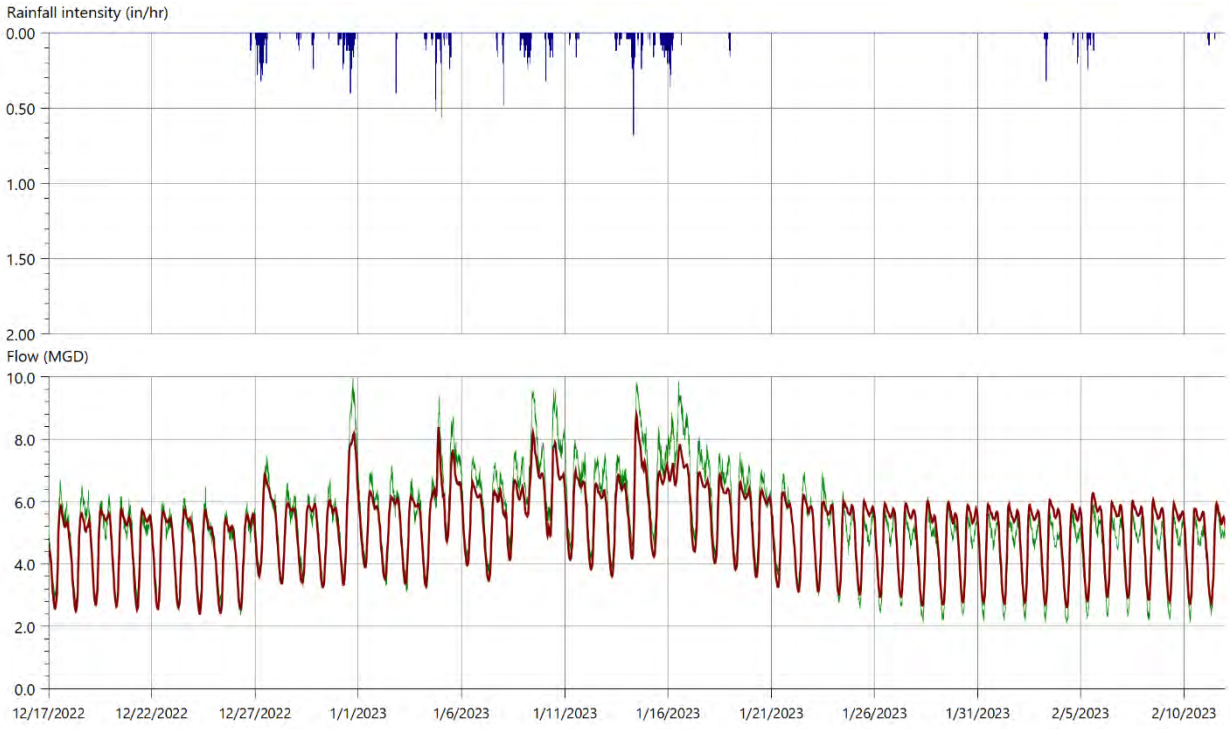
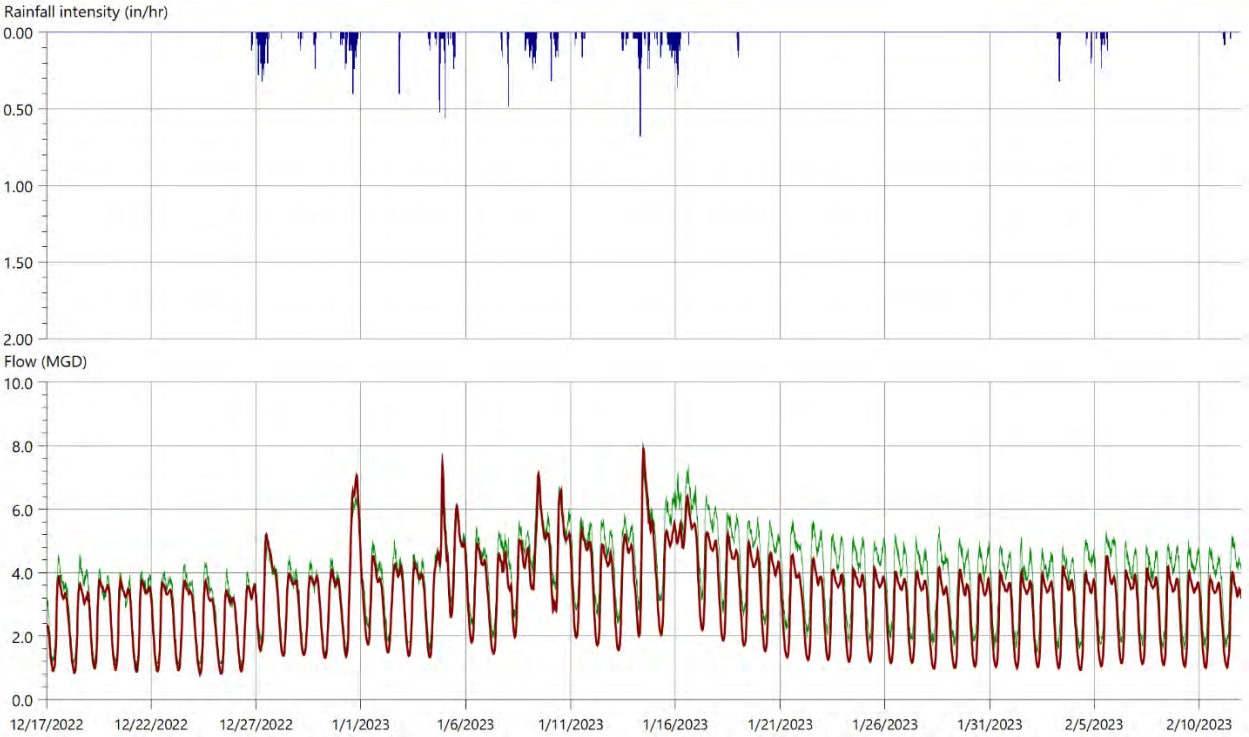


FIGURE 3-12: WET WEATHER CALIBRATION RESULTS AT FM 3



The results of the wet weather calibration are shown in **Table 3-10**. Wet weather peaking factors were calculated for each flow meter based on the ratio of peak flow to average flow.

TABLE 3-9: WET WEATHER FLOW CALIBRATION RESULTS SUMMARY[1]

FM IDs	Discharge Location	Meter PWWF (mgd)	Model PWWF (mgd)	Difference (mgd)[2]	Difference (%)[2]
1+2+3	Lafayette and GAP Trunks	23.03	24.22	1.19	5.2%
16+17+18+25	Trimble Trunk	13.65	13.93	0.28	2.1%

[1] Model results are compared to the 2022-2023 flow monitoring data.
[2] Difference is reported as model flow minus meter flow.

TABLE 3-10: WET WEATHER FLOW CALIBRATION RESULTS VS. 2022-2023 FLOW MONITORING DATA[1]

FM ID	Meter PWWF (mgd)[2]	Model PWWF (mgd)	Difference (mgd, %)	Avg Flow (mgd)[3]	Peaking Factor[4]
1	8.67	7.59	-1.07, -12.4%	2.91	3.0
2	9.97	8.75	-1.22, -12.2%	4.71	2.1
3	7.39	7.88	0.49, 6.6%	2.92	2.5
4[5]	1.25	0.44	-0.81, -64.8%	0.04	31.3
5	8.96	7.78	-1.18, -13.2%	2.93	3.1
6	4.88	7.90	3.02, 61.8%	2.75	1.8
7	2.27	1.80	-0.47, -20.5%	1.10	2.1
8	3.12	2.77	-0.36, -11.5%	1.46	2.1
9	3.85	7.59	3.74, 97.1%	2.24	1.7
10	3.41	3.28	-0.13, -3.7%	0.65	5.2
11	4.94	4.57	-0.37, -7.4%	0.77	6.4
12	-[6]	5.28	-[6]	0.83	-[6]
13	8.56	5.75	-2.81, -32.8%	2.10	4.1
14	1.14	1.05	-0.10, -8.5%	0.41	2.8
15	0.84	0.95	0.11, 12.6%	0.23	3.6
16	2.77	3.03	0.26, 9.2%	1.46	1.9
17	1.68	1.62	-0.06, -3.3%	0.77	2.2
18	2.53	2.81	0.28, 11.1%	1.18	2.1
19	5.98	5.94	-0.05, -0.7%	2.65	2.3
20	1.94	2.26	0.32, 16.6%	0.42	4.6
21	2.90	3.30	0.39, 13.6%	0.89	3.3
22	1.95	2.07	0.11, 5.8%	0.82	2.4
23	1.22	1.49	0.27, 2.2%	0.59	2.1
24	8.30	7.14	-1.16, -13.9%	2.39	3.5
25	6.67	6.47	-0.197, -3.0%	1.24	5.4

FM ID	Meter PWWF (mgd)[2]	Model PWWF (mgd)	Difference (mgd, %)	Avg Flow (mgd)[3]	Peaking Factor[4]
26	1.70	1.70	0.004, 0.2%	0.55	3.1
27	0.47	0.46	-0.001, -0.2%	0.02	23.5
28	1.36	0.88	-0.48, -3.5%	0.08	17.0
29	1.16	1.04	-0.12, -10.4%	0.20	5.8
30	0.14	0.11	-0.02, -17.0%	0.04	3.5
31	1.23	1.28	0.06, 4.6%	0.24	5.1
32[7]	9.51	8.95	-0.56, -5.9%	3.45	6.0

[1] Model results are compared to the 2022-2023 flow monitoring data and assume a blockage at the Lawrence/ Homestead gate structure.
[2] Based on meter response during January 15-16, 2023 rainfall event.
[3] Average metered dry weather flow from **Table 3-5**.
[4] Ratio of metered peak flow to metered average flow.
[5] FM 4 base flows were highly variable because of sporting events held at Levi's Stadium. FM was calibrated to match the wet weather response from rainfall on non-gamedays, resulting in an underestimation of total gameday flows.
[6] Meter was not installed in the correct location during the wet weather flow monitoring period, so data are not available.
[7] Permanent CuSD flow meter.

TABLE 3-11: WET WEATHER FLOW CALIBRATION RESULTS VS. SELECT 2014-2015 FLOW MONITORING DATA[1]

FM ID	Meter PWWF (mgd)[2]	Model PWWF (mgd)	Difference (mgd, %)
2+3	17.59	17.72	0.13, 0.7%
5+6	16.69	16.30	-0.39, -2.3%
9[3]	6.34	6.43	0.09, 1.4%
13	7.22	7.65	0.43, 6.0%

[1] Model results are compared to the 2014-2015 flow monitoring data and assume normal settings (no blockages) at the Lawrence/Homestead gate structure.
[2] Based on meter response during December 11, 2014 rainfall event.
[3] FM 9 is located along the Calabazas trunk but upstream of FM 9A (south of Central Expressway).

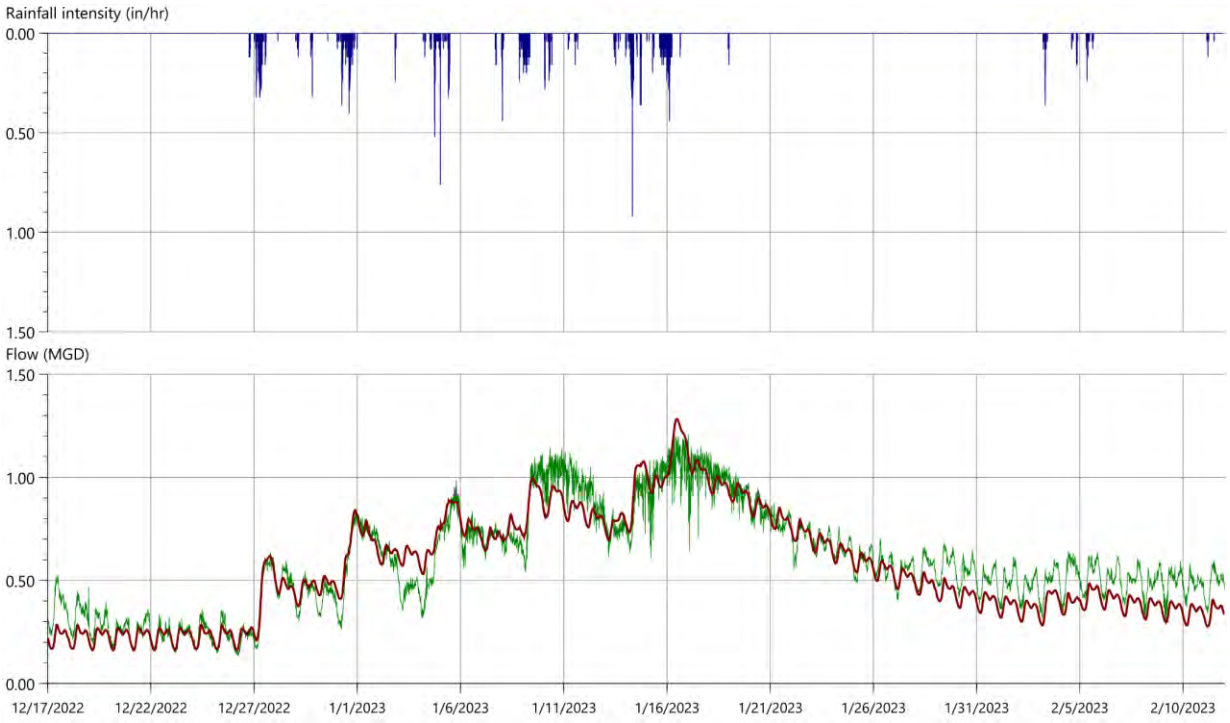
3.5.2.1 RDI/I Response

As discussed in **Section 2.3** and shown in **Figure 2-6**, RDI/I is estimated in the model using five runoff components that reflect a range of response times from fast to slow. The total RDI/I hydrograph for each flow meter basin is the summation of all the component hydrographs for the duration of the rainfall events.

As expected, a very high RDI/I response was observed within the meter basins that collect flows from the CMC tributary area which is upstream of FMs 11 and 12 (discussed in **Section 2.1**) and at FM 31 which is a basin that is adjacent to the CMC tributary area but upstream of FM 24. Examples of the very high RDI/I responses observed at a few of these meters (FM 31 and FM 27) are presented in **Figure 3-13** and **Figure 3-14**. In both examples, the nature of the response is indicative of significant infiltration as the response is generally slower and takes a long time to recede (i.e., several weeks after the January 15-16, 2023 storm as shown in the figures). Moreover, because several consecutive rainfall events occurred within a short period of time, the infiltration response did not fully recede before another rainfall event occurred.

These flow monitoring results are consistent with the findings of other field investigations that were completed recently in the CMC basin. The City retained V&A to perform I/I investigations within the CMC tributary area with the objective of identifying specific areas of high I/I to a sub-basin or micro-basin level. Investigation methods included targeted night-time I/I reconnaissance and CCTV inspections, which occurred during the 2022-2023 winter wet weather season. V&A's report[1], which details the scope and findings of these investigations, concluded that rainfall-dependent infiltration appeared to be the most severe component in the CMC basin, as opposed to the rainfall-dependent inflow. V&A observed a rapid response but also long-term, sustained rainfall-dependent infiltration, which are presumably due to increased groundwater elevations that take a long time to recede. V&A suspected that the rainfall-dependent infiltration was entering the sewer system from defects in sewer laterals and mains, rather than from defects within the sewer manhole structures. City staff suspect that laterals in some areas within the CMC basin were constructed using Orangeburg pipe material, which is known to have high rates of defects and may be a significant source of RDI/I. V&A's report recommended that the City consider smoke testing in the CMC basin, which may better identify lateral defects. Options to identify and reduce RDI/I in the CMC basin were identified and are suggested as part of the system capacity assessment (refer to **Section 4.6.3**).

FIGURE 3-13: WET WEATHER CALIBRATION RESULTS – RDI/I RESPONSE AT FM 31



[1] Sewer Flow Monitoring and Inflow/Infiltration Study prepared by V&A for City of Santa Clara dated August 2023.

FIGURE 3-14: WET WEATHER CALIBRATION RESULTS – RDI/I RESPONSE AT FM 27

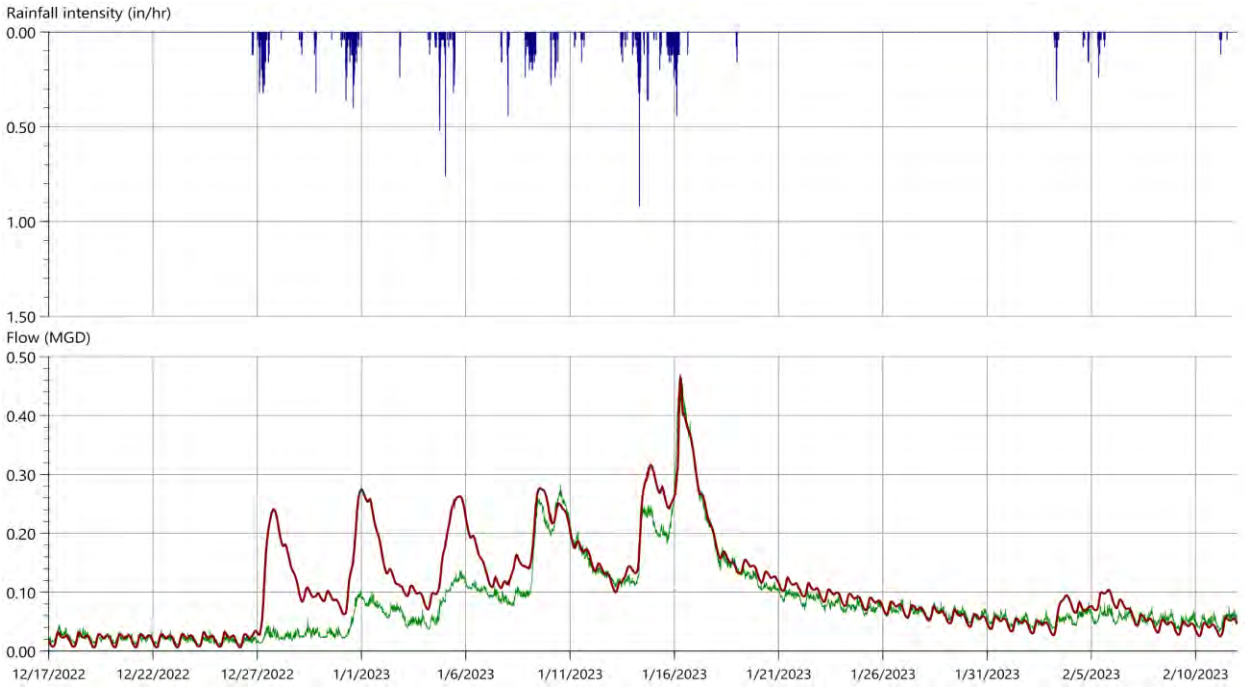
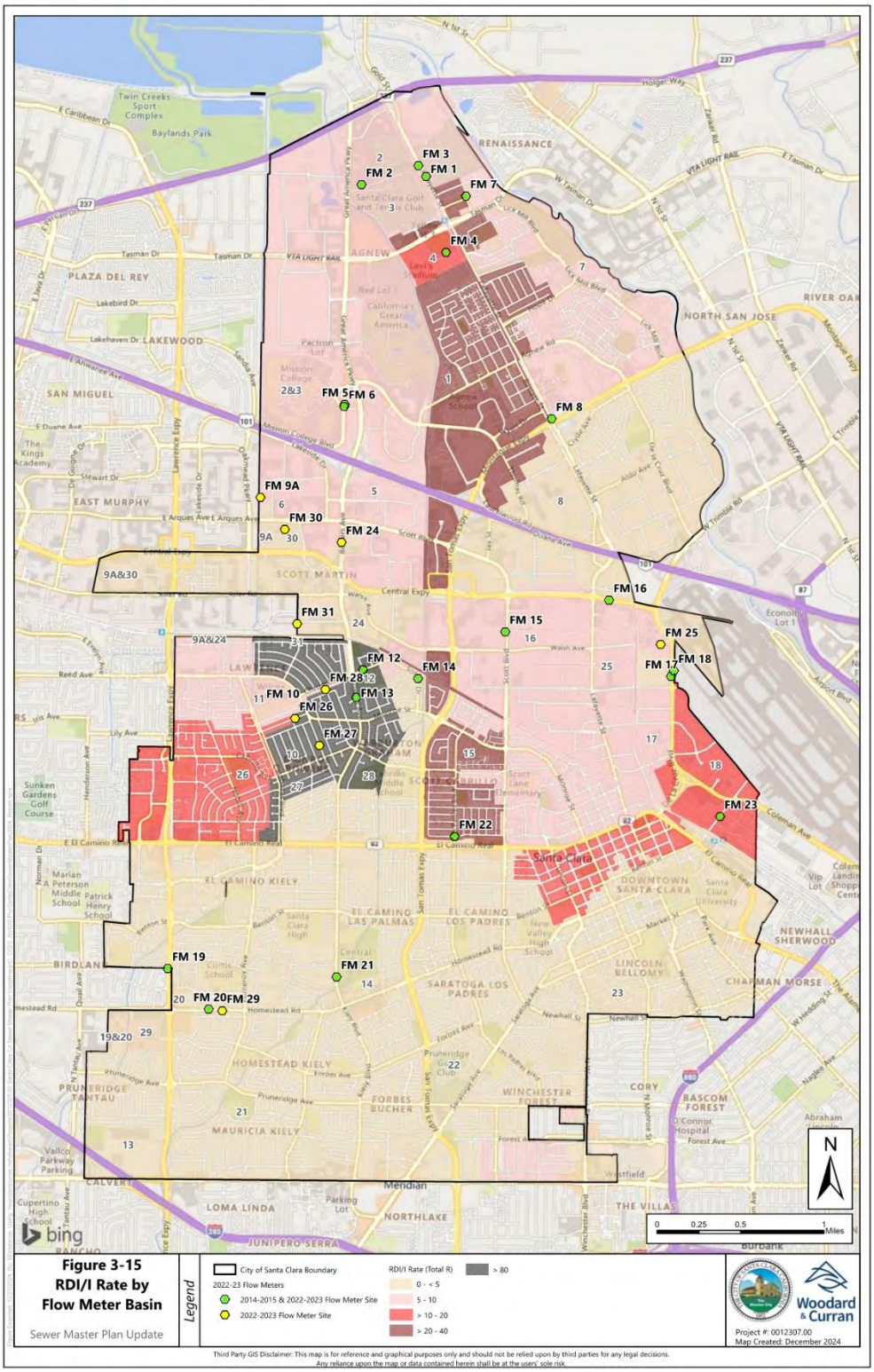


Figure 3-15 on the next page presents a visual representation of the wet weather calibration results in terms of the total RDI/I rate that was applied to the model for each meter basin to try to match modeled and metered flows.

FIGURE 3-15: WET WEATHER CALIBRATION RESULTS – RDI/I RATES BY FLOW METER BASIN



4. SYSTEM CAPACITY ANALYSIS

This section defines the basis for the capacity assessment of the system, including the selected design storm and performance criteria used to identify deficiencies, and presents the capacity deficiencies identified based on the model results. The section also identifies areas of the system with high I/I and recommends additional investigations to isolate potential direct inflow sources in those areas.

4.1 Hydraulic Assumptions Used for the Capacity Analysis

This section summarizes the hydraulic assumptions used for the capacity evaluation, including the dry weather flow scenarios (i.e., existing, near-term future, long-term future), wet weather design flows, performance (or capacity deficiency) criteria, and physical model network.

The various flow components and the development of existing, near-term future, and long-term future wastewater flows (referred to as model "loads") are discussed in **Section 2**. That section also discusses the application of a design storm in conjunction with calibrated model parameters that represent rainfall-dependent infiltration and inflow (RDI/I) into the sewer system to generate wet weather design flows.

The characteristics of the City's design storm event that is used to generate wet weather design flows are presented in **Section 4.1.1**. That section also summarizes the performance criteria that are applied to identify system capacity deficiencies and the design criteria that are applied to develop project solutions for the identified capacity deficiencies.

The physical model network assumptions, including development of a new "Lined Model Network" as requested by the City, is described in more detail in **Section 4.1.2**.

4.1.1 Summary of Design Storm, Performance Criteria, and Design Criteria

Criteria used by other agencies both inside and outside of California were referenced when selecting the criteria that was used for the City's sewer system capacity analysis. These references are further discussed in the Sewer Performance and Design Criteria Technical Memorandum, which is attached to this report as **Appendix G**.

Design Storm

Key factors needed to define a design storm event for the purpose of sewer modeling and master planning include return period, rainfall depth, storm duration, temporal and spatial distribution of rainfall, storm timing, and antecedent conditions. Characteristics of the selected design storm related to these key factors are presented in **Table 4-1** and discussed further below.

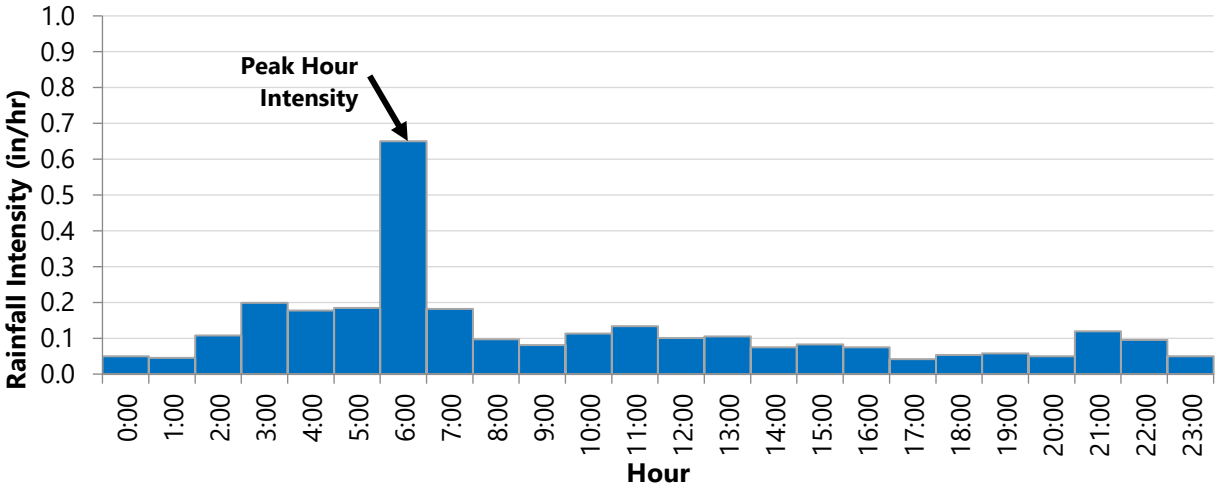
The City elected to continue to use the same 10-year, 24-hour design storm event that was used for its 2016 Master Plan for this Master Plan Update. The design storm used for the 2016 Master Plan Update is a 10-year, 24-hour storm that varies across the service area. The storm pattern and hourly rainfall intensities are based on the Santa Clara County's Drainage Manual (October 2007)[1]. The manual includes mean annual precipitation (MAP) isohyetal lines from Santa Clara Valley Water District (SCVWD) and distinct intensity, depth, frequency (IDF) curves for each MAP area in Appendix B. In addition to the IDF curves, Appendix D of the manual includes a 24-hour design storm pattern. According to the manual, this storm pattern is based

[1] Santa Clara County's Drainage Manual is available online at: https://stgenpln.blob.core.windows.net/document/DrainageManual_Final.pdf.

on an actual three-day rainfall event that occurred in December 1955, but with some adjustments to better reflect IDF statistics for various storm durations.

Figure 4-1 shows the design storm hourly rainfall as it occurs in the vicinity of central Santa Clara, including the San Jose International Airport area. At this location, the total rainfall for the 1-, 6-, and 24-hour durations is 0.65, 1.49, and 2.92 inches, respectively. For this graph, the storm timing has been adjusted so that the peak intensity coincides with the weekday morning peak of the diurnal wastewater pattern.

FIGURE 4-1: DESIGN STORM EVENT FOR CENTRAL SANTA CLARA (MAP ~14.5 INCHES)



Santa Clara selected its design storm event based on the key considerations presented in **Table 4-1** with respect to its desired level of service to reflect the level of risk that is acceptable to the City. For future modeling efforts, the City may consider applying a more conservative design storm event with a higher return period and/or perform a sensitivity analysis to evaluate potential impacts of climate change. The analysis could either be performed prior to, or concurrent with, the next update.

TABLE 4-1: RAINFALL DESIGN EVENT CRITERIA USED FOR SANTA CLARA MASTER PLAN UPDATE

Design Event Criterion	Santa Clara Selection
Return Period	10 years
Rainfall Depth	Based on County Drainage Manual IDF curves
Storm Duration	24 hours
Rainfall Temporal Distribution	Based on County Drainage Manual (developed from historical rainfall event in December 1955)
Storm Timing	Peak-on-Peak (weekday)
Spatial Rainfall Distribution	Lowest intensity: North Highest intensity: Southwest
Antecedent Conditions	Wet, saturated soils

The key factors used to define Santa Clara's selected design storm event are further described below:

- *Return Period*: The return period defines the probability that the design rainfall will be exceeded in any given year. For example, a storm with a 5-year return period means that there is a 1 in 5 chance, or 20 percent probability, that the design rainfall will be exceeded in any given year. For sewer

modeling and master planning applications, the chosen return period reflects the degree of risk that an agency is willing to accept regarding the potential of experiencing sanitary sewer overflows (SSOs) due to future storm events. However, selecting a design storm with a very high return period (reflecting a very low risk tolerance) could lead to identification of a significant number of system capacity deficiencies that would make the cost of improvements prohibitive. Additionally, sizing a system for a very infrequent event could mean that the system does not function well under typical conditions during much lower flows (due to slow velocities in oversized pipes, or oversized pump stations).

- *Rainfall Depth*: Synthetic design storms are typically based on rainfall IDF or depth, duration, frequency (DDF) statistics that have been compiled for a local area. These statistics give the rainfall depths or intensities for various return periods (e.g., 2-year, 5-year, etc.) and durations of rainfall (e.g., 1-hour, 2-hour, etc.). Rainfall IDF statistics are available through the National Oceanic and Atmospheric Administration (NOAA), which provides the IDF statistics for any location in the U.S. based on latitude/longitude coordinates. IDF curves specific to Santa Clara County (one for each MAP area) for various return periods and durations are provided in Appendix B of the 2007 County Drainage Manual. These IDF curves were used to define the selected design storm event. MAP varies spatially throughout Santa Clara, with the highest average annual rainfall typically occurring in the southern portion of the City. In central Santa Clara, according to the County Drainage Manual, the MAP is approximately 14.5 inches, and the 10-year, 24-hour rainfall depth is approximately 2.92 inches (versus 2.63 inches according to NOAA Atlas 14).

- *Storm Duration*: A storm duration must be specified for the design storm along with the return period. Most Bay Area agencies use a 24-hour storm, although shorter or longer durations may sometimes be appropriate (e.g., a shorter duration in a very small system with fast response to rainfall or in an area where storm events are typically very brief; a longer duration in a very large system or one with a very slow response to rainfall). Typically, the 24-hour duration storms are constructed such that the more intense rainfall occurs during a shorter (e.g., 4- to 6-hour) period. Santa Clara's selected design storm uses a 24-hour duration.

  Rainfall Temporal Distribution: The temporal rainfall distribution of a design storm may be based on a synthetic storm or an actual historical event. Commonly used synthetic storm distributions include nested storms (which incorporate design rainfall intensities for a given return period for several durations within the total storm duration), or a "SCS" storm distribution, a dimensionless 24-hour rainfall distribution developed by the SCS (Soil Conservation Service), now known as the NRCS (Natural Resources Conservation Service). The SCS developed four 24-hour distributions, with each distribution representative of a specific region of the U.S., as presented in the USDA guidance document Urban Hydrology for Small Watersheds TR-55 (June 1986). The City's service area generally falls within the area covered by the "Type I" distribution, but it is close to the boundary between the "Type I" and "Type IA" distributions. It is sometimes preferable to use historical rainfall patterns to depict the design storm temporal rainfall distribution of the design event. As described above and shown in **Figure 4-3**, Santa Clara County's Drainage Manual defines a temporal rainfall distribution based on a historical event that occurred during December of 1955. The rainfall for a historical storm could be scaled to match the desired rainfall depth and return period of the design storm. **Table 4-2** compares the peak hour intensity of the County Drainage Manual design storm distribution to the peak hour intensities of the synthetic distributions (SCS-I and SCS-IA, and nested) based on the County Drainage Manual IDF statistics for a 10-year, 24-hour rainfall event. As shown in the table, in central Santa Clara, peak hour rainfall intensity of the County Drainage Manual distribution is very similar to that of the synthetic SCS Type I distribution, moderately lower than

that of the synthetic nested distribution, and significantly higher than that of the SCS Type IA distribution. The temporal distribution of Santa Clara's selected design storm is based on an actual historical event (i.e., December 1955).

TABLE 4-2: CHARACTERISTICS OF DESIGN STORM DISTRIBUTIONS CONSIDERED[1]

Frequency	Duration	IDF Statistics Source	Temporal Distribution	Volume (in)	Peak Hour Intensity (in/hr)
10-yr	24-hr	Historical, County Drainage Manual	Historical, County Drainage Manual	2.92	0.65
10-yr	24-hr	NOAA	Synthetic, Nested	2.92	0.64
10-yr	24-hr	NOAA	Synthetic, SCS-I	2.92	0.76
10-yr	24-hr	NOAA	Synthetic, SCS-IA	2.92	0.46

[1]Based on County Drainage Manual and assumed MAP of 14.5 inches for central Santa Clara.

- *Storm Timing*: The selected event is based on the Santa Clara County Drainage Manual design storm with peak-on-peak BWF timing. Generally, peak-on-peak timing is achieved by adjusting the timing of the peak intensity of the rainfall event so that it occurs one to two hours prior to the peak BWF to account for the typical delay between the rainfall occurring and observation of the RDI/I response. For the 2016 Master Plan, the design storm rainfall was timed such that the peak rainfall occurred around 8 a.m., resulting in a peak RDI/I flow at approximately the same time as the typical weekend day peak BWF in most areas of the system (graphically depicted in **Figure 4-2**). Given that the peak BWF typically occurs earlier on a weekday compared to a weekend day, Santa Clara's selected design storm for this Master Plan Update was evaluated assuming an earlier peak rainfall intensity (around 6 a.m.) so as to align the peak intensity with the typical weekday peak BWF (graphically depicted in **Figure 4-3**).

FIGURE 4-2: DESIGN STORM EVENT FOR CENTRAL SANTA CLARA (WEEKEND)

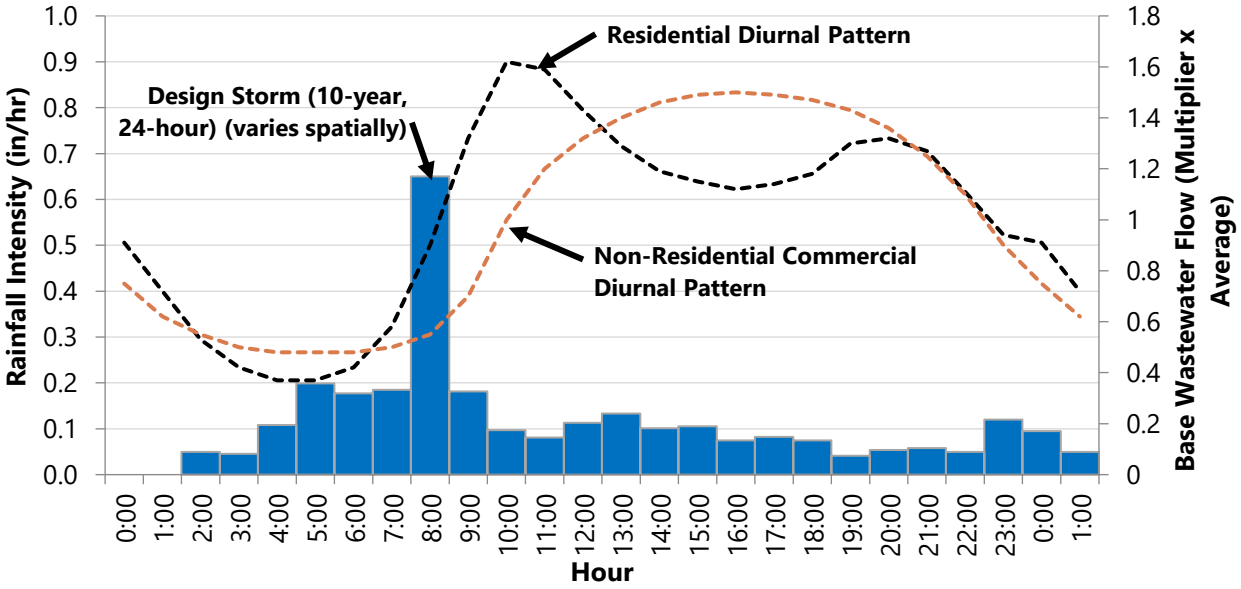
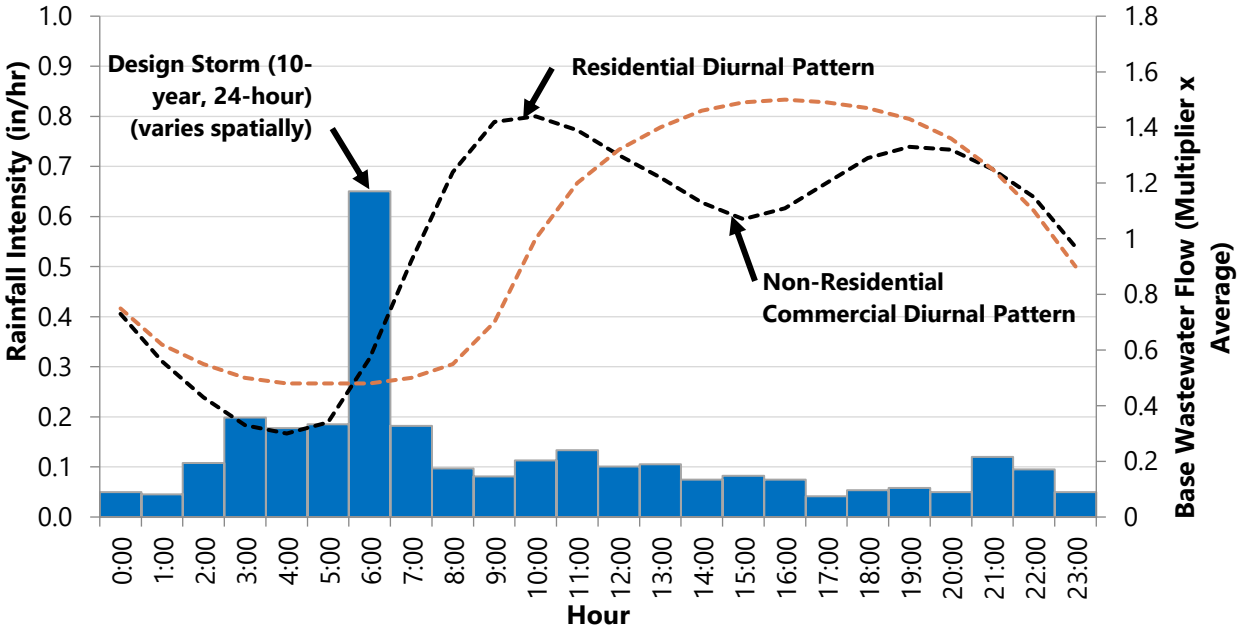
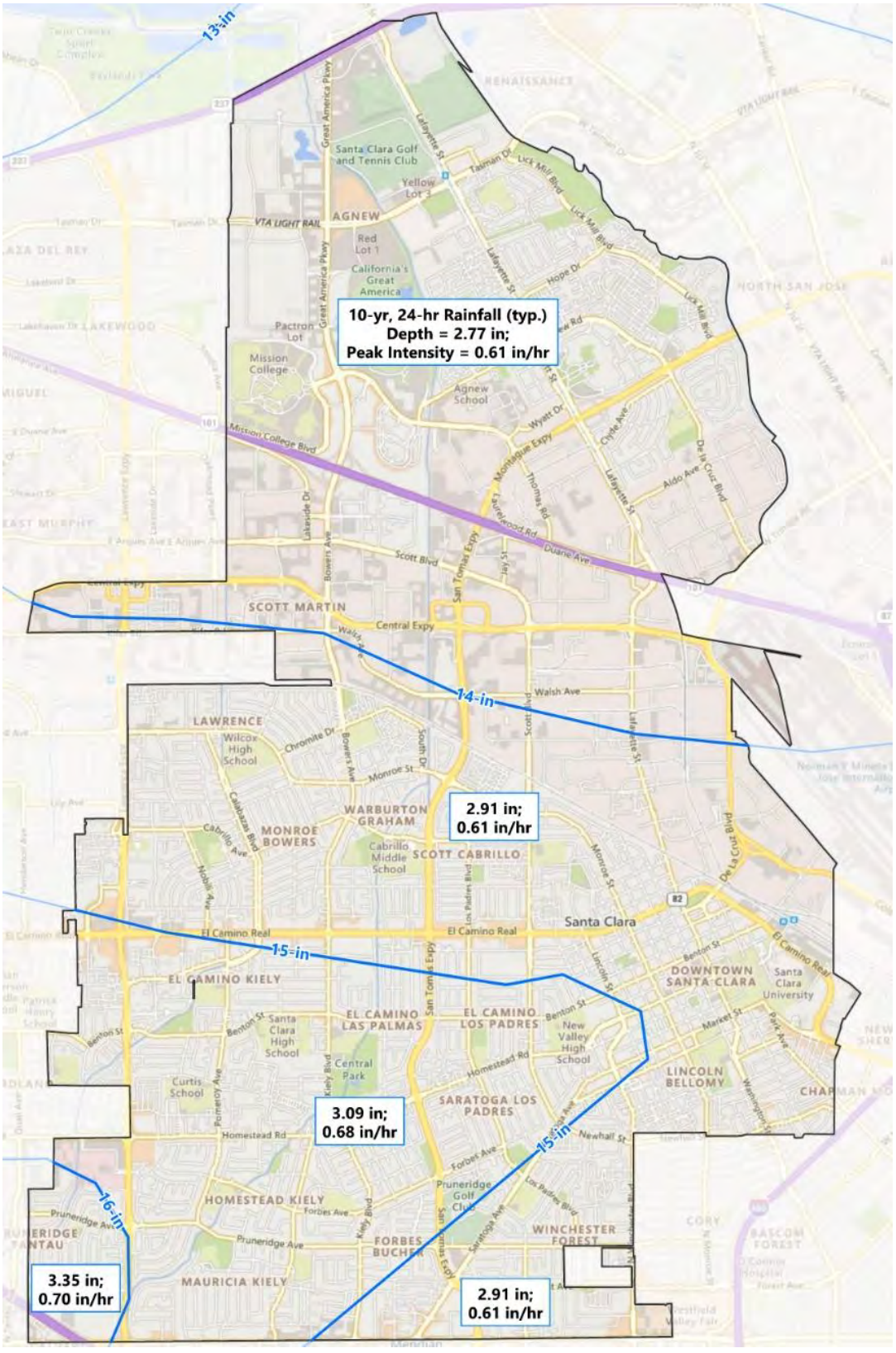


FIGURE 4-3: DESIGN STORM EVENT FOR CENTRAL SANTA CLARA (WEEKDAY)



- *Spatial Rainfall Distribution*: The magnitude of rainfall may vary spatially, generally based on topography and the typical movement of storms over the service area. Based on the County Drainage Manual, MAP in the City's service area varies from about 13 to 16 inches in a north to southwest direction. While this pattern may not hold true for every storm event, it is common practice to apply the spatial variation of average annual rainfall to the design storm. As such, the IDF curves (one for each MAP) provided in Appendix B of the County Drainage Manual were referenced to obtain IDF statistics (rainfall depth, duration, and peak intensity) for subareas within the City. **Figure 4-4** presents the spatial variation of rainfall depth and peak intensity throughout the City's service area for a 10-year, 24-hour event that the selected design storm is based upon; it illustrates that the highest and most intense rainfall typically occurs within the southwest portion of the City.
- *Antecedent Conditions*: Based on flow monitoring data from the 2022-2023 winter season, flow response to rainfall in portions of the City's service area (e.g., CMC tributary area) is characterized by prolonged elevated flows extending for several days and in some cases weeks after storm events. Thus, a storm happening later in the season after several storm events have occurred may produce higher peak flows because the ground is saturated (meaning less rainfall can be "absorbed" by the soil) and flows are already elevated due to the preceding events. This "wet" antecedent condition can be modeled as a prolonged RDI/I response (when the model simulation includes multiple events) or as an elevated, antecedent GWI condition (when modeling a single event such as a design storm). Because it is not unusual for large storm events to occur after periods of preceding rainfall, it is common to define a design storm as occurring under "saturated soil" or "wet" antecedent conditions; this approach was applied when defining Santa Clara's selected design storm. Assuming dry or moderately dry soil conditions would be a less conservative approach.

FIGURE 4-4: SPATIAL VARIATION OF RAINFALL THROUGHOUT SANTA CLARA'S SERVICE AREA



Capacity Deficiency Criteria

Capacity deficiency criteria are used to determine if the capacity of an existing sewer facility is exceeded to the extent that a capacity improvement project is needed. These criteria are sometimes called "trigger" criteria, in that they trigger the need for a capacity improvement project. An agency defines its capacity deficiency criteria based on its desired level of service. As such, the criteria vary by agency and are reflective of the level of risk that is acceptable to each agency.

The capacity deficiency criteria differ from the design criteria that are applied to determine the size of a new facility; the latter typically being more conservative. The difference between capacity deficiency criteria and design criteria reflect the concept that some existing facilities can continue to provide adequate, if not optimal, conveyance capacity without undue risk, but new facilities should be designed to a higher standard.

The capacity deficiency criteria utilized for the Master Plan Update to identify capacity deficiencies under both Peak Dry Weather Flow (PDWF) and Peak Wet Weather Flow (PWWF) design flow conditions are summarized in **Table 4-3**. The City's selected criteria were conservative in order to identify all potential projects, recognizing that conditions may change in the future due to variable risk factors (e.g., sewer condition, additional development, climate change). Evaluating system capacity based on conservative criteria provides an "advance warning" of more vulnerable areas of the system that could require deficiencies to be corrected as these future potential risks materialize. All projects identified were prioritized based on the cause and extent of the model-predicted capacity deficiency as discussed in **Section 5**.

TABLE 4-3: CAPACITY DEFICIENCY CRITERIA USED FOR SANTA CLARA MASTER PLAN UPDATE

Facility	Design Flow Condition(s)	Capacity Deficiency Criteria
Gravity Sewer	PDWF or PWWF	No surcharge allowed (d/D[1] ≤ 1.0)
Force Main	PDWF or PWWF	Velocities less than 10 feet per second
Pump Station	PDWF or PWWF	Flows less than firm capacity[2]

[1] Ratio of depth (d) of water to pipe diameter (D), which represents the approximate percent full within a pipe.
[2] Firm capacity is defined as the capacity of the pump station with the largest pump out of service.

For evaluating the performance of existing sewers, a Manning's "n" value of 0.013 was assumed for all pipes, regardless of material or age. Although new pipes, particularly plastic materials, would provide a lower initial roughness factor, it was assumed that over time, a "slime layer" formation on the walls of the pipes and/or other obstructions in the sewer, such as roots, debris, or structural defects, may increase pipe roughness. Therefore, an assumption of 0.013 for all pipes was considered appropriately conservative for master planning purposes.

Note that engineering judgment was used in conjunction with applying the capacity deficiency criteria presented above to identify model-predicted capacity deficiencies in gravity sewers. Gravity sewers that showed only minor criteria violations were not considered deficient if one or more of the following conditions applied:

- Surcharged on one end only (i.e., downstream end caused by backwater);
- Isolated flat pipe segments;
- Invert differences (i.e., offsets) between adjacent pipes;
- Smaller diameter sewers connected to larger diameter pipes at equal inverts; or
- Sewers protected from overflows by a high-level flow diversion or parallel pipe.

Design Criteria

The key design criteria that were applied for the Master Plan Update when developing project solutions to relieve the identified capacity deficiencies are summarized in **Table 4-4**. The City's "Design Criteria" (April 2015)[1], which specify criteria for hydraulic design of sanitary sewer facilities (e.g., pipe material and diameter and roughness for gravity sewers), were referenced to develop the design criteria used for this Master Plan Update.

TABLE 4-4: DESIGN CRITERIA USED FOR SANTA CLARA MASTER PLAN UPDATE

Facility	Component	Design Criteria
Gravity Sewer	d/D Ratio	Less than or equal to 0.75 unless minimum velocities are a concern.
Gravity Sewer	Velocity	Minimum 2 fps during existing peak dry weather flow; maximum 10 fps during design peak wet weather flow.
Gravity Sewer	Diameter	Minimum 8-inch, 10-inch, and 12-inch for residential, commercial, and industrial land uses, respectively; downstream pipes are at least as large as upstream pipes where feasible.
Gravity Sewer	Roughness	Manning's n friction coefficient of 0.013.
Gravity Sewer	Inverts	Match crowns at junctions of side sewers and trunk sewers.
Gravity Sewer	Slope	Determined based on velocity criteria to the extent feasible.
Gravity Sewer	Cover	6 feet from finished grade to sewer crown if feasible.
Gravity Sewer	Material[1]	Lined RCP for 24-inch and larger; VCP for greater than 12- to 24-inch or PVC if approval given by Director of Public Works / City Engineer; VCP or PVC SDR 26 for 12-inch and smaller.
Gravity Sewer	Alignment[2]	Generally, 5-foot offset from street centerline on side opposite the storm drain and 8-foot clear distance separation from all other parallel facilities.
Gravity Sewer	Manhole Placement and Spacing[2]	Located at sewer main or street intersections, at upstream terminal ends of sewer lines, at any change in pipe direction, slope, diameter, or material, and where laterals have the same diameter as the sewer main or are 8 inches or larger. Nominal and maximum manhole spacing shall be 450 and 500 feet, respectively.
Force Main	Velocity	Minimum 3 fps to prevent solids from settling out and maximum 8 fps to prevent excessive head losses in the force main.
Force Main	Cover	6 feet from finished grade to sewer crown if feasible.
Pump Station	Roughness	Hazen-Williams C-value of 100 but must have proper operation at C-value of 120.

[1] Note that material is tracked in the hydraulic model, but roughness values are what impact the hydraulic analysis.
[2] Note that these details were considered for the hydraulic modeling analysis but are generally more applicable to project development during the pre-design stage.

[1] City of Santa Clara's Sanitary Sewer Design Criteria (Section 5) are available online at: https://www.santaclaraca.gov/home/showpublisheddocument/61878/636766631787130000.

4.1.2 Physical Model Network

Two physical model networks were used to evaluate the capacity of the City's sanitary sewer system. One of these networks included future lining assumptions applied to City-identified RCP trunks and VCP siphons within the City's sewer system based on information provided by the City ("Lined Model Network"); the other did not ("Unlined Model Network"). **Section 4.1.2.1** discusses the assumptions applied to the Lined Model Network in more detail.

The following assumptions were applied to the physical model network (both the Lined Model Network and Unlined Model Network):

- A Manning's n of 0.013 was assumed for all pipes in the model, including lined pipes. Lined pipes can initially reduce the friction factor. However, over time, with sedimentation and fouling, the friction factor may increase. Assuming a friction factor of 0.013 for lined pipes therefore represents a conservative assumption.
- The flume diversion structure located at Homestead Road and Lawrence Expressway (Lawrence/Homestead gate structure), which splits the flow to either the eastern sewer on Homestead or the northern sewer on Lawrence Expressway, was modeled assuming a 50% flow split for the capacity evaluation. Therefore, half of the influent sewer flows are sent east to the Homestead sewer and the other half are sent north to the Lawrence sewer. This even flow split assumption was applied for the capacity evaluation because it is the City's normal and desired flow setting at that structure. It should be noted that the model calibration (described in **Section 3.3**) considered both normal settings and a temporary blockage condition which existed during the flow monitoring period but was investigated and cleared by City staff thereafter.
- Pump stations were set up in the model using Archimedean screw pumps, meaning that all the influent sewer flows from the upstream sewer system would be pumped out through the force main at the same flow rate they reach the pump station (i.e., influent flow rate = effluent flow rate). Pump station firm capacities were estimated based on information provided by the City and compared to the model PWWF as described further in **Section 4.4**.
- Non-free-fall (submerged) conditions were assumed at the downstream most discharge structure where the Rabello and Northside force mains outfall to a discharge box structure. Based on information provided by the City, the water level in the structure was set to be eight (8) feet above the crown of the force mains which was the approximate water level during a City field inspection completed on June 19, 2024. At the time of the field inspection, the City noted that the high-water level within the structure appeared to be approximately 13 feet above the crown of the force mains; however, considering it is not known when or how often that condition occurs, it was not used as the design condition.
- Project solutions for the following specific development projects that were already identified and modeled during previous development reviews were included in the appropriate future loading model scenario(s) based on timing:
    - *Patrick Henry Drive (PHD)*: Included in both the near-term future and long-term future model load scenarios. The sanitary sewer improvements within the PHD plan area and the upsize of the Great America Parkway (GAP) West Trunk (from PHD to the Bay Division pipelines crossing) are both to be paid by the developers; therefore, the previously modeled improvements for PHD will not be further discussed in this Master Plan Update or included in the City's Sewer Capacity CIP.

- *Tasman/GAP*: Included in the long-term future model load scenario only. The City is allowing either of two developer-proposed alternatives, one of which (Revised Option 2A) is included in the model. Both alternatives are assumed to be completely at the developer's cost and therefore will not be further discussed in this Master Plan Update or included in the City's Sewer Capacity CIP.
- *Mission College Boulevard*: Included in the long-term future model load scenario only. No separate infrastructure fee area has been established for the Freedom Circle Focus Area; therefore, the previously modeled improvements are presented in this Master Plan Update and will be included in the City's Sewer Capacity CIP.

4.1.2.1 Lined Model Network Assumptions

The Lined Model Network assumes RCP trunks identified by the City to be in poor condition would be lined in future as shown in **Table 4-6** and **Figure 4-5**). The Lined Model Network also assumes that select unlined siphons constructed of either vitrified clay pipe (VCP), cast iron pipe (CIP), or ductile iron pipe (DIP) material would be lined as identified in the table provided as **Appendix H**. The table also includes condition assessment information (i.e., structural quick rating score) from recent CCTV inspections that the City conducted on select siphons between January 2024 and May 2024. The four siphons with the highest severity grade of 4 were part of the group of siphons identified for future lining.

Future lining assumptions were only incorporated into the Lined Model Network, while sewers and siphons already lined were incorporated into both the lined and unlined networks. Gravity sewers and siphons assumed to be lined in the future were assigned a reduced diameter based on an assumed liner thickness and the "FLIN" (future lining) model flag was then applied to the diameter field.

Liner thicknesses, and the corresponding diameter reductions, were calculated based on conservative assumptions. Woodard & Curran referenced information provided by the City from recent lining projects and expertise from condition assessment experts to develop conservative lining assumptions based on the original diameter as shown in **Table 4-5**.

TABLE 4-5: FUTURE LINER THICKNESS ASSUMPTIONS FOR RCP TRUNKS AND SIPHONS (LINED MODEL NETWORK ONLY)[1]

Original Diameter (in)	Assumed Liner Thickness (in)	Assumed Diameter Reduction (in)
12	0.297	0.594
18	0.446	0.892
19	0.471	0.942
20	0.496	0.992
21	0.521	1.042
24	0.596	1.192
27	0.671	1.342
30	0.745	1.49
33	0.82	1.64
36	0.895	1.79
39	0.97	1.94
42	1.046	2.092
53	1.324	2.648

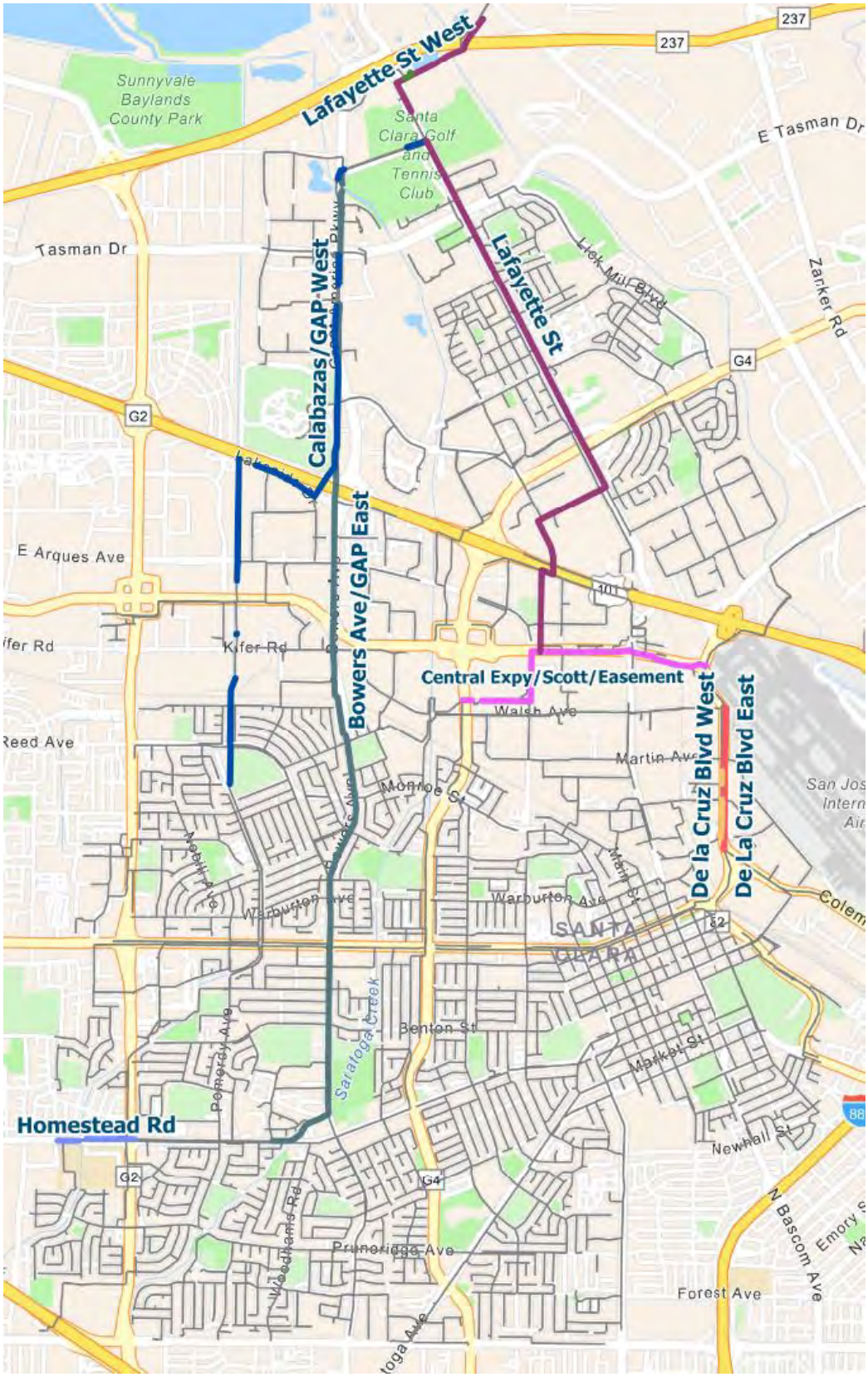
[1] Assumed future liner thicknesses were conservatively calculated based on key assumptions such as host pipe condition, groundwater table, soil properties, etc.

TABLE 4-6: RCP TRUNKS IDENTIFIED FOR FUTURE LINING (LINED MODEL NETWORK ONLY)

Trunk	Lined Section[1]	Original Diameter (in)	Lined Diameter (in)[2]	Capacity Reduction[3]
Homestead	S20-9 to S21-43	27-30	25.7-28.5	12.8%
Calabazas	S52-113 to S83-17	24-33	22.8-31.4	12.8%
Bowers	S22-51 to S83-18	21-33	20-31.4	12.8%
Lafayette	S65-30 to S115-8	24-53	22.8-50.4	12.8%
Central Expressway	S64-44 to S67-21	24-27	22.8-25.7	12.9%
De La Cruz East	S48-11 to S58-2	24	22.8	12.8%
De la Cuz West	S48-2 to S58-14	24	22.8	12.7%
Lafayette West	S114-23 to S114-18	42	39.9	12.8%
GAP E Trunk	S83-18 to S104-30	33-42	31.4-39.9	12.8%
GAP W Trunk	S83-17 to S104-51	30-33	28.5-31.4	12.8%

[1] Upstream to downstream manhole. [2] Rounded to the nearest 0.01-in. [3] Capacity Reduction was calculated as the maximum percent difference of the full capacities of the unlined and lined scenarios.

FIGURE 4-5: RCP TRUNKS IDENTIFIED FOR FUTURE LINING (LINED MODEL NETWORK ONLY)



4.2 Capacity Evaluation Results

The calibrated model was run for existing, near-term future, and long-term future load conditions using both the Unlined Model Network and Lined Model Network to identify areas of the system that fail to meet the specified performance criteria described in **Section 4.1.1**. Areas that fail to meet the specified performance criteria were identified as capacity deficiencies.

This section presents the results of the system capacity evaluation as it relates to the City's gravity sewers (**Section 4.3**) and pump stations and force mains (**Section 4.4**).

4.3 Gravity Sewer System Capacity Deficiencies

All the capacity deficiencies identified in the model for the City's gravity sewer pipes are summarized in **Table 4-7**, including the load scenario, design flow, and physical network conditions that would trigger each deficiency. An overview map showing the locations of all the model-identified capacity deficiencies is provided as **Figure 4-6**. In the figure, pipes shown in pink are predicted to surcharge due to "throttle" conditions, indicating that the full capacity of the pipe is less than the predicted peak flow. Pipes shown in purple are predicted to surcharge due to backwater from a downstream throttle condition. The deficiencies listed in **Table 4-7** are the gravity sewer pipes that would fail to meet the City's specified performance criteria and would therefore need some type of capacity relief, either by increasing their capacity (e.g., upsize to larger diameter) or reducing the flow (e.g., divert flow away from pipe, reducing RDI/I). Project solutions modeled to relieve the identified capacity deficiencies are discussed in **Section 4.5**.

Profiles of the capacity deficient sewers, both before and after project implementation, are provided in **Appendix I**. Profiles are not provided for the specific development projects identified in **Section 4.1.2** that have been previously modeled as part of the development review process (i.e., PHD, Tasman/GAP, Mission College Boulevard). Note that model-predicted surcharging or overflows (depicted in the before profiles) do not necessarily mean that pipes would be capacity deficient at that location, as flows can back up due to downstream capacity limitations and cause surcharging or potential overflows at upstream locations due to backwater. Additionally, although the profiles indicate where modeled surcharging would occur due to backwater versus due to a capacity limitation ("throttle" condition), the results reflect an "unrelieved" system, meaning that peak flows are dampened out in the pipes that are under heavy surcharge or reduced due to overflows. This means that, as upstream deficiencies are relieved through capacity projects, the peak flows reaching downstream pipes would increase, potentially causing additional surcharging or overflows and triggering additional deficiencies and projects. Therefore, it would be necessary to model the project solutions starting upstream and then proceed to review the deficiencies downstream to confirm that any additional downstream deficiencies are addressed, as the system starts to be relieved.

TABLE 4-7: SUMMARY OF MODEL-PREDICTED GRAVITY SEWER CAPACITY DEFICIENCIES

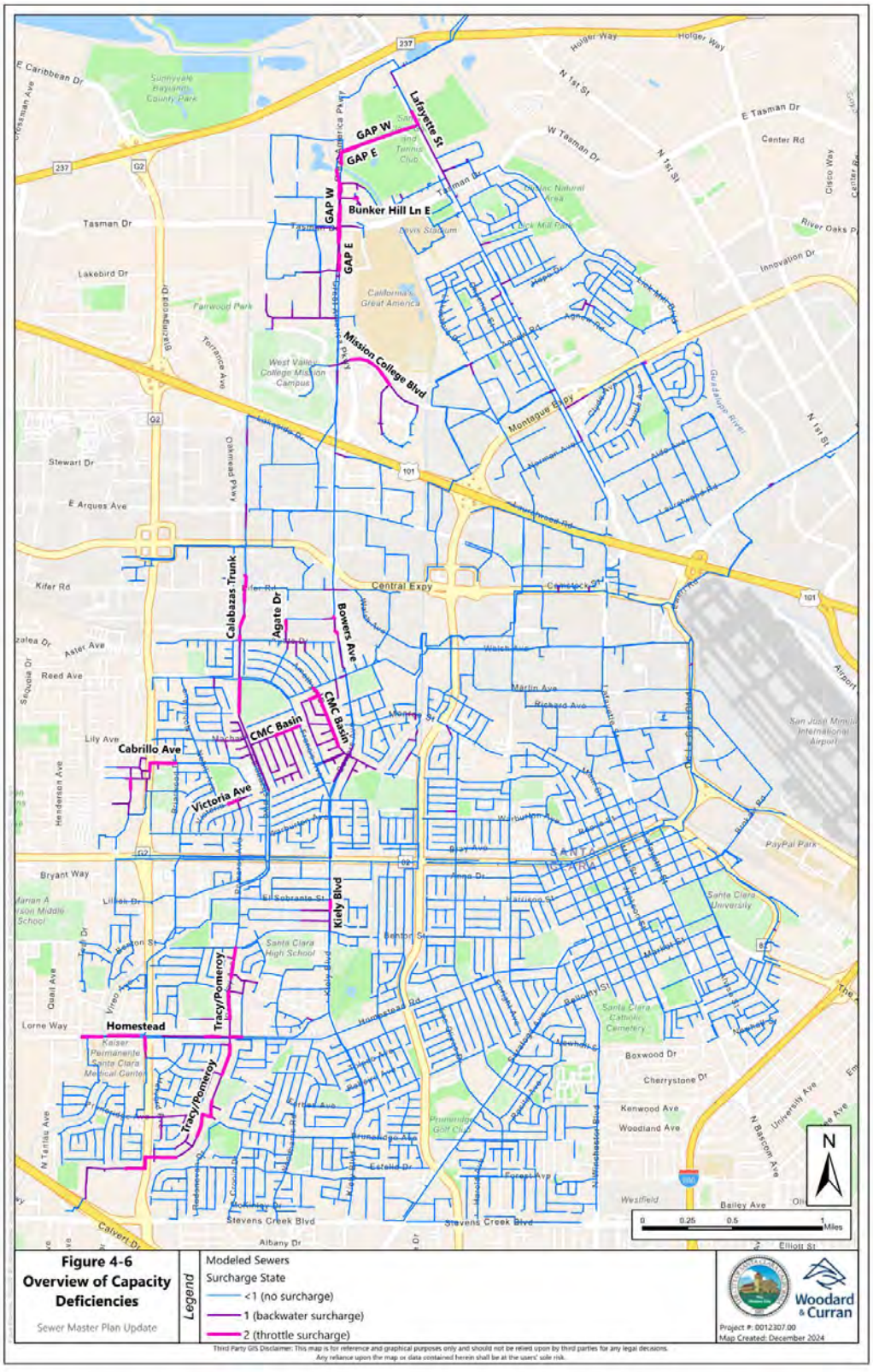
Deficiency Name	Wastewater Flow Trigger[1]			Design Flow Trigger		Network Trigger	
	Existing (EL)	Near-Term Future (NTFL)	Long-Term Future (LTFL)	Dry Weather (DWF)	Wet Weather (WWF)	Unlined (UMN)	Future Lined (LMN)
Tracy/Pomeroy/Homestead/Kiely			✓ (E)	✓		✓	N/A
Homestead Road			✓		✓	✓	N/A
Kiely Boulevard			✓ (GP)		✓	✓	N/A

Deficiency Name	Wastewater Flow Trigger[1]			Design Flow Trigger		Network Trigger	
	Existing (EL)	Near-Term Future (NTFL)	Long-Term Future (LTFL)	Dry Weather (DWF)	Wet Weather (WWF)	Unlined (UMN)	Future Lined (LMN)
Victoria Avenue			✓ (SD, GP)		✓	✓	N/A
Cabrillo Avenue	✓				✓	✓	N/A
CMC Basin	✓				✓	✓	N/A
Bowers Avenue			✓		✓		✓
Calabazas Trunk	✓				✓		✓
Agate Drive			✓ (O[2])		✓	✓	N/A
Mission College Boulevard			✓ (SD)	✓		✓	N/A
PHD		✓ (SD)		✓		✓	N/A
Tasman/GAP			✓ (SD)	✓		✓	N/A
GAP West Trunk			✓		✓	✓	N/A
GAP East Trunk			✓		✓		✓
Bunker Hill Lane East			✓ (E)		✓	✓	N/A
Lafayette Street			✓		✓	✓	N/A

[1] Deficiency cause: SD = Specific Development Project; GP = General Plan; E = Entitlement Flow. O = Other (see notes). If no specific cause is listed, deficiency would be caused by future lining assumption and/or cumulative impacts from upstream due to development and/or relieving upstream capacity constraints.

[2] During wet weather design flows only, Agate Drive deficiency would be triggered because the Calabazas Trunk has insufficient capacity. Flows from Calabazas would backup and overflow to the Agate Drive sewers in the model through manhole S52-4, which is located just upstream of the Agate Drive siphon crossing. However, once the Calabazas Trunk deficiency is relieved, the model runs show that the Agate Drive deficiency would go away. Therefore, **Section 4.5** does not include a capacity improvement project specific to Agate Drive, but **Section 4.6** discusses this area in more detail due to the prolonged RDI/I observed during the flow monitoring program.

FIGURE 4-6: CAPACITY DEFICIENCIES OVERVIEW MAP



4.4 Pump Station and Force Main Capacity Deficiencies

Table 4-8 compares the estimated (theoretical) firm and total capacity of each modeled pump station to the modeled flows under buildout PWWF conditions. The table indicates that all pump stations would have sufficient capacity to convey model-predicted buildout PWWF. The table also indicates that model-predicted force main velocities under buildout PWWF for Westside, Tasman, De La Cruz, Primavera, and Stadium Pump Stations would all be less than the capacity deficiency criteria threshold of 10 fps. Velocities are not reported for the Rabello and Northside Pump Station force mains because sufficient information was not available to reasonably represent the operation of these pump stations and force mains in the model (i.e., City could not confirm settings at the flow split gate structure upstream of the pump stations located at S114-19; City reported that the force main discharge pipes are normally submerged but could not provide monitored level data; actual typical pump operations / pump sequencing is unknown).

It should be noted that the model-predicted PWWFs and force main velocities presented may be slightly underpredicted compared to actual measured flows because of the way that the pumps are modeled; all pump stations are represented in the model network using Archimedean screw pumps, meaning that all the influent sewer flows from the upstream sewer system would be pumped through the force main at the same flow rate they reach the pump station (i.e., influent flow rate = effluent flow rate). Therefore, modeled Archimedean screw pumps mimic the smoother trunk flows coming into the pump station rather than the "peakier" downstream flows created by nature of the pumps turning on and off. However, considering SCADA flow data were not available to compare observed flows to model-predicted flows, this approach was considered to be a reasonable representation of flows and velocities.

TABLE 4-8: SUMMARY OF MODEL-PREDICTED PUMP STATION AND FORCE MAIN CAPACITY DEFICIENCIES

Pump Station (Number of Pumps)	Model-Predicted Buildout PWWF (mgd)[1]	Firm Capacity (mgd)	Total Capacity (mgd)	Force Main Velocity at Buildout PWWF (mgd)[1]	Capacity Deficiency[4]
Westside (2)	0.99	1.55[2]	2.53[2]	4.41	No
Tasman (2)	0.52	1.61[2]	2.34[2]	3.20	No
De La Cruz (2)	0.64	1.61[2]	2.52[2]	2.92	No
Primavera (6)	2.65	5.72[2]	6.39[2]	7.9	No
Stadium (6)	0.66	2.56[2]	2.68[2]	4.78	No
Rabello (8)	44.8	25.4[3]	27.9[5]	-	No
Northside (4)		19.8[3]	21.3[5]	-	No

[1] Model Buildout PWWF values and force main velocities reported are from the long-term future load scenario using the Lined Model Network and the relieved system (assuming project solutions have been implemented). mgd = million gallons per day.

[2] Theoretical firm and total capacities were estimated for Westside, Tasman, De La Cruz, Primavera, and Stadium Pump Stations based on basic information, pump settings, pump curves, and system curves provided by the City. Refer to **Appendix D** for detailed calculations for each pump station.

[3] Theoretical firm capacities for Rabello and Northside Pump Stations were estimated by Schaaf & Wheeler Consulting Civil Engineers (S&W) as reported in a memorandum titled "Northside and Rabello Pump Station Firm Capacity Evaluation", dated July 5, 2022.

[4] A capacity deficiency would be identified for cases where model-predicted PWWF exceeds the theoretical firm capacity or where force main velocity during PWWF exceeds 10 fps (refer to **Table 4-3** for the capacity deficiency criteria).

[5] Theoretical total capacities for Rabello and Northside Pump Stations were estimated using excel spreadsheet tools developed by Schaaf & Wheeler as part of the firm capacity study (refer to footnote 3). System curves for total capacities were estimated based on inferred data because Schaaf & Wheeler did not collect test points with all pumps running.

4.5 Capacity Improvement Projects

This section presents the capacity improvement projects that were identified for the City's sanitary sewer system based on the results of the performance evaluation described in **Sections 4.3** and **4.4**. An overview map showing the locations of all the model-identified capacity improvement projects is provided as **Figure 4-7**.

For most of the gravity sewer capacity deficiencies identified in **Table 4-7**, a project was developed to either replace the existing pipe with a larger pipe or redirect flows to other existing sewers with adequate available capacity. The PHD and Tasman/GAP projects were already modeled during the development review process and will be paid for by the developers (as discussed in **Sections 4.1.2** and **5.6**); these projects will not be included in the Master Plan Update's Sewer Capacity CIP but are still included in **Table 4-9** for reference. The Mission College Boulevard project is also included in **Table 4-9** and discussed below; no separate infrastructure fee area has been established for the Freedom Circle Focus Area, so the previously modeled improvements are included in the City's Sewer Capacity CIP. Additionally, a specific project was not identified to address the Agate Drive deficiency because model runs showed that this deficiency would be relieved once the Calabazas Trunk project was implemented to relieve existing capacity constraints within the Calabazas Trunk. The assumptions used to define the capacity improvement projects, including the design criteria applied (refer to **Section 4.1.1** for more detail), are discussed briefly below.

Replacement pipes were sized to convey the buildout PWWF using the Lined Model Network with a maximum d/D ratio of 0.75; some exceptions were made to allow a slightly higher d/D ratio (always less than 1) to avoid oversizing isolated, flat segments just to meet this criterion. Existing pipe slopes and depths were preserved when upsizing sewers in-place. Projects that included re-sloping (i.e., replacing the existing pipe at a different slope) are identified as such in the project descriptions. Diameters were increased as minimally as possible to prevent oversizing and subsequent low velocities during dry weather conditions, while also considering standard pipe sizes.

Iterative model runs with all capacity improvement projects in place were performed to verify that no additional sewer system capacity deficiencies would occur after upstream capacity improvements were implemented and to review the flow and capacity of the pump stations in the sewer system. These model runs assessed the cumulative impact of increased capacity from upstream projects on peak flows in pipes downstream. Therefore, project solutions for the GAP West and GAP East Trunks were modeled last.

The recommended capacity improvement projects are all listed in **Table 4-9** and discussed in more detail in the following subsections. In total, the table presents fifteen (15) capacity improvement projects which were identified as part of this Master Plan Update. Each project is documented in further detail in **Appendix I** with an individual plan view map and profile views of the impacted sewers before and after project implementation. Project prioritization and planning-level capital cost estimates were prepared for each of the thirteen (13) recommended projects to be funded by the City and included in its Sewer Capacity CIP; these are presented in **Section 5** of this report.

FIGURE 4-7: CAPACITY IMPROVEMENT PROJECTS OVERVIEW MAP

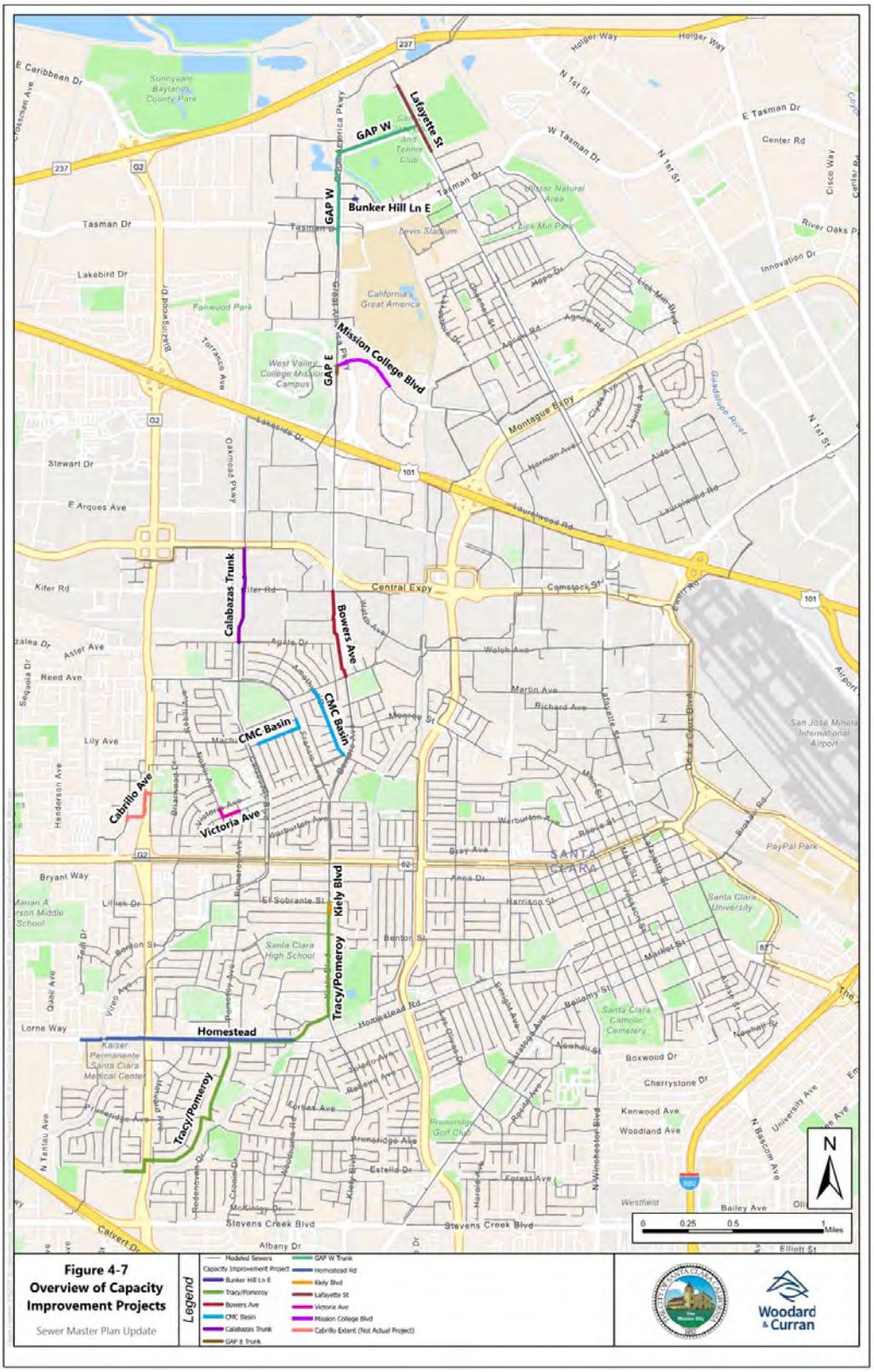


TABLE 4-9: SUMMARY OF CAPACITY IMPROVEMENT PROJECTS

Project	Triggers[1]	Project Details					
		MH IDs (US - DS)	Length (LF)[2]	Pre-Project Diameters (in)[3]	Post-Project Diameters (in)[3]	New Weirs	Location & Description
1. Tracy/Pomeroy/ Homestead/Kiely (*Section 0)*	LTFL DWF UMN	S10-77 - S33-33	12,313	10, 21, 24	15, 24, 27	S22-55	Tracy Dr, Pomeroy Ave, Homestead Rd (S Trunk), Kiely Blvd
2. Homestead Road (*Section 4.5.2)*	LTFL WWF UMN	S20-9 - S23-18 (excluding siphon)	6,407	18, 27, 30	24, 30, 33	S20-16	N Homestead Trunk from Swallow Wy to Saratoga Creek
3. Kiely Boulevard (*Section 4.5.3)*	LTFL WWF UMN	S33-42 - S33-35	270	8	10	-	Orthello Wy to S of El Sobrante St
4. Victoria Avenue (*Section 4.5.4)*	LTFL WWF UMN	S42-113 - S42-36	765	8	10	-	Fowler Ave & Pomeroy Ave to Nobili Ave & Victoria Ave
5. Cabrillo Avenue (*Section 4.5.5)*	EL WWF UMN	-	-	-	-	S40-16, S41-38	Halford Ave & Buckley St; St. Lawrence Dr, W of Lawrence Expwy
6. CMC Basin (*Section 4.5.6)*	EL WWF UMN	S52-104 - S52-80 S43-14 - S53-103	3,655	8	12, 15	-	Santa Maria Ave & Francis Ave; Amethyst Dr
7. Bowers Avenue (*Section 4.5.7)*	LTFL WWF LMN	S53-34 - S63-20	2,605	25.7	30	-	Chromite Dr to Walsh Ave
8. Calabazas Trunk (*Section 4.5.8)*	EL WWF LMN	S52-4 - S62-31 S62-31 - S62-10 S62-37 - S62-38	2,760[4]	22.8, 24, 27	18, 27	-	Calabazas Creek from S of Agate Dr to Central Expwy
9. Mission College Boulevard (*Section 4.5.9)*	LTFL DWF UMN	S84-12 - S83-18	1,885[5]	12	15	-	Mission College Blvd from Freedom Cir to west of Great America Pkwy

Project	Triggers[1]	Project Details					
		MH IDs (US - DS)	Length (LF)[2]	Pre-Project Diameters (in)[3]	Post-Project Diameters (in)[3]	New Weirs	Location & Description
10. Patrick Henry Drive (PHD)[6]	LTFL DWF UMN	S92-16 – S93-50	6,185	-	6-39	-	Patrick Henry Drive and Great America Parkway.
11. Tasman/GAP[6]	LTFL DWF UMN	S92-15 – PHD-11	6,560	-	12-15	-	West Tasman Drive and Great America Parkway.
12. GAP West Trunk (*Section 4.5.10)*	LTFL WWF UMN	S93-42 - S104-19 (excluding siphon)	4,810	28.5-35.7	36, 42	-	S of West Tasman Dr to Lafayette St
13. GAP East Trunk (*Section 4.5.11)*	LTFL WWF LMN	S83-20 to S83-18	231	31.4	39	-	Old Glory Ln to S of Bunker Hill Ln; Stars and Stripes Dr
14. Bunker Hill Lane East (*Section 4.5.12)*	LTFL WWF UMN	S93-10 - S93-7	110	6	8	-	E of Great America Pkwy
15. Lafayette Street (*Section 4.5.13)*	LTFL WWF UMN	S104-29 - S104-8	2,290[5]	34.2, 40.3, 42	42, 48	-	N of Calle del Mundo to S of Great America Wy

[1] Triggers include: EL = Existing Loads; NTFL = Near-Term Future Loads; LTFL = Long-Term Future Loads; DWF = Dry Weather Flows; WWF = Wet Weather Flows; UMN = Unlined Model Network; LMN = Lined Model Network.

[2] Length of sewers included in upsizing project, rounded up to the nearest 5 linear feet (LF).

[3] Range of pipe diameters included in the project. If the project sewers were identified for future lining, the pre-project diameters represent the future lined diameter assumption that was applied to the Lined Model Network which may be different from the existing diameters that exist in the field.

[4] Includes length of sewers to be re-sloped and new parallel sewer segment. [5] Includes length of sewers to be re-sloped.

[6] Proposed project to be paid for by the Mission Point developer.

4.5.1 Tracy/Pomeroy/Homestead/Kiely

The Tracy/Pomeroy/Homestead/Kiely capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during dry weather conditions, in the Unlined Model Network (as indicated in **Table 4-7**).

The recommended project includes replacement of 12,557 LF of 10-, 21-, and 24-inch pipe with 15-, 24-, and 27-inch pipe along Tracy Drive, Pruneridge Avenue, Pomeroy Avenue, Homestead Road (South Homestead Trunk), Saratoga Creek, and Kiely Boulevard (from manhole S10-79 to S33-33). The recommended project also includes installation of a weir at manhole S22-55 to divert the influent flows from Homestead Road South Trunk and Pomeroy Avenue sewers to the Homestead Road South Trunk, which would be upsized as part of the project. The recommended project would maximize capacity in the Homestead Road South Trunk and send as much flow as possible to an upsized Bowers Avenue Trunk.

An alternative involving diverting flows to the larger diameter Homestead Road North Trunk instead of the South Trunk was also preliminarily considered and investigated. However, pipe condition data provided by the City showed that the Homestead Road South Trunk was known to be in worse condition; this pipe had defect scores of 4 or 5 (assigned based on the severity of the worst defect detected) along the stretch of pipe that would be upsized. Therefore, the recommended alternative includes upsizing of the Homestead Road South Trunk. Moreover, it should be noted that a capacity improvement project was also identified for the Homestead Road North Trunk and is discussed in **Section 4.5.2**.

The primary reason for this capacity deficiency is a historic entitlement flow of 0.95 mgd associated with Parcel APN 316-17-018 located at 5301 Stevens Creek Boulevard (current owner Agilent Technologies). This entitlement flow is significantly greater than the company's recent historical water usage of approximately 0.02 mgd[1]. Implementing this project in the near term would result in oversized sewers where the daily flow is not sufficient to provide the minimum cleaning velocity and thus could create potential debris and odor issues. However, the City should implement the Tracy/Pomeroy/Homestead/Kiely capacity improvement project to address the potential capacity deficiency before the parcel begins to discharge its entitled flow of 0.95 mgd. Based on model runs, the maximum flow that Agilent could discharge before the capacity project would be needed is approximately 0.23 mgd; the deficiency would first occur in the sewers along Pomeroy Avenue, south of Homestead Road.

4.5.2 Homestead Road

The Homestead Road capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Unlined Model Network. The long-term future loads scenario assumes that the Cupertino Sanitary District (CuSD) discharges a future flow to the City's sanitary sewer system up to its current contractual limit (13.8 mgd), which contributes to the deficiency identified in the Homestead Road sewers.

The recommended project includes replacement of 6,565 LF of 18-inch, 27-inch, and 30-inch pipe with 24-inch, 30-inch, and 33-inch pipe along Homestead Road from Swallow Way to Saratoga Creek (from manhole S20-9 to S23-18). The proposed upsizing project that was modeled maintains the existing pipe slopes; however, if feasible, the City may wish to evaluate alternatives during preliminary design that would re-

[1] Based on winter season billing data from 2019-2022. Annual water billing data from 2021 and 2022 suggest that the annual flow may be as high as 0.07 mgd.

slope and steepen the flatter pipe segments (i.e., proposed 33-inch pipes between manholes S20-18 and S21-43). It should be noted that the proposed project does not include improvements to the siphon between manhole S20-26 and S20-18 because the siphon would not be capacity deficient. Per the City's records, that siphon is not currently lined and is made of polyethylene with an internal diameter of 20.2 inches; therefore, it was not assumed for future lining in the Lined Model Network based on the material classification.

The recommended project also includes installation of a weir at manhole S20-16 to divert as much flow as possible to maximize the available capacity within the upsized Homestead Road South Trunk (refer to description of the Tracy/Pomeroy/Homestead/Kiely project in **Section 4.5.1**). The Homestead Road and Tracy/Pomeroy/Homestead/Kiely capacity improvement projects would work together to maximize capacity within both trunks along Homestead Road to send as much flow as possible to an upsized Bowers Avenue Trunk. This approach targets replacement efforts to older pipelines assumed to be in worse condition and diverts flow away from the Calabazas Trunk, which is relatively shallow in some locations (i.e., at higher risk of sewer overflows) and also had capacity issues during wet weather flows which were first identified under existing loading conditions using the Lined Model Network and under near-term loading conditions in the Unlined Model Network (refer to **Section 4.5.8** for discussion of the Calabazas Trunk project). Although the Homestead Road and Tracy/Pomeroy/Homestead/Kiely projects will work together to solve both deficiencies, the two deficiencies are not dependent of each other, meaning that if Agilent never discharges its entitled flow (i.e. The Tracy/Pomeroy/Homestead/Kiely deficiency does not occur), the improvements to the Homestead Road trunk are still needed.

4.5.3 Kiely Boulevard

The Kiely Boulevard capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Unlined Model Network. Simulation results show that the capacity deficiency is caused by cumulative impacts of increased discharges from General Plan parcels (discussed in **Section 2.2.2.2**), specifically parcels draining to the Homestead Road North Trunk and the sewer along Brookdale Drive.

The recommended project includes upsizing of one 270 LF segment of 8-inch pipe to 10-inch pipe on Kiely Boulevard from Orthello Way to south of El Sobrante Street (from manhole S32-42 to S33-35).

4.5.4 Victoria Avenue

The Victoria Avenue capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Unlined Model Network. According to the simulation results, the capacity deficiency is caused by cumulative impacts of increased discharges from the El Camino Real Specific Plan and General Plan parcels, specifically parcels draining to the sewers on the north side of El Camino Real and along Warburton Avenue.

The recommended project includes upsizing and re-sloping of 515 LF of 8-inch pipe to 10-inch pipe on Fowler Avenue from Pomeroy Avenue to Nobili Avenue and installation of 250 LF of new 10-inch pipe on Nobili Avenue from Fowler Avenue to Victoria Avenue (from manhole S42-113 to S42-36). The project also would include abandoning 255 LF of existing 8-inch sewer between Fowler Avenue and Victoria Avenue (from manhole S42-48 to S42-36), which crosses through an easement underneath single-family residential parcels.

The recommended project is an alternative solution to the project that was preliminarily modeled, which included upsizing of only two pipe segments along Victoria Avenue from Pomeroy Avenue to Nobili Avenue

(from manhole S42-36 to S42-113). However, upon further review and based on discussions with the City, the alternative was expanded so that the pipe located within the existing easement could be abandoned.

This project solution does not include two pipe segments between manholes S42-113 and S41-53, because they would have adequate capacity based on the City's capacity criteria (no surcharge), thus they were not included in the proposed project. However, considering these pipe segments are located between the Victoria Avenue proposed project and the recently upsized section downstream of manhole S41-53, the City may wish to consider expanding the project to include these pipes during preliminary design.

4.5.5 Cabrillo Avenue

The Cabrillo Avenue capacity improvement project would relieve the surcharge capacity deficiency first triggered in the Unlined Model Network under existing sewer loads during wet weather conditions. Note that the capacity deficiency is also triggered during dry weather conditions but only under long-term future loads.

The recommended project includes installation of two weirs (at manhole S40-16 and S41-38) to divert as much flow as possible away from the capacity deficient sewers along Cabrillo Avenue and maximize use of available capacity within adjacent existing sewers. The first weir would be installed in manhole S40-16 at the intersection of Halford Avenue and Buckley Street and would divert flow east through the sewers along Buckley Street and away from the sewers to the north along Halford Avenue that eventually drain to Cabrillo Avenue. The second weir, which would be located downstream of the first weir, would be installed in manhole S41-38 at the intersection of Lawrence Expressway and Saint Lawrence Drive and would continue to divert flow east through the sewers along Saint Lawrence Drive and away from the sewers to the north that eventually drain to Cabrillo Avenue. Model simulation results suggest a maximum change in d/D of 28% (from 37% to 65% full) in the sections downstream of the weirs. However, with flows diverted away from Cabrillo Avenue through these two new weirs, the capacity deficiency along Cabrillo Avenue would be eliminated.

An alternative solution was preliminarily modeled to upsize existing 8-inch pipes to 12-inch along Cabrillo Avenue (from manhole S41-13 to S41-20) and one pipe segment on Lawrence Expressway from 8-inch to 10-inch; however, the City preferred the recommended solution which avoids the need for pipe replacement. Additionally, any pipe replacement along Lawrence Expressway would require obtaining a permit from Santa Clara County, which would add cost and complexity to the project.

4.5.6 CMC Basin

The CMC Basin capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under existing sewer loads, during wet weather conditions, in the Unlined Model Network.

The recommended upsizing project includes replacement of approximately 3,655 LF of 8-inch pipe with 12-inch pipe along Amethyst Drive (from manhole S43-14 to S53-103) and 15-inch pipe along Santa Maria Avenue and Francis Avenue (from manhole S52-104 to S52-80).

Although the model runs show that the recommended upsizing project would meet the City's d/D design criteria under PWWF as shown in the project solution profile presented in **Appendix I**, it would not meet the City's velocity design criteria under PDWF (i.e., minimum of 2 fps) within the upsized 12-inch pipe segments between S43-14 and S53-103 on Amethyst Drive and the upsized 15-inch pipe segments between S52-104 and S53-74 on Santa Maria Avenue. These criteria often come into conflict with one another because increasing the size of the pipe to meet the required maximum d/D criterion under a relatively short-

duration PWWF condition means that the pipe will experience lower velocities during normal dry weather conditions which occur much more often.

Flow meters within the CMC Basin tributary area exhibited a very high RDI/I response during the monitoring program. Therefore, it is recommended that the City conduct I/I investigations prior to project implementation to attempt to pinpoint and eliminate significant sources of excessive I/I within the CMC Basin, if possible. However, model runs show that the RDI/I would need to be reduced by at least 50% to 60% to eliminate the capacity deficiency. Refer to **Section 4.6** for a more detailed discussion on I/I, including source detection and control methods and previous investigations and recommendations for Santa Clara.

4.5.7 Bowers Avenue

The Bowers Avenue capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Lined Model Network only. The capacity deficiency would be caused by the assumed future lining of the Bowers Trunk, which the City identified as a RCP sewer.

The recommended upsizing project includes replacement of approximately 2,605 LF of existing 27-inch pipe (25.7-inch with assumed future lining) with 30-inch pipe along Bowers Avenue (from manhole S53-34 to S63-20) from Chromite Drive to Walsh Avenue. The project profile in **Appendix I** shows that the downstream end of the downstream-most pipe segment included in the proposed project (from manhole S63-26 to S63-20) would exceed the City's 0.75 maximum d/D design criterion under PWWF; however, the pipe was not upsized because the resulting d/D ratio was still less than 1 and the City preferred to keep diameters consistent rather than upsize one isolated pipe segment just to meet the d/D design criterion.

4.5.8 Calabazas Trunk

The Calabazas Trunk capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under existing sewer loads, during wet weather conditions, in the Lined Model Network. The capacity deficiency also appears in the Unlined Model Network under near-term and long-term future loads during wet weather flow conditions.

The recommended project includes upsizing of approximately 2,000 LF of existing 22.8 – 27-inch pipes along Calabazas Creek (from manhole S52-4 to S62-10) from south of Agate Drive to Central Expressway. It should be noted that the recommended project includes pipe segments that are already lined between manhole S62-51 and S62-32. The Lined Model Network assumes existing, unlined 27-inch RCP pipes would be lined resulting in a diameter of 25.7-inch. Roughly 750 LF of pipe between manhole S62-31 and S62-10 of the 2,000 LF that would be upsized to 27-inch would also be re-sloped. In addition to upsizing and re-sloping, the project includes installation of a new 18-inch pipe between manhole S62-37 and S62-38 that runs parallel to the existing sewer to relieve the capacity restriction at that location due to a storm drain crossing north of Kifer Road.

The model runs show that the Calabazas Trunk project would eliminate the overflow diversion from the Calabazas Trunk into the Agate Drive sewers at manhole S52-4, which is located just upstream of the Agate Drive siphon crossing. Therefore, the Calabazas Trunk project solution would eliminate the Agate Drive capacity deficiency so that no additional project would be required for Agate Drive.

4.5.9 Mission College Boulevard

The Mission College Boulevard capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during dry weather conditions,

in the Unlined Model Network. The capacity deficiency would be caused by increased flows from the Freedom Circle Focus Area specific development project that would discharge into the City's sewers along Freedom Circle Drive and Mission College Boulevard. This project was previously modeled during the development review process but is still identified as a Master Plan Update project to be included in the City's Sewer Capacity CIP. The recommended project is a slight modification of the project identified during the development review and includes re-sloping to meet the City's design criteria d/D (maximum of 0.75 during PWWF).

The recommended upsizing project includes replacement and re-sloping of 1,885 LF of 12-inch pipe and 15-inch pipe with 15-inch pipe along Mission College Boulevard (from manhole S84-12 - S83-18) from Freedom Circle Drive to west of Great America Parkway. The downstream most segment of the project (from manhole S83-13 to S83-18) was assumed to connect to the GAP East trunk at equal crown elevations to minimize impacts from the GAP East trunk hydraulics.

4.5.10 GAP West Trunk

The GAP West Trunk capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Unlined Model Network. The GAP West Trunk sits lower than the GAP East Trunk, to which it is interconnected, and therefore reaches capacity first. However, a capacity deficiency project was also identified for the GAP East Trunk (triggered by the Lined Model Network only) and is discussed further in **Section 4.5.11**. Considering that the capacity deficient sewers are located towards the downstream end of the City's sewer system, the capacity deficiency would likely be caused by the cumulative impacts of long-term future loads on the system combined with wet weather conditions. The deficiency would be slightly exacerbated with assumed future lining of the GAP West Trunk, which the City identified as a RCP sewer.

The recommended upsizing project includes replacement of approximately 4,810 LF of existing 28.8-31.7-inch pipe (already lined), 30-inch pipe, and 33-inch pipe with 36-inch and 42-inch pipe along Great America and the easement north of Stars and Stripes Drive (from manhole S93-42 to S104-19) from south of West Tasman Drive to Lafayette Street. The recommended project does not include improvements to the existing siphon between manhole S103-19 and S103-16, because the simulation results do not predict this siphon to be deficient. It should be noted that this siphon was assumed to be lined in the future as part of the Lined Model Network, but it is not currently lined. Even with the reduced diameter assumed based on future lining, the siphon would not be capacity deficient. However, the City may wish to consider evaluating alternatives during preliminary design that would replace or remove this siphon that crosses under the San Tomas Aquino Creek, if feasible.

It should also be noted that the project does not include the GAP West Trunk improvements associated with the PHD development. The cost to upsize the GAP West Trunk from the PHD specific development project's discharge point to the Bay Division pipelines crossing (from manhole S83-5 to S93-53) is to be paid by the developers as discussed in **Section 4.1.2**; therefore, this portion of the project is not included in the Master Plan Update and will not be reflected in the City's Sewer Capacity CIP. The Master Plan Update and Sewer Capacity CIP will only include the GAP West Trunk capacity improvements located downstream (north of Old Glory Lane) and which are not part of the PHD agreement. There are, however, two pipe segments between manholes S93-48 and S93-42 that are downstream of the PHD project and the GAP West project that would still have capacity based on the City's capacity criteria of no surcharge. They are not included in the proposed project, but the City may wish to consider expanding the project to include them during preliminary design.

4.5.11 GAP East Trunk

The GAP East Trunk capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Lined Model Network only because the City identified the GAP East Trunk as a RCP sewer. Therefore, the capacity deficiency would not be triggered in the Unlined Model Network. Considering the capacity deficient sewers are located at the downstream end of the City's sewer system, the deficiency is due to the combined effects of the assumed future lining plus long-term future loads plus wet weather conditions.

The recommended upsizing project includes replacement of approximately 230 LF of existing 33-inch (assumed lined inside diameter of 31.4-inches) to 39-inch pipe from manhole S83-20 to S83-18 (at the manhole connecting the Freedom Circle trunk with the GAP East Trunk). The scope of the recommended improvement project is minimal because simulation results show that the recommended improvements to the GAP West Trunk (discussed in **Section 4.5.10**) would relieve most of the deficiencies in the GAP East Trunk.

4.5.12 Bunker Hill Lane East

The Bunker Hill Lane East capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Unlined Model Network. The primary cause of the capacity deficiency is due to historic entitlements held by parcel APNs 104-55-012 and 104-55-013 (located near Bunker Hill Lane and east of Great America Parkway by the Santa Clara Convention Center). Combined, these two parcels are entitled to discharge up to 0.27 mgd into the City's sewer system.

Assuming that the entitlement flow would be loaded to the City's sewer system, the existing 6-inch sewers between manhole S93-13 and S93-7 would be surcharged during PWWF conditions (as shown in the profile provided in **Appendix I**); specifically, the sewer between manhole S93-10 and S93-7 would be capacity deficient and would need to be upsized to convey the flow. Therefore, the recommended project includes replacement of the existing 6-inch pipe that would experience the throttle surcharge (between manhole S93-10 and S93-7) with approximately 110 LF of 8-inch pipe. The project solution profile in **Appendix I** shows that the pipe segment immediately downstream of the pipe to be upsized would still be surcharged at the downstream end. However, this model-predicted surcharge is a backwater surcharge on one end only that is caused by the hydraulic grade line from the connection to the larger diameter GAP East Trunk. Prior to project implementation, the City should verify the inverts of sewers along the project alignment and at the downstream connection to the GAP East trunk sewer.

This project should not be implemented until these parcels begin to discharge their entitled flow.

4.5.13 Lafayette Street

The Lafayette Street capacity improvement project would relieve the surcharge capacity deficiency first triggered in the model under long-term future sewer loads, during wet weather conditions, in the Unlined Model Network. Considering the capacity deficient sewers are located towards the downstream end of the City's sewer system, the capacity deficiency would likely be caused by the cumulative impacts of long-term future loads on the system combined with wet weather conditions. The deficiency would be slightly exacerbated with assumed future lining of the Lafayette Trunk, which the City identified as a RCP sewer.

The recommended upsizing project includes replacement of approximately 2,290 LF of existing 36-inch (34.2-inch with assumed future lining), 40.3-inch pipe (already lined), and 42-inch pipe with 42-inch and 48-inch pipe along Lafayette Street (from manhole S104-29 to S104-8) from north of Calle del Mundo to south

of Great America Way. The project also includes some re-sloping of the existing pipe segments from manhole S104-22 to S104-14; per record information, the existing slope is minimal at approximately 0.02%.

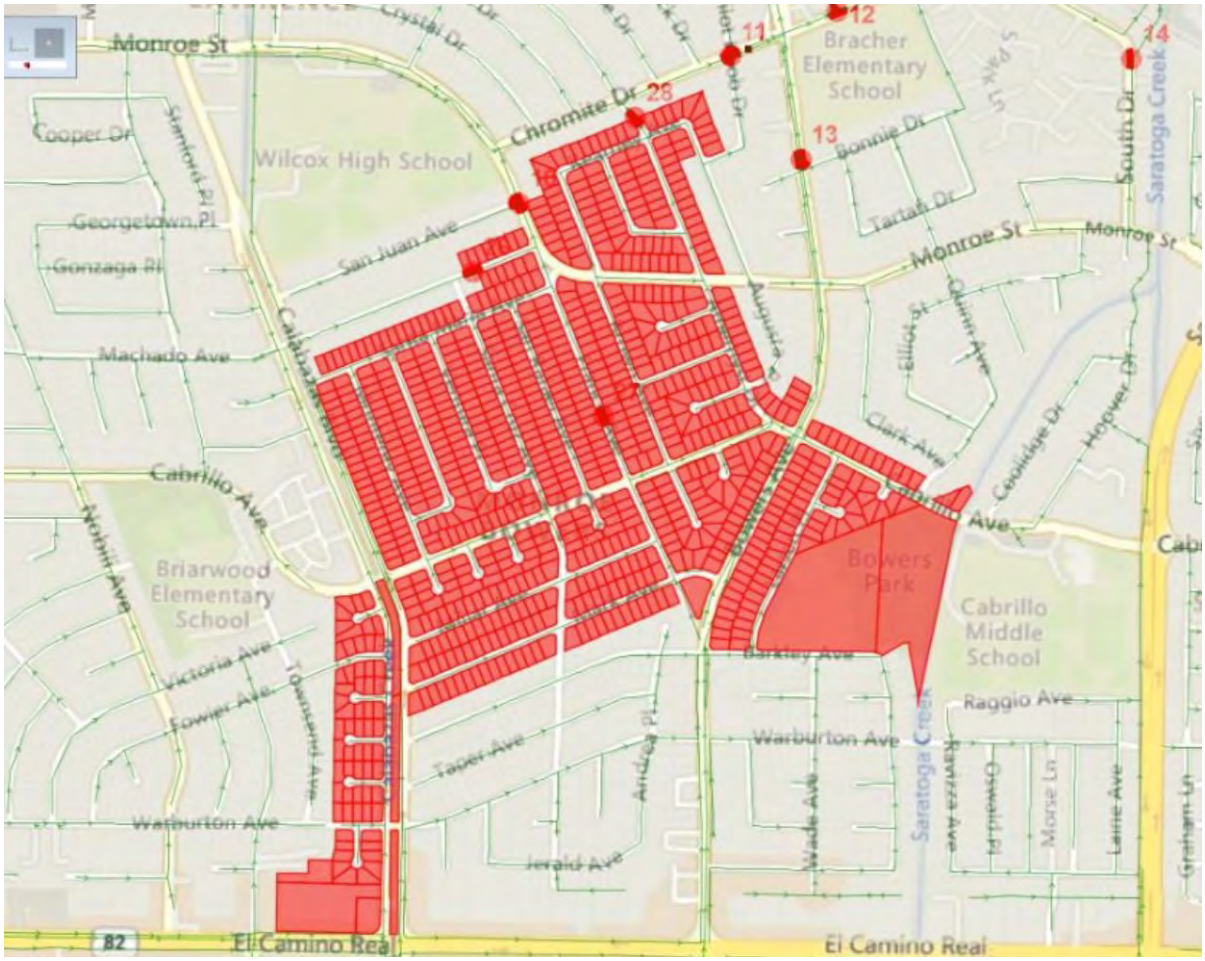
4.6 Infiltration and Inflow Discussion

There are various methods for characterizing the relative contributions of RDI/I from different areas of the sewer system. Because the critical issue with respect to RDI/I is the impact that peak flows have on the system, the focus is on characterizing peak RDI/I in particular. Potential approaches to quantify peak RDI/I include: the ratio of PWWF to average dry weather flow (ADWF), referred to as the wet weather peaking factor; peak RDI/I per acre of contributing area; and peak RDI/I per foot of pipe; where PWWF and peak RDI/I are based on design storm flows. The RDI/I response can be characterized for each metered basin based on these parameters.

4.6.1 Completed Infiltration and Inflow Investigations

Based on the flow monitoring data collected during the winter 2022-2023 season and as discussed in **Sections 2.1** and **3.5.2.1**, a very high RDI/I response was observed within the flow meter (FM) basins in the CMC tributary area, the extent of which is shown in **Figure 4-8**.

FIGURE 4-8: CMC BASIN TRIBUTARY AREA



During the flow monitoring period, wet weather peaking factors of 23.5 and 17.0 were observed in the FM 27 and FM 28 basins, respectively; these peaking factors (presented in **Section 3.5.2**) were much higher than the peaking factors observed in other FM basins throughout the City which, when averaged together not including FM 27, FM 28, and FM 4 (Levis stadium flows), were approximately 3.4. The adjacent Agate Drive tributary area (FM 31) also showed a significant and sustained response to rainfall. The nature of the responses at FM 27 and FM 31 were indicative of significant infiltration, as the response was generally slower and took a long time to recede (i.e., several weeks following rainfall). Moreover, because several consecutive rainfall events occurred within a short period of time during the flow monitoring period, the infiltration response did not fully recede before another rainfall event occurred. For example, the FM 31 data indicate that depth of flow did not return to baseline levels in between rainfall events from December 27, 2023, and January 19, 2024, as shown in **Figure 4-9**. Based on NOAA rainfall statistics (refer to **Figure 4-10**), actual rainfall observed during the wet weather monitoring season was greater than a 10-yr event for longer durations (10+ days).

FIGURE 4-9: OBSERVED FLOW MONITORING DATA AT FM 31 (S62-50, 10")

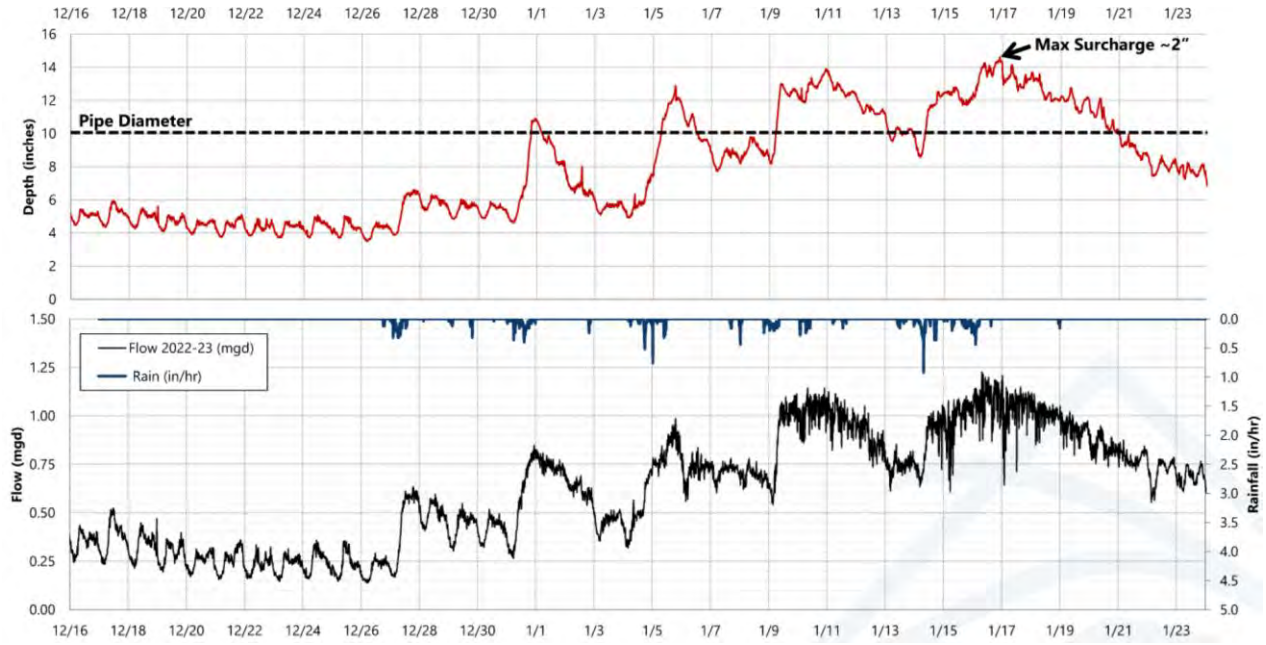
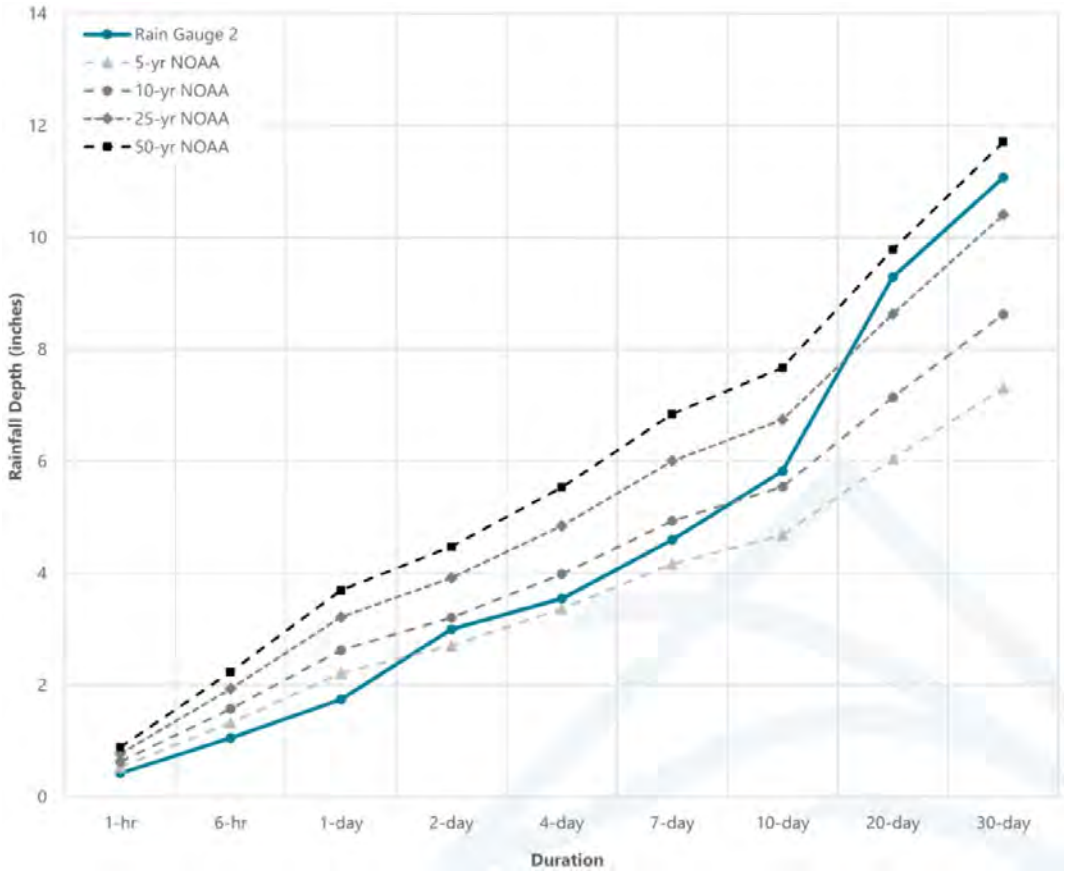


FIGURE 4-10: NOAA RAINFALL STATISTICS COMPARED TO OBSERVED JANUARY 2023 RAINFALL IN SANTA CLARA, CA



The flow monitoring results are consistent with the findings of other field investigations that V&A recently completed in the CMC basin as discussed in **Section 3.5.2.1**. V&A's associated report recommended that the City consider smoke testing in the CMC basin, which may better identify lateral defects.

4.6.2 I/I Source Detection and Control Methods

A necessary step in identifying potential I/I control measures is a realistic assessment of the actual sources of I/I in the sewer system. Based on the pattern and magnitude of flows in the City's sewer system, the likely sources of RDI/I flows are defects in sewers and service laterals, and possibly some direct connections (e.g., illegally connected roof and area drains, direct connections from the storm drain system, etc.). Appropriate I/I control methods depend on the type and sources of I/I. Control methods must include detection as well as correction.

Direct Inflow Sources

Direct inflow sources can contribute significantly to both volume and peak rates of I/I and have the greatest probability of being cost effective to eliminate. The main methods used to detect and locate direct inflow sources are smoke and dye testing (dye testing is used primarily as a confirmatory test). Smoke testing is considered to be a relatively easy and inexpensive method (cost is approximately $1.00 to $1.25 per foot if a substantial length of pipe is tested), and discovery of just a few direct storm drain cross-connections, for example, can make the effort worthwhile. However, unless there is some indication or knowledge of the

existence of direct connections in the system, finding them may require an extensive smoke testing program, which requires public notification measures and access to private property to document the smoke returns. For this reason, smoke testing is generally targeted at specific areas with high peak RDI/I rates.

Generally, the most numerous types of sources found during smoke testing are not direct inflow connections but defects in shallow pipes, primarily laterals. Rehabilitation of laterals may be a challenging institutional issue (see discussion below on correction of private property I/I sources).

Manholes subject to ponding or located in drainage courses may also be sources of direct inflow. The amount of I/I depends on the manhole location, type of manhole cover (number and size of holes), and the condition of the cover and frame. Physical inspection of manholes is the most effective way to identify such conditions, and correction is relatively straightforward (replace cover, realign frame, raise manhole to grade, remove or relocate manhole in watercourse, etc.). Physical inspection can be conducted in conjunction with sewer inspection or routine cleaning work, or as a separate activity.

Elimination of direct inflow connections requires disconnection of the source and re-direction of the drainage to an appropriate location. This may simply be to the ground surface (as in the case of roof drains), or connection to a nearby storm drain or street gutter. In general, each identified source needs to be evaluated on a case-by-case basis to identify the appropriate corrective measure.

Infiltration Sources in Sewer Mains and Manholes

Infiltration sources are defects in sewer pipes or manholes caused by defective materials or construction, general deterioration, or damage caused by physical conditions such as ground movement or settlement, traffic loads, or root intrusion. Infiltration sources (defects) are detected by inspection: visual inspection in the case of manholes and CCTV inspection for sewer mains. However, visual observation of active I/I is generally not feasible because the RDI/I generally occurs for only short periods during rainfall events, and the pipes may fill up during those periods, making CCTV inspection difficult or impossible.

Infiltration correction methods involve rehabilitation or replacement of entire pipe segments or manholes or spot repair of localized defects. There are numerous materials and methods used for this type of rehabilitation. In general, however, the cost per unit amount of I/I removed is relatively high, because the defects individually contribute relatively small amounts of flow. It is recognized that infiltration in the sewer system will "migrate" to other nearby defects that are left un-repaired. Therefore, a fairly extensive area of the system may need to be included in the rehabilitation effort in order to achieve substantial flow reduction. Furthermore, reductions greater than about 30% can rarely be achieved without also addressing the infiltration from private laterals. Generally, rehabilitation to reduce infiltration is cost effective only if a significant amount of infiltration can be isolated to a relatively small area, or there are extremely costly improvements required downstream to convey, treat, and dispose of the excess flow.

I/I Sources on Private Property

I/I sources on private property are primarily defective laterals, but may also include broken cleanouts or cleanout caps, or directly connected roof and area drains. Smoke testing is the primary method for detecting private property I/I sources.

It should be noted that low lying areas and any buildings with basements are likely to have sump pumps. It is possible that some sump pumps may be directly connected to the sewer system, rather than the storm system, or may be discharging to the street, in which case those flows would likely enter the storm system but could also enter the sewer system through manhole cover openings. Connected sump pumps would not be identified by any of the source detection methods described here, but building inspectors may have

more information about whether these types of connections exist in the area. Therefore, for more aggressive programs, building or property inspections can be conducted, and/or laterals can be CCTV inspected or tested for leaks using air or water pressure tests. These types of inspections and tests generally require that the lateral have cleanout access, ideally at both the connection to the building plumbing and at or near the property line. However, new technologies are now available, such as cameras that can be "launched" up the lateral during CCTV inspection of the mainline, that make it easier to inspect private laterals.

4.6.3 I/I Investigation Recommendations for Santa Clara

Reducing I/I through locating defects and sewer main replacement programs could be an effective alternative to capacity improvement projects; specifically, the capacity improvement project recommended for the CMC Basin. However, it can be difficult to predict the extent of I/I reduction that could be achieved through any individual I/I reduction project. In the CMC Basin tributary area, for example, model runs show that RDI/I would need to be reduced by at least 50% to 60% to eliminate the CMC Basin capacity deficiency (i.e., surcharge along Amethyst Drive and Santa Maria Avenue and Francis Avenue) and the need for a capacity improvement project that includes upsizing the existing sewers.

Even if the required I/I reduction is achievable, the cost of the significant sewer main (and sewer lateral) replacement needed to achieve meaningful reductions of I/I is often more expensive than adding additional conveyance capacity. Moreover, the time needed to implement I/I reduction projects and assess their impacts on system through pre-and-post-implementation flow monitoring programs could be significant. Therefore, I/I reduction may not be a cost-effective approach.

Still, it is recommended that the City's Sewer Capacity CIP include some budget for I/I source detection methods to attempt to further characterize and pinpoint significant sources of I/I to the sanitary sewer system. The V&A report (discussed in **Section 4.6.1**) recommended CIPP lining of pipe segments that were investigated via CCTV during the study because all showed condition defects; however, it is recommended that further basin wide investigations be completed prior to implementing targeted rehabilitation projects. At minimum, smoke testing and CCTV investigations should be conducted within the CMC Basin prior to implementation of the capacity improvement project discussed in **Section 0**, which consists of upsizing the capacity deficient sewers. Additionally, the City should consider conducting smoke testing and CCTV investigations within the FM 31 basin area that is tributary to the Agate Drive sewers. An allowance for these recommended I/I investigations is included in the Sewer Capacity CIP in the form of other additional costs (refer to **Section 5.5**).

5. RECOMMENDED SEWER CAPACITY CAPITAL IMPROVEMENT PROGRAM

This section presents the specific sewer projects that are recommended for inclusion in the City's Sewer Capacity CIP based on the findings of the sewer system capacity analysis discussed in **Section 4**.

The sections below give an overview of the process, information and assumptions used, specifically:

- Project development process
- The methodology used to prioritize projects and estimate their costs
- Indirect cost resulting from implementing the capacity improvement projects
- Level of confidence in the projects
- Projects that will not be financed by the City
- An overall summary of all recommended projects, along with a brief discussion for each project focusing on the rationale and validation to justify the need for the project (refer to **Sections 0-4.5.13** for more detailed descriptions of the model-predicted capacity deficiencies and the solutions modeled)
- Project schedule

Details for each project are included in **Appendix I**.

5.1 Project Development Process

Capital improvement projects were developed to address potential deficiencies identified in the capacity analysis. One project was developed from up to three alternatives analyzed for each of the capacity deficiencies presented in **Section 4**.

The capacity deficiencies were relieved by a) increasing the capacity of deficient segments by upsizing sewers, adding additional parallel pipes, and/or re-sloping segments b) decreasing the flow through deficient pipe segments by diverting flow towards pipe segments with more capacity, or c) a combination of both a and b. All new pipes were sized according to the City's Design Criteria (refer to **Table 4-4**), except when the City decided not to do so, which is stated in the project descriptions included in **Section 4.5**.

Each project solution was tested in the hydraulic model to confirm that it would provide system capacity relief and to determine the pipe size required for any new sewers. Finally, the proposed pipe alignment was reviewed using GIS maps and aerial imagery to identify potential constructability issues. Complicating factors such as highway crossings, railroad crossings, creek proximity and crossings, and projects on sewers with many laterals (thereby impacting flow control during construction) were noted. Although this constructability review was done at a high level for planning rather than a detailed design level, the issues identified provide a reasonable starting point for further project development during the pre-design phase. The goal of the constructability review was to flag key areas where trenchless construction may be required. Pipe-bursting may be feasible but was not evaluated during this Master Plan Update; detailed utility separation and geotechnical investigations would be required to fully evaluate feasibility.

5.2 Project Prioritization Methodology

Each project was prioritized from "1" (highest priority) to "7" (lowest priority) based on a combination of factors including the wastewater flow trigger (existing load or EL vs. near-term future load or NTFL vs. long-term future load or LTFL), design flow trigger (dry weather flow or DWF vs. wet weather flow or WWF), physical network trigger (future lined network or LMN vs. no future lining network or UMN), and assumed

structural condition trigger (RCP segments present vs. not present). Projects that address existing deficiencies with future lining assumptions not in place should have the highest priority because they pose the greatest risk of a sanitary sewer overflow (SSO). **Table 5-1** shows the ranking classifications used to assign priorities to each of the projects.

TABLE 5-1: PROJECT PRIORITIZATION RANKING[1]

Priority Ranking	Wastewater Flow Trigger(s)	Design Flow Trigger(s)	Physical Network Trigger	Structural Condition Trigger	Notes
1	EL	WWF	UMN	-	
2	EL	WWF	LMN	-	
3	LTFL	WWF	UMN	RCP trunk	Not Priority 1 or 2 but alignment includes RCP trunk identified for future lining.
4	LTFL	WWF	LMN	RCP trunk	Not Priority 1 or 2 but alignment includes RCP trunk identified for future lining.
5	LTFL	DWF	UMN	-	
6	LTFL	WWF	UMN	-	
7	LTFL (entitlement)	DWF or WWF	UMN	-	

[1]Note: Triggers include: EL = Existing Loads; NTFL = Near-Term Future Loads; LTFL = Long-Term Future Loads; DWF = Dry Weather Flows; WWF = Wet Weather Flows; UMN = Unlined Model Network; LMN = Lined Model Network.

5.3 Project Level of Confidence

The capacity improvement projects developed to resolve the hydraulic deficiencies are primarily based on forecasted flows predicted from the calibrated model. As discussed in **Section 4.1**, the hydraulic model utilizes a design rainfall event along with other modeling assumptions to identify hydraulic deficiencies and resulting capacity improvement projects. Because these assumptions impact the recommended capacity improvement projects, it becomes necessary to independently validate the need for these projects by reviewing local flow monitoring data, review of reported surcharging and operational issues, and compatibility between flow meter data and the model. The project validation process, often referred to as a 'level of confidence' evaluation, was conducted for each recommended project with the results discussed by project in **Section 5.7**. The confirmation levels used in the validation process are shown in **Table 5-2**.

TABLE 5-2: PROJECT FLOW CONFIRMATION LEVELS

Flow Confirmation Level	Description
1	Flow meter on or very near to the project reach surcharged during metered storm.
2	Flow meter on or very near to the project reach confirms flow, but did not surcharge during metered storm.
3	Flow meter near the project reach (upstream or downstream) confirms flow.
4	No flow meter near the project reach to confirm flow.
5	Conflicting flow between meter and model.

For projects with a Level 1 rating, the need for the project has effectively already been confirmed by previous flow monitoring data. Level 2 projects were confirmed to have reasonably accurate model flows based on

model comparison to flow meter data but have no confirmed surcharging during the monitoring period (calibration events may have been too small to cause surcharging at these locations). Level 3 projects were confirmed to have reasonably accurate model flows based on model comparison to flow meter data. Level 4 and 5 projects have no reliable confirmation of model flows; conducting flow monitoring on these project reaches prior to design would provide a greater level of confidence in modeled flows.

It should be noted that projects triggered by projected flows from historic entitlement agreements or specific future development flow estimates were not assigned a confidence level as it relates to monitored flows.

5.4 Project Cost Estimates

Planning level cost estimates were developed for each recommended project. This level of cost estimate corresponds to the Planning-Level "Class-5" cost as defined by the American Association of Cost Engineers, International (AACE 2005). The AACE provides guidelines on accuracy ranges defined as percentages +/- of the expected average bid cost of the work. The Planning Level cost is expected to range from a high of: +30% to+100% and from a low of: -20% to -50% of the eventual cost of the project.

The cost index used for escalation of past bid prices was the Engineering News Records Construction Cost Index (ENR 2024) for the San Francisco area as of August 2024 (CCI of 15367.24).

Cost criteria include baseline construction costs for gravity trunk sewers using open-cut construction[1]. Unit costs for gravity trunk sewers vary with pipe diameter and depth. Baseline costs include all standard materials, equipment, possible weir installation or adjustment, potential lateral reconnection, potential manhole modifications, and labor to construct a pipeline project, except for site-specific items (e.g., possible dewatering and shoring needs or bypass pumping). The unit cost for open-cut construction ranged from $654 per linear-foot (LF) for a shallow (pipe depth less than 16 feet), 8-inch sewer to $1,579 per LF for a deep (from 25 to 30 ft of depth), 60-inch sewer.

An allowance of 10% of baseline construction costs was provided for traffic control, or 20% for high traffic areas. Additional allowances were provided for dewatering, bypass pumping, remove and replace activities, and pavement restoration. Subtotal construction costs reflect these allowances plus the baseline construction cost. The estimated construction subtotal cost for each project also includes an allowance for mobilization/demobilization (5% of subtotal construction costs), plus an additional allowance for contingencies and unknown conditions (30% of construction cost subtotal, and an allowance for engineering and inspection costs (25% of construction cost). Costs for lining City-identified RCP trunks are not included in the Sewer Capacity CIP as these are condition-related maintenance costs.

The itemized cost estimate for each project is detailed in the individual project information sheets included in **Appendix I**. Note that all costs presented in this Master Plan Update report represent August 2024 costs for the San Francisco Area and are not escalated for future years.

5.5 Other Costs

The project cost estimates developed would reflect costs derived directly from construction of the projects only. However, there would be other additional costs associated with improvement of flow conveyance in the City's sanitary sewer system. For this Master Plan Update, these costs were categorized as three-fold:

[1] Pipe-bursting may be feasible but was not evaluated during this Master Plan Update. Detailed utility separation and geotechnical investigations would be required to fully evaluate feasibility.

1) **Hydraulic Model Maintenance & Support Costs**, which include continuous updates to the hydraulic model to reflect improvements to the system, updates to base flow scenarios based on specific development project status or General Plan updates, and maintenance of consistent documentation in model files;

2) **Future Master Plan Update Costs**, which include updates to the master plan to incorporate updates to the hydraulic model, compare model results to flow monitoring data, update model calibration, perform system capacity evaluations, develop capacity improvement projects to resolve deficiencies, and produce accompanying memoranda and reports; and

3) **Technical Analyses to Support System Verification and Hydraulic Model Accuracy**, which includes performing I/I studies, conducting flow monitoring to verify system hydraulic conditions (in addition to flow monitoring mentioned above), analyzing water usage and sewer generation rates, performing pump station evaluations, evaluating proposed improvements for system performance, and conducting other studies and analyses.

Table 5-3 shows the additional anticipated other costs by category, which were provided by the City. Note that these costs reflect 2024 US Dollars and should be escalated for future years.

TABLE 5-3: OTHER COSTS IN ADDITION TO SEWER CAPACITY CIP PROJECT COSTS

Category	Frequency	Cost[1]
Hydraulic Model Maintenance & Support	Annual	$75,000
Future Master Plan Updates	Every 7-8 years	$950,000
Technical Analyses to Support System Verification and Hydraulic Model Accuracy	Annual	$25,000

[1]Cost is estimated in 2024 Dollars. Use an escalation factor of 3% to 5% per year for subsequent years.

5.6 Project Costs Financed by Developers

As discussed in **Section 4.5**, two capacity improvement projects were developed to address the model-predicted deficiencies resulting from the PHD and Mission Point developments. These improvement projects will be paid for by the developers and not by the City. For this reason, they are not included in the Sewer Capacity CIP project list and are not addressed further in this section. Any changes to their respective design and/or elimination may impact the sizing and timing of the capacity improvement projects identified in this study, specifically those proposed downstream along the GAP and Lafayette trunks.

5.7 Summary of Recommended Capacity Improvement Projects

Based on results of the capacity evaluation discussed in **Section 4**, there are thirteen (13) recommended capacity improvement projects with a total length of approximately 38,100 LF of new pipelines. The total estimated cost of the capacity improvement projects is approximately $100.6 million.

Table 5-4 shows a summary of the capacity improvement projects, including their priority, flow confidence level, wastewater flow trigger, design flow trigger, physical network trigger, and the estimated planning-level cost. **Figure 4-7** provides a system overview map and shows the locations of all thirteen (13) projects. **Appendix I** includes a plan view figure for and a detailed description of each project as well as an associated cost estimate. The projects are listed in upstream-to-downstream order. The project descriptions on the cost estimate page follow a standard format, consisting of a summary project description, project triggers, estimated cost, priority, and any associated comments, assumptions, or project alternatives. Each cost estimate page also includes an itemized cost estimate, as well as the estimated existing and future flows and dry weather velocities. Note the comments listed on each project description page. In some cases, the

need for additional verification is noted. A brief discussion for each project focusing on the rationale and validation justifying the project need is included in **Sections 5.7.1-5.7.13**.

TABLE 5-4: CAPACITY IMPROVEMENT PROJECTS

Project No.[1]	Project ID	Project Location	Pre-Project Pipe Diameter(s)[2]	Project Description	Priority[3]	Flow Confidence Level[4]	Wastewater Flow Trigger[5]	Design Flow Trigger[5]	Physical Network Trigger[5]	Project Cost[6]
1	**Tracy/Pomeroy/Homestead/Kiely**	Tracy Dr, Pomeroy Ave, Homestead Rd (S Trunk), Kiely Blvd	10 to 22.8-inch	12,313 LF of 15 to 27-inch diameter pipe	7	N/A	LTFL (entitlement)	DWF	UMN	**$26,942,000**
2	**Homestead Road**	N Homestead Trunk from Swallow Wy to Saratoga Creek	18 to 30-inch	6,407 LF of 24 to 33-inch diameter pipe	3	3	LTFL	WWF	UMN	**$17,156,000**
3	**Kiely Boulevard**	Orthello Wy to S of El Sobrante St	8-inch	266 LF of 10-inch diameter pipe	6	4	LTFL	WWF	UMN	**$513,000**
4	**Victoria Avenue**	Fowler Ave & Pomeroy Ave to Nobili Ave & Victoria Ave	8-inch	764 LF of 10-inch diameter pipe	6	3	LTFL	WWF	UMN	**$1,337,000**
5	**Cabrillo Avenue**	Halford Ave & Buckley St; St. Lawrence Dr, W of Lawrence Expwy	8-inch	Flow Diversion Weirs only. No pipe replacement.	1	3	EL	WWF	UMN	**$154,000**
6	**CMC Basin**	Santa Maria Ave & Francis Ave; Amethyst Dr	8 to 12-inch	3655 LF of 12 to 15-inch diameter pipe	1	1 & 2	EL	WWF	UMN	**$7,263,000**
7	**Bowers Avenue**	Bowers Ave from Chromite Dr to Walsh Ave	25.7-inch	2605 LF of 30-inch diameter pipe	4	5	LTFL	WWF	LMN	**$8,047,000**
8	**Calabazas Trunk**	Calabazas Creek from S of Agate Dr to Central Expwy	22.8 to 27-inch	2791 LF of 18 to 27-inch diameter pipe	2	5	EL	WWF	LMN	**$8,731,000**
9	**Mission College Blvd**	Mission College Blvd from Freedom Cir to west of Great America Pkwy	12 to 15-inch	1886 LF of 15-inch diameter pipe	5	N/A	LTFL (specific development)	DWF	UMN	**$3,830,000**
12	**GAP West Trunk**	S of West Tasman Dr to Lafayette St	28.5 to 35.7-inch	4810 LF of 36 to 42-inch diameter pipe	3	2	LTFL	WWF	UMN	**$17,781,000**
13	**GAP East Trunk**	Old Glory Ln to S of Bunker Hill Ln; Stars and Stripes Dr	31.4-inch	231 LF of 39-inch diameter pipe	4	2	LTFL	WWF	LMN	**$1,002,000**
14	**Bunker Hill Lane East**	E of Great America Pkwy	6-inch	107 LF of 8-inch diameter pipe	7	N/A	LTFL (entitlement)	WWF	UMN	**$301,000**
15	**Lafayette Street**	N of Calle del Mundo to S of Great America Wy	34.2 to 40.3-inch	2290 LF of 42 to 48-inch diameter pipe	3	2	LTFL	WWF	UMN	**$7,515,000**
TOTAL ESTIMATED COST	**$100,572,000**									

[1]Projects are numbered from upstream to downstream. Table does not include Project Nos. 10 (Patrick Henry Drive) and 11 (Tasman/GAP) because project costs will be paid for by the developers.

[2]Pre-project pipe diameters include future lining assumptions.

[3]Projects are prioritized based on wastewater flow, design flow, and physical network triggers as well as assumed structural condition.

[4]Rating assigned to validate the need for the project through review of flow monitoring data and reported surcharging and operational issues, and compatibility between flow meter data and the model. Descriptions of the flow confidence levels are as follows: N/A = Not assigned because project would be triggered by entitlement flow or specific development; 1 = Flow meter on or very near to the project reach surcharged during metered storm; 2 = Flow meter on or very near to the project reach confirms flow, but did not surcharge during metered storm; 3 = Flow meter near the project reach (upstream or downstream) confirms flow; 4 = No flow meter near the project reach to confirm flow; 5 = Conflicting flow between meter and model.

[5]EL = Existing Loads; LTFL = Long-Term Future Loads; DWF = Dry Weather Flow; WWF = Wet Weather Flow; UMN = Unlined Model Network; LMN = Lined Model Network.

[6]Costs are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area and are Class 5 estimates (planning level).

5.7.1 Tracy/Pomeroy/Homestead/Kiely

This project was assigned priority 7 (least priority) as it was created to accommodate mainly the historic entitlement flow from Agilent Technologies (average dry weather flow of 0.95 million gallons per day or mgd).

Because the project is driven by the projected flows from the Agilent historic entitlement agreement, it was not assigned a confidence level as it relates to monitored flows. This project should not be implemented until the City has more certainty on the parcel's plan to discharge its entitled flow.

It should also be noted that a trenchless crossing would be required to cross under Lawrence Expressway (from manhole S11-77 to S11-80) so the cost estimate assumes that the PTGAB construction method would be used for these segments.

5.7.2 Homestead Road

This project was assigned priority 3 as it is triggered under the long-term future peak wet weather flows in the unlined model network. The deficiency in the north Homestead trunk is just upstream of FMs 19 and 20. Neither flow meter surcharged during monitored wet weather flow events. As a result, the project has a confidence Level 3 because the downstream flow meters confirmed the flow but did not surcharge during the monitored events. This project is also highly dependent on the projected future incoming peak wet weather flows (13.8 mgd) from CuSD, which were based on the current contractual agreement. Any change to the contractual agreement affecting the maximum flow would affect the resulting deficiency and project.

It should also be noted that a trenchless crossing would be required to cross under Lawrence Expressway (from manhole S20-10 to S21-43) so the cost estimate assumes that the PTGAB construction method would be used for this segment. Special considerations should be given to the construction set up upstream of this crossing as manhole S20-10 houses the Lawrence/Homestead gate structure.

5.7.3 Kiely Boulevard

This project was assigned priority 6 as it is triggered under the long-term future peak wet weather flows in the unlined model network. Although its wastewater flow, design flow, and physical network triggers are the same as those assigned to the Homestead Road project, it is much lower priority because it is not located on an alignment that includes RCP trunks identified for future lining by the City.

The Kiely Boulevard trunk flowed into FM 13, which was located on the Bowers Avenue trunk a considerable distance downstream of the deficient segment. As a result, this project has a confidence Level 4 and conducting flow monitoring on the project reach prior to design would provide a greater level of confidence.

5.7.4 Victoria Avenue

This project was assigned priority 6 as it is triggered under the long-term future peak wet weather flows in the unlined model network. Although its wastewater flow, design flow, and physical network triggers are the same as those assigned to the Homestead Road project, it is much lower priority because it is not located on an alignment that includes RCP trunks identified for future lining by the City.

The Victoria Avenue trunk flowed into FM 26 which did not surcharge during the monitored rainfall events. FM 26 was downstream of the project (i.e., not on the Victoria Avenue trunk itself). The project therefore has confidence Level 3 as the model was confirmed to have reasonably accurate model flows based on model comparison to flow meter data, but there was no confirmed surcharging during the wet weather calibration events.

5.7.5 Cabrillo Avenue

This project was assigned priority 1 as it is triggered under the existing peak wet weather flows in the unlined model network. As discussed in **Section 4.5.5**, this project consists of the installation of two weirs to divert flow to segments with more capacity, which are reflected in the costs for the Cabrillo Avenue project.

The Cabrillo Avenue trunk flowed into FM 26 which did not surcharge during the monitored rainfall events. FM 26 was downstream of the project (i.e., not on the Cabrillo trunk itself). The project therefore has confidence Level 3 as the model was confirmed to have reasonably accurate model flows based on model comparison to flow meter data, but there was no confirmed surcharging during the wet weather calibration events.

5.7.6 CMC Basin

The segments in Santa Maria Ave and Amethyst Drive become deficient under existing loads and wet weather flow due to high rainfall-derived infiltration and inflow (RDI/I) that occur in the CMC basin. As a result, they have a priority ranking of 1.

The Amethyst Drive trunk flowed into FM 28 which surcharged during the monitored rainfall event on January 1st, 5th, and 9th, 2023. As a result, the project was assigned a high level of confidence (i.e., Level 1) because the need has been confirmed by previous flow monitoring data.

The Santa Maria Ave project flowed into FM 10. FM 10 showed a high RDI/I response during the monitored rainfall events but did not surcharge. This project was assigned a Level 2 confidence rating as the model was confirmed to have reasonably accurate model flows based on model comparison to flow meter data, but there was no confirmed surcharging during the wet weather calibration events.

The recommended capacity improvement upsizing project was developed to accommodate the flow during wet weather; however, the City also has the option to reduce the RDI/I in the basin. The cost of reducing the RDI/I would include smoke testing to identify specific sources of infiltration and additional flow monitoring in the basin. An annual allowance for these other non-construction costs is shown in **Section 5.5**.

5.7.7 Bowers Avenue

This project was assigned priority 4 as it is triggered under long-term future peak wet weather flows in the lined model network and is located on an alignment that includes RCP trunks identified for future lining by the City.

The Bowers Avenue deficiency was just downstream of flow meter 13 which did not surcharge during the monitored wet weather events. However, as described in **Section 3.4.3.1**, the 2022-2023 flow monitoring data at FM 13 showed that observed flows in the Bowers trunk at this location were significantly lower than the model-predicted flows based on the assumed system flow routing under normal conditions. Further investigation by Woodard & Curran and additional field surveys conducted by the City revealed that the system was not operating under normal conditions during the 2022-2023 flow monitoring program; the Lawrence/Homestead gate structure was routing significantly more flow to the trunk on Lawrence Expressway (80%) and only 20% to the trunk on Homestead Road, compared to the approximate 50/50 split that is observed during normal conditions. Additionally, City staff observed surcharge conditions farther downstream during dry weather, suggesting that some of the increased flows to the trunk on Lawrence Expressway were backing up through the El Sobrante overflow pipe towards FM 13 and away from FM 9A. Because of these atypical and temporary issues, a flow balance between FMs 13 and 9A was impossible to

achieve. Model-predicted flows assuming normal system flow routing were compared to the 2014-2015 flow monitoring data and matched more closely, but due to the inconsistencies discussed above with the 2022-2023 flow monitoring data, this project was assigned a confidence Level 5 (flow meter shows significantly different flow than model). Therefore, it is recommended that additional flow monitoring be conducted prior to design to provide a greater level of confidence in modeled flows.

It should be noted that the proposed alignment would require a trenchless crossing under the Caltrain railroad tracks (between manhole S53-7 and S63-36). Additionally, the alignment between manholes S63-36 and S63-27 has many bends and does not follow the Bowers Avenue public right-of-way (ROW). The design of the new project may want to consider realigning the sewer to be closer to Bowers Avenue.

5.7.8 Calabazas Trunk

The Calabazas Trunk project is triggered by existing wet weather flows in the lined model network and therefore was assigned a priority ranking of 2. The Calabazas Trunk Improvements assume that all deficiencies upstream have been relieved. Because this project is a higher priority than the projects upstream (i.e., Tracy/Pomeroy/Homestead/Kiely and Homestead Road), this assumption should be considered during the design phase.

The deficient segments of the Calabazas trunk flowed into FM 9A located somewhat downstream. FM 9A did not surcharge during the monitored wet weather events. However, as described in **Section 3.4.3.1** and in **Section 5.7.7** above, inconsistencies with the 2022-2023 flow monitoring data made it impossible to achieve a flow balance at FMs 9A and 13. Due to the atypical flow routing, the model comparison to FM 9A is inconclusive. As a result, this project has confidence Level 5 (flow meter shows significantly different flow than model), and it is recommended that additional flow monitoring be conducted prior to design to provide a greater level of confidence in modeled flows.

It should be noted that the alignment would require a trenchless crossing under the Caltrain and private railroad tracks to the north (between manhole S52-4 and S62-52).

5.7.9 Mission College Boulevard

The proposed project was assigned priority ranking 5 as it is triggered by long-term future dry weather flows as a result of the proposed Freedom Circle Focus Area development project. It is therefore highly dependent on the final loads generated by the proposed development and should be reviewed should those flows change.

This project is driven by the projected flows from the Freedom Circle Focus Area specific development. As a result, it was not assigned a confidence level as it relates to monitored flows.

5.7.10 GAP West Trunk

The proposed project was assigned priority ranking 3 as it is triggered by long-term future loads combined with wet weather flow conditions in the unlined model network and is located on an alignment that includes RCP trunks identified for future lining by the City.

The GAP West trunk had a flow meter on the deficient sewer segment (FM 2). Flow monitoring data showed the sewer did not surcharge during the monitored wet weather events although the d/D ratio reached 75%. As a result, the project has a confidence Level 2 (flow meter on capacity deficient pipe reach confirms model flow, but did not surcharge).

It should be noted that the alignment would require a trenchless crossing under the Valley Transportation Authority (VTA) light rail tracks on West Tasman Drive.

Because of their interconnections, the GAP West and East trunks should be evaluated together during the pre-design and design phases.

5.7.11 GAP East Trunk

The proposed project was assigned priority ranking 4 as it is triggered under long-term future peak wet weather flows in the lined model network and is located on an alignment that includes RCP trunks identified for future lining by the City.

The GAP East trunk had FM 5 just upstream of the deficient sewer segment. However, the flow meter data did not show a surcharge condition under the monitored wet weather events. As a result, this project was assigned a confidence Level 2.

Because of their interconnections, the GAP West and East trunks should be evaluated together during the pre-design and design phases.

5.7.12 Bunker Hill East Lane

This project was assigned priority 7 (least priority) because it is triggered by long-term future loads as a result of a historic entitlement flow assumption from parcels with APNs 104-55-012 and 104-55-013 (site of the current Santa Clara Convention Center) under wet weather flows. During the pre-design phase, the City should verify the inverts along the alignment and at the downstream connection with the GAP East Trunk at manhole S93-7.

This project is driven by the projected flows from the historic entitlement agreement from the two parcels identified above. As a result, it was not assigned a confidence level as it relates to monitored flows.

5.7.13 Lafayette Street

This project was assigned priority 3 as it is triggered under long-term future peak wet weather flows in the unlined model network and is located on an alignment that includes RCP trunks identified for future lining by the City. As discussed in **Section 4.5.13**, the project would include re-sloping of some minimally sloped (approximately 0.02%) existing pipe segments according to record information. Due to lack of data, it was not possible to confirm if there are other utilities near the deficient segment in Lafayette Street. Therefore, the project alignment was developed assuming that there are no obstacles in upsizing and re-sloping the segments to relieve the deficiency. However, this assumption should be confirmed during the pre-design phase.

The Lafayette trunk had FM 1 on one of the deficient sewer segments. Flow monitoring data showed the sewer did not surcharge during the monitored wet weather events and the d/D ratio reached a maximum of 50%. As a result, the project has a confidence Level 2 (flow meter on capacity deficient pipe reach confirms model flow, but did not surcharge).

5.8 Schedule

A preliminary Sewer Capacity CIP schedule was developed and is presented in **Table 5-5**. Because none of the projects have a near-term future loads wastewater flow trigger, the projects are scheduled for either implementation within the next five years (2025-2030), if triggered by existing loads, or implementation within the next 10 years (or beyond 2035), if triggered by long-term future loads. Projects triggered by

entitlement flows (i.e., Tracy/Pomeroy/Homestead/Kiely and Bunker Hill Lane East) are still listed for implementation beyond 2035; however, if the entitlement holders do not exercise their rights, then implementation of these projects would not be necessary. Preliminary design, including condition assessments (e.g., smoke testing, CCTV, etc.), final design, and permitting activities should commence two (2) to three (3) years prior to project trigger. It is worth noting that all costs are calculated in August 2024 dollars; thus, if a project is scheduled to be constructed in 2035, the cost should be scaled to 2035 using an escalation factor of 3% to 5% per year.

TABLE 5-5: CAPACITY IMPROVEMENT PROJECTS SCHEDULE

Project No.	Project ID	Schedule
1	Tracy/Pomeroy/Homestead/Kiely	2035
2	Homestead Road	2035
3	Kiely Boulevard	2035
4	Victoria Avenue	2035
5	Cabrillo Avenue	2025
6	CMC Basin	2025
7	Bowers Avenue	2035
8	Calabazas Trunk	2025
9	Mission College Blvd	2035
12	GAP West Trunk	2035
13	GAP East Trunk	2035
14	Bunker Hill Lane East	2035
15	Lafayette Street	2035

5.9 Implementation Recommendations

The City should begin implementation of the Sewer Capacity CIP recommended in this Master Plan Update, starting with the highest priority projects needed to address existing system capacity deficiencies. The following items should be considered in project scheduling and design, and in future updates of the Master Plan:

- The City should consider conducting additional flow monitoring or observation to document flow levels during large storm events at locations in the system where the model predicts significant surcharge or where there is a significant difference between previous flow monitoring conducted and the model results. Flow levels during large storm events should be compared to the water levels simulated by the hydraulic model to verify if the modeling predictions for the design storm seem reasonable, and to confirm the need for and, if necessary, refine project sizing.
- The alignments and sizes of all recommended projects should be verified with detailed pre-design analyses, including topographic surveys, geotechnical investigations, utility research, and constructability reviews. Detailed pre-design analyses should consider feasibility of trenchless construction methods including pipe-bursting and Pilot Tube Guided Auger Boring (PTGAB), especially at major roadway, railway, and creek crossings.
- The decision to parallel or replace existing sewers should consider the physical condition and remaining useful life of the existing pipelines and laterals; the availability of pipeline corridors for new sewer construction; and operation and maintenance concerns.

- Capacity improvement projects triggered by long-term future flow assumptions associated with entitlement agreements would not need to be implemented until the entitled parcel(s) begin to discharge their entitled flow(s).
- The hydraulic model has been developed to assist the City in performing capacity analyses and updating the Master Plan in the future. The model should be kept up to date with any changes to existing sewer connections, development plans, and sewer system facilities.

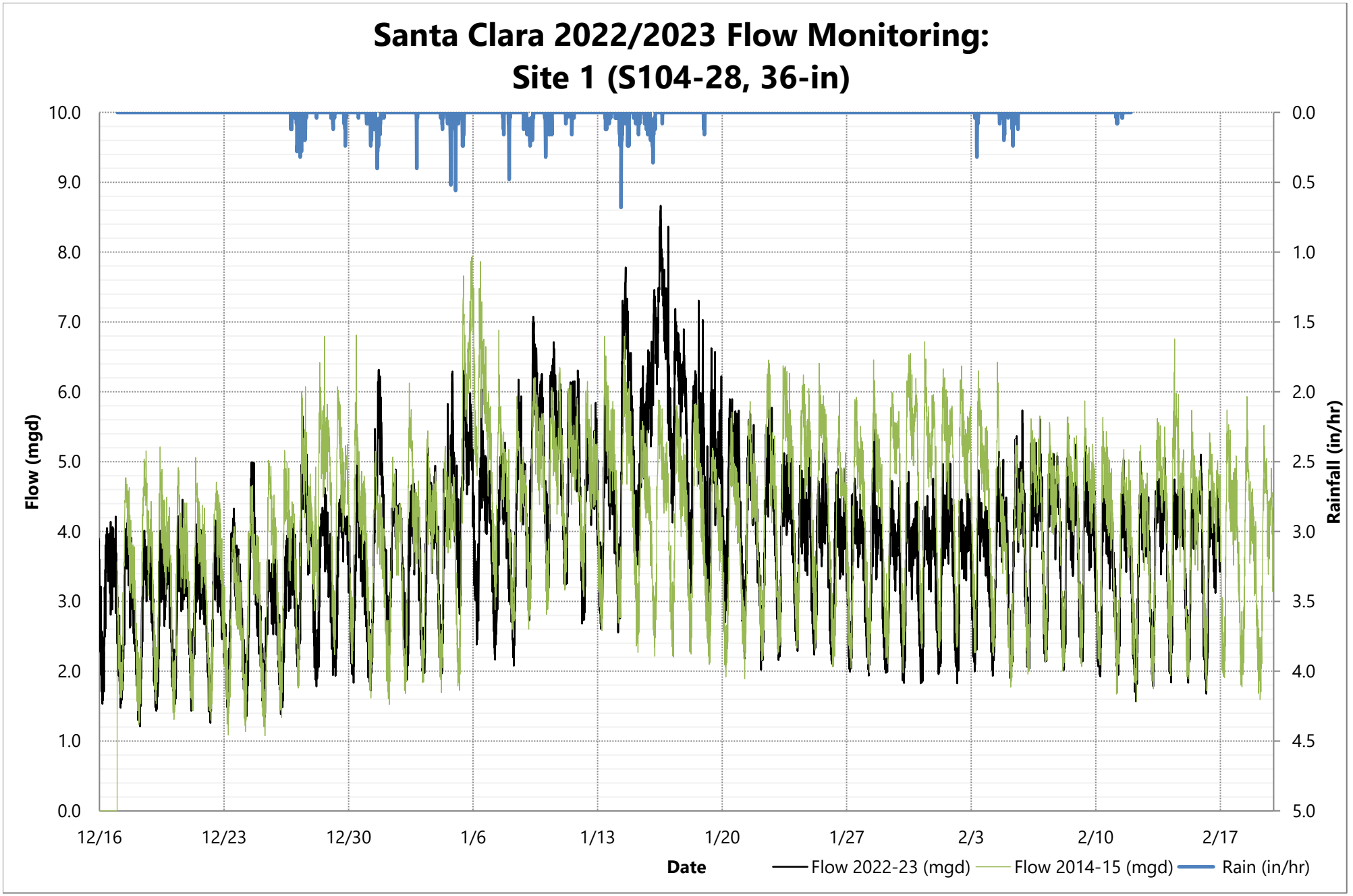
This Master Plan Update report is intended to be a working document to be refined and updated as additional data and new planning information become available. The capacity assessment should be updated whenever there are major changes in planning assumptions or, at a minimum, every five to ten years.

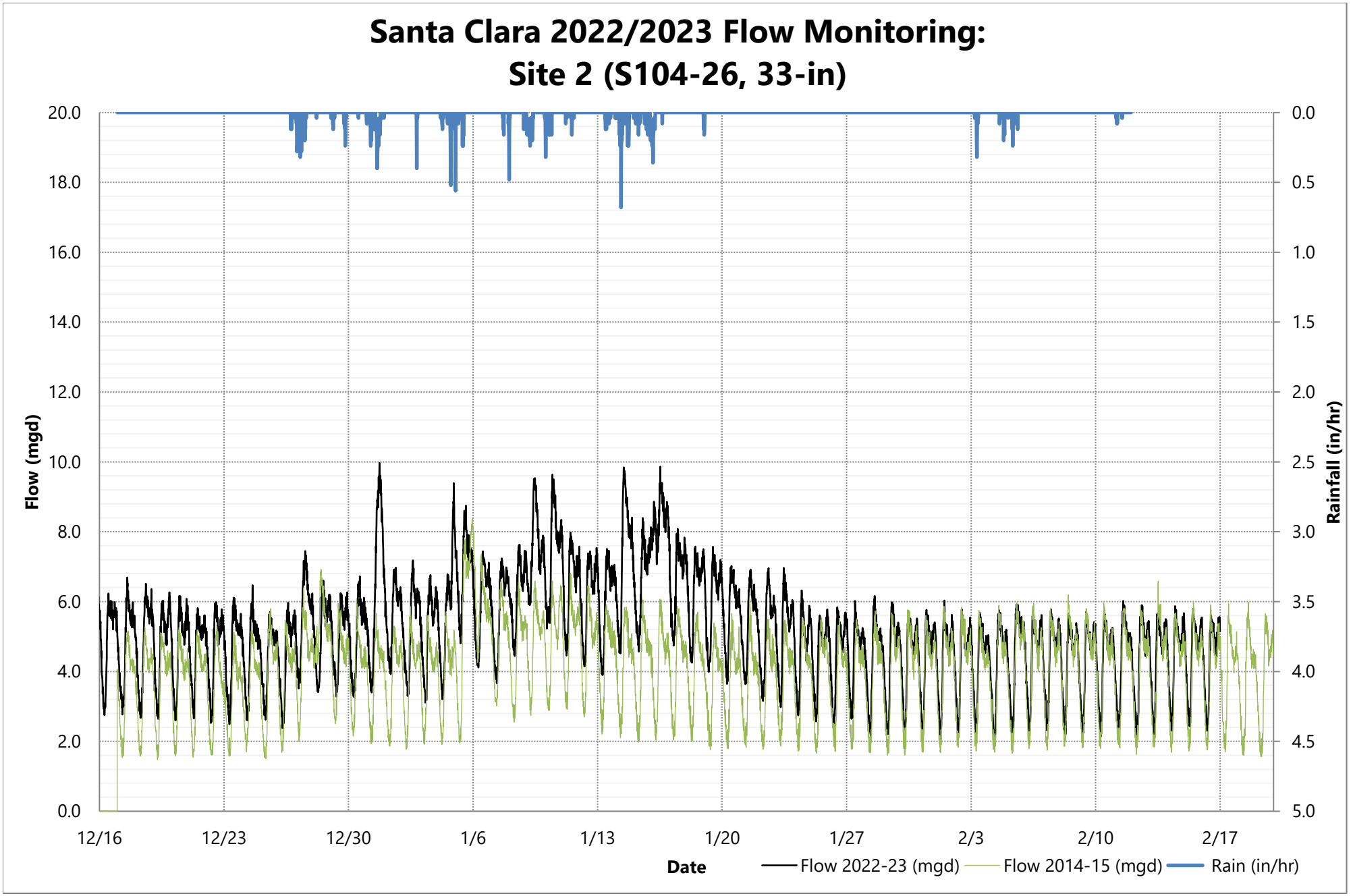
APPENDIX A: SUMMARY OF EXISTING INFORMATION

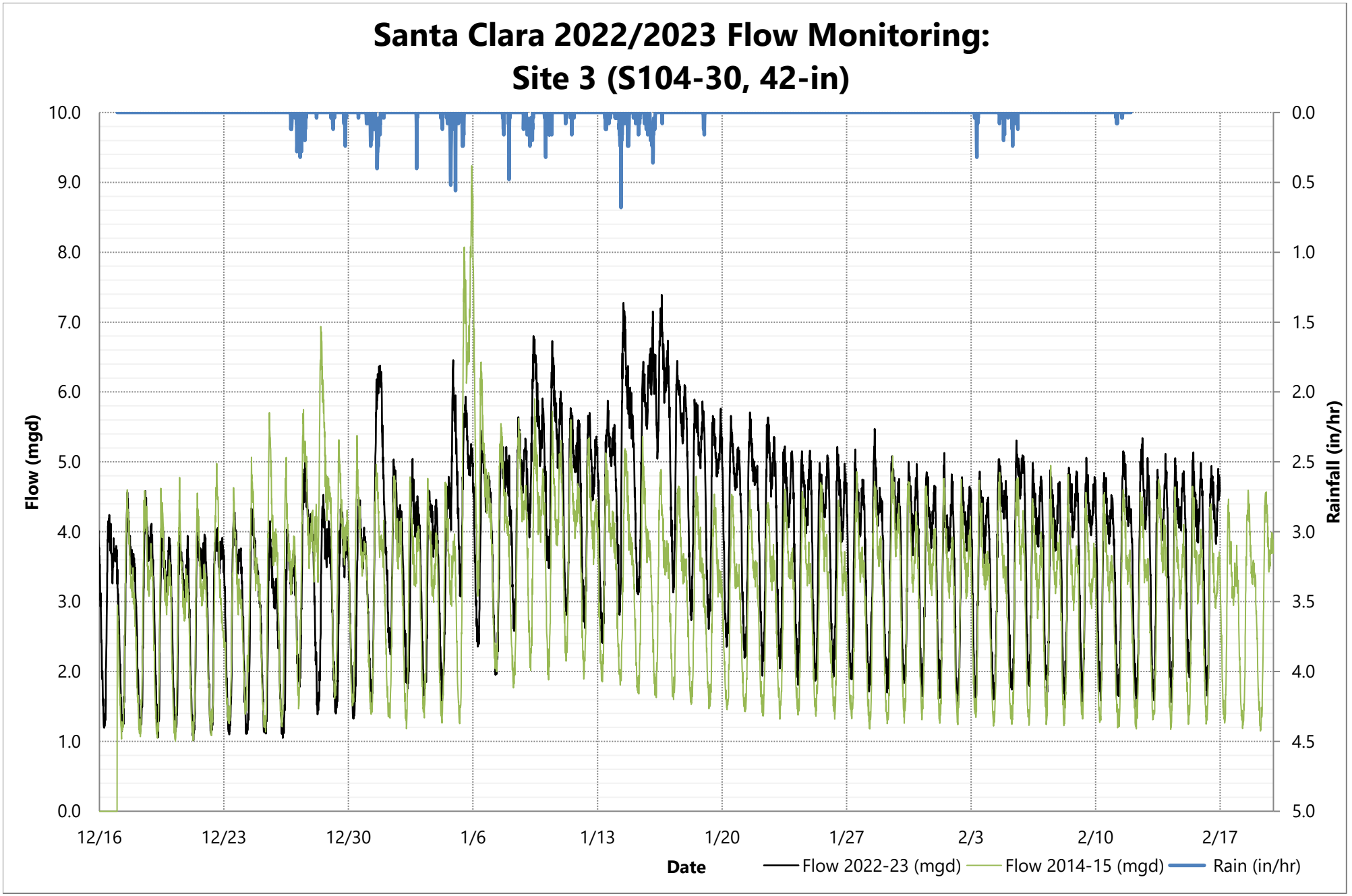
List and Summary of Existing Information

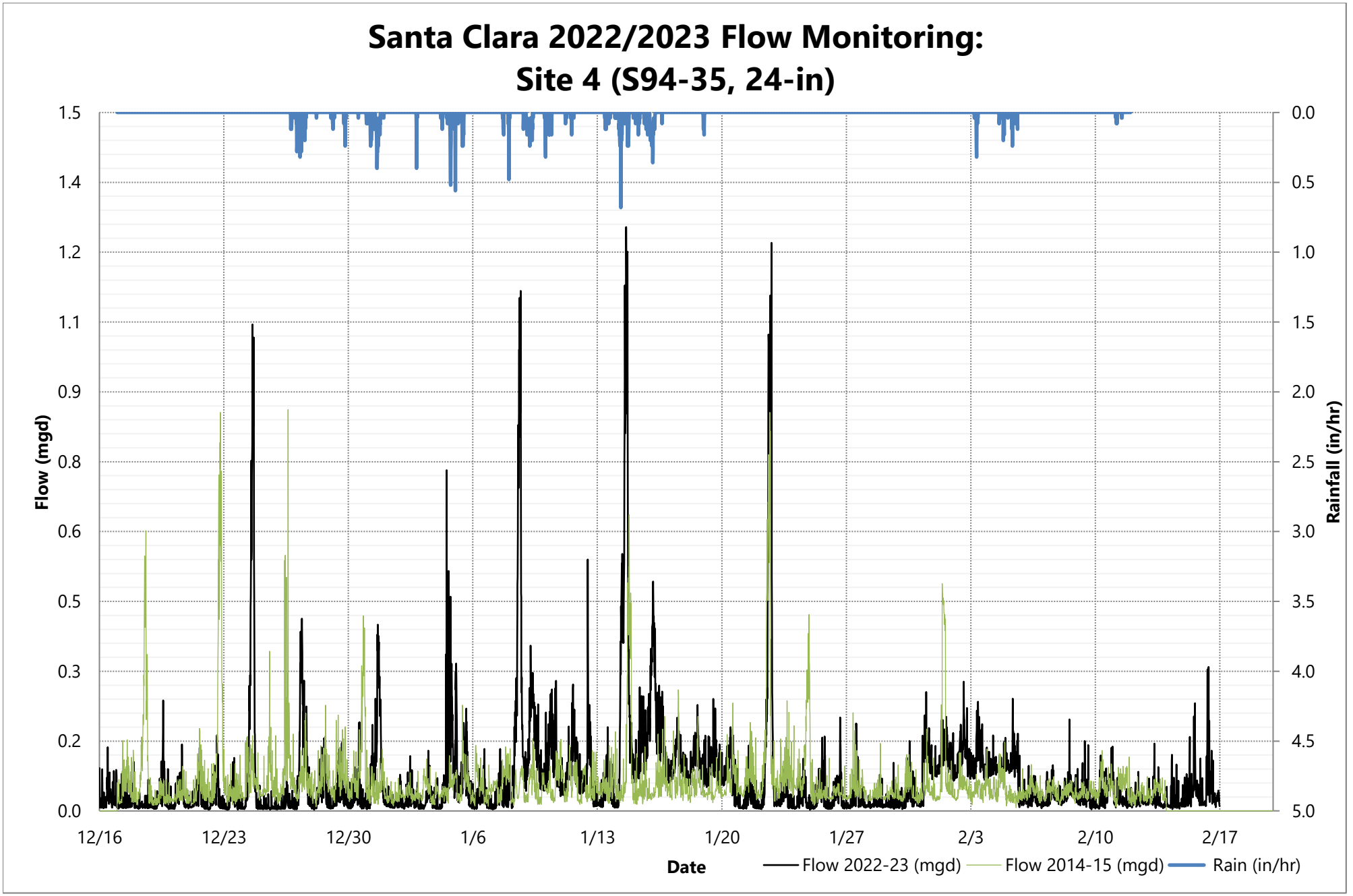
No.	Item	Description	File Type	Requested for
1	2016 Sanitary Sewer Master Plan Update Hydraulic model	Trunk model created and calibrated as a part of the 2016 Sanitary Sewer Master Plan. Updated continuously to the present	InfoWorks ICM transportable database	Task 3
2	Sanitary Sewer Geospatial Data	database containing all Manhole IDs and hydraulic information of all pipes, such as diameters, materials, invert elevations, and lengths.	Shapefile	Task 3
3	Sanitary Sewer Block Book (2020)	File that shows a summary of all sewer pipe alignments, manholes, and other structures	pdf file	Task 3
4	Siphon information	Location for all siphons in the City's Sanitary system	Shapefile	Task 3
5	Flow data from system pump stations and lift stations	SCADA data for Rabello and Northside pump stations	Excel Spreadsheet	Task 3
6	flow monitoring data	Flow data for all meters for the 2022/2023 flow monitoring period	Excel Spreadsheet	Task 2
7	Citywide Parcel data	Parcel information for all parcels within the limits of the City of Santa Clara	Shapefile	Task 3
8	County Parcel Data	Parcel information for all the parcels within Santa Clara County	Shapefile	Task 3
9	land use mapping	Zoning information for each parcel in the City of Santa Clara	Shapefile	Task 3
10	Ground Elevation Data	2-ft by 2-ft hydroflattened ground model DEM of the County of Santa Clara	tiff raster	Task 3
11	Known proposed development plans under discussion	List of Near-term and long-term Proposed developments	Excel Spreadsheet	Task 3
12	Water use records to update the model loads and unit flow criteria	Water Billing data for the City of Santa Clara by account number (with address)	Microsoft Excel CSV file	Task 3
13	2024 Calabazas/Great America Pkwy Lining	List of lining projects carried out by the City	Spreadsheer	Task 3
14	Flow data for Tributary agencies (Cupertino Sanitary District)	Existing, near-term, and long-term dry and wet flow from Cupertino Sanitary District. 15-min intervals between readings	Microsoft Excel CSV file	Task 3
15	Sewer inspection records	Sewer gravity main with defect scores	Shapefile	Task 3/4
16	Siphon inspection reports	CCTV Assessment for siphons	Excel Spreadsheet	Task 3/4
17	Sewer System Management Plan	Plan that identifies network susceptibilites, people responsible, and activities to minimize SSOs	pdf file	Task 3/4
18	known problem areas	Summary of the locations identified by the City as "Hotspots"	pdf file	Task 3/4
19	Sewer rates, fees, and expenditures	Summary of the current sewer fees adopted for residential and non-residential users	Website link	Task 6
20	2007 Sanitary Sewer Capacity Assessment Final Report	Report for the City of Santa Clara on the capacity assessment of the sewer system in 2007	pdf file	Task 4
21	2016 Sanitary Sewer Master Plan Update Final report	Report for the update to the Sanitary Sewer Master Plan, carried out in 2016	pdf file	Task 3/4
22	2022 addendum to the 2016 Sanitary Sewer Master Plan Update	Report to update the capacity improvement of project E1 and address capacity deficiencies along the Calabazas Creek trunk and the Great America Pkwy West trunk	Word Document	Task 4
23	2022 Citywide Data Center Discharge Study	File that summarizes the peak summer flow into the City's sanitary sewer from several data centers	Excel Spreadsheet	Task 3
24	Current Municipal Fee including sewer conveyance fee	Summary of the current conveyance fee and other municipal fees	pdf file	Task 6
25	Northside and Rabello Pump Station Firm Capacity Evaluation Memorandum/report	Technical memorandum describing the firm capacities of the Rabello and Northside pump stations and the tests conducted to determine them.	pdf file	Task 3
26	Entitlement Assumptions	Excel spreadsheet provided to City for review. City provided feedback on which entitlement parcel no longer applies.	Excel Spreadsheet	Task 3/4
27	Field verification of flow split manholes and structures	Field survey data sheets provided by City.	pdf, jpg, mov files	Task 3
28	2024 Sewer Flow Monitoring and Inflow/Infiltration Study	I/I Study for the Chromite-Machado-Cabrillo (CMC) basin.	pdf file	Task 3
29	Record Drawings	Various record drawings provided by the City.	pdf file	Task 3
30	2007 Santa Clara County Drainage Manual	Drainage Manual with information on the County's rainfall statistics including design storm.	pdf file	Task 3
31	General Plan Parcel Data	Parcel and future land use data for all parcels in the General Plan Phase 3	Shapefile	Task 3
32	2023-2031 Housing Element	Housing Element with information about the City's housing goals from 2023 to 2031	pdf file	Task 3

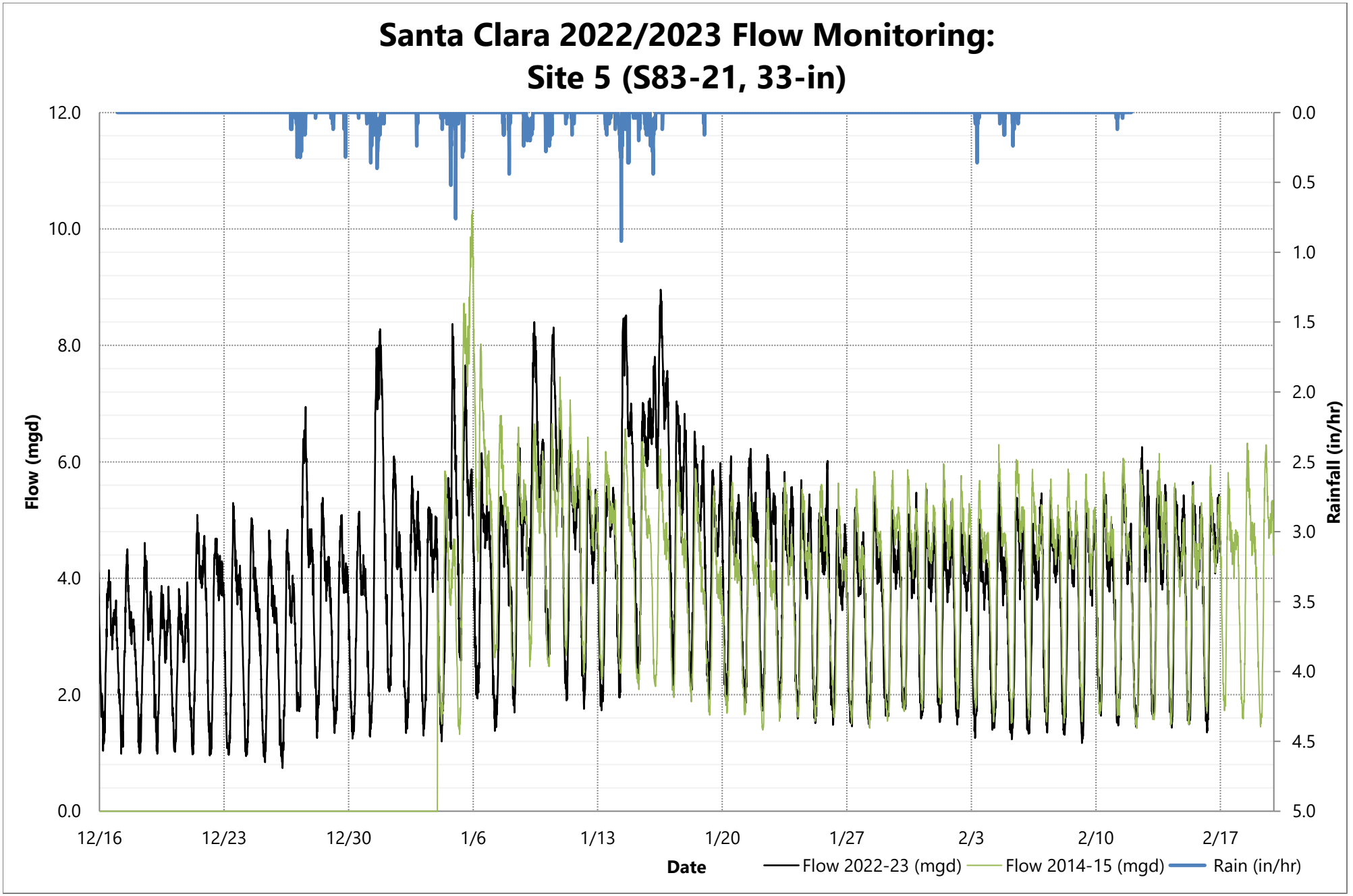
APPENDIX B: FLOW MONITORING DATA PLOTS

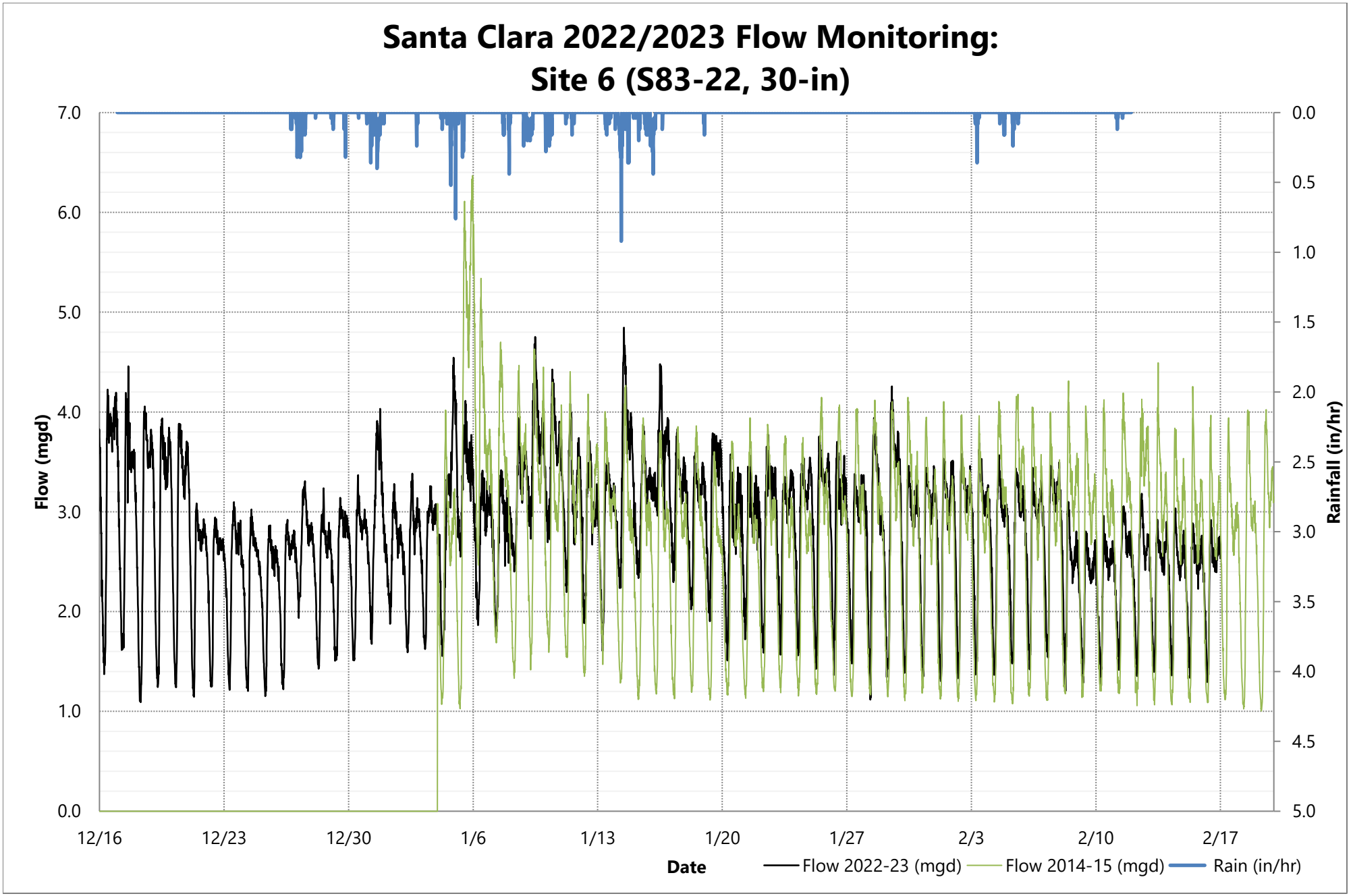

Santa Clara 2022/2023 Flow Monitoring:
Site 1 (S104-28, 36-in)
Flow (mgd)
Rainfall (in/hr)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

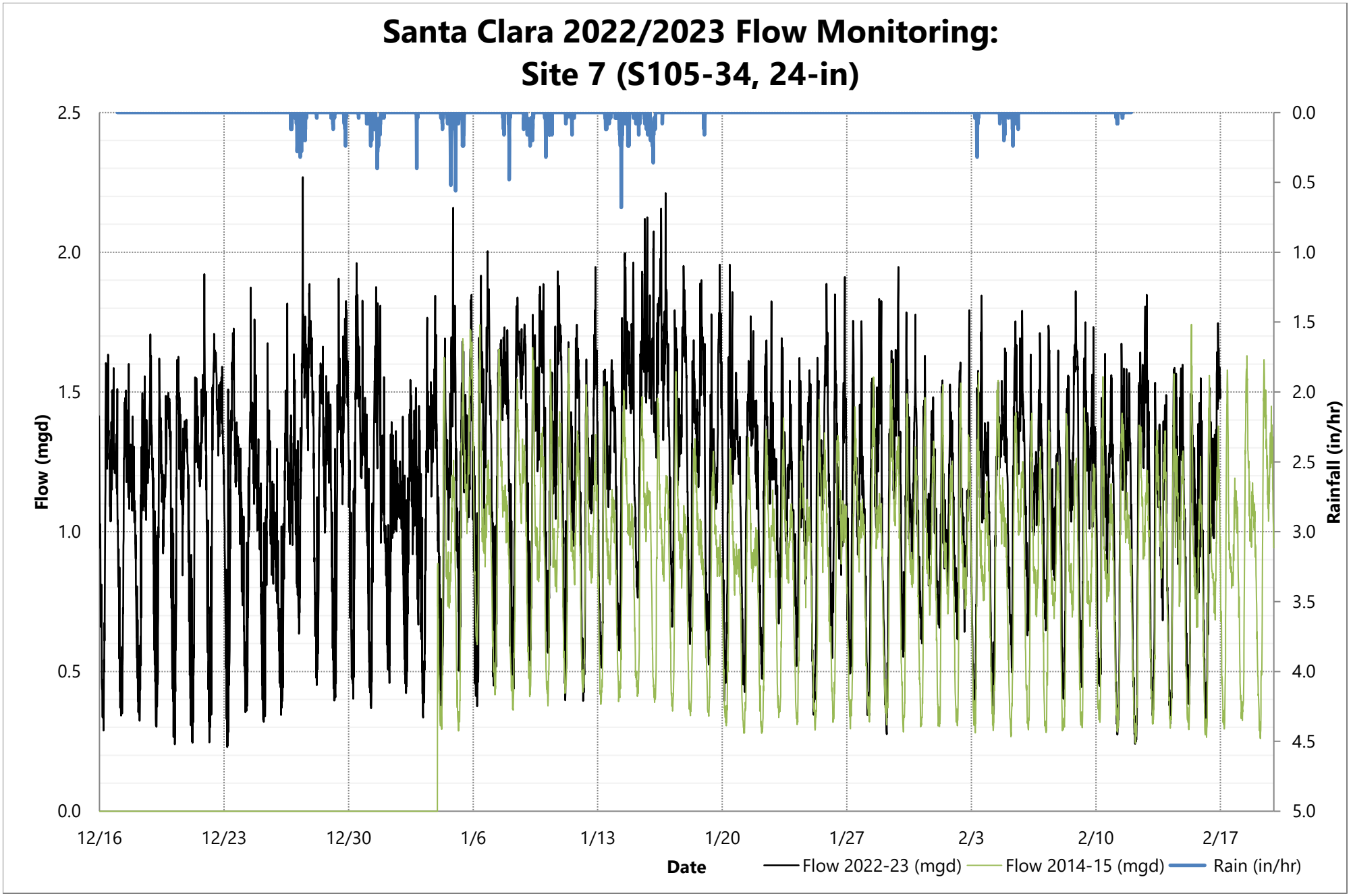

Santa Clara 2022/2023 Flow Monitoring:
Site 2 (S104-26, 33-in)
Flow (mgd)
Rainfall (in/hr)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

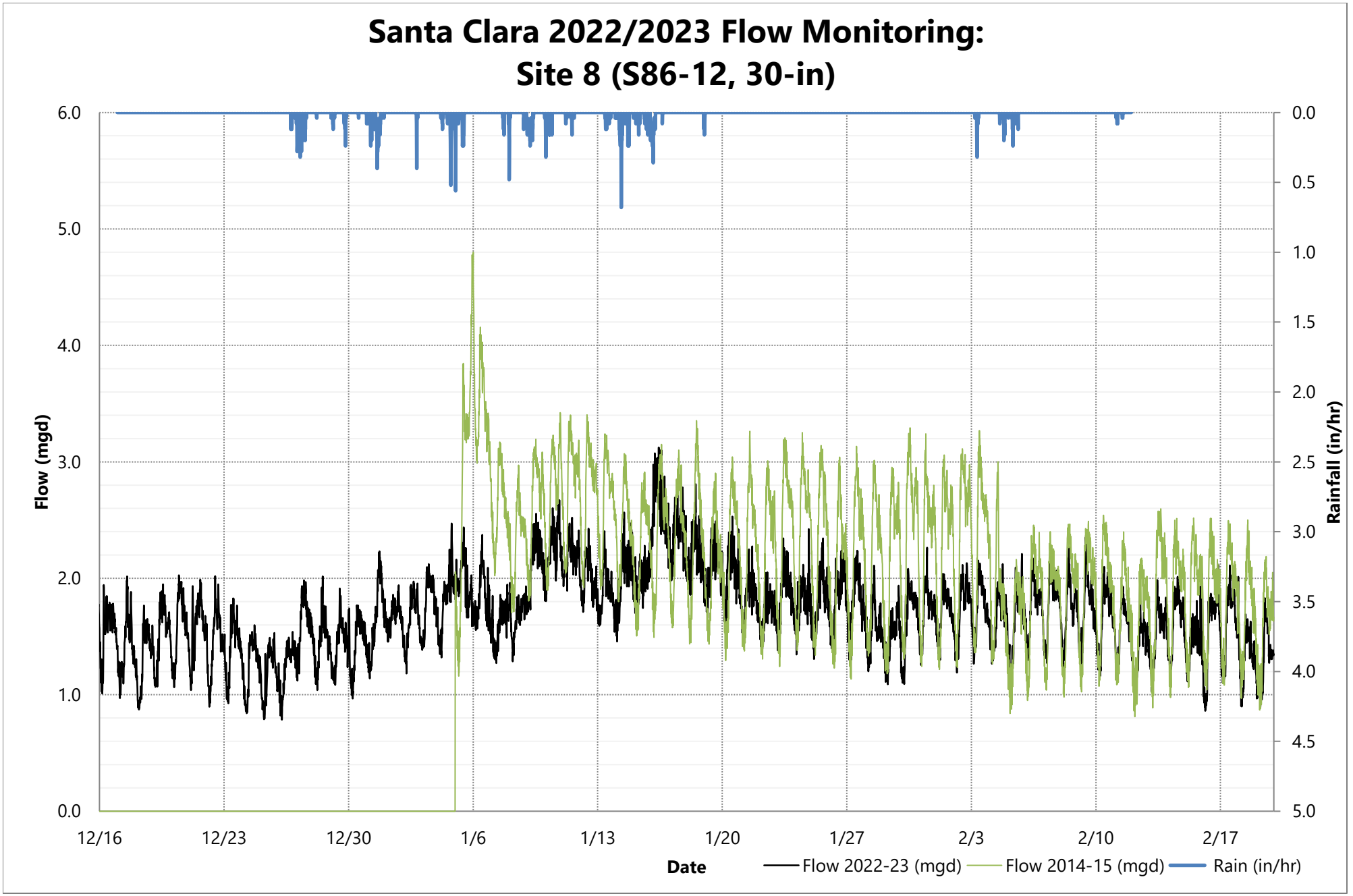

Santa Clara 2022/2023 Flow Monitoring:
Site 3 (S104-30, 42-in)
Flow (mgd)
Rainfall (in/hr)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

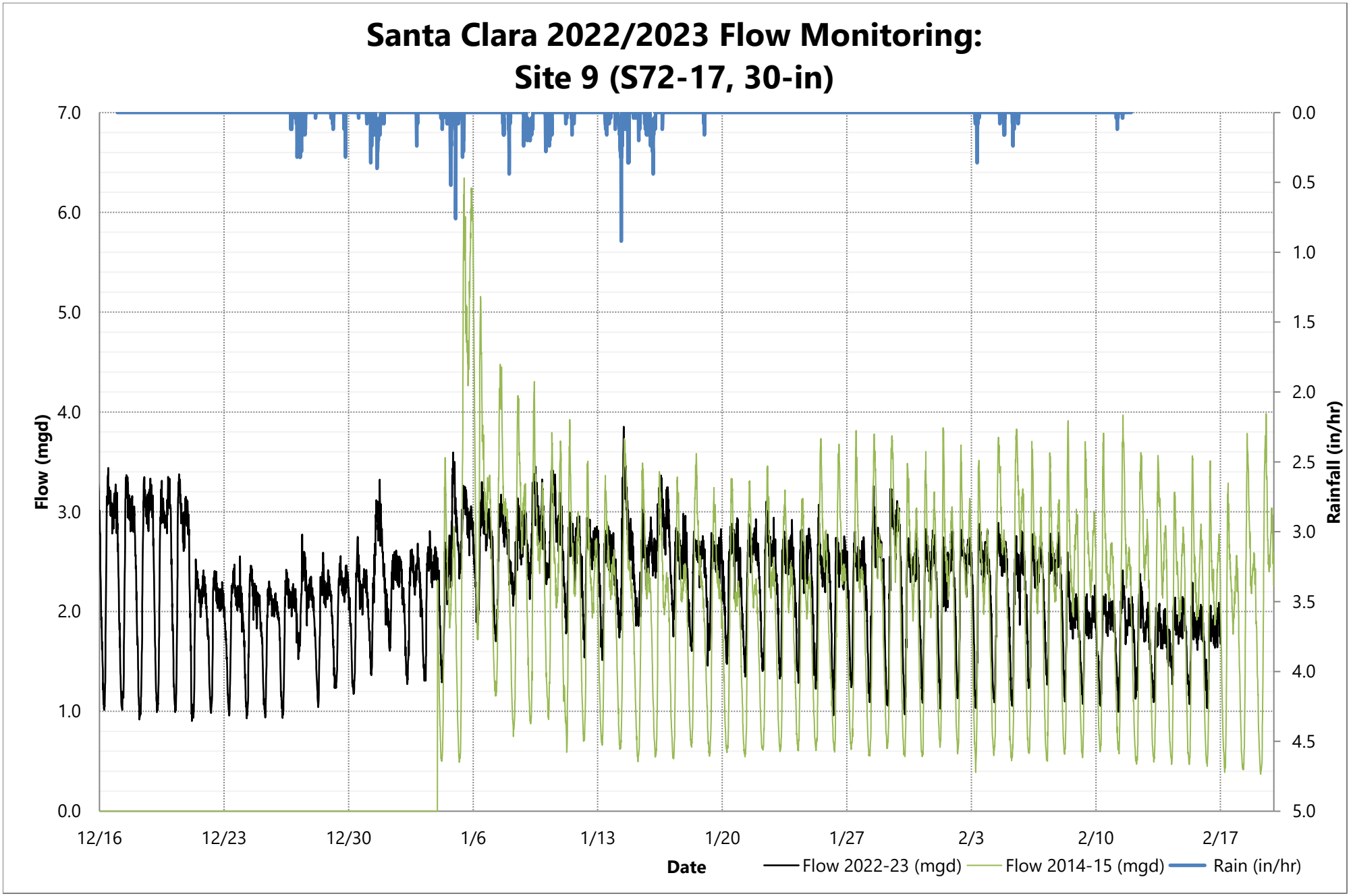

Santa Clara 2022/2023 Flow Monitoring:
Site 4 (S94-35, 24-in)
Flow (mgd)
Rainfall (in/hr)
1.5
1.4
1.2
1.1
0.9
0.8
0.6
0.5
0.3
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

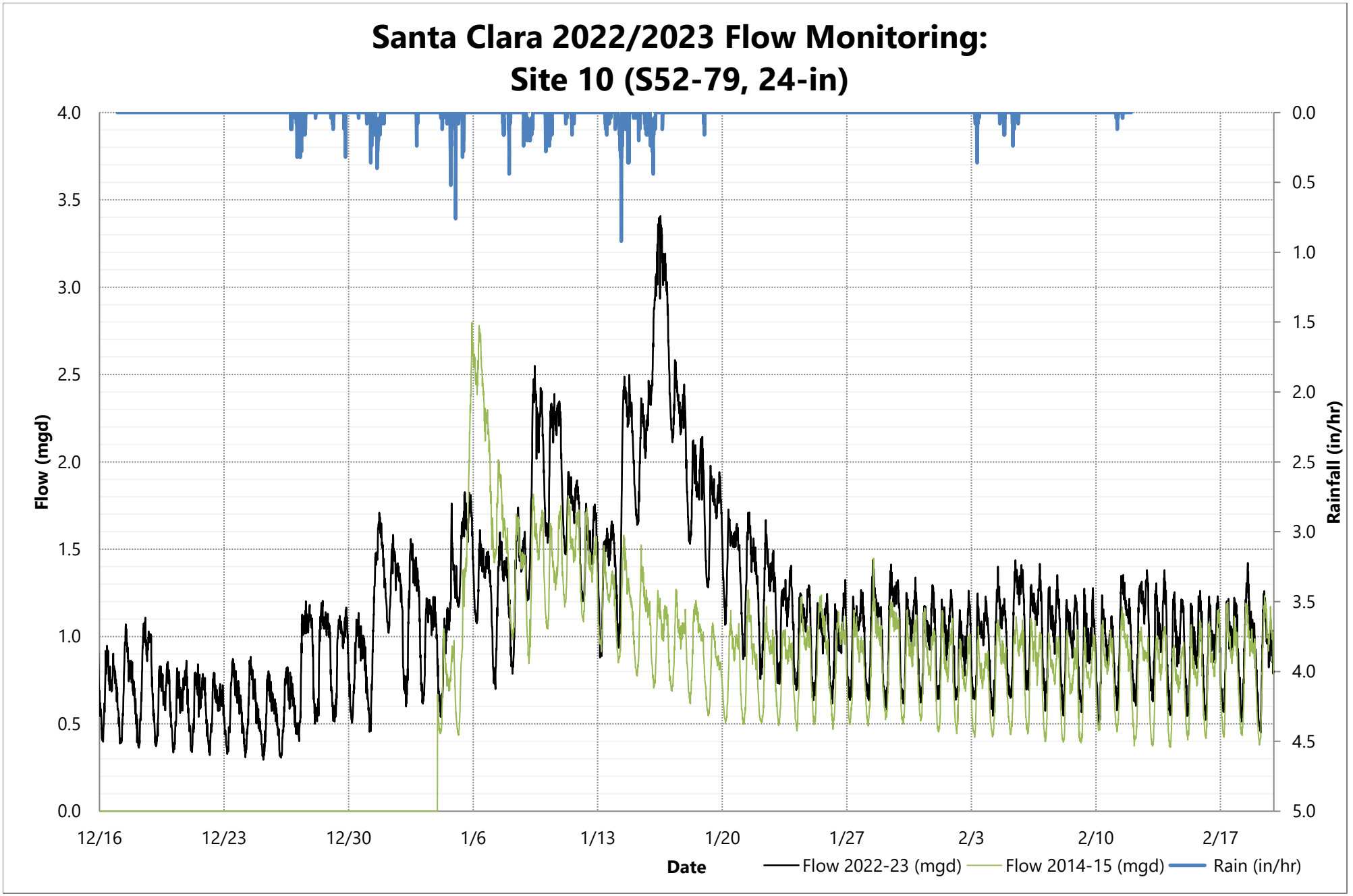

Santa Clara 2022/2023 Flow Monitoring:
Site 5 (S83-21, 33-in)
Flow (mgd)
Rainfall (in/hr)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

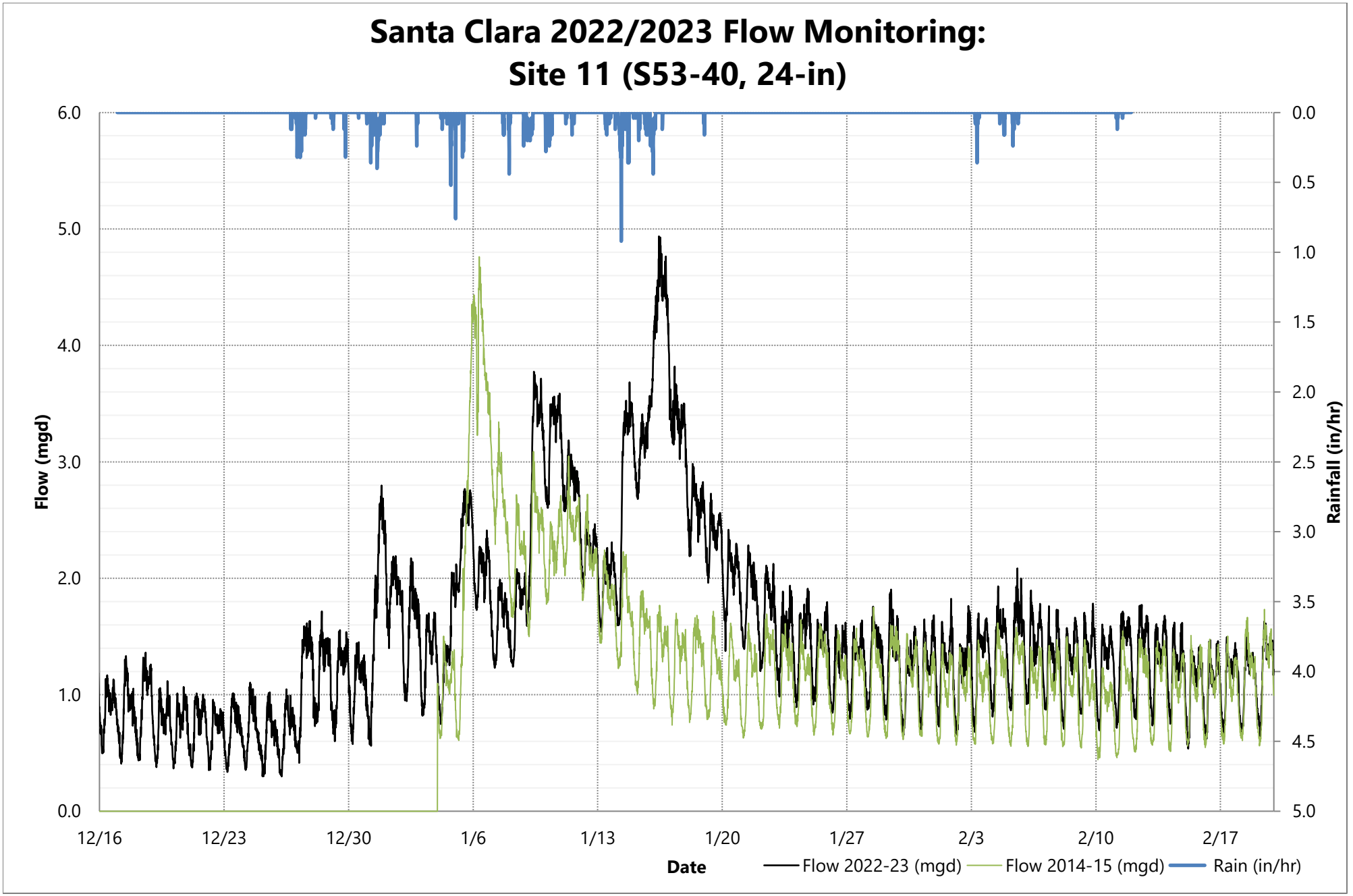

Santa Clara 2022/2023 Flow Monitoring:
Site 6 (S83-22, 30-in)
Flow (mgd)
Rainfall (in/hr)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

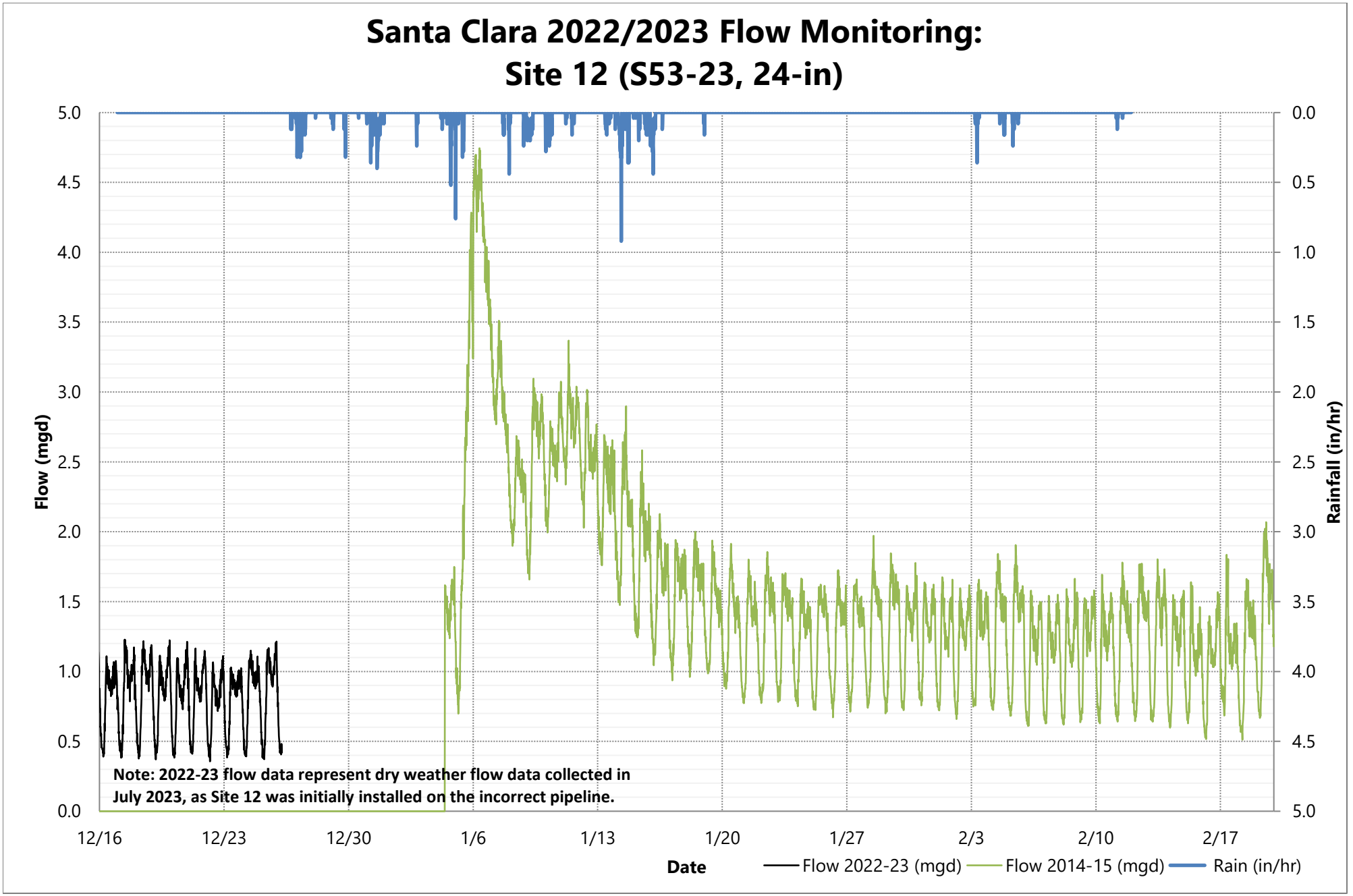

Santa Clara 2022/2023 Flow Monitoring:
Site 7 (S105-34, 24-in)
Flow (mgd)
Rainfall (in/hr)
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

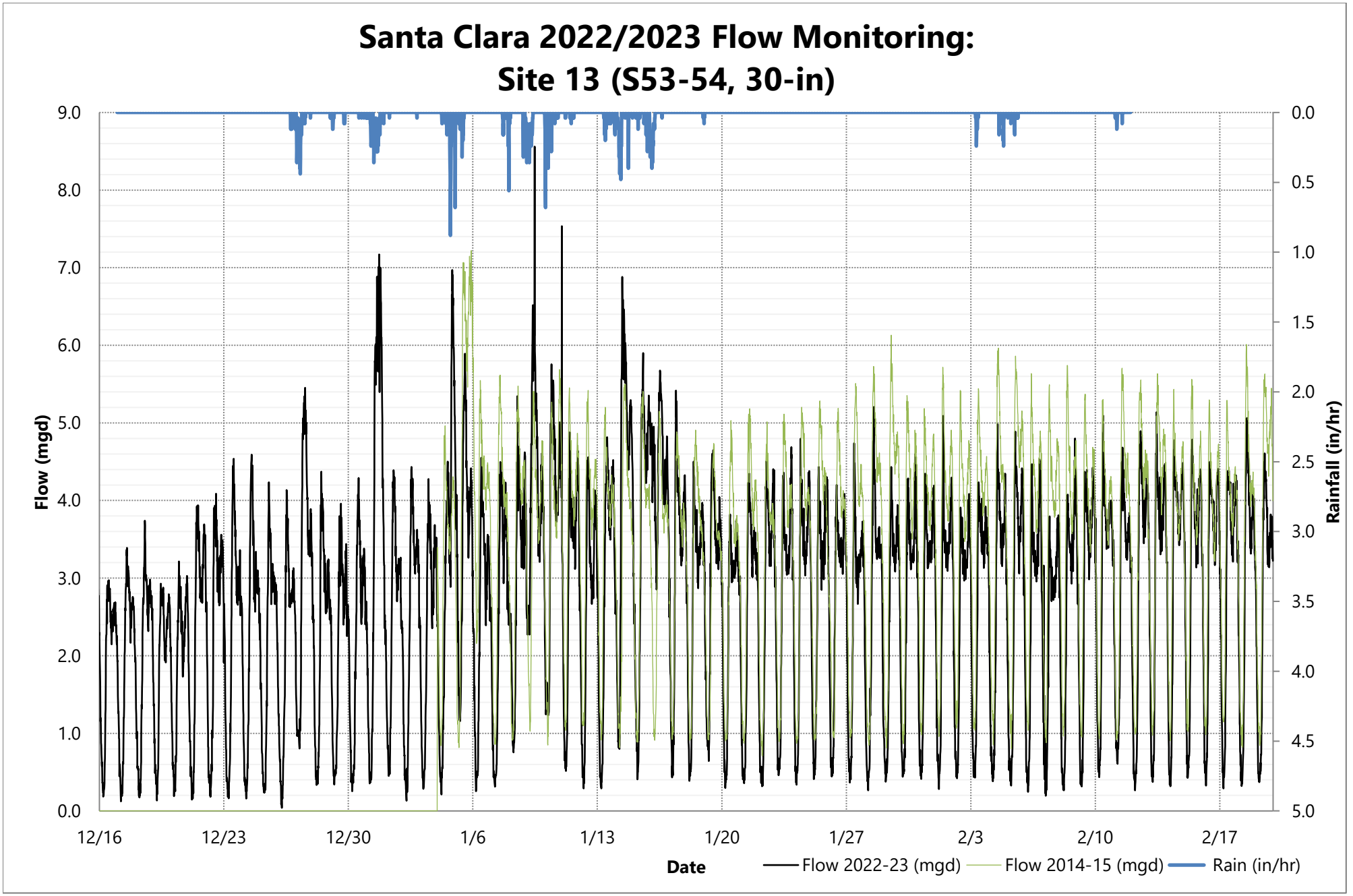

Santa Clara 2022/2023 Flow Monitoring:
Site 8 (S86-12, 30-in)
Flow (mgd)
Rainfall (in/hr)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

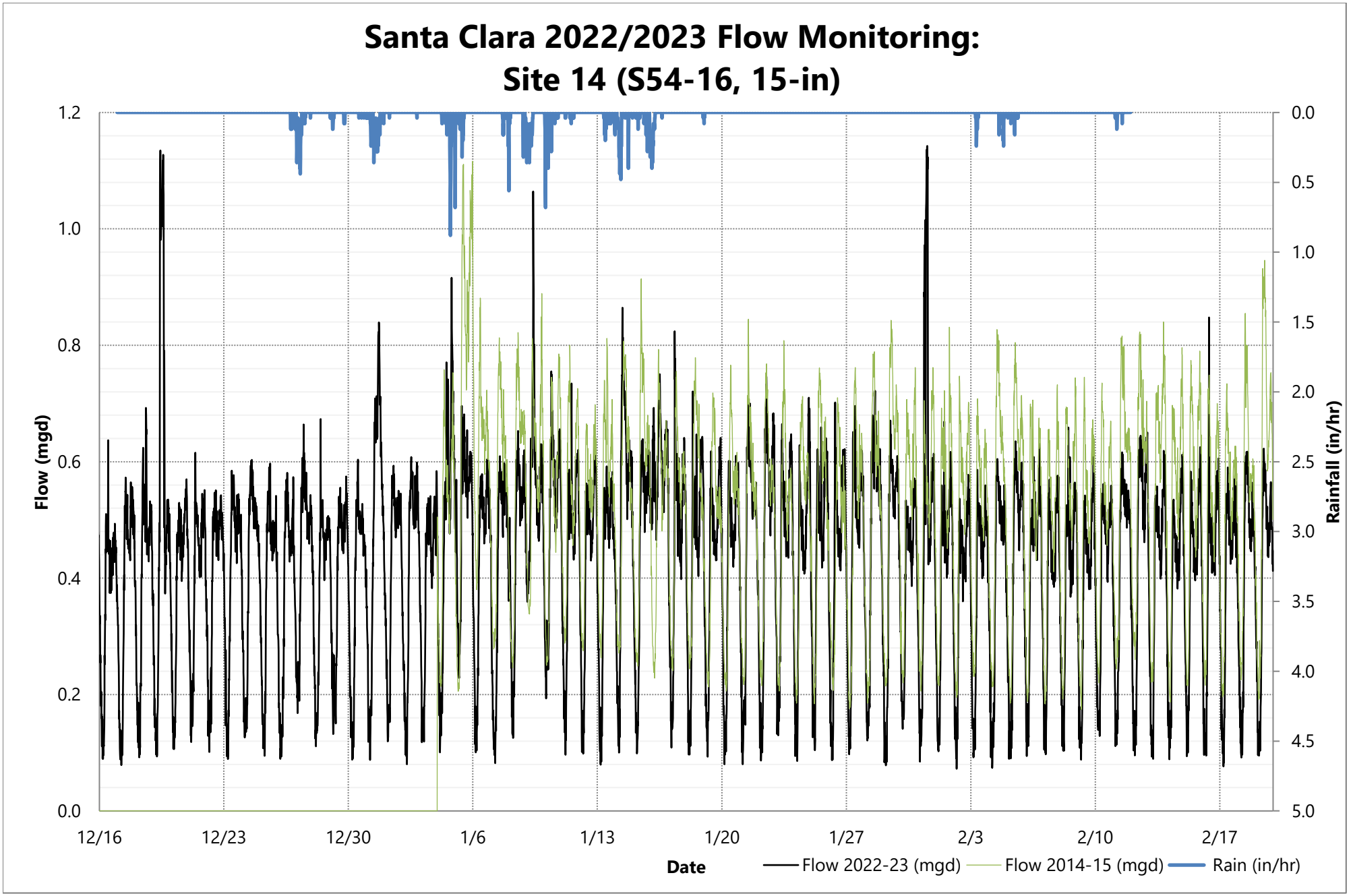

Santa Clara 2022/2023 Flow Monitoring:
Site 9 (S72-17, 30-in)
Flow (mgd)
Rainfall (in/hr)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

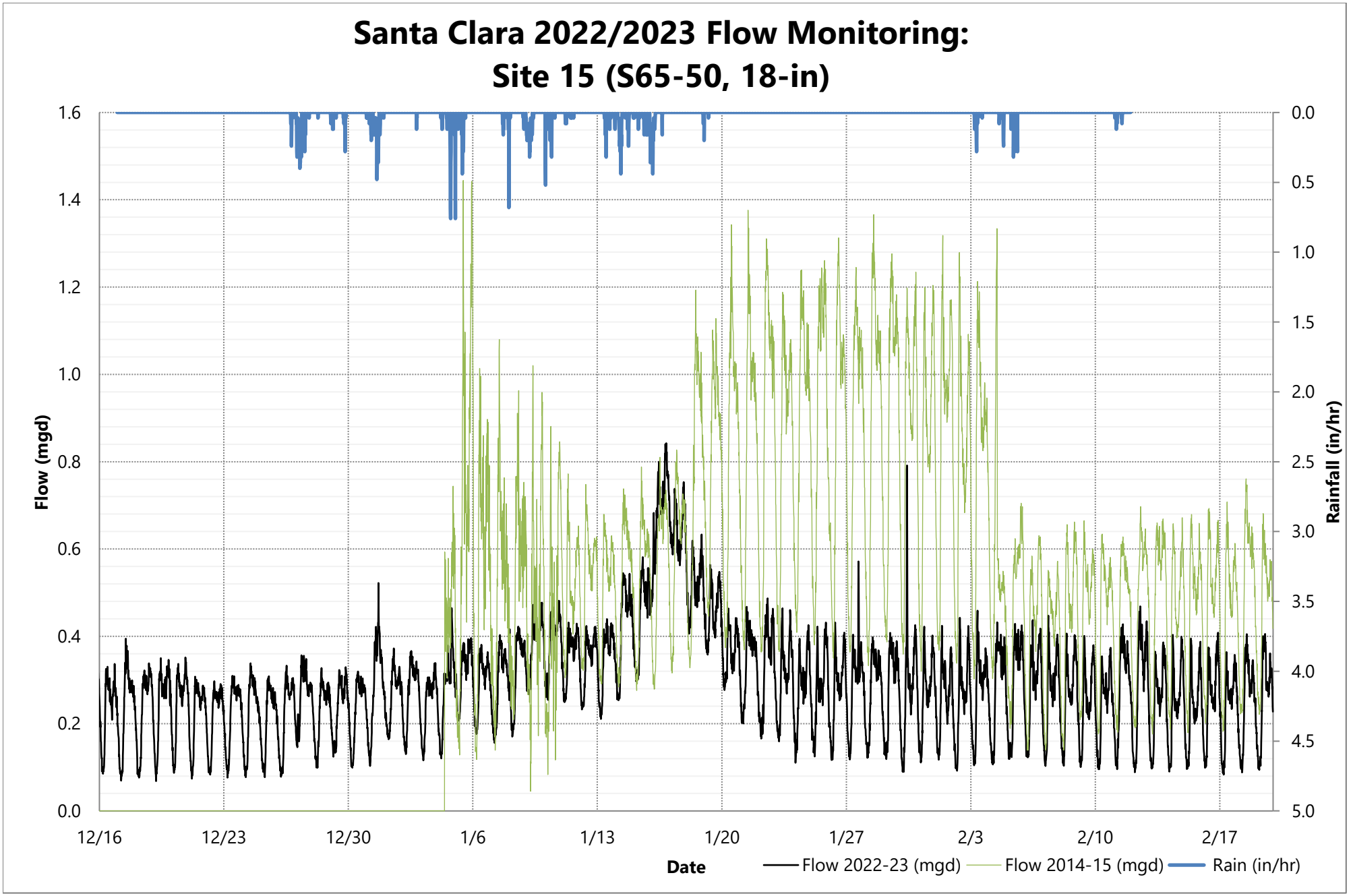

Santa Clara 2022/2023 Flow Monitoring:
Site 10 (S52-79, 24-in)
Flow (mgd)
Rainfall (in/hr)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

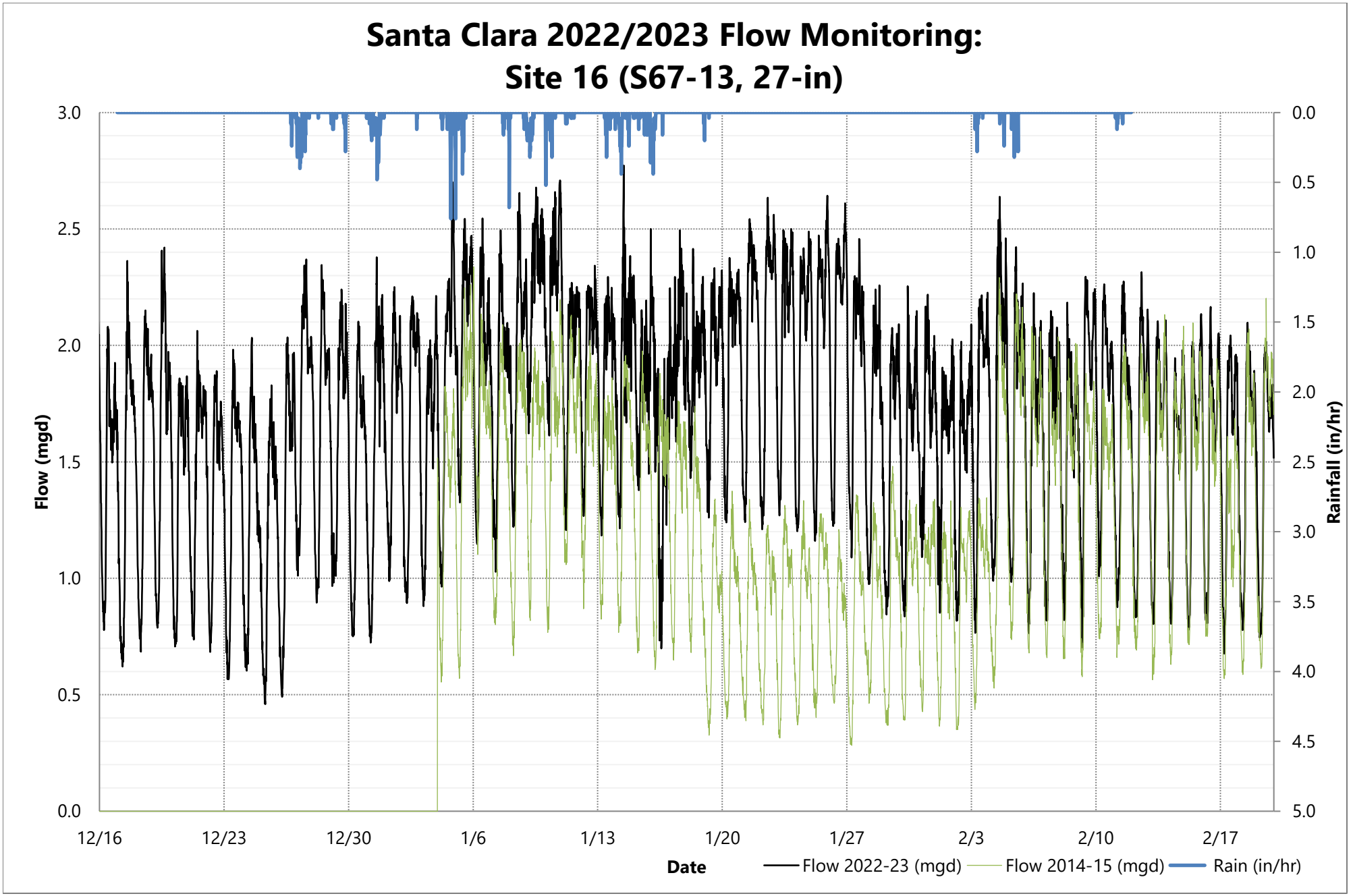

Santa Clara 2022/2023 Flow Monitoring:
Site 11 (S53-40, 24-in)
Flow (mgd)
Rainfall (in/hr)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

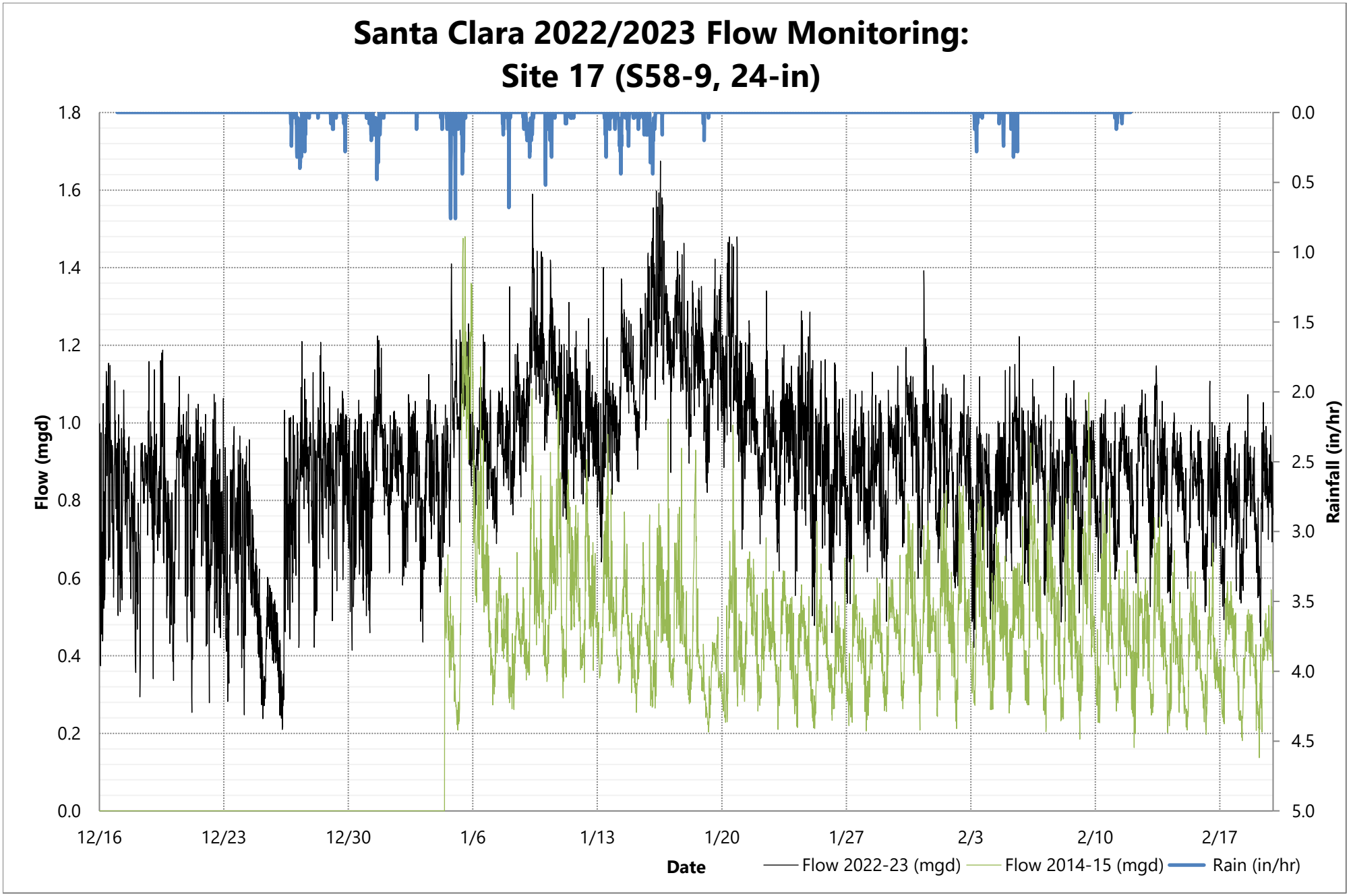

Santa Clara 2022/2023 Flow Monitoring:
Site 12 (S53-23, 24-in)
Flow (mgd)
Rainfall (in/hr)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Note: 2022-23 flow data represent dry weather flow data collected in July 2023, as Site 12 was initially installed on the incorrect pipeline.
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

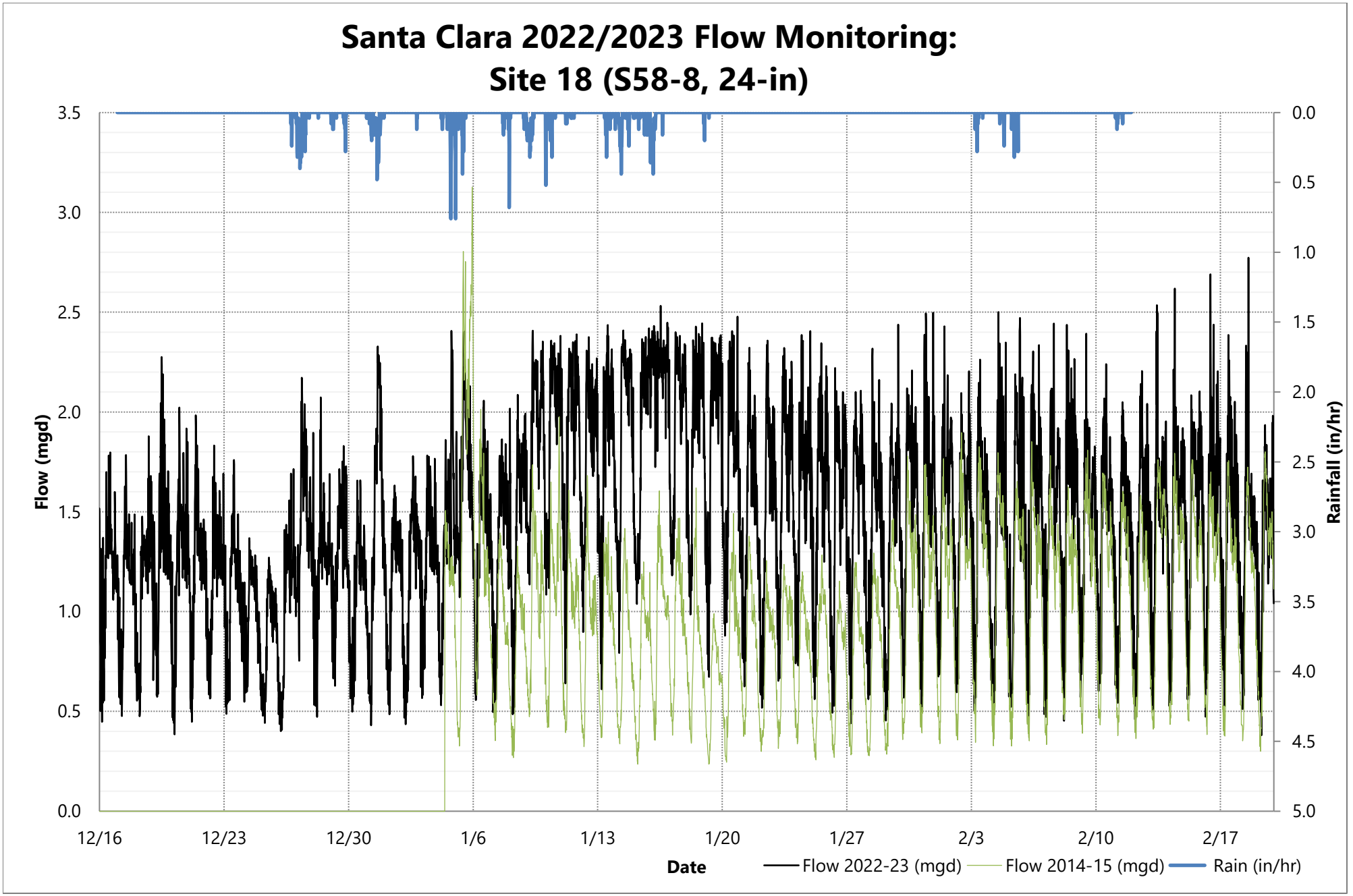

Santa Clara 2022/2023 Flow Monitoring:
Site 13 (S53-54, 30-in)
Flow (mgd)
Rainfall (in/hr)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

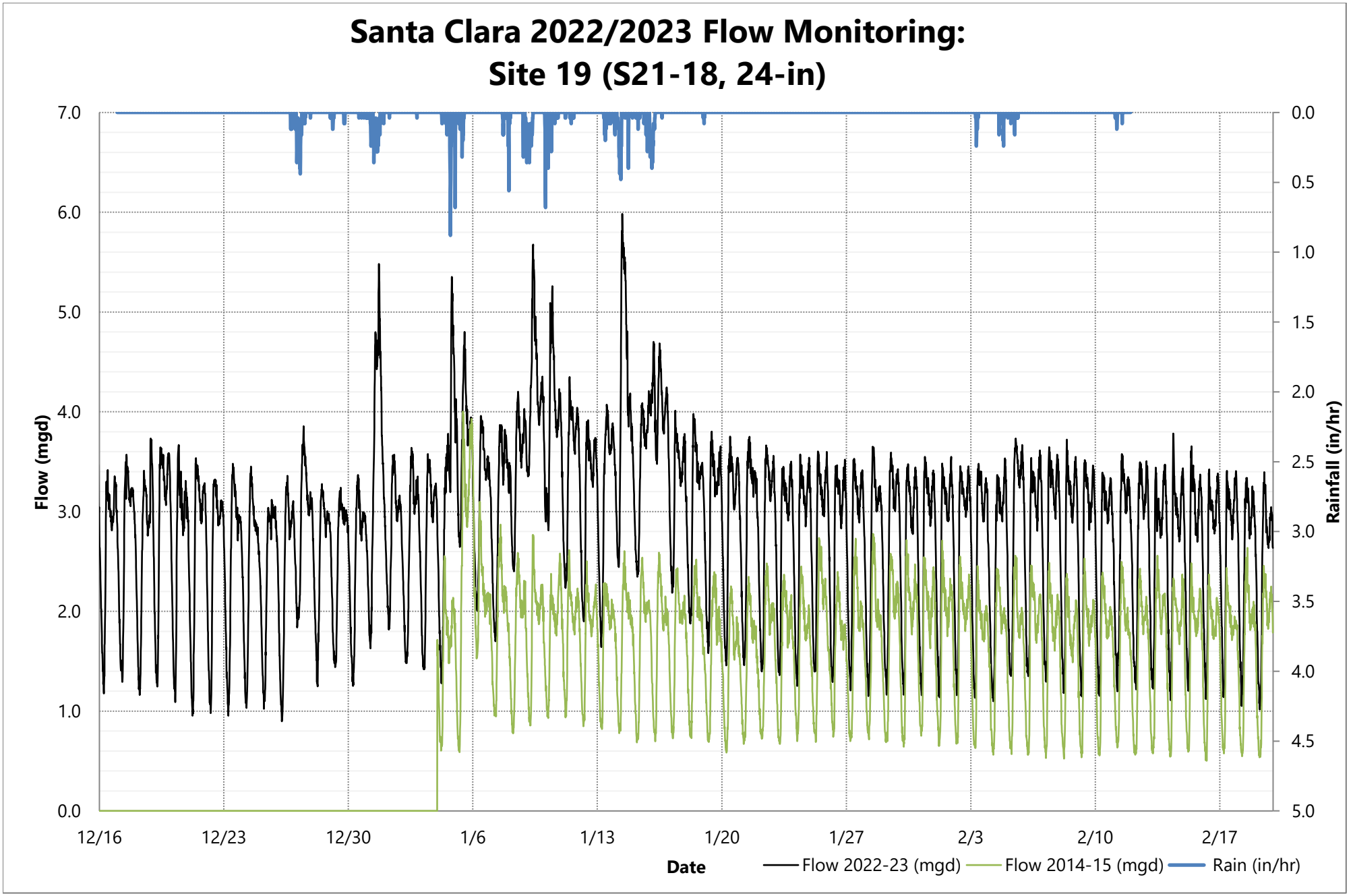

Santa Clara 2022/2023 Flow Monitoring:
Site 14 (S54-16, 15-in)
Flow (mgd)
Rainfall (in/hr)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

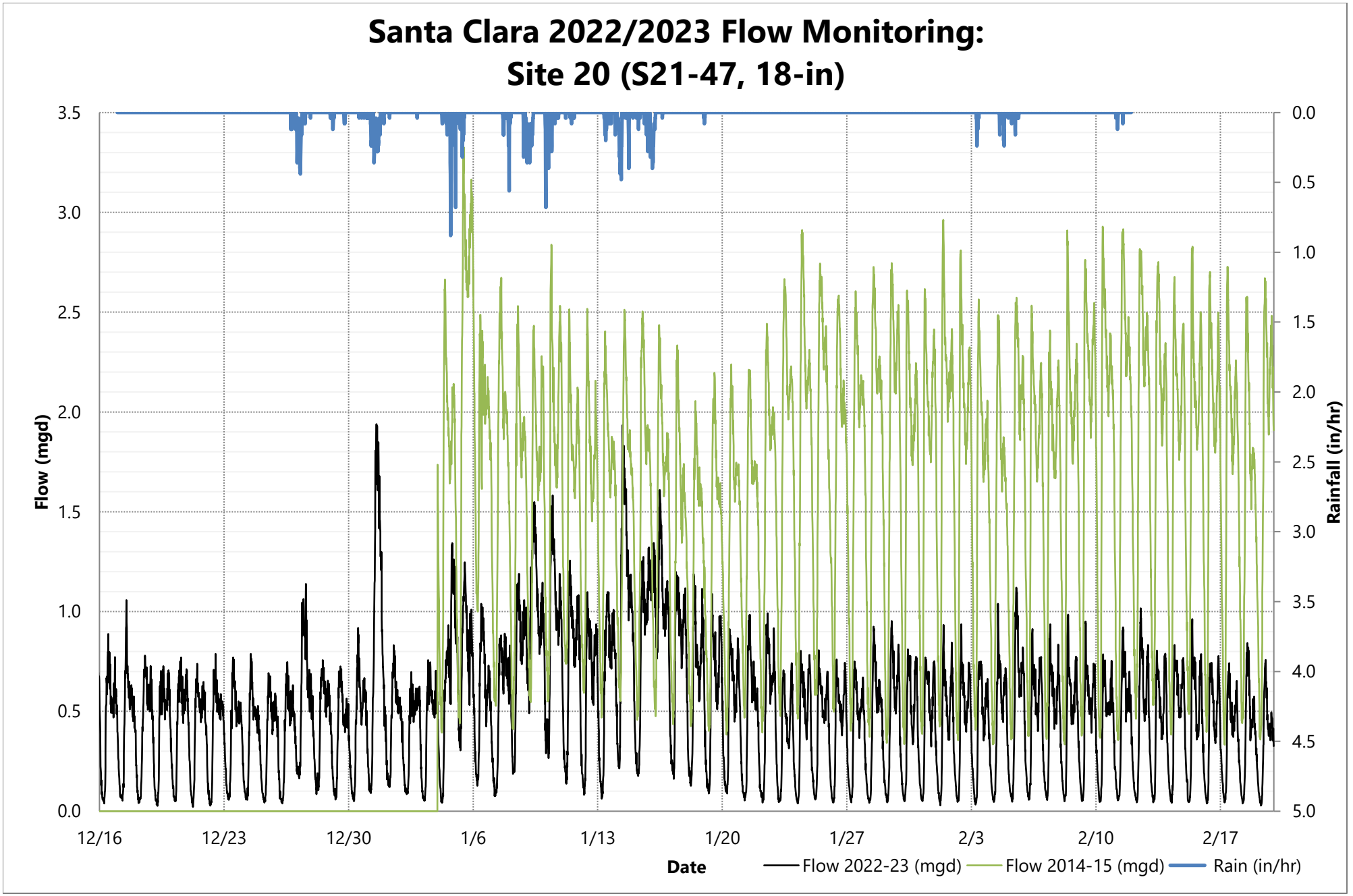

Santa Clara 2022/2023 Flow Monitoring:
Site 15 (S65-50, 18-in)
Flow (mgd)
Rainfall (in/hr)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

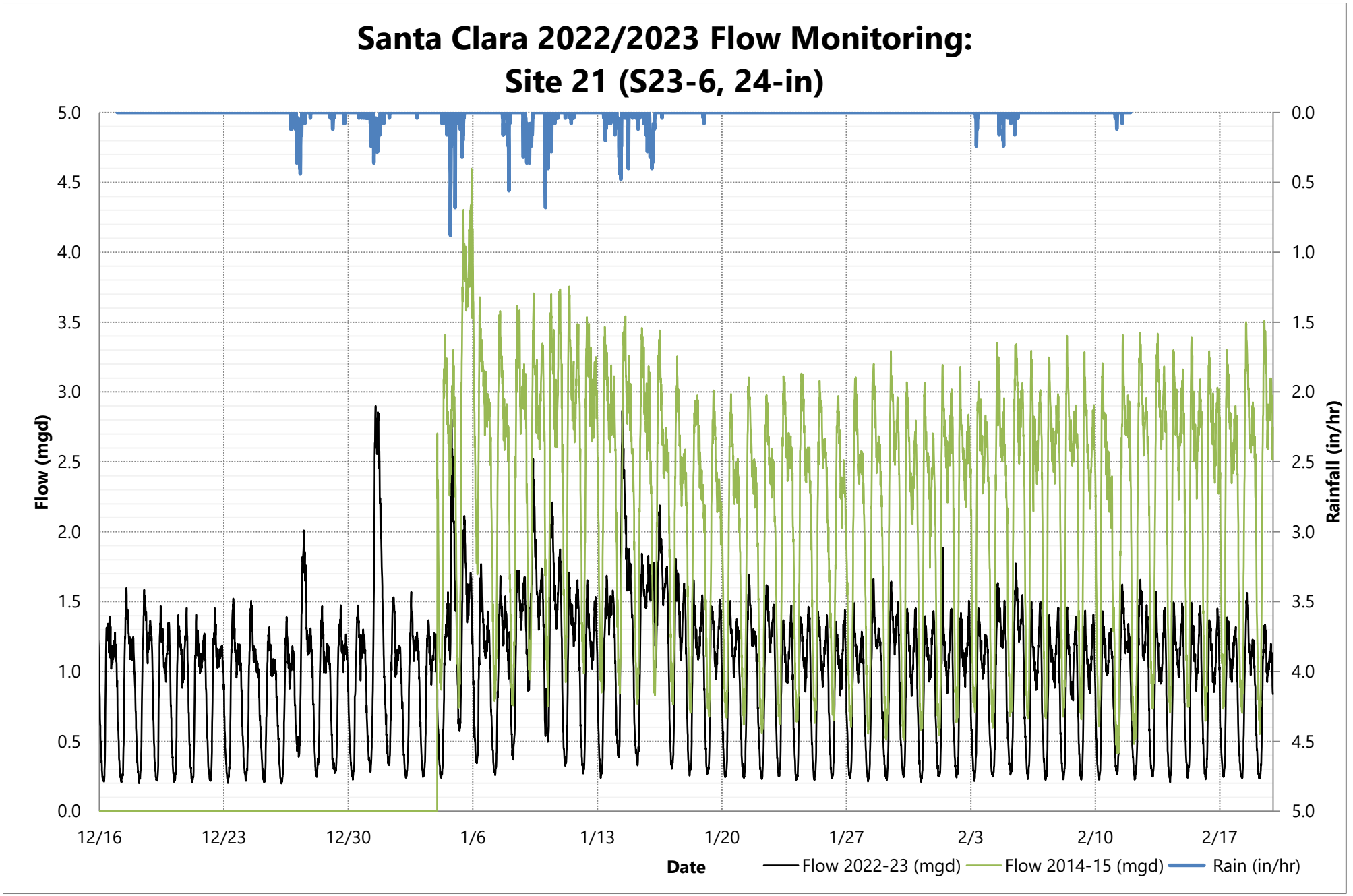

Santa Clara 2022/2023 Flow Monitoring:
Site 16 (S67-13, 27-in)
Flow (mgd)
Rainfall (in/hr)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

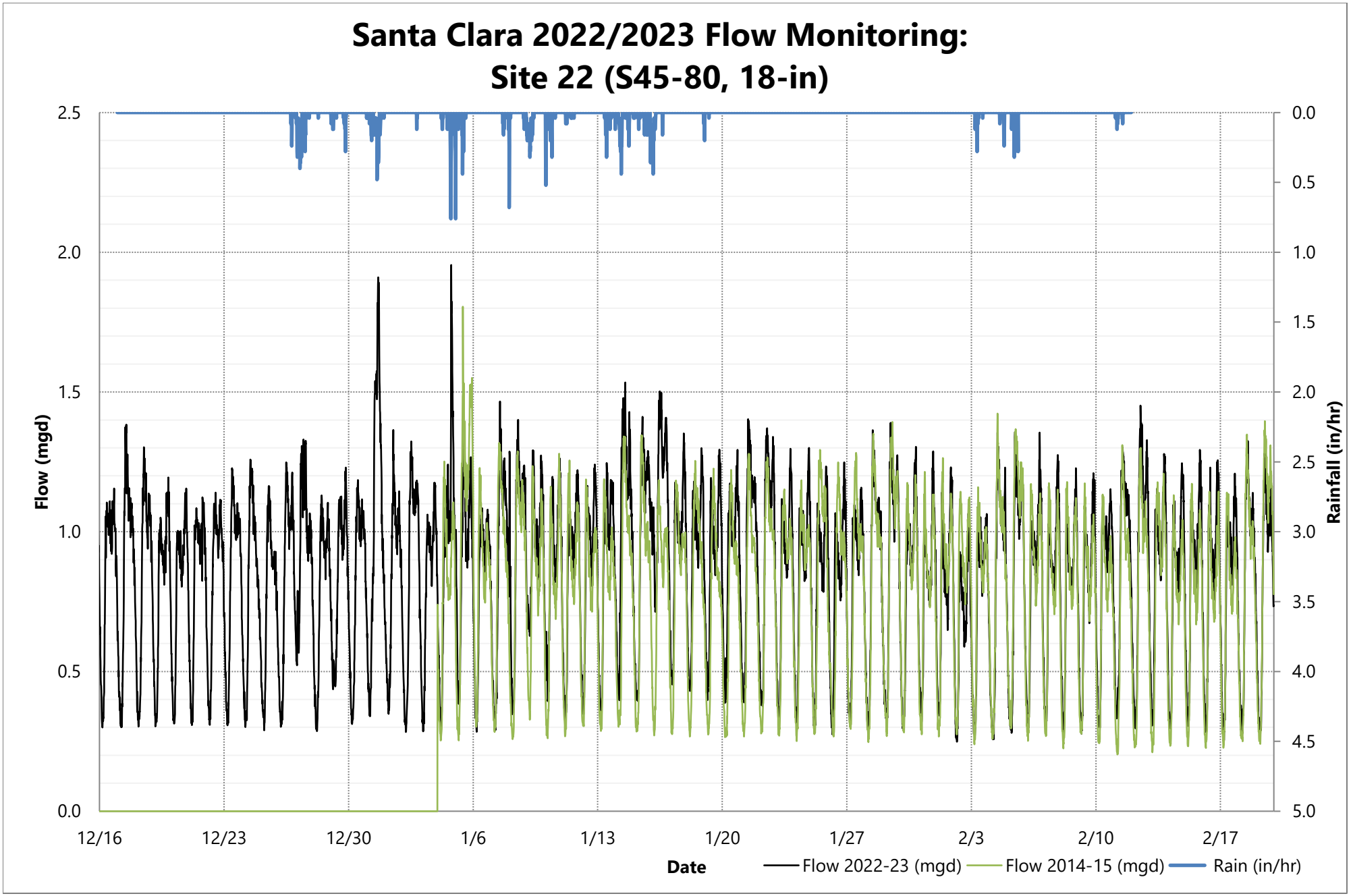

Santa Clara 2022/2023 Flow Monitoring:
Site 17 (S58-9, 24-in)
Flow (mgd)
Rainfall (in/hr)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

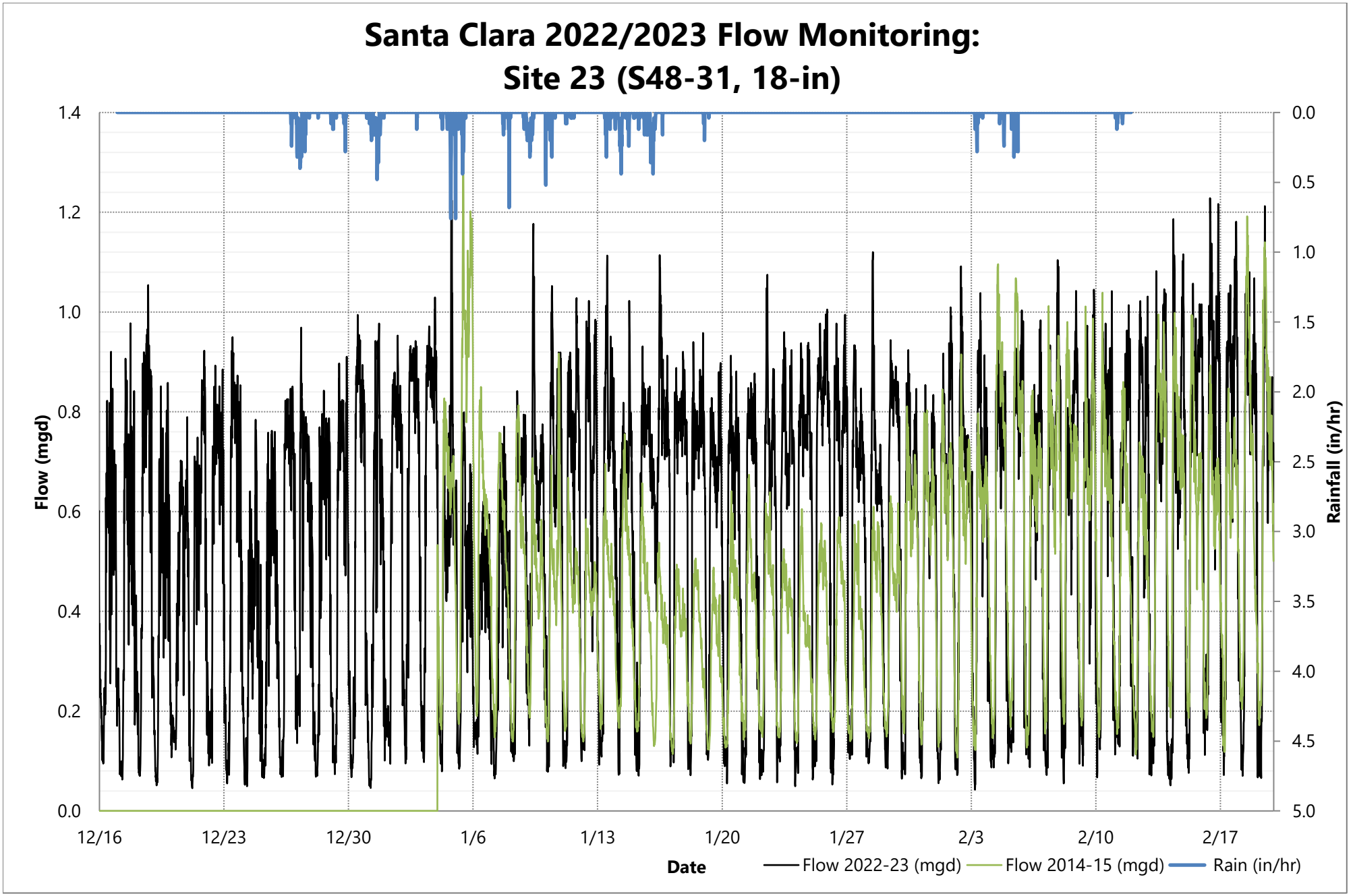

Santa Clara 2022/2023 Flow Monitoring:
Site 18 (S58-8, 24-in)
Flow (mgd)
Rainfall (in/hr)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

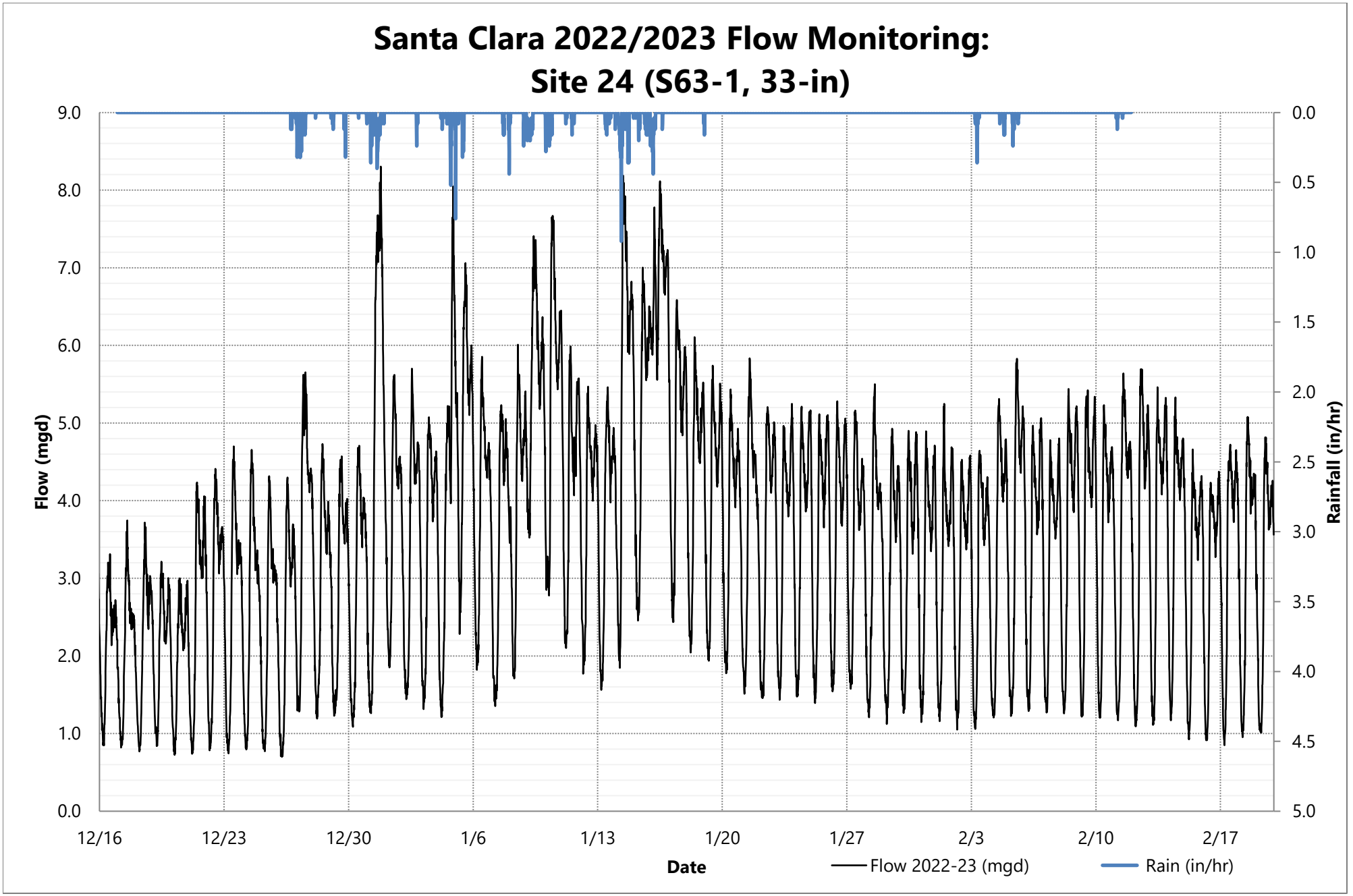

Santa Clara 2022/2023 Flow Monitoring:
Site 19 (S21-18, 24-in)
Flow (mgd)
Rainfall (in/hr)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

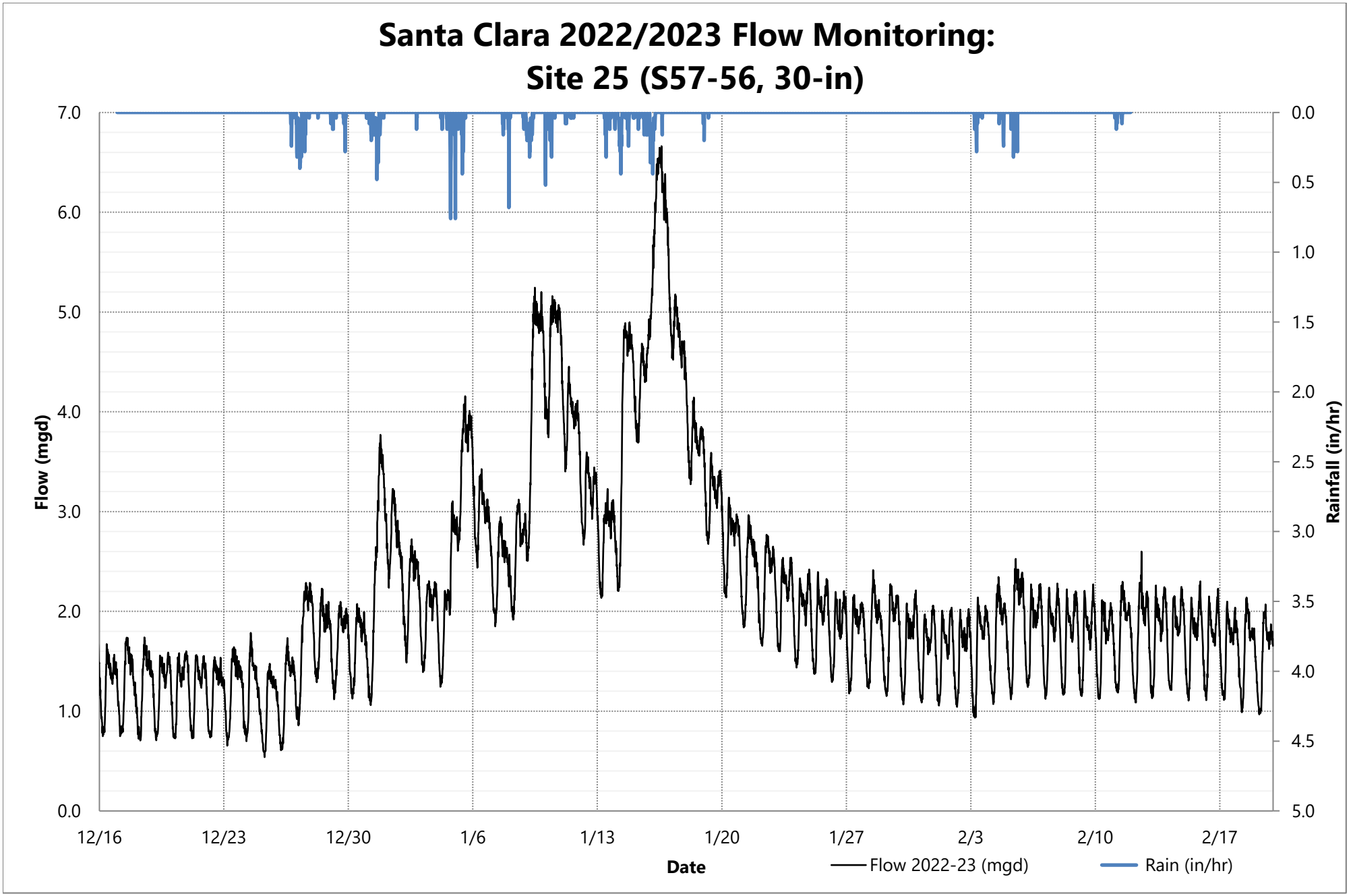

Santa Clara 2022/2023 Flow Monitoring:
Site 20 (S21-47, 18-in)
Flow (mgd)
Rainfall (in/hr)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

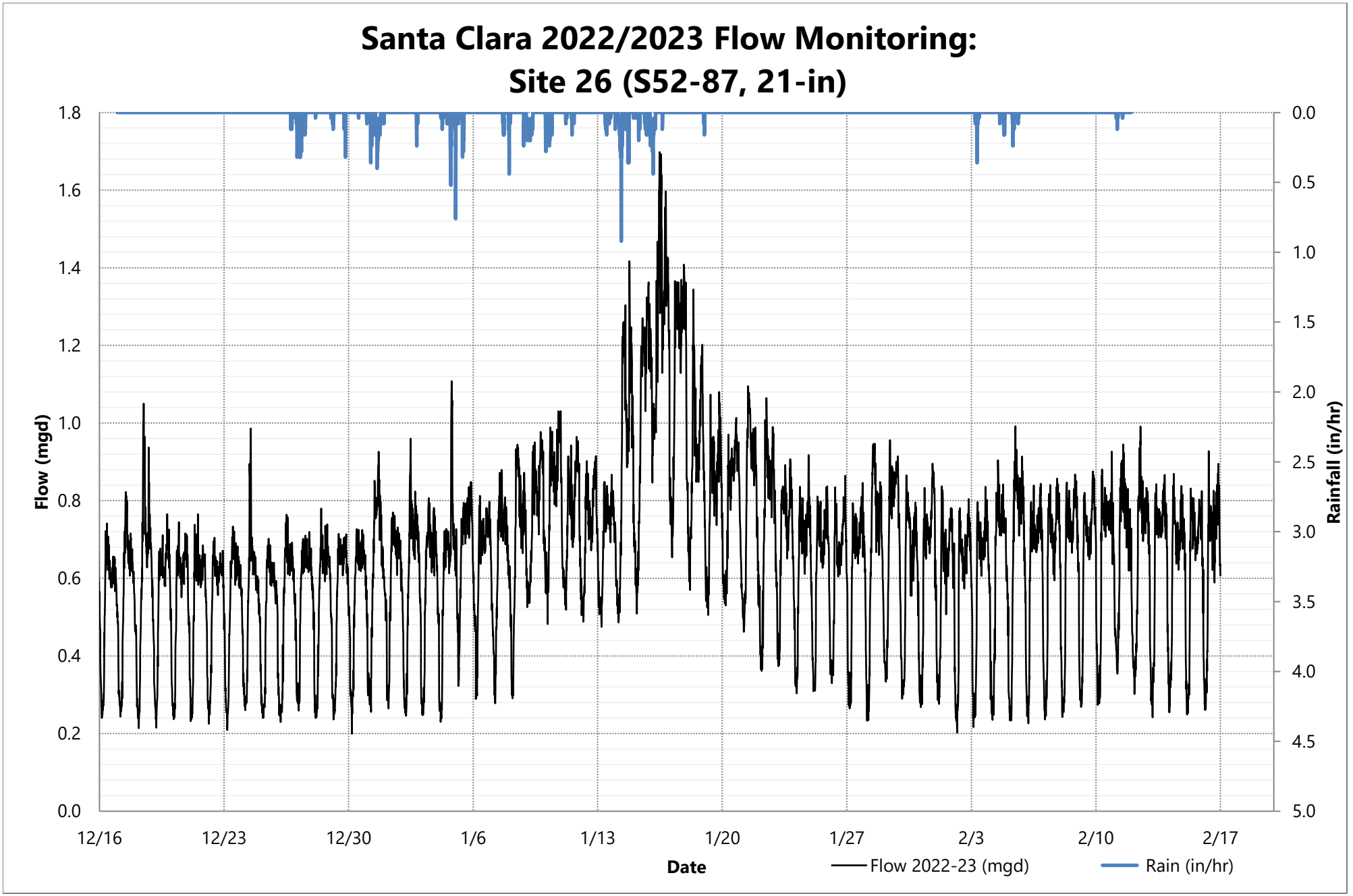

Santa Clara 2022/2023 Flow Monitoring:
Site 21 (S23-6, 24-in)
Flow (mgd)
Rainfall (in/hr)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

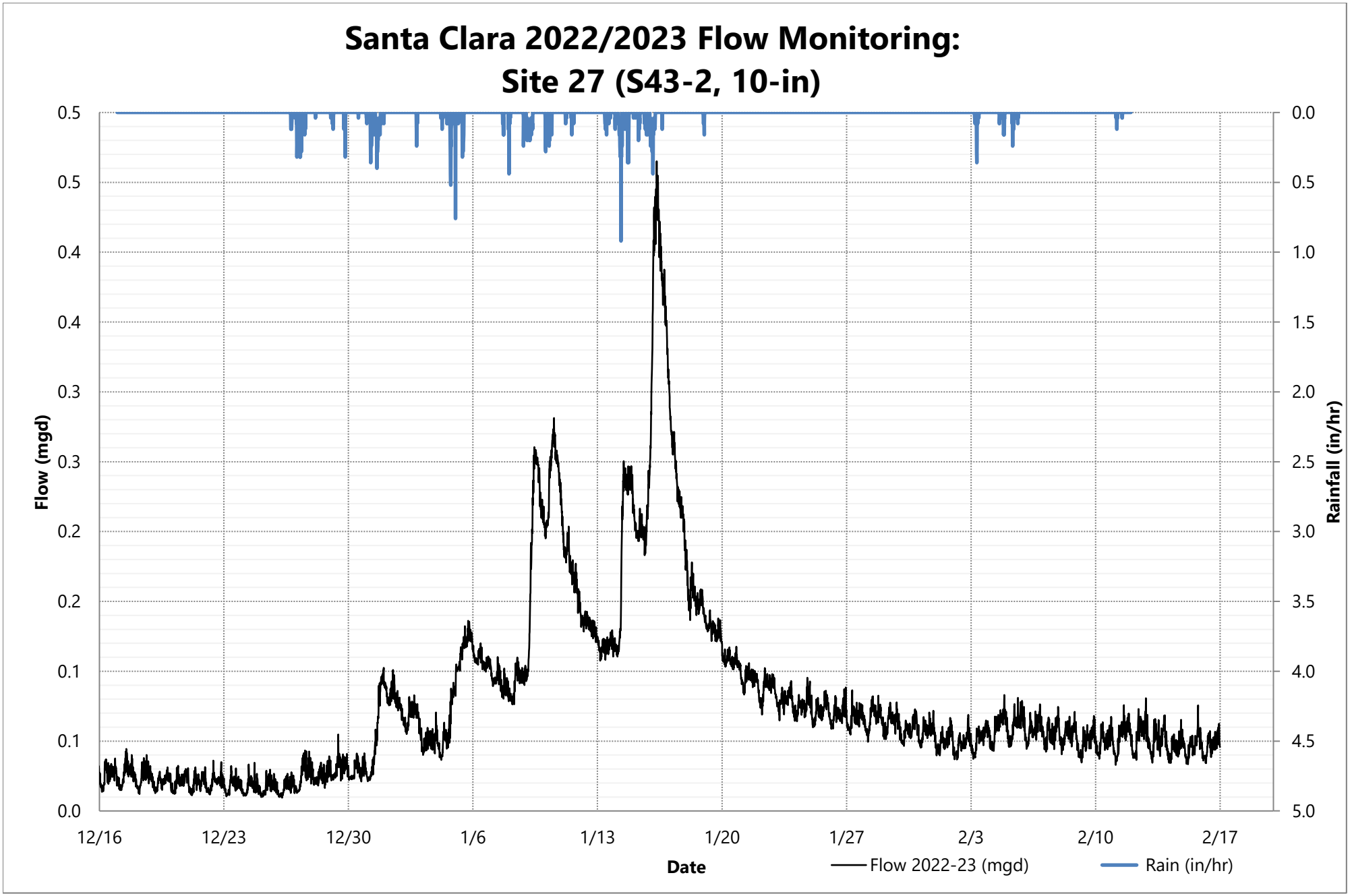

Santa Clara 2022/2023 Flow Monitoring:
Site 22 (S45-80, 18-in)
Flow (mgd)
Rainfall (in/hr)
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

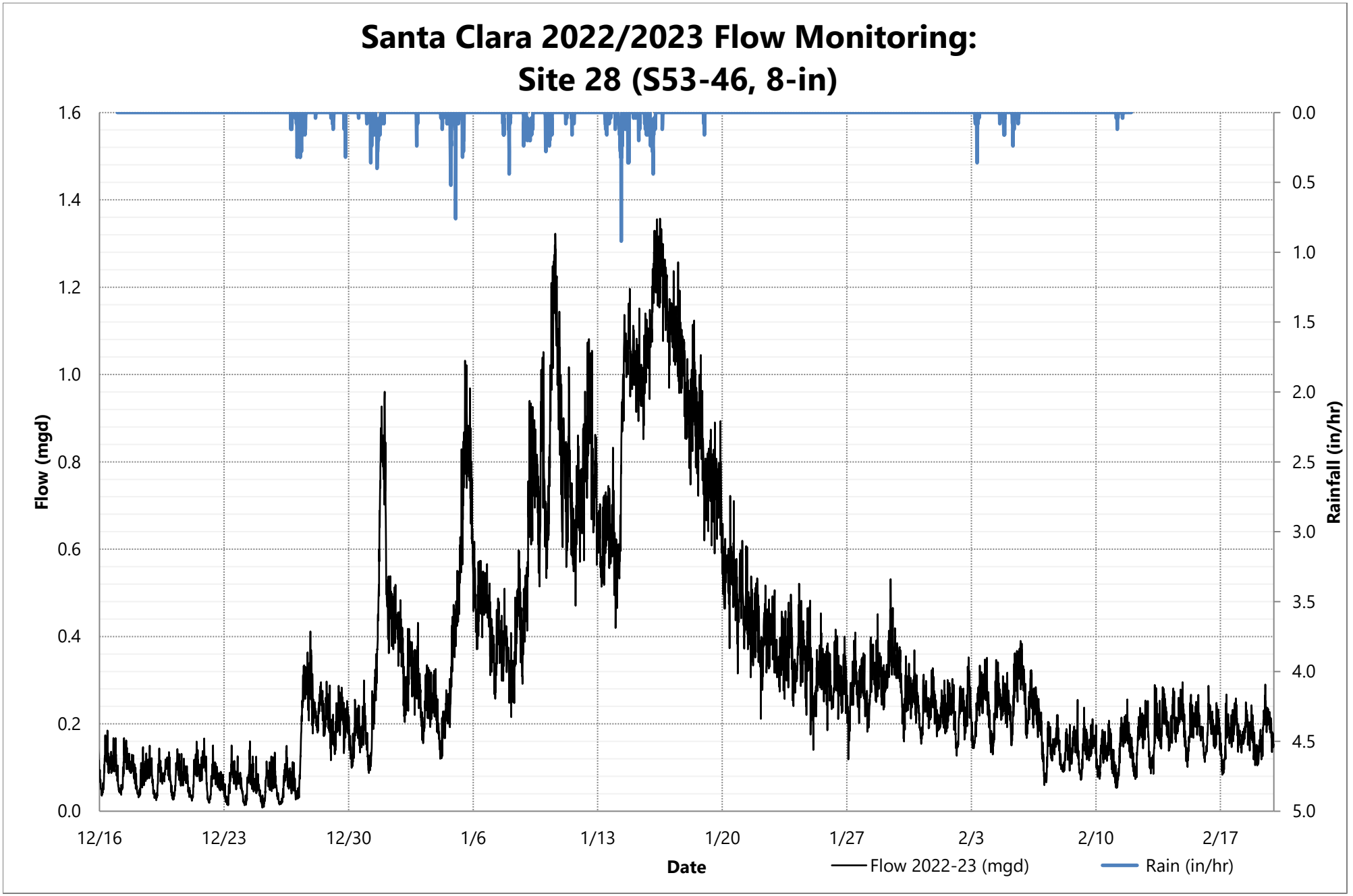

Santa Clara 2022/2023 Flow Monitoring:
Site 23 (S48-31, 18-in)
Flow (mgd)
Rainfall (in/hr)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Rain (in/hr)

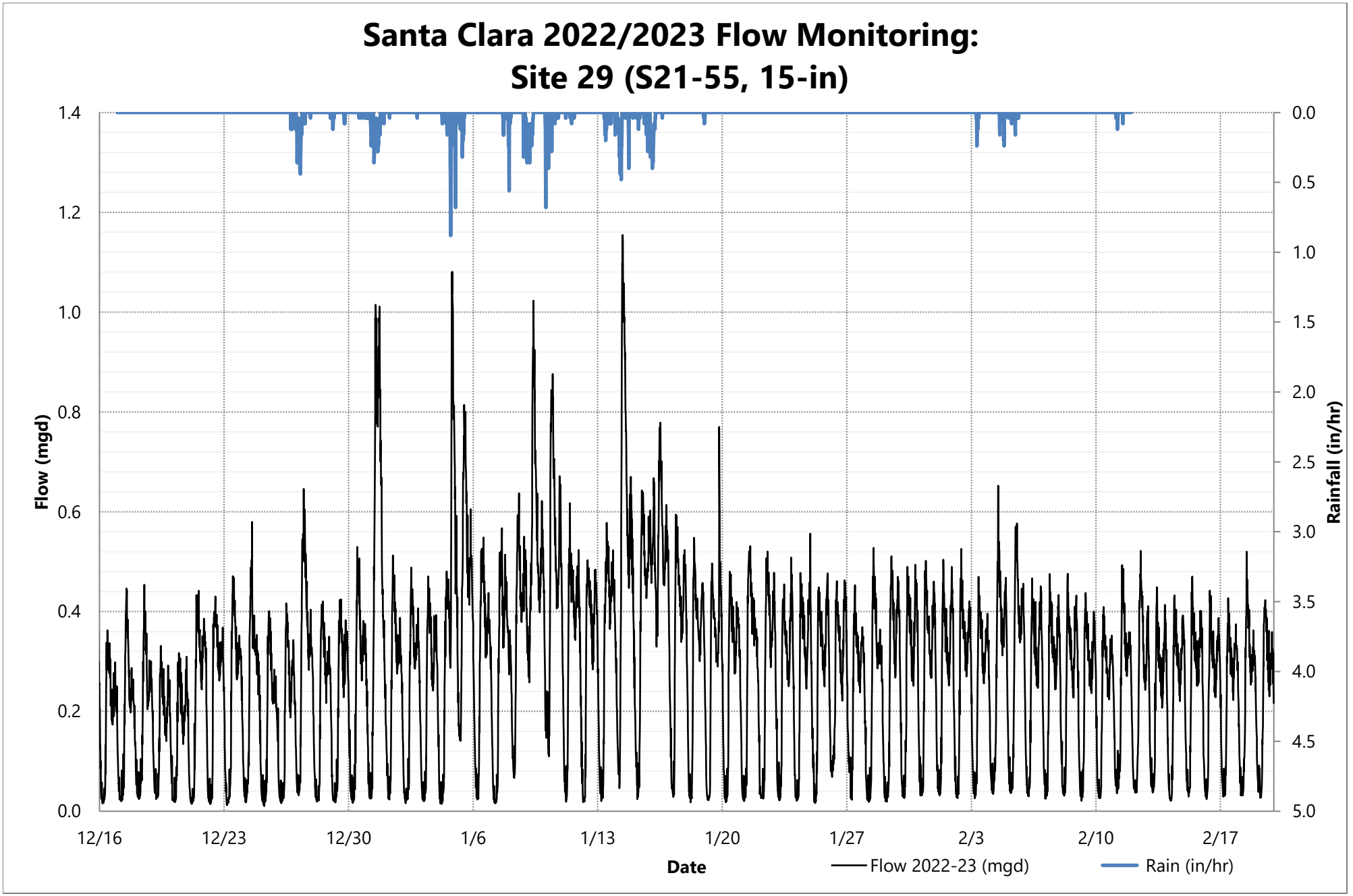

Santa Clara 2022/2023 Flow Monitoring:
Site 24 (S63-1, 33-in)
Flow (mgd)
Rainfall (in/hr)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Rain (in/hr)

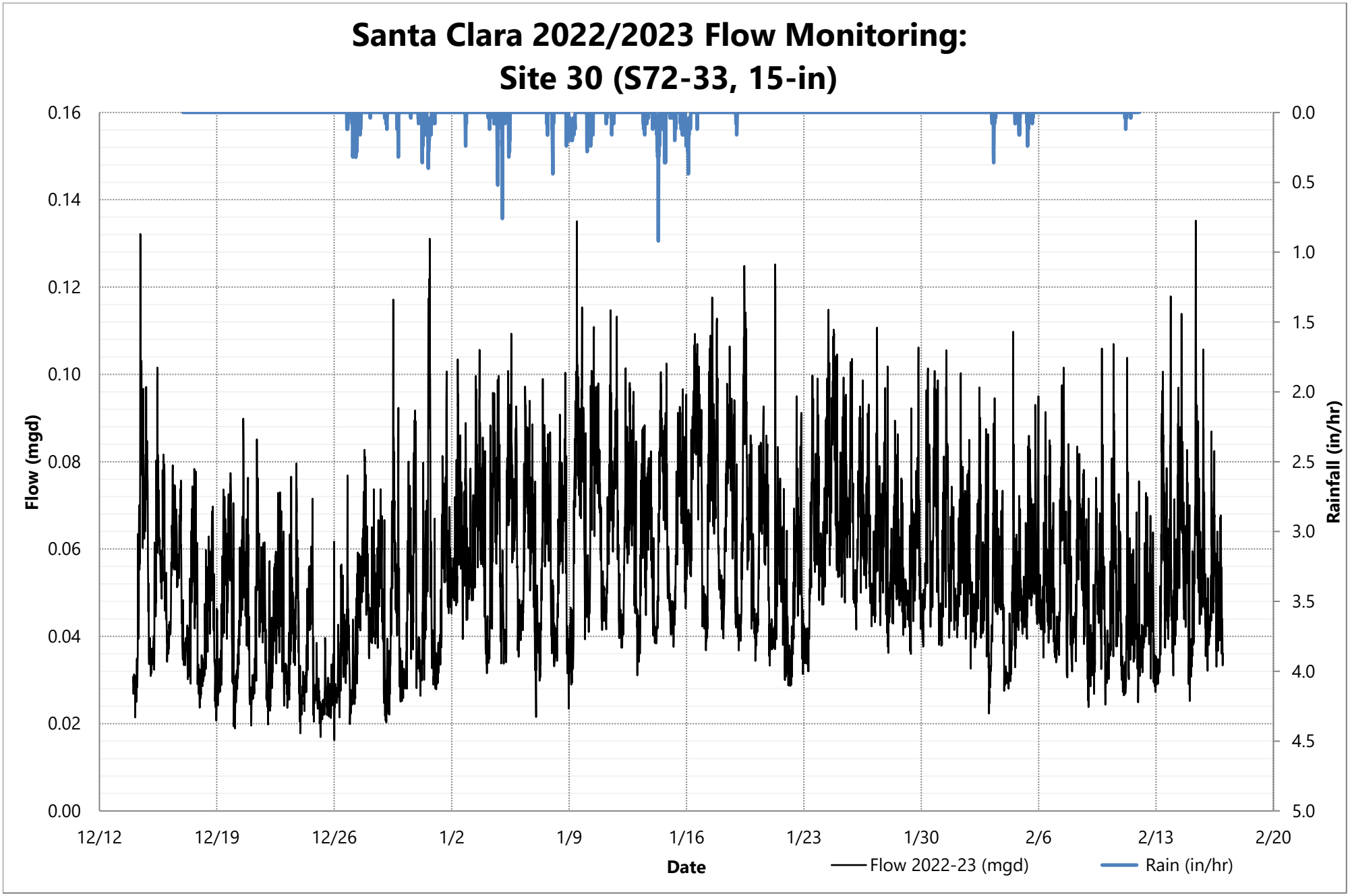

Santa Clara 2022/2023 Flow Monitoring:
Site 25 (S57-56, 30-in)
Flow (mgd)
Rainfall (in/hr)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Rain (in/hr)

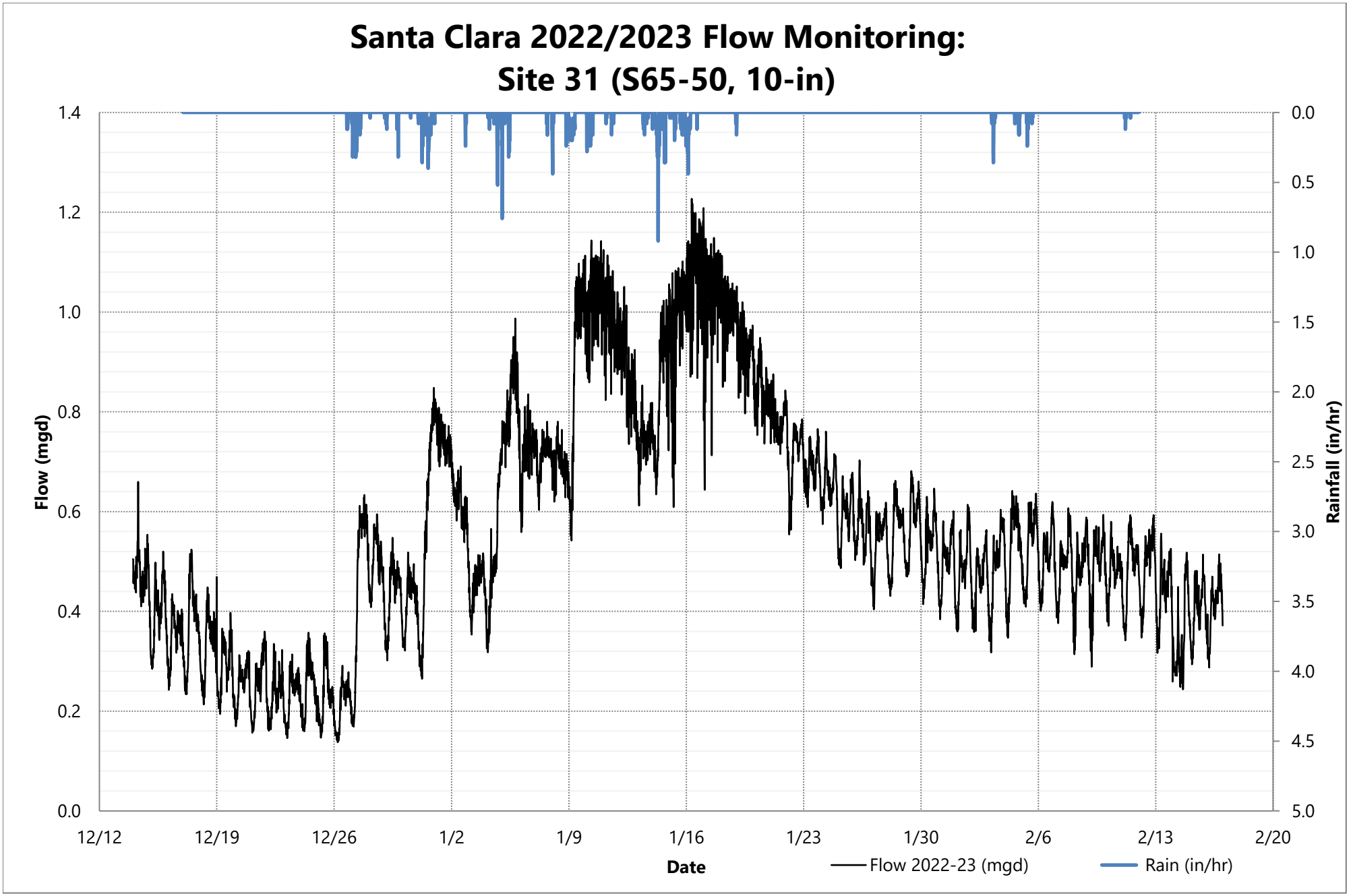

Santa Clara 2022/2023 Flow Monitoring:
Site 26 (S52-87, 21-in)
Flow (mgd)
Rainfall (in/hr)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Rain (in/hr)

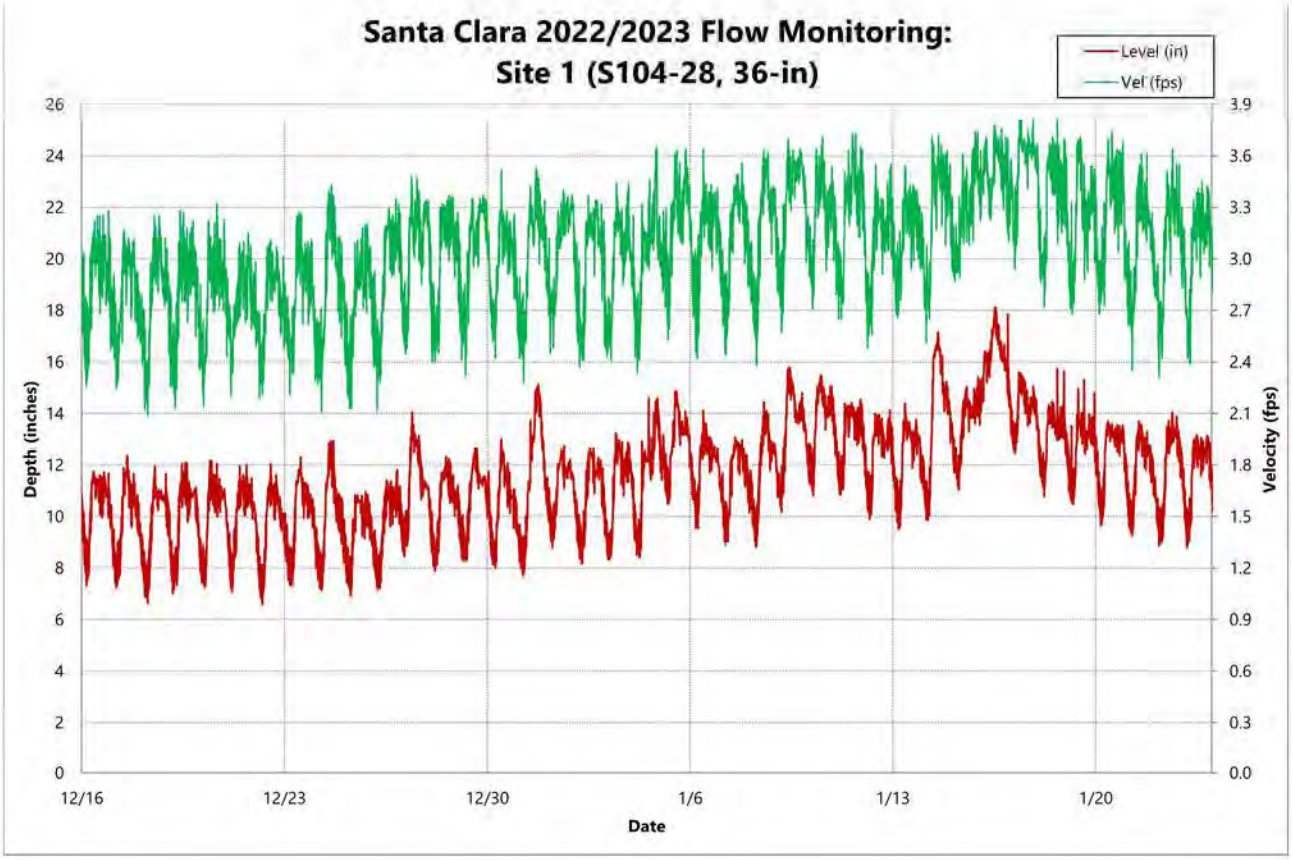

Santa Clara 2022/2023 Flow Monitoring:
Site 27 (S43-2, 10-in)
Flow (mgd)
Rainfall (in/hr)
0.5
0.4
0.3
0.2
0.1
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Rain (in/hr)

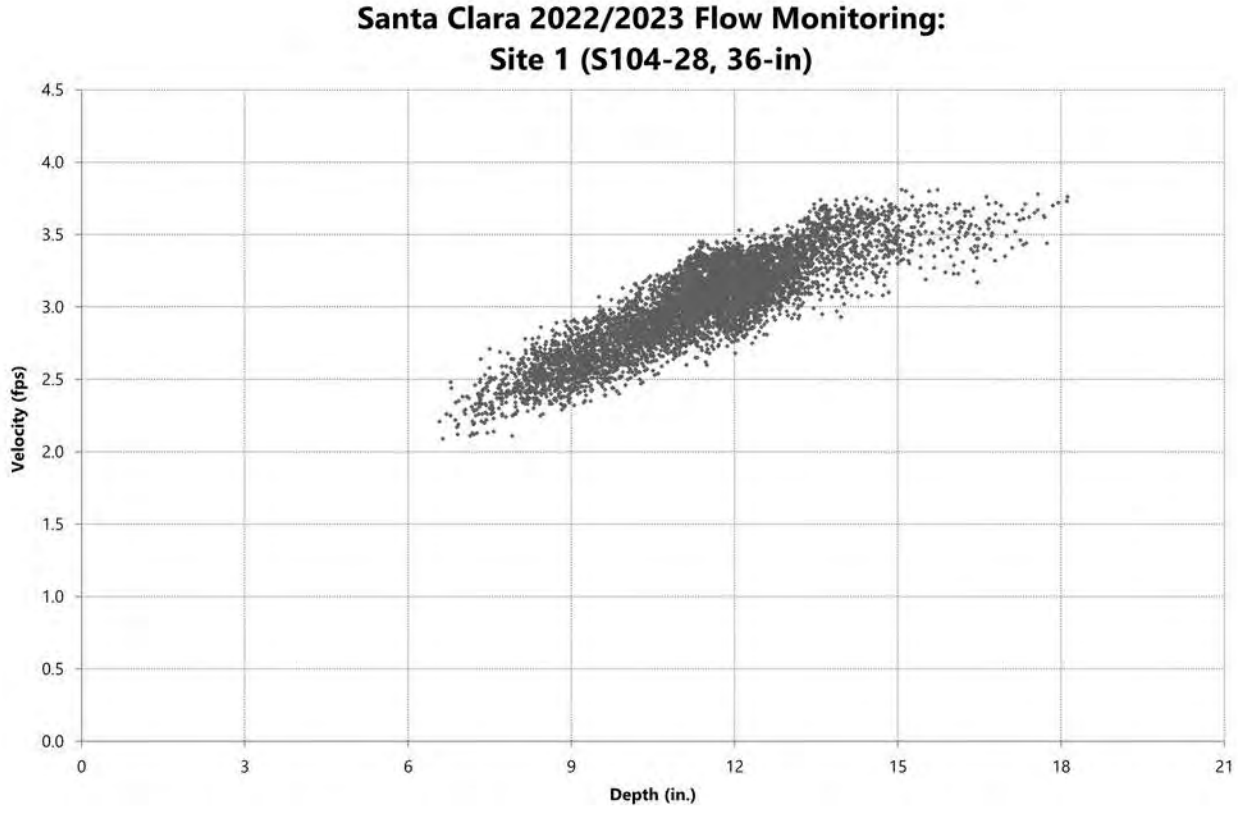

Santa Clara 2022/2023 Flow Monitoring:
Site 28 (S53-46, 8-in)
Flow (mgd)
Rainfall (in/hr)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Rain (in/hr)

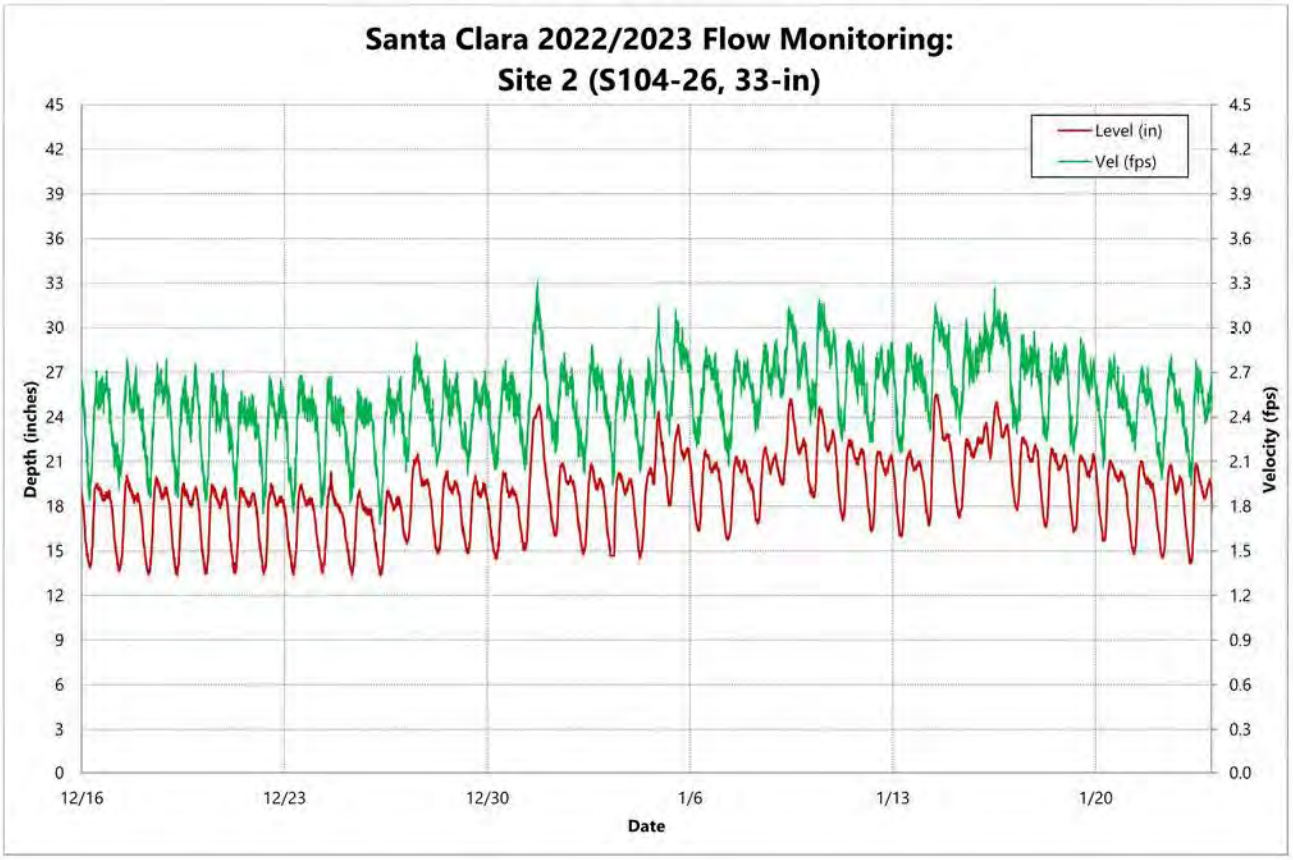

Santa Clara 2022/2023 Flow Monitoring:
Site 29 (S21-55, 15-in)
Flow (mgd)
Rainfall (in/hr)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/16
12/23
12/30
1/6
1/13
1/20
1/27
2/3
2/10
2/17
Date
Flow 2022-23 (mgd)
Rain (in/hr)

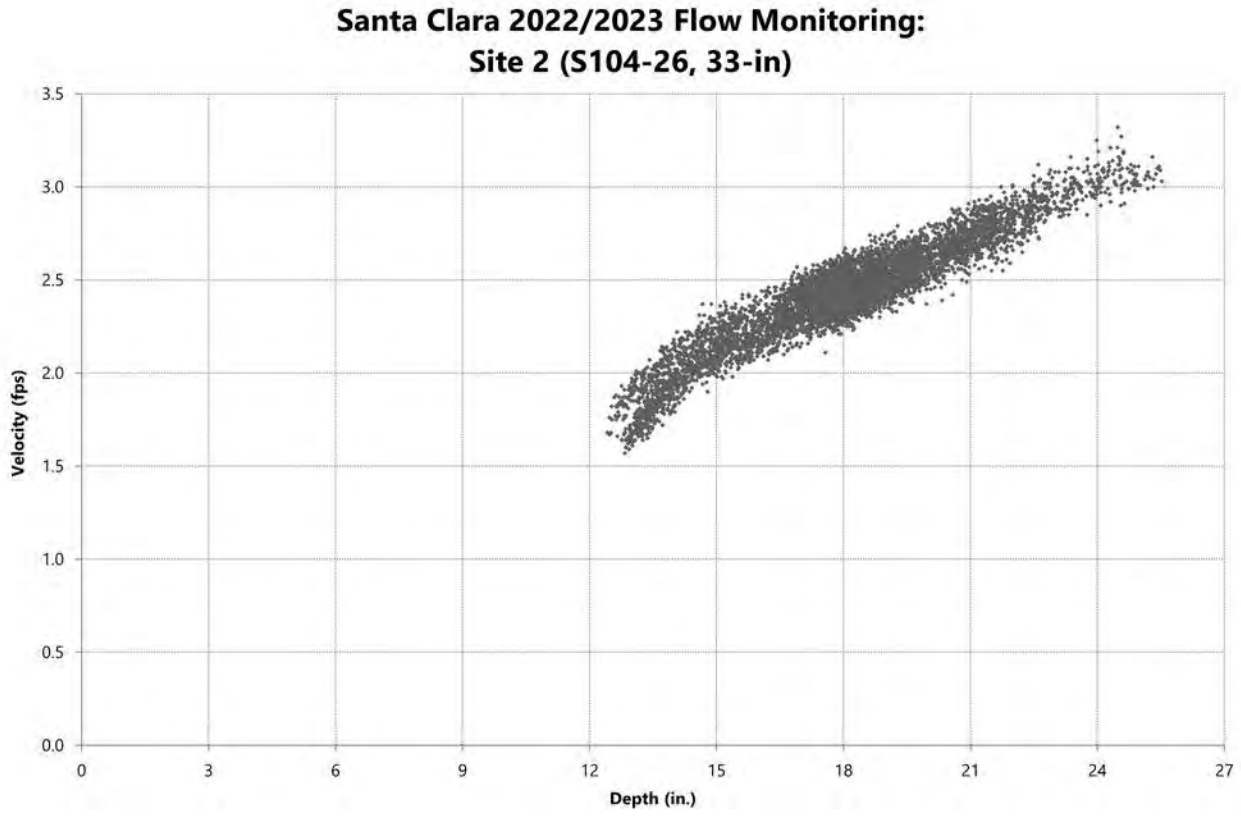

Santa Clara 2022/2023 Flow Monitoring:
Site 30 (S72-33, 15-in)
Flow (mgd)
Rainfall (in/hr)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/12
12/19
12/26
1/2
1/9
1/16
1/23
1/30
2/6
2/13
2/20
Date
Flow 2022-23 (mgd)
Rain (in/hr)

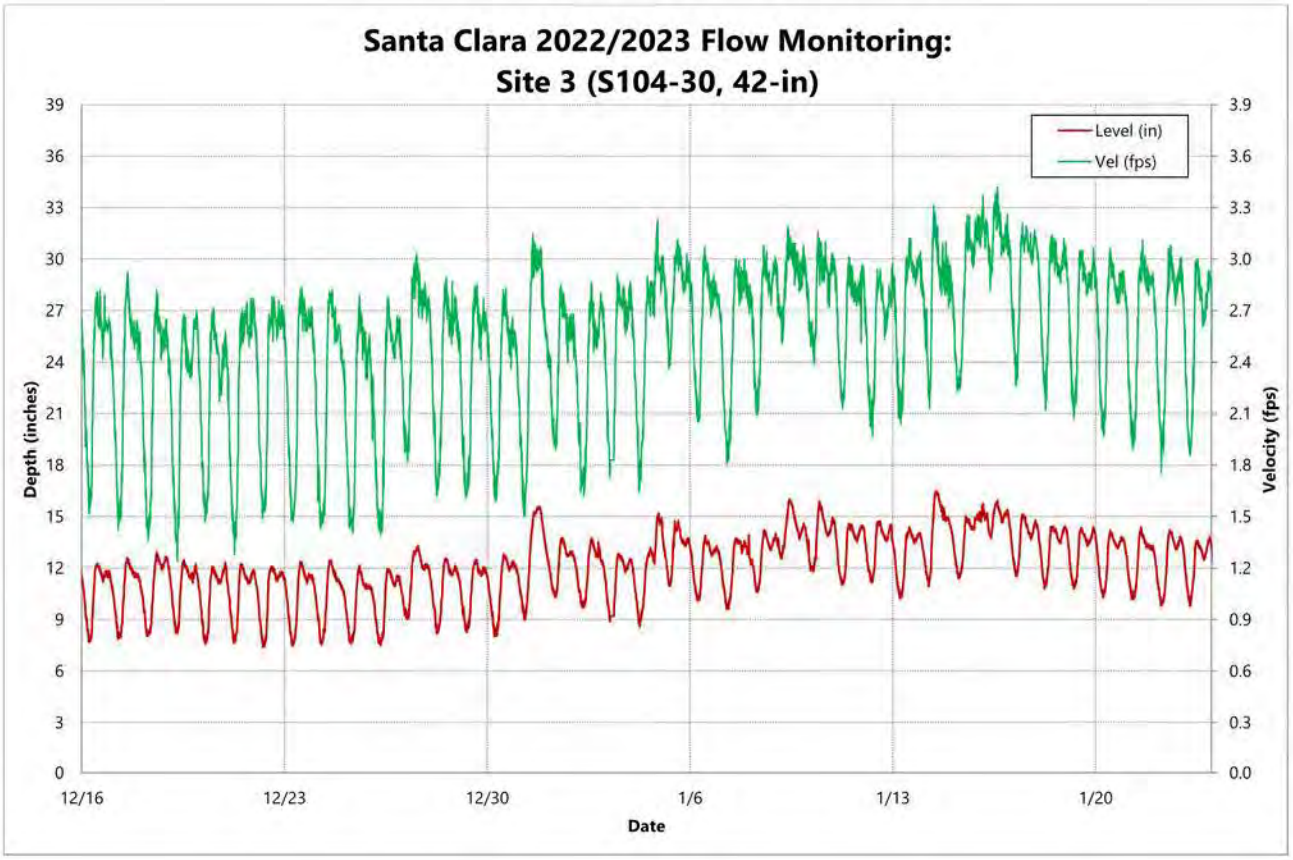

Santa Clara 2022/2023 Flow Monitoring:
Site 31 (S65-50, 10-in)
Flow (mgd)
Rainfall (in/hr)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
12/12
12/19
12/26
1/2
1/9
1/16
1/23
1/30
2/6
2/13
2/20
Date
Flow 2022-23 (mgd)
Rain (in/hr)

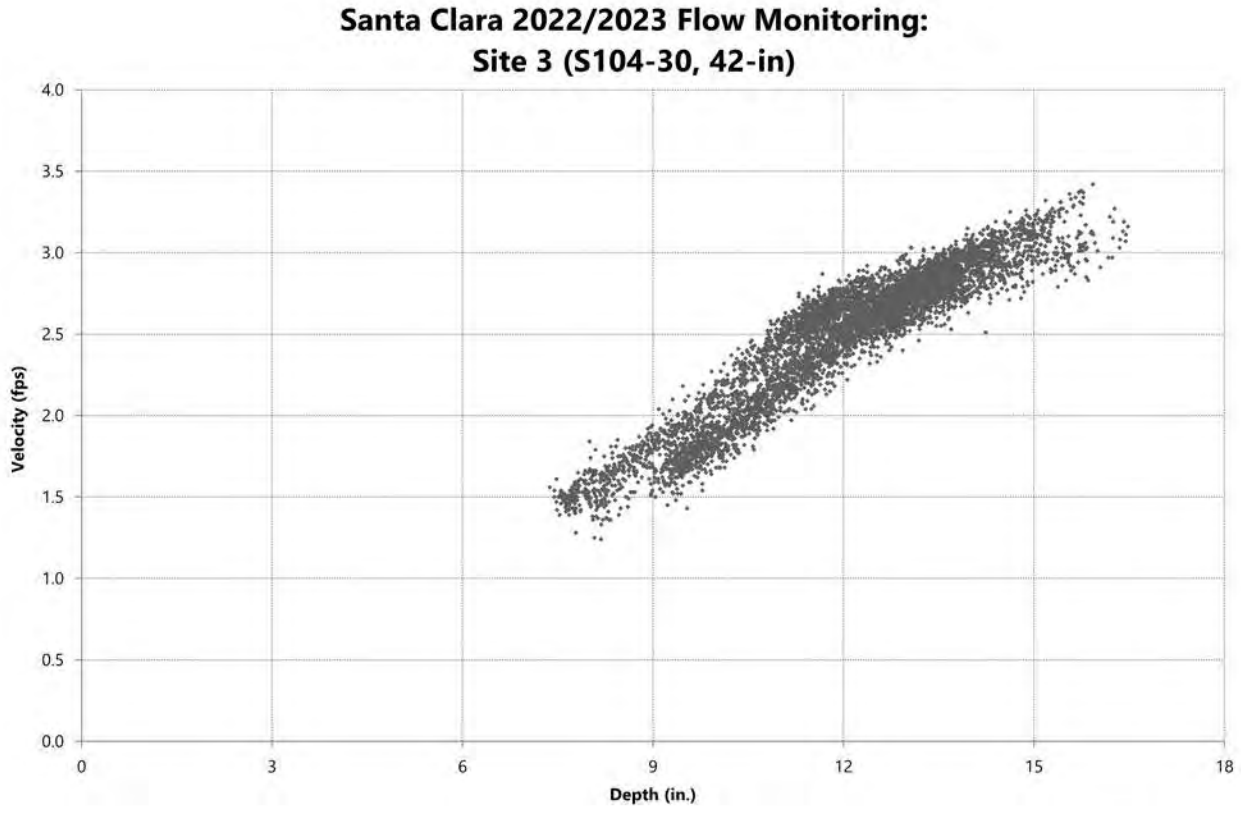

Santa Clara 2022/2023 Flow Monitoring:
Site 1 (S104-28, 36-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

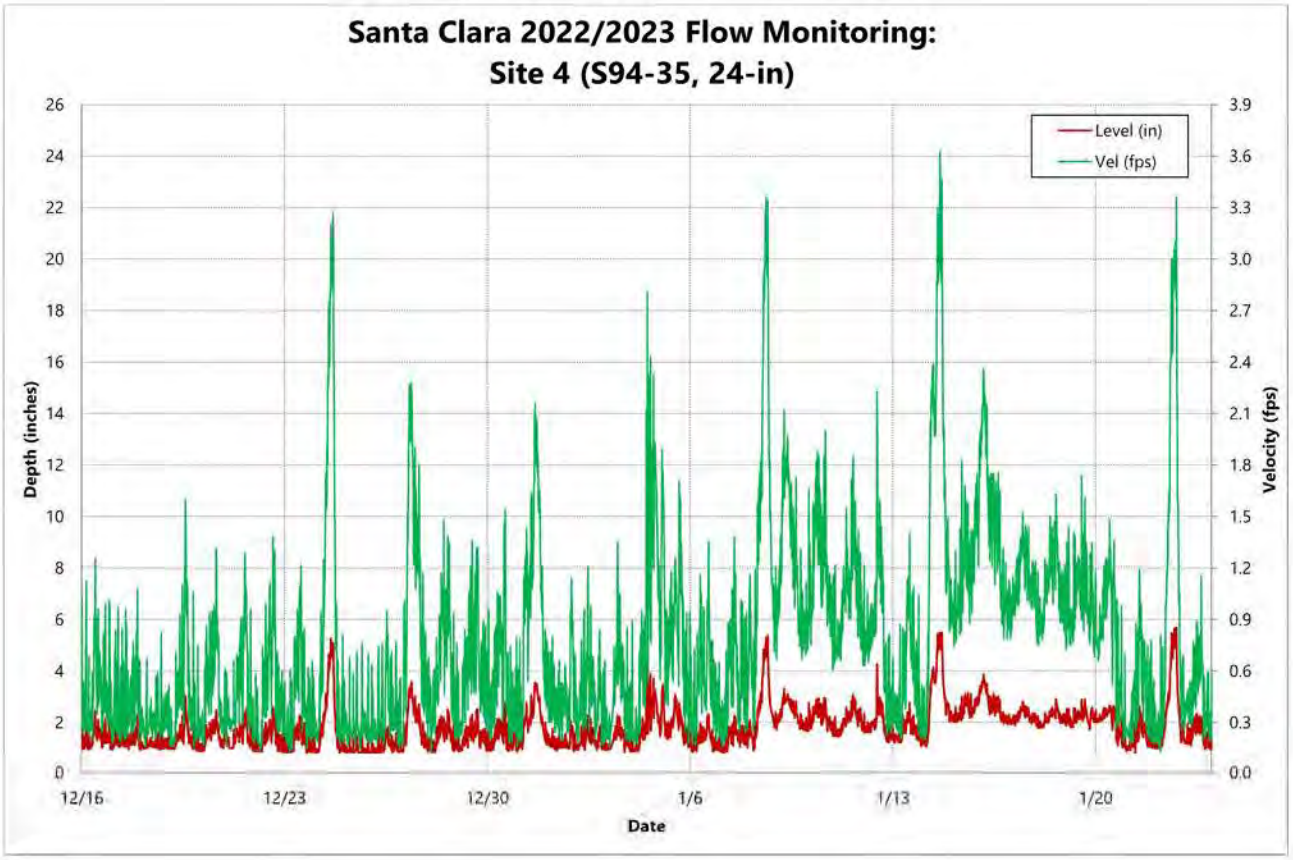

Santa Clara 2022/2023 Flow Monitoring:
Site 1 (S104-28, 36-in)
Velocity (fps)
Depth (in.)

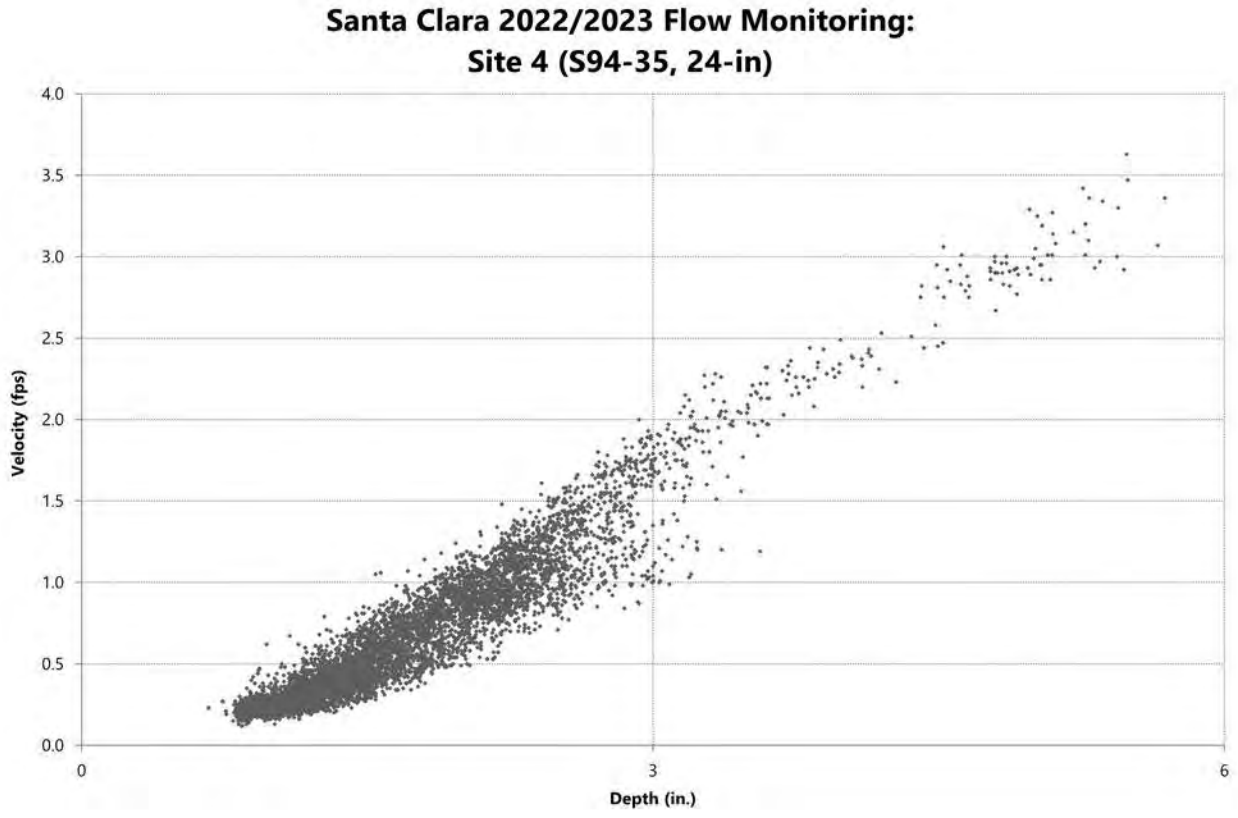

Santa Clara 2022/2023 Flow Monitoring:
Site 2 (S104-26, 33-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

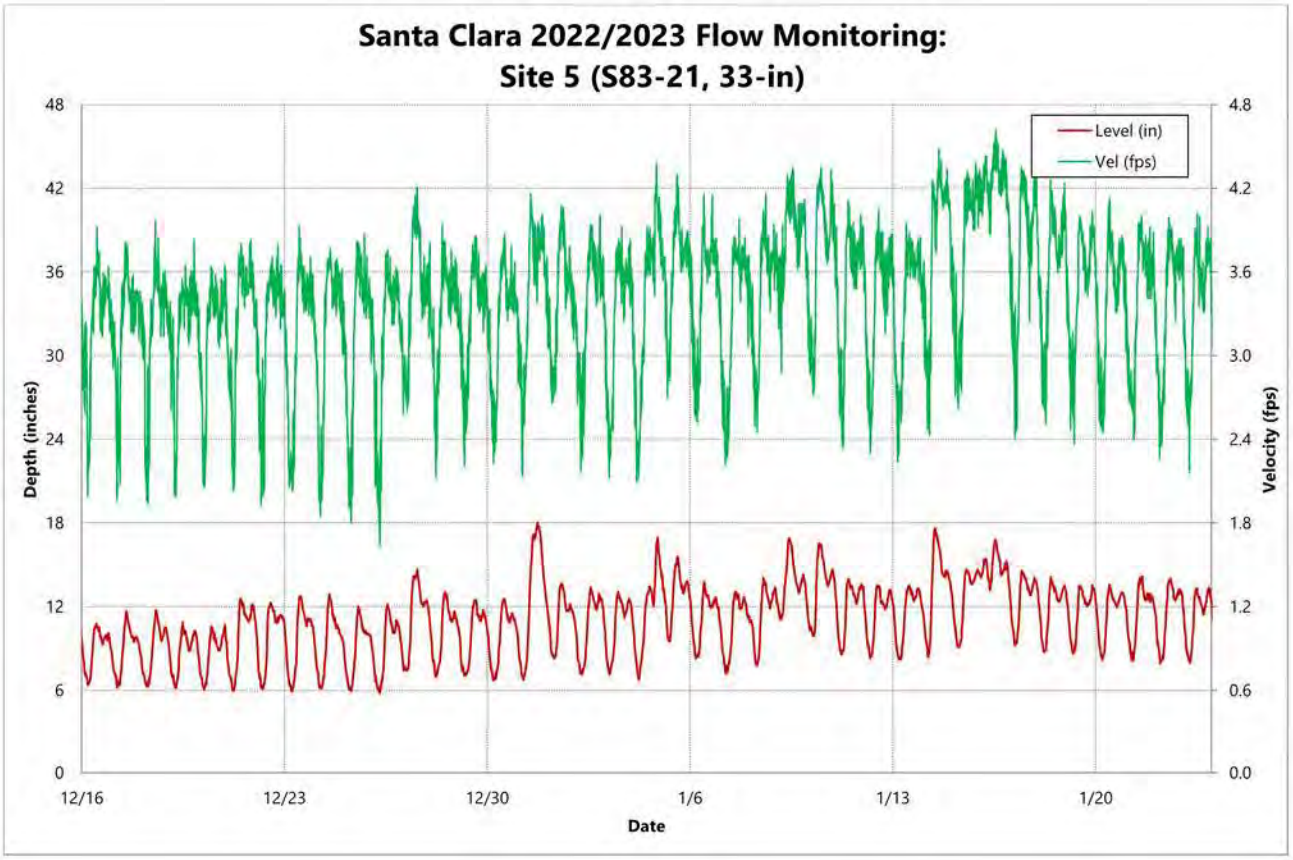

Santa Clara 2022/2023 Flow Monitoring:
Site 2 (S104-26, 33-in)
Velocity (fps)
Depth (in.)

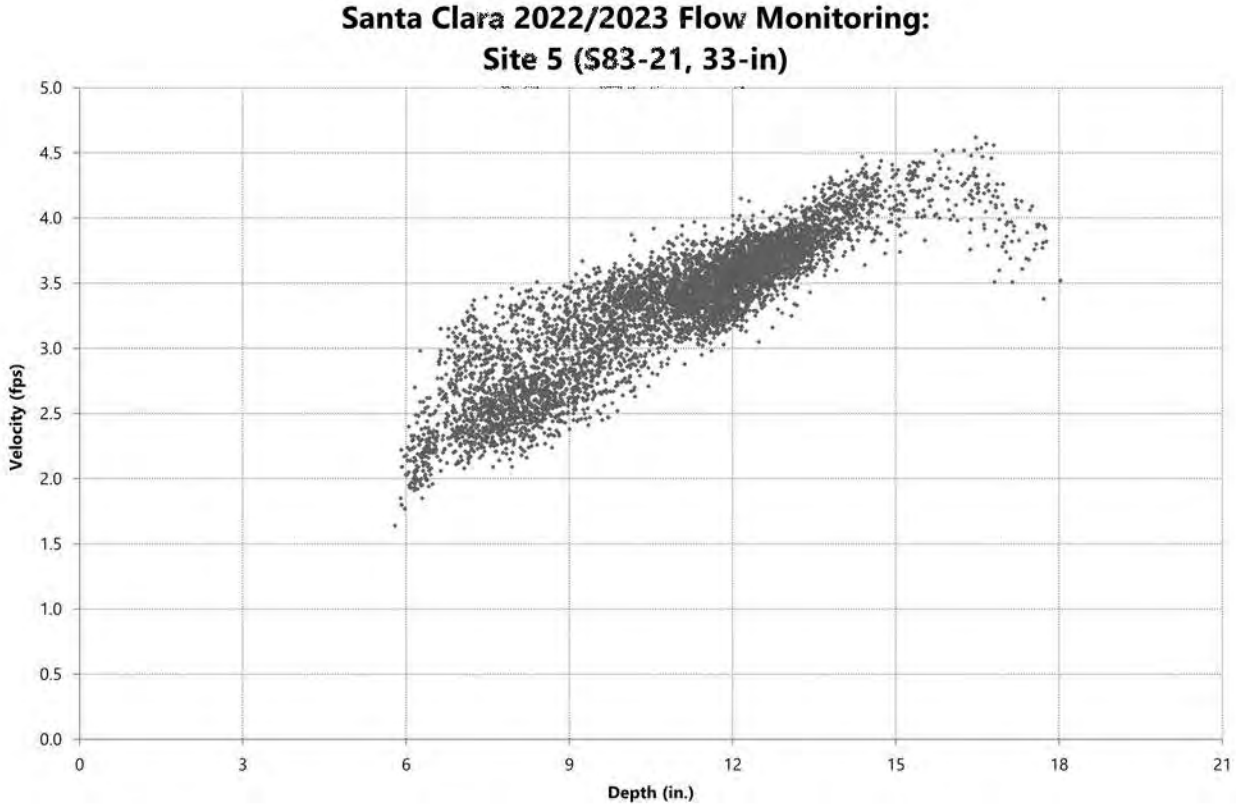

Santa Clara 2022/2023 Flow Monitoring:
Site 3 (S104-30, 42-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

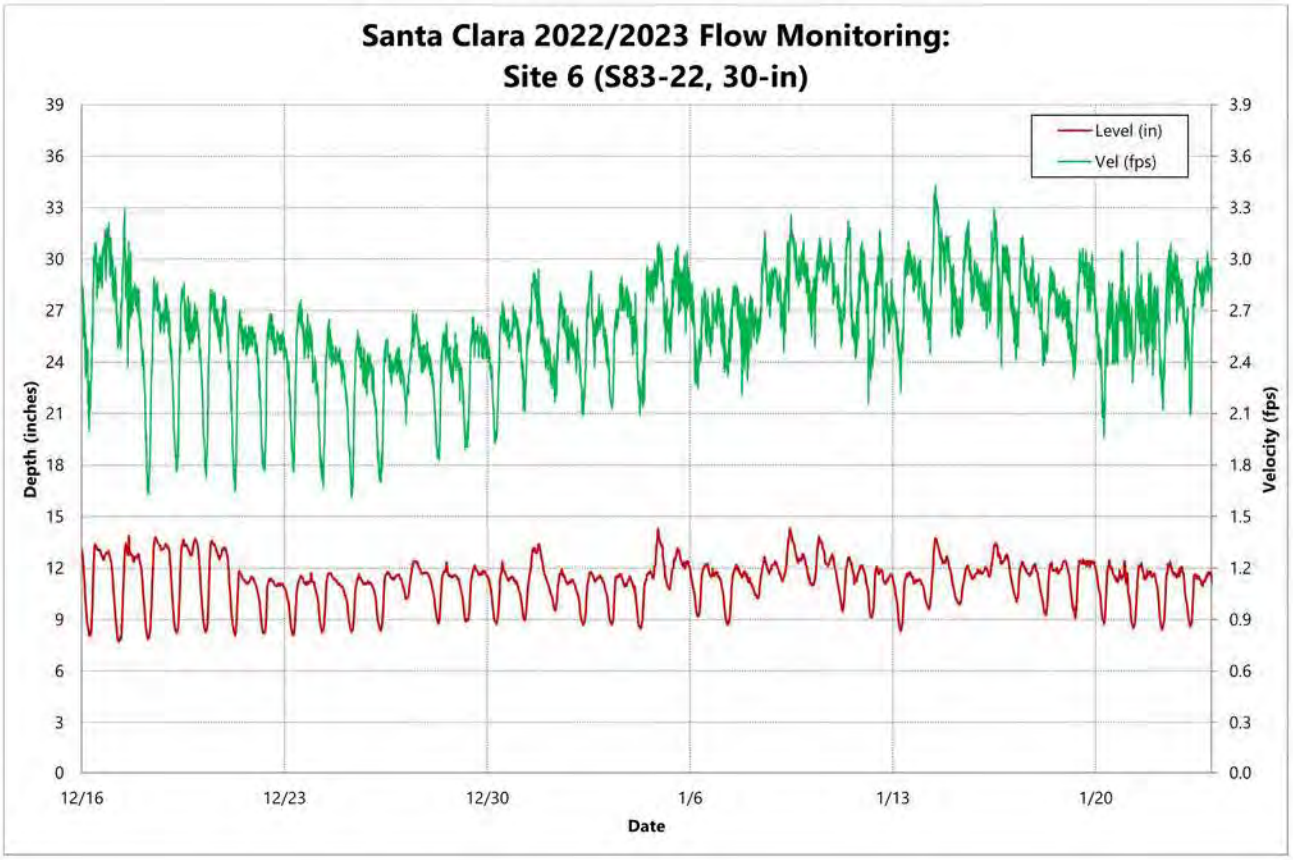

Santa Clara 2022/2023 Flow Monitoring:
Site 3 (S104-30, 42-in)
Velocity (fps)
Depth (in.)

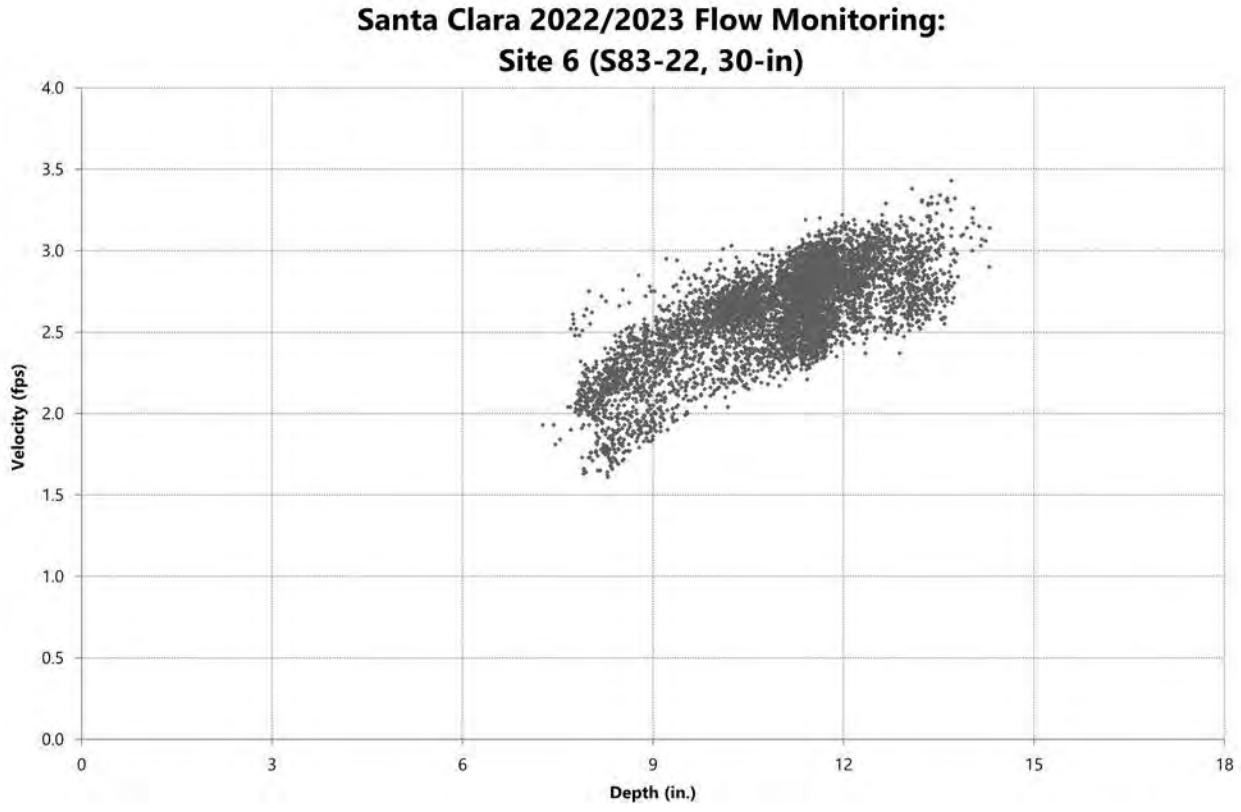

Santa Clara 2022/2023 Flow Monitoring:
Site 4 (S94-35, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20
0
2
4
6
8
10
12
14
16
18
20
22
24
26
0.0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4
2.7
3.0
3.3
3.6
3.9

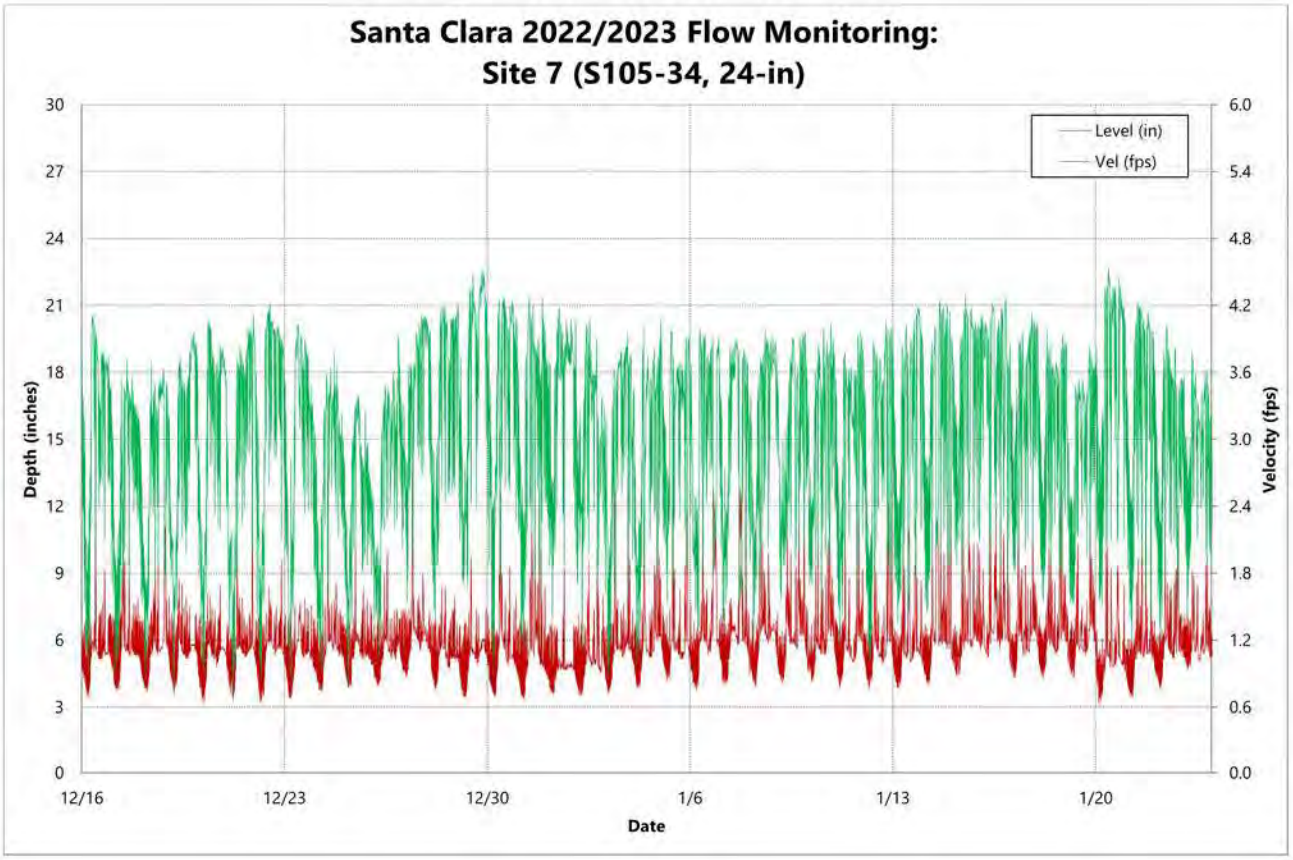

Santa Clara 2022/2023 Flow Monitoring:
Site 4 (S94-35, 24-in)
Velocity (fps)
Depth (in.)
0
3
6
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0

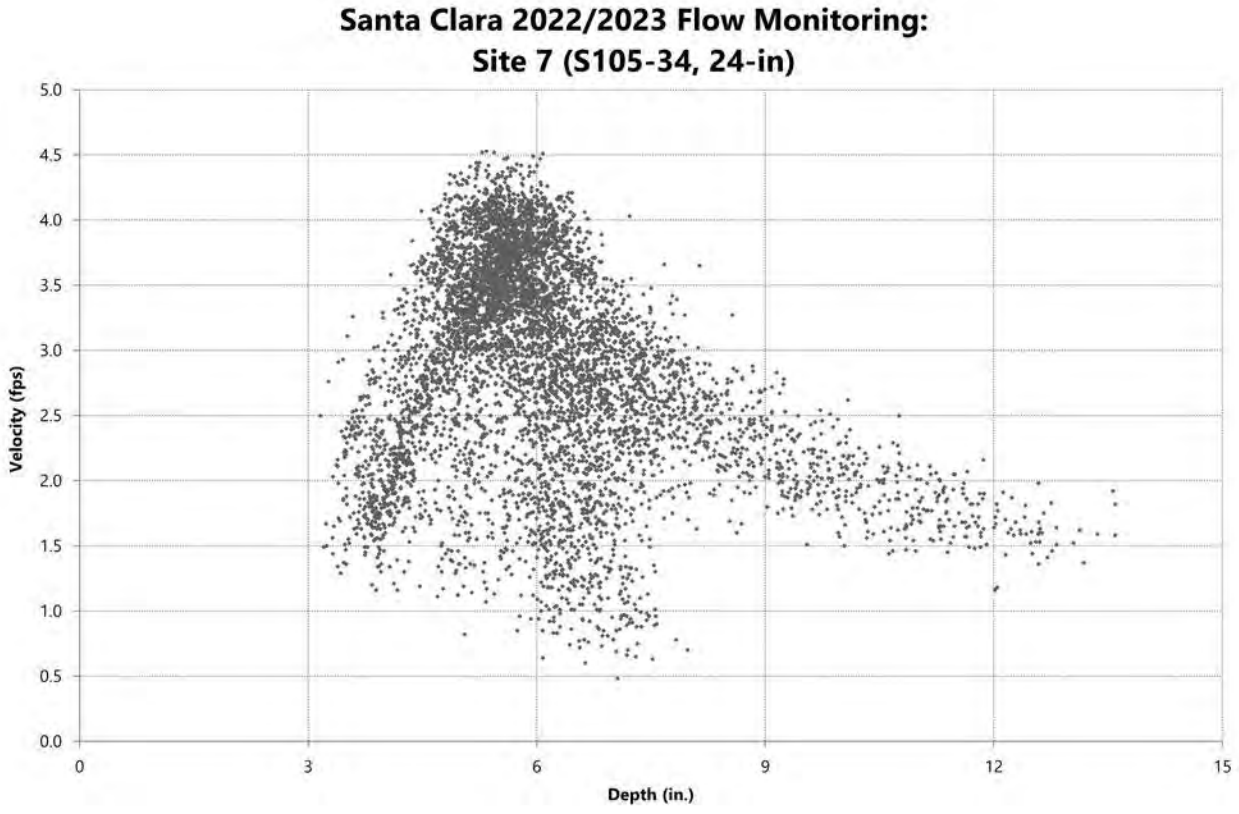

Santa Clara 2022/2023 Flow Monitoring:
Site 5 (S83-21, 33-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
48
42
36
30
24
18
12
6
0
4.8
4.2
3.6
3.0
2.4
1.8
1.2
0.6
0.0
12/16
12/23
12/30
1/6
1/13
1/20

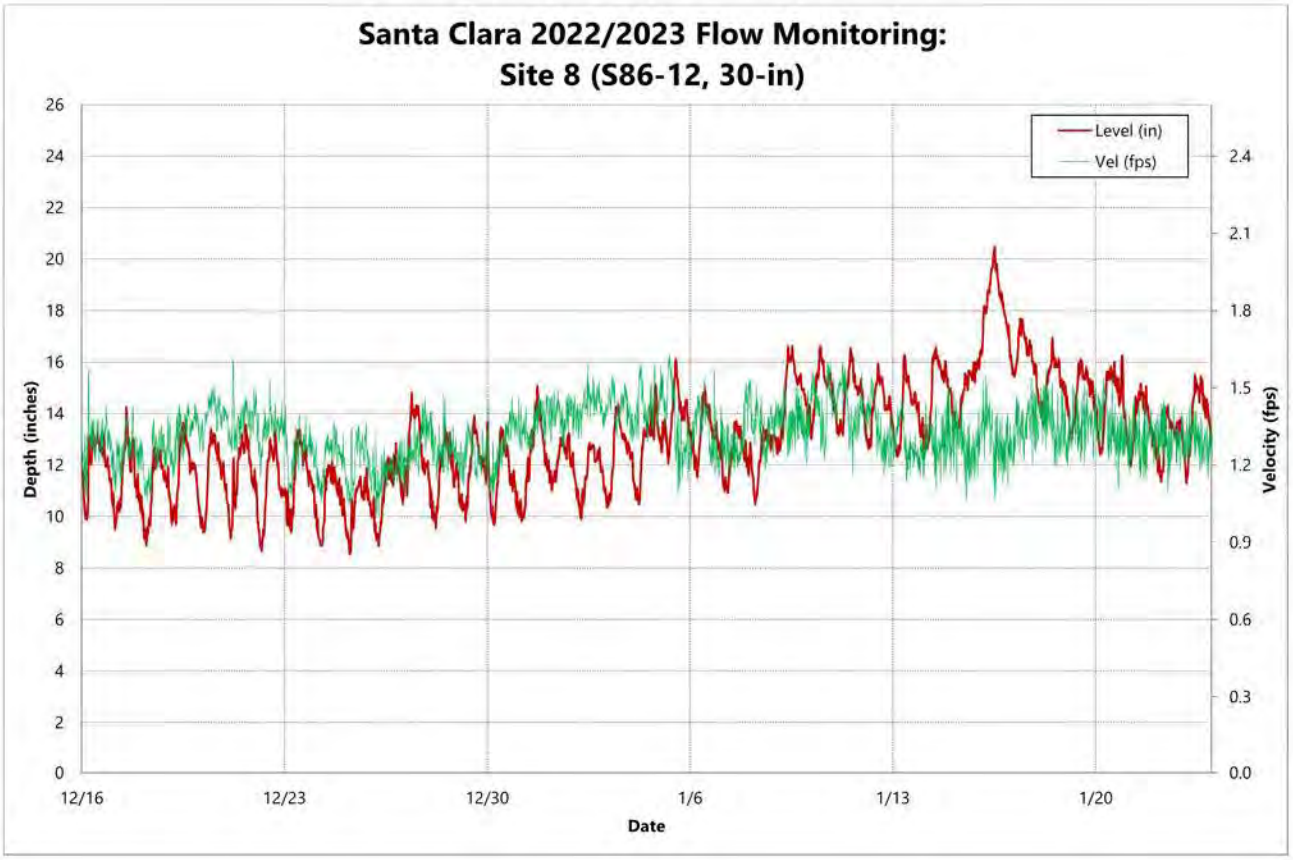

Santa Clara 2022/2023 Flow Monitoring:
Site 5 (S83-21, 33-in)
Velocity (fps)
Depth (in.)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
3
6
9
12
15
18
21

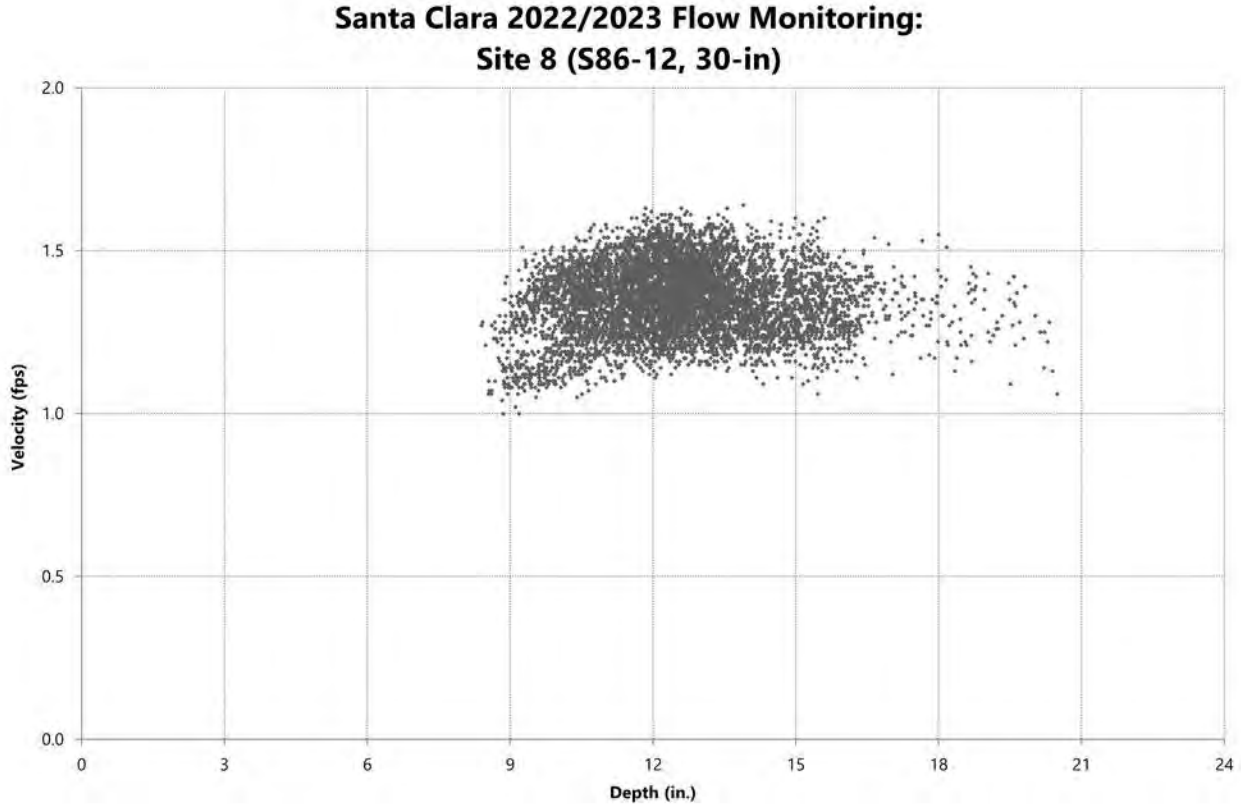

Santa Clara 2022/2023 Flow Monitoring:
Site 6 (S83-22, 30-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

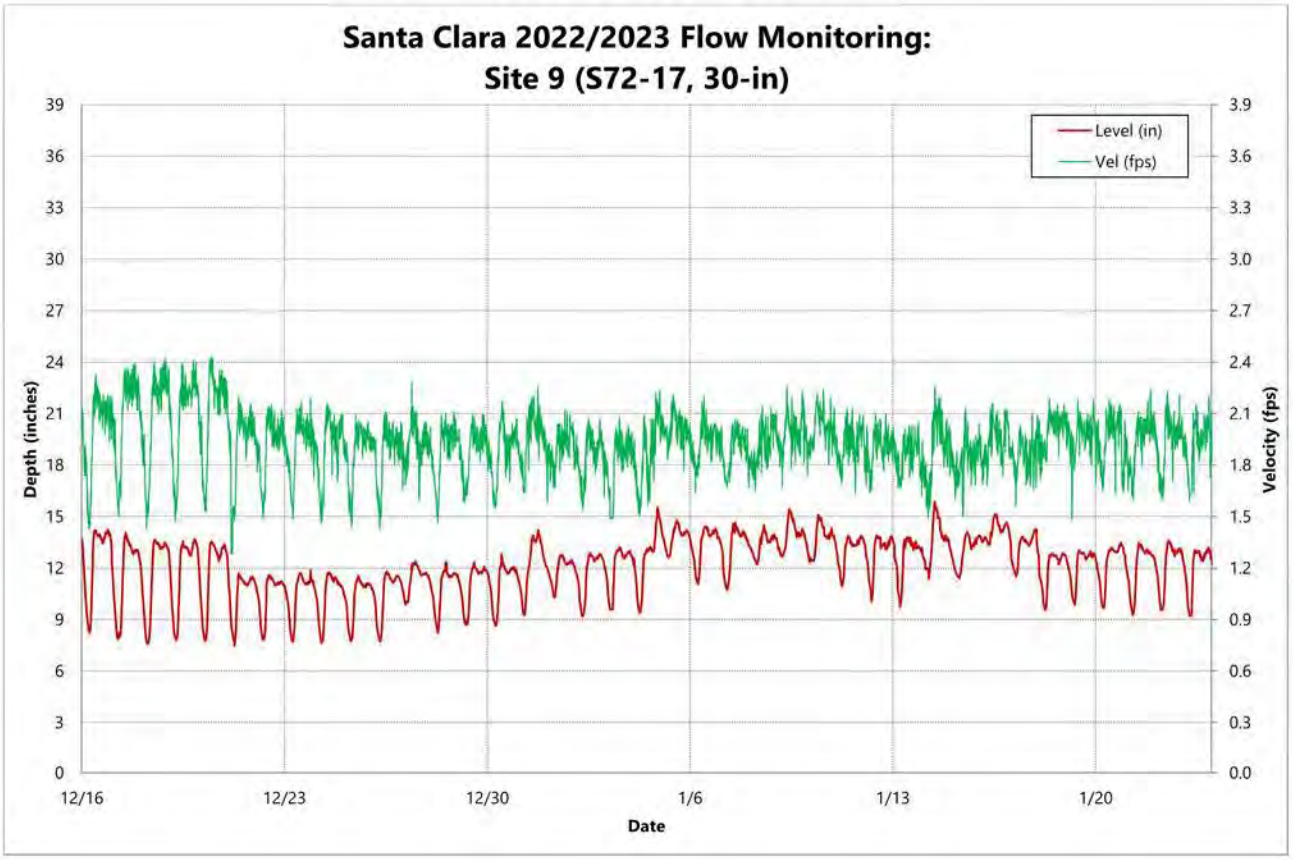

Santa Clara 2022/2023 Flow Monitoring:
Site 6 (S83-22, 30-in)
Velocity (fps)
Depth (in.)

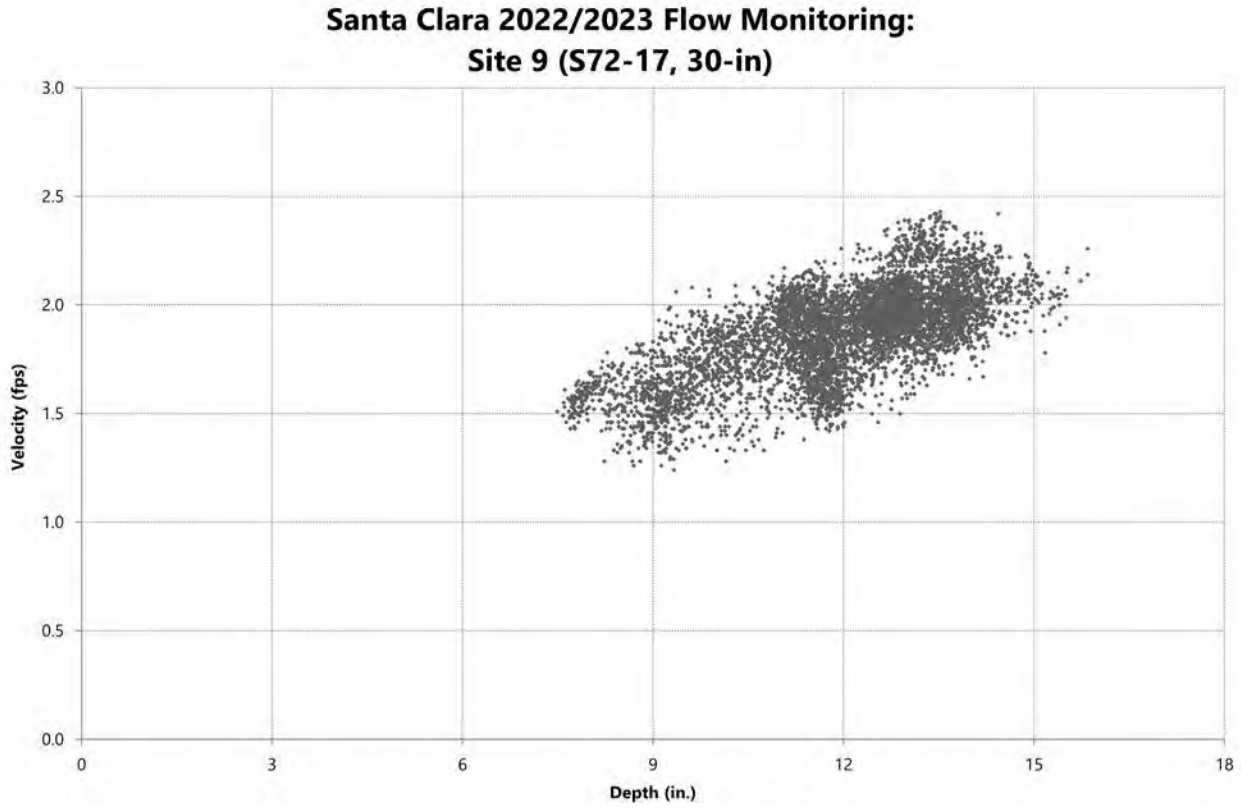

Santa Clara 2022/2023 Flow Monitoring:
Site 7 (S105-34, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

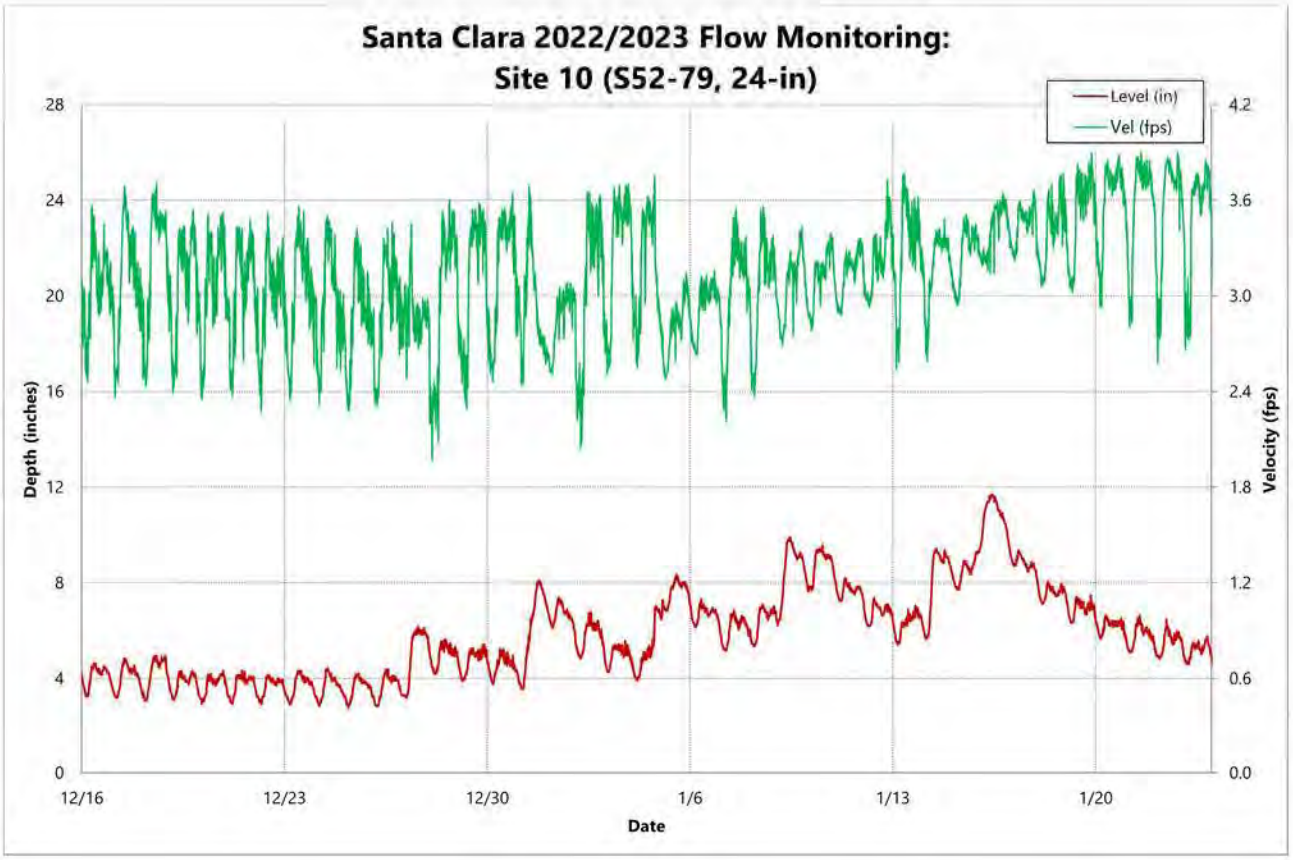

Santa Clara 2022/2023 Flow Monitoring:
Site 7 (S105-34, 24-in)
Velocity (fps)
Depth (in.)

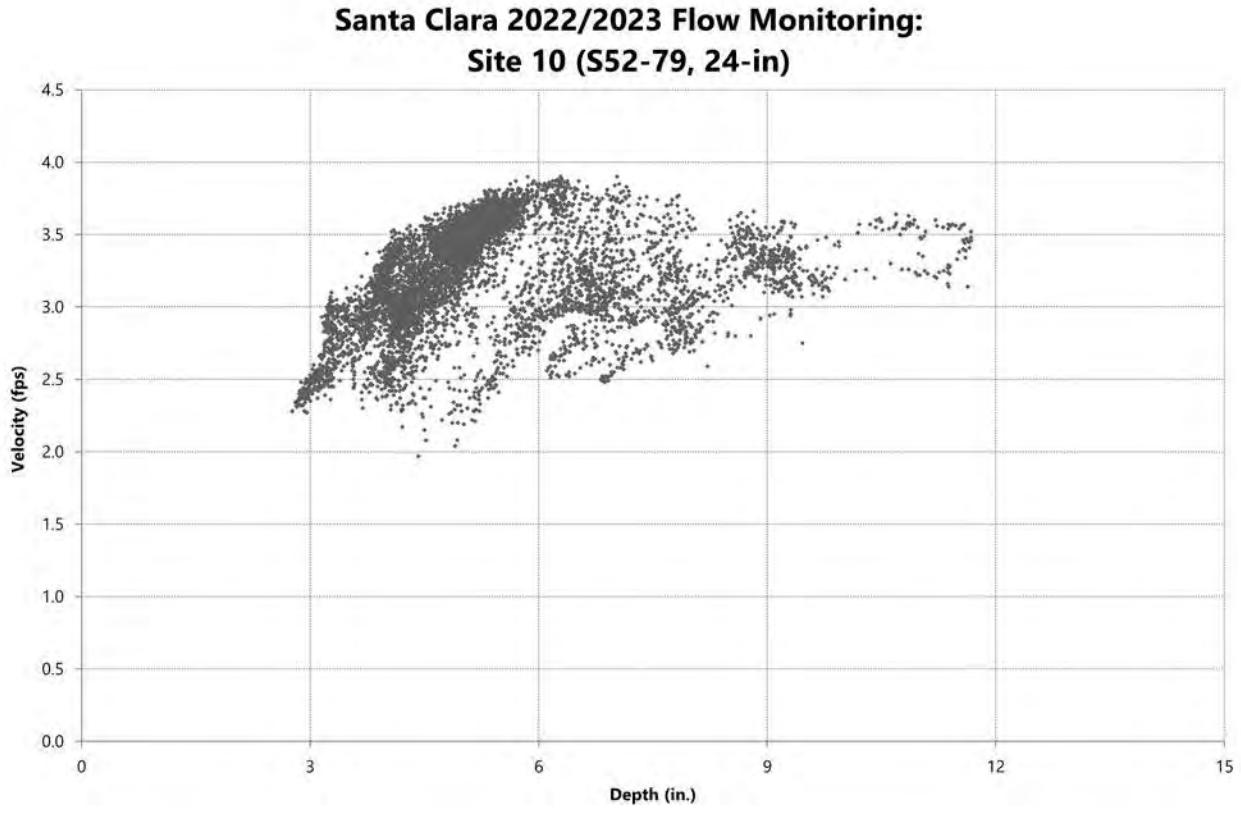

Santa Clara 2022/2023 Flow Monitoring:
Site 8 (S86-12, 30-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

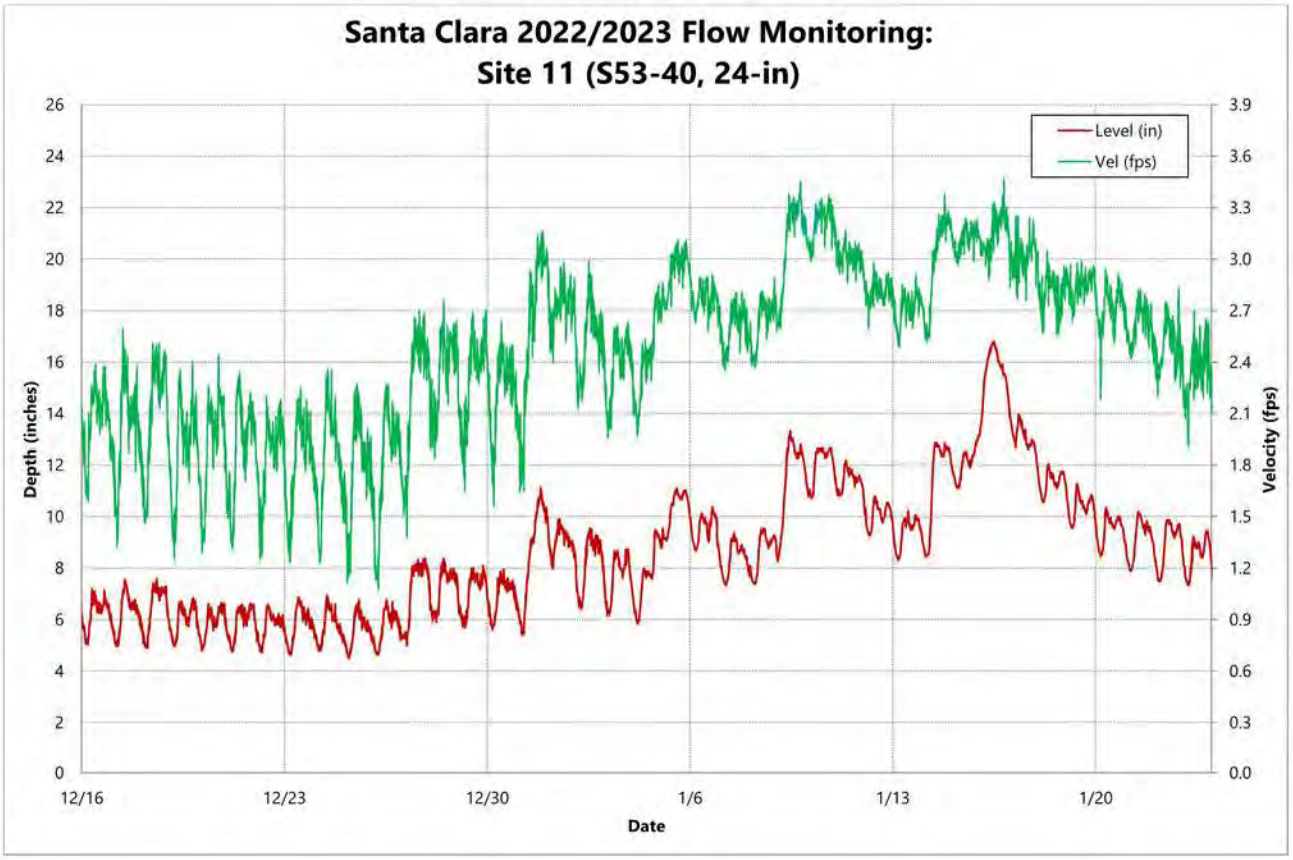

Santa Clara 2022/2023 Flow Monitoring:
Site 8 (S86-12, 30-in)
Velocity (fps)
Depth (in.)

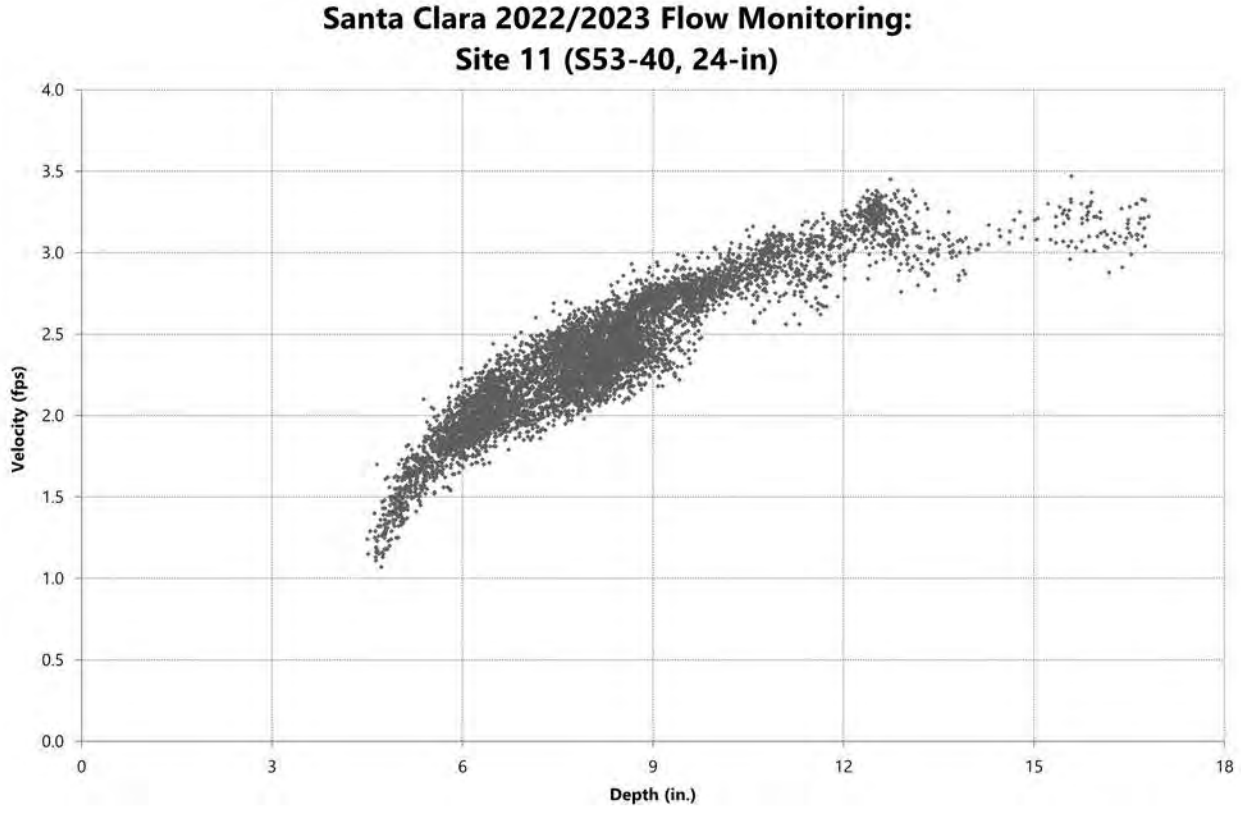

Santa Clara 2022/2023 Flow Monitoring:
Site 9 (S72-17, 30-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
39
36
33
30
27
24
21
18
15
12
9
6
3
0
3.9
3.6
3.3
3.0
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0.0
12/16
12/23
12/30
1/6
1/13
1/20

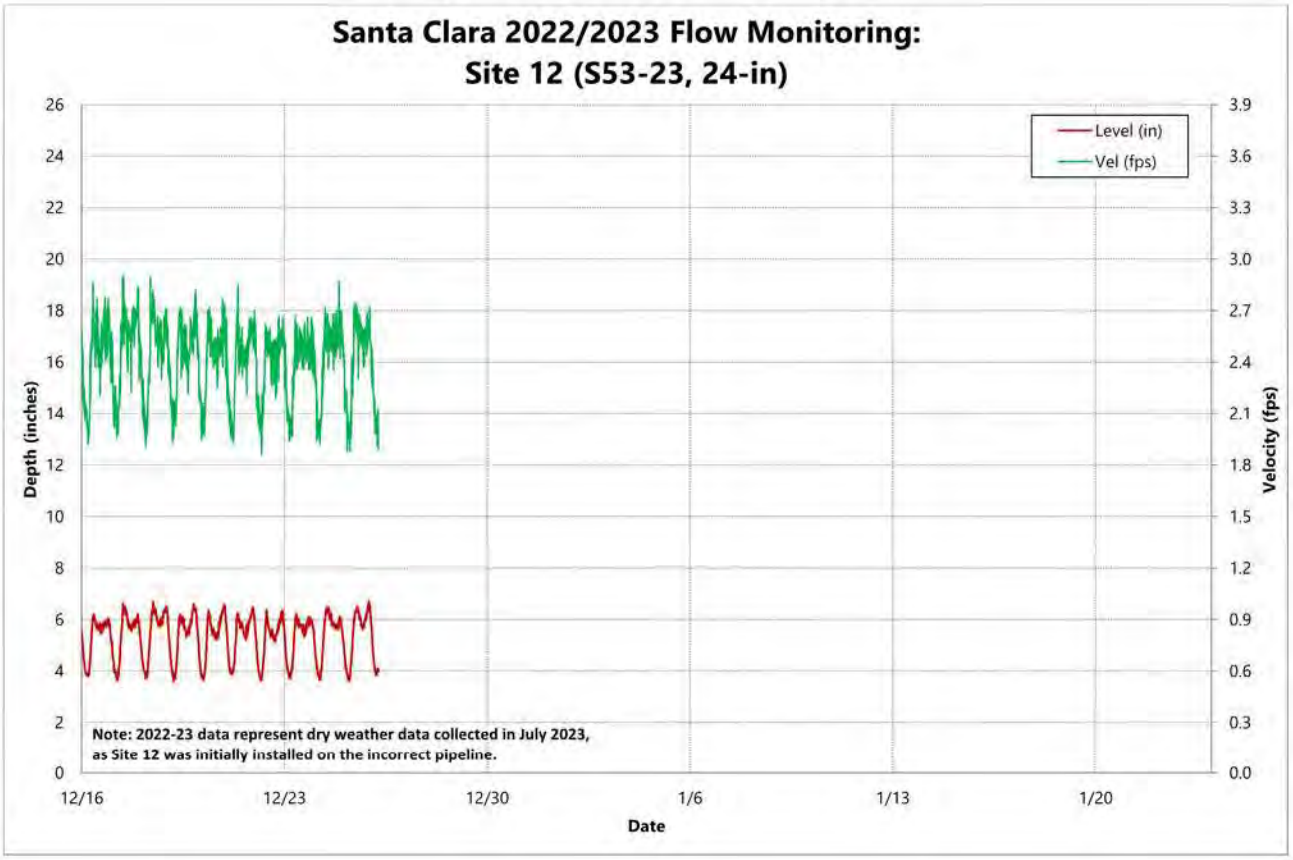

Santa Clara 2022/2023 Flow Monitoring:
Site 9 (S72-17, 30-in)
Velocity (fps)
Depth (in.)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
3
6
9
12
15
18

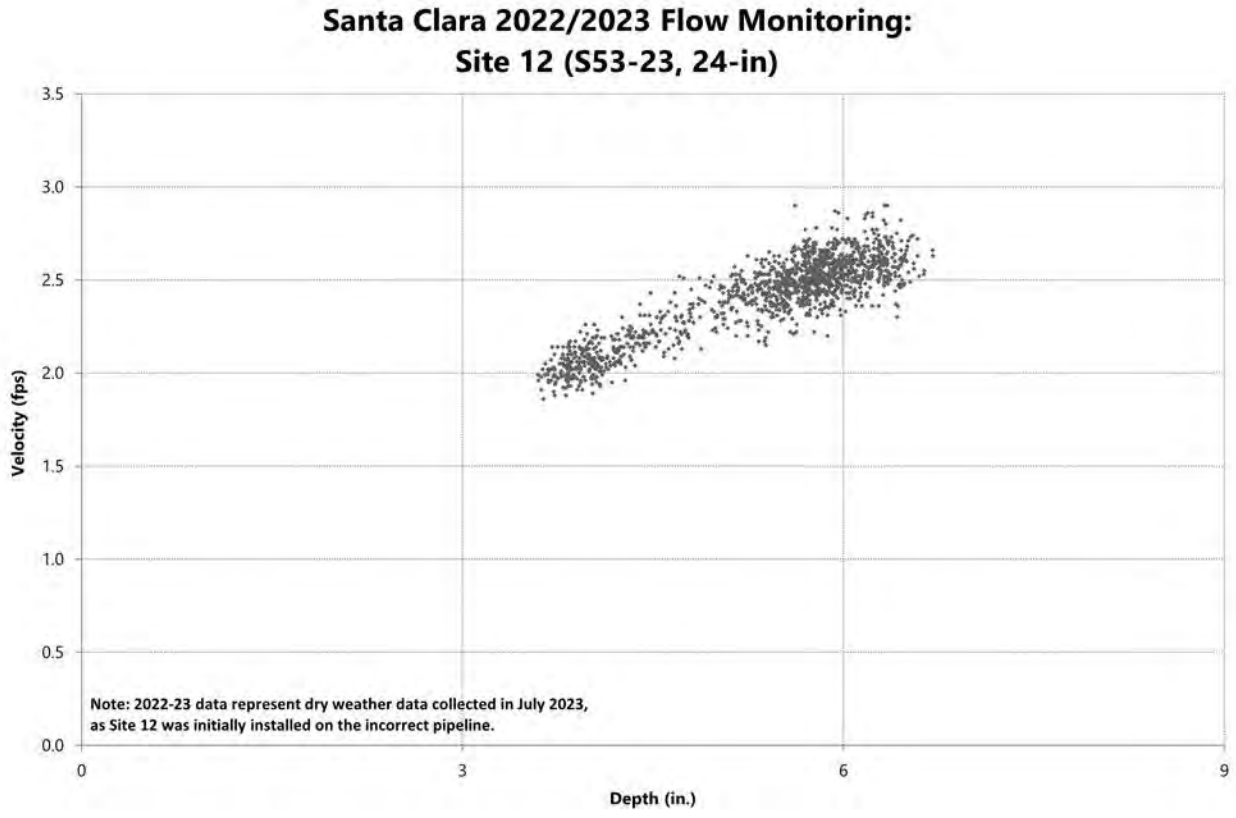

Santa Clara 2022/2023 Flow Monitoring:
Site 10 (S52-79, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
28
24
20
16
12
8
4
0
4.2
3.6
3.0
2.4
1.8
1.2
0.6
0.0
12/16
12/23
12/30
1/6
1/13
1/20

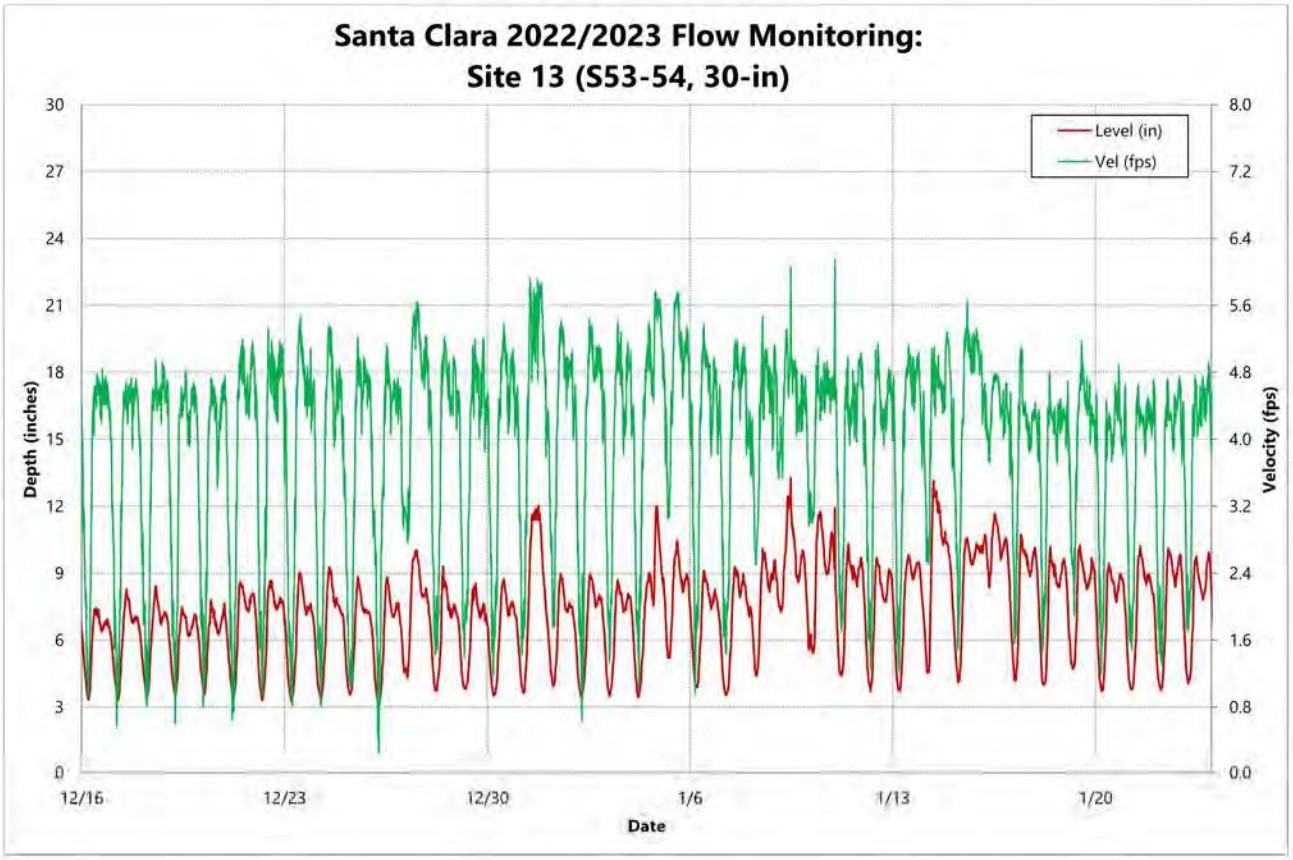

Santa Clara 2022/2023 Flow Monitoring:
Site 10 (S52-79, 24-in)
Velocity (fps)
Depth (in.)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
3
6
9
12
15

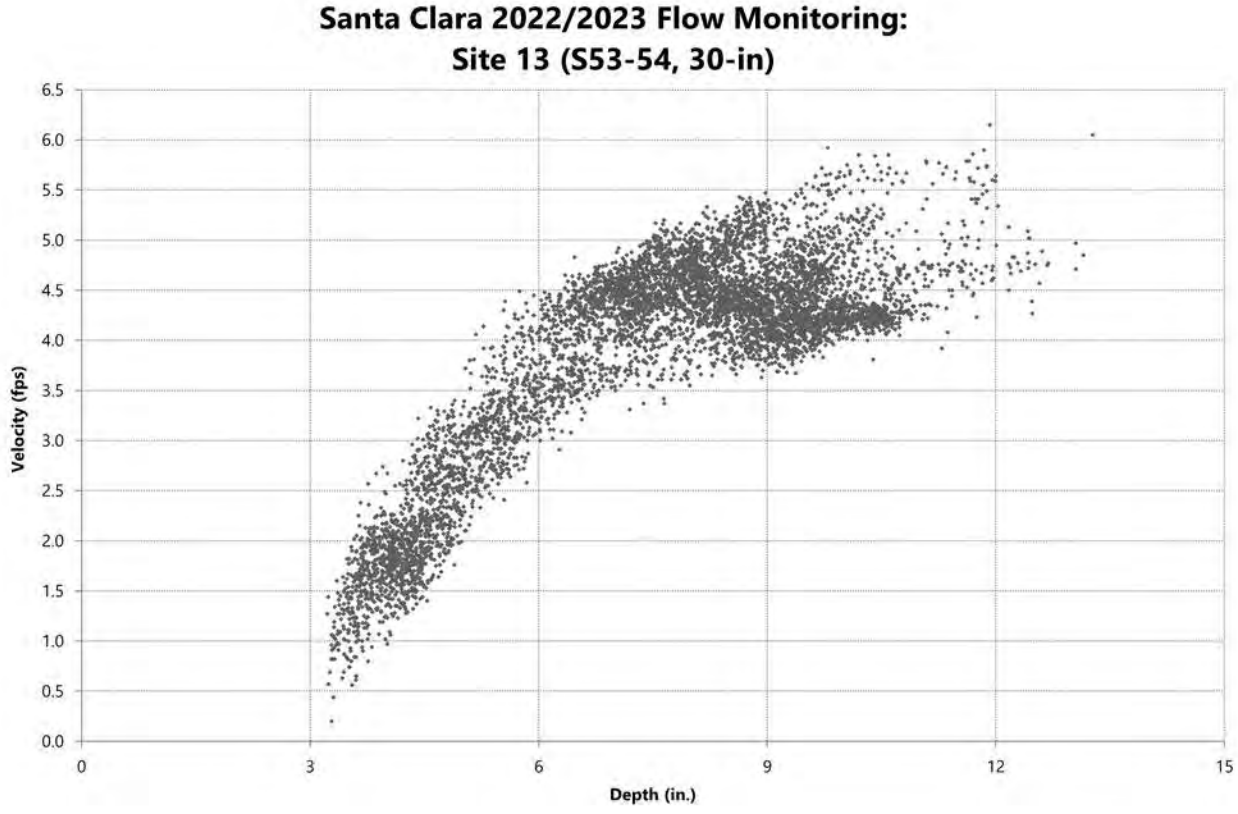

Santa Clara 2022/2023 Flow Monitoring:
Site 11 (S53-40, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

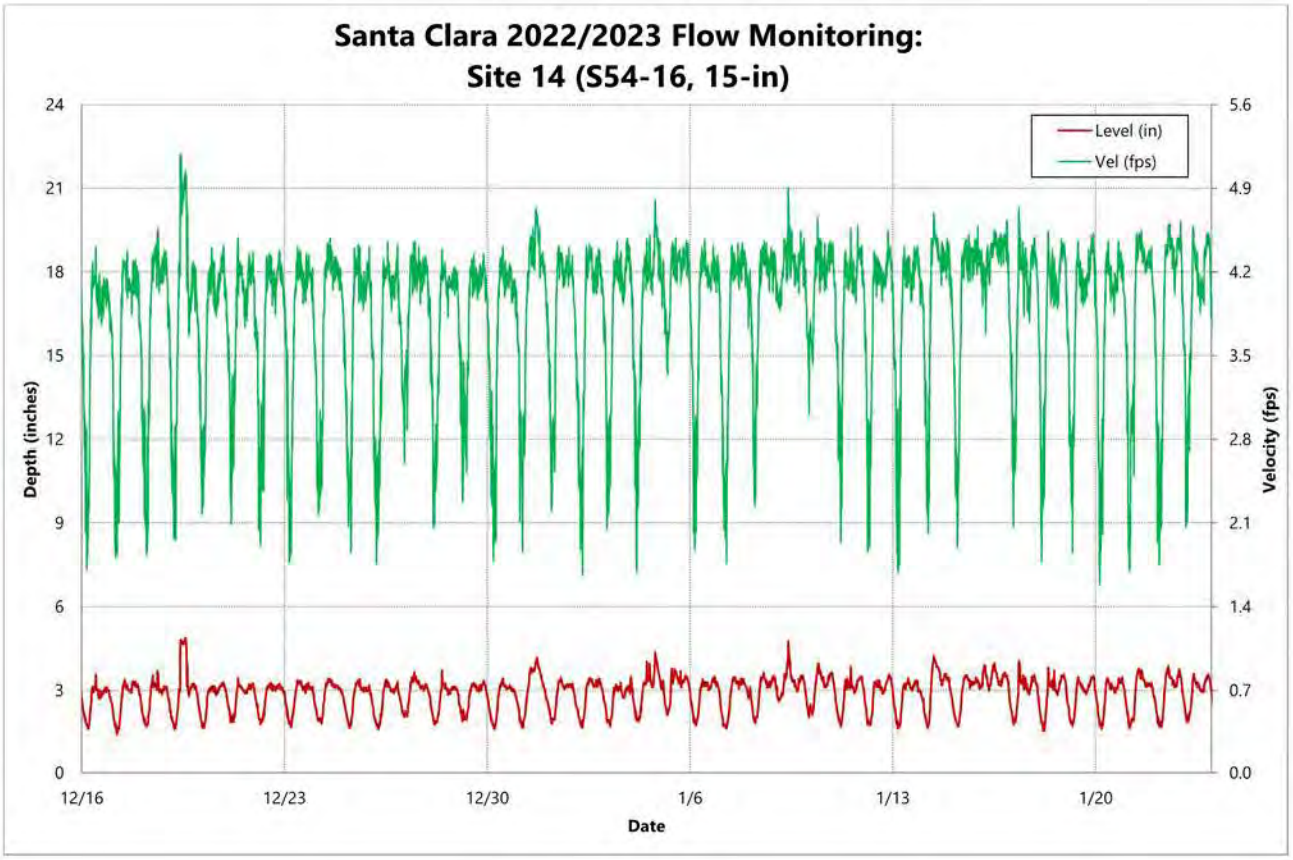

Santa Clara 2022/2023 Flow Monitoring:
Site 11 (S53-40, 24-in)
Velocity (fps)
Depth (in.)

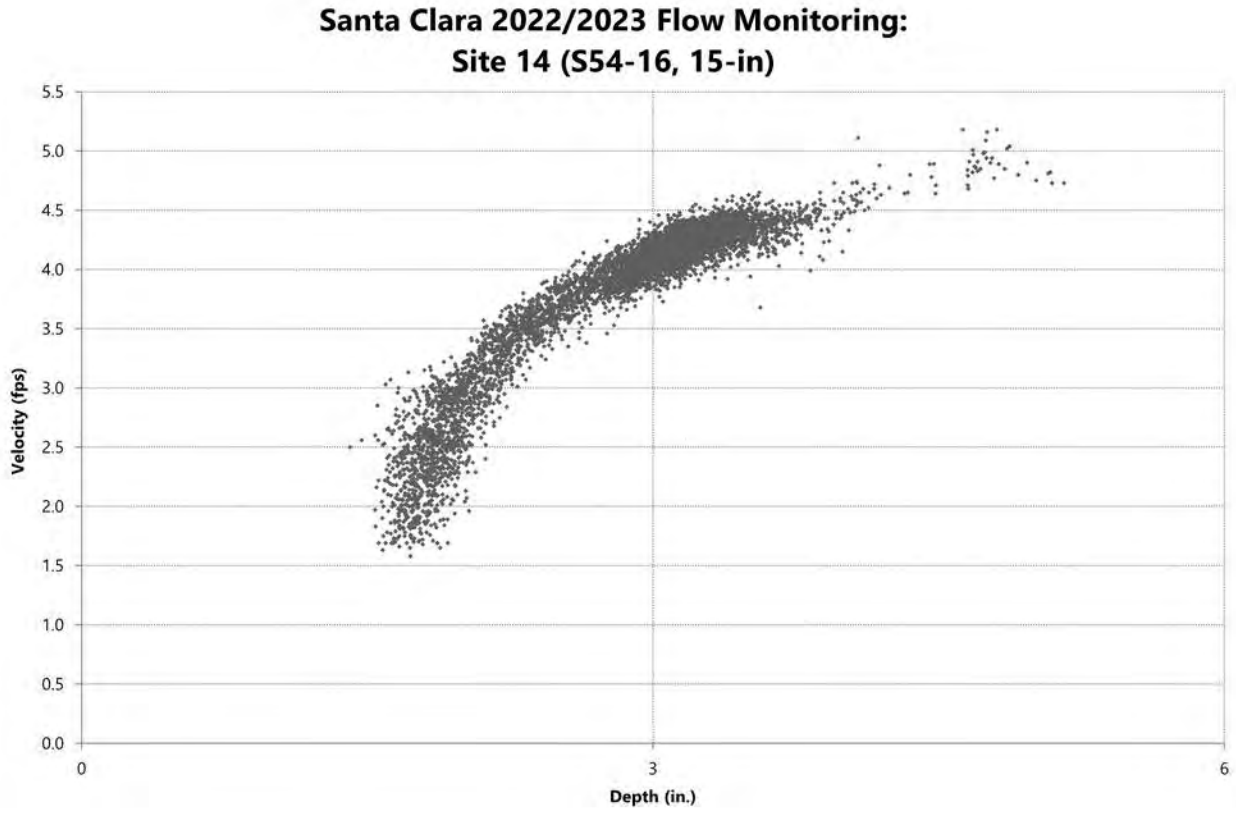

Santa Clara 2022/2023 Flow Monitoring:
Site 12 (S53-23, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20
Note: 2022-23 data represent dry weather data collected in July 2023,
as Site 12 was initially installed on the incorrect pipeline.

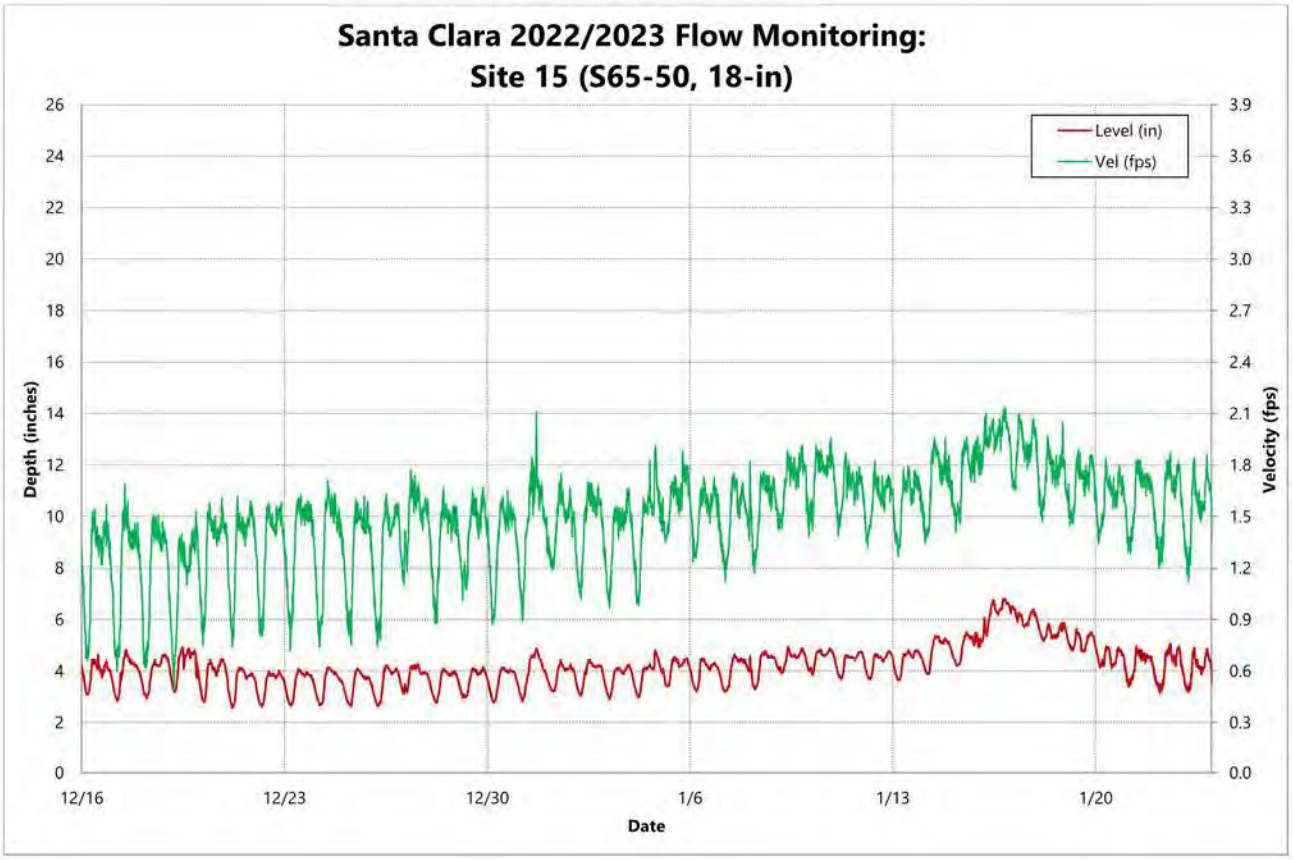

Santa Clara 2022/2023 Flow Monitoring:
Site 12 (S53-23, 24-in)
Velocity (fps)
Depth (in.)
Note: 2022-23 data represent dry weather data collected in July 2023,
as Site 12 was initially installed on the incorrect pipeline.

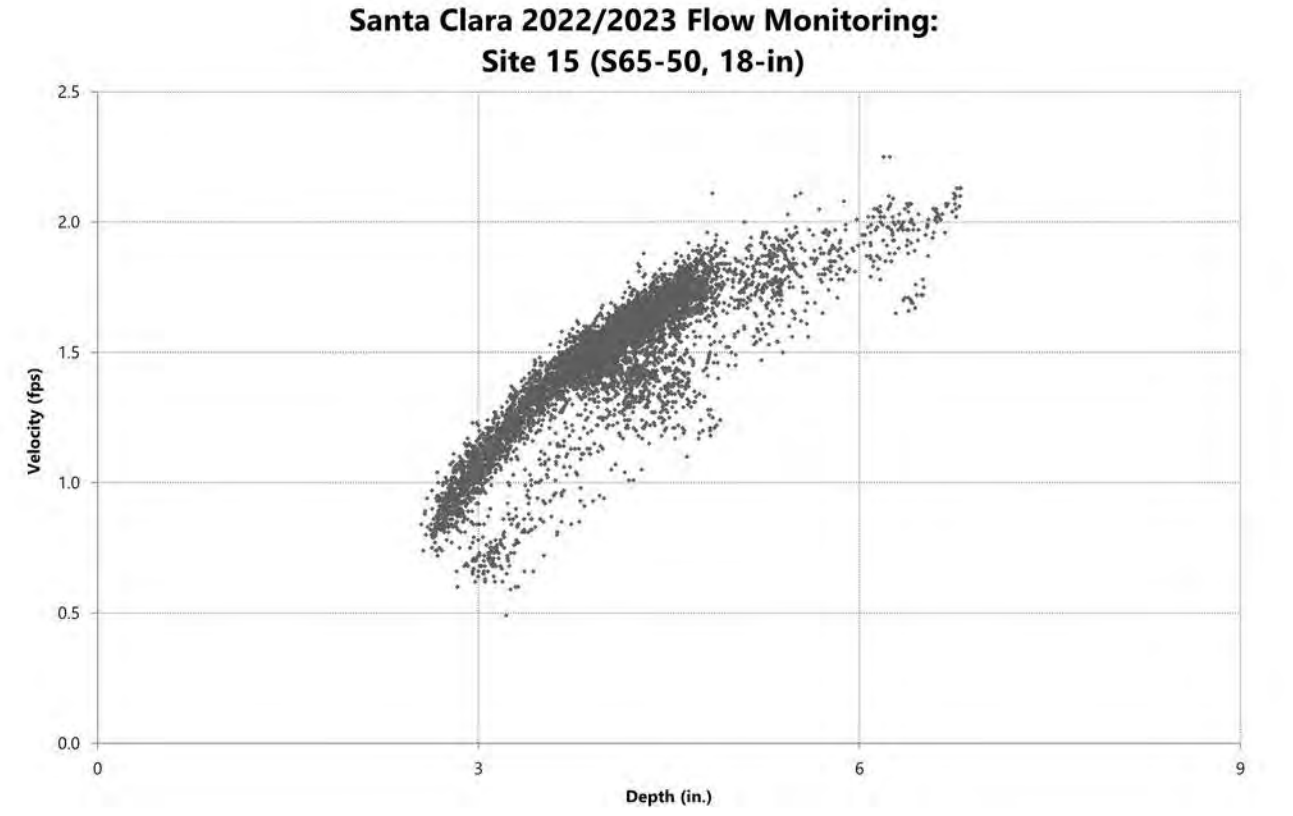

Santa Clara 2022/2023 Flow Monitoring:
Site 13 (S53-54, 30-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

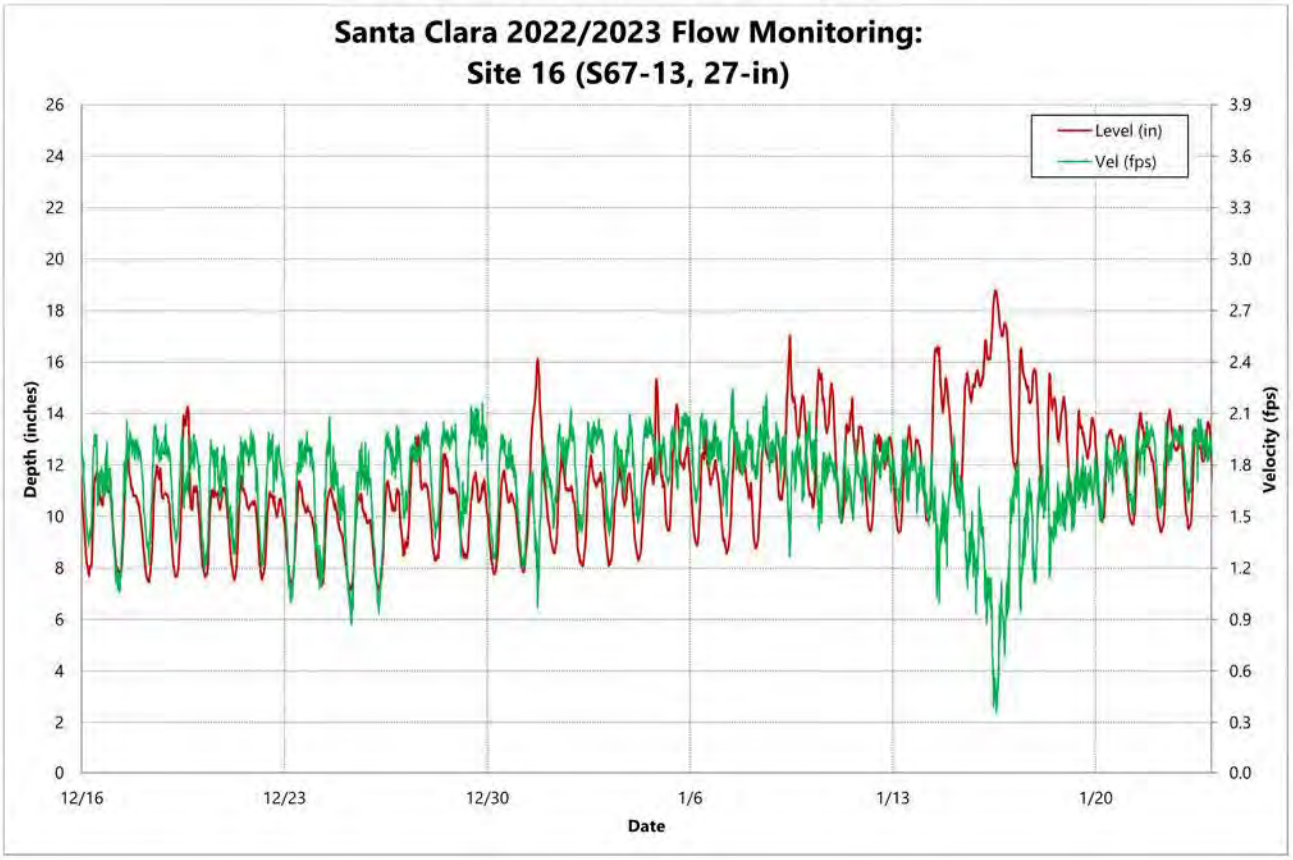

Santa Clara 2022/2023 Flow Monitoring:
Site 13 (S53-54, 30-in)
Velocity (fps)
Depth (in.)

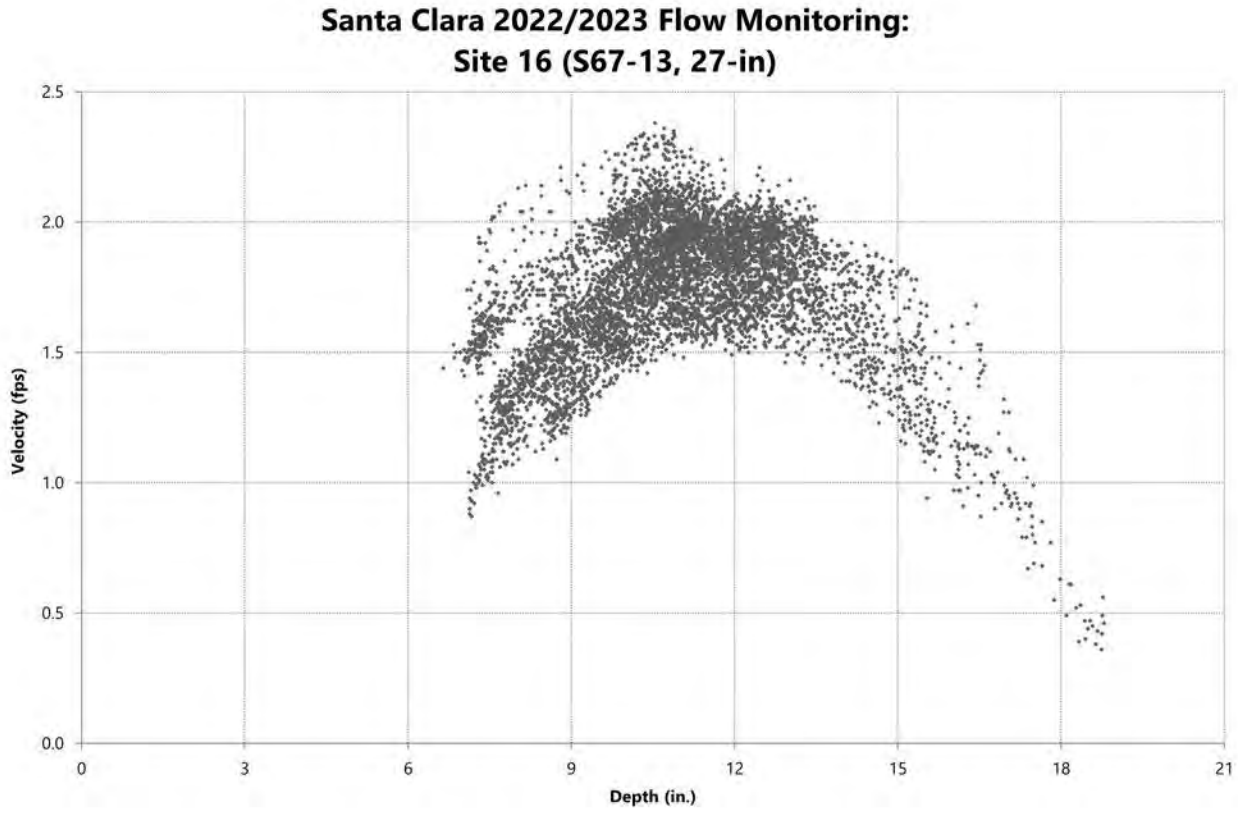

Santa Clara 2022/2023 Flow Monitoring:
Site 14 (S54-16, 15-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
24
21
18
15
12
9
6
3
0
5.6
4.9
4.2
3.5
2.8
2.1
1.4
0.7
0.0
12/16
12/23
12/30
1/6
1/13
1/20

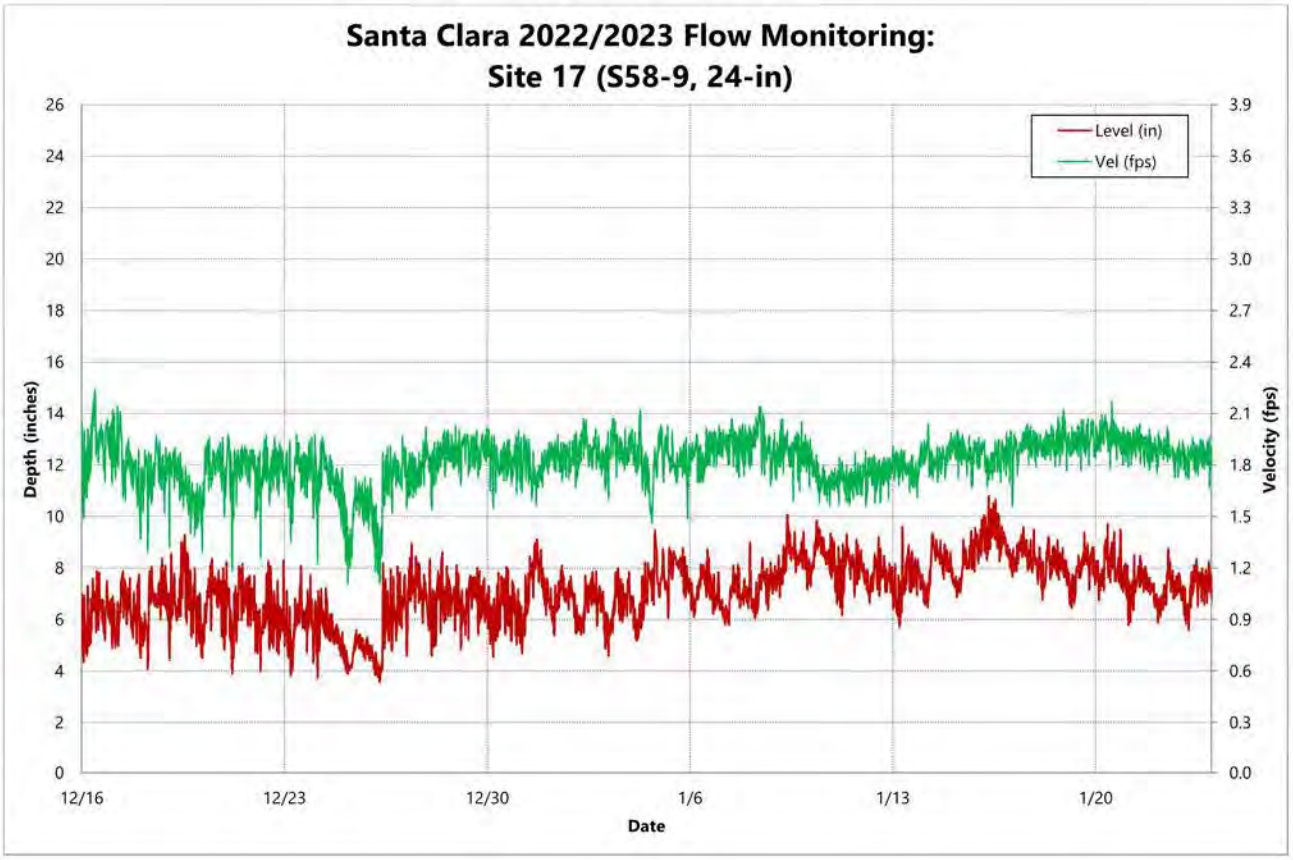

Santa Clara 2022/2023 Flow Monitoring:
Site 14 (S54-16, 15-in)
Velocity (fps)
Depth (in.)
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
3
6

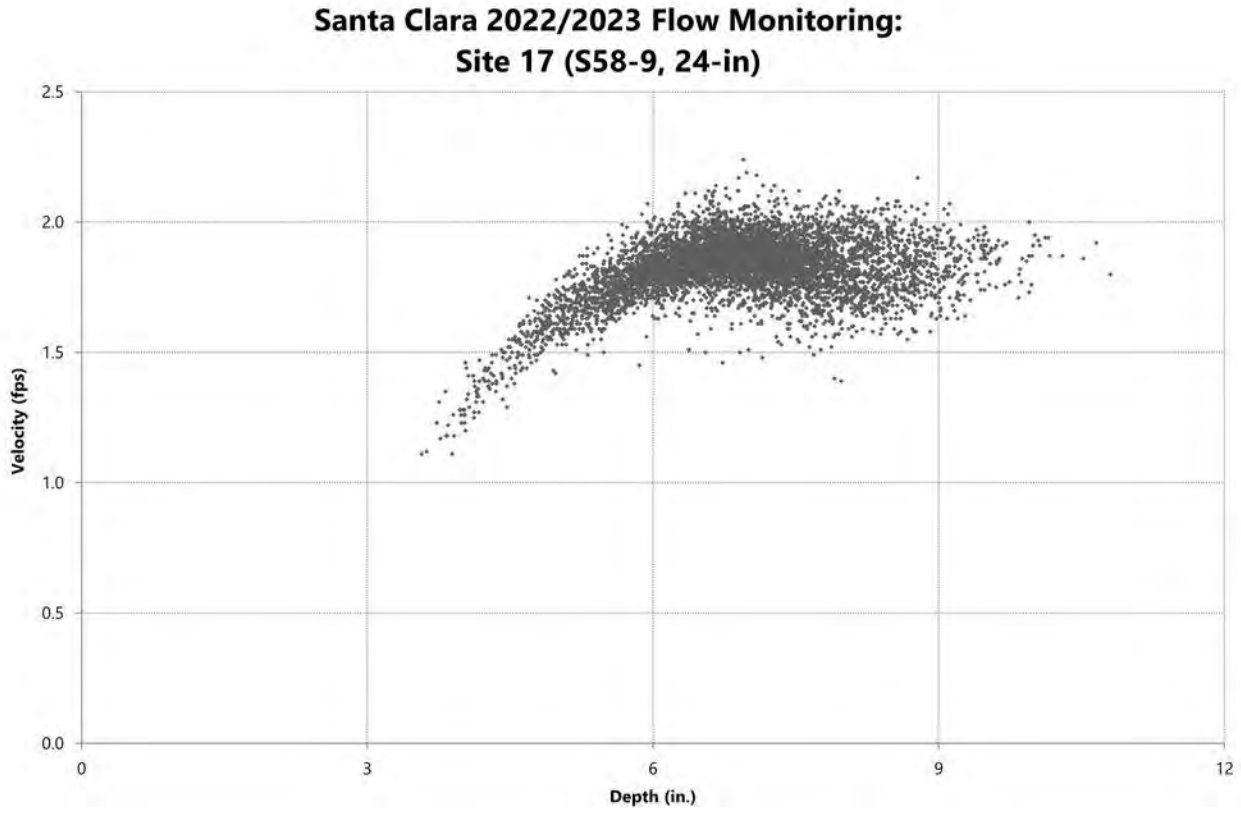

Santa Clara 2022/2023 Flow Monitoring:
Site 15 (S65-50, 18-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20
0
2
4
6
8
10
12
14
16
18
20
22
24
26
0.0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4
2.7
3.0
3.3
3.6
3.9

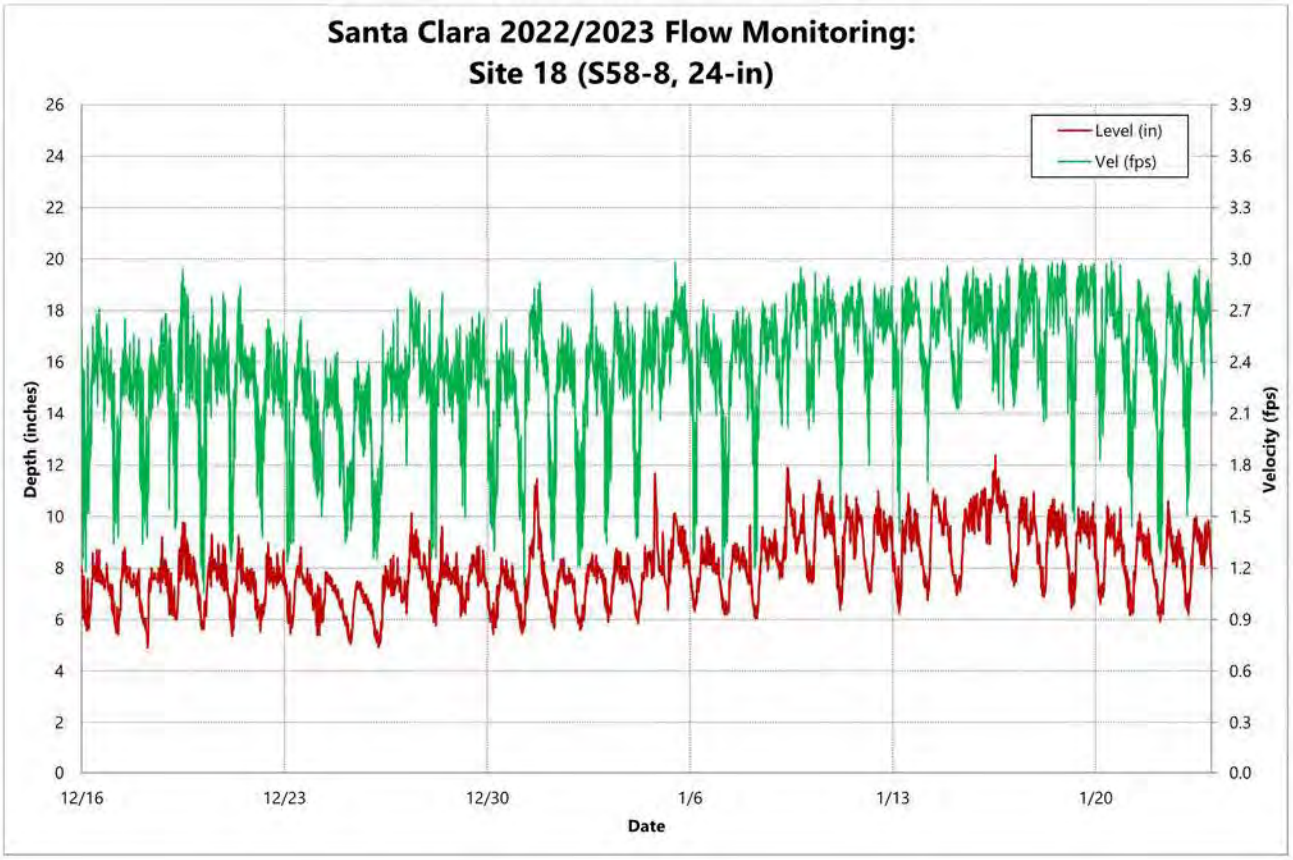

Santa Clara 2022/2023 Flow Monitoring:
Site 15 (S65-50, 18-in)
Velocity (fps)
Depth (in.)
0
3
6
9
0.0
0.5
1.0
1.5
2.0
2.5

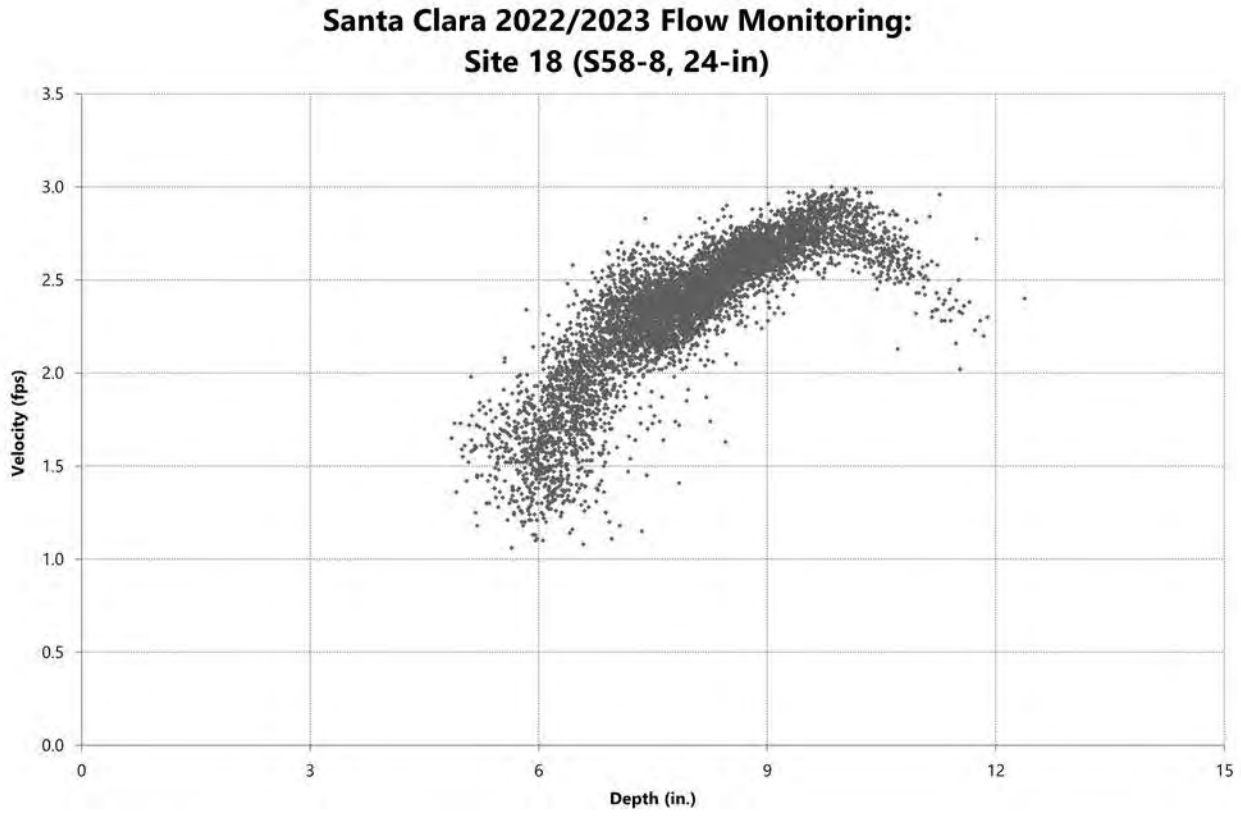

Santa Clara 2022/2023 Flow Monitoring:
Site 16 (S67-13, 27-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

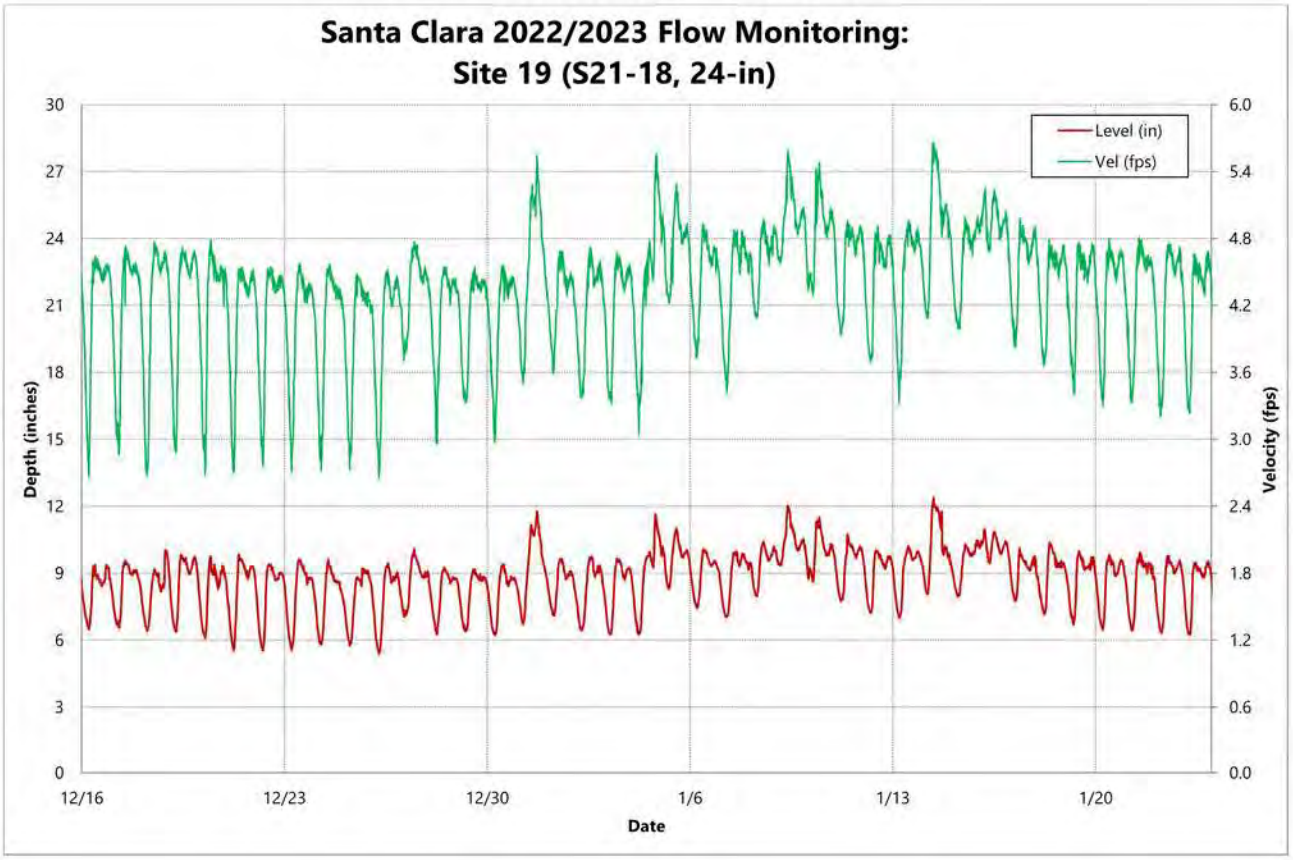

Santa Clara 2022/2023 Flow Monitoring:
Site 16 (S67-13, 27-in)
Velocity (fps)
Depth (in.)

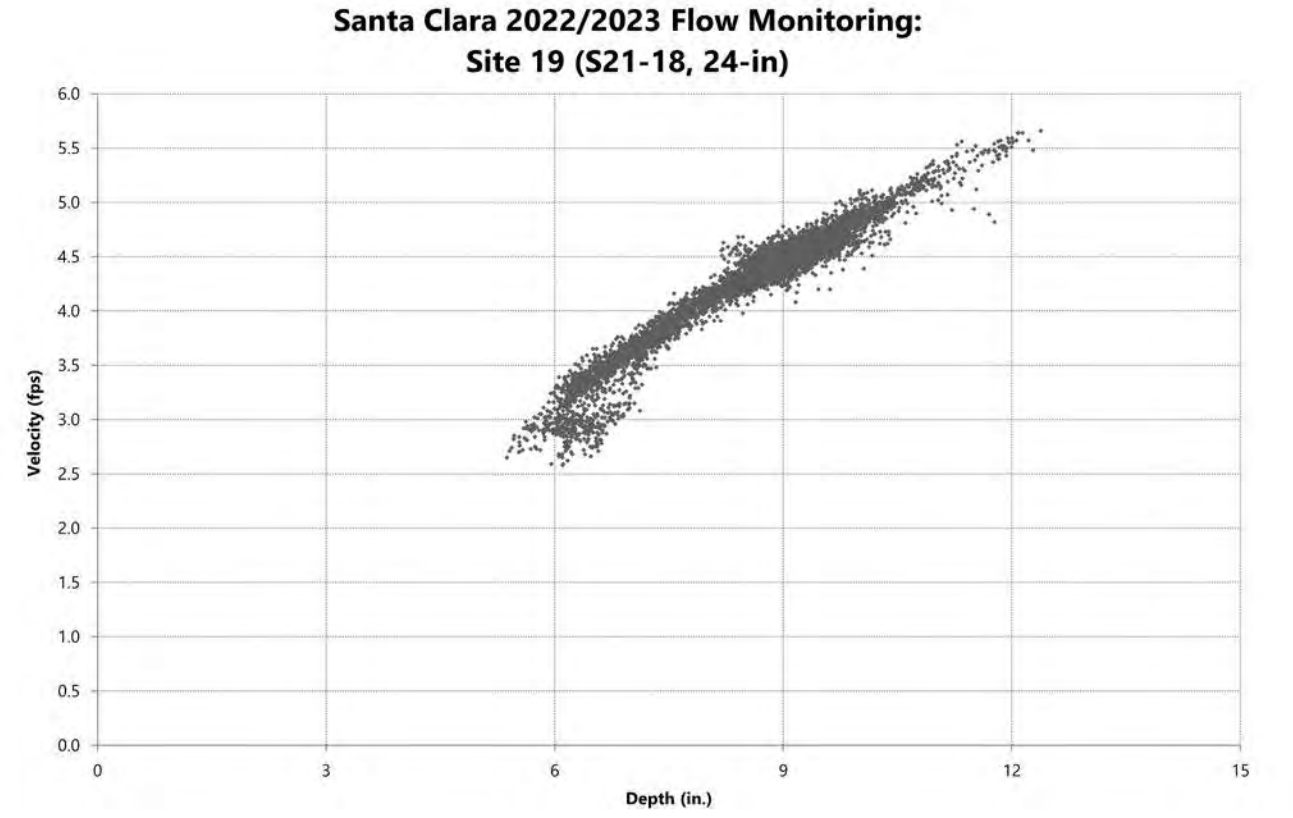

Santa Clara 2022/2023 Flow Monitoring:
Site 17 (S58-9, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20
0
2
4
6
8
10
12
14
16
18
20
22
24
26
0.0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4
2.7
3.0
3.3
3.6
3.9

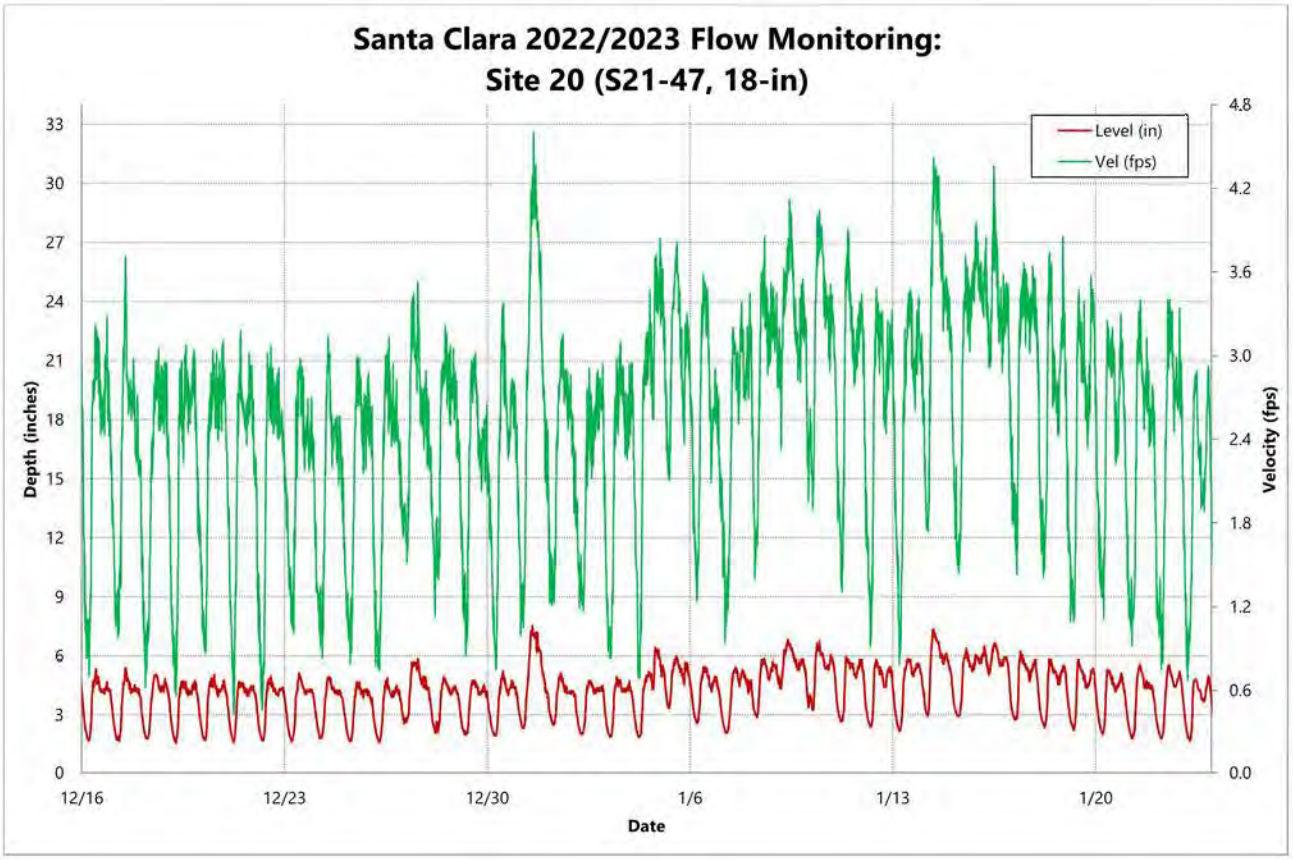

Santa Clara 2022/2023 Flow Monitoring:
Site 17 (S58-9, 24-in)
Velocity (fps)
Depth (in.)
0
3
6
9
12
0.0
0.5
1.0
1.5
2.0
2.5

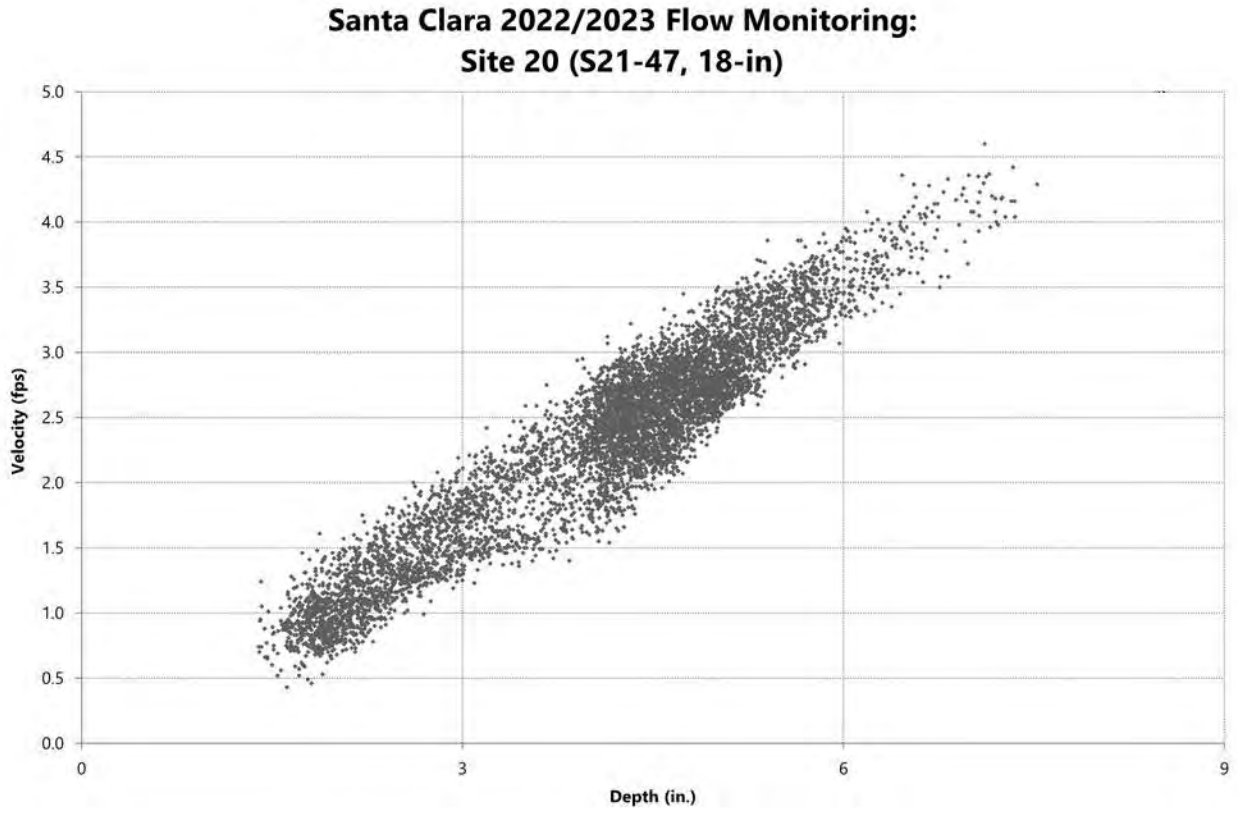

Santa Clara 2022/2023 Flow Monitoring:
Site 18 (S58-8, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

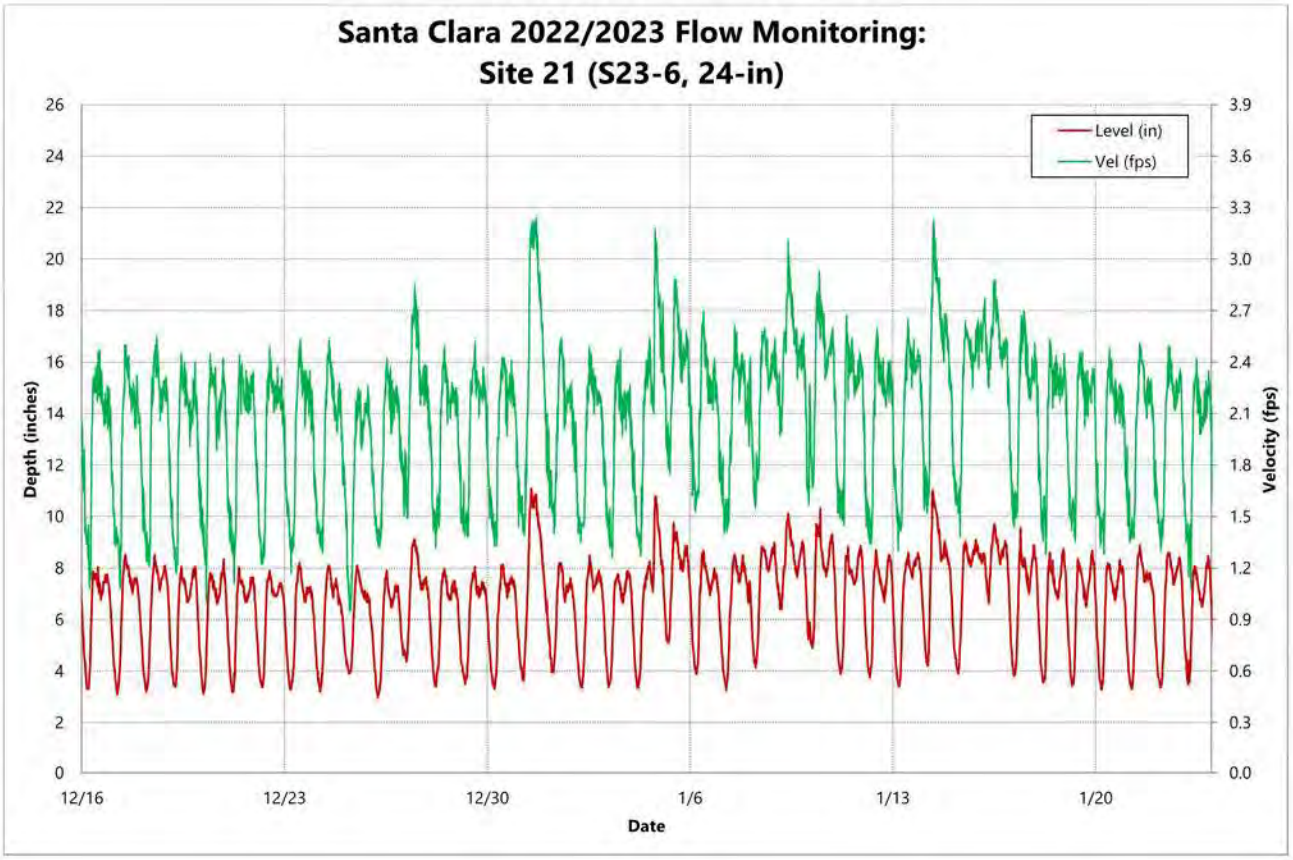

Santa Clara 2022/2023 Flow Monitoring:
Site 18 (S58-8, 24-in)
Velocity (fps)
Depth (in.)

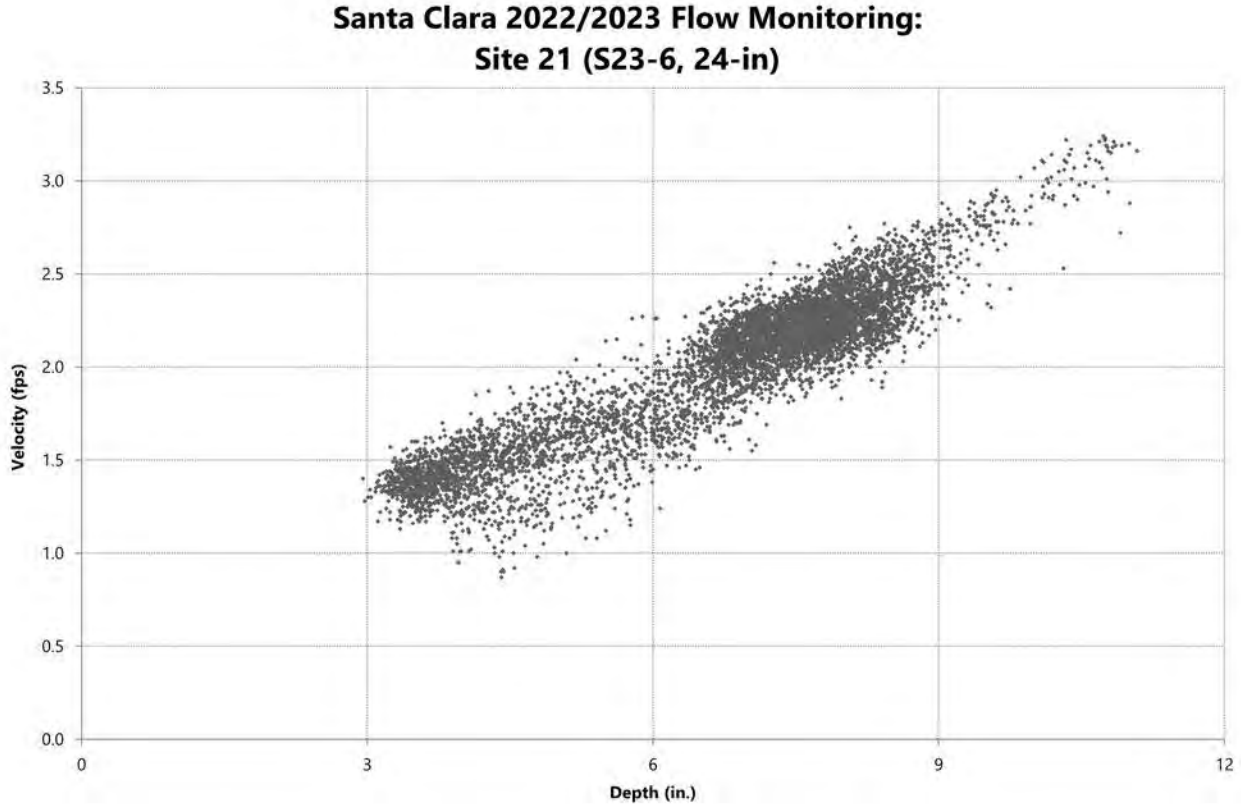

Santa Clara 2022/2023 Flow Monitoring:
Site 19 (S21-18, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
30
27
24
21
18
15
12
9
6
3
0
6.0
5.4
4.8
4.2
3.6
3.0
2.4
1.8
1.2
0.6
0.0
12/16
12/23
12/30
1/6
1/13
1/20

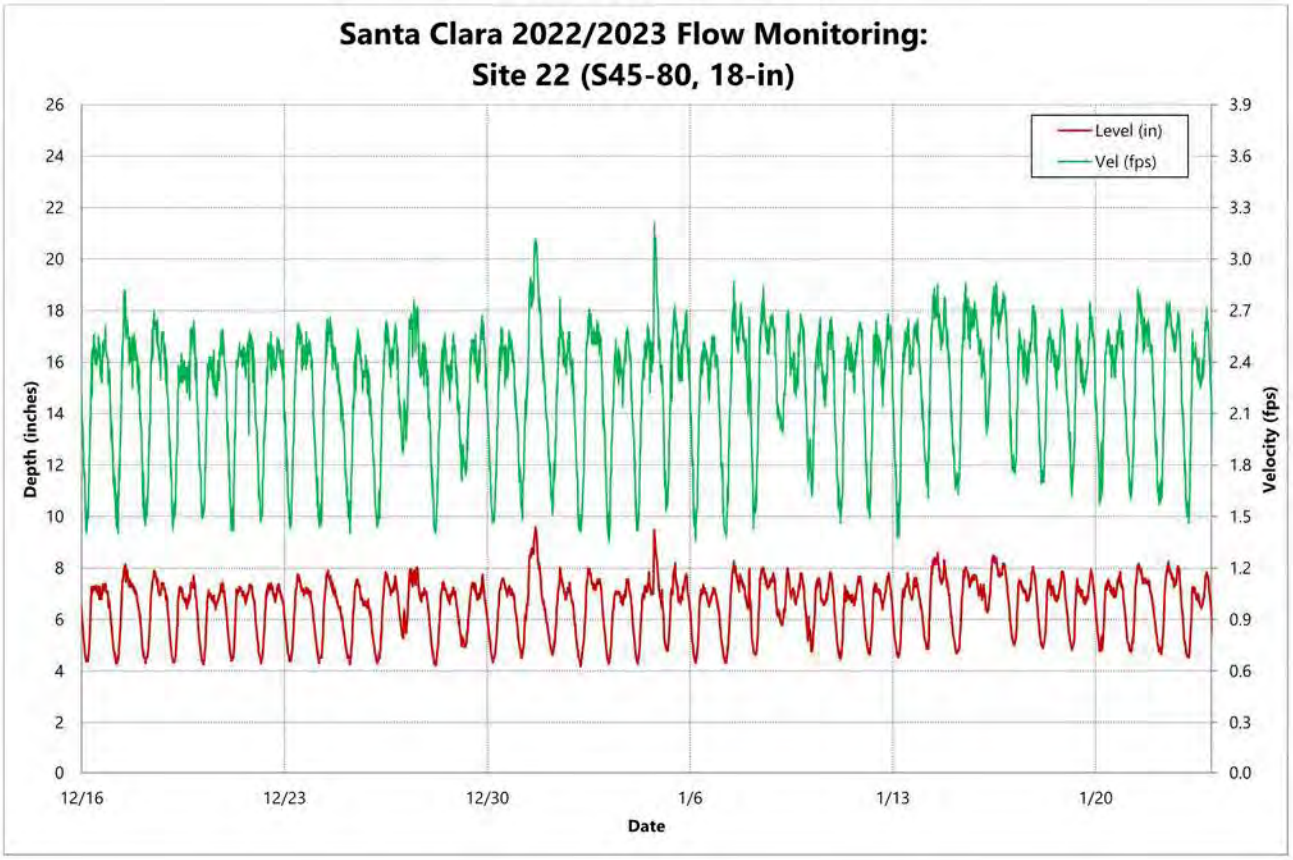

Santa Clara 2022/2023 Flow Monitoring:
Site 19 (S21-18, 24-in)
Velocity (fps)
Depth (in.)
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
3
6
9
12
15

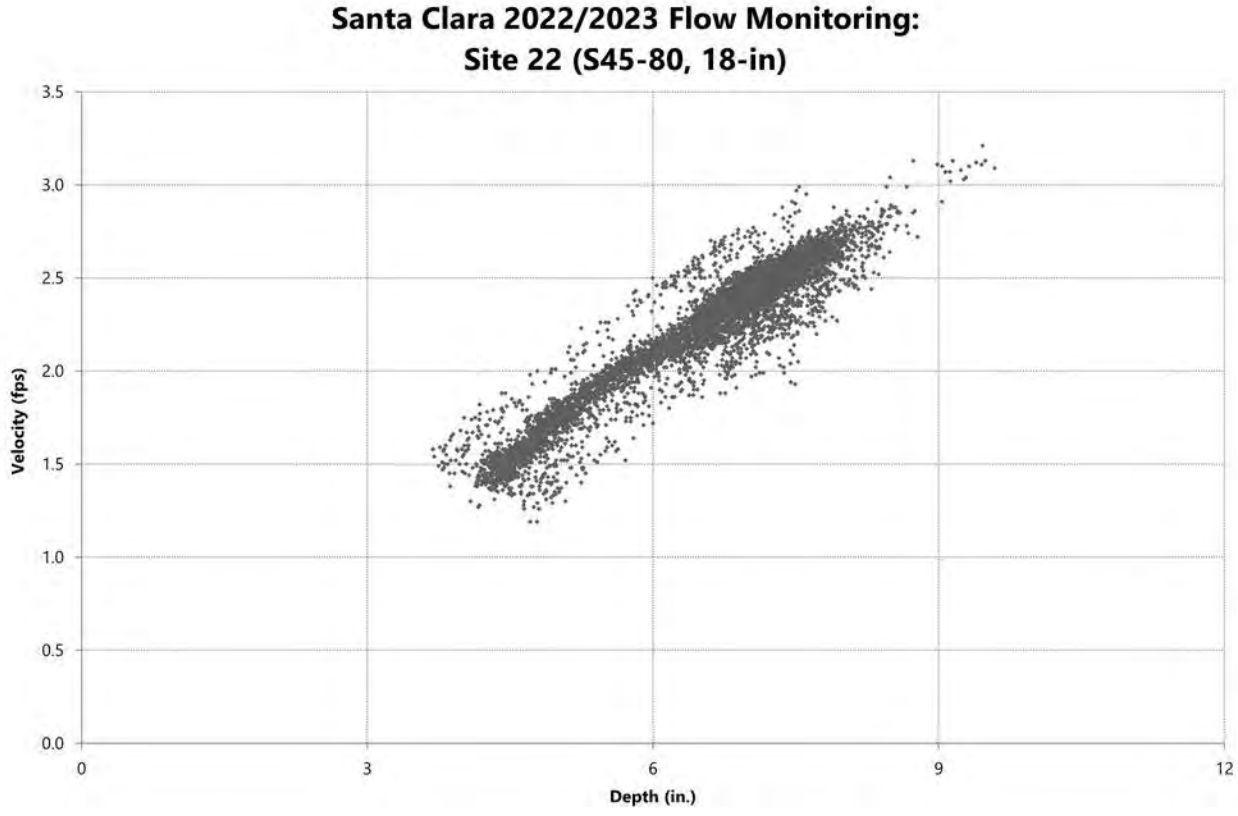

Santa Clara 2022/2023 Flow Monitoring:
Site 20 (S21-47, 18-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
0
3
6
9
12
15
18
21
24
27
30
33
0.0
0.6
1.2
1.8
2.4
3.0
3.6
4.2
4.8
12/16
12/23
12/30
1/6
1/13
1/20

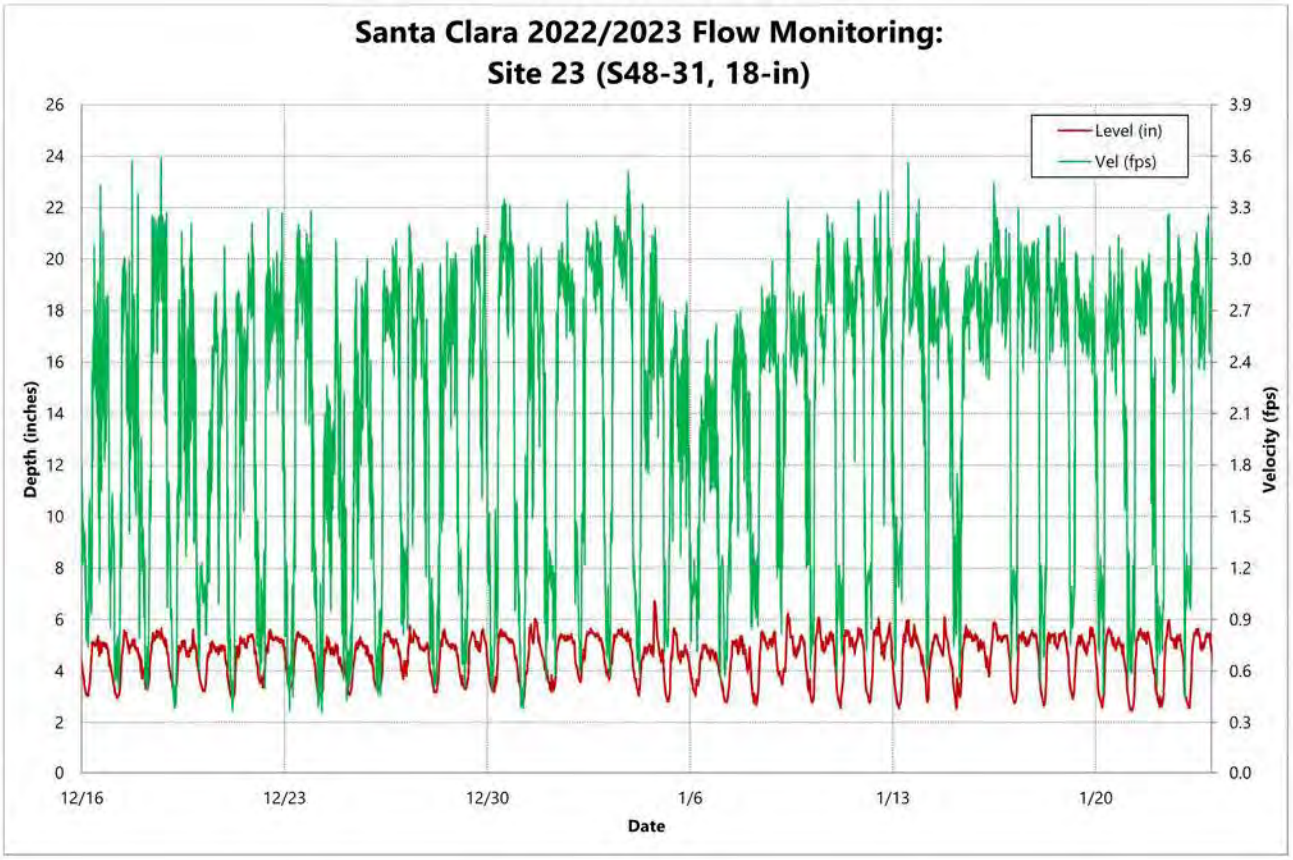

Santa Clara 2022/2023 Flow Monitoring:
Site 20 (S21-47, 18-in)
Velocity (fps)
Depth (in.)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
0
3
6
9

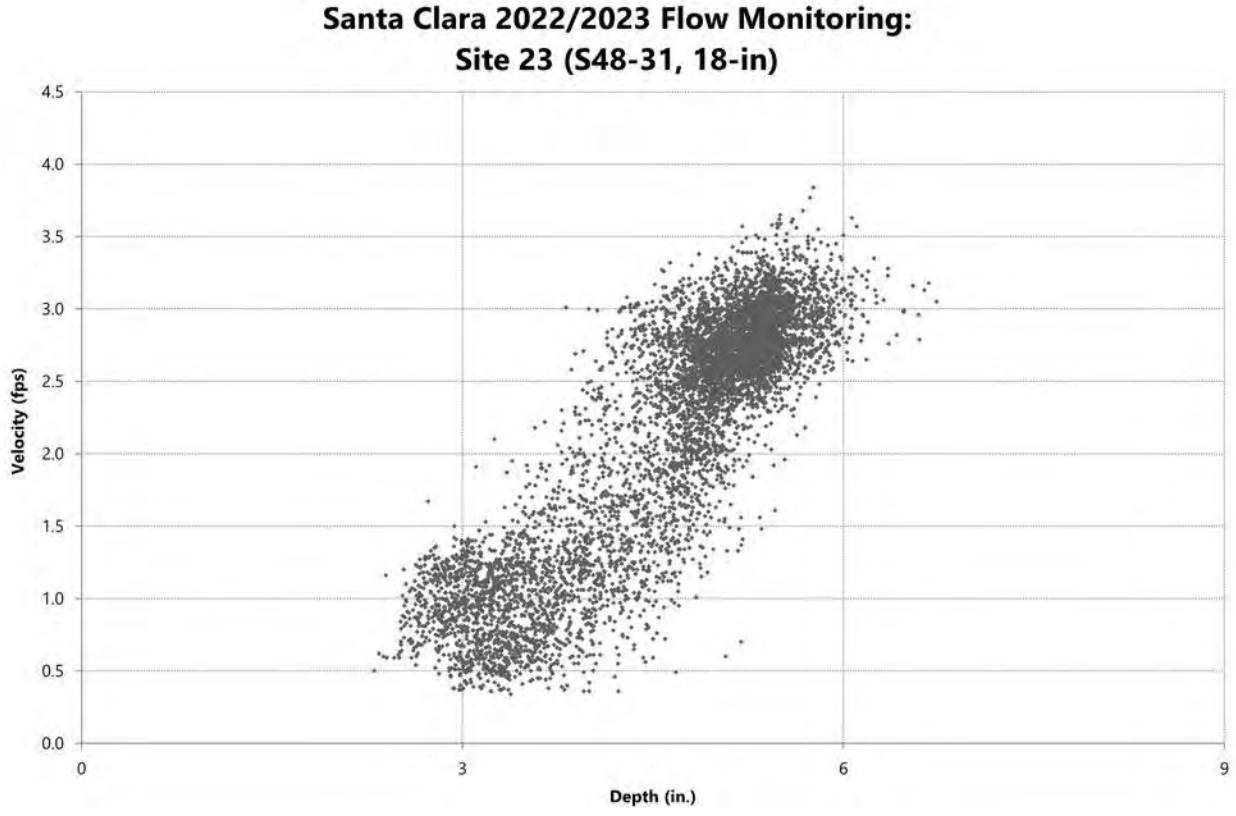

Santa Clara 2022/2023 Flow Monitoring:
Site 21 (S23-6, 24-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

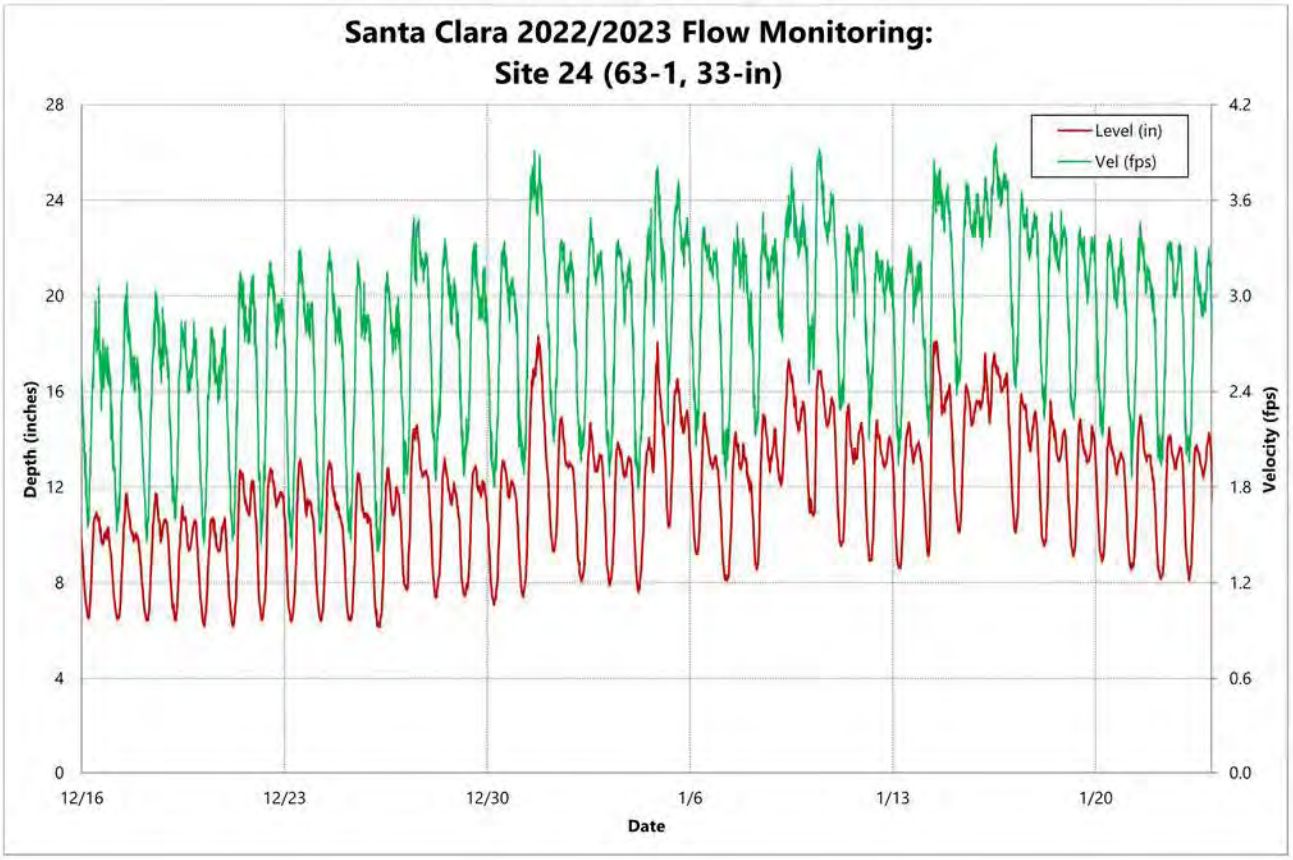

Santa Clara 2022/2023 Flow Monitoring:
Site 21 (S23-6, 24-in)
Velocity (fps)
Depth (in.)

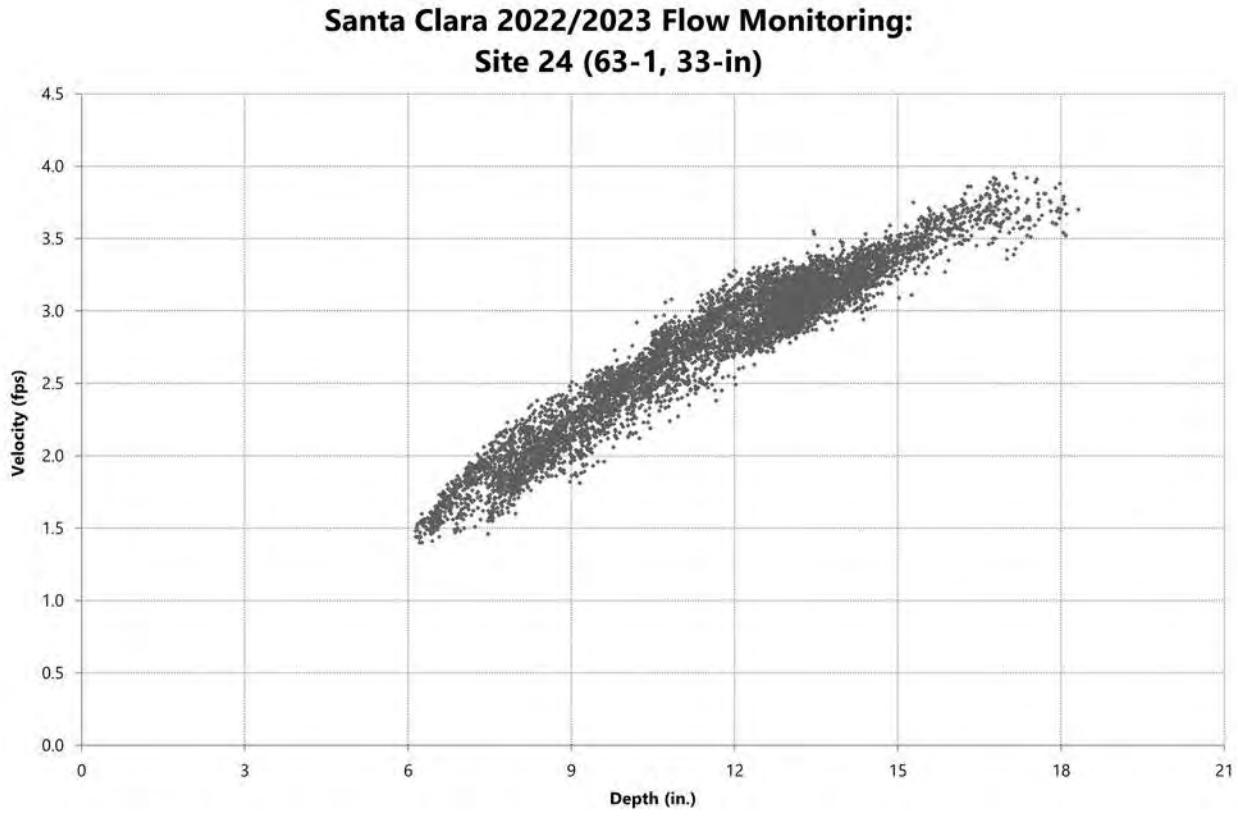

Santa Clara 2022/2023 Flow Monitoring:
Site 22 (S45-80, 18-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20


Santa Clara 2022/2023 Flow Monitoring:
Site 22 (S45-80, 18-in)
Velocity (fps)
Depth (in.)

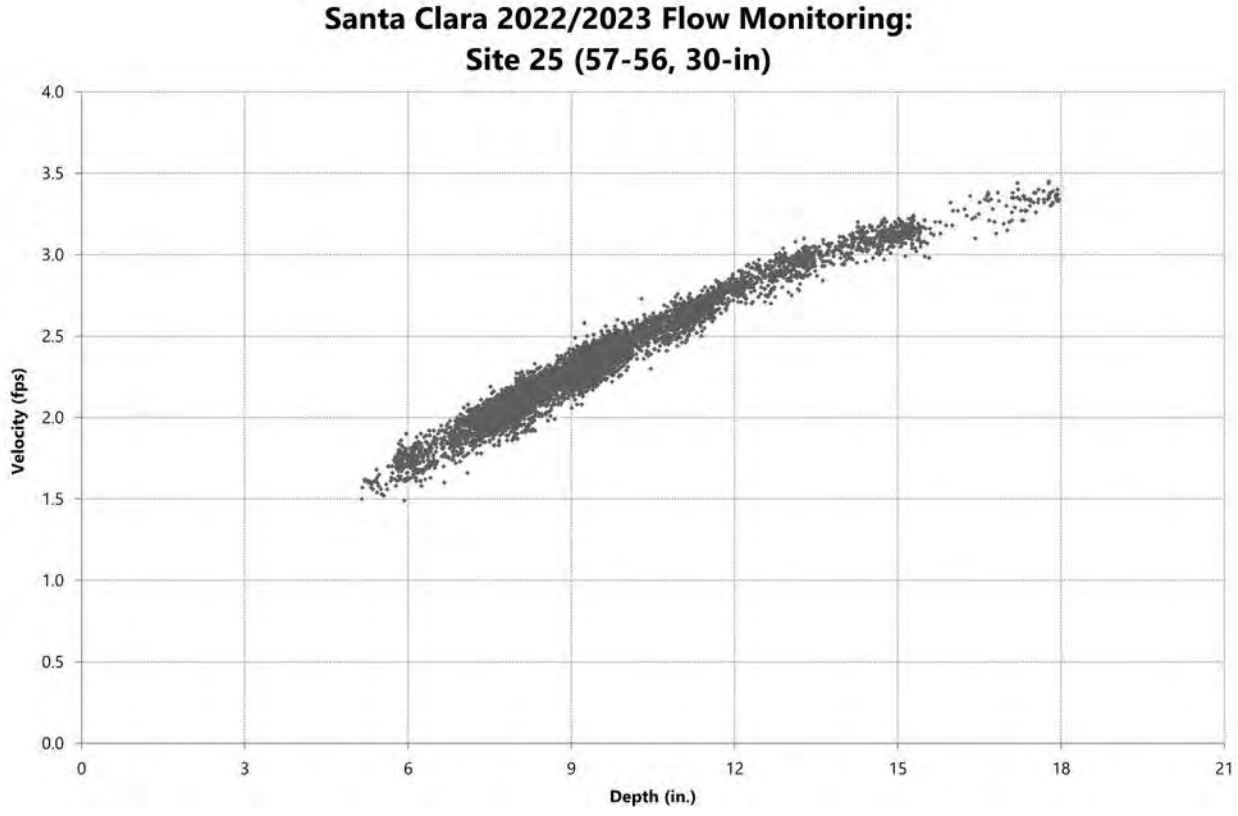

Santa Clara 2022/2023 Flow Monitoring:
Site 23 (S48-31, 18-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

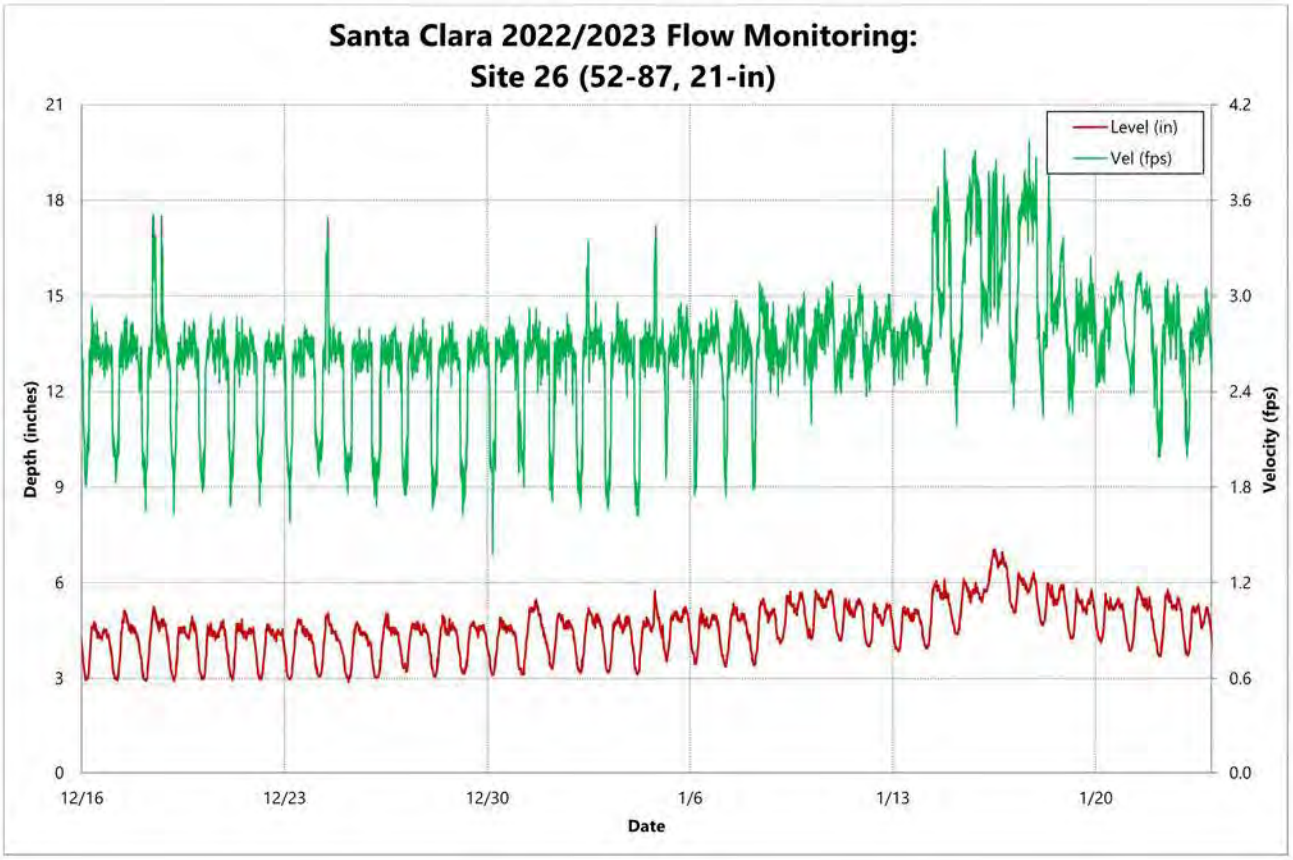

Santa Clara 2022/2023 Flow Monitoring:
Site 23 (S48-31, 18-in)
Velocity (fps)
Depth (in.)

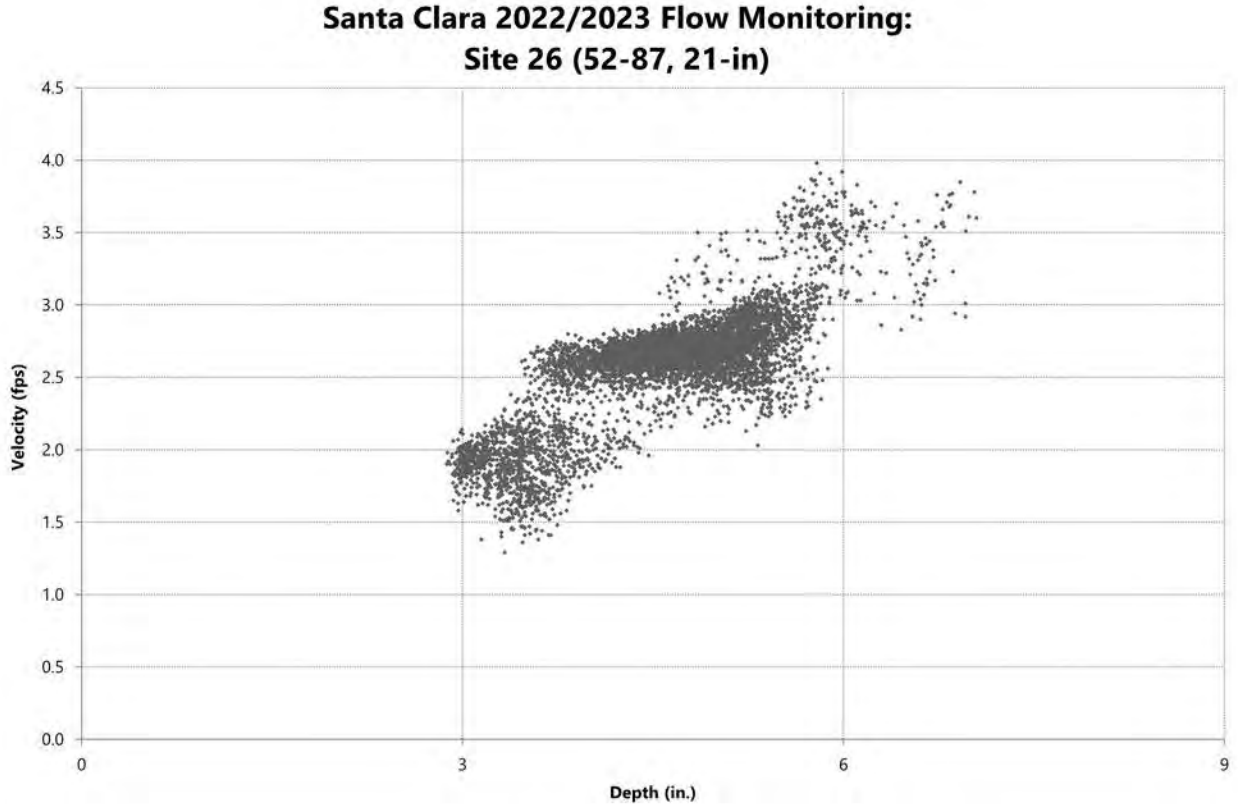

Santa Clara 2022/2023 Flow Monitoring:
Site 24 (63-1, 33-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
28
24
20
16
12
8
4
0
4.2
3.6
3.0
2.4
1.8
1.2
0.6
0.0
12/16
12/23
12/30
1/6
1/13
1/20

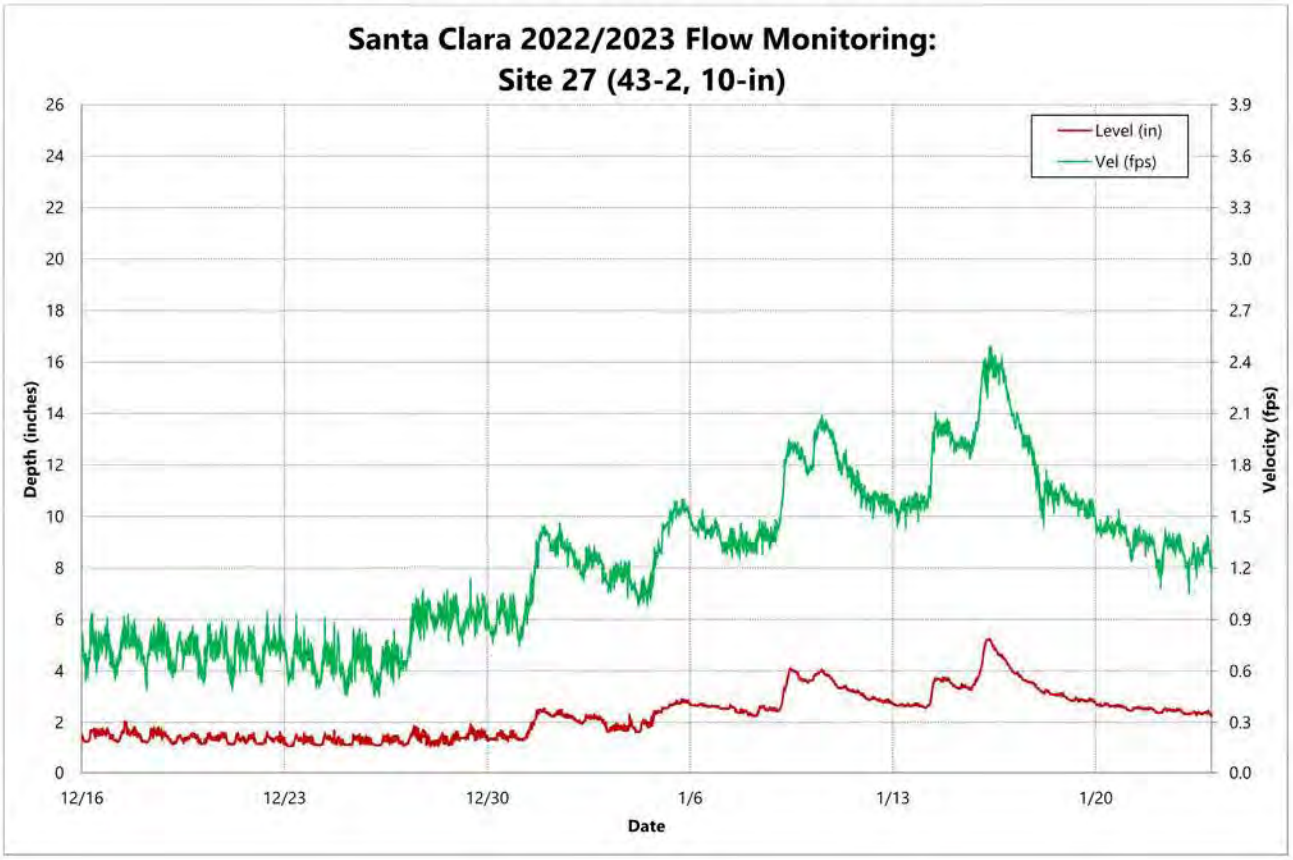

Santa Clara 2022/2023 Flow Monitoring:
Site 24 (63-1, 33-in)
Velocity (fps)
Depth (in.)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
3
6
9
12
15
18
21

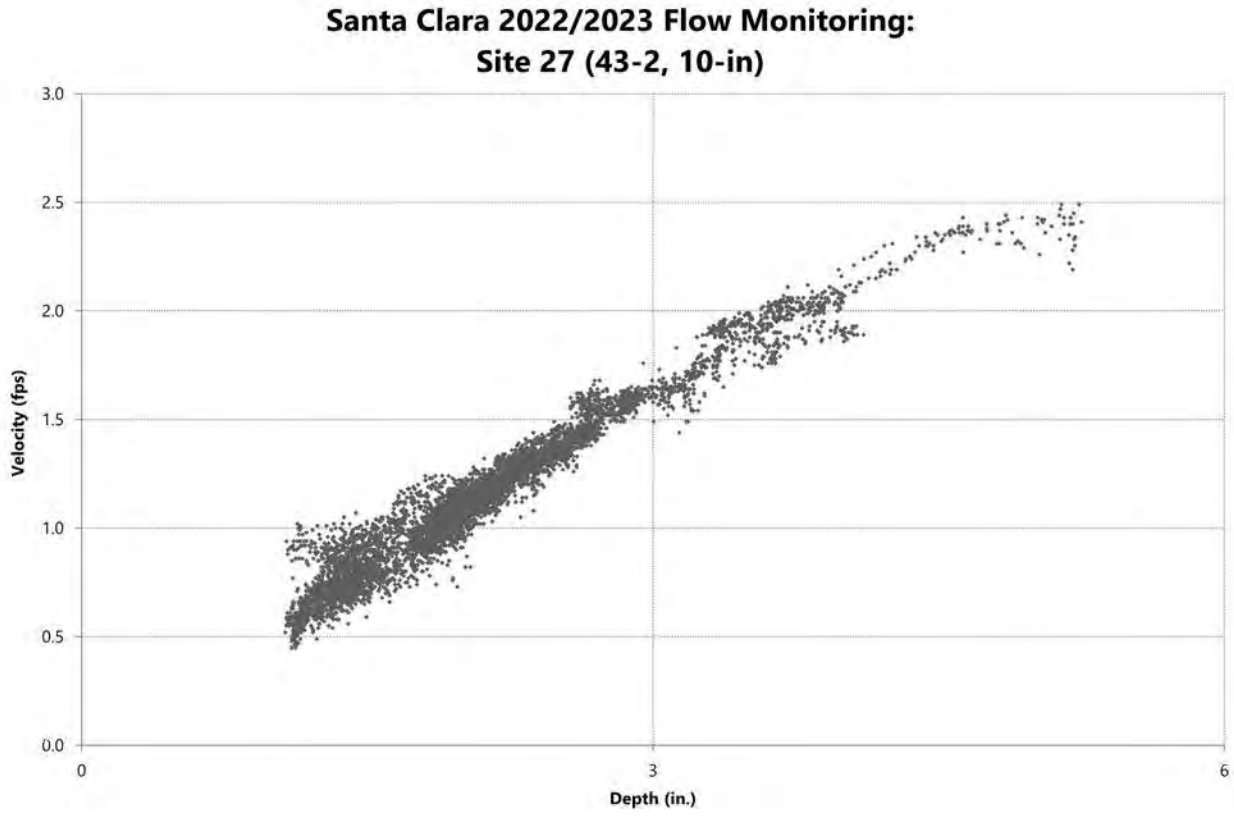
Santa Clara 2022/2023 Flow Monitoring:
Site 25 (57-56, 30-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20

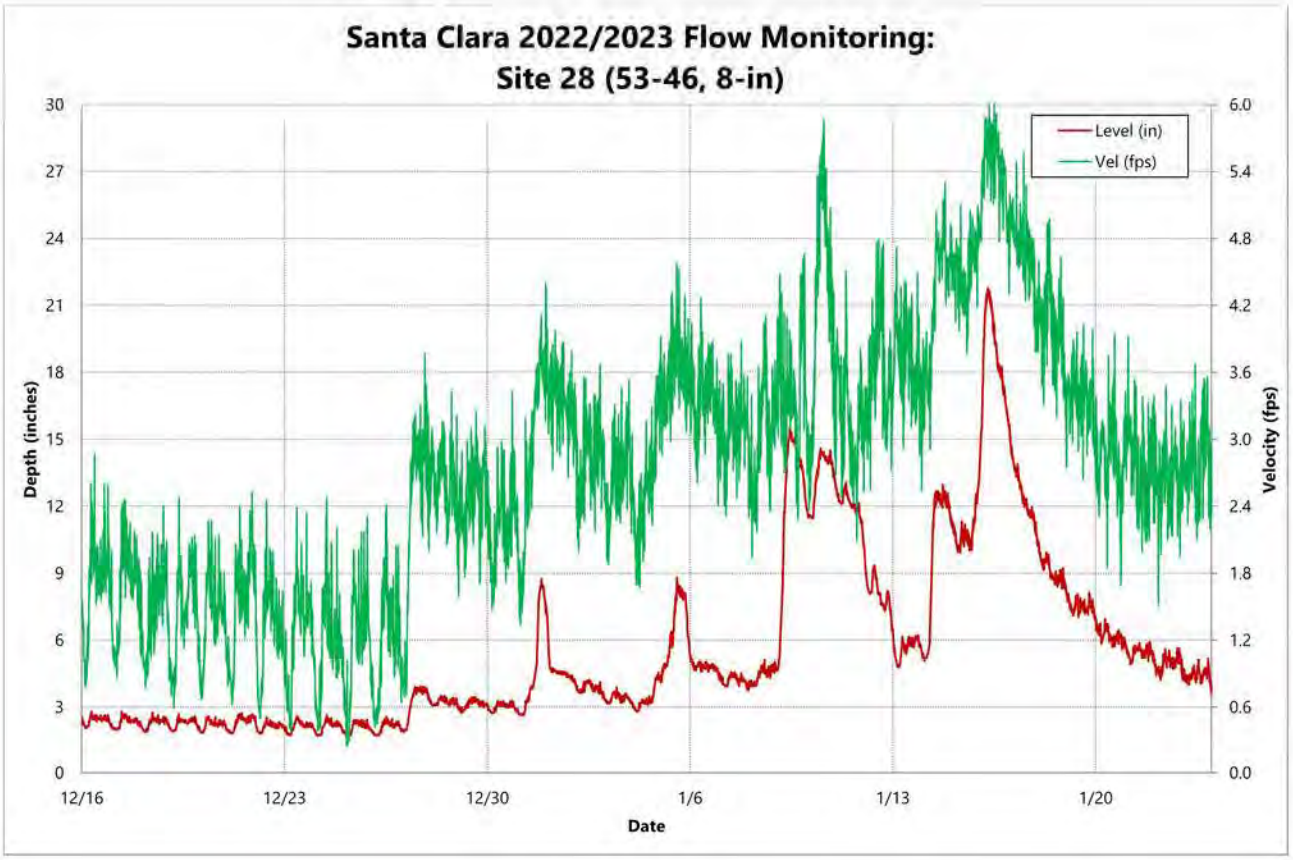

Santa Clara 2022/2023 Flow Monitoring:
Site 25 (57-56, 30-in)
Velocity (fps)
Depth (in.)

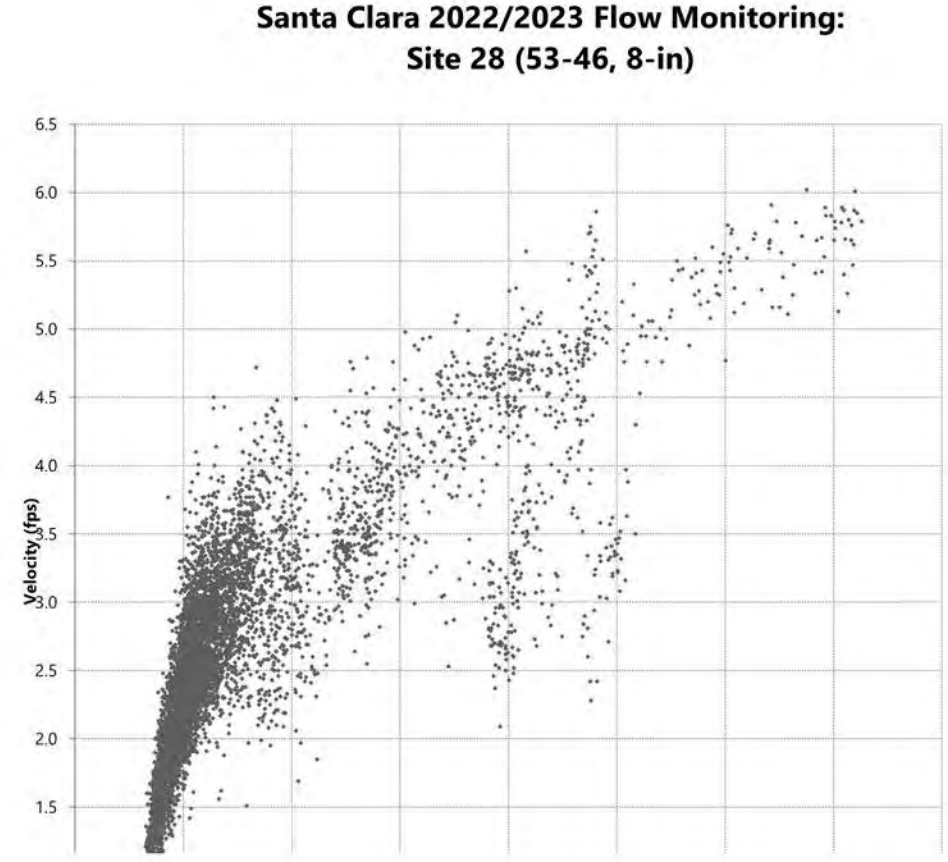

Santa Clara 2022/2023 Flow Monitoring:
Site 26 (52-87, 21-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
21
18
15
12
9
6
3
0
4.2
3.6
3.0
2.4
1.8
1.2
0.6
0.0
12/16
12/23
12/30
1/6
1/13
1/20

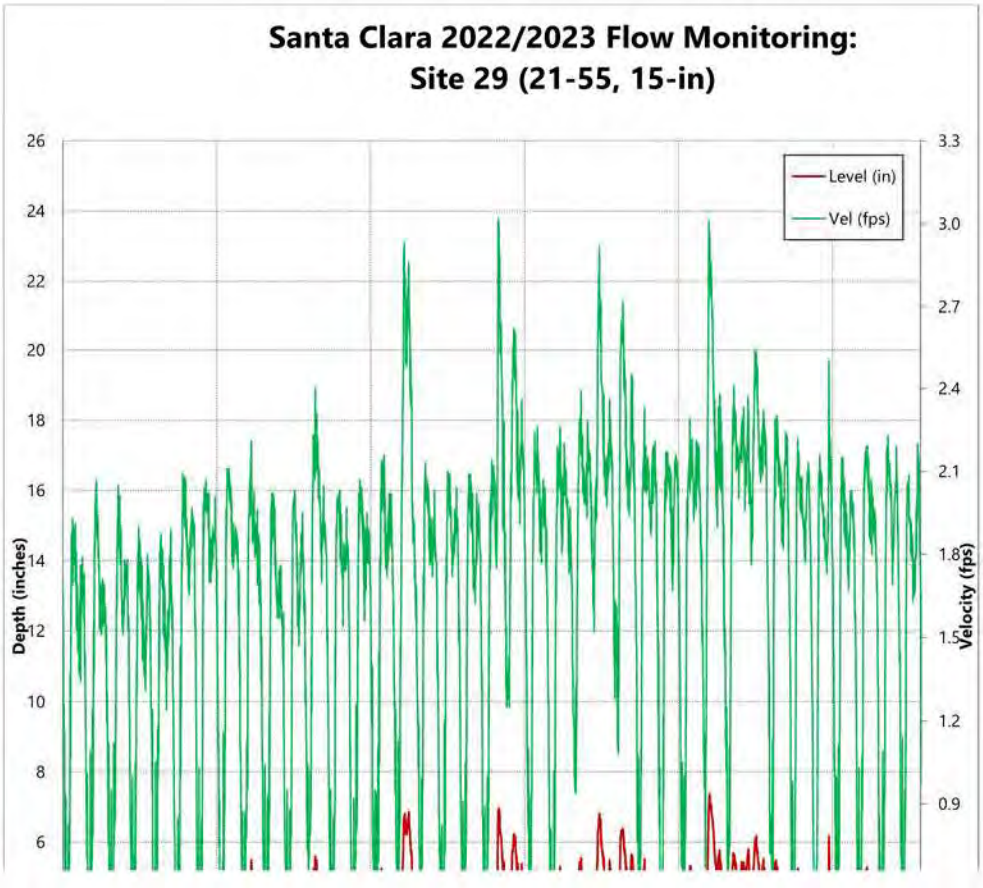

Santa Clara 2022/2023 Flow Monitoring:
Site 26 (52-87, 21-in)
Velocity (fps)
Depth (in.)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
3
6
9

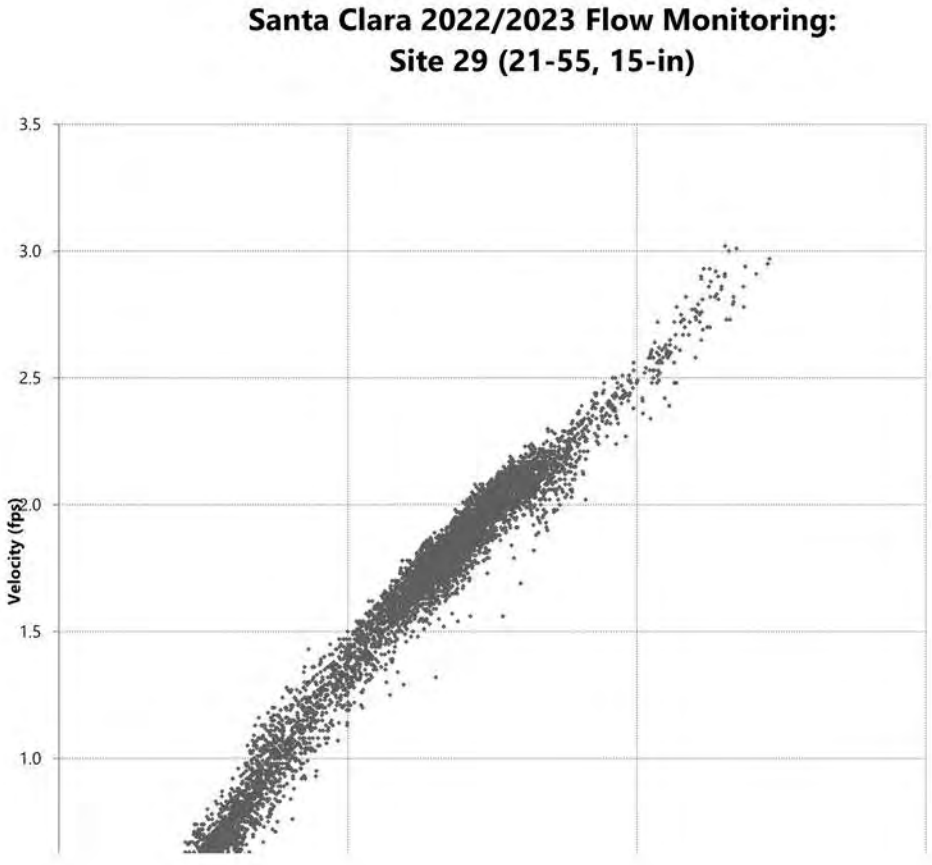

Santa Clara 2022/2023 Flow Monitoring:
Site 27 (43-2, 10-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20
0
2
4
6
8
10
12
14
16
18
20
22
24
26
0.0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4
2.7
3.0
3.3
3.6
3.9

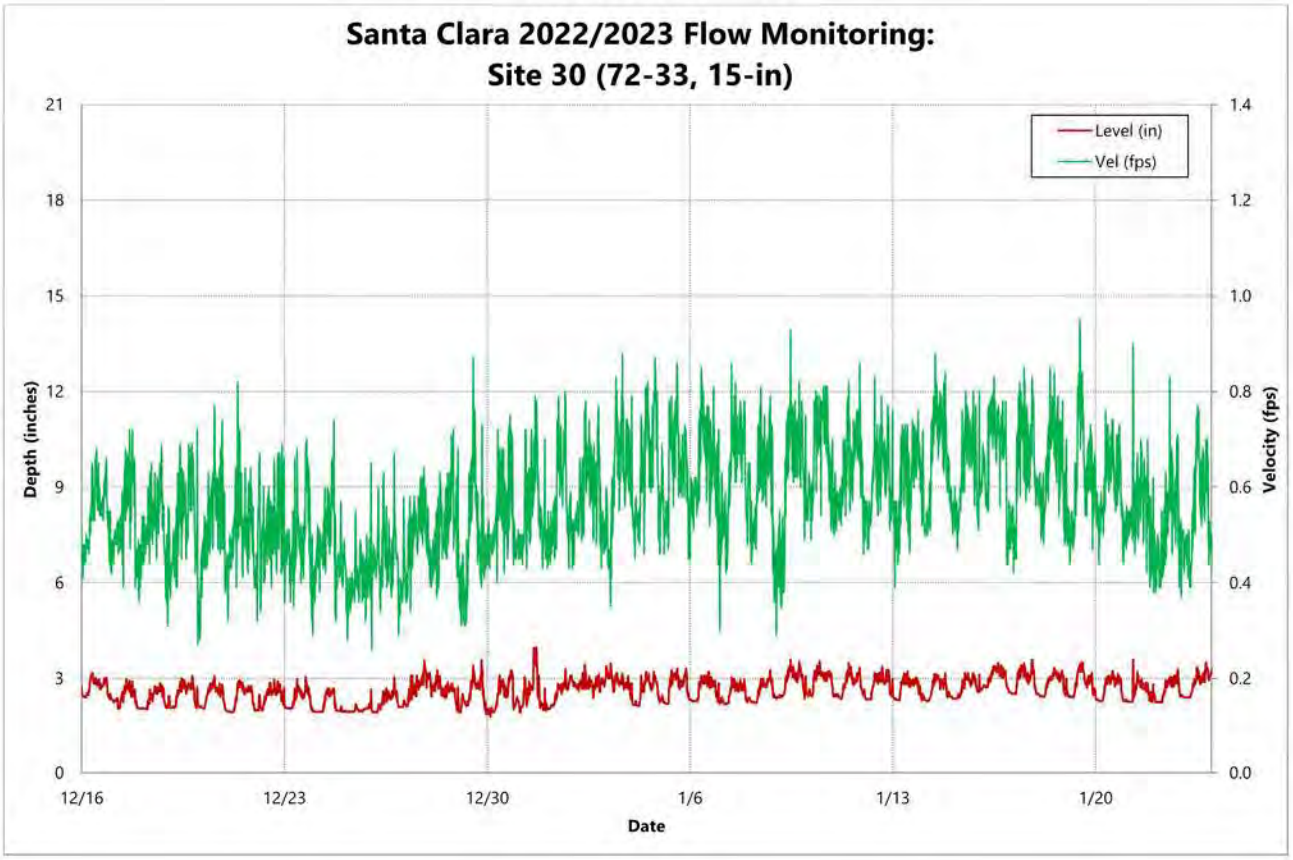

Santa Clara 2022/2023 Flow Monitoring:
Site 27 (43-2, 10-in)
Velocity (fps)
Depth (in.)
0
3
6
0.0
0.5
1.0
1.5
2.0
2.5
3.0

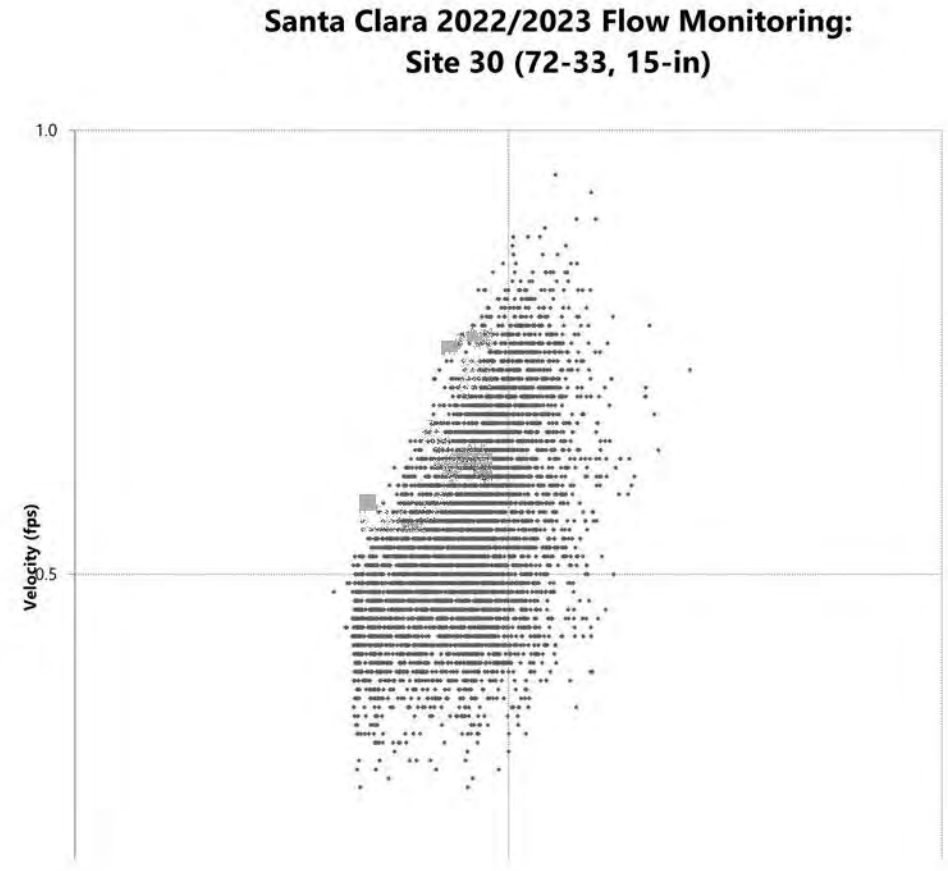

Santa Clara 2022/2023 Flow Monitoring:
Site 28 (53-46, 8-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
12/16
12/23
12/30
1/6
1/13
1/20
0
3
6
9
12
15
18
21
24
27
30
0.0
0.6
1.2
1.8
2.4
3.0
3.6
4.2
4.8
5.4
6.0

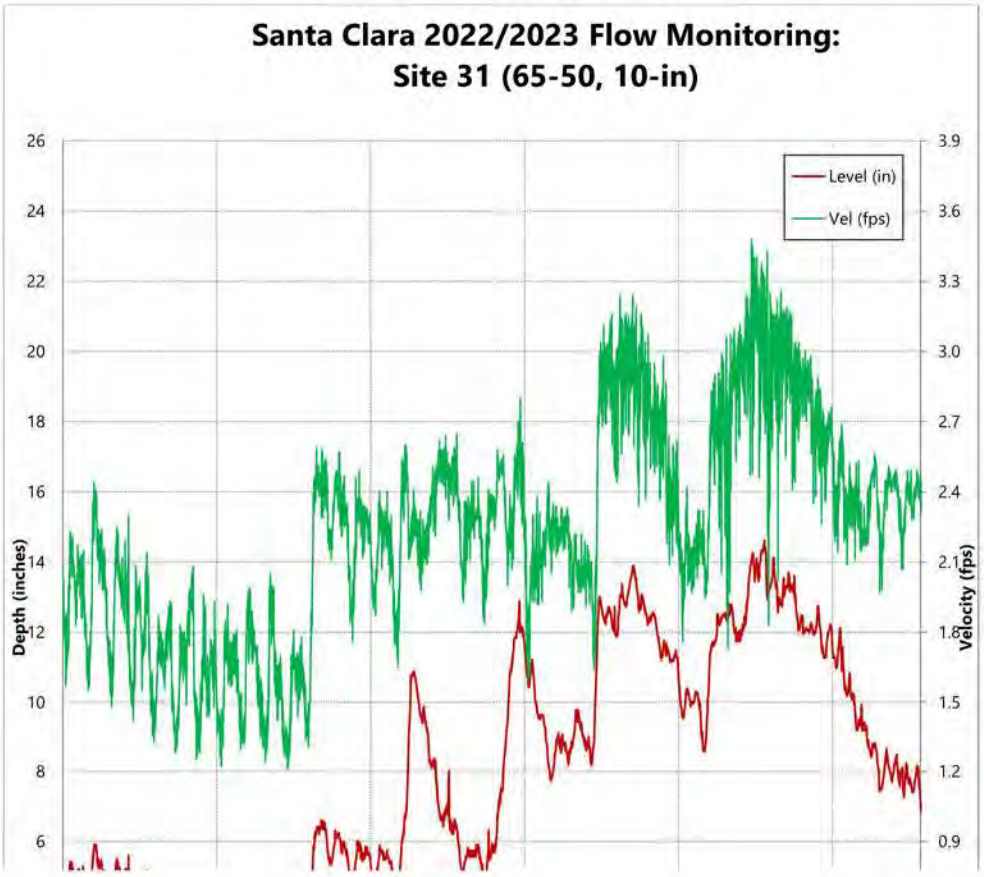

Santa Clara 2022/2023 Flow Monitoring:
Site 28 (53-46, 8-in)
Velocity (fps)
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5


Santa Clara 2022/2023 Flow Monitoring:
Site 29 (21-55, 15-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
26
24
22
20
18
16
14
12
10
8
6
3.3
3.0
2.7
2.4
2.1
1.8
1.5
1.2
0.9


Santa Clara 2022/2023 Flow Monitoring:
Site 29 (21-55, 15-in)
Velocity (fps)
3.5
3.0
2.5
2.0
1.5
1.0


Santa Clara 2022/2023 Flow Monitoring:
Site 30 (72-33, 15-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
Date
21
18
15
12
9
6
3
0
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
12/16
12/23
12/30
1/6
1/13
1/20


Santa Clara 2022/2023 Flow Monitoring:
Site 30 (72-33, 15-in)
Velocity (fps)
1.0
0.5


Santa Clara 2022/2023 Flow Monitoring:
Site 31 (65-50, 10-in)
Level (in)
Vel (fps)
Depth (inches)
Velocity (fps)
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24
22
20
18
16
14
12
10
8
6
3.9
3.6
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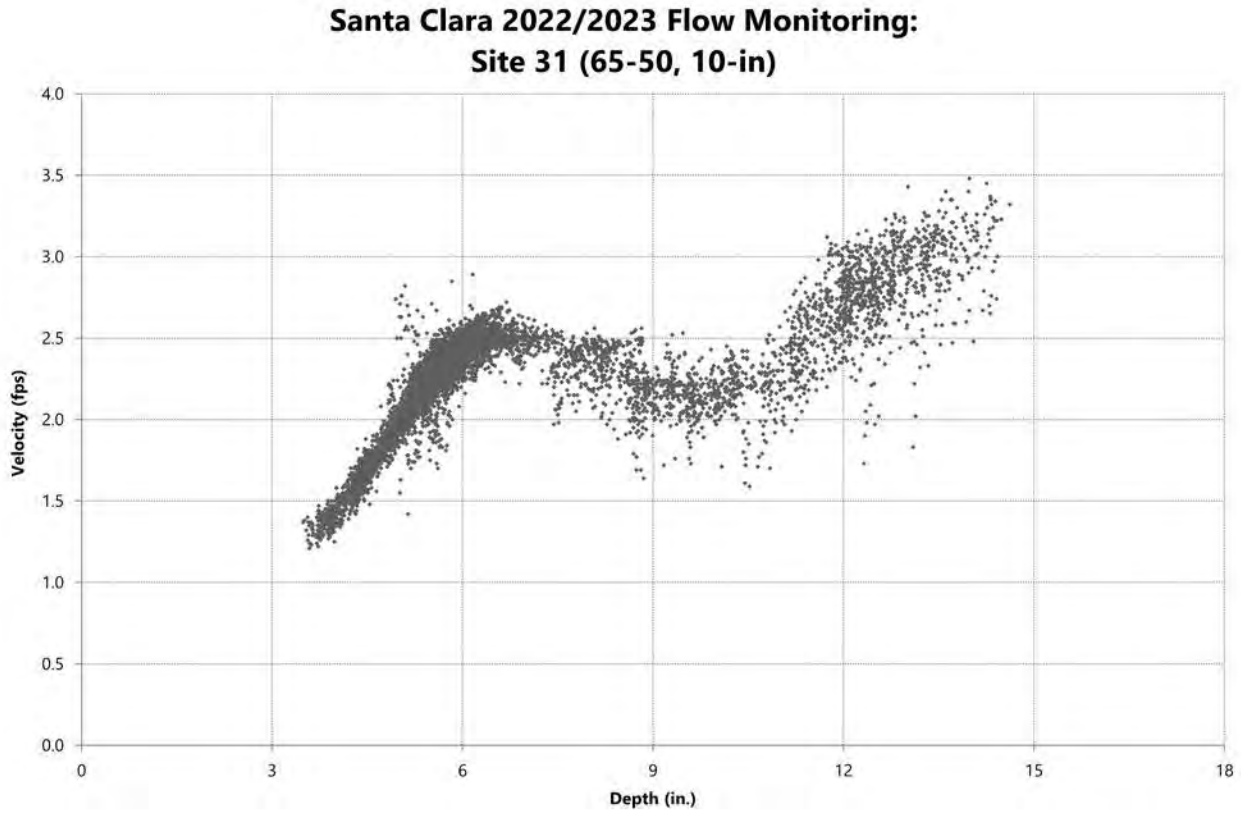
3.0
2.7
2.4
2.1
1.8
1.5
1.2
0.9


Santa Clara 2022/2023 Flow Monitoring:
Site 31 (65-50, 10-in)
Velocity (fps)
Depth (in.)
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3.0
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2.0
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0.5
0.0
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3
6
9
12
15
18

APPENDIX C: FUTURE DEVELOPMENT ASSUMPTIONS

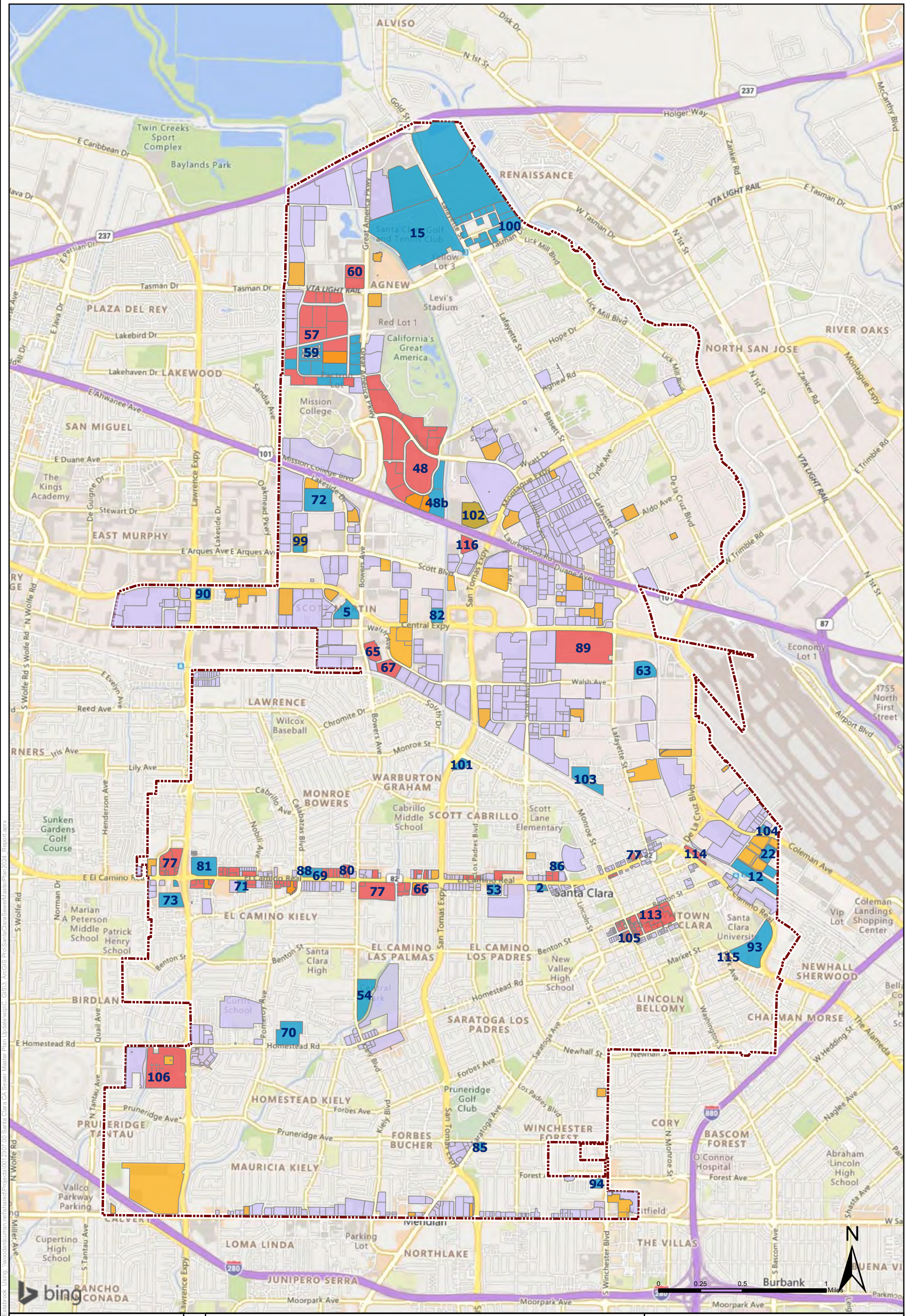

Figure B-1: Map of Future Development & Entitlement Parcels

Sewer Master Plan Update

Legend

- City Limit
- Parcel with Future Flow Assumption
  - Near-Term Specific Development (2025-2030)
  - Long-Term Specific Development (2030-2035)
  - Long-Term General Plan Phase 3 (2030-2035)
  - Entitlements

Woodard & Curran

Figure Exported: 12/27/2024 By: SEstabrook Using: \\woodardcurran.net\shared\Projects\001230\00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\Santa Clara Sewer Master Plan2024_Report.aprx

Name of Development	PLN #	BLD #	Address #	Street Name	APN	Block Book Page	W&C Notes	Ref_ID	January 2023 Status (per City Planning)	Residential Units	Residential Type	Non-Residential SF	Non-Residential Type	Non-Residential Type 2 SF/Units	Non-Residential Type 2	Future Model Scenario	Residential Flow (mgd)	Non-Residential Flow (mgd)
1890 El Camino Real	PLN2015-11361	BLD2017-47840	1890	El Camino Real	269-01-081, 269-63-000	35, 36	Still under construction, May 2023	2	Under construction	56	Condos					Near-Term	0.0098	0
Bowers Ave	PLN2012-09162	BLD2016 41725 & BLD2016-41470	3000	Bowers Ave.	216-48-033	63	Empty lots as of 9/2021. No billing point associated with this parcel. No longer a development Update (5/19/23): two 165,000 square foot five-story office buildings totaling 330,000 square feet; a five-level parking garage and surface lots providing a total of 980 parking spaces; and site and public right-of-way improvements.	5	Approved			330,000	Office			Near-Term	0	0.033
VTA BART station and yard			480	Brokaw Road	230-06-054		Billing database does not account for development.	12				351,512	Community (yard, BART station, and parking garage)			Near-Term	0	0.032339104
Related (land use changed in parcels 4 & 5)	PLN2014-10554		2351, 5155	2351, 5155 Stars and Stripes Dr	104-03-036	94, 103, 104, 105, 114	Some parcels within development constructed and accounted for in billing database. Others not.	15	Approved	1,680	Apts	4,080,000 2,889,640	Office Mixed Use	4,128	Hotel	Near-Term	0.32872	0.98910174
Coleman Highline (old FMC site) - Gateway Crossing project added	PLN2016-12318		1205	Coleman Ave	230-46-069, 230-59-001	48	No billing point here. Development proposal in review (see folder T001).	22	Phase 1 Under Construction	230 760 610	Studio 1-b Units (SF) 2-d Units (SF)	15,000	Retail	700 (rooms)	Hotel	Near-Term	0.28171	0.114
Freedom Circle Focus Area					104-40-019, 104-40-020, 104-40-030, 104-40-031, 104-40-034, 104-40-035, 104-40-038, 104-41-031, 104-41-032, 104-41-043, 104-41-044, 104-42-020, 104-42-021		Focus Area approved - Specific Plan still required. Development timing for residential should be considered near-term. (6/1/2023)	48	Approved	2,500	Apts	4,229,000	Retail/Office			Future	0.385	0.5085
Greystar	PLN2017-12516		3905	Freedom Circle	104-40-021, 104-40-036		Development permit approved. Could be moving forward in the next couple of years.	48	Approved	1,100	Apts	2,000	Retail			Near-Term	0.1694	0.0002
South Bay Development	PLN2007-06433 & PLN2013-09743	BLD2015-40394	2350	Mission College Bl.			Site under construction until summer 2018 therefore not confident billing database accounts for full building being occupied. The proposed project consists of the construction of two 6-story office buildings each supporting 150,000 square fet of space (300,000 square feet total), a 6,000 square foot retail building and a 6-level parking garage. The site currently contains the 13-story Regency Plaza Interational building (251,000 square feet).	49	Constructed			306,000	Office/Retail (6,000 SF)				0	0.0306
Summer Hill Apartments	PLN2017-12723		2230 (?), 2232 & 2240 El Camino Real	El Camino Real	290-10-090, 290-10-091	35	Development not constructed yet (not even under construction). Billing database only accounts for the existing non-residential use.	53	Approved	151	Apts	5,000 5,000	Retail Restaurant			Near-Term	0.04158	0
Santa Clara CRC, ISC & ISHOF (International Swim Center)	PLN2015-10939	BLD1974-42418	Central Park	Kiely Boulevard	290-26-029	23, 33	Development not even under construction. Recreation/swim center (275,369 SF) and a theater (400 seats)	54	Approved			275,369	Swim center (UFF = 0.3 GPD/SF)	400	Seats (UFF = 5 gpd/seat)	Near-Term	0	0.0826107
(Now called Kylli) Yahoo! at Tasman (In addition to the previously modeled Yahoo! development)	PLN2002-07218, PLN2017-12724		5010 Old Ironsides	Surrounded by Patrick Henry, Hetch Hetchy ROW, Old Ironsides Dr., and Tasman Dr.	104-04-064, 104-04-065, 104-04-111, 104-04-112, 104-04-113, 104-04-142, 104-04-143, 104-04-150, 104-04-151		General Plan amendment for a nine-parcel property to amend the designation from High-Intensity Office/Research to a newly-established mixed-use designation allowing a high-intensity mix of office, commercial, and residential uses. The Project proposes a PD rezone for the development of 3,000,000 +/- square feet of commercial office/lab space, 100,000 +/- square feet of neighborhood retail, 1,800 +/- new multi-family residential, a childcare facility, and indoor and outdoor community spaces.	57	Under Review	1,800		3,000,000 100,000 5,000 800 10,000	Office Retail Community Police Daycare			Future	0.2772	0.303048

Name of Development	PLN #	BLD #	Address #	Street Name	APN	Block Book Page	W&C Notes	Ref_ID	January 2023 Status (per City Planning)	Residential Units	Residential Type	Non-Residential SF	Non-Residential Type	Non-Residential Type 2 SF/Units	Non-Residential Type 2	Future Model Scenario	Residential Flow (mgd)	Non-Residential Flow (mgd)
Patrick Henry Specific Plans Phase 1					104-04-078, 104-04-093, 104-04-094, 104-04-123, 104-04-131, 104-04-136, 104-04-138, 104-04-139, 104-04-140, 104-04-141, 104-53-000			59	Approved	1,200	Condos	200,000 110,000	Retail Public (Commercial facilities)			Near-Term	1.3495	0.02
																Future	0.5117	0.02796
2901 Tasman Dr	PLN2020-14361		2901	Tasman Dr	104-49-025, 104-49-026	S93		60	Under Review			1,070,344	R&D			Future	0	0.1605516
651 Walsh Ave	PLN2018-13303 (Debby)		651	Walsh Ave	224-04-059	57, 67	Approved. To be accounted for as future data center.	63	Under construction			435,050	Data Center			Near-Term	0	0.059173
2805 Bowers Avenue	PLN2021-15069		2805	Bowers Avenue	216-28-063		Accounted for in model as future data center.	65	Under Review			244,068	Data Center			Future	0	0.012816
2500 El Camino Real (Mariani)	PLN2016-11686	BLD1968-33480	2500	El Camino Real	290-46-001, 290-46-002, 290-46-003, 290-46-015, 290-46-016, 290-46-017	34	Last submittal - 2018	66	Under Review	392	Condos	8,000	Restaurant	311 (rooms)	Hotel	Future	0.0641	0.03942
2590 Walsh Ave Vantage Data Center CA3			2590	Walsh Ave	216-28-112	63	Will be modeled as future data center.	67				450,800	Data Center			Future	0	0.01692
3035 El Camino Real	PLN2018-13265		3035	El Camino Real	220-32-059	42		69	Under construction	42	Condos					Near-Term	0.00735	0
3131 Homestead Rd	PLN2019-13869 PLN2018-13339 (Debby)		3131	Homestead Rd	290-24-071	22		70	Under construction	225	Apts					Near-Term	0.070991976	0
3402/3410 El Camino Real	PLN2017-12578	BLD2019-57108 (3406 ECR, same APN)	3402/3410	El Camino Real	290-01-136			71	Under construction	69	Apts	10,000 3,458	Restaurant Commercial			Near-Term	0.010626	0.0110578
3625 Peterson Way	PLN2018-13144		3625	Peterson Way	216-30-049	72, 73	Two 8-story office buildings totaling 632,216 SF; a 13,370 SF 1-story ammenity building, 4 level parking structure.	72	Approved			658630	Office	13,370	Ammenity	Near-Term	0	0.1008
ECR (Gateway Village) - See line 116	PLN2012-09540	BLD2016-41881 (for apartment BLD)	3610, 3700	3610, 3640, 3650, & 3700 ECR	313-06-002, 313-06-008	30, 40	Development under construction 2017 through 2018. Billing database would not have accounted for development.	73	Residencies constructed	476	Condos	23,010 15,340 14,750 9,357 15,257 9,386	Restaurant (small food Service) Restaurant (full Service) Retail Fitness Beauty Parlor Medical Office			Near-Term	0.0833	0.05402519

Name of Development	PLN #	BLD #	Address #	Street Name	APN	Block Book Page	W&C Notes	Ref_ID	January 2023 Status (per City Planning)	Residential Units	Residential Type	Non-Residential SF	Non-Residential Type	Non-Residential Type 2 SF/Units	Non-Residential Type 2	Future Model Scenario	Residential Flow (mgd)	Non-Residential Flow (mgd)
El Camino Real Specific Plans EIR				El Camino Real	220-31-079, 220-31-080, 220-02-049, 220-31-075, 220-32-056, 220-32-054, 220-02-020, 220-02-048, 220-02-045, 220-02-040, 220-02-046, 220-02-022, 290-03-084, 290-03-083, 290-03-081, 290-03-085, 290-03-059, 290-03-088, 290-03-087, 290-03-064, 290-63-008, 290-02-102, 290-02-095, 290-02-094, 290-01-012, 290-01-114, 290-01-113, 290-01-117, 290-01-116, 290-01-115, 224-15-037, 216-01-053, 216-01-047, 216-01-043, 216-01-050, 224-28-051, 269-03-086, 269-03-130, 213-34-008, 213-34-011, 213-34-005, 213-34-013, 213-34-012, 213-34-010, 213-34-004, 224-49-009, 224-49-008, 269-03-079, 269-03-131, 224-28-069, 216-01-040, 290-06-020, 290-06-021, 224-15-034, 224-49-012, 224-14-111, 224-14-089, 224-14-090, 224-15-017, 224-28-067, 224-28-048, 224-28-035, 224-28-050			77	Re-do Under Review	1,920 401 2,580	Corridor Mixed Use Corridor Residential Regional Commercial Mixed	182,646 224,658	Corridor Mixed Use Regional Commercial Mixed			Future	0.7398	0.13644684
Warmington Residential	PLN22-00151 PLN22-00160		2855	El Camino Real	220-31-082, 220-31-083		Pending review. 23 new townhomes and 65 affordable senior apartment units and 3,912 square feet of ground floor commercial in a five-story building. Total residential load = 0.014 MGD, non-residential load = 0.00039 MGD. Model has a total residential load of 0.0082 mgd. Model corrected.	80	Under Review	47	Condos & townhomes					Future	0.008225	0
Prometheus	PLN2015-11478		3501	El Camino Real	220-03-010		Part of ECR Specific Plan. three-, four- and five-story development would sit on 10.6 acres and comprise 701 apartments above 84,000 square feet of retail space. Model loads match proposed development description.	81	Not a File	700	Apts	86,000	Retail			Near-Term	0.1078	0.0086
2905 Stender Way Data Center	PLN2019-14118		2905	Stender Way	216-29-108		Parcel accounted for in model as future data center.	82	Under construction							Near-Term	0	0
275 Saratoga Ave	PLN2021-15005		275	Saratoga Avenue	303-46-051		4 Story Assisted Living Facility – 61,287 SF including 146 bed spaces	85	Under Review					146	Beds	Near-Term	0.011242	0
1601 Civic Center Dr	PLN202-14401		1601	Civic Center Dr	224-49-006	S46	106 DU affordable apartments	86	Approved	106	Apts					Near-Term	0.016324	0
3155 El Camino Real	PLN2020-14674		3155	El Camino Real	220-32-057, 220-32-058		60-unit, three-story townhome development	88	Approved	60	Townhomes					Near-Term	0.0105	0

Name of Development	PLN #	BLD #	Address #	Street Name	APN	Block Book Page	W&C Notes	Ref_ID	January 2023 Status (per City Planning)	Residential Units	Residential Type	Non-Residential SF	Non-Residential Type	Non-Residential Type 2 SF/Units	Non-Residential Type 2	Future Model Scenario	Residential Flow (mgd)	Non-Residential Flow (mgd)
960 Central Expressway	PLN21-15299		960	Central Expressway	224-07-099		Architectural review of three development scenarios for redevelopment of an existing Heavy Industrial (MH) zoned parcel occupied by 747,424 square feet of industrial warehouse buildings and 130,00 square feet of covered truck loading docks and surface parking. The proposal is to demolish the existing structures and site improvements to construct three Class "A" speculative buildings totaling up to 890,000 square feet for warehousing and/or data center uses, associated parking, on- and off-site improvements and landscaping. The proposal includes subdivision of the parcel into three separate parcels and the addition of new ingress and egress driveways along the project frontages. Development replaces Large User 9 (trade flow = 0.0994 MGD). Actual usage (based on billing database) is 0.01713 MGD. For the development load, assumed data center (Scenario 1) usage. Note data center survey received. Parcel will be counted as a future data center.	89	Under Review			388,482	Data Center			Future	0	0.1136448
3517 Ryder St			3517	Ryder St	216-34-052		Part of Lawrence Station development. 5-story 328-unit residential complex. Building Permit Under Review	90	Approved	328	Apts					Near-Term	0.050512	0
Santa Clara University Master Plan (5-years plan)	PLN2014-10779	BLD2016-42681 (Charney Hall of Law_UC), BLD2017-48533 (South Residence Hall)_UC), BLD2018-49473 (Benson Hall_UC)	500	El Camino Real	230-13-023	38, 39	Finn Residence Hall - construction begun February 2018. Constructed by October 2019. Billing database likely does not account for discharge. Approximately 30 residents live on each of the twelve wings, with one Community Facilitator on each wing. Total number of residents = 360. Phase 2 involves the construction of a four-story, 250 bed residence hall with a gross floor area of 55,800 sf on the site of the existing 19,000 square foot Fine Arts Building to be demolished. Construction has not begun. Benson Hall - This project involves one and two-story additions to the north and west building elevations totaling 21 ,363 sf and includes partial renovations of the building interior to accommodate the new additions and create meeting and common space. Residence hall loads accounted for in new subcatchment 23013023.	93	Under construction							Near-Term	0.0427	0

Name of Development	PLN #	BLD #	Address #	Street Name	APN	Block Book Page	W&C Notes	Ref_ID	January 2023 Status (per City Planning)	Residential Units	Residential Type	Non-Residential SF	Non-Residential Type	Non-Residential Type 2 SF/Units	Non-Residential Type 2	Future Model Scenario	Residential Flow (mgd)	Non-Residential Flow (mgd)
Worthington Circle (Former BAREC site/Summerhill and Charity Housing at 90 N. Winchester Blvd)	PLN2016-12389		1834	Worthington Circle	303-17-053		Agrihood Mixed-Use Development Project. Construction initiated September 2021. Development not accounted for in billing database. Parcel does not have a billing point. residential mixed-use development consisting of up to 160 mixed-income apartments,165 affordable senior apartments, 36 townhomes and approximately 1.5 acres of agricultural open space. Development accounted for in model in subcatchment 30317053 which replaced original development subcatchment DVPT_NWinchester.	94	Under construction	36 325	SF Apt	65,340		Agricultural Open Space		Near-Term	0.05635	0
3375 Scott Blvd.	PLN2016-12232		3375	Scott Blvd.	216-31-059, 216-31-060	72	Project would demolish the existing office buildings and construct a six-story, 237,107 SF office building, and a four-level parking structure with an attached two-story amenity building. Remove existing billing point loads. Model reflects development flow in new sub ID 21631059 and 21631060.	99	Approved			237,107	Office			Near-Term	0	0.0237107
Tasman East Specific Plan (+1,500 units)	PLN2016-12400			Surrounded by TasmanDr, Lafayette St, Calle Del Mundo, and Guadalupe River	097-05-062, 097-05-063, 097-05-110, 097-05-060, 097-05-061, 097-05-059, 097-05-058, 097-05-056, 097-05-057, 097-46-019, 097-46-029, 097-46-016, 097-46-017, 097-46-018, 097-46-033, 097-46-011, 097-46-024, 097-46-002, 097-46-020, 097-46-027	104, 105	Project website (link below) lists 5 approved projects (2343 Calle del Mundo, 5123 Calle del Sol, 2200 Calle de Luna, 2300 Calle de Luna, and 2302/2310 Calle del Mundo) and 6 proposed projects. These projects have not been subject to individual development reviews and are therefore not specifically reflected in the model. Instead, the model reflects the original (June 2018) review of the overall Tasman East Specific Plan. Modeling the specific approved or proposed projects within this Specific Plan is not in the scope of work for the near-term network development.	100	Under construction	5,998	Transit Neighborhood	93,600 10,000 35,147	Retail Daycare School			Near-Term	0.725758	0.046664575
2330 Monroe St	PLN2019-13723		2330	Monroe Steet	224-37-068	54	Architectural Review for an approved 2-3 story building containing 65 affordable residential units in a mix of studios and one-, two-, and threebedroom units, including 25 percent of the units set aside for people with developmental disabilities. Currently vacant lot with no billing point. Model accounts for development flow in new sub ID 22437068.	101	Under construction	65	Apt					Near-Term	0.01001	0
2201 Laurelwood	PLN2019-13742	BLD2021-61850	2201	Laurelwood	104-39-023	75	Proposed future data center (data center Ref ID = 13). Will be included in the model as a future data center. Development replaces large user LU02 (Siliconix) with modeled trade flow = 1.2327 mgd. Actual flow (based on billing data) = 0.00711 mgd. Construction begun June 2019. Model updated with development parcel. Future data center flows to be modeled as inflow file. LU02 subcatchment deleted from model.	102	Under construction			536,730	Data Center			Near-Term	0	0.091020833
1200 Memorex Drive data center	PLN2019-14055		1200	Memorex Drive	224-66-006		Development will be modeled as a future data center (data center Ref ID = 80). New sub ID 22466006 added to model to represent data center parcel. Remove existing billing point.	103	Under construction							Near-Term	0	0

Name of Development	PLN #	BLD #	Address #	Street Name	APN	Block Book Page	W&C Notes	Ref_ID	January 2023 Status (per City Planning)	Residential Units	Residential Type	Non-Residential SF	Non-Residential Type	Non-Residential Type 2 SF/Units	Non-Residential Type 2	Future Model Scenario	Residential Flow (mgd)	Non-Residential Flow (mgd)
1290, 1240 Coleman Ave and 312 Brokaw Rd - Santa Clara Dual-Branded Hotel	PLN2019-14051; CEQ2020-01073		1290, 1240, 312	1290 and 1240 Coleman Ave and 312 Brokaw Rd	230-05-045, 230-05-049, 230-05-050	48, 49	Model accounts for development with new subs IDs 23005045, 049, and 050. Development consists of 396 room, 6-story hotel, totaling 204,444 square feet. Old sub ID 23005045, Parcel_23005049, Parcel_23005050, Parcel_23005049!, and Parcel_23005050! replaced.	104	Approved			7,480	Restaurant	630.3447	Hotel	Near-Term	0.0351	0.0077792
906, 930, 940, 950 Monroe St	PLN2020-14457		906, 930, 940, 950	Monroe St	269-20-086, 269-20-087, 269-20-095		Residential mix-use redevelopment. Construct a five story building with 61 condo rental units, 3,844 sf general retail, a 6,224 sf restaurant on the ground floor, 116 residential parking spaces, and 71 retail parking spaces. The project also includes relocation of two existing historic houses located at 906 and 930 Monroe. Development accounted for in model with new sub IDs 26920086, 26920095, and 26920087.	105	Under Review	64	condos	3,844	Retail	6,224	Restaurant	Future	0.0113	0.00685736
Kaiser Entitlement					316-09-046		Entitlement flow.	106								Future	0	0
Downtown Precise Plan			Various	Various	269-22-088, 269-22-089, 269-22-072, 269-22-096, 269-22-084, 269-22-079, 269-22-094, 269-22-093, 269-22-095, 269-22-108, 269-22-109, 269-22-110, 269-22-111, 269-22-112, 269-22-097, 269-22-098, 269-22-099, 269-22-100, 269-22-101, 269-22-102, 269-22-103, 269-22-104, 269-22-105, 269-22-106, 269-22-107, 269-22-113, 269-22-114, 269-22-115, 269-20-082, 269-20-083, 269-20-084, 269-20-085, 269-20-089, 269-20-090, 269-20-091, 269-20-078, 269-20-075, 269-20-081, 269-20-080, 269-62-000, 269-20-079, 269-20-074, 269-20-077		Development review dated 3/20/2023. Note that 5 parcels are on top of other recent developments (Ref_ID 23 and 105).	113		386 578	Condos Apts	637,440 197,900	Commercial Retail	74,160 SF	Hotel	Future	0.1566	0.1191308
611 El Camino Real			611	El Camino Real	230-06-053		70 affordable apartment units to replace existing women's facility. The zone is ML-Light Industrial but the general plan use has it as Public/Quasi Public as the parcel is owned by the City of Santa Clara.	114		70	Apt					Future	0.01078	0
2655 The Alameda	PLN2022-00448		2655	The Alameda	230-12-012		4-story mixed use development with 1,500 SF ground floor commercial & 39 residential units	115		39	Apt	1,500	Commercial			Future	0.006006	0.00015
3301 Olcott Street	PLN22-00560		3301	Olcott Street	224-47-019		189,153 SF (Building 1 discharging to MH S74-28) 151,384 SF (Building 2 discharging to MH S74-43) commercial R&D office.	116				340,537	Office R&D			Future	0	0.025540275
Santa Clara Station Area Plan							Plan is in the early stages of development--no project description yet--for now, use GP estimates from Table 5.2.1, footnote 1.											
4701 Great America Parkway			4701	Great America Parkway	104-42-014, 104-42-014-019	83	Amusement park lease may be up in the next couple of years, but no details are available. Assume will operate as is into the future.	NA										

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
230-03-090	HYIN	211,963.46	4.87	Heavy Industrial	0.15	1.25	0	0.0000	0.0397	Future
294-18-037	NHMX	18,696.46	0.43	Neighborhood Commercial	0.1	0.3	25	0.0017	0.0006	Future
290-23-059	NHMX	23,162.02	0.53	Neighborhood Commercial	0.1	0.3	25	0.0020	0.0007	Future
104-51-015	LDRD	27,934.37	0.64	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
104-51-016	LDRD	28,860.54	0.66	Office: 100%	0.1	0.85	0	0.0000	0.0025	Future
104-51-017	LDRD	28,221.53	0.65	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
104-51-008	LDRD	21,568.32	0.50	Office: 100%	0.1	0.85	0	0.0000	0.0018	Future
104-51-007	LDRD	23,675.58	0.54	Office: 100%	0.1	0.85	0	0.0000	0.0020	Future
104-15-025	LDRD	8,849.96	0.20	Office: 100%	0.1	0.85	0	0.0000	0.0008	Future
104-51-006	LDRD	27,949.92	0.64	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
104-51-009	LDRD	19,521.75	0.45	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
104-51-014	LDRD	23,350.55	0.54	Office: 100%	0.1	0.85	0	0.0000	0.0020	Future
104-51-005	LDRD	31,103.49	0.71	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
104-15-092	LDRD	54,693.70	1.26	Office: 100%	0.1	0.85	0	0.0000	0.0046	Future
104-15-141	LDRD	46,524.15	1.07	Office: 100%	0.1	0.85	0	0.0000	0.0040	Future
104-15-140	LDRD	32,608.15	0.75	Office: 100%	0.1	0.85	0	0.0000	0.0028	Future
104-51-010	LDRD	33,028.98	0.76	Office: 100%	0.1	0.85	0	0.0000	0.0028	Future
104-15-029	LDRD	16,356.77	0.38	Office: 100%	0.1	0.85	0	0.0000	0.0014	Future
104-51-013	LDRD	24,912.63	0.57	Office: 100%	0.1	0.85	0	0.0000	0.0021	Future
290-29-009	PKOS	1,357,204.52	31.16	Parks/Recreation	0	0.2	0	0.0000	0.0000	Future
101-11-042	LHIN	34,719.96	0.80	Light Industrial	0.15	0.85	0	0.0000	0.0044	Future
220-02-047	CMXU	14,277.06	0.33	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
220-01-059	CMXU	26,194.76	0.60	Community Commercial	0.1	0.4	25	0.0023	0.0010	Future
220-01-055	CMXU	29,422.83	0.68	Community Commercial	0.1	0.4	25	0.0026	0.0012	Future
220-01-053	CMXU	13,950.79	0.32	Community Commercial	0.1	0.4	25	0.0012	0.0006	Future
220-31-077	CMXU	14,566.71	0.33	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
220-31-078	CMXU	15,046.30	0.35	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
220-01-054	CMXU	30,351.56	0.70	Community Commercial	0.1	0.4	25	0.0027	0.0012	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
220-02-015	VLDR	9,665.35	0.22	Low Density Residential	245	0	25	0.0014	0.0000	Future
220-02-014	VLDR	9,376.27	0.22	Low Density Residential	245	0	25	0.0013	0.0000	Future
220-02-013	VLDR	9,375.20	0.22	Low Density Residential	245	0	25	0.0013	0.0000	Future
220-02-012	VLDR	9,376.26	0.22	Low Density Residential	245	0	25	0.0013	0.0000	Future
220-02-011	VLDR	9,376.20	0.22	Low Density Residential	245	0	25	0.0013	0.0000	Future
220-02-010	VLDR	9,375.63	0.22	Low Density Residential	245	0	25	0.0013	0.0000	Future
220-02-009	VLDR	9,291.32	0.21	Low Density Residential	245	0	25	0.0013	0.0000	Future
230-05-005	RGCO	6,564.42	0.15	Regional Commercial	0.1	0.5	0	0.0000	0.0003	Future
230-05-020	RGCO	27,964.10	0.64	Regional Commercial	0.1	0.5	0	0.0000	0.0014	Future
230-05-037	RGCO	53,420.53	1.23	Regional Commercial	0.1	0.5	0	0.0000	0.0027	Future
230-05-017	RGCO	25,013.75	0.57	Regional Commercial	0.1	0.5	0	0.0000	0.0013	Future
230-05-016	RGCO	25,005.08	0.57	Regional Commercial	0.1	0.5	0	0.0000	0.0013	Future
230-05-015	RGCO	23,825.51	0.55	Regional Commercial	0.1	0.5	0	0.0000	0.0012	Future
230-05-084	RGCO	20,980.12	0.48	Regional Commercial	0.1	0.5	0	0.0000	0.0010	Future
230-05-021	RGCO	166,493.71	3.82	Regional Commercial	0.1	0.5	0	0.0000	0.0083	Future
230-05-083	RGCO	22,351.24	0.51	Regional Commercial	0.1	0.5	0	0.0000	0.0011	Future
230-05-054	RGCO	83,262.85	1.91	Regional Commercial	0.1	0.5	0	0.0000	0.0042	Future
104-14-052	LDRD	41,745.26	0.96	Office: 100%	0.1	0.85	0	0.0000	0.0035	Future
104-14-090	LDRD	33,524.38	0.77	Office: 100%	0.1	0.85	0	0.0000	0.0028	Future
104-14-141	LDRD	23,021.12	0.53	Office: 100%	0.1	0.85	0	0.0000	0.0020	Future
104-14-071	LDRD	30,847.01	0.71	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
104-14-053	LDRD	23,417.60	0.54	Office: 100%	0.1	0.85	0	0.0000	0.0020	Future
104-14-047	LDRD	30,846.99	0.71	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
104-14-124	LDRD	131,211.66	3.01	Office: 100%	0.1	0.85	0	0.0000	0.0112	Future
104-14-036	LDRD	19,855.46	0.46	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
104-14-048	LDRD	30,847.01	0.71	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
104-15-131	LDRD	444,843.84	10.21	Office: 100%	0.1	0.85	0	0.0000	0.0378	Future
104-14-023	LDRD	19,842.58	0.46	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
104-14-038	LDRD	30,846.99	0.71	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
101-09-023	LDRD	170,155.51	3.91	Office: 100%	0.1	0.85	0	0.0000	0.0145	Future
290-05-060	CMXU	18,140.31	0.42	Community Commercial	0.1	0.4	25	0.0016	0.0007	Future
220-01-018	CMXU	12,754.24	0.29	Community Commercial	0.1	0.4	25	0.0011	0.0005	Future
220-01-044	CMXU	18,789.19	0.43	Community Commercial	0.1	0.4	25	0.0017	0.0008	Future
220-31-114	CMXU	44,562.59	1.02	Community Commercial	0.1	0.4	25	0.0039	0.0018	Future
230-05-116	LHIN	449,148.01	10.31	Light Industrial	0.15	0.85	0	0.0000	0.0573	Future
230-47-068	LHIN	23,098.35	0.53	Light Industrial	0.15	0.85	0	0.0000	0.0029	Future
230-03-108	HYIN	821,203.99	18.85	Heavy Industrial	0.15	1.25	0	0.0000	0.1540	Future
230-03-047	HYIN	14,575.93	0.33	Heavy Industrial	0.15	1.25	0	0.0000	0.0027	Future
290-55-012	NHMX	1,549.42	0.04	Neighborhood Commercial	0.1	0.3	25	0.0001	0.0000	Future
290-02-092	CMXU	13,792.24	0.32	Community Commercial	0.1	0.4	25	0.0012	0.0006	Future
290-05-076	CMXU	29,128.38	0.67	Community Commercial	0.1	0.4	25	0.0026	0.0012	Future
290-05-074	CMXU	22,490.01	0.52	Community Commercial	0.1	0.4	25	0.0020	0.0009	Future
290-05-055	CMXU	45,529.94	1.05	Community Commercial	0.1	0.4	25	0.0040	0.0018	Future
290-05-054	CMXU	22,055.98	0.51	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
290-04-007	CMXU	98,212.43	2.25	Community Commercial	0.1	0.4	25	0.0087	0.0039	Future
290-04-006	CMXU	48,009.37	1.10	Community Commercial	0.1	0.4	25	0.0042	0.0019	Future
290-04-005	CMXU	23,809.87	0.55	Community Commercial	0.1	0.4	25	0.0021	0.0010	Future
290-04-004	CMXU	32,223.14	0.74	Community Commercial	0.1	0.4	25	0.0028	0.0013	Future
290-04-003	CMXU	28,816.85	0.66	Community Commercial	0.1	0.4	25	0.0025	0.0012	Future
290-04-002	CMXU	24,001.59	0.55	Community Commercial	0.1	0.4	25	0.0021	0.0010	Future
290-04-045	CMXU	25,858.00	0.59	Community Commercial	0.1	0.4	25	0.0023	0.0010	Future
290-02-099	CMXU	6,669.50	0.15	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
290-02-098	CMXU	6,540.84	0.15	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
290-02-087	CMXU	3,637.06	0.08	Community Commercial	0.1	0.4	25	0.0003	0.0001	Future
290-02-105	CMXU	12,089.50	0.28	Community Commercial	0.1	0.4	25	0.0011	0.0005	Future
290-02-104	CMXU	13,782.03	0.32	Community Commercial	0.1	0.4	25	0.0012	0.0006	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
290-02-101	CMXU	6,483.39	0.15	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
290-02-100	CMXU	9,650.45	0.22	Community Commercial	0.1	0.4	25	0.0009	0.0004	Future
290-02-103	CMXU	41,169.09	0.95	Community Commercial	0.1	0.4	25	0.0036	0.0016	Future
101-13-003	LHIN	311,364.82	7.15	Light Industrial	0.15	0.85	0	0.0000	0.0397	Future
101-09-024	RGCO	92,430.01	2.12	Regional Commercial	0.1	0.5	0	0.0000	0.0046	Future
303-02-013	PUQP	74,316.43	1.71	Public/Institutional	0.21	0.2	0	0.0000	0.0031	Future
290-23-088	PUQP	1,173,909.65	26.95	Public/Institutional	0.21	0.2	0	0.0000	0.0493	Future
303-21-071	RGCO	48,269.26	1.11	Regional Commercial	0.1	0.5	0	0.0000	0.0024	Future
303-21-072	RGCO	21,356.10	0.49	Regional Commercial	0.1	0.5	0	0.0000	0.0011	Future
303-19-072	RGCO	18,582.19	0.43	Regional Commercial	0.1	0.5	0	0.0000	0.0009	Future
303-22-014	RGCO	10,447.18	0.24	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
303-23-036	RGCO	159,016.92	3.65	Regional Commercial	0.1	0.5	0	0.0000	0.0080	Future
303-23-002	RGCO	21,753.41	0.50	Regional Commercial	0.1	0.5	0	0.0000	0.0011	Future
303-23-032	CMXU	59,698.08	1.37	Community Commercial	0.1	0.4	25	0.0053	0.0024	Future
303-22-015	RGCO	11,663.35	0.27	Regional Commercial	0.1	0.5	0	0.0000	0.0006	Future
303-22-039	RGCO	22,016.42	0.51	Regional Commercial	0.1	0.5	0	0.0000	0.0011	Future
303-21-068	RGCO	24,215.83	0.56	Regional Commercial	0.1	0.5	0	0.0000	0.0012	Future
303-22-037	RGCO	22,012.72	0.51	Regional Commercial	0.1	0.5	0	0.0000	0.0011	Future
303-18-046	RGCO	48,506.89	1.11	Regional Commercial	0.1	0.5	0	0.0000	0.0024	Future
303-18-023	RGCO	19,000.00	0.44	Regional Commercial	0.1	0.5	0	0.0000	0.0009	Future
303-18-022	RGCO	28,265.76	0.65	Regional Commercial	0.1	0.5	0	0.0000	0.0014	Future
303-18-037	RGCO	9,191.61	0.21	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
303-23-044	CMXU	35,632.59	0.82	Community Commercial	0.1	0.4	25	0.0031	0.0014	Future
303-19-078	RGCO	31,754.11	0.73	Regional Commercial	0.1	0.5	0	0.0000	0.0016	Future
303-18-050	RGCO	48,396.21	1.11	Regional Commercial	0.1	0.5	0	0.0000	0.0024	Future
303-18-049	RGCO	120,162.09	2.76	Regional Commercial	0.1	0.5	0	0.0000	0.0060	Future
303-23-043	CMXU	40,282.23	0.92	Community Commercial	0.1	0.4	25	0.0036	0.0016	Future
303-23-029	CMXU	45,256.12	1.04	Community Commercial	0.1	0.4	25	0.0040	0.0018	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
303-23-026	CMXU	14,329.30	0.33	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
303-23-030	RGCO	79,488.65	1.82	Regional Commercial	0.1	0.5	0	0.0000	0.0040	Future
303-18-048	RGCO	63,348.69	1.45	Regional Commercial	0.1	0.5	0	0.0000	0.0032	Future
303-23-037	RGCO	66,753.62	1.53	Regional Commercial	0.1	0.5	0	0.0000	0.0033	Future
303-23-034	RGCO	99,561.24	2.29	Regional Commercial	0.1	0.5	0	0.0000	0.0050	Future
303-23-035	CMXU	45,156.65	1.04	Community Commercial	0.1	0.4	25	0.0040	0.0018	Future
303-23-022	CMXU	13,600.82	0.31	Community Commercial	0.1	0.4	25	0.0012	0.0005	Future
290-01-125	CMXU	98,936.97	2.27	Community Commercial	0.1	0.4	25	0.0087	0.0040	Future
303-20-073	RGCO	720.06	0.02	Regional Commercial	0.1	0.5	0	0.0000	0.0000	Future
303-18-042	RGCO	8,656.02	0.20	Regional Commercial	0.1	0.5	0	0.0000	0.0004	Future
303-18-036	RGCO	9,198.41	0.21	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
303-19-077	RGCO	18,664.05	0.43	Regional Commercial	0.1	0.5	0	0.0000	0.0009	Future
303-19-075	RGCO	9,375.00	0.22	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
303-20-068	RGCO	8,879.83	0.20	Regional Commercial	0.1	0.5	0	0.0000	0.0004	Future
303-20-069	RGCO	2,310.91	0.05	Regional Commercial	0.1	0.5	0	0.0000	0.0001	Future
303-20-070	RGCO	3,080.93	0.07	Regional Commercial	0.1	0.5	0	0.0000	0.0002	Future
303-20-071	RGCO	10,741.45	0.25	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
303-20-072	RGCO	4,061.67	0.09	Regional Commercial	0.1	0.5	0	0.0000	0.0002	Future
303-20-074	RGCO	11,981.14	0.28	Regional Commercial	0.1	0.5	0	0.0000	0.0006	Future
303-18-035	RGCO	11,513.82	0.26	Regional Commercial	0.1	0.5	0	0.0000	0.0006	Future
296-20-006	RGCO	21,323.88	0.49	Regional Commercial	0.1	0.5	0	0.0000	0.0011	Future
290-02-096	CMXU	9,078.63	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
290-05-053	CMXU	28,774.74	0.66	Community Commercial	0.1	0.4	25	0.0025	0.0012	Future
290-01-123	CMXU	138,195.80	3.17	Community Commercial	0.1	0.4	25	0.0122	0.0055	Future
290-23-048	MDRE	49,544.21	1.14	Medium Density Residential	154	0	25	0.0044	0.0000	Future
290-39-037	NHMX	48,028.13	1.10	Neighborhood Commercial	0.1	0.3	25	0.0042	0.0014	Future
290-39-083	NHMX	16,996.75	0.39	Neighborhood Commercial	0.1	0.3	25	0.0015	0.0005	Future
290-23-092	NHMX	61,504.56	1.41	Neighborhood Commercial	0.1	0.3	25	0.0054	0.0018	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
290-39-053	NHMX	40,305.12	0.93	Neighborhood Commercial	0.1	0.3	25	0.0036	0.0012	Future
290-39-081	NHMX	16,798.50	0.39	Neighborhood Commercial	0.1	0.3	25	0.0015	0.0005	Future
290-39-012	NHMX	15,174.41	0.35	Neighborhood Commercial	0.1	0.3	25	0.0013	0.0005	Future
290-39-035	NHMX	19,585.89	0.45	Neighborhood Commercial	0.1	0.3	25	0.0017	0.0006	Future
293-02-028	NHMX	208,966.89	4.80	Neighborhood Commercial	0.1	0.3	25	0.0185	0.0063	Future
290-39-065	NHMX	23,534.53	0.54	Neighborhood Commercial	0.1	0.3	25	0.0021	0.0007	Future
290-23-053	NHMX	159,663.43	3.67	Neighborhood Commercial	0.1	0.3	25	0.0141	0.0048	Future
290-23-049	NHMX	84,194.27	1.93	Neighborhood Commercial	0.1	0.3	25	0.0074	0.0025	Future
290-23-071	NHMX	46,444.96	1.07	Neighborhood Commercial	0.1	0.3	25	0.0041	0.0014	Future
293-02-036	NHMX	61,913.63	1.42	Neighborhood Commercial	0.1	0.3	25	0.0055	0.0019	Future
269-20-020	CMXU	5,784.49	0.13	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-28-061	CMXU	25,783.00	0.59	Community Commercial	0.1	0.4	25	0.0023	0.0010	Future
269-20-099	CMXU	3,996.19	0.09	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-28-075	CMXU	3,608.44	0.08	Community Commercial	0.1	0.4	25	0.0003	0.0001	Future
269-28-024	CMXU	9,180.95	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
269-20-101	CMXU	3,758.41	0.09	Community Commercial	0.1	0.4	25	0.0003	0.0002	Future
224-26-050	CMXU	10,726.43	0.25	Community Commercial	0.1	0.4	25	0.0009	0.0004	Future
293-02-025	NHMX	17,597.17	0.40	Neighborhood Commercial	0.1	0.3	25	0.0016	0.0005	Future
293-02-029	NHMX	15,975.24	0.37	Neighborhood Commercial	0.1	0.3	25	0.0014	0.0005	Future
293-02-021	NHMX	29,723.03	0.68	Neighborhood Commercial	0.1	0.3	25	0.0026	0.0009	Future
293-25-037	NHMX	22,463.73	0.52	Neighborhood Commercial	0.1	0.3	25	0.0020	0.0007	Future
104-14-095	LDRD	46,270.51	1.06	Office: 100%	0.1	0.85	0	0.0000	0.0039	Future
104-14-024	LDRD	31,233.37	0.72	Office: 100%	0.1	0.85	0	0.0000	0.0027	Future
104-14-096	LDRD	21,592.89	0.50	Office: 100%	0.1	0.85	0	0.0000	0.0018	Future
104-16-112	RGCO	910,541.85	20.90	Regional Commercial	0.1	0.5	0	0.0000	0.0455	Future
104-16-111	RGCO	131,271.33	3.01	Regional Commercial	0.1	0.5	0	0.0000	0.0066	Future
104-50-025	LDRD	359,669.04	8.26	Office: 100%	0.1	0.85	0	0.0000	0.0306	Future
296-20-003	RGCO	28,882.37	0.66	Regional Commercial	0.1	0.5	0	0.0000	0.0014	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
296-20-011	RGCO	111,910.33	2.57	Regional Commercial	0.1	0.5	0	0.0000	0.0056	Future
104-52-024	LDRD	523,726.09	12.02	Office: 100%	0.1	0.85	0	0.0000	0.0445	Future
104-52-023	HDRD	942,817.65	21.64	Office	0.15	1.25	0	0.0000	0.1768	Future
290-39-050	PUQP	16,357.67	0.38	Public/Institutional	0.21	0.2	0	0.0000	0.0007	Future
296-21-010	RGCO	100,277.78	2.30	Regional Commercial	0.1	0.5	0	0.0000	0.0050	Future
296-21-009	RGCO	28,038.05	0.64	Regional Commercial	0.1	0.5	0	0.0000	0.0014	Future
296-21-008	RGCO	28,053.03	0.64	Regional Commercial	0.1	0.5	0	0.0000	0.0014	Future
296-21-007	RGCO	25,832.30	0.59	Regional Commercial	0.1	0.5	0	0.0000	0.0013	Future
296-21-005	RGCO	19,411.04	0.45	Regional Commercial	0.1	0.5	0	0.0000	0.0010	Future
296-21-006	RGCO	19,507.52	0.45	Regional Commercial	0.1	0.5	0	0.0000	0.0010	Future
296-20-004	RGCO	45,412.92	1.04	Regional Commercial	0.1	0.5	0	0.0000	0.0023	Future
296-34-017	RGCO	82,216.67	1.89	Regional Commercial	0.1	0.5	0	0.0000	0.0041	Future
296-34-018	RGCO	39,059.89	0.90	Regional Commercial	0.1	0.5	0	0.0000	0.0020	Future
224-29-017	CMXU	7,496.67	0.17	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
216-28-113	LHIN	143,382.91	3.29	Light Industrial	0.15	0.85	0	0.0000	0.0183	Future
216-28-126	LHIN	191,506.23	4.40	Light Industrial	0.15	0.85	0	0.0000	0.0244	Future
294-18-034	NHMX	22,695.80	0.52	Neighborhood Commercial	0.1	0.3	25	0.0020	0.0007	Future
296-17-036	RGCO	11,138.36	0.26	Regional Commercial	0.1	0.5	0	0.0000	0.0006	Future
296-17-001	RGCO	16,631.96	0.38	Regional Commercial	0.1	0.5	0	0.0000	0.0008	Future
296-17-037	RGCO	9,679.83	0.22	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
296-20-005	RGCO	17,441.64	0.40	Regional Commercial	0.1	0.5	0	0.0000	0.0009	Future
296-21-030	RGCO	33,437.98	0.77	Regional Commercial	0.1	0.5	0	0.0000	0.0017	Future
296-21-011	RGCO	17,214.11	0.40	Regional Commercial	0.1	0.5	0	0.0000	0.0009	Future
296-21-012	RGCO	49,573.01	1.14	Regional Commercial	0.1	0.5	0	0.0000	0.0025	Future
296-37-030	RGCO	71,651.08	1.64	Regional Commercial	0.1	0.5	0	0.0000	0.0036	Future
296-37-031	RGCO	47,537.77	1.09	Regional Commercial	0.1	0.5	0	0.0000	0.0024	Future
296-34-015	RGCO	135,803.85	3.12	Regional Commercial	0.1	0.5	0	0.0000	0.0068	Future
296-34-016	RGCO	300,944.07	6.91	Regional Commercial	0.1	0.5	0	0.0000	0.0150	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
104-50-001	LDRD	161,596.64	3.71	Office: 100%	0.1	0.85	0	0.0000	0.0137	Future
230-05-057	RGCO	37,460.68	0.86	Regional Commercial	0.1	0.5	0	0.0000	0.0019	Future
104-01-100	HDRD	896,389.01	20.58	Office	0.15	1.25	0	0.0000	0.1681	Future
104-04-117	LDRD	187,293.35	4.30	Office: 100%	0.1	0.85	0	0.0000	0.0159	Future
104-04-147	LDRD	38,029.74	0.87	Office: 100%	0.1	0.85	0	0.0000	0.0032	Future
104-15-101	LDRD	1,585.42	0.04	Office: 100%	0.1	0.85	0	0.0000	0.0001	Future
104-50-011	LDRD	245,423.15	5.63	Office: 100%	0.1	0.85	0	0.0000	0.0209	Future
104-50-018	LDRD	299,221.75	6.87	Office: 100%	0.1	0.85	0	0.0000	0.0254	Future
104-50-007	LDRD	163,238.01	3.75	Office: 100%	0.1	0.85	0	0.0000	0.0139	Future
104-50-016	LDRD	472,755.41	10.85	Office: 100%	0.1	0.85	0	0.0000	0.0402	Future
104-01-107	HDRD	3,590.42	0.08	Office	0.15	1.25	0	0.0000	0.0007	Future
104-52-026	HDRD	374,809.37	8.60	Office	0.15	1.25	0	0.0000	0.0703	Future
104-04-119	LDRD	159,816.73	3.67	Office: 100%	0.1	0.85	0	0.0000	0.0136	Future
104-04-118	LDRD	175,792.09	4.04	Office: 100%	0.1	0.85	0	0.0000	0.0149	Future
104-43-054	RGCO	170,051.74	3.90	Regional Commercial	0.1	0.5	0	0.0000	0.0085	Future
104-42-017	HDRD	280,398.58	6.44	Office	0.15	1.25	0	0.0000	0.0526	Future
104-04-120	LDRD	166,248.03	3.82	Office: 100%	0.1	0.85	0	0.0000	0.0141	Future
104-16-091	RGCO	162,086.73	3.72	Regional Commercial	0.1	0.5	0	0.0000	0.0081	Future
104-14-120	LDRD	24,376.36	0.56	Office: 100%	0.1	0.85	0	0.0000	0.0021	Future
104-14-121	LDRD	19,520.29	0.45	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
104-14-131	LDRD	19,544.67	0.45	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
104-14-154	LDRD	42,839.05	0.98	Office: 100%	0.1	0.85	0	0.0000	0.0036	Future
104-14-159	LDRD	124,601.55	2.86	Office: 100%	0.1	0.85	0	0.0000	0.0106	Future
104-14-160	LDRD	238,912.02	5.48	Office: 100%	0.1	0.85	0	0.0000	0.0203	Future
104-48-010	HDRD	1,695,829.23	38.93	Office	0.15	1.25	0	0.0000	0.3180	Future
104-38-011	LDRD	157,141.89	3.61	Office: 100%	0.1	0.85	0	0.0000	0.0134	Future
104-16-113	HDRD	609,770.70	14.00	Office	0.15	1.25	0	0.0000	0.1143	Future
104-13-090	LDRD	208,242.04	4.78	Office: 100%	0.1	0.85	0	0.0000	0.0177	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
104-13-091	LDRD	56,780.67	1.30	Office: 100%	0.1	0.85	0	0.0000	0.0048	Future
104-13-094	LDRD	215,698.87	4.95	Office: 100%	0.1	0.85	0	0.0000	0.0183	Future
104-13-095	LDRD	215,831.58	4.95	Office: 100%	0.1	0.85	0	0.0000	0.0183	Future
216-29-116	LHIN	277,119.40	6.36	Light Industrial	0.15	0.85	0	0.0000	0.0353	Future
104-12-180	NHMX	10,379.13	0.24	Neighborhood Commercial	0.1	0.3	25	0.0009	0.0003	Future
104-15-087	LDRD	81,123.41	1.86	Office: 100%	0.1	0.85	0	0.0000	0.0069	Future
104-15-061	LDRD	56,001.87	1.29	Office: 100%	0.1	0.85	0	0.0000	0.0048	Future
104-15-047	LDRD	40,392.68	0.93	Office: 100%	0.1	0.85	0	0.0000	0.0034	Future
104-51-004	LDRD	35,579.63	0.82	Office: 100%	0.1	0.85	0	0.0000	0.0030	Future
104-15-127	LDRD	30,658.22	0.70	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
104-15-089	LDRD	58,355.47	1.34	Office: 100%	0.1	0.85	0	0.0000	0.0050	Future
104-51-011	LDRD	27,074.40	0.62	Office: 100%	0.1	0.85	0	0.0000	0.0023	Future
104-15-096	LDRD	54,801.05	1.26	Office: 100%	0.1	0.85	0	0.0000	0.0047	Future
104-51-012	LDRD	27,699.23	0.64	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
104-15-114	LDRD	10,746.71	0.25	Office: 100%	0.1	0.85	0	0.0000	0.0009	Future
104-51-003	LDRD	32,105.77	0.74	Office: 100%	0.1	0.85	0	0.0000	0.0027	Future
104-51-002	LDRD	28,444.71	0.65	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
104-51-001	LDRD	23,285.21	0.53	Office: 100%	0.1	0.85	0	0.0000	0.0020	Future
104-15-105	LDRD	5,951.68	0.14	Office: 100%	0.1	0.85	0	0.0000	0.0005	Future
104-15-109	LDRD	235,123.60	5.40	Office: 100%	0.1	0.85	0	0.0000	0.0200	Future
104-15-113	LDRD	125,741.82	2.89	Office: 100%	0.1	0.85	0	0.0000	0.0107	Future
104-15-135	LDRD	48,996.33	1.12	Office: 100%	0.1	0.85	0	0.0000	0.0042	Future
104-15-128	LDRD	102,258.97	2.35	Office: 100%	0.1	0.85	0	0.0000	0.0087	Future
104-15-123	LDRD	177,907.28	4.08	Office: 100%	0.1	0.85	0	0.0000	0.0151	Future
104-15-097	LDRD	239,795.76	5.50	Office: 100%	0.1	0.85	0	0.0000	0.0204	Future
104-15-122	LDRD	185,710.26	4.26	Office: 100%	0.1	0.85	0	0.0000	0.0158	Future
104-15-124	LDRD	52,383.65	1.20	Office: 100%	0.1	0.85	0	0.0000	0.0045	Future
104-15-130	LDRD	268,248.12	6.16	Office: 100%	0.1	0.85	0	0.0000	0.0228	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
104-15-134	LDRD	124,677.01	2.86	Office: 100%	0.1	0.85	0	0.0000	0.0106	Future
104-14-091	LDRD	95,797.97	2.20	Office: 100%	0.1	0.85	0	0.0000	0.0081	Future
104-15-133	LDRD	136,626.87	3.14	Office: 100%	0.1	0.85	0	0.0000	0.0116	Future
104-39-012	LDRD	46,027.35	1.06	Office: 100%	0.1	0.85	0	0.0000	0.0039	Future
104-15-132	LDRD	35,477.40	0.81	Office: 100%	0.1	0.85	0	0.0000	0.0030	Future
104-15-125	LDRD	110,690.62	2.54	Office: 100%	0.1	0.85	0	0.0000	0.0094	Future
104-14-125	LDRD	248,197.72	5.70	Office: 100%	0.1	0.85	0	0.0000	0.0211	Future
104-14-158	LDRD	66,441.61	1.53	Office: 100%	0.1	0.85	0	0.0000	0.0056	Future
104-14-068	LDRD	18,508.21	0.42	Office: 100%	0.1	0.85	0	0.0000	0.0016	Future
104-14-089	LDRD	201,639.86	4.63	Office: 100%	0.1	0.85	0	0.0000	0.0171	Future
104-14-142	LDRD	37,016.40	0.85	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
104-14-111	LDRD	27,695.18	0.64	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
104-14-110	LDRD	40,106.86	0.92	Office: 100%	0.1	0.85	0	0.0000	0.0034	Future
104-14-143	LDRD	16,149.72	0.37	Office: 100%	0.1	0.85	0	0.0000	0.0014	Future
104-14-144	LDRD	17,509.25	0.40	Office: 100%	0.1	0.85	0	0.0000	0.0015	Future
104-14-171	LDRD	289,159.69	6.64	Office: 100%	0.1	0.85	0	0.0000	0.0246	Future
104-14-140	LDRD	36,975.96	0.85	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
104-14-139	LDRD	52,502.92	1.21	Office: 100%	0.1	0.85	0	0.0000	0.0045	Future
104-14-168	LDRD	284,381.69	6.53	Office: 100%	0.1	0.85	0	0.0000	0.0242	Future
104-14-166	LDRD	43,576.87	1.00	Office: 100%	0.1	0.85	0	0.0000	0.0037	Future
104-14-170	LDRD	29,087.38	0.67	Office: 100%	0.1	0.85	0	0.0000	0.0025	Future
104-14-133	LDRD	15,395.68	0.35	Office: 100%	0.1	0.85	0	0.0000	0.0013	Future
104-14-114	LDRD	49,019.67	1.13	Office: 100%	0.1	0.85	0	0.0000	0.0042	Future
104-14-161	LDRD	43,451.86	1.00	Office: 100%	0.1	0.85	0	0.0000	0.0037	Future
104-14-132	LDRD	32,756.94	0.75	Office: 100%	0.1	0.85	0	0.0000	0.0028	Future
104-14-146	LDRD	43,629.84	1.00	Office: 100%	0.1	0.85	0	0.0000	0.0037	Future
104-14-169	LDRD	169,127.91	3.88	Office: 100%	0.1	0.85	0	0.0000	0.0144	Future
104-14-106	LDRD	66,746.62	1.53	Office: 100%	0.1	0.85	0	0.0000	0.0057	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
104-14-118	LDRD	39,669.06	0.91	Office: 100%	0.1	0.85	0	0.0000	0.0034	Future
104-14-156	LDRD	76,619.12	1.76	Office: 100%	0.1	0.85	0	0.0000	0.0065	Future
104-14-107	LDRD	50,125.41	1.15	Office: 100%	0.1	0.85	0	0.0000	0.0043	Future
104-14-164	LDRD	46,277.09	1.06	Office: 100%	0.1	0.85	0	0.0000	0.0039	Future
104-14-108	LDRD	19,513.18	0.45	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
104-13-097	HDRD	42,636.40	0.98	Office	0.15	1.25	0	0.0000	0.0080	Future
104-14-113	LDRD	24,349.67	0.56	Office: 100%	0.1	0.85	0	0.0000	0.0021	Future
216-48-030	LDRD	78,112.76	1.79	Office: 100%	0.1	0.85	0	0.0000	0.0066	Future
216-32-030	LDRD	90,656.42	2.08	Office: 100%	0.1	0.85	0	0.0000	0.0077	Future
216-48-026	LDRD	53,536.77	1.23	Office: 100%	0.1	0.85	0	0.0000	0.0046	Future
216-46-019	LHIN	73,951.07	1.70	Light Industrial	0.15	0.85	0	0.0000	0.0094	Future
216-48-005	LDRD	97,626.99	2.24	Office: 100%	0.1	0.85	0	0.0000	0.0083	Future
216-48-004	LDRD	94,115.77	2.16	Office: 100%	0.1	0.85	0	0.0000	0.0080	Future
216-48-035	LDRD	111,197.42	2.55	Office: 100%	0.1	0.85	0	0.0000	0.0095	Future
216-32-040	LDRD	361,825.88	8.31	Office: 100%	0.1	0.85	0	0.0000	0.0308	Future
216-32-041	LDRD	74,070.56	1.70	Office: 100%	0.1	0.85	0	0.0000	0.0063	Future
216-48-003	LDRD	131,522.42	3.02	Office: 100%	0.1	0.85	0	0.0000	0.0112	Future
216-29-107	LHIN	147,528.17	3.39	Light Industrial	0.15	0.85	0	0.0000	0.0188	Future
216-29-083	LHIN	43,868.28	1.01	Light Industrial	0.15	0.85	0	0.0000	0.0056	Future
216-49-023	LDRD	151,178.71	3.47	Office: 100%	0.1	0.85	0	0.0000	0.0129	Future
216-01-041	CMXU	27,647.14	0.63	Community Commercial	0.1	0.4	25	0.0024	0.0011	Future
216-01-060	CMXU	63,809.87	1.46	Community Commercial	0.1	0.4	25	0.0056	0.0026	Future
216-01-059	RGMX	38,518.76	0.88	Regional Commercial	0.1	0.5	40	0.0054	0.0019	Future
216-01-051	CMXU	28,186.25	0.65	Community Commercial	0.1	0.4	25	0.0025	0.0011	Future
290-39-034	NHMX	19,585.27	0.45	Neighborhood Commercial	0.1	0.3	25	0.0017	0.0006	Future
290-39-033	NHMX	19,583.68	0.45	Neighborhood Commercial	0.1	0.3	25	0.0017	0.0006	Future
290-08-010	CMXU	15,857.59	0.36	Community Commercial	0.1	0.4	25	0.0014	0.0006	Future
290-08-141	CMXU	17,637.41	0.40	Community Commercial	0.1	0.4	25	0.0016	0.0007	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
290-08-135	CMXU	21,723.07	0.50	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
216-26-027	MDRE	12,224.97	0.28	Medium Density Residential	154	0	25	0.0011	0.0000	Future
216-26-028	MDRE	13,090.94	0.30	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-029	MDRE	14,020.44	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-030	MDRE	13,942.08	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-031	MDRE	13,941.47	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-032	MDRE	13,927.52	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-033	MDRE	13,913.87	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-034	MDRE	13,899.89	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-035	MDRE	13,896.39	0.32	Medium Density Residential	154	0	25	0.0012	0.0000	Future
216-26-036	MDRE	27,978.65	0.64	Medium Density Residential	154	0	25	0.0025	0.0000	Future
216-48-025	LDRD	71,026.36	1.63	Office: 100%	0.1	0.85	0	0.0000	0.0060	Future
216-29-106	LHIN	93,596.65	2.15	Light Industrial	0.15	0.85	0	0.0000	0.0119	Future
213-37-015	RGMX	43,810.63	1.01	Regional Commercial	0.1	0.5	40	0.0062	0.0022	Future
313-05-012	RGMX	51,476.79	1.18	Regional Commercial	0.1	0.5	40	0.0073	0.0026	Future
224-09-173	LHIN	20,081.82	0.46	Light Industrial	0.15	0.85	0	0.0000	0.0026	Future
224-09-178	HDRD	320,161.58	7.35	Office	0.15	1.25	0	0.0000	0.0600	Future
224-47-011	HDRD	147,038.83	3.38	Office	0.15	1.25	0	0.0000	0.0276	Future
269-28-029	CMXU	12,611.17	0.29	Community Commercial	0.1	0.4	25	0.0011	0.0005	Future
269-20-000	CMXU	13,257.80	0.30	Community Commercial	0.1	0.4	25	0.0012	0.0005	Future
269-16-081	LDRE	40,665.93	0.93	Low Density Residential	245	25	25	0.0057	0.0000	Future
269-05-058	CMXU	5,066.77	0.12	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
224-08-146	LDRD	242,279.02	5.56	Office: 100%	0.1	0.85	0	0.0000	0.0206	Future
224-42-001	LDRD	56,303.38	1.29	Office: 100%	0.1	0.85	0	0.0000	0.0048	Future
224-42-011	LDRD	27,425.81	0.63	Office: 100%	0.1	0.85	0	0.0000	0.0023	Future
224-42-010	LDRD	29,601.66	0.68	Office: 100%	0.1	0.85	0	0.0000	0.0025	Future
224-47-010	HDRD	90,447.13	2.08	Office	0.15	1.25	0	0.0000	0.0170	Future
224-09-168	LDRD	141,873.70	3.26	Office: 100%	0.1	0.85	0	0.0000	0.0121	Future

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224-09-176	LDRD	37,256.71	0.86	Office: 100%	0.1	0.85	0	0.0000	0.0032	Future
224-09-175	LDRD	51,330.24	1.18	Office: 100%	0.1	0.85	0	0.0000	0.0044	Future
224-47-009	HDRD	88,616.97	2.03	Office	0.15	1.25	0	0.0000	0.0166	Future
224-47-018	HDRD	187,994.16	4.32	Office	0.15	1.25	0	0.0000	0.0352	Future
269-26-092	CMXU	5,045.57	0.12	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-28-065	CMXU	26,816.67	0.62	Community Commercial	0.1	0.4	25	0.0024	0.0011	Future
269-28-028	CMXU	6,806.80	0.16	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
269-26-079	CMXU	5,538.36	0.13	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-26-120	CMXU	5,411.85	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-26-084	CMXU	9,310.59	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
269-26-081	CMXU	7,925.53	0.18	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-20-065	CMXU	11,043.91	0.25	Community Commercial	0.1	0.4	25	0.0010	0.0004	Future
269-26-082	CMXU	5,078.92	0.12	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-28-011	CMXU	3,873.44	0.09	Community Commercial	0.1	0.4	25	0.0003	0.0002	Future
269-20-053	CMXU	10,883.87	0.25	Community Commercial	0.1	0.4	25	0.0010	0.0004	Future
269-26-121	CMXU	8,170.95	0.19	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-20-037	CMXU	10,487.24	0.24	Community Commercial	0.1	0.4	25	0.0009	0.0004	Future
294-01-003	CMXU	19,029.93	0.44	Community Commercial	0.1	0.4	25	0.0017	0.0008	Future
294-01-006	CMXU	18,958.54	0.44	Community Commercial	0.1	0.4	25	0.0017	0.0008	Future
269-28-012	CMXU	4,638.02	0.11	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-20-038	CMXU	6,308.92	0.14	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
269-20-039	CMXU	6,131.89	0.14	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-28-067	CMXU	4,940.43	0.11	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-28-066	CMXU	4,782.93	0.11	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-20-098	CMXU	3,747.28	0.09	Community Commercial	0.1	0.4	25	0.0003	0.0001	Future
269-20-021	CMXU	5,648.19	0.13	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-20-100	CMXU	3,521.06	0.08	Community Commercial	0.1	0.4	25	0.0003	0.0001	Future
269-28-018	CMXU	6,061.11	0.14	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
269-28-025	CMXU	4,653.62	0.11	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-28-074	CMXU	4,009.02	0.09	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-28-015	CMXU	7,590.17	0.17	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-28-054	CMXU	3,855.92	0.09	Community Commercial	0.1	0.4	25	0.0003	0.0002	Future
269-28-073	CMXU	8,234.43	0.19	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-16-034	CMXU	40,806.52	0.94	Community Commercial	0.1	0.4	25	0.0036	0.0016	Future
294-36-001	RGCO	9,162.97	0.21	Regional Commercial	0.1	0.5	0	0.0000	0.0005	Future
294-35-021	RGCO	8,695.67	0.20	Regional Commercial	0.1	0.5	0	0.0000	0.0004	Future
294-36-002	MDRE	9,312.85	0.21	Medium Density Residential	154	0	25	0.0008	0.0000	Future
294-35-020	MDRE	8,936.77	0.21	Medium Density Residential	154	0	25	0.0008	0.0000	Future
294-39-010	CMXU	25,661.70	0.59	Community Commercial	0.1	0.4	25	0.0023	0.0010	Future
294-39-004	CMXU	6,113.49	0.14	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
294-39-009	CMXU	25,319.39	0.58	Community Commercial	0.1	0.4	25	0.0022	0.0010	Future
294-35-023	RGCO	108,335.81	2.49	Regional Commercial	0.1	0.5	0	0.0000	0.0054	Future
294-39-002	CMXU	44,529.78	1.02	Community Commercial	0.1	0.4	25	0.0039	0.0018	Future
294-39-001	CMXU	127,776.81	2.93	Community Commercial	0.1	0.4	25	0.0113	0.0051	Future
294-35-025	RGCO	78,581.26	1.80	Regional Commercial	0.1	0.5	0	0.0000	0.0039	Future
294-01-015	CMXU	132,726.89	3.05	Community Commercial	0.1	0.4	25	0.0117	0.0053	Future
294-01-004	CMXU	22,443.42	0.52	Community Commercial	0.1	0.4	25	0.0020	0.0009	Future
294-01-011	CMXU	23,291.59	0.53	Community Commercial	0.1	0.4	25	0.0021	0.0009	Future
294-18-035	NHMX	395,927.79	9.09	Neighborhood Commercial	0.1	0.3	25	0.0350	0.0119	Future
216-29-059	LHIN	80,632.00	1.85	Light Industrial	0.15	0.85	0	0.0000	0.0103	Future
216-46-002	HDRD	183,201.72	4.21	Office	0.15	1.25	0	0.0000	0.0344	Future
216-49-017	LDRD	155,505.49	3.57	Office: 100%	0.1	0.85	0	0.0000	0.0132	Future
216-49-019	LDRD	166,629.95	3.83	Office: 100%	0.1	0.85	0	0.0000	0.0142	Future
216-49-018	LDRD	149,900.69	3.44	Office: 100%	0.1	0.85	0	0.0000	0.0127	Future
216-31-063	LDRD	89,829.40	2.06	Office: 100%	0.1	0.85	0	0.0000	0.0076	Future
224-28-064	CMXU	25,154.69	0.58	Community Commercial	0.1	0.4	25	0.0022	0.0010	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
294-01-010	CMXU	114,948.89	2.64	Community Commercial	0.1	0.4	25	0.0102	0.0046	Future
294-18-031	NHMX	13,733.57	0.32	Neighborhood Commercial	0.1	0.3	25	0.0012	0.0004	Future
269-16-083	LDRE	21,969.79	0.50	Low Density Residential	245	25	25	0.0031	0.0000	Future
269-16-082	LDRE	6,750.64	0.15	Low Density Residential	245	25	25	0.0009	0.0000	Future
316-19-032	RGCO	39,604.73	0.91	Regional Commercial	0.1	0.5	0	0.0000	0.0020	Future
313-06-003	RGMX	29,253.05	0.67	Regional Commercial	0.1	0.5	40	0.0041	0.0015	Future
313-05-010	RGMX	29,601.59	0.68	Regional Commercial	0.1	0.5	40	0.0042	0.0015	Future
313-05-011	RGMX	56,183.00	1.29	Regional Commercial	0.1	0.5	40	0.0079	0.0028	Future
205-38-023	DHRE	87,447.39	2.01	High Density Residential	154	40	40	0.0124	0.0000	Future
205-38-021	DHRE	194,466.58	4.46	High Density Residential	154	40	40	0.0275	0.0000	Future
205-38-024	DHRE	82,952.93	1.90	High Density Residential	154	40	40	0.0117	0.0000	Future
205-38-001	DHRE	35,017.13	0.80	High Density Residential	154	40	40	0.0050	0.0000	Future
205-38-007	DHRE	39,416.06	0.90	High Density Residential	154	40	40	0.0056	0.0000	Future
205-38-008	DHRE	39,857.56	0.92	High Density Residential	154	40	40	0.0056	0.0000	Future
205-38-022	DHRE	76,671.09	1.76	High Density Residential	154	40	40	0.0108	0.0000	Future
205-38-020	DHRE	24,243.28	0.56	High Density Residential	154	40	40	0.0034	0.0000	Future
230-08-021	LDRE	10,700.73	0.25	Low Density Residential	245	25	25	0.0015	0.0000	Future
216-28-094	LDRD	152,700.83	3.51	Office: 100%	0.1	0.85	0	0.0000	0.0130	Future
230-06-049	RGMX	131,470.74	3.02	Regional Commercial	0.1	0.5	40	0.0186	0.0066	Future
230-06-048	RGMX	33,651.84	0.77	Regional Commercial	0.1	0.5	40	0.0048	0.0017	Future
205-39-002	DHRE	109,402.55	2.51	High Density Residential	154	40	40	0.0155	0.0000	Future
205-39-024	MDRE	29,086.65	0.67	Medium Density Residential	154	0	25	0.0026	0.0000	Future
269-01-085	CMXU	53,012.27	1.22	Community Commercial	0.1	0.4	25	0.0047	0.0021	Future
269-02-077	CMXU	30,191.78	0.69	Community Commercial	0.1	0.4	25	0.0027	0.0012	Future
269-02-078	CMXU	13,026.73	0.30	Community Commercial	0.1	0.4	25	0.0012	0.0005	Future
269-02-080	CMXU	10,578.66	0.24	Community Commercial	0.1	0.4	25	0.0009	0.0004	Future
230-06-033	RGMX	548,274.30	12.59	Regional Commercial	0.1	0.5	40	0.0775	0.0274	Future
213-35-032	RGMX	50,554.93	1.16	Regional Commercial	0.1	0.5	40	0.0071	0.0025	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
213-35-035	RGMX	95,178.19	2.18	Regional Commercial	0.1	0.5	40	0.0135	0.0048	Future
274-43-059	RGCO	19,161.77	0.44	Regional Commercial	0.1	0.5	0	0.0000	0.0010	Future
224-49-010	CMXU	60,265.32	1.38	Community Commercial	0.1	0.4	25	0.0053	0.0024	Future
230-08-018	LDRE	21,973.57	0.50	Low Density Residential	245	25	25	0.0031	0.0000	Future
230-08-019	LDRE	9,003.59	0.21	Low Density Residential	245	25	25	0.0013	0.0000	Future
230-08-020	LDRE	6,561.48	0.15	Low Density Residential	245	25	25	0.0009	0.0000	Future
216-28-083	LDRD	214,833.40	4.93	Office: 100%	0.1	0.85	0	0.0000	0.0183	Future
216-48-032	LDRD	55,403.94	1.27	Office: 100%	0.1	0.85	0	0.0000	0.0047	Future
216-48-029	LDRD	85,689.32	1.97	Office: 100%	0.1	0.85	0	0.0000	0.0073	Future
224-04-071	HYIN	322,762.73	7.41	Heavy Industrial	0.15	1.25	0	0.0000	0.0605	Future
224-10-119	LDRD	180,002.68	4.13	Office: 100%	0.1	0.85	0	0.0000	0.0153	Future
224-10-069	LDRD	94,509.08	2.17	Office: 100%	0.1	0.85	0	0.0000	0.0080	Future
224-10-130	LDRD	58,158.84	1.34	Office: 100%	0.1	0.85	0	0.0000	0.0049	Future
224-10-107	LDRD	30,686.39	0.70	Office: 100%	0.1	0.85	0	0.0000	0.0026	Future
224-10-106	LDRD	19,213.62	0.44	Office: 100%	0.1	0.85	0	0.0000	0.0016	Future
224-10-105	LDRD	148,684.73	3.41	Office: 100%	0.1	0.85	0	0.0000	0.0126	Future
224-10-080	LDRD	61,246.48	1.41	Office: 100%	0.1	0.85	0	0.0000	0.0052	Future
224-10-118	LDRD	77,019.71	1.77	Office: 100%	0.1	0.85	0	0.0000	0.0065	Future
224-10-066	LDRD	32,927.93	0.76	Office: 100%	0.1	0.85	0	0.0000	0.0028	Future
224-10-068	LDRD	37,041.51	0.85	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
224-10-067	LDRD	36,958.61	0.85	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
224-11-064	LDRD	411,756.58	9.45	Office: 100%	0.1	0.85	0	0.0000	0.0350	Future
224-11-063	LDRD	280,884.22	6.45	Office: 100%	0.1	0.85	0	0.0000	0.0239	Future
224-58-001	PUQP	414,248.77	9.51	Public/Institutional	0.21	0.2	0	0.0000	0.0174	Future
224-57-008	LDRD	35,388.10	0.81	Office: 100%	0.1	0.85	0	0.0000	0.0030	Future
224-45-009	LDRD	35,765.74	0.82	Office: 100%	0.1	0.85	0	0.0000	0.0030	Future
230-07-014	LDRE	5,533.35	0.13	Low Density Residential	245	25	25	0.0008	0.0000	Future
230-07-047	LDRE	22,778.52	0.52	Low Density Residential	245	25	25	0.0032	0.0000	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
230-07-048	LDRE	7,214.30	0.17	Low Density Residential	245	25	25	0.0010	0.0000	Future
230-07-045	LDRE	8,284.00	0.19	Low Density Residential	245	25	25	0.0012	0.0000	Future
230-07-046	LDRE	4,658.13	0.11	Low Density Residential	245	25	25	0.0007	0.0000	Future
230-06-042	PUQP	520,830.24	11.96	Public/Institutional	0.21	0.2	0	0.0000	0.0219	Future
269-05-011	CMXU	5,249.97	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-05-056	CMXU	5,223.89	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-05-003	CMXU	5,049.62	0.12	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-05-091	MDRE	8,193.12	0.19	Medium Density Residential	154	0	25	0.0007	0.0000	Future
269-05-093	CMXU	16,596.41	0.38	Community Commercial	0.1	0.4	25	0.0015	0.0007	Future
230-09-017	RGMX	52,635.73	1.21	Regional Commercial	0.1	0.5	40	0.0074	0.0026	Future
230-09-020	RGMX	481,376.41	11.05	Regional Commercial	0.1	0.5	40	0.0681	0.0241	Future
230-08-061	RGMX	31,261.22	0.72	Regional Commercial	0.1	0.5	40	0.0044	0.0016	Future
230-08-078	RGMX	89,580.36	2.06	Regional Commercial	0.1	0.5	40	0.0127	0.0045	Future
269-02-039	CMXU	5,529.70	0.13	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-02-006	CMXU	5,458.81	0.13	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-02-008	CMXU	5,100.25	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
269-02-082	CMXU	6,828.27	0.16	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
269-03-003	CMXU	7,875.27	0.18	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-02-005	CMXU	7,968.31	0.18	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-02-004	CMXU	7,979.70	0.18	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
269-03-004	CMXU	11,000.36	0.25	Community Commercial	0.1	0.4	25	0.0010	0.0004	Future
269-03-006	CMXU	4,000.14	0.09	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
269-02-079	CMXU	8,975.61	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
269-03-132	CMXU	1,564.90	0.04	Community Commercial	0.1	0.4	25	0.0001	0.0001	Future
269-03-051	CMXU	23,569.95	0.54	Community Commercial	0.1	0.4	25	0.0021	0.0009	Future
269-02-083	CMXU	34,085.10	0.78	Community Commercial	0.1	0.4	25	0.0030	0.0014	Future
216-28-062	LHIN	85,429.32	1.96	Light Industrial	0.15	0.85	0	0.0000	0.0109	Future
216-28-091	LDRD	84,980.10	1.95	Office: 100%	0.1	0.85	0	0.0000	0.0072	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
216-28-092	LDRD	11,676.99	0.27	Office: 100%	0.1	0.85	0	0.0000	0.0010	Future
216-28-093	LDRD	5,193.89	0.12	Office: 100%	0.1	0.85	0	0.0000	0.0004	Future
216-28-103	LDRD	125,080.84	2.87	Office: 100%	0.1	0.85	0	0.0000	0.0106	Future
216-28-102	LDRD	265,103.47	6.09	Office: 100%	0.1	0.85	0	0.0000	0.0225	Future
216-28-127	LHIN	223,792.30	5.14	Light Industrial	0.15	0.85	0	0.0000	0.0285	Future
216-28-044	LHIN	108,141.49	2.48	Light Industrial	0.15	0.85	0	0.0000	0.0138	Future
216-28-089	LDRD	256,220.27	5.88	Office: 100%	0.1	0.85	0	0.0000	0.0218	Future
216-28-090	LDRD	7,325.70	0.17	Office: 100%	0.1	0.85	0	0.0000	0.0006	Future
216-28-084	LDRD	7,511.17	0.17	Office: 100%	0.1	0.85	0	0.0000	0.0006	Future
216-28-055	LHIN	82,516.42	1.89	Light Industrial	0.15	0.85	0	0.0000	0.0105	Future
216-28-047	LHIN	53,122.75	1.22	Light Industrial	0.15	0.85	0	0.0000	0.0068	Future
224-06-169	LDRD	20,348.77	0.47	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
224-06-149	LDRD	56,242.08	1.29	Office: 100%	0.1	0.85	0	0.0000	0.0048	Future
224-06-142	LDRD	35,499.06	0.81	Office: 100%	0.1	0.85	0	0.0000	0.0030	Future
216-26-070	MDRE	36,540.64	0.84	Medium Density Residential	154	0	25	0.0032	0.0000	Future
216-28-115	LHIN	137,562.20	3.16	Light Industrial	0.15	0.85	0	0.0000	0.0175	Future
216-31-069	LDRD	125,038.39	2.87	Office: 100%	0.1	0.85	0	0.0000	0.0106	Future
216-30-053	HDRD	128,918.91	2.96	Office	0.15	1.25	0	0.0000	0.0242	Future
216-30-042	HDRD	23,650.32	0.54	Office	0.15	1.25	0	0.0000	0.0044	Future
216-31-068	LDRD	236,103.75	5.42	Office: 100%	0.1	0.85	0	0.0000	0.0201	Future
216-30-044	HDRD	61,150.67	1.40	Office	0.15	1.25	0	0.0000	0.0115	Future
216-30-043	HDRD	19,180.76	0.44	Office	0.15	1.25	0	0.0000	0.0036	Future
224-65-010	LDRD	546,769.64	12.55	Office: 100%	0.1	0.85	0	0.0000	0.0465	Future
216-26-042	MDRE	12,284.17	0.28	Medium Density Residential	154	0	25	0.0011	0.0000	Future
216-26-041	MDRE	14,342.90	0.33	Medium Density Residential	154	0	25	0.0013	0.0000	Future
216-26-040	MDRE	14,354.33	0.33	Medium Density Residential	154	0	25	0.0013	0.0000	Future
216-26-043	MDRE	14,269.73	0.33	Medium Density Residential	154	0	25	0.0013	0.0000	Future
216-26-039	MDRE	28,745.58	0.66	Medium Density Residential	154	0	25	0.0025	0.0000	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
216-26-038	MDRE	14,391.60	0.33	Medium Density Residential	154	0	25	0.0013	0.0000	Future
216-26-037	MDRE	16,815.24	0.39	Medium Density Residential	154	0	25	0.0015	0.0000	Future
224-71-006	LDRD	3,156.19	0.07	Office: 100%	0.1	0.85	0	0.0000	0.0003	Future
269-20-062	CMXU	1,790.65	0.04	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
269-20-061	CMXU	1,732.17	0.04	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
269-20-060	CMXU	1,722.60	0.04	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
269-20-059	CMXU	1,722.33	0.04	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
269-20-058	CMXU	1,732.82	0.04	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
269-20-057	CMXU	1,790.54	0.04	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
216-50-005	LDRD	7,974.91	0.18	Office: 100%	0.1	0.85	0	0.0000	0.0007	Future
269-05-104	CMXU	659.00	0.02	Community Commercial	0.1	0.4	25	0.0001	0.0000	Future
216-28-114	LHIN	138,163.27	3.17	Light Industrial	0.15	0.85	0	0.0000	0.0176	Future
216-48-031	LDRD	795,820.37	18.27	Office: 100%	0.1	0.85	0	0.0000	0.0676	Future
216-48-006	LDRD	75,580.15	1.74	Office: 100%	0.1	0.85	0	0.0000	0.0064	Future
216-31-032	RGCO	44,669.28	1.03	Regional Commercial	0.1	0.5	0	0.0000	0.0022	Future
216-31-072	HDRD	21,880.32	0.50	Office	0.15	1.25	0	0.0000	0.0041	Future
216-31-071	HDRD	57,595.21	1.32	Office	0.15	1.25	0	0.0000	0.0108	Future
216-26-073	MDRE	30,638.70	0.70	Medium Density Residential	154	0	25	0.0027	0.0000	Future
224-06-146	LDRD	6,350.31	0.15	Office: 100%	0.1	0.85	0	0.0000	0.0005	Future
224-06-175	LDRD	5,020.27	0.12	Office: 100%	0.1	0.85	0	0.0000	0.0004	Future
224-06-085	LDRD	36,326.27	0.83	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
224-06-119	LDRD	18,751.84	0.43	Office: 100%	0.1	0.85	0	0.0000	0.0016	Future
224-06-120	LDRD	2,271.83	0.05	Office: 100%	0.1	0.85	0	0.0000	0.0002	Future
224-28-039	CMXU	9,300.57	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
224-29-008	CMXU	7,826.61	0.18	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
224-29-023	CMXU	6,795.49	0.16	Community Commercial	0.1	0.4	25	0.0006	0.0003	Future
224-29-009	CMXU	8,474.60	0.19	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
224-29-010	CMXU	11,433.43	0.26	Community Commercial	0.1	0.4	25	0.0010	0.0005	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
224-29-016	CMXU	7,496.72	0.17	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
216-31-062	LDRD	113,507.12	2.61	Office: 100%	0.1	0.85	0	0.0000	0.0096	Future
216-30-050	HDRD	43,557.94	1.00	Office	0.15	1.25	0	0.0000	0.0082	Future
216-30-057	HDRD	38,594.54	0.89	Office	0.15	1.25	0	0.0000	0.0072	Future
216-31-070	LDRD	105,255.55	2.42	Office: 100%	0.1	0.85	0	0.0000	0.0089	Future
216-30-045	HDRD	5,236.77	0.12	Office	0.15	1.25	0	0.0000	0.0010	Future
216-30-040	LDRD	653,406.10	15.00	Office: 100%	0.1	0.85	0	0.0000	0.0555	Future
216-28-081	LHIN	186,276.94	4.28	Light Industrial	0.15	0.85	0	0.0000	0.0238	Future
216-28-109	LHIN	88,943.87	2.04	Light Industrial	0.15	0.85	0	0.0000	0.0113	Future
224-47-020	HDRD	23,418.70	0.54	Office	0.15	1.25	0	0.0000	0.0044	Future
224-28-068	CMXU	5,239.94	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
224-26-055	CMXU	9,006.06	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
224-28-037	CMXU	4,034.10	0.09	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
224-28-036	CMXU	4,034.77	0.09	Community Commercial	0.1	0.4	25	0.0004	0.0002	Future
216-01-056	RGMX	15,712.15	0.36	Regional Commercial	0.1	0.5	40	0.0022	0.0008	Future
216-01-044	CMXU	21,689.08	0.50	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
216-01-042	RGMX	14,775.77	0.34	Regional Commercial	0.1	0.5	40	0.0021	0.0007	Future
216-01-058	RGMX	54,219.09	1.24	Regional Commercial	0.1	0.5	40	0.0077	0.0027	Future
104-42-018	HDRD	325,210.13	7.47	Office	0.15	1.25	0	0.0000	0.0610	Future
104-13-083	LDRD	249,231.13	5.72	Office: 100%	0.1	0.85	0	0.0000	0.0212	Future
104-13-085	LDRD	130,494.37	3.00	Office: 100%	0.1	0.85	0	0.0000	0.0111	Future
290-10-068	CMXU	17,341.17	0.40	Community Commercial	0.1	0.4	25	0.0015	0.0007	Future
224-08-049	HDRD	98,542.70	2.26	Office	0.15	1.25	0	0.0000	0.0185	Future
224-08-119	LDRD	68,705.01	1.58	Office: 100%	0.1	0.85	0	0.0000	0.0058	Future
224-08-120	LDRD	64,431.51	1.48	Office: 100%	0.1	0.85	0	0.0000	0.0055	Future
224-08-151	HDRD	89,600.68	2.06	Office	0.15	1.25	0	0.0000	0.0168	Future
290-10-031	CMXU	15,120.32	0.35	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
290-10-096	RGMX	920,253.35	21.13	Regional Commercial	0.1	0.5	40	0.1301	0.0460	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
290-10-028	RGMX	42,075.24	0.97	Regional Commercial	0.1	0.5	40	0.0060	0.0021	Future
290-10-078	RGMX	41,167.15	0.95	Regional Commercial	0.1	0.5	40	0.0058	0.0021	Future
290-08-136	CMXU	21,499.91	0.49	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
290-08-109	CMXU	21,499.92	0.49	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
290-08-116	CMXU	21,499.74	0.49	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
290-08-137	CMXU	21,154.45	0.49	Community Commercial	0.1	0.4	25	0.0019	0.0008	Future
290-08-153	CMXU	28,068.52	0.64	Community Commercial	0.1	0.4	25	0.0025	0.0011	Future
290-08-152	CMXU	33,051.55	0.76	Community Commercial	0.1	0.4	25	0.0029	0.0013	Future
290-07-138	CMXU	52,654.99	1.21	Community Commercial	0.1	0.4	25	0.0047	0.0021	Future
224-06-130	LDRD	40,600.66	0.93	Office: 100%	0.1	0.85	0	0.0000	0.0035	Future
224-06-166	LDRD	86,532.24	1.99	Office: 100%	0.1	0.85	0	0.0000	0.0074	Future
224-06-165	LDRD	66,796.10	1.53	Office: 100%	0.1	0.85	0	0.0000	0.0057	Future
224-06-127	LDRD	39,269.31	0.90	Office: 100%	0.1	0.85	0	0.0000	0.0033	Future
224-06-150	LDRD	19,193.90	0.44	Office: 100%	0.1	0.85	0	0.0000	0.0016	Future
224-06-176	LDRD	36,651.21	0.84	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
224-10-117	LDRD	288,521.71	6.62	Office: 100%	0.1	0.85	0	0.0000	0.0245	Future
224-10-098	LDRD	83,754.38	1.92	Office: 100%	0.1	0.85	0	0.0000	0.0071	Future
224-35-017	HYIN	207,087.34	4.75	Heavy Industrial	0.15	1.25	0	0.0000	0.0388	Future
224-10-097	LDRD	87,984.01	2.02	Office: 100%	0.1	0.85	0	0.0000	0.0075	Future
224-61-002	LDRD	44,428.12	1.02	Office: 100%	0.1	0.85	0	0.0000	0.0038	Future
224-61-007	LDRD	26,414.71	0.61	Office: 100%	0.1	0.85	0	0.0000	0.0022	Future
224-61-008	LDRD	25,675.79	0.59	Office: 100%	0.1	0.85	0	0.0000	0.0022	Future
224-10-115	LDRD	73,391.17	1.68	Office: 100%	0.1	0.85	0	0.0000	0.0062	Future
224-61-001	LDRD	16,149.31	0.37	Office: 100%	0.1	0.85	0	0.0000	0.0014	Future
224-61-003	LDRD	8,601.44	0.20	Office: 100%	0.1	0.85	0	0.0000	0.0007	Future
224-61-004	LDRD	64,004.31	1.47	Office: 100%	0.1	0.85	0	0.0000	0.0054	Future
224-10-121	LDRD	204,760.26	4.70	Office: 100%	0.1	0.85	0	0.0000	0.0174	Future
224-60-013	HYIN	118,217.10	2.71	Heavy Industrial	0.15	1.25	0	0.0000	0.0222	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
224-10-126	LDRD	188,685.04	4.33	Office: 100%	0.1	0.85	0	0.0000	0.0160	Future
224-10-057	LDRD	72,205.64	1.66	Office: 100%	0.1	0.85	0	0.0000	0.0061	Future
224-61-009	LDRD	62,780.64	1.44	Office: 100%	0.1	0.85	0	0.0000	0.0053	Future
224-10-122	LDRD	137,809.08	3.16	Office: 100%	0.1	0.85	0	0.0000	0.0117	Future
224-10-123	LDRD	27,813.12	0.64	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
224-10-125	LDRD	96,709.30	2.22	Office: 100%	0.1	0.85	0	0.0000	0.0082	Future
224-60-014	HYIN	189,025.30	4.34	Heavy Industrial	0.15	1.25	0	0.0000	0.0354	Future
224-61-005	PUQP	147,332.98	3.38	Public/Institutional	0.21	0.2	0	0.0000	0.0062	Future
224-61-006	PUQP	438,706.55	10.07	Public/Institutional	0.21	0.2	0	0.0000	0.0184	Future
224-61-010	LDRD	62,783.57	1.44	Office: 100%	0.1	0.85	0	0.0000	0.0053	Future
224-10-131	LDRD	68,534.53	1.57	Office: 100%	0.1	0.85	0	0.0000	0.0058	Future
224-45-008	LDRD	17,716.99	0.41	Office: 100%	0.1	0.85	0	0.0000	0.0015	Future
224-45-027	LDRD	199,140.76	4.57	Office: 100%	0.1	0.85	0	0.0000	0.0169	Future
224-57-003	LDRD	106,948.39	2.46	Office: 100%	0.1	0.85	0	0.0000	0.0091	Future
224-57-013	LDRD	56,556.82	1.30	Office: 100%	0.1	0.85	0	0.0000	0.0048	Future
224-57-006	LDRD	43,541.19	1.00	Office: 100%	0.1	0.85	0	0.0000	0.0037	Future
224-57-007	LDRD	45,835.48	1.05	Office: 100%	0.1	0.85	0	0.0000	0.0039	Future
224-45-006	LDRD	13,852.82	0.32	Office: 100%	0.1	0.85	0	0.0000	0.0012	Future
224-45-028	LDRD	94,706.79	2.17	Office: 100%	0.1	0.85	0	0.0000	0.0081	Future
224-57-011	LDRD	155,439.63	3.57	Office: 100%	0.1	0.85	0	0.0000	0.0132	Future
224-45-029	LDRD	189,474.75	4.35	Office: 100%	0.1	0.85	0	0.0000	0.0161	Future
224-45-030	LDRD	630,206.01	14.47	Office: 100%	0.1	0.85	0	0.0000	0.0536	Future
224-45-031	LDRD	133,774.51	3.07	Office: 100%	0.1	0.85	0	0.0000	0.0114	Future
224-07-123	LDRD	223,031.31	5.12	Office: 100%	0.1	0.85	0	0.0000	0.0190	Future
224-07-121	LDRD	592,999.10	13.61	Office: 100%	0.1	0.85	0	0.0000	0.0504	Future
224-08-109	LDRD	45,669.11	1.05	Office: 100%	0.1	0.85	0	0.0000	0.0039	Future
224-08-101	LDRD	28,681.23	0.66	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
224-08-102	LDRD	29,091.31	0.67	Office: 100%	0.1	0.85	0	0.0000	0.0025	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
224-08-058	LDRD	29,720.80	0.68	Office: 100%	0.1	0.85	0	0.0000	0.0025	Future
224-08-092	LDRD	66,219.60	1.52	Office: 100%	0.1	0.85	0	0.0000	0.0056	Future
224-43-003	LDRD	85,296.50	1.96	Office: 100%	0.1	0.85	0	0.0000	0.0073	Future
224-08-147	LDRD	133,093.62	3.06	Office: 100%	0.1	0.85	0	0.0000	0.0113	Future
224-43-002	LDRD	197,082.09	4.52	Office: 100%	0.1	0.85	0	0.0000	0.0168	Future
224-08-085	LDRD	118,687.70	2.72	Office: 100%	0.1	0.85	0	0.0000	0.0101	Future
224-08-132	LDRD	19,701.48	0.45	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
224-08-133	LDRD	20,721.64	0.48	Office: 100%	0.1	0.85	0	0.0000	0.0018	Future
224-08-153	LHIN	336,272.79	7.72	Light Industrial	0.15	0.85	0	0.0000	0.0429	Future
224-08-134	LDRD	59,221.47	1.36	Office: 100%	0.1	0.85	0	0.0000	0.0050	Future
224-42-007	LDRD	36,961.31	0.85	Office: 100%	0.1	0.85	0	0.0000	0.0031	Future
224-08-144	LDRD	79,841.88	1.83	Office: 100%	0.1	0.85	0	0.0000	0.0068	Future
224-08-099	LDRD	57,516.22	1.32	Office: 100%	0.1	0.85	0	0.0000	0.0049	Future
224-08-135	LDRD	25,991.68	0.60	Office: 100%	0.1	0.85	0	0.0000	0.0022	Future
224-08-143	LDRD	16,209.74	0.37	Office: 100%	0.1	0.85	0	0.0000	0.0014	Future
224-08-082	LHIN	264,753.16	6.08	Light Industrial	0.15	0.85	0	0.0000	0.0338	Future
224-08-136	LDRD	20,109.40	0.46	Office: 100%	0.1	0.85	0	0.0000	0.0017	Future
224-08-006	LDRD	43,564.96	1.00	Office: 100%	0.1	0.85	0	0.0000	0.0037	Future
224-42-008	LDRD	42,463.43	0.97	Office: 100%	0.1	0.85	0	0.0000	0.0036	Future
224-08-145	LDRD	58,919.34	1.35	Office: 100%	0.1	0.85	0	0.0000	0.0050	Future
224-09-113	LDRD	320,572.47	7.36	Office: 100%	0.1	0.85	0	0.0000	0.0272	Future
224-08-142	LDRD	33,502.96	0.77	Office: 100%	0.1	0.85	0	0.0000	0.0028	Future
224-08-137	LDRD	20,714.89	0.48	Office: 100%	0.1	0.85	0	0.0000	0.0018	Future
224-08-138	LDRD	25,545.20	0.59	Office: 100%	0.1	0.85	0	0.0000	0.0022	Future
224-08-141	LDRD	31,949.48	0.73	Office: 100%	0.1	0.85	0	0.0000	0.0027	Future
224-08-123	LDRD	22,059.18	0.51	Office: 100%	0.1	0.85	0	0.0000	0.0019	Future
224-42-003	LDRD	84,435.13	1.94	Office: 100%	0.1	0.85	0	0.0000	0.0072	Future
224-08-122	LDRD	24,633.00	0.57	Office: 100%	0.1	0.85	0	0.0000	0.0021	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
224-08-127	LDRD	28,216.48	0.65	Office: 100%	0.1	0.85	0	0.0000	0.0024	Future
224-08-089	LDRD	53,116.36	1.22	Office: 100%	0.1	0.85	0	0.0000	0.0045	Future
224-09-140	LDRD	89,912.39	2.06	Office: 100%	0.1	0.85	0	0.0000	0.0076	Future
224-42-002	LDRD	41,805.84	0.96	Office: 100%	0.1	0.85	0	0.0000	0.0036	Future
224-65-009	LDRD	228,010.35	5.23	Office: 100%	0.1	0.85	0	0.0000	0.0194	Future
224-15-030	CMXU	5,401.82	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
224-20-094	CMXU	18,193.10	0.42	Community Commercial	0.1	0.4	25	0.0016	0.0007	Future
224-20-095	CMXU	22,728.81	0.52	Community Commercial	0.1	0.4	25	0.0020	0.0009	Future
224-20-096	CMXU	29,526.30	0.68	Community Commercial	0.1	0.4	25	0.0026	0.0012	Future
224-20-081	CMXU	32,679.25	0.75	Community Commercial	0.1	0.4	25	0.0029	0.0013	Future
224-14-114	CMXU	17,491.07	0.40	Community Commercial	0.1	0.4	25	0.0015	0.0007	Future
224-14-094	CMXU	21,945.47	0.50	Community Commercial	0.1	0.4	25	0.0019	0.0009	Future
224-14-109	CMXU	12,329.51	0.28	Community Commercial	0.1	0.4	25	0.0011	0.0005	Future
224-14-110	CMXU	9,560.58	0.22	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
224-14-106	CMXU	15,079.50	0.35	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
224-15-031	CMXU	9,926.16	0.23	Community Commercial	0.1	0.4	25	0.0009	0.0004	Future
224-14-086	CMXU	14,645.77	0.34	Community Commercial	0.1	0.4	25	0.0013	0.0006	Future
224-15-022	CMXU	15,656.29	0.36	Community Commercial	0.1	0.4	25	0.0014	0.0006	Future
224-15-029	RGMX	53,635.66	1.23	Regional Commercial	0.1	0.5	40	0.0076	0.0027	Future
224-48-009	CMXU	9,239.30	0.21	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
224-48-011	CMXU	22,092.35	0.51	Community Commercial	0.1	0.4	25	0.0020	0.0009	Future
224-26-073	CMXU	20,776.62	0.48	Community Commercial	0.1	0.4	25	0.0018	0.0008	Future
224-26-060	CMXU	11,107.62	0.25	Community Commercial	0.1	0.4	25	0.0010	0.0004	Future
224-26-065	CMXU	7,439.28	0.17	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
224-26-012	CMXU	7,575.30	0.17	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
224-26-066	CMXU	8,788.94	0.20	Community Commercial	0.1	0.4	25	0.0008	0.0004	Future
224-26-058	CMXU	13,547.21	0.31	Community Commercial	0.1	0.4	25	0.0012	0.0005	Future
224-20-080	MDRE	58,008.42	1.33	Medium Density Residential	154	0	25	0.0051	0.0000	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
224-29-038	CMXU	13,664.26	0.31	Community Commercial	0.1	0.4	25	0.0012	0.0005	Future
224-28-058	CMXU	11,846.08	0.27	Community Commercial	0.1	0.4	25	0.0010	0.0005	Future
224-29-030	CMXU	8,121.91	0.19	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
224-25-074	PUQP	451,036.23	10.35	Public/Institutional	0.21	0.2	0	0.0000	0.0189	Future
224-29-007	CMXU	16,145.09	0.37	Community Commercial	0.1	0.4	25	0.0014	0.0006	Future
224-29-041	CMXU	31,918.48	0.73	Community Commercial	0.1	0.4	25	0.0028	0.0013	Future
224-29-018	CMXU	7,426.58	0.17	Community Commercial	0.1	0.4	25	0.0007	0.0003	Future
224-29-033	CMXU	146,637.38	3.37	Community Commercial	0.1	0.4	25	0.0130	0.0059	Future
293-02-034	NHMX	7,757.23	0.18	Neighborhood Commercial	0.1	0.3	25	0.0007	0.0002	Future
293-02-033	NHMX	21,414.98	0.49	Neighborhood Commercial	0.1	0.3	25	0.0019	0.0006	Future
293-02-032	NHMX	33,739.12	0.77	Neighborhood Commercial	0.1	0.3	25	0.0030	0.0010	Future
293-02-030	NHMX	1,803.92	0.04	Neighborhood Commercial	0.1	0.3	25	0.0002	0.0001	Future
293-02-031	NHMX	1,748.95	0.04	Neighborhood Commercial	0.1	0.3	25	0.0002	0.0001	Future
104-55-013	RGCO	69,034.46	1.58	Regional Commercial	0.1	0.5	0	0.0000	0.0035	Future
104-39-024	LDRD	360.55	0.01	Office: 100%	0.1	0.85	0	0.0000	0.0000	Future
224-75-023	LHIN	1,538.63	0.04	Light Industrial	0.15	0.85	0	0.0000	0.0002	Future
097-37-112	NHMX	1,413.10	0.03	Neighborhood Commercial	0.1	0.3	25	0.0001	0.0000	Future
269-05-089	CMXU	18,382.06	0.42	Community Commercial	0.1	0.4	25	0.0016	0.0007	Future
316-09-044	PUQP	603,655.61	13.86	Public/Institutional	0.21	0.2	0	0.0000	0.0254	Future
097-11-000	DHRE	197,344.59	4.53	High Density Residential	154	40	40	0.0279	0.0000	Future
290-21-059	MDRE	1,181.34	0.03	Medium Density Residential	154	0	25	0.0001	0.0000	Future
290-53-025	MDRE	2,499.33	0.06	Medium Density Residential	154	0	25	0.0002	0.0000	Future
316-51-008	MDRE	1,142.09	0.03	Medium Density Residential	154	0	25	0.0001	0.0000	Future
104-59-039	MDRE	2,415.77	0.06	Medium Density Residential	154	0	25	0.0002	0.0000	Future
224-76-061	MDRE	843.21	0.02	Medium Density Residential	154	0	25	0.0001	0.0000	Future
290-71-058	CMXU	2,141.60	0.05	Community Commercial	0.1	0.4	25	0.0002	0.0001	Future
104-15-142	LDRD	55,510.68	1.27	Office: 100%	0.1	0.85	0	0.0000	0.0047	Future
104-15-143	LDRD	80,861.26	1.86	Office: 100%	0.1	0.85	0	0.0000	0.0069	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
269-05-094	CMXU	13,850.43	0.32	Community Commercial	0.1	0.4	25	0.0012	0.0006	Future
104-12-215	MDRE	4,110.43	0.09	Medium Density Residential	154	0	25	0.0004	0.0000	Future
269-05-106	CMXU	561.94	0.01	Community Commercial	0.1	0.4	25	0.0000	0.0000	Future
216-28-129	LHIN	59,722.21	1.37	Light Industrial	0.15	0.85	0	0.0000	0.0076	Future
290-44-143	MDRE	5,236.45	0.12	Medium Density Residential	154	0	25	0.0005	0.0000	Future
269-33-051	MDRE	3,016.20	0.07	Medium Density Residential	154	0	25	0.0003	0.0000	Future
269-05-090	CMXU	293.06	0.01	Community Commercial	0.1	0.4	25	0.0000	0.0000	Future
294-01-014	CMXU	20,318.83	0.47	Community Commercial	0.1	0.4	25	0.0018	0.0008	Future
303-17-051	MDRE	41,241.29	0.95	Medium Density Residential	154	0	25	0.0036	0.0000	Future
316-09-052	PUQP	495.30	0.01	Public/Institutional	0.21	0.2	0	0.0000	0.0000	Future
097-22-00G	NHMX	5,537.12	0.13	Neighborhood Commercial	0.1	0.3	25	0.0005	0.0002	Future
216-31-067	LDRD	179,532.35	4.12	Office: 100%	0.1	0.85	0	0.0000	0.0153	Future
216-01-054	CMXU	19,102.84	0.44	Community Commercial	0.1	0.4	25	0.0017	0.0008	Future
224-49-011	CMXU	5,195.08	0.12	Community Commercial	0.1	0.4	25	0.0005	0.0002	Future
104-48-009	HDRD	495.30	0.01	Office	0.15	1.25	0	0.0000	0.0001	Future
104-52-027	HDRD	174,604.01	4.01	Office	0.15	1.25	0	0.0000	0.0327	Future
224-06-177	LDRD	1,351.59	0.03	Office: 100%	0.1	0.85	0	0.0000	0.0001	Future
216-31-093	LDRD	247,968.38	5.69	Office: 100%	0.1	0.85	0	0.0000	0.0211	Future
293-02-035	NHMX	26,099.53	0.60	Neighborhood Commercial	0.1	0.3	25	0.0023	0.0008	Future
104-38-016	LDRD	109,021.33	2.50	Office: 100%	0.1	0.85	0	0.0000	0.0093	Future
104-38-014	LDRD	301,191.72	6.91	Office: 100%	0.1	0.85	0	0.0000	0.0256	Future
220-35-001	MDRE	2,769.02	0.06	Medium Density Residential	154	0	25	0.0002	0.0000	Future
220-35-002	MDRE	2,227.07	0.05	Medium Density Residential	154	0	25	0.0002	0.0000	Future
220-35-003	MDRE	3,074.10	0.07	Medium Density Residential	154	0	25	0.0003	0.0000	Future
220-35-004	MDRE	2,326.29	0.05	Medium Density Residential	154	0	25	0.0002	0.0000	Future
220-35-005	MDRE	2,086.74	0.05	Medium Density Residential	154	0	25	0.0002	0.0000	Future
220-35-006	MDRE	2,140.26	0.05	Medium Density Residential	154	0	25	0.0002	0.0000	Future
220-35-009	MDRE	2,738.91	0.06	Medium Density Residential	154	0	25	0.0002	0.0000	Future

APN	GPLANCRT	Area (SF)	Area (Acres)	Assumed Land Use	Flow Factor	FAR	DUA	Residential Flow (mgd)	Non-Residential Flow (mgd)	Future Model Scenario
220-35-007	MDRE	3,277.50	0.08	Medium Density Residential	154	0	25	0.0003	0.0000	Future
220-35-008	MDRE	3,148.35	0.07	Medium Density Residential	154	0	25	0.0003	0.0000	Future
205-39-026	MDRE	122,629.84	2.82	Medium Density Residential	154	0	25	0.0108	0.0000	Future
224-42-013	LDRD	84,412.03	1.94	Office: 100%	0.1	0.85	0	0.0000	0.0072	Future
224-42-014	LDRD	98,739.54	2.27	Office: 100%	0.1	0.85	0	0.0000	0.0084	Future
230-06-055	PUQP	68,335.37	1.57	Public/Institutional	0.21	0.2	0	0.0000	0.0029	Future
274-43-099	RGCO	264,044.93	6.06	Regional Commercial	0.1	0.5	0	0.0000	0.0132	Future
097-08-109	DHRE	233,446.43	5.36	High Density Residential	154	40	40	0.0330	0.0000	Future
303-18-051	RGCO	70,063.84	1.61	Regional Commercial	0.1	0.5	0	0.0000	0.0035	Future
296-37-035	RGCO	89,133.81	2.05	Regional Commercial	0.1	0.5	0	0.0000	0.0045	Future
224-57-016	LDRD	57,961.86	1.33	Office: 100%	0.1	0.85	0	0.0000	0.0049	Future
224-59-031	HYIN	224,958.92	5.16	Heavy Industrial	0.15	1.25	0	0.0000	0.0422	Future
104-14-172	LDRD	73,656.43	1.69	Office: 100%	0.1	0.85	0	0.0000	0.0063	Future
205-39-029	MDRE	1,204,315.75	27.65	Medium Density Residential	154	0	25	0.1064	0.0000	Future
205-39-028	MDRE	559,453.44	12.84	Medium Density Residential	154	0	25	0.0494	0.0000	Future

Flow Assumptions for Parcels with Entitlements
(Provided by the City)

LABELID	APN	OWNERNAM	Entitled Flow (gpd) 2016	Entitled Flow (gpd) 2024	Flow Difference (gpd) 2023-2016	Entitled Flow (mgd) 2024
1	230-03-090	Newark Group Industries Inc.	267,189	267,189	0	0.2671890
2	101-11-042	Dorothy Nutto Trustee	11,656	11,657	1	0.0116570
4	104-15-131	M West Prop Co. LLC	49,672	28,686	-20,986	0.0286860
5	104-39-023	Siliconix Inc	1,232,651	1,232,651	0	1.2326510
6	101-09-023	Dick Lee Corp	30,700	30,700	0	0.0307000
8	230-03-079	Xeres Ventures LLC	5,890	5,538	-352	0.0055380
9	230-47-068	Robert Jung Et. Al.	14,655	14,655	0	0.0146550
10	290-03-087	G6 Hospitality Property LLC	14,408	14,345	-63	0.0143450
11	101-13-003	AMB Property Corporation LP	8,132	8,106	-26	0.0081060
12	303-02-013	Annine Untiedt Trustee & Et. Al.	29,000	29,000	0	0.0290000
13	303-23-029	Machado Children's Trust	49,300	49,300	0	0.0493000
14	290-01-113	Shri Jai Ranchhodrai Inc	39,078	19,045	-20,033	0.0190450
15	104-50-025	Coherent	220,414	220,414	0	0.2204140
17	296-20-004	LJS LLC	9,780	9,777	-3	0.0097770
18	104-49-026	Marriott Plaza Associates L.P.	14,694	14,630	-64	0.0146300
19	104-50-018	Abbott Laboratories	9,998	9,998	0	0.0099980
20	104-43-054	City of Santa Clara	58,719	58,719	0	0.0587190
21	104-14-154	Cemex	6,911	5,689	-1,222	0.0056890
23	104-16-113	West Valley-Mission Community College Dist	54,000	54,000	0	0.0540000
24	104-51-001	Ixys Corporation	15,837	18,006	2,169	0.0180060
25	104-14-089	Kang Family Partners LP	58,282	58,282	0	0.0582820
26	104-40-020	Intel Corporation	17,608	17,608	0	0.0176080
27	104-40-031	Santa Clara Towers LP	29,540	29,540	0	0.0295400
28	216-48-035	James Lindsey Trustee & Et. Al.	32,303	32,303	0	0.0323030
29	216-34-076	Si 34 LLC	22,499	22,751	252	0.0227510
30	216-34-079	Si 34 LLC	12,591	12,464	-127	0.0124640
31	216-32-040	Ksl Capital Partners	40,384	40,384	0	0.0403840
32	216-01-060	Sunita Kumar Et. Al.	13,572	13,572	0	0.0135720
34	216-34-005	Erik Naslund Trustee	40,069	40,069	0	0.0400690
35	224-46-007	Act Ponderosa LLC Et. Al.	7,351	6,006	-1,345	0.0060060
36	224-08-146	Digital 1350 Duane LLC	79,530	79,530	0	0.0795300
37	224-09-165	Akt America Inc	62,052	61,209	-843	0.0612090
38	294-39-010	Donna Bonasera Trustee & Et. Al.	8,091	8,118	27	0.0081180
39	216-46-003	Chawla Ventures LLC	38,218	38,218	0	0.0382180
40	316-19-032	Yangs Brother Intl Corp	14,326	14,326	0	0.0143260
41	316-17-018	Agilent Technologies Inc	949,151	949,151	0	0.9491510
42	274-43-071	Federated Western Properties, Inc.	19,348	19,348	0	0.0193480
43	213-35-035	K D W Santa Clara	21,798	21,798	0	0.0217980
44	224-04-071	Gahrahmat Fam LP II	20,189	20,189	0	0.0201890
45	224-59-029	Hertz Investors Inc	41,582	20,791	-20,791	0.0207910
46	224-06-170	Leon and Colette Mardirossian Trustee	68,135	73,268	5,133	0.0732680
48	216-30-053	Ashford Santa Claraparts LP	86,122	86,122	0	0.0861220
49	216-28-101	Vantage Data Centers	121,199	95,370	-25,829	0.0652462
49	216-28-118	Vantage Data Centers		95,370	95,370	0.0301238
50	216-46-020	Latham & Watkins, LLP	32,114	31,841	-273	0.0318410
51	216-31-060	Cooperage-Rose Investments	26,309	26,309	0	0.0263090
52	216-30-054	Sierra-Santa Clara Inc	65,520	65,520	0	0.0655200
53	104-04-077	Digital-Pr Old Ironsides 1 LLC	24,091	29,240	5,149	0.0292400
54	104-13-083	SCP 2001 PE LLC	88,636	89,422	786	0.0894220
56	290-46-016	Dennis Mariani Trustee & Et. Al.	19,000	19,000	0	0.0190000
57	290-06-020	Moonlite Associates LLC	40,188	40,188	0	0.0401880
58	224-35-017	Sunset Properties Inc	8,767	8,767	0	0.0087670
59	224-60-013	1065 Martin Ave LLC	18,125	22,667	4,542	0.0226670
60	224-10-126	San Tomas Income Partners LLC	58,788	58,788	0	0.0587880
61	224-60-014	Martin Investment Properties LLC	11,239	11,218	-21	0.0112180
62	224-08-101	Renault & Handley Employee's Investment Co	11,139	11,139	0	0.0111390
63	224-08-147	1100 Space Park LLC	41,036	41,015	-21	0.0410150
64	224-08-085	Pacific Bell Lease	17,921	20,083	2,162	0.0200830
65	224-08-134	Harbor Electronics Inc	44,586	44,586	0	0.0445860
66	224-20-080	Masonic Hall Corp of Santa Clara	35,934	35,934	0	0.0359340
67	104-55-005	City of Santa Clara	117,735	117,735	0	0.1177350
68	104-55-013	City of Santa Clara	148,087	148,087	0	0.1480870
69	224-03-085	2045-2055 Lafayette Street	42,000	42,000	0	0.0420000
70	316-09-035	Kaiser Foundation Hospital	374,350	374,350	0	0.3743500
71	230-46-061	BFV LLC	13,111	13,111	0	0.0131110

Hydraulic Model Input Data for Parcels with Entitlements
(Based on Information Provided by the City)

Owner	APN	Subcatchment ID	WC Address	Additional foul flow (MGD)	Trade flow (MGD)	Customer Type	NAICS Description	DC Num/ RefID	DC/NTD/LTD Name
CALIFORNIA PAPERBOARD	230-03-090	311	525 Mathew Street	0	0.2672	MJ	Paperboard Mills	GP_Ph3	
BAB FACILITIES GROUP	101-11-042	1574	3295 Woodward Avenue	0	0.0117	CI	General Warehousing and Storage	GP_Ph3	
SILICONIX INC	104-39-023	2593	2201 Laurelwood Road	0	1.2327	CI	Semiconductor & Related Device Manufacturing	102	2201 Laurelwood Data Center
SST INVESTMENTS LLC	101-09-023	2978	805 Aldo Avenue	0	0.0307	CI	Lessors of Nonresid. Build. excpt Miniwarehou	GP_Ph3	
ALTAFLEX	230-47-068	4586	336 Martin Avenue	0	0.0147	CI	Bare Printed Circuit Board Manufacturing	GP_Ph3	
MOTEL SIX # 263	290-03-087	5628	3208 El Camino Real	0.0099	0.0045	CI	Hotels (except Casino Hotels) and Motels	77	ECR_CMU
MISSION HOSPITAL INC	303-02-013	6122	410 North Winchester Boulevard	0	0.029	CI	Homes for the Elderly	GP_Ph3	
SCCW LLC	303-23-029	6850	3655 Stevens Creek Boulevard	0.0339	0.0154	CI	Car Washes	GP_Ph3	
SHRI JAI RANCHHODRAI INC	290-01-113	7089	3550 El Camino Real	0.0141	0.005	CI	Hotels (except Casino Hotels) and Motels	77	ECR_CMU
COHERENT INC	104-50-025	9416	5100 Patrick Henry Drive	0	0.2204	CI	Semiconductor & Related Device Manufacturing	GP_Ph3	
BRIGHT HORIZONS CHILDREN CTR	296-20-004	10028	4945 Stevens Creek Boulevard	0	0.0098	CI	Child Day Care Services	GP_Ph3	
ONTARIO AIRPORT HOTEL CORP	104-43-054	11327	4949 Great America Parkway	0.0404	0.0183	CI	Hotels (except Casino Hotels) and Motels	GP_Ph3	
CEMEX INC	104-14-154	11740	1555 Russell Avenue	0	0.0057	CI	Ready-Mix Concrete Manufacturing	GP_Ph3	
VIVID INC	104-51-001	11892	3400 Bassett Street	0	0.018	CI	Household Appliance Stores	GP_Ph3	
BILTMORE HOTEL & SUITES	104-14-089	11910	2151 Laurelwood Road	0	0.0583	CI	Hotels (except Casino Hotels) and Motels	GP_Ph3	
GOLDEN STATE RESTAURANTS	104-40-020	11915	3935 Freedom Circle	0	0.0176	CI	Full-Service Restaurants	48	Freedom Circle
SCT OWNER LLC	104-40-031	11917	3945 Freedom Circle	0	0.0295	CI	Lessors of Nonresid. Build. excpt Miniwarehou	48	Freedom Circle
PROMEX INC	216-48-035	12068	3075 Oakmead Village Drive	0	0.0323	CI	Radio&TV Broadcast&Wireless Comm Equip Manuf	GP_Ph3	
AFFYMETRIX INC	216-34-079	12070	3450 Central Expressway	0	0.0125	CI	R&D in Physical, Engineering & Life Sciences		
WESTERN ATHLETIC CLUBS	216-32-040	12071	3250 Central Expressway	0	0.0404	CI	Fitness and Recreational Sports Centers	GP_Ph3	
HAWTHORN SUITES LTD	216-01-060	12109	2455 El Camino Real	0.0093	0.0042	CI	Hotels (except Casino Hotels) and Motels	GP_Ph3	
PONDEROSA OFFICE CENTER	224-46-007	14397	3080 Olcott Street	0	0.006	CI	Lessors of Nonresid. Build. excpt Miniwarehou		
EQUINIX INC	224-08-146	14398	1350 Duane Avenue	0	0.0795	CI	Data Processing, Hosting, & Related Services	GP_Ph3	
AKT AMERICA INC	224-09-165	14400	3101 Scott Boulevard	0	0.0612	CI	Semiconductor & Related Device Manufacturing		
M.B. EXCLUSIVELY PROPERTIES LL	294-39-010	15281	3941 Stevens Creek Boulevard	0.0056	0.0025	CI	Lessors of Nonresid. Build. excpt Miniwarehou	GP_Ph3	
DUARTE COMMUNICATIONS INC	216-46-003	15637	3200 Coronado Drive	0	0.0382	CI	Lessors of Nonresid. Build. excpt Miniwarehou		
WOODCREST HOTEL	316-19-032	16763	5415 Stevens Creek Boulevard	0	0.0143	CI	Hotels (except Casino Hotels) and Motels	GP_Ph3	
AGILENT TECHNOLOGY #9000089889	316-17-018	16766	5301 Stevens Creek Boulevard	0	0.9492	CI	Semiconductor & Related Device Manufacturing		
KDW CORP	213-35-035	17444	1550 Halford Avenue	0.0161	0.0057	CI	Lessors of Nonresid. Build. excpt Miniwarehou	GP_Ph3	
STREAMLINE CIRCUITS CORP	224-06-170	18371	1415 Richard Avenue	0	0.0733	CI	Bare Printed Circuit Board Manufacturing		
SANTA CLARA TENANT CORP	216-30-053	18456	2885 Lakeside Drive	0	0.0861	CI	Hotels (except Casino Hotels) and Motels	GP_Ph3	
CORESITE CORONADO STENDER LLC	216-46-021	18967	3020 Coronado Drive	0	0.0209	CI	Data Processing, Hosting, & Related Services	DC_47	Coresite / Telecom SV7
PENINSULAR INVESTMENTS INC	216-30-054	19335	3100 Lakeside Drive	0	0.0655	CI	Hotels (except Casino Hotels) and Motels		
CYXTERA DATA CENTERS INC	104-04-077	20154	4650 Old Ironsides Drive	0	0.0292	CI	Data Processing, Hosting, & Related Services	59	Patrick Henry Drive
VAREX IMAGING WEST HLDNGS INC	104-13-083	20170	2175 Mission College Boulevard	0	0.0894	CI	Semiconductor & Related Device Manufacturing	GP_Ph3	
LOMBARDI AUTO	290-46-016	20411	2540 El Camino Real	0.0131	0.0059	CI	Gasoline Stations with Convenience Stores	66	2570 ECR
D&T FOODS CO	224-60-013	20508	1061 Martin Avenue	0	0.0227	CI	Ice Cream and Frozen Dessert Manufacturing	GP_Ph3	
FUJIFILM DIAMATIX INC	224-10-126	20509	2210 Martin Avenue	0	0.0588	CI	R&D in Physical, Engineering & Life Sciences	GP_Ph3	
ONSPEC TECHNOLOGY PARTNERS INC	224-08-101	20554	975 Comstock Street	0	0.0111	CI	Semiconductor & Related Device Manufacturing	GP_Ph3	
DIGITAL REALTY TRUST LP	224-08-147	20568	1100 Space Park Drive	0	0.041	CI	Semiconductor & Related Device Manufacturing	GP_Ph3	
ELEC DEPT	224-08-085	20575	3025 Raymond Street	0	0.0201	MU	Other General Government Support	GP_Ph3	
HARBOR ELECTRONICS INC	224-08-134	20582	3021 Kenneth Street	0	0.0446	CI	Othr Electronic Parts and Equip Wholesalers	GP_Ph3	
NIC 13 THE WESTMONT OWNER LLC	224-20-080	21015	1675 Scott Boulevard	0.0359	0	CI	Residential Mental Retardation Facilities	GP_Ph3	
HUDSON TECHMART COMM CTR LLC	104-55-013	21654	5201 Great America Parkway	0	0.1481	CI	Lessors of Residential Buildings and Dwelling	GP_Ph3	
MICROSOFT CORPORATION	224-03-085	21746	2045 Lafayette Street	0	0.042	CI	Data Processing, Hosting, & Related Services		
ELEC DEPT SUBSTATION	216-46-022	22799	2920 Coronado Drive	0	0.0109	MU	Other General Government Support		
MACYS WEST INC # 17012B	274-43-071	23069	3051 Stevens Creek Boulevard	0	0.003	CI	Department Stores (except Discount Stores)		
	104-55-012	25819		0	0				
	316-09-035	26155		0	0.372				
	230-46-069	26350		0	0.0017				

Hydraulic Model Input Data for Parcels with Entitlements
(Based on Information Provided by the City)

Owner	APN	Subcatchment ID	WC Address	Additional foul flow (MGD)	Trade flow (MGD)	Customer Type	NAICS Description	DC Num/ RefID	DC/NTD/LTD Name
	216-31-060	26372		0	0.0263			99	3375 Scott Blvd
	316-09-054	26708		0	0.0024				
AFFYMETRIX INC	216-34-076	26820	3380 Central Expressway	0	0.0221	CI	R&D in Physical, Engineering & Life Sciences		
AFFYMETRIX INC	216-34-076	26821	3380 Central Expressway	0	0.0007	CI	R&D in Physical, Engineering & Life Sciences		
VANTAGE DATA CENTERS LLC	216-28-118	26847	2820 Northwestern Parkway	0	0.0301	CI	Semiconductor & Related Device Manufacturing		
456200 HERTZ MAIL STOP 2	224-59-029	26853	1000 Walsh Avenue	0	0.0005	CI	Passenger Car Rental		
VANTAGE DATA CENTERS LLC	216-28-131	26913	2565 Walsh Avenue	0	0.0038	CI	Data Processing, Hosting, & Related Services		
VANTAGE DATA CENTERS LLC	216-28-131	26914	2565 Walsh Avenue	0	0.0614	CI	Data Processing, Hosting, & Related Services	DC_28	Vantage SC I (1/6) CA11 / V1
	104-55-005	26993		0	0.1177				
	230-46-069	27003		0	0.0017				
	230-46-069	27005		0	0.0009				
	230-46-069	27006		0	0.0003				
	230-46-069	27007		0	0.0024				
	230-46-069	27008		0	0.0012				
	230-46-069	27010		0	0.0023				
	216-59-038	27288		0	0.0023				
	216-59-038	27289		0	0.0023				
	216-59-038	27290		0	0.002				
	216-59-038	27291		0	0.0017				
	216-59-037	27293		0	0.0023				
	216-59-037	27294		0	0.002				
	216-59-037	27295		0	0.0019				
	216-59-037	27296		0	0.0017				
	216-59-037	27297		0	0.0023				
	216-59-037	27298		0	0.0023				
	216-59-037	27299		0	0.0019				
	216-59-037	27300		0	0.0176				
MACYS WEST INC # 17012B	274-43-092	27337	3051 Stevens Creek Boulevard	0	0.0161	CI	Department Stores (except Discount Stores)		
MACYS WEST INC # 17012B	274-43-071	27355	3051 Stevens Creek Boulevard	0	0.0003	CI	Department Stores (except Discount Stores)		

Flow Assumptions for Parcels with Entitlements and Planned Future Development
(Based on Information Provided by the City)

Entitlement Information from City				Assumptions Used for Future Flow Calculations[3]									
Entitlement APN	Entitlement ID	Entitled Flow (gpd)	Future Flow (gpd)[1]	Phase[2]	Land Use	Parcel Area (SF)	Non-Res Dev. Area (SF)	FAR	No. of Res Units	No. of Hotel Rooms	Non-Res UFF (gpd/SF)	Res UFF (gpd/unit)	Hotel UFF (gpd/room)
104-15-131	4	28,686	37,812	GP Phase 3	Office: 100%	444,844	-	0.85	-	-	0.1	-	-
101-13-003	11	8,106	39,699	GP Phase 3	Light Industrial	311,365	-	0.85	-	-	0.15	-	-
104-50-018	19	9,998	25,434	GP Phase 3	Office: 100%	299,222	-	0.85	-	-	0.1	-	-
104-16-113	23	54,000	114,332	GP Phase 3	Office	609,771	-	1.25	-	-	0.15	-	-
224-04-071	44	20,189	60,518	GP Phase 3	Heavy Industrial	322,763	-	1.25	-	-	0.15	-	-
224-59-029	45	20,791	42,180	GP Phase 3	Heavy Industrial	224,959	-	1.25	-	-	0.15	-	-
224-35-017	58	8,767	38,829	GP Phase 3	Heavy Industrial	207,087	-	1.25	-	-	0.15	-	-
224-60-014	61	11,218	35,442	GP Phase 3	Heavy Industrial	189,025	-	1.25	-	-	0.15	-	-
230-46-061	71	13,111	395,710	NTD	Mixed Use	-	1,140,000[4]	-	1,600	225	0.1	154 or 175	100

[1]Where entitlement flows were less than future flows, the more conservative future flows were used in the model for the long-term future scenario.

[2]GP = General Plan. NTD = Near-Term Development. The one NTD is the Gateway Crossing project (Reference ID = 22).

[3]UFF = Unit Flow Factor. FAR = Floor-Area Ratio. SF = Square Feet. Parcel Area, FAR, and UFF were used to calculate GP Phase 3 future flows. No. of Units/Rooms, UFFs, and dev. area were used to calculate NTD future flows.

[4]Includes 15,000 SF of retail/commercial for the Gateway Crossing Project, plus 1,125,000 SF of office/R&D space associated with the adjacent Coleman Highline development that still needs to connect to the sewer system.

APPENDIX D: PUMP STATION CAPACITY CALCULATIONS

Westside Lift Station Capacity Analysis

Cell Legend

Input Cell	*(and try to add as much explanatory text as you can)*
Calculation Cell	*(do not overwrite the formulas!)*
Output Cell	*(this is your results - i.e., firm & total capacity)*

Table 1: Basic Information

FM length (feet)	49	*Total length from bottom of wetwell to discharge elevation (17.4') to the discharge manhole (32')*
FM diameter (inches)	8	*Two 8" discharge lines.*
FM area (ft^2)	0.35	*Calculated*
Material	C.I.	*Cast Iron*
Approx Year Built	1977	*Approx. pump age: 2 years (source: pump station survey)*
number of pumps	2	*Source: Lift Station Level Summary, received from City on 2/23/2015*
wet well floor elevation	-17.4	*Source: Dwg 77054-16, Sheet C-13. 1977*
approx discharge elevation	0.0	*Source: Dwg 77054-16, Sheet C-13. 1977*
f	0.020	*Default value for Darcy-Weisbach*
C	120	*Default value for Hazen-Williams*
K - force main	1.48	*Calculated*
K - allowance for minor losse	5	

Table 2: Pump Settings

Source: data provided by City on PS Info Sheet/Questionnaire

	On Set Pt	On Elev.	Lift	Off	Off Level	Lift
Pump #1 (IW ID: S103-8.1)	7.5	-9.9	9.9	5.33	-12.07	12.07
Pump #2 (IW ID: S103-8.2)	8	-9.4	9.4	5.33	-12.07	12.07

Table 3: Pump Curves

Sources: Pump curves provided by City. Two pumps are identical.

Pump Model: Flygt NP 3127 MT 3~ Adaptive 438 Pump Serial Number: 3127.090-1780054

	Pump #1 & #2	
HEAD (ft)	Flow (gpm)	Flow (mgd)
15	1215	1.75
20	1100	1.58
25	980	1.41
30	865	1.25
35	745	1.07
40	620	0.89
45	505	0.73
50	390	0.56
55	265	0.38
60	190	0.27
65	80	0.12
70	0	0.00

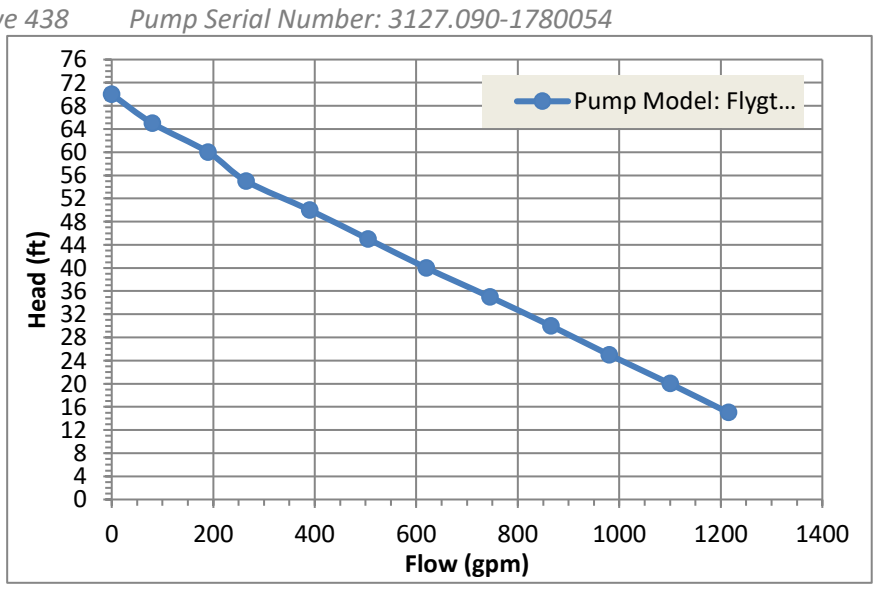


Table 4: Operation Scenarios

	Firm Pump Curve		Total Pump Curve	
HEAD (ft)	Flow (gpm)	Flow (mgd)	Flow (gpm)	Flow (mgd)
15	1215	1.75	2430	3.50
20	1100	1.58	2200	3.17
25	980	1.41	1960	2.82
30	865	1.25	1730	2.49
35	745	1.07	1490	2.15
40	620	0.89	1240	1.79
45	505	0.73	1010	1.45
50	390	0.56	780	1.12
55	265	0.38	530	0.76
60	190	0.27	380	0.55
65	80	0.12	160	0.23
70	0	0.00	0	0.00

Table 5: Total Dynamic Head (TDH) Calculations

Scenario:	Firm TDH	Total TDH	Other (use as-needed)
Lift:	9.9	9.4	

					Friction Headloss (ft)		Total Dynamic Head (ft)					
Flow			Velocity (ft/s)	Minor Headloss (ft)	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams
mgd	gpm	cfs										
0.00	0	0.0	0.0	0.0	0.0	0.0	9.9	9.9	9.4	9.4	0.0	0.0
0.23	162	0.4	1.0	0.1	0.0	0.0	10.0	10.0	9.5	9.5	0.1	0.1
0.47	324	0.7	2.1	0.3	0.1	0.1	10.3	10.4	9.8	9.9	0.4	0.5
0.70	486	1.1	3.1	0.7	0.2	0.3	10.9	10.9	10.4	10.4	1.0	1.0
0.93	648	1.4	4.1	1.3	0.4	0.5	11.6	11.7	11.1	11.2	1.7	1.8
1.17	810	1.8	5.2	2.1	0.6	0.7	12.6	12.7	12.1	12.2	2.7	2.8
1.40	972	2.2	6.2	3.0	0.9	1.0	13.8	13.9	13.3	13.4	3.9	4.0
1.63	1134	2.5	7.2	4.1	1.2	1.3	15.2	15.3	14.7	14.8	5.3	5.4
1.87	1296	2.9	8.3	5.3	1.6	1.7	16.8	16.9	16.3	16.4	6.9	7.0
2.10	1458	3.2	9.3	6.7	2.0	2.1	18.6	18.8	18.1	18.3	8.7	8.9
2.33	1620	3.6	10.3	8.3	2.5	2.6	20.7	20.8	20.2	20.3	10.8	10.9
2.57	1782	4.0	11.4	10.1	3.0	3.1	22.9	23.1	22.4	22.6	13.0	13.2
2.80	1944	4.3	12.4	12.0	3.5	3.7	25.4	25.5	24.9	25.0	15.5	15.6
3.03	2106	4.7	13.5	14.0	4.2	4.2	28.1	28.2	27.6	27.7	18.2	18.3
3.27	2269	5.1	14.5	16.3	4.8	4.9	31.0	31.1	30.5	30.6	21.1	21.2
3.50	2431	5.4	15.5	18.7	5.5	5.5	34.1	34.1	33.6	33.6	24.2	24.2

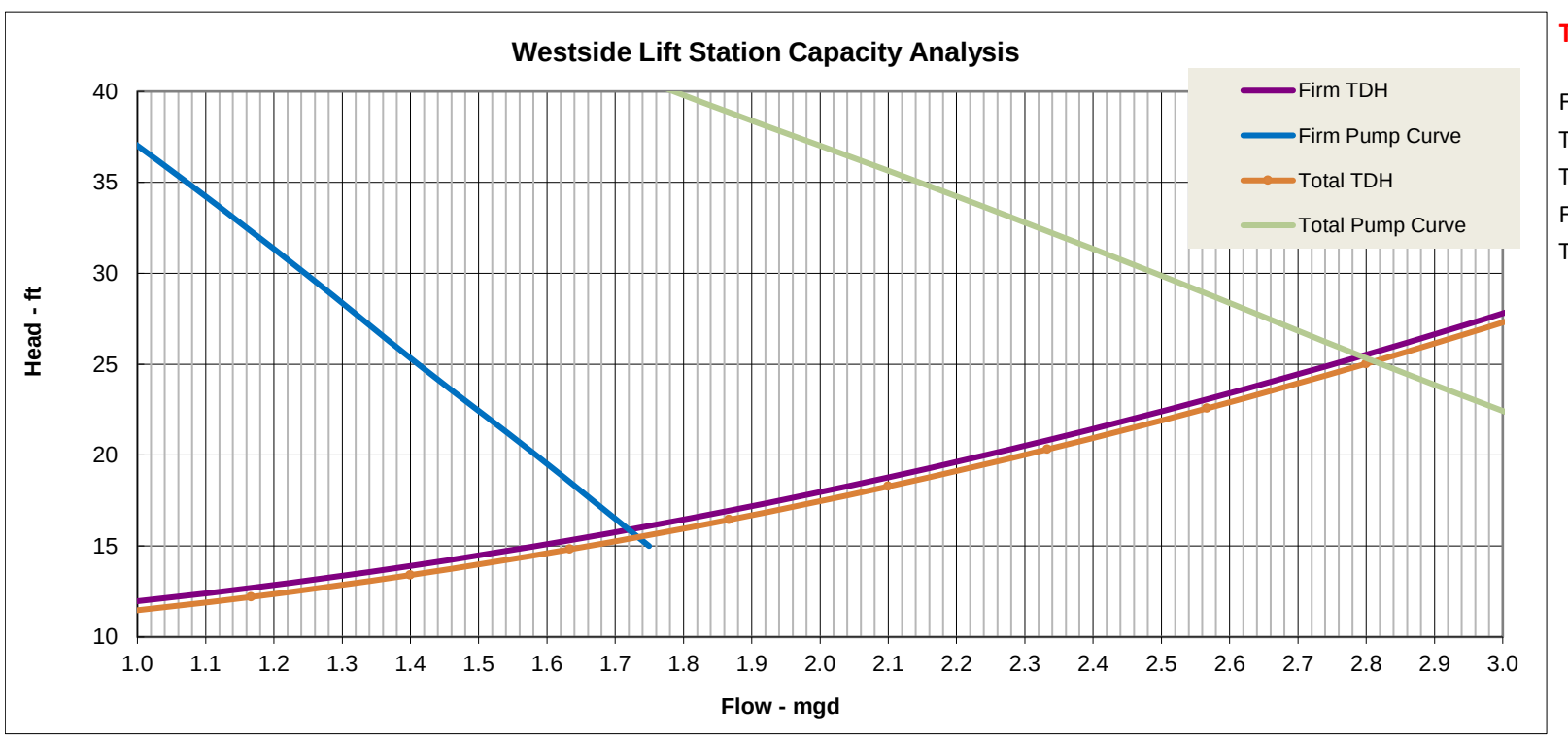


Table 6: Estimated Capacity

Firm Capacity:	1.72	mgd
Total Capacity:	2.81	mgd
Tear & Wear factor:	10%	
Firm Capacity:	**1.55**	mgd
Total Capacity:	**2.53**	mgd

Tasman Lift Station Capacity Analysis

Cell Legend

Input Cell	*(and try to add as much explanatory text as you can)*
Calculation Cell	*(do not overwrite the formulas!)*
Output Cell	*(this is your results - i.e., firm & total capacity)*

Table 1: Basic Information

FM length (feet)	47	*Total length from bottom of wetwell to discharge elevation (-12.5' to 4.3') to the discharge manhole (~30')*
FM diameter (inches)	8	*Two discharge lines.*
FM area (ft^2)	0.35	*Calculated*
Material	D.I.	*Ductile Iron*
Approx Year Built		
number of pumps	2	*Source: Lift Station Level Summary, received from City on 2/23/2015*
wet well floor elevation	-12.50	*Source: Dwg 9542-D, Sheet 29. 1986*
approx discharge elevation	4.30	*Source: Dwg 9542-D, Sheet 29. 1986*
f	0.0	*Default value for Darcy-Weisbach*
C	120	*Default value for Hazen-Williams*
K - force main	1.40	*Calculated*
K - allowance for minor losse	10	

Table 2: Pump Settings

Source: data provided by City on PS Info Sheet/Questionnaire

	On Set Pt	On Elev.	Lift	Off	Off Level	Lift
Pump #1 (IW ID: S103-8.1)	7.3	-5.20	9.50	2.7	-9.8	14.1
Pump #2 (IW ID: S103-8.2)	9.8	-2.70	7.00	2.7	-9.8	14.1

Table 3: Pump Curves

Sources: Pump curves provided by City. Two pumps are identical.

Pump Model: Flygt NP 3127 LT3~ Adaptive 425 *Pump Serial Number: 3127.070-1780057*

	Pump #1 & #2	
HEAD (ft)	Flow (gpm)	Flow (mgd)
7	1730	2.49
10	1630	2.35
15	1470	2.12
20	1280	1.84
25	1090	1.57
30	930	1.34
33	830	1.20
35	740	1.07
38	570	0.82
40	420	0.60
45	240	0.35
50	80	0.12
52	0	0.00

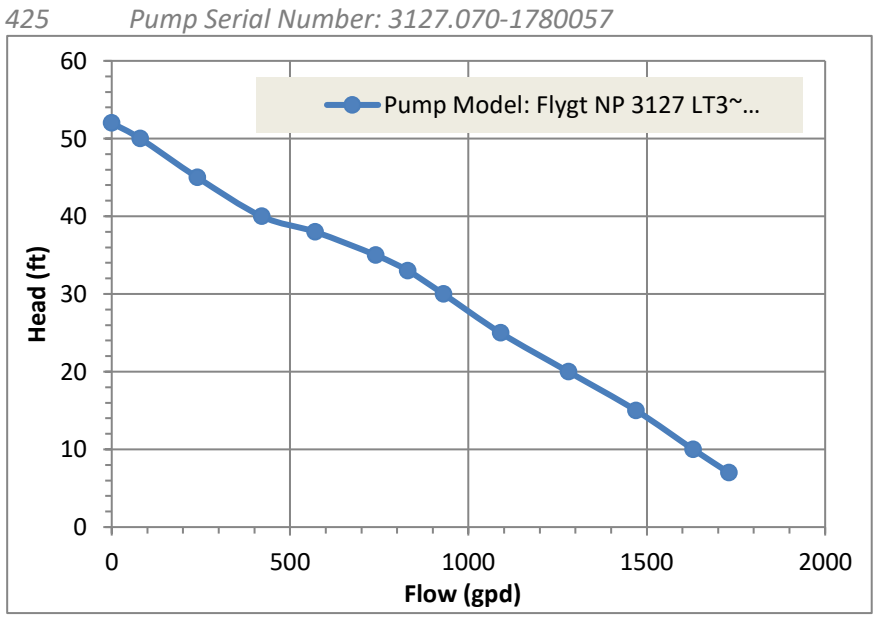


Table 4: Operation Scenarios

	Firm Pump Curve		Total Pump Curve	
HEAD (ft)	Flow (gpm)	Flow (mgd)	Flow (gpm)	Flow (mgd)
7	1730	2.49	3460	4.98
10	1630	2.35	3260	4.69
15	1470	2.12	2940	4.23
20	1280	1.84	2560	3.69
25	1090	1.57	2180	3.14
30	930	1.34	1860	2.68
33	830	1.20	1660	2.39
35	740	1.07	1480	2.13
38	570	0.82	1140	1.64
40	420	0.60	840	1.21
45	240	0.35	480	0.69
50	80	0.12	160	0.23
52	0	0.00	0	0.00

Table 5: Total Dynamic Head (TDH) Calculations

Scenario:	Firm TDH	Total TDH	Other (use as-needed)
Lift:	9.5	7	

					Friction Headloss (ft)		Total Dynamic Head (ft)					
Flow			Velocity (ft/s)	Minor Headloss (ft)	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams
mgd	gpm	cfs										
0.00	0	0.0	0.0	0.0	0.0	0.0	9.5	9.5	7.0	7.0	0.0	0.0
0.25	171	0.4	1.1	0.2	0.0	0.0	9.7	9.7	7.2	7.2	0.2	0.2
0.49	343	0.8	2.2	0.7	0.1	0.1	10.3	10.4	7.8	7.9	0.8	0.9
0.74	514	1.1	3.3	1.7	0.2	0.3	11.4	11.5	8.9	9.0	1.9	2.0
0.99	685	1.5	4.4	3.0	0.4	0.5	12.9	13.0	10.4	10.5	3.4	3.5
1.23	856	1.9	5.5	4.6	0.7	0.8	14.8	14.9	12.3	12.4	5.3	5.4
1.48	1028	2.3	6.6	6.7	0.9	1.1	17.1	17.3	14.6	14.8	7.6	7.8
1.73	1199	2.7	7.7	9.1	1.3	1.4	19.9	20.0	17.4	17.5	10.4	10.5
1.97	1370	3.1	8.8	11.9	1.7	1.8	23.1	23.2	20.6	20.7	13.6	13.7
2.22	1542	3.4	9.8	15.1	2.1	2.3	26.7	26.8	24.2	24.3	17.2	17.3
2.47	1713	3.8	10.9	18.6	2.6	2.7	30.7	30.8	28.2	28.3	21.2	21.3
2.71	1884	4.2	12.0	22.5	3.2	3.3	35.1	35.2	32.6	32.7	25.6	25.7
2.96	2056	4.6	13.1	26.8	3.8	3.8	40.0	40.1	37.5	37.6	30.5	30.6
3.21	2227	5.0	14.2	31.4	4.4	4.4	45.3	45.4	42.8	42.9	35.8	35.9
3.45	2398	5.3	15.3	36.4	5.1	5.1	51.0	51.0	48.5	48.5	41.5	41.5
3.70	2569	5.7	16.4	41.8	5.9	5.8	57.2	57.1	54.7	54.6	47.7	47.6

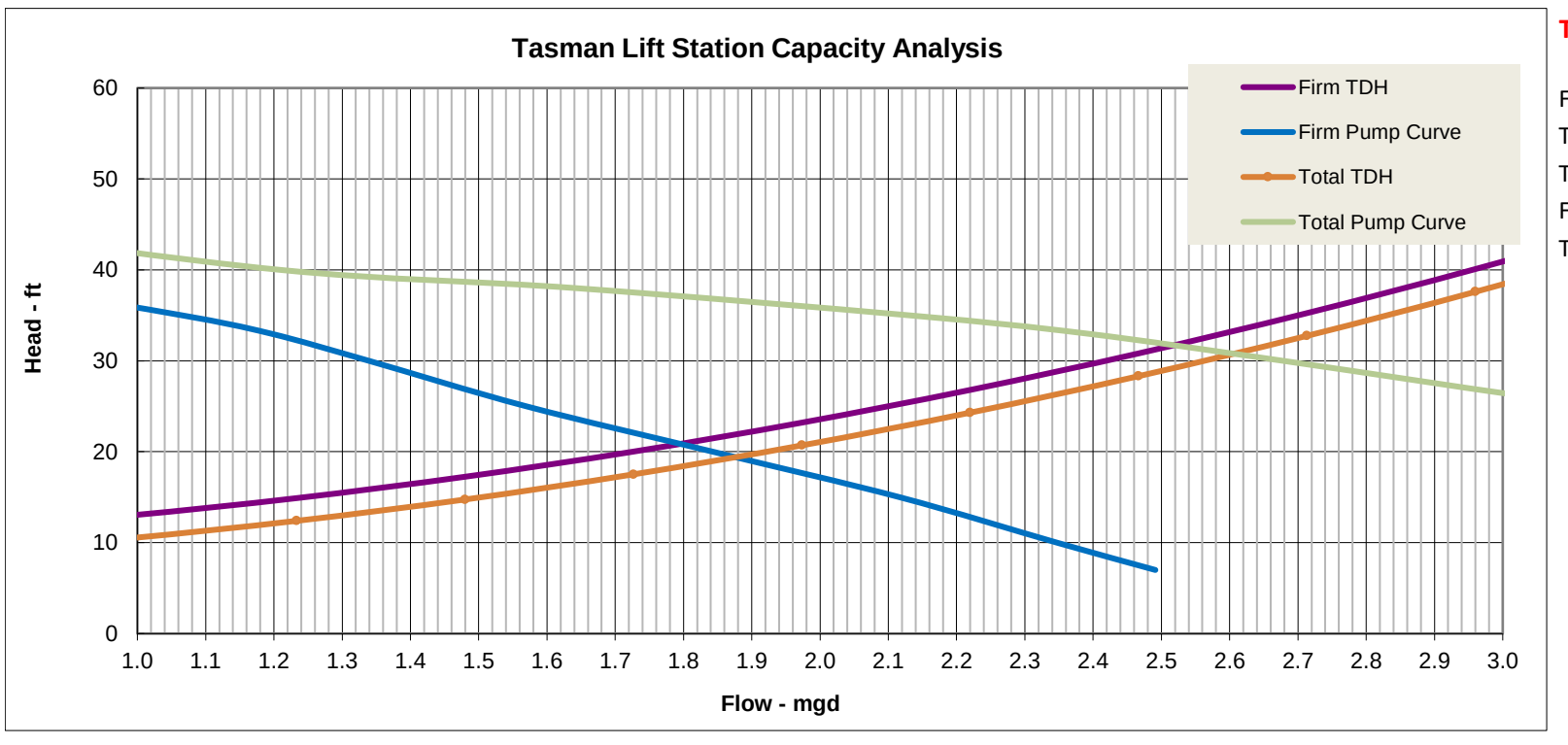


Table 6: Estimated Capacity

Firm Capacity:	1.79	mgd
Total Capacity:	2.60	mgd
Tear & Wear factor:	10%	
Firm Capacity:	**1.61**	mgd
Total Capacity:	**2.34**	mgd

De La Cruz Lift Station Capacity Analysis

Cell Legend

Input Cell	*(and try to add as much explanatory text as you can)*
Calculation Cell	*(do not overwrite the formulas!)*
Output Cell	*(this is your results - i.e., firm & total capacity)*

Table 1: Basic Information

FM length (feet)	23	*Total length from bottom of wetwell to discharge elevation (-6.74' to 12.05') to the discharge manhole (~4')*
FM diameter (inches)	8	*Two discharge lines.*
FM area (ft^2)	0.35	*Calculated*
Material	DIP	*Source: Dwg 10016-D, Sheet 2. 1992*
Approx Year Built	1992	*FYI: approx. pump age: 5 years (source: pump station survey)*
number of pumps	2	*Source: Lift Station Level Summary, received from City on 2/23/2015*
wet well floor elevation	-6.74	*Source: Dwg 10016-D, Sheet 2. 1992*
approx discharge elevation	12.05	*Source: Dwg 10016-D, Sheet 2. 1992*
f	0.0	*Default value for Darcy-Weisbach*
C	120	*Default value for Hazen-Williams*
K - force main	0.68	*Calculated*
K - allowance for minor losses	5	

Table 2: Pump Settings

Source: data provided by City on PS Info Sheet/Questionnaire

	On Set Pt	On Elev.	Lift	Off	Off Level	Lift
Pump #1 (IW ID: S103-8.1)	3.5	-3.24	15.29	1	-5.74	17.79
Pump #2 (IW ID: S103-8.2)	4	-2.74	14.79	1	-5.74	17.79

Table 3: Pump Curves

Sources: Pump curves provided by City. Two pumps are identical.

Pump Model: Flygt NP 3127 LT3~ Adaptive 425 *Pump Serial Number: 3127.090-1780054*

	Pump #1 & #2	
HEAD (ft)	Flow (gpm)	Flow (mgd)
15	1470	2.12
20	1280	1.84
25	1080	1.56
30	930	1.34
33	830	1.20
35	740	1.07
37	570	0.82
40	420	0.60
45	240	0.35
50	80	0.12
51	0	0.00
		0.00
		0.00
		0.00

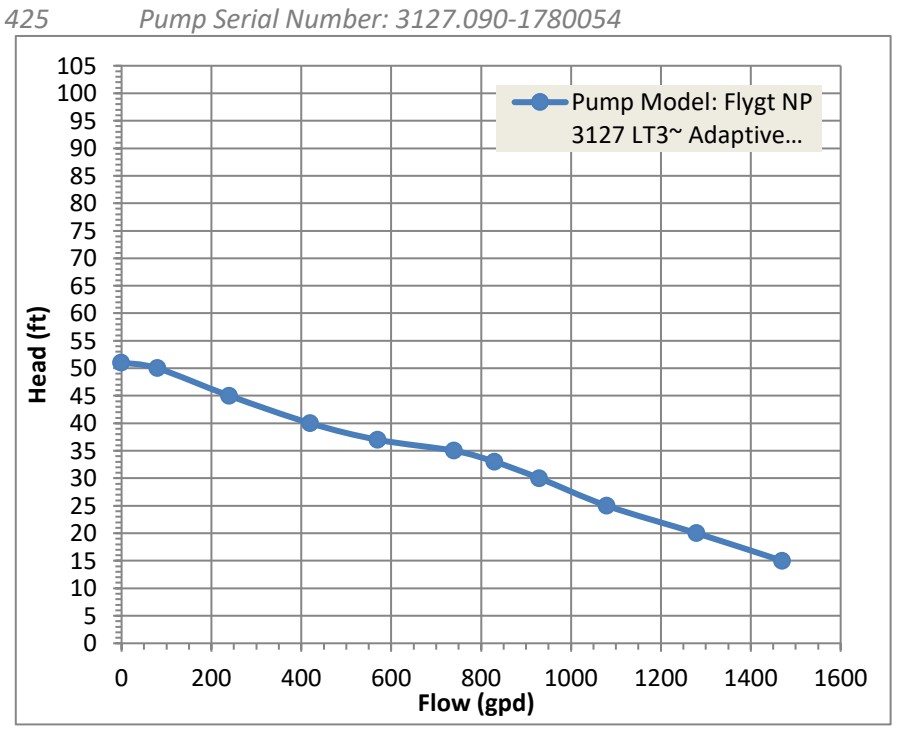


Table 4: Operation Scenarios

	Firm Pump Curve		Total Pump Curve	
HEAD (ft)	Flow (gpm)	Flow (mgd)	Flow (gpm)	Flow (mgd)
15	1470	2.12	2940	4.23
20	1280	1.84	2560	3.69
25	1080	1.56	2160	3.11
30	930	1.34	1860	2.68
33	830	1.20	1660	2.39
35	740	1.07	1480	2.13
37	570	0.82	1140	1.64
40	420	0.60	840	1.21
45	240	0.35	480	0.69
50	80	0.12	160	0.23
51	0	0.00	0	0.00

Table 5: Total Dynamic Head (TDH) Calculations

Scenario:	Firm TDH	Total TDH	Other (use as-needed)
Lift:	15.29	14.79	

Flow			Velocity (ft/s)	Minor Headloss (ft)	Friction Headloss (ft)		Total Dynamic Head (ft)					
					Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams
mgd	gpm	cfs										
0.00	0	0.0	0.0	0.0	0.0	0.0	15.3	15.3	14.8	14.8	0.0	0.0
0.29	199	0.4	1.3	0.1	0.0	0.0	15.4	15.4	14.9	14.9	0.1	0.2
0.57	398	0.9	2.5	0.5	0.1	0.1	15.9	15.9	15.4	15.4	0.6	0.6
0.86	597	1.3	3.8	1.1	0.2	0.2	16.6	16.6	16.1	16.1	1.3	1.3
1.15	796	1.8	5.1	2.0	0.3	0.3	17.6	17.6	17.1	17.1	2.3	2.3
1.43	995	2.2	6.4	3.1	0.4	0.5	18.9	18.9	18.4	18.4	3.6	3.6
1.72	1194	2.7	7.6	4.5	0.6	0.7	20.4	20.5	19.9	20.0	5.1	5.2
2.01	1394	3.1	8.9	6.1	0.8	0.9	22.3	22.3	21.8	21.8	7.0	7.1
2.29	1593	3.5	10.2	8.0	1.1	1.2	24.4	24.5	23.9	24.0	9.1	9.2
2.58	1792	4.0	11.4	10.2	1.4	1.4	26.8	26.9	26.3	26.4	11.6	11.6
2.87	1991	4.4	12.7	12.5	1.7	1.8	29.6	29.6	29.1	29.1	14.3	14.3
3.15	2190	4.9	14.0	15.2	2.1	2.1	32.5	32.6	32.0	32.1	17.3	17.3
3.44	2389	5.3	15.3	18.1	2.5	2.5	35.8	35.8	35.3	35.3	20.5	20.5
3.73	2588	5.8	16.5	21.2	2.9	2.9	39.4	39.4	38.9	38.9	24.1	24.1
4.01	2787	6.2	17.8	24.6	3.4	3.3	43.2	43.2	42.7	42.7	28.0	27.9
4.30	2986	6.7	19.1	28.2	3.9	3.7	47.4	47.3	46.9	46.8	32.1	32.0

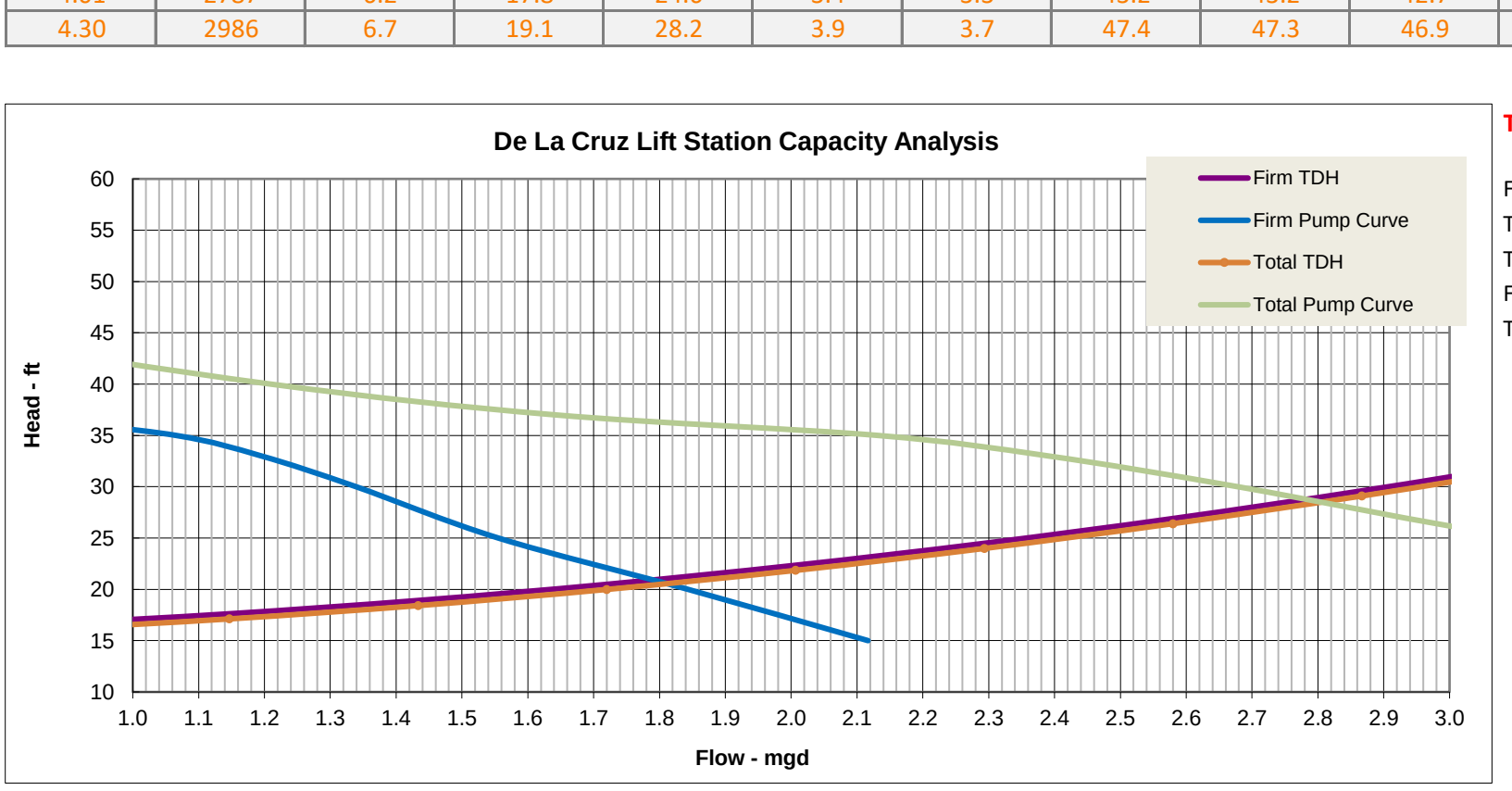


Table 6: Estimated Capacity

Firm Capacity:	1.79	mgd
Total Capacity:	2.8	mgd
Tear & Wear factor:	10%	
Firm Capacity:	**1.61**	mgd
Total Capacity:	**2.52**	mgd

Primavera Pump Station Capacity Analysis

Cell Legend

Input Cell	*(and try to add as much explanatory text as you can)*
Calculation Cell	*(do not overwrite the formulas!)*
Output Cell	*(this is your results - i.e., firm & total capacity)*

Table 1: Basic Information

FM length (feet)	68	*Source; Sanitary Sewer Pump Station Evaluation, Schaaf & Wheeler, 2010.*
FM diameter (inches)	16	*1 discharge line*
FM area (ft^2)	1.40	*Calculated*
Material	C.I.	*Cast Iron*
Approx Year Built	unknown	
number of pumps	6	*Source: Lift Station Level Summary, received from City on 2/23/2015*
wet well floor elevation	-22.00	*Source: Dwg 9518, Sheet 57, 1988*
approx discharge elevation	-0.35	*Source: Dwg 9518, Sheet 57, 1988*
f	0.02	*Default value for Darcy-Weisbach*
C	120	*Default value for Hazen-Williams*
K - force main	1.02	*Calculated*
K - allowance for minor losses	20	

Table 2: Pump Settings

Source: data provided by City on PS Info Sheet/Questionnaire

	On	On Level	Lift	Off	Off Level	Lift
Pump #1	9	-13.00	12.65	4.8	-17.20	16.85
Pump #2	9.3	-12.70	12.35	4.8	-17.20	16.85
Pump #3	9.7	-12.30	11.95	5.2	-16.80	16.45
Pump #4	9.8	-12.20	11.85	5.2	-16.80	16.45
Pump #5	9.9	-12.10	11.75	5.3	-16.70	16.35
Pump #6	10.2	-11.80	11.45	7.5	-14.50	14.15

Table 3: Pump Curves

Sources: Pump curves provided by City

Pump Model: Flygt NP 3127 MT 3~ Adaptive 438 *Pump Serial Number: 3127.090-1260005*

	Pump #1-#6	
HEAD (ft)	Flow (gpm)	Flow (mgd)
15	1210	1.74
20	1090	1.57
25	980	1.41
30	860	1.24
35	735	1.06
40	615	0.89
45	500	0.72
50	380	0.55
55	260	0.37
58	190	0.27
60	145	0.21
65	60	0.09
69	0	0.00

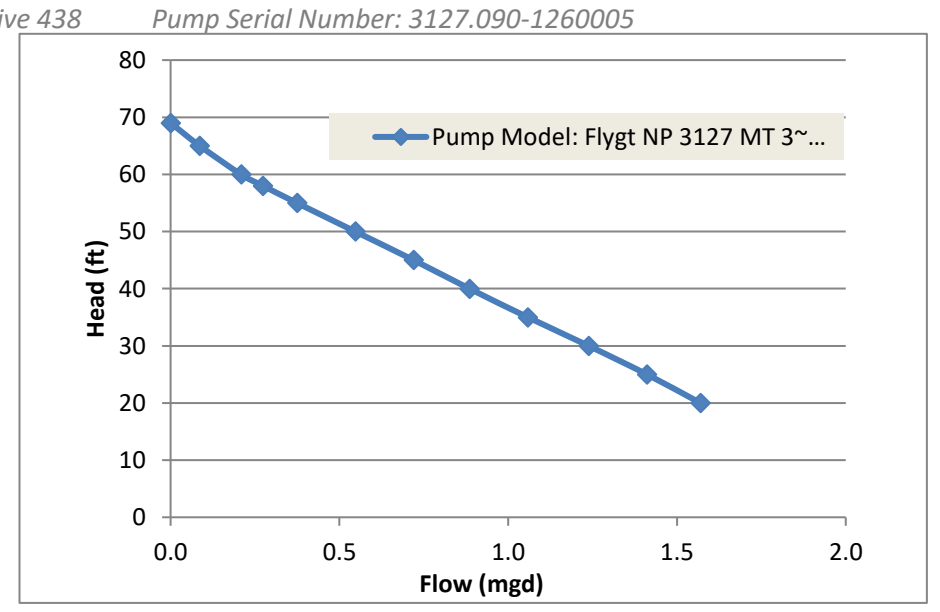


Table 4: Operation Scenarios

	Firm Pump Curve		Total Pump Curve	
HEAD (ft)	Flow (gpm)	Flow (mgd)	Flow (gpm)	Flow (mgd)
15	6050	8.71	7260	10.45
20	5450	7.85	6540	9.42
25	4900	7.06	5880	8.47
30	4300	6.19	5160	7.43
35	3675	5.29	4410	6.35
40	3075	4.43	3690	5.31
45	2500	3.60	3000	4.32
50	1900	2.74	2280	3.28
55	1300	1.87	1560	2.25
58	950	1.37	1140	1.64
60	725	1.04	870	1.25
65	300	0.43	360	0.52
69	0	0.00	0	0.00

Table 5: Total Dynamic Head (TDH) Calculations

Scenario:	Pump #1 only (Firm)			All On (High Level)			Other (use as-needed)		
Lift:	12.65			11.45					

					Friction Headloss (ft)		Total Dynamic Head (ft)					
Flow			Velocity (ft/s)	Minor Headloss (ft)	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams
mgd	gpm	cfs										
0.00	0	0.0	0.0	0.0	0.0	0.0	12.7	12.7	11.5	11.5	0.0	0.0
0.70	486	1.1	0.8	0.2	0.0	0.0	12.8	12.9	11.6	11.7	0.2	0.2
1.40	972	2.2	1.6	0.7	0.0	0.0	13.4	13.4	12.2	12.2	0.8	0.8
2.10	1458	3.2	2.3	1.7	0.1	0.1	14.4	14.4	13.2	13.2	1.8	1.8
2.80	1944	4.3	3.1	3.0	0.2	0.2	15.8	15.8	14.6	14.6	3.1	3.2
3.50	2431	5.4	3.9	4.7	0.2	0.3	17.6	17.6	16.4	16.4	4.9	4.9
4.20	2917	6.5	4.7	6.7	0.3	0.4	19.7	19.7	18.5	18.5	7.1	7.1
4.90	3403	7.6	5.4	9.2	0.5	0.5	22.3	22.3	21.1	21.1	9.6	9.7
5.60	3889	8.7	6.2	12.0	0.6	0.6	25.2	25.2	24.0	24.0	12.6	12.6
6.30	4375	9.7	7.0	15.2	0.8	0.8	28.6	28.6	27.4	27.4	15.9	15.9
7.00	4861	10.8	7.8	18.7	1.0	0.9	32.3	32.3	31.1	31.1	19.7	19.6
7.70	5347	11.9	8.5	22.6	1.2	1.1	36.4	36.4	35.2	35.2	23.8	23.8
8.40	5833	13.0	9.3	26.9	1.4	1.3	41.0	40.9	39.8	39.7	28.3	28.3
9.10	6319	14.1	10.1	31.6	1.6	1.5	45.9	45.8	44.7	44.6	33.2	33.1
9.80	6806	15.2	10.9	36.7	1.9	1.8	51.2	51.1	50.0	49.9	38.5	38.4
10.50	7292	16.2	11.6	42.1	2.1	2.0	56.9	56.7	55.7	55.5	44.2	44.1

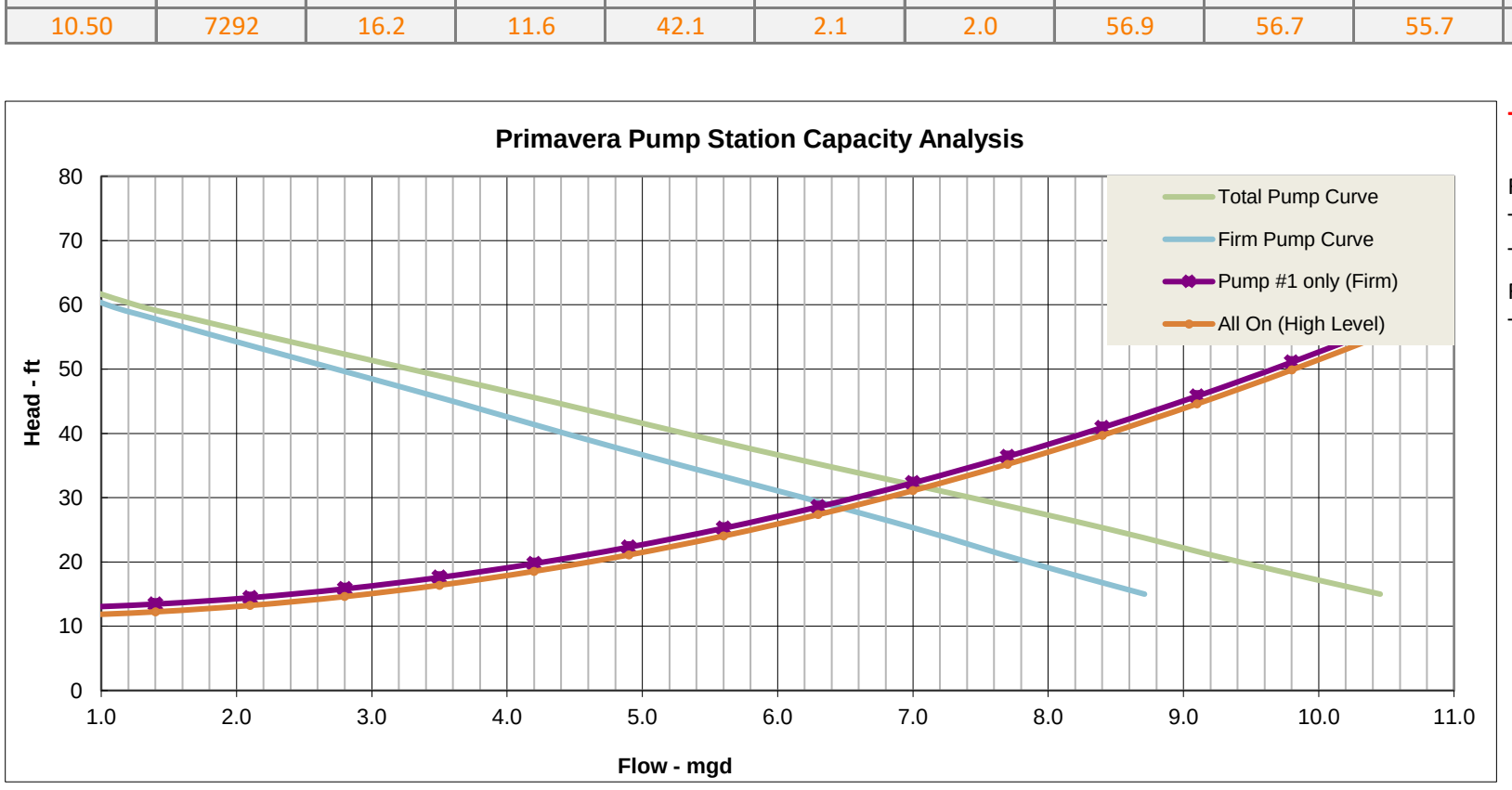


Table 6: Estimated Capacity

Firm Capacity:	6.35	mgd
Total Capacity:	7.1	mgd
Tear & Wear factor:	10%	
Firm Capacity:	**5.72**	mgd
Total Capacity:	**6.39**	mgd

Levis Stadium Pump Station Capacity Analysis

Cell Legend

Input Cell	*(and try to add as much explanatory text as you can)*
Calculation Cell	*(do not overwrite the formulas!)*
Output Cell	*(this is your results - i.e., firm & total capacity)*

Table 1: Basic Information

FM length (feet)	220	*Source: As-Built Drawings*
FM diameter (inches)	10	*Note: Two 6-inch and four 8-inch turn into 10 inch FM.*
FM area (ft^2)	0.55	*Calculated*
Material	N/A	
Approx Year Built	2014	*Approx. pump age: 1 year (source: pump station survey)*
number of pumps	6	*Source: Lift Station Level Summary, received from City on 2/23/2015*
wet well floor elevation	-16.63	*Source: Dwg M101, Sheet 11, 2013*
approx discharge elevation	-2	*Source: Dwg C-102, Sheet 5, 2012*
f	0.02	*Default value for Darcy-Weisbach*
C	120	*Default value for Hazen-Williams*
K - force main	5.28	*Calculated*
K - allowance for minor losse	20	

Table 2: Pump Settings

Source: data provided by City on PS Info Sheet/Questionnaire

	On	On Level	Lift	Off	Off Level	Lift
Pump #1	11.75	-12.9	10.9	11.25	-15.4	13.4
Pump #2	12.75	-11.9	9.9	12.25	-12.4	10.4
Pump #3	8.55	-8.1	6.1	8.05	-10.6	8.6
Pump #4	9.55	-7.1	5.1	9.05	-9.3	7.3
Pump #5	10.55	-6.1	4.1	10.05	-8.3	6.3
Pump #6	11.55	-5.6	3.6	11.1	-7.6	5.6

Table 3: Pump Curves

Sources: Pump curves provided by City

	Lower Flow		Higher Flow	
	Pump #1-#2		Pump #3-#6	
HEAD (ft)	Flow (gpm)	Flow (mgd)	Flow (gpm)	Flow (mgd)
0				
5				
10			1470	2.12
15	760	1.09	1300	1.87
20	670	0.96	1105	1.59
25	575	0.83	910	1.31
30	480	0.69	740	1.07
35	390	0.56	590	0.85
40	300	0.43	345	0.50
45	210	0.30	130	0.19
50	130	0.19	20	0.03
55	45	0.06		
60				
65				
70				
75				
80				
85				
90				
95				
100				

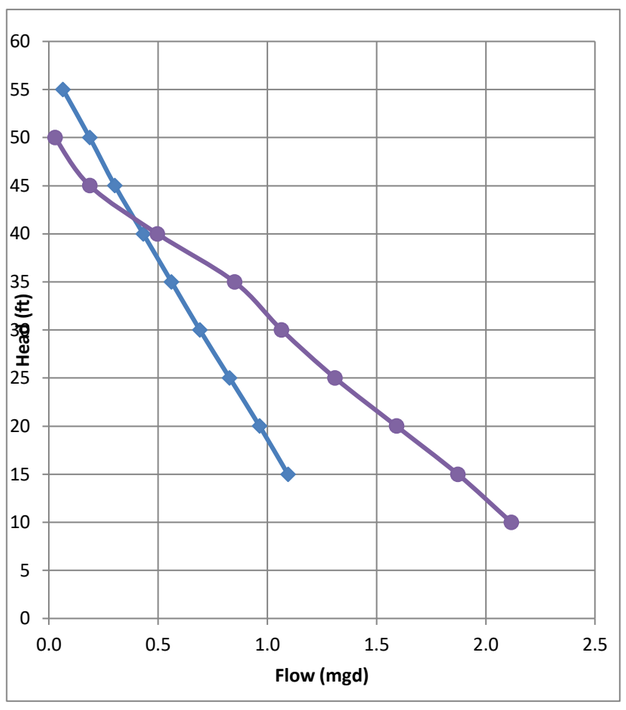


Table 4: Operation Scenarios

	Pump #1-#5 On		All Pumps On	
HEAD (ft)	Flow (gpm)	Flow (mgd)	Flow (gpm)	Flow (mgd)
0				
5				
10				
15			6,720	9.68
20	4,655	6.70	5,760	8.29
25	3,880	5.59	4,790	6.90
30	3,180	4.58	3,920	5.64
35	2,550	3.67	3,140	4.52
40	1,635	2.35	1,980	2.85
45	810	1.17	940	1.35
50	320	0.46	340	0.49
55	90	0.13	90	0.13
60				
65				
70				
75				
80				

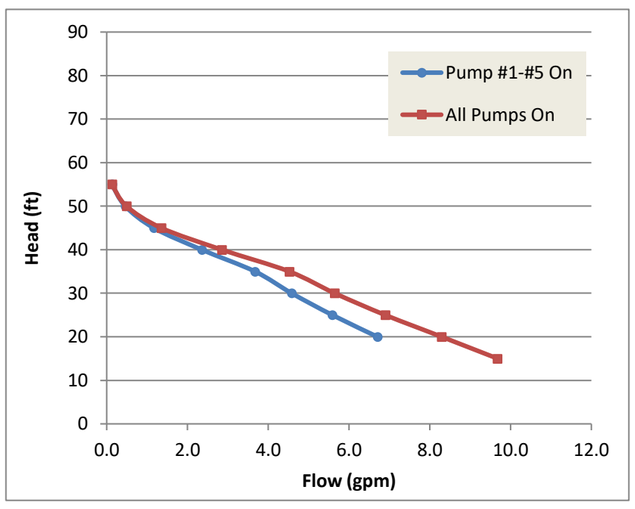


Table 5: Total Dynamic Head (TDH) Calculations

Scenario:	Pump #1-5 (Firm)	All On (High Level)	
Lift:	4.1	3.6	

Flow			Velocity (ft/s)	Minor Headloss (ft)	Friction Headloss (ft)		Total Dynamic Head (ft)					
mgd	gpm	cfs			Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams	Darcy-Weisbach	Hazen-Williams
0	0	0.0	0.0	0.0	0.0	0.0	4.1	4.1	3.6	3.6	0.0	0.0
5	3472	7.7	14.2	62.5	16.5	16.1	83.1	82.7	82.7	82.2	79.1	78.6
10	6944	15.5	28.4	250.2	66.0	58.0	320.3	312.3	319.8	311.8	316.2	308.2
15	10417	23.2	42.6	562.9	148.6	123.0	715.6	689.9	715.1	689.5	711.5	685.9
20	13889	30.9	56.8	1000.7	264.2	209.5	1269.0	1214.3	1268.5	1213.8	1264.9	1210.2
25	17361	38.7	71.0	1563.6	412.8	316.7	1980.4	1884.4	1980.0	1883.9	1976.4	1880.3
30	20833	46.4	85.1	2251.6	594.4	443.9	2850.0	2699.6	2849.6	2699.1	2846.0	2695.5
35	24306	54.2	99.3	3064.6	809.1	590.6	3877.7	3659.3	3877.3	3658.8	3873.7	3655.2
40	27778	61.9	113.5	4002.8	1056.7	756.3	5063.6	4763.1	5063.1	4762.7	5059.5	4759.1
45	31250	69.6	127.7	5066.0	1337.4	940.7	6407.5	6010.7	6407.0	6010.3	6403.4	6006.6
50	34722	77.4	141.9	6254.3	1651.1	1143.3	7909.5	7401.7	7909.1	7401.3	7905.4	7397.6
55	38194	85.1	156.1	7567.7	1997.9	1364.1	9569.7	8935.8	9569.2	8935.4	9565.6	8931.8
60	41667	92.8	170.3	9006.2	2377.6	1602.6	11387.9	10612.9	11387.5	10612.4	11383.8	10608.8
65	45139	100.6	184.5	10569.8	2790.4	1858.6	13364.3	12432.5	13363.8	12432.1	13360.2	12428.4
75	48611	108.3	198.7	12258.4	3236.2	2132.1	15498.7	14394.6	15498.3	14394.1	15494.7	14390.5
70	52083	116.0	212.9	14072.2	3715.1	2422.7	17791.3	16498.9	17790.9	16498.5	17787.2	16494.9

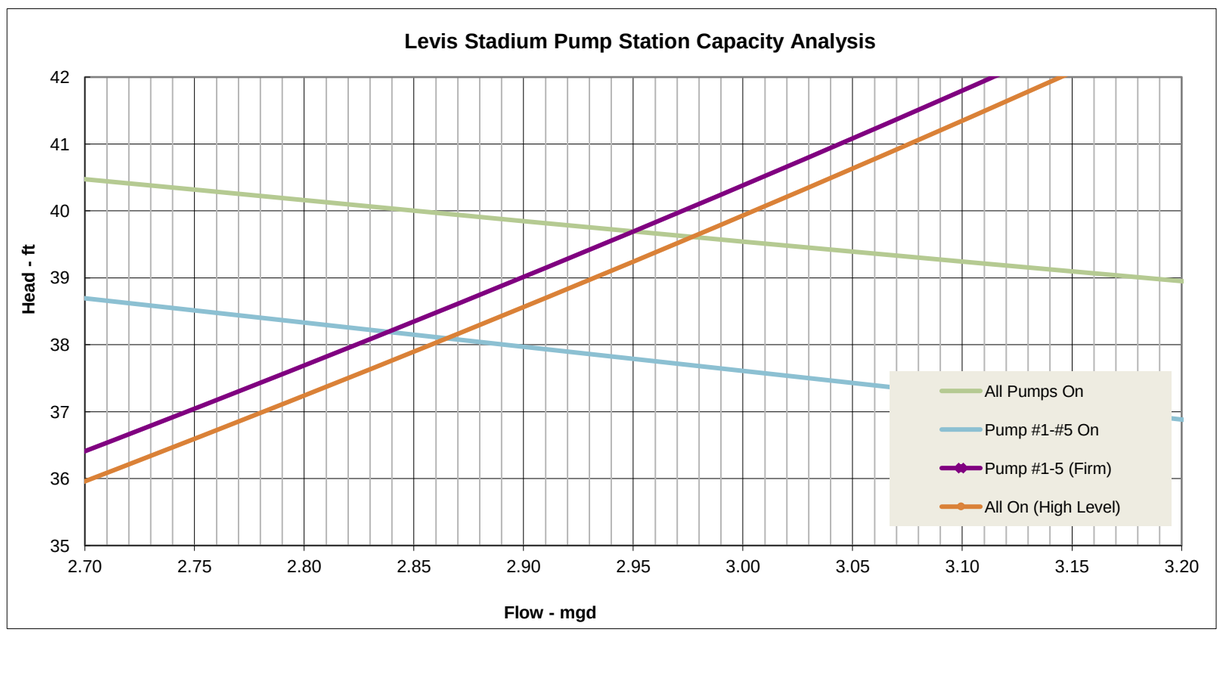


Table 6: Estimated Capacity

Firm Capacity:	2.84	mgd	*(manual input base on info from the graph. This is the total pump capacity with the largest pump out of service)*
Total Capacity:	2.98	mgd	*(manual input base on info from the graph)*
Tear & Wear factor:	10%		*(per recommendations from Dennis G)*
Firm Capacity:	**2.56**	mgd	
Total Capacity:	**2.68**	mgd	

APPENDIX E: FIELD-COLLECTED SURVEY INFORMATION DATA SHEETS

Field Verification

Date: 3/20/23 Time: 10 30 am Weather: Dry/Rain

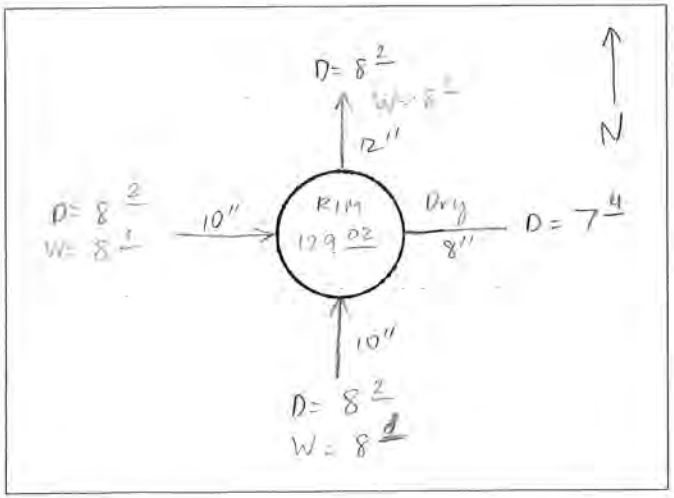
Name of Field Observer(s): CL & KT

MH Number: S 12 - 50

Street/Intersection: Pruneridge @ Woodtor

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/20/23 Time: 10-10 am Weather: Dry/Rain

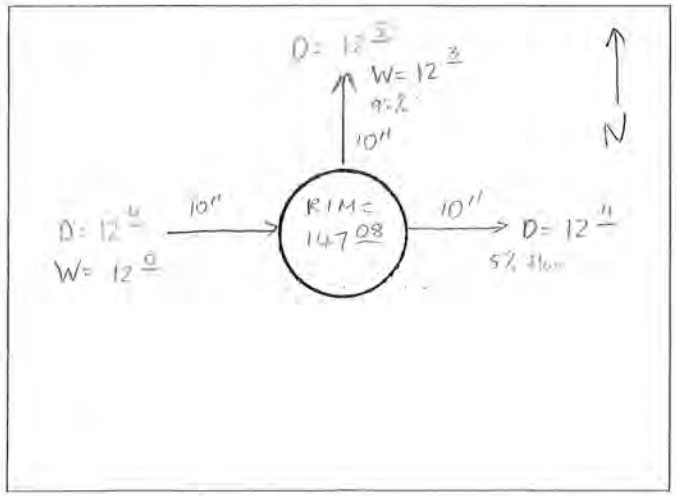
Name of Field Observer(s): CL & KT

MH Number: S10 - 29

Street/Intersection: Pruneridge @ Norwood Dr

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
most flow goes north. East pipe blocked by debris

Other Observations:
All VCP

Field Verification

Date: 3/20/23 Time: 10:45 am Weather: (Dry)/Rain

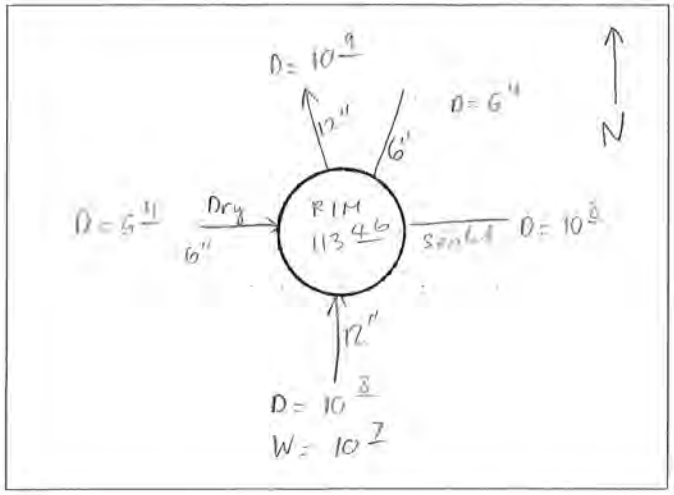
Name of Field Observer(s): CL & KT

MH Number: S13-38

Street/Intersection: Kiely @ S. of Forbes

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

flow goes north

Other Observations:

All VCP

Field Verification

Date: 3/20/23 Time: 10:45 am Weather: (Dry)/Rain

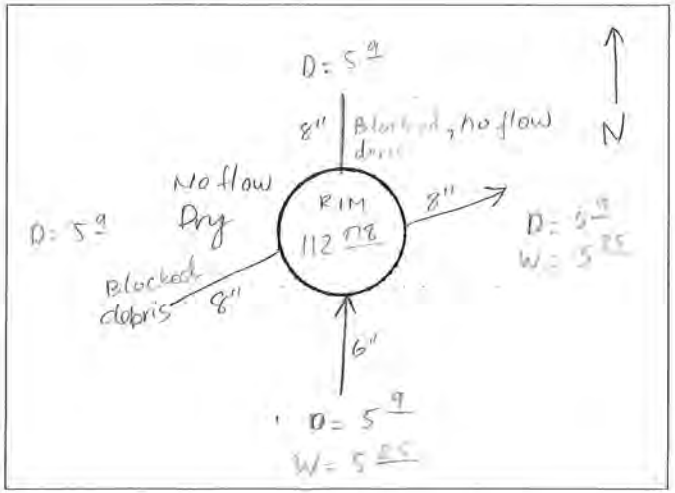
Name of Field Observer(s): CL & KT

MH Number: S13-27

Street/Intersection: Kiely @ Forbes

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

all from south into east.

Other Observations:

ALL VCP

K:\Engineering\Draft\AutoCAD\Surveys\Field Photos\Field Data Verification Form.doc

Field Verification

Date: 3/2/23 Time: 2:30 pm Weather: (Dry)/Rain

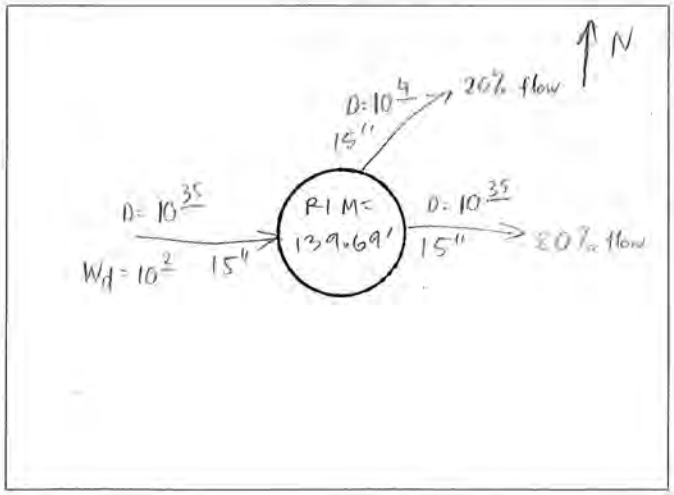
Name of Field Observer(s): CL & KT (CHANNELERHOI TWAIN)

MH Number: S20-16 West of

Street/Intersection: Homestead Rd @/Kaiser Entrance

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



ELEVATION IS BASED ON NAD88.
D = INVERT DEPTH
W OR W_d = DEPTH OF WATER LEVEL

Where is most of the flow going out to? Or is the flow evenly split?

80% going W to E
20% to NE

Other Observations:

$W_d = 10\frac{2}{}$ VCP
Fast flow

Field Verification

Date: 4/5/23 Time: 2:45 pm Weather: (Dry)/Rain

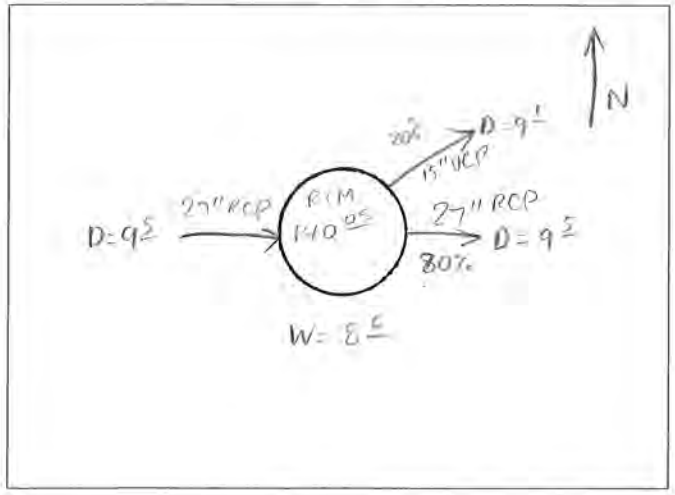
Name of Field Observer(s): CL & KT

MH Number: S 20-9

Street/Intersection: Homestead @ Swallow

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/5/23 Time: 2:30 pm Weather: (Dry)/Rain

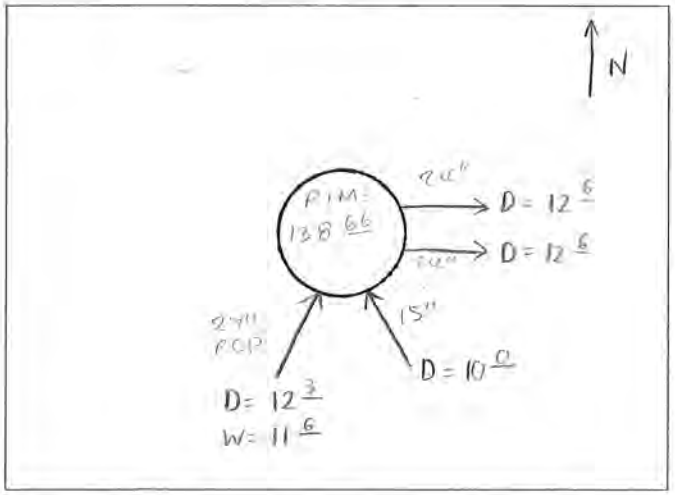
Name of Field Observer(s): CL & KT

MH Number: S 20-26

Street/Intersection: Homestead @ West of Kaiser Entrance

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/2/23 Time: 2:45 pm Weather: (Dry)/Rain

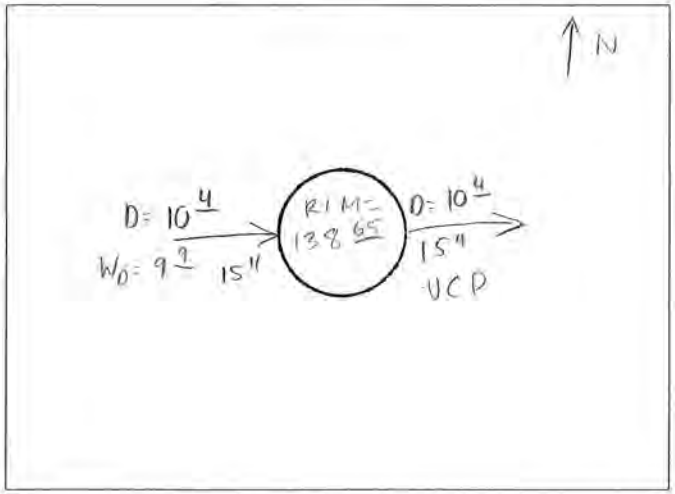
Name of Field Observer(s): CL & KT

MH Number: S 20-17

Street/Intersection: Homestead @ Kaiser Entrance

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
VCP

Field Verification

Date: 3/20/23 Time: 11:15 am Weather: Dry/Rain

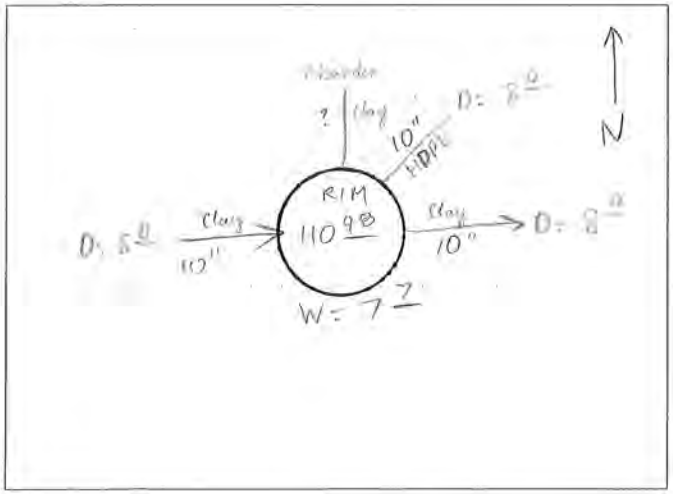
Name of Field Observer(s): CL & KT

MH Number: S 22 - 61

Street/Intersection: Homestead @ Saratoga Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/5/23 Time: 3 pm Weather: Dry/Rain

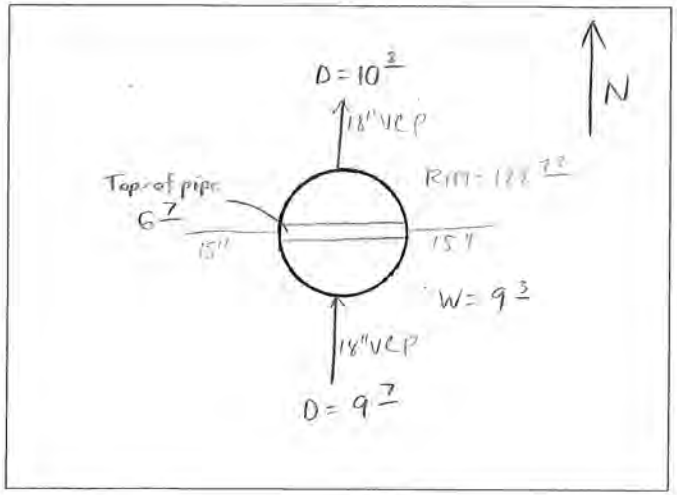
Name of Field Observer(s): CL & KT

MH Number: S 22-55

Street/Intersection: Homestead @ Pomeroy

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

All VCP

Field Verification

Date: 3/20/23 Time: 11:30 am Weather: (Dry)/Rain

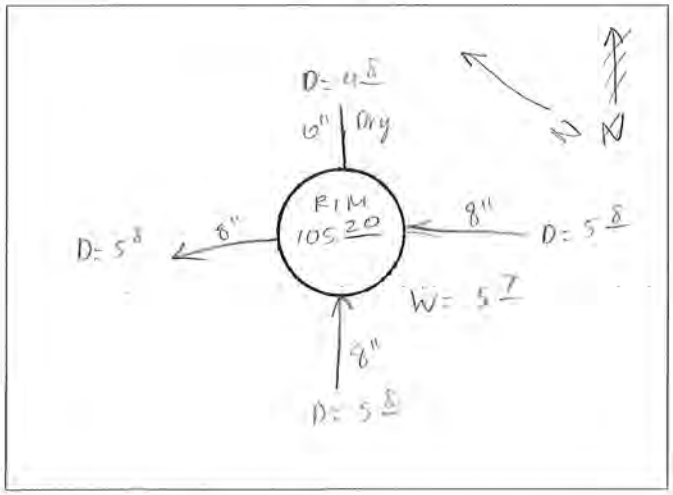
Name of Field Observer(s): CL & KT

MH Number: S 23-51

Street/Intersection: Kiely @ Barcroft

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
flow all goes west

Other Observations:
All VCP

Field Verification

Date: 3/27/23 Time: 10 am Weather: (Dry)/Rain

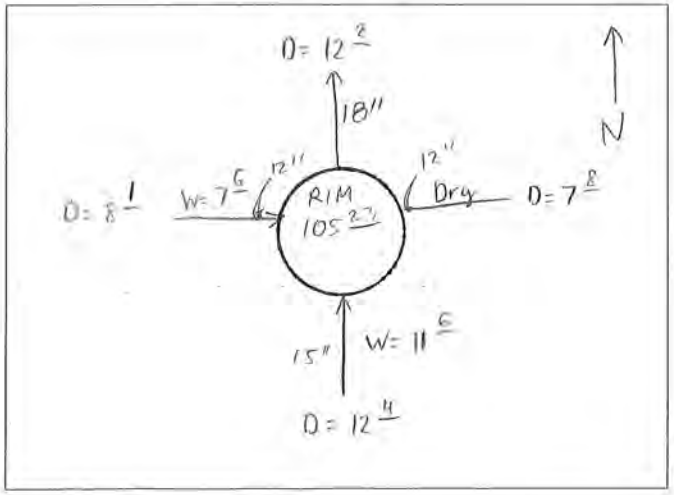
Name of Field Observer(s): CL & KT

MH Number: S 23-27

Street/Intersection: Homestead @ Kiely

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
Can't tell how flow is split.

Other Observations:

Field Verification

Date: 3/20/23 Time: 1:45 pm Weather: (Dry)/Rain

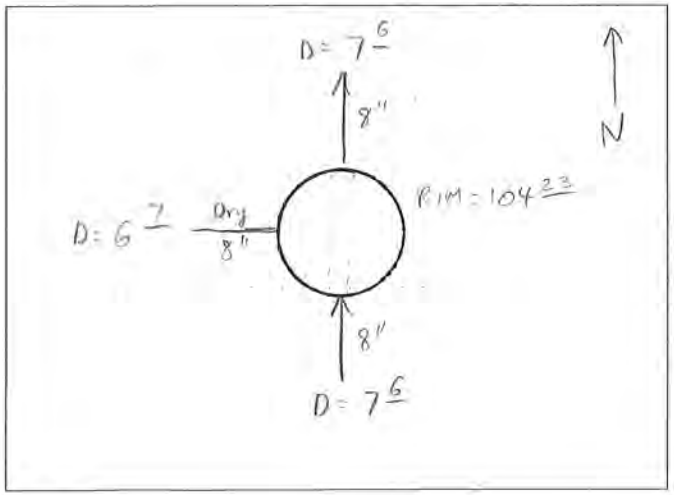
Name of Field Observer(s): CL & KT

MH Number: S26 - 70

Street/Intersection: Newhall @ N. Winchester

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
W = 7 11
All VCP

Field Verification

Date: 4/6/23 Time: 9:15 am Weather: (Dry)/Rain

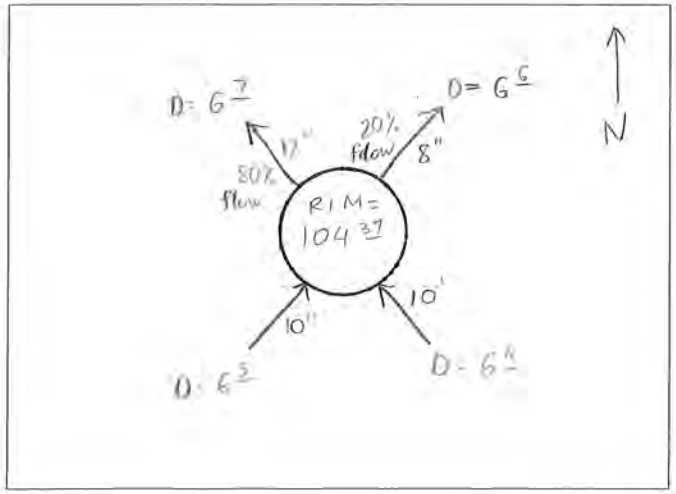
Name of Field Observer(s): CL & KT

MH Number: S25 - 85

Street/Intersection: Las Padres @ Saratoga

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
W = 6 3
All VCP

Field Verification

Date: 3/20/23 Time: 11:45 am Weather: (Dry)/Rain

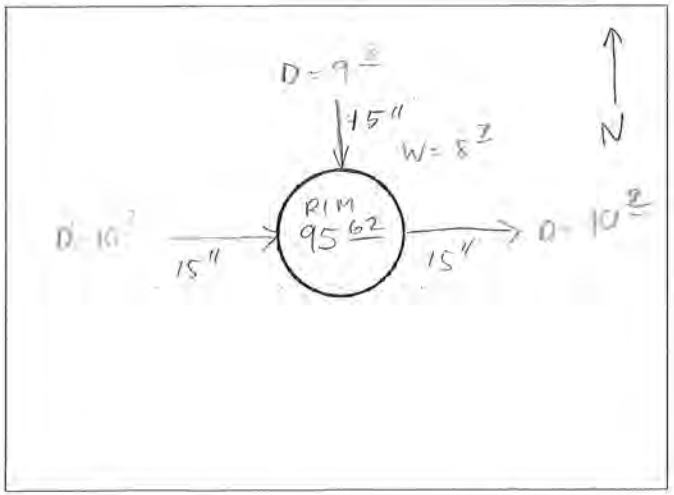
Name of Field Observer(s): CL & KT

MH Number: S 32 - 101

Street/Intersection: Pomeroy @ El Sabrosa

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

most flow goes to the east

Other Observations:

All VCP

Field Verification

Date: 4/5/23 Time: 3:15 pm Weather: (Dry)/Rain

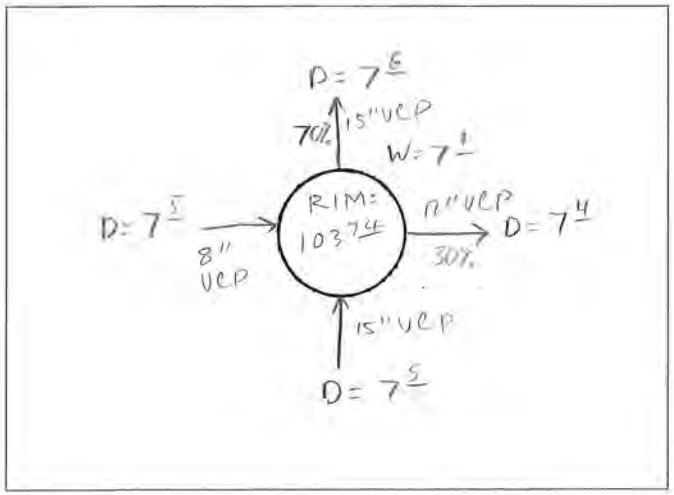
Name of Field Observer(s): CL & KT

MH Number: S 32 - 68

Street/Intersection: Benton @ Pomeroy

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 11:15 am Weather: (Dry)/Rain

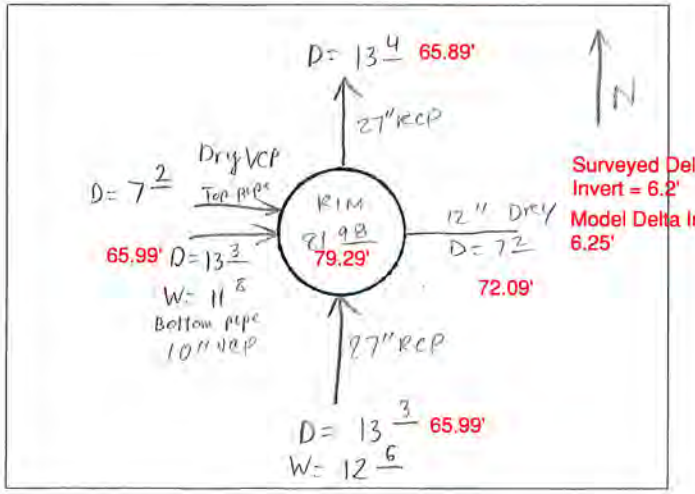
Name of Field Observer(s): CL & KT

MH Number: S 33-5

Street/Intersection: ECR @ Kiely

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/20/23 Time: 11:50 am Weather: (Dry)/Rain

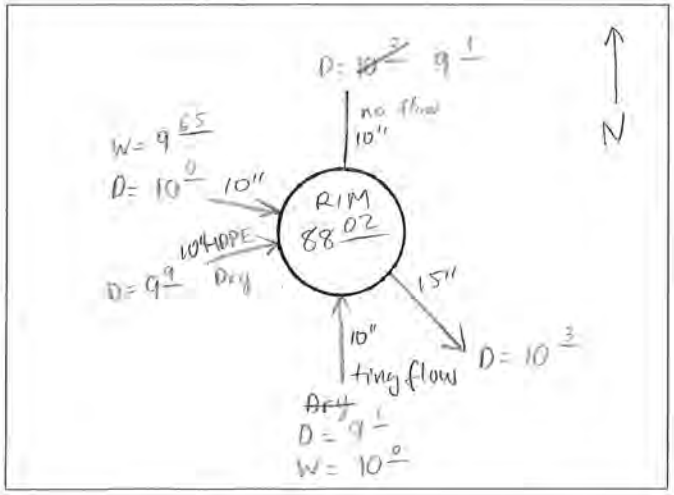
Name of Field Observer(s): CL & KT

MH Number: S 32 102

Street/Intersection: Calaveras @ ECR

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All 100% flow from north western pipe to south eastern pipe

Field Verification

Date: 3/20/23 Time: 9:45 am Weather: (Dry)/Rain

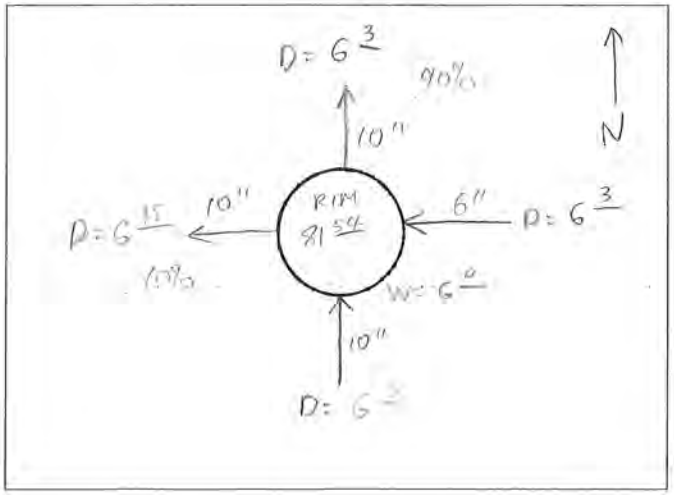
Name of Field Observer(s): CL & KT

MH Number: 535-25

Street/Intersection: Scott @ Clay

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
most flows to north (90%)

Other Observations:
All VCP

Field Verification

Date: 3/17/23 Time: 11:30 am Weather: (Dry)/Rain

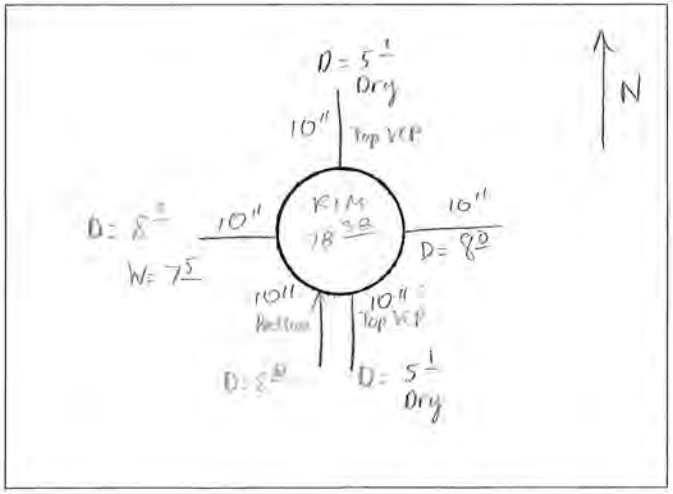
Name of Field Observer(s): CL & KT

MH Number: 535-17

Street/Intersection: ECR @ Scott

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/6/23 Time: 9:30 am Weather: (Dry)/Rain

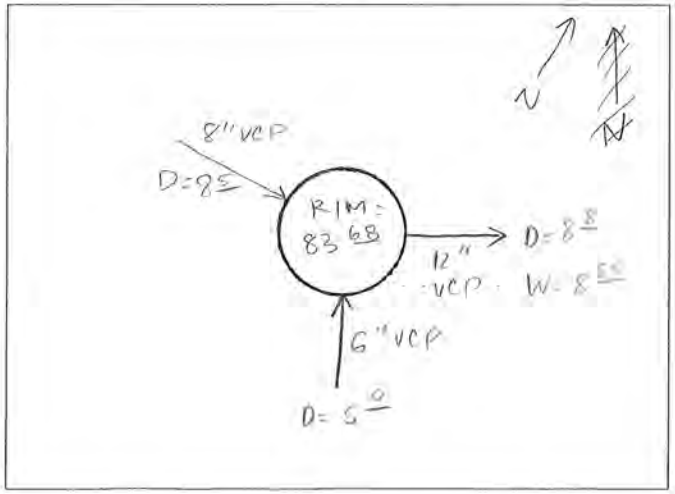
Name of Field Observer(s): CL & KT

MH Number: S 37-49

Street/Intersection: Monroe @ Homestead

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/20/23 Time: 9:30 am Weather: (Dry)/Rain

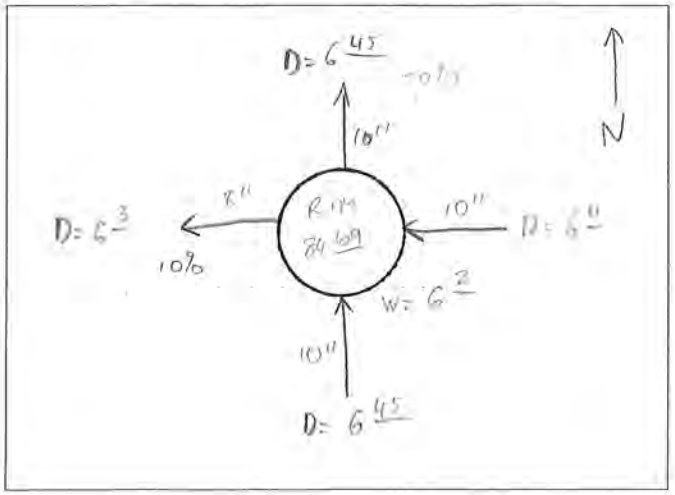
Name of Field Observer(s): CL & KT

MH Number: S 35-42

Street/Intersection: Scott @ Harrison

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
most flow goes north (90%).

Other Observations:
All VCP

Field Verification

Date: 3/17/23 Time: 10:45 a.m. Weather: (Dry)/Rain

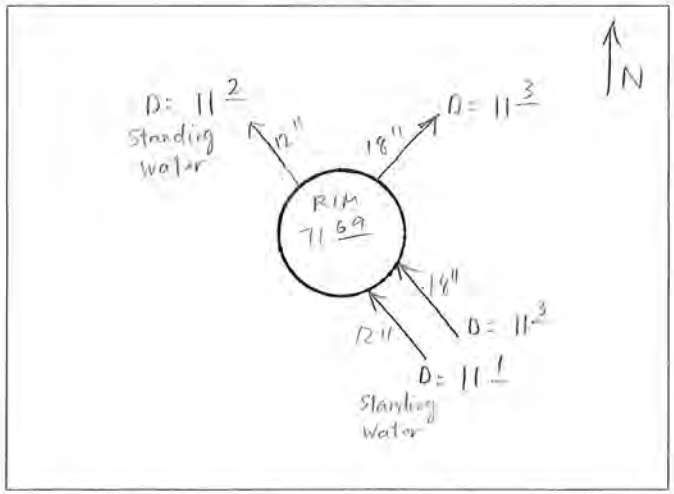
Name of Field Observer(s): CL & KT

MH Number: 538 - 41

Street/Intersection: The Alameda @ Benton

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Most flows from 18" SE to 18" NE, 12" SE to 12" NW seems to have standing water or slow moving

Other Observations:

All VCP
W = 10 95

Field Verification

Date: 3/20/23 Time: 9:15 am Weather: (Dry)/Rain

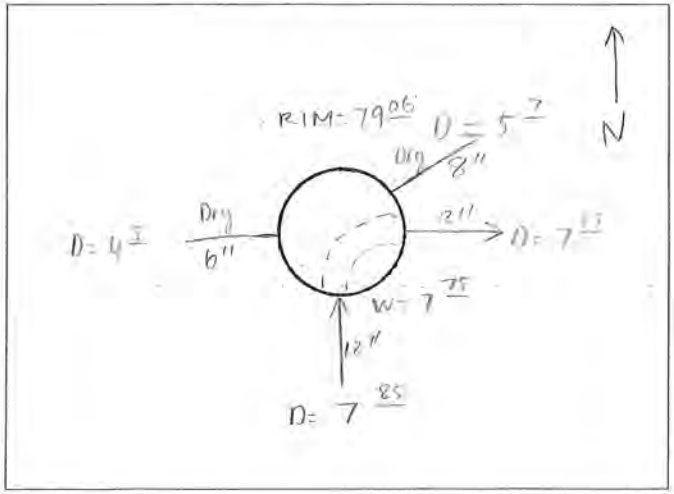
Name of Field Observer(s): CL & KT

MH Number: 537 - 90

Street/Intersection: Monroe @ Benton

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

All VCP

Field Verification

Date: 3/17/23 Time: 11 am Weather: (Dry)/Rain

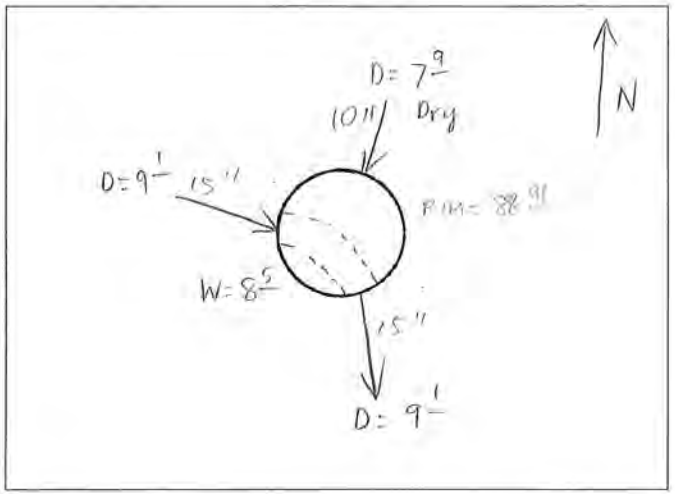
Name of Field Observer(s): CL & KT

MH Number: S42-125

Street/Intersection: ECR @ Calabazas

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 4/5/23 Time: 3:20 pm Weather: (Dry)/Rain

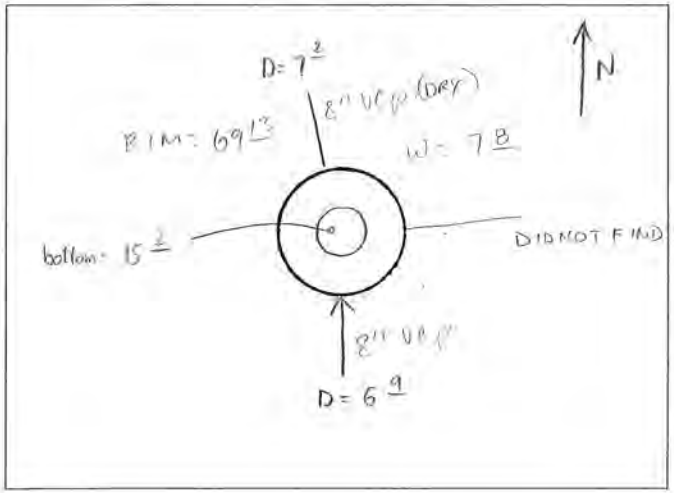
Name of Field Observer(s): CL & KT

MH Number: S42-30

Street/Intersection: Calabazas @ Cabrillo

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 10 am Weather: (Dry)/Rain

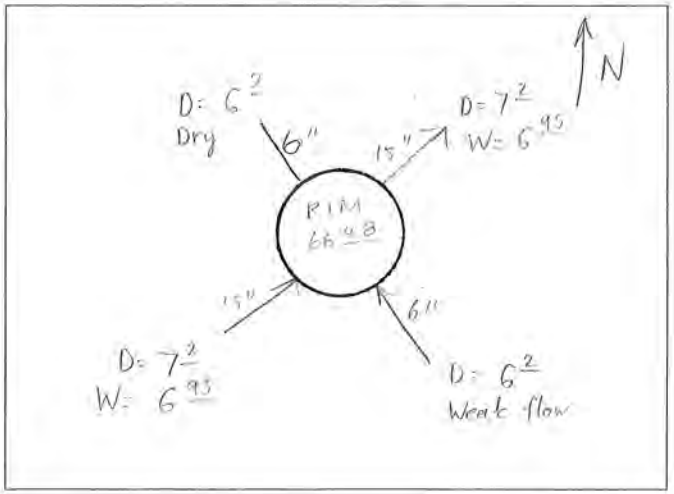
Name of Field Observer(s): CL & KT

MH Number: S47-17

Street/Intersection: Safaglio @ ECR

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/17/23. Time: 10:20 am Weather: (Dry)/Rain

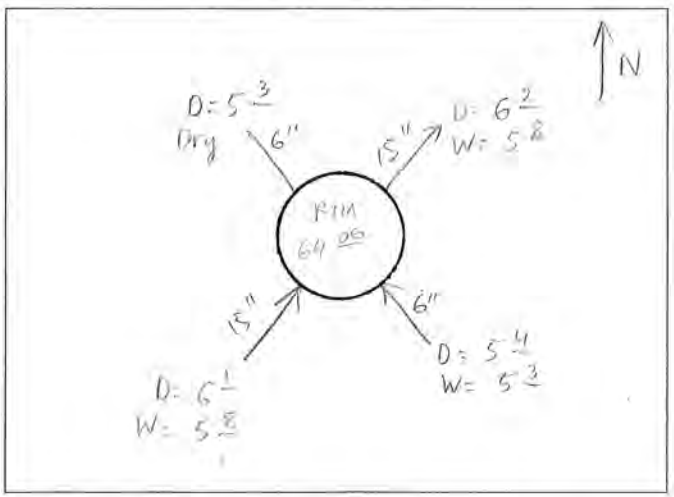
Name of Field Observer(s): CL & KT

MH Number: S47-60

Street/Intersection: ECR @ Alviso St

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

K:\Engineering\Draft\AutoCAD\Surveys\Field Photos\Field Data Verification Form.doc

Field Verification

Date: 3/20/23 Time: 2 pm Weather: (Dry)/Rain

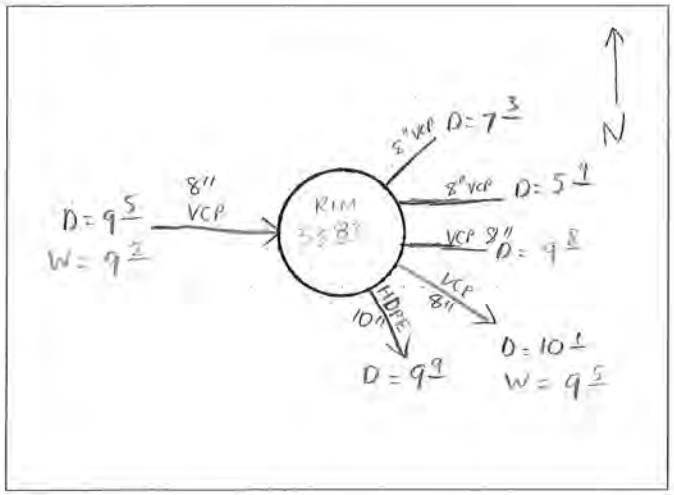
Name of Field Observer(s): CL & KT

MH Number: 552-05

Street/Intersection: Agate @ Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
Most flow goes out to the VCP pipe

Other Observations:

Field Verification

Date: 3/17/23 Time: 9:45 am Weather: (Dry)/Rain

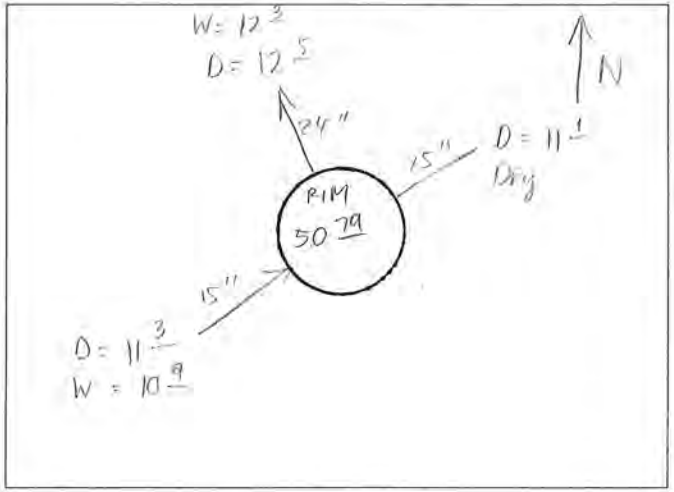
Name of Field Observer(s): CL & KT

MH Number: 548 2

Street/Intersection: De La Cruz @ Reed

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
All flow S/E to N/W.

Other Observations:

Field Verification

Date: 3/20/23 Time: 2:35 pm Weather: (Dry)/Rain

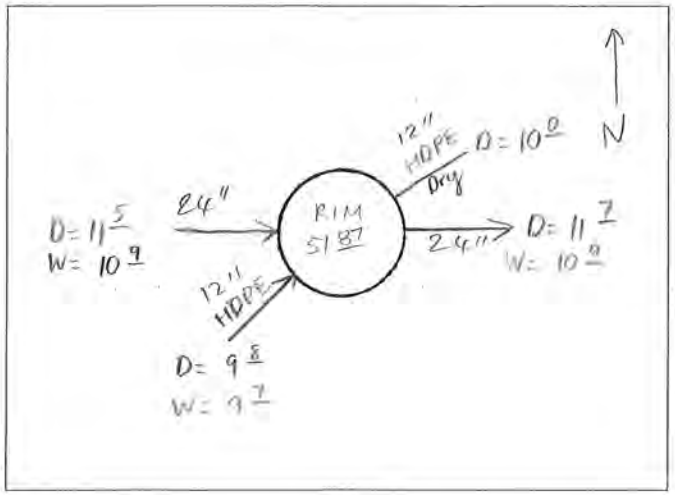
Name of Field Observer(s): CL & KT

MH Number: 553-110

Street/Intersection: Chromite @ East of Cortez

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/2/23 Time: 3:15 pm Weather: (Dry)/Rain

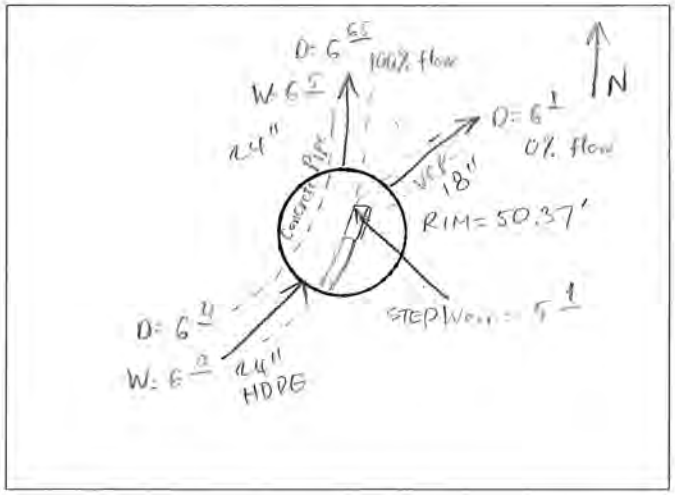
Name of Field Observer(s): CL & KT

MH Number: 553-105

Street/Intersection: Chromite @ East Pilot Knob

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

flow goes from SW to N

No flow goes into VCP

Other Observations:

Field Verification

Date: 4/6/23 Time: 10:15 am Weather: (Dry)/Rain

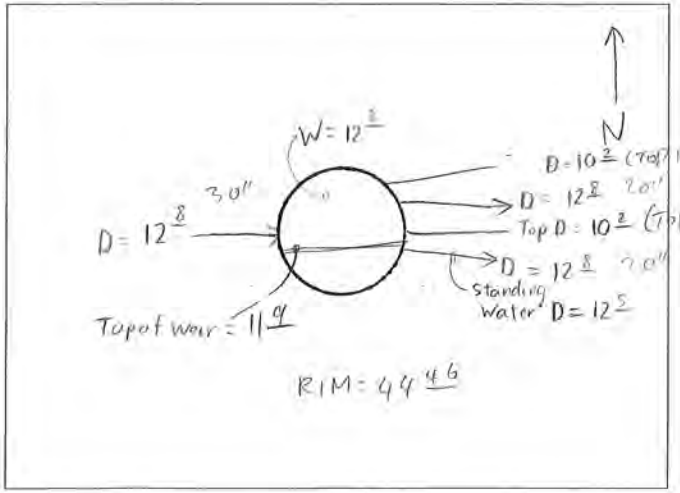
Name of Field Observer(s): CL & KT

MH Number: S55-51

Street/Intersection: Walsh @ Scott

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/5/23 Time: 4:15 pm Weather: (Dry)/Rain

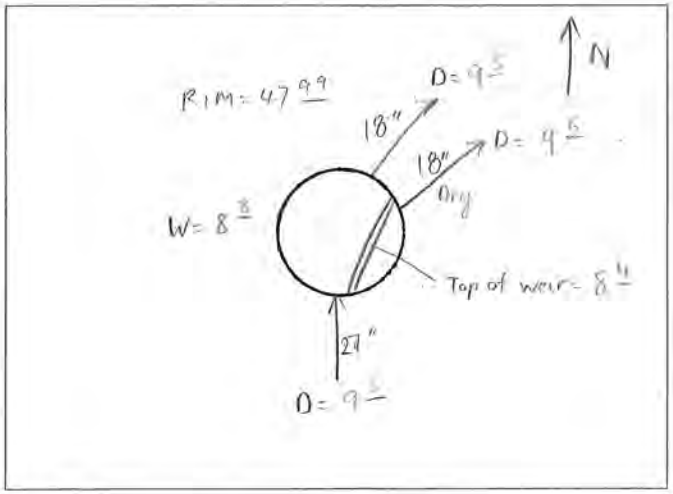
Name of Field Observer(s): CL & KT

MH Number: S54-94

Street/Intersection: Parking lot South of Walsh

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/6/23 Time: 9:45 am Weather: (Dry)/Rain

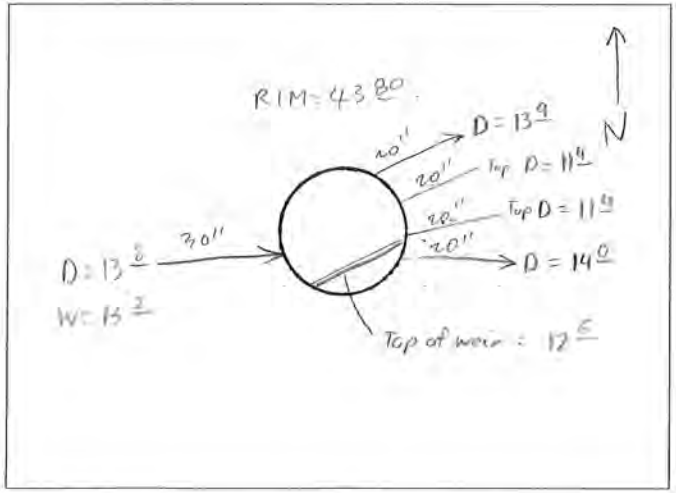
Name of Field Observer(s): CL & KT

MH Number: S56-58

Street/Intersection: Walsh @ Lafayette

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
ALL PIPES = HDPE

Field Verification

Date: 4/6/23 Time: 10 am Weather: (Dry)/Rain

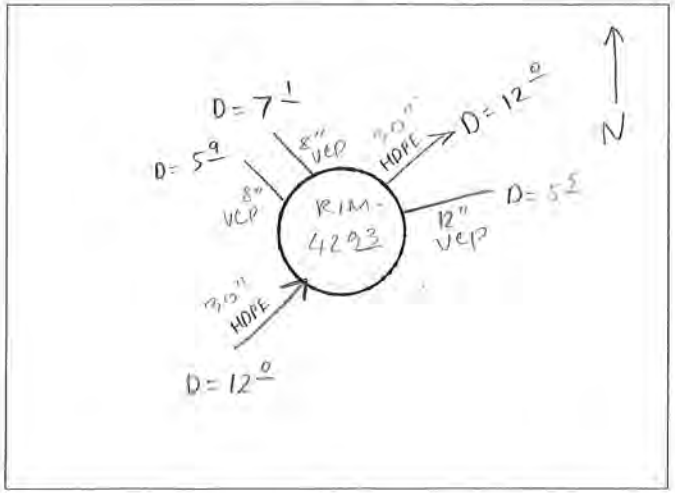
Name of Field Observer(s): CL & KT

MH Number: S56-02

Street/Intersection: Walsh in front of sub-station

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
W = 11 1

Field Verification

Date: 3/17/23 Time: 9:30 am Weather: (Dry/Rain)

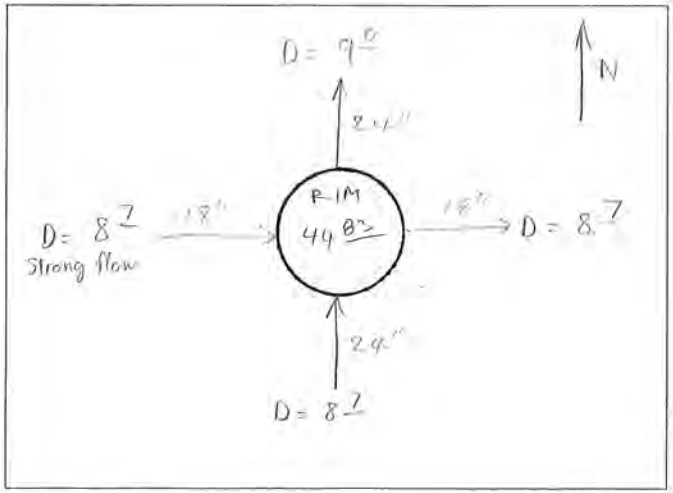
Name of Field Observer(s): CL & KT

MH Number: 558-21

Street/Intersection: De la Cruz @ Mathew

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
Mostly going out to north pipe

Other Observations:
W_D = 8 1

Field Verification

Date: 3/17/23 Time: 9 am Weather: (Dry/Rain)

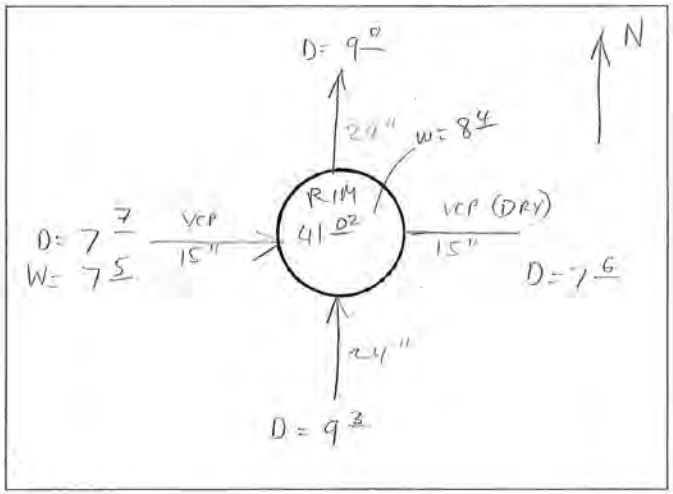
Name of Field Observer(s): CL & KT

MH Number: 558-12

Street/Intersection: De la Cruz @ Martin

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

K:\Engineering\Draft\AutoCAD\Surveys\Field Photos\Field Data Verification Form.doc

Field Verification

Date: 3/17/23 Time: 2 pm Weather: Dry/Rain

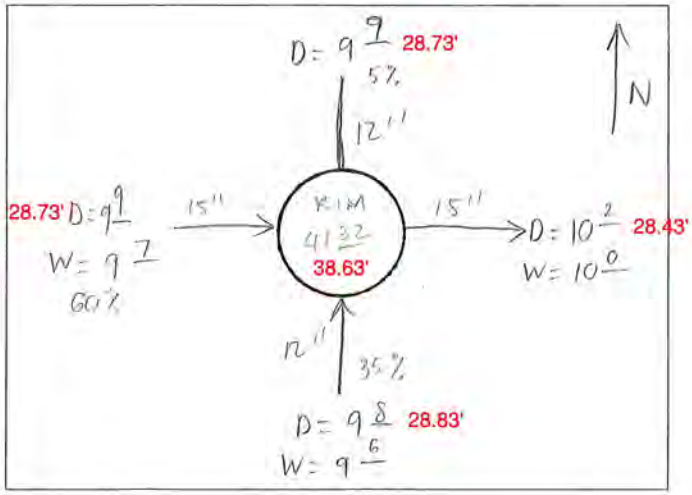
Name of Field Observer(s): CL & KT

MH Number: SG2-11

Street/Intersection: Corvin @ Central

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

K:\Engineering\Draft\AutoCAD\Surveys\Field Photos\Field Data Verification Form.doc

Field Verification

Date: 3/17/23 Time: 2:15 pm Weather: Dry/Rain

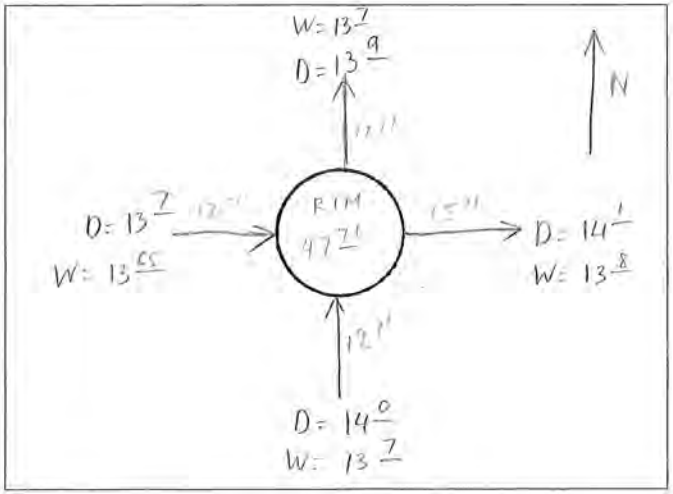
Name of Field Observer(s): CL & KT

MH Number: SG1-16

Street/Intersection: Central Expy

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
strong flow west to east.
weak flow west to [illegible]

Other Observations:
All VCP

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Field Verification

Date: 3/6/23 Time: 3:00 pm Weather: (Dry)/Rain

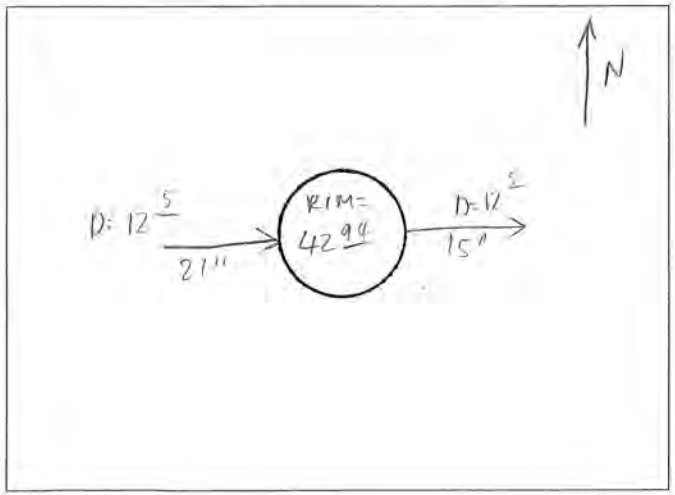
Name of Field Observer(s): CL & KT

MH Number: SG2 - 7

Street/Intersection: Central Expwy @ Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

All VCP

W_D : 12 6/8

Field Verification

Date: 3/6/23 Time: 2:45 pm Weather: (Dry)/Rain

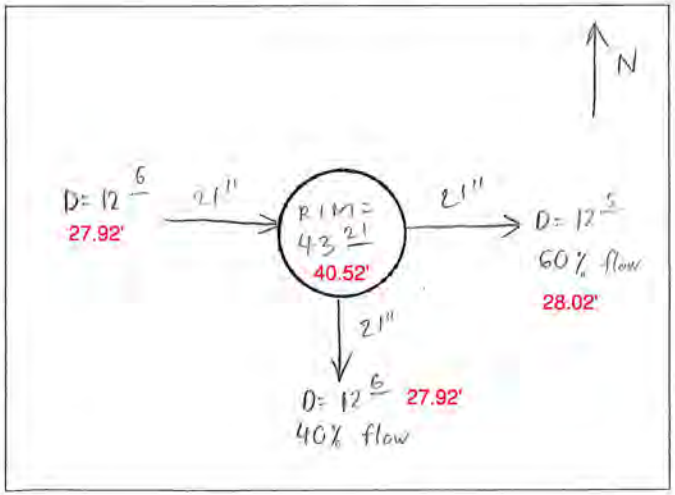
Name of Field Observer(s): CL & KT

MH Number: SG2 - 6

Street/Intersection: Central Expwy @ Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Most flow goes east

Other Observations:

W_D = 12 4/8 28.12'

All VCP

Field Verification

Date: 3/17/23 Time: 1:45 pm Weather: Dry/Rain

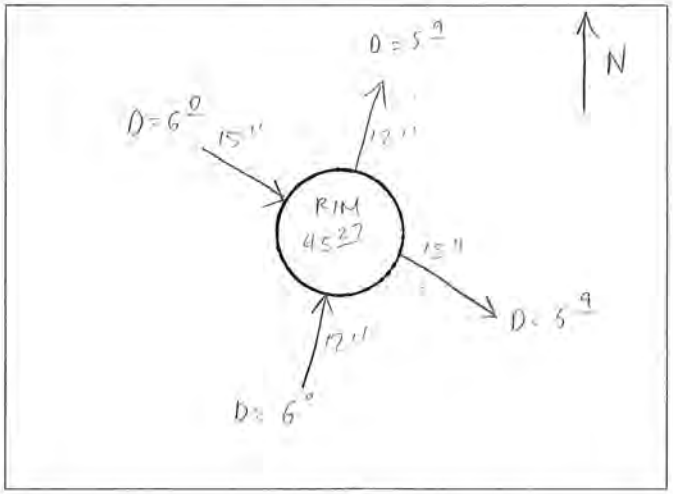
Name of Field Observer(s): CL & KT

MH Number: S64-32

Street/Intersection: Walsh @ Northwestern

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP
W = 5 85

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Field Verification

Date: 3/6/23 Time: 3:15 pm Weather: Dry/Rain

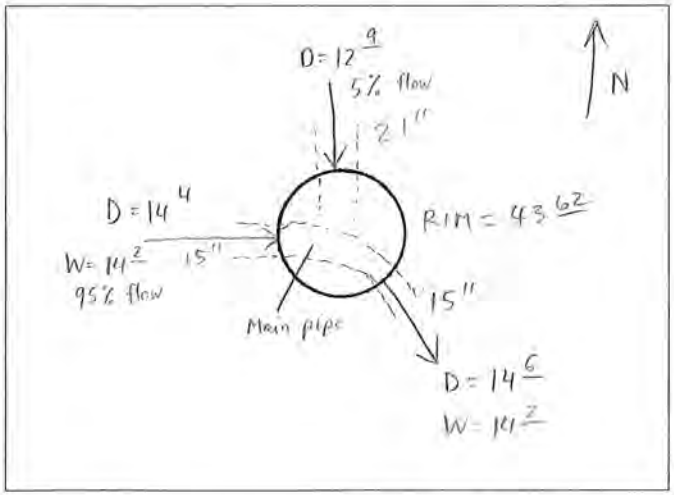
Name of Field Observer(s): CL & KT

MH Number: S62-8

Street/Intersection: Central Expwy @ Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

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Field Verification

Date: 4/5/23 Time: 3:45 pm Weather: (Dry)/Rain

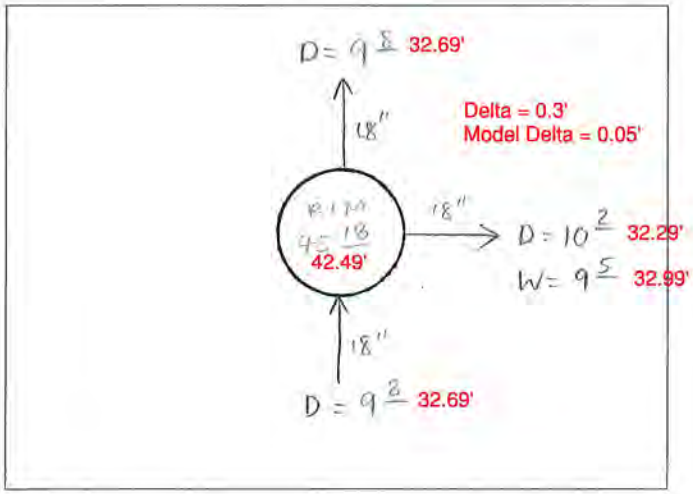
Name of Field Observer(s): CL & KT

MH Number: S64-46

Street/Intersection: San Tomas Expy

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

70% North

30 % East

Other Observations:

All VCP

Field Verification

Date: 4/5/23 Time: 4 pm Weather: (Dry)/Rain

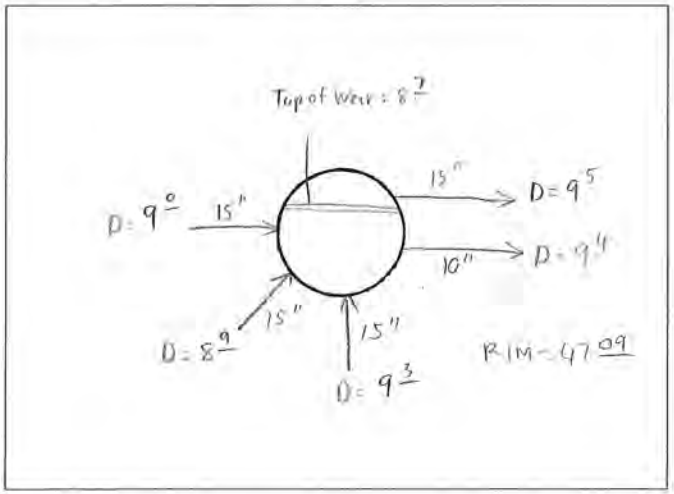
Name of Field Observer(s): CL & KT

MH Number: S64-34

Street/Intersection: San Tomas Creek trail North of Walsh

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

WO = 8 9

All VCP

Field Verification

Date: _____ Time: _____ Weather: Dry/Rain

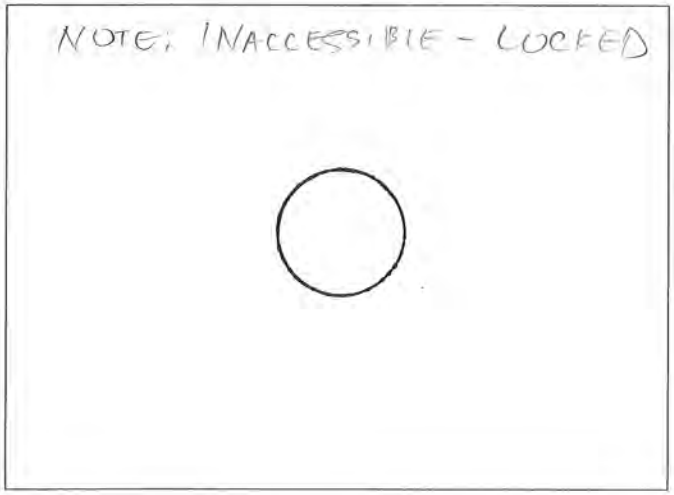
Name of Field Observer(s): _____

MH Number: S68-9

Street/Intersection: _____

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/3/23 Time: 11:15 am Weather: (Dry)/Rain

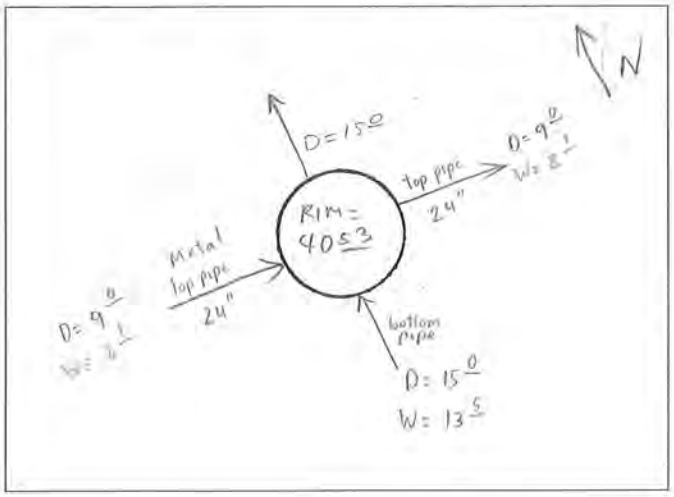
Name of Field Observer(s): CL & KT

MH Number: S65-30

Street/Intersection: Central Expwy @ ~~North~~ East of Scott Blvd

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
top pipe obstructs the view of the bottom pipe

Field Verification

Date: 3/17/23 Time: 3:30 pm Weather: (Dry)/Rain

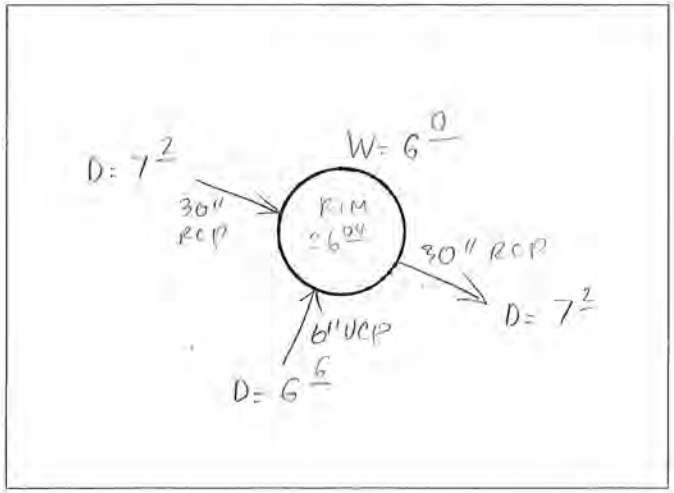
Name of Field Observer(s): CL & KT

MH Number: 572-3

Street/Intersection: Lakeside

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: _____ Time: _____ Weather: Dry/Rain

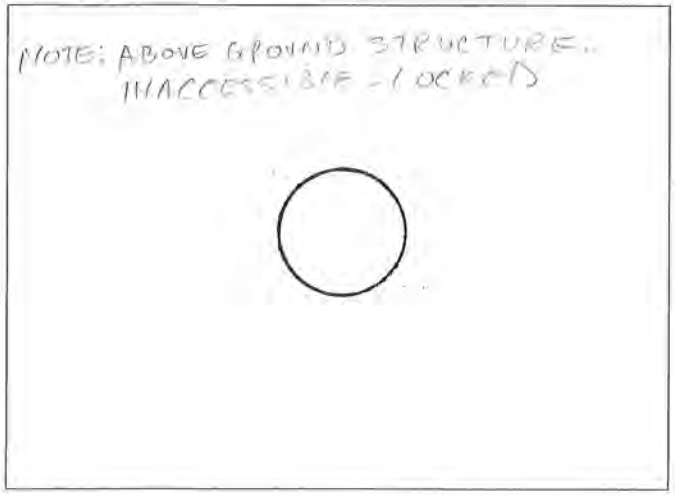
Name of Field Observer(s): _____

MH Number: S68-10

Street/Intersection: _____

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

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Field Verification

Date: 3/17/23 Time: 3:15 pm Weather: (Dry)/Rain

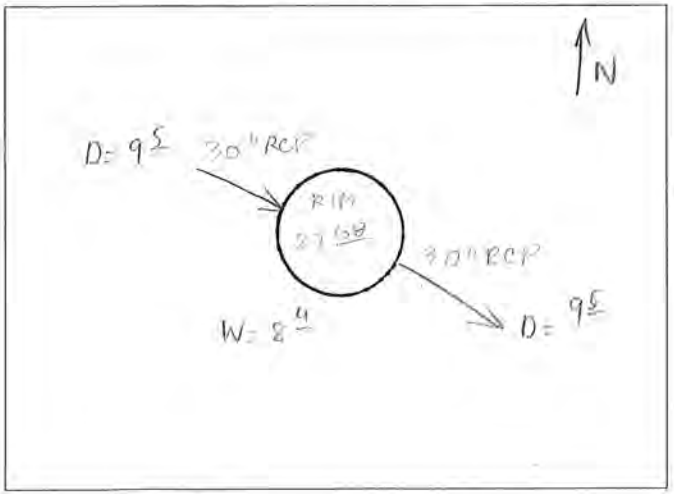
Name of Field Observer(s): CL & KT

MH Number: 572-5

Street/Intersection: Lakeside @ E of Peterson

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 3:20 pm Weather: (Dry)/Rain

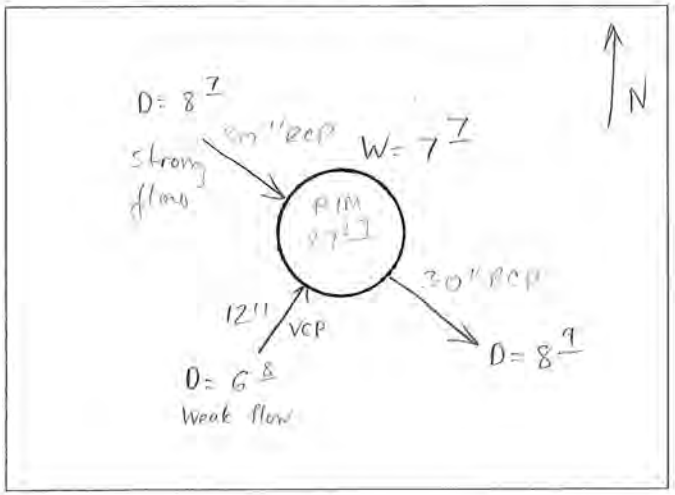
Name of Field Observer(s): CL & KT

MH Number: 572-4

Street/Intersection: Lakeside @ Peterson

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 3:50 pm Weather: (Dry)/Rain

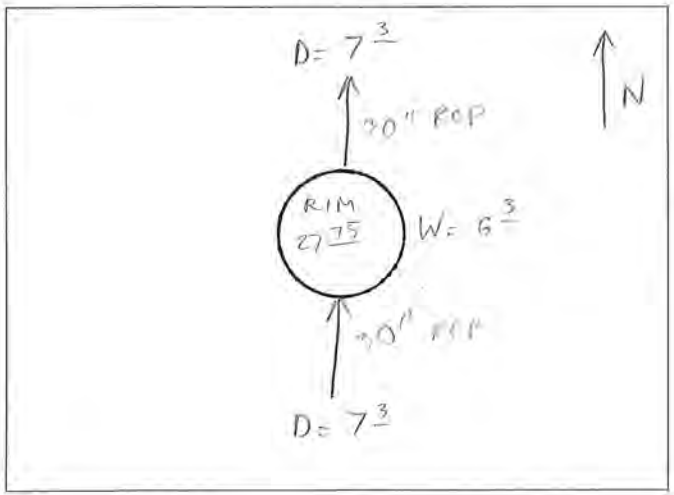
Name of Field Observer(s): CL & KT

MH Number: 572-7

Street/Intersection: Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 3:45 pm Weather: (Dry)/Rain

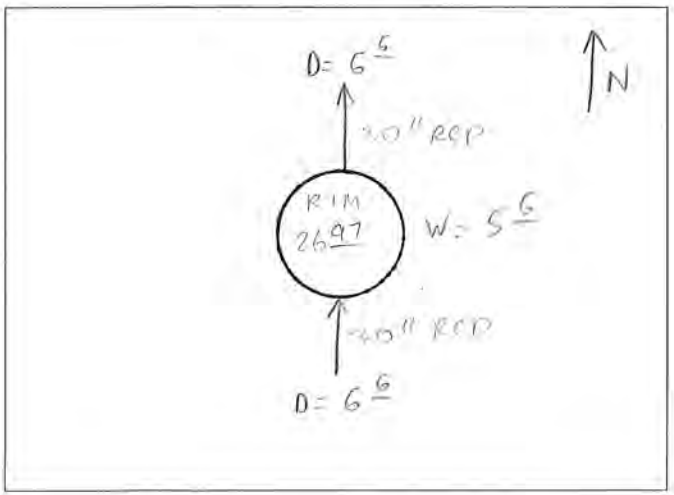
Name of Field Observer(s): CL & KT

MH Number: 572-6

Street/Intersection: Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

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Field Verification

Date: 3/17/23 Time: 3:55 pm Weather: (Dry)/Rain

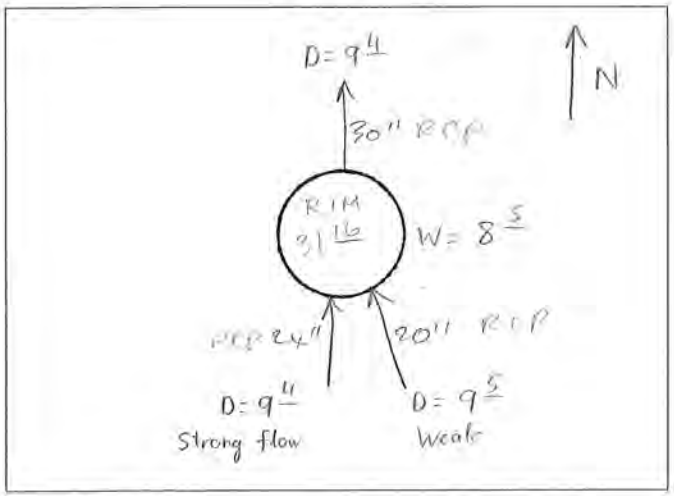
Name of Field Observer(s): CL & KT

MH Number: S72-11

Street/Intersection: Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 3:50 pm Weather: (Dry)/Rain

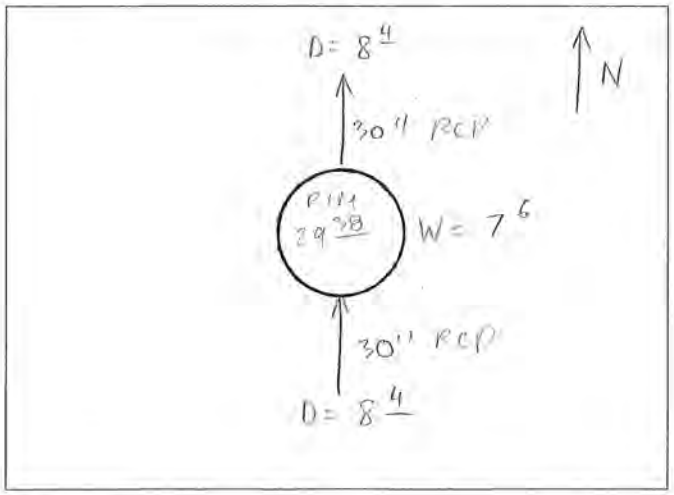
Name of Field Observer(s): CL & KT

MH Number: S72-8

Street/Intersection: Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 2:50 pm Weather: (Dry)/Rain

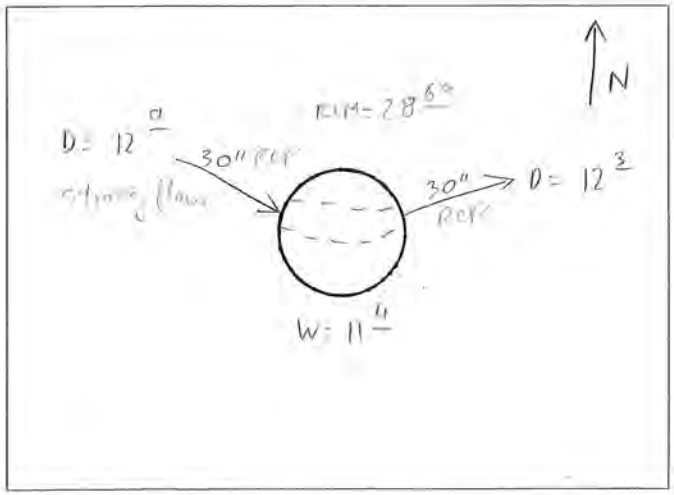
Name of Field Observer(s): CL & KT

MH Number: S73-6

Street/Intersection: Lakeside Dr

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/17/23 Time: 3 pm Weather: (Dry)/Rain

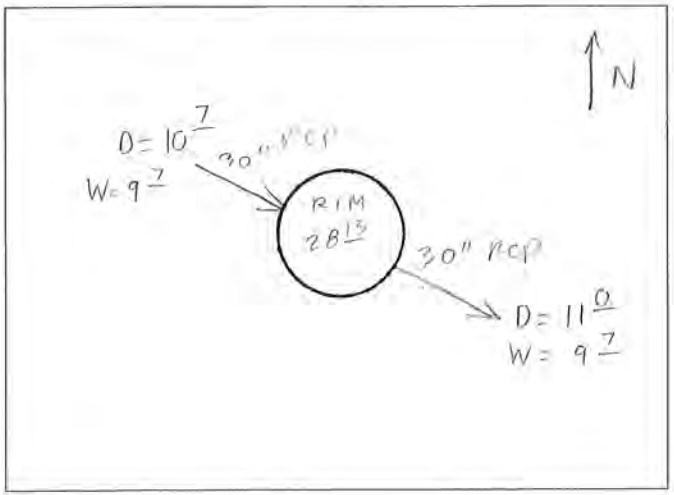
Name of Field Observer(s): CL & KT

MH Number: S73-5

Street/Intersection: Lakeside Rd

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

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Field Verification

Date: 4/5/23 Time: 2:10 pm Weather: (Dry)/Rain

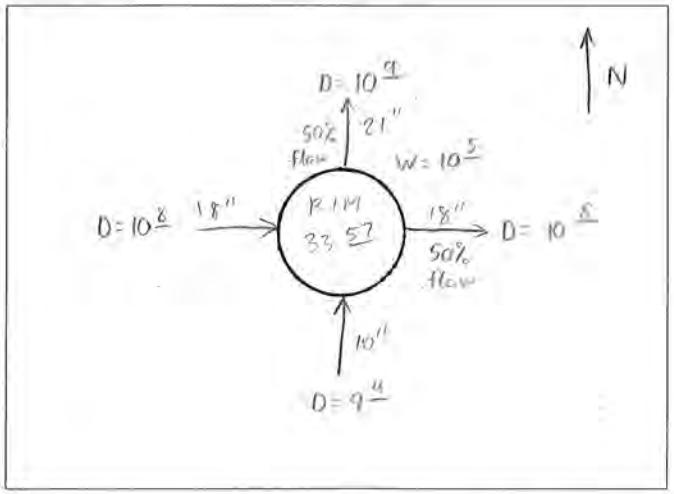
Name of Field Observer(s): CL & KT

MH Number: S 73 - 29

Street/Intersection: Scott @ Lakeside

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
Alt VCP

Field Verification

Date: 3/17/23 Time: 2:40 pm Weather: (Dry)/Rain

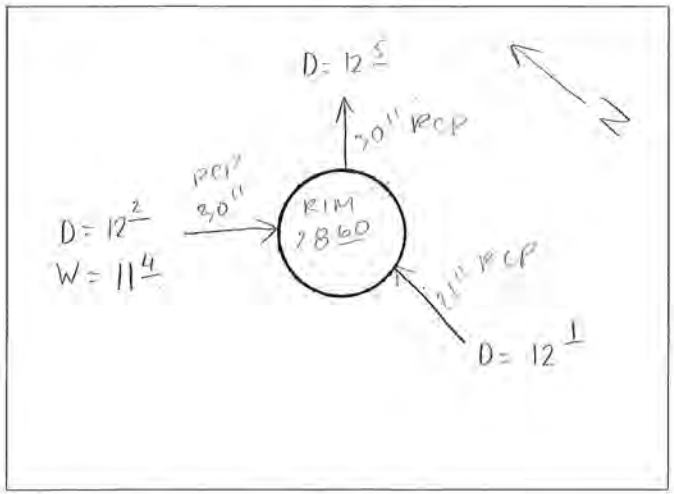
Name of Field Observer(s): CL & KT

MH Number: S73 - 7

Street/Intersection: Lakeside Dr

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
Most flow goes from NW to NE.

Other Observations:
W= 11 4

Field Verification

Date: 3/17/23 Time: 3:40 pm Weather: (Dry)/Rain

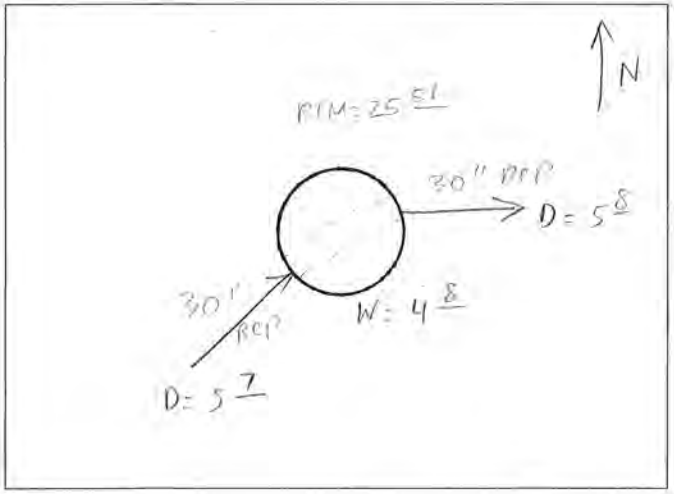
Name of Field Observer(s): CL & KT

MH Number: 582-9

Street/Intersection: Soboside @ Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/5/23 Time: 2 pm Weather: (Dry)/Rain

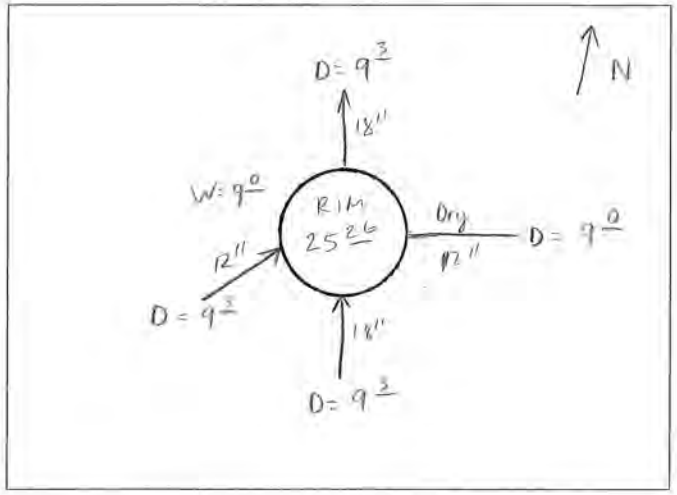
Name of Field Observer(s): CL & KT

MH Number: S 74 - 46

Street/Intersection: Juliette Ln

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/20/23 Time: 3pm Weather: (Dry)/Rain

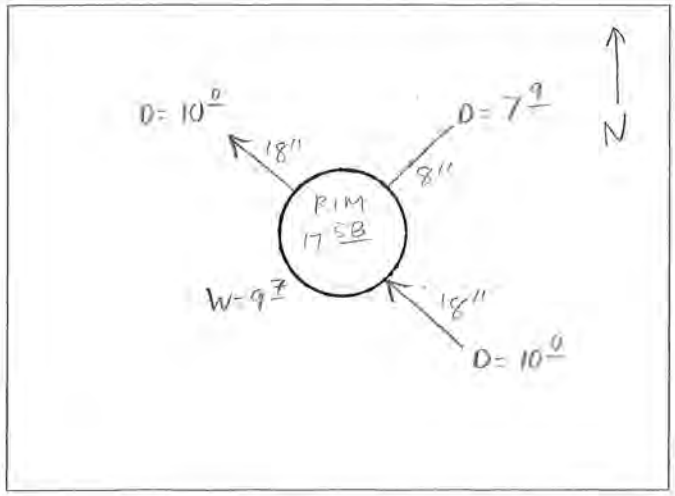
Name of Field Observer(s): CL & KT

MH Number: S 85 - 9

Street/Intersection: Bassett @ Second St

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

All VCP

Field Verification

Date: 3/17/23 Time: 3:35 pm Weather: (Dry)/Rain

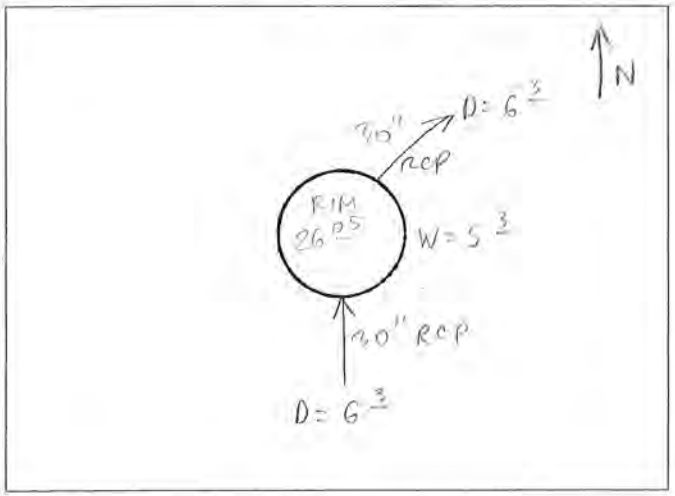
Name of Field Observer(s): CL & KT

MH Number: S 82 - 10

Street/Intersection: Lakeside @ Calabazas Creek

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/8/23 Time: 11:10 am Weather: (Dry)/Rain

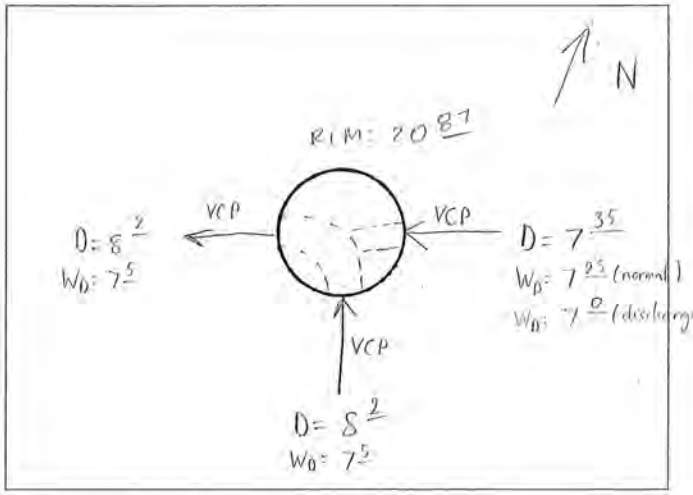
Name of Field Observer(s): CL & KT

MH Number: 587 - 1

Street/Intersection: Della Cruz @ Montague Expwy

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 3/20/23 Time: 2:50 pm Weather: (Dry)/Rain

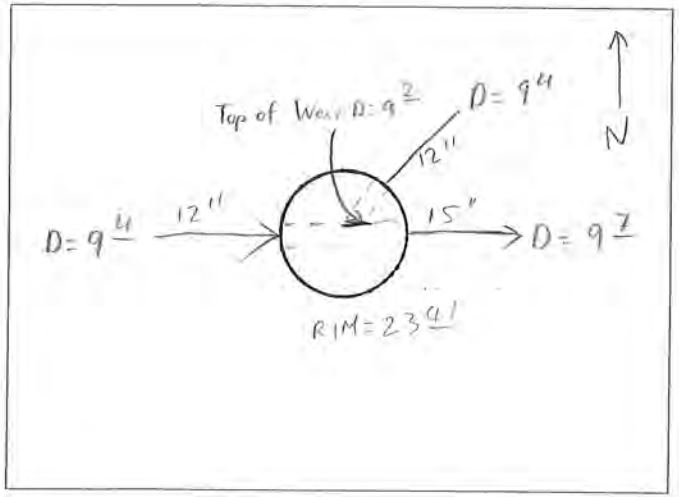
Name of Field Observer(s): CL & KT

MH Number: 585-76

Street/Intersection: MCB @ Burton

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
W= 9 3

Field Verification

Date: 3/20/23 Time: 3:15 pm Weather: (Dry)/Rain

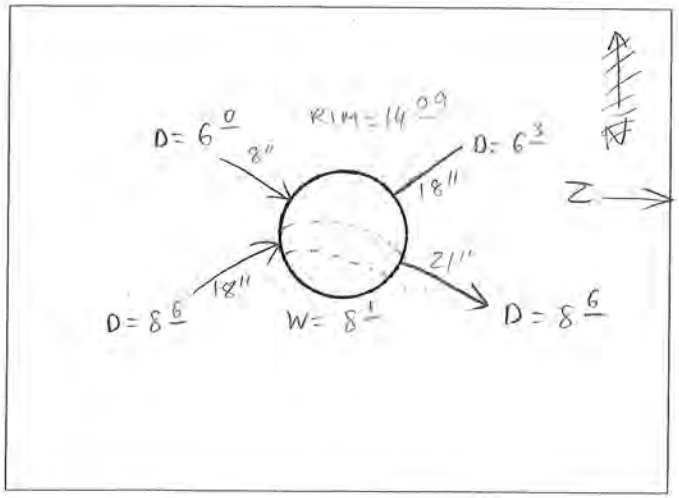
Name of Field Observer(s): CL & KT

MH Number: 595-74

Street/Intersection: Wilcox @ E of Esperanza

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/3/23 Time: 11:45 am Weather: (Dry)/Rain

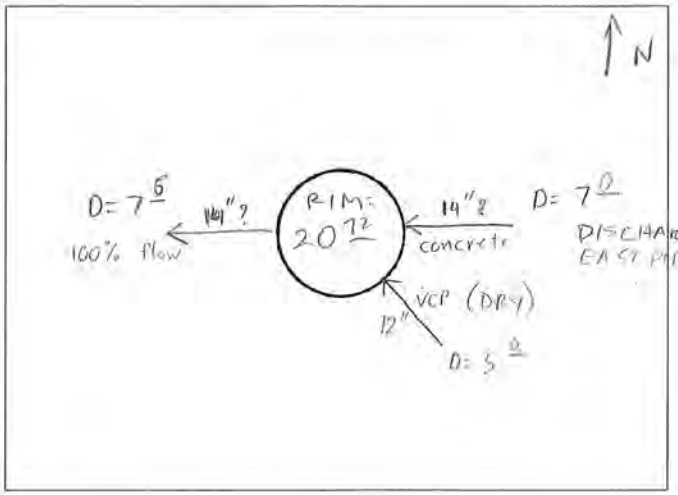
Name of Field Observer(s): CL & KT

MH Number: 587-02

Street/Intersection: De la Cruz Lift Station

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
Most flow goes from East to West on the concrete pipe

Other Observations:
Water level when discharging is 5 7 and 6 5 when water is standing still

Field Verification

Date: 3/6/23 Time: 2:15 pm Weather: (Dry)/Rain

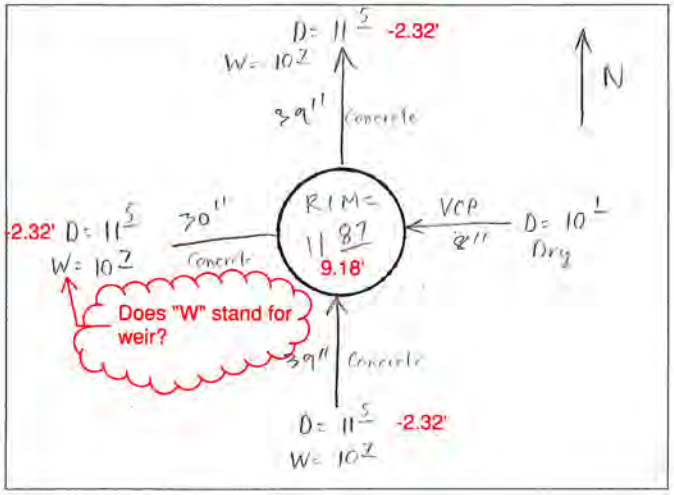
Name of Field Observer(s): CL & KT

MH Number: S103 - 23

Street/Intersection: Great America Pkwy @ Convention Center

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
Flow mostly goes north

Other Observations:

Field Verification

Date: 3/6/23 Time: 2:30 pm Weather: (Dry)/Rain

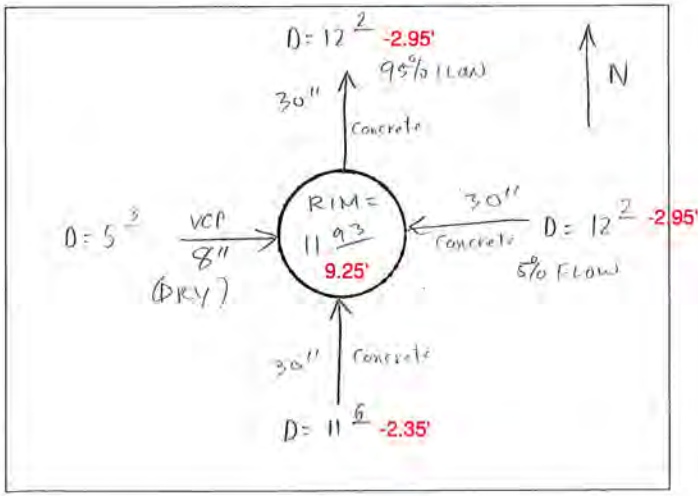
Name of Field Observer(s): CL & KT

MH Number: S103 - 22

Street/Intersection: Great America Pkwy @ 5200 block

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?
Flow most goes north

Other Observations:
W_D = 10 8/12

Field Verification

Date: 4/5/23 Time: 11:40 pm Weather: (Dry)/Rain

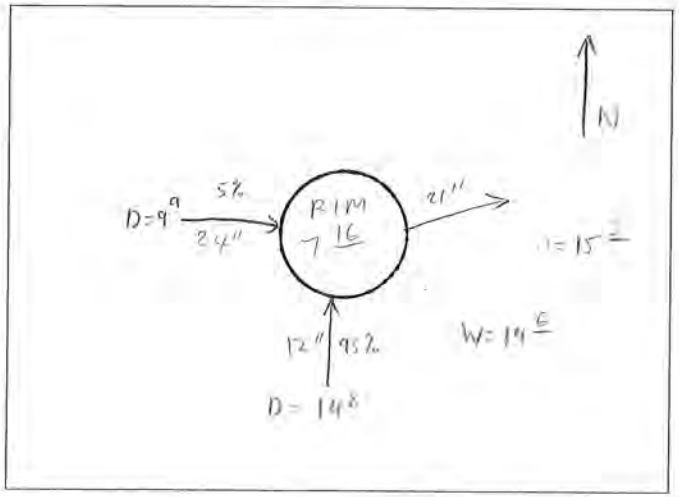
Name of Field Observer(s): CL & KT

MH Number: S105-36

Street/Intersection: Calle Do Sol @ Calle Or Luna

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:
All VCP

Field Verification

Date: 3/6/23 Time: 2:00 pm Weather: (Dry)/Rain

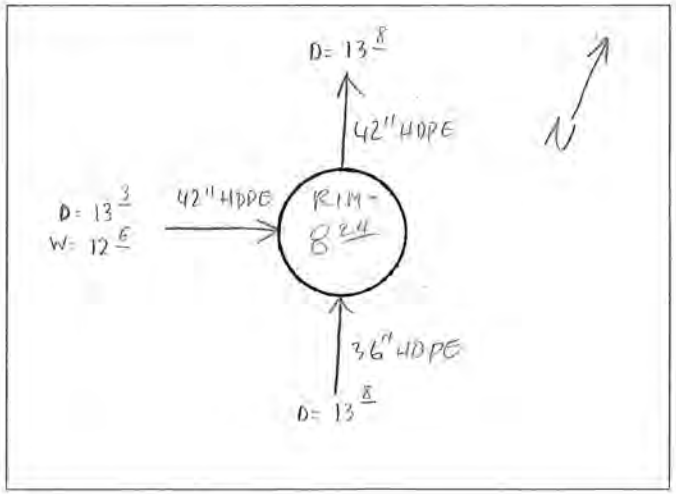
Name of Field Observer(s): CL & KT

MH Number: S104-19

Street/Intersection: Lafayette St

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

Field Verification

Date: 4/5/23 Time: 1:30 pm Weather: (Dry)/Rain

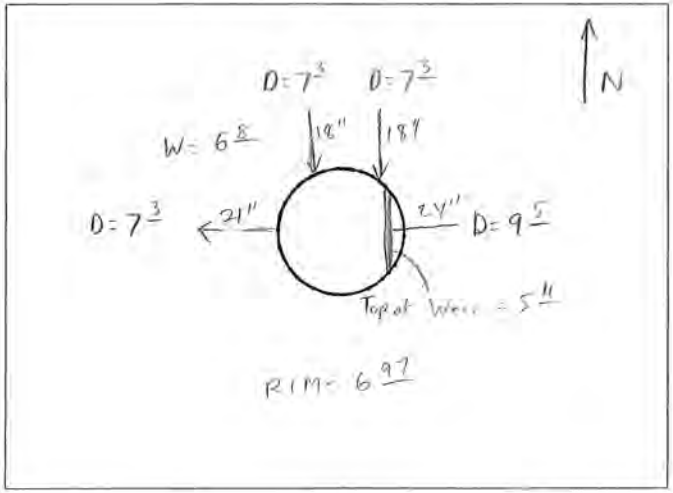
Name of Field Observer(s): CL & KT

MH Number: S105-37

Street/Intersection: Calle De Sol @ Calle De Luna

Manhole sketch:

Draw all inlet and outlet pipes.
Note all pipe sizes and materials. If pipe is lined, note on drawing.
Measure depth to each invert for all pipes.
Provide rim and invert elevations, if possible (note datum)
If there is channelization, note on drawing.
Draw all weirs and gates and measure depth to top of weir.
Always take pictures.



Where is most of the flow going out to? Or is the flow evenly split?

Other Observations:

All VCP

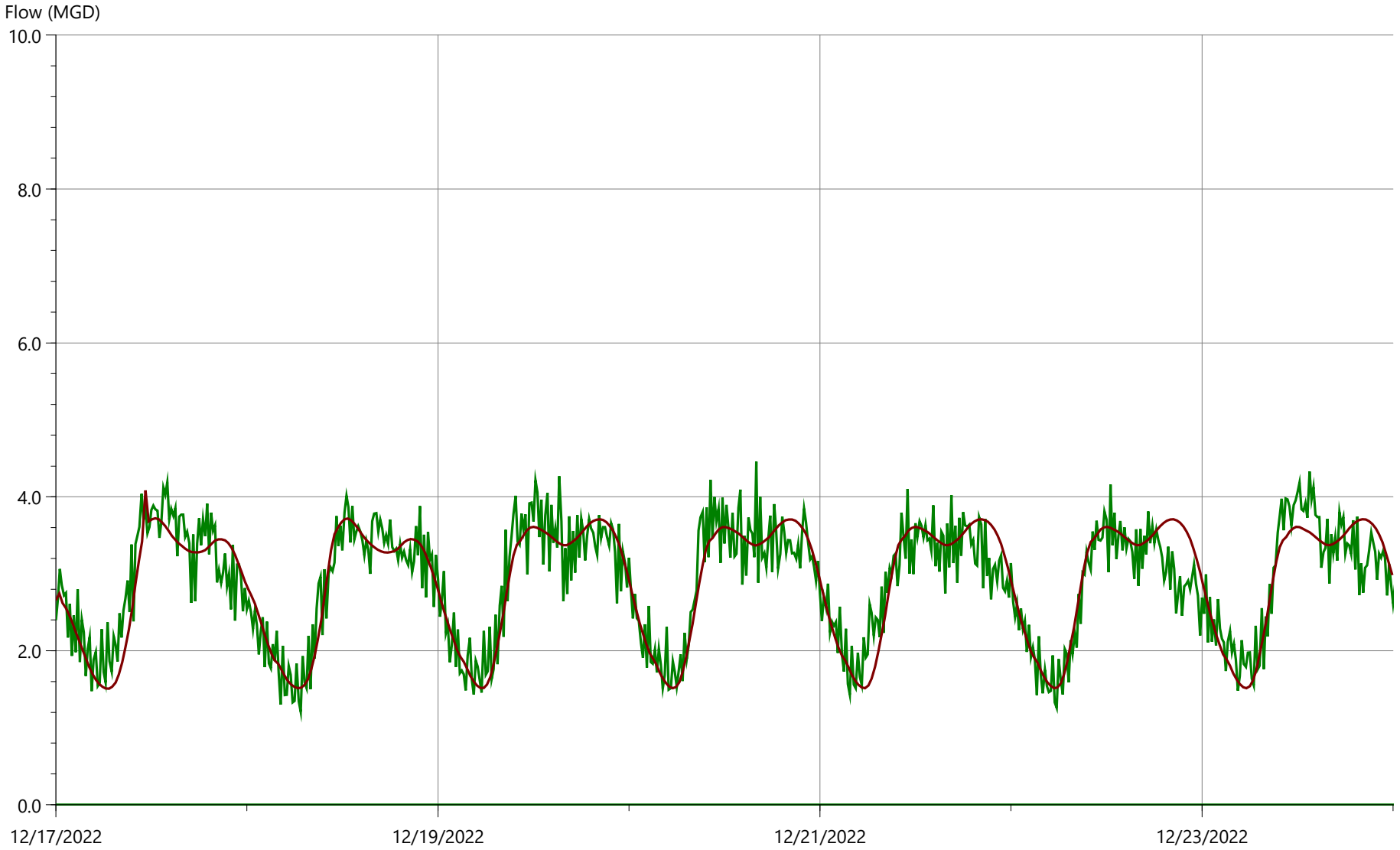
APPENDIX F: CALIBRATION RESULTS

Dry Weather Flow Calibration Plots
Modeled vs. 2022-2023 Metered Flows

(*assumes clog at Homestead/Lawrence gate structure*)

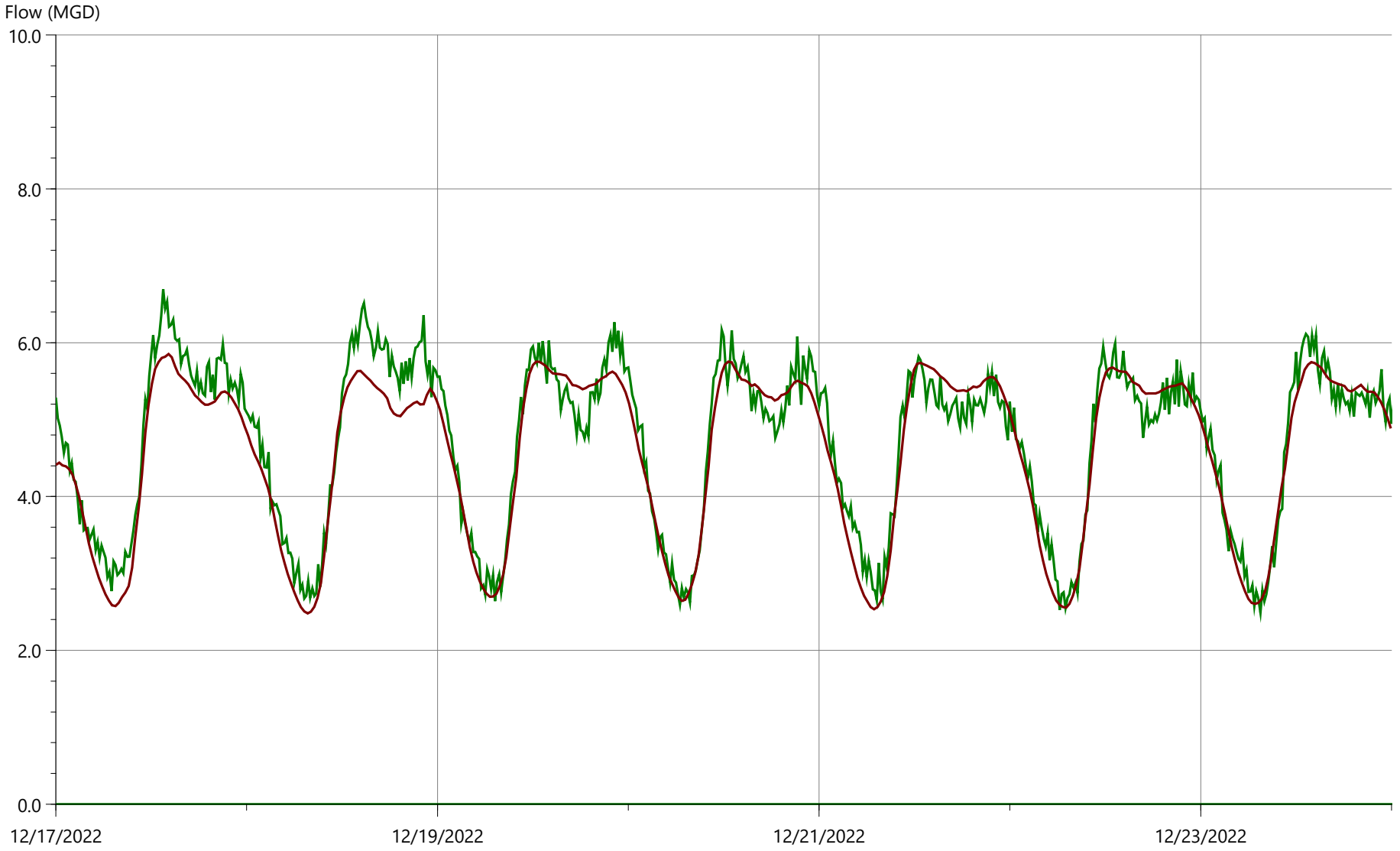
Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...

Flow Survey Location (Obs.) 1, Model Location (Pred.) D/S S104-29.1



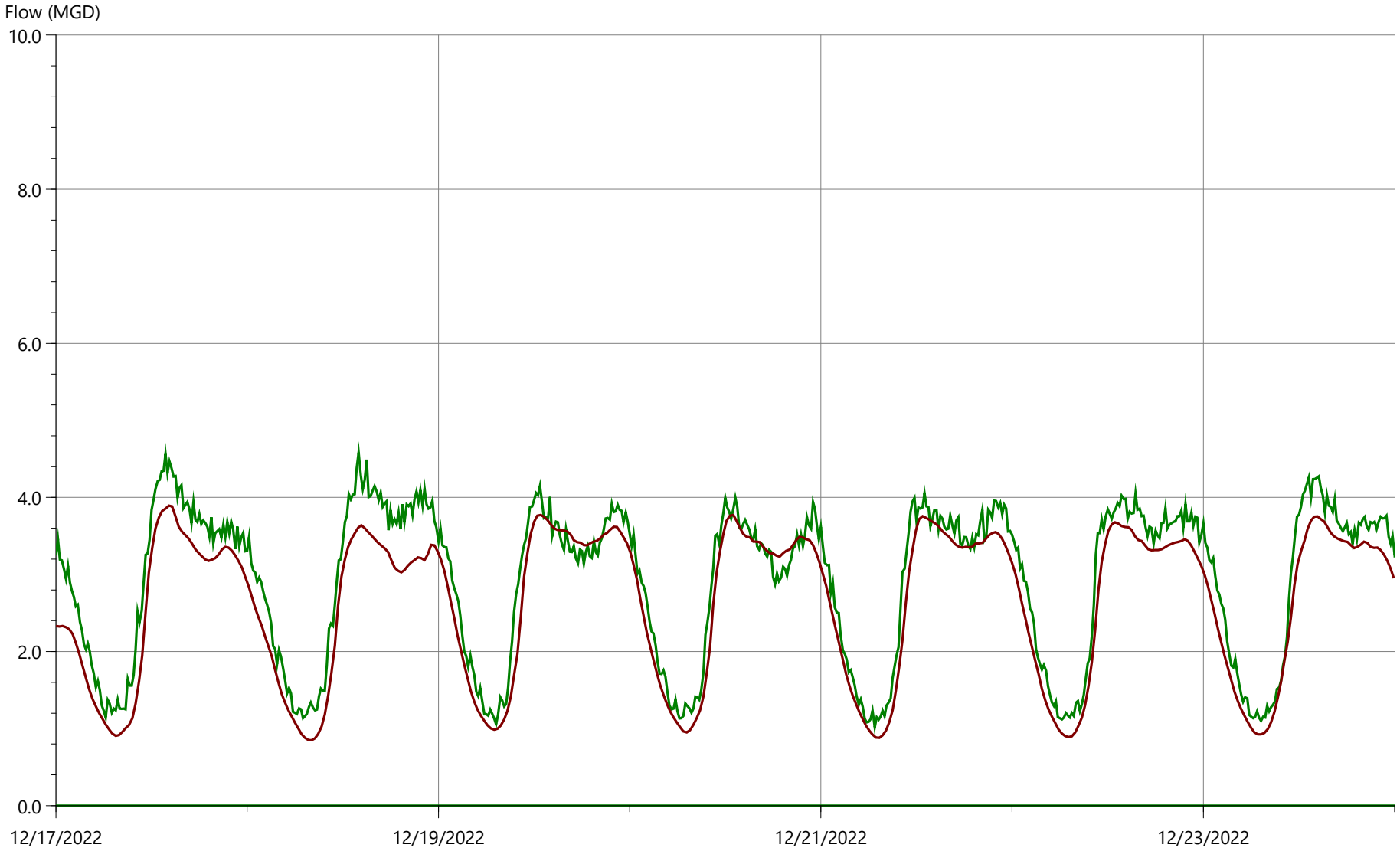
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	1.210	4.456	20.361
...ation (Homestead Blockage) DWF	1.509	4.082	20.343

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 2, Model Location (Pred.) D/S S103-9.1



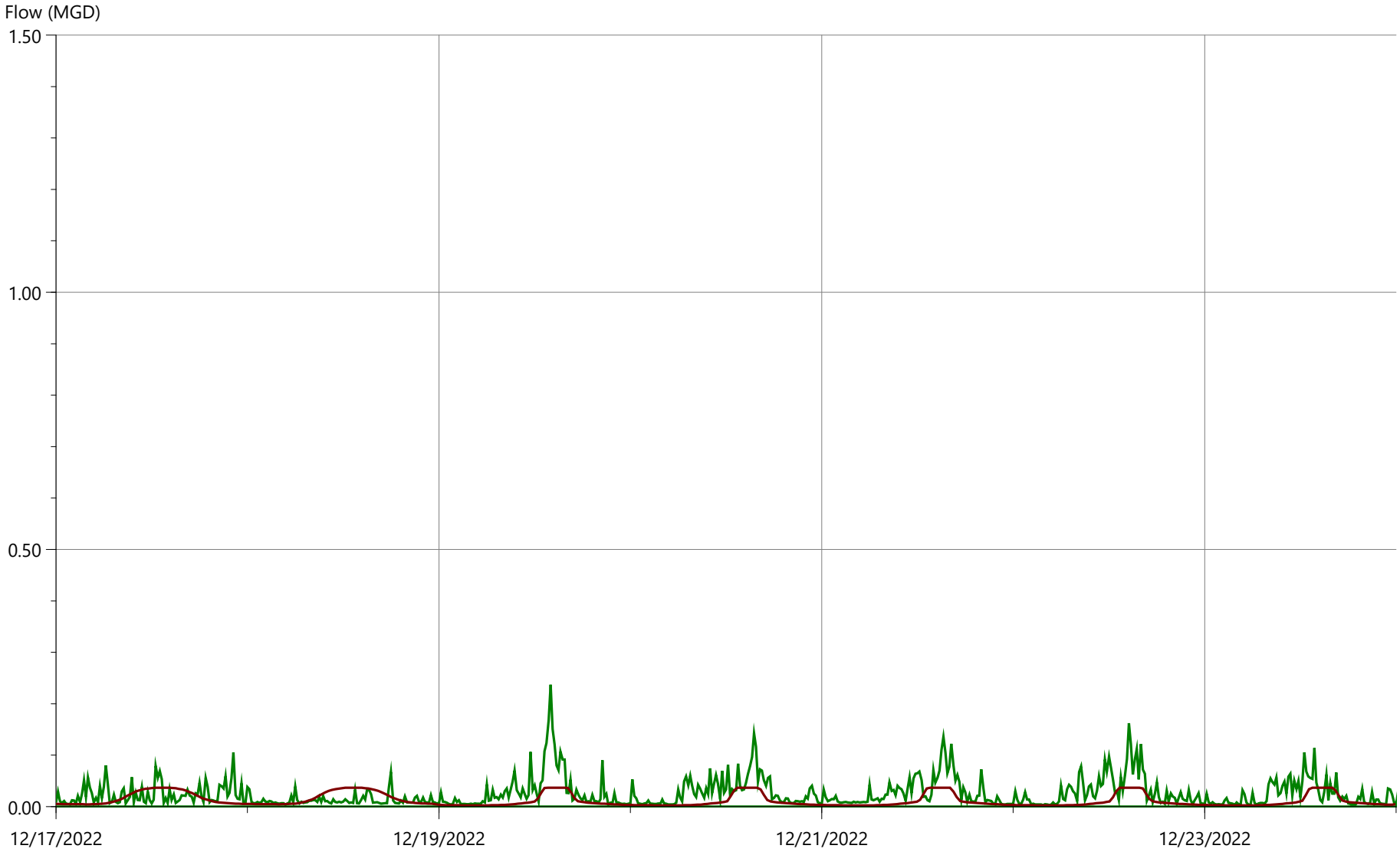
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	2.491	6.695	33.003
...ation (Homestead Blockage) DWF	2.482	5.853	31.993

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 3, Model Location (Pred.) D/S S104-27.1



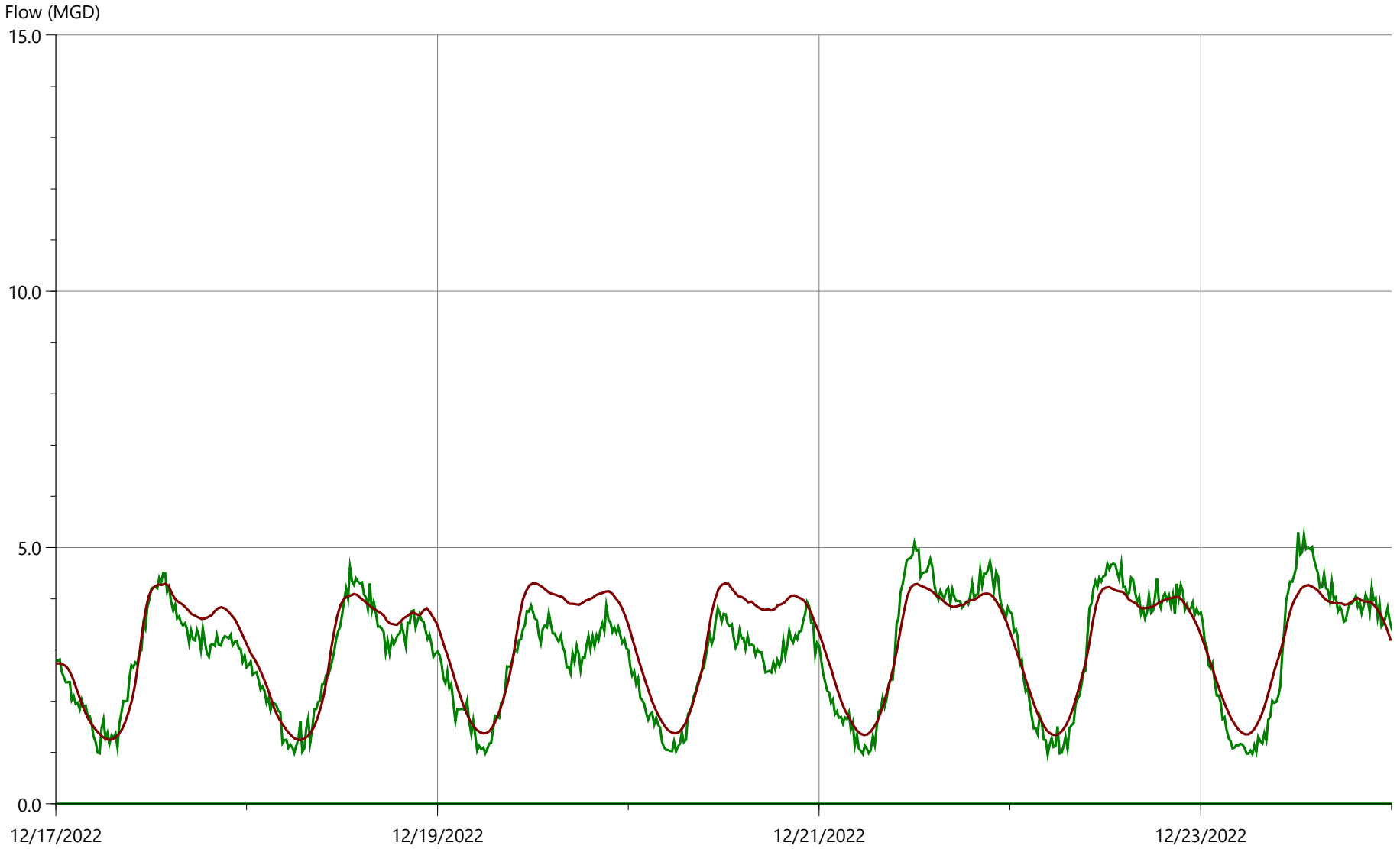
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	1.016	4.583	20.466
...ation (Homestead Blockage) DWF	0.850	3.894	18.244

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 4, Model Location (Pred.) D/S S94-36.1



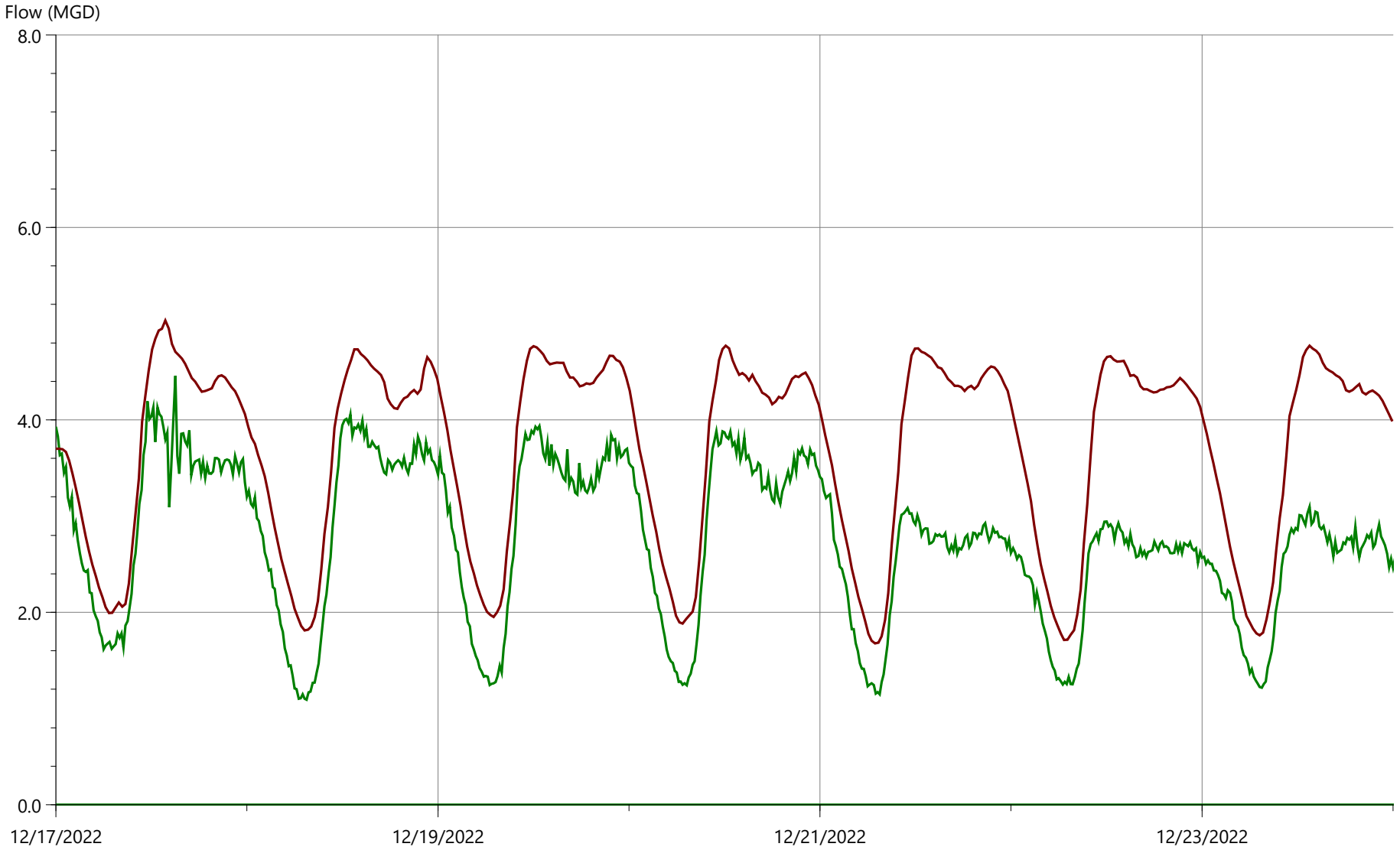
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.003	0.237	0.181
...ation (Homestead Blockage) DWF	0.003	0.037	0.085

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 5, Model Location (Pred.) D/S S83-23.1



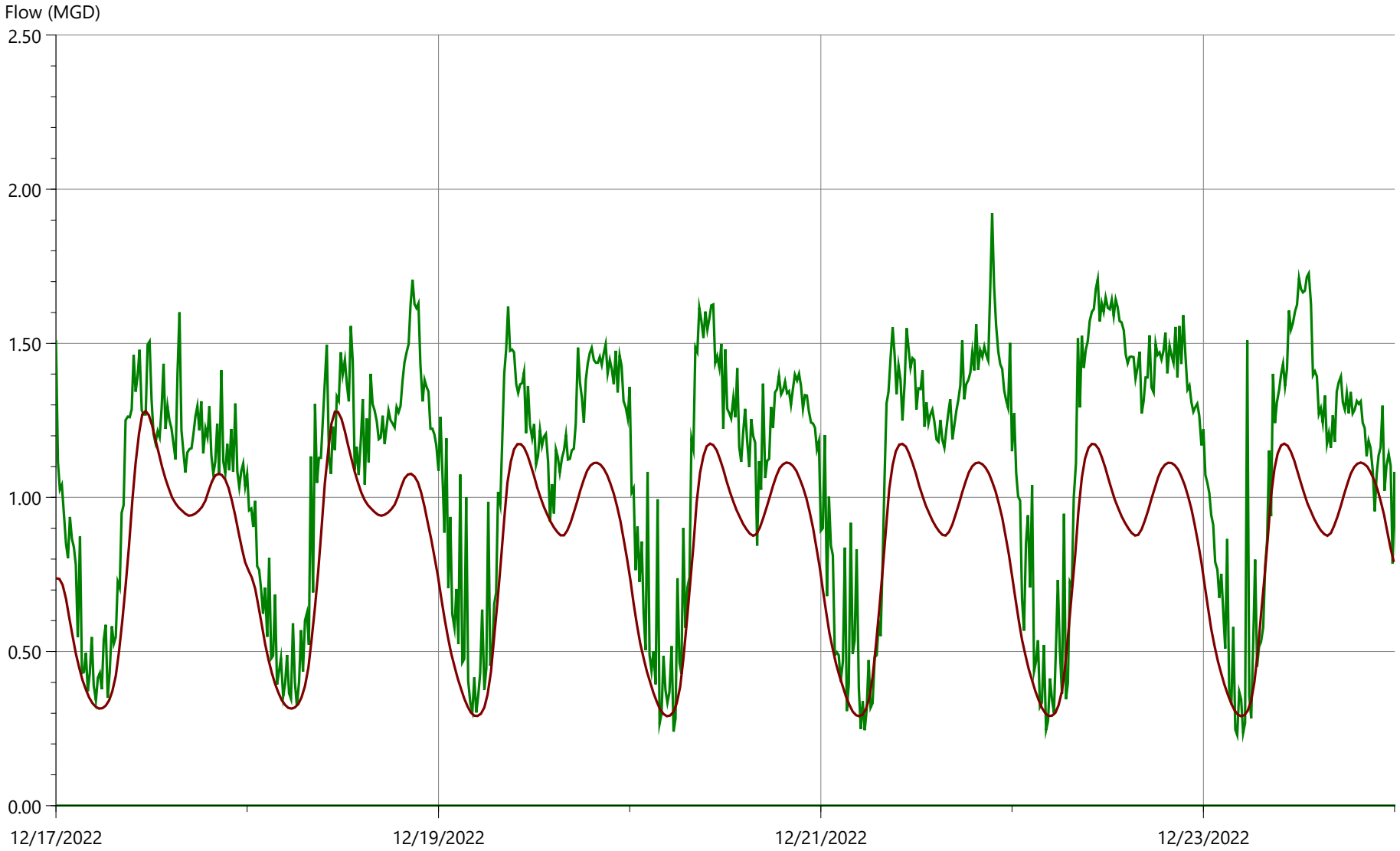
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.957	5.296	20.493
...ation (Homestead Blockage) DWF	1.247	4.301	21.735

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 6, Model Location (Pred.) D/S S83-25.1



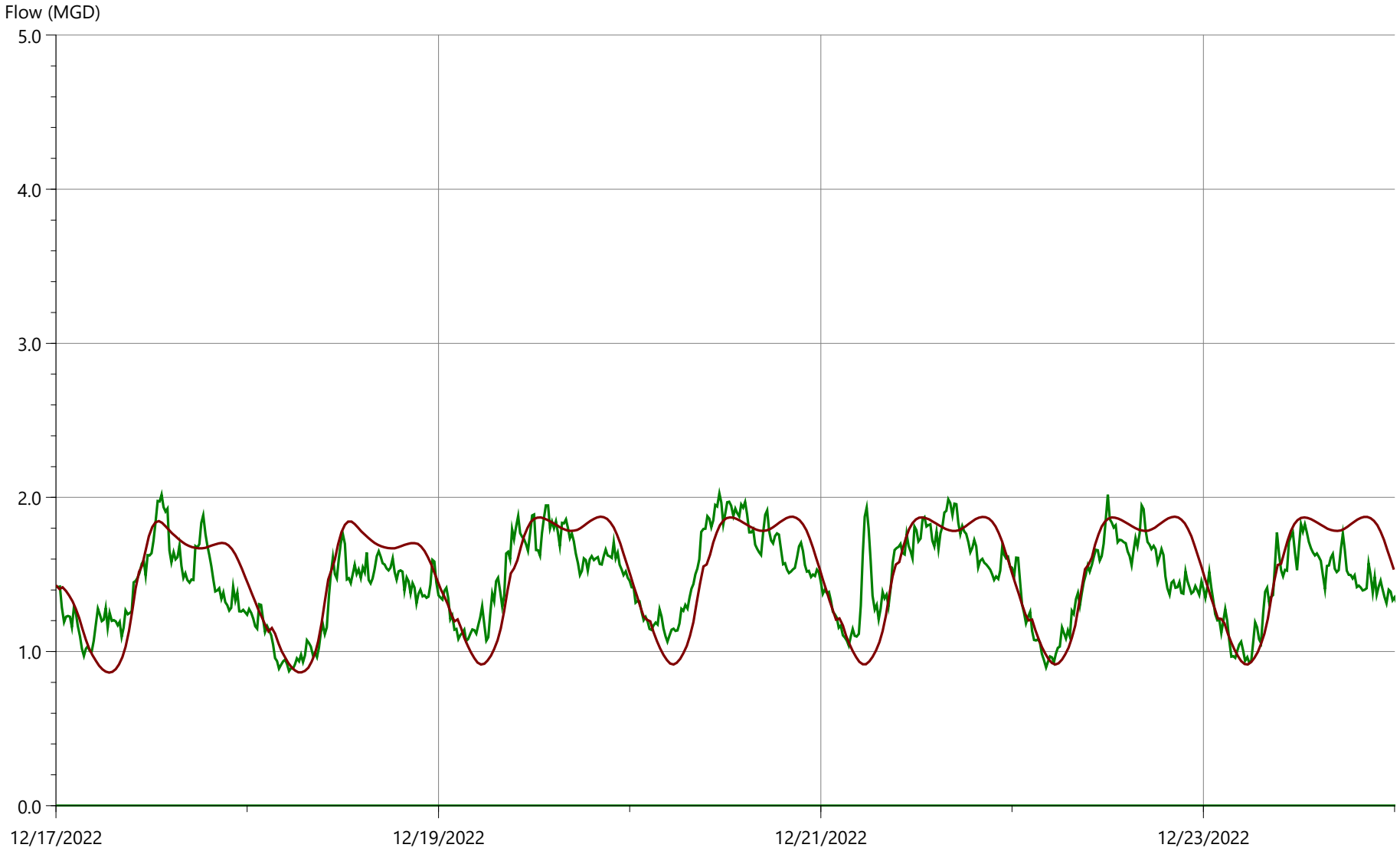
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	1.092	4.457	19.238
...ation (Homestead Blockage) DWF	1.676	5.034	25.837

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 7, Model Location (Pred.) D/S S105-6.1



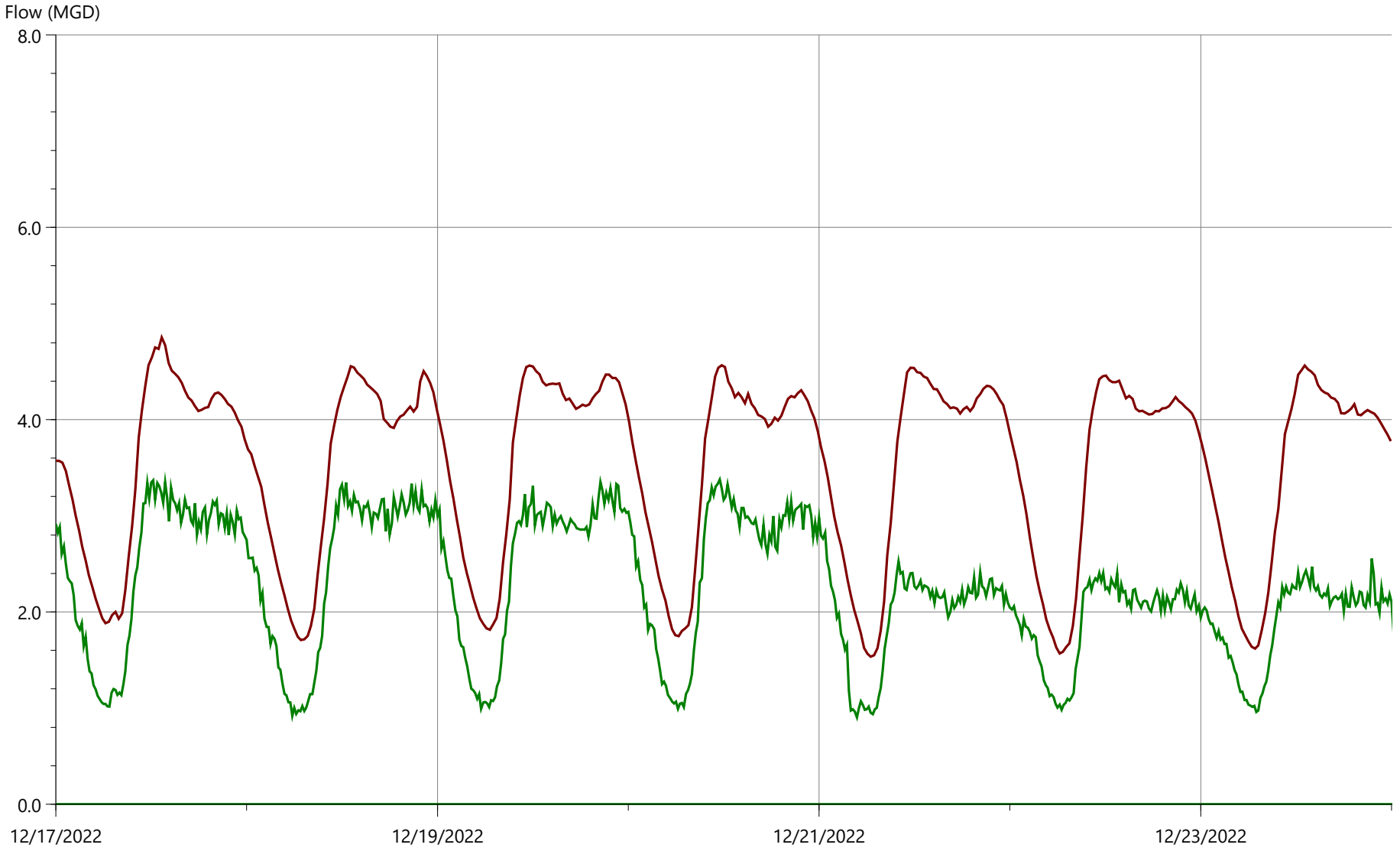
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.229	1.922	7.675
...ation (Homestead Blockage) DWF	0.290	1.280	5.781

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 8, Model Location (Pred.) D/S S86-13.1



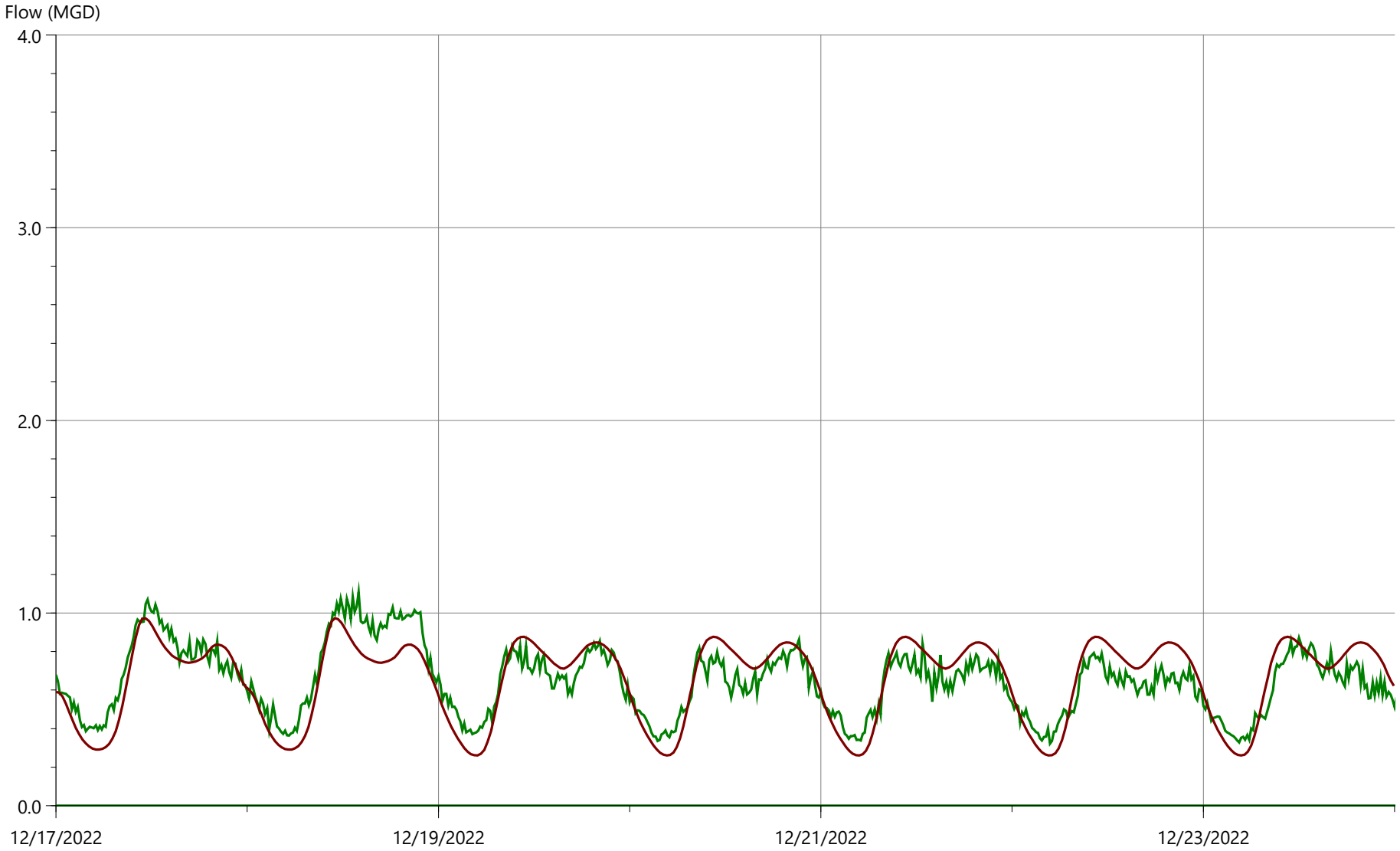
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.873	2.026	10.240
...ation (Homestead Blockage) DWF	0.864	1.875	10.578

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 9, Model Location (Pred.) D/S S72-20.1



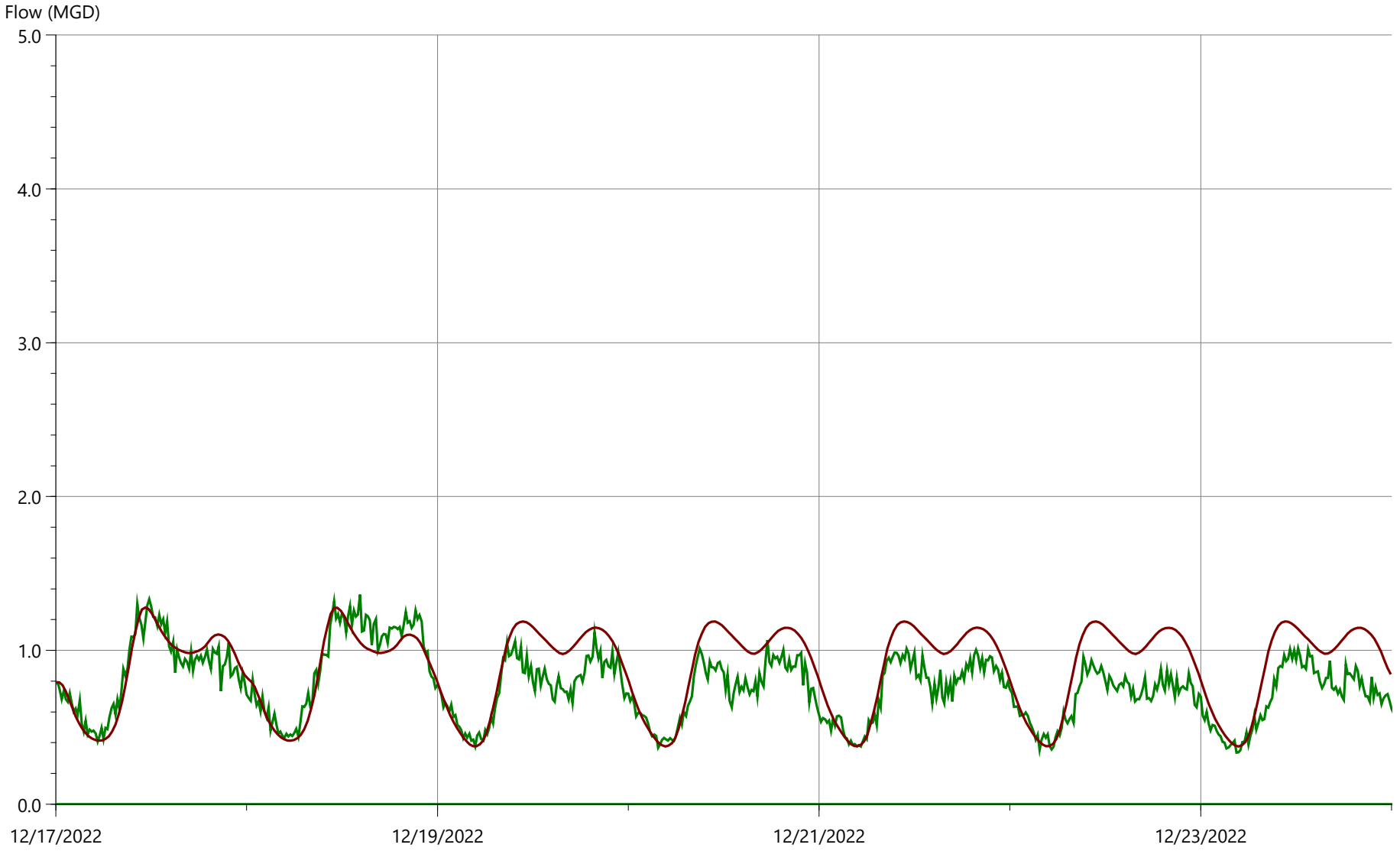
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.904	3.377	15.707
...ation (Homestead Blockage) DWF	1.535	4.856	24.662

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 10, Model Location (Pred.) D/S S52-80.1



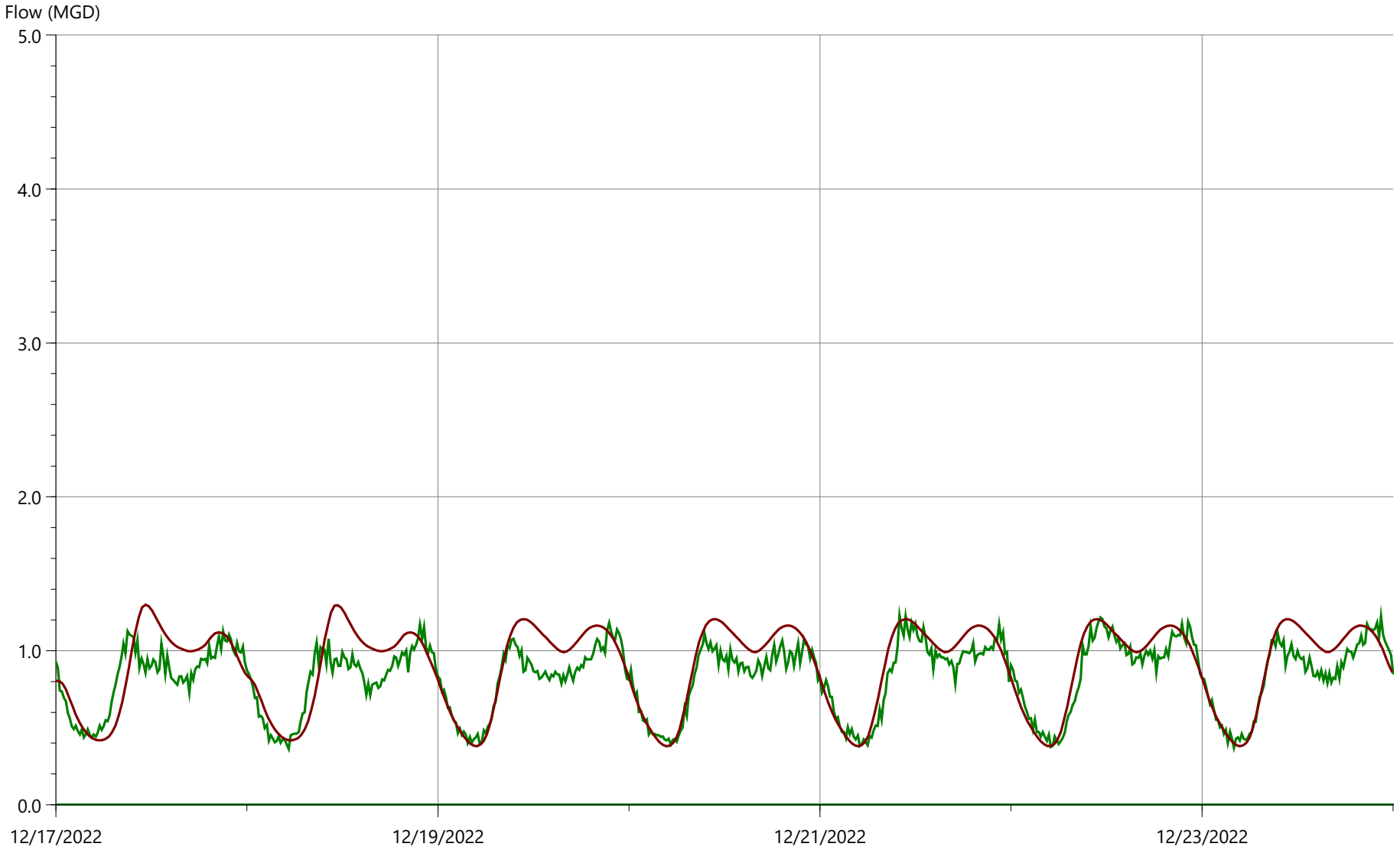
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.321	1.108	4.553
...ation (Homestead Blockage) DWF	0.261	0.973	4.560

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 11, Model Location (Pred.) D/S S53-9.1



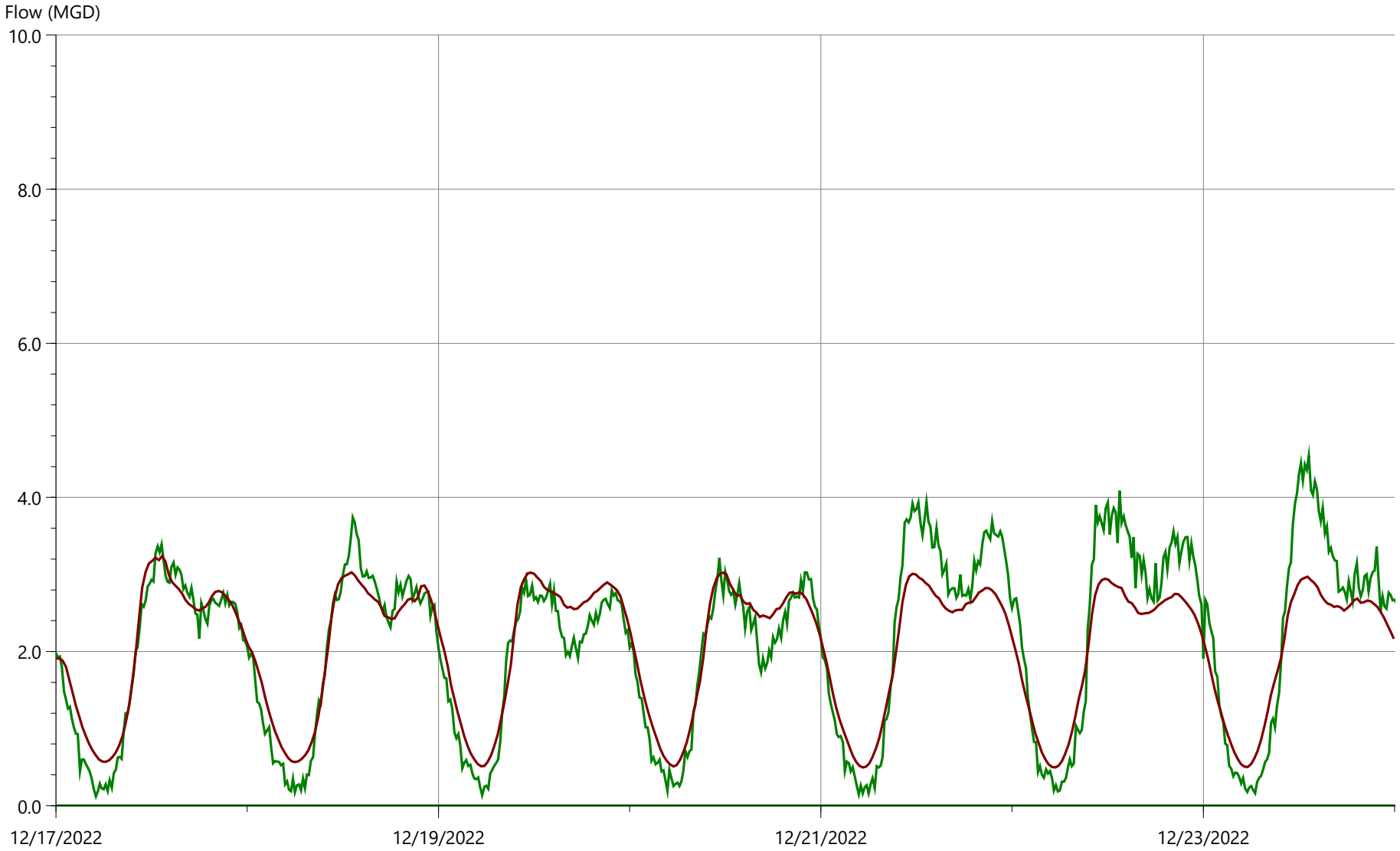
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.336	1.363	5.402
...ation (Homestead Blockage) DWF	0.376	1.279	6.198

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 12, Model Location (Pred.) D/S S53-109.1



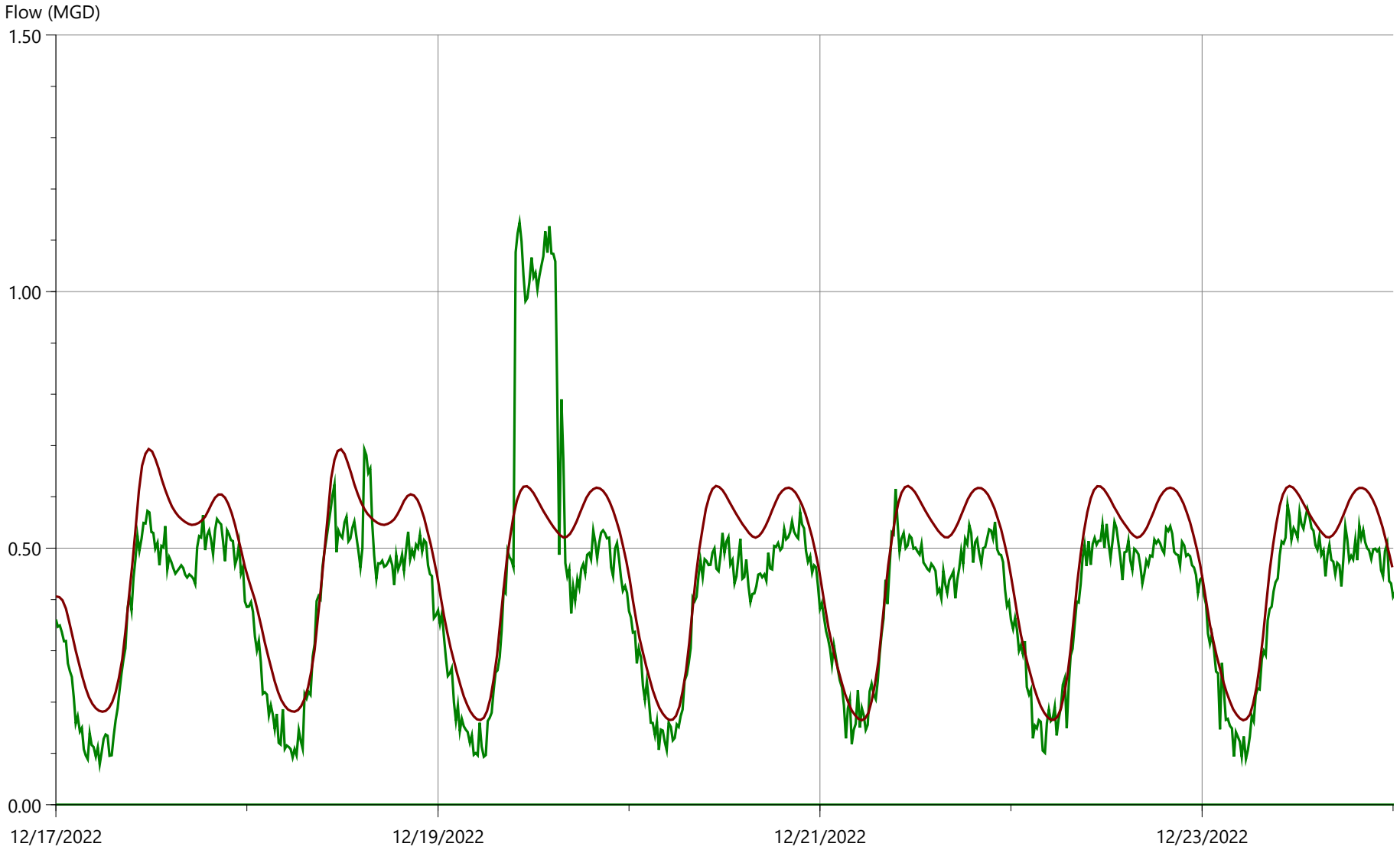
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.363	1.229	5.803
...ation (Homestead Blockage) DWF	0.380	1.299	6.286

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 13, Model Location (Pred.) D/S S53-73.1



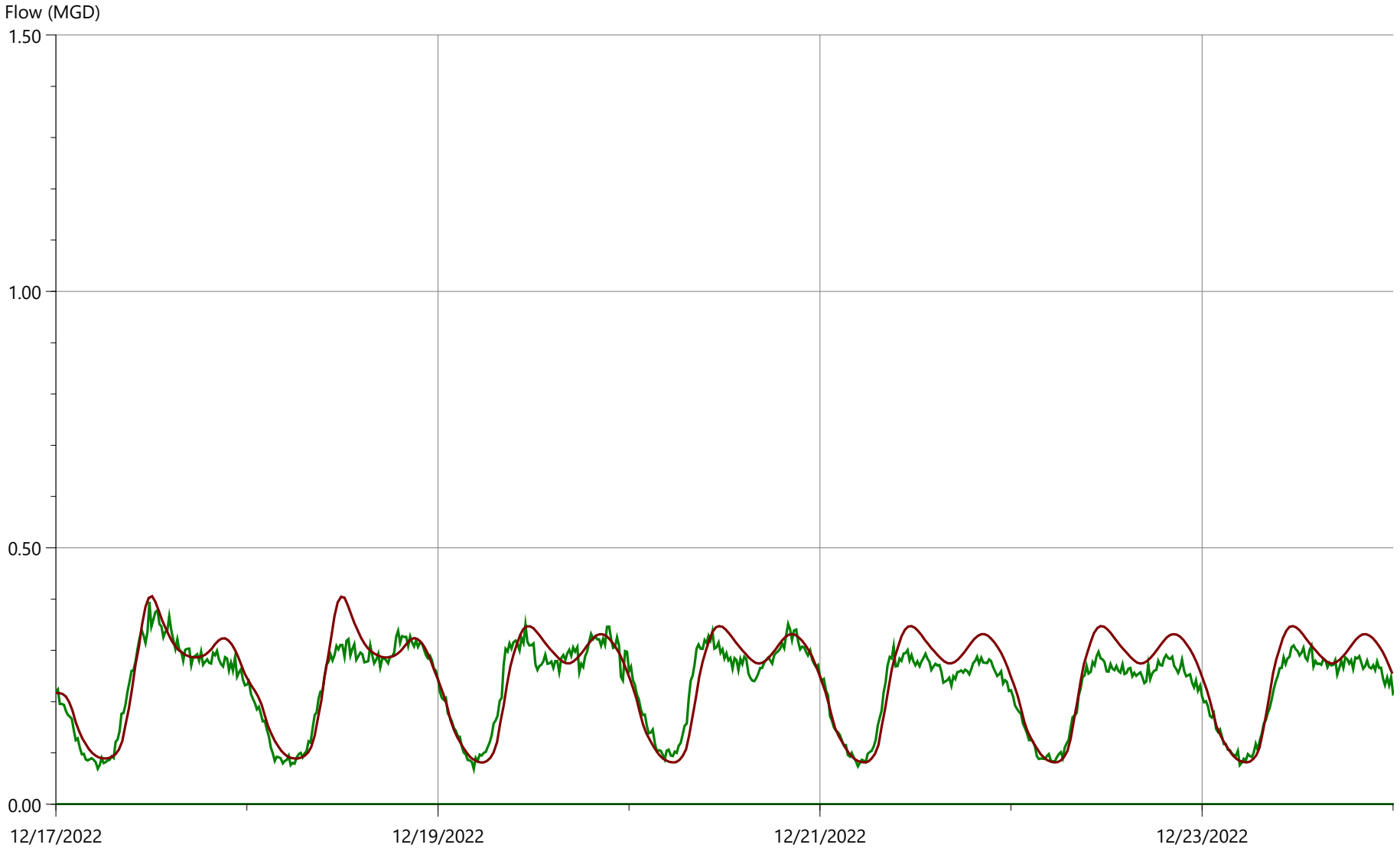
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.122	4.539	14.702
...ation (Homestead Blockage) DWF	0.496	3.237	14.336

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 14, Model Location (Pred.) D/S S54-17.1



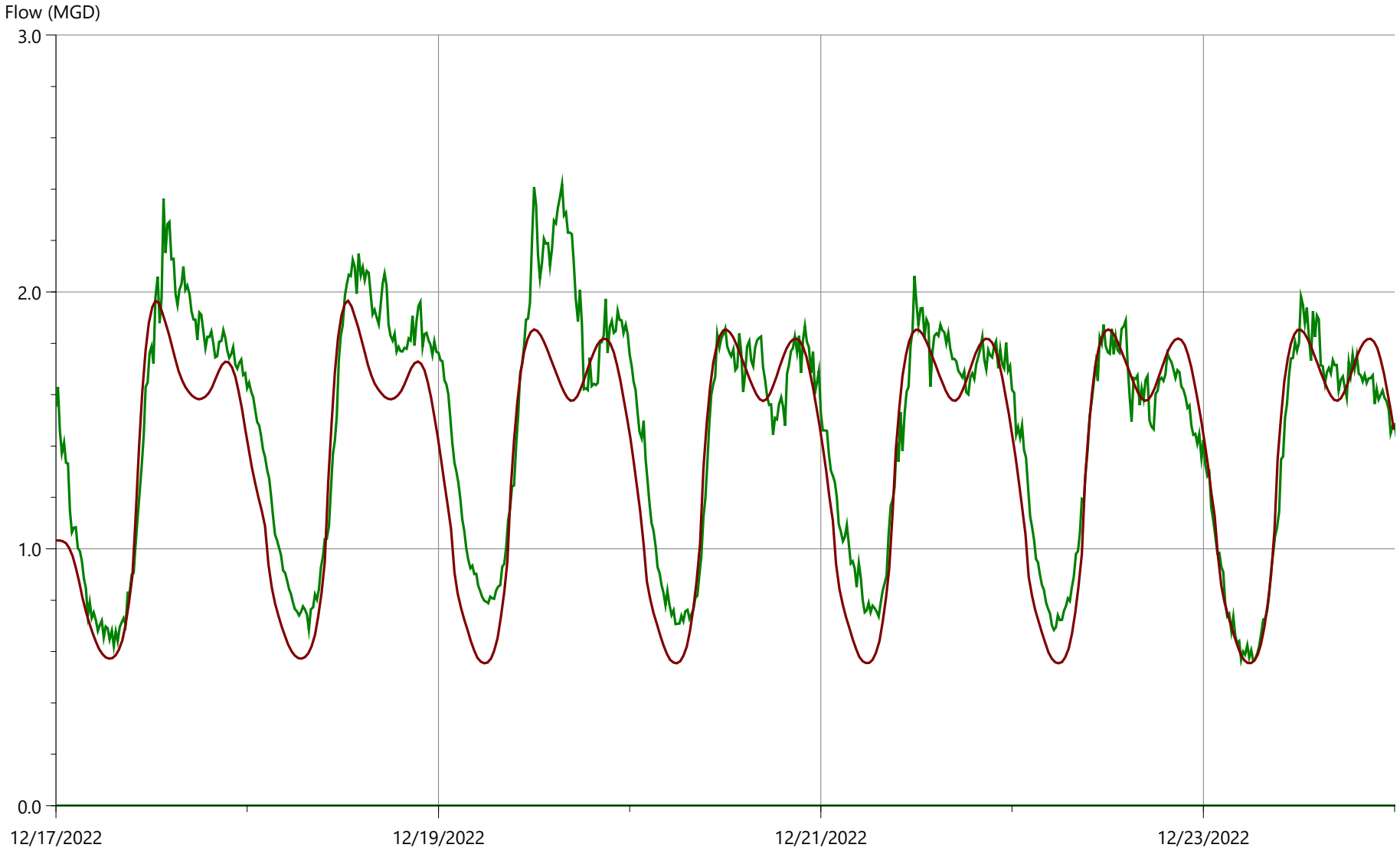
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.079	1.135	2.874
...ation (Homestead Blockage) DWF	0.165	0.693	3.216

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 15, Model Location (Pred.) D/S S65-48.1



	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.068	0.395	1.615
...ation (Homestead Blockage) DWF	0.081	0.406	1.709

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 16, Model Location (Pred.) D/S S67-12.1

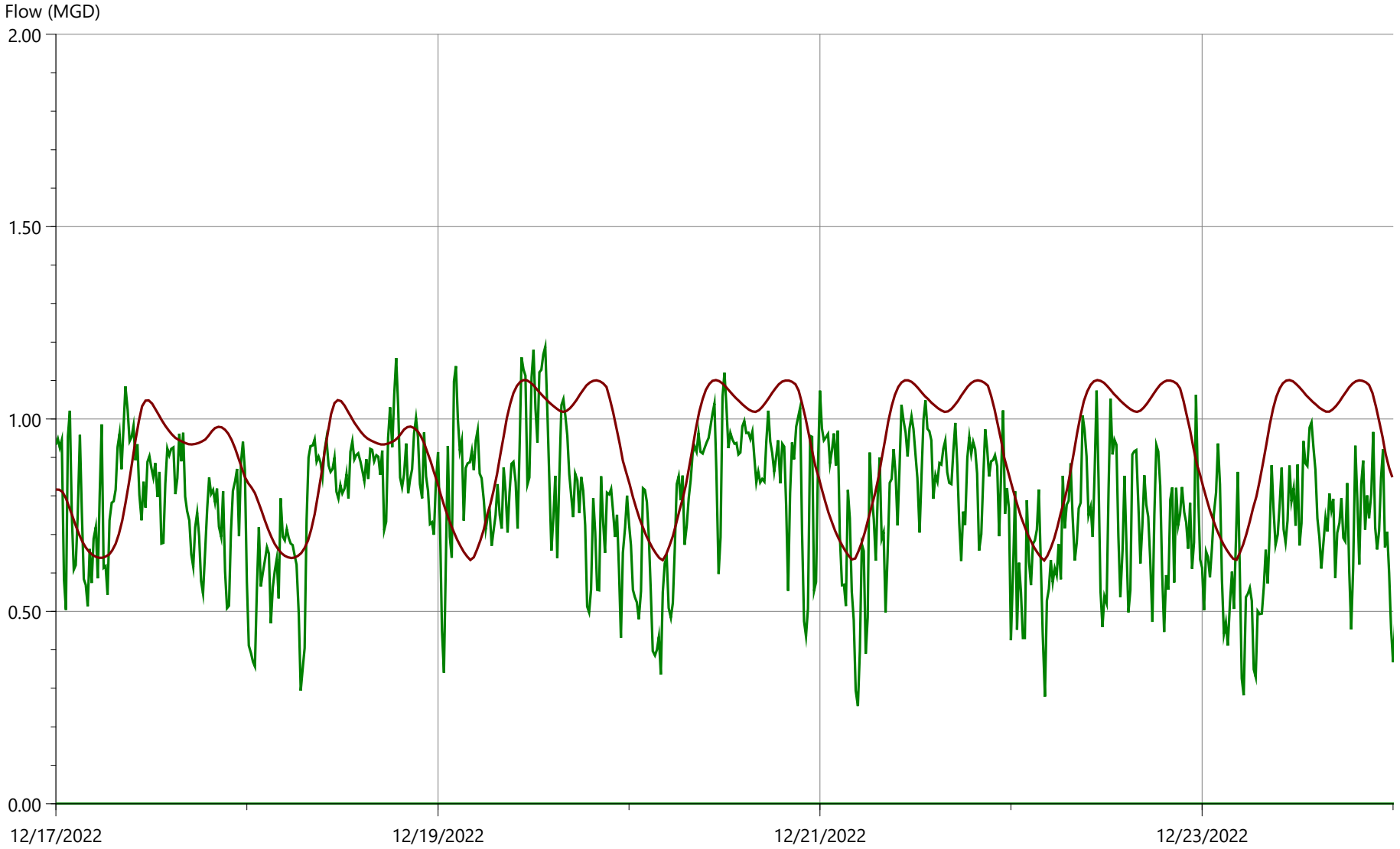


	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.566	2.420	10.213
...ation (Homestead Blockage) DWF	0.555	1.966	9.440

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)

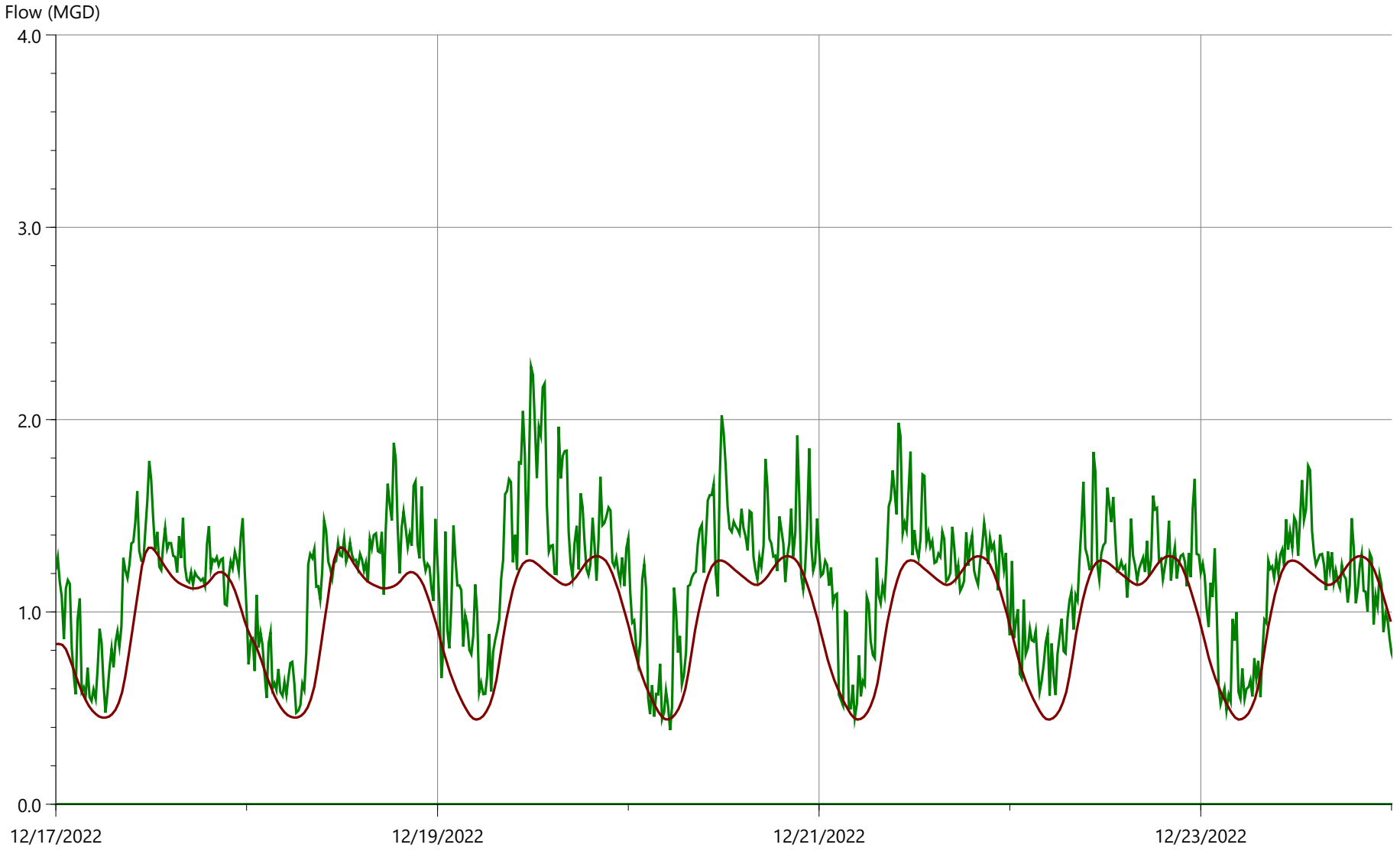
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...

Flow Survey Location (Obs.) 17, Model Location (Pred.) D/S S58-12.2



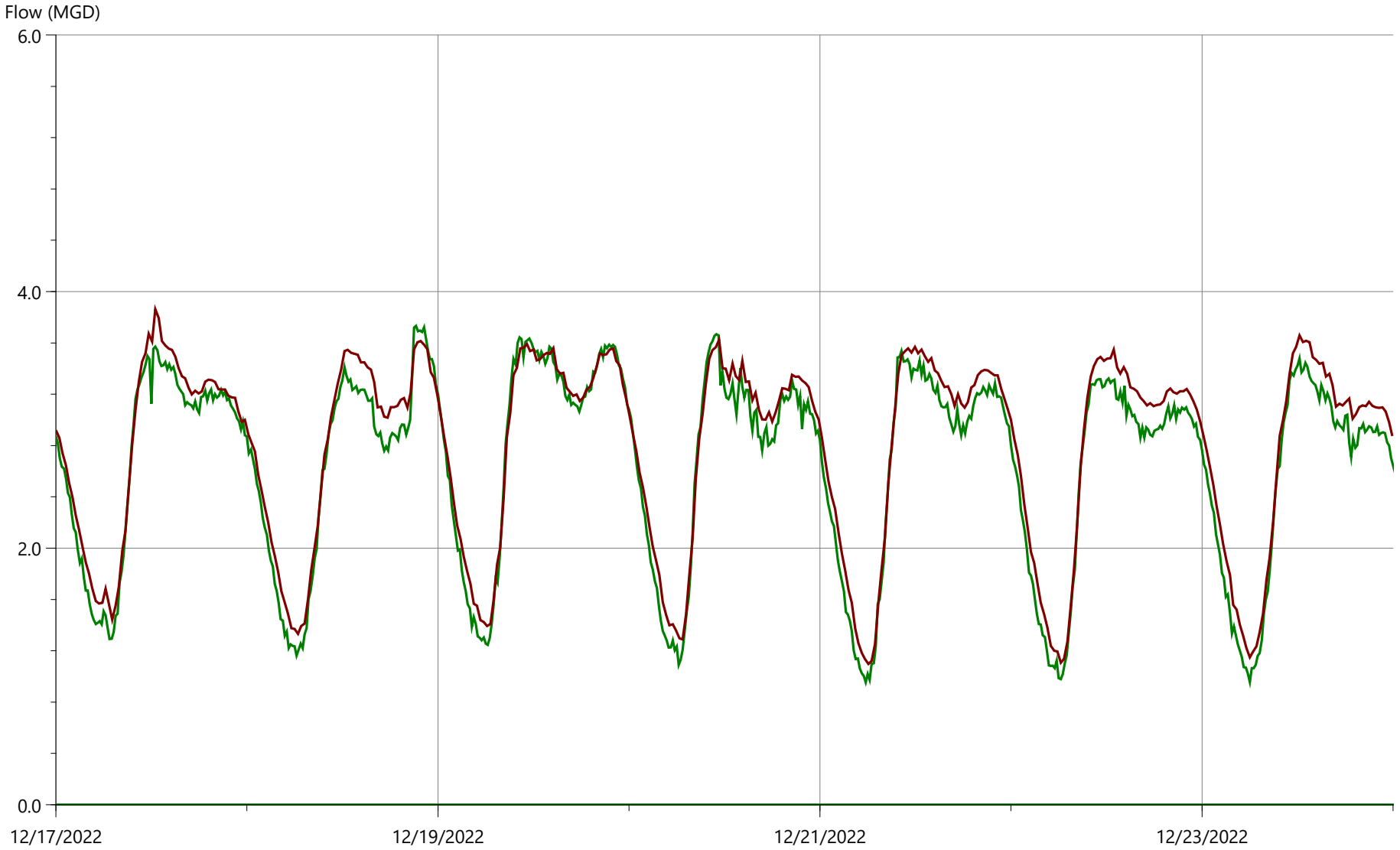
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.254	1.188	5.406
...ation (Homestead Blockage) DWF	0.632	1.101	6.417

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 18, Model Location (Pred.) D/S S58-11.1



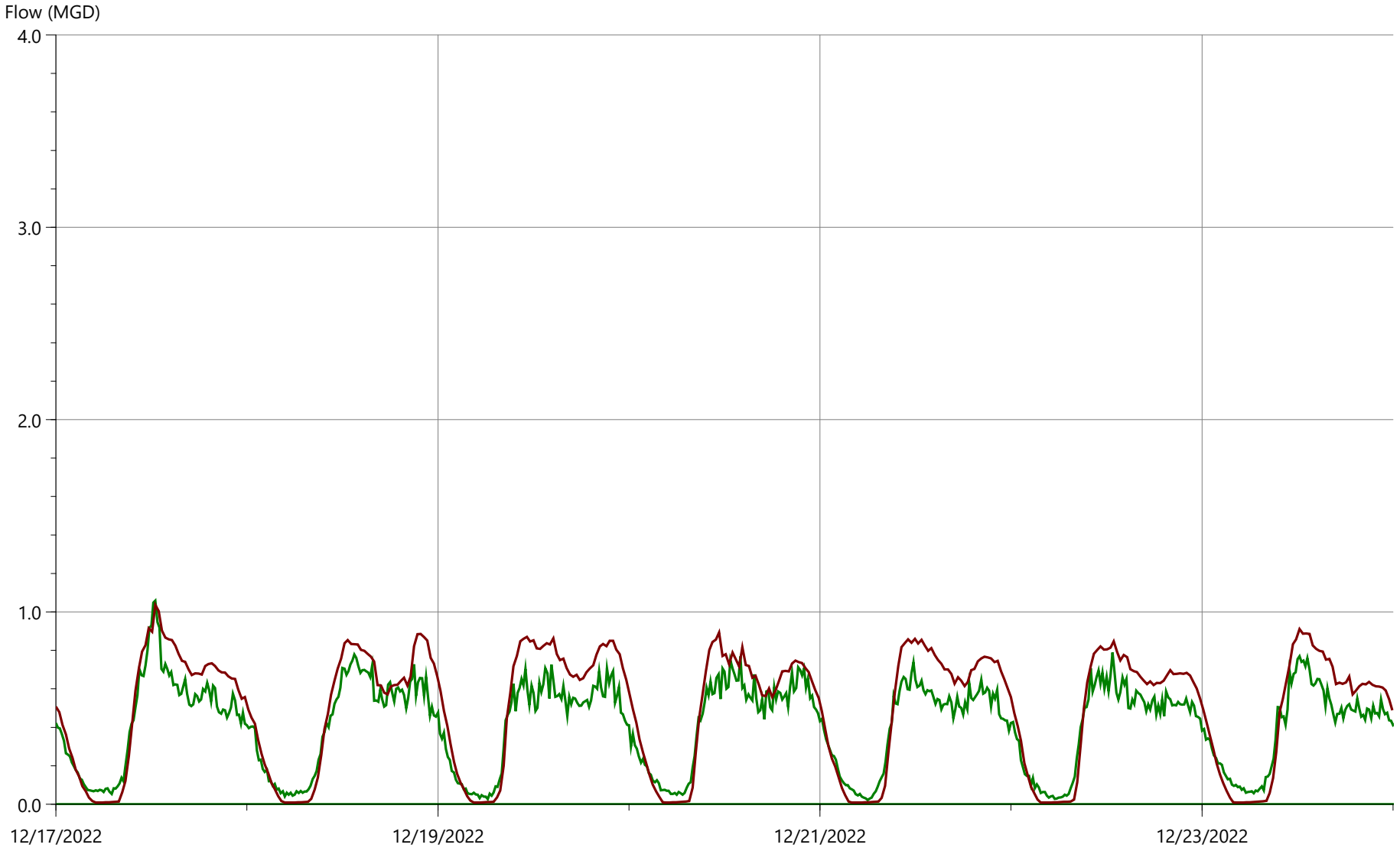
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.385	2.276	8.249
...ation (Homestead Blockage) DWF	0.440	1.336	6.799

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 19, Model Location (Pred.) D/S S21-23.1



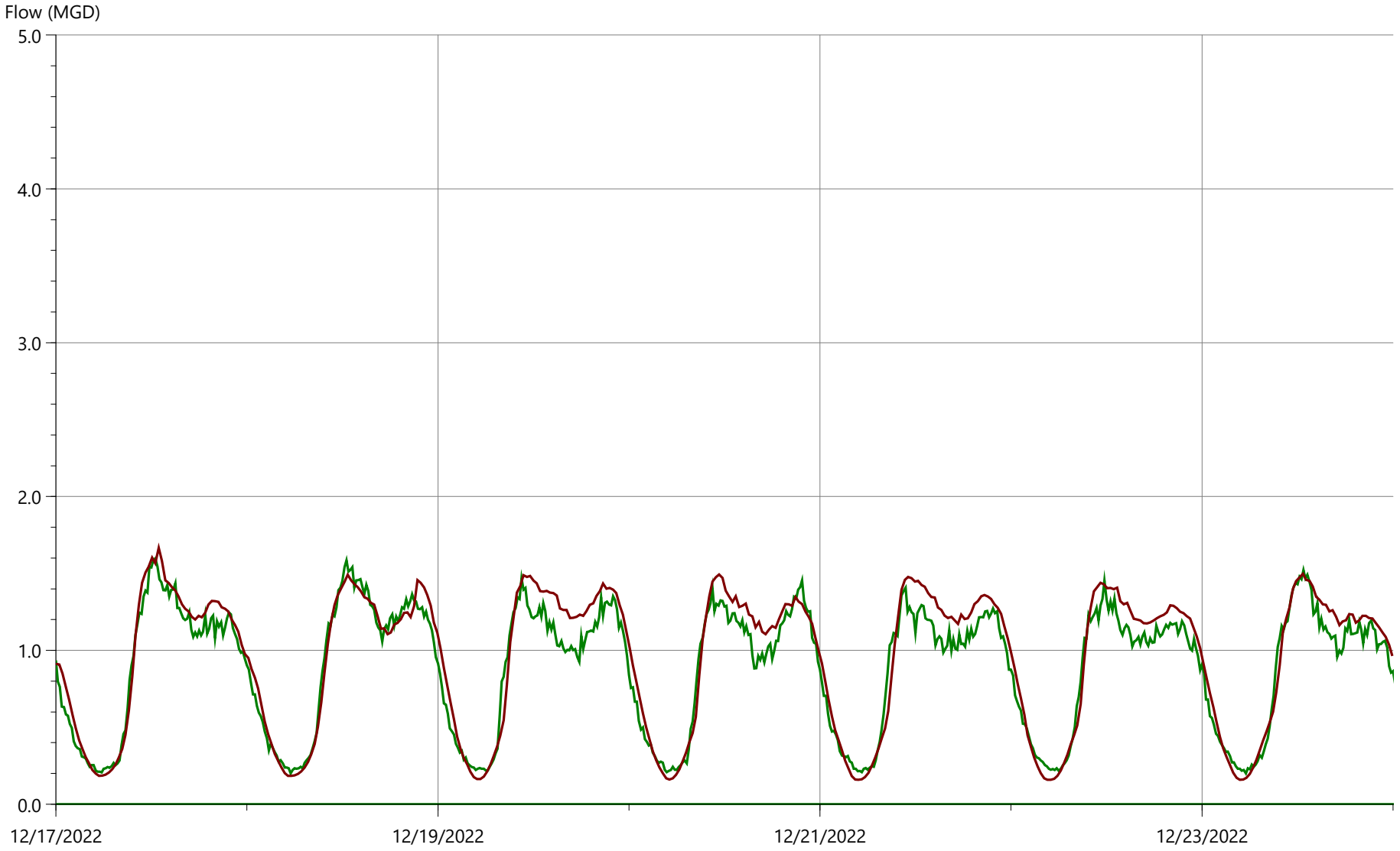
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.955	3.733	18.569
...ation (Homestead Blockage) DWF	1.098	3.862	19.445

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 20, Model Location (Pred.) D/S S21-46.1



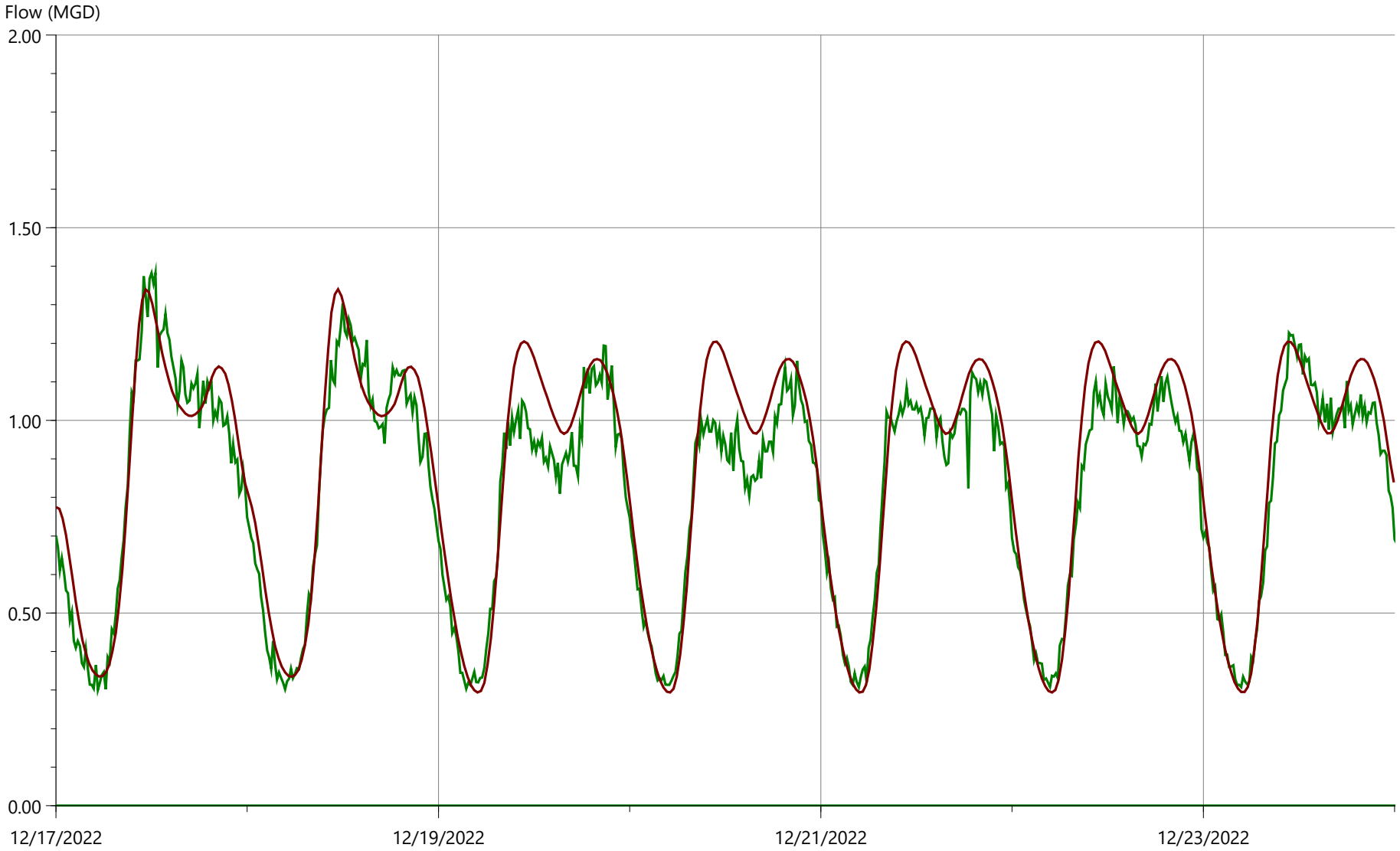
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.022	1.058	2.906
...ation (Homestead Blockage) DWF	0.009	1.037	3.464

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 21, Model Location (Pred.) D/S S23-14.1



	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.200	1.598	6.243
...ation (Homestead Blockage) DWF	0.158	1.667	6.646

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 22, Model Location (Pred.) D/S S45-88.1

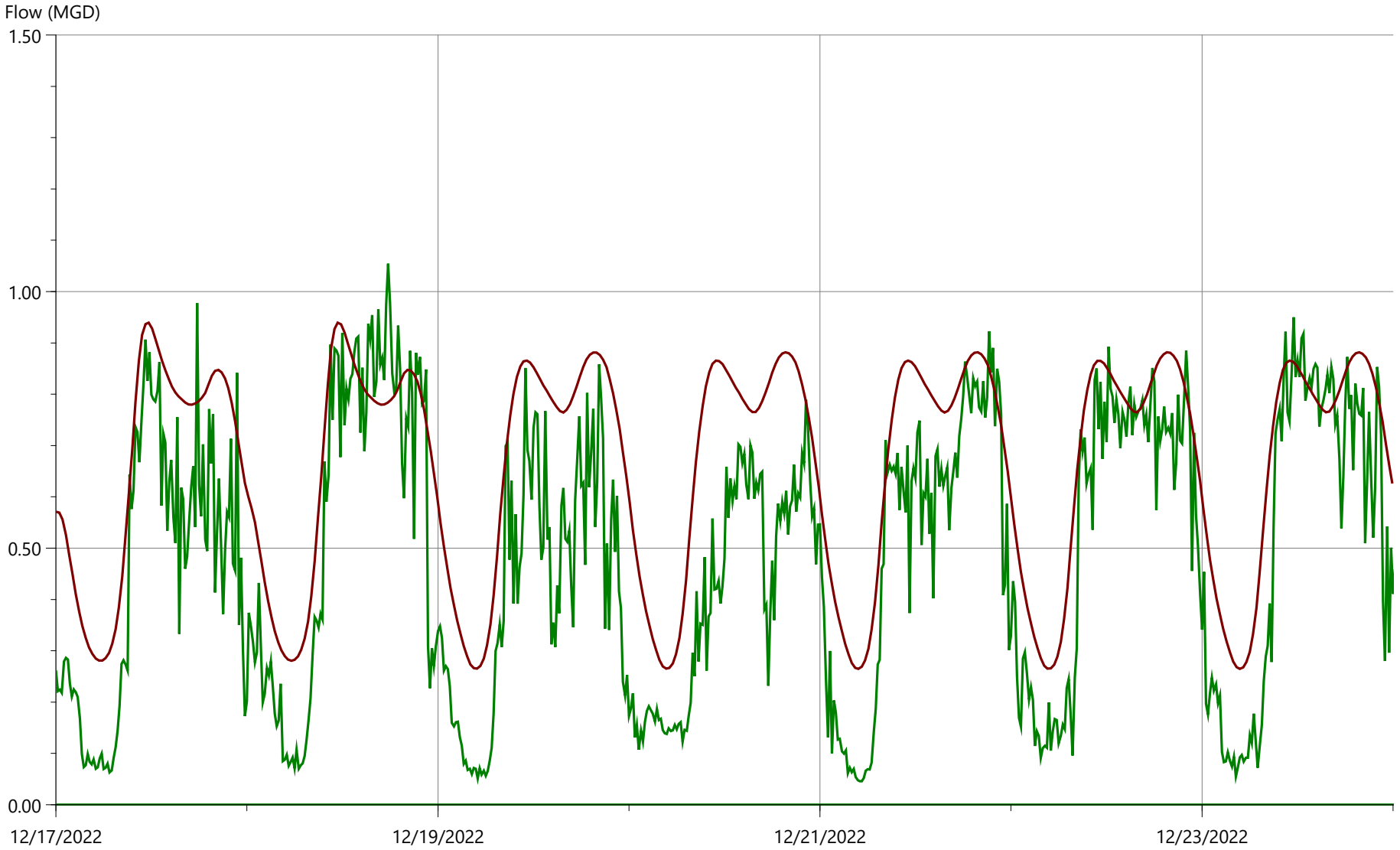


	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.300	1.382	5.769
...ation (Homestead Blockage) DWF	0.294	1.340	6.078

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)

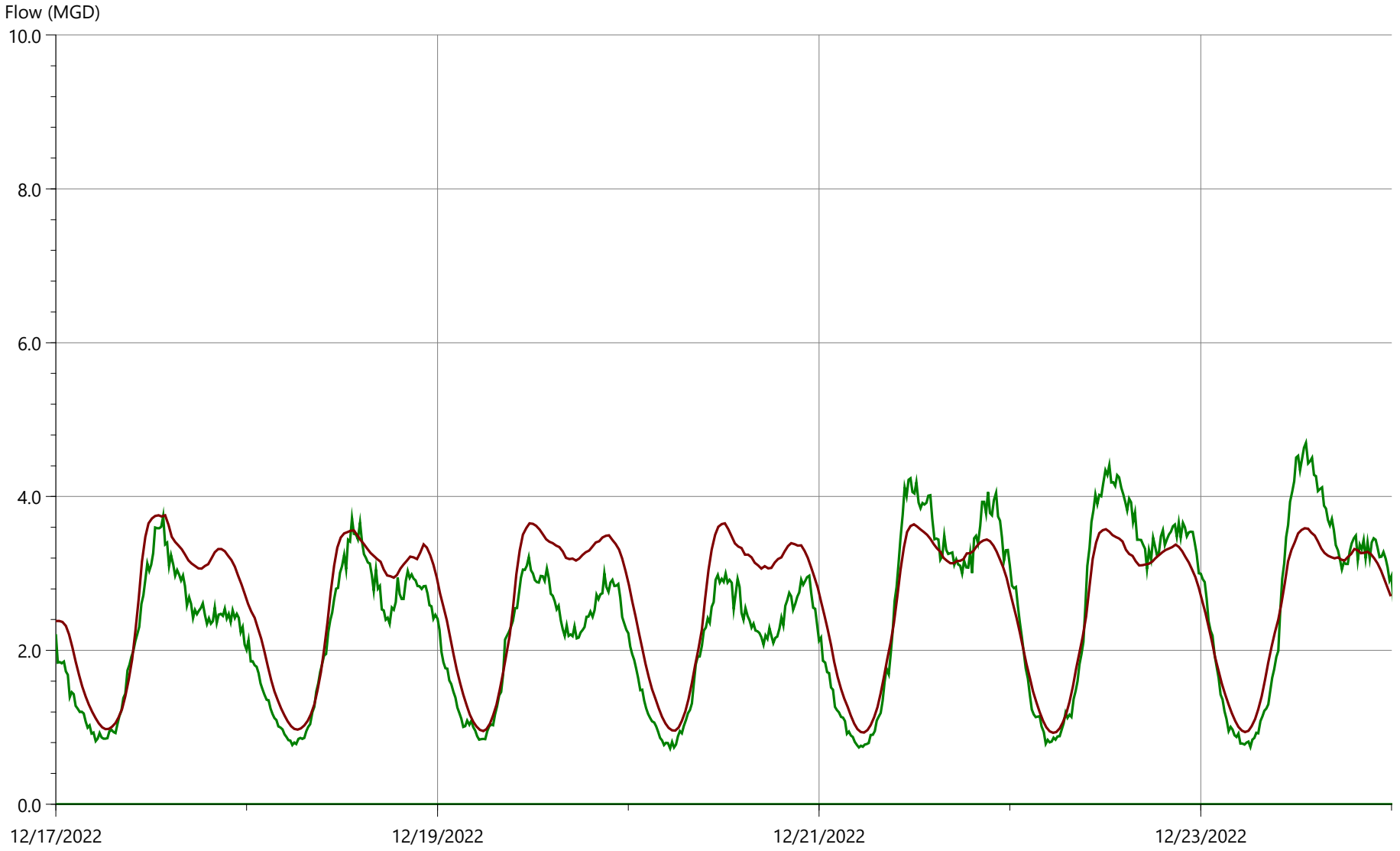
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...

Flow Survey Location (Obs.) 23, Model Location (Pred.) D/S S48-32.1



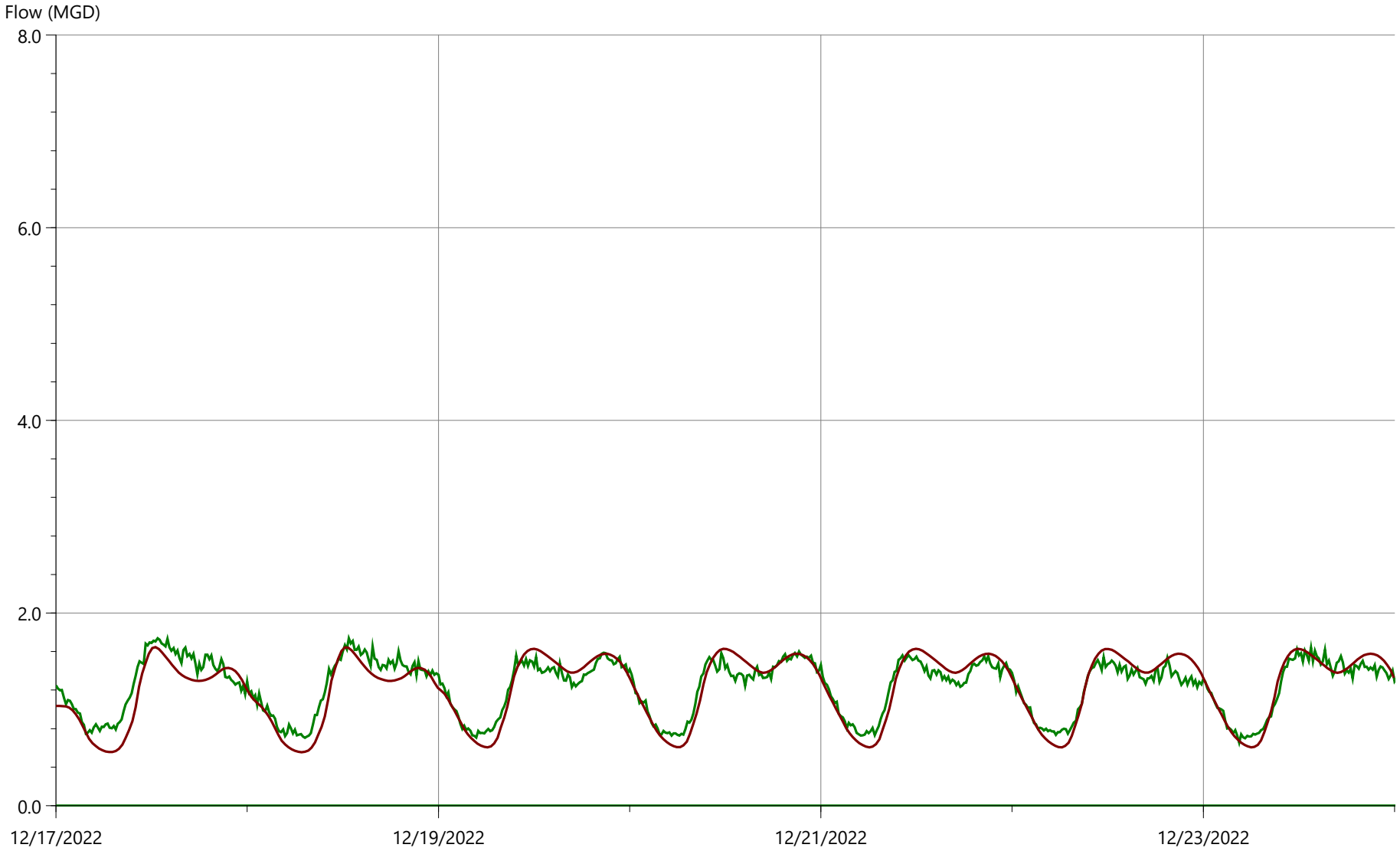
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.046	1.054	3.386
...ation (Homestead Blockage) DWF	0.265	0.939	4.607

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 24, Model Location (Pred.) D/S S63-2.1



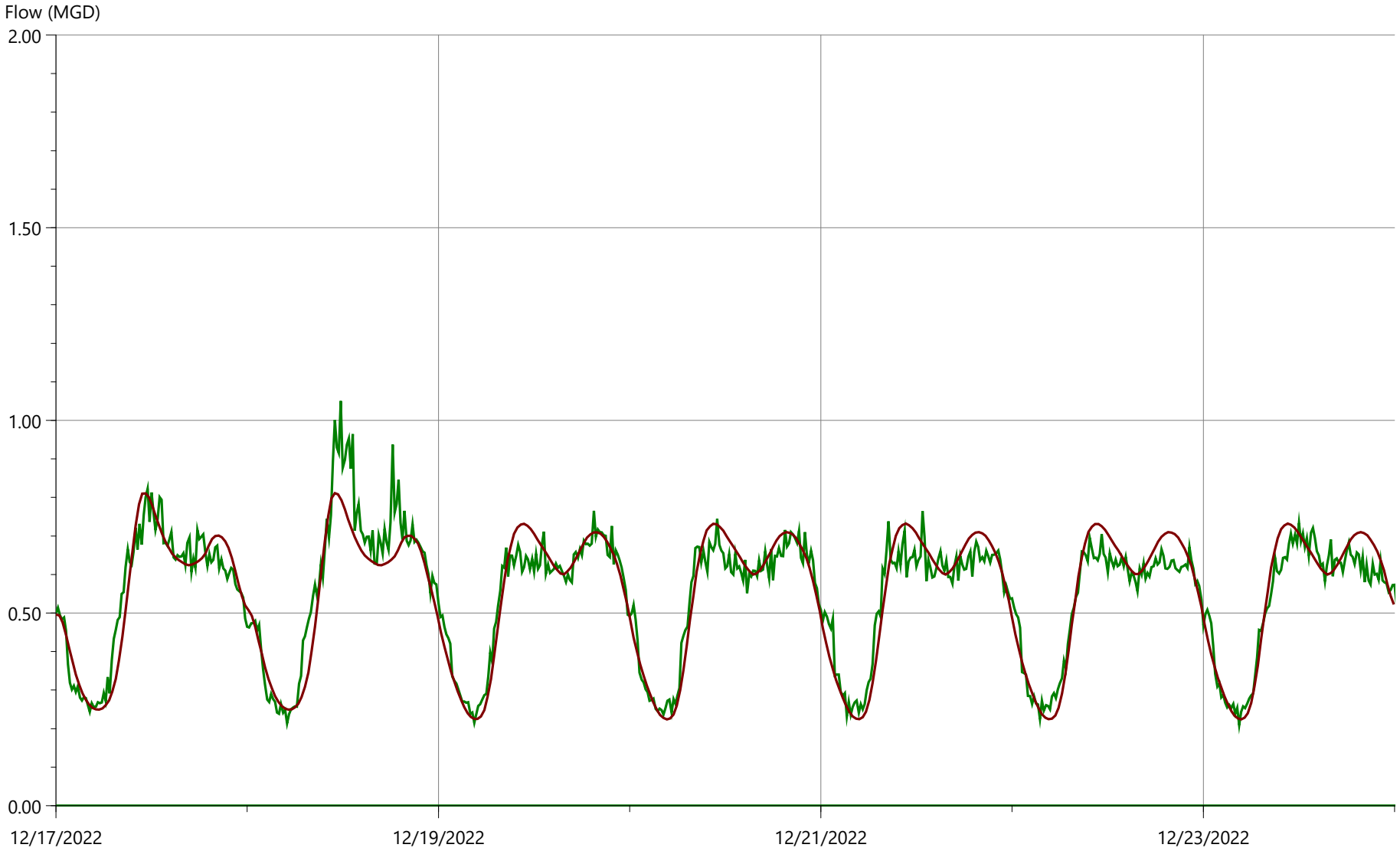
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.725	4.699	16.699
...ation (Homestead Blockage) DWF	0.928	3.757	18.065

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 25, Model Location (Pred.) D/S S57-6.1



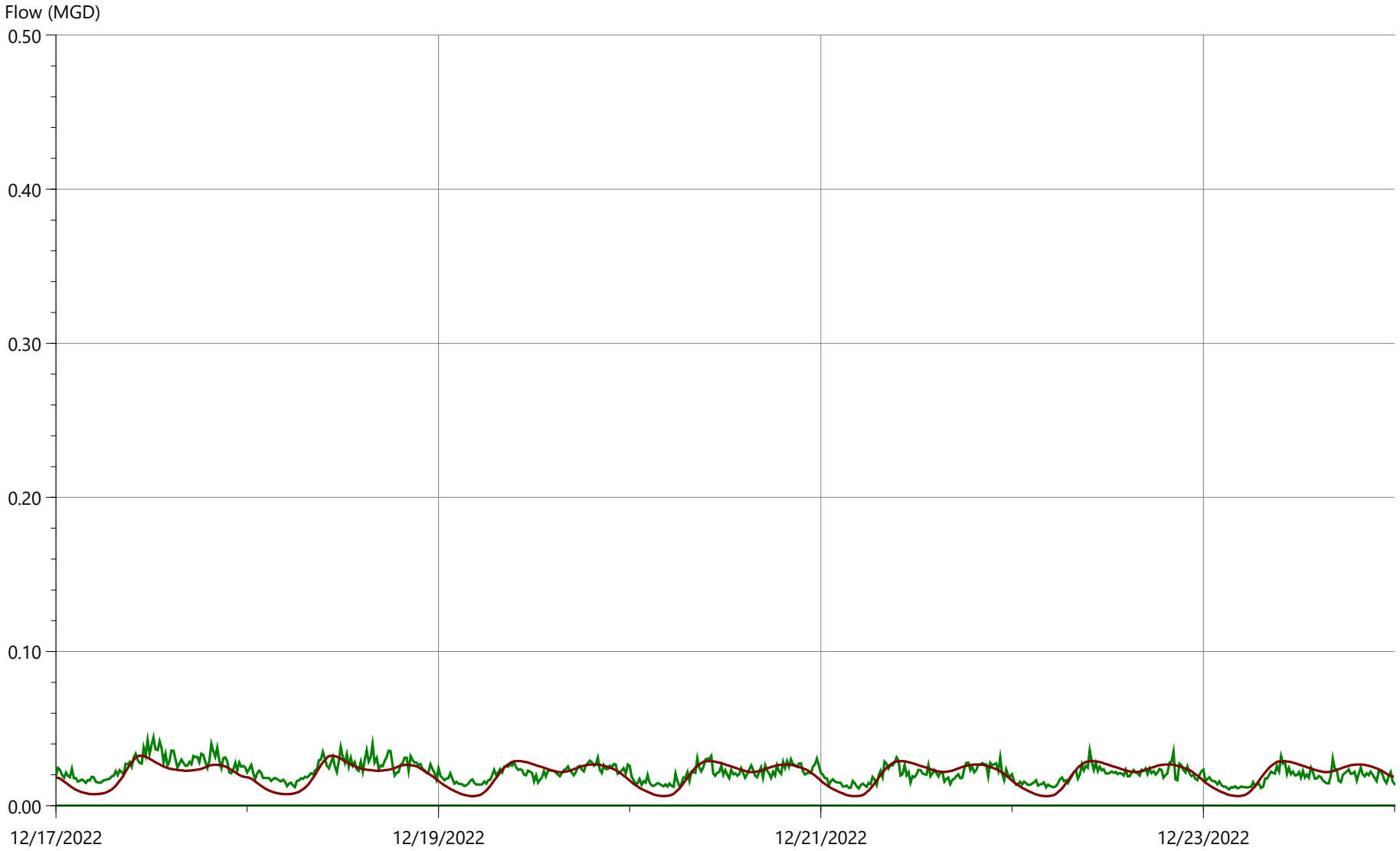
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.653	1.739	8.697
...ation (Homestead Blockage) DWF	0.555	1.646	8.531

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 26, Model Location (Pred.) D/S S52-86.1



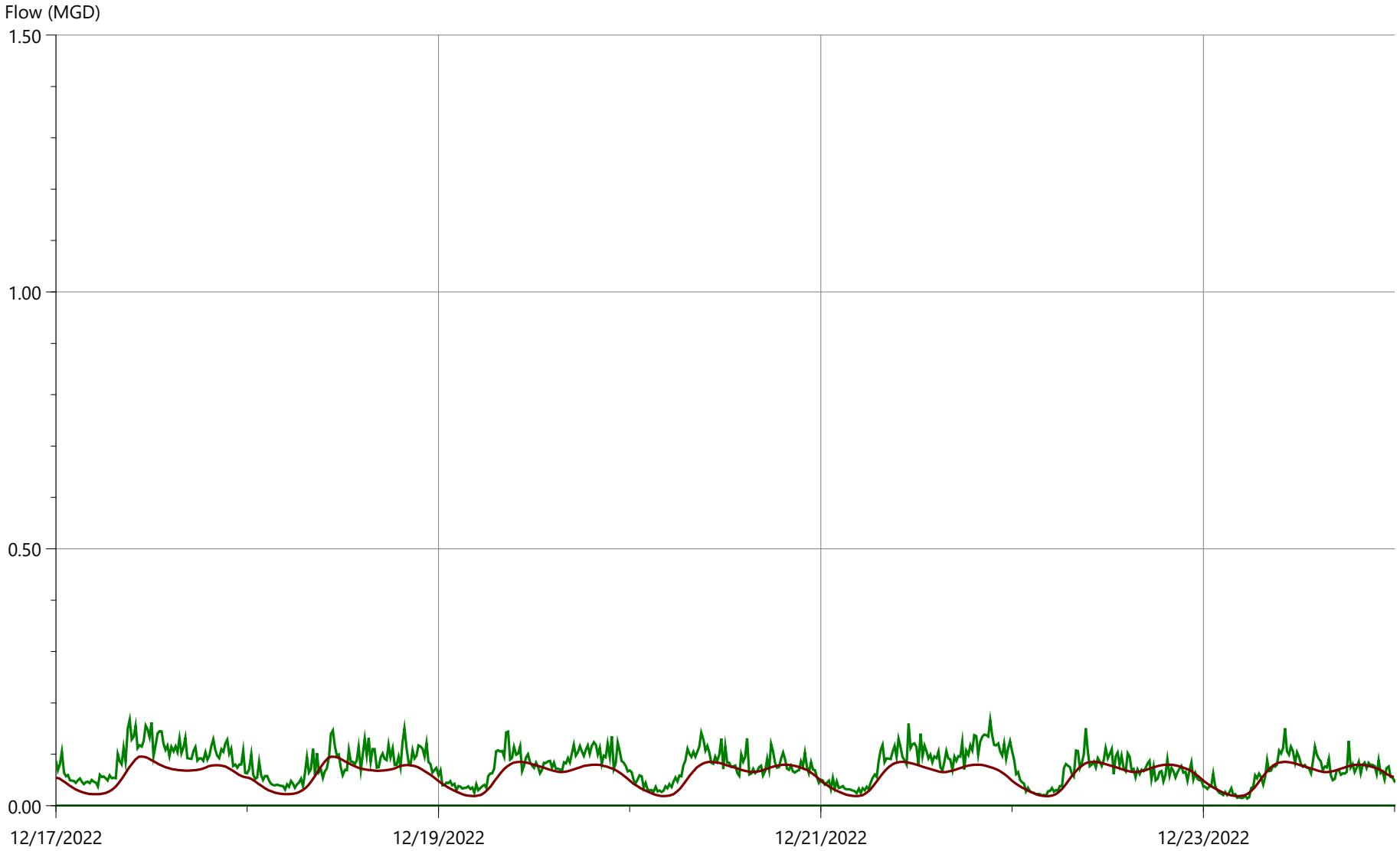
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.209	1.050	3.846
...ation (Homestead Blockage) DWF	0.224	0.811	3.832

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 27, Model Location (Pred.) D/S S43-8.1



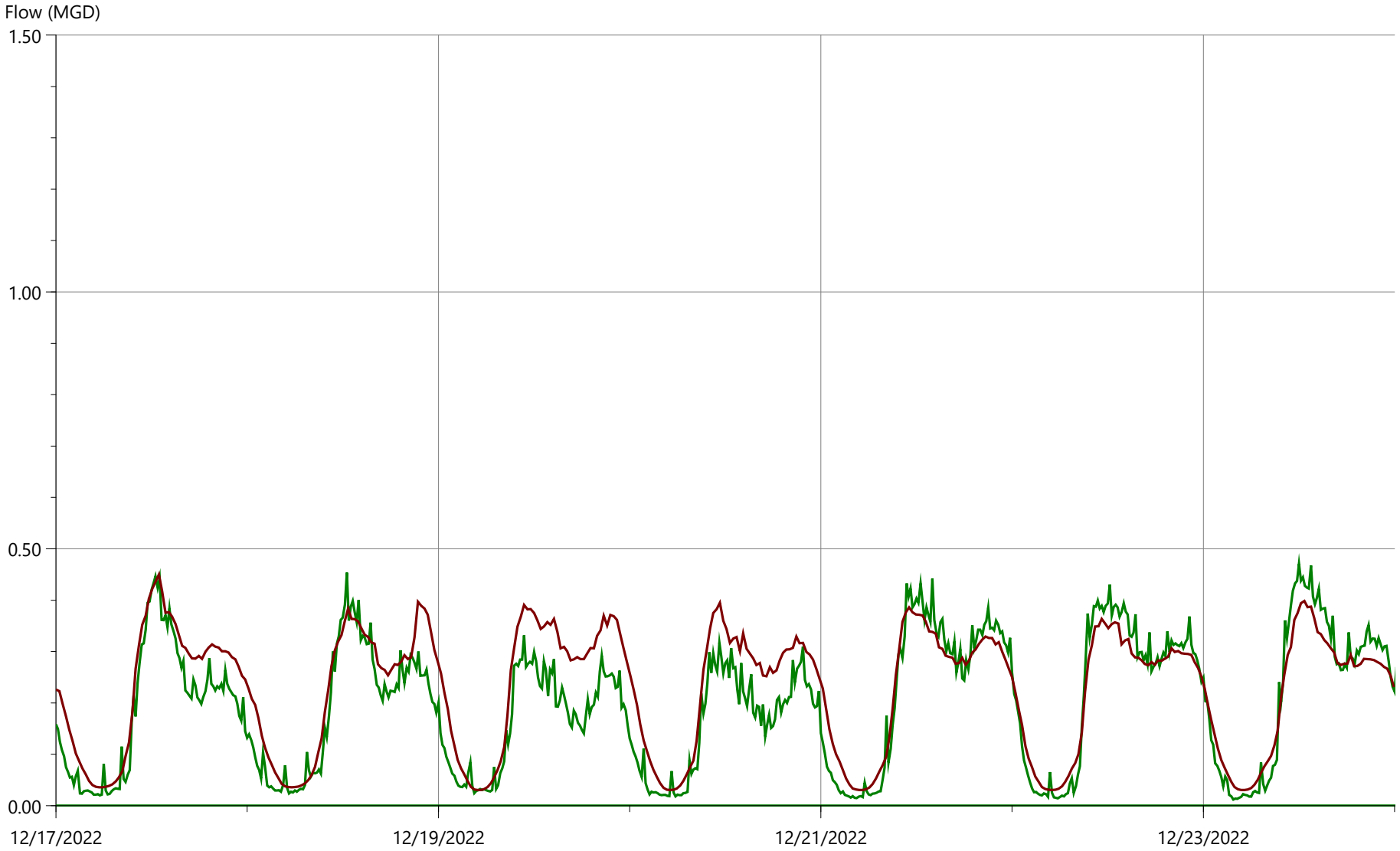
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.010	0.044	0.151
...ation (Homestead Blockage) DWF	0.006	0.032	0.141

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 28, Model Location (Pred.) D/S S53-47.1



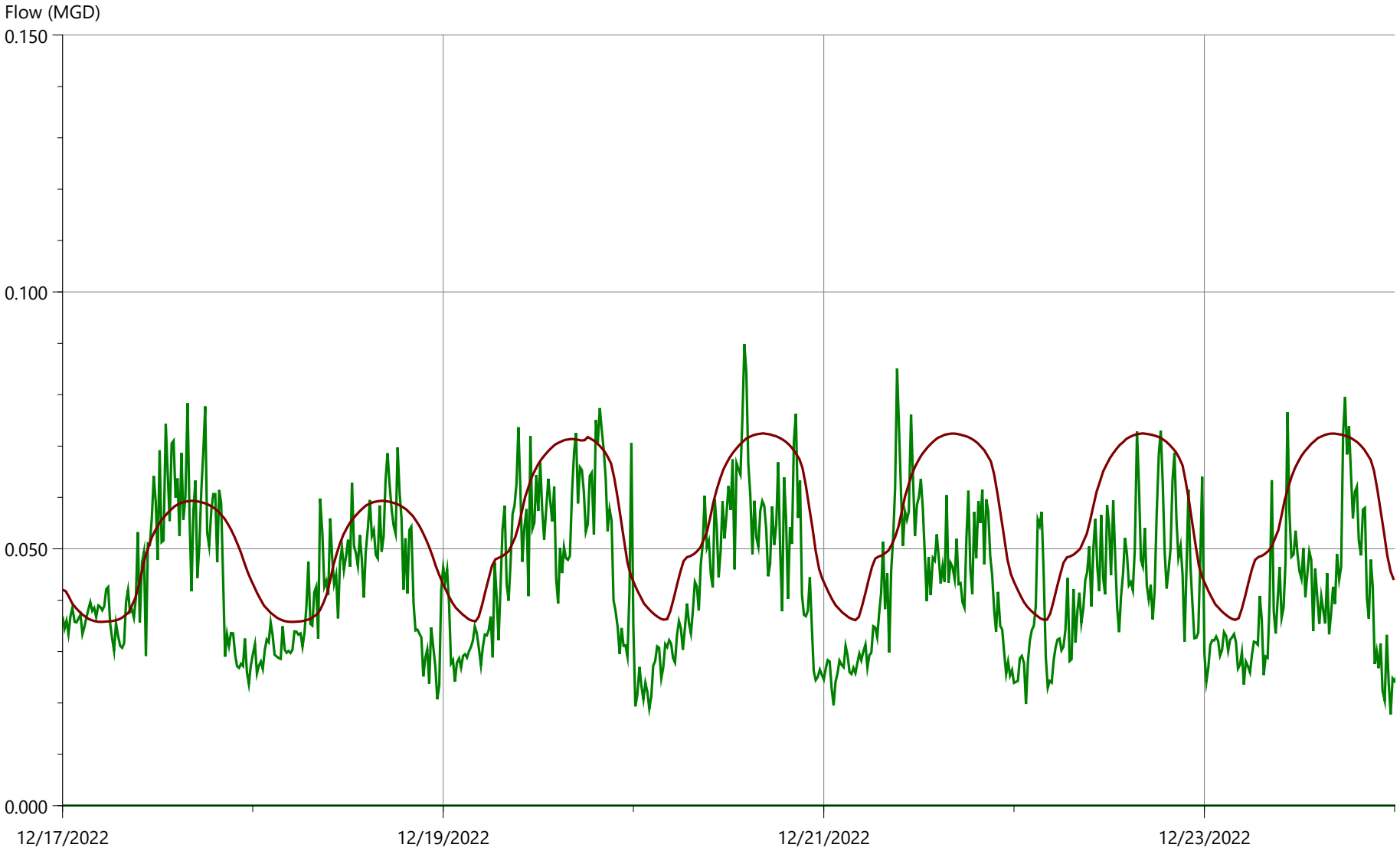
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.014	0.167	0.542
...ation (Homestead Blockage) DWF	0.019	0.096	0.421

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 29, Model Location (Pred.) D/S S21-54.1



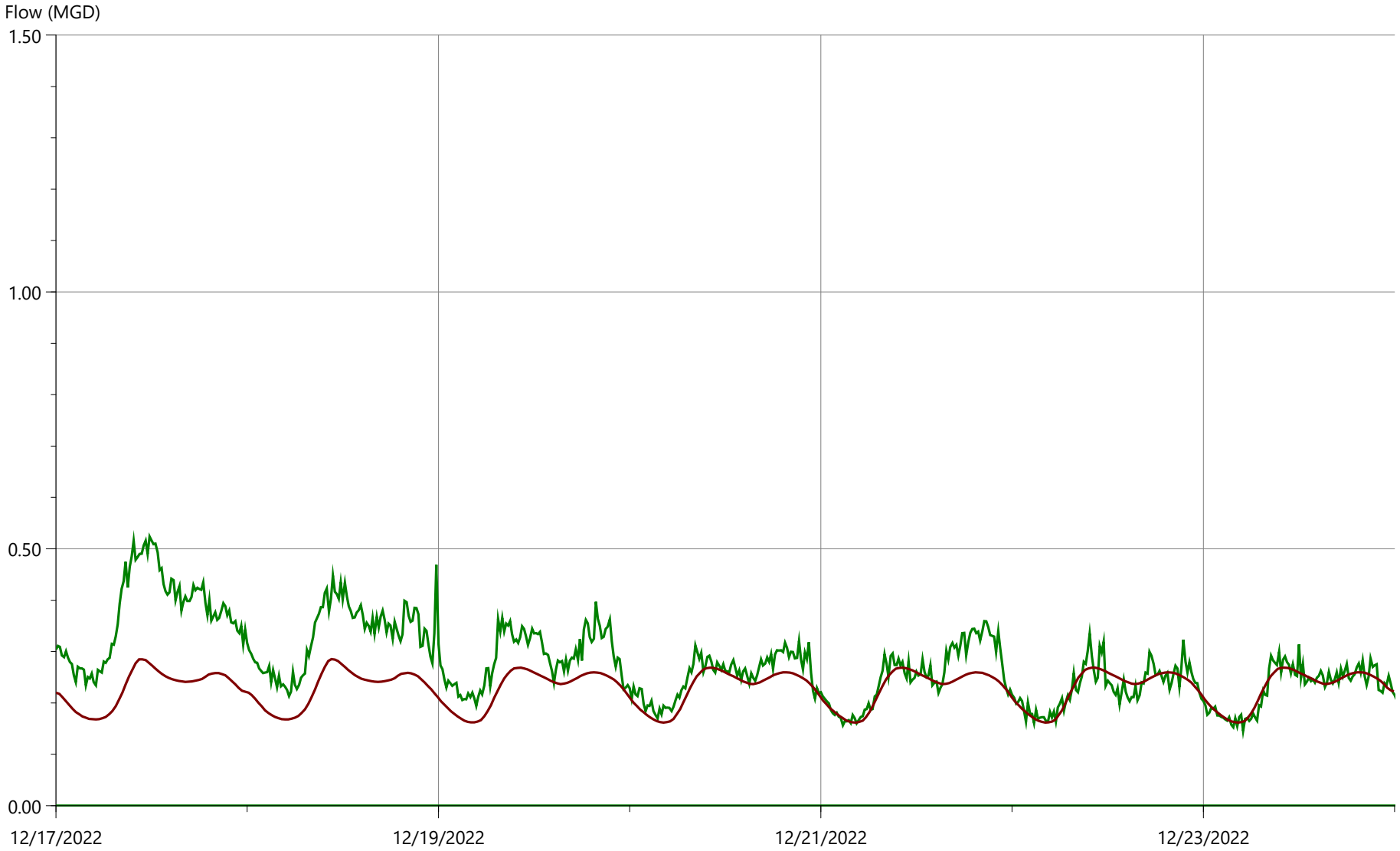
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.012	0.471	1.385
...ation (Homestead Blockage) DWF	0.030	0.450	1.589

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 30, Model Location (Pred.) D/S S62-24.1



	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.018	0.090	0.305
...ation (Homestead Blockage) DWF	0.036	0.072	0.380

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>Existing_DWF_2022.12.17_7d_WithBlock...
Flow Survey Location (Obs.) 31, Model Location (Pred.) D/S S62-23.1



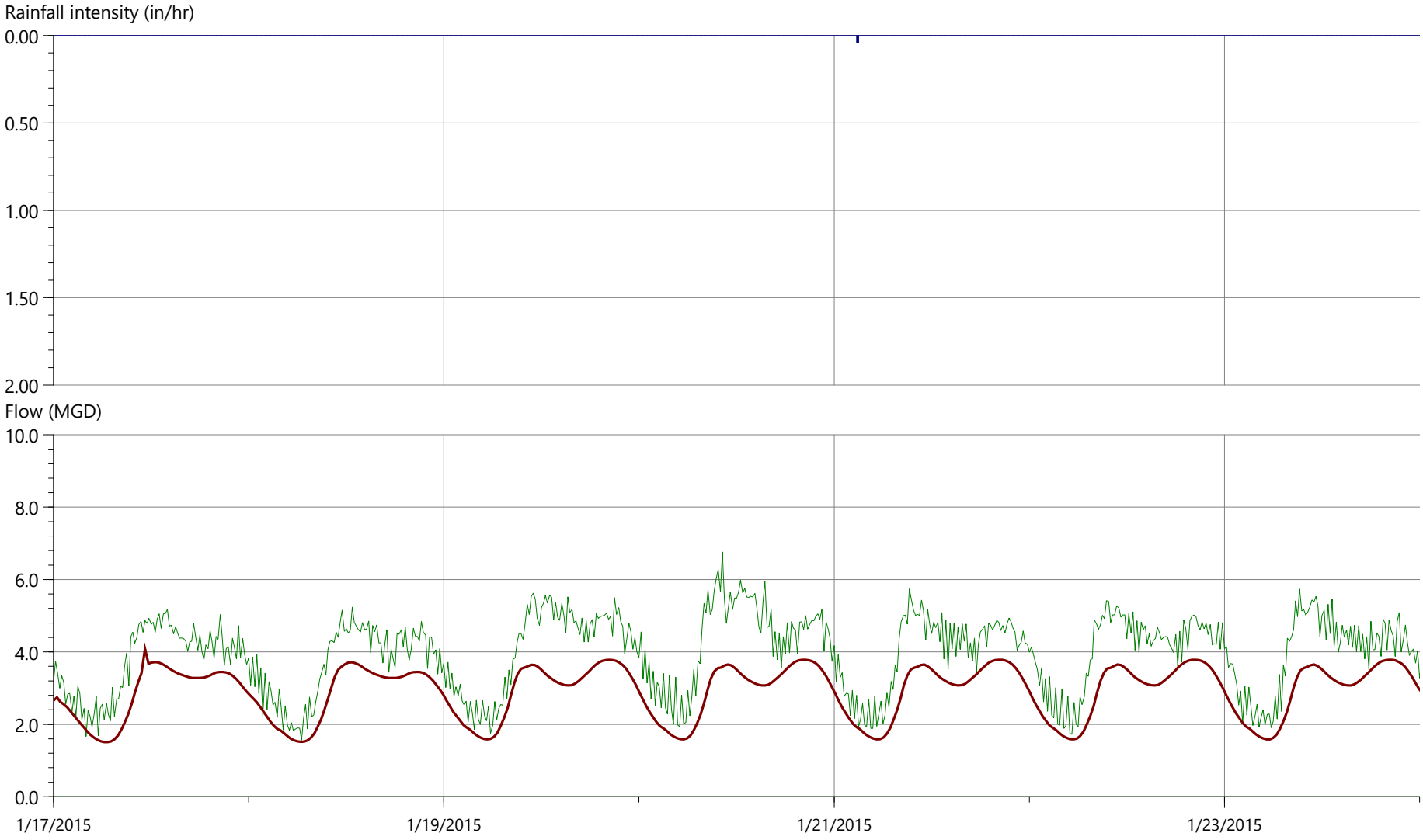
	Flow		
	Min (MGD)	Max (MGD)	Volume (US Mgal)
Observed	0.146	0.524	1.961
...ation (Homestead Blockage) DWF	0.162	0.285	1.599

Dry Weather Flow Calibration Plots
Modeled vs. 2014-2015 Metered Flows

(*assumes normal settings at Homestead/Lawrence gate structure*)

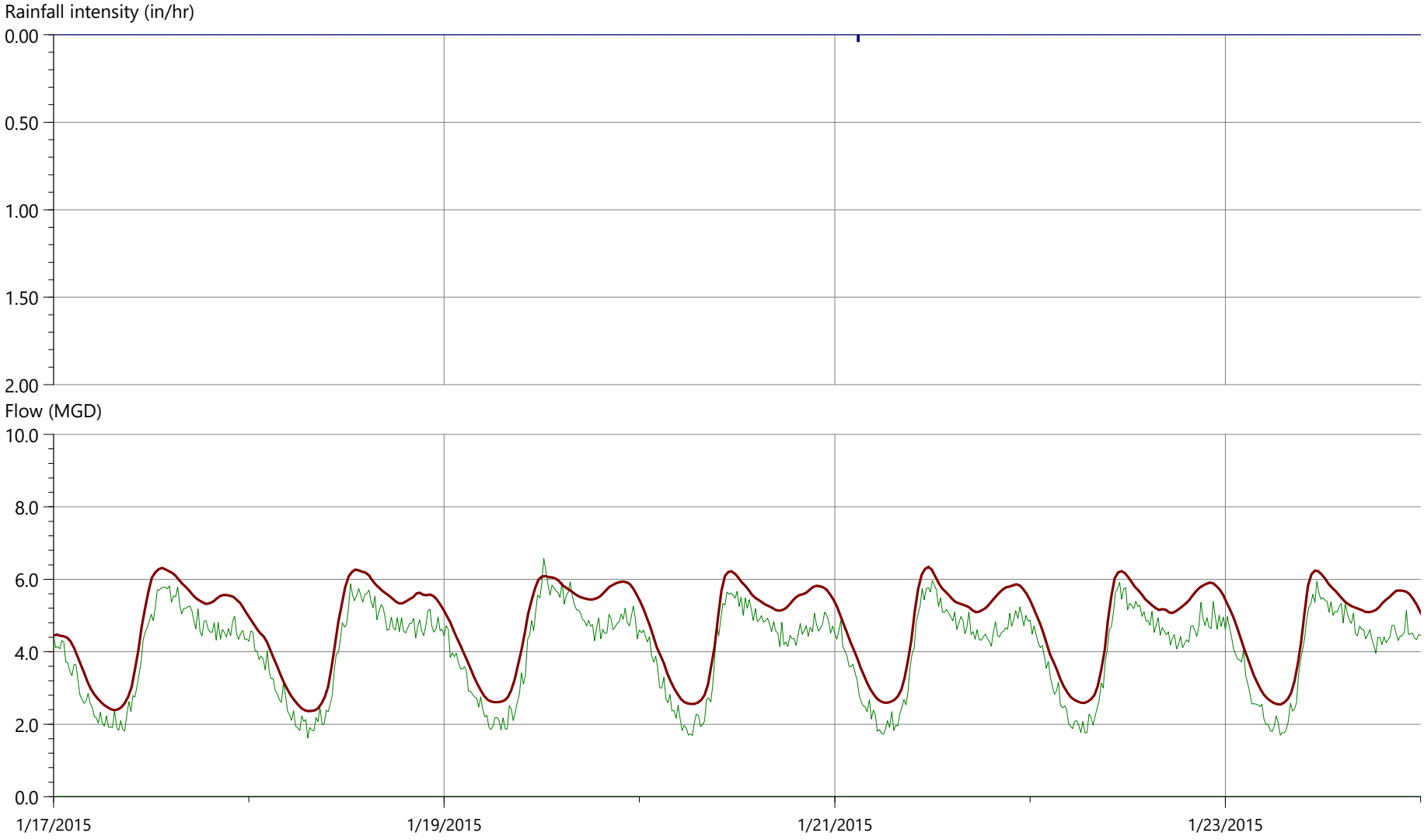
Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...

Flow Survey Location (Obs.) 1, Model Location (Pred.) D/S S104-29.1, Rainfall Profile: 1



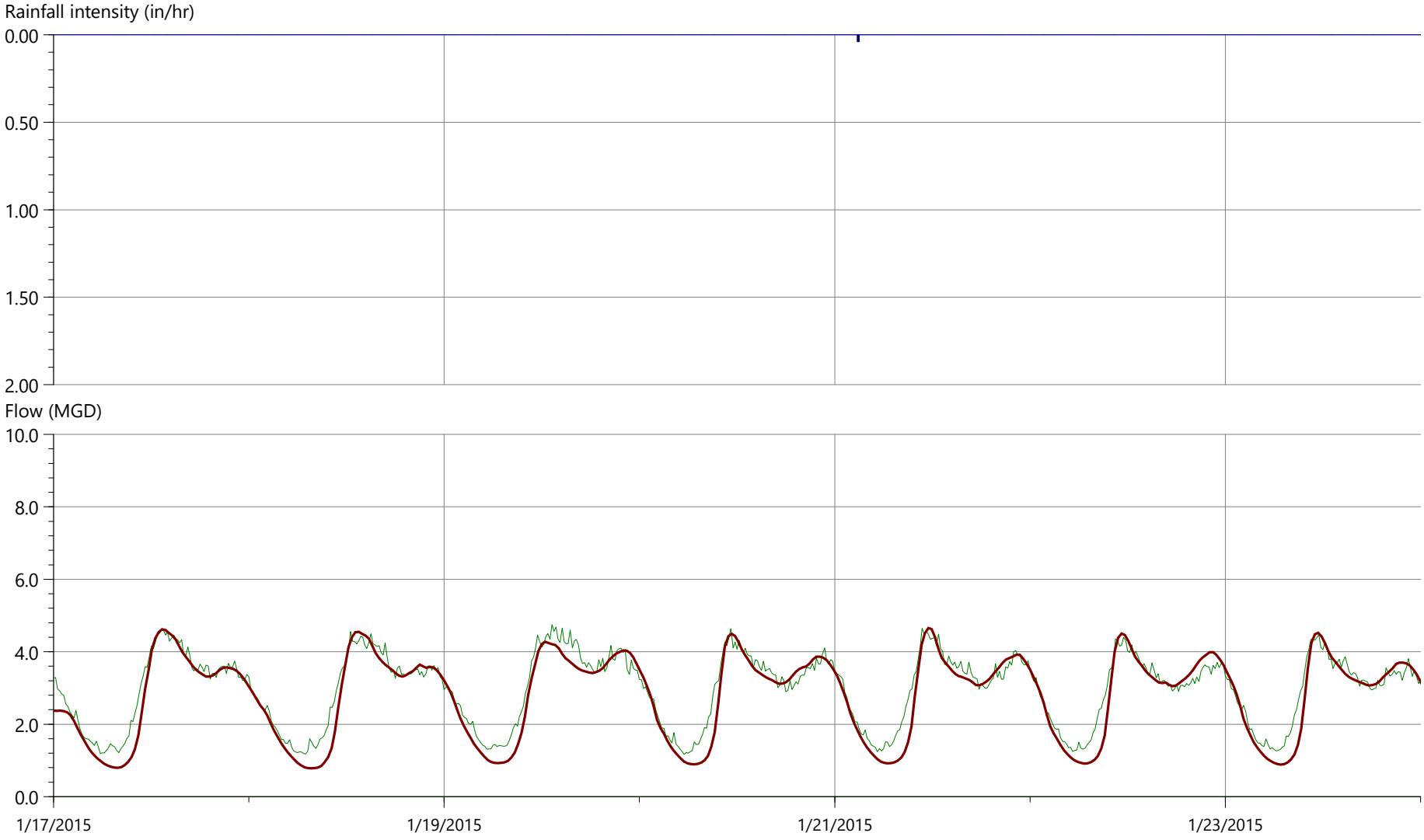
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.010	0.040	0.000			
Observed				1.565	6.760	27.798
...4d_10232023>DWF				1.509	4.083	20.338

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 2, Model Location (Pred.) D/S S103-9.1, Rainfall Profile: 1



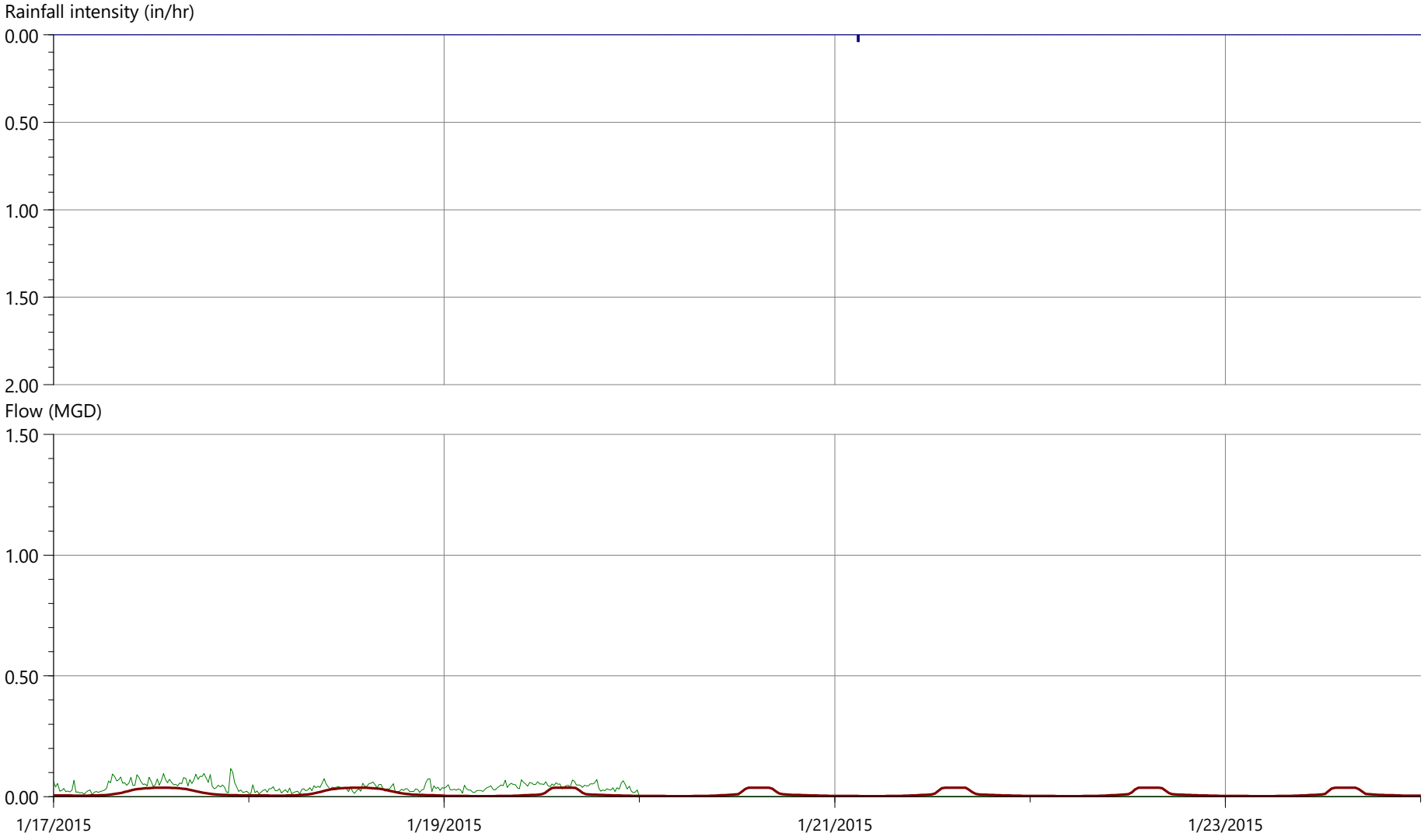
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.010	0.040	0.000			
Observed				1.622	6.578	28.333
...4d_10232023>DWF				2.363	6.345	33.008

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 3, Model Location (Pred.) D/S S104-27.1, Rainfall Profile: 1



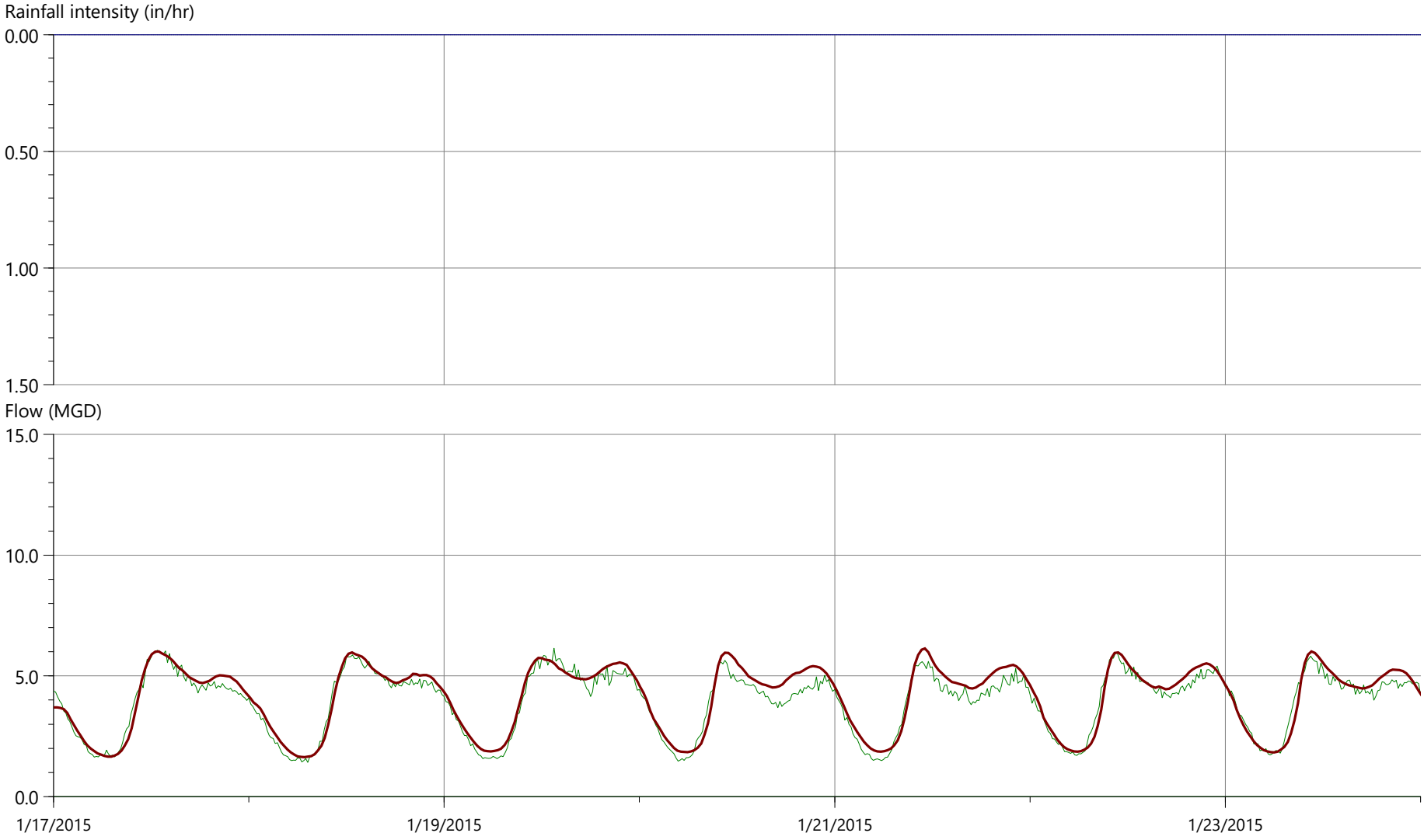
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.010	0.040	0.000			
Observed				1.168	4.748	20.854
...4d_10232023>DWF				0.780	4.654	19.551

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 4, Model Location (Pred.) D/S S94-36.1, Rainfall Profile: 1



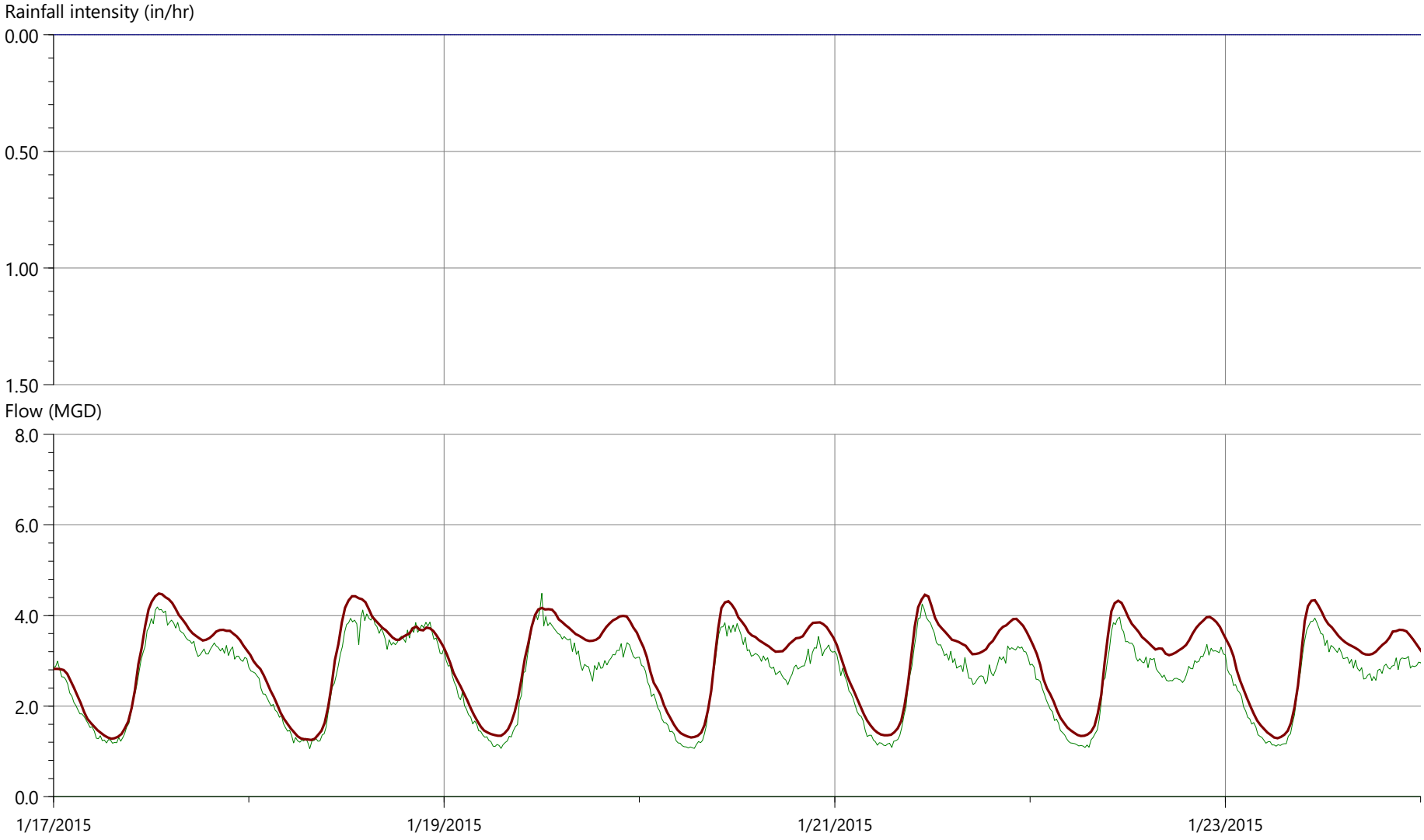
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.010	0.040	0.000			
Observed				0.000	0.116	0.125
...4d_10232023>DWF				0.003	0.037	0.085

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 5, Model Location (Pred.) D/S S83-23.1, Rainfall Profile: 2



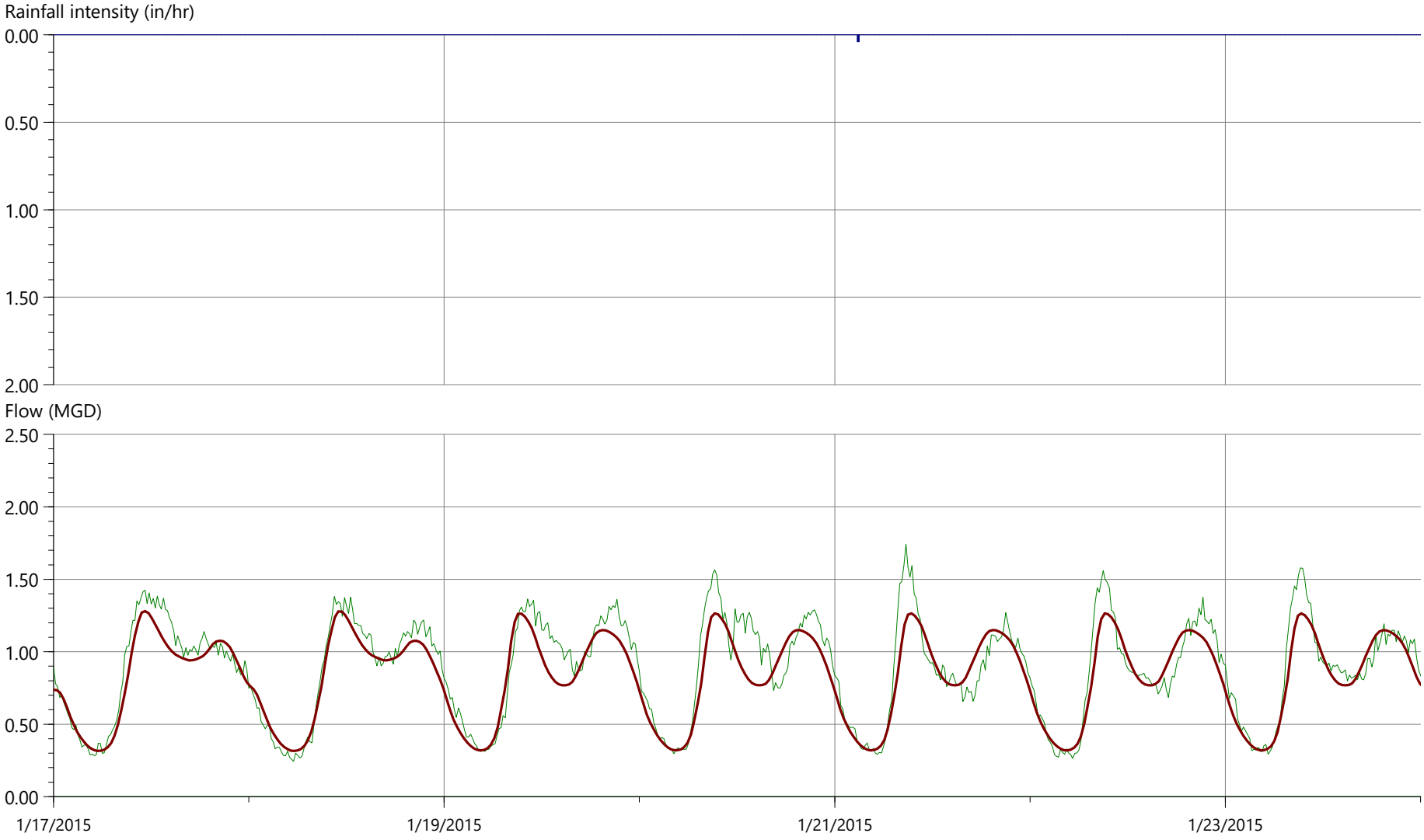
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				1.422	6.144	27.553
...4d_10232023>DWF				1.638	6.131	28.906

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 6, Model Location (Pred.) D/S S83-25.1, Rainfall Profile: 2



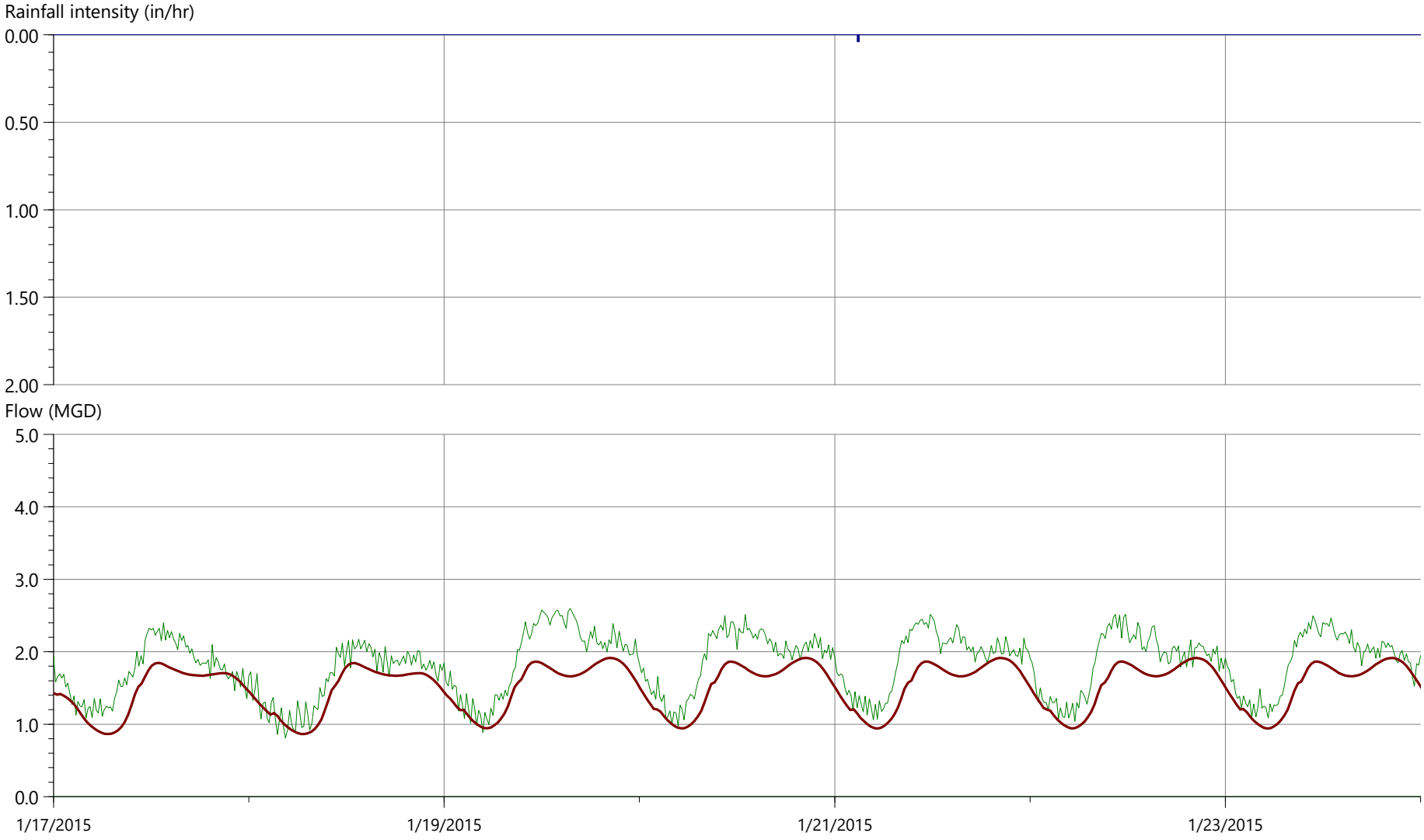
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				1.058	4.493	18.522
...4d_10232023>DWF				1.253	4.485	20.993

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 7, Model Location (Pred.) D/S S105-6.1, Rainfall Profile: 1



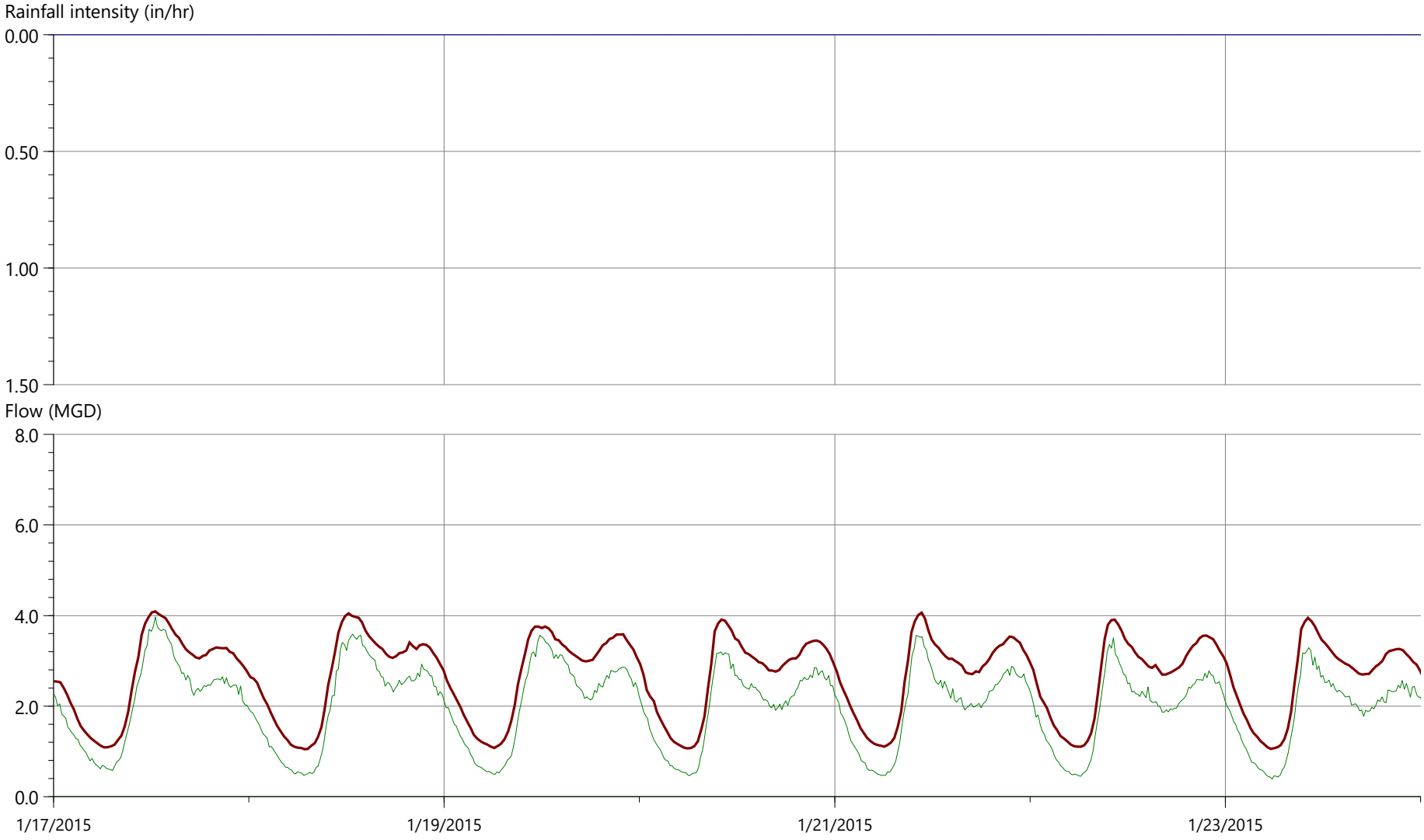
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.010	0.040	0.000			
Observed				0.243	1.742	6.178
...4d_10232023>DWF				0.315	1.280	5.774

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 8, Model Location (Pred.) D/S S86-13.1, Rainfall Profile: 1



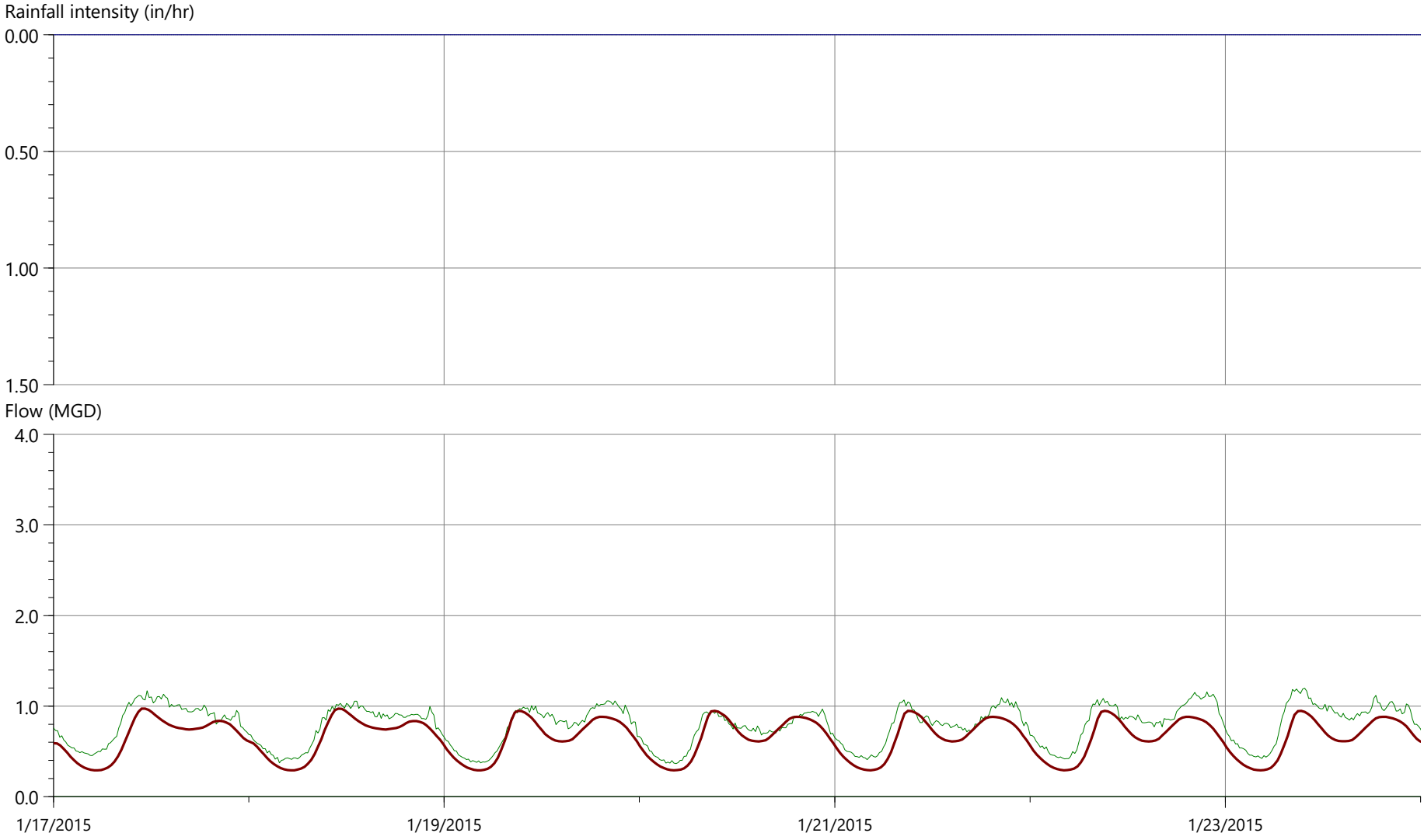
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.010	0.040	0.000			
Observed				0.811	2.598	12.782
...4d_10232023>DWF				0.864	1.915	10.581

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 9, Model Location (Pred.) D/S S62-48.1, Rainfall Profile: 2



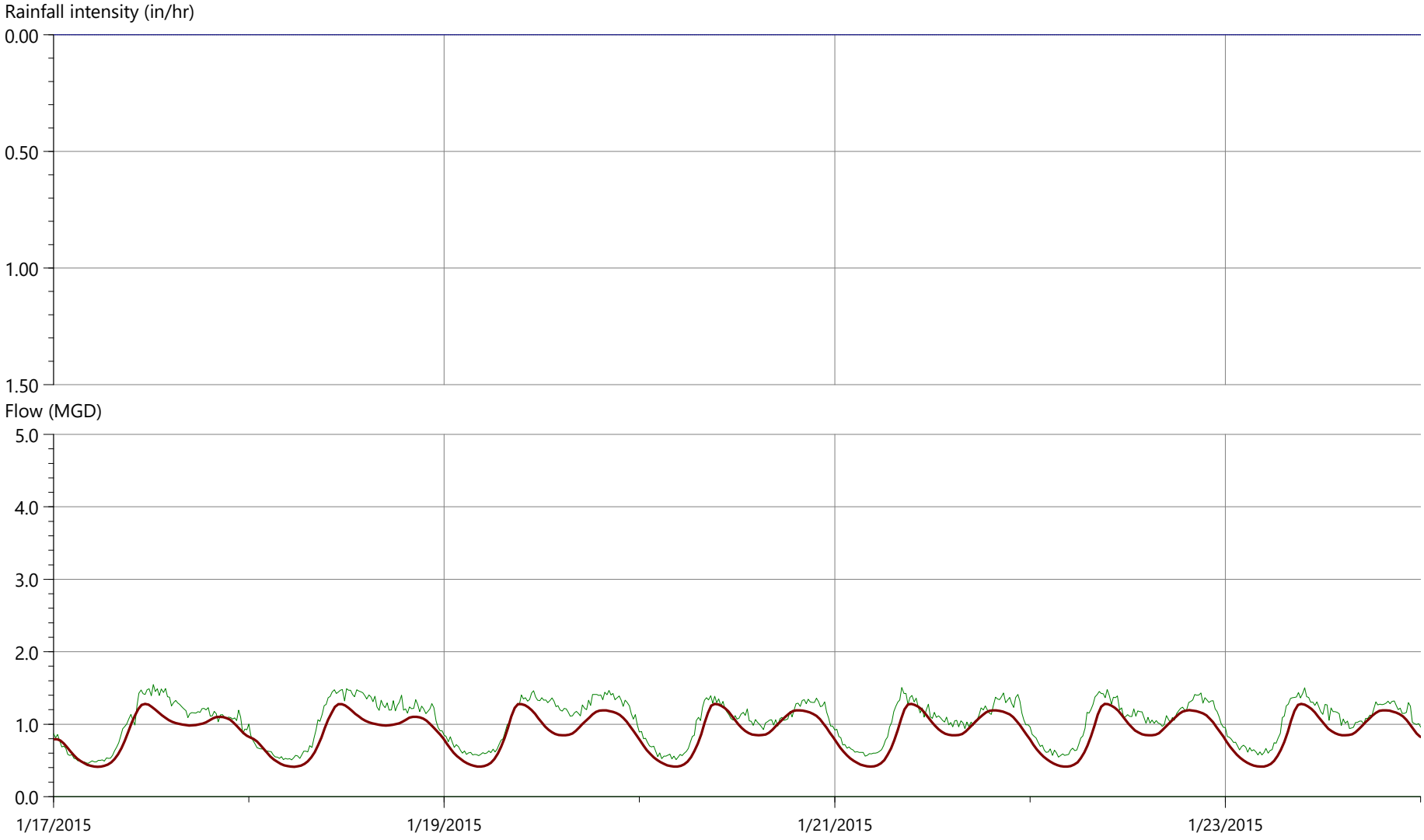
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.389	3.968	13.993
...4d_10232023>DWF				1.048	4.093	18.629

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 10, Model Location (Pred.) D/S S52-80.1, Rainfall Profile: 2



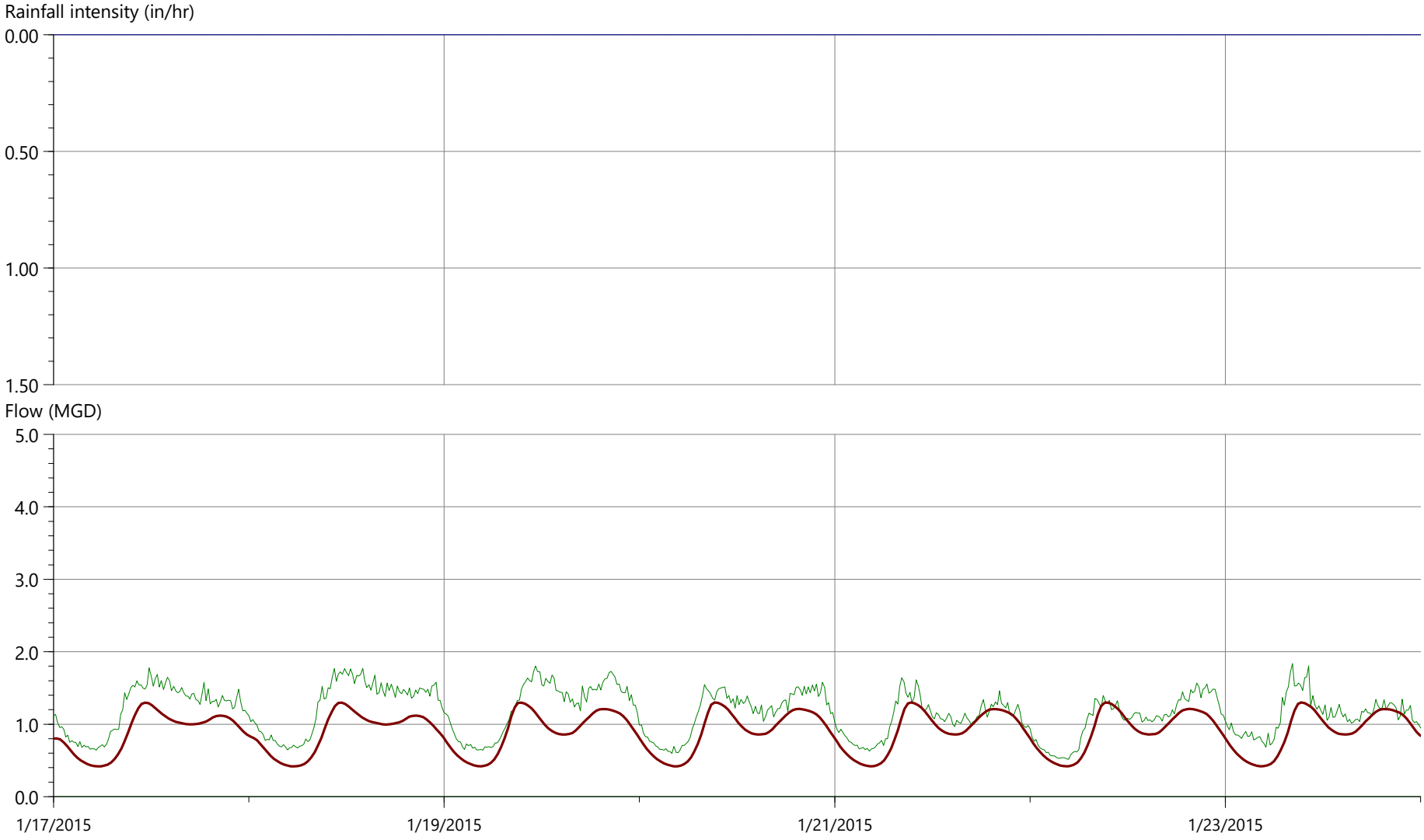
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.365	1.198	5.546
...4d_10232023>DWF				0.291	0.973	4.553

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 11, Model Location (Pred.) D/S S53-9.1, Rainfall Profile: 2



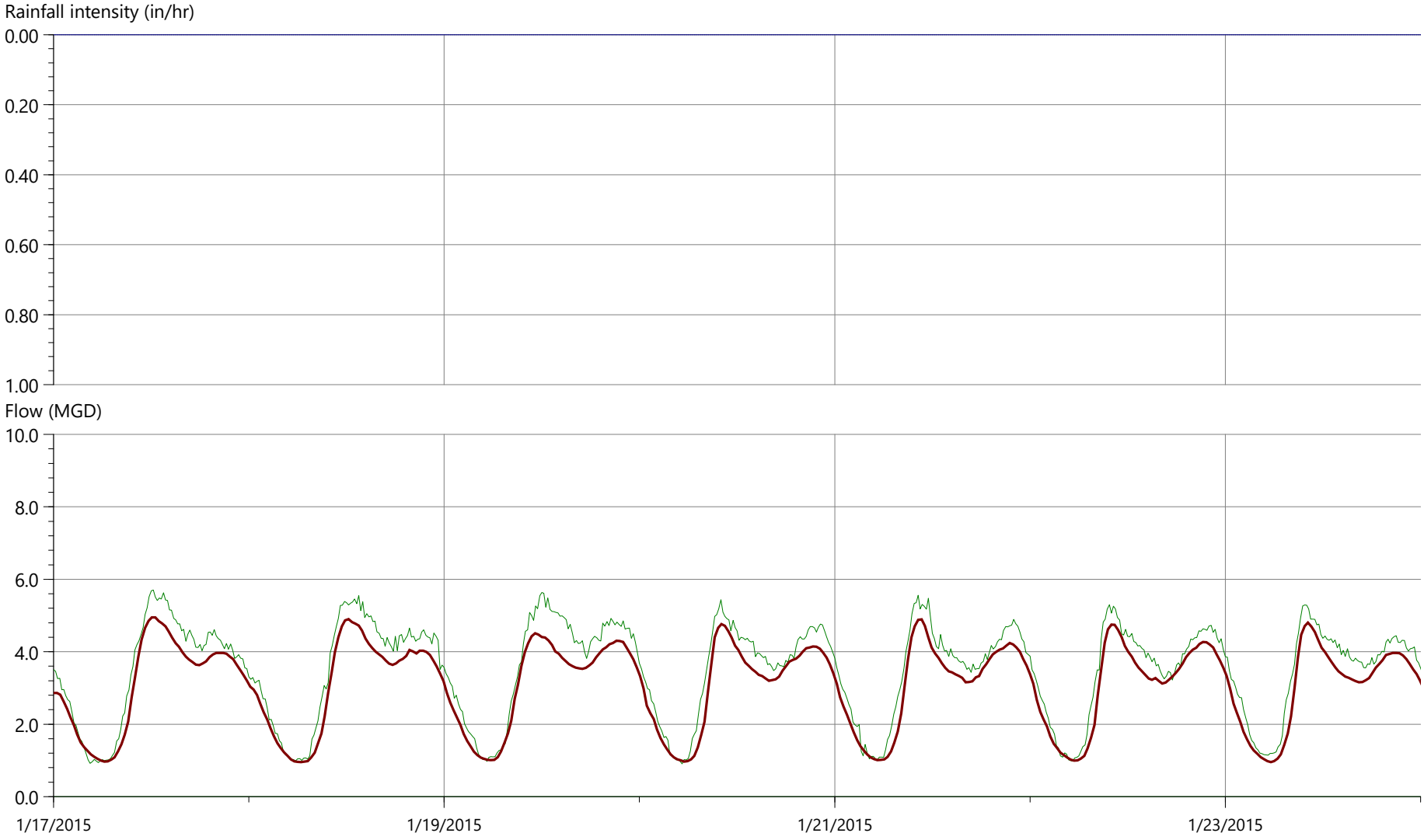
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.459	1.547	7.290
...4d_10232023>DWF				0.413	1.280	6.190

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 12, Model Location (Pred.) D/S S53-109.1, Rainfall Profile: 2



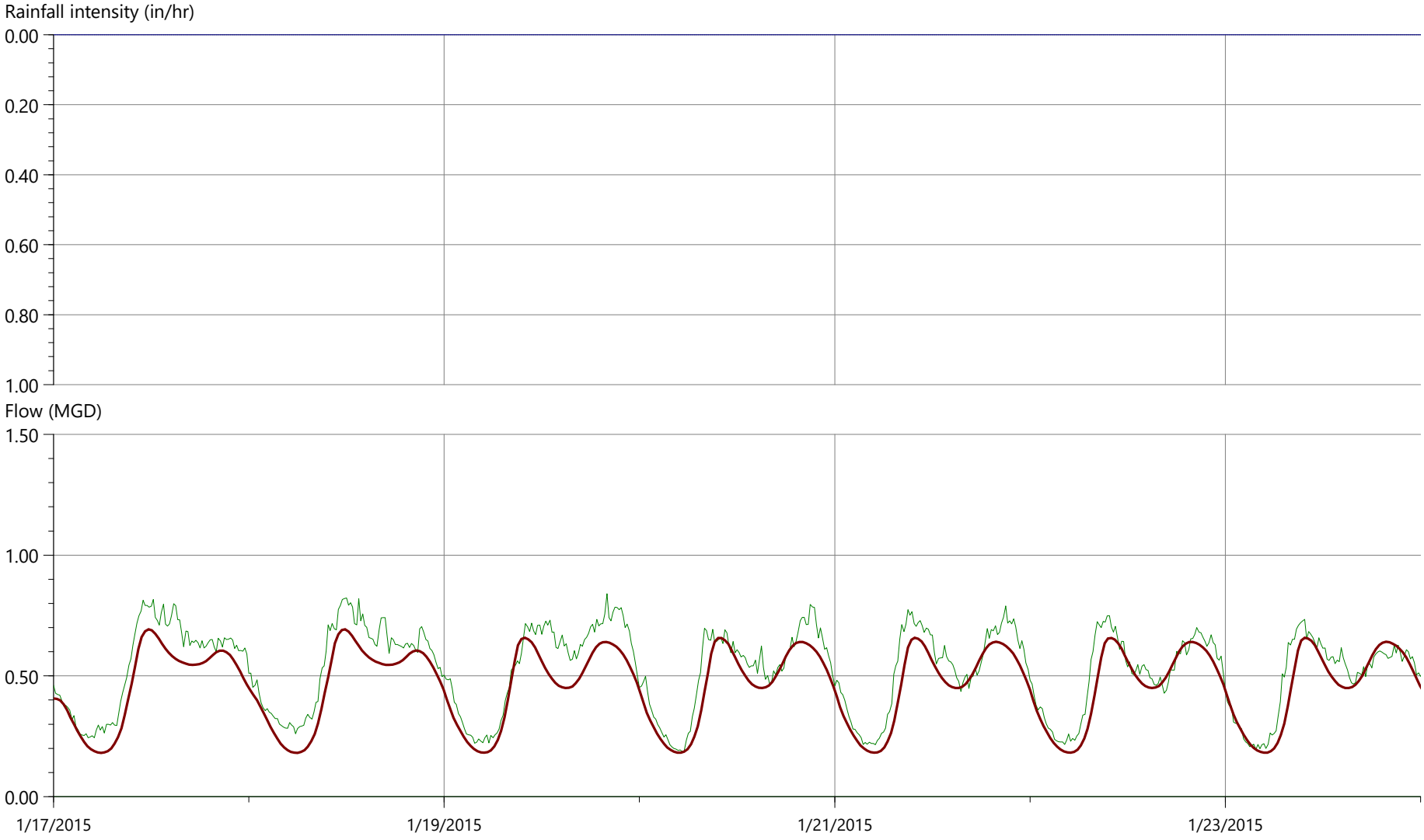
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.516	1.835	8.168
...4d_10232023>DWF				0.418	1.300	6.278

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 13, Model Location (Pred.) D/S S53-73.1, Rainfall Profile: 3



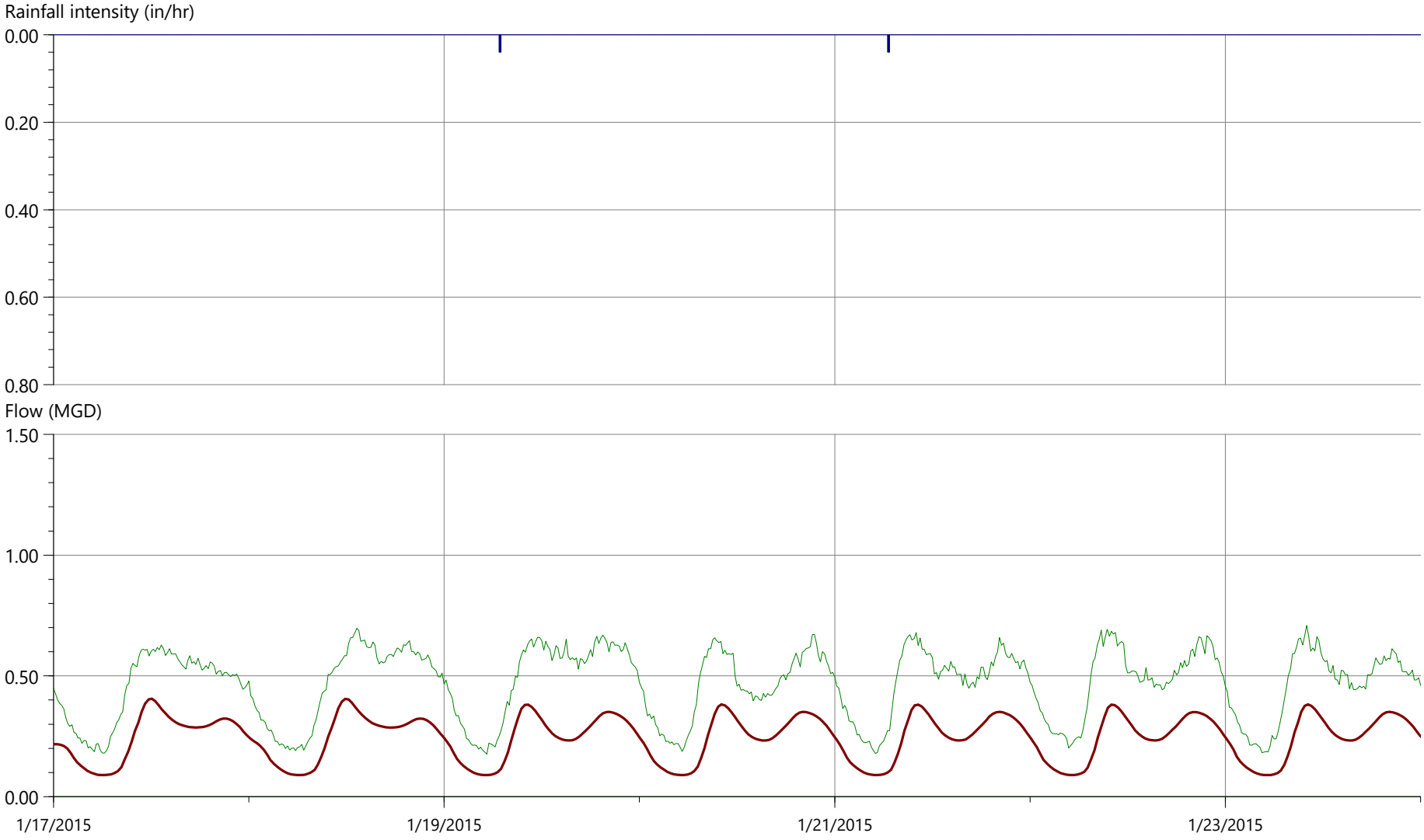
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.904	5.704	24.523
...4d_10232023>DWF				0.954	4.945	21.504

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 14, Model Location (Pred.) D/S S54-17.1, Rainfall Profile: 3



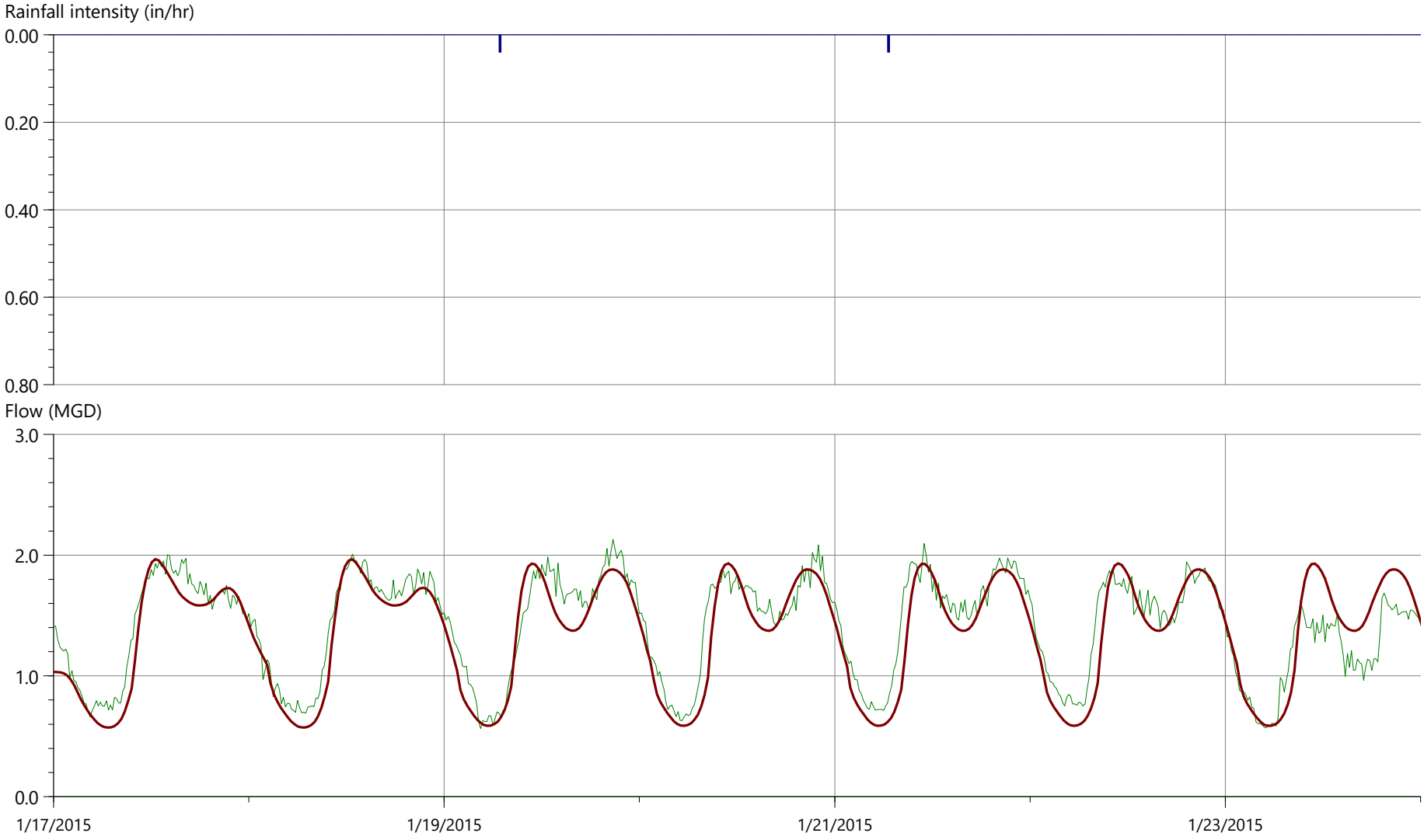
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.187	0.840	3.691
...4d_10232023>DWF				0.181	0.693	3.212

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 15, Model Location (Pred.) D/S S65-48.1, Rainfall Profile: 4



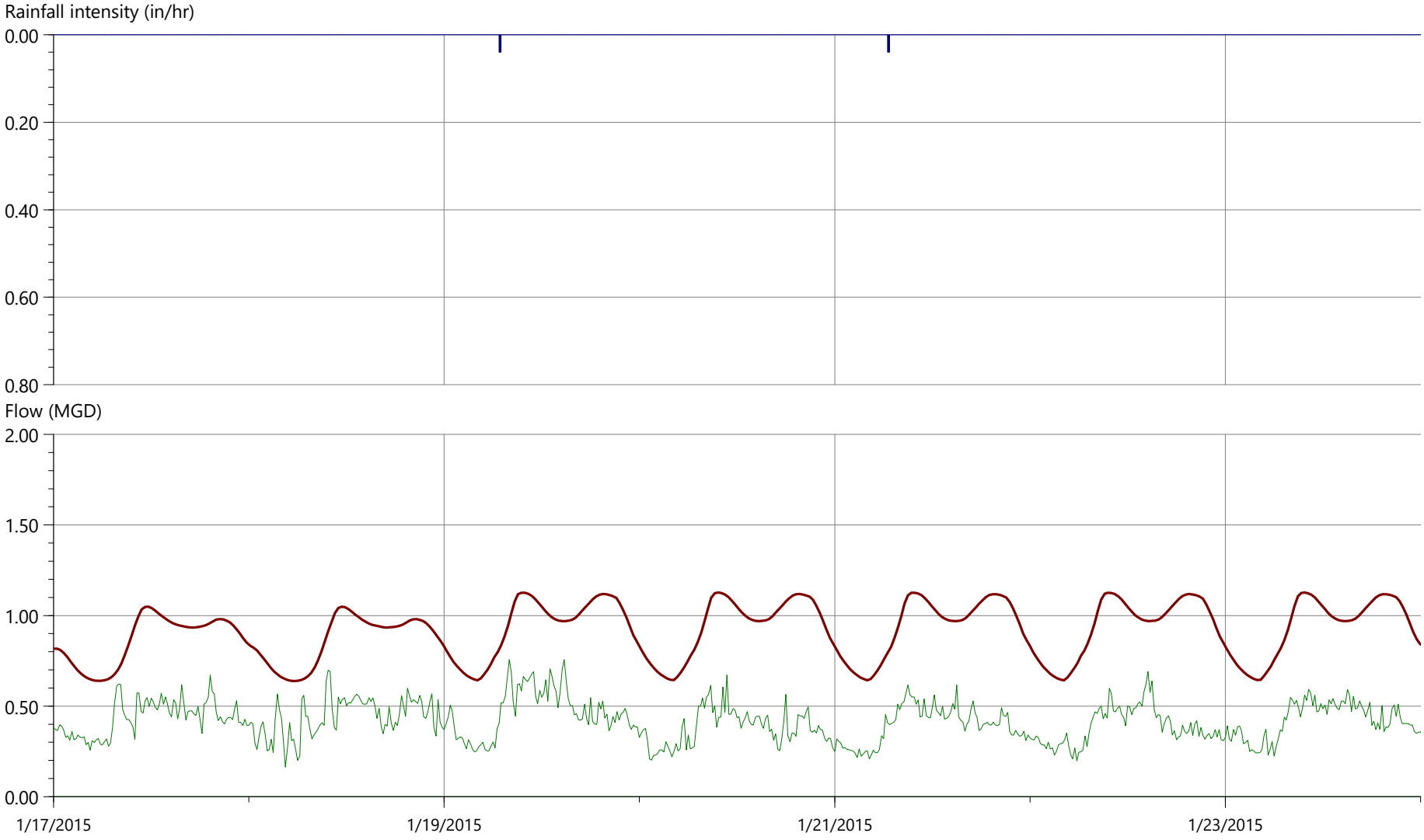
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.176	0.708	3.273
...4d_10232023>DWF				0.089	0.406	1.711

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 16, Model Location (Pred.) D/S S67-12.1, Rainfall Profile: 4



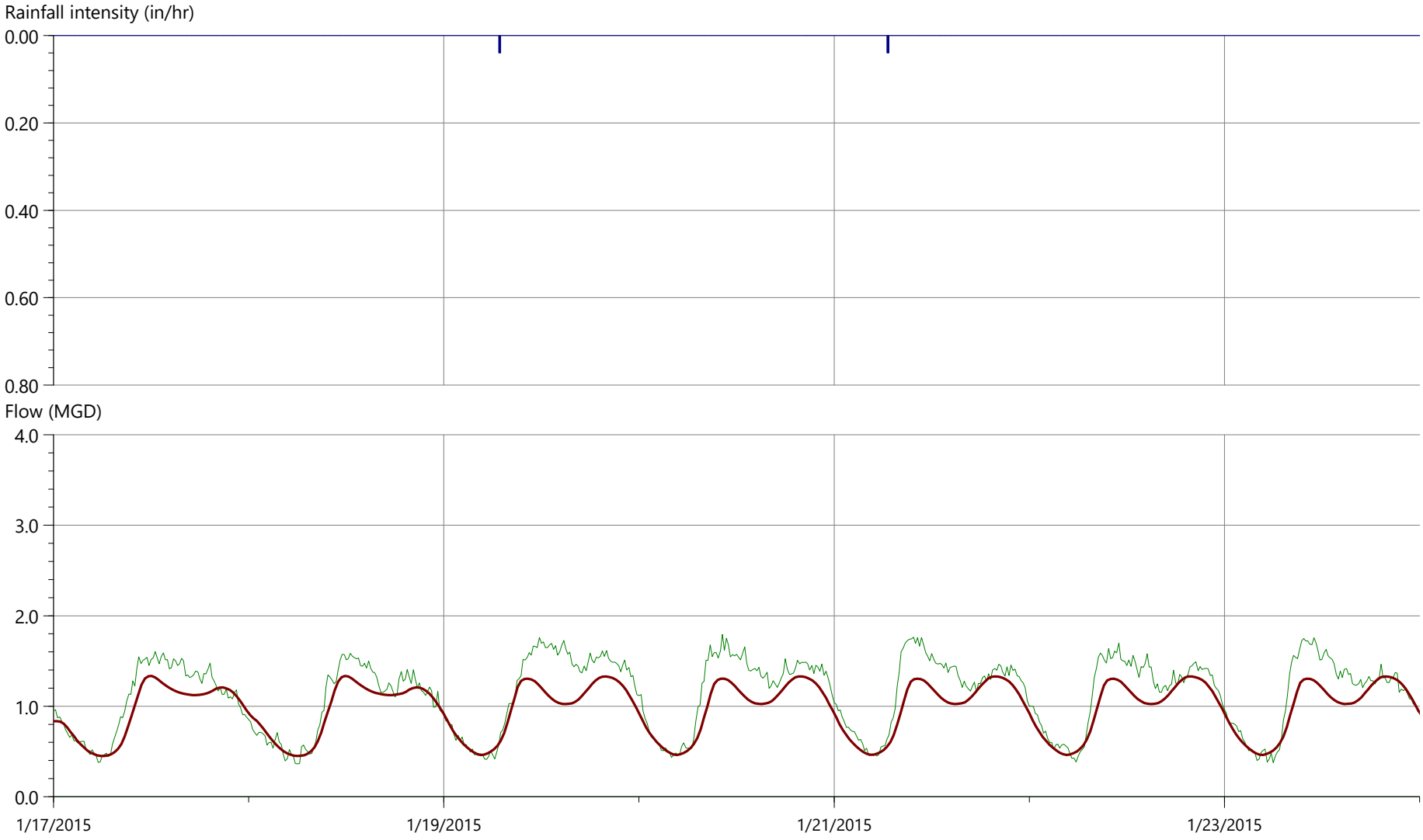
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.564	2.132	9.871
...4d_10232023>DWF				0.572	1.966	9.424

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 17, Model Location (Pred.) D/S S58-12.2, Rainfall Profile: 4



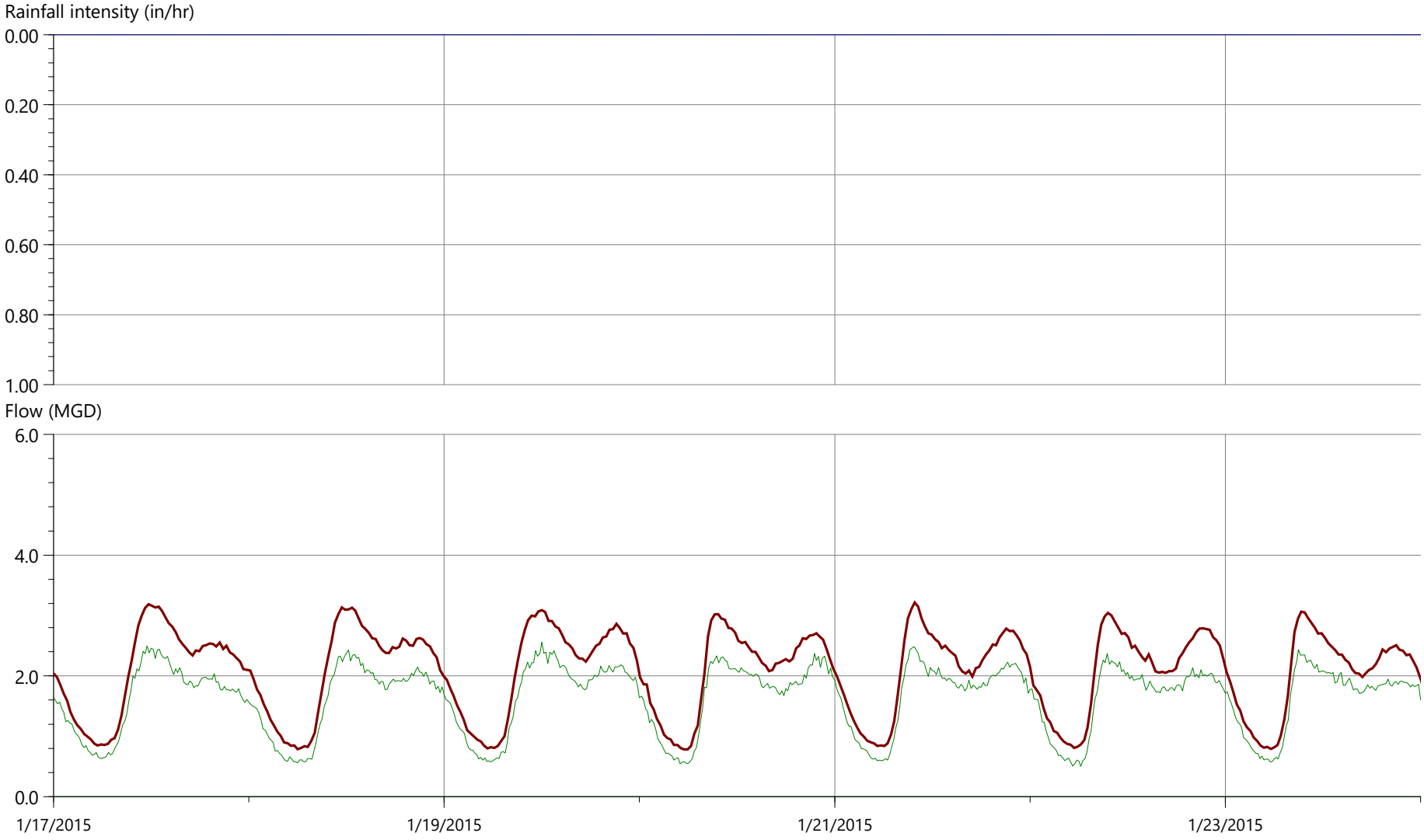
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.163	0.757	2.925
...4d_10232023>DWF				0.639	1.126	6.419

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 18, Model Location (Pred.) D/S S58-11.1, Rainfall Profile: 4



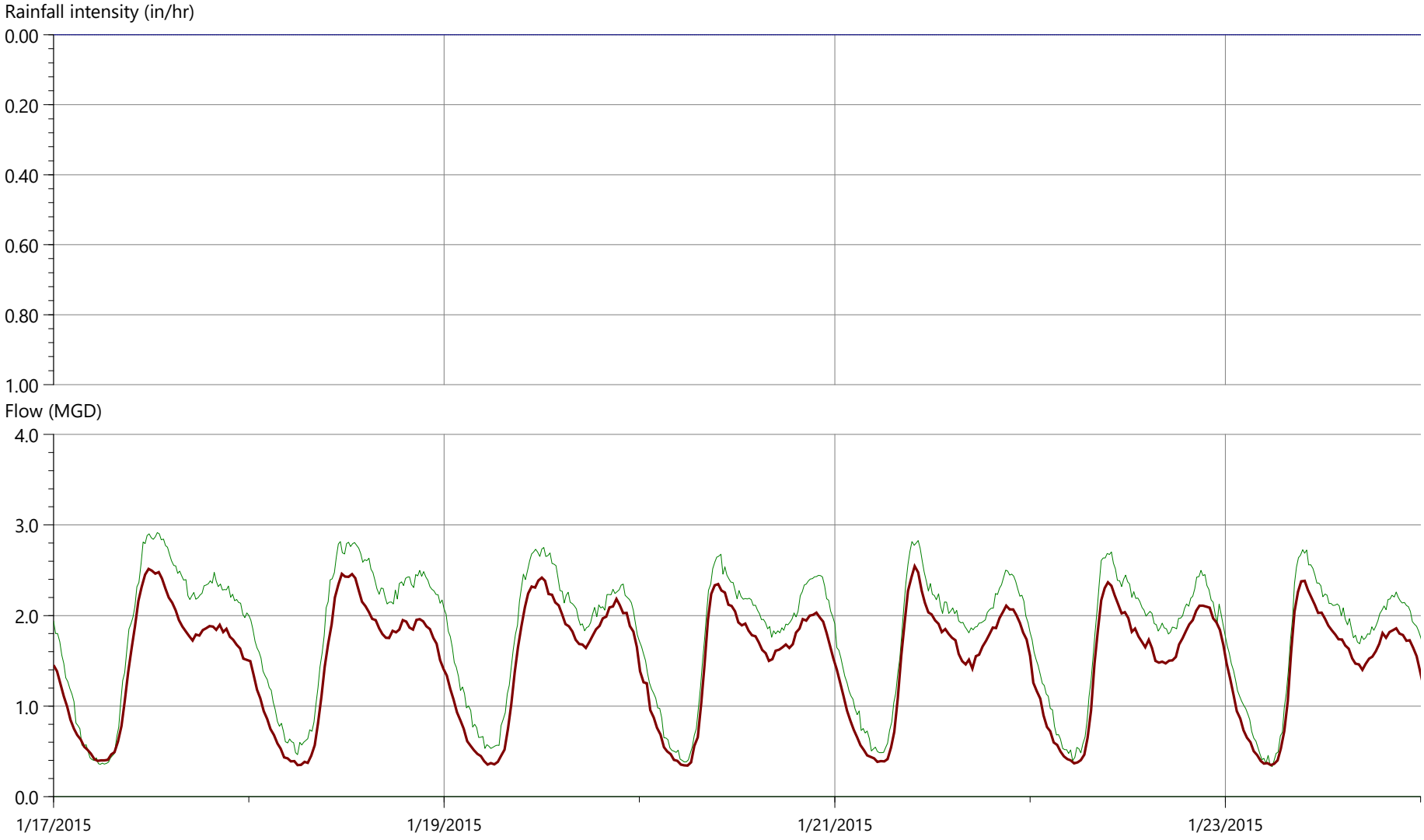
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.363	1.793	7.940
...4d_10232023>DWF				0.450	1.336	6.796

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 19, Model Location (Pred.) D/S S21-23.1, Rainfall Profile: 3



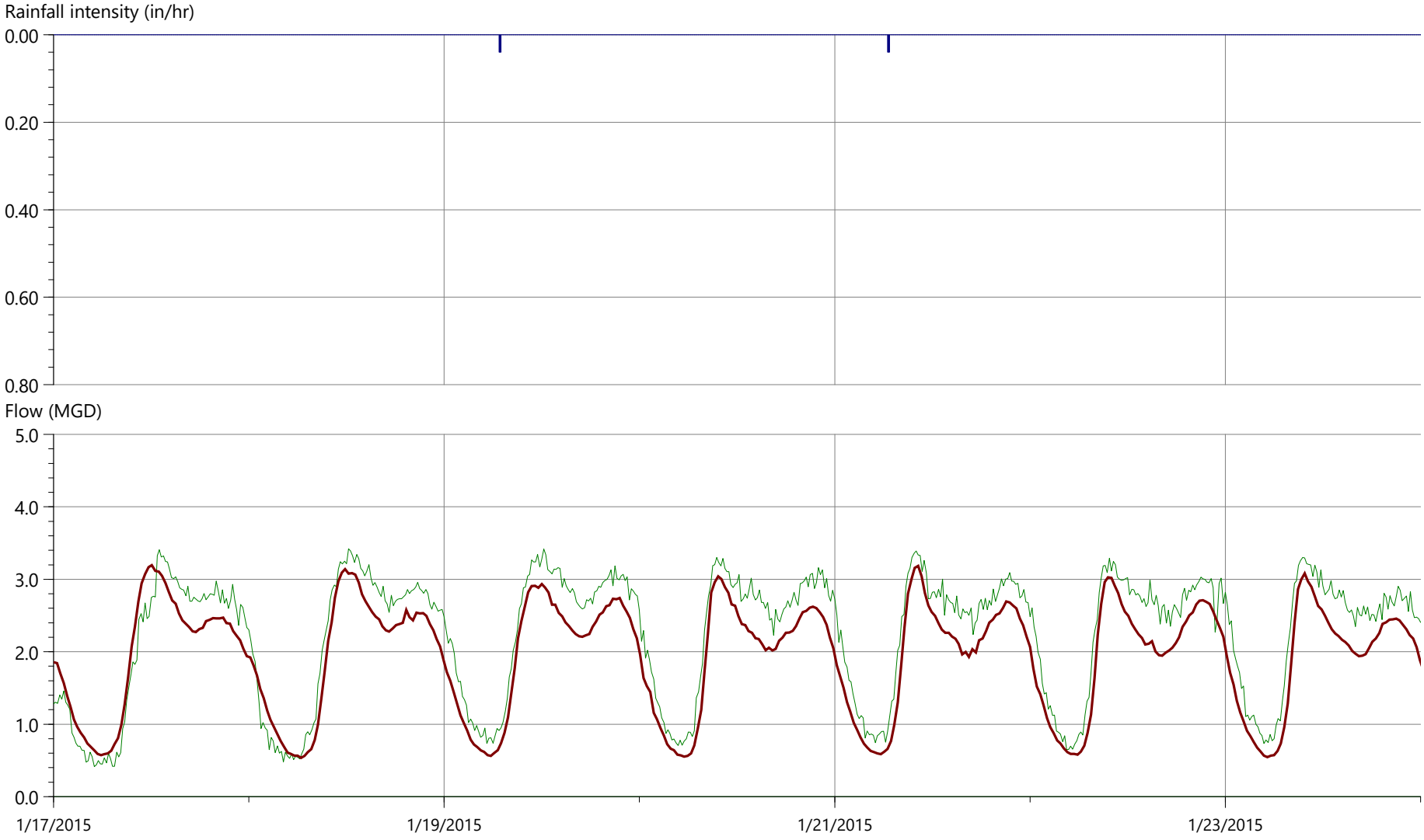
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.503	2.559	11.445
...4d_10232023>DWF				0.782	3.218	14.555

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 20, Model Location (Pred.) D/S S21-46.1, Rainfall Profile: 3



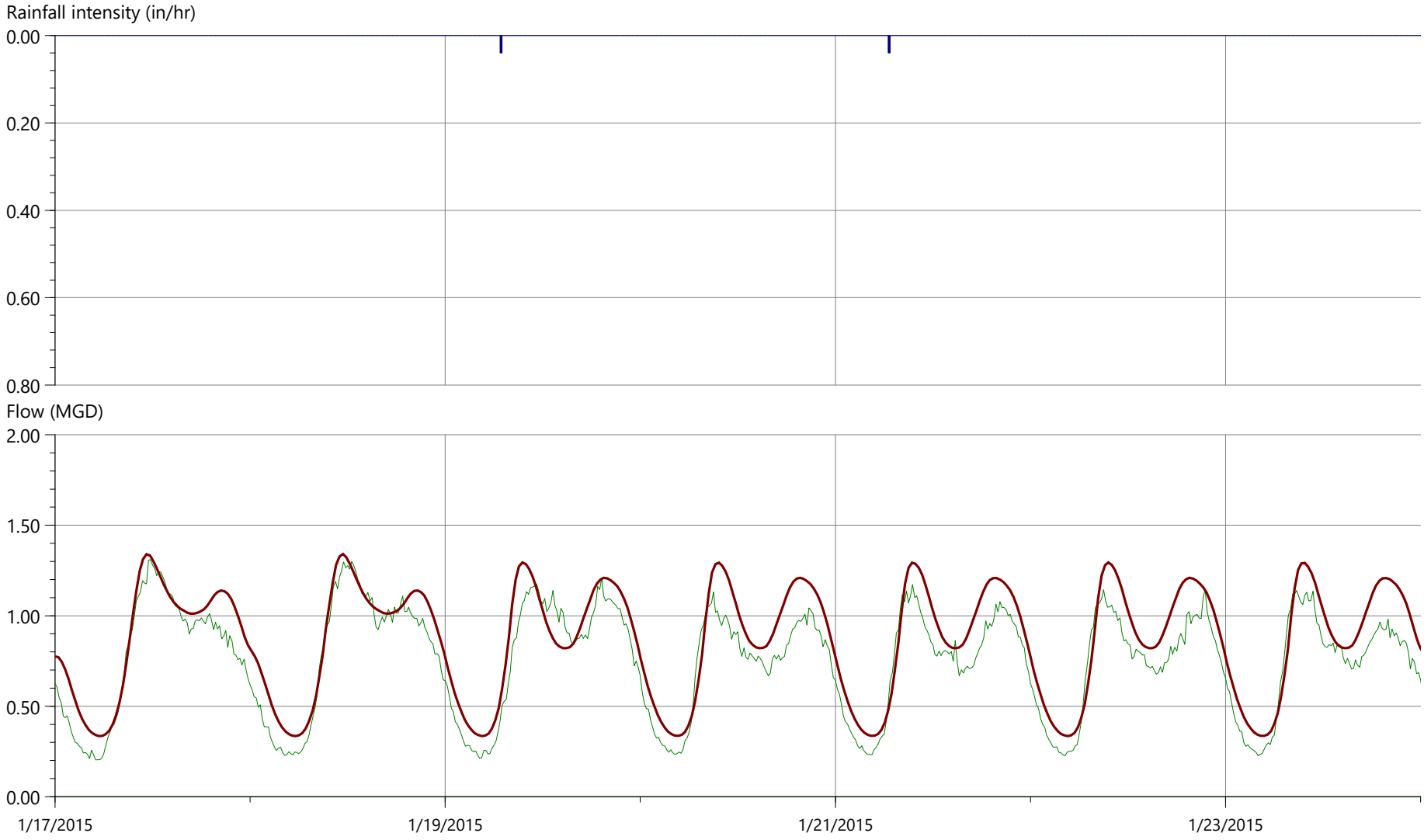
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.333	2.916	12.509
...4d_10232023>DWF				0.342	2.544	10.374

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 21, Model Location (Pred.) D/S S23-14.1, Rainfall Profile: 4



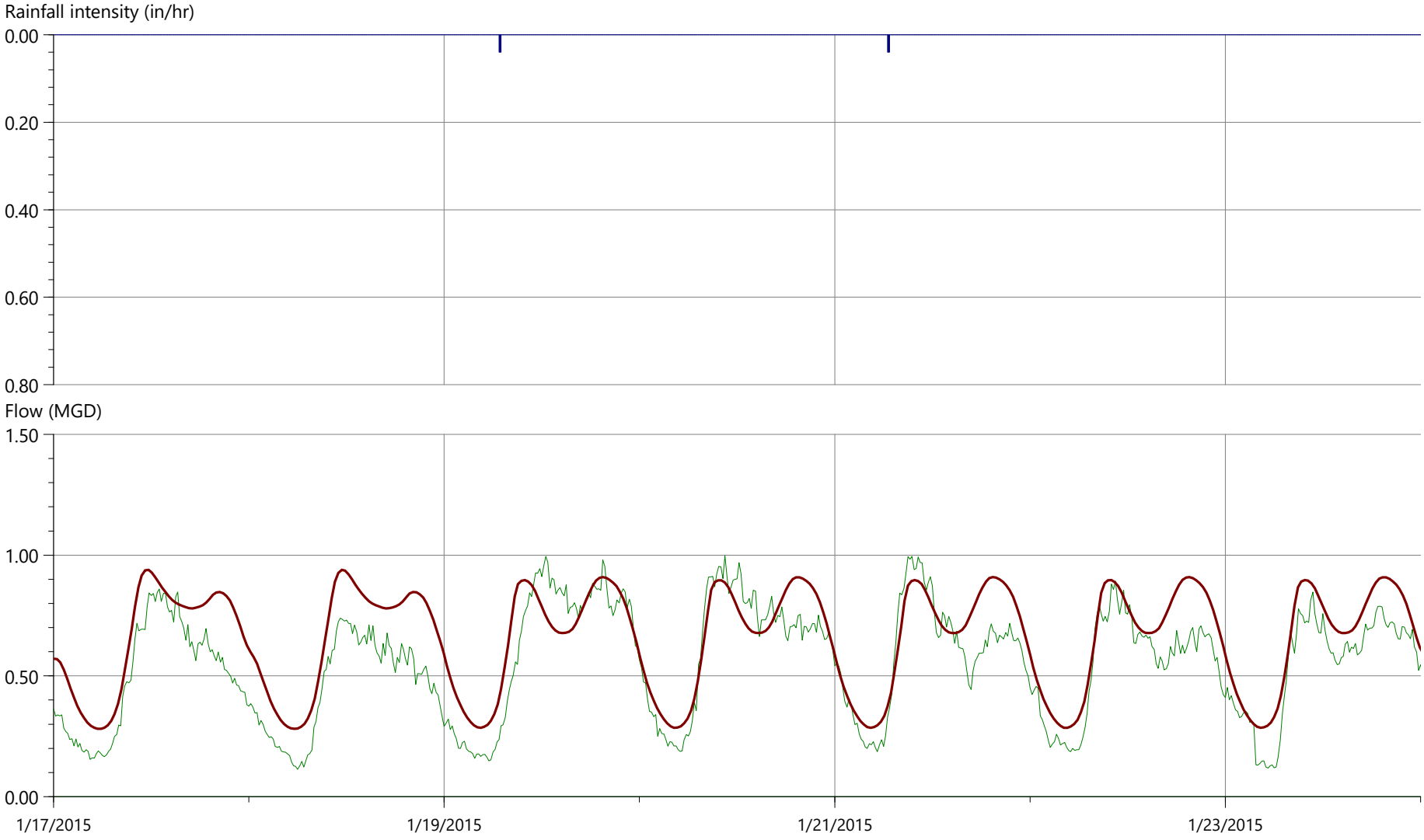
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.415	3.422	15.707
...4d_10232023>DWF				0.535	3.196	13.548

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 22, Model Location (Pred.) D/S S45-88.1, Rainfall Profile: 4



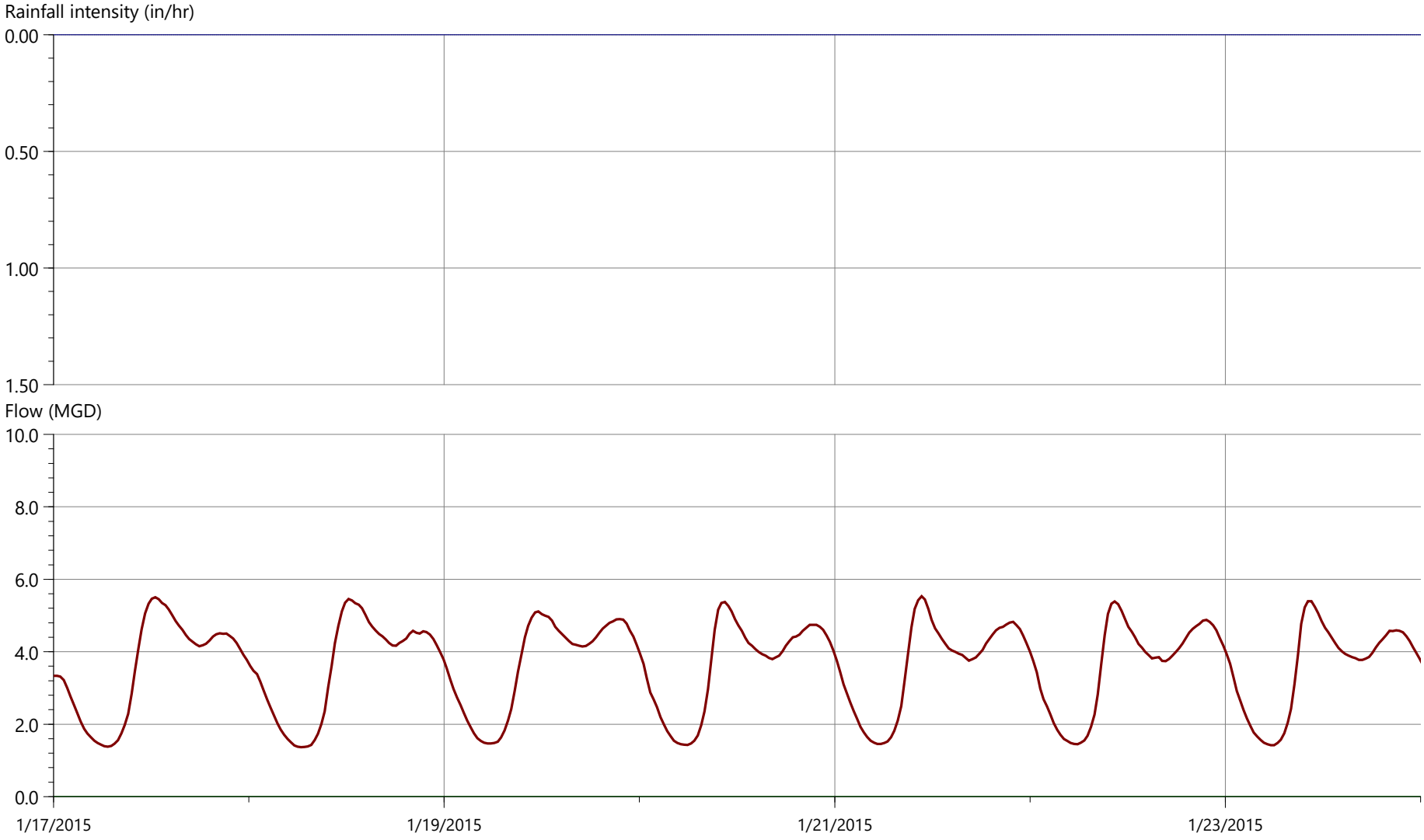
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.203	1.310	5.264
...4d_10232023>DWF				0.335	1.340	6.068

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 23, Model Location (Pred.) D/S S48-32.1, Rainfall Profile: 4



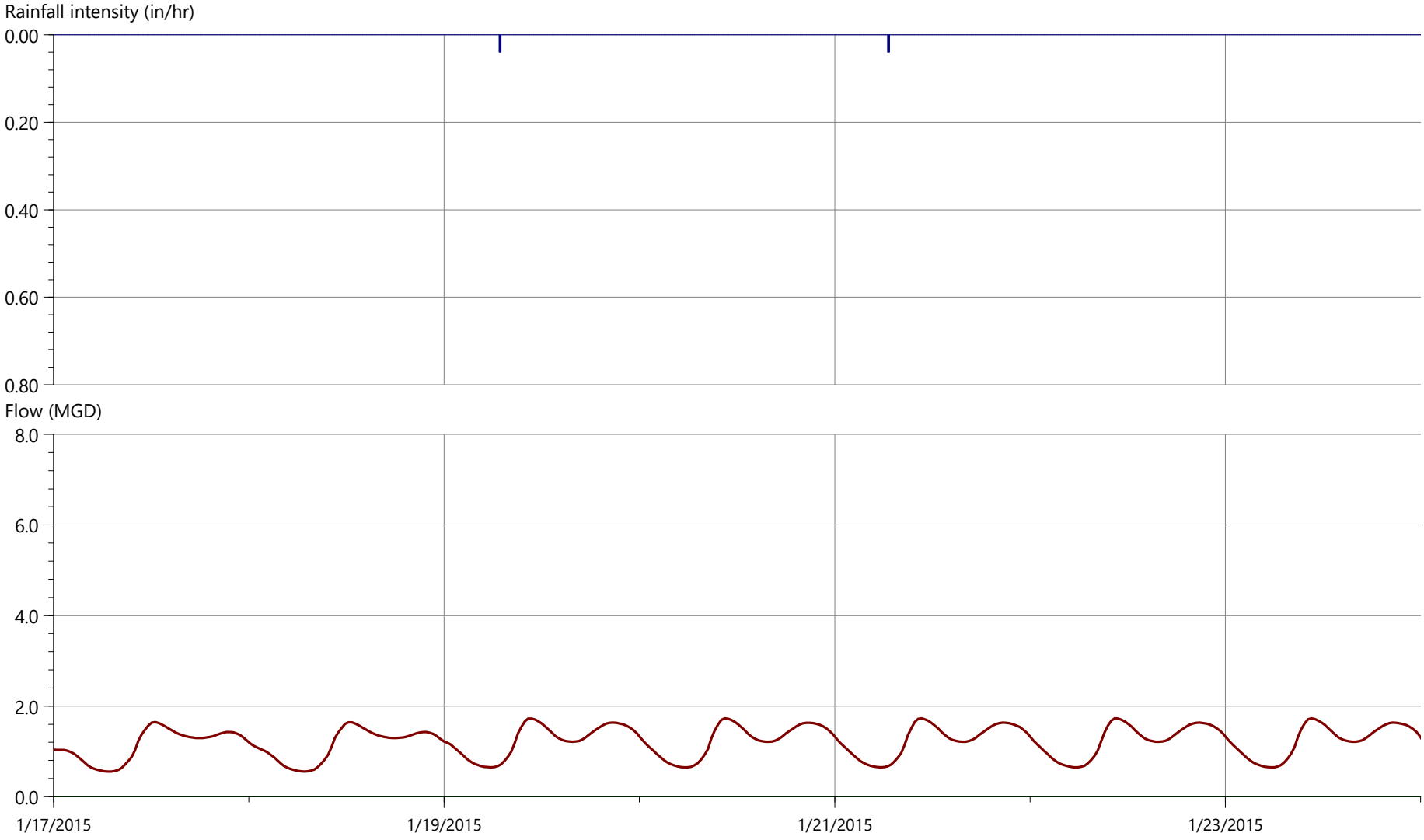
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.113	0.998	3.870
...4d_10232023>DWF				0.281	0.939	4.601

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 24, Model Location (Pred.) D/S S63-2.1, Rainfall Profile: 2



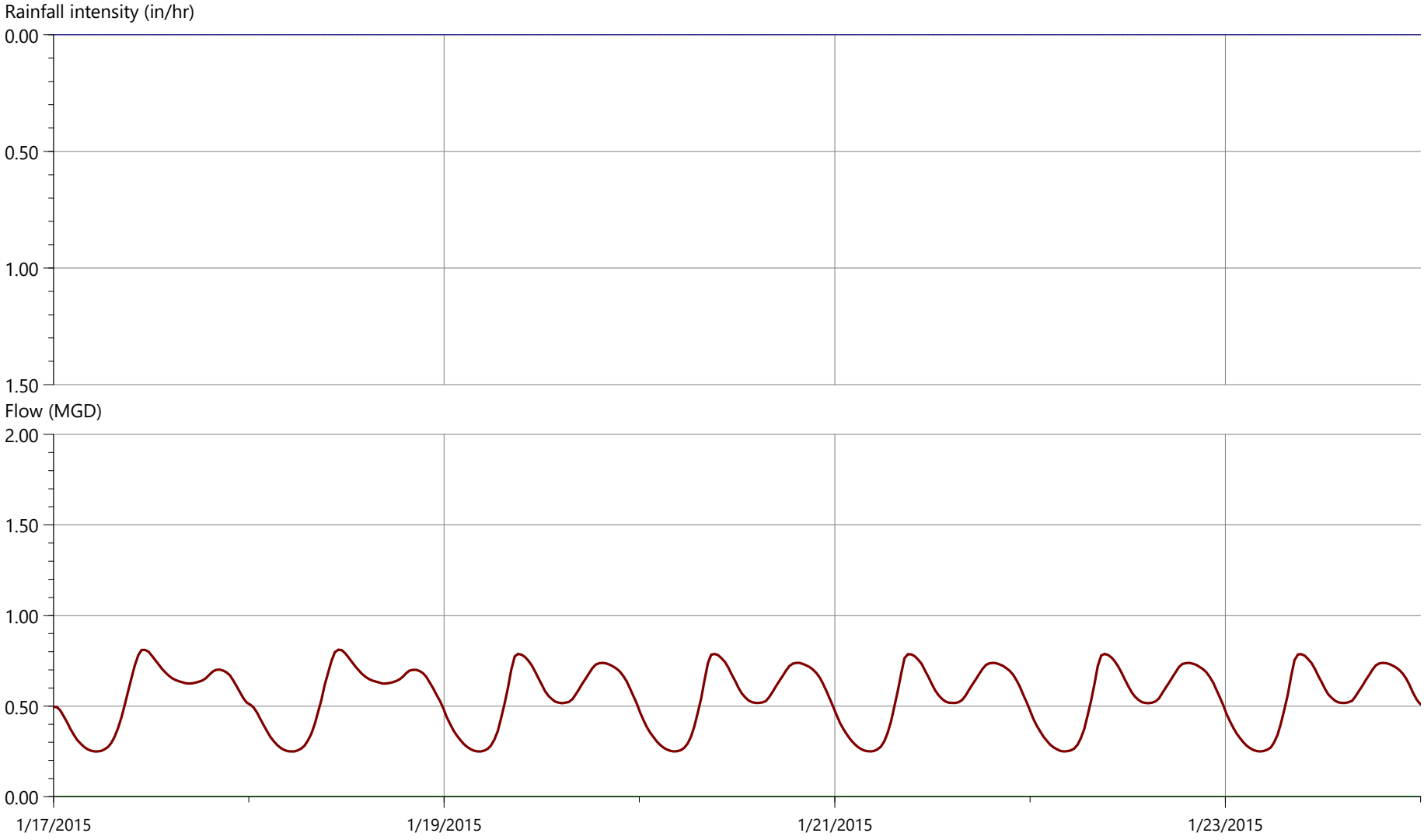
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				1.364	5.533	25.234

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 25, Model Location (Pred.) D/S S57-6.1, Rainfall Profile: 4



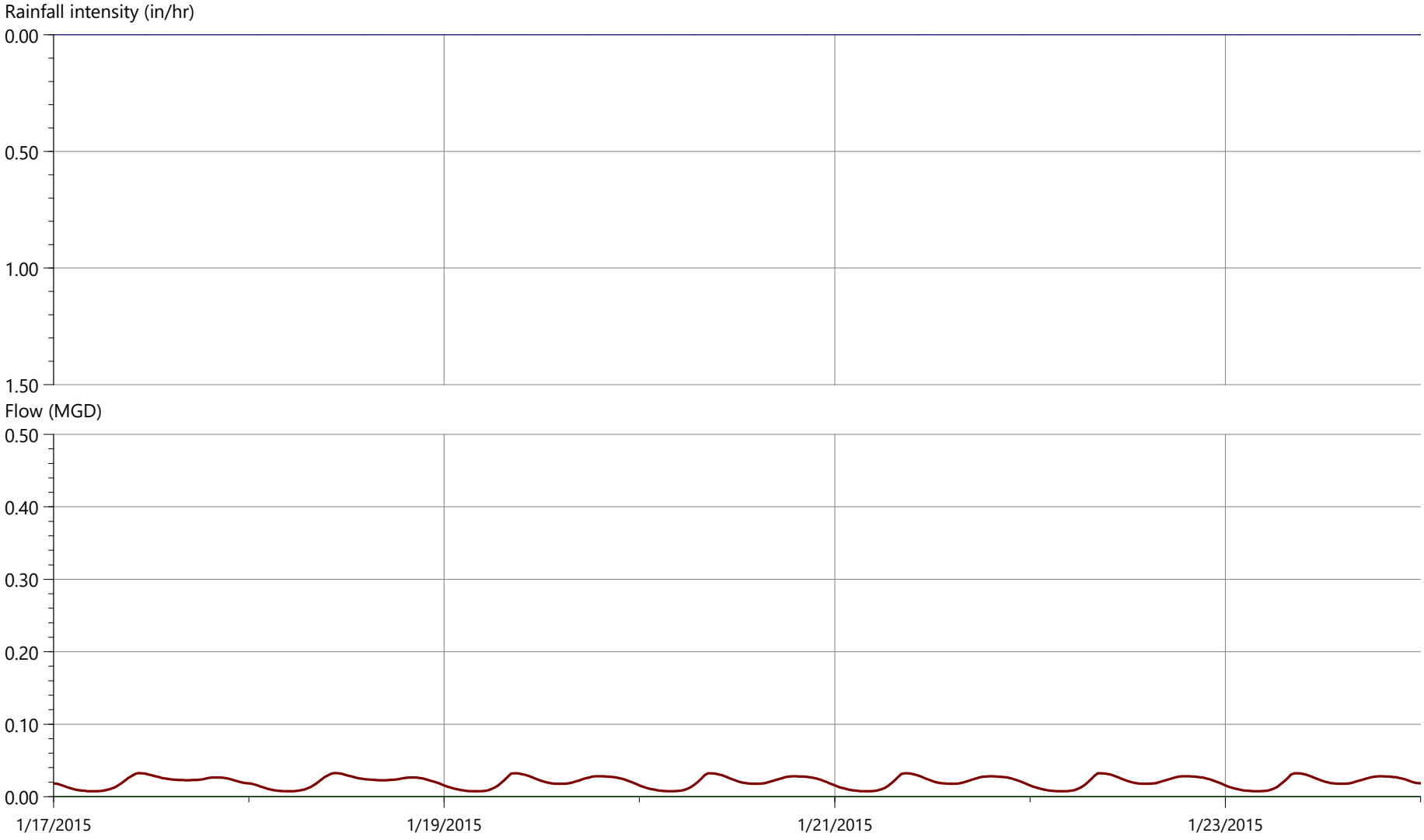
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.020	0.040	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.555	1.729	8.523

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 26, Model Location (Pred.) D/S S52-86.1, Rainfall Profile: 2



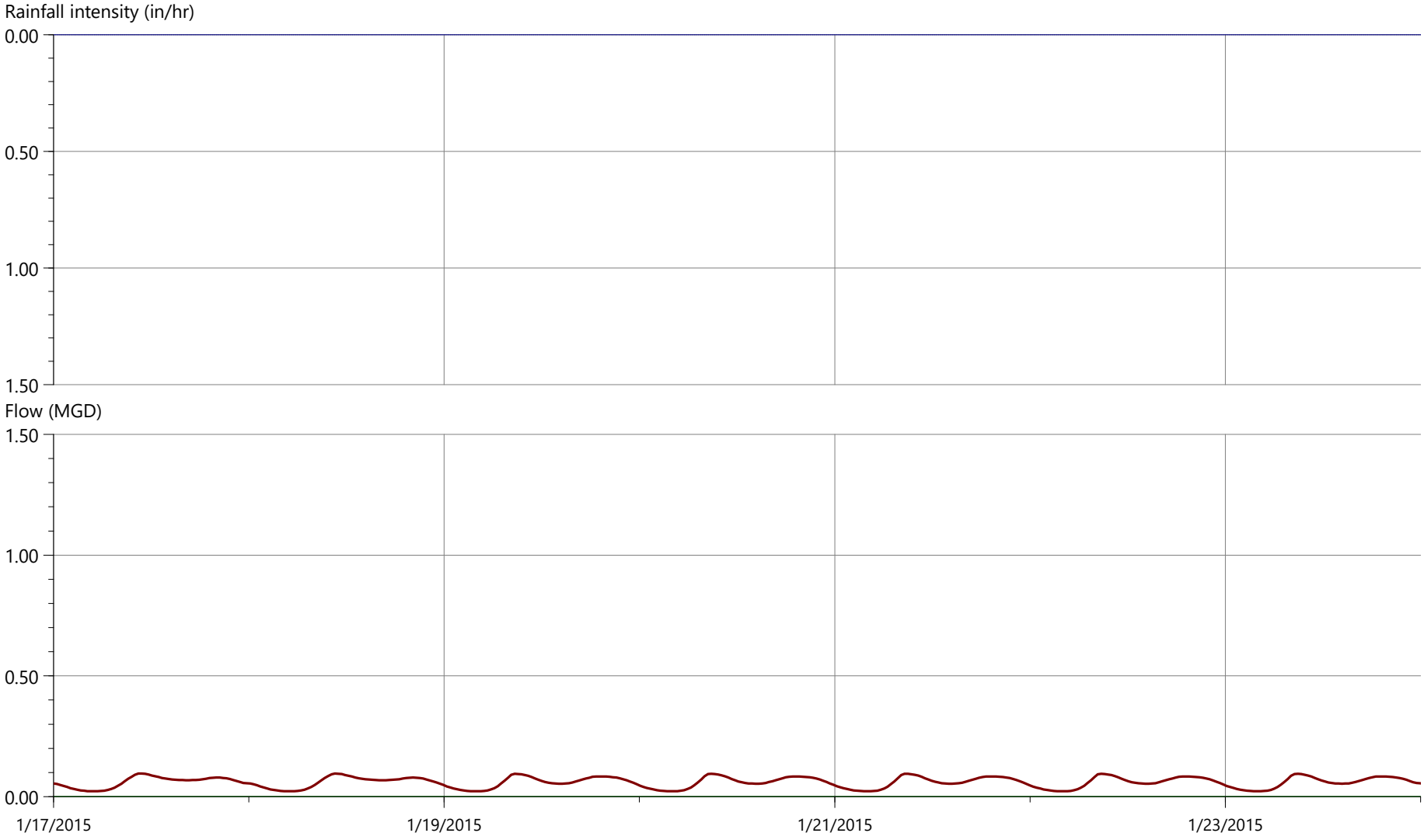
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.249	0.811	3.826

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 27, Model Location (Pred.) D/S S43-8.1, Rainfall Profile: 2



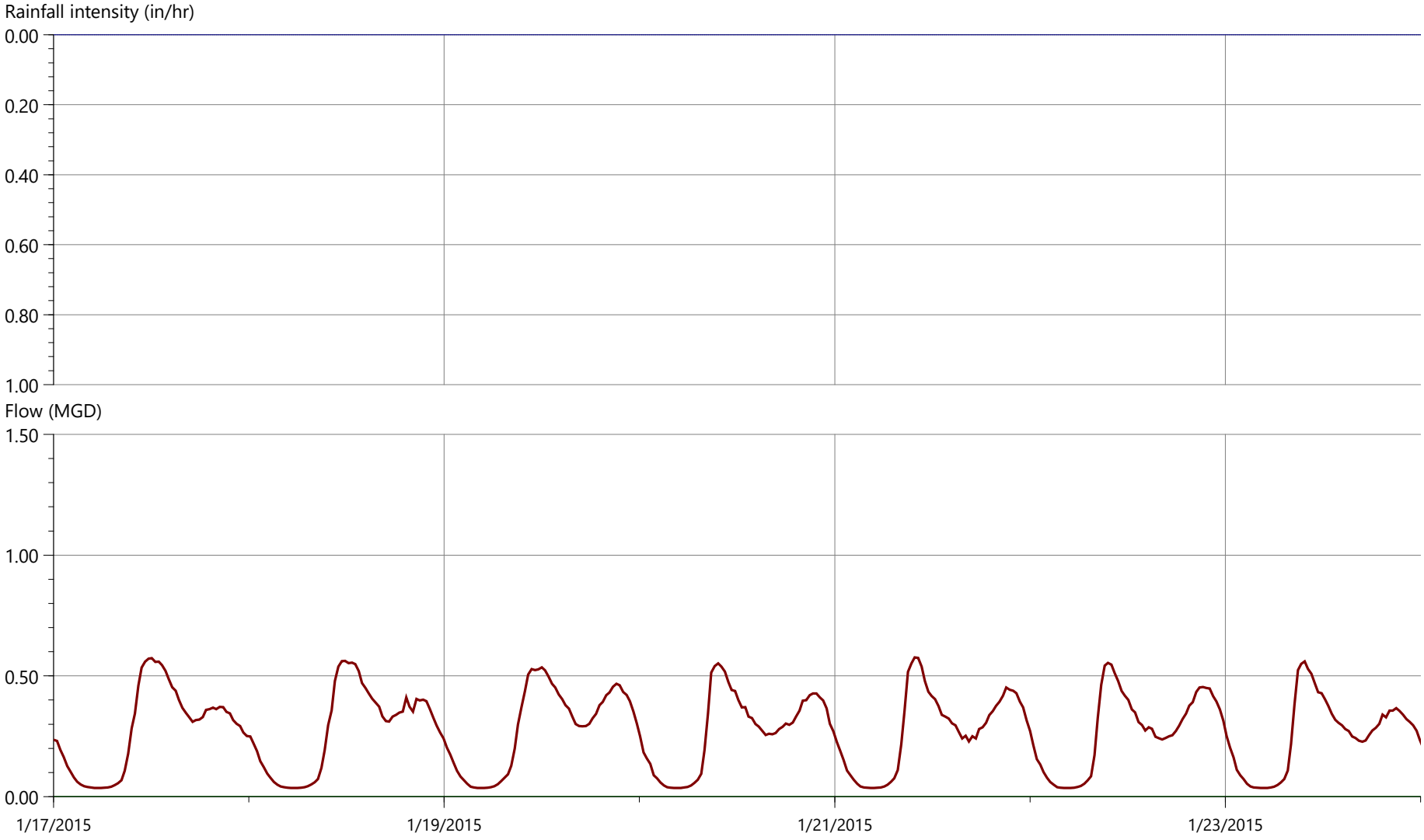
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.007	0.032	0.141

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 28, Model Location (Pred.) D/S S53-47.1, Rainfall Profile: 2



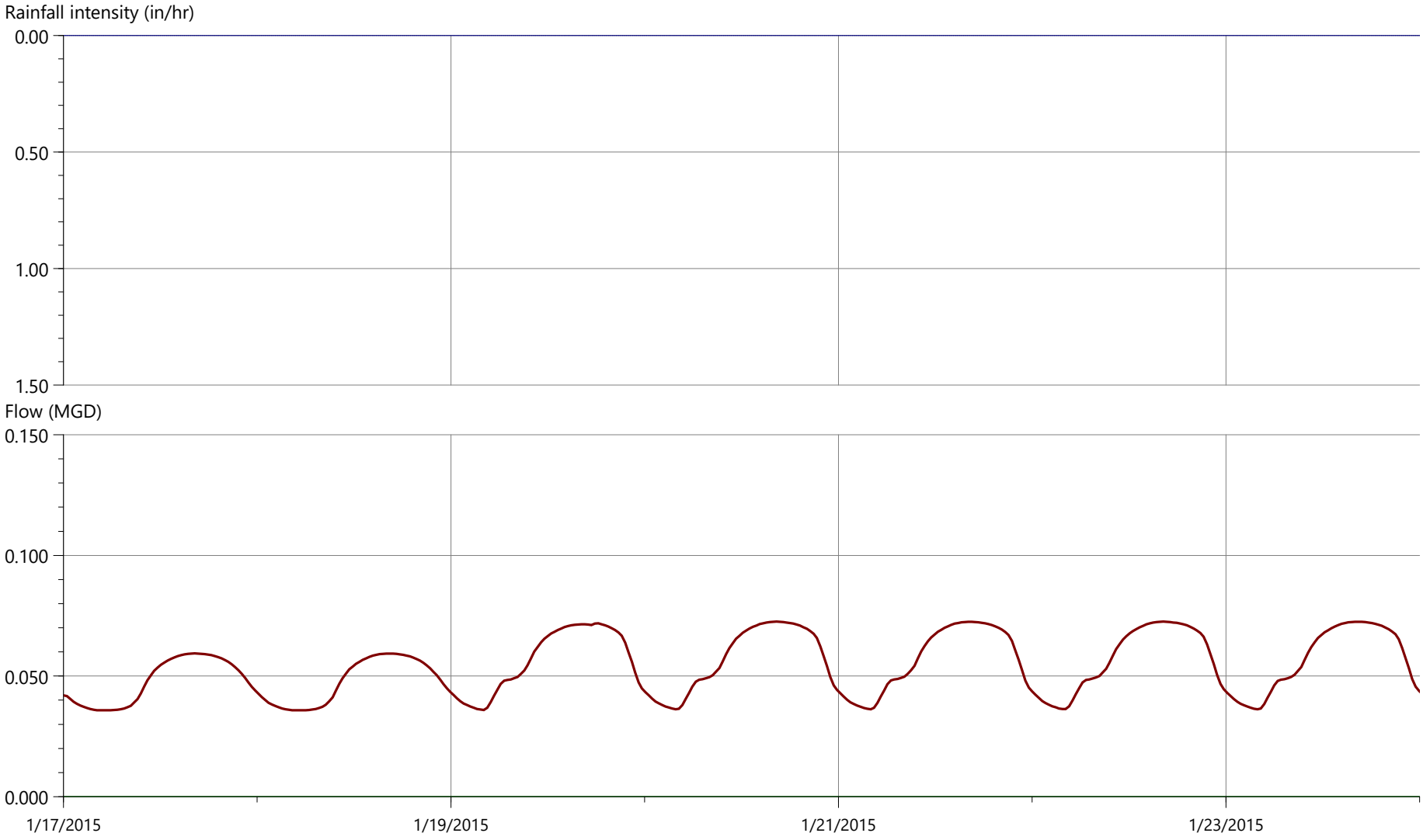
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.022	0.096	0.420

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 29, Model Location (Pred.) D/S S21-54.1, Rainfall Profile: 3



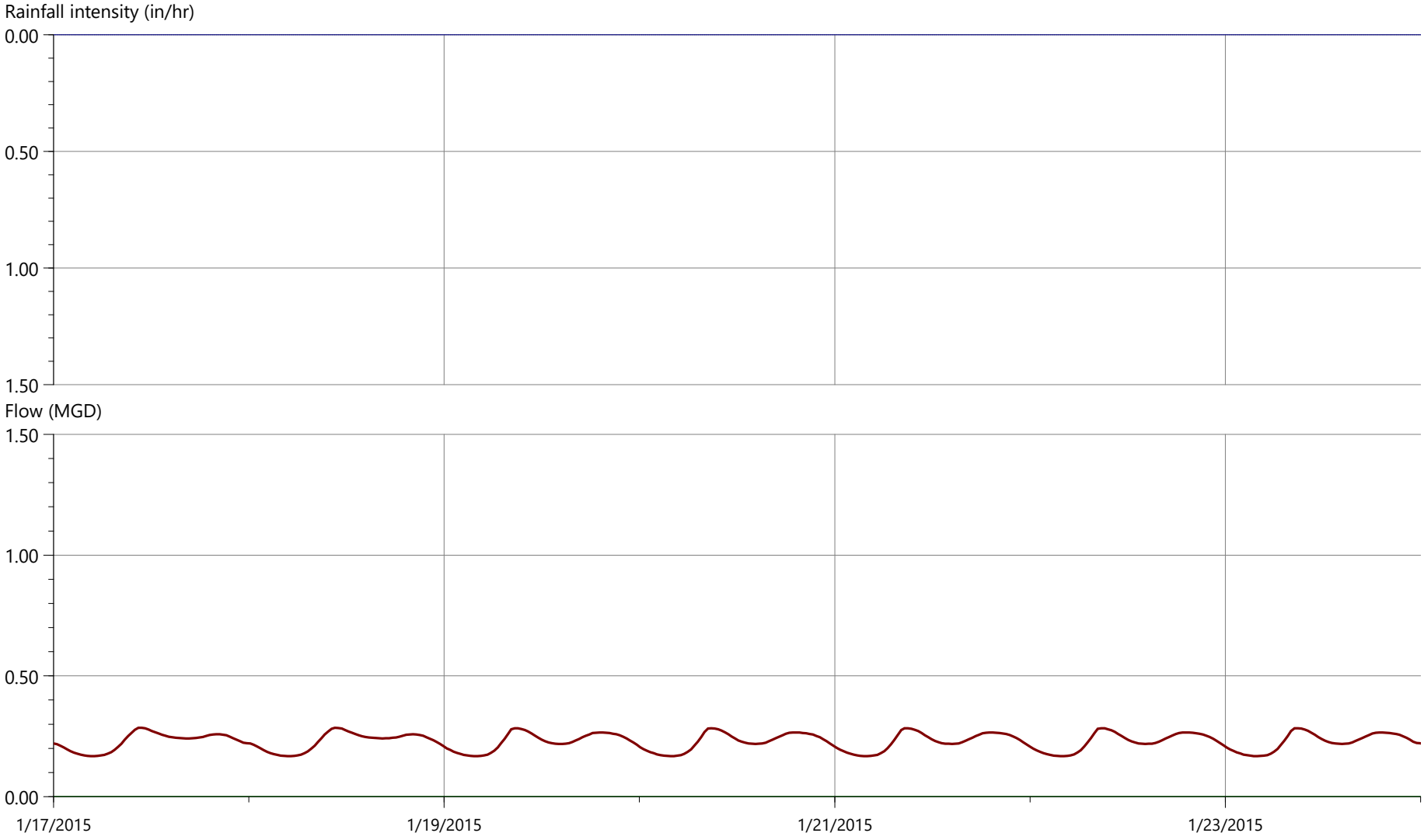
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.036	0.576	1.915

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 30, Model Location (Pred.) D/S S62-24.1, Rainfall Profile: 2



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.036	0.073	0.381

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Dry Weather>2023.10.07 SAH DWF MODS (WORKING)>2015_DWF_2015.01.17_14d_10232023>...
Flow Survey Location (Obs.) 31, Model Location (Pred.) D/S S62-23.1, Rainfall Profile: 2



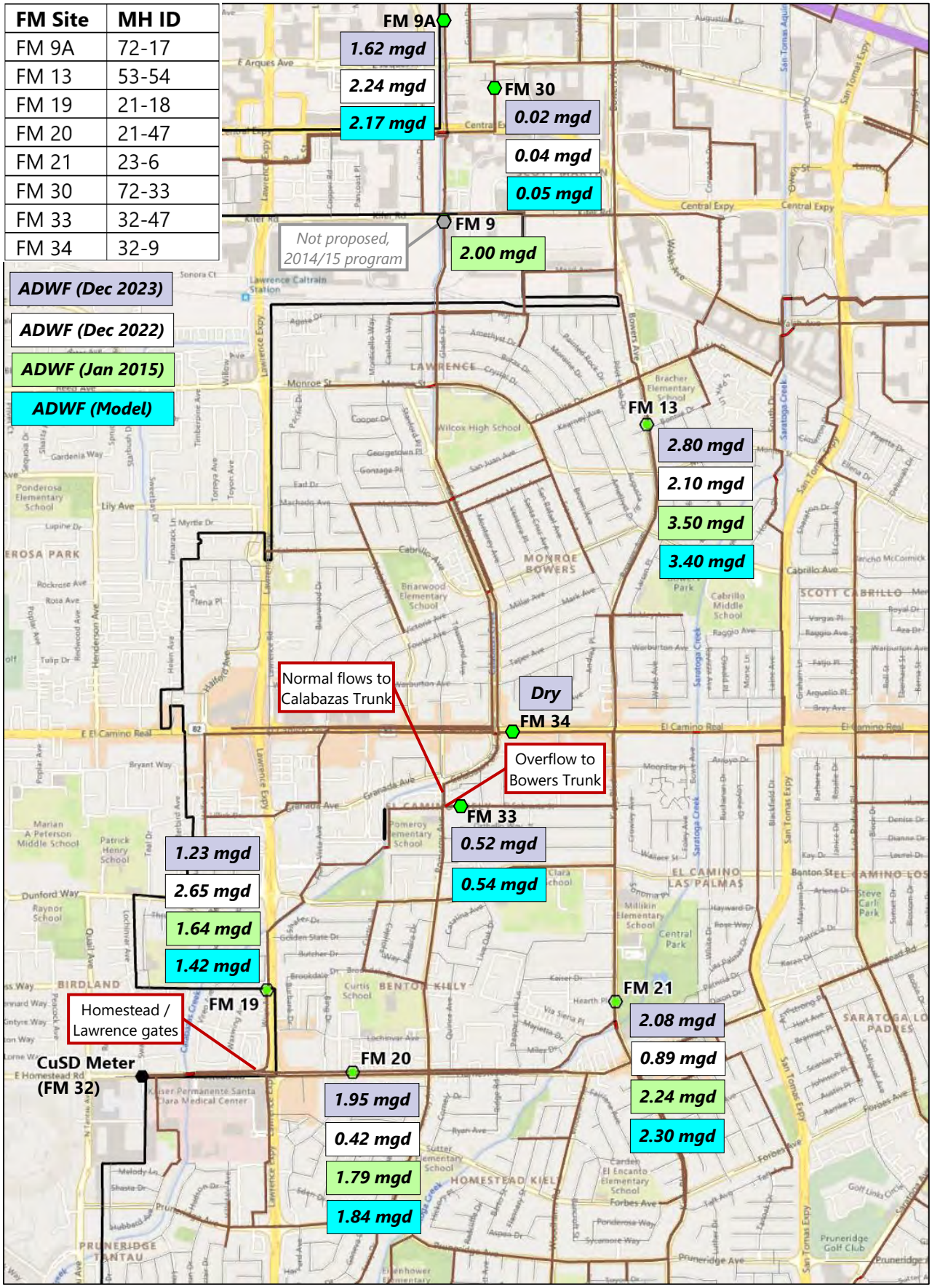
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	0.000	0.000	0.000			
Observed				0.000	0.000	0.000
...4d_10232023>DWF				0.168	0.285	1.598

Dry Weather Flow Calibration Plots
Modeled vs. Metered Flows (Dec 2024, Dec 2022, Jan 2015)

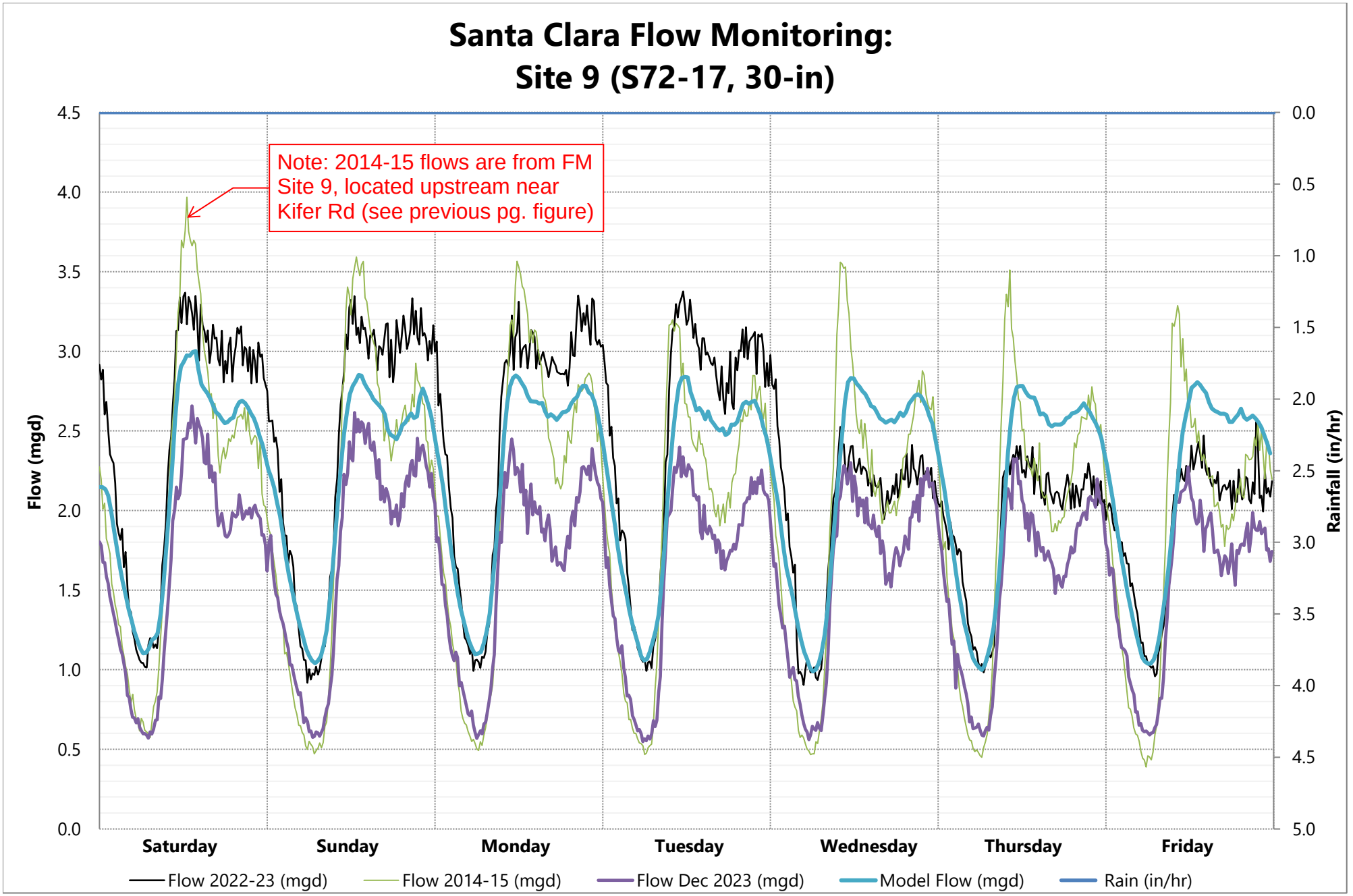
(*assumes normal settings at Homestead/Lawrence gate structure*)

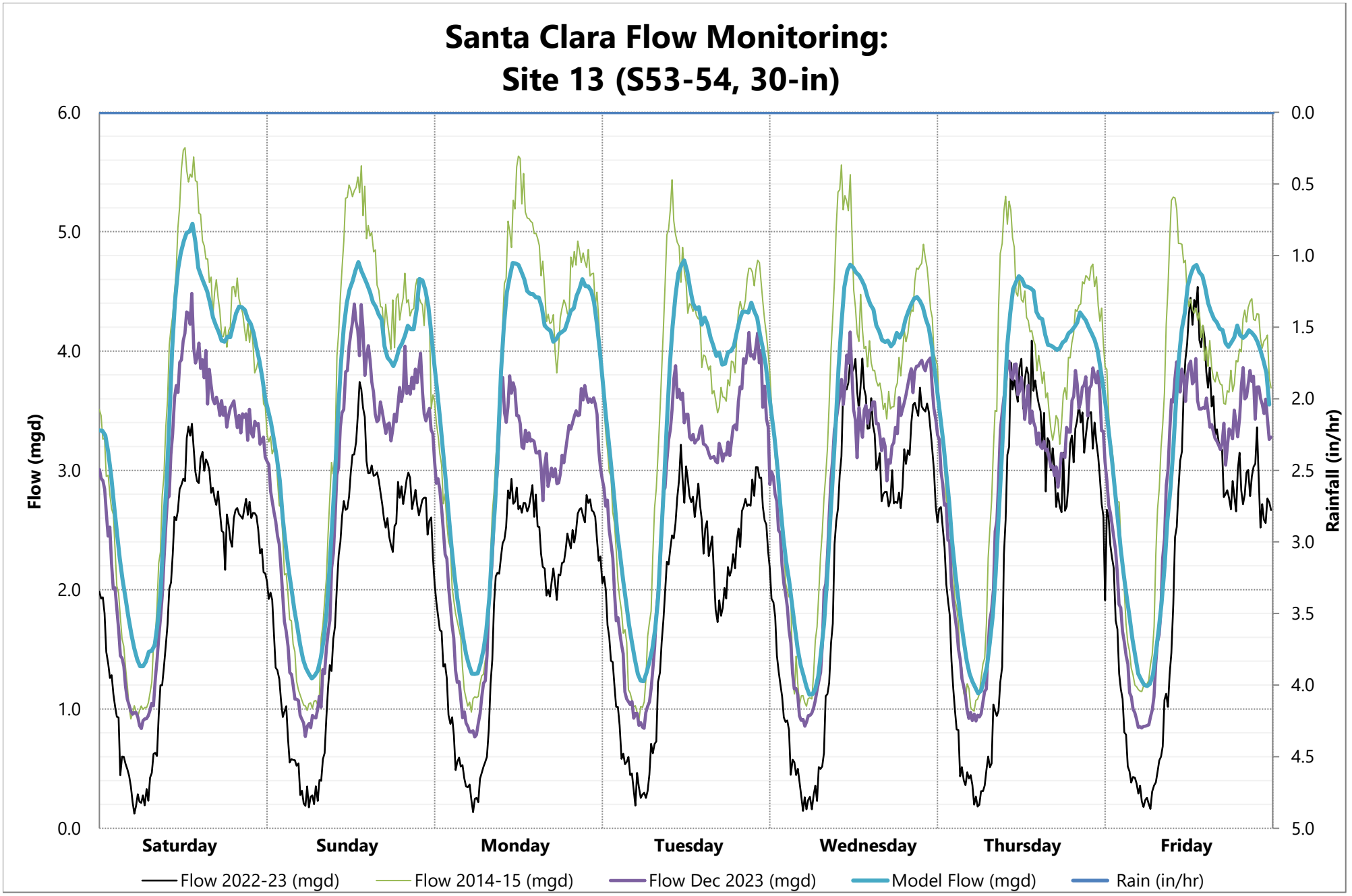
City of Santa Clara
Sanitary Sewer Master Plan Update
Site Locations for Additional Dry Weather Flow Monitoring

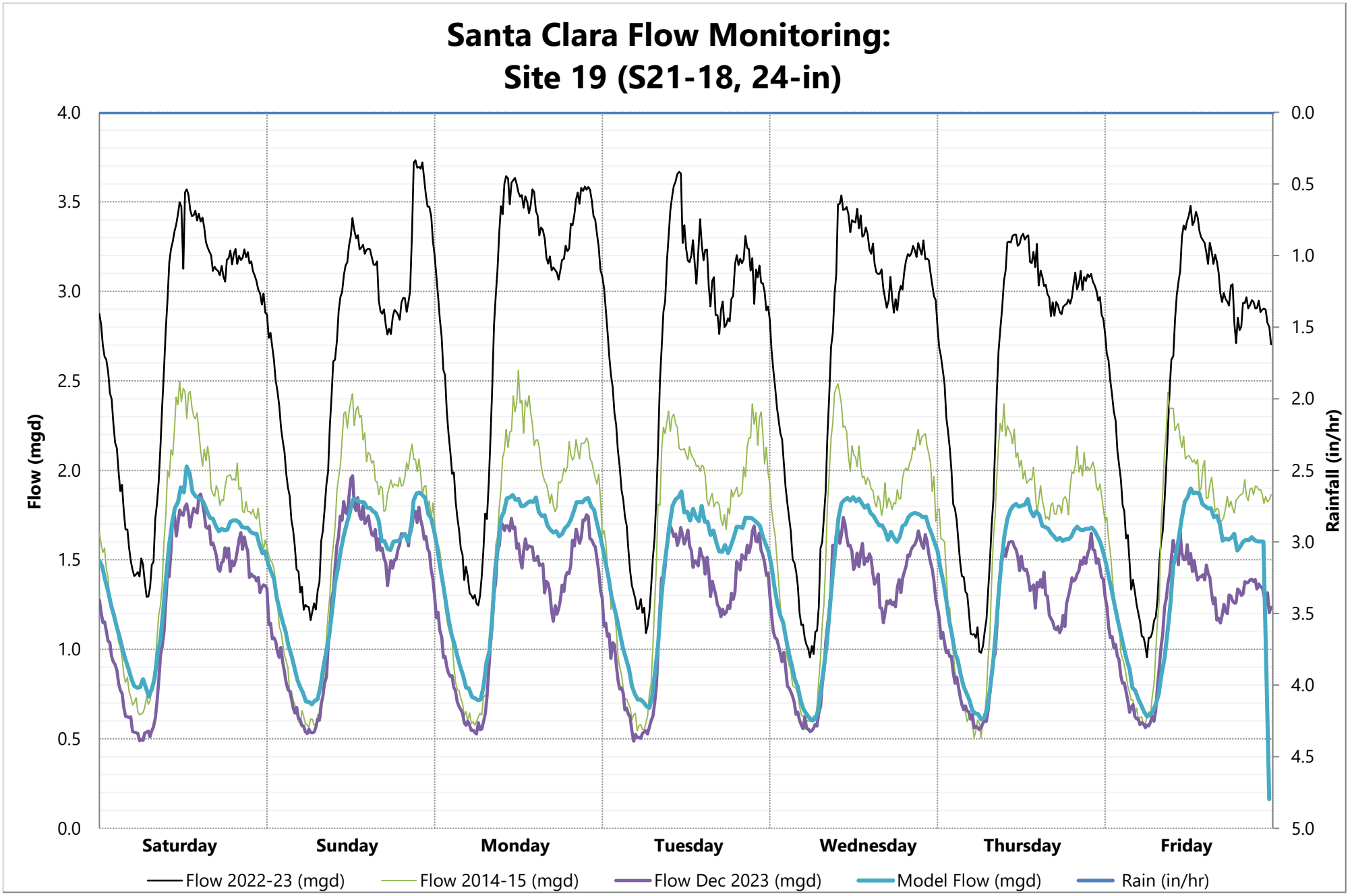
FM Site	MH ID
FM 9A	72-17
FM 13	53-54
FM 19	21-18
FM 20	21-47
FM 21	23-6
FM 30	72-33
FM 33	32-47
FM 34	32-9

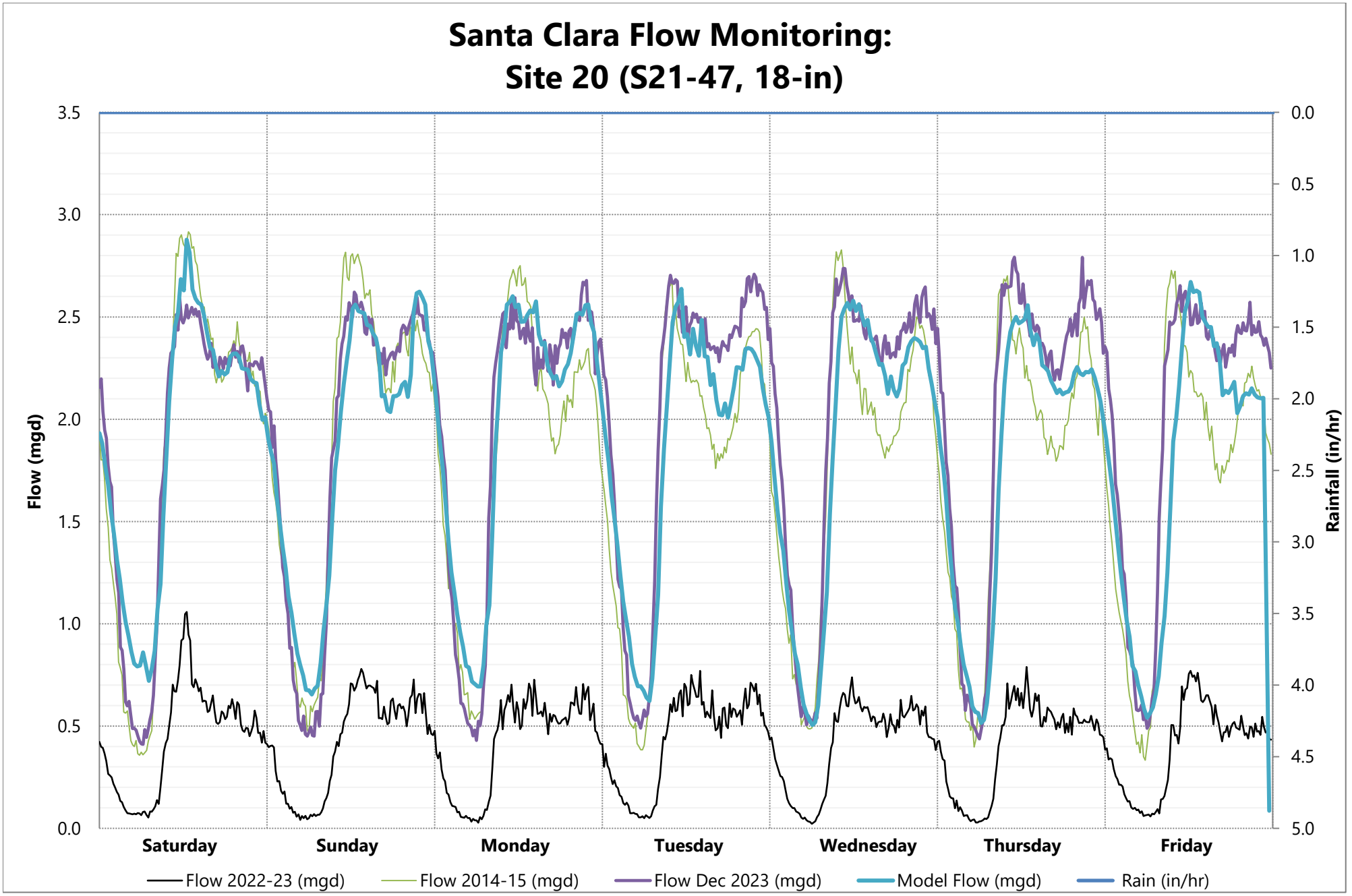


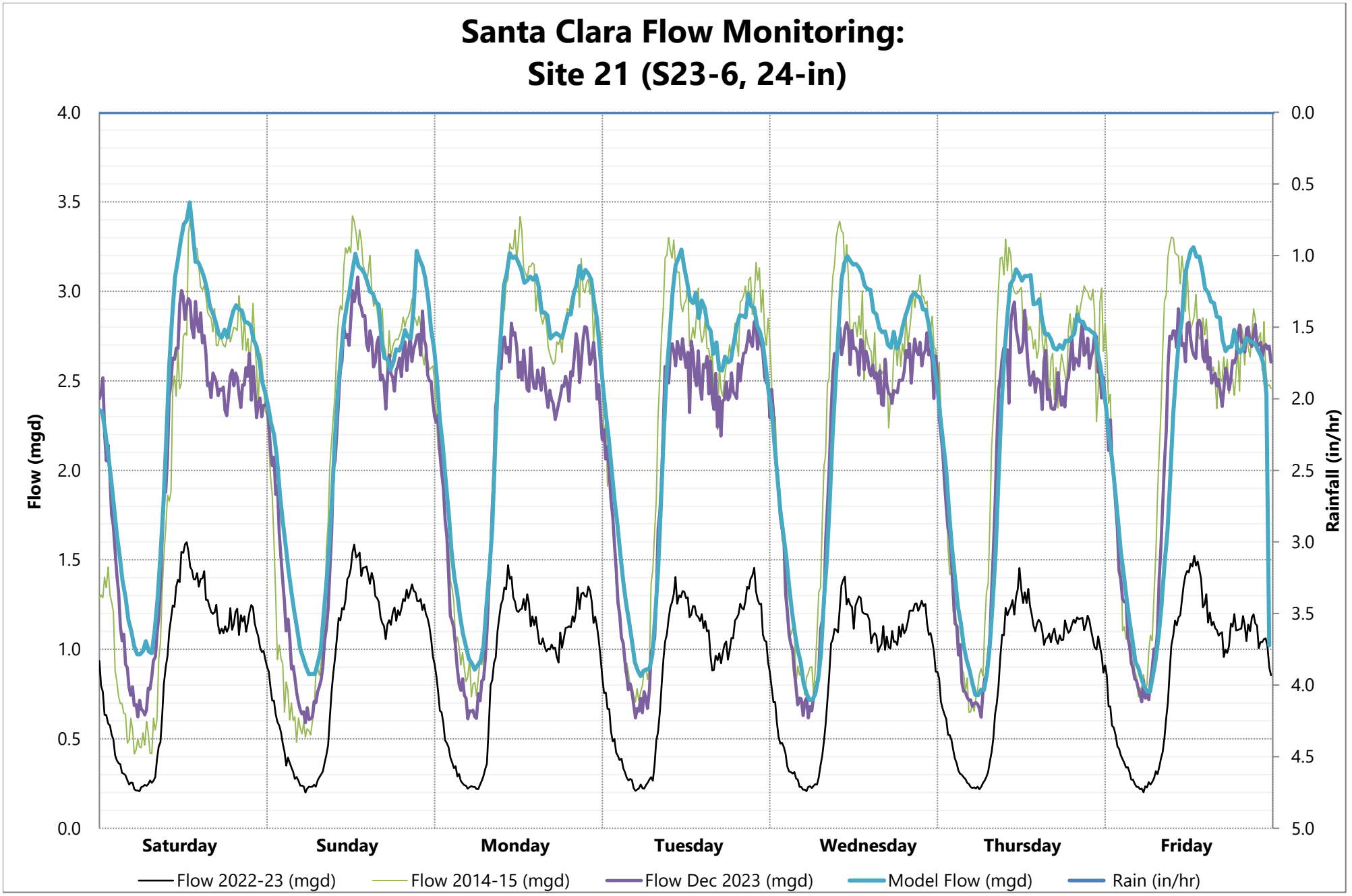
Santa Clara Flow Monitoring:
Site 9 (S72-17, 30-in)

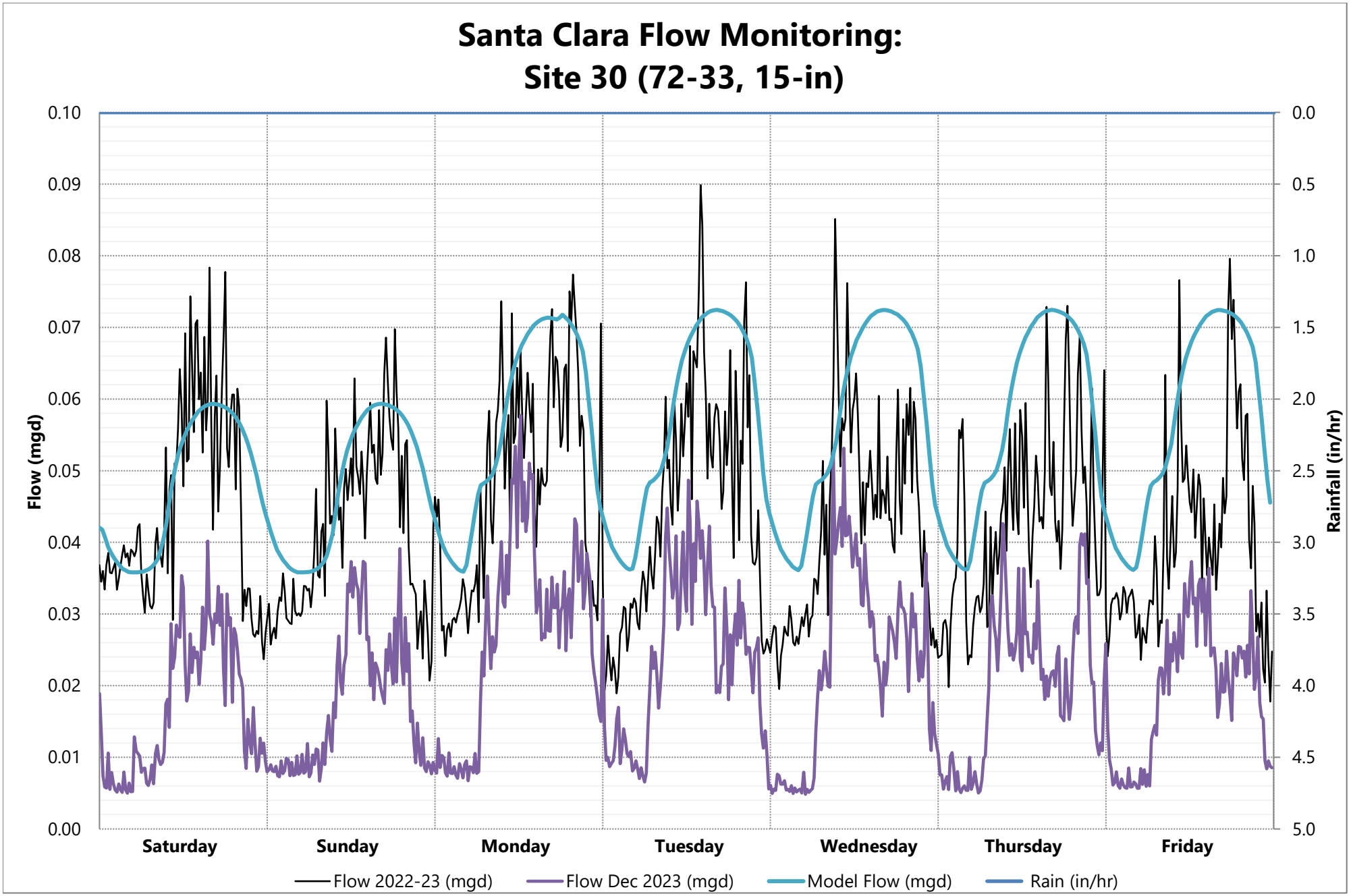


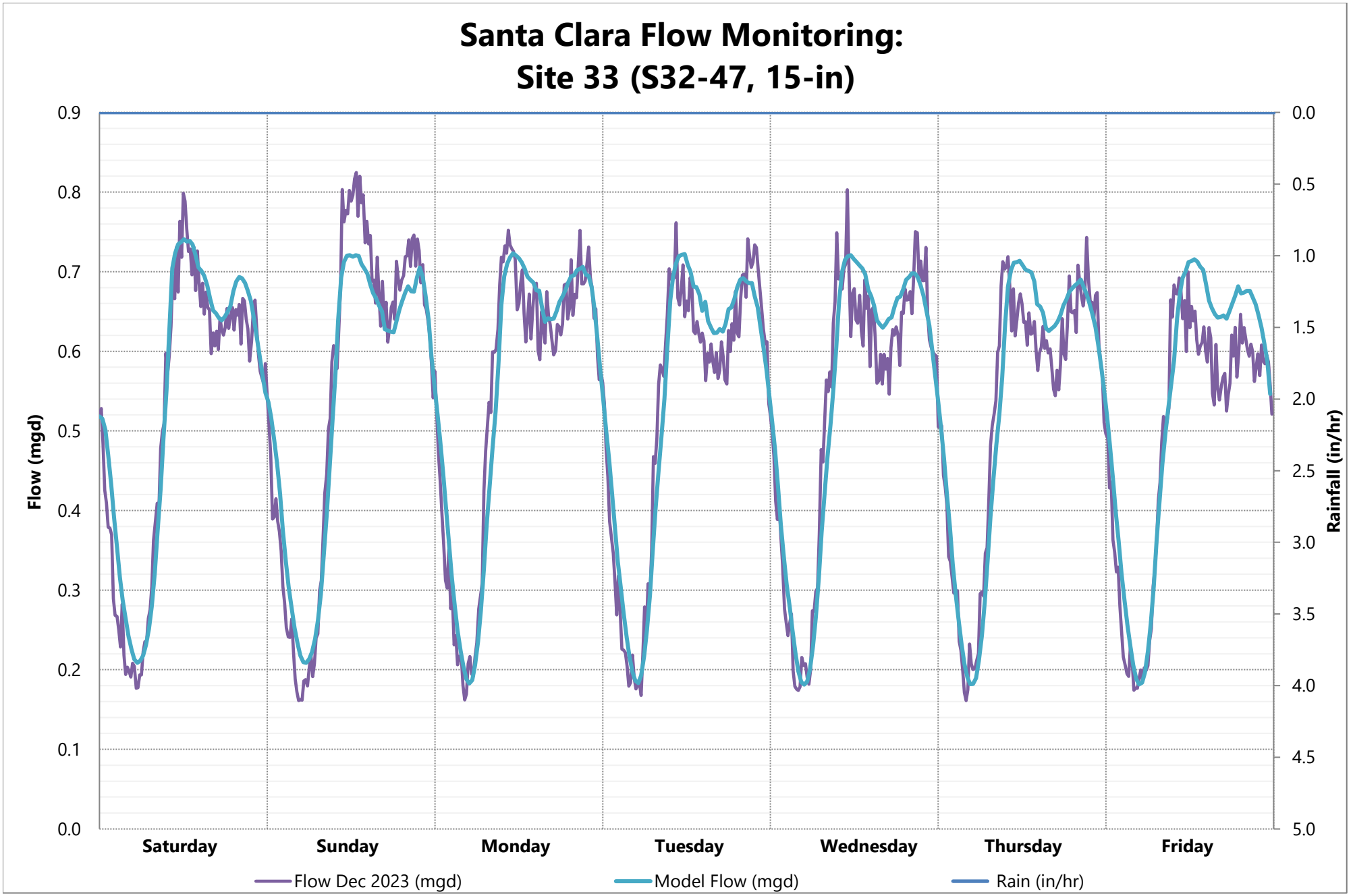

Santa Clara Flow Monitoring:
Site 13 (S53-54, 30-in)
Flow (mgd)
Rainfall (in/hr)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Saturday
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Flow Dec 2023 (mgd)
Model Flow (mgd)
Rain (in/hr)


Santa Clara Flow Monitoring:
Site 19 (S21-18, 24-in)
Flow (mgd)
Rainfall (in/hr)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Saturday
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Flow Dec 2023 (mgd)
Model Flow (mgd)
Rain (in/hr)


Santa Clara Flow Monitoring:
Site 20 (S21-47, 18-in)
Flow (mgd)
Rainfall (in/hr)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Saturday
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Flow Dec 2023 (mgd)
Model Flow (mgd)
Rain (in/hr)


Santa Clara Flow Monitoring:
Site 21 (S23-6, 24-in)
Flow (mgd)
Rainfall (in/hr)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Saturday
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Flow 2022-23 (mgd)
Flow 2014-15 (mgd)
Flow Dec 2023 (mgd)
Model Flow (mgd)
Rain (in/hr)


Santa Clara Flow Monitoring:
Site 30 (72-33, 15-in)
Flow (mgd)
Rainfall (in/hr)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Saturday
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Flow 2022-23 (mgd)
Flow Dec 2023 (mgd)
Model Flow (mgd)
Rain (in/hr)

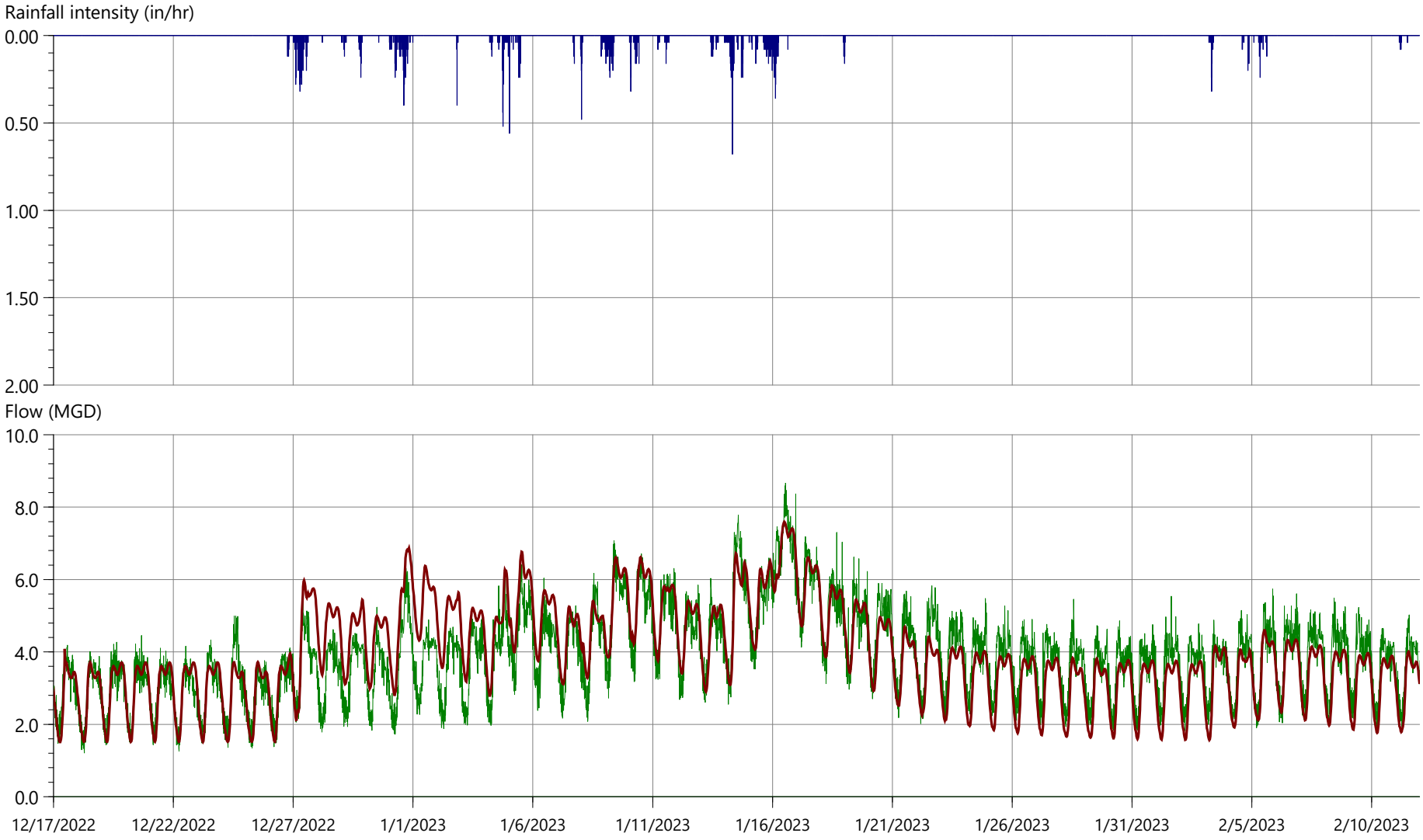

Santa Clara Flow Monitoring:
Site 33 (S32-47, 15-in)
Flow (mgd)
Rainfall (in/hr)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Saturday
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Flow Dec 2023 (mgd)
Model Flow (mgd)
Rain (in/hr)

Wet Weather Flow Calibration Plots
Modeled vs. 2022-2023 Metered Flows

(*assumes clog at Homestead/Lawrence gate structure*)

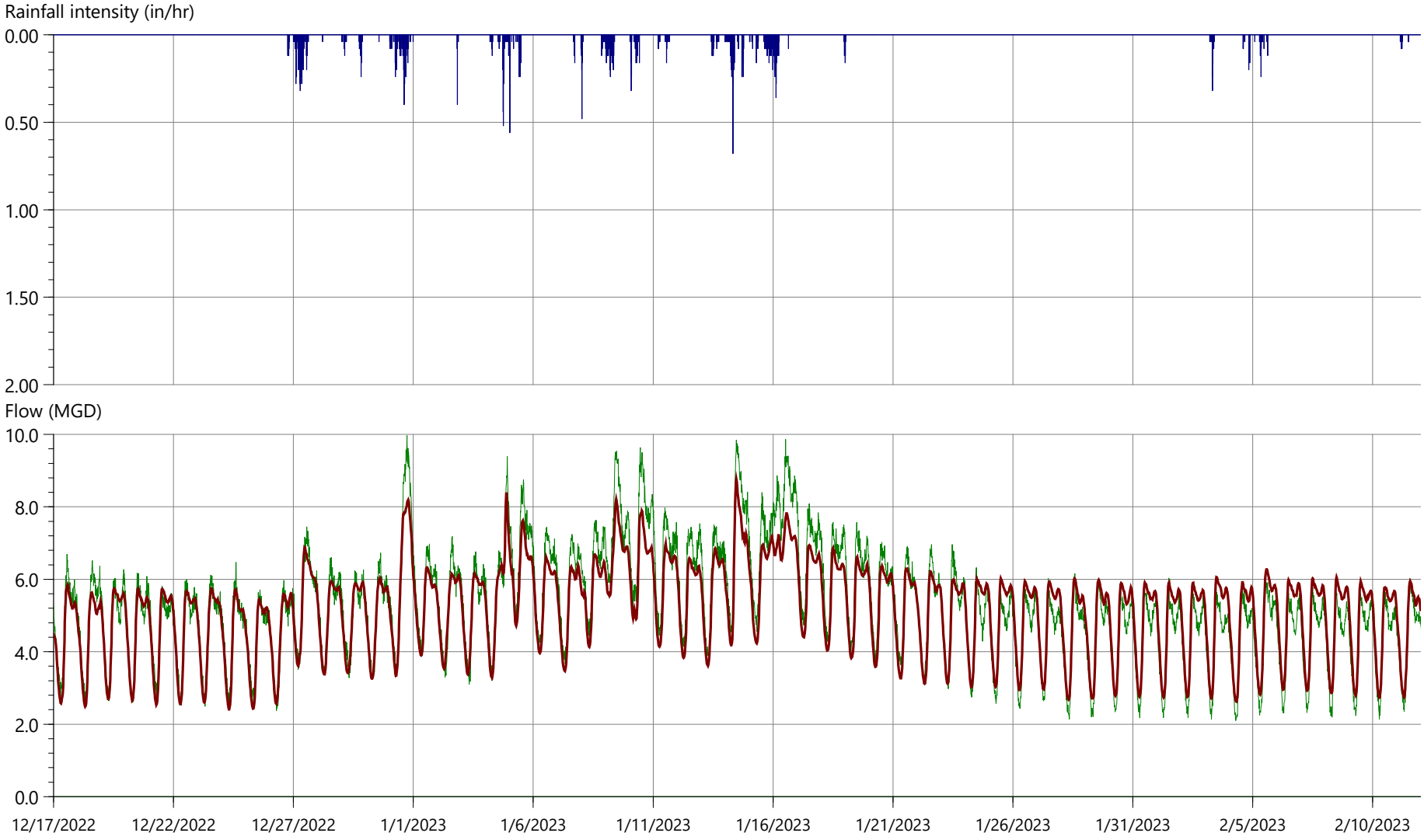
Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...

Flow Survey Location (Obs.) 1, Model Location (Pred.) D/S S104-29.1, Rainfall Profile: 1



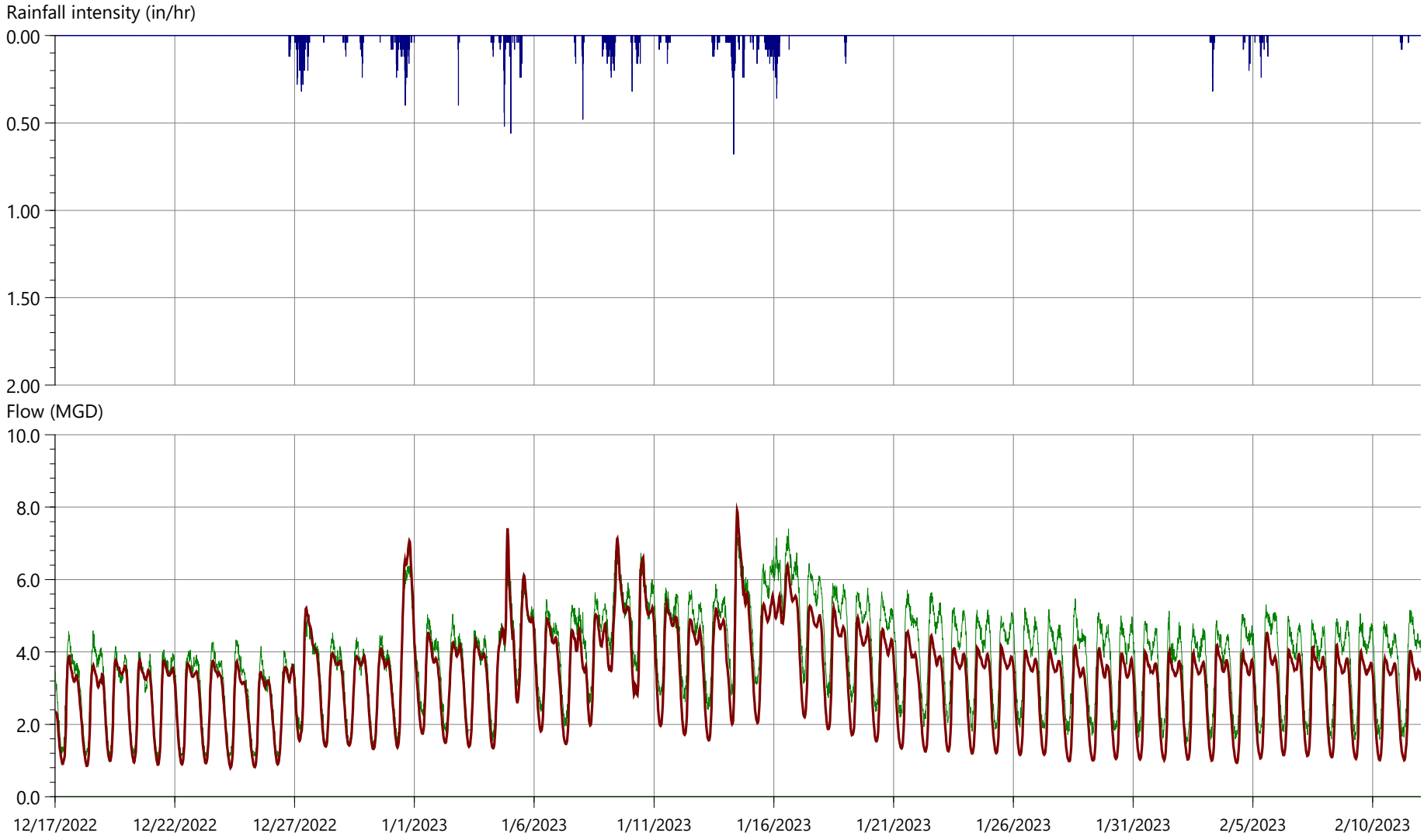
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.270	0.680	0.008			
Observed				1.210	8.665	223.590
... Data 2023 and 2015				1.509	7.594	225.159

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 2, Model Location (Pred.) D/S S103-9.1, Rainfall Profile: 1



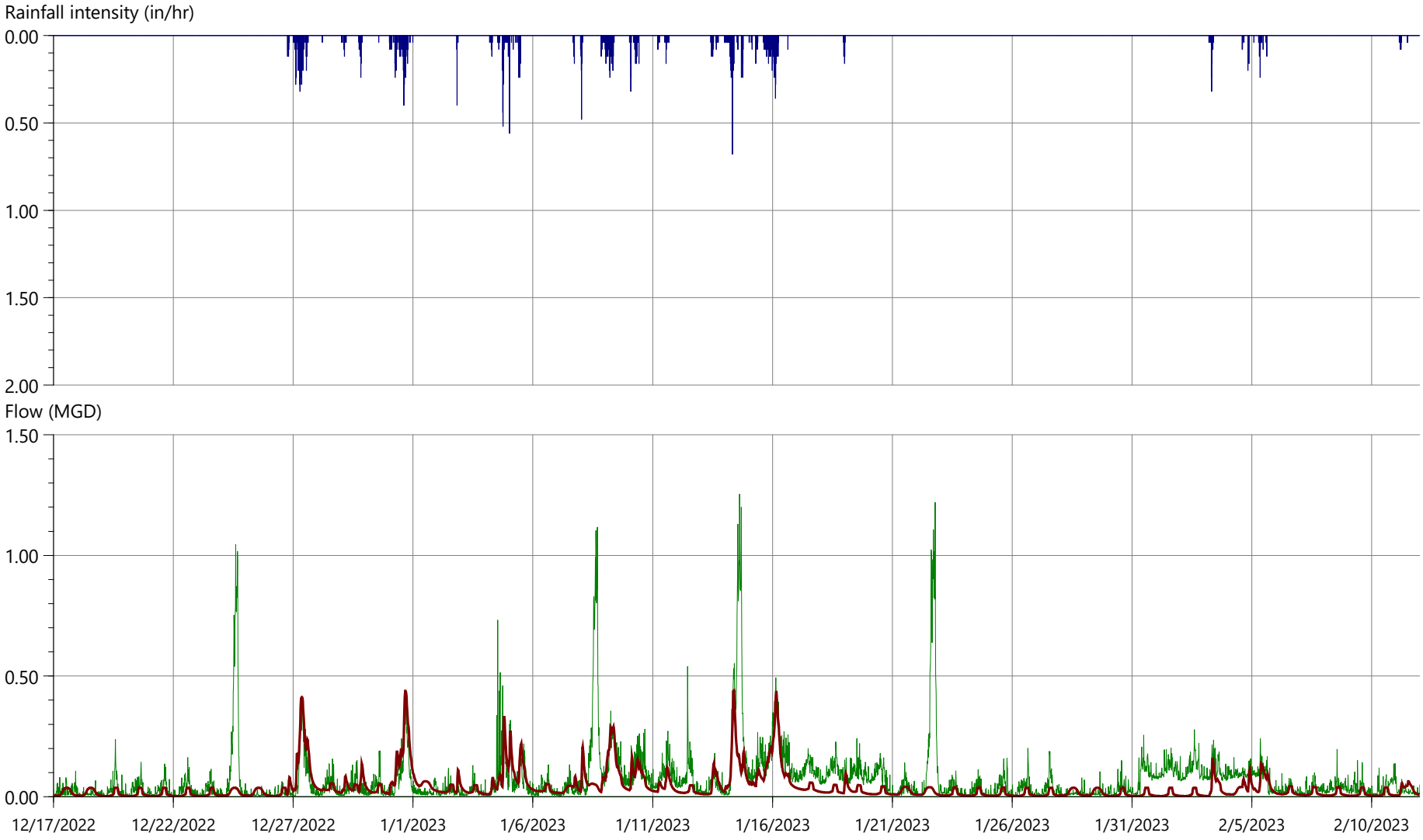
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.270	0.680	0.008			
Observed				2.099	9.967	301.286
... Data 2023 and 2015				2.407	8.766	295.289

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 3, Model Location (Pred.) D/S S104-27.1, Rainfall Profile: 1



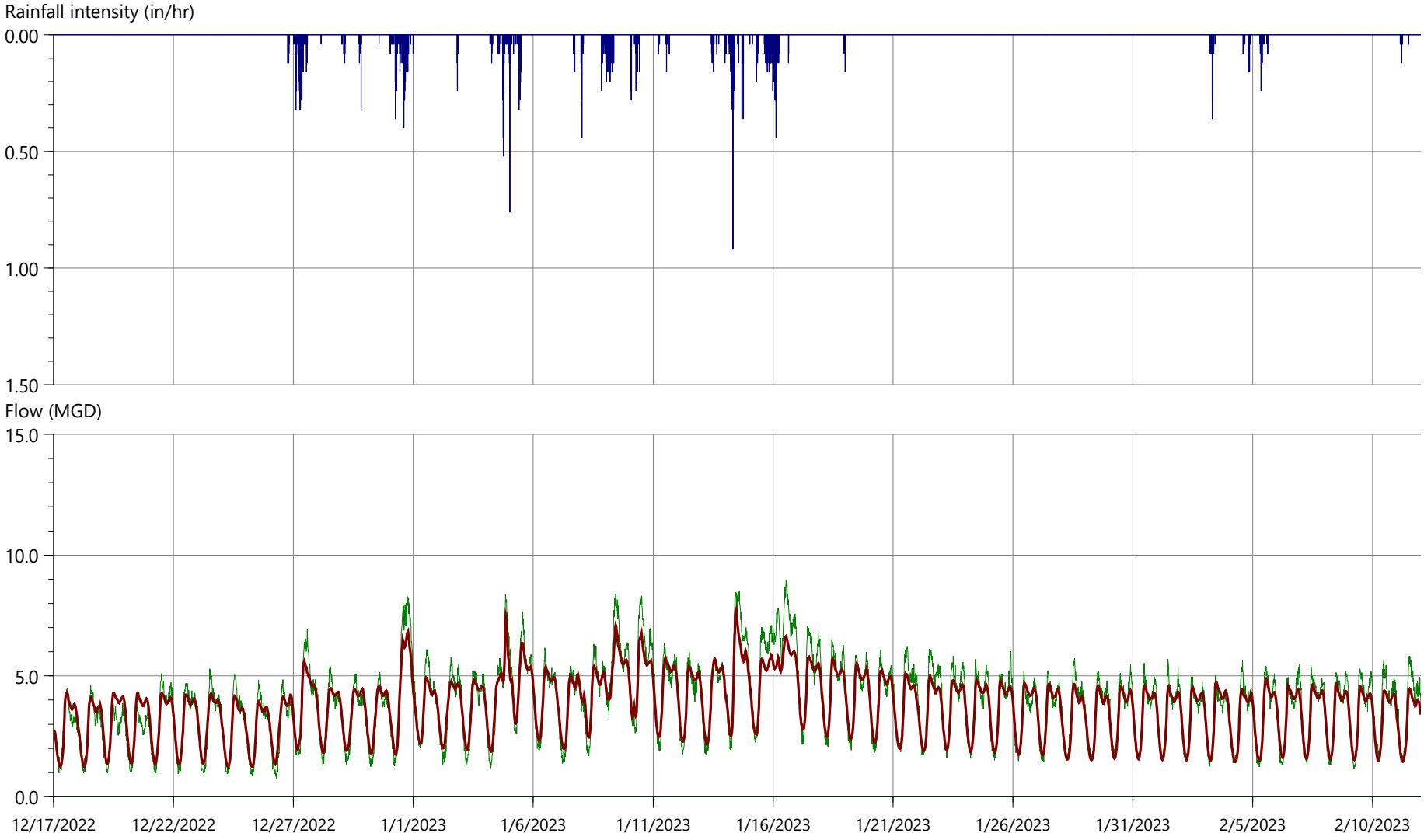
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.270	0.680	0.008			
Observed				1.016	7.391	219.358
... Data 2023 and 2015				0.799	7.906	184.787

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 4, Model Location (Pred.) D/S S94-36.1, Rainfall Profile: 1



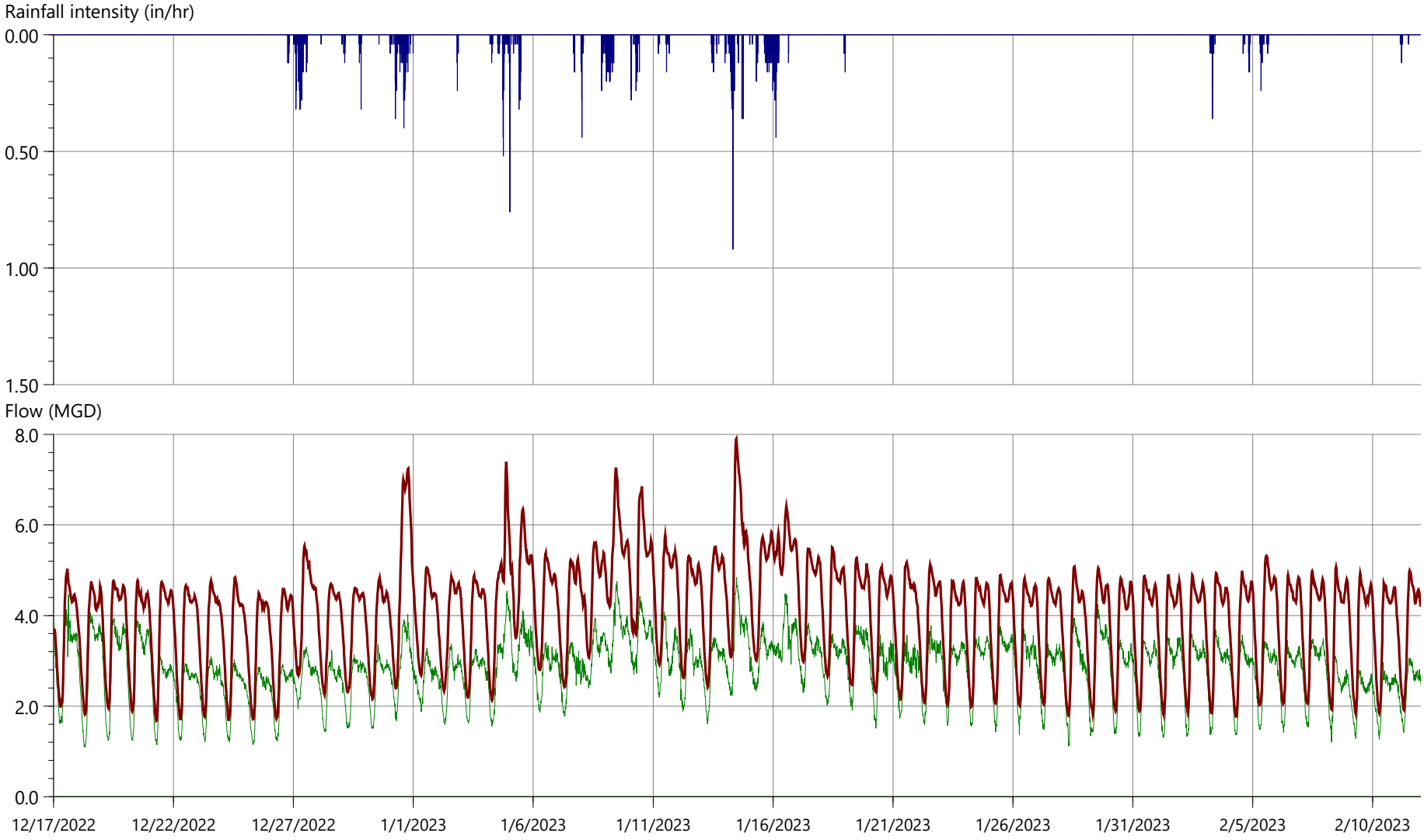
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.270	0.680	0.008			
Observed				0.003	1.254	4.199
... Data 2023 and 2015				0.003	0.440	2.251

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 5, Model Location (Pred.) D/S S83-23.1, Rainfall Profile: 2



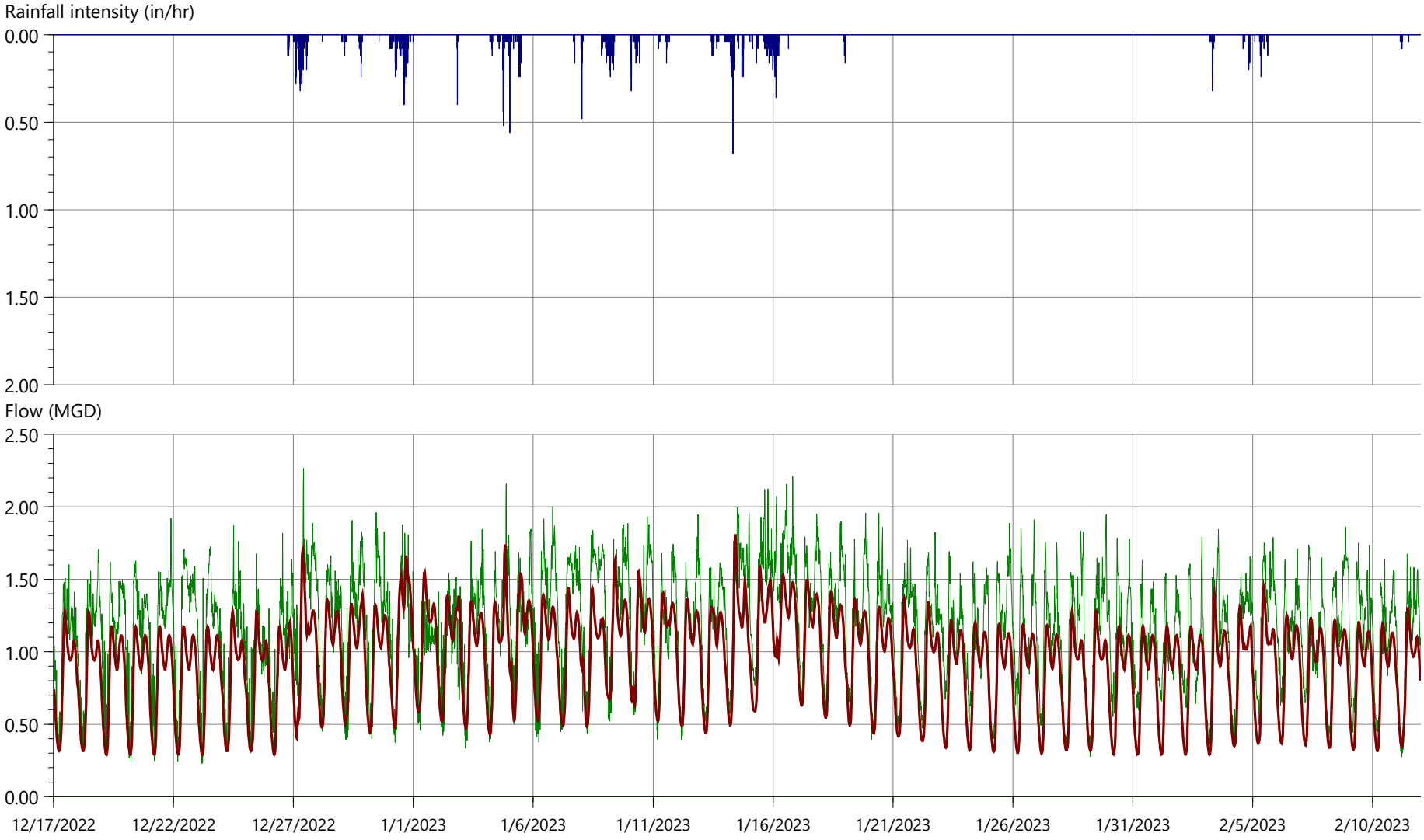
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.742	8.959	222.725
... Data 2023 and 2015				1.239	7.776	214.979

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 6, Model Location (Pred.) D/S S83-25.1, Rainfall Profile: 2



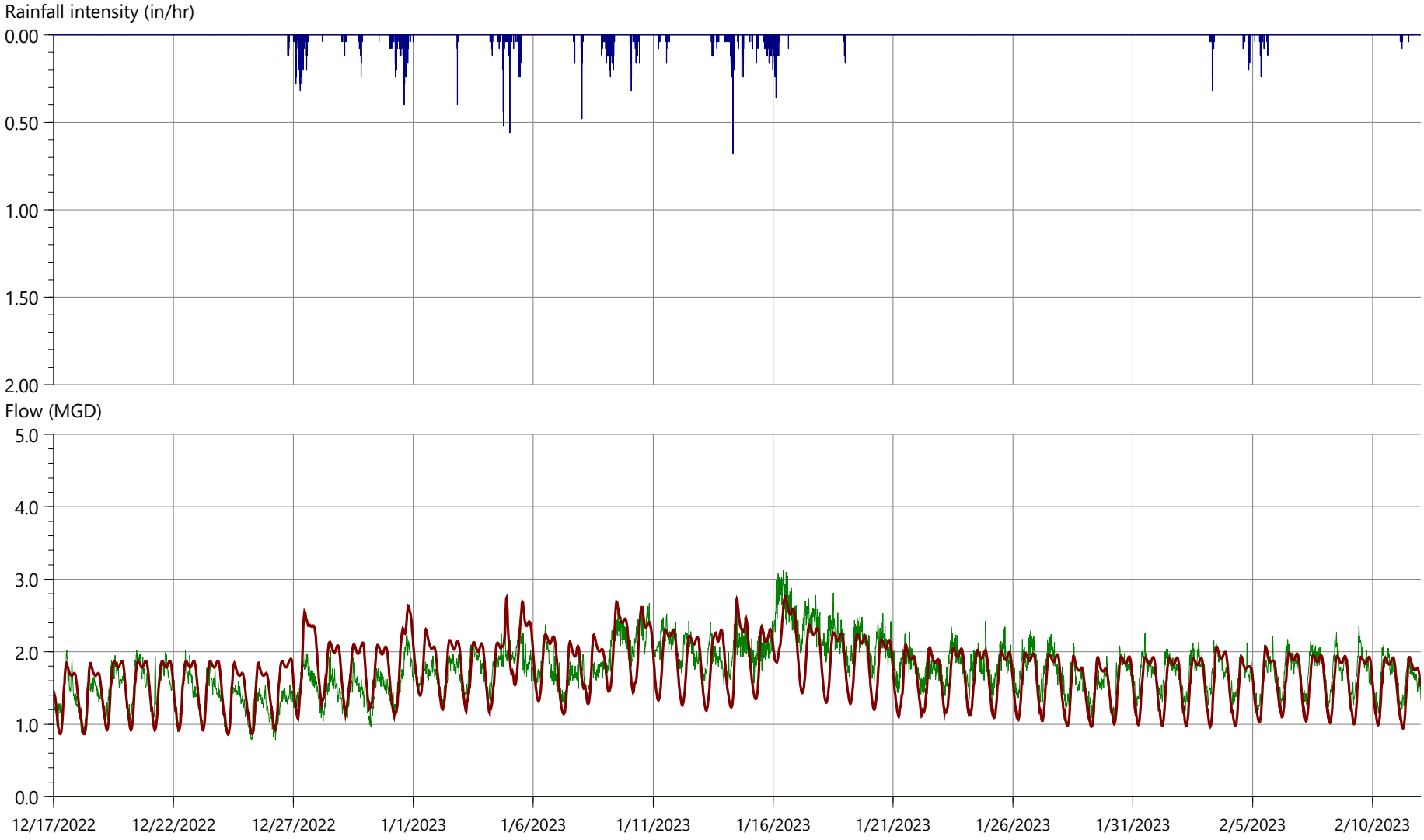
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				1.092	4.844	161.024
... Data 2023 and 2015				1.676	7.903	232.228

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 7, Model Location (Pred.) D/S S105-6.1, Rainfall Profile: 1



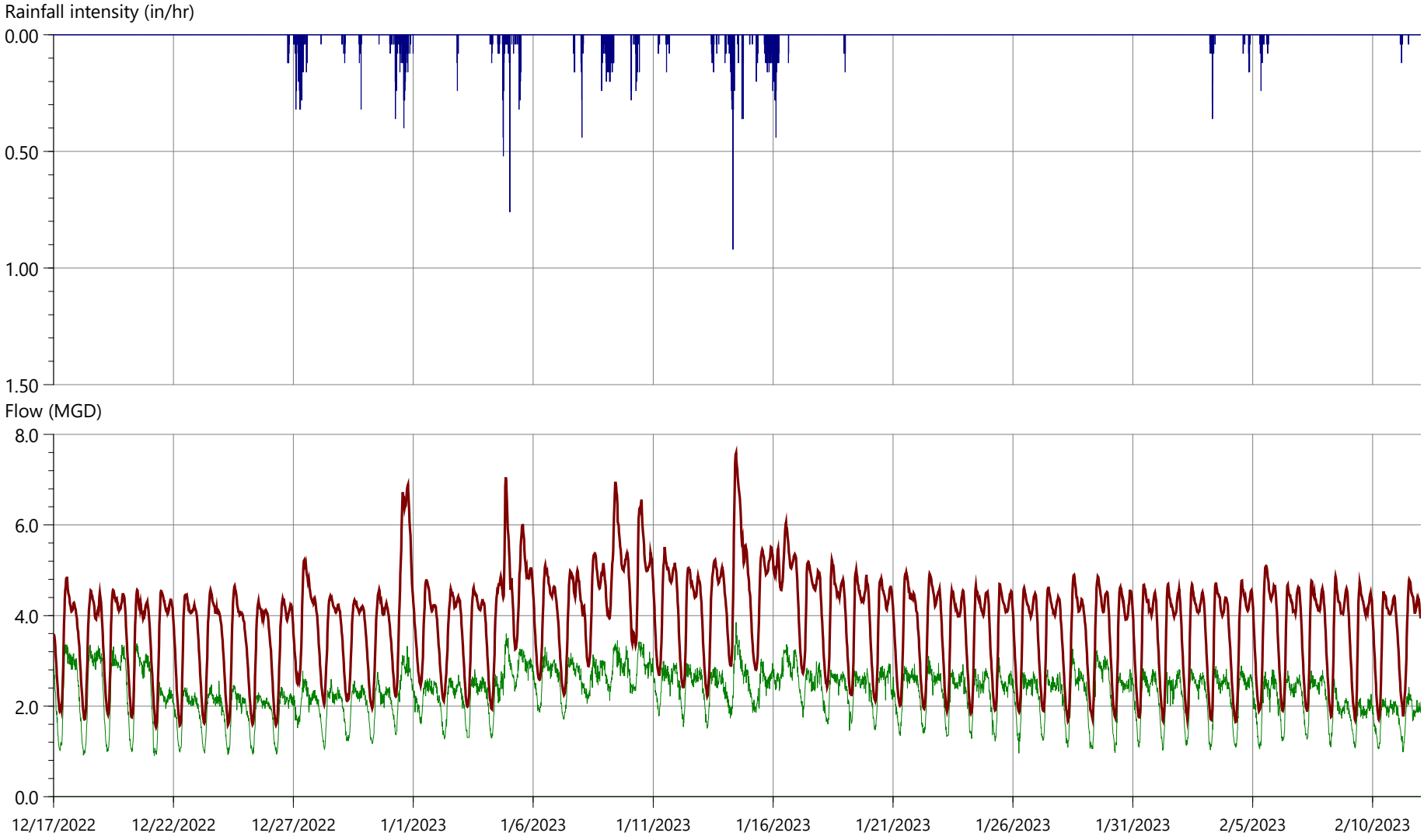
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.270	0.680	0.008			
Observed				0.229	2.269	66.613
... Data 2023 and 2015				0.290	1.804	53.713

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 8, Model Location (Pred.) D/S S86-13.1, Rainfall Profile: 1



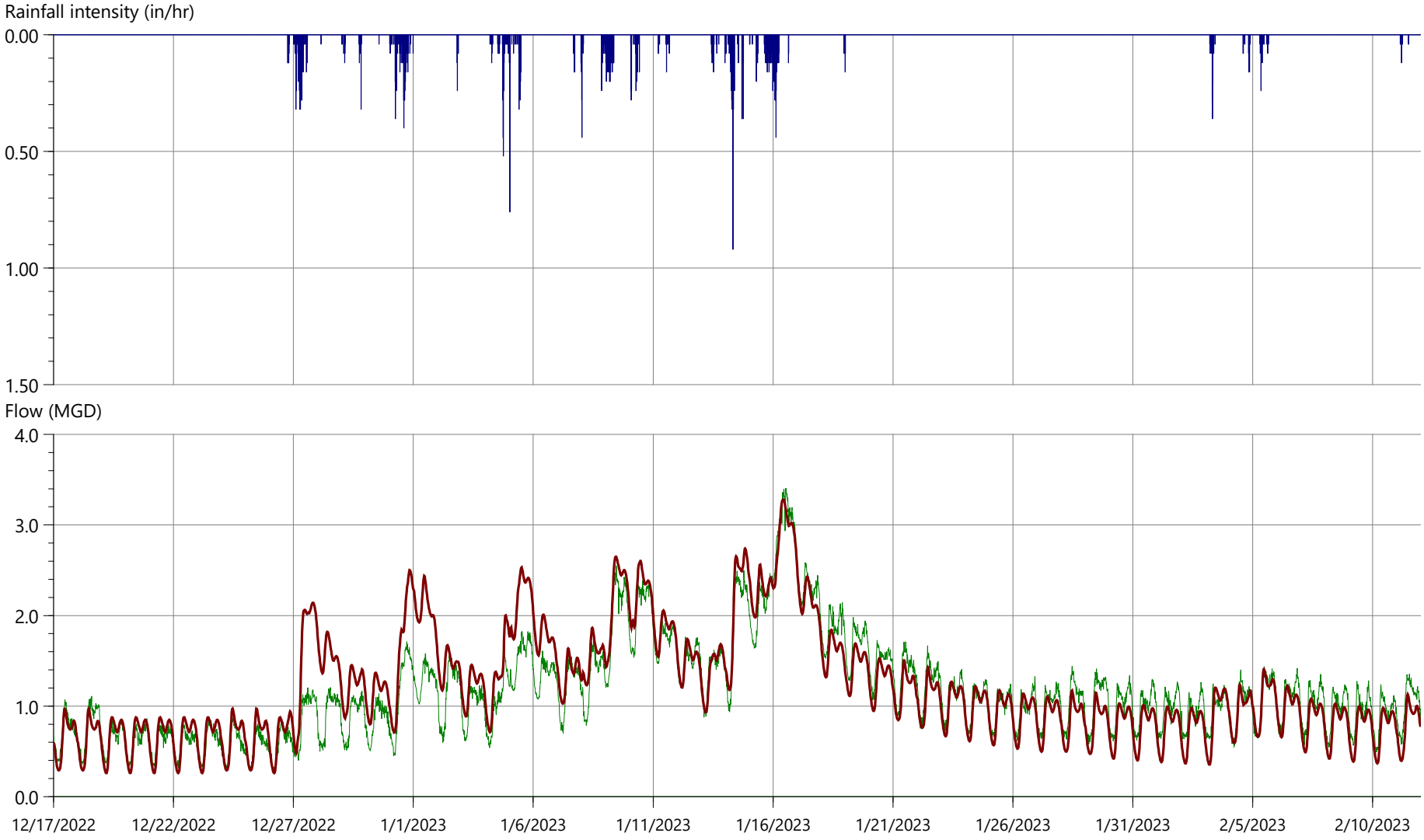
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.270	0.680	0.008			
Observed				0.785	3.123	99.151
... Data 2023 and 2015				0.864	2.765	98.422

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 9, Model Location (Pred.) D/S S72-20.1, Rainfall Profile: 2



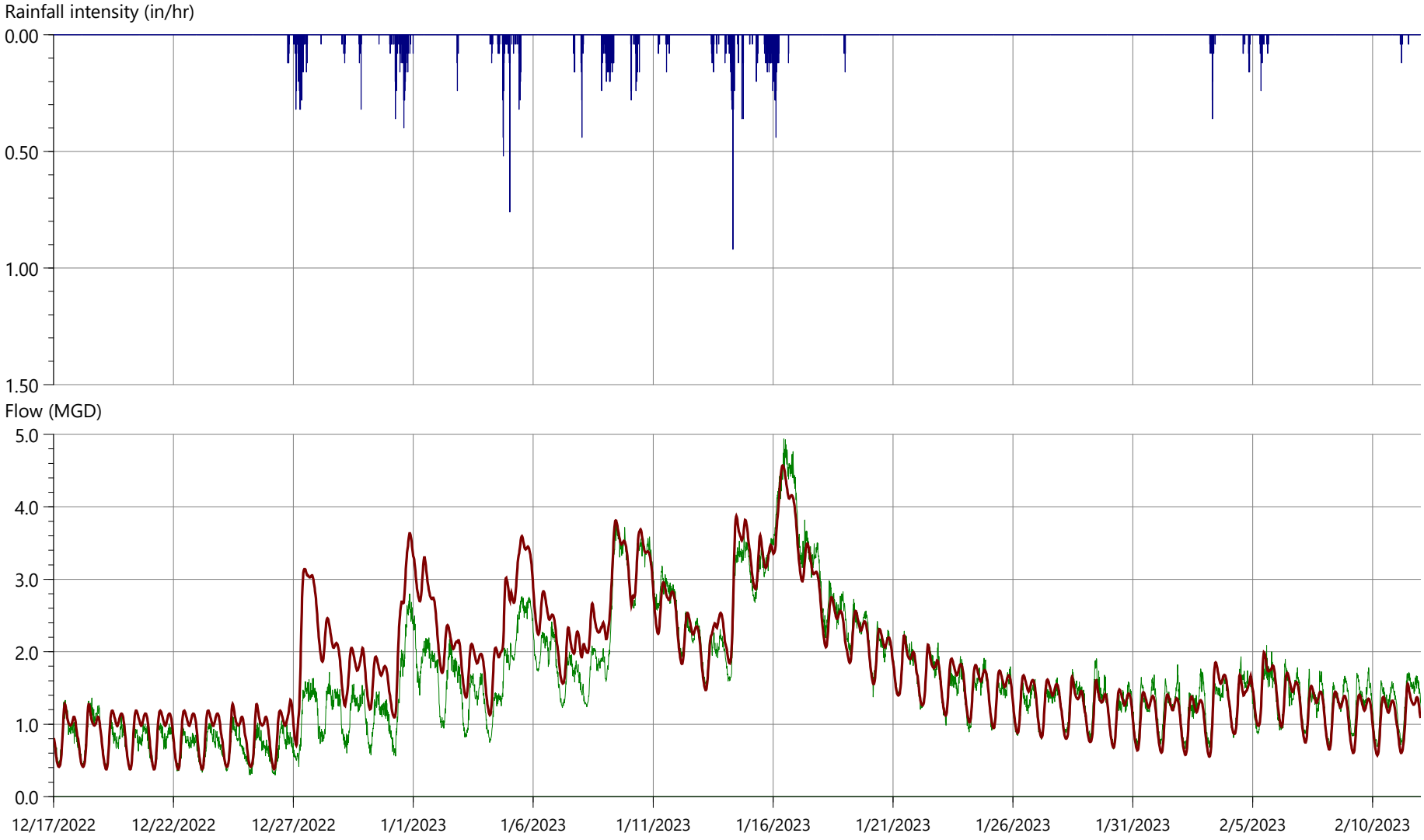
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.904	3.852	130.258
... Data 2023 and 2015				1.535	7.588	220.094

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 10, Model Location (Pred.) D/S S52-80.1, Rainfall Profile: 2



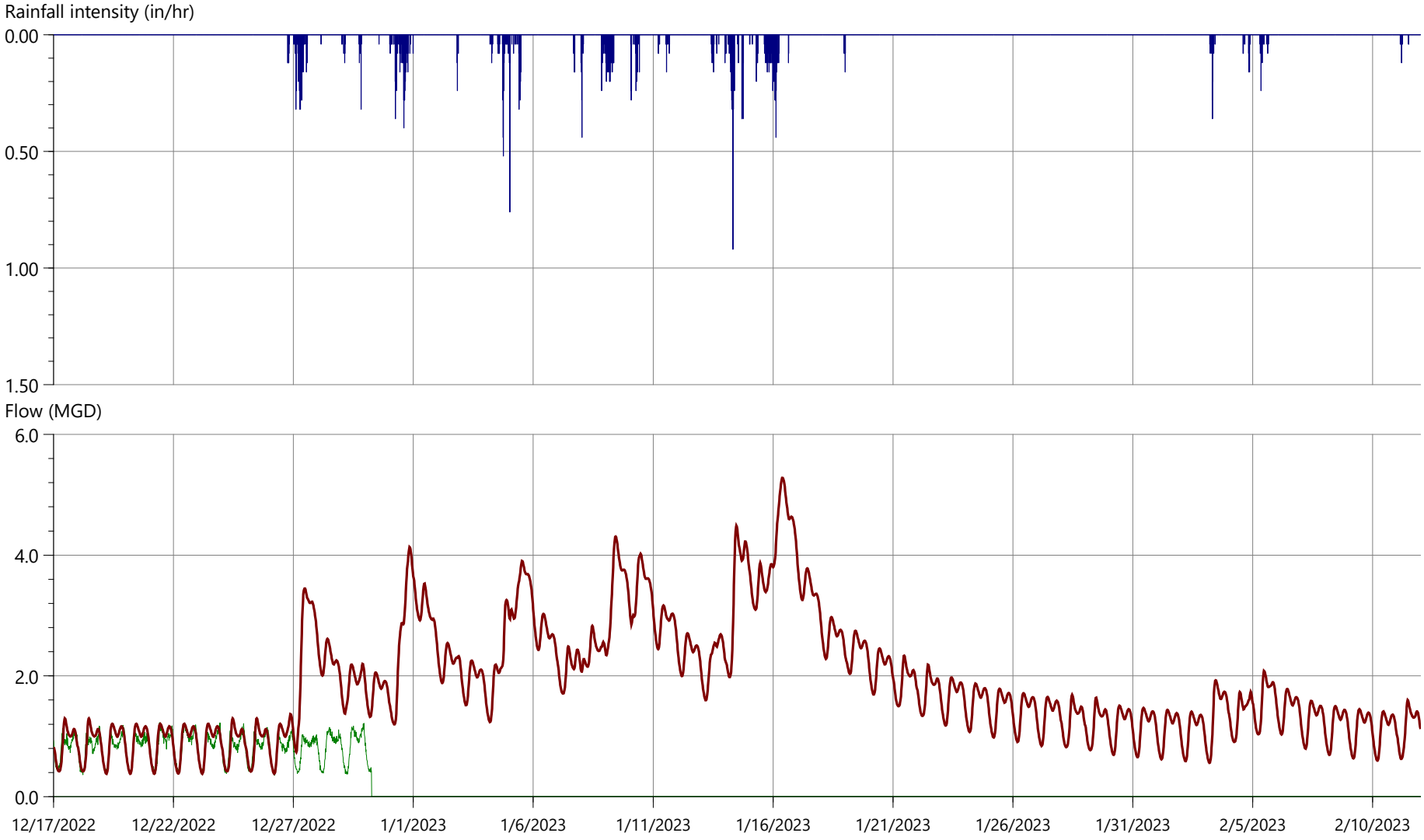
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.293	3.408	66.545
... Data 2023 and 2015				0.261	3.281	69.344

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 11, Model Location (Pred.) D/S S53-9.1, Rainfall Profile: 2



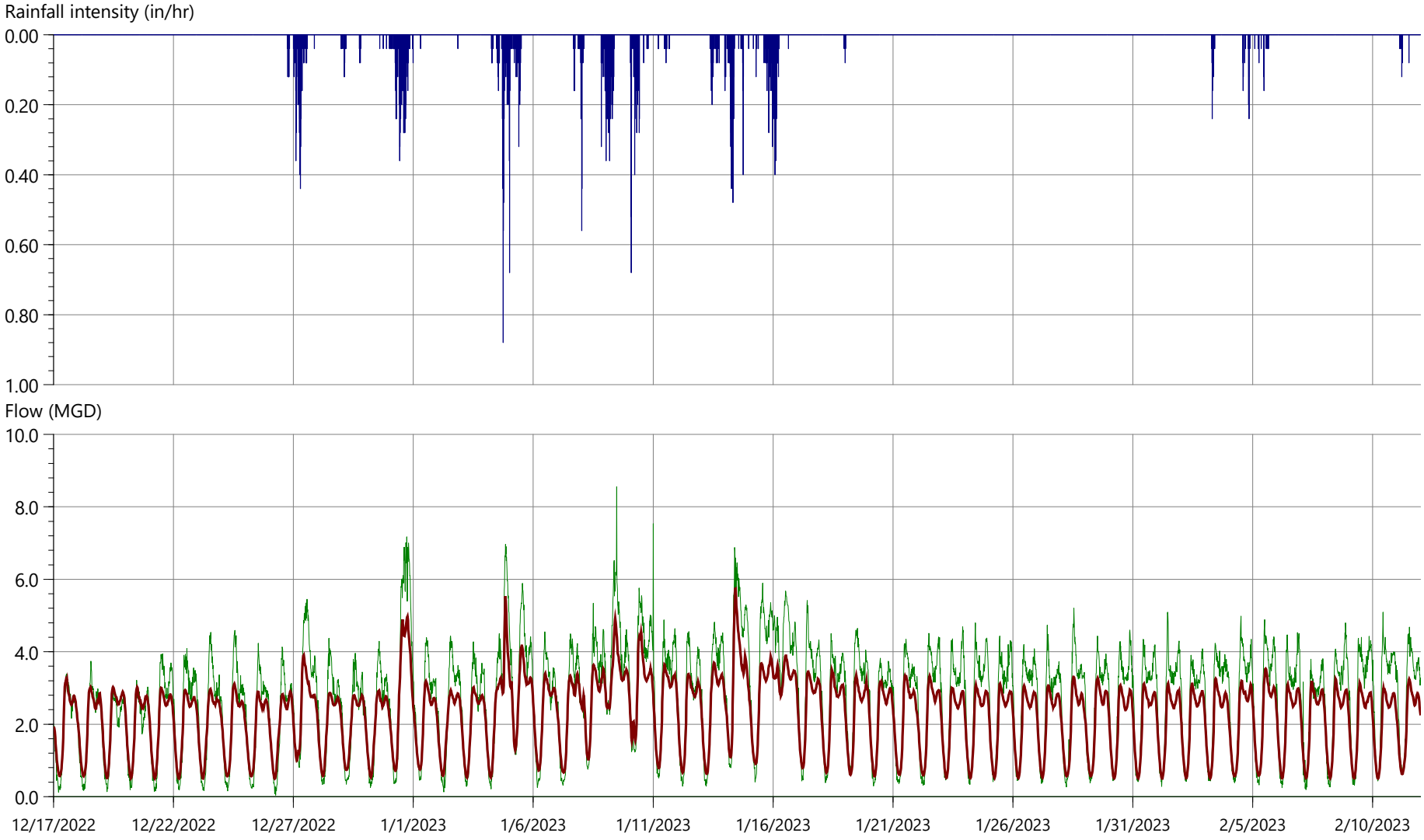
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.299	4.937	91.451
... Data 2023 and 2015				0.376	4.572	100.543

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 12, Model Location (Pred.) D/S S53-109.1, Rainfall Profile: 2



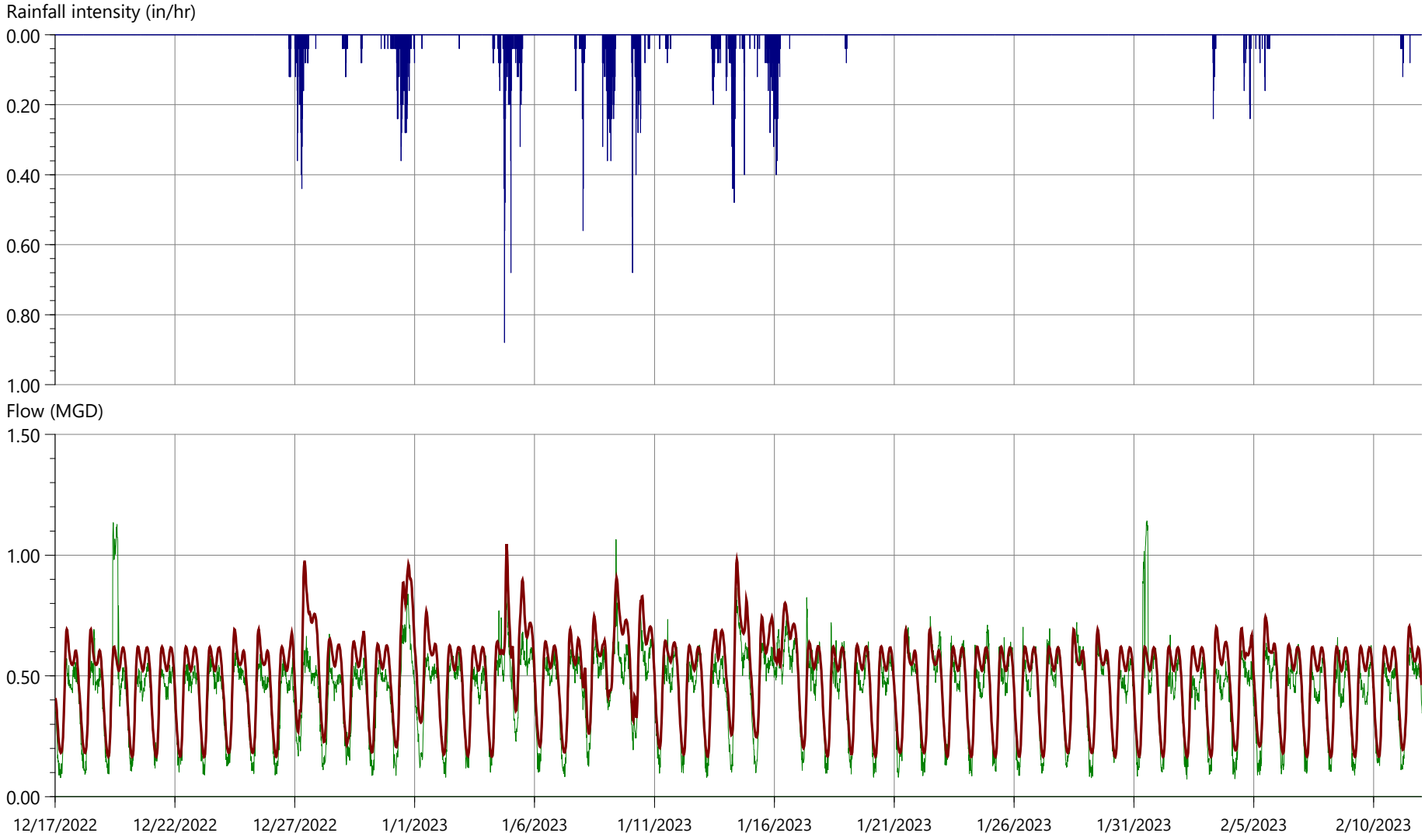
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.000	1.229	10.854
... Data 2023 and 2015				0.380	5.281	106.907

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 13, Model Location (Pred.) D/S S53-73.1, Rainfall Profile: 3



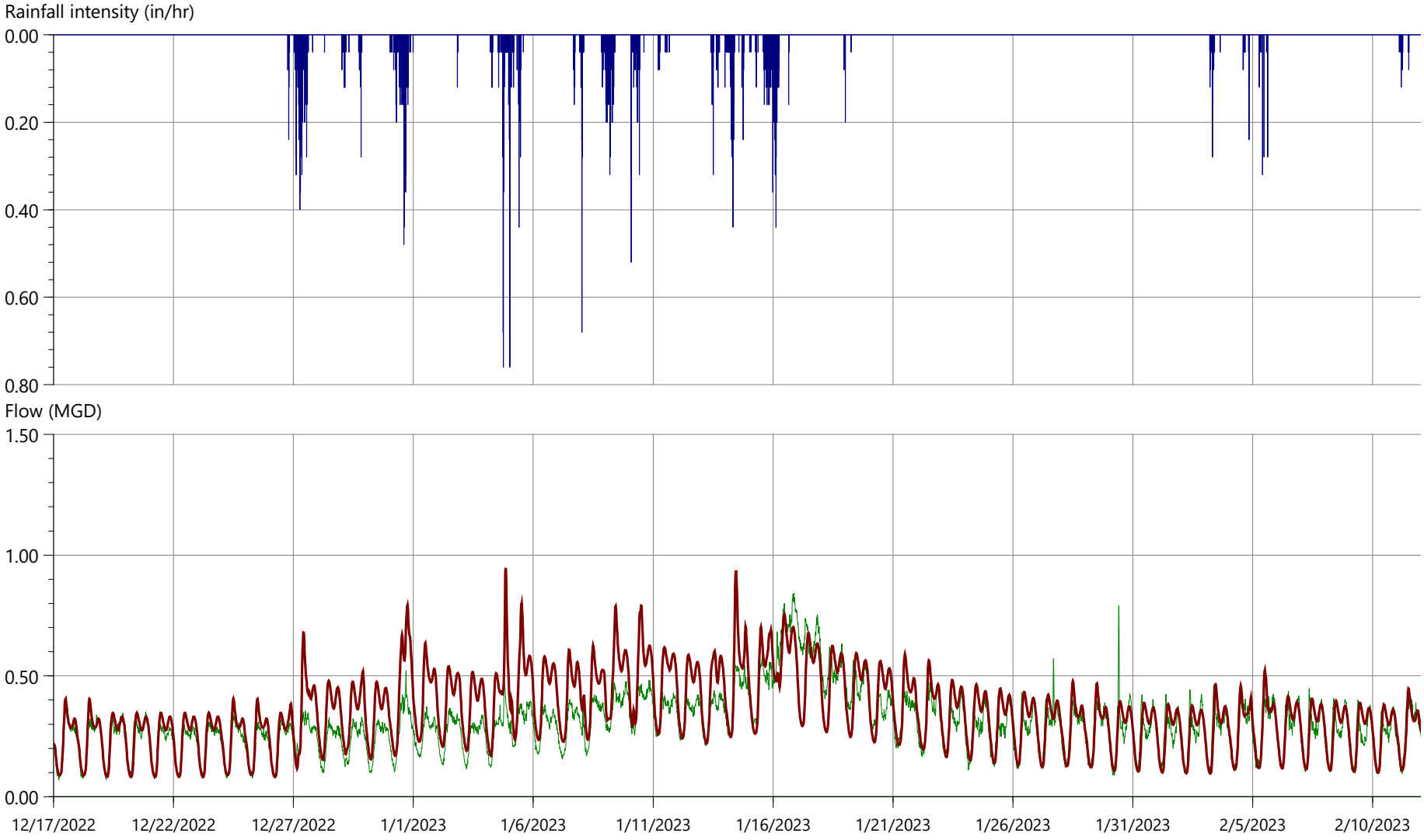
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	15.790	0.880	0.012			
Observed				0.039	8.561	156.493
... Data 2023 and 2015				0.496	5.745	130.152

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 14, Model Location (Pred.) D/S S54-17.1, Rainfall Profile: 3



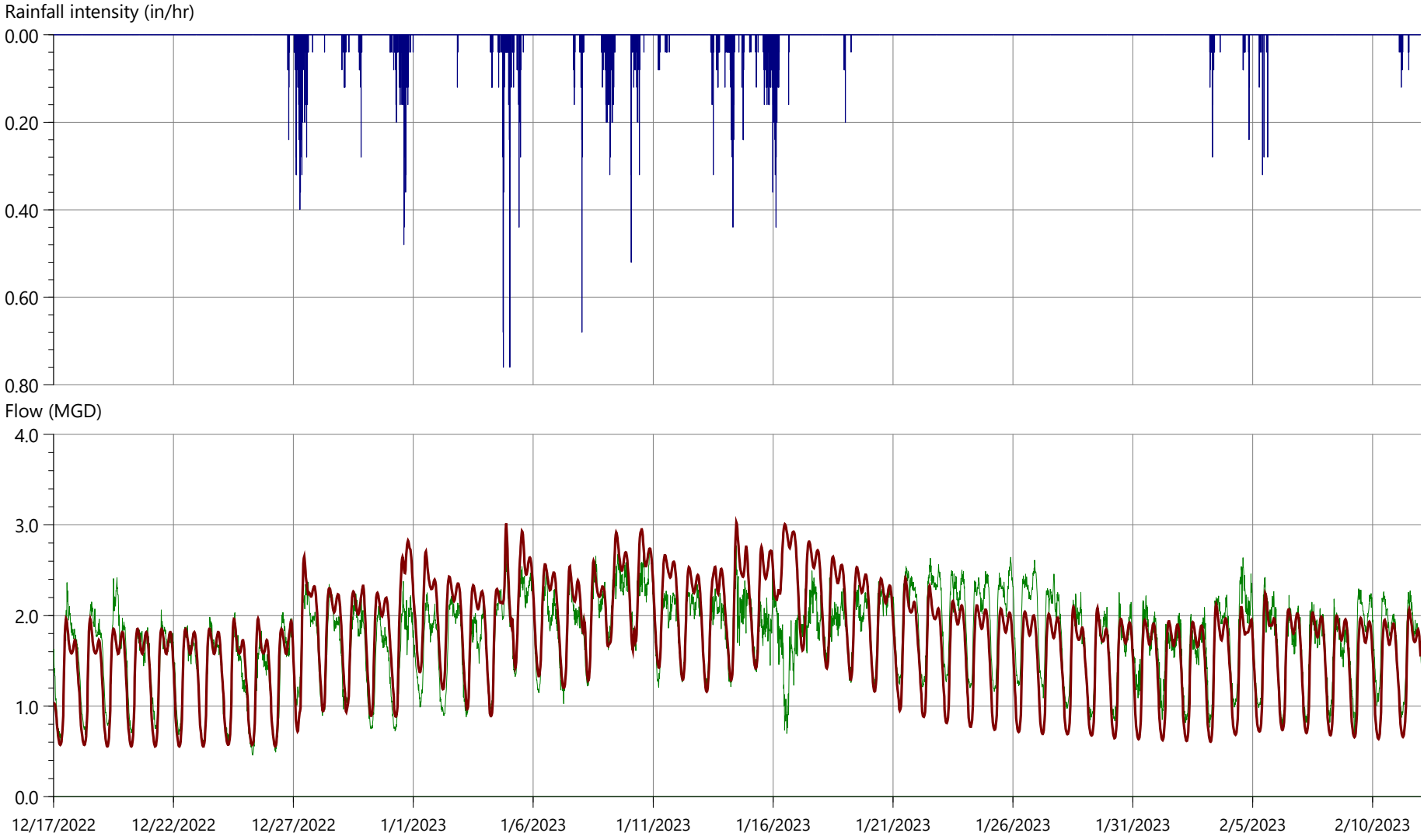
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	15.790	0.880	0.012			
Observed				0.072	1.143	24.509
... Data 2023 and 2015				0.165	1.046	28.116

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 15, Model Location (Pred.) D/S S65-48.1, Rainfall Profile: 4



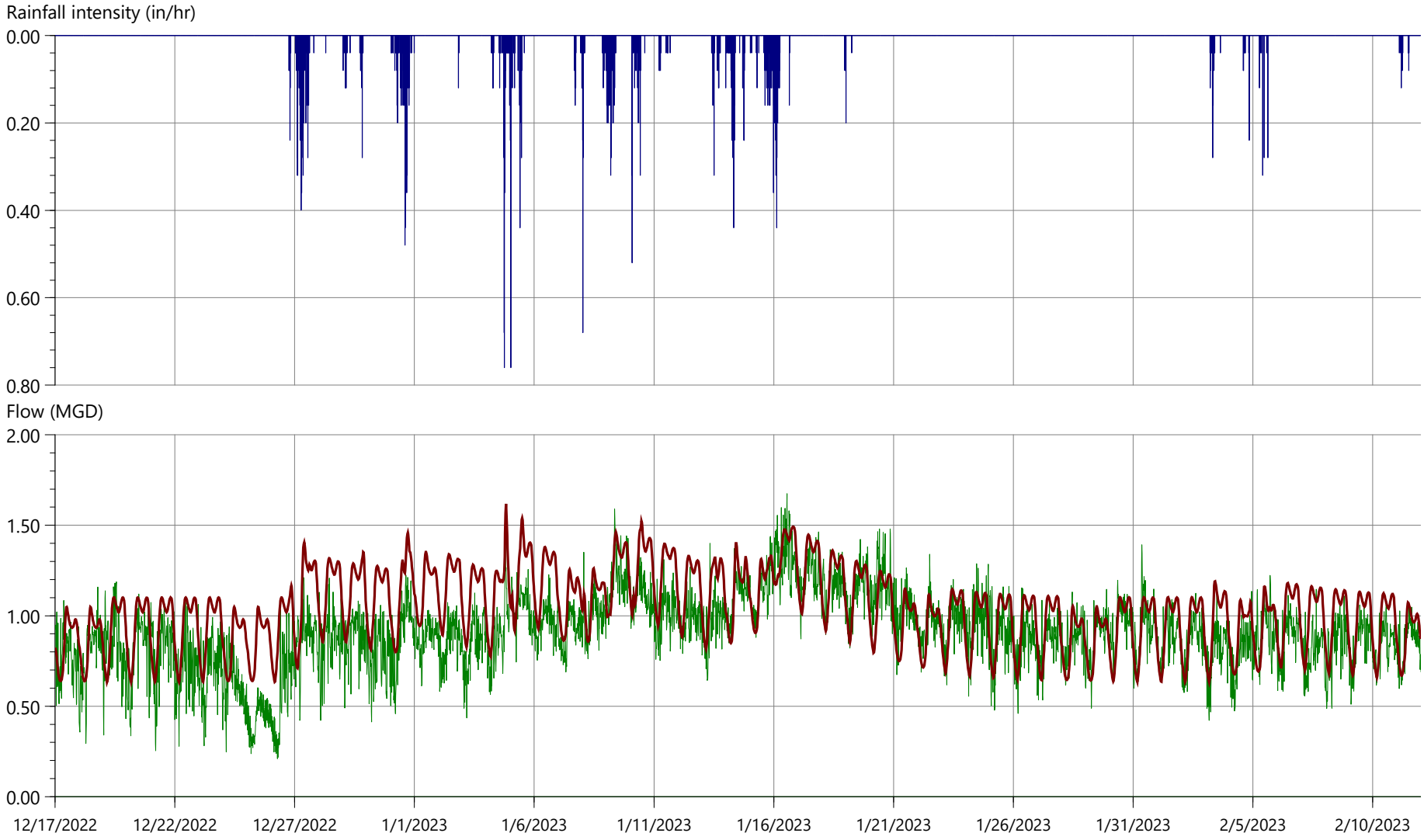
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.068	0.842	17.364
... Data 2023 and 2015				0.081	0.947	20.260

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 16, Model Location (Pred.) D/S S67-12.1, Rainfall Profile: 4



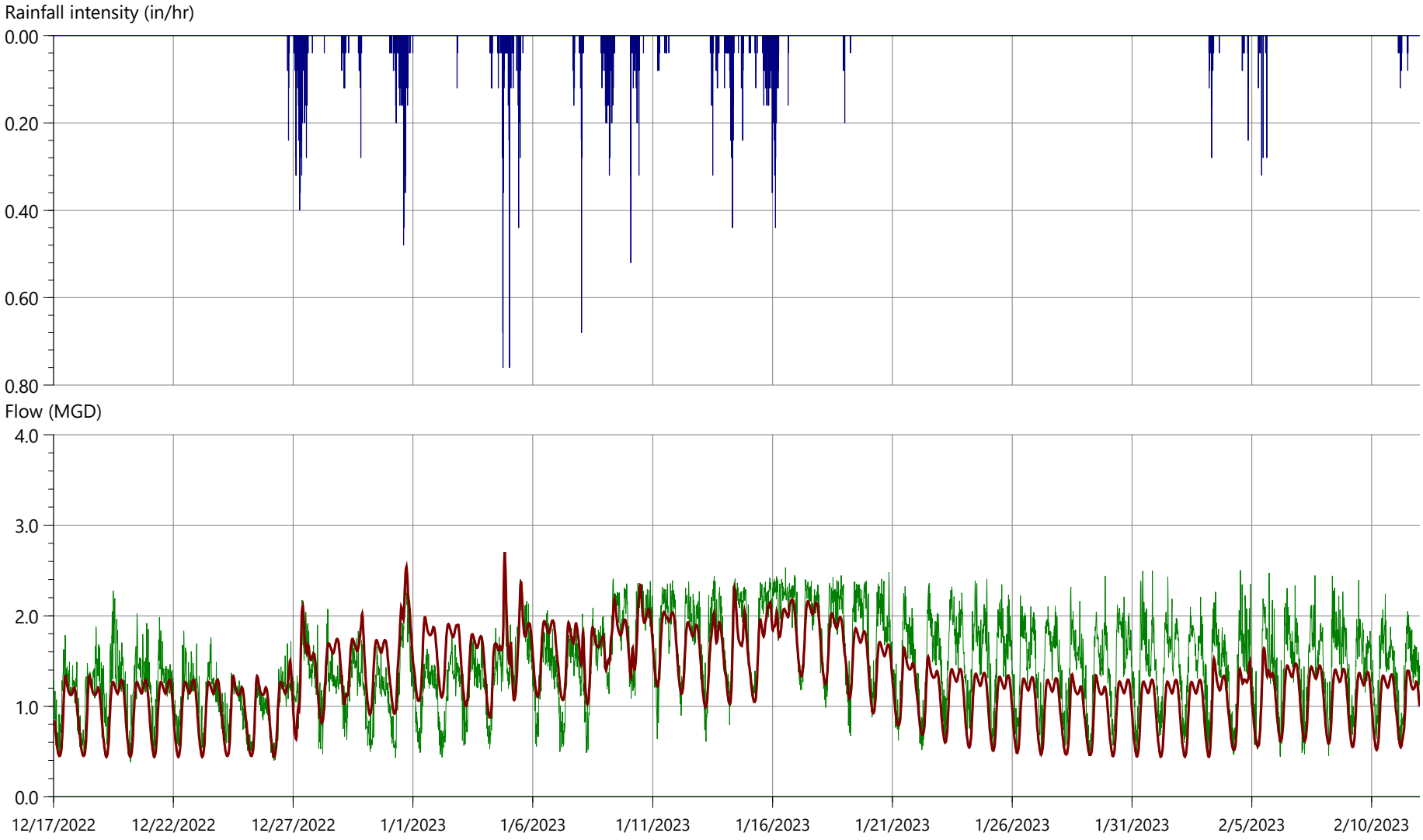
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.459	2.773	98.978
... Data 2023 and 2015				0.555	3.028	99.594

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 17, Model Location (Pred.) D/S S58-12.2, Rainfall Profile: 4



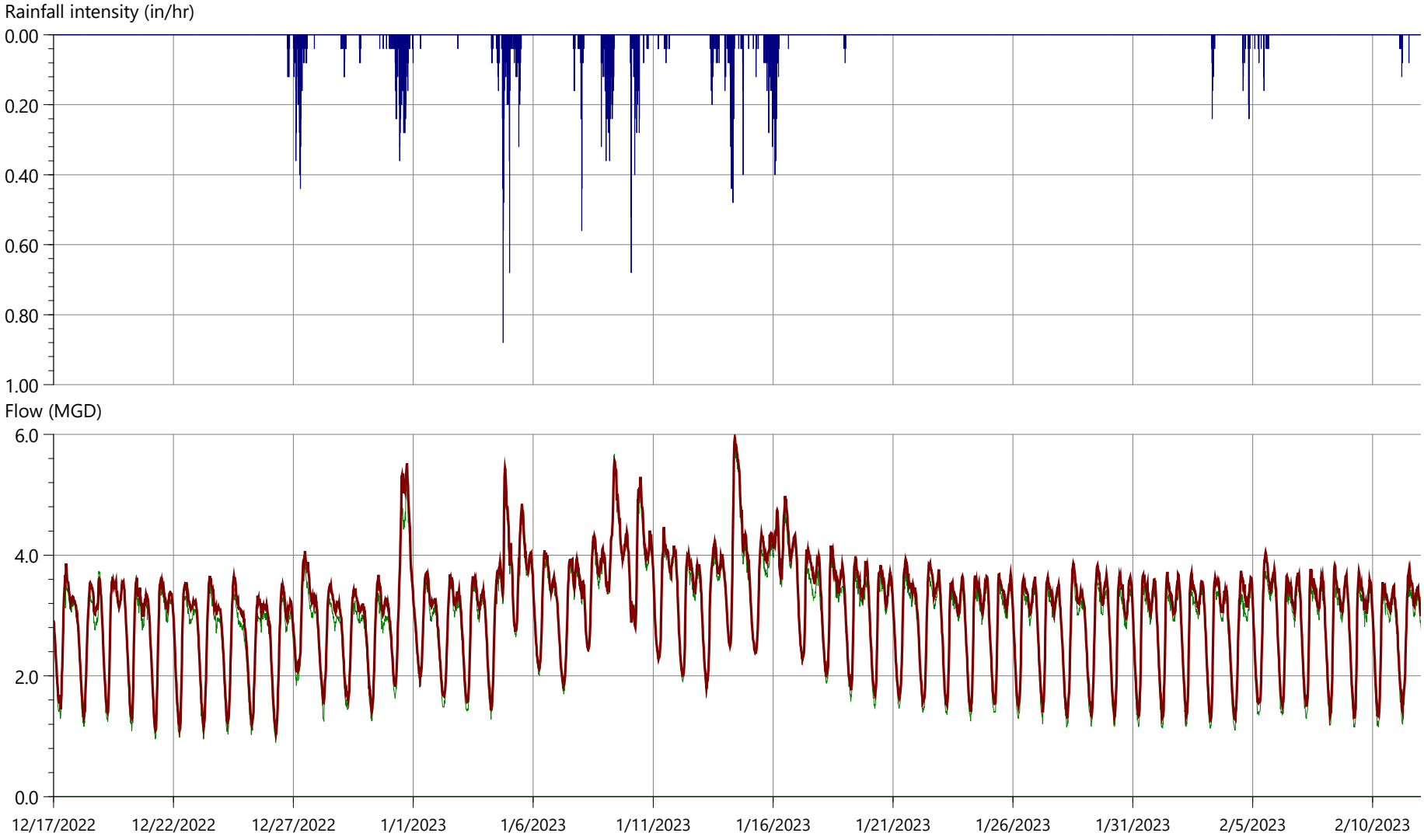
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.210	1.675	51.663
... Data 2023 and 2015				0.632	1.619	59.316

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 18, Model Location (Pred.) D/S S58-11.1, Rainfall Profile: 4



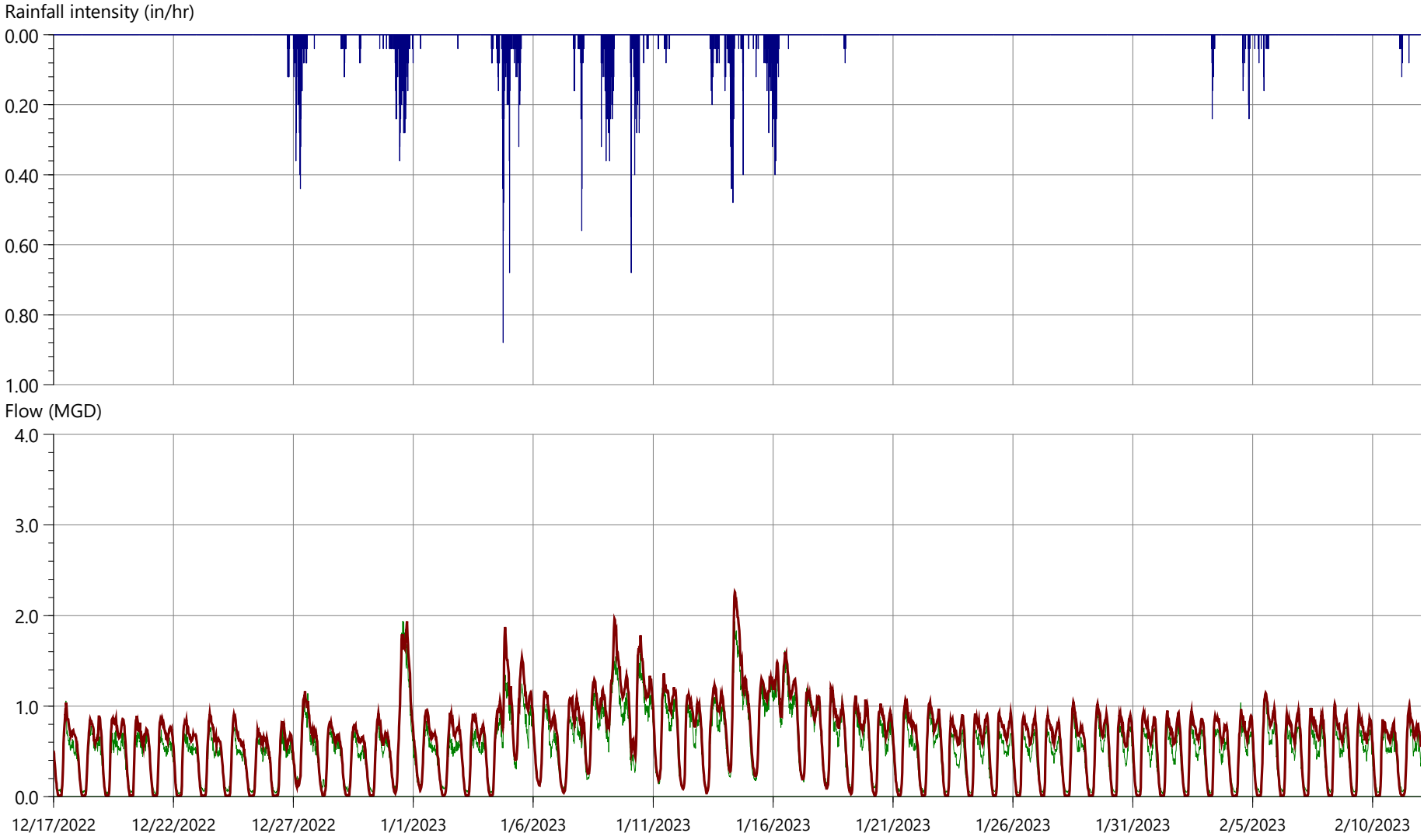
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.385	2.531	82.942
... Data 2023 and 2015				0.440	2.704	73.747

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 19, Model Location (Pred.) D/S S21-23.1, Rainfall Profile: 3



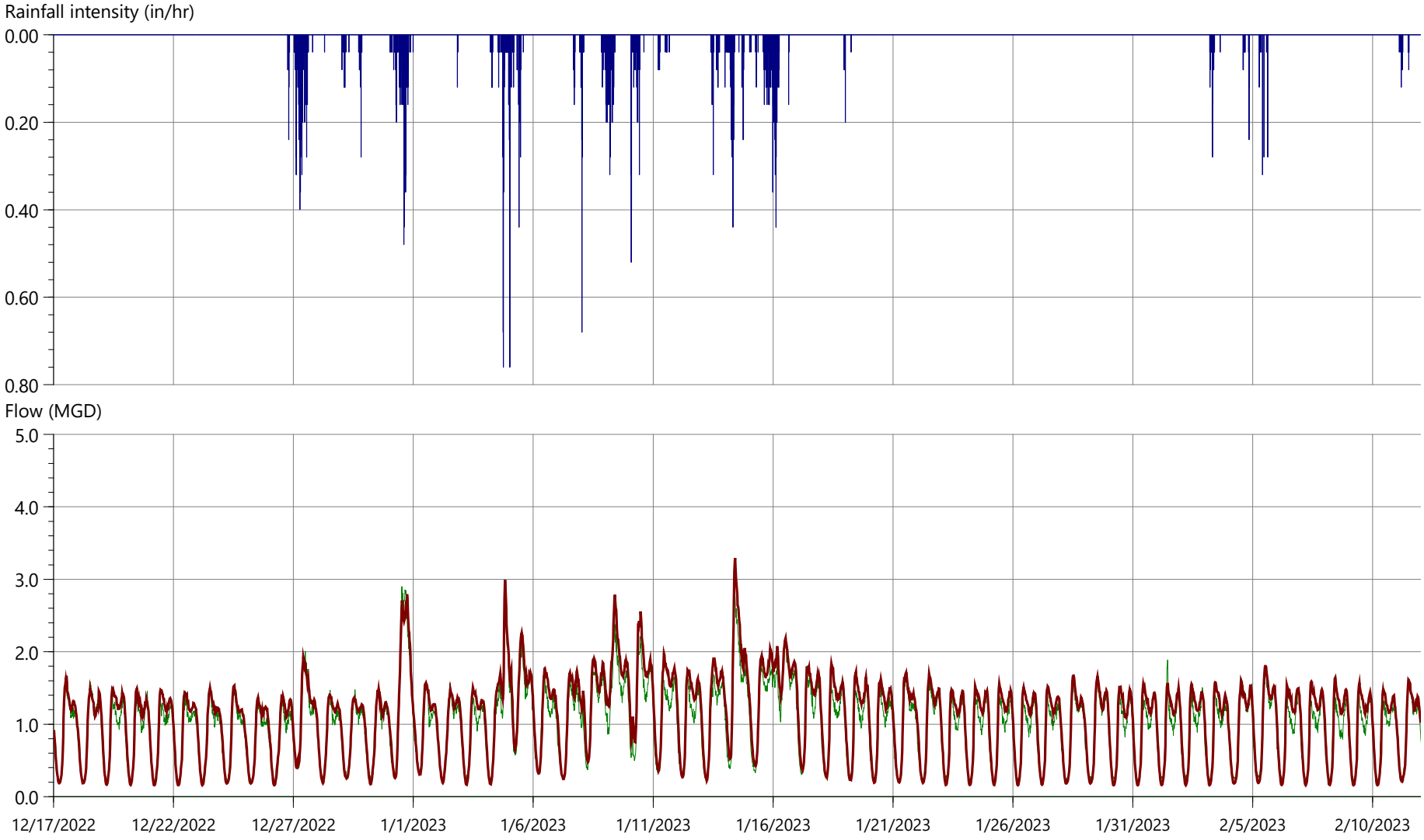
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	15.790	0.880	0.012			
Observed				0.899	5.983	166.563
... Data 2023 and 2015				1.039	5.938	175.023

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 20, Model Location (Pred.) D/S S21-46.1, Rainfall Profile: 3



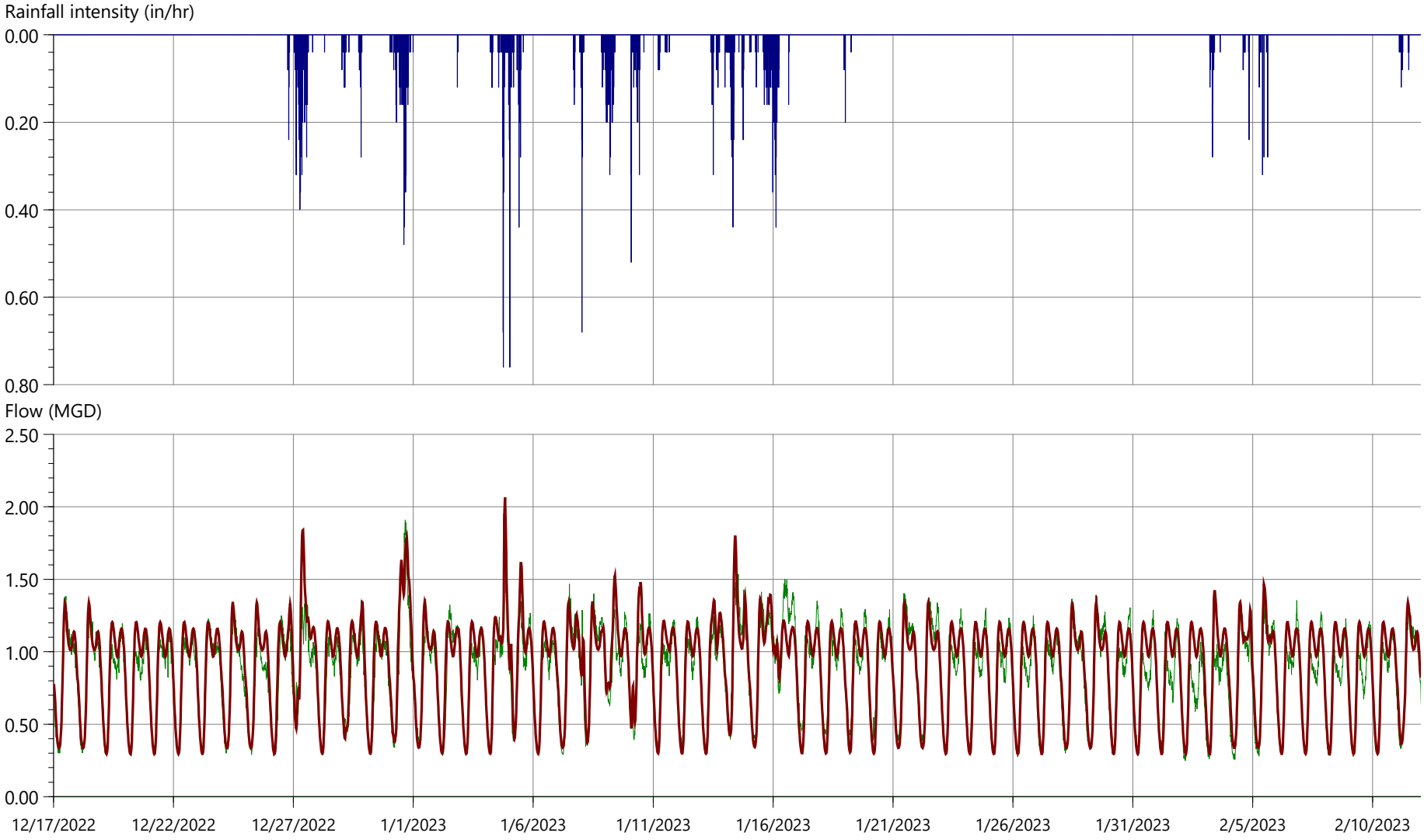
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	15.790	0.880	0.012			
Observed				0.022	1.939	30.414
... Data 2023 and 2015				0.009	2.260	35.967

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 21, Model Location (Pred.) D/S S23-14.1, Rainfall Profile: 4



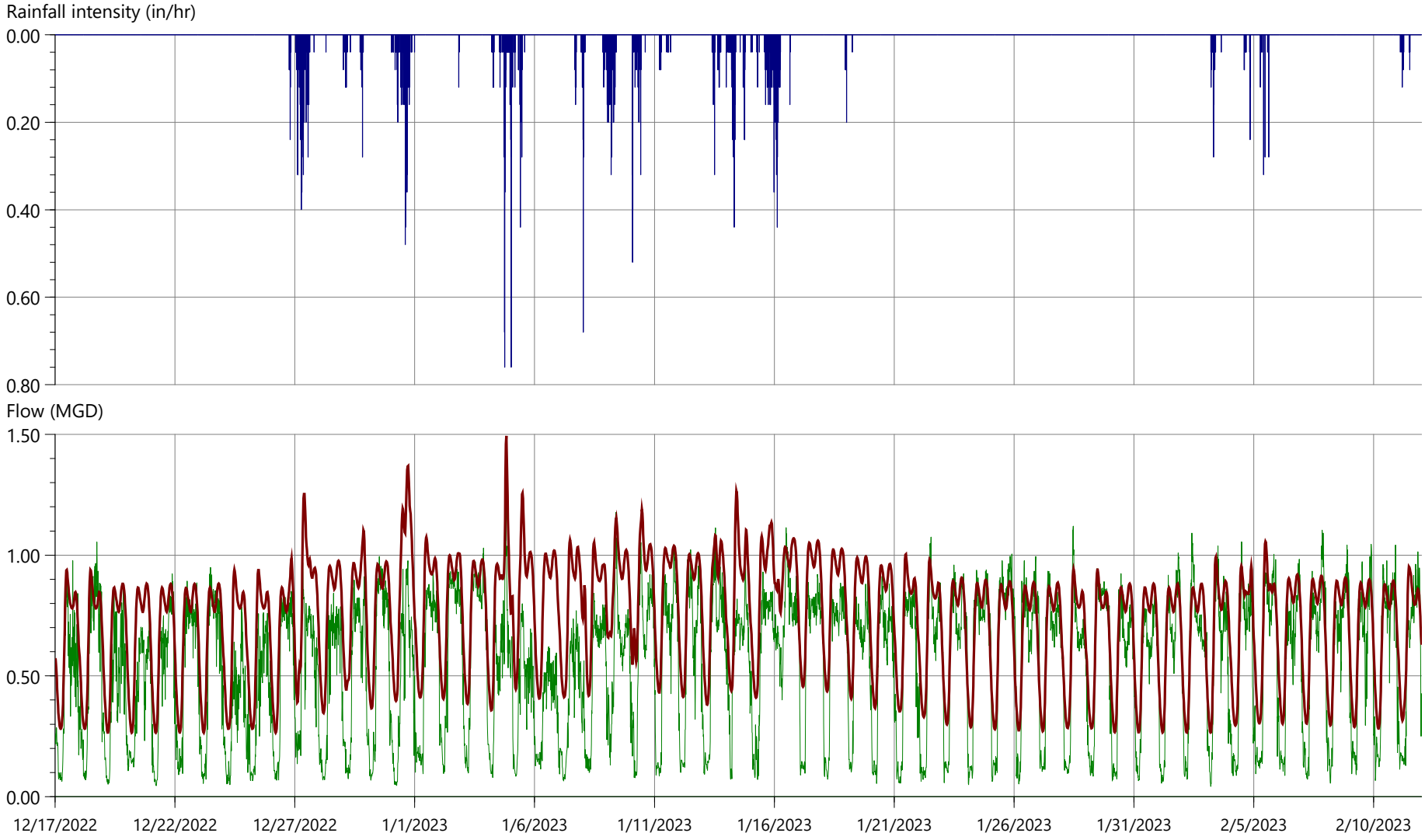
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.199	2.901	57.470
... Data 2023 and 2015				0.158	3.295	62.917

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 22, Model Location (Pred.) D/S S45-88.1, Rainfall Profile: 4



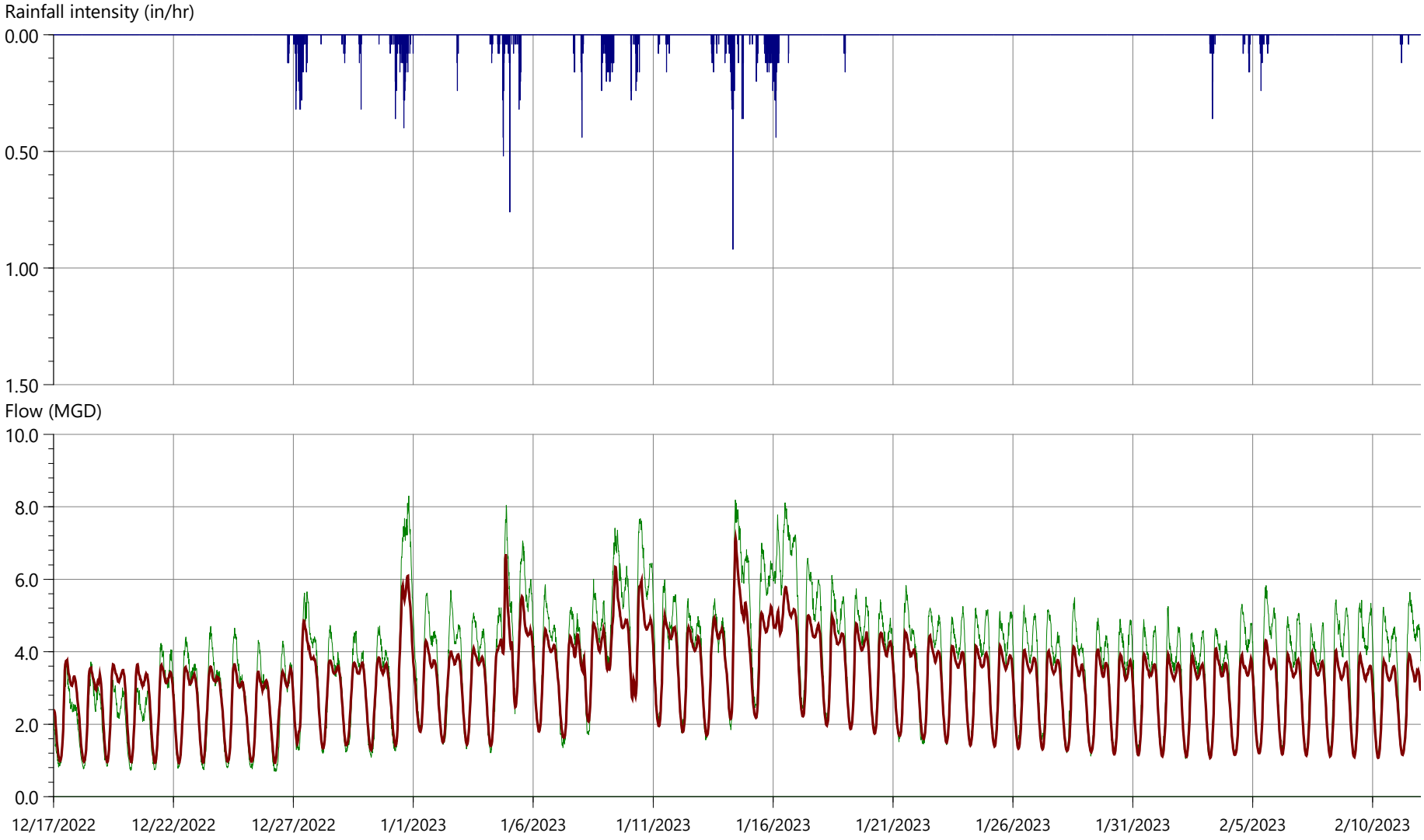
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.249	1.954	48.806
... Data 2023 and 2015				0.294	2.067	51.449

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 23, Model Location (Pred.) D/S S48-32.1, Rainfall Profile: 4



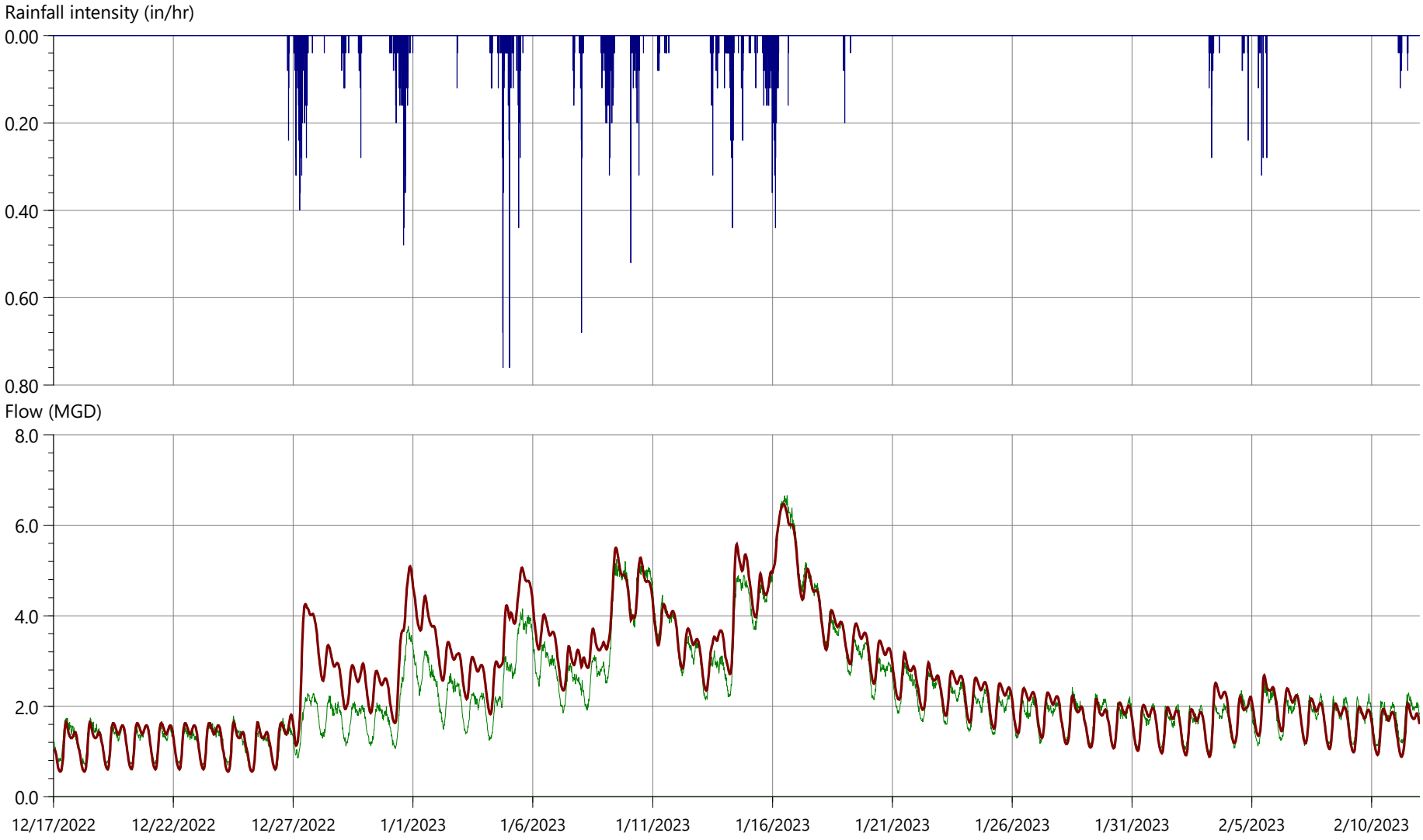
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.043	1.224	31.114
... Data 2023 and 2015				0.265	1.494	42.122

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 24, Model Location (Pred.) D/S S63-2.1, Rainfall Profile: 2



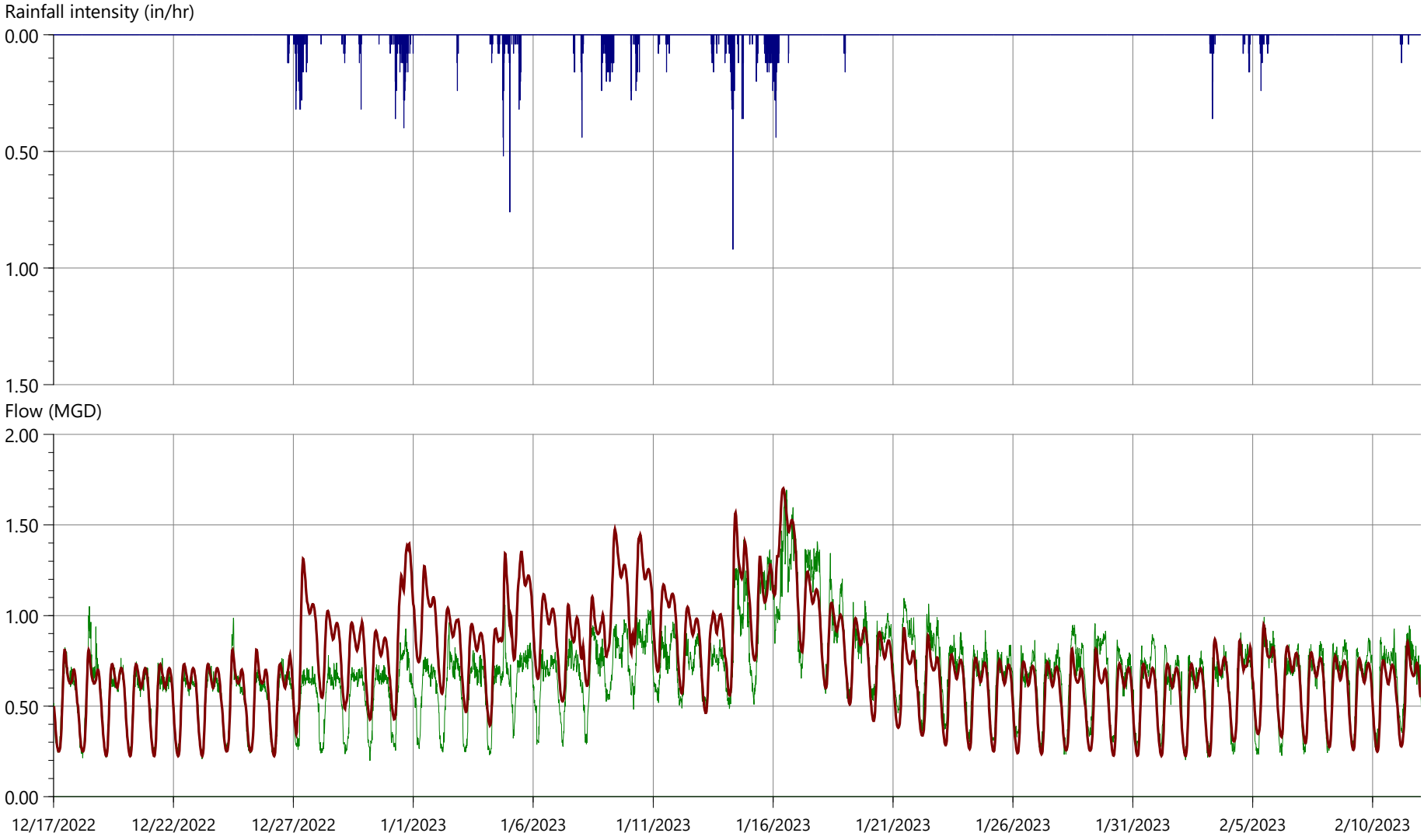
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.701	8.304	207.686
... Data 2023 and 2015				0.928	7.143	182.287

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 25, Model Location (Pred.) D/S S57-6.1, Rainfall Profile: 4



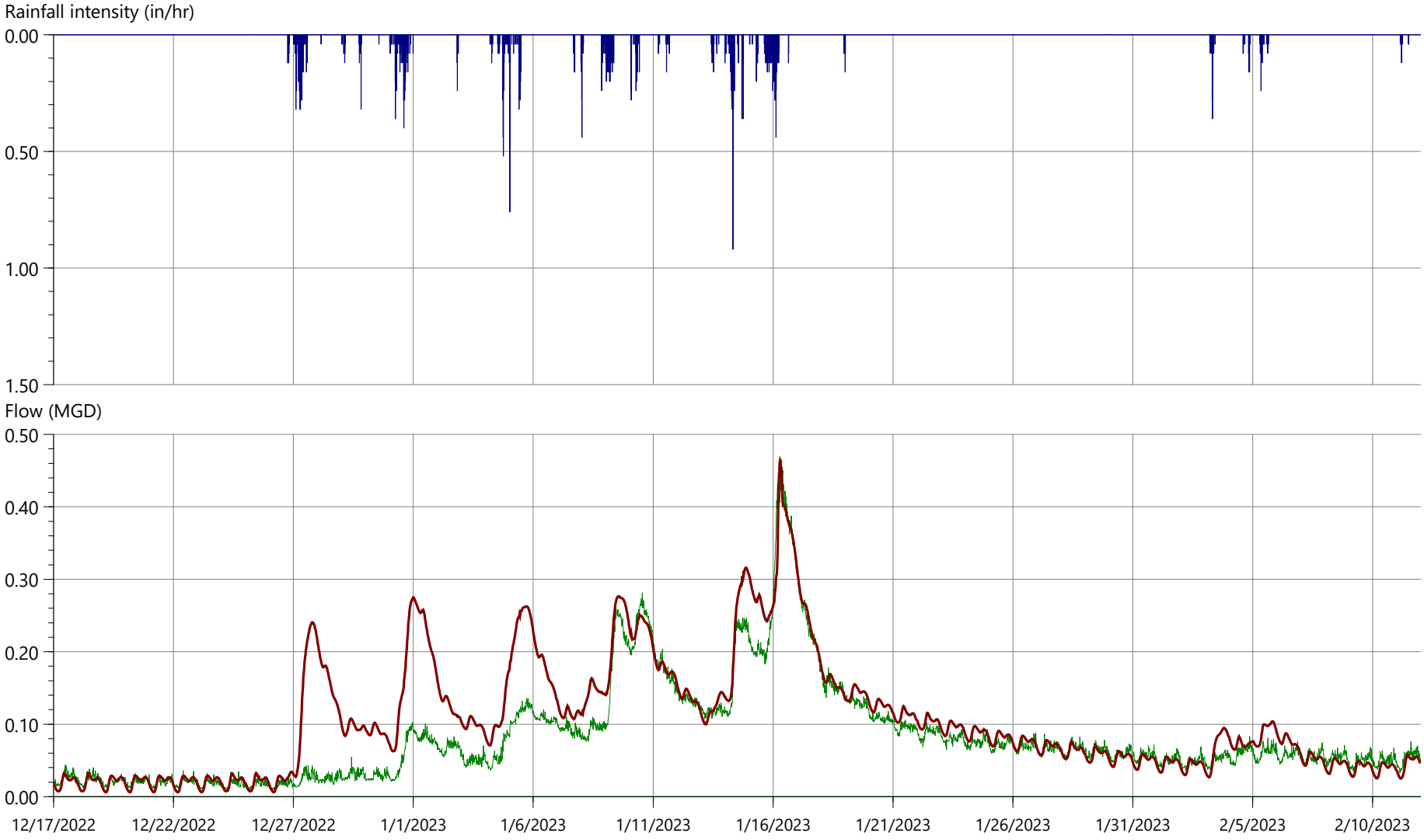
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	13.810	0.760	0.010			
Observed				0.540	6.661	130.153
... Data 2023 and 2015				0.555	6.470	144.336

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 26, Model Location (Pred.) D/S S52-86.1, Rainfall Profile: 2



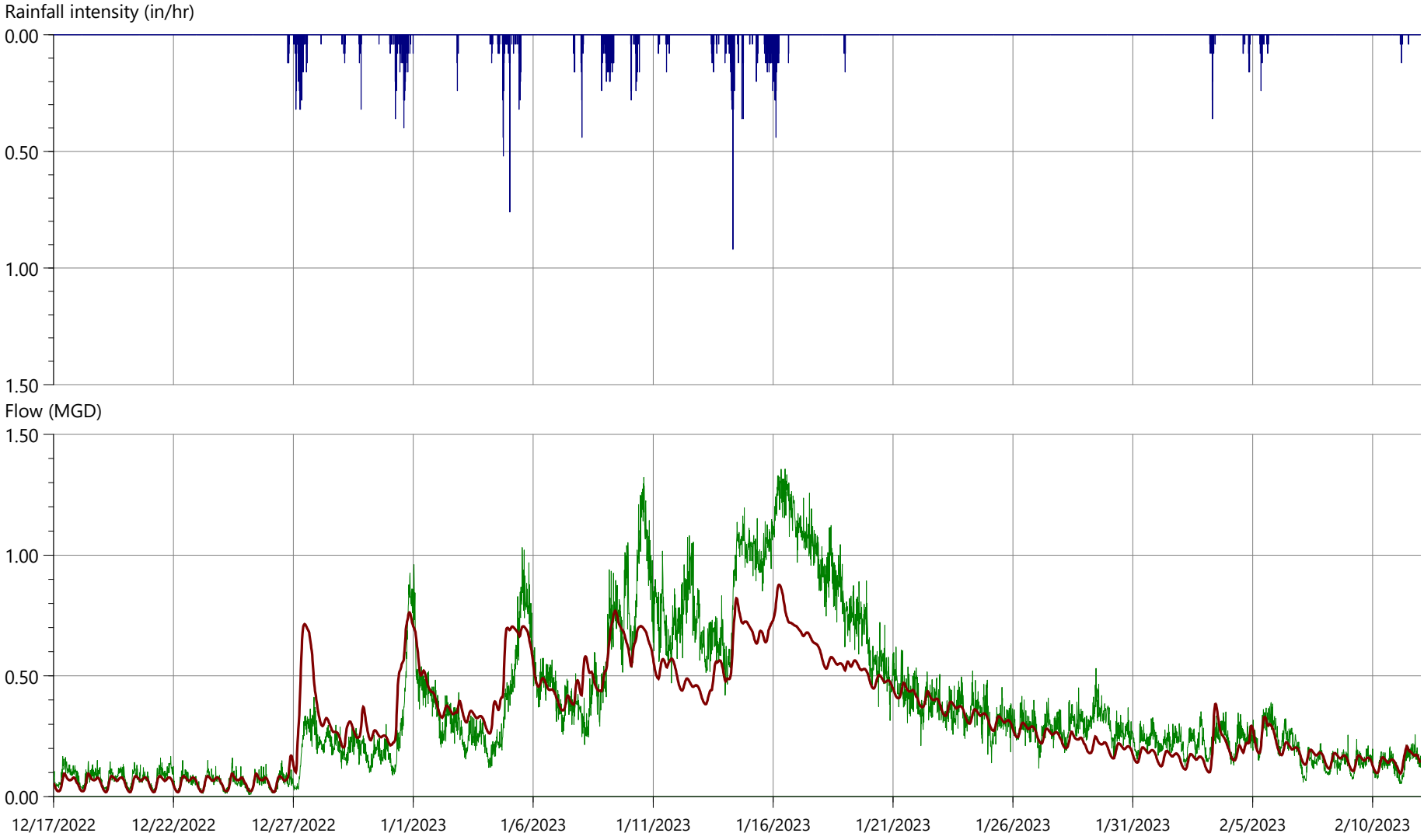
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.200	1.698	38.187
... Data 2023 and 2015				0.224	1.702	41.875

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 27, Model Location (Pred.) D/S S43-8.1, Rainfall Profile: 2



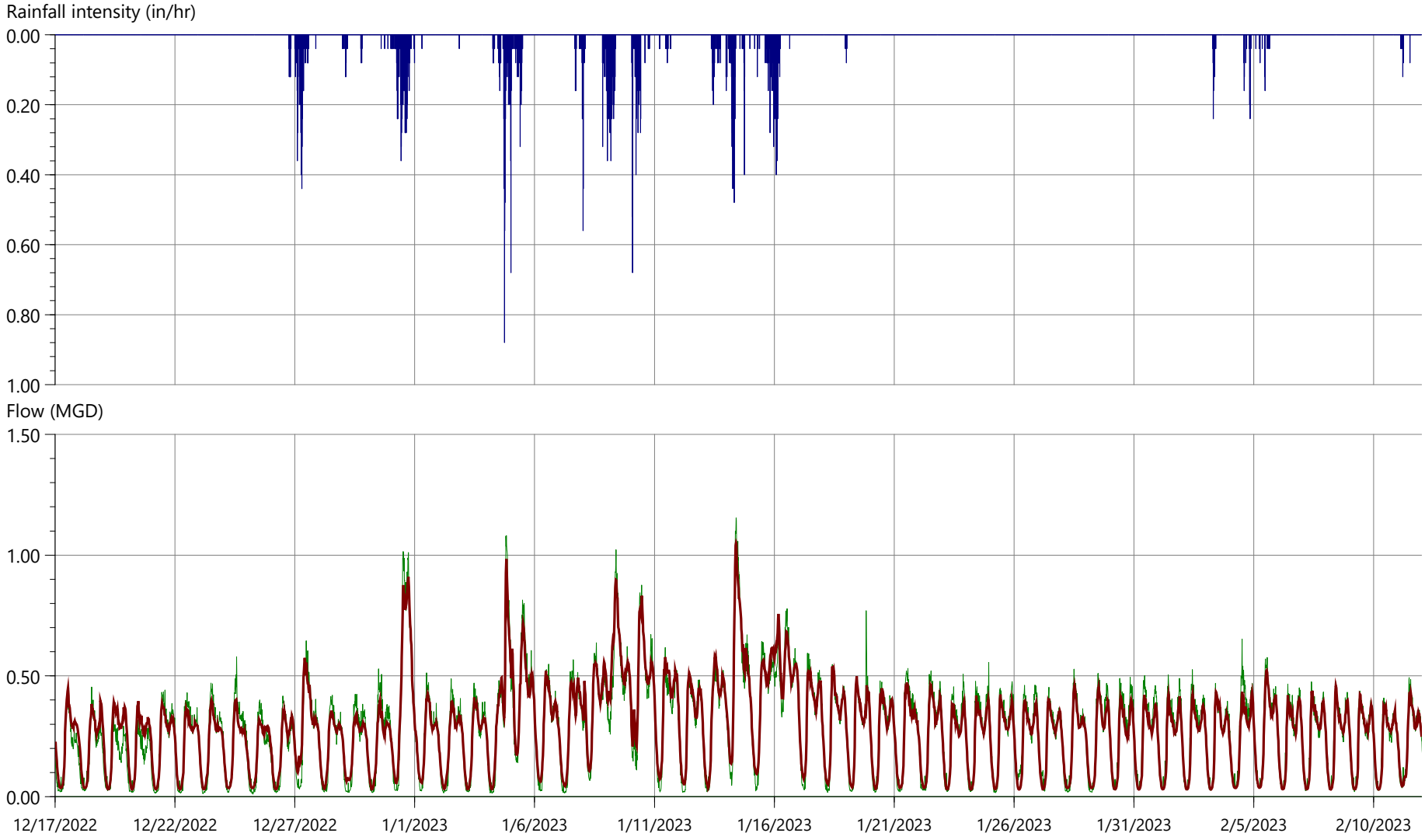
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.009	0.465	4.696
... Data 2023 and 2015				0.006	0.464	5.989

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 28, Model Location (Pred.) D/S S53-47.1, Rainfall Profile: 2



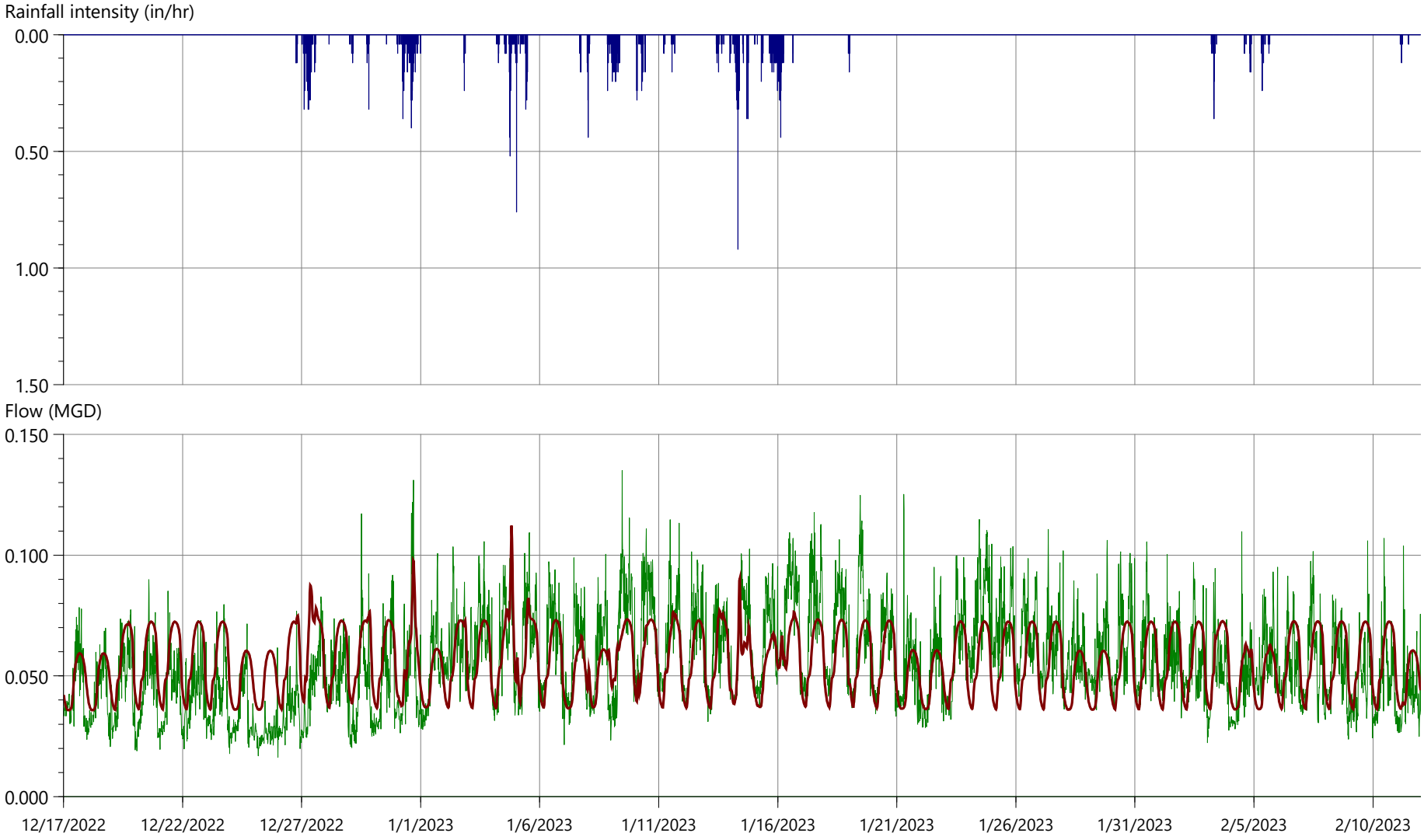
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.009	1.357	21.009
... Data 2023 and 2015				0.019	0.877	18.369

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 29, Model Location (Pred.) D/S S21-54.1, Rainfall Profile: 3



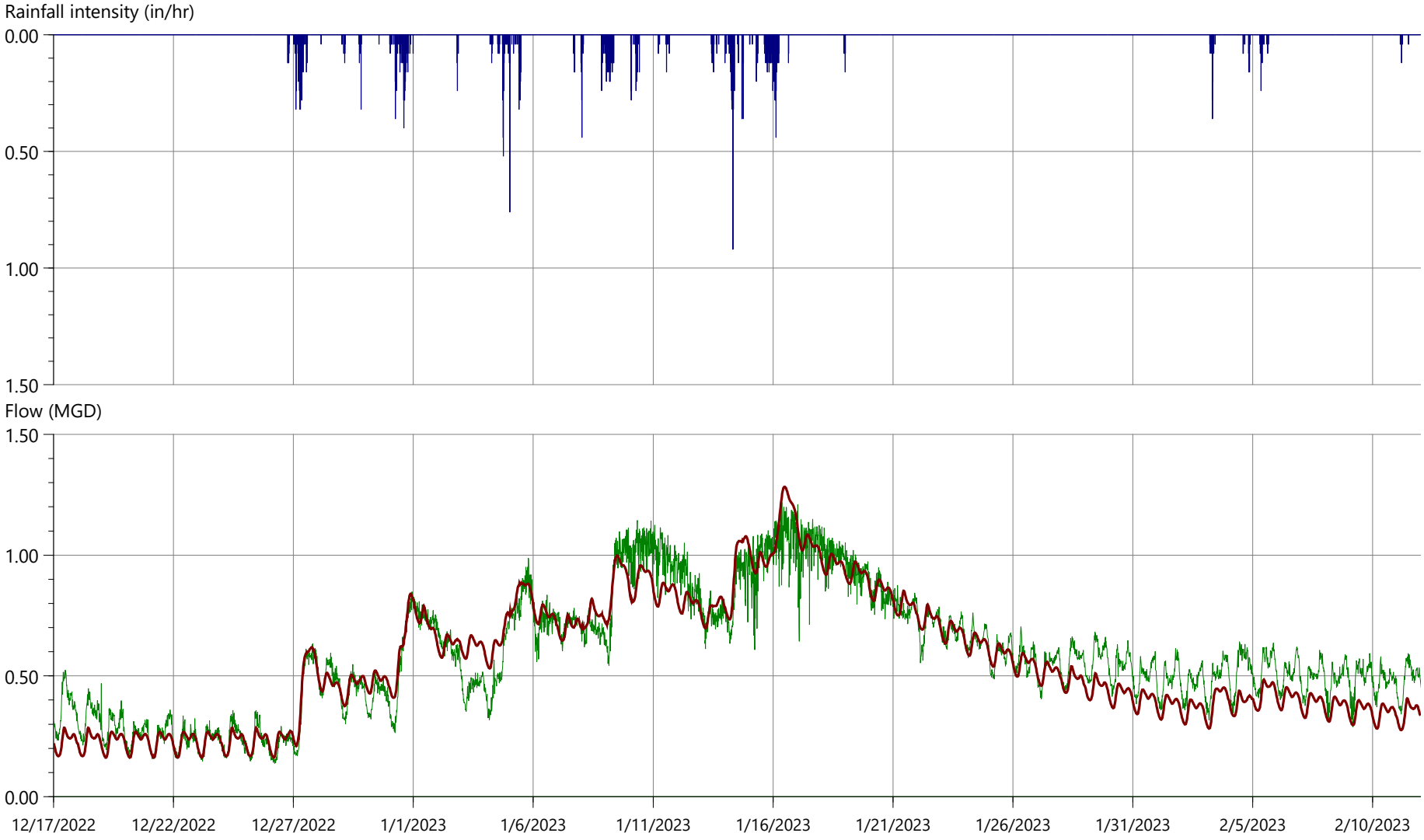
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	15.790	0.880	0.012			
Observed				0.010	1.155	16.332
... Data 2023 and 2015				0.030	1.052	16.361

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 30, Model Location (Pred.) D/S S62-24.1, Rainfall Profile: 2



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.016	0.135	3.157
... Data 2023 and 2015				0.036	0.112	3.179

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2023 WWF Existing_WithBlockage_10232023>Calibration (Homestead Blockage) ...
Flow Survey Location (Obs.) 31, Model Location (Pred.) D/S S62-23.1, Rainfall Profile: 2



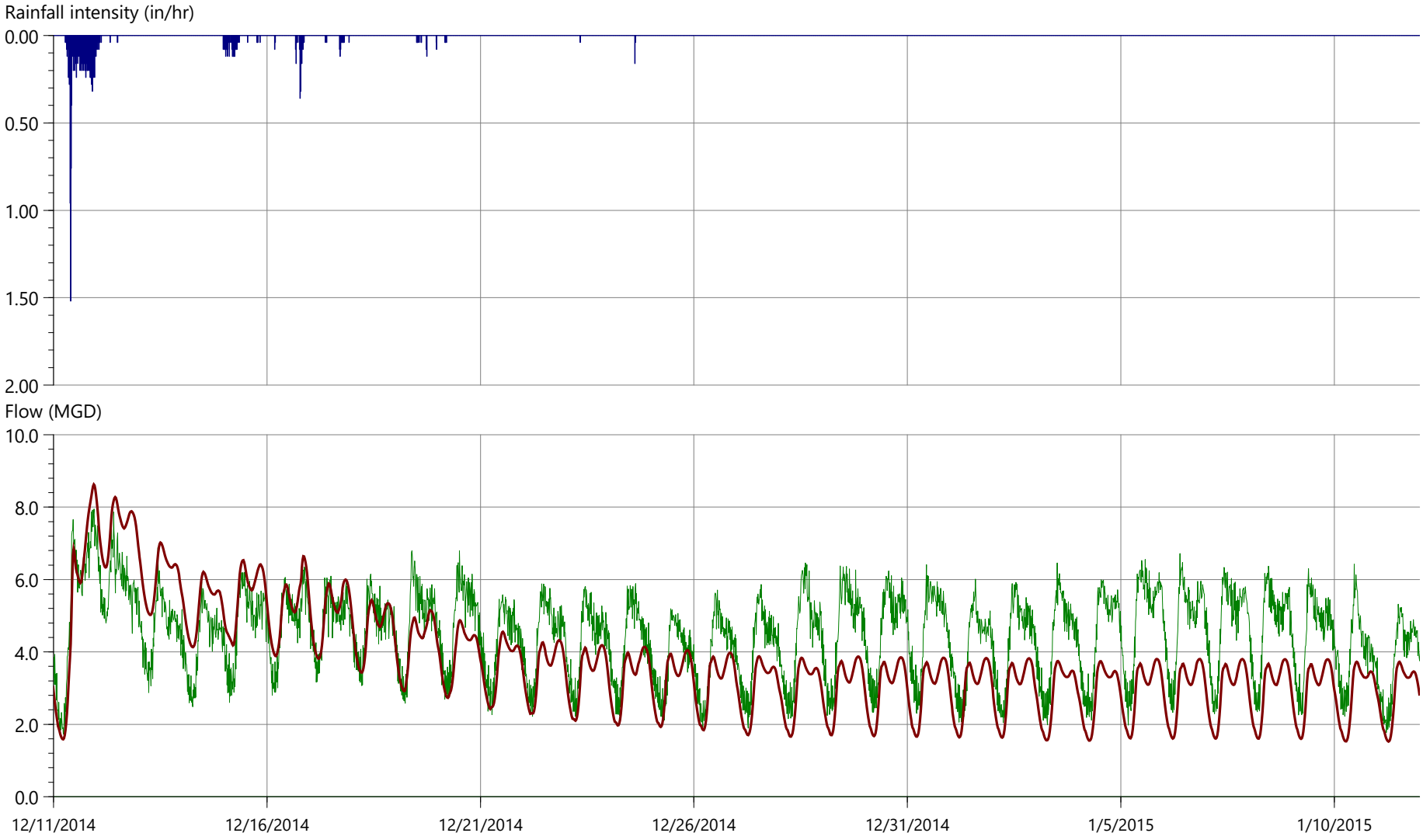
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	11.920	0.920	0.009			
Observed				0.138	1.227	33.687
... Data 2023 and 2015				0.162	1.283	31.984

Wet Weather Flow Calibration Plots
Modeled vs. 2014-2015 Metered Flows

(*assumes normal settings at Homestead/Lawrence gate structure*)

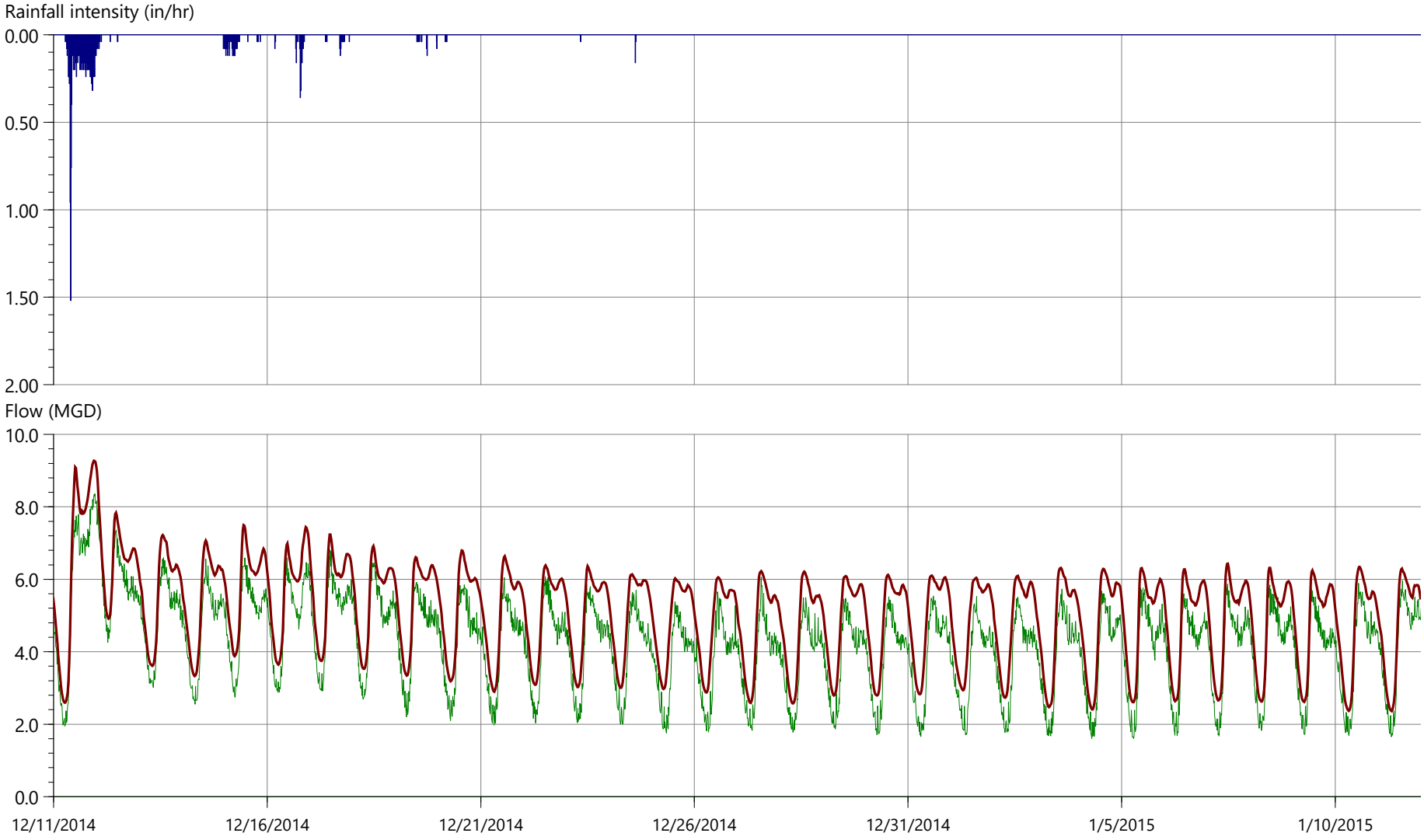
Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...

Flow Survey Location (Obs.) 1, Model Location (Pred.) D/S S104-29.1, Rainfall Profile: 1



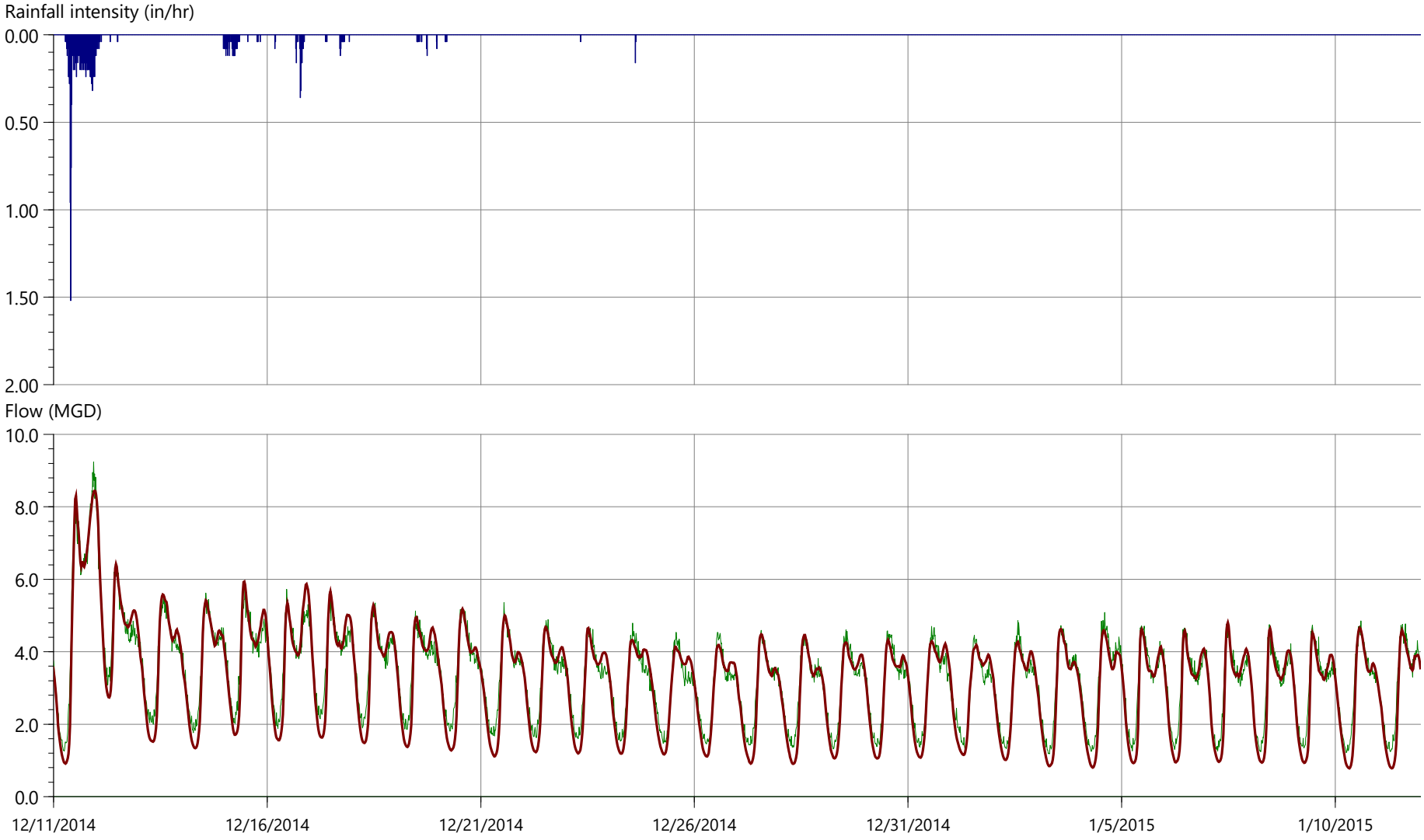
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.280	1.520	0.007			
Observed				1.726	7.950	144.336
... Data 2023 and 2015				1.525	8.628	119.999

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 2, Model Location (Pred.) D/S S103-9.1, Rainfall Profile: 1



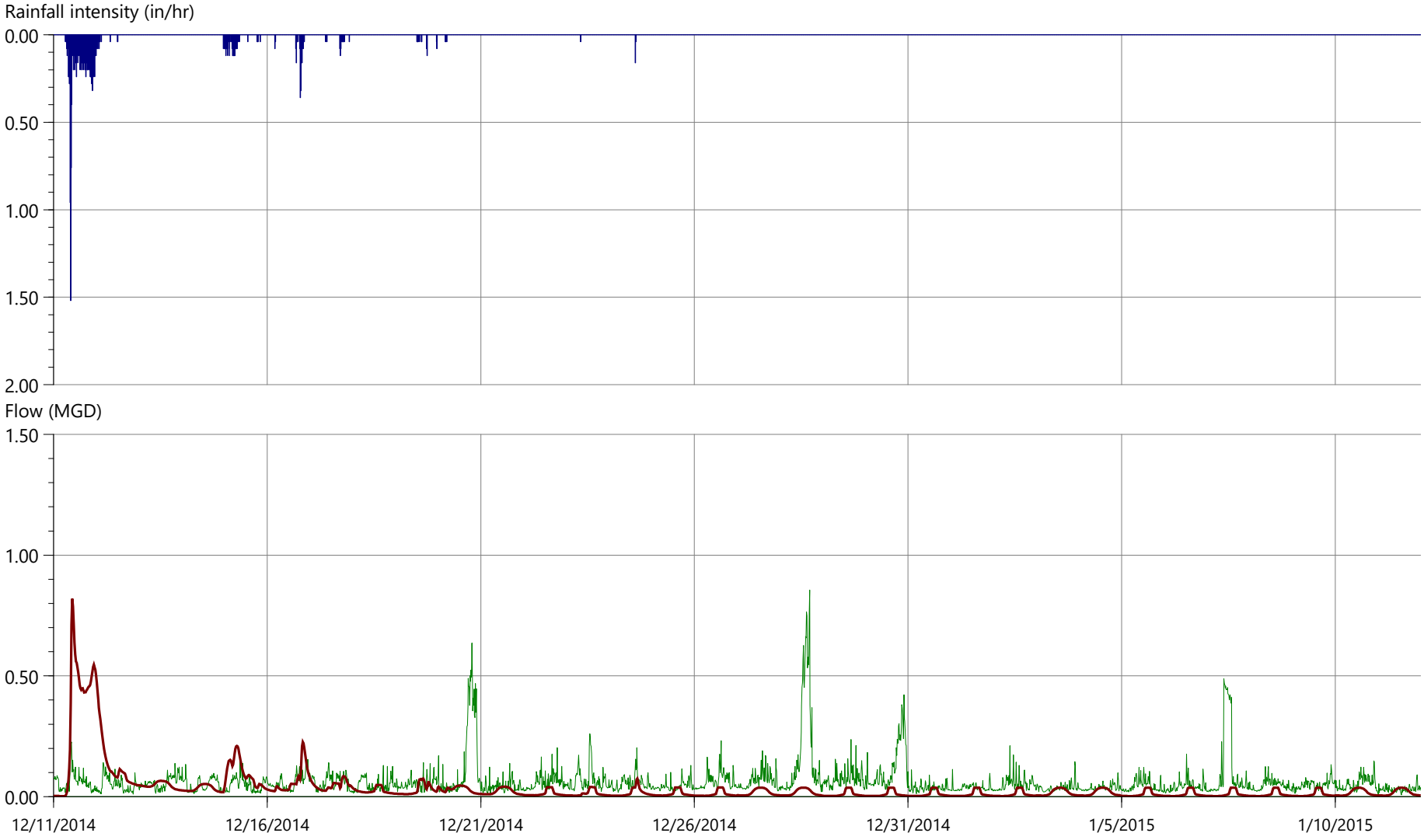
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.280	1.520	0.007			
Observed				1.605	8.363	135.825
... Data 2023 and 2015				2.362	9.269	164.340

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 3, Model Location (Pred.) D/S S104-27.1, Rainfall Profile: 1



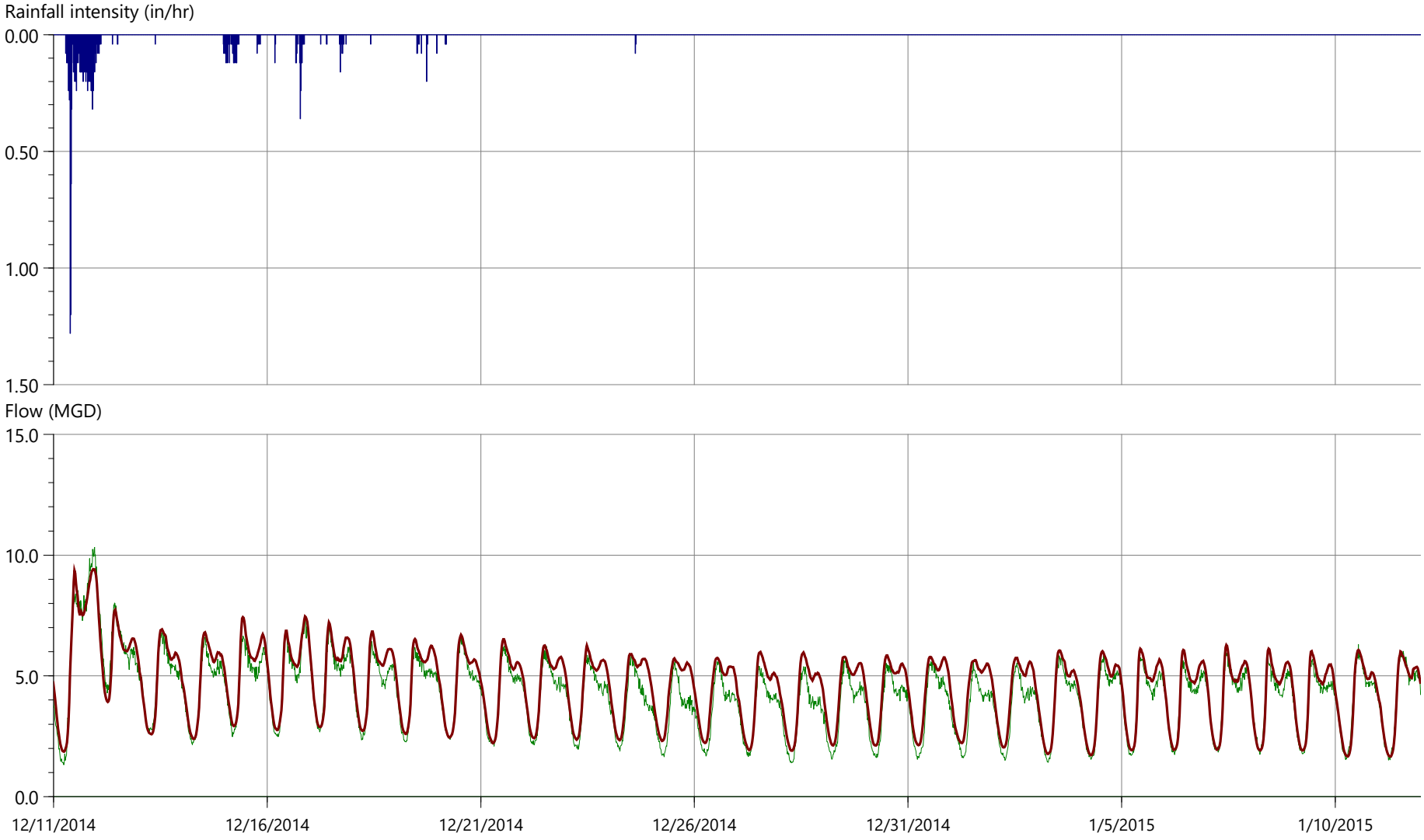
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.280	1.520	0.007			
Observed				1.179	9.236	108.117
... Data 2023 and 2015				0.782	8.445	103.228

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 4, Model Location (Pred.) D/S S94-36.1, Rainfall Profile: 1



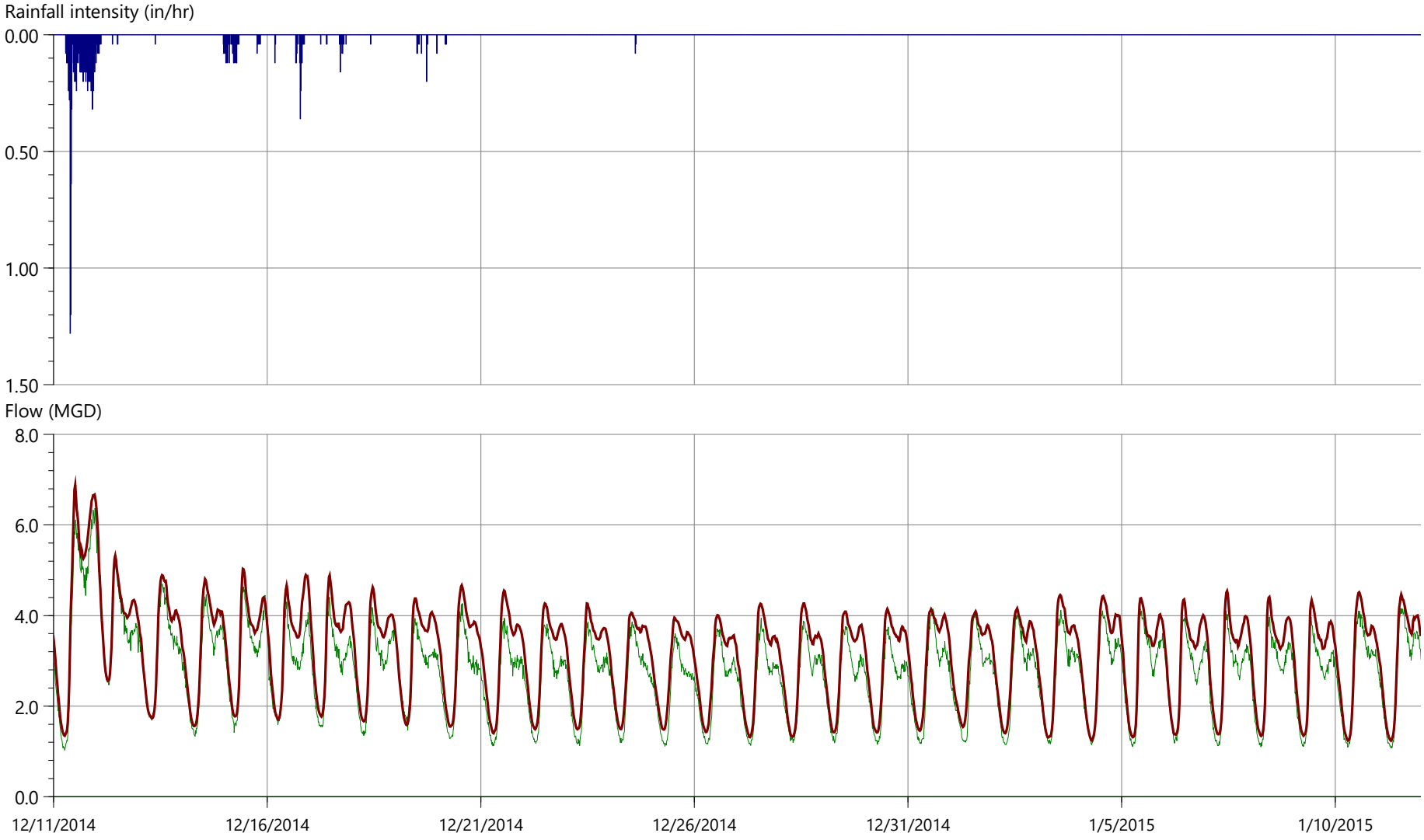
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.280	1.520	0.007			
Observed				0.007	0.856	2.021
... Data 2023 and 2015				0.003	0.819	1.125

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 5, Model Location (Pred.) D/S S83-23.1, Rainfall Profile: 2



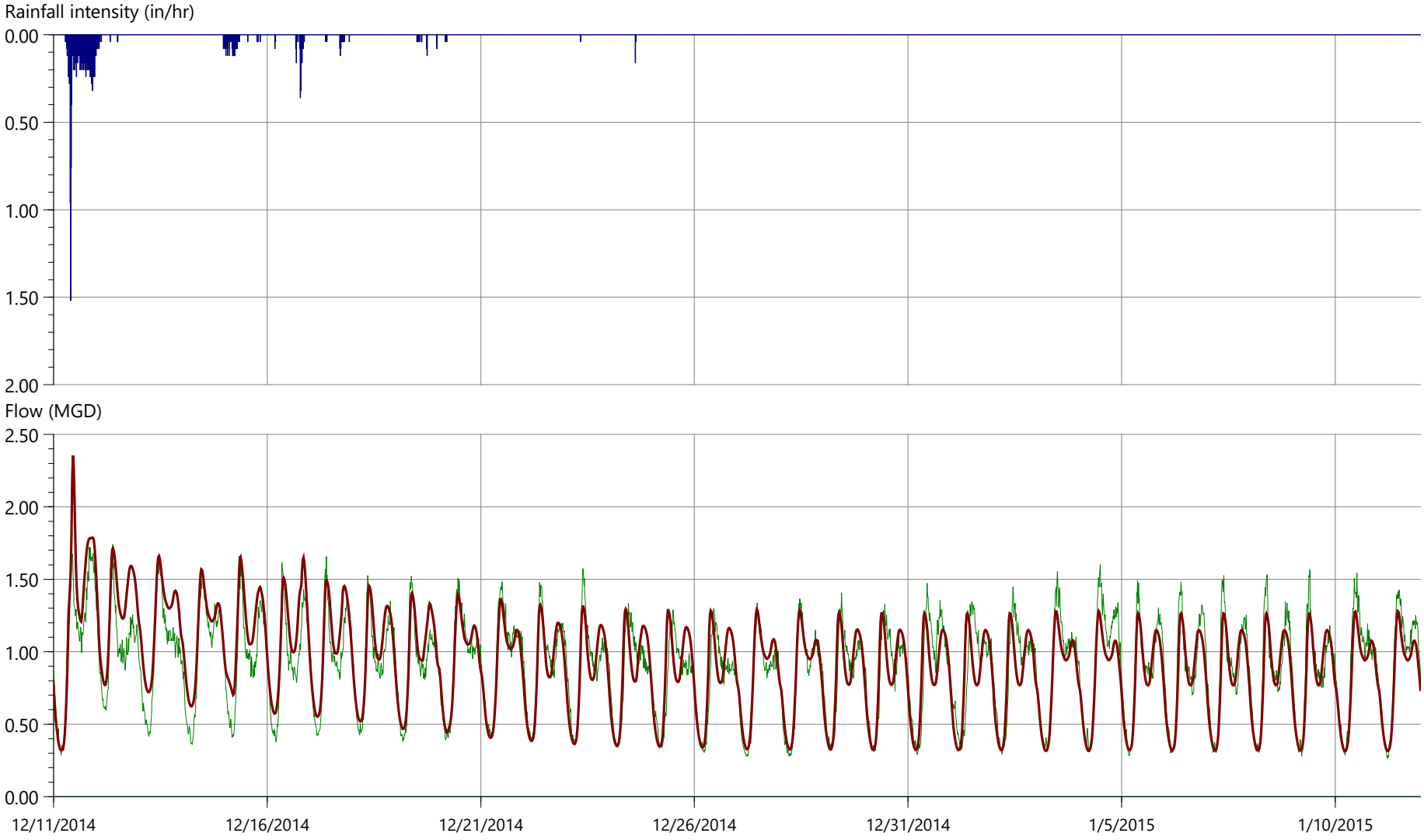
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				1.319	10.323	135.549
... Data 2023 and 2015				1.658	9.423	148.110

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 6, Model Location (Pred.) D/S S83-25.1, Rainfall Profile: 2



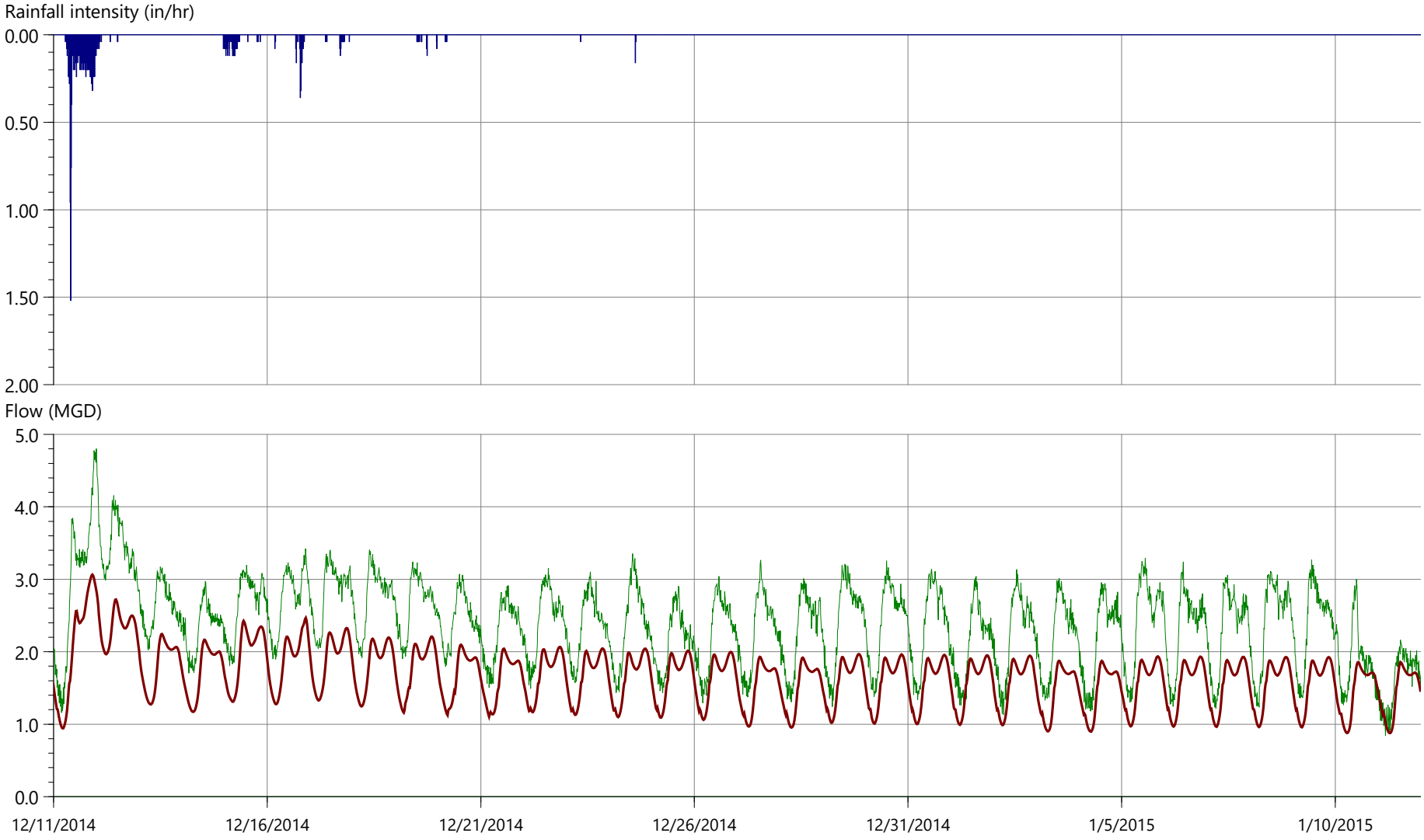
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				1.026	6.367	88.800
... Data 2023 and 2015				1.234	6.879	102.203

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 7, Model Location (Pred.) D/S S105-6.1, Rainfall Profile: 1



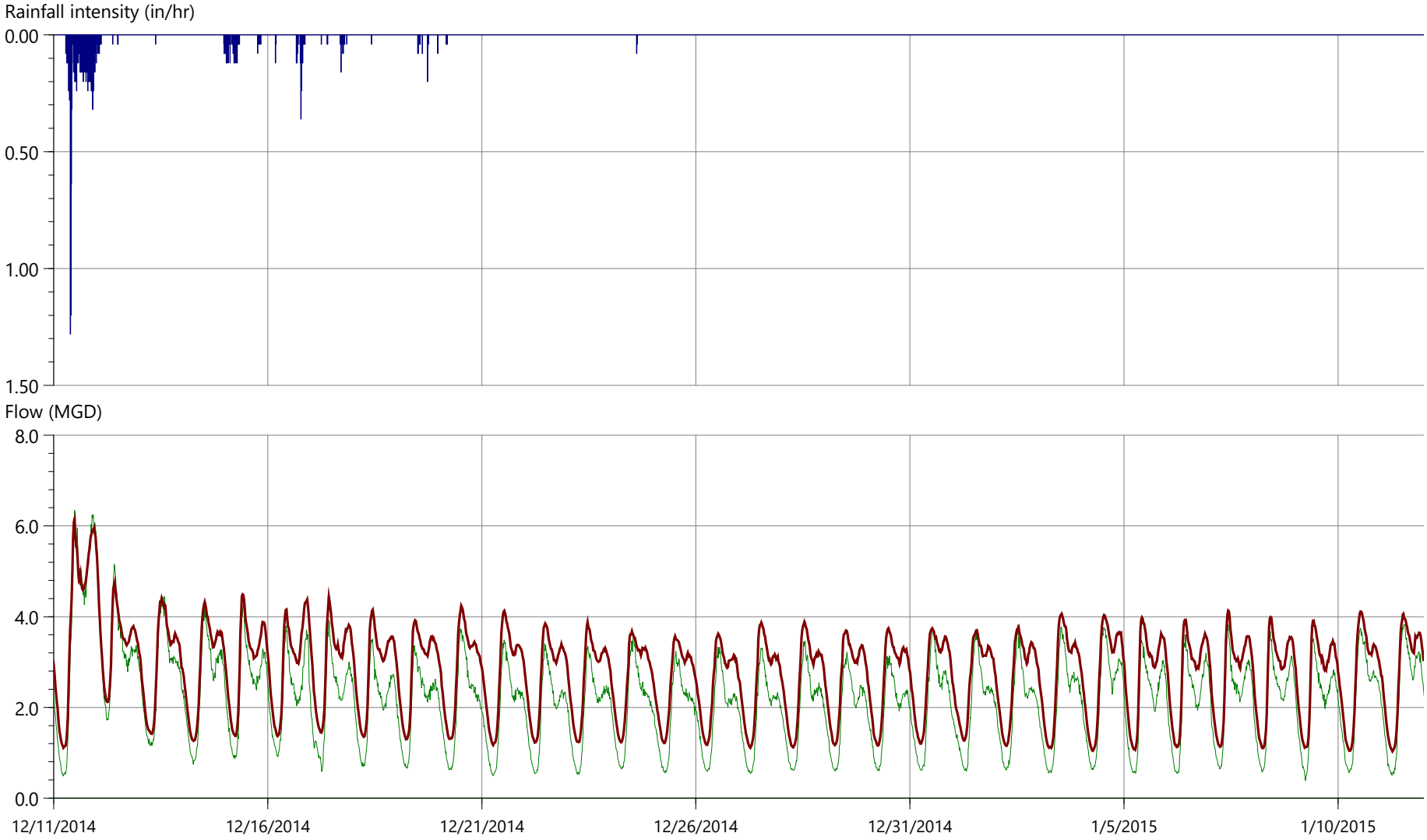
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.280	1.520	0.007			
Observed				0.266	1.740	29.016
... Data 2023 and 2015				0.315	2.354	29.534

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 8, Model Location (Pred.) D/S S86-13.1, Rainfall Profile: 1



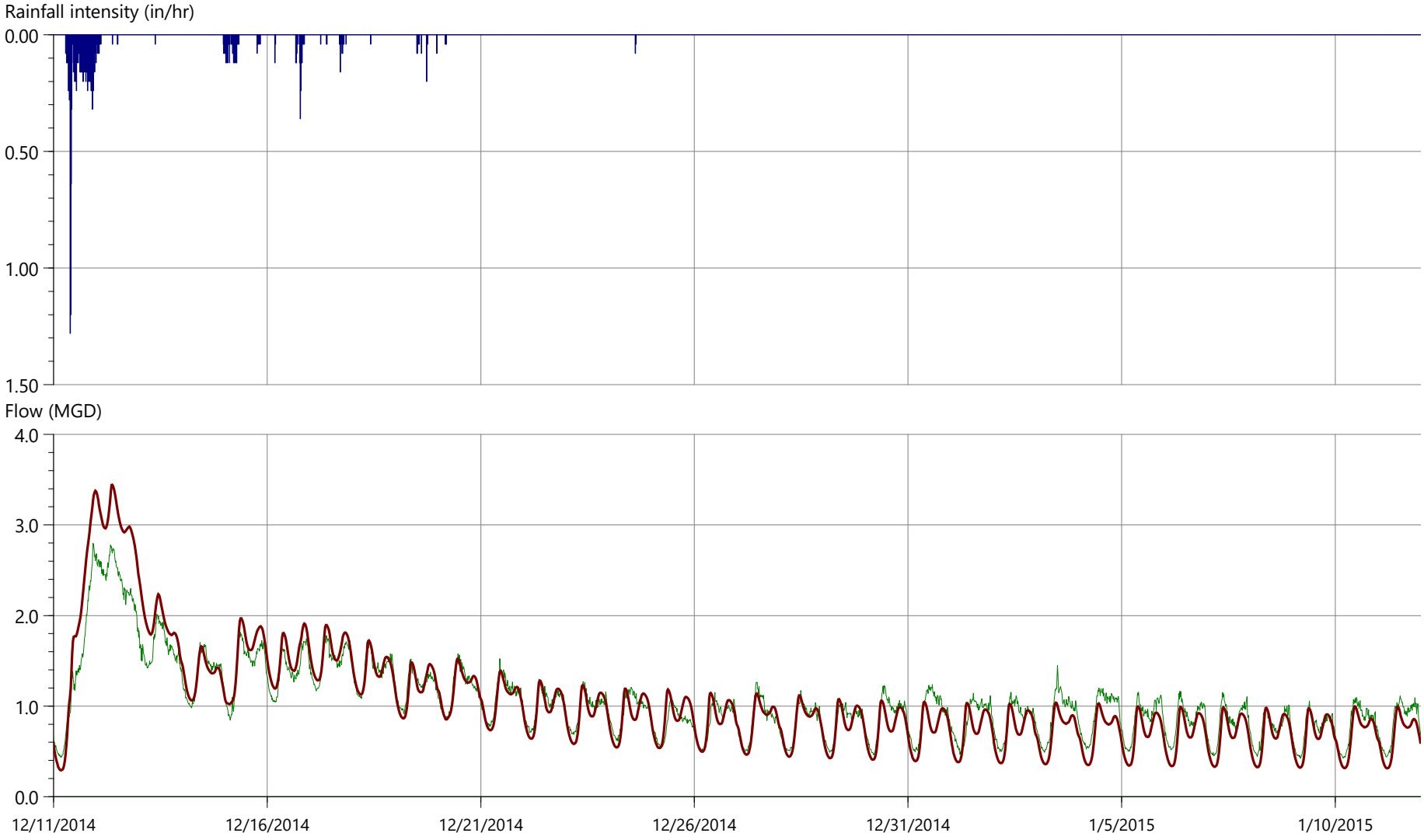
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.280	1.520	0.007			
Observed				0.840	4.800	76.804
... Data 2023 and 2015				0.877	3.064	53.414

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 9, Model Location (Pred.) D/S S62-48.1, Rainfall Profile: 2



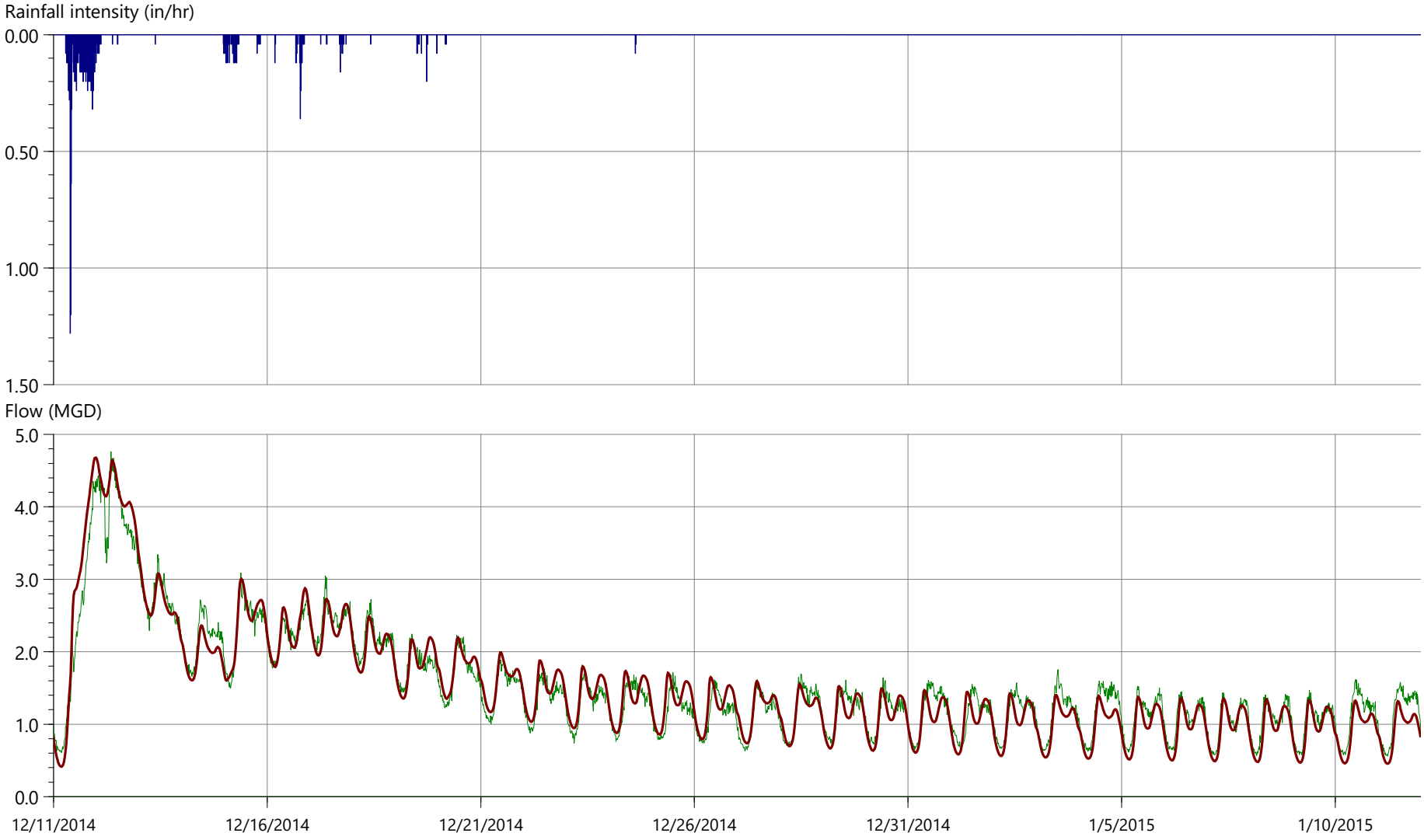
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.388	6.343	70.300
... Data 2023 and 2015				1.034	6.151	90.221

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 10, Model Location (Pred.) D/S S52-80.1, Rainfall Profile: 2



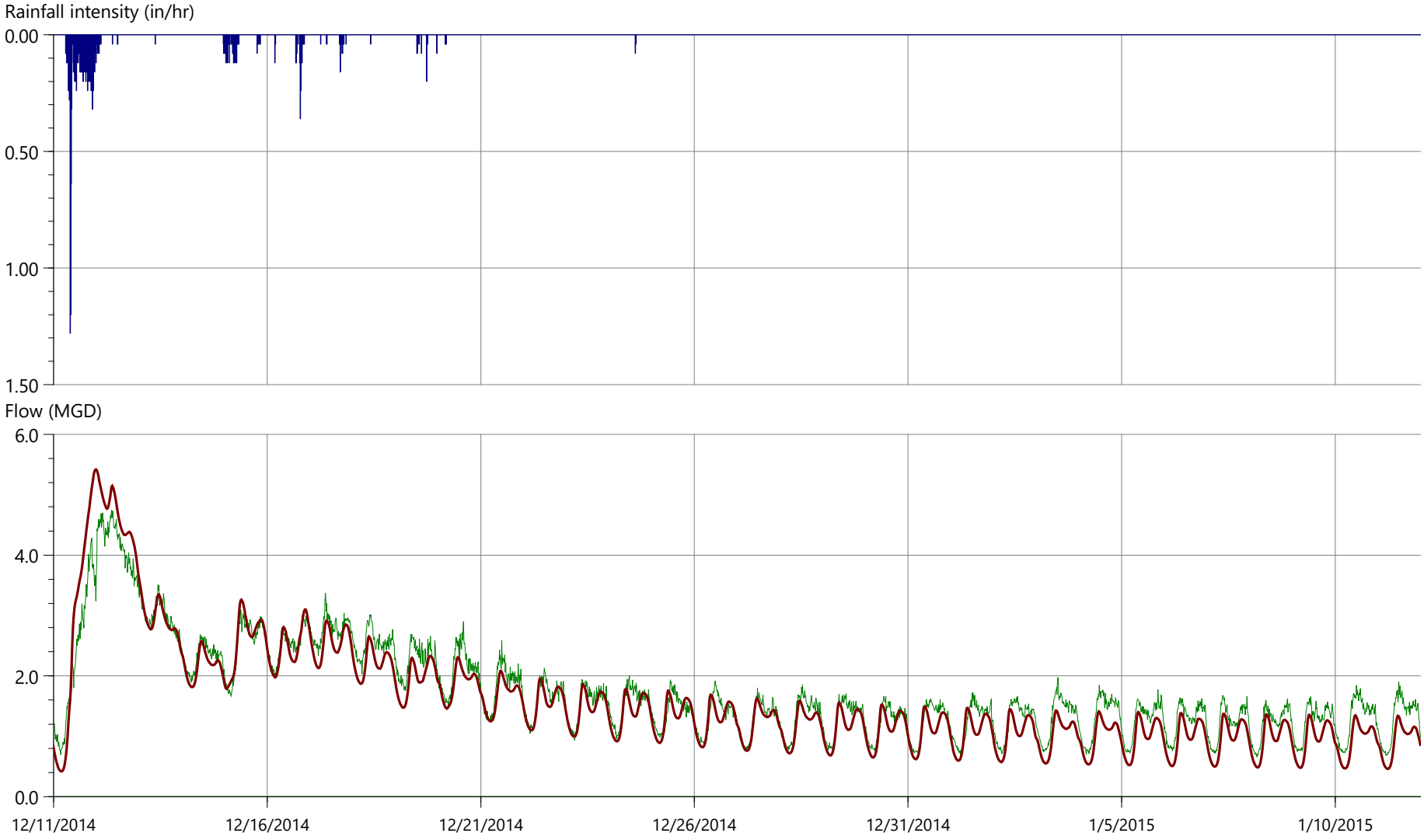
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.423	2.798	33.900
... Data 2023 and 2015				0.292	3.444	33.611

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 11, Model Location (Pred.) D/S S53-9.1, Rainfall Profile: 2



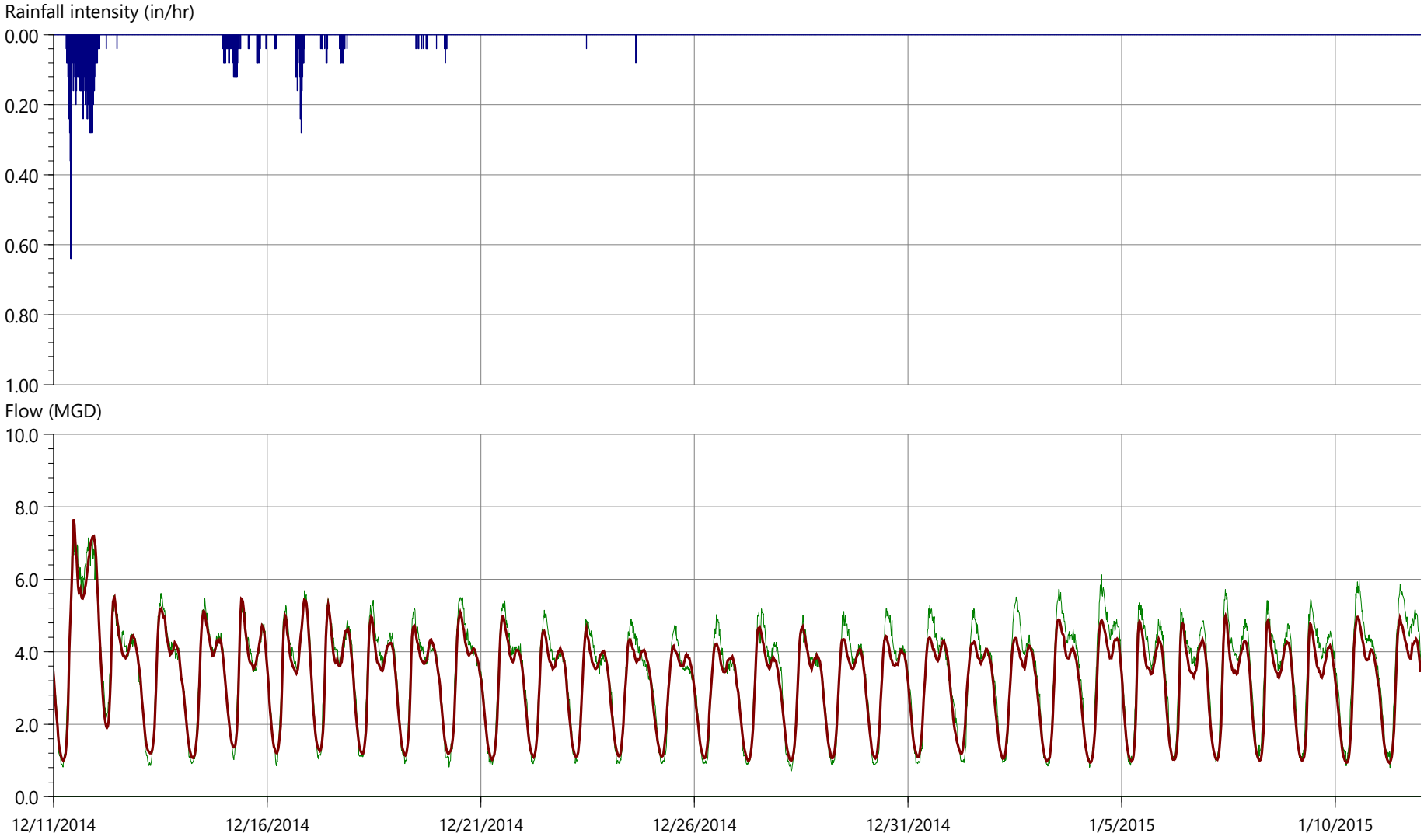
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.558	4.760	49.282
... Data 2023 and 2015				0.415	4.679	48.633

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 12, Model Location (Pred.) D/S S53-109.1, Rainfall Profile: 2



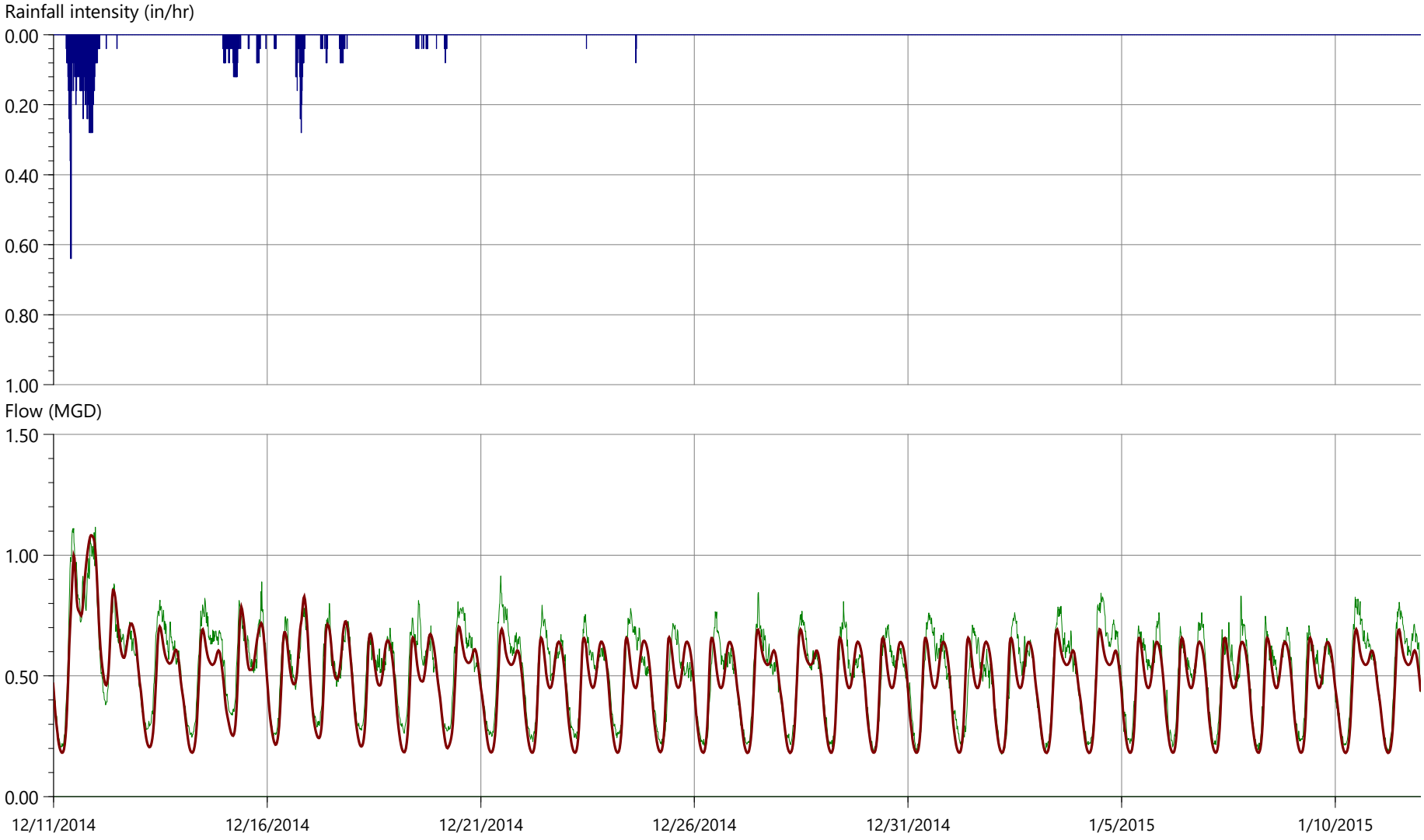
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.660	4.744	55.973
... Data 2023 and 2015				0.420	5.417	51.478

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 13, Model Location (Pred.) D/S S53-73.1, Rainfall Profile: 3



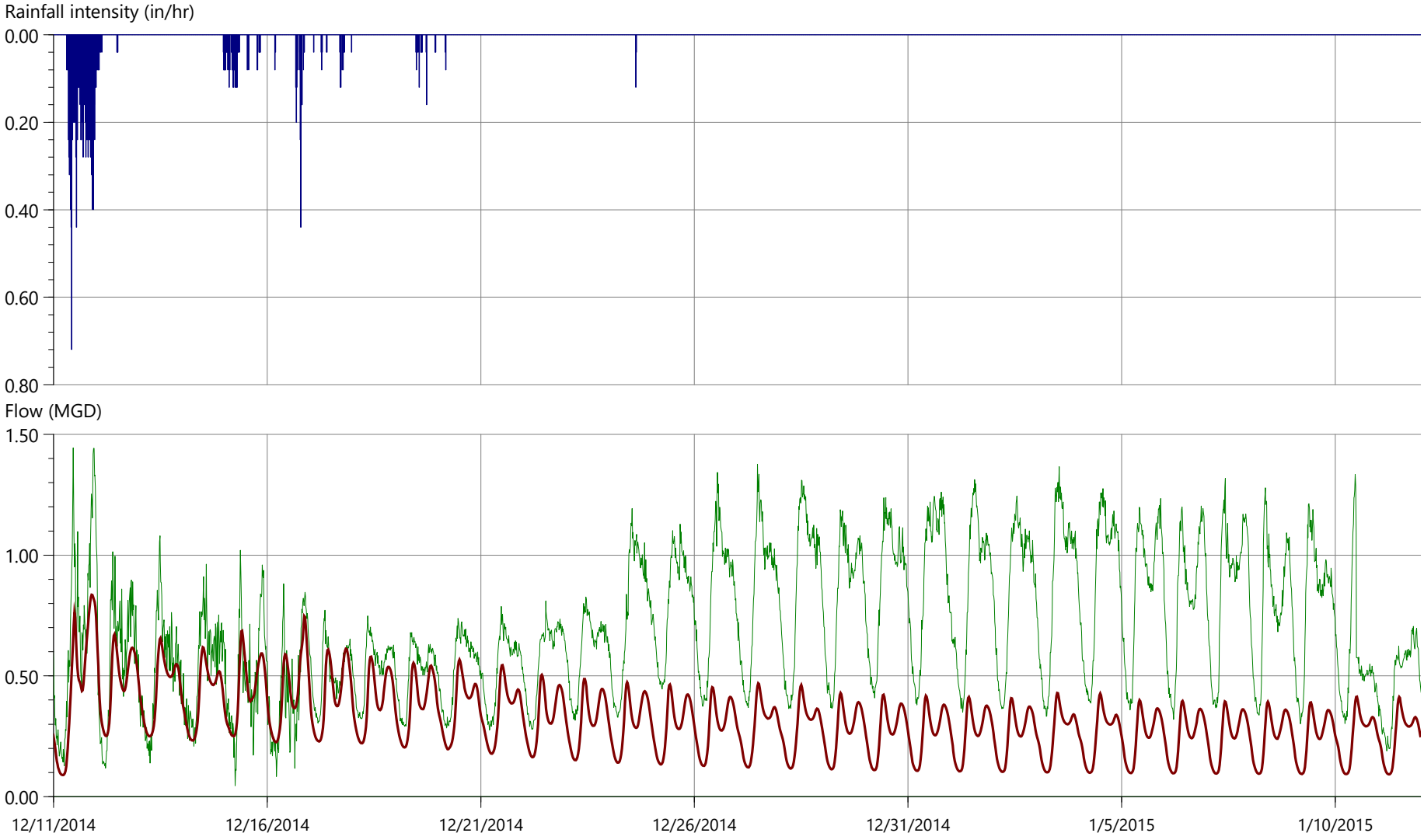
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	4.950	0.640	0.006			
Observed				0.709	7.220	110.750
... Data 2023 and 2015				0.932	7.651	103.773

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 14, Model Location (Pred.) D/S S54-17.1, Rainfall Profile: 3



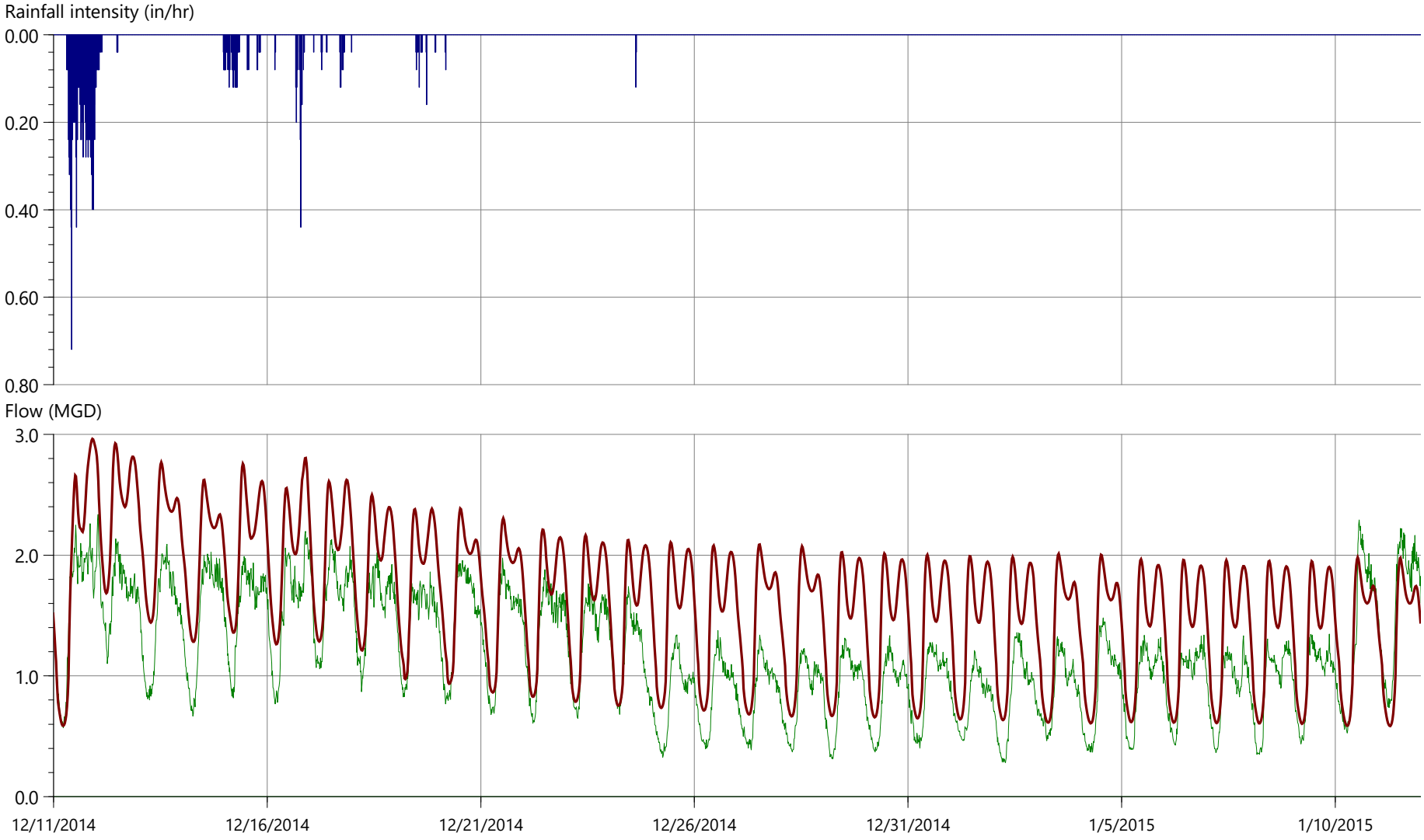
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	4.950	0.640	0.006			
Observed				0.176	1.116	16.638
... Data 2023 and 2015				0.181	1.082	15.366

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 15, Model Location (Pred.) D/S S65-48.1, Rainfall Profile: 4



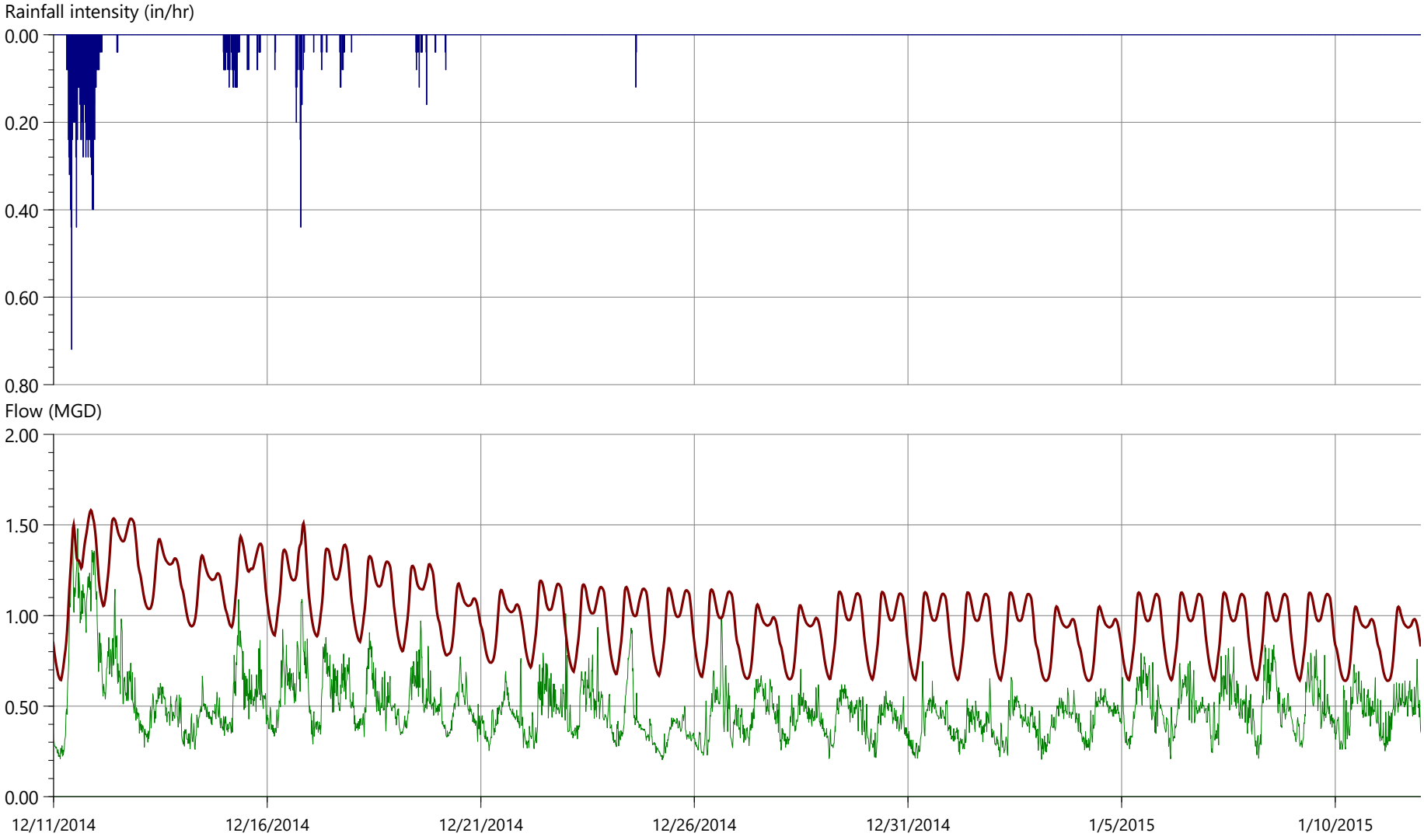
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.045	1.444	22.418
... Data 2023 and 2015				0.089	0.836	10.376

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 16, Model Location (Pred.) D/S S67-12.1, Rainfall Profile: 4



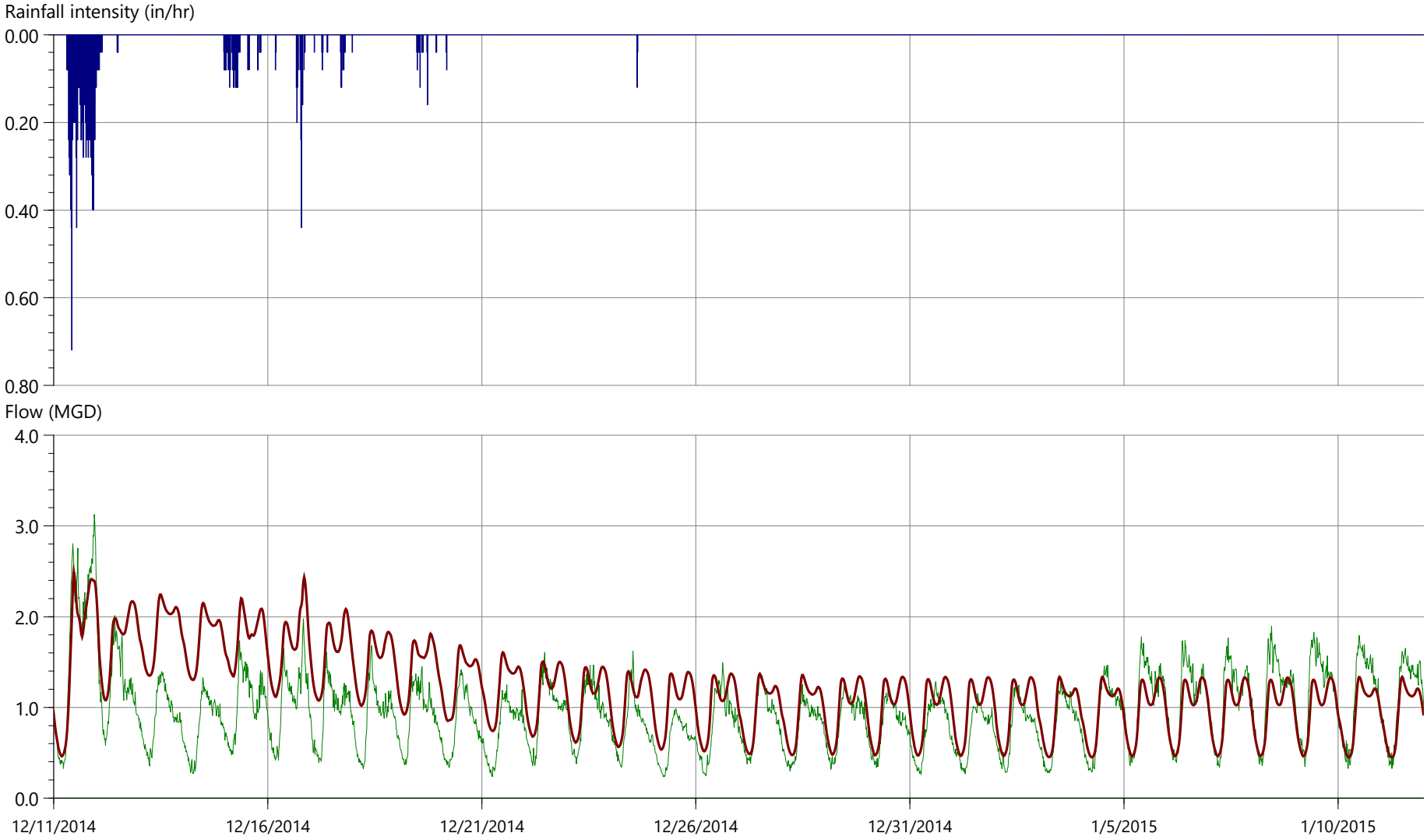
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.283	2.337	37.855
... Data 2023 and 2015				0.586	2.963	52.355

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 17, Model Location (Pred.) D/S S58-12.2, Rainfall Profile: 4



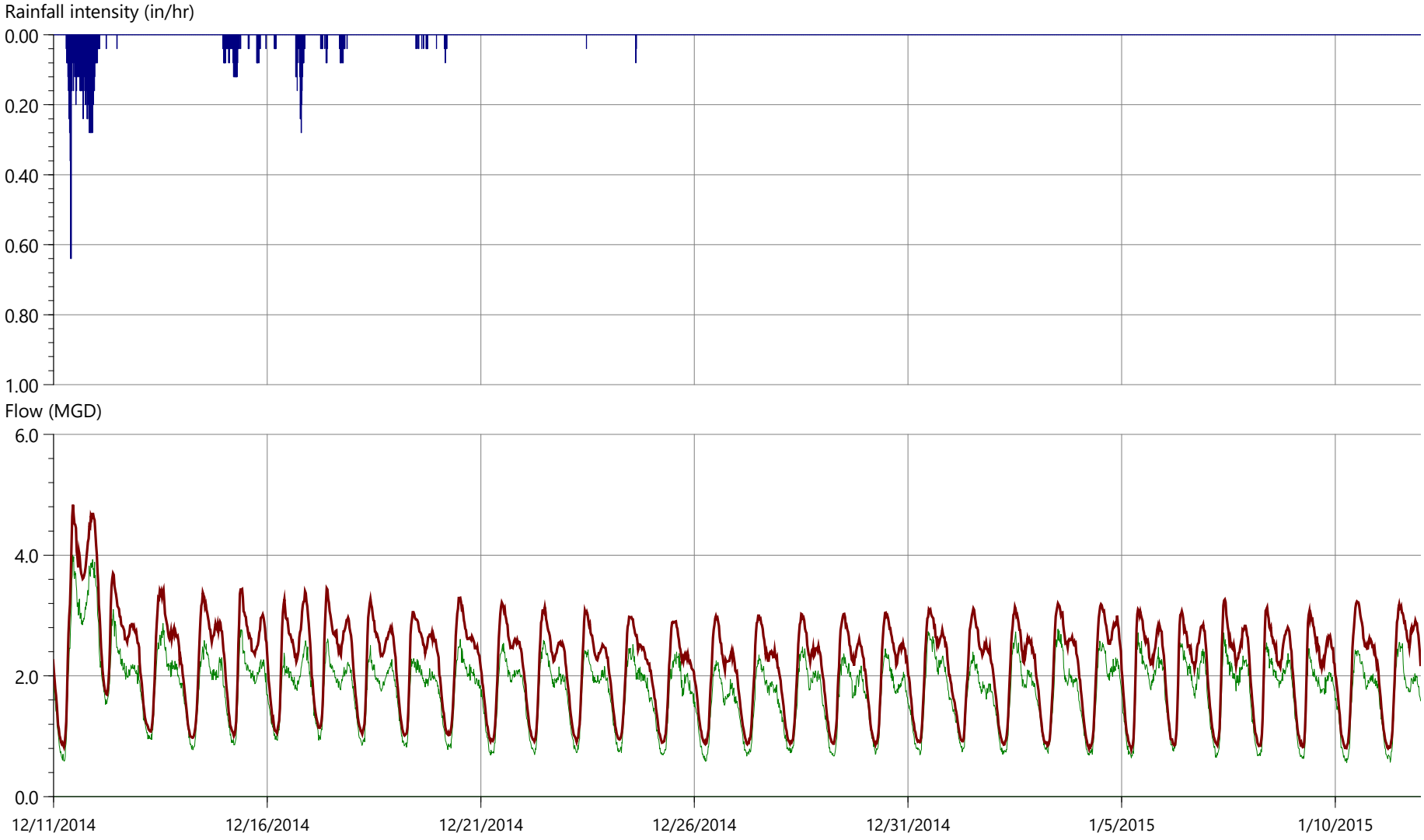
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.203	1.480	15.720
... Data 2023 and 2015				0.639	1.581	32.173

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 18, Model Location (Pred.) D/S S58-11.1, Rainfall Profile: 4



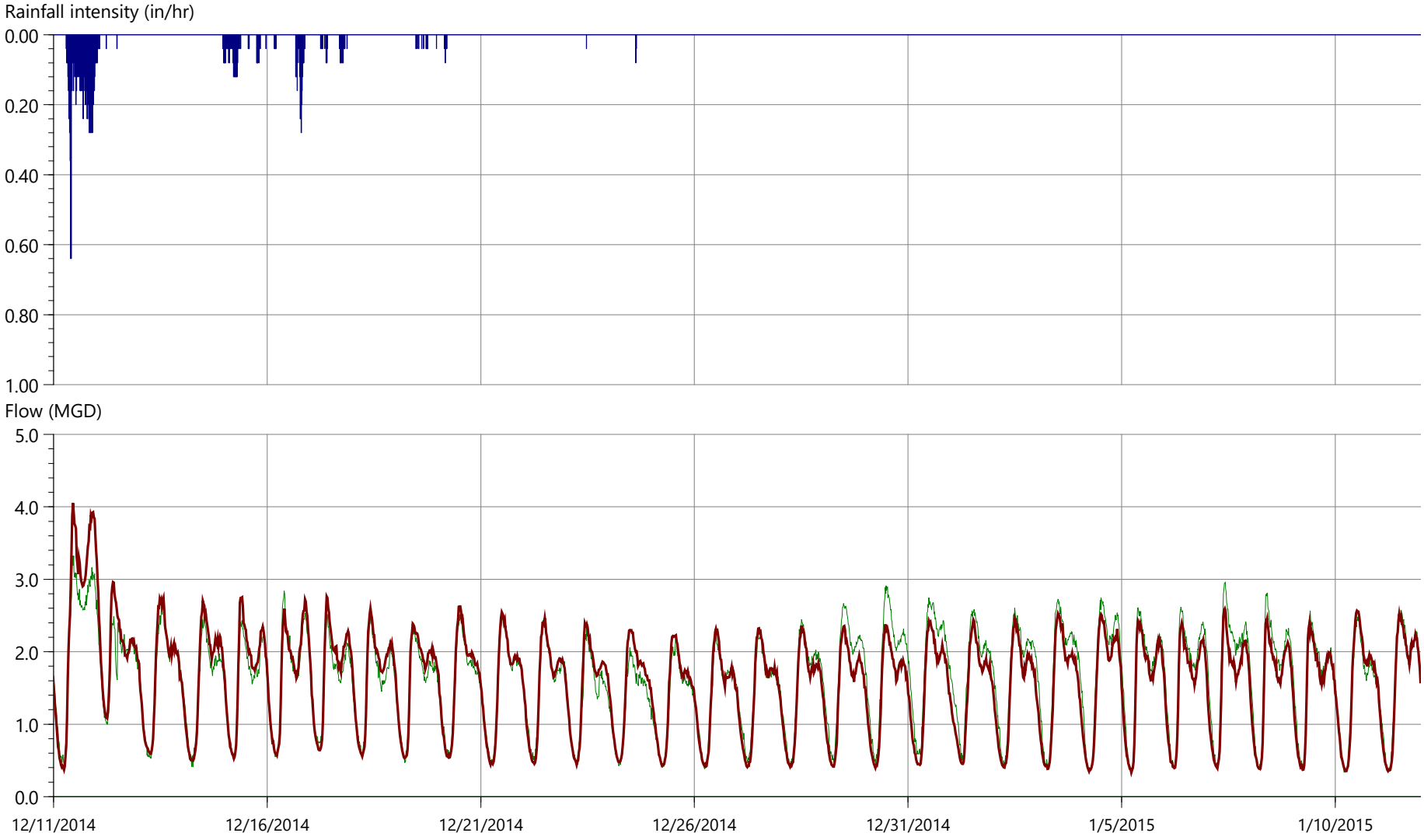
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.236	3.126	30.382
... Data 2023 and 2015				0.450	2.489	38.534

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 19, Model Location (Pred.) D/S S21-23.1, Rainfall Profile: 3



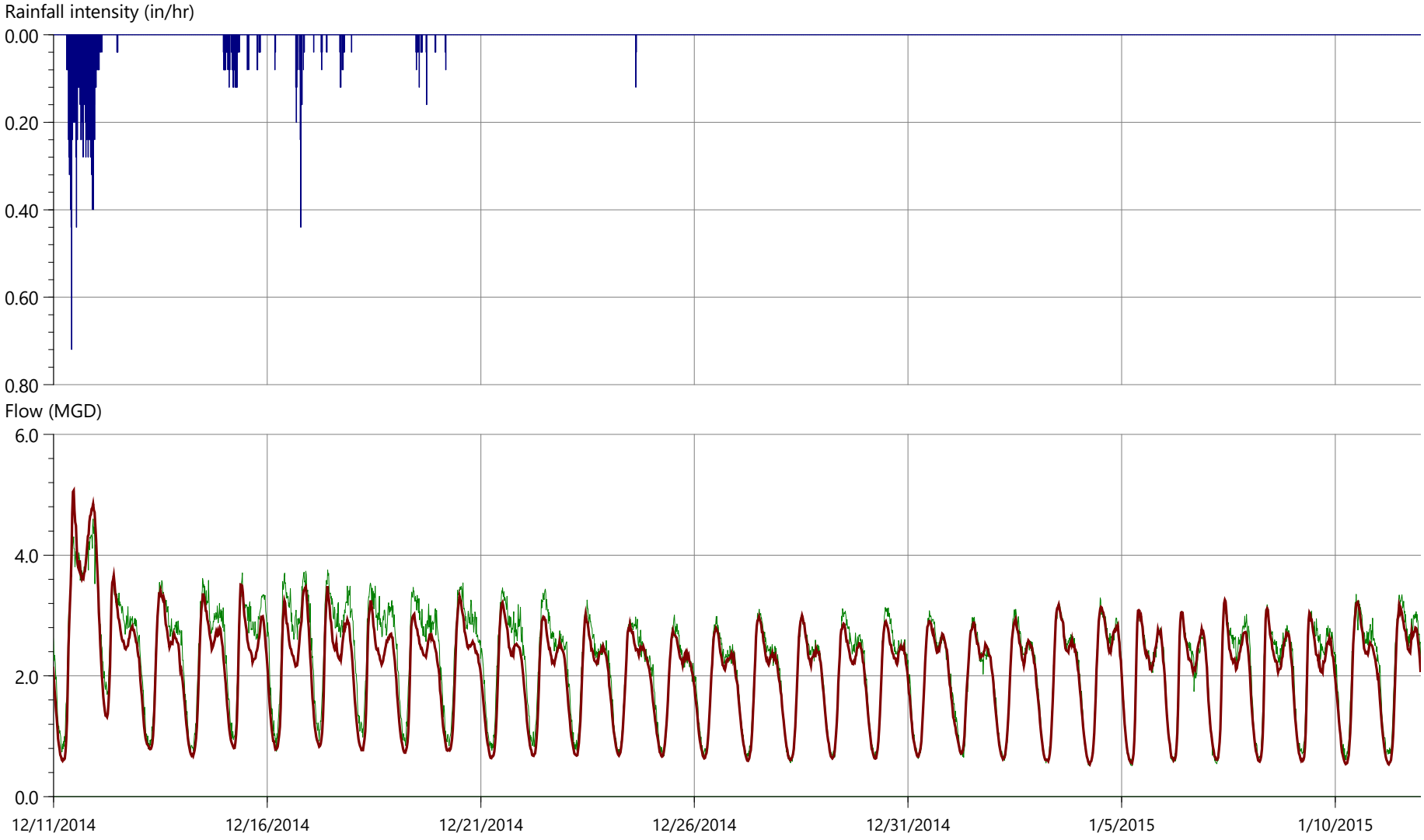
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	4.950	0.640	0.006			
Observed				0.564	4.003	56.266
... Data 2023 and 2015				0.772	4.835	70.665

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 20, Model Location (Pred.) D/S S21-46.1, Rainfall Profile: 3



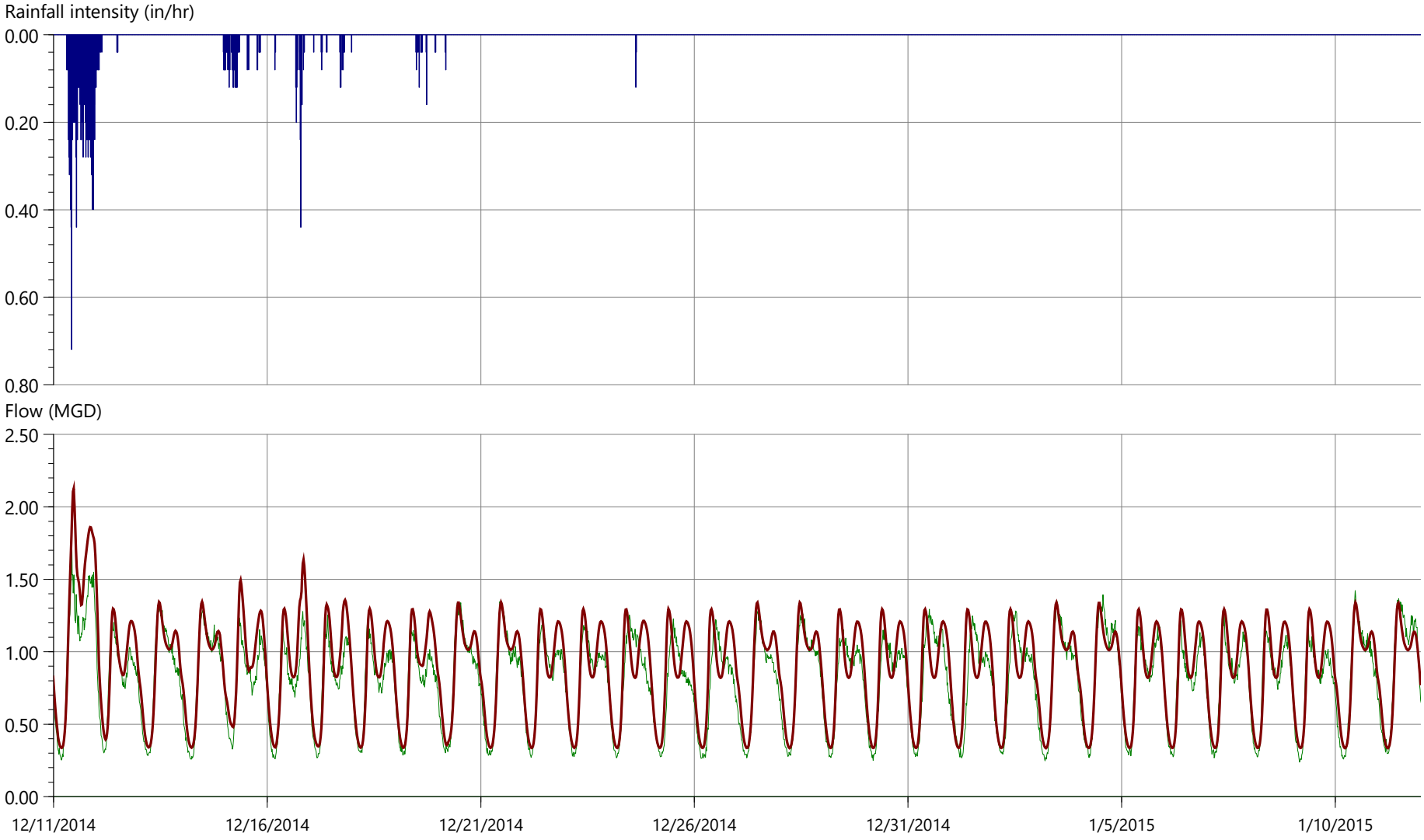
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	4.950	0.640	0.006			
Observed				0.335	3.327	52.396
... Data 2023 and 2015				0.334	4.053	51.122

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 21, Model Location (Pred.) D/S S23-14.1, Rainfall Profile: 4



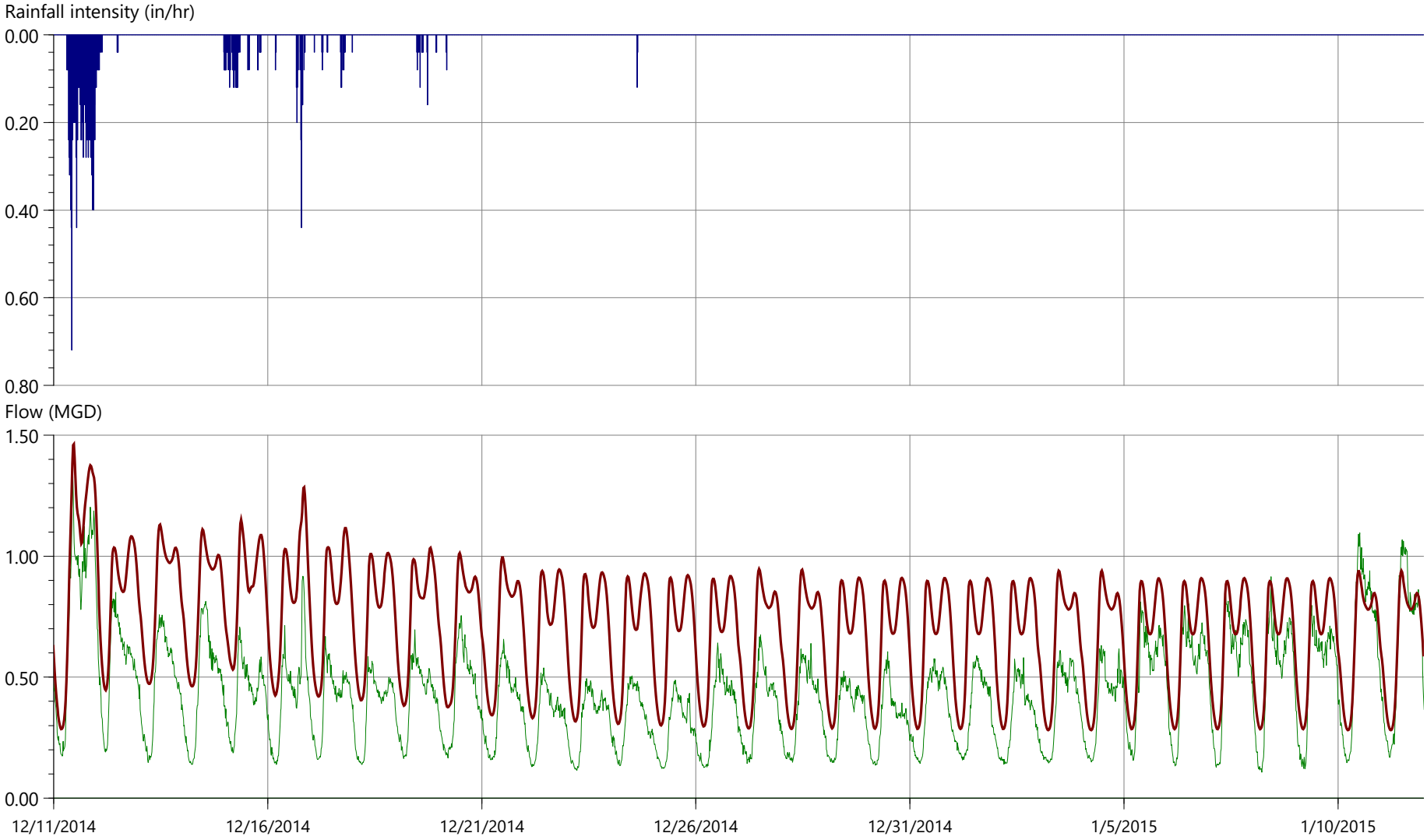
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.511	4.598	72.002
... Data 2023 and 2015				0.535	5.069	65.968

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 22, Model Location (Pred.) D/S S45-88.1, Rainfall Profile: 4



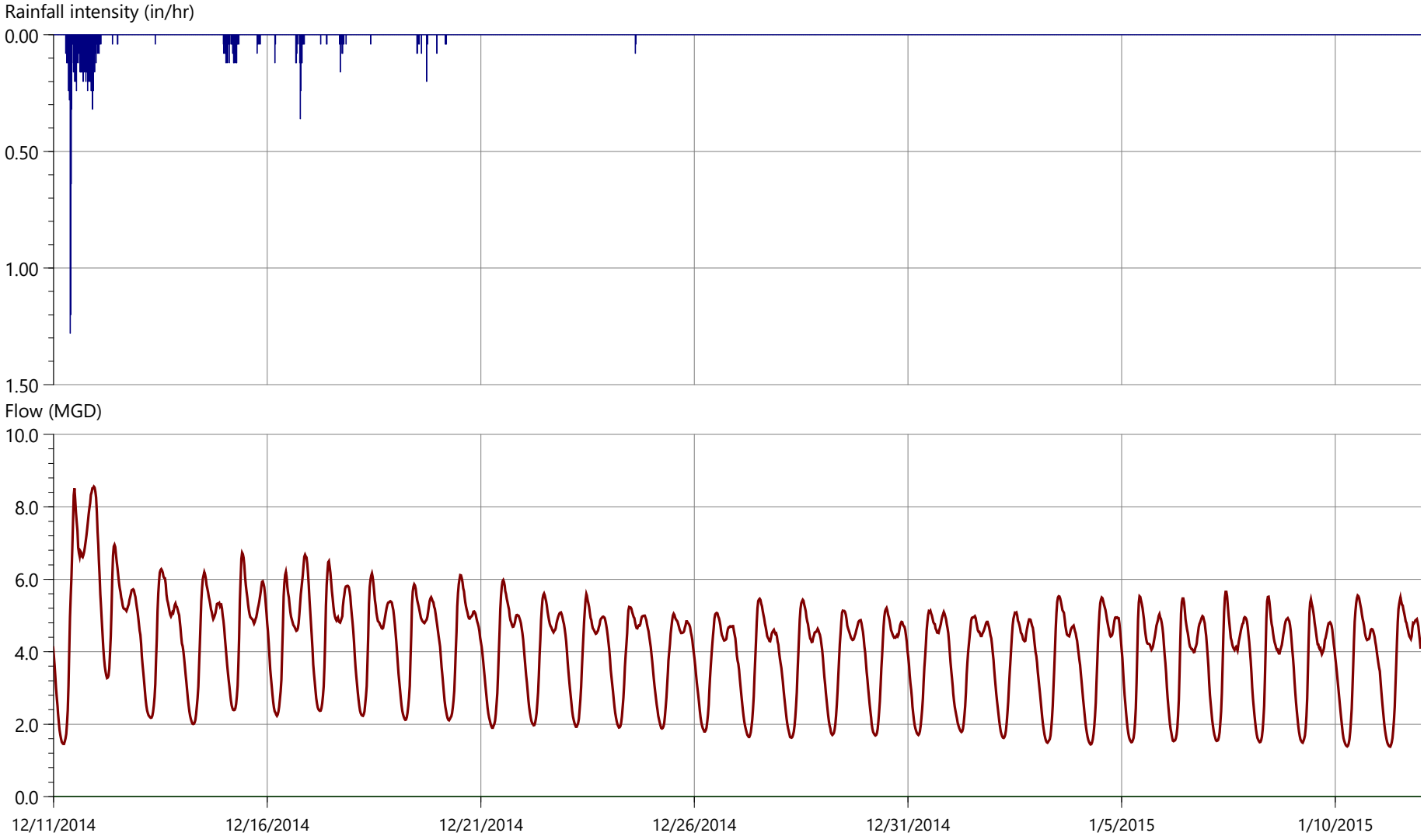
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.239	1.805	26.012
... Data 2023 and 2015				0.335	2.125	28.494

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 23, Model Location (Pred.) D/S S48-32.1, Rainfall Profile: 4



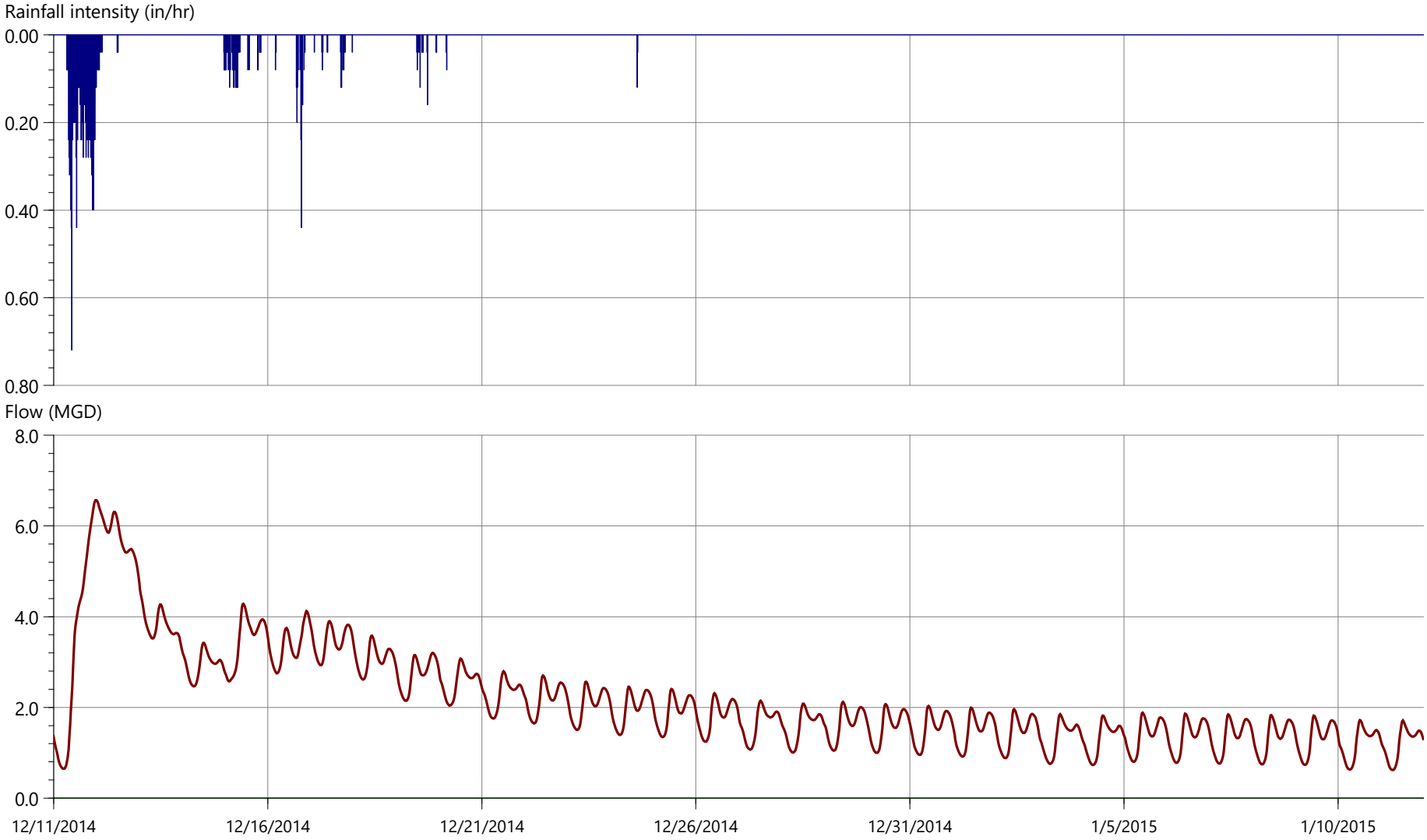
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.107	1.328	13.863
... Data 2023 and 2015				0.281	1.463	22.889

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 24, Model Location (Pred.) D/S S63-2.1, Rainfall Profile: 2



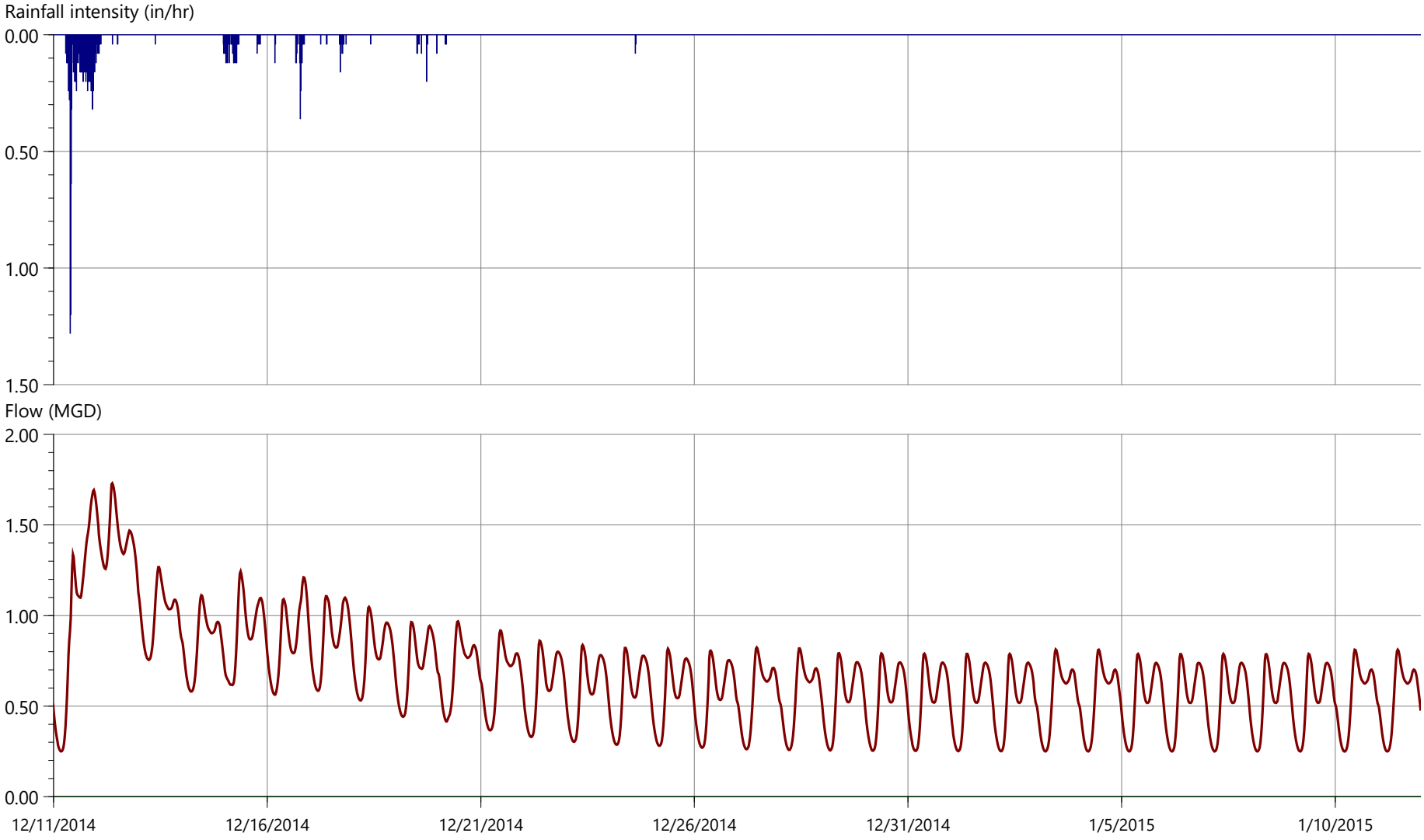
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				1.379	8.556	130.203

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 25, Model Location (Pred.) D/S S57-6.1, Rainfall Profile: 4



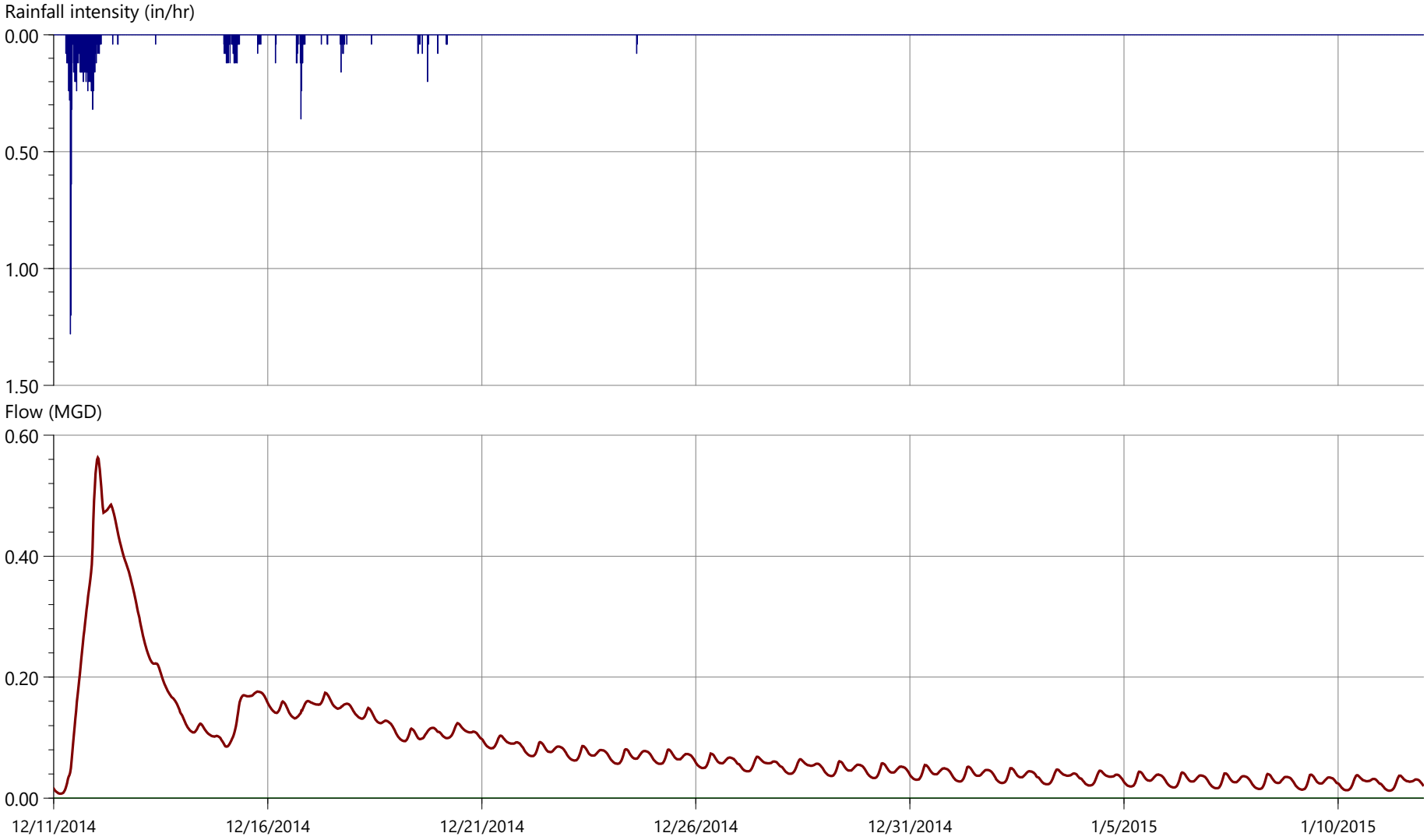
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.550	0.720	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.620	6.569	69.782

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 26, Model Location (Pred.) D/S S52-86.1, Rainfall Profile: 2



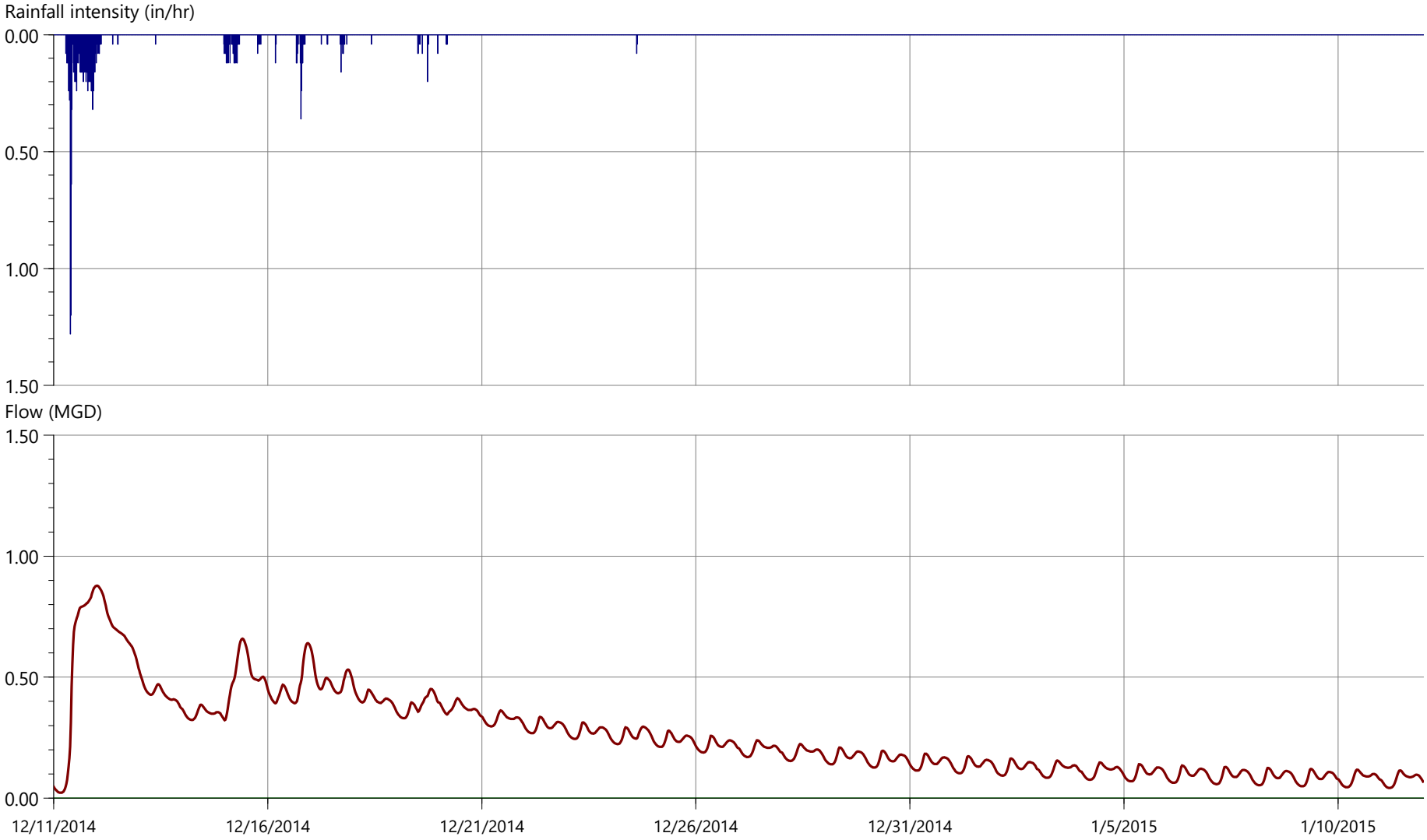
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.249	1.729	21.528

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 27, Model Location (Pred.) D/S S43-8.1, Rainfall Profile: 2



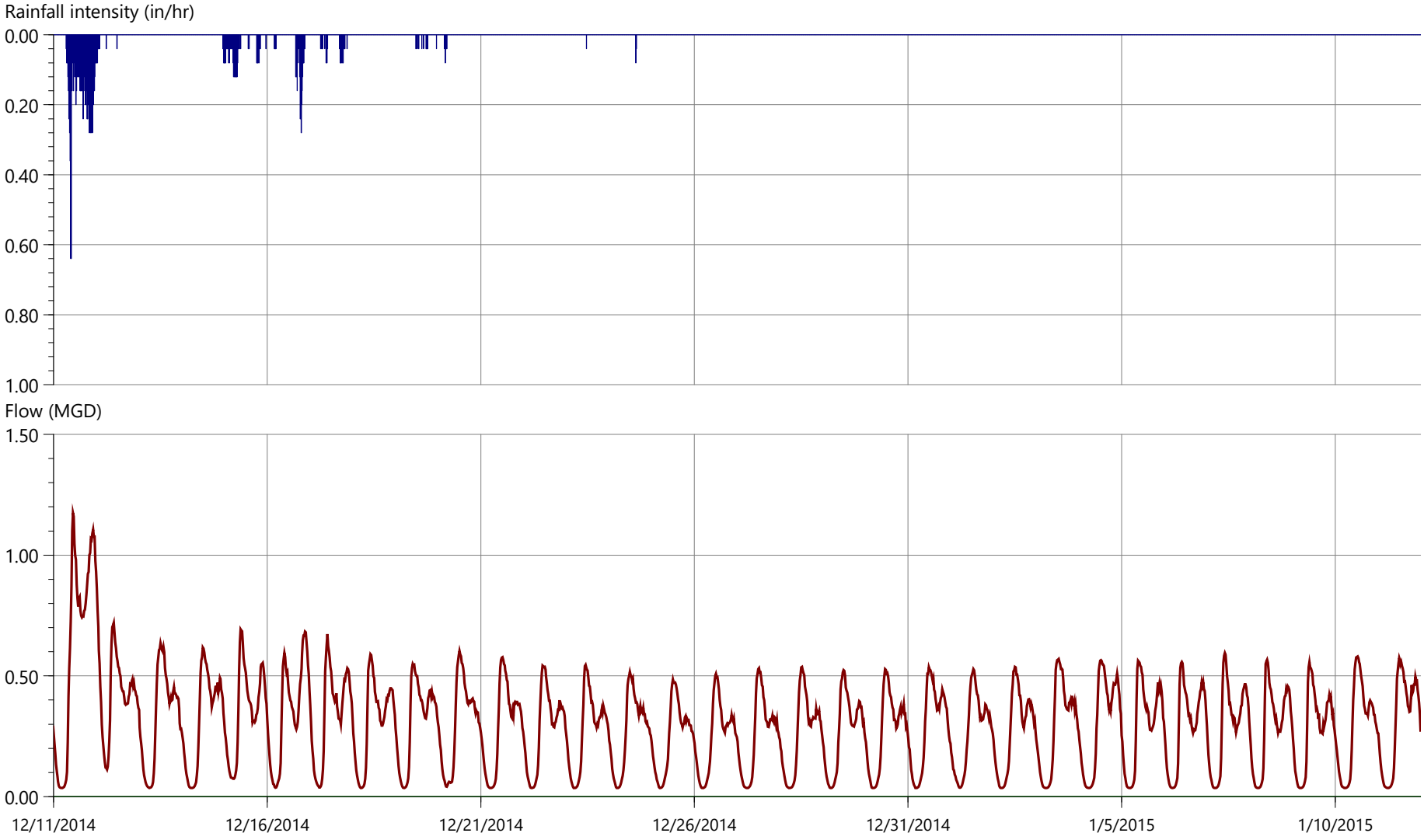
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.007	0.563	2.735

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 28, Model Location (Pred.) D/S S53-47.1, Rainfall Profile: 2



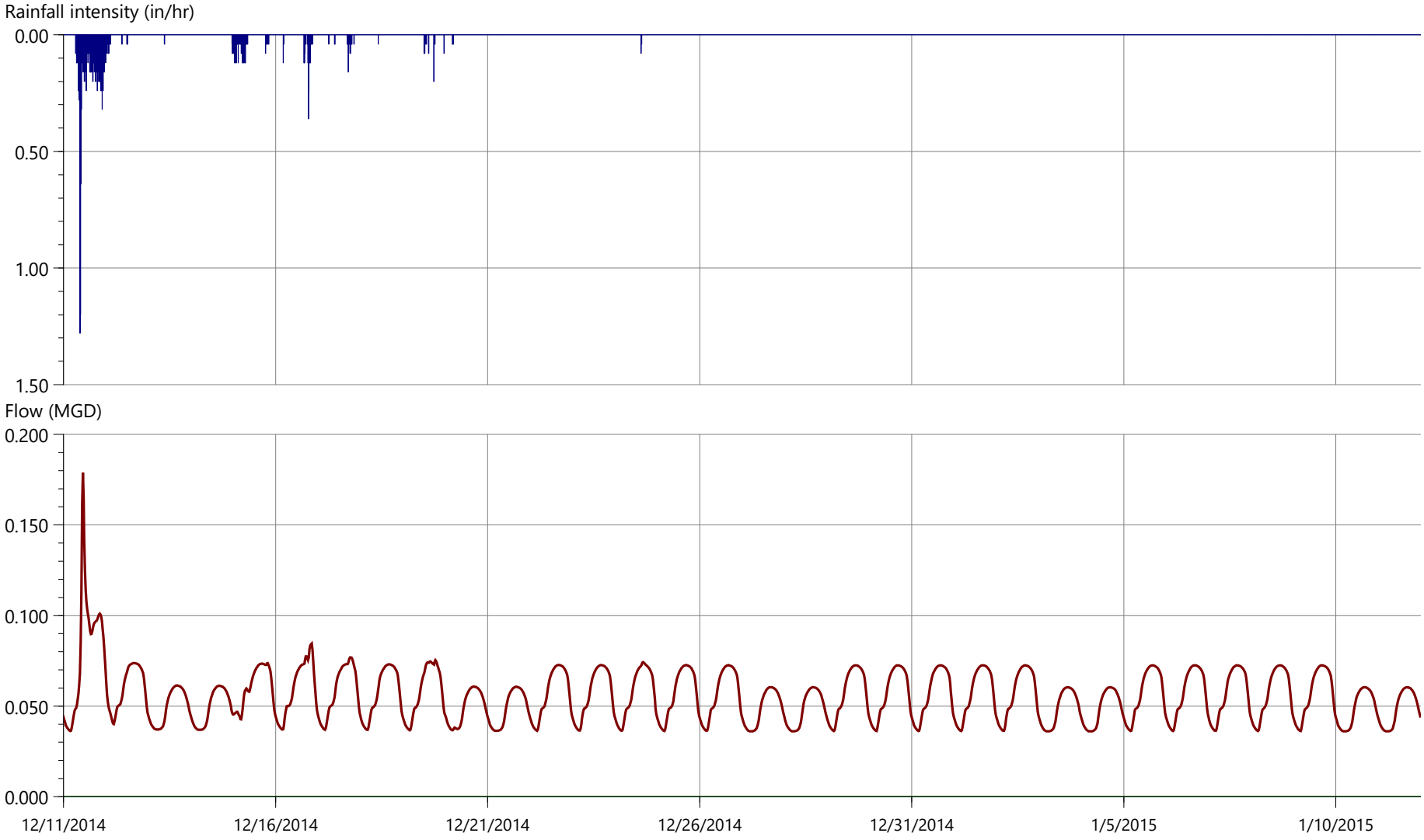
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.022	0.878	8.229

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 29, Model Location (Pred.) D/S S21-54.1, Rainfall Profile: 3



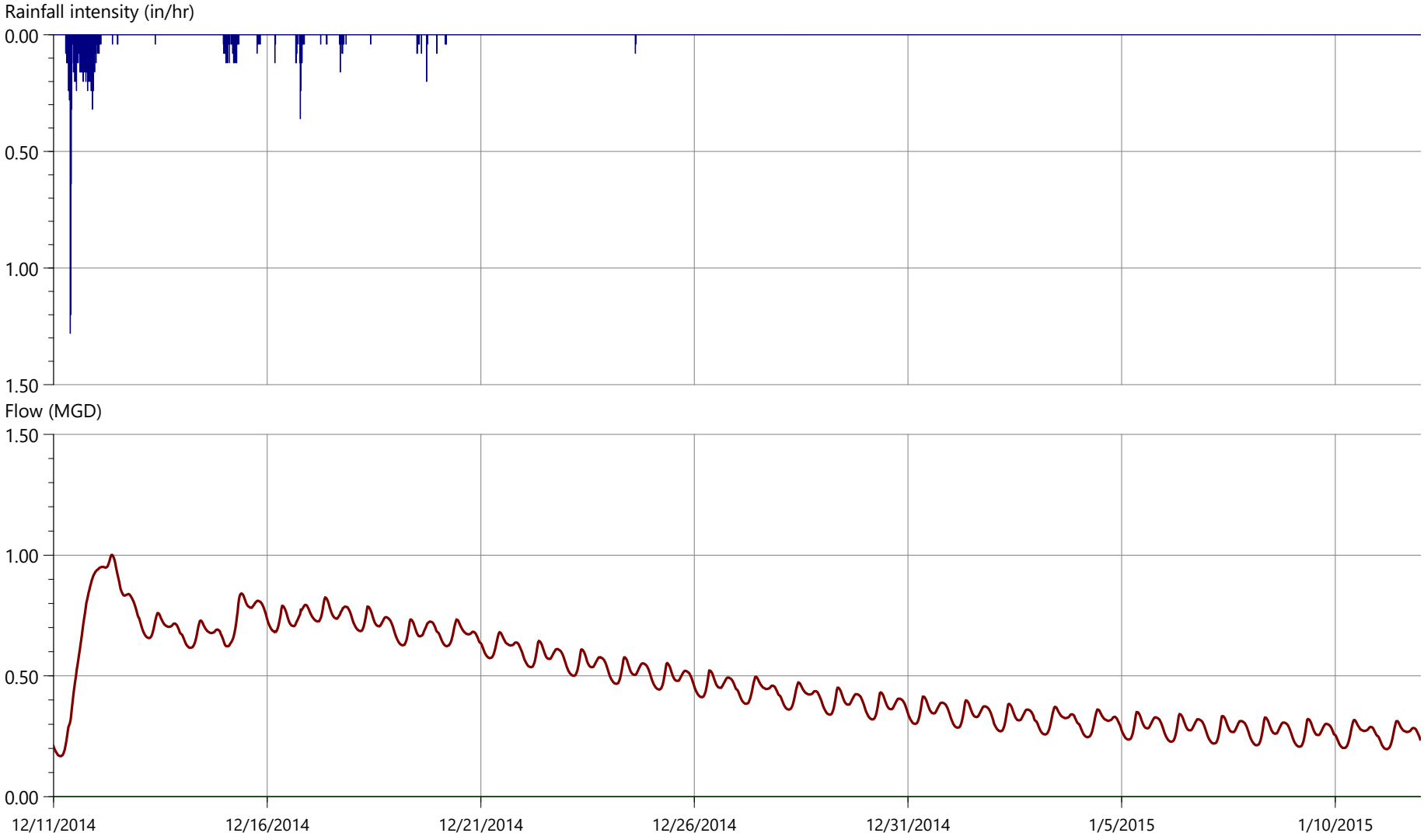
	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	4.950	0.640	0.006			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.036	1.175	9.810

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 30, Model Location (Pred.) D/S S62-24.1, Rainfall Profile: 2



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.036	0.179	1.780

Flow survey: >2022/2023 Sewer Master Plan (0012307.00)>03 DATA>A FLOW DATA>Flow Meter Data>2022/2023 Flow Meters Updated FM12_with2015 (4/11/2023 8:49:09 PM)
Sim: >2022/2023 Sewer Master Plan (0012307.00)>04 RUNS>A CALIBRATION>Wet Weather>2015 WWF Existing_WithBlockage_10192023>Rainfall Data 2023 and 2015 (10/19/...
Flow Survey Location (Obs.) 31, Model Location (Pred.) D/S S62-23.1, Rainfall Profile: 2



	Rainfall			Flow		
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min (MGD)	Max (MGD)	Volume (US Mgal)
Rain	5.020	1.280	0.007			
Observed				0.000	0.000	0.000
... Data 2023 and 2015				0.168	1.001	15.500

APPENDIX G: SEWER PERFORMANCE AND DESIGN CRITERIA TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM

PROJECT: City of Santa Clara Sanitary Sewer Master Plan

TO: Craig Temple, City of Santa Clara

PREPARED BY: Stephanie Estabrook, PE; Woodard & Curran

REVIEWED BY: Nuria Bertran-Ortiz, PE; Cathy Greenman, PE, Woodard & Curran

DATE: September 23, 2024

SUBJECT: Technical Memorandum – Santa Clara Sewer Performance and Design Criteria

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1. INTRODUCTION

This Technical Memorandum (TM) summarizes a range of options for the performance and design criteria associated with the City of Santa Clara's Sanitary Sewer Master Plan update (Master Plan Update). This TM discusses the following criteria:

- Selection of a design storm event;
- Performance or trigger criteria to evaluate the capacity of the existing sewer system and assign relative risk (priority for improvements); and
- Design criteria to size new or relief facilities.

The selected performance and design criteria will be used in subsequent tasks to analyze the capacity of the system, identify areas of capacity deficiencies, and develop recommendations for capacity improvements which will be incorporated into the City's Capital Improvement Program (CIP).

2. DESIGN STORM CRITERIA

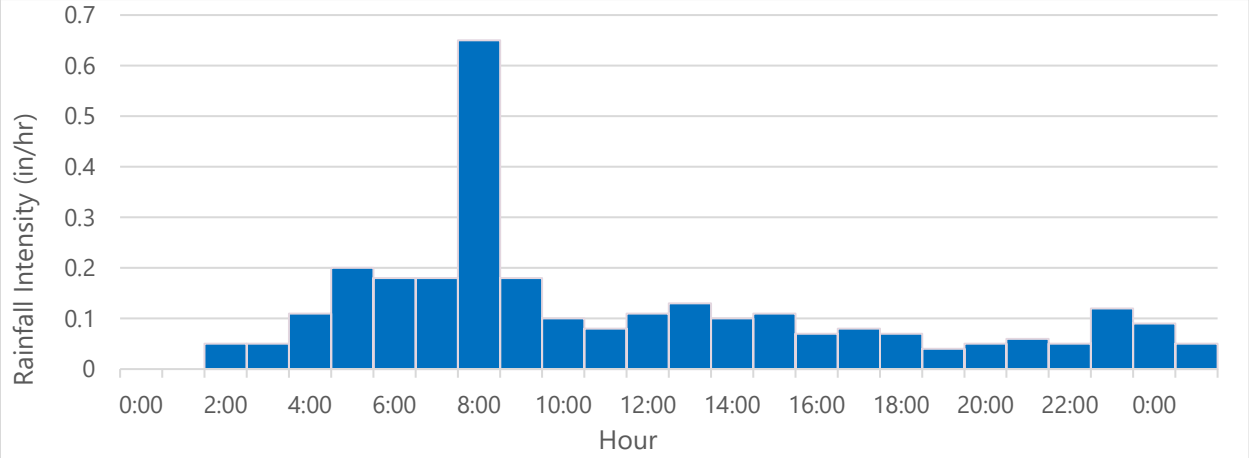
Peak design flows for sewer systems consist of dry weather base wastewater flow (BWF), groundwater infiltration (GWI), and rainfall-dependent infiltration/inflow (RDI/I). Criteria for computing existing BWF, GWI, and RDI/I were developed as part of model calibration. However, the peak design flow criteria must not only consider the magnitude of flow but also specify the set of conditions (e.g., design storm rainfall and timing with respect to seasonal GWI and diurnal BWF) that will generate the highest peak flows that the sewer system must be considered capable of hydraulically conveying without risk of overflows.

The following subsections describe the design storm used in the City's previous (2016) Master Plan Update and discuss key considerations for selecting a design storm for this Master Plan Update.

2.1 Previous Master Plan

The design storm used for the 2016 Master Plan Update is a 10-year, 24-hour storm that varies across the service area. The storm pattern and hourly rainfall intensities are based on the Santa Clara County's Drainage Manual (October 2007)[1]. The manual includes mean annual precipitation (MAP) isohyetal lines from Santa Clara Valley Water District (SCVWD) and distinct IDF curves for each MAP area in Appendix B. In addition to the IDF curves, Appendix D of the manual includes a 24-hour design storm pattern. According to the manual, this storm pattern is based on an actual three-day rainfall event that occurred in December 1955, but with some adjustments to better reflect IDF statistics for various storm durations. **Figure 2-1** shows the design storm hourly rainfall as it occurs in the vicinity of central Santa Clara, including the San Jose International Airport area. At this location, the total rainfall for the 1, 6-, and 24-hour durations is 0.65, 1.49, and 2.92 inches, respectively. For this graph, the storm timing has been adjusted so that the peak intensity coincides with the morning peak of the diurnal wastewater pattern.

Figure 2-1: Design Storm Event for Central Santa Clara (MAP ~14.5 inches)



The design event criteria that were adopted for Santa Clara's 2016 Master Plan are summarized in **Table 2-1**. These criteria are described in more detail in **Section 2.2**.

[1] Santa Clara County's Drainage Manual is available online at: https://stgenpln.blob.core.windows.net/document/DrainageManual_Final.pdf.

Table 2-1: Design Event Criteria Used in Santa Clara 2016 Master Plan

Design Event Criterion	TM Reference	Santa Clara 2016 Selection
Return Period	Section 2.2.1	10 years
Rainfall Depth	Section 2.2.2	Based on County Drainage Manual IDF curves
Storm Duration	Section 2.2.3	24 hours
Rainfall Temporal Distribution	Section 2.2.4	Based on County Drainage Manual (developed from historical rainfall event in December 1955)
Storm Timing	Section 2.2.5	Peak-on-Peak
Spatial Rainfall Distribution	Section 2.2.6	Lowest intensity: North Highest intensity: Southwest
Antecedent Conditions	Section 2.2.7	Wet, saturated soils

2.2 Key Considerations for Design Storms

The use of wet weather design events as the basis for capacity evaluation of sanitary sewer systems is an accepted industry practice for sewer modeling and master planning purposes. A model is first calibrated to reasonably simulate the wet weather flows from observed storms, and then a separate design storm event is applied and used to identify deficiencies and size improvement projects. The design event may be synthesized from rainfall statistics or may be an actual historical rainfall event of appropriate duration and intensity.

Key factors needed to define a design storm event for the purpose of sewer modeling and master planning include return period, rainfall depth, storm duration, temporal and spatial distribution of rainfall, storm timing, and antecedent conditions. These factors are discussed below.

2.2.1 Return Period

The return period defines the probability that the design rainfall will be exceeded in any given year. For example, a storm with a 5-year return period means that there is a 1 in 5 chance, or 20 percent probability, that the design rainfall will be exceeded in any given year. For sewer modeling and master planning applications, the chosen return period reflects the degree of risk that an agency is willing to accept regarding the potential of experiencing sanitary sewer overflows (SSOs) due to future storm events. However, selecting a design storm with a very high return period (reflecting a very low risk tolerance) could lead to identification of a significant number of system capacity deficiencies that would make the cost of improvements prohibitive. Additionally, sizing a system for a very infrequent event could mean that the system does not function well under typical conditions during much lower flows (due to slow velocities in oversized pipes, or oversized pump stations).

Although there is no regulatory standard for design storm return periods for wastewater collection systems, most Bay Area agencies that have adopted a specific return period have selected return periods of 5 or 10 years. Some of the storms chosen by these agencies are historical rainfall events; others are synthetic storms.

As discussed further in the subsequent sections, depending on the type of rainfall distribution chosen, although the overall return period for the full storm is as stated, shorter durations within each storm may or may not be an equivalent return period. It should also be noted that the return period from a rainfall event can differ from the return period of a resulting peak flow occurrence in the collection system due to other factors such as timing of the storm with respect to the normal diurnal wastewater pattern and the antecedent conditions (e.g., groundwater levels, soil saturation, prior rainfall) under which the storm occurs.

The choice of a target return period is a subjective decision that is made by each agency based on the desired level of service, potential impacts of SSO events, and cost to achieve.

2.2.2 Rainfall Depth

Synthetic design storms are typically based on rainfall depth, duration, frequency (DDF) or intensity, depth, frequency (IDF) statistics that have been compiled for a local area. These statistics give the rainfall depths or intensities for various return periods (e.g., 2-year, 5-year, etc.) and durations of rainfall (e.g., 1-hour, 2-hour, etc.). Rainfall IDF statistics are available through the National Oceanic and Atmospheric Administration (NOAA)[1], which provides the IDF statistics for any location in the U.S. based on latitude/longitude coordinates.

IDF curves specific to Santa Clara County (one for each MAP area) for various return periods and durations are provided in Appendix B of the 2007 County Drainage Manual. These IDF curves were used to define the design storm event used for the 2016 Master Plan (as discussed in **Section 2.1**). MAP varies spatially throughout Santa Clara, with the highest average annual rainfall typically occurring in the southern portion of the City (discussed further in **Section 2.2.6**). In central Santa Clara, according to the County Drainage Manual, the MAP is approximately 14.5 inches and the 10-year, 24-hour rainfall depth is approximately 2.92 inches (versus 2.63 inches according to NOAA Atlas 14).

2.2.3 Storm Duration

A storm duration must be specified for the design storm along with the return period. Most Bay Area agencies use a 24-hour storm, although shorter or longer durations may sometimes be appropriate (e.g., a shorter duration in a very small system with fast response to rainfall or in an area where storm events are typically very brief; a longer duration in a very large system or one with a very slow response to rainfall). Typically, the 24-hour duration storms are constructed such that the more intense rainfall occurs during a shorter (e.g., 4- to 6-hour) period.

2.2.4 Rainfall Temporal Distribution

The temporal rainfall distribution of a design storm may be based on a synthetic storm or an actual historical event. Commonly used synthetic storm distributions include nested storms (which incorporate design rainfall intensities for a given return period for several durations within the total storm duration), or a "SCS" storm distribution, a dimensionless 24-hour rainfall distribution developed by the SCS (Soil Conservation Service), now known as the NRCS (Natural Resources Conservation Service). The SCS developed four 24-hour distributions, with each distribution representative of a specific region of the U.S., as presented in the

[1] NOAA Atlas 14, Volume 6, Version 2 Point Precipitation Frequency Estimates are available online at: http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ca.

USDA guidance document Urban Hydrology for Small Watersheds TR-55 (June 1986). The City's service area generally falls within the area covered by the "Type I" distribution, but it is close to the boundary between the "Type I" and "Type IA" distributions.

It is sometimes preferable to use historical rainfall patterns to depict the design storm temporal rainfall distribution of the design event. As described above in **Section 2.1** and shown in **Figure 2-1**, Santa Clara County's Drainage Manual defines a temporal rainfall distribution based on a historical event that occurred during December of 1955. The rainfall for a historical storm could be scaled to match the desired rainfall depth and return period of the design storm.

Table 2-2 compares the peak hour intensity of the County Drainage Manual design storm distribution to the peak hour intensities of the synthetic distributions (SCS-I and SCS-IA, and nested) based on the County Drainage Manual IDF statistics for a 10-year, 24-hour rainfall event. As shown in the table, in central Santa Clara, peak hour rainfall intensity of the County Drainage Manual distribution is very similar to that of the synthetic SCS Type I distribution, moderately lower than that of the synthetic nested distribution, and significantly higher than that of the SCS Type IA distribution.

Table 2-2: Potential Design Storm Characteristics[1]

Frequency	Duration	IDF Statistics Source	Temporal Distribution	Volume (in)	Peak Hour Intensity (in/hr)
10-yr	24-hr	Historical, County Drainage Manual	Historical, County Drainage Manual	2.92	0.65
10-yr	24-hr	NOAA	Synthetic, Nested	2.92	0.64
10-yr	24-hr	NOAA	Synthetic, SCS-I	2.92	0.76
10-yr	24-hr	NOAA	Synthetic, SCS-IA	2.92	0.46

[1]Based on County Drainage Manual and assumed MAP of 14.5 inches for central Santa Clara.

2.2.5 Storm Timing

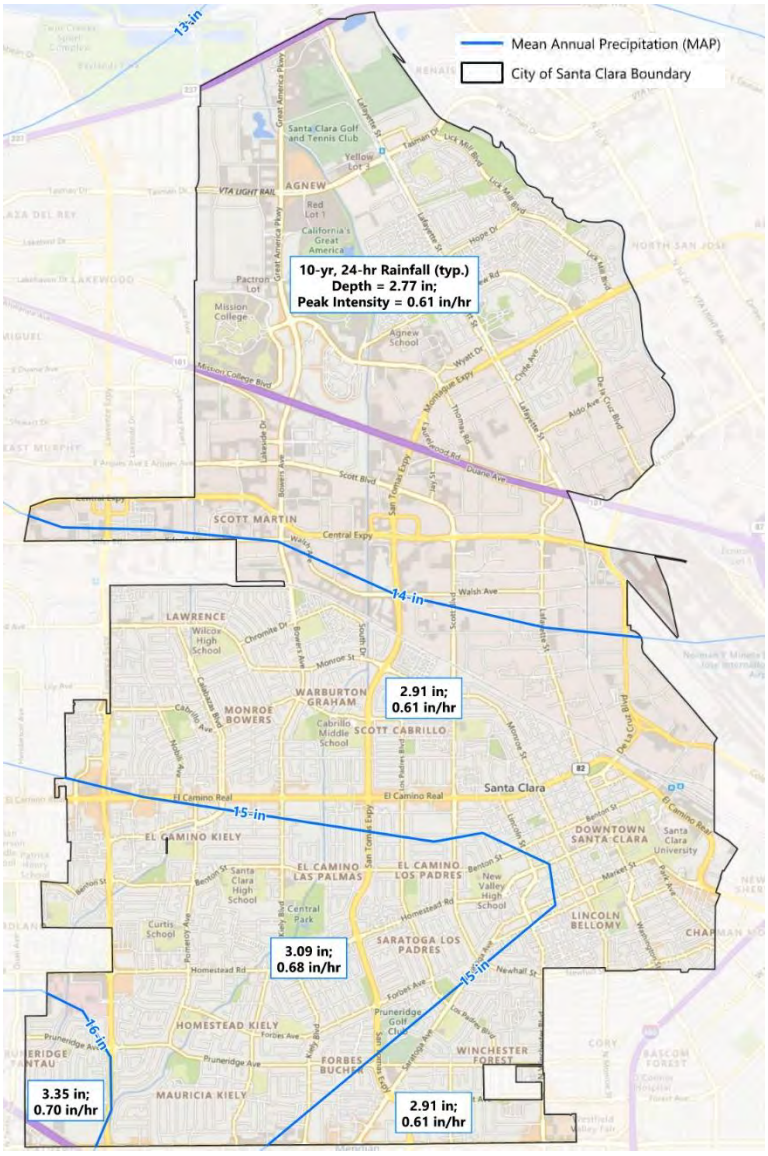
The timing of the rainfall distribution should also be considered in relation to the sewer dry weather flow diurnal profile. For example, rainfall can be timed to generate RDI/I that occurs at approximately the same time as the peak BWF in most areas ("peak-on-peak"). This consideration is most important in systems where flow from RDI/I is relatively small compared to BWF and in systems where the response to rainfall occurs relatively quickly (over a few hours instead of days). Alternately, a less conservative approach would be to time the rainfall such that the peak RDI/I coincides with average BWF conditions, based on the assumption that the design storm could occur at any time of day. This approach can be applied when using a synthetic design storm distribution (nested or SCS); however, if an actual historical rainfall pattern is used, the timing could be based on the actual time of the rainfall, or it could be adjusted to align the highest intensity period of rainfall with the peak BWF.

2.2.6 Spatial Rainfall Distribution

The magnitude of rainfall may vary spatially, generally based on topography and the typical movement of storms over the service area. Based on the County Drainage Manual, and as illustrated in **Figure 2-2**, mean annual precipitation (MAP) in the City's service area varies from about 13 to 16 inches in a north to

southwest direction. While this pattern may not hold true for every storm event, it is common practice to apply the spatial variation of average annual rainfall to the design storm. As such, the IDF curves (one for each MAP) provided in Appendix B of the County Drainage Manual were referenced to obtain IDF statistics (rainfall depth, duration, and peak intensity) for subareas within the City. **Figure 2-2** also presents the spatial variation of rainfall depth and peak intensity throughout the City for a 10-year, 24-hour event based on the IDF data from the County Drainage Manual. Similarly, the highest and most intense rainfall typically occurs within the southwest portion of the City.

Figure 2-2: Spatial Variation of MAP & 10-Year, 24-Hour Rainfall Event (County Drainage Manual)



2.2.7 Antecedent Conditions

Based on flow monitoring data from the 2022-2023 winter season, flow response to rainfall in portions of the City's service area (e.g., Chromite-Machado-Cabrillo (CMC) tributary area) is characterized by prolonged

elevated flows extending for several days and in some cases weeks after storm events. Thus, a storm happening later in the season after several storm events have occurred may produce higher peak flows because the ground is saturated (meaning less rainfall can be "absorbed" by the soil) and flows are already elevated due to the preceding events. This "wet" antecedent condition can be modeled as a prolonged RDI/I response (when the model simulation includes multiple events) or as an elevated, antecedent GWI condition (when modeling a single event such as a design storm). Because it is not unusual for large storm events to occur after periods of preceding rainfall, it is common to define a design storm as occurring under "saturated soil" or "wet" antecedent conditions. Assuming dry or moderately dry soil conditions would be a less conservative approach.

2.3 Design Storms Used by Other Agencies

An agency selects a design storm event based on the key considerations discussed in **Section 2.2** with respect to its desired level of service. As such, design storm criteria vary by agency and are reflective of the level of risk that is acceptable to each agency. **Attachment 1** describes design storm criteria used for several agencies throughout California and **Table 2-3** presents a summary of this information for agencies in close proximity to Santa Clara.

Table 2-3: Common Design Storm Criteria for California Agencies

Agency (year of report)	Return Period (years)	Duration (hours)	Temporal Distributions	Baseflow Conditions
City of Santa Clara (2016)	10	24	2007 Santa Clara County Drainage Manual	Peak-on-peak
City of San Jose (2013)	10	24	2007 Santa Clara County Drainage Manual	Peak-on-peak
City of Sunnyvale (2023)	10	24	2007 Santa Clara County Drainage Manual	Peak-on-peak
City of Mountain View (2022)	10	24	NOAA Atlas 14	Peak-on-peak
City of Milpitas (2021)	10	24	Unknown	Peak-on-peak
Cupertino Sanitary District (2019)	10	24	2007 Santa Clara County Drainage Manual	Peak-on-peak
West Valley Sanitation District (2018)	10	24	2007 Santa Clara County Drainage Manual	Peak-on-peak

[1] Represents the number of agencies that use the specified criteria (typical).
[2] MP = Master Plan.

Several other cities located in the San Francisco Bay Area but in adjacent counties, such as San Carlos, San Leandro, and San Bruno, also selected a 10-year, 24-hour design storms with peak-on-peak BWF conditions for their master plans. Agencies must balance their desired level of service with the anticipated costs to achieve. A larger target return period could result in an extensive list of model-predicted capacity deficiencies that could be financially infeasible for an agency to address. Considering that many sewer

systems in the Bay Area have historically been subjected to high rates of RDI/I and elevated peaking factors, the costs associated with implementing capacity improvement projects that are identified based on design storms with larger return periods could be substantial.

Although the California agencies referenced above utilize the 10-year return period for their design storms, there are examples of agencies outside of California that selected design storms with larger return periods for their master planning efforts. For example, the cities of Boulder, Colorado and Richmond, Michigan elected to utilize 25-year, 24-hour design storms to evaluate system capacity. Moreover, some agencies have conservatively intensified their design storms to consider the potential impacts of climate change given that severe rainfall events have occurred more frequently in recent years and more intense events are anticipated to occur more frequently in the future. Research conducted by City staff identified several agencies that have evaluated the potential for larger storms in the future as part of their sewer system capacity planning. The City of Windsor in Ontario, Canada evaluated system capacity by applying a 5-year, 25-year, and 100-year design storm (all with 4-hour duration) as well as a hypothetical "Climate Change Stress Test" design storm which consisted of increasing the total rainfall volume and peak intensity of the 100-year design storm by 40 percent. The City of Lloydminster in Saskatoon, Canada also utilized a design storm with a 25-year return period as its target level of service for its sanitary sewer master plan capacity analysis. The 50-year and 100-year design storms were also analyzed.

2.4 Design Storm Selection

In consideration of all the factors discussed above, it was determined not to adopt a more conservative (severe) design storm but to continue to use the same 10-year, 24-hour design storm event that was used for the 2016 Master Plan for this Master Plan update. For future modeling efforts, the City may consider applying a more conservative design storm event with a higher return period and/or perform a sensitivity analysis to evaluate potential impacts of climate change. The analysis could either be performed prior to, or concurrent with, the next Master Plan update.

Also, no modifications to the depth or distribution of the design storm event used for the City's 2016 Master Plan (summarized in **Table 2-1**) were made for this Master Plan update. This event is based on the Santa Clara County Drainage Manual design storm with peak-on-peak BWF timing. Generally, peak-on-peak timing is achieved by adjusting the timing of the peak intensity of the rainfall event so that it occurs one to two hours prior to the peak BWF to account for the typical delay between the rainfall occurring and observation of the RDI/I response. For the 2016 Master Plan, the design storm rainfall was timed such that the peak rainfall occurred around 8 a.m., resulting in a peak RDI/I flow at approximately the same time as the typical weekend day peak BWF in most areas of the system (graphically depicted in **Figure 2-3**). Given that the peak BWF typically occurs earlier on a weekday compared to a weekend day, it is also recommended that the design storm be evaluated assuming an earlier peak rainfall intensity (around 6 a.m.) so as to align the peak intensity with the typical weekday peak BWF (graphically depicted in **Figure 2-4**).

Figure 2-3: Recommended Design Storm (Weekend)

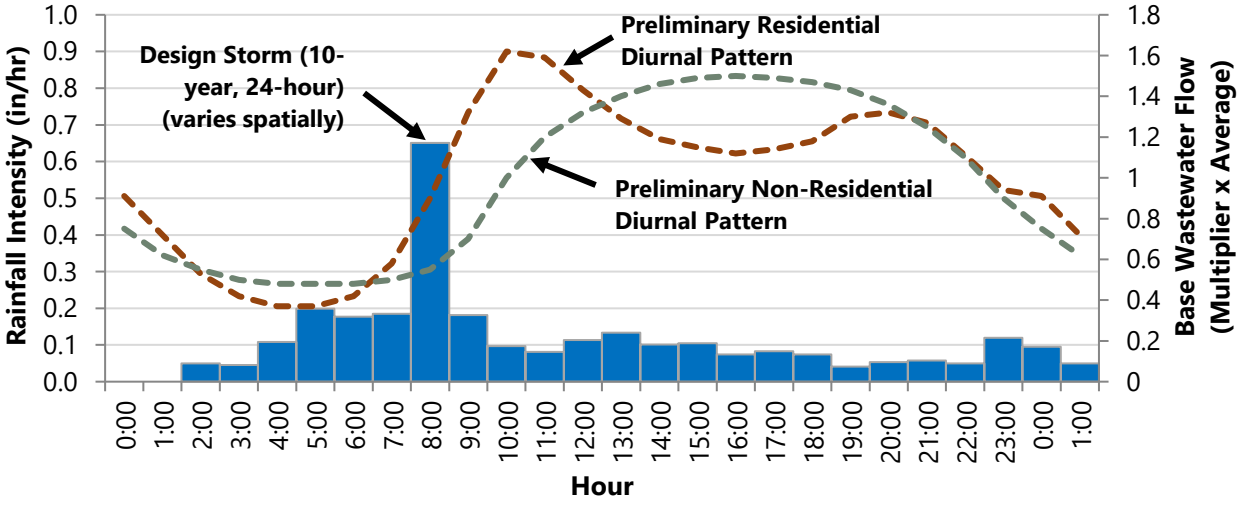
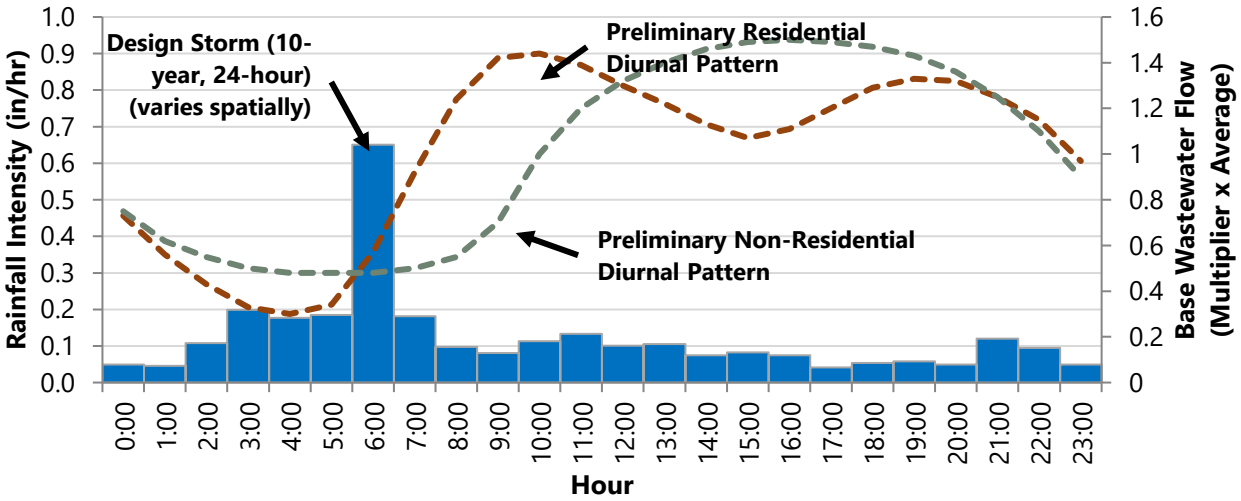


Figure 2-4: Recommended Design Storm (Weekday)



3. HYDRAULIC CRITERIA

Hydraulic criteria include both capacity deficiency criteria, which are used to identify the sewer pipes or pump stations needing relief due to inadequate capacity, and design criteria, which determine how large new sewers or facilities should be. The criteria used by the City should ideally be stringent enough to ensure that sewer overflows caused by capacity limitations (as distinguished from other causes such as obstructions or structural failures) are rare occurrences, but not so conservative that they result in oversized pipes where cleaning velocities cannot be achieved under normal flow (non-rainfall) conditions, or that cause the City to spend capital improvement funds unnecessarily.

Sections 3.1 and **3.2**, respectively, discuss the capacity deficiency and design criteria in more detail.

3.1 Capacity Deficiency Criteria

Capacity deficiency criteria are used to determine if the capacity of an existing sewer facility is exceeded to the extent that a capacity improvement project is needed. These criteria are sometimes called "trigger" criteria, in that they trigger the need for a capacity improvement project. These criteria differ from the design criteria that are applied to determine the size of a new facility; the latter typically being more conservative. The difference between capacity deficiency criteria and design criteria reflect the concept that some existing facilities can continue to provide adequate, if not optimal, conveyance capacity without undue risk, but new facilities should be designed to a higher standard as discussed in **Section 3.2**.

It is important to coordinate capacity deficiency criteria with peak design flow criteria. For example, if peak design flow were to be based solely on peak dry weather flow (PDWF), the deficiency criteria would need to be more conservative (e.g., require pipes to flow less than full to allow capacity for I/I). Whereas if the peak design flow includes I/I from an infrequent storm event and is based on peak wet weather flow (PWWF), it may be appropriate to allow the sewers to flow surcharged to some extent because the peak flows will be infrequent and brief in duration.

Additionally, the City should consider what level of surcharge under design storm PWWF is acceptable. This could take the form of an allowable freeboard (depth of water below ground level or the manhole rim elevation), such as 1 foot, 3 feet, or 5 feet. It could also be an allowable depth of surcharge above the pipe crown, such as between 0 feet and 2 feet, which could also depend on the depth of the pipe. The surcharge criteria could vary for different locations in the system; for example, areas where the consequence of overflows could be more significant (e.g., adjacent to sensitive water bodies or hospitals) could be assigned more conservative criteria. This variation would allow the City to focus capital spending on the most critical issues.

For master planning capacity assessments, pump stations are typically considered capacity deficient if the peak design flow exceeds the station's estimated firm capacity (capacity with largest pump out of service). Force mains are considered deficient if velocity under peak design flow exceeds some maximum value (typically 8 to 10 feet per second (fps)) generally because head losses would be very high, reducing the available pumping capacity. Therefore, it is important to evaluate pump stations and force mains as integrated systems.

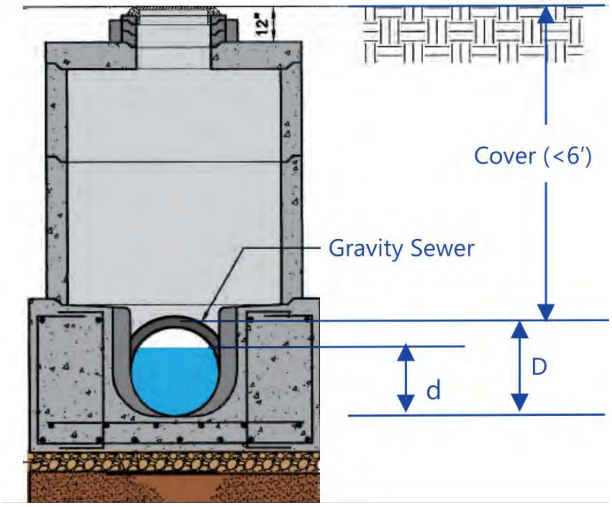
3.1.1 Capacity Deficiency Criteria Used in Previous Master Plan

Given that the peak wet weather design flow used for the 2016 Master Plan included RDI/I from a 10-year return period event and was assumed to be concurrent with peak BWF, it was considered acceptable, at the time, to allow gravity sewers to flow surcharged to some extent before a capacity relief project was triggered. The selected criteria allowed for more significant surcharging in larger, deeper sewers provided that the hydraulic gradeline remained a reasonable distance below the ground surface and that no surcharging occurred during dry weather flow conditions. For shallow sewers (typically smaller diameter), where potential risk of an SSO is higher, a more conservative criteria was considered to account for the chance that capacity could also be compromised by factors such as offset joints, roots, grease, and debris (which cannot be accounted for in the hydraulic model), or that surcharge could result in flow backing up into connecting laterals.

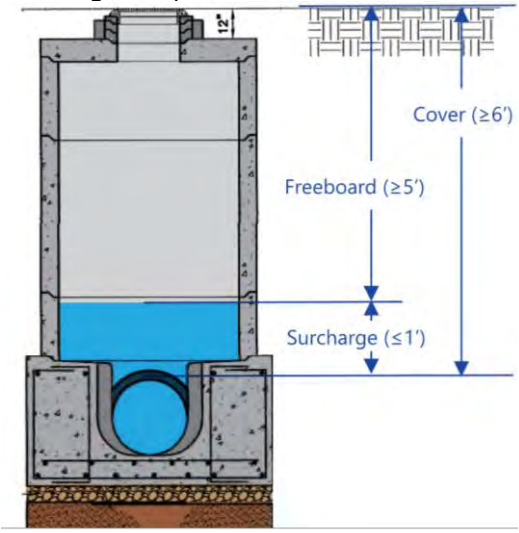
The following criteria were developed for the 2016 Master Plan based on consideration of the risk factors discussed above and were used to identify capacity deficient sewers within the system:

- PDWF: No surcharge allowed (d/D ≤ 1.0)
- PWWF:

Scenario A
Gravity sewer with less than 6 feet of cover:
No surcharge allowed (i.e., d/D ≤ 1.0).



Scenario B
Gravity sewer with 6 feet or more of cover:
Surcharge of up to 1 foot under PWWF.



- Case-by-case exceptions were made for isolated short pipe reaches. Conversely, the option to use more stringent criteria for sewers located in areas where the consequences of an overflow would be greater (e.g., adjacent to creeks, schools, or hospitals) was also provided; however, it was not applied in the 2016 Master Plan.
- Note that for evaluating the performance of existing sewers, a Manning's "n" value of 0.013 was assumed for all pipes, regardless of material or age. Although new pipes, particularly plastic materials, would provide a lower initial roughness factor, it was assumed that over time, a "slime layer" formation on the walls of the pipes and/or other obstructions in the sewer, such as roots,

debris, or structural defects, may increase pipe roughness. Therefore, an assumption of 0.013 for all pipes was considered appropriately conservative for master planning purposes.

3.1.2 Capacity Deficiency Criteria Used by Other Agencies

An agency defines its capacity deficiency criteria based on its desired level of service. As such, the criteria vary by agency and are reflective of the level of risk that is acceptable to each agency. **Attachment 1** describes common capacity criteria used for several agencies throughout California, and **Table 3-1** presents a summary of this information for several South Bay Area agencies.

Table 3-1: Common Capacity Deficiency Criteria for California Agencies in the South Bay Area

Agency (year of report)	PDWF	PWWF
City of Santa Clara (2016)	No surcharge allowed (d/D ≤ 1.0)	- Pipe cover < 6 feet: No surcharge allowed (d/D ≤ 1.0) - Pipe cover ≥ 6 feet: Surcharge up to 1 foot above crown allowed
City of San Jose (2013)	No surcharge allowed (d/D ≤ 0.9)	- Diameter < 18-inch: Minimal surcharge allowed (d/D ≤ 1.1) - Diameter ≥ 18-inch: Surcharge allowed up to 20 percent of the cover over the pipe, with at least 4 feet of freeboard (*interceptor system uses different criteria, not applicable to typical system*)
City of Sunnyvale (2023)	No surcharge allowed (d/D ≤ 1.0)	Minimum freeboard = 5 feet (no stormwater scenarios). No overflows allowed (with stormwater scenarios)
City of Mountain View (2010)	Unknown	- Diameter ≤ 12-inch: Allowed to flow ½ full (d/D ≤ 0.5) - Diameter > 12-inch: Allowed to flow ¾ full (d/D ≤ 0.75)
City of Milpitas (2021)	Unknown	Minimum freeboard = 5 feet
Cupertino Sanitary District (2019)	Unknown. Undefined in Master Plan Report; possibly based on surcharge.	
West Valley Sanitation District (2018)	- Diameter ≤ 15-inch: Allowed to flow ¾ full (d/D ≤ 0.75) - Diameter > 15-inch: No surcharge allowed (d/D ≤ 1.0)	- Diameter ≤ 15-inch: No surcharge allowed (d/D ≤ 1.0), except on a case-by-case basis for deep pipes. - Diameter > 15-inch: Surcharge allowed up to 1 foot above crown, where freeboard ≥ 5 feet.

As shown in **Table 3-1**, the PDWF capacity criterion used for Santa Clara's 2016 Master Plan Update is comparable to other agencies; however, the PWWF criterion is one of the most conservative, particularly the criterion for pipes with cover equal to or greater than 6 feet. For example, if surcharge over a pipe exceeds 1 foot, then this criterion could trigger a project even in cases where the pipe has significant cover and there is plenty of freeboard at the manhole (e.g., greater than 10 feet).

Although Santa Clara's PWWF capacity deficiency criteria are conservative, research provided in **Attachment 1** indicates there are examples of stricter criteria being applied for agencies both inside of California (e.g., City

of Escondido and City of Chula Vista as shown in **Attachment 1**) and in other states (e.g., City of Boulder, Colorado and MidValley Improvement District, or MID, in Utah). Capacity deficiency criteria are typically selected based on an agency's desired level of service criteria and risk tolerance; however, the state of its hydraulic model being used for the analysis is also considered. In cases where hydraulic models are less reliable or accurate, more conservative criteria could be applied. For example, the MID in Utah used a stricter PWWF capacity deficiency criteria because it did not model inflow directly due to the wide variability in storm events and inflow response possible in the District. Therefore, the MID included a capacity allowance in its criteria to account for inflow into its collection system.

For the Cities of Escondido and Chula Vista, the PWWF capacity deficiency criterion does not allow any surcharge; allowable d/D in 12-inch diameter and smaller sewers is 0.75 and 0.70, respectively, 0.85 in sewers larger than 12-inch diameter. Outside of California, the City of Boulder, Colorado and the MID in Utah both have more conservative PWWF capacity deficiency criteria than Santa Clara. The City of Boulder, Colorado does not allow surcharge under PWWF; for sewers up to 24-inch diameter, maximum allowable d/D is 0.60 and for sewers larger than 24-inch, maximum allowable d/D is 0.80. MidValley Improvement District similarly allows no surcharge under PWWF; for 12-inch diameter and smaller sewers, peak flow must be less than 50 percent of the pipe's full flow capacity and for 15-inch and larger diameter sewers, peak flow in the pipe must be less than 75 percent of the pipe's full flow capacity or depth at peak flow must be less than 65 percent of the pipe diameter.

3.1.3 Revised Capacity Deficiency Criteria Used for this Master Plan

One component of the capacity deficiency criteria (i.e., PWWF surcharge for pipelines with pipe cover ≥ 6 feet) is being updated with this Master Plan Update while the other components remain unchanged. The components that are unchanged are the PDWF (i.e., no surcharge allowed) and PWWF for pipelines with less than 6 feet of cover (i.e., no surcharge allowed). A summary of the criteria used in the prior 2016 Master Plan and the criteria to be used for this Master Plan Update are included below in **Table 3-2**.

Table 3-2: Revised Capacity Deficiency Criteria for Santa Clara

Condition	2016 Master Plan Criteria	Revised Criteria[1]
PDWF	No surcharge allowed (d/D ≤ 1.0)	No surcharge allowed (d/D ≤ 1.0)
PWWF	- Pipe cover < 6 feet: No surcharge allowed (d/D ≤ 1.0) - Pipe cover ≥ 6 feet: Surcharge up to 1 foot above crown allowed	No surcharge allowed (d/D ≤ 1.0)

[1]Revised criteria are to be used for identifying model-predicted deficiencies for this Master Plan Update.

The factors that contributed to the criteria change include the following:

- Potential for climate-related increase to severity of storms;
- Sewer system condition degradation over time;
- Increase in development and intensification of land use not currently identified;
- Interest in identifying all potential future projects; and
- Better alignment of modeling results with level of service goals and existing sewer design criteria (which does not allow for surcharge in new/rehabilitated sewers).

The first three items above represent risk factors associated with the ability of the hydraulic model to predict future problem areas. They are addressed in more detail below.

Climate-related Increase to Storm Severity

To date, the design storm used for the Master Plan updates has not been modified to include anticipated climate change impacts as have some other agencies. The design storm selected for system capacity analysis (i.e., 10-year return period, 24-hour duration) has not been modified from previous analyses. Therefore, modification of the capacity deficiency criteria to be more conservative serves to provide some additional insurance against the anticipated increasing severity of storm events. See **Sections 2.3** and **2.4** for additional discussion on climate-related increase to severity of storms and other agencies' approaches to the issue.

Sewer System Condition Degradation

As the City's sewer infrastructure continues to age, the condition of pipe-to-pipe and pipe-to-manhole joints can degrade. This degradation can create pathways for groundwater to infiltrate into the sewer system or for sewerage to exfiltrate (or leave) the sewer system. Thus, applying a conservative capacity deficiency criteria that minimizes allowable surcharge in the sewer system can reduce the chance of exfiltration and the associated potential risk of soil/groundwater contamination.

Land Use Intensification

This current Master Plan Update incorporates planned future development in accordance with the City's 2035 General Plan. However, a General Plan update is planned to be completed prior to the next Master Plan update (anticipated to be approximately 7-8 years hence), which would likely result in additional land use intensification. Because the exact location(s) and levels of intensification are unknown, future loads assumed for the current Master Plan update do not reflect all anticipated intensification from future development. The City will require hydraulic modeling of its sanitary sewer system prior to adopting any amendments to its General Plan.

The risk factors discussed above cannot be predicted with respect to the possible extent of impacts on the sewer system and specific locations of potential deficiencies. Modification of the capacity deficiency criteria (to be more conservative) provides an "advance warning" of more vulnerable areas of the system that could require deficiencies to be corrected as these future risks materialize.

System capacity evaluation will be based on the capacity deficiency criteria per **Table 3-2**. However, note that engineering judgment will be used in conjunction with applying the revised capacity deficiency criteria to identify model-predicted capacity deficiencies. Gravity sewers that show only minor criteria violations would not be considered deficient if the following conditions apply:

- Surcharged on one end only (i.e., downstream end caused by backwater);
- Isolated flat pipe segments;
- Invert differences (i.e., offsets) between adjacent pipes;
- Smaller diameter sewers connected to larger diameter pipes at inverts; or
- Sewers protected from overflows by a high-level flow diversion or parallel pipe.

The potential impact of capacity deficiencies, based on location (i.e., proximity to land uses with higher risk of public exposure or to sensitive water bodies), will be considered in prioritizing improvements rather than in determining the need for them. This approach will result in a straightforward and objective method to identify needed improvements, and allow for other considerations such as location, extent of surcharge or magnitude of overflow volume, timing of need (e.g., based on projected development), and level of model confidence (based on flow monitoring and model calibration results) to be used as factors for prioritizing and scheduling improvements for the City's capital improvement program. These factors will be developed and discussed as part of Task 5, Capital Improvement Program.

3.2 Design Criteria for New or Relief Sewer Facilities

The City's "Design Criteria" (April 2015)[1] specify criteria for hydraulic design of sanitary sewer facilities (e.g., pipe material and diameter and roughness for gravity sewers) and were referenced to develop the design criteria used for the 2016 Master Plan. These criteria would be based on the modeled design storm peak wet weather flows in the system.

3.2.1 Gravity Sewers

The design criteria applied for sizing new gravity sewers as part of the 2016 Master Plan were generally consistent with the City's sanitary sewer design criteria. Note that the City may use somewhat different criteria for new developments or actual design (e.g., varying Manning's "n" for different pipe materials, or a more conservative d/D for smaller diameter sewer mains).

Design criteria applied to gravity sewers for the 2016 Master Plan included:

- Maximum Allowable Depth-to-Diameter (d/D) Ratio at Peak Design Flow: Less than 0.75.
- Manning's "n" Friction Coefficient: 0.013 (*Note: The City's design standards specify a "n" value of 0.011 for PVC pipes; however, all pipes were modeled using a conservative "n" of 0.013*).
- Minimum Pipe Diameter:

Land Use Served	Diameter (inches)
Residential	8
Commercial	10
Industrial	12

- General Pipe Sizing: Downstream pipes at least as large as upstream pipes.
- Minimum Cover: 6 feet from finished grade to crown of sanitary sewer.
- Minimum Velocity: 2 fps at half-full or full pipe.
- Maximum Velocity: 10 fps at peak design flow.

[1] City of Santa Clara's Sanitary Sewer Design Criteria (Section 5) are available online at: https://www.santaclaraca.gov/home/showpublisheddocument/61878/636766631787130000.

- Minimum and Maximum Slopes: Determined based on the above velocity criteria to the extent feasible (it is recognized that elevation constraints in the existing system may prevent achieving desired minimum slopes for some projects, and terrain may dictate higher maximum slopes in some cases).

Other gravity sewer design criteria that are either included in the City's "Design Criteria" or generally best practices for sewer design will also be considered for the capacity analysis. These criteria include:

- Matching crowns at junctions of side sewers and trunk sewers.
- Pipe Material (*Note: Material is tracked in the model, but roughness values are what impact the hydraulic analysis*):

Diameter (inches)	Material
24 and larger	Fully lined reinforced concrete pipe (RCP)
Between 12 and 24	Vitrified clay pipe (VCP). Polyvinyl chloride (PVC) pipe larger than 12 inches in diameter may be used upon approval by the Director of Public Works/City Engineer.
12 and smaller	VCP or PVC SDR 26

- Pipe Alignment: Generally, 5-foot offset from street centerline on side opposite the storm drain and 8-foot clear distance separation from all other parallel facilities.
- Manhole Placement: Manholes shall be located at sewer main or street intersections, at upstream terminal ends of sewer lines, at any change in pipe direction, slope, diameter, or material, and where laterals have the same diameter as the sewer main or are 8 inches or larger. Nominal and maximum spacing of manholes shall be 450 and 500 feet, respectively.

3.2.2 Pump Stations and Force Mains

Pump stations should be designed to have firm capacity to handle the design PWWF; this design criterion was also used for the 2016 Master Plan. The firm capacity criterion is considered appropriate so long as the pump station design accounts for pumping efficiency under both existing and future dry weather flow conditions, "normal" wet weather conditions, and phasing in determining the number and size of pumps.

Criteria recommended for force main design based on the City's standards as well as general industry best practices include:

- Minimum and maximum velocities of 3 and 8 fps, respectively (3 fps would be considered a reasonable minimum velocity to keep solids from settling out if it can be reasonably achieved, and 8 fps would prevent excessive head losses in the force main)
- Hazen-Williams C-value of 100, but must have proper operation at C-value of 120
- Minimum pipe cover of 6 feet

ATTACHMENT 1 – CAPACITY & DESIGN STORM CRITERIA BY CA AGENCY

			Design Storm Criteria				
City/Agency	**Year of Report**	**Performance/Deficiency Criteria**	**Duration (hours)**	**Return Period**	**Temporal Distribution**	**Base Flow Conditions**	**Source of Information/(Consultant)**
Santa Clara County							
Santa Clara	2016	• PDWF: No surcharge • PWWF: - No surcharge allowed for sewers with less than 6 feet of cover. - Surcharge up to 1 foot above crown allowed for sewers with 6 feet or more of cover.	24	10	Santa Clara County Drainage Manual (2007)	Peak-on-Peak	Final Report (RMC)
San Jose	2013	• PDWF: More than 90 percent full (q/Q>0.9) • PWWF: - Sewers < 18-inches: More than 110 percent full (q/Q>1.1) - Sewers >= 18-inches: Surcharge allowed up to 20 percent of the cover over the pipe, with at least 4 feet of freeboard (Interceptor system uses different criteria, not applicable to typical system)	24	10	Santa Clara County Drainage Manual (2007)	Peak-on-Peak	Final Report (RMC)
West Valley Sanitation District	2018	• PDWF: - Sewers <= 15-inches: Maximum d/D of 0.75 - Sewers > 15-inches: No surcharge • PWWF: - Sewers <= 15-inches: No surchage, except on a case-by-case basis for deep pipes. - Sewers > 15-inches: Surcharge allowed up to 1 foot above crown, with at least 5 feet of freeboard	24	10	Santa Clara County Drainage Manual (2007)	Peak-on-Peak	Model Update and Capacity Analysis TM (Woodard & Curran)
Palo Alto	2004	• PWWF: Surcharge allowed up to 1 foot above crown of pipe, with at least 5 feet of freeboard	6	5	Palo Alto IDF data	Peak-on-Peak	Final Report (MWH; by Gisa Ju)
150	2018	• PDWF: No surcharge • PWWF: Surcharge allowed, with at least 5 feet of freeboard. Minimal surcharge of less than 3 inches (over the crown of the pipe) was also not considered deficient, even if the pipe is shallow.	24	10	Santa Clara County Drainage Manual (2007)	Peak-on-Peak	Final Report (Woodard & Curran)
Milpitas	2021	• PWWF: Less than 5 feet of freeboard.	24	10	Santa Clara County Drainage Manual (2007)	Peak-on-Peak	Draft Report posted online (Hydroscience)
City of Los Altos	2013	• PWWF: No surcharge	n/a	Between 5 and 10	n/a	Capacity analysis used a diurnal profile with a peaking factor of 5, rather than applying a specific design storm. This was estimated as a 5-10 year event.	Master Plan Report posted online (Brown & Caldwell)
Mountain View	2010	• PWWF: - Sewers 12-inches and smaller: Half-full - Sewers larger than 12-inches: 3/4 full **[Note, Mountain View issued an RFP for a new Master Plan in late 2019 or early 2020; criteria could change]*	Unknown	10	Unknown	Unknown	Capacity assurance section of City's SSMP posted online
Sunnyvale	2023	• PDWF: No surcharge • PWWF: Minimum freeboard = 5 feet (no stormwater scenarios). No overflows allowed (with stormwater scenarios).	24	10	Santa Clara County Drainage Manual (2007)	Peak-on-Peak	Final Report (Woodard & Curran)
Cupertino Sanitary District	2018 Master Plan 2019 Modeling TM	Undefined in Master Plan Report; possibly surcharge	24	10	Santa Clara County Drainage Manual (2007)	Peak-on-Peak	10-Year District-Wide Capital Improvement Project Master Plan (2018); Flow Modeling Analysis Homestead Flume Outfall to City of Santa Clara (2019) (In-house/Mark Thomas)
San Mateo County							
San Carlos	2013	• PWWF: Surcharge allowed, with at least 4 feet of freeboard	24	10	SCS Type 1A	Peak-on-Peak	Final Report (RMC)
San Bruno	2014	• PDWF: No surcharge • PWWF: Surcharge allowed, with at least 4 feet of freeboard	24	10	SCS Type 1A	Peak-on-Peak	Final Report (RMC)
			Design Storm Criteria				
City/Agency	**Year of Report**	**Performance/Deficiency Criteria**	**Duration (hours)**	**Return Period**	**Temporal Distribution**	**Base Flow Conditions**	**Source of Information/(Consultant)**
Pacifica	2011	• PDWF: No surcharge • PWWF: Surcharge allowed, with at least 4 feet of freeboard	24	10	SCS Type 1A	Peak-on-Peak	Final Report (RMC)
Daly City	2009 2015 Update	• PWWF: Surcharge allowed, with at least 5 feet of freeboard	4	5	Nested, basis unknown	Peak-on-Peak to identify deficiencies Peak-on-Average to help prioritize	Capacity Analysis TMs (RMC)
San Mateo	2014	Description in TM unclear. Possibly 3 feet of freeboard.	6	5	Nested based on City or County IDF		Collection System Capacity Analysis TM, contained within City's SSMP posted online (Arcadis)
Alameda County							
Union Sanitary District	2019	• PDWF and PWWF: Minor surcharge (up to about 0.5 foot above crown of pipe) generally considered acceptable	48	10	Historical Storm	Peak-on-Peak	Final Report, Newark Basin (Woodard & Curran)
Hayward	2015	• PDWF: Surcharge allowed, with at least 5 feet of freeboard • PWWF: Surcharge allowed, with at least 3 feet of freeboard	8 days	unspecified	Historical Storm	Actual storm timing. The historical storm chosen had generated the highest flows to treatment plant in recent history and had also been used for the treatment plant master plan.	Final Report (RMC)
San Leandro	2015	• PDWF: No surcharge • PWWF: Surcharge allowed, with at least 4 feet of freeboard	24	10	SCS Type 1A	Peak-on-Peak	Final Report (RMC)
Contra Costa County							
CCCSD	2017	• PDWF: No surcharge • PWWF: Surcharge allowed, with at least 5 feet of freeboard	24	10	Scaled Historical Pattern	Peak-on-Peak	Final Report (Woodard & Curran; Carollo)

Sacramento County							
City of Sacramento	2018	• PWWF: Surcharge allowed up to 2 feet above crown of pipe, with at least 2 feet of freeboard	6	10	Nested based on Sacramento County Drainage Manual	Peak-on-Peak	Final Report (Woodard & Curran)
Sonoma County							
Sonoma County Water Agency	2016	• PDWF: No surcharge • PWWF: Surcharge allowed, with at least 5 feet of freeboard	24	10	SCS Type 1A	Peak-on-Peak	Final Report (RMC)
Southern California							
Orange County Sanitation District	2019	• PDWF: - Maximum d/D of 0.75 for existing pipes - Maximum d/D of 1.0 for lined pipes • PWWF: - Sewers <= 12-inches: No surcharge - Sewers > 12-inches: Surcharge allowed up to 2 feet above pipe crown, with at least 5 feet of freeboard	24	10	Scaled Historical Pattern	Actual storm timing (Peak-on-Above Average)	Final Report (Woodard & Curran)
City of San Diego	--	• Sewers classified as “critical” if d/D is greater than 100% and the freeboard is less than 2 feet. • Sewers classified as “semi-critical” if d/D is greater than 100% and the freeboard is greater than 2 feet. • Sewers classified as “non-critical” if d/D is less than or equal to 100%.	--	10	--	--	OCSD Strategic Model Development TM
City of Santa Ana	2016	• PDWF: - Sewers < 12-inches: Maximum d/D of 0.50 - Sewers >= 12-inches: Maximum d/D of 0.75 • PWWF: - Sewers < 12-inches: No surcharge - Sewers >= 12-inches: Surcharge allowed up to 2 feet above crown, with at least 5 feet of freeboard	24	10	Scaled Historical Pattern	Actual storm timing (Peak-on-Above Average)	Final Report (RMC)
			Design Storm Criteria				
City/Agency	**Year of Report**	**Performance/Deficiency Criteria**	**Duration (hours)**	**Return Period**	**Temporal Distribution**	**Base Flow Conditions**	**Source of Information/(Consultant)**
City of Fullerton	2009	• PDWF and PWWF: Surcharge allowed up to 2 feet above crown, with at least 5 feet of freeboard	24	10	Scaled Historical Pattern	Actual storm timing (Peak-on-Above Average)	Final Report (RMC)
City of Escondido	--	• PDWF: - Sewers <= 12-inches: Maximum d/D of 0.50 - Sewers > 12-inches: Maximum d/D of 0.75 • PWWF: - Sewers <= 12-inches: Maximum d/D of 0.75 - Sewers > 12-inches: Maximum d/D of 0.75	--	5, 10	--	--	OCSD Strategic Model Development TM
City of Chula Vista	--	• PWWF: - Sewers <= 12-inches: Maximum d/D of 0.70 - Sewers > 12-inches: Maximum d/D of 0.85	--	--	--	--	OCSD Strategic Model Development TM

APPENDIX H: SIPHON LINING ASSUMPTIONS

USNODE	USNODE_FLAG	SUFFIX	DSNODE	DSNODE_FLAG	ASSETID	ASSETID_FLAG	MATERIAL	MATERIAL_FLAG	FUTURE LINING?	WIDTH_EXISTING	WIDTH_FLAG_EXISTING	WIDTH_LINED	WIDTH_FLAG_LINED	2024 CCTV_Structural Quick Rating
S103-19	SPH2	1	S103-16		103-00008	SPH2	VCP	GIS	Yes	24	RD	22.808	RN	
S103-19	SPH2	2	S103-16		103-00049	SPH2	VCP	GIS	Yes	12	RD	11.406	RN	
S103-20	SPH3	1	S103-18		103-00007	SPH3	VCP	GIS	No	17.3	RE24	17.3	RE24	
S103-20	SPH3	2	S103-18		103-00047	SPH3	VCP	GIS	No	23.2	RE24	23.2	RE24	
S103-20	SPH3	3	S103-18		103-00048	SPH3	VCP	GIS	No	22.4	RE24	22.4	RE24	
S14-61	SPH1	1	S14-62		14-00027	GIS	VCP	GIS	Yes	8	RD	7.406	RN	4132
S14-65	SPH1	1	S15-62		15-00061	GIS	CIP	RN	Yes	8	RN	7.406	RN	4331
S20-16(2)	SPH1	2	S20-17(2)		20-00032	GIS	PE	GIS	No	13.49	RN	13.49	RN	
S20-26D1	SPH2	1	S20-26D3		20-00059	GIS	PE	GIS	No	20.23	RN	20.23	RN	
S20-26D2	SPH2	2	S20-26D4		20-00058	GIS	PE	GIS	No	20.23	RN	20.23	RN	
S22-64	SPH1	2	S22-102		22-00114	GIS	CIP	RN	Yes	8	RN	7.406	RN	
S23-15	SPH2	1	S23-14		23-00023	GIS	VCP	GIS	Yes	8	RN	7.406	RN	
S23-15	SPH2	2	S23-14		23-00094	GIS	VCP	GIS	Yes	12	MU	11.406	RN	
S31-24	SPH1	1	S31-25		31-00029	SPH1	DIP	RN	Yes	24	MU	22.808	RN	
S32-2	SPH2	1	S32-102		32-00118	GIS	PVC	RN	No	10	RD	10	RD	0000
S32-2	SPH2	2	S32-102		32-00120	GIS	PVC	RN	No	8	RN	8	RN	0000
S33-9	SPH1	1	S33-10		33-00059	SPH1	CIP	RN	Yes	8	MU	7.406	RN	
S42-30	SPH1	2	S42-31		42-00051	GIS	CIP	RN	Yes	6	M2	5.406	RN	
S46-114	SPH2	1	S46-115	SPH2	46-00132	GIS	HDPE	RD	No	5.35	RN	5.35	RN	0000
S46-114W	SPH2	1	S46-115	SPH2			HDPE	RD	No	5.35	RN	5.35	RN	0000
S52-116	SPH2	1	S52-119		52-00146	GIS	HDPE	RN	No	10.29	RN	10.29	RN	
S52-116	SPH2	2	S52-119		52-00147	GIS	HDPE	RN	No	10.29	RN	10.29	RN	
S52-123	SPH2	1	S52-124		52-00136	GIS	HDPE	RN	No	6.96	RN	6.96	RN	2700
S52-123	SPH2	2	S52-124		52-00137	GIS	HDPE	RN	No	6.96	RN	6.96	RN	2700
S52-3	SPH1	1	S52-5 (SiphonOutlet)		52-00028	GIS	VCP	GIS	Yes	8	GIS	7.406	RN	
S54-79	SPH2	1	S54-78		54-00044	SPH2	VCP	GIS	Yes	10	MU	9.406	RN	4231
S54-79	SPH2	2	S54-78		54-00094	SPH2	VCP	GIS	Yes	10	MU	9.406	RN	4231
S54-94	SPH2	1	S54-95		54-00092	GIS	HDPE	RN	No	15.17	RN	15.17	RN	
S54-94	SPH2	2	S54-95		54-00093	GIS	HDPE	RN	No	15.17	RN	15.17	RN	
S55-51	SPH2	2	S55-52		55-00056	GIS	HDPE	RN	No	17.5	RN	17.5	RN	2B00
S55-51	SPH2	1	S55-52		55-00055	GIS	HDPE	RN	No	17.5	RN	17.5	RN	2B00
S56-58	SPH2	2	S56-59		56-00062	GIS	HDPE	RN	No	17.51	RN	17.51	RN	2500
S56-58	SPH2	1	S56-59		56-00061	GIS	HDPE	RN	No	17.51	RN	17.51	RN	2500
S62-7D	SPH2	2	S62-12		62-00063	GIS	VCP	GIS	Yes	8	GIS	7.406	RN	
S62-7D!	SPH2	1	S62-12		62-00027	GIS	VCP	GIS	Yes	10	GIS	9.406	RN	
S62-9	SPH1	1	S62-11	RD	62-00025	GIS	DIP	RN	Yes	16	RD	15.108	RN	
S64-34	SPH2	2	S64-36		64-00045	GIS	VCP	GIS	Yes	15	RD	14.108	RN	2900
S64-34	SPH2	1	S64-36		64-00015	SPH1	VCP	GIS	Yes	8	RD	7.406	RN	2900
S67-21	SPH2	1	S67-29	SPH2	67-00015	SPH2	DIP	RD	No	23.17	RN	23.17	RN	3600
S67-21	SPH2	2	S67-29	SPH2	67-00035	SPH2	DIP	RD	No	23.17	RN	23.17	RN	3600
S68-10	SPH2	1	D_S68-7		68-00002	GIS	VCP	GIS	No	23.3	GIS	23.3	GIS	
S68-10	SPH2	2	S68-7		68-00025	GIS	VCP	GIS	No	14.4	GIS	14.4	GIS	
S68-15	SPH1	1	S68-12		68-00012	SPH1	VCP	GIS	No	23.6	RD	23.6	RD	3C00
S68-15	SPH1	2	S68-16		68-00013	SPH1	VCP	GIS	No	23.5	RD	23.5	RD	3C00
S68-9	SPH2	1	D_S68-6		68-00018	GIS	VCP	GIS	No	23.3	GIS	23.3	GIS	
S68-9	SPH2	2	S68-6		68-00026	GIS	VCP	GIS	No	14.5	GIS	14.5	GIS	
S72-12	SPH2	1	S72-11		72-00018	SPH2	CIP	GIS	Yes	20	RD	19.008	RN	
S72-12	SPH2	2	S72-11		72-00051	SPH2	CIP	GIS	Yes	20	SV	19.008	RN	
S85-86	SPH1	1	S85-85		85-00068	GIS	HDPE	RN	No	15.17	RN	15.17	RN	0000
S93-50	SPH2	1	S93-48		93-00014	GIS	VCP	GIS	Yes	12	RD	11.406	RN	3124
S93-50	SPH2	2	S93-48		93-00070	GIS	VCP	GIS	Yes	24	RD	22.808	RN	3124

USNODE	USNODE_FLAG	SUFFIX	DSNODE	DSNODE_FLAG	ASSETID	ASSETID_FLAG	MATERIAL	MATERIAL_FLAG	FUTURE LINING?	WIDTH_EXISTING	WIDTH_FLAG_EXISTING	WIDTH_LINED	WIDTH_FLAG_LINED	2024 CCTV_Structural Quick Rating
S93-51	SPH3	1	S93-49	SPH3	93-00061	GIS	RCP	RE24	No	22.8	RE24	22.8	RE24	
S93-51	SPH3	2	S93-49	SPH3	93-00069	GIS	VCP	GIS	No	16.8	RE24	16.8	RE24	
S93-51	SPH3	3	S93-49	SPH3	93-00071	GIS	RCP	RE24	No	22.8	RE24	22.8	RE24	
S95-45	SPH3	1	S95-44		95-00067	GIS	VCP	GIS	No	17	RE24	17	RE24	3C22
S95-45	SPH3	2	S95-44		95-00150	GIS	VCP	GIS	No	14.3	RE24	14.3	RE24	3C22
S95-45	SPH3	3	S95-44		95-00151	GIS	VCP	GIS	No	17	RE24	17	RE24	3C22
S96-14	SPH2	1	S96-13		96-00014	SPH2	HDPE	RN	No	12.3	RN	12.3	RN	2300
S96-14	SPH2	2	S96-13		96-00090	SPH2	HDPE	RN	No	8.68	RN	8.68	RN	2300

FLAG	Description
SPH1	Single barrel siphon.
SPH2	Twin barrel siphon.
SPH3	Triple barrel siphon.
GIS	Data originated from City's GIS (2023).
RN	Refer to note.
RD	Data originated from record drawing.
RE24	Data originated from Condition Assessment Repairs [CIPP Liners] (data sent by Craig).
MU	Data originated from original Mike Urban model.
SV	Data was surveyed.
M2	Data originated from 2007 Mike Urban model.

Legend for "2024 CCTV_Structural Quick Rating"

Severity grade goes from 1 to 5 with 5 being most severe.

5 – Most significant defect grade. Needs immediate attention. Possible failure within 5 years.

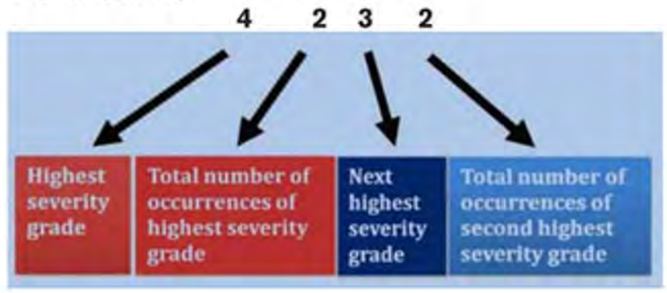
4 – Significant defect grade. Possible failure within 5 to 10 years. Will likely progress to 5 if not addressed.

3 – Moderate defect

2 – Minor to moderate defect

1 – Minor defect grade

PACP Quick Rating



APPENDIX I: SEWER CAPACITY CIP PROJECT COST ESTIMATES, MAPS, AND PROFILES

Capital Improvement Project Summary Table

Project No.[1]	Project ID	Project Location	Pre-Project Pipe Diameter(s)[2]	Project Description	Priority[3]	Flow Confidence Level[4]	Loads Trigger[5]	Design Flow Trigger[5]	Physical Network Trigger[5]	Project Cost[6]
1	**Tracy/Pomeroy/Homestead/ Kiely**	Tracy Dr, Pomeroy Ave, Homestead Rd (S Trunk), Kiely Blvd	10 to 22.8-inch	12313 LF of 15 to 27-inch diameter pipe	7	N/A	LTFL (entitlement)	DWF	UMN	**$26,942,000**
2	**Homestead Road**	N Homestead Trunk from Swallow Wy to Saratoga Creek	18 to 30-inch	6407 LF of 24 to 33-inch diameter pipe	3	3	LTFL	WWF	UMN	**$17,156,000**
3	**Kiely Boulevard**	Orthello Wy to S of El Sobrante St	8-inch	266 LF of 10-inch diameter pipe	6	4	LTFL	WWF	UMN	**$513,000**
4	**Victoria Avenue**	Fowler Ave & Pomeroy Ave to Nobili Ave & Victoria Ave	8-inch	764 LF of 10-inch diameter pipe	6	3	LTFL	WWF	UMN	**$1,337,000**
5	**Cabrillo Avenue**	Halford Ave & Buckley St; St. Lawrence Dr, W of Lawrence Expwy	8-inch	Flow Diversion Weirs only. No pipe	1	3	EL	WWF	UMN	**$154,000**
6	**CMC Basin**	Santa Maria Ave & Francis Ave; Amethyst Dr	8 to 12-inch	3655 LF of 12 to 15-inch diameter pipe	1	1 & 2	EL	WWF	UMN	**$7,263,000**
7	**Bowers Avenue**	Bowers Ave from Chromite Dr to Walsh Ave	25.7-inch	2605 LF of 30-inch diameter pipe	4	5	LTFL	WWF	LMN	**$8,047,000**
8	**Calabazas Trunk**	Calabazas Creek from S of Agate Dr to Central Expwy	22.8 to 27-inch	2791 LF of 18 to 27-inch diameter pipe	2	5	EL	WWF	LMN	**$8,731,000**
9	**Mission College Boulevard**	Mission College Blvd from Freedom Cir to west of Great America Pkwy	12 to 15-inch	1886 LF of 15-inch diameter pipe	5	N/A	LTFL (specific development)	DWF	UMN	**$3,830,000**
12	**GAP West Trunk**	S of West Tasman Dr to Lafayette St	28.5 to 35.7-inch	4810 LF of 36 to 42-inch diameter pipe	3	2	LTFL	WWF	UMN	**$17,781,000**
13	**GAP East Trunk**	Old Glory Ln to S of Bunker Hill Ln; Stars and Stripes Dr	31.4-inch	231 LF of 39-inch diameter pipe	4	2	LTFL	WWF	LMN	**$1,002,000**
14	**Bunker Hill Lane East**	E of Great America Pkwy	6-inch	107 LF of 8-inch diameter pipe	7	N/A	LTFL (entitlement)	WWF	UMN	**$301,000**
15	**Lafayette Street**	N of Calle del Mundo to S of Great America Wy	34.2 to 40.3-inch	2290 LF of 42 to 48-inch diameter pipe	3	2	LTFL	WWF	UMN	**$7,515,000**
									CIP Total:	**$100,572,000**

[1]Projects are numbered from upstream to downstream. Table does not include Project Nos. 10 (Patrick Henry Drive) and 11 (Mission Point) because project costs will be paid for by the developers.

[2]Pre-project pipe diameters include future lining assumptions.

[3]Projects are prioritized based on wastewater flow, design flow, and physical network triggers as well as assumed structural condition.

[4]Rating assigned to validate the need for the project through review of flow monitoring data and reported surcharging and operational issues, and compatibility between flow meter data and the model. Descriptions of the flow confidence levels are as follows: N/A = Not assigned because project would be triggered by entitlement flow or specific development; 1 = Flow meter on or very near to the project reach surcharged during metered storm; 2 = Flow meter on or very near to the project reach confirms flow, but did not surcharge during metered storm; 3 = Flow meter near the project reach (upstream or downstream) confirms flow; 4 = No flow meter near the project reach to confirm flow; 5 = Conflicting flow between meter and model.

[5]EL = Existing Loads; LTFL = Long-Term Future Loads; DWF = Dry Weather Flow; WWF = Wet Weather Flow; UMN = Unlined Model Network; LMN = Lined Model Network.

[6]Costs are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area and are Class 5 estimates (planning level).

Total Cost by Priority Category

Priority	# of Projects	Estimated Capital Cost	%
1	2	$ 7,417,000	7%
2	1	$ 8,731,000	9%
3	3	$ 42,452,000	42%
4	2	$ 9,049,000	9%
5	1	$ 3,830,000	4%
6	2	$ 1,850,000	2%
7	2	$ 27,243,000	27%
Total	13	**$ 100,572,000**	

Project 1: Tracy/Pomeroy/Homestead/Kiely

PROJECT DESCRIPTION

Project No.	1
Project ID	Tracy/Pomeroy/Homestead/Kiely
Project Location	Tracy Dr, Pomeroy Ave, Homestead Rd (S Trunk), Kiely Blvd
Description	12313 LF of 15 to 27-inch diameter pipe
Priority	7
Flow Confidence Level	N/A
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Dry Weather Flow (DWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$26,942,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii) Project also includes installation of a weir at manhole S22-55 to divert the influent flows from Homestead Rd (S Trunk) and Pomeroy Ave sewers to Homestead Rd (S Trunk).
	(iv) Deficiency would be caused by Agilent Technologies historic entitlement flow (0.95 mgd). Project should be implemented before parcel begins to discharge its entitled flow.
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

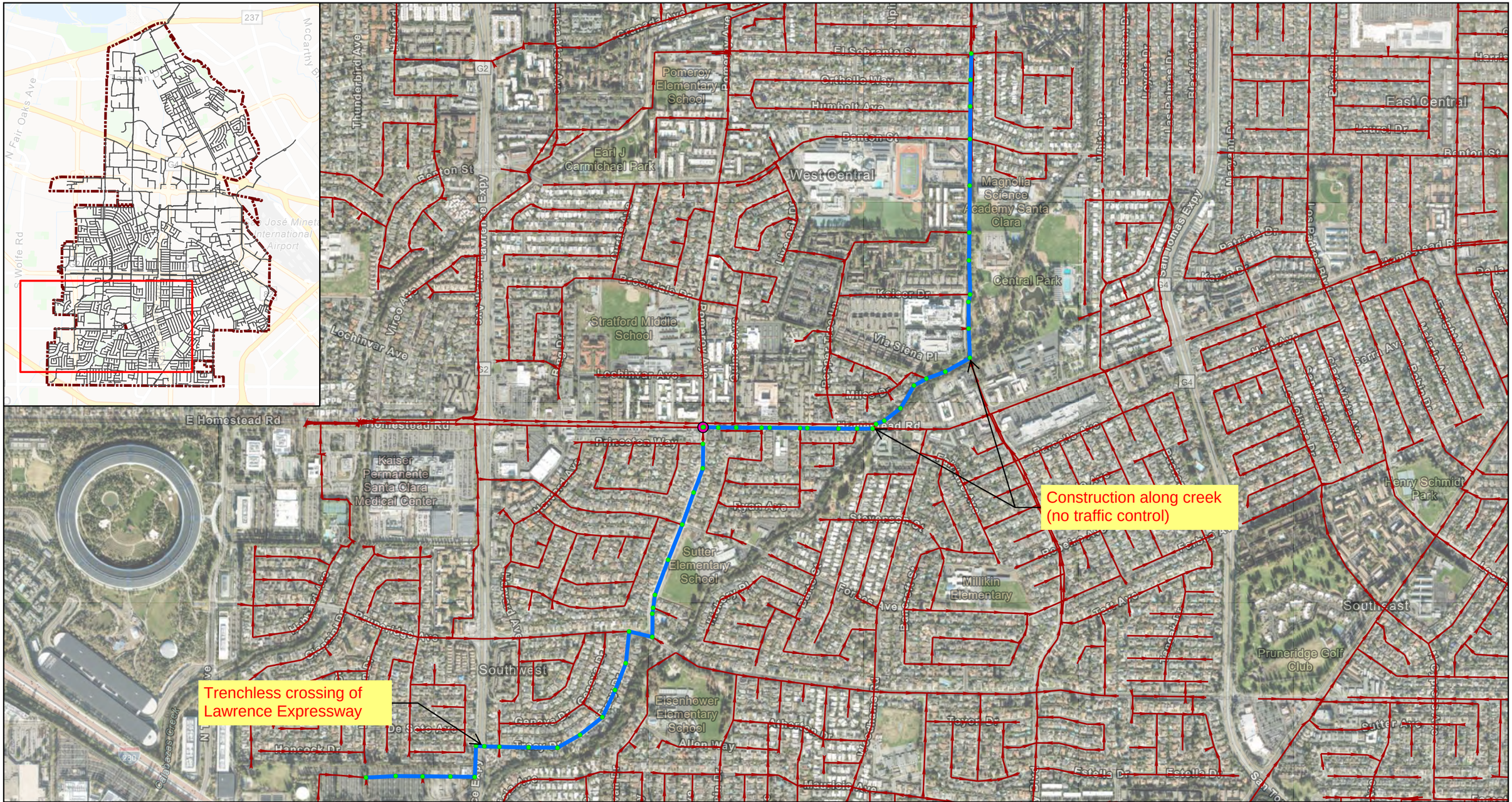
PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S10-79	S10-80	10	15	305	0.16	11	0.56	1.66	1.46	1.49	3.06	$804			$804	$ 244,898
S10-80	S11-83	10	15	264	0.31	9	0.78	2.31	1.46	1.49	3.55	$804			$804	$ 212,497
S11-83	S11-76	10	15	337	0.47	9	0.97	2.85	1.46	1.49	3.45	$804			$804	$ 270,787
S11-76	S11-77	10	15	93	0.51	10	1.01	2.97	1.46	1.49	3.52	$804			$804	$ 74,450
S11-77	S11-78	10	15	164	0.44	9	0.94	2.77	1.46	1.49	3.85	$804	PTGAB	30.00	$1,922	$ 314,514
S11-78	S11-80	10	15	319	0.48	7	0.98	2.88	1.47	1.49	3.80	$804	PTGAB	30.00	$1,922	$ 612,687
S11-80	S11-81	10	15	316	0.55	7	1.05	3.08	1.47	1.49	3.85	$804			$804	$ 253,903
S11-81	S11-70	10	15	283	0.87	8	1.32	3.89	1.47	1.49	4.51	$804			$804	$ 227,532
S11-70	S11-67	10	15	311	1.21	8	1.56	4.59	1.47	1.50	4.15	$804			$804	$ 249,883
S11-67	S11-60	10	15	325	0.70	8	1.18	3.49	1.48	1.51	3.08	$804			$804	$ 261,139
S11-60	S11-50	10	15	319	0.31	8	0.79	2.34	1.48	1.51	3.44	$804			$804	$ 256,315
S11-50	S11-41	10	15	346	0.42	8	0.92	2.70	1.48	1.51	3.87	$804			$804	$ 278,104
S11-41	S11-42	10	15	260	0.27	9	0.73	2.17	1.53	1.59	3.91	$804			$804	$ 209,281
S11-42	S11-30	10	15	257	0.50	9	1.00	2.96	1.53	1.59	3.10	$804			$804	$ 206,950
S11-30	S11-29	10	15	65	0.48	8	0.98	2.88	1.53	1.59	3.91	$804			$804	$ 52,421
S11-29	S11-19	10	15	142	0.64	9	1.13	3.34	1.53	1.59	3.48	$804			$804	$ 114,168
S11-19	S11-10	10	15	405	1.00	9	1.41	4.16	1.54	1.60	4.80	$804			$804	$ 325,700
S11-10	S22-93	10	15	414	1.09	10	1.48	4.35	1.54	1.60	4.81	$804			$804	$ 332,534
S22-93	S22-80	10	15	372	0.51	11	1.01	2.97	1.62	1.69	3.82	$804			$804	$ 299,249
S22-80	S22-74	10	15	284	0.52	10	1.02	3.02	1.62	1.69	2.71	$804			$804	$ 227,934
S22-74	S22-69	10	15	269	0.21	10	0.65	1.92	1.62	1.70	3.42	$804			$804	$ 216,115
S22-55	S22-53	15	15	9	0.95	11	8.92	4.07	2.20	2.28	5.14	$804			$804	$ 7,075
S22-53	S22-56	10	15	159	0.95	11	1.93	4.07	2.20	2.28	4.37	$804			$804	$ 127,595
S22-56	S22-57	10	15	195	0.62	11	1.12	3.30	2.20	2.28	4.41	$804			$804	$ 157,102
S22-57	S22-58	10	15	278	0.64	11	1.13	3.33	2.20	2.28	4.02	$804			$804	$ 223,190
S22-58	S22-59	10	15	89	0.55	11	1.05	3.10	2.21	2.29	3.74	$804			$804	$ 71,556
S22-59	S22-60	10	15	332	0.42	10	0.92	2.71	2.21	2.29	3.33	$804			$804	$ 266,526
S22-60	S22-61	10	15	79	0.16	10	0.57	1.69	2.22	2.31	4.48	$804			$804	$ 63,757
S22-61	S22-62	10	15	339	0.47	9	0.97	2.85	2.22	2.31	3.91	$804			$804	$ 272,315
S22-62	S22-63	10	15	205	0.47	9	0.97	2.86	2.22	2.31	3.86	$804			$804	$ 164,820
S22-63	S22-64	10	15	168	0.45	9	0.95	2.79	2.23	2.32	4.47	$804			$804	$ 135,152
S22-52	S23-21	20	24	96	0.68	15	7.36	12.03	7.62	7.83	5.16	$1,039			$1,039	$ 99,744
S23-21	S23-18	20	24	223	0.45	15	6.02	9.84	7.62	7.83	5.40	$1,039			$1,039	$ 231,801
S23-18	S23-19	20	24	289	0.52	15	6.42	10.50	7.62	7.83	5.77	$1,039			$1,039	$ 300,375
S23-19	S23-12	20	24	154	0.68	15	7.36	12.03	7.62	7.83	5.38	$1,039			$1,039	$ 159,590
S23-12	S23-13	20	24	221	0.49	15	6.25	10.22	7.63	7.85	5.78	$1,039			$1,039	$ 229,619
S23-13	S23-14	20	24	307	0.63	15	7.07	11.56	7.63	7.85	4.93	$1,039			$1,039	$ 319,181
S23-14	S23-6	23	27	322	0.33	15	7.36	11.55	8.40	8.95	4.40	$1,089			$1,089	$ 350,222
S23-6	S23-88	23	27	290	0.25	15	6.44	10.09	8.43	9.00	4.90	$1,089			$1,089	$ 316,028
S23-88	S23-4	23	27	84	0.25	15	6.43	10.09	8.48	9.04	5.64	$1,089			$1,089	$ 91,040
S23-4	S23-1	23	27	371	0.51	15	9.09	14.25	8.56	9.14	5.76	$1,089			$1,089	$ 404,019
S23-1	S33-79	23	27	305	0.62	14	10.02	15.71	8.56	9.14	5.66	$1,089			$1,089	$ 332,363
S33-79	S33-75	23	27	511	0.51	14	9.07	14.23	8.67	9.26	5.46	$1,089			$1,089	$ 556,370
S33-75	S33-63	23	27	507	0.45	14	8.54	13.39	8.67	9.26	5.04	$1,089			$1,089	$ 552,341
S33-63	S33-50	23	27	359	0.40	14	8.12	12.73	9.12	9.85	5.42	$1,089			$1,089	$ 390,624
S33-50	S33-41	23	27	289	0.42	14	8.30	13.01	9.12	9.85	5.76	$1,089			$1,089	$ 314,394
S33-41	S33-33	23	27	286	0.52	14	9.21	14.44	9.12	9.85	4.98	$1,089			$1,089	$ 311,890

Total Baseline Pipe Construction Cost	$	10,762,552
Total Trenchless Installation Cost	$	927,201
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure (1)	$	45,000
Lateral Reconnection Cost (Approx. 130)	$	65,000
Modify Existing Manholes Cost (Approx. 22)	$	385,000
Baseline Construction Cost:	**$**	**12,184,753**
Dewatering	$	415,215
Bypass Pumping	$	1,168,975
Remove & Replace Factor	$	584,488
Traffic Control (10%)	$	1,168,975
Pavement Restoration (T-trench)	$	267,617
Subtotal:	**$**	**15,790,023**
Mobilization/Demobilization (5% of subtotal)	$	789,501.14
Estimated Construction Cost Subtotal:	**$**	**16,579,524**
Contingencies (30% of construction subtotal)	$	4,973,857.21
Estimated Construction Cost:	**$**	**21,553,381**
Engineering and Inspection (25% of construction cost)	$	5,388,345
Estimated Capital Improvement Cost:	**$**	**26,942,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)

Figure Exported: 8/18/2025 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2024_Report.aprx



Project 1
Tracy/Pomeroy/ Homestead/Kiely

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Proposed Weir
- Project Sewers
- Other Modeled Sewers

(8-in) (Existing Diameter)
10-in Proposed Diameter

0 0.13 0.25 0.5 Miles

N

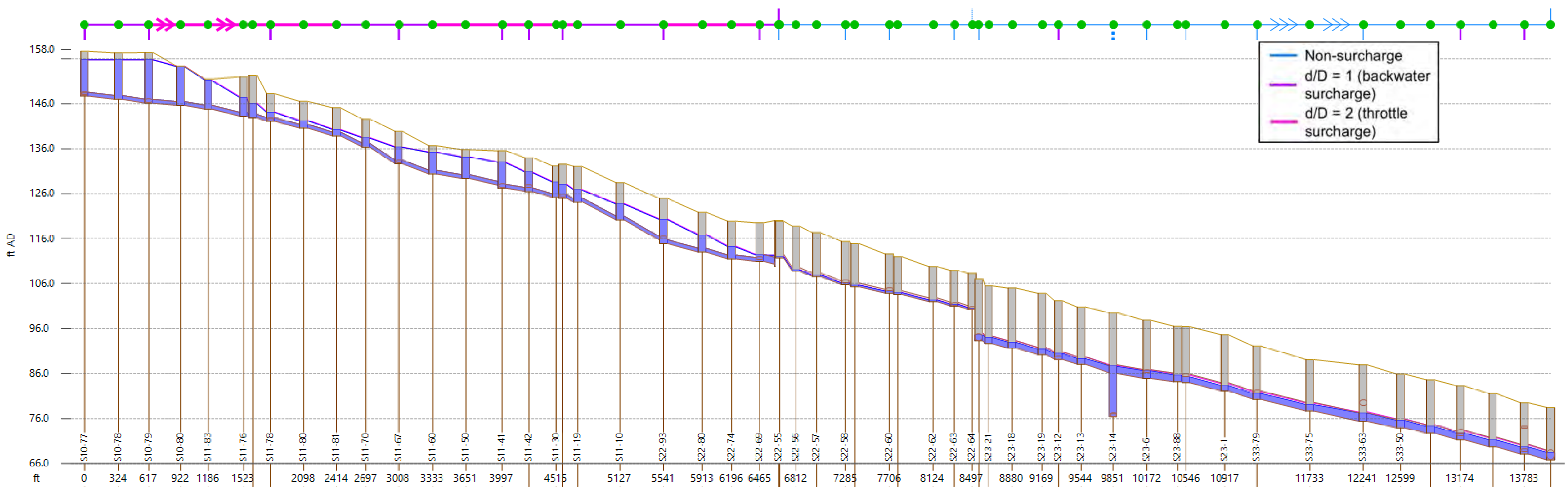
Project #: 0012307.00
Map Created: July 2024

Woodard & Curran

Project 1: Tracy/Pomeroy/Homestead/Kiely

Capacity Deficiency Profile View

Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network

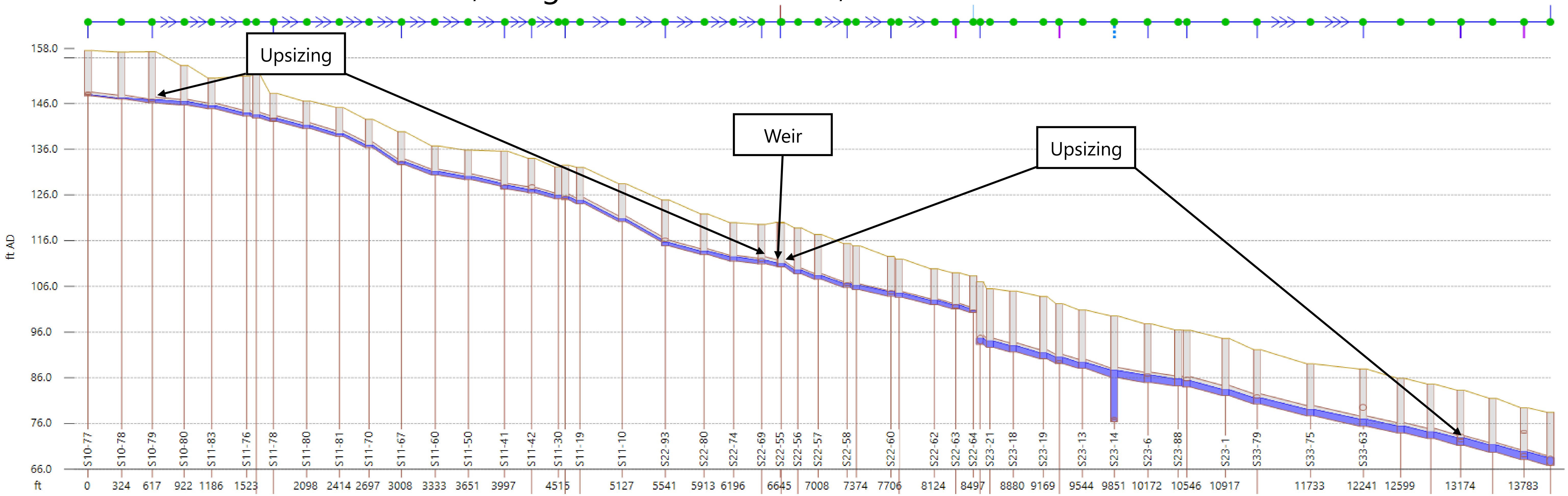


Link	Conduit mate	width (in)	length (ft)	pfc (MGD)	us inv (ft AD)	ds inv (ft AD)	surc	DS flow (MGD)	DS velocity (ft/s)
-	VCP	10.0	323.8	0.66	-	-	1.00	-	0.901
-	VCP	10.0	293.6	0.75	-	-	1.00	-	0.271
-	VCP	10.0	304.6	0.56	-	-	2.00	-	3.302
-	VCP	10.0	-	0.78	-	-	2.00	-	-
-	VCP	10.0	336.8	0.97	-	-	2.00	1.4800	3.706
-	-	-	-	-	-	-	-	-	-
-	VCP	10.0	318.7	0.98	-	-	2.00	-	3.275
-	VCP	10.0	315.8	1.05	-	-	2.00	-	3.789
-	VCP	10.0	283.0	1.32	-	-	1.00	-	4.105
-	VCP	10.0	310.8	1.56	-	-	1.00	-	3.428
-	VCP	10.0	324.8	1.18	-	-	1.00	-	2.749
-	VCP	10.0	318.8	0.79	-	-	2.00	-	2.846
-	VCP	10.0	345.9	0.92	-	-	2.00	1.0575	3.718
-	VCP	10.0	-	0.73	-	-	2.00	-	-
-	VCP	10.0	-	1.00	-	-	2.00	-	-
-	-	-	-	-	-	-	-	-	-
-	VCP	10.0	405.1	1.41	124.180	120.150	1.00	1.2433	4.345
-	VCP	10.0	413.6	1.48	120.150	115.660	1.00	1.2468	4.250
-	VCP	10.0	372.2	1.01	-	-	2.00	1.3421	3.379
-	VCP	10.0	283.5	1.02	-	-	2.00	-	3.496
-	VCP	10.0	-	0.65	-	-	2.00	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	VCP	10.0	277.6	1.13	-	-	0.36	-	2.264
-	VCP	10.0	331.5	0.92	-	-	0.48	-	1.615
-	VCP	10.0	338.7	0.97	-	-	0.39	0.2948	2.341
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	RCP	20.0	-	6.02	-	-	0.78	-	-
-	RCP	20.0	289.1	6.42	-	-	0.74	-	5.217
-	-	-	-	-	-	-	-	-	-
-	VCP	20.0	-	6.25	-	-	0.76	-	-
-	VCP	20.0	307.2	7.07	-	-	0.91	-	4.341
-	RCP	22.8	321.6	7.36	-	-	0.85	-	4.018
-	RCP	22.8	290.2	6.44	-	-	0.84	-	4.502
-	RCP	22.8	371.0	9.09	83.990	82.110	0.65	6.8350	5.672
-	RCP	22.8	305.2	10.02	-	-	0.67	-	5.257
S33-79.1	RCP	22.8	510.9	9.07	80.230	77.650	0.71	6.9573	5.041
S33-75.1	RCP	22.8	507.2	8.54	77.650	75.380	0.95	6.9501	4.206
-	RCP	22.8	358.7	8.12	75.380	73.930	0.93	8.2795	5.084
-	RCP	22.8	288.7	8.30	-	-	0.83	-	5.499
-	RCP	22.8	286.4	9.21	-	-	0.78	-	5.396
-	RCP	25.7	307.1	12.33	-	-	0.68	-	5.859
-	RCP	25.7	301.2	12.62	-	-	0.70	-	5.703
-	RCP	25.7	-	-	-	-	0.74	-	-

Node	ground (ft AD)	flood dep (ft)
-	-	-4.825
S33-75	89.040	-10.046
S33-63	87.890	-
- (all other nodes)	-	-

Project 1: Tracy/Pomeroy/Homestead/Kiely
Project Solution Profile View

Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	Conduit mate	width (in)	length (ft)	pfc (MGD)	us inv (ft AD)	ds inv (ft AD)	surc	DS flow (MGD)	DS velocity (ft/s)
-	VCP	10.0	323.8	0.66	-	-	0.19	-	1.022
-	VCP	10.0	293.6	0.75	-	-	0.79	-	0.278
-	VCP	15.0	304.6	1.66	-	-	0.59	-	3.068
-	VCP	15.0	-	2.31	-	-	0.59	-	-
-	VCP	15.0	336.8	2.85	-	-	0.53	1.4866	3.447
-	-	-	-	-	-	-	-	-	-
-	VCP	15.0	318.7	2.88	-	-	0.51	-	3.818
-	VCP	15.0	315.8	3.08	-	-	0.49	-	3.874
-	VCP	15.0	283.0	3.89	-	-	0.43	-	4.532
-	VCP	15.0	310.8	4.59	-	-	0.46	-	4.165
-	VCP	15.0	324.8	3.49	-	-	0.59	-	3.094
-	VCP	15.0	318.8	2.34	-	-	0.59	-	3.451
-	VCP	15.0	345.9	2.70	-	-	0.54	1.5129	3.896
-	VCP	15.0	-	2.17	-	-	0.63	-	-
-	VCP	15.0	-	2.96	-	-	0.61	-	-
-	-	-	-	-	-	-	-	-	-
-	VCP	15.0	405.1	4.16	124.180	120.150	0.43	1.5965	4.853
-	VCP	15.0	413.6	4.35	120.150	115.660	0.43	1.6002	4.864
-	VCP	15.0	372.2	2.97	-	-	0.54	1.6918	3.859
-	VCP	15.0	283.5	3.02	-	-	0.73	-	2.736
-	VCP	15.0	-	1.92	-	-	0.72	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	VCP	15.0	277.6	3.33	-	-	0.67	-	4.032
-	VCP	15.0	331.5	2.71	-	-	0.80	2.2945	3.367
-	VCP	15.0	338.7	2.85	-	-	0.70	2.3144	3.930
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	RCP	24.0	-	9.84	-	-	0.68	-	-
-	RCP	24.0	289.1	10.50	-	-	0.65	-	5.835
-	-	-	-	-	-	-	-	-	-
-	VCP	24.0	-	-	-	-	0.66	-	-
-	VCP	24.0	307.2	11.56	-	-	0.76	-	4.751
-	RCP	27.0	321.6	11.55	-	-	0.73	-	4.458
-	RCP	27.0	290.2	10.09	-	-	0.72	-	4.956
S23-4.1	RCP	27.0	371.0	14.25	83.990	82.110	0.58	9.1363	5.867
-	RCP	27.0	305.2	15.71	-	-	0.60	-	5.729
S33-79.1	RCP	27.0	510.9	14.23	80.230	77.650	0.62	9.2617	5.521
S33-75.1	RCP	27.0	507.2	13.39	77.650	75.380	0.67	9.2628	5.051
-	RCP	27.0	358.7	12.73	75.380	73.930	0.66	9.8512	5.491
-	RCP	27.0	288.7	13.01	-	-	0.65	-	5.811
-	RCP	27.0	286.4	14.44	-	-	0.72	-	4.983
-	RCP	25.7	307.1	12.33	-	-	0.75	-	5.930
-	RCP	25.7	301.2	12.62	-	-	0.77	-	5.770
-	RCP	25.7	-	-	-	-	0.81	-	-

Node	ground (ft AD)	flood dep (ft)
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-7.759
-	-	-9.368
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	92.130	-
S33-75	89.040	-9.994
S33-63	87.890	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

Project 2: Homestead Road

PROJECT DESCRIPTION

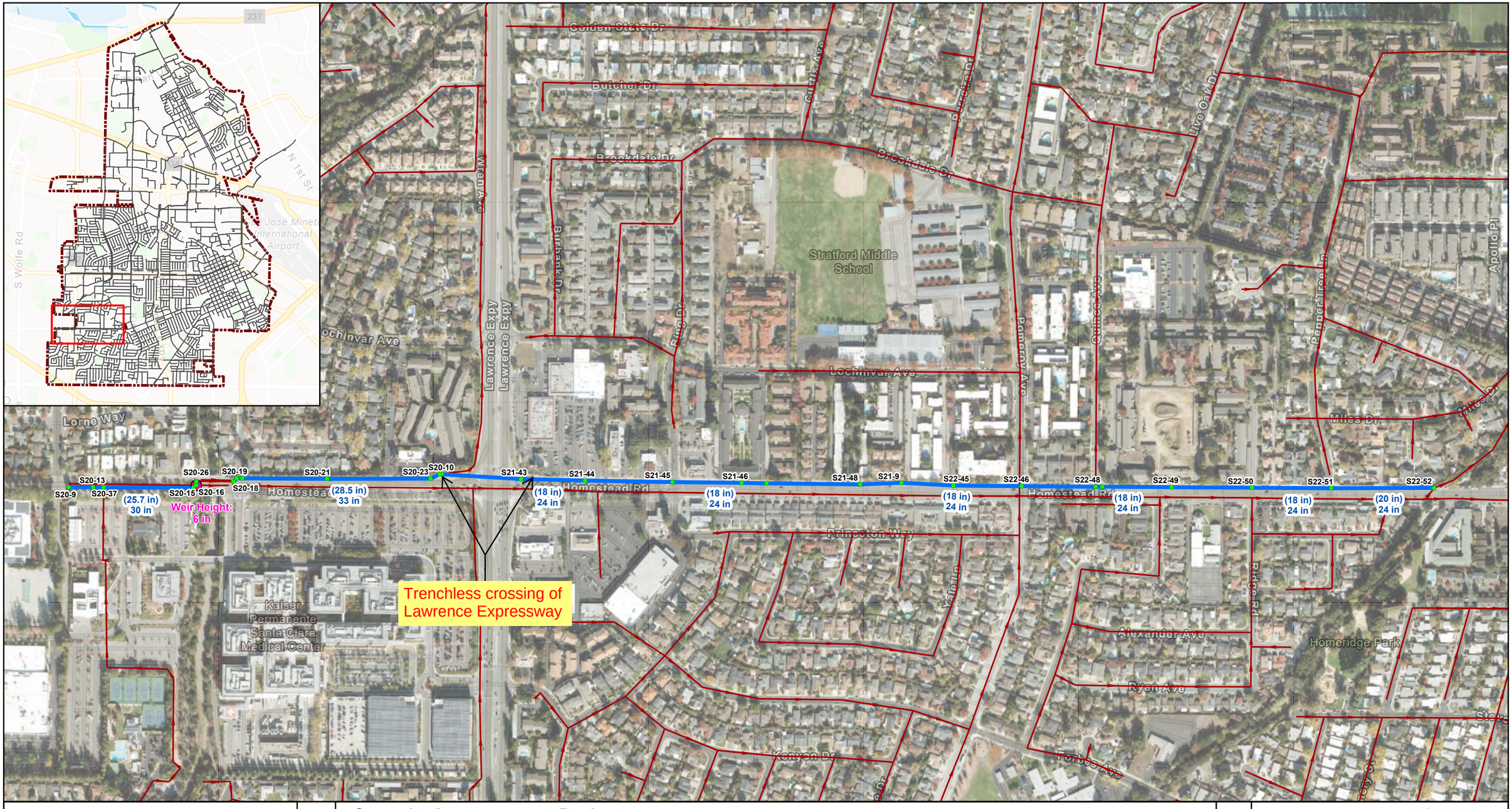
Project No.	2
Project ID	Homestead Road
Project Location	N Homestead Trunk from Swallow Wy to Saratoga Creek
Description	6407 LF of 24 to 33-inch diameter pipe
Priority	3
Flow Confidence Level	3
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$17,156,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii) Project also includes installation of a weir at manhole S20-16 to divert as much flow as possible to maximize capacity within upsized Homestead Rd (S Trunk). See Agilent project.
	(iv) Project would not include improvements to siphon between manholes S20-26 and S20-18. Per City records, siphon is unlined and made of polyethylene (internal diameter 20.2-inch).
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S20-9	S20-13	26	30	111	0.40	12	11.06	16.79	11.65	11.65	5.91	$1,139			$1,139	$ 126,315
S20-13	S20-37	26	30	49	0.40	12	11.07	16.79	11.65	11.65	6.14	$1,139			$1,139	$ 55,469
S20-37	S20-15	26	30	409	0.58	13	13.25	20.10	11.69	11.72	6.48	$1,139			$1,139	$ 465,851
S20-15	S20-26	27	30	33	0.51	14	-23.81	18.96	11.69	11.72	6.03	$1,139		16.00	$1,139	$ 37,815
S20-18	S20-19	30	33	22	0.23	16	12.56	16.20	11.96	11.99	4.17	$1,189		16.00	$1,189	$ 26,515
S20-19	S20-12	29	33	25	0.20	19	10.35	15.29	11.96	11.99	4.10	$1,219		16.00	$1,219	$ 30,475
S20-12	S20-21	29	33	386	0.20	19	10.41	15.37	11.96	11.99	3.72	$1,219			$1,219	$ 470,412
S20-21	S20-23	29	33	473	0.08	14	6.65	9.82	11.96	11.99	5.28	$1,189			$1,189	$ 562,040
S20-23	S20-10	29	33	45	0.11	13	7.71	11.39	11.96	11.99	5.99	$1,189			$1,189	$ 53,505
00_Gate_2	S21-43	29	33	372	0.30	13	12.58	18.59	5.74	5.75	4.61	$1,189	PTGAB	42.00	$2,531	$ 941,840
S21-43	S21-44	18	24	291	0.65	13	5.49	11.82	5.77	5.79	5.74	$1,039			$1,039	$ 302,765
S21-44	S21-45	18	24	399	0.69	14	5.65	12.17	5.79	5.81	5.87	$1,039			$1,039	$ 414,873
S21-45	S21-46	18	24	315	0.73	15	5.80	12.49	5.80	5.82	5.79	$1,039			$1,039	$ 327,701
S21-46	S21-47	18	24	113	0.67	16	5.55	11.95	5.80	5.82	5.80	$1,039			$1,039	$ 117,511
S21-47	S21-48	18	24	427	0.68	16	5.58	12.01	5.80	5.82	5.49	$1,039			$1,039	$ 443,861
S21-48	S21-9	18	24	189	0.59	15	5.19	11.19	5.80	5.82	5.37	$1,039			$1,039	$ 196,059
S21-9	S22-45	18	24	237	0.55	15	5.05	10.86	5.81	5.84	5.40	$1,039			$1,039	$ 246,035
S22-45	S22-46	18	24	312	0.73	16	5.79	12.47	5.82	5.84	5.66	$1,039			$1,039	$ 323,649
S22-46	S22-47	18	24	337	0.63	16	5.38	11.59	5.82	5.85	5.67	$1,039			$1,039	$ 350,039
S22-47	S22-48	18	24	31	0.66	15	5.51	11.87	5.82	5.85	5.78	$1,039			$1,039	$ 31,897
S22-48	S22-49	18	24	315	0.69	15	5.62	12.10	5.92	5.95	5.85	$1,039			$1,039	$ 327,701
S22-49	S22-50	18	24	367	0.68	15	5.58	12.02	5.92	5.95	5.77	$1,039			$1,039	$ 380,897
S22-50	S22-51	18	24	361	0.65	15	5.48	11.80	5.92	5.96	5.73	$1,039			$1,039	$ 375,495
S22-51	S22-52	20	24	469	0.64	16	7.17	11.72	5.92	5.96	4.37	$1,039			$1,039	$ 487,187
S22-52	S23-21	20	24	96	0.68	15	7.36	12.03	7.62	7.83	5.16	$1,039			$1,039	$ 99,744
S23-21	S23-18	20	24	223	0.45	15	6.02	9.84	7.62	7.83	5.40	$1,039			$1,039	$ 231,801

Total Baseline Pipe Construction Cost	$	6,485,611
Total Trenchless Installation Cost	$	941,840
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure (1)	$	45,000
Lateral Reconnection Cost (Approx. 21)	$	10,500
Modify Existing Manholes Cost (Approx. 26)	$	455,000
Baseline Construction Cost:	**$**	**7,937,951**
Dewatering	$	103,446
Bypass Pumping	$	742,745
Remove & Replace Factor	$	371,373
Traffic Control (10%)	$	742,745
Pavement Restoration (T-trench)	$	156,576
Subtotal:	**$**	**10,054,836**
Mobilization/Demobilization (5% of subtotal)	$	502,741.80
Estimated Construction Cost Subtotal:	**$**	**10,557,578**
Contingencies (30% of construction subtotal)	$	3,167,273.35
Estimated Construction Cost:	**$**	**13,724,851**
Engineering and Inspection (25% of construction cost)	$	3,431,213
Estimated Capital Improvement Cost:	**$**	**17,156,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 2
Homestead Rd

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter
- Proposed Weir
- Other Modeled Sewers

0 0.03 0.05 0.1 Miles

N

Project #: 0012307.00
Map Created: July 2024

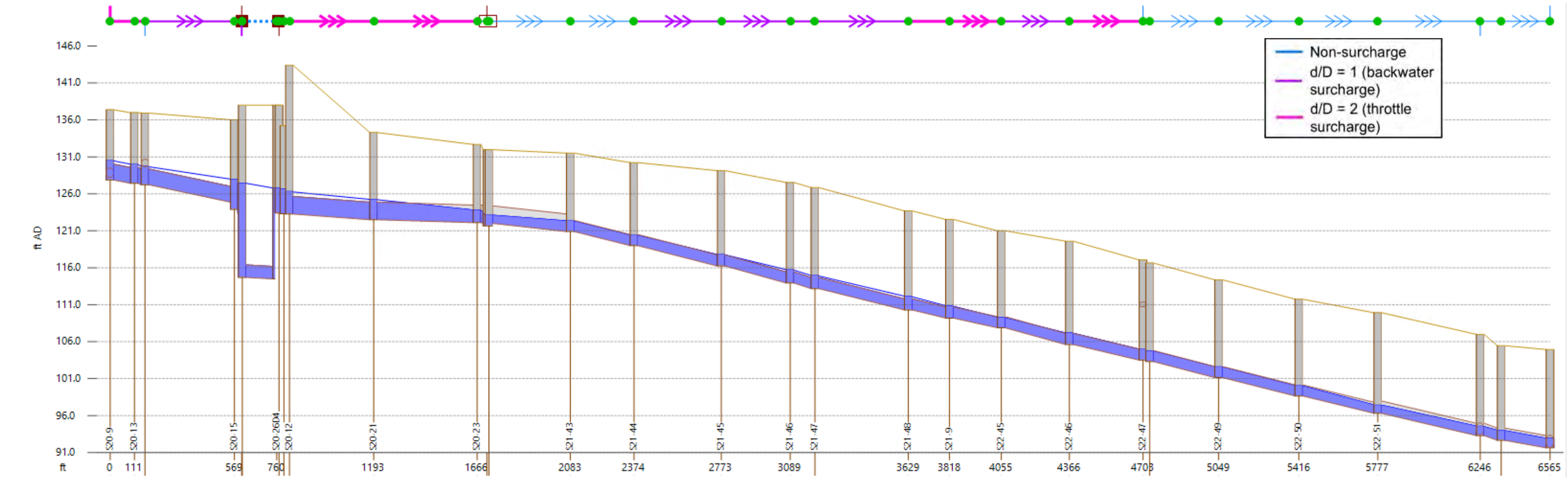
Woodard & Curran

Figure Exported: 7/17/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

Project 2: Homestead Rd

Capacity Deficiency Profile View

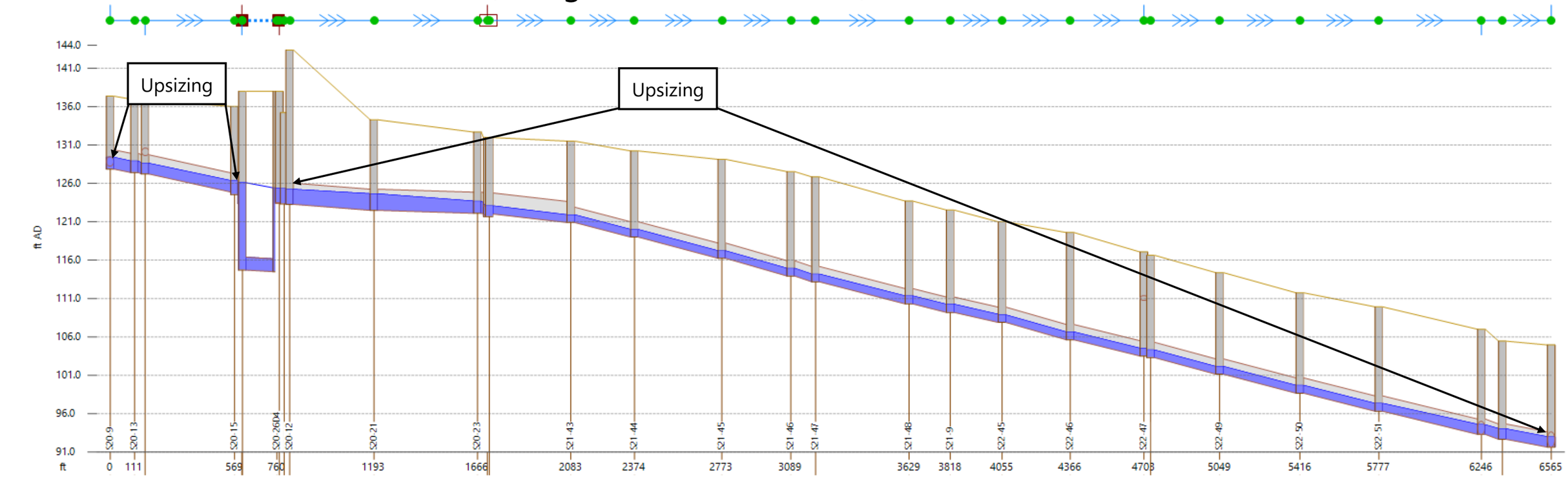
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	-	-	S20-37.1	-	S20-12.1	S20-21.1	00_Gate_2.1	S21-43.1	S21-44.1	S21-45.1	-	S21-47.1	-	S21-9.1	S22-45.1	S22-46.1	S22-48.1	S22-49.1	S22-50.1	S22-51.1	-	S23-21.1
Conduit mate	RCP	-	RCP	PE	RCP	RCP	RCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	RCP	-	RCP
width (in)	25.7	-	25.7	20.2	28.5	28.5	28.5	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	20.0	-	20.0
length (ft)	-	-	409.0	158.0	385.9	472.7	372.1	291.4	399.3	315.4	-	427.2	188.7	236.8	311.5	336.9	315.4	366.6	361.4	468.9	-	223.1
pfc (MGD)	-	-	13.25	3.38	10.41	6.65	12.58	5.49	5.65	5.80	5.55	5.58	5.19	5.05	5.79	5.38	5.62	5.58	5.48	7.17	-	6.02
us inv (ft AD)	-	-	127.220	-	123.270	122.490	122.000	120.900	118.996	116.233	-	113.175	110.293	109.189	107.882	105.617	103.299	101.140	98.663	96.310	-	92.650
ds inv (ft AD)	-	-	124.870	-	122.490	122.100	120.900	118.996	116.233	113.931	-	110.293	109.189	107.882	105.617	103.502	101.140	98.663	96.310	93.300	-	91.640
surc	2.00	-	1.00	2.00	2.00	2.00	0.60	0.94	1.00	1.00	1.00	1.00	2.00	2.00	1.00	2.00	0.97	0.95	0.90	0.77	-	0.78
DS flow (MGD)	-	-	11.1434	5.8906	11.7801	11.7800	5.4006	5.4260	5.4089	5.4081	-	5.4073	5.4083	5.4184	5.4201	5.4208	5.5272	5.5265	5.5283	5.5273	-	5.7408
DS velocity (ft/s)	-	-	6.025	4.083	3.957	5.362	3.646	5.450	5.558	5.324	-	4.975	4.911	5.516	5.210	5.253	5.388	5.312	5.961	5.043	-	4.885

Node	S20-37	S20-15	-	S20-12	S20-21	S20-23	-	S21-43	S21-44	S21-45	S21-46	S21-47	S21-48	S21-9	S22-45	S22-46	-	-	S22-49	S22-50	S22-51	S22-52	-	-
ground (ft AD)	136.920	136.020	-	-	134.280	132.680	-	131.500	130.220	129.130	-	126.840	123.690	-	121.000	119.590	-	-	114.370	111.750	109.910	106.990	-	-
flood dep (ft)	-7.194	-8.084	-	-	-9.040	-8.884	-8.860	-9.163	-9.817	-11.337	-11.797	-11.895	-11.539	-11.668	-11.731	-12.398	-	-	-11.774	-11.703	-12.480	-12.416	-	-

Project 2: Homestead Rd
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	-	-	S20-37.1	-	S20-12.1	S20-21.1	00_Gate_2.1	S21-43.1	S21-44.1	S21-45.1	-	S21-47.1	-	S21-9.1	S22-45.1	S22-46.1	S22-48.1	S22-49.1	S22-50.1	S22-51.1	-	S23-21.1
Conduit mate	RCP	-	RCP	PE	RCP	RCP	RCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	RCP	-	RCP
width (in)	30.0	-	30.0	20.2	33.0	33.0	33.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	-	24.0
length (ft)	-	-	409.0	158.0	385.9	472.7	372.1	291.4	399.3	315.4	-	427.2	188.7	236.8	311.5	336.9	315.4	366.6	361.4	468.9	-	223.1
pfc (MGD)	-	-	20.10	3.38	15.37	9.82	18.59	11.82	12.17	12.49	-	12.01	11.19	10.86	12.47	11.59	12.10	12.02	11.80	11.72	-	9.84
us inv (ft AD)	-	-	127.220	-	123.270	122.490	122.000	120.900	118.996	116.233	-	113.175	110.293	109.189	107.882	105.617	103.299	101.140	98.663	96.310	-	92.650
ds inv (ft AD)	-	-	124.870	-	122.490	122.100	120.900	118.996	116.233	113.931	-	110.293	109.189	107.882	105.617	103.502	101.140	98.663	96.310	93.300	-	91.640
surc	0.61	-	0.59	2.00	0.78	0.78	0.38	0.50	0.49	0.50	0.50	0.52	0.53	0.52	0.51	0.51	0.50	0.51	0.51	0.65	-	0.68
DS flow (MGD)	-	-	11.7184	5.9957	11.9855	11.9851	5.7539	5.7937	5.8074	5.8194	-	5.8206	5.8226	5.8367	5.8431	5.8455	5.9542	5.9539	5.9554	5.9556	-	7.8279
DS velocity (ft/s)	-	-	6.470	4.156	3.721	5.286	4.613	5.749	5.877	5.799	-	5.495	5.373	5.409	5.668	5.677	5.857	5.772	5.739	4.251	-	5.417

Node			S20-37	S20-15		-	S20-12	S20-21	S20-23	-	S21-43	S21-44	S21-45	S21-46	S21-47	S21-48	S21-9	S22-45	S22-46	-	-	S22-49	S22-50	S22-51	S22-52	-	-
ground (ft AD)			136.920	136.020		-	-	134.280	132.680	-	131.500	130.220	129.130	-	126.840	123.690	-	121.000	119.590	-	-	114.370	111.750	109.910	106.990	-	-
flood dep (ft)			-8.311	-9.674		-	-	-9.640	-9.011	-8.912	-9.608	-10.245	-11.932	-12.608	-12.677	-12.363	-12.288	-12.149	-12.961	-	-	-12.229	-12.075	-12.583	-12.389	-	-

Project 3: Kiely Boulevard

PROJECT DESCRIPTION

Project No.	3
Project ID	Kiely Boulevard
Project Location	Orthello Wy to S of El Sobrante St
Description	266 LF of 10-inch diameter pipe
Priority	6
Flow Confidence Level	4
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$513,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii)
	(iv)
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S33-42	S33-35	8	10	266	0.32	8	0.44	0.80	0.31	0.36	2.63	$704			$704	$ 187,053

Total Baseline Pipe Construction Cost	$	187,053
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 6)	$	3,000
Modify Existing Manholes Cost (Approx. 2)	$	35,000
Baseline Construction Cost:	**$**	**225,053**
Dewatering	$	23,913
Bypass Pumping	$	18,705
Remove & Replace Factor	$	9,353
Traffic Control (10%)	$	18,705
Pavement Restoration (T-trench)	$	5,021
Subtotal:	**$**	**300,750**
Mobilization/Demobilization (5% of subtotal)	$	15,037.51
Estimated Construction Cost Subtotal:	**$**	**315,788**
Contingencies (30% of construction subtotal)	$	94,736.34
Estimated Construction Cost:	**$**	**410,524**
Engineering and Inspection(25% ofconstruction cost)	$	102,631
Estimated Capital Improvement Cost:	**$**	**513,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)

Project 3
Kiely Blvd

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

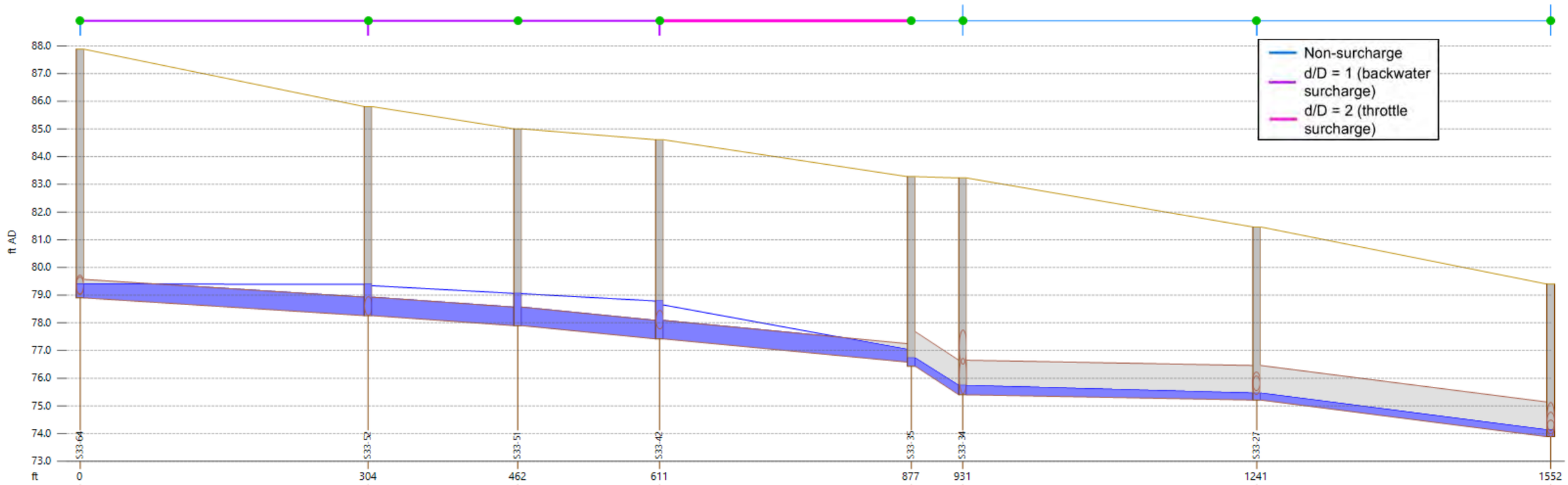
0 0.03 0.05 0.1 Miles

N

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 7/17/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

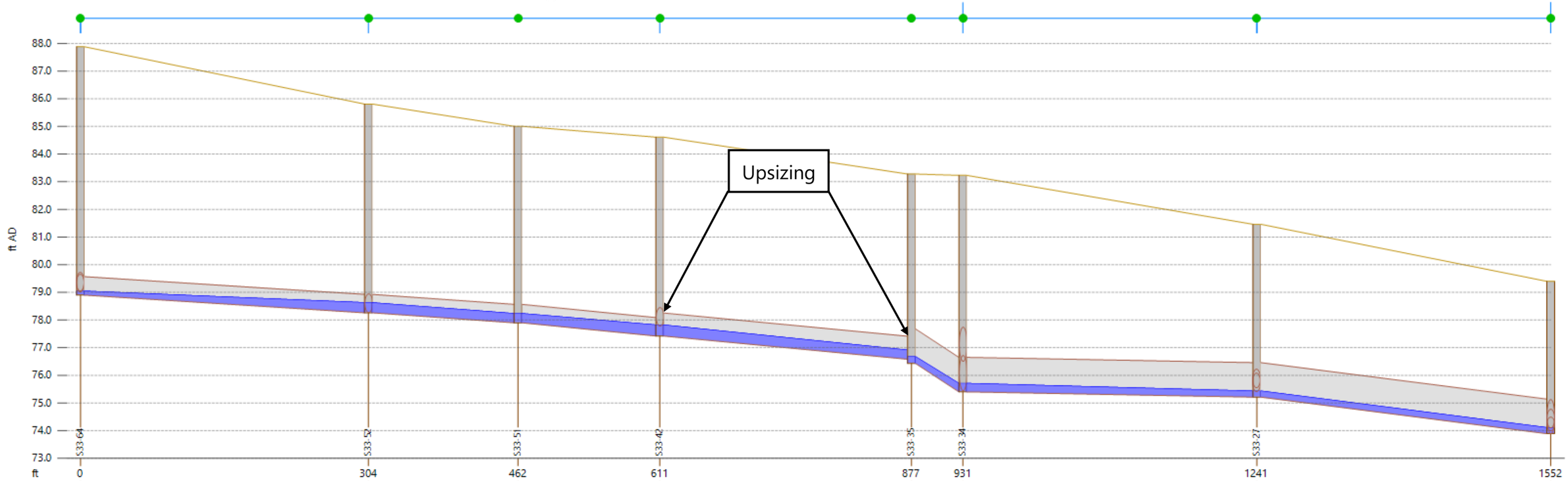
Project 3: Kiely Blvd
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S33-64.1	S33-52.1	S33-51.1	S33-42.1	S33-35.1	S33-34.2	S33-27.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP
width (in)	8.0	8.0	8.0	8.0	15.0	15.0	15.0
length (ft)	303.8	157.9	149.6	265.7	54.2	310.3	310.1
pfc (MGD)	0.36	0.37	0.44	0.44	5.76	1.03	2.72
us inv (ft AD)	78.900	78.260	77.900	77.420	76.430	75.400	75.210
ds inv (ft AD)	78.260	77.900	77.420	76.580	75.400	75.210	73.890
surc	1.00	1.00	1.00	2.00	0.27	0.27	0.20
DS flow (MGD)	0.0293	0.3206	0.3212	0.5881	0.5881	0.1644	0.2187
DS velocity (ft/s)	0.238	1.897	1.341	3.578	3.412	1.488	2.059

Node	S33-64	S33-52	S33-51	S33-42	S33-35	S33-34	S33-27	S33-17
ground (ft AD)	87.881	85.808	85.004	84.610	83.280	83.230	81.460	79.400
flood dep (ft)	-8.483	-6.414	-5.942	-5.823	-6.553	-7.493	-6.003	-5.270

Project 3: Kiely Blvd
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S33-64.1	S33-52.1	S33-51.1	S33-42.1	S33-35.1	S33-34.2	S33-27.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP
width (in)	8.0	8.0	8.0	10.0	15.0	15.0	15.0
length (ft)	303.8	157.9	149.6	265.7	54.2	310.3	310.1
pfc (MGD)	0.36	0.37	0.44	0.80	5.76	1.03	2.72
us inv (ft AD)	78.900	78.260	77.900	77.420	76.430	75.400	75.210
ds inv (ft AD)	78.260	77.900	77.420	76.580	75.400	75.210	73.890
surc	0.55	0.54	0.60	0.48	0.24	0.24	0.18
DS flow (MGD)	0.0299	0.2076	0.2081	0.3562	0.3562	0.1334	0.1687
DS velocity (ft/s)	0.337	1.864	1.487	2.740	2.373	1.426	1.828

Node	S33-64	S33-52	S33-51	S33-42	S33-35	S33-34	S33-27	S33-17
ground (ft AD)	87.881	85.808	85.004	84.610	83.280	83.230	81.460	79.400
flood dep (ft)	-8.838	-7.182	-6.774	-6.793	-6.606	-7.525	-6.030	-5.293

Project 4: Victoria Avenue

PROJECT DESCRIPTION

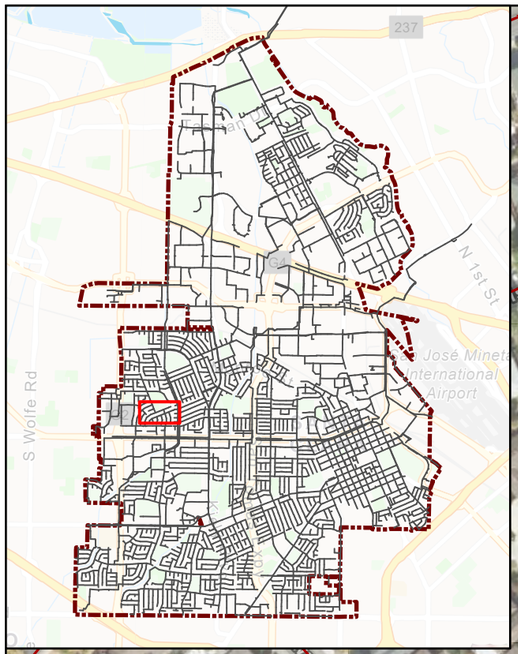
Project No.	4
Project ID	Victoria Avenue
Project Location	Fowler Ave & Pomeroy Ave to Nobili Ave & Victoria Ave
Description	764 LF of 10-inch diameter pipe
Priority	6
Flow Confidence Level	3
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$1,337,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii) Project would also would include abandonment 255 LF of existing 8-inch sewer between Fowler Avenue and Victoria Avenue (from manhole S42-48 to S42-36), which crosses through an easement underneath single-family residential parcels
	(iv) Two pipe segments between manholes S42-113 and S41-53 would have sufficient capacity and therefore were not included in the proposed project. However, considering these pipe segments are located between the proposed project and the recently upsized section downstream of manhole S41-53, the City may wish to consider expanding the project to include these pipes during preliminary design.
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S42-48	S42-47	8	10	253	0.36	8	0.48	0.84	0.31	0.38	2.13	$704			$704	$ 178,042
S42-47	S42-46	8	10	261	0.36	11	0.66	0.84	0.32	0.40	2.11	$704			$704	$ 183,814
S42-46	S42-113	N/A	10	250	0.36	12	N/A	0.85	0.33	0.43	2.21	$704			$704	$ 176,211

Total Baseline Pipe Construction Cost	$	538,067
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 14)	$	7,000
Modify Existing Manholes Cost (Approx. 4)	$	70,000
Baseline Construction Cost:	**$**	**615,067**
Dewatering	$	46,026
Bypass Pumping	$	36,186
Remove & Replace Factor	$	18,093
Traffic Control (10%)	$	53,807
Pavement Restoration (T-trench)	$	14,444
Subtotal:	**$**	**783,622**
Mobilization/Demobilization (5% of subtotal)	$	39,181.12
Estimated Construction Cost Subtotal:	**$**	**822,803**
Contingencies (30% of construction subtotal)	$	246,841.03
Estimated Construction Cost:	**$**	**1,069,644**
Engineering and Inspection(25% ofconstruction cost)	$	267,411
Estimated Capital Improvement Cost:	**$**	**1,337,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 4
Victoria Ave

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Modeled Sewers Included in the Project
- Other Modeled Sewers
- Pipe to be Abandoned

(8-in) (Existing Diameter)
10-in Proposed Diameter

0 0.03 0.05 0.1 Miles

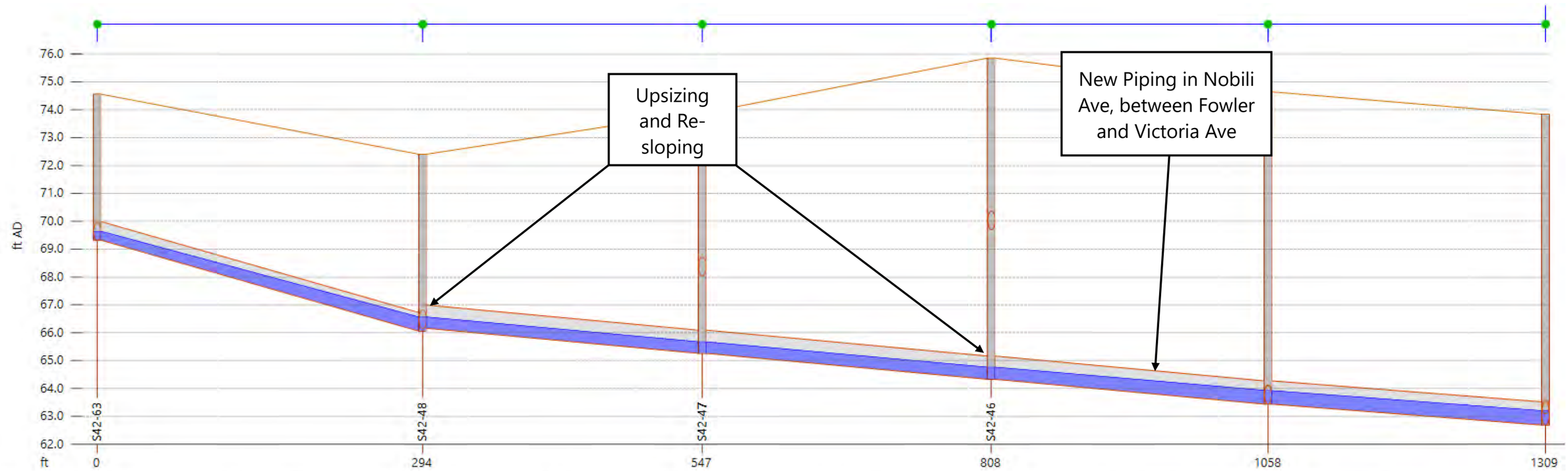
N

Woodard & Curran

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 8/29/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023.aprx

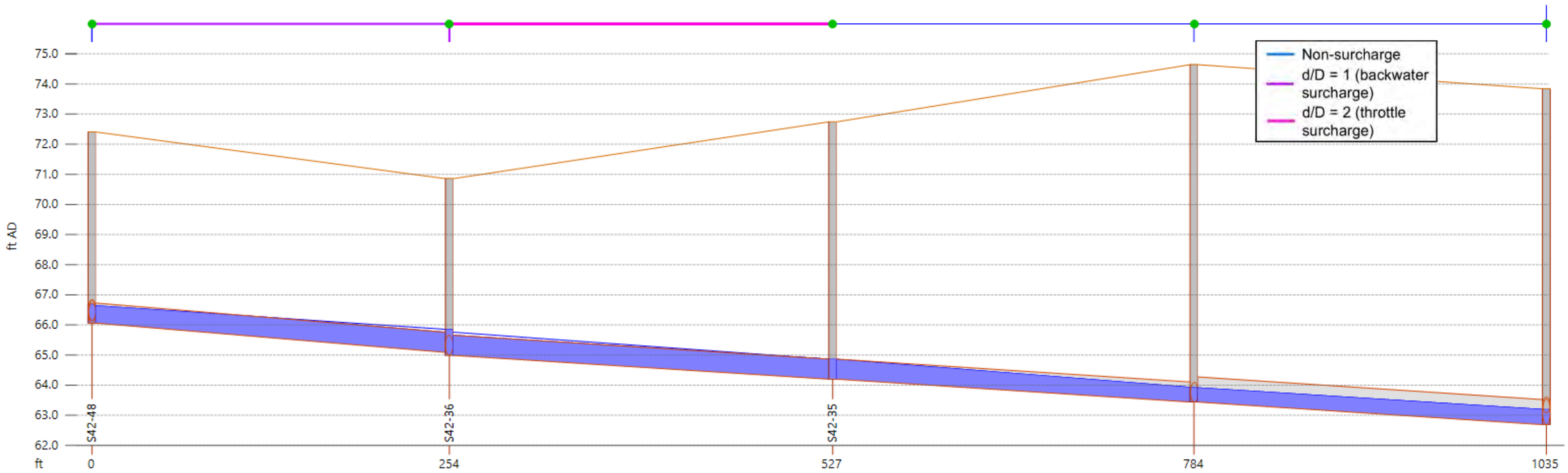
Project 4: Victoria Ave
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S42-63.1	S42-48.1	S42-47.1	S42-46.2	S42-113.1
Conduit mate	VCP	VCP	VCP	UNKN	VCP
width (in)	8.0	10.0	10.0	10.0	10.0
length (ft)	294.1	252.9	261.1	250.3	250.8
pfc (MGD)	0.82	0.84	0.84	0.85	0.77
us inv (ft AD)	69.320	66.160	65.260	64.331	63.440
ds inv (ft AD)	66.060	65.260	64.331	63.440	62.690
surc	0.75	0.49	0.51	0.58	0.61
DS flow (MGD)	0.3530	0.3807	0.3958	0.4253	0.4726
DS velocity (ft/s)	1.954	2.231	2.194	1.997	2.111

Node	S42-63	S42-48	S42-47	S42-46	S42-113	S41-55
ground (ft AD)	74.557	72.405	73.900	75.851	74.640	73.840
flood dep (ft)	-4.926	-5.848	-8.234	-11.096	-10.713	-10.644

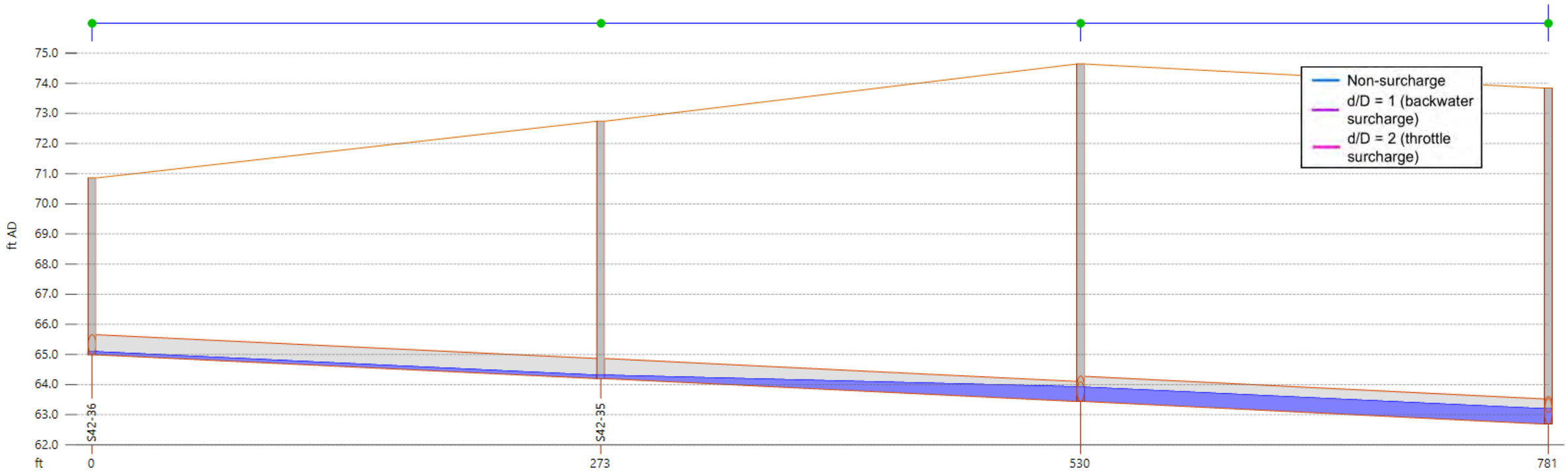
Project 4: Victoria Ave
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S42-48.1	S42-36.1	S42-35.1	S42-113.1
Conduit mate	VCP	VCP	VCP	VCP
width (in)	8.0	8.0	8.0	10.0
length (ft)	254.4	272.7	257.1	250.8
pfc (MGD)	0.48	0.42	0.42	0.77
us inv (ft AD)	66.060	64.990	64.200	63.440
ds inv (ft AD)	65.090	64.200	63.440	62.690
surc	1.00	2.00	0.99	0.60
DS flow (MGD)	0.4240	0.4403	0.4452	0.4695
DS velocity (ft/s)	2.636	2.081	2.517	2.109

Node	S42-48	S42-36	S42-35	S42-113	S41-55
ground (ft AD)	72.405	70.858	72.742	74.640	73.840
flood dep (ft)	-5.724	-5.010	-7.879	-10.715	-10.647

Project 4: Victoria Ave
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S42-36.1	S42-35.1	S42-113.1
Conduit mate	VCP	VCP	VCP
width (in)	8.0	8.0	10.0
length (ft)	272.7	257.1	250.8
pfc (MGD)	0.42	0.42	0.77
us inv (ft AD)	64.990	64.200	63.440
ds inv (ft AD)	64.200	63.440	62.690
surc	0.17	0.73	0.61
DS flow (MGD)	0.0178	0.0227	0.4726
DS velocity (ft/s)	0.698	0.138	2.111

Node	S42-36	S42-35	S42-113	S41-55
ground (ft AD)	70.858	72.742	74.640	73.840
flood dep (ft)	-5.767	-8.429	-10.713	-10.644

Project 5: Cabrillo Avenue

PROJECT DESCRIPTION

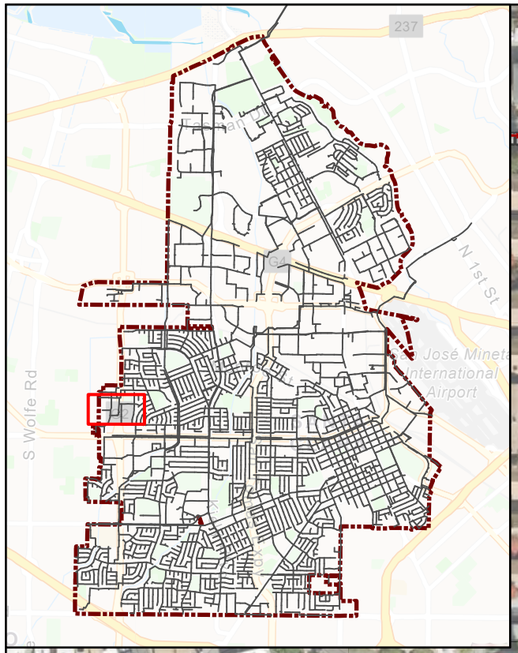
Project No.	5
Project ID	Cabrillo Avenue
Project Location	Halford Ave & Buckley St; St. Lawrence Dr, W of Lawrence Expwy
Description	Flow Diversion Weirs only. No pipe replacement.
Priority	1
Flow Confidence Level	3
Loads Trigger	Existing Loads (EL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$154,000
Comments	(i) Pipes are listed in order from upstream to downstream. (ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy. (iii) Project would include installation of two weirs at manholes S40-16 and S41-38 to divert flow away from capacity deficient sewers along Cabrillo Ave and maximize use of available capacity within existing adjacent sewers. Weirs would be installed at the intersection of Halford Ave and Buckley St and Lawrence Expwy and Saint Lawrence Dr. (iv) Two pipe segments between manholes S42-113 and S41-53 would have sufficient capacity and therefore were not included in the proposed project. However, considering these pipe segments are located between the proposed project and the recently upsized section downstream of manhole S41-53, the City may wish to consider expanding the project to include these pipes during preliminary design. (v) (vi)
Assumptions	(i) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR. (ii)
Alternatives	Upsize existing 8-inch pipes to 12-inch along Cabrillo Avenue from manhole S41-13 to S41-20.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
															$0	$ -

Total Baseline Pipe Construction Cost	$	-
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure (2)	$	90,000
Lateral Reconnection Cost (Approx. 0)	$	-
Modify Existing Manholes Cost (Approx. 0)	$	-
Baseline Construction Cost:	**$**	**90,000**
Dewatering	$	-
Bypass Pumping	$	-
Remove & Replace Factor	$	-
Traffic Control (N/A)	$	-
Pavement Restoration	$	-
Subtotal:	**$**	**90,000**
Mobilization/Demobilization (5% of subtotal)	$	4,500.00
Estimated Construction Cost Subtotal:	**$**	**94,500**
Contingencies (30% of construction subtotal)	$	28,350.00
Estimated Construction Cost:	**$**	**122,850**
Engineering and Inspection(25% ofconstruction cost)	$	30,713
Estimated Capital Improvement Cost:	**$**	**154,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 5
Cabrillo Ave

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Proposed Weir
- Manholes Within the Project Area
- Pipes within the Project Area (not Part of the Project)
- Other Modeled Sewers

0 0.03 0.05 0.1 Miles

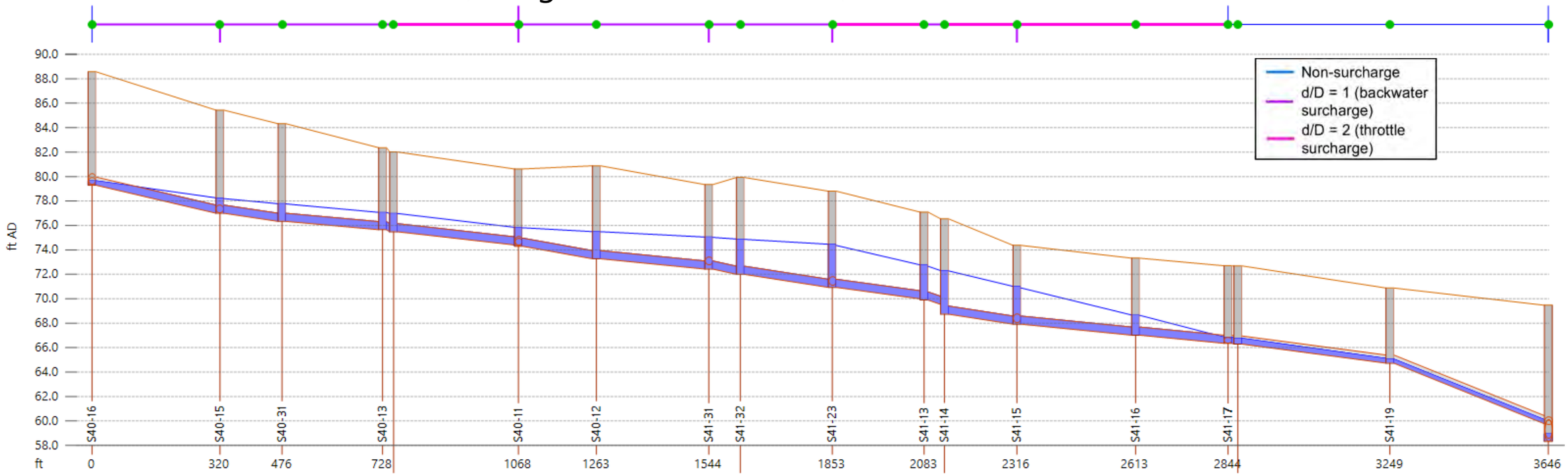
N

Woodard & Curran

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 10/20/2024 By: nbarrerlopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wipC. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

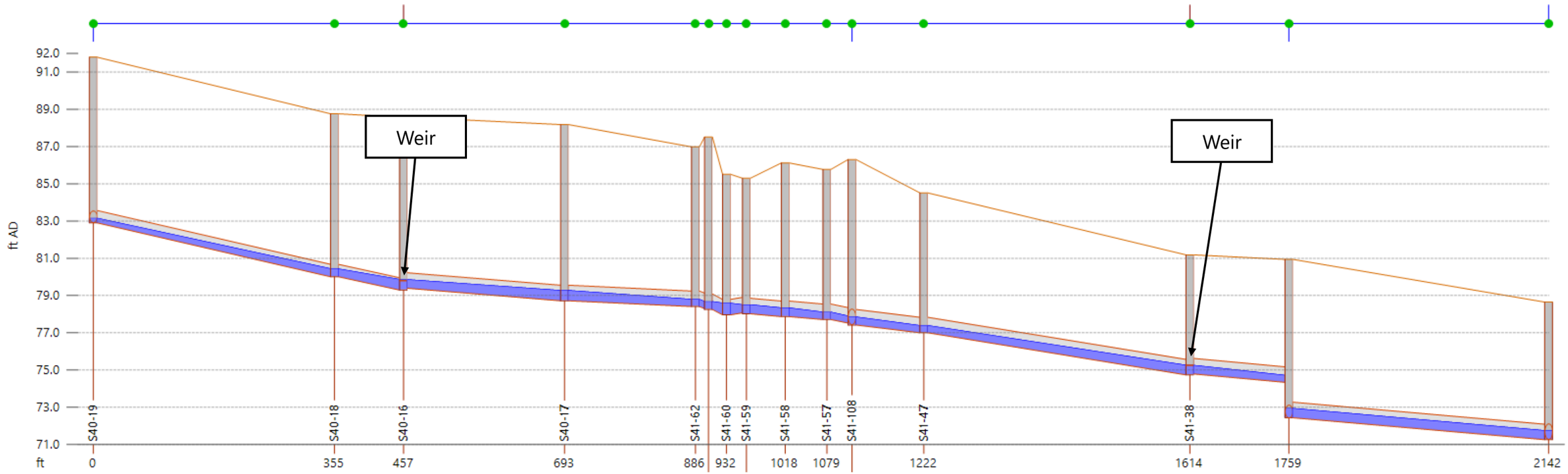
Project 5: Cabrillo Ave
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S40-16.1	S40-15.1	S40-31.1	S40-30.1	S40-11.2	S40-12.1	-	S41-32.1	S41-23.1	-	S41-14.1	S41-15.1	S41-16.1	S41-18.1	S41-19.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	-	VCP	VCP	VCP	VCP	VCP
width (in)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
length (ft)	320.4	155.4	251.7	312.6	195.2	281.4	79.0	230.0	230.1	-	181.3	297.3	231.3	380.7	396.5
pfc (MGD)	0.66	0.51	0.41	0.46	0.57	0.43	0.58	0.53	0.50	-	0.53	0.43	0.42	0.50	0.87
us inv (ft AD)	79.290	77.000	76.330	75.480	74.300	73.270	-	72.000	70.930	-	68.740	67.920	67.020	66.290	64.730
ds inv (ft AD)	77.000	76.330	75.650	74.400	73.270	72.430	-	70.930	69.990	-	67.920	67.020	66.350	64.730	59.770
surc	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	2.00	-	2.00	2.00	2.00	0.70	0.50
DS flow (MGD)	0.3525	0.4006	0.4006	0.4989	0.3167	0.3134	-	0.4026	0.6401	-	0.6429	0.6674	0.6720	0.4138	0.4214
DS velocity (ft/s)	2.110	1.984	2.468	3.272	2.006	2.006	-	1.649	3.368	-	2.527	2.759	3.687	3.099	3.717

Node	S40-16	S40-15	S40-31	S40-13	S40-30	S40-11	S40-12	S41-31	S41-32	S41-23	S41-13	-	S41-15	S41-16	-	S41-18	S41-19	S41-20
ground (ft AD)	88.574	85.436	84.320	82.361	82.009	80.620	80.880	79.342	79.921	78.804	77.090	-	74.370	73.320	72.700	72.690	70.880	69.470
flood dep (ft)	-8.928	-7.182	-6.543	-5.291	-5.025	-4.784	-5.385	-4.293	-5.037	-4.342	-4.331	-	-3.355	-4.656	-5.842	-5.930	-5.818	-10.524

Project 5: Cabrillo Ave
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



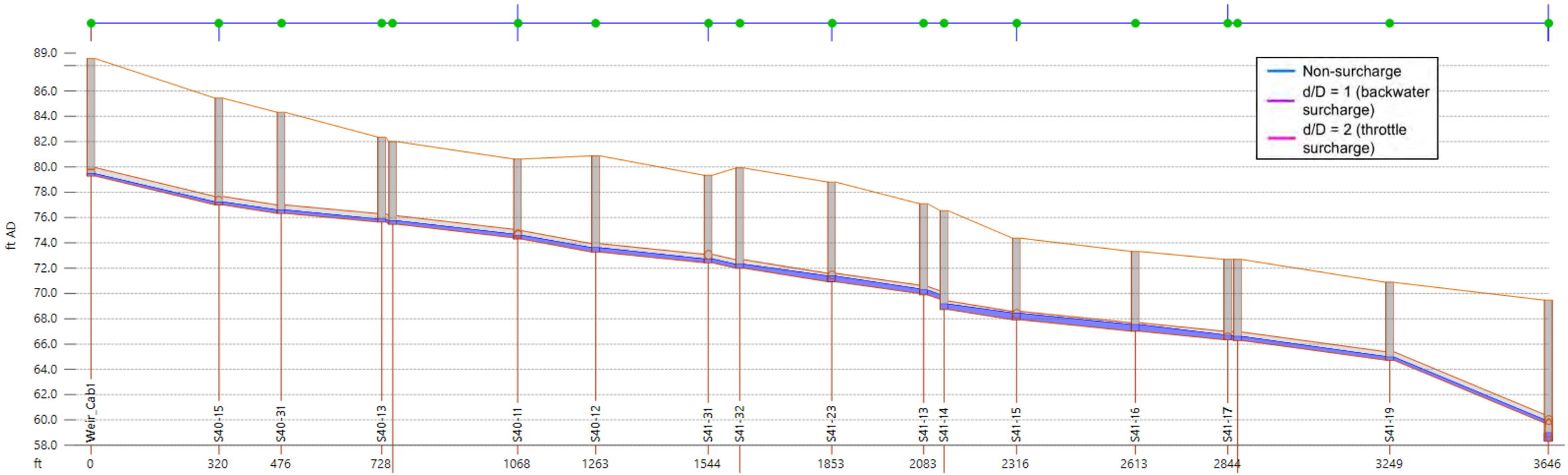
Link	S40-19.1	S40-18.1	S40-16.2	S40-17.1	-	-	-	-	-	-	S41-108.1	S41-47.1	S41-38.2	S41-39.1
Conduit mate	VCP	VCP	VCP	VCP	-	-	-	VCP	VCP	-	VCP	VCP	VCP	VCP
width (in)	8.0	8.0	10.0	10.0	-	-	-	10.0	10.0	-	10.0	10.0	10.0	10.0
length (ft)	354.9	101.8	236.8	192.7	-	-	-	57.1	61.3	-	105.7	391.5	145.6	382.2
pfc (MGD)	0.70	0.66	0.75	0.57	-	-	-	0.72	0.73	-	0.89	1.08	0.79	0.79
us inv (ft AD)	82.900	80.010	79.390	78.720	-	-	-	-	77.870	-	77.420	77.000	74.790	72.440
ds inv (ft AD)	80.010	79.290	78.720	78.410	-	-	-	-	77.710	-	77.000	74.740	74.340	71.260
surc	0.64	0.85	0.65	0.65	-	-	-	0.57	0.55	-	0.51	0.62	0.55	0.60
DS flow (MGD)	0.4327	0.4954	0.4377	0.4526	-	-	-	-	0.4525	-	0.4525	0.4525	0.4516	0.5192
DS velocity (ft/s)	2.841	2.427	1.792	2.879	-	-	-	2.257	2.778	-	2.854	1.984	2.962	2.439

Node	S40-19	S40-18	S40-16	S40-17	S41-62			-	-	-	-	S41-47	S41-38	S41-39	S41-40
ground (ft AD)	91.798	88.761	88.574	88.180	86.984			-	-	-	-	84.510	81.184	80.945	78.649
flood dep (ft)	-8.652	-8.326	-8.723	-8.914	-8.193			-	-	-	-	-7.127	-5.932	-8.007	-6.904

Project 5: Cabrillo Ave

Project Solution Profile View 1 of 2 (*Sewers Along Cabrillo Avenue*)

Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



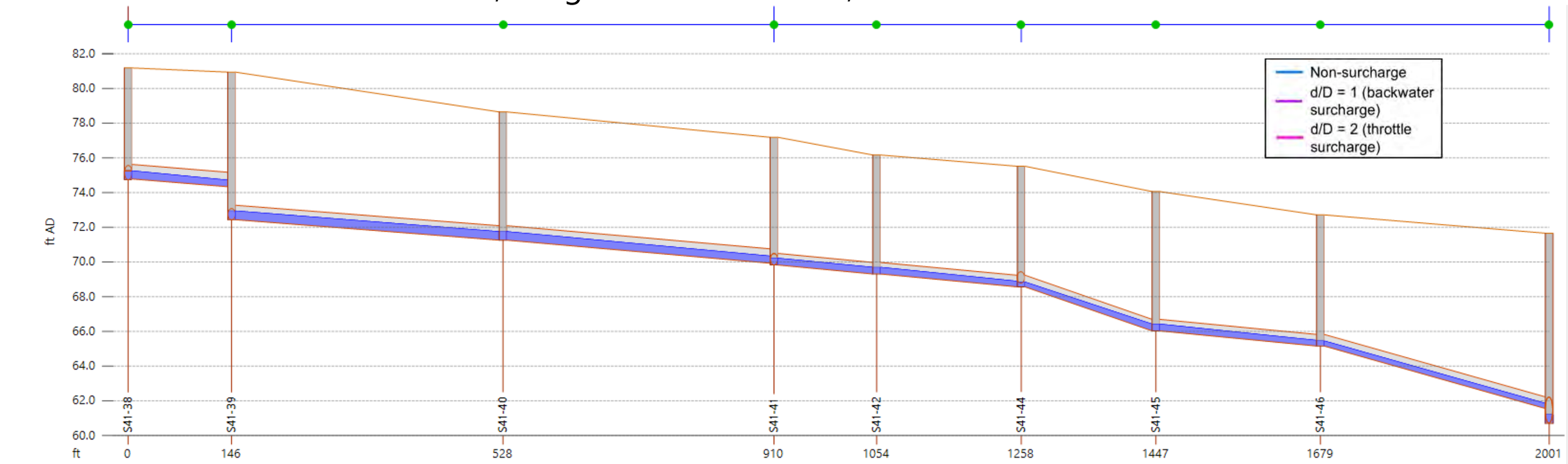
Link	Weir_Cab1.1	S40-15.1	S40-31.1	S40-30.1	S40-11.2	S40-12.1	-	S41-32.1	S41-23.1	-	S41-14.1	S41-15.1	S41-16.1	S41-18.1	S41-19.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	-	VCP	VCP	VCP	VCP	VCP
width (in)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
length (ft)	320.4	155.4	251.7	312.6	195.2	281.4	79.0	230.0	230.1	-	181.3	297.3	231.3	380.7	396.5
pfc (MGD)	0.66	0.51	0.41	0.46	0.57	0.43	0.58	0.53	0.50	-	0.53	0.43	0.42	0.50	0.87
us inv (ft AD)	79.290	77.000	76.330	75.480	74.300	73.270	-	72.000	70.930	-	68.740	67.920	67.020	66.290	64.730
ds inv (ft AD)	77.000	76.330	75.650	74.400	73.270	72.430	-	70.930	69.990	-	67.920	67.020	66.350	64.730	59.770
surc	0.33	0.39	0.39	0.42	0.50	0.50	0.44	0.66	0.63	-	0.78	0.76	0.76	0.45	0.35
DS flow (MGD)	0.0733	0.1219	0.1219	0.2209	0.2021	0.2021	-	0.2029	0.3520	-	0.3548	0.3797	0.3844	0.2067	0.2145
DS velocity (ft/s)	1.138	1.500	1.921	2.488	1.808	2.225	-	1.316	2.919	-	1.894	2.056	3.023	2.427	3.019

Node	-	S40-15	S40-31	S40-13	S40-30	S40-11	S40-12	S41-31	S41-32	S41-23	S41-13	-	S41-15	S41-16	-	S41-18	S41-19	S41-20
ground (ft AD)	88.574	85.436	84.320	82.361	82.009	80.620	80.880	79.342	79.921	78.804	77.090	-	74.370	73.320	72.700	72.690	70.880	69.470
flood dep (ft)	-9.121	-8.215	-7.730	-6.495	-6.273	-6.036	-7.279	-6.629	-7.627	-7.435	-6.833	-	-5.927	-5.792	-6.022	-6.098	-5.919	-10.503

Project 5: Cabrillo Ave

Project Solution Profile View 2 of 2 (*Sewers Downstream of Proposed Diversions*)

Model Run Scenario: Wet Weather, Long-Term Future Load, and Lined Model Network



Link	S41-38.2	S41-39.1	S41-40.1	S41-41.2	S41-42.1	S41-44.1	S41-45.1	S41-46.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP
width (in)	10.0	10.0	10.0	8.0	8.0	8.0	8.0	8.0
length (ft)	145.6	382.2	381.7	144.6	203.5	189.7	231.6	322.2
pfc (MGD)	0.79	0.79	0.84	0.47	0.47	0.90	0.48	0.83
us inv (ft AD)	74.790	72.440	71.260	69.830	69.310	68.570	66.030	65.160
ds inv (ft AD)	74.340	71.260	69.930	69.310	68.570	66.030	65.160	61.560
surc	0.55	0.60	0.58	0.57	0.57	0.58	0.57	0.43
DS flow (MGD)	0.4516	0.5192	0.5302	0.2798	0.2809	0.2893	0.2937	0.3008
DS velocity (ft/s)	2.962	2.439	3.123	2.101	2.699	2.146	2.740	3.236

Node	-	S41-39	S41-40	S41-41	S41-42	S41-44	S41-45	S41-46	S41-37
ground (ft AD)	81.184	80.945	78.649	77.188	76.168	75.517	74.060	72.718	71.660
flood dep (ft)	-5.932	-8.007	-6.904	-6.978	-6.478	-6.679	-7.645	-7.274	-10.461

Project 6: CMC Basin

PROJECT DESCRIPTION

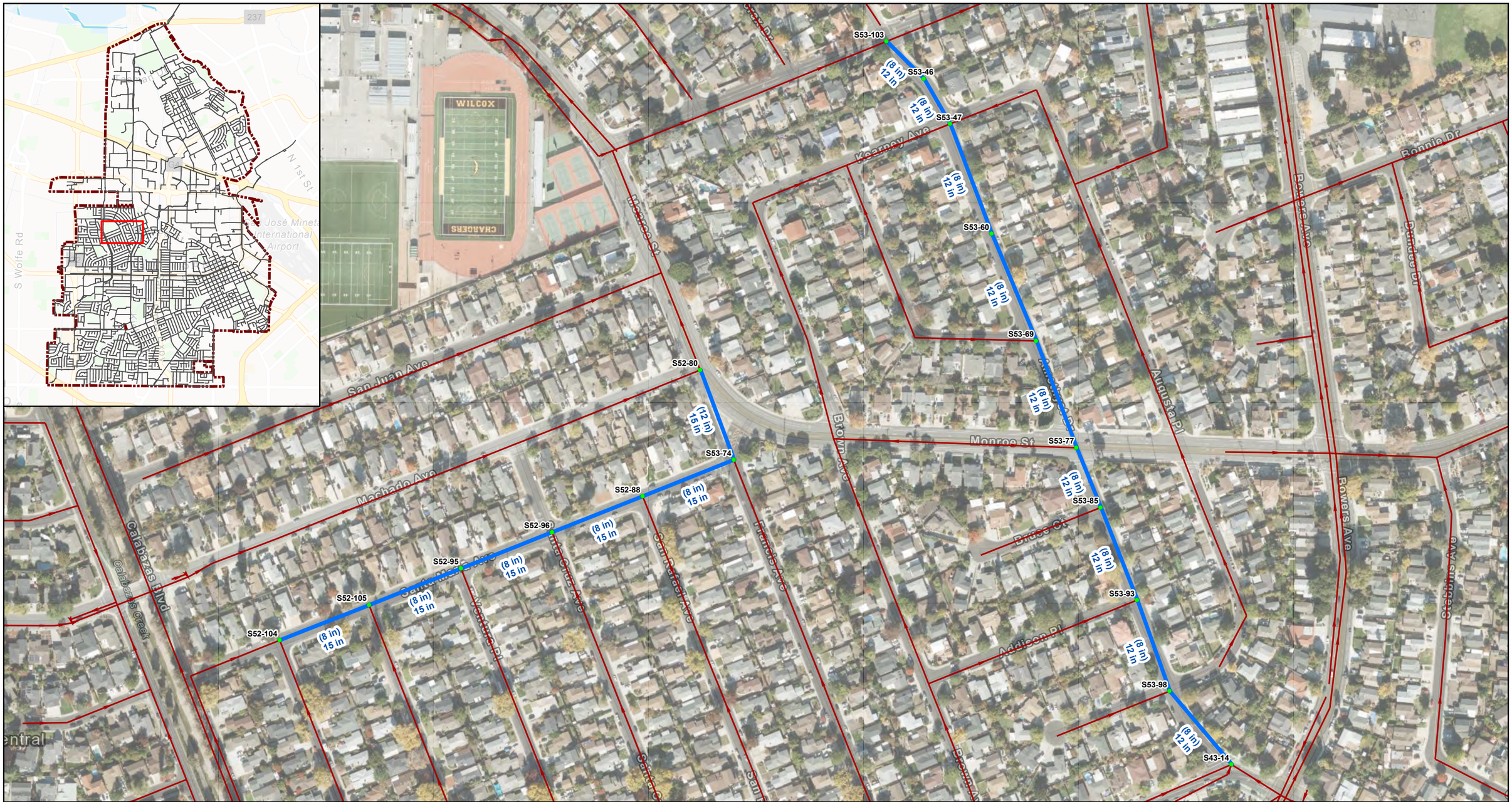
Project No.	6
Project ID	CMC Basin
Project Location	Santa Maria Ave & Francis Ave; Amethyst Dr
Description	3655 LF of 12 to 15-inch diameter pipe
Priority	1
Flow Confidence Level	1 & 2
Loads Trigger	Existing Loads (EL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$7,263,000
Comments	(i) Pipes are listed in order from upstream to downstream. (ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy. (iii) It is recommended that the City conduct infiltration and inflow (I/I) investigations prior to project implementation to attempt to pinpoint and eliminate significant sources of excessive I/I within the CMC Basin, if possible. (iv) Model runs show that the proposed upsizing project would be needed to meet the City's depth to diameter (d/D) ratio criteria. However, it would not meet the City's velocity design criteria under PDWF (i.e., minimum of 2 feet per second) within the upsized 12-inch pipe segments between manholes S43-14 and S53-103 on Amethyst Dr and within the upsized 15-inch pipe segments between manholes S52-104 and S53-74 on Santa Maria Ave. (v) (vi)
Assumptions	(i) New diameter based on pipe replacement. (ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	Eliminate significant sources of excessive I/I. However, model runs show that the rainfall dependent I/I would need to be reduced by at least 50-60% to eliminate the capacity deficiency.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S52-104	S52-105	8	15	252	0.38	9	0.48	2.57	0.09	0.44	1.30	$804			$804	$ 202,447
S52-105	S52-95	8	15	260	0.42	9	0.50	2.69	0.10	0.57	1.30	$804			$804	$ 208,638
S52-95	S52-96	8	15	257	0.35	9	0.46	2.46	0.11	0.68	1.25	$804			$804	$ 206,628
S52-96	S52-88	8	15	256	0.33	9	0.45	2.38	0.13	0.95	0.74	$804			$804	$ 205,422
S52-88	S53-74	8	15	257	0.53	10	0.57	3.03	0.15	1.10	0.56	$804			$804	$ 206,708
S53-74	S52-80	12	15	252	0.75	11	1.99	3.61	0.19	1.57	2.23	$804			$804	$ 202,206
S43-14	S53-98	8	12	251	0.35	8	0.46	1.36	0.04	0.55	1.00	$754			$754	$ 189,556
S53-98	S53-93	8	12	254	0.35	8	0.46	1.36	0.05	0.61	0.97	$754			$754	$ 191,214
S53-93	S53-85	8	12	261	0.31	8	0.43	1.28	0.06	0.70	1.43	$754			$754	$ 196,643
S53-85	S53-77	8	12	169	0.37	8	0.47	1.39	0.06	0.76	1.45	$754			$754	$ 127,652
S53-77	S53-69	8	12	300	0.33	9	0.45	1.32	0.06	0.80	1.22	$754			$754	$ 225,898
S53-69	S53-60	8	12	304	0.37	8	0.47	1.39	0.07	0.84	1.21	$754			$754	$ 229,291
S53-60	S53-47	8	12	308	0.32	8	0.44	1.30	0.07	0.88	1.05	$754			$754	$ 232,157
S53-47	S53-46	8	12	137	0.35	7	0.46	1.36	0.10	1.14	1.72	$754			$754	$ 103,223
S53-46	S53-103	8	12	139	0.35	7	0.46	1.36	0.10	1.14	1.72	$754			$754	$ 104,655

Total Baseline Pipe Construction Cost	$	2,832,339
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 69)	$	34,500
Modify Existing Manholes Cost (Approx. 16)	$	280,000
Baseline Construction Cost:	**$**	**3,146,839**
Dewatering	$	328,932
Bypass Pumping	$	283,234
Remove & Replace Factor	$	141,617
Traffic Control (10%)	$	283,234
Pavement Restoration (T-trench)	$	72,880
Subtotal:	**$**	**4,256,736**
Mobilization/Demobilization (5% of subtotal)	$	212,836.82
Estimated Construction Cost Subtotal:	**$**	**4,469,573**
Contingencies (30% of construction subtotal)	$	1,340,871.96
Estimated Construction Cost:	**$**	**5,810,445**
Engineering and Inspection (25% of construction cost)	$	1,452,611
Estimated Capital Improvement Cost:	**$**	**7,263,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 6
CMC Basin

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

0 0.03 0.05 0.1 Miles

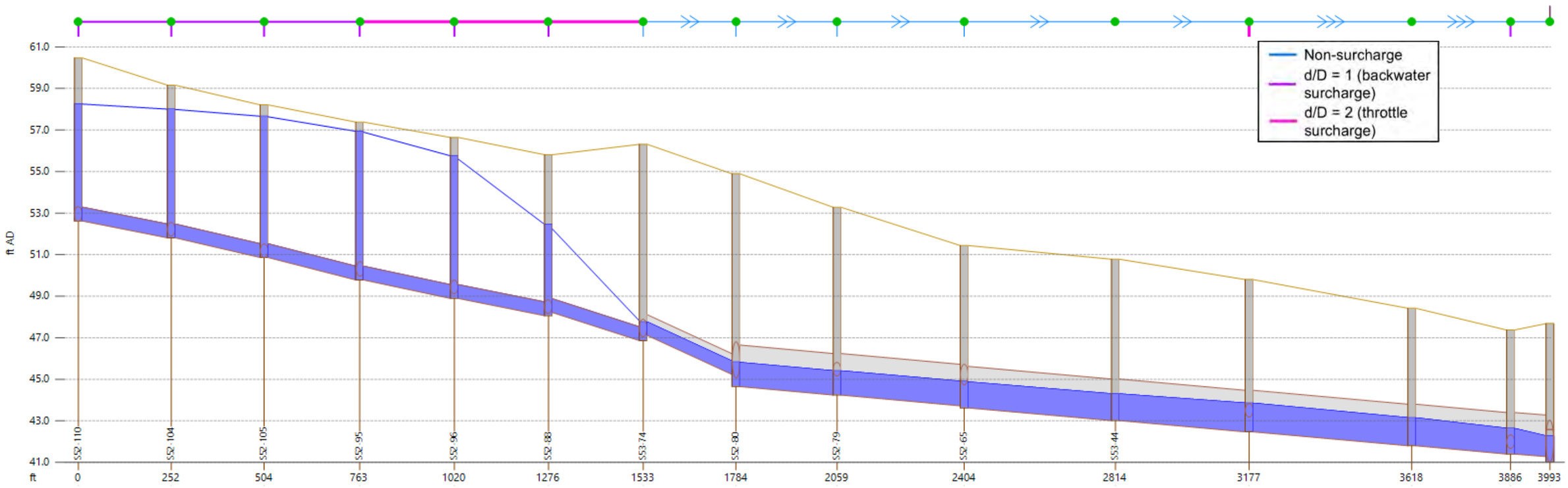
N

Project #: 0012307.00
Map Created: July 2024

Woodard & Curran

Figure Exported: 7/16/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023.aprx

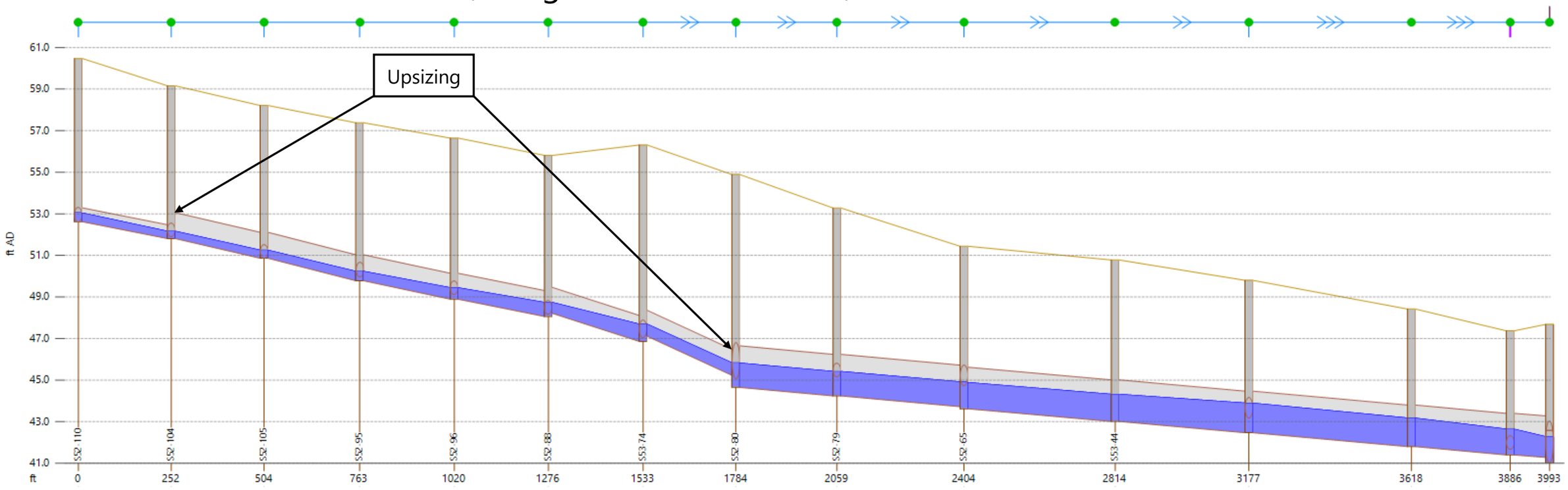
Project 6: CMC Basin - Santa Maria Avenue
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S52-110.1	S52-104.1	S52-105.1	S52-95.1	S52-96.1	S52-88.1	S53-74.1	S52-80.1	S52-79.1	S52-65.1	S53-44.1	S53-103.1	S53-9.1	-
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	PE	PE	PE	PE	PE	PE	PE
width (in)	8.0	8.0	8.0	8.0	8.0	8.0	12.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
length (ft)	252.0	251.8	259.5	257.0	255.5	257.1	251.5	274.5	344.7	410.4	362.7	441.5	267.9	106.9
pfc (MGD)	0.44	0.48	0.50	0.46	0.45	0.57	1.99	5.65	5.68	5.64	5.64	5.70	5.65	4.90
us inv (ft AD)	52.620	51.810	50.860	49.780	48.890	48.210	47.110	44.650	44.240	43.620	43.010	42.470	41.800	41.400
ds inv (ft AD)	51.810	50.860	49.780	48.890	48.060	46.860	45.230	44.240	43.720	43.010	42.470	41.800	41.400	41.280
surc	1.00	1.00	1.00	2.00	2.00	2.00	0.65	0.58	0.59	0.65	0.69	0.69	0.67	0.62
DS flow (MGD)	0.2889	0.3774	0.4747	0.5709	0.8616	1.0161	1.4822	3.5628	3.5951	3.9762	3.9797	4.6972	4.7003	5.0382
DS velocity (ft/s)	1.704	1.872	1.809	2.081	3.244	4.307	4.259	2.891	2.882	2.871	2.675	3.222	3.553	4.990

Node	-	S52-104	S52-105	S52-95	S52-96	S52-88	S53-74	S52-80	S52-79	S52-65	S53-44	S53-103	S53-9	S53-40	-
ground (ft AD)	60.470	59.160	58.210	57.380	56.640	55.810	56.310	54.890	53.280	51.440	50.780	49.800	48.420	47.370	-
flood dep (ft)	-2.210	-1.154	-0.547	-0.441	-0.883	-3.359	-8.542	-9.064	-7.872	-6.534	-6.480	-5.943	-5.271	-4.730	-

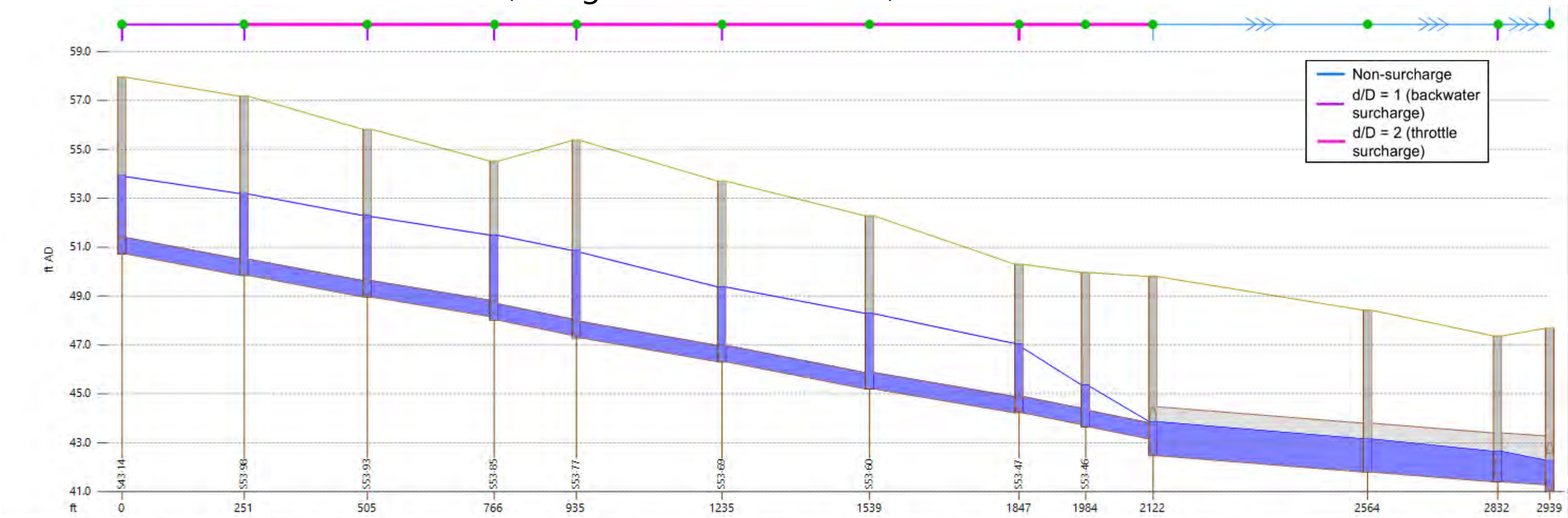
Project 6: CMC Basin - Santa Maria Avenue
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S52-110.1	S52-104.1	S52-105.1	S52-95.1	S52-96.1	S52-88.1	S53-74.1	S52-80.1	S52-79.1	S52-65.1	S53-44.1	S53-103.1	S53-9.1	-
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	PE	PE	PE	PE	PE	PE	PE
width (in)	8.0	15.0	15.0	15.0	15.0	15.0	15.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
length (ft)	252.0	251.8	259.5	257.0	255.5	257.1	251.5	274.5	344.7	410.4	362.7	441.5	267.9	106.9
pfc (MGD)	0.44	2.57	2.69	2.46	2.38	3.03	3.61	5.65	5.68	5.64	5.64	5.70	5.65	4.90
us inv (ft AD)	52.620	51.810	50.860	49.780	48.890	48.210	47.110	44.650	44.240	43.620	43.010	42.470	41.800	41.400
ds inv (ft AD)	51.810	50.860	49.780	48.890	48.060	46.860	45.230	44.240	43.720	43.010	42.470	41.800	41.400	41.280
surc	0.63	0.31	0.36	0.44	0.54	0.67	0.48	0.59	0.60	0.65	0.71	0.71	0.68	0.62
DS flow (MGD)	0.3220	0.4411	0.5672	0.6812	0.9465	1.1017	1.5691	3.5805	3.6129	3.9946	3.9983	4.8694	4.8723	5.0473
DS velocity (ft/s)	2.668	2.098	2.201	2.026	2.171	1.965	4.357	2.892	2.873	2.876	2.683	3.272	3.677	4.993

Node	-	S52-104	S52-105	S52-95	S52-96	S52-88	S53-74	S52-80	S52-79	S52-65	S53-44	S53-103	S53-9	S53-40	-
ground (ft AD)	60.470	59.160	58.210	57.380	56.640	55.810	56.310	54.890	53.280	51.440	50.780	49.800	48.420	47.370	-
flood dep (ft)	-7.419	-6.998	-6.961	-7.149	-7.200	-7.076	-8.619	-9.059	-7.867	-6.527	-6.464	-5.907	-5.246	-4.728	-

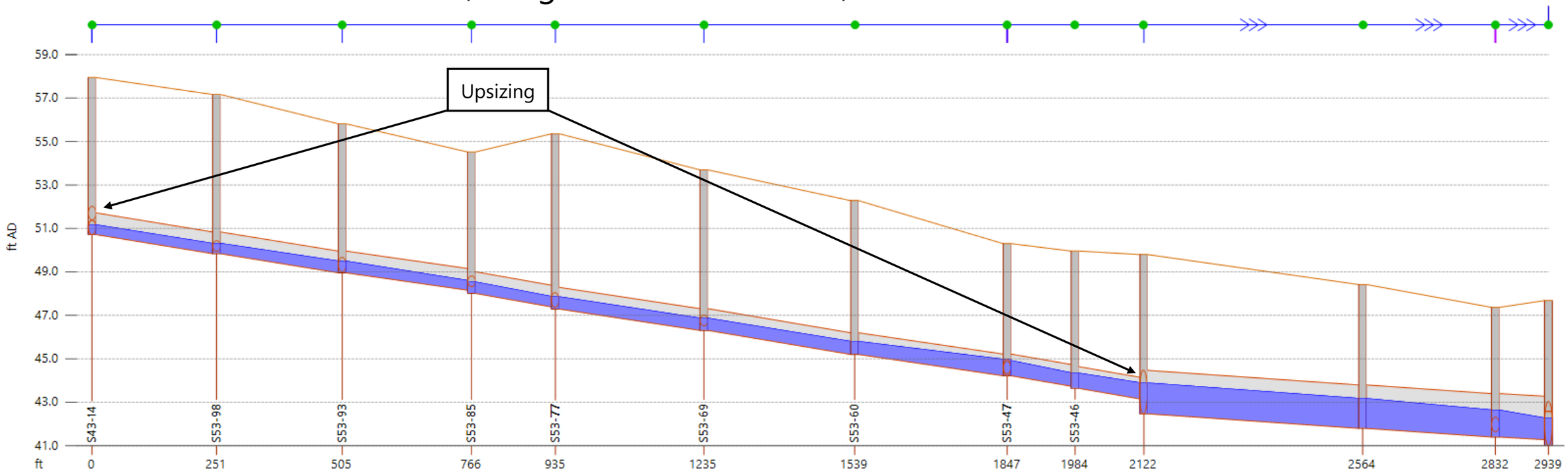
Project 6: CMC Basin - Amethyst Drive
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S43-14.1	S53-98.1	S53-93.1	S53-85.1	S53-77.1	S53-69.1	S53-60.1	S53-47.1	S53-46.1	S53-103.1	S53-9.1	S53-40.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	PE	PE	PE
width (in)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	24.0	24.0	24.0
length (ft)	251.4	253.6	260.8	169.3	299.6	304.1	307.9	136.9	138.8	441.5	267.9	106.9
pfc (MGD)	0.46	0.46	0.43	0.47	0.45	0.47	0.44	0.46	0.46	5.70	5.65	4.90
us inv (ft AD)	50.720	49.840	48.960	48.010	47.290	46.310	45.200	44.220	43.640	42.470	41.800	41.400
ds inv (ft AD)	49.840	48.960	48.160	47.390	46.310	45.200	44.220	43.740	43.153	41.800	41.400	41.280
surc	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	0.69	0.67	0.62
DS flow (MGD)	0.4121	0.4642	0.5388	0.5911	0.5330	0.4722	0.4964	0.8055	0.8055	4.6970	4.7001	5.0379
DS velocity (ft/s)	1.997	1.823	3.057	2.709	2.211	2.095	2.033	3.333	4.069	3.222	3.553	4.990

Node	S43-14	S53-98	S53-93	S53-85	S53-77	S53-69	S53-60	S53-47	S53-46	S53-103	S53-9	S53-40	-
ground (ft AD)	57.950	57.169	55.816	54.522	55.360	53.697	52.281	50.300	49.960	49.800	48.420	47.370	-
flood dep (ft)	-4.024	-3.980	-3.527	-3.029	-4.498	-4.324	-3.991	-3.246	-4.604	-5.943	-5.271	-4.730	-

Project 6: CMC Basin - Amethyst Drive
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S43-14.1	S53-98.1	S53-93.1	S53-85.1	S53-77.1	S53-69.1	S53-60.1	S53-47.1	S53-46.1	S53-103.1	S53-9.1	-
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	PE	PE	PE
width (in)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	24.0	24.0	24.0
length (ft)	251.4	253.6	260.8	169.3	299.6	304.1	307.9	136.9	138.8	441.5	267.9	106.9
pfc (MGD)	1.36	1.36	1.28	1.39	1.32	1.39	1.30	1.36	1.36	5.70	5.65	4.90
us inv (ft AD)	50.720	49.840	48.960	48.010	47.290	46.310	45.200	44.220	43.640	42.470	41.800	41.400
ds inv (ft AD)	49.840	48.960	48.160	47.390	46.310	45.200	44.220	43.740	43.153	41.800	41.400	41.280
surc	0.47	0.54	0.53	0.53	0.56	0.60	0.75	0.70	0.74	0.71	0.68	0.62
DS flow (MGD)	0.5531	0.6086	0.7036	0.7568	0.7994	0.8433	0.8759	1.1428	1.1424	4.8693	4.8723	5.0473
DS velocity (ft/s)	2.351	2.192	3.246	3.218	2.729	2.650	2.133	3.570	3.738	3.272	3.677	4.993

Node	S43-14	S53-98	S53-93	S53-85	S53-77	S53-69	S53-60	S53-47	S53-46	S53-103	S53-9	S53-40	-
ground (ft AD)	57.950	57.169	55.816	54.522	55.360	53.697	52.281	50.300	49.960	49.800	48.420	47.370	-
flood dep (ft)	-6.782	-6.858	-6.319	-5.984	-7.494	-6.826	-6.481	-5.327	-5.608	-5.907	-5.246	-4.728	-

Project 7: Bowers Avenue

PROJECT DESCRIPTION

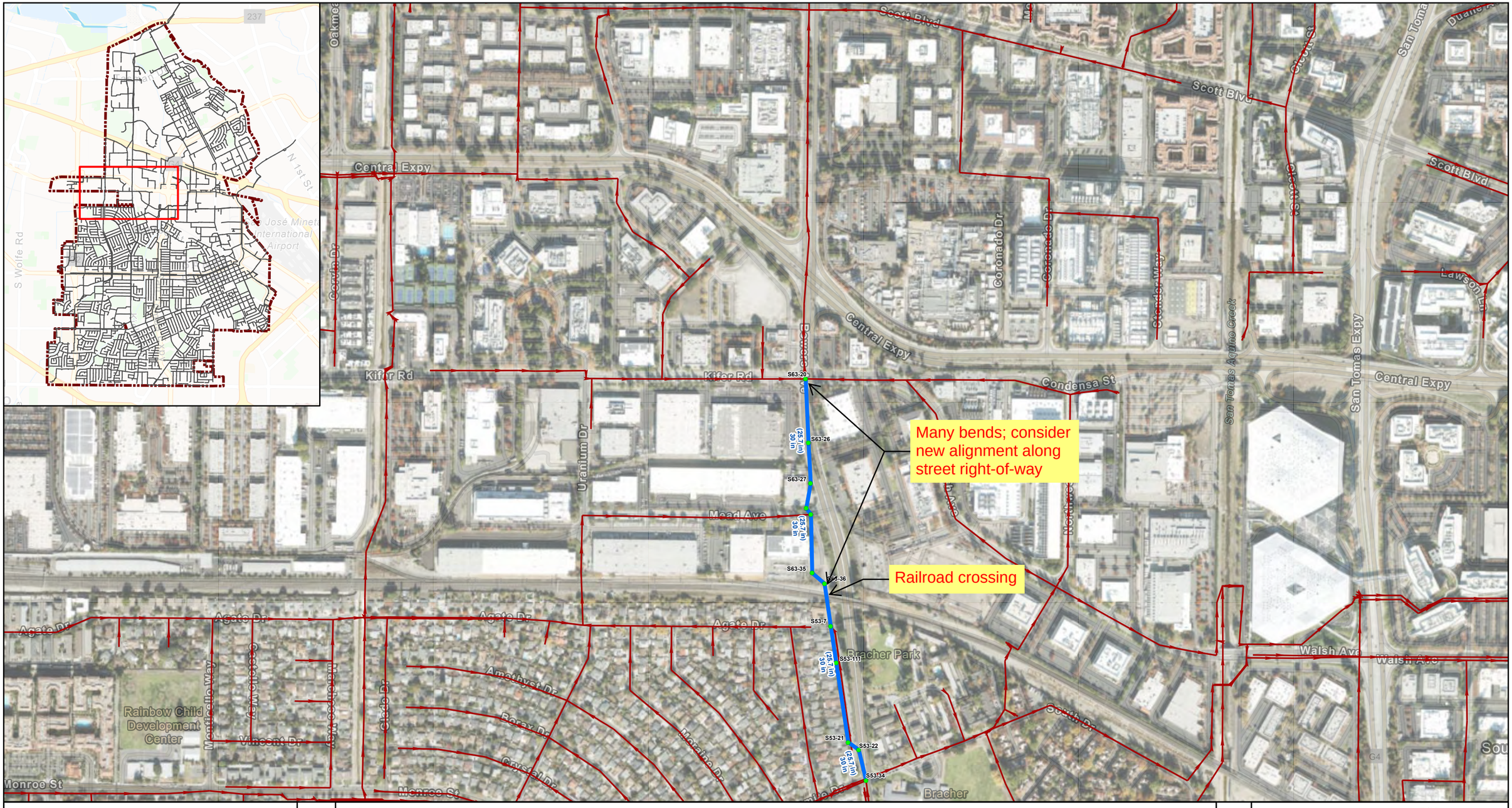
Project No.	7
Project ID	Bowers Avenue
Project Location	Bowers Ave from Chromite Dr to Walsh Ave
Description	2605 LF of 30-inch diameter pipe
Priority	4
Flow Confidence Level	5
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Lined Model Network (LMN)
Estimated Capital Improvement Cost	$8,047,000
Comments	(i) Pipes are listed in order from upstream to downstream. (ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy. (iii) Project would be required due to assumed future lining of Bowers Ave trunk sewer. (iv) Downstream-most pipe segment included in the proposed project (from manhole S63-26 to S63-20) would exceed the City's 0.75 maximum d/D design criterion under PWWF; however, the pipe was not upsized because the resulting d/D ratio was still less than 1 and the City preferred to keep diameters consistent rather than upsize one isolated pipe segment just to meet the d/D design criterion. (v) (vi)
Assumptions	(i) New diameter based on pipe replacement. (ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S53-34	S53-22	26	30	197	0.38	14	10.71	16.24	10.68	11.68	5.95	$1,139			$1,139	$ 224,611
S53-22	S53-21	26	30	80	0.65	15	14.09	21.38	10.68	11.68	5.63	$1,139			$1,139	$ 91,120
S53-21	S53-111	26	30	501	0.41	15	11.16	16.93	10.68	11.68	5.24	$1,139			$1,139	$ 570,753
S53-111	S53-7	26	30	231	0.41	15	11.16	16.93	10.68	11.68	5.95	$1,139			$1,139	$ 263,109
S53-7	S63-36	26	30	269	0.45	16	11.72	17.78	10.69	11.70	5.06	$1,169	PTGAB	42.00	$2,511	$ 676,001
S63-36	S63-35	26	30	102	0.26	17	8.84	13.42	10.69	11.70	5.95	$1,169			$1,169	$ 118,654
S63-35	S63-33	26	30	366	0.53	16	12.69	19.26	10.69	11.70	4.92	$1,139			$1,139	$ 416,532
S63-33	S63-32	26	30	48	0.31	16	9.79	14.86	11.03	12.38	5.35	$1,139			$1,139	$ 54,444
S63-32	S63-27	26	30	158	0.39	17	10.87	16.50	11.03	12.38	5.83	$1,169			$1,169	$ 184,118
S63-27	S63-26	26	30	253	0.46	18	11.84	17.97	11.04	12.39	6.02	$1,169			$1,169	$ 295,173
S63-26	S63-20	26	30	401	0.55	18	12.91	19.59	11.04	12.36	4.45	$1,169			$1,169	$ 468,886

Total Baseline Pipe Construction Cost	$	2,687,399
Total Trenchless Installation Cost	$	676,001
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 3)	$	1,500
Modify Existing Manholes Cost (Approx. 12)	$	210,000
Baseline Construction Cost:	**$**	**3,574,900**
Dewatering	$	234,414
Bypass Pumping	$	336,340
Remove & Replace Factor	$	168,170
Traffic Control (10%)	$	336,340
Pavement Restoration (T-trench)	$	66,196
Subtotal:	**$**	**4,716,360**
Mobilization/Demobilization (5% of subtotal)	$	235,817.98
Estimated Construction Cost Subtotal:	**$**	**4,952,178**
Contingencies (30% of construction subtotal)	$	1,485,653.28
Estimated Construction Cost:	**$**	**6,437,831**
Engineering and Inspection (25% of construction cost)	$	1,609,458
Estimated Capital Improvement Cost:	**$**	**8,047,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 7
Bowers Ave

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Project Sewers
  - **(8-in)** (Existing Diameter)
  - **10-in** Proposed Diameter
- Other Modeled Sewers
- Manholes

0 0.05 0.1 0.2 Miles

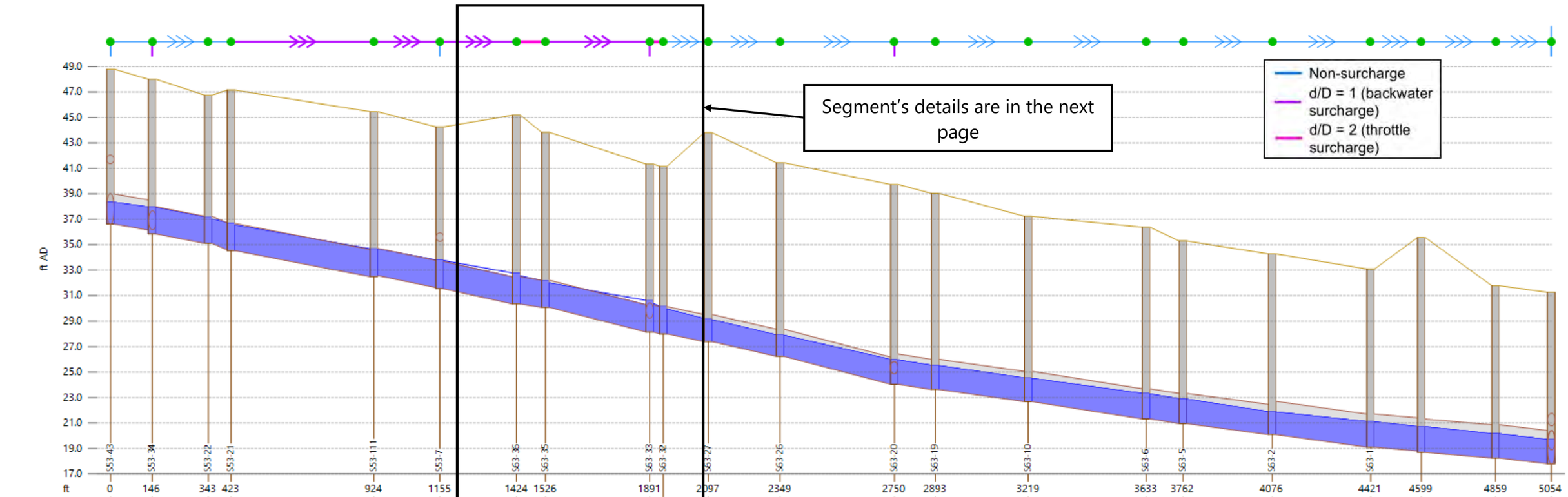
N

Woodard & Curran

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 9/10/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

Project 7: Bowers Ave
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



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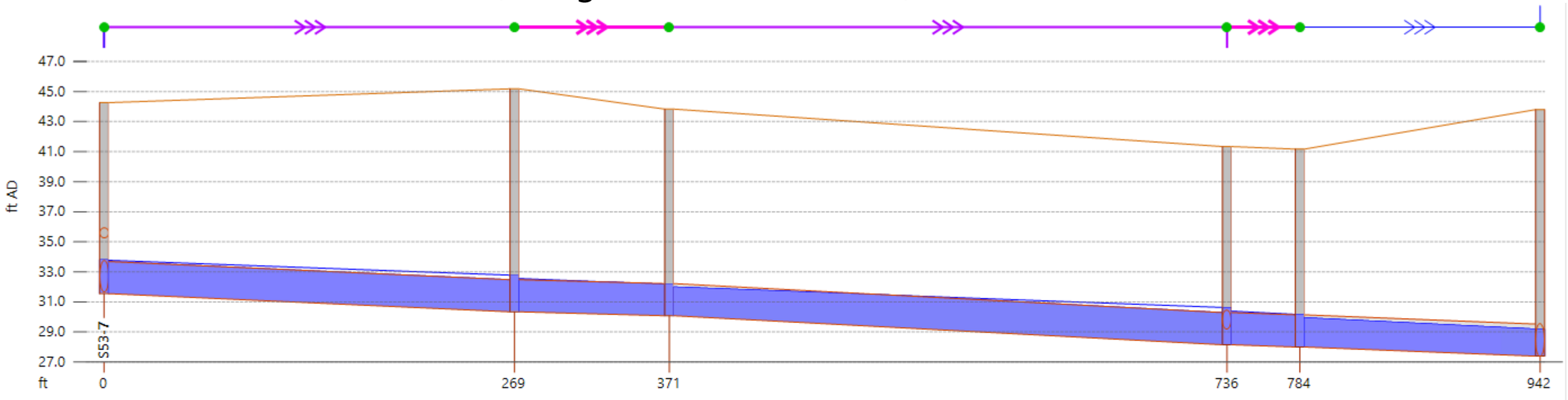
Conduit mate	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP
width (in)	28.5	25.7	25.7	25.7	25.7	25.7	25.7	25.7	-	25.7	25.7	25.7	28.5	28.5	28.5	28.5	28.5	31.4	31.4	31.4	31.4
length (ft)	145.7	197.2	80.0	501.1	231.0	269.2	101.5	365.7	-	157.5	252.5	401.1	142.8	326.2	413.3	129.9	313.0	345.4	177.8	260.4	194.8
pfc (MGD)	13.14	10.71	-	11.16	11.16	11.72	8.84	12.69	-	10.87	11.84	12.91	12.40	12.49	13.28	12.35	12.13	15.98	12.34	12.34	14.34
us inv (ft AD)	36.620	35.850	-	34.534	32.577	31.550	-	30.080	-	28.000	27.390	26.230	24.040	23.630	22.680	21.320	20.950	20.090	19.100	18.695	18.250
ds inv (ft AD)	36.150	35.110	-	32.491	31.635	30.340	-	28.150	-	27.390	26.230	24.040	23.630	22.680	21.320	20.950	20.090	19.100	18.796	18.250	17.800
surc	0.76	0.97	1.00	1.00	1.00	1.00	2.00	1.00	-	0.91	0.81	0.91	0.80	0.79	0.84	0.82	0.80	0.77	0.76	0.77	0.73
DS flow (MGD)	10.6088	10.5883	-	10.5524	10.5416	10.5511	-	10.5422	-	11.5446	11.5584	11.5548	11.9672	11.9660	11.9633	-	12.1433	12.1470	12.1464	12.1453	12.3499
DS velocity (ft/s)	5.890	5.583	-	5.069	5.678	4.604	5.396	4.380	-	5.596	5.997	5.249	4.871	5.045	4.700	4.767	5.246	4.260	4.456	4.477	4.585

Node	-	S53-34	-	S53-21	S53-111	S53-7	S63-36	S63-35	S63-33	-	S63-27	S63-26	S63-20	S63-19	S63-10	S63-6	S63-5	S63-2	S63-1	S63-1A	S73-35	-
ground (ft AD)	-	48.000	-	47.150	45.451	44.260	45.180	43.830	41.340	-	43.800	41.440	39.730	39.040	37.240	36.380	35.300	34.280	33.100	35.572	31.790	-
flood dep (ft)	-	-10.042	-	-10.444	-10.763	-10.451	-12.418	-11.671	-10.726	-	-14.617	-13.527	-13.755	-13.510	-12.712	-13.061	-12.402	-12.403	-11.998	-14.859	-11.629	-

Project 7: Bowers Ave

Capacity Deficiency Profile View (*Zoomed-in section*)

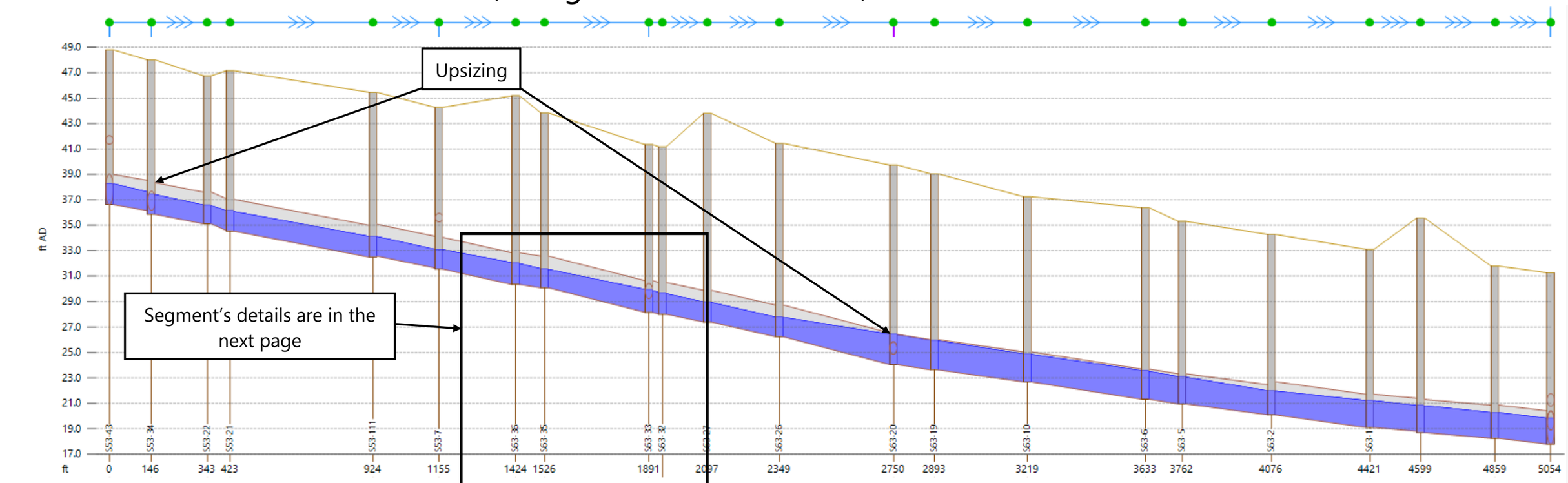
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S53-7.1	S63-36.1	S63-35.1	S63-33.1	S63-32.1
Conduit mate	RCP	RCP	RCP	RCP	RCP
width (in)	25.7	25.7	25.7	25.7	25.7
length (ft)	269.2	101.5	365.7	47.8	157.5
pfc (MGD)	11.72	8.84	12.69	9.79	10.87
us inv (ft AD)	31.550	30.340	30.080	28.150	28.000
ds inv (ft AD)	30.340	30.080	28.150	28.000	27.390
surc	1.00	2.00	1.00	2.00	0.91
DS flow (MGD)	10.5511	10.5484	10.5422	11.5444	11.5446
DS velocity (ft/s)	4.604	5.396	4.380	4.960	5.596

Node	S53-7	S63-36	S63-35	S63-33	S63-32	S63-27
ground (ft AD)	44.260	45.180	43.830	41.340	41.170	43.800
flood dep (ft)	-10.451	-12.418	-11.671	-10.726	-11.018	-14.617

Project 7: Bowers Ave
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



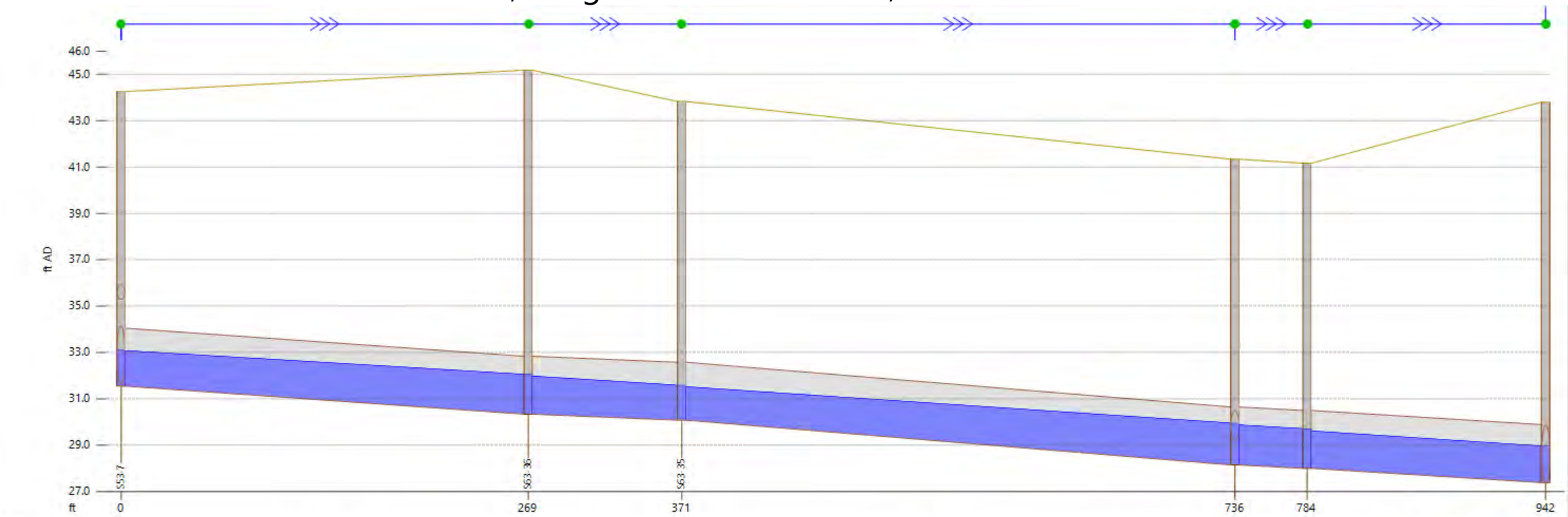
Link	-	S53-34.1	-	S53-21.1	S53-111.1	S53-7.1	-	S63-35.1	-	S63-32.1	S63-27.1	S63-26.1	-	S63-19.1	S63-10.1	-	S63-5.1	S63-2.1	S63-1.1	S63-1A.1	S73-35.1
Conduit mate	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP
width (in)	28.5	30.0	30.0	30.0	30.0	30.0	30.0	30.0	-	30.0	30.0	30.0	28.5	28.5	28.5	28.5	28.5	31.4	31.4	31.4	31.4
length (ft)	145.7	197.2	80.0	501.1	231.0	269.2	101.5	365.7	-	157.5	252.5	401.1	142.8	326.2	413.3	129.9	313.0	345.4	177.8	260.4	194.8
pfc (MGD)	13.14	16.24	-	16.93	16.93	17.78	13.42	19.26	-	16.50	17.97	19.59	12.39	12.48	13.26	12.34	12.12	15.98	12.34	12.34	14.34
us inv (ft AD)	36.620	35.850	-	34.534	32.577	31.550	-	30.080	-	28.000	27.390	26.230	24.040	23.630	22.680	21.320	20.950	20.090	19.100	18.695	18.250
ds inv (ft AD)	36.150	35.110	-	32.491	31.635	30.340	-	28.150	-	27.390	26.230	24.040	23.630	22.680	21.320	20.950	20.090	19.100	18.796	18.250	17.800
surc	0.69	0.62	0.62	0.65	0.61	0.68	0.65	0.72	-	0.64	0.61	0.95	0.99	0.95	0.94	0.92	0.88	0.81	0.80	0.81	0.77
DS flow (MGD)	11.6816	11.6813	-	11.6839	11.6842	1.6968	-	11.6961	-	12.3812	12.3896	12.3625	12.6729	12.6664	12.6614	-	12.8125	12.8131	12.8101	12.8045	12.9957
DS velocity (ft/s)	6.292	6.073	-	5.375	6.128	5.066	5.935	4.816	-	5.941	6.239	4.503	4.887	5.062	4.720	4.792	5.282	4.293	4.484	4.525	4.651

Node	-	S53-34	-	S53-21	S53-111	S53-7	S63-36	S63-35	S63-33	-	S63-27	S63-26	S63-20	S63-19	S63-10	S63-6	S63-5	S63-2	S63-1	S63-1A	S73-35	-
ground (ft AD)	-	48.000	-	47.150	45.451	44.260	45.180	43.830	41.340	-	43.800	41.440	39.730	39.040	37.240	36.380	35.300	34.280	33.100	35.572	31.790	-
flood dep (ft)	-	-10.580	-	-11.011	-11.342	-11.175	-13.137	-12.258	-11.402	-	-14.348	-13.676	-13.311	-13.100	-12.365	-12.821	-12.212	-12.312	-11.888	-14.751	-11.526	-

Project 7: Bowers Ave

Project Solution Profile View (*Zoomed-in section*)

Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S53-7.1	S63-36.1	S63-35.1	S63-33.1	S63-32.1
Conduit mate	RCP	RCP	RCP	RCP	RCP
width (in)	30.0	30.0	30.0	30.0	30.0
length (ft)	269.2	101.5	365.7	47.8	157.5
pfc (MGD)	17.78	13.42	19.26	14.86	16.50
us inv (ft AD)	31.550	30.340	30.080	28.150	28.000
ds inv (ft AD)	30.340	30.080	28.150	28.000	27.390
surc	0.68	0.65	0.72	0.69	0.64
DS flow (MGD)	11.6968	11.6968	11.6961	12.3807	12.3812
DS velocity (ft/s)	5.066	5.935	4.816	5.386	5.941

Node	S53-7	S63-36	S63-35	S63-33	S63-32	S63-27
ground (ft AD)	44.260	45.180	43.830	41.340	41.170	43.800
flood dep (ft)	-11.175	-13.137	-12.258	-11.402	-11.476	-14.848

Project 8: Calabazas Trunk

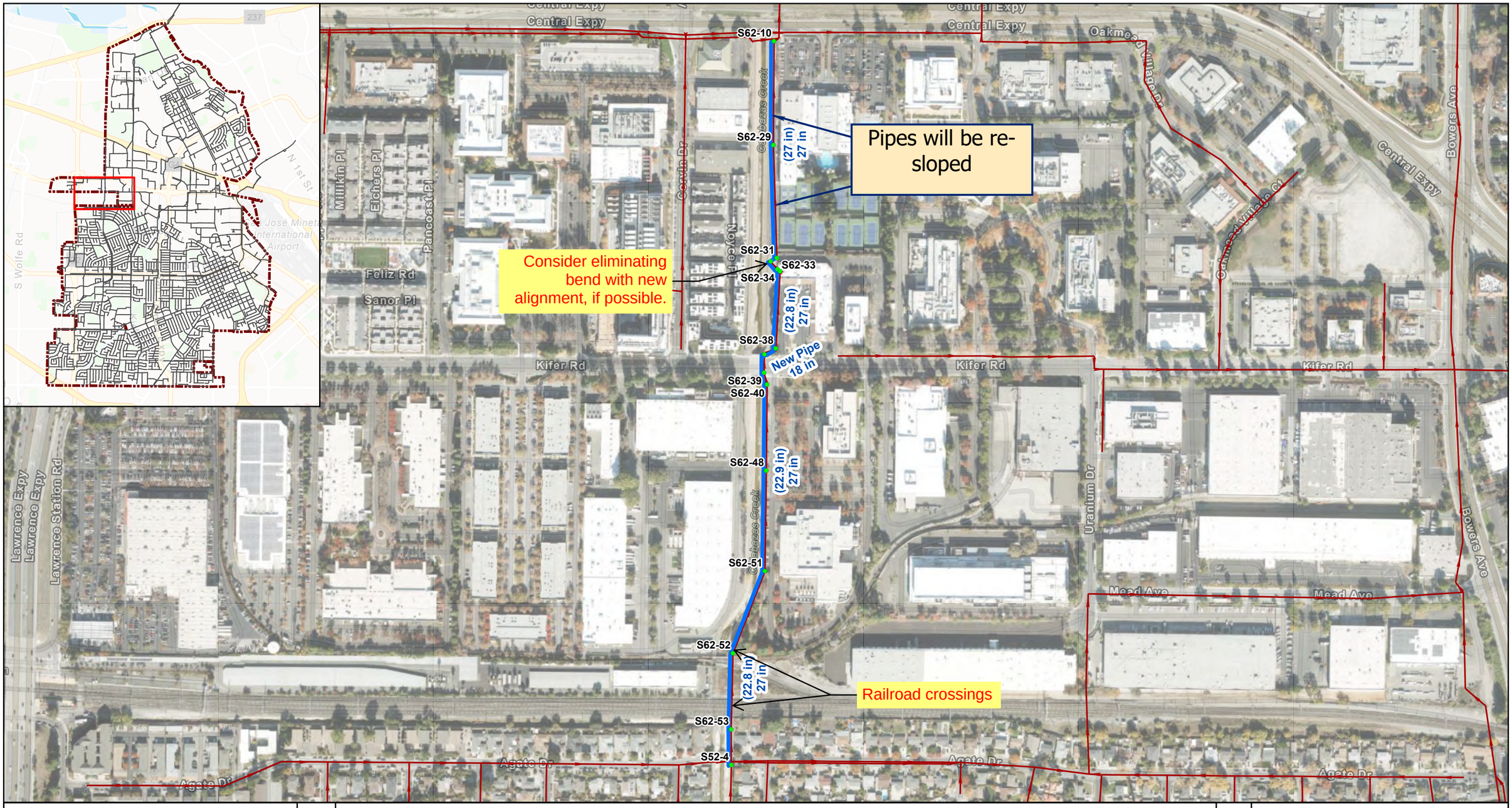
PROJECT DESCRIPTION	
Project No.	8
Project ID	Calabazas Trunk
Project Location	Calabazas Creek from S of Agate Dr to Central Expwy
Description	2791 LF of 18 to 27-inch diameter pipe
Priority	2
Flow Confidence Level	5
Loads Trigger	Existing Loads (EL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Lined Model Network (LMN)
Estimated Capital Improvement Cost	$8,731,000
Comments	(i) Pipes are listed in order from upstream to downstream. (ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy. (iii) Recommended project includes pipe segments that are already lined between manhole S62-51 and S62-32. (iv) The Lined Model Network assumes existing, unlined 27-inch pipes would be lined in the future resulting in a diameter of 25.7-inch. (v) Roughly 750 LF of pipe between manhole S62-31 and S62-10 of the 2,000 LF that would be upsized to 27-inch would also be re-sloped. In addition to upsizing and re-sloping, the project includes installation of a new 18-inch pipe between manhole S62-37 and S62-38 that runs parallel to the existing sewer to relieve the capacity restriction at that location due to a storm drain crossing north of Kifer Road. (vi) Calabazas Trunk project solution would eliminate the Agate Drive capacity deficiency by eliminating the overflow diversion from the Calabazas Trunk into the Agate Drive sewers at manhole S52-4, which is located just upstream of Agate Drive siphon crossing.
Assumptions	(i) New diameter based on pipe replacement. (ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S52-4	S62-53	23	27	136	0.17	15	5.25	8.24	7.52	7.85	5.09	$1,089	PTGAB	42.00	$2,431	$ 329,907
S62-53	S62-52	23	27	282	0.41	14	8.15	12.78	7.52	7.85	4.85	$1,089	PTGAB	42.00	$2,431	$ 685,584
S62-52	S62-51	23	27	240	0.26	13	6.54	10.26	7.52	7.85	5.48	$1,089			$1,089	$ 261,360
S62-51	S62-48	23	27	503	0.72	13	10.96	16.94	7.52	7.85	4.74	$1,089			$1,089	$ 547,767
S62-48	S62-40	23	27	307	0.33	13	7.40	11.43	7.52	7.85	5.48	$1,089			$1,089	$ 334,323
S62-40	S62-39	23	27	55	0.69	15	10.63	16.64	7.52	7.85	6.26	$1,089			$1,089	$ 59,895
S62-39	S62-37	23	27	66	0.68	16	10.55	16.53	7.52	7.85	5.69	$1,089			$1,089	$ 71,874
S62-37	S62-38	N/A	18	60	0.12	16	N/A	2.33	2.59	2.70	2.48	$854			$854	$ 50,813
S62-38	S62-34	23	27	343	0.32	17	7.24	11.34	7.52	7.85	5.31	$1,119			$1,119	$ 383,817
S62-34	S62-33	23	27	14	0.50	17	9.04	14.16	7.52	7.85	5.39	$1,119			$1,119	$ 15,666
S62-33	S62-32	23	27	40	0.33	17	7.29	11.41	7.52	7.85	5.42	$1,119			$1,119	$ 44,760
S62-32	S62-31	23	27	14	0.71	18	10.80	16.92	7.52	7.85	5.20	$1,119			$1,119	$ 15,666
S62-31	S62-29	27	27	386	0.33	18	4.32	11.44	7.52	7.85	4.72	$1,119			$1,119	$ 431,934
S62-29	S62-10	27	27	346	0.33	18	16.00	11.44	7.52	7.85	5.44	$1,119			$1,119	$ 387,174

Total Baseline Pipe Construction Cost	$	2,605,049
Total Trenchless Installation Cost	$	1,015,491
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 0)	$	-
Modify Existing Manholes Cost (Approx. 16)	$	280,000
Baseline Construction Cost:	**$**	**3,900,540**
Dewatering	$	251,208
Bypass Pumping	$	356,973
Remove & Replace Factor	$	178,486
Traffic Control (10%)	$	362,054
Pavement Restoration (T-trench)	$	67,625
Subtotal:	**$**	**5,116,886**
Mobilization/Demobilization (5% of subtotal)	$	255,844.30
Estimated Construction Cost Subtotal:	**$**	**5,372,730**
Contingencies (30% of construction subtotal)	$	1,611,819.09
Estimated Construction Cost:	**$**	**6,984,549**
Engineering and Inspection (25% of construction cost)	$	1,746,137
Estimated Capital Improvement Cost:	**$**	**8,731,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 8
Calabazas Trunk

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

0 0.04 0.07 0.15 Miles

N

Project #: 0012307.00
Map Created: July 2024

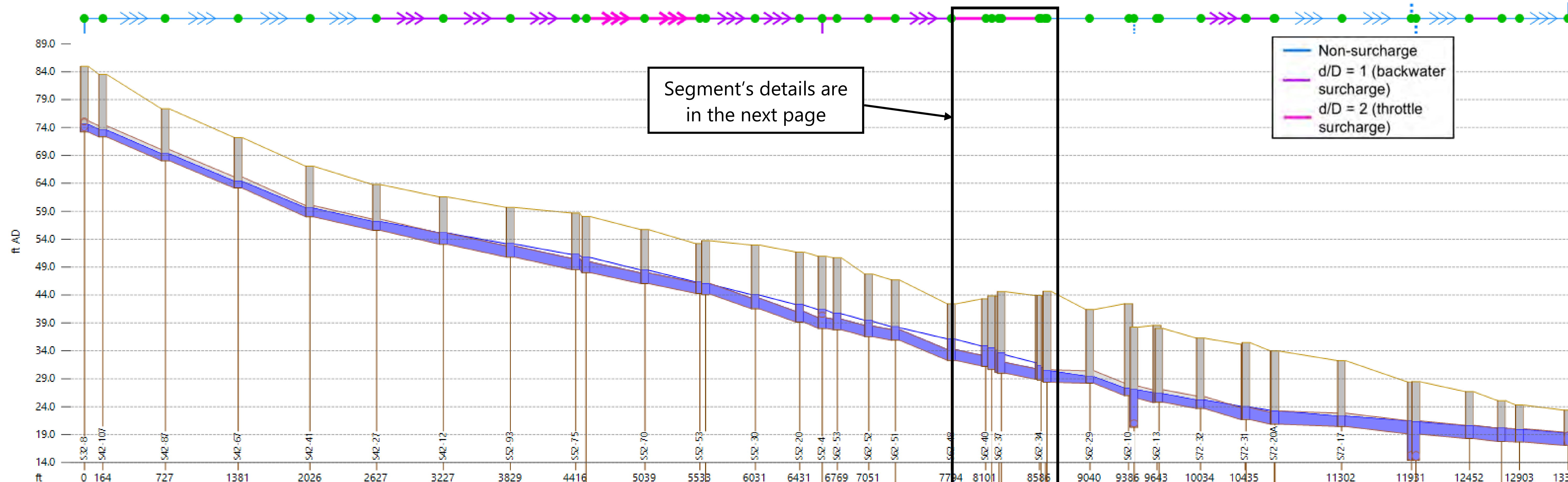
Woodard & Curran

Figure Exported: 9/10/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

Project 8: Calabazas Trunk

Capacity Deficiency Profile View

Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



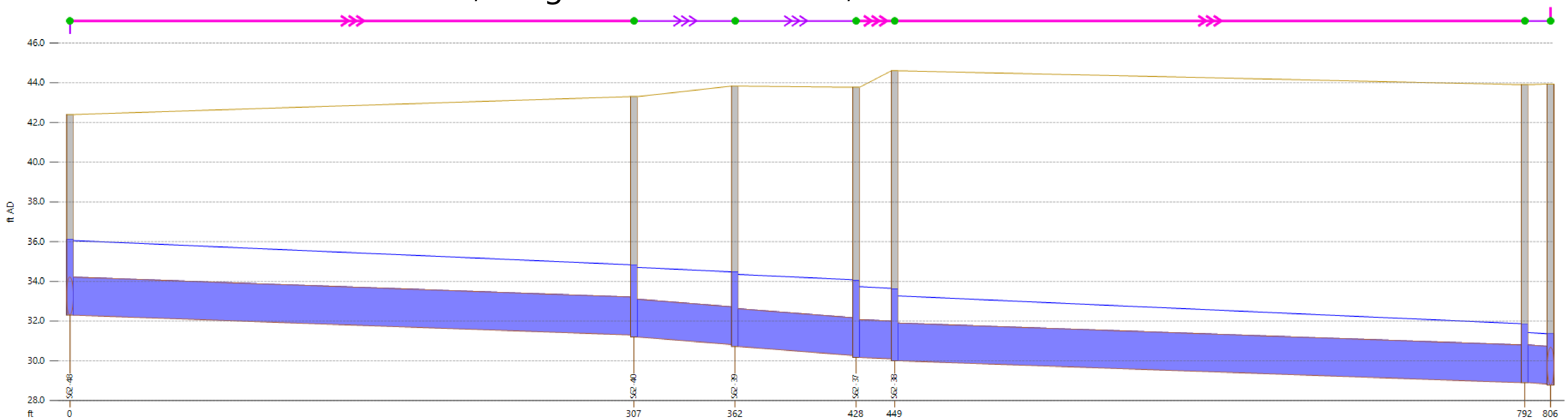
Link	Conduit mate	width (in)	length (ft)	pfc (MGD)	us inv (ft AD)	ds inv (ft AD)	surc	DS flow (MGD)	DS velocity (ft/s)
-	-	-	-	-	-	-	-	-	-
S42-107.1	VCP	24.0	563.0	12.74	72.325	68.055	0.61	8.4056	6.506
S42-87.1	VCP	24.0	654.0	12.64	68.055	63.165	0.60	8.4053	6.624
S42-67.1	VCP	24.0	645.0	13.08	63.165	58.005	0.78	8.4048	4.939
S42-41.1	VCP	24.0	601.0	9.28	58.005	55.585	0.78	8.4032	5.145
S42-27.1	VCP	24.0	600.0	9.46	55.585	53.075	1.00	8.3582	4.935
S42-12.1	VCP	24.0	602.0	9.02	53.075	50.785	1.00	8.2538	4.917
S52-93.1	VCP	24.0	587.0	9.03	50.785	48.545	1.00	8.2362	5.015
-	-	-	-	-	-	-	-	-	-
S52-113.1	RCP	22.8	530.0	7.78	48.015	46.045	2.00	8.2542	4.668
S52-70.1	RCP	22.8	494.0	7.62	46.045	44.285	2.00	8.2534	4.988
S52-52.1	RCP	22.8	446.2	9.86	44.190	41.530	1.00	8.2523	5.752
-	RCP	22.8	399.9	9.85	41.530	39.150	1.00	8.2522	5.148
-	RCP	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	RCP	22.8	282.0	8.15	-	-	1.00	-	4.578
-	RCP	22.8	-	6.54	-	-	2.00	-	-
S62-51.1	RCP	22.9	503.0	10.96	35.900	32.300	1.00	8.1322	4.574
-	RCP	22.9	307.0	7.40	-	-	2.00	-	5.650
-	RCP	22.8	343.0	7.24	30.000	28.900	2.00	8.1322	4.222
-	HDPE	27.0	386.0	4.32	28.365	28.185	0.89	8.1321	5.644
-	HDPE	27.0	346.0	16.00	28.185	25.975	0.59	8.1322	5.562
-	PVC	-	-	-	-	-	-	-	-
-	HDPE	27.0	373.0	11.02	24.795	23.665	0.67	8.5649	5.203
-	RCP	25.7	401.0	12.34	23.665	21.665	1.00	8.5571	3.805
-	RCP	25.7	-	9.81	-	-	1.00	-	-
S72-20.1	RCP	28.5	598.0	6.02	20.865	20.460	0.98	8.5410	3.987
S72-17.1	RCP	28.5	629.0	10.68	20.460	19.120	0.96	8.5256	3.385
S72-11.1	RCP	28.5	481.0	9.32	19.070	18.290	0.95	8.5208	3.439
-	RCP	28.5	288.8	9.91	-	-	1.00	-	3.136
-	-	-	-	-	-	-	-	-	-
S72-6.1	RCP	28.5	436.0	8.73	17.680	17.060	0.93	8.5156	3.352

Node	ground (ft AD)	flood dep (ft)
-	-	-
S42-87	77.355	-8.086
S42-67	72.215	-7.863
S42-41	67.055	-7.493
S42-27	63.785	-6.648
S42-12	61.575	-6.434
S52-93	59.685	-6.500
-	-	-
-	-	-
S52-70	55.695	-7.213
-	-	-
-	-	-
S52-30	52.950	-8.896
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	42.400	-6.271
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
S72-17	32.250	-9.972
-	-	-
-	-	-
S72-8	-	-6.139
-	-	-
-	-	-
-	-	-

Project 8: Calabazas Trunk

Capacity Deficiency Profile View (*Zoomed-in section*)

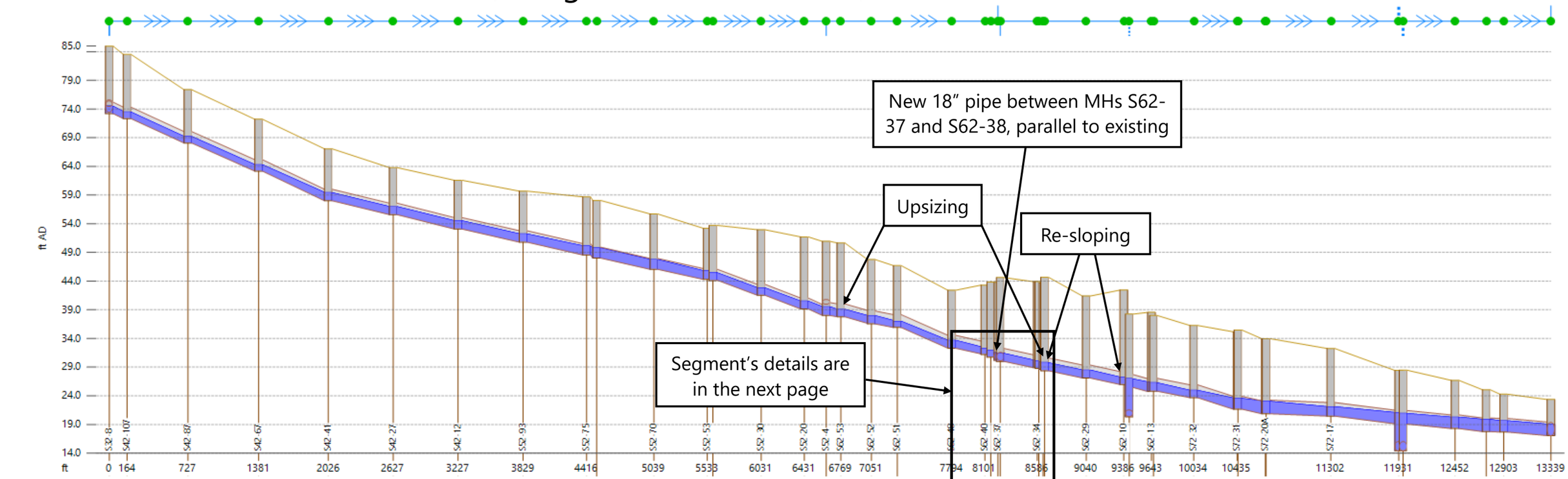
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S62-48.1	S62-40.1	S62-39.1	-	S62-38.1	-
Conduit mate	RCP	RCP	RCP	RCP	RCP	RCP
width (in)	22.9	22.8	22.8	22.8	22.8	22.8
length (ft)	307.0	55.0	66.0	21.0	343.0	14.0
pfc (MGD)	7.40	10.63	10.55	7.38	7.24	9.04
us inv (ft AD)	32.300	31.200	30.720	30.170	30.000	-
ds inv (ft AD)	31.300	30.820	30.270	30.100	28.900	-
surc	2.00	1.00	1.00	2.00	2.00	1.00
DS flow (MGD)	8.1153	8.1153	8.1153	8.1153	8.1153	-
DS velocity (ft/s)	5.617	5.816	5.089	4.513	4.214	4.238

Node	S62-48	S62-40	S62-39	S62-37	S62-38	S62-34
ground (ft AD)	42.400	43.300	43.830	43.770	44.600	43.900
flood dep (ft)	-6.293	-8.475	-9.363	-9.723	-10.989	-12.071

Project 8: Calabazas Trunk
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



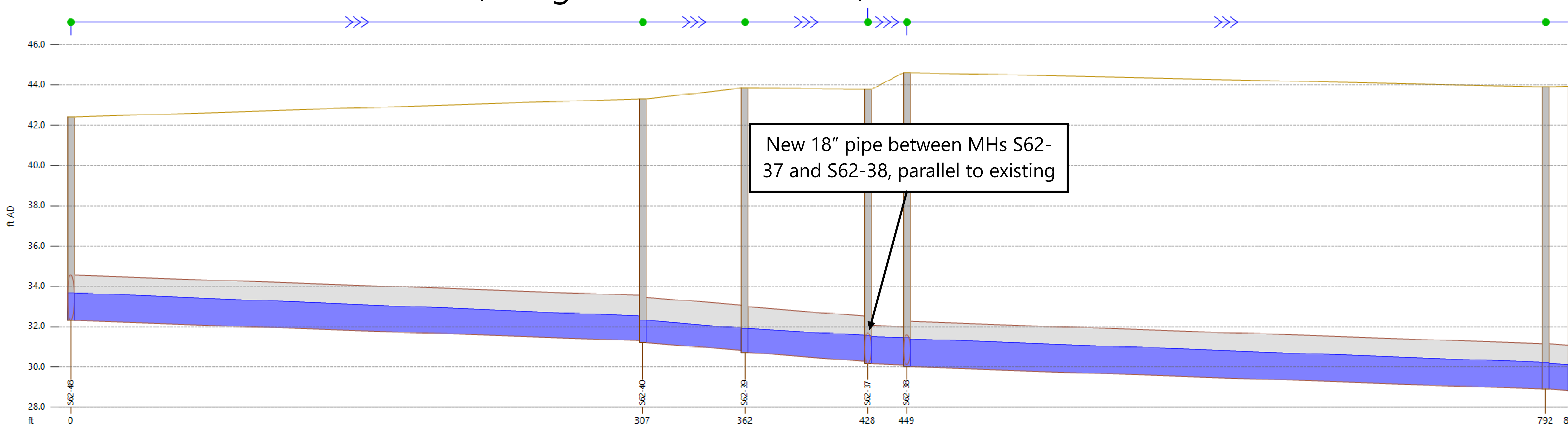
Link	-	S42-107.1	S42-87.1	S42-67.1	S42-41.1	S42-27.1	S42-12.1	S52-93.1	-	S52-113.1	S52-70.1	S52-52.1	-	-	-	-	-	S62-51.1	-	-	-	-	-	-	-	S72-20.1	S72-17.1	S72-11.1	-	-	S72-6.1
Conduit mate	-	VCP	VCP	VCP	VCP	VCP	VCP	VCP	-	RCP	RCP	RCP	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	HDPE	HDPE	PVC	HDPE	RCP	RCP	RCP	RCP	RCP	RCP	-	RCP
width (in)	-	24.0	24.0	24.0	24.0	24.0	24.0	24.0	-	22.8	22.8	22.8	22.8	-	-	27.0	27.0	27.0	27.0	27.0	27.0	27.0	-	27.0	27.0	27.0	28.5	28.5	28.5	28.5	-	28.5
length (ft)	-	563.0	654.0	645.0	601.0	600.0	602.0	587.0	-	530.0	494.0	446.2	399.9	-	-	282.0	-	503.0	307.0	343.0	386.0	346.0	-	373.0	401.0	-	598.0	629.0	481.0	288.8	-	436.0
pfc (MGD)	-	12.74	12.64	13.08	9.28	9.46	9.02	9.03	-	7.78	7.62	9.86	9.85	-	-	12.78	-	16.94	11.43	11.34	11.44	11.44	-	11.02	14.14	-	6.02	10.68	9.32	9.91	-	8.73
us inv (ft AD)	-	72.325	68.055	63.165	58.005	55.585	53.075	50.785	-	48.015	46.045	44.190	41.530	-	-	-	-	35.900	-	30.000	28.365	27.105	-	24.795	23.665	-	20.865	20.460	19.070	-	-	17.680
ds inv (ft AD)	-	68.055	63.165	58.005	55.585	53.075	50.785	48.545	-	46.045	44.285	41.530	39.150	-	-	-	-	32.300	-	28.900	27.105	25.975	-	23.665	21.665	-	20.460	19.120	18.290	-	-	17.060
surc	-	0.57	0.57	0.72	0.70	0.72	0.72	0.80	-	0.92	0.89	0.68	0.71	-	-	0.60	0.63	0.61	0.61	0.61	0.61	0.61	-	0.64	0.86	0.99	0.91	0.83	0.83	0.90	-	0.84
DS flow (MGD)	-	7.6901	7.6902	7.6895	7.6893	7.6884	7.6878	7.6785	-	7.6866	7.6845	7.6843	7.6837	-	-	-	-	7.8481	-	7.8470	7.8468	7.8460	-	8.2851	8.2807	-	8.2735	8.2572	8.2358	-	-	8.2116
DS velocity (ft/s)	-	6.407	6.489	4.895	5.087	4.894	4.894	5.016	-	4.658	4.952	5.782	5.477	-	-	4.884	-	4.787	5.558	5.334	4.754	5.427	-	5.501	3.808	-	3.978	3.392	3.450	3.131	-	3.361

Node	-	S42-87	S42-67	S42-41	S42-27	S42-12	S52-93	-	-	S52-70	-	-	S52-30	-	-	-	-	-	-	42.400	-	-	-	-	-	-	-	-	-	-	S72-17	-	-	S72-8	-	-	-
ground (ft AD)	-	77.355	72.215	67.055	63.785	61.575	59.685	-	-	55.695	-	-	52.950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32.250	-	-	-	-	-	-
flood dep (ft)	-	-8.157	-7.932	-7.609	-6.807	-7.057	-7.456	-	-	-7.930	-	-	-	-	-	-	-	-	-	-8.750	-	-	-	-	-	-	-	-	-	-	-10.161	-	-	-6.421	-	-	-

Project 8: Calabazas Trunk

Project Solution Profile View (*Zoomed-in section*)

Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S62-48.1	S62-40.1	S62-39.1	-	S62-38.1	-
Conduit mate	RCP	RCP	RCP	RCP	RCP	RCP
width (in)	27.0	27.0	27.0	22.8	27.0	27.0
length (ft)	307.0	55.0	66.0	21.0	343.0	14.0
pfc (MGD)	11.43	16.64	16.53	7.38	11.34	14.16
us inv (ft AD)	32.300	31.200	30.720	30.170	30.000	-
ds inv (ft AD)	31.300	30.820	30.270	30.100	28.900	-
surc	0.61	0.49	0.57	0.71	0.61	0.57
DS flow (MGD)	7.8481	7.8481	7.8480	5.1498	7.8470	-
DS velocity (ft/s)	5.558	6.333	5.684	3.770	5.334	5.389

Node	S62-48	S62-40	S62-39	S62-37	S62-38	S62-34
ground (ft AD)	42.400	43.300	43.830	43.770	44.600	43.900
flood dep (ft)	-8.730	-11.005	-11.939	-12.223	-13.163	-13.692

Project 9: Mission College Boulevard

PROJECT DESCRIPTION

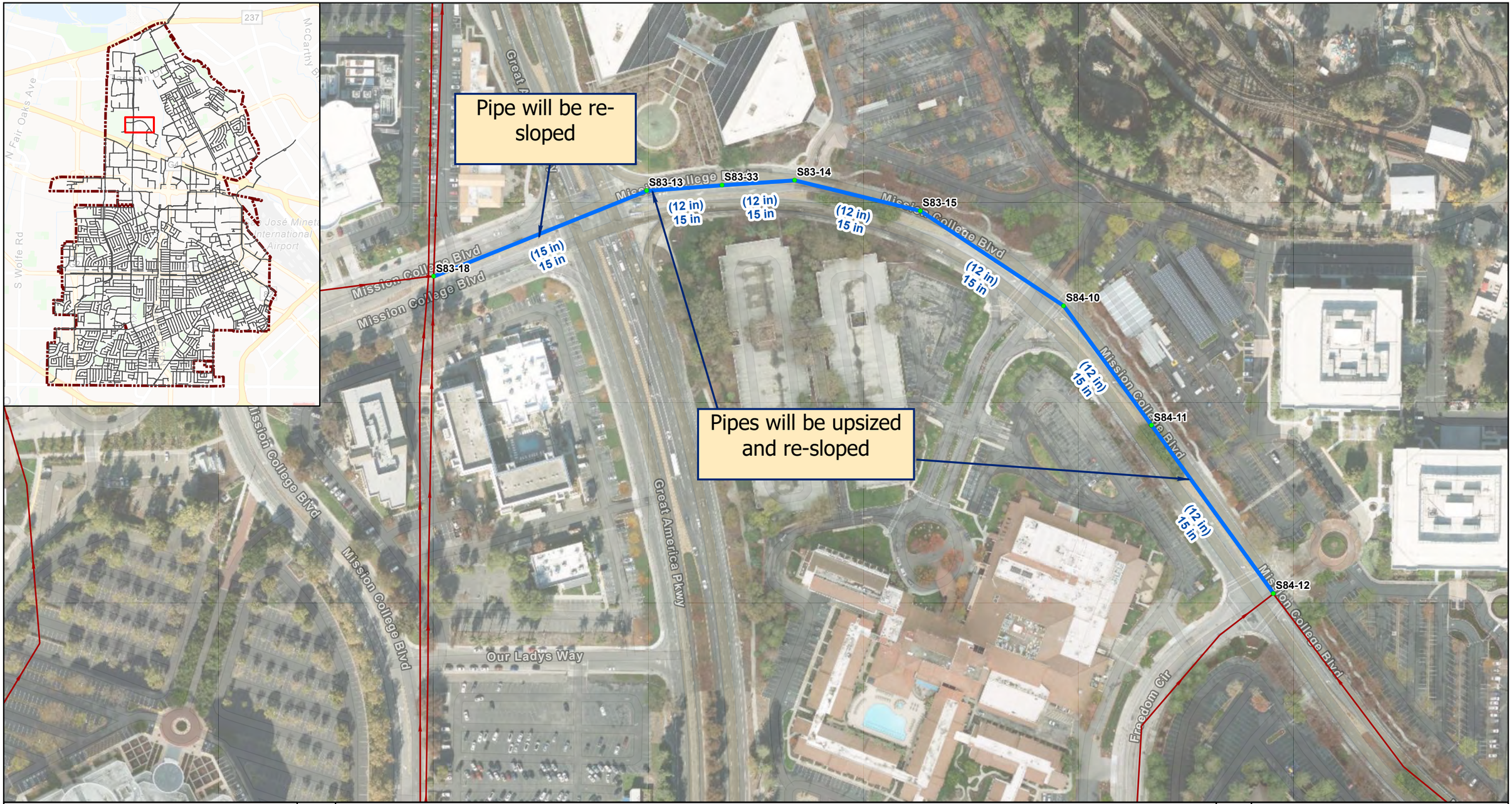
Project No.	9
Project ID	Mission College Boulevard
Project Location	Mission College Blvd from Freedom Cir to west of Great America Pkwy
Description	1886 LF of 15-inch diameter pipe
Priority	5
Flow Confidence Level	N/A
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Dry Weather Flow (DWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$3,830,000
Comments	(i) Pipes are listed in order from upstream to downstream. (ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy. (iii) Project would be required due to increased flows from the Freedom Circle Focus Area specific development project that would discharge into the City's sewers along Freedom Circle Drive and Mission College Boulevard. The recommended project is a slight modification of the project identified during the development review process and includes re-sloping to meet the City's design criteria d/D (maximum of 0.75 during PWWF). (iv) Downstream-most pipe segment included in the proposed project (from manhole S63-26 to S63-20) would exceed the City's 0.75 maximum d/D design criterion under PWWF; however, the pipe was not upsized because the resulting d/D ratio was still less than 1 and the City preferred to keep diameters consistent rather than upsize one isolated pipe segment just to meet the d/D design criterion. (v) (vi)
Assumptions	(i) New diameter based on pipe replacement. (ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S84-12	S84-11	12	15	378	0.18	7	1.98	1.77	1.21	1.24	2.28	$804			$804	$ 303,832
S84-11	S84-10	12	15	270	0.18	7	2.00	1.77	1.28	1.31	2.21	$804			$804	$ 217,402
S84-10	S83-15	12	15	313	0.18	7	1.87	1.77	1.48	1.57	2.44	$804			$804	$ 251,572
S83-15	S83-14	12	15	236	0.18	7	1.80	1.77	1.48	1.57	2.44	$804			$804	$ 189,583
S83-14	S83-33	12	15	132	0.18	7	2.18	1.77	1.48	1.57	2.47	$804			$804	$ 106,369
S83-33	S83-13	12	15	138	0.18	7	2.33	1.77	1.47	1.57	2.48	$804			$804	$ 110,872
S83-13	S83-18	15	15	418	0.18	8	1.87	1.77	1.47	1.57	3.87	$804			$804	$ 336,313

Total Baseline Pipe Construction Cost	$	1,515,942
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 3)	$	1,500
Modify Existing Manholes Cost (Approx. 8)	$	140,000
Baseline Construction Cost:	**$**	**1,657,442**
Dewatering	$	169,695
Bypass Pumping	$	151,594
Remove & Replace Factor	$	75,797
Traffic Control (10%)	$	151,594
Pavement Restoration (T-trench)	$	38,705
Subtotal:	**$**	**2,244,827**
Mobilization/Demobilization (5% of subtotal)	$	112,241.36
Estimated Construction Cost Subtotal:	**$**	**2,357,068**
Contingencies (30% of construction subtotal)	$	707,120.54
Estimated Construction Cost:	**$**	**3,064,189**
Engineering and Inspection (25% of construction cost)	$	766,047
Estimated Capital Improvement Cost:	**$**	**3,830,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 9
Mission College Blvd

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

0 0.01 0.03 0.05 Miles

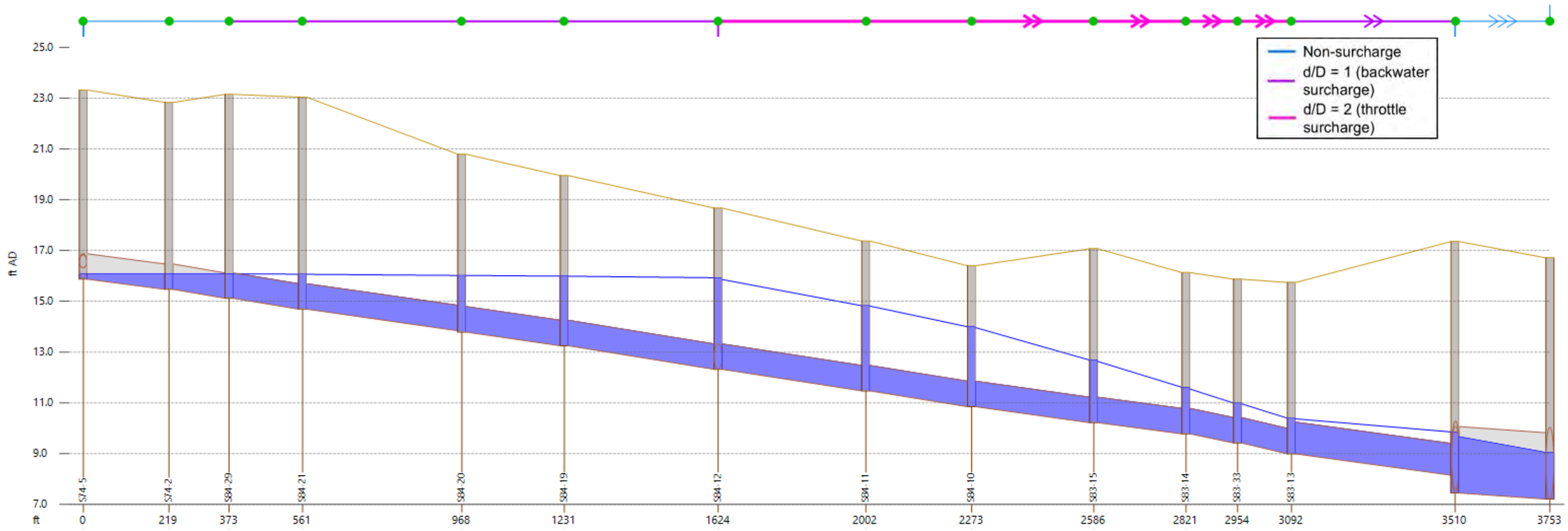
N

Project #: 0012307.00
Map Created: July 2024

Woodard & Curran

Figure Exported: 8/19/2025 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2024_Report.aprx

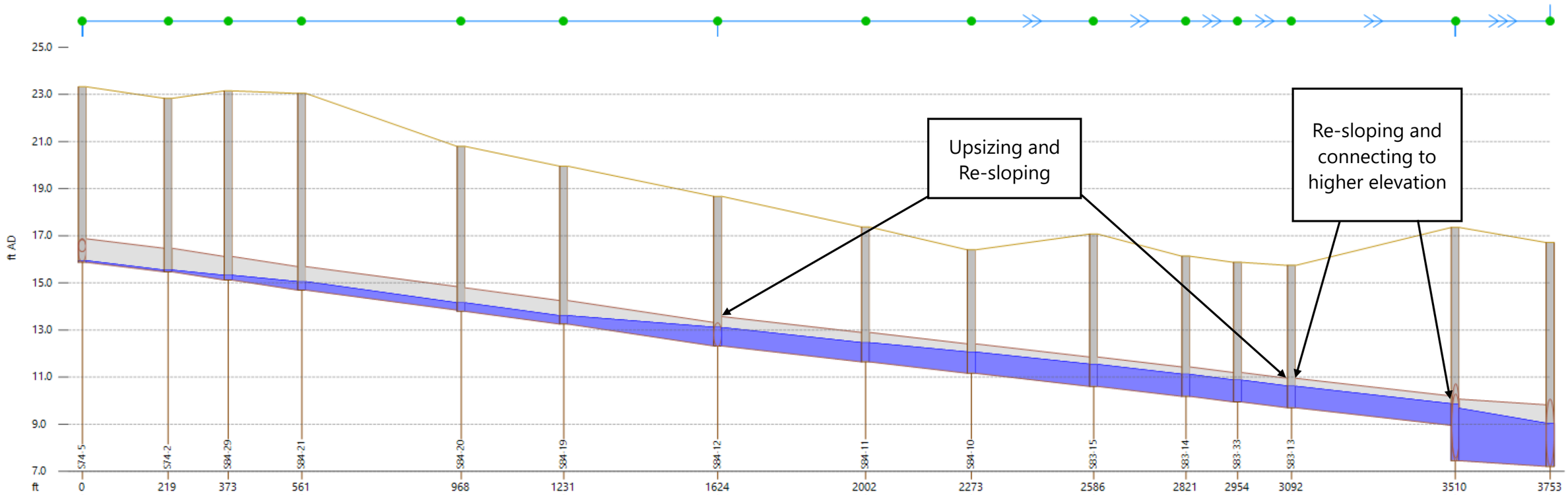
Project 9: Mission College Blvd
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S74-5.1	S74-2.1	S84-29.1	S84-21.1	S84-20.1	S84-19.1	S84-12.1	S84-11.1	S84-10.1	S83-15.1	S83-14.1	S83-33.1	S83-13.1	S83-18.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	RCP
width (in)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	15.0	31.4
length (ft)	218.9	154.0	188.0	407.5	262.3	393.7	377.9	270.4	312.9	235.8	132.3	137.9	418.3	243.0
pfc (MGD)	0.98	1.10	1.10	1.05	1.05	1.12	1.09	1.10	1.03	0.99	1.20	1.29	1.87	9.38
us inv (ft AD)	15.870	15.470	15.118	14.690	13.790	13.250	12.320	11.470	10.850	10.220	9.780	9.420	8.990	7.450
ds inv (ft AD)	15.470	15.118	14.690	13.840	13.250	12.320	11.470	10.850	10.220	9.780	9.420	8.990	8.150	7.210
surc	0.61	0.96	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	0.85
DS flow (MGD)	0.0101	0.0210	0.2770	0.2766	0.2584	0.3163	1.1959	1.2819	1.5473	1.5473	1.5472	1.5472	1.5467	13.2916
DS velocity (ft/s)	0.065	0.068	1.705	2.077	1.680	0.628	2.307	2.318	2.844	2.891	2.914	3.044	3.020	5.148

Node	S74-5	S74-2	S84-29	S84-21	S84-20	S84-19	S84-12	S84-11	S84-10	S83-15	S83-14	S83-33	S83-13	S83-18	S83-12
ground (ft AD)	-	22.832	23.148	23.040	20.790	19.950	18.670	17.370	16.400	17.070	16.130	15.870	15.740	17.350	16.710
flood dep (ft)	-	-6.752	-7.068	-6.974	-4.772	-3.962	-2.743	-2.548	-2.408	-4.392	-4.526	-4.881	-5.353	-7.503	-7.675

Project 9: Mission College Blvd
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network

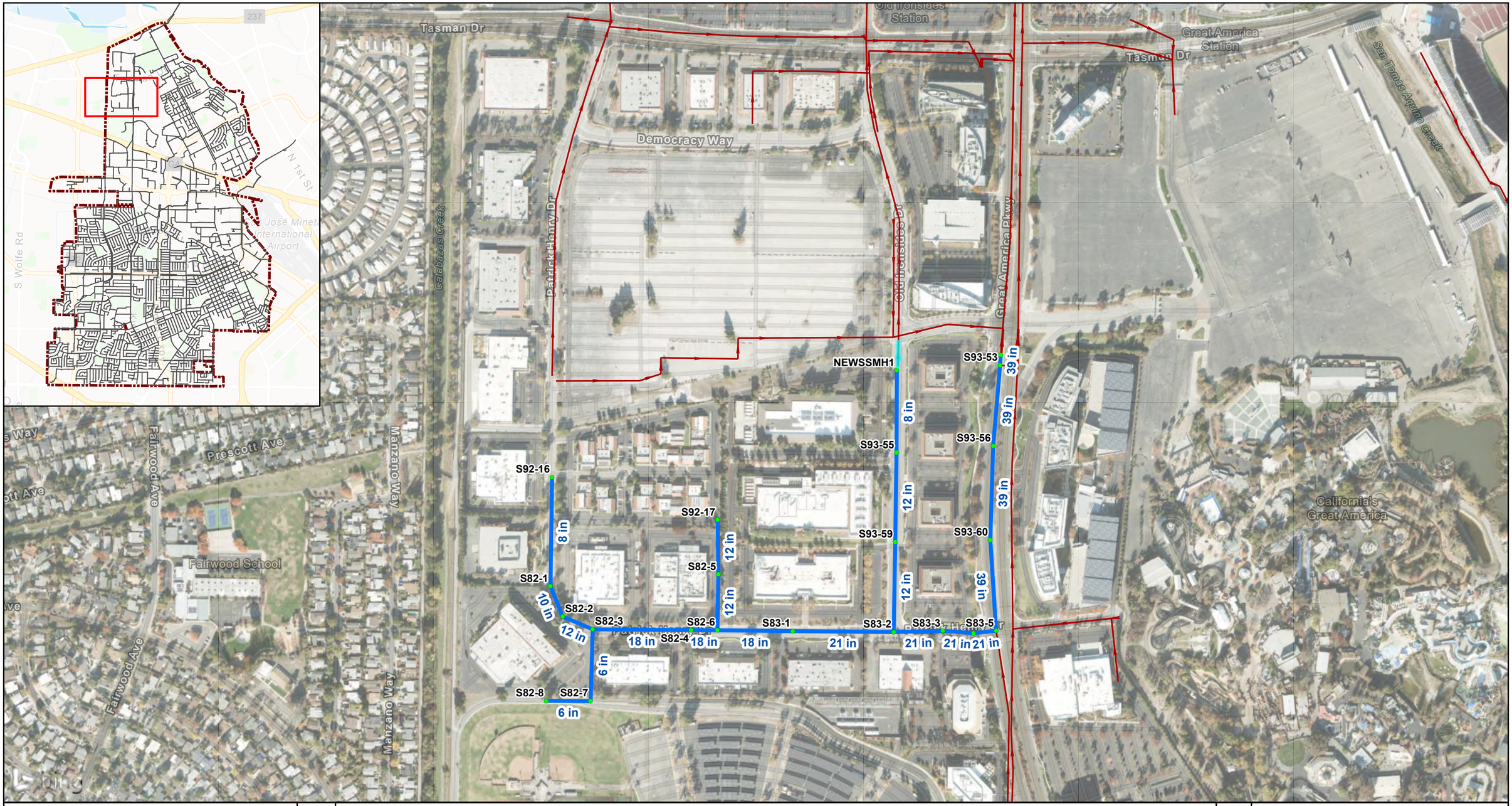


Link	S74-5.1	S74-2.1	S84-29.1	S84-21.1	S84-20.1	S84-19.1	S84-12.1	S84-11.1	S84-10.1	S83-15.1	S83-14.1	S83-33.1	S83-13.1	S83-18.1
Conduit mate	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	VCP	RCP
width (in)	12.0	12.0	12.0	12.0	12.0	12.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	31.4
length (ft)	218.9	154.0	188.0	407.5	262.3	393.7	377.9	270.4	312.9	235.8	132.3	137.9	418.3	243.0
pfc (MGD)	0.98	1.10	1.10	1.05	1.05	1.12	1.77	1.77	1.77	1.77	1.77	1.77	1.77	9.38
us inv (ft AD)	15.870	15.470	15.118	14.690	13.790	13.250	12.320	11.645	11.161	10.602	10.181	9.944	9.698	7.450
ds inv (ft AD)	15.470	15.118	14.690	13.840	13.250	12.320	11.645	11.161	10.602	10.181	9.944	9.698	8.950	7.210
surc	0.07	0.20	0.36	0.36	0.36	0.79	0.65	0.72	0.75	0.75	0.74	0.74	0.73	0.85
DS flow (MGD)	-0.0000	-0.0002	0.2770	0.2779	0.2778	0.3288	1.2383	1.3075	1.5729	1.5729	1.5729	1.5728	1.5725	13.3632
DS velocity (ft/s)	-0.000	-0.004	1.705	2.091	1.744	0.767	2.280	2.210	2.454	2.463	2.493	2.515	3.915	5.161

Node	S74-5	S74-2	S84-29	S84-21	S84-20	S84-19	S84-12	S84-11	S84-10	S83-15	S83-14	S83-33	S83-13	S83-18	S83-12
ground (ft AD)	-	22.832	23.148	23.040	20.790	19.950	18.670	17.370	16.400	17.070	16.130	15.870	15.740	17.350	16.710
flood dep (ft)	-	-7.296	-7.832	-7.993	-6.642	-6.348	-5.556	-4.913	-4.339	-5.527	-5.012	-4.999	-5.124	-7.493	-7.674

Project 10: Patrick Henry Drive

Cost estimate not included because project will be paid for by the developer.



Project 10
Patrick Henry Drive

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- PHD Manholes
- Other Modeled Sewers
- PHD Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

0 0.05 0.1 0.2 Miles

N

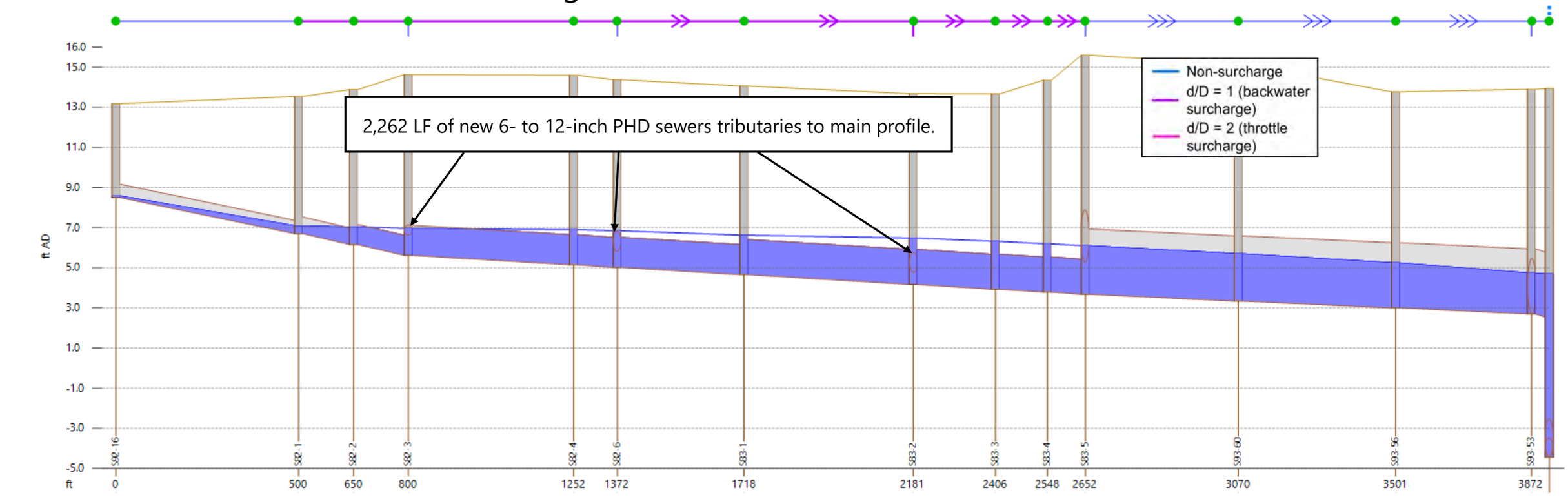
Woodard & Curran

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 9/2/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

Project 10: Patrick Henry Drive
Project Solution Profile View

Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network

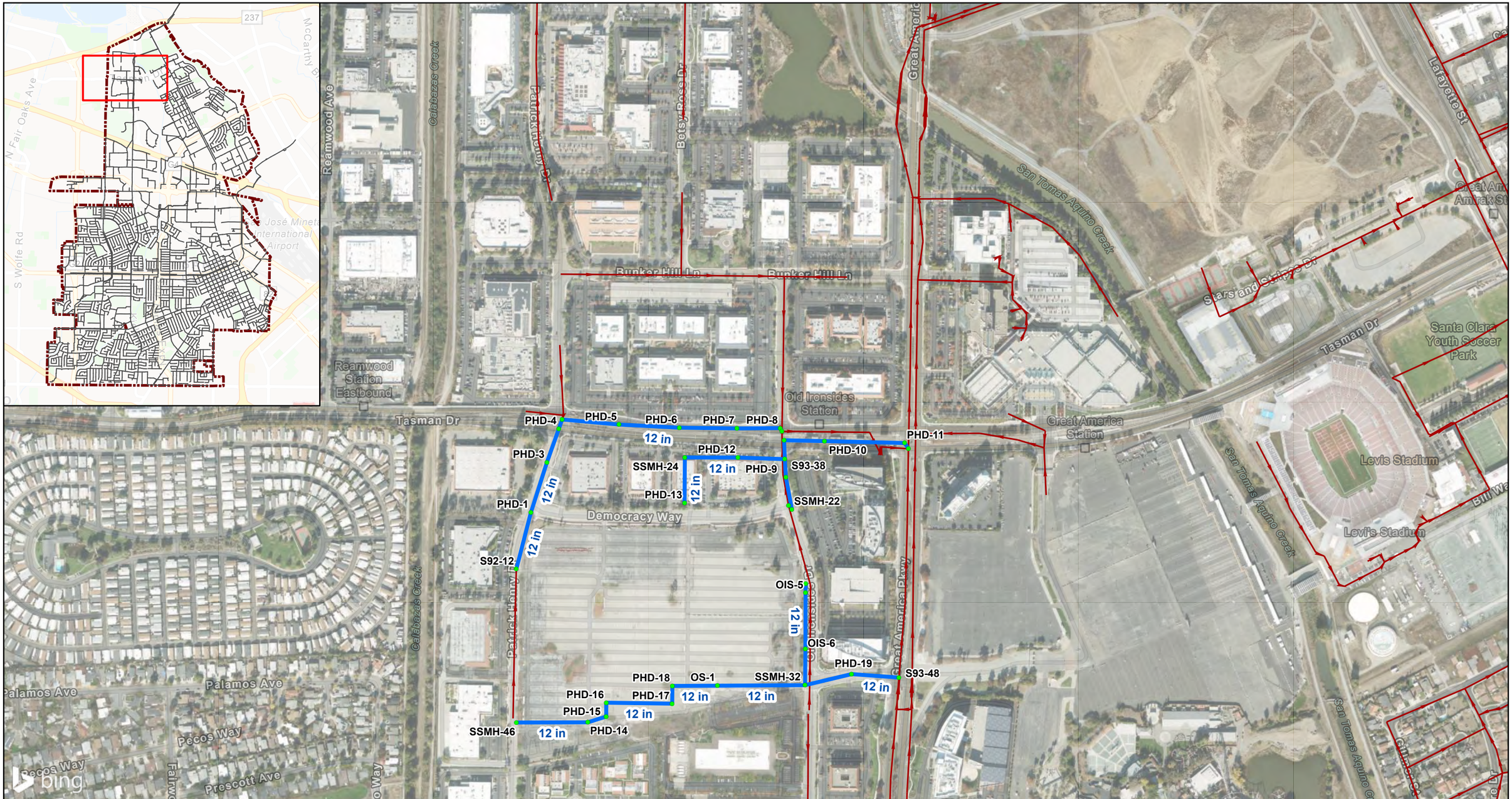


Link	S92-16.1	S82-1.1	S82-2.1	S82-3.1	S82-4.1	S82-6.1	S83-1.1	S83-2.2	S83-3.1	-	S83-5.1	S93-60.1	S93-56.1	-
Conduit mate	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	-
width (in)	8.0	10.0	12.0	18.0	18.0	18.0	21.0	21.0	21.0	21.0	39.0	39.0	39.0	-
length (ft)	500.0	150.0	150.0	452.0	120.0	346.0	463.0	225.3	142.0	104.0	418.0	431.0	371.0	-
pfc (MGD)	0.47	0.85	1.38	2.19	2.23	2.19	3.33	3.34	3.22	3.33	15.22	14.99	15.18	-
us inv (ft AD)	8.500	6.700	6.160	5.620	5.150	5.020	4.660	4.170	3.930	3.790	3.680	3.340	3.000	-
ds inv (ft AD)	6.700	6.160	5.620	5.150	5.020	4.660	4.170	3.930	3.790	3.680	3.340	3.000	2.700	-
surc	0.59	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.74	0.73	0.69	-
DS flow (MGD)	0.1486	0.2963	0.5975	0.9243	1.3644	1.8146	1.9345	2.8987	3.0675	3.0664	14.3167	14.4272	14.5425	-
DS velocity (ft/s)	1.661	1.694	1.526	1.105	1.522	1.953	1.345	1.882	1.943	1.932	3.417	3.660	4.367	-

Node	S92-16	S82-1	S82-2	S82-3	S82-4	S82-6	S83-1	S83-2	S83-3	S83-4	S83-5	S93-60	S93-56	S93-53
ground (ft AD)	13.180	13.540	13.880	14.630	14.600	14.370	14.060	13.680	13.667	14.354	15.600	15.150	13.770	13.900
flood dep (ft)	-4.600	-6.446	-6.847	-7.670	-7.703	-7.523	-7.432	-7.194	-7.344	-8.154	-9.491	-9.438	-8.519	-9.152

Project 11: Tasman/GAP

Cost estimate not included because project will be paid for by the developer.



Project 11
Tasman/GAP
(Revised Option 2A)

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Tasman/GAP Manholes
- Other Modeled Sewers
- Tasman/GAP Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

0 0.05 0.1 0.2 Miles

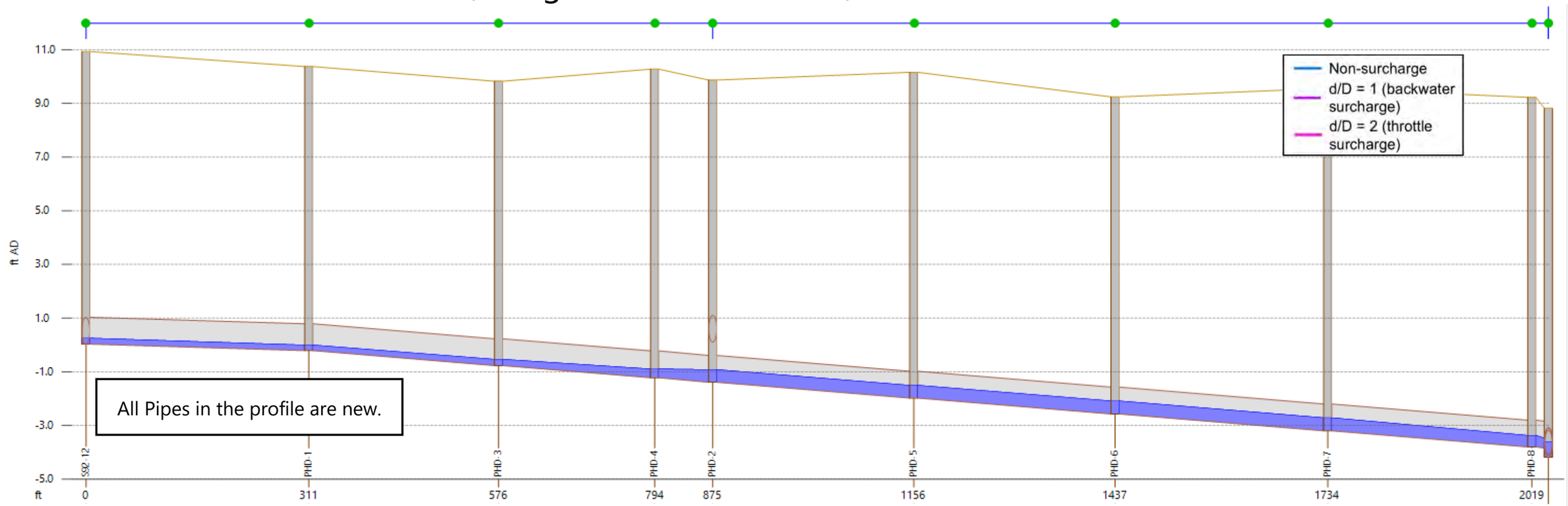
N

Woodard & Curran

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 8/18/2025 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2024_Report.aprx

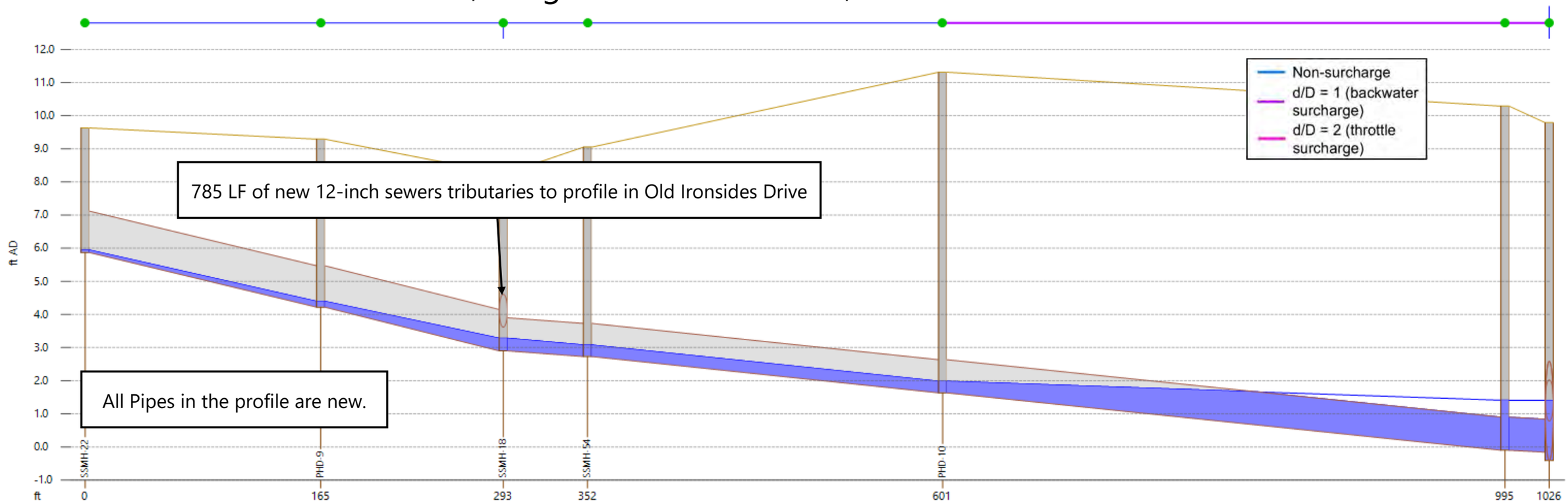
Project 11: Tasman/GAP
Project Solution Profile View 1 of 3
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S92-12.1	PHD-1.1	PHD-3.1	PHD-4.1	PHD-2.1	PHD-5.1	PHD-6.1	PHD-7.1	-
Conduit mate	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	-
width (in)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	-
length (ft)	311.0	265.0	218.0	81.0	281.0	281.0	297.0	285.0	-
pfc (MGD)	0.64	1.06	1.05	1.06	1.06	1.06	1.06	1.06	-
us inv (ft AD)	0.030	-0.210	-0.770	-1.220	-1.390	-1.980	-2.570	-3.200	-
ds inv (ft AD)	-0.210	-0.770	-1.220	-1.390	-1.980	-2.570	-3.200	-3.800	-
surc	0.21	0.23	0.32	0.46	0.47	0.48	0.48	0.48	-
DS flow (MGD)	0.0775	0.1064	0.1122	0.1123	0.4524	0.4787	0.4787	0.4786	-
DS velocity (ft/s)	1.082	1.239	0.894	0.489	1.940	2.007	2.004	2.362	-

Node	S92-12	PHD-1	PHD-3	PHD-4	PHD-2	PHD-5	PHD-6	PHD-7	PHD-8
ground (ft AD)	10.930	10.370	9.826	10.274	9.869	10.156	9.241	9.556	9.225
flood dep (ft)	-10.686	-10.381	-10.370	-11.178	-10.796	-11.668	-11.334	-12.279	-12.604

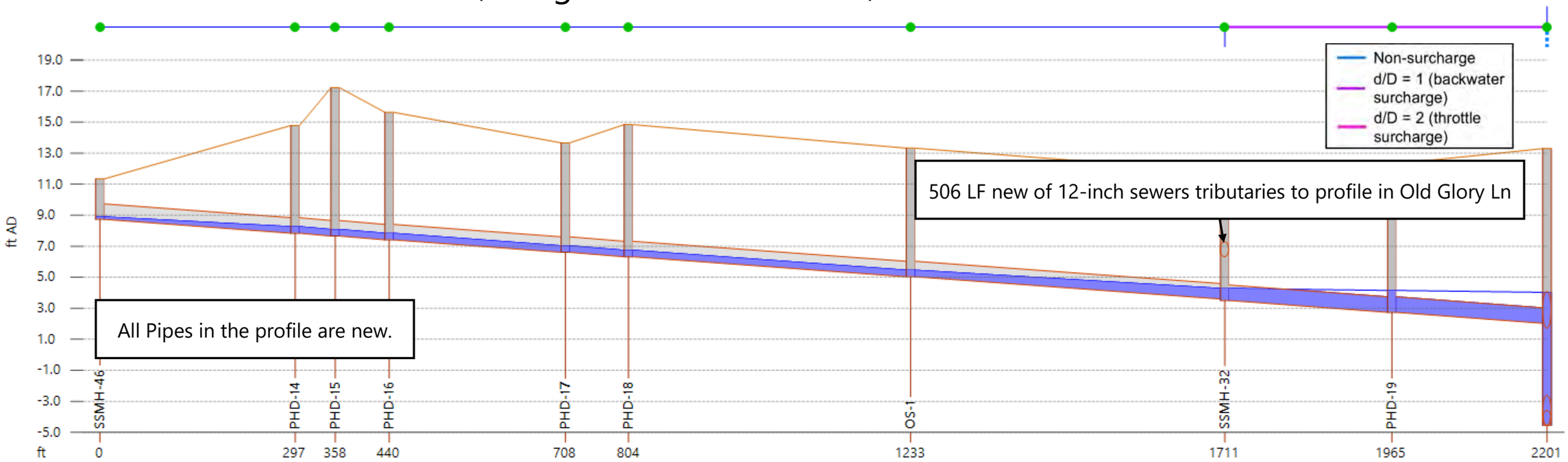
Project 11: Tasman/GAP
Project Solution Profile View 2 of 3
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	SSMH-22.1	PHD-9.1	SSMH-18.1	SSMH-54.1	PHD-10.1	-
Conduit mate	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN
width (in)	15.0	15.0	12.0	12.0	12.0	12.0
length (ft)	165.0	128.0	59.0	249.0	394.0	31.0
pfc (MGD)	4.18	4.24	1.24	1.53	1.53	1.02
us inv (ft AD)	5.870	4.220	2.900	2.730	1.634	-0.099
ds inv (ft AD)	4.220	2.900	2.730	1.634	-0.099	-0.160
surc	0.14	0.31	0.38	0.35	1.00	1.00
DS flow (MGD)	0.0908	0.0908	0.3863	0.3863	0.3867	0.3867
DS velocity (ft/s)	1.342	0.441	2.449	2.443	0.728	0.727

Node	SSMH-22	PHD-9	SSMH-18	SSMH-54	PHD-10	PHD-11	-
ground (ft AD)	9.630	9.291	8.270	9.050	11.313	10.288	-
flood dep (ft)	-3.684	-4.896	-4.987	-5.971	-9.329	-8.877	-

Project 11: Tasman/GAP
Project Solution Profile View 3 of 3
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	SSMH-46.1	-	-	PHD-16.1	-	PHD-18.1	OS-1.1	SSMH-32.1	PHD-19.1
Conduit mate	UNKN	-	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN	UNKN
width (in)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
length (ft)	297.0	61.0	82.0	268.0	96.0	429.0	478.0	254.0	236.0
pfc (MGD)	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26
us inv (ft AD)	8.730	7.839	7.656	7.410	6.606	6.318	5.031	3.500	2.738
ds inv (ft AD)	7.839	7.656	7.410	6.606	6.318	5.031	3.597	2.738	2.030
surc	0.42	0.42	0.42	0.42	0.42	0.42	0.68	1.00	1.00
DS flow (MGD)	0.4552	-	0.4550	0.4549	0.4549	0.4548	0.4992	0.5503	0.5499
DS velocity (ft/s)	2.244	2.244	2.244	2.244	2.243	2.222	2.863	1.744	1.031

Node	SSMH-46	PHD-14	-	PHD-16	PHD-17	PHD-18	OS-1	SSMH-32	PHD-19	S93-48
ground (ft AD)	11.340	14.785	-	15.636	13.668	14.842	13.320	11.810	12.312	13.290
flood dep (ft)	-2.449	-6.525	-	-7.805	-6.641	-8.103	-7.865	-7.532	-8.160	-9.263

Project 12: GAP West Trunk

PROJECT DESCRIPTION

Project No.	12
Project ID	GAP West Trunk
Project Location	S of West Tasman Dr to Lafayette St
Description	4810 LF of 36 to 42-inch diameter pipe
Priority	3
Flow Confidence Level	2
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$17,781,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii) Project would not include improvements to siphon between manholes S103-19 and S103-16. Siphon is unlined but was assumed to be lined in the future in the Lined Model Network.
	(iv) Project does not include the GAP West Trunk improvements associated with the PHD development. The cost to upsize the GAP West Trunk from the PHD specific development project's discharge point to the Bay Division pipelines crossing (from manhole S83-5 to S93-53) is to be paid by the developers as discussed in Section 2.2; therefore, this portion of the project is not included the City's CIP.
	(v) Two pipe segments between manholes S93-48 and S93-42 that are downstream of the PHD project and the GAP West project are not included in the proposed project because they would still have capacity based on the City's capacity criteria of no surcharge; however, the City may wish to consider expanding the project to include them during preliminary design.
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	City may wish to consider evaluating alternatives during preliminary design that would replace or remove this siphon that crosses under the San Tomas Aquino Creek, if feasible.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S93-42	S93-36	29	36	401	0.13	14	8.41	15.67	10.16	10.57	3.71	$1,239			$1,239	$ 496,839
S93-36	S93-21	29	36	452	0.16	13	9.51	17.09	10.79	11.33	3.91	$1,239	PTGAB	48.00	$2,805	$ 1,267,788
S93-21	S93-4	29	36	451	0.18	13	10.17	18.27	10.88	11.43	3.47	$1,239			$1,239	$ 558,789
S93-4	S103-22	29	36	447	0.09	14	7.36	13.22	11.00	11.55	5.28	$1,239			$1,239	$ 553,337
S103-22	S103-19	29	42	388	0.05	20	5.55	15.14	12.48	12.85	5.21	$1,399			$1,399	$ 542,113
S103-16	S103-14	31	42	245	0.12	23	10.45	22.77	12.48	12.85	3.37	$1,399			$1,399	$ 342,335
S103-14	S103-9	31	42	101	0.20	20	13.28	28.95	12.48	12.85	3.25	$1,399			$1,399	$ 141,159
S103-9	S103-10	32	42	375	0.09	19	9.38	19.87	13.21	13.70	3.46	$1,369			$1,369	$ 513,375
S103-10	S103-12	32	42	468	0.10	17	9.53	20.17	13.20	13.70	3.49	$1,369			$1,369	$ 640,281
S103-12	S104-24	32	42	468	0.10	16	9.53	20.17	13.20	13.70	3.58	$1,369			$1,369	$ 640,144
S104-24	S104-26	32	42	477	0.09	19	9.43	19.98	13.20	13.70	3.91	$1,369			$1,369	$ 652,739
S104-26	S104-23	31	42	423	0.10	17	9.18	20.00	13.20	13.69	5.68	$1,369			$1,369	$ 579,087
S104-23	S104-51	31	42	62	0.71	16	25.20	54.92	13.20	13.69	5.68	$1,369			$1,369	$ 84,467
S104-51	S104-19	36	42	54	0.80	17	37.62	58.03	13.20	13.69	4.46	$1,369			$1,369	$ 73,926

Total Baseline Pipe Construction Cost	$	5,818,593
Total Trenchless Installation Cost	$	1,267,788
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 6)	$	3,000
Modify Existing Manholes Cost (Approx. 16)	$	280,000
Baseline Construction Cost:	**$**	**7,369,380**
Dewatering	$	432,855
Bypass Pumping	$	708,638
Remove & Replace Factor	$	354,319
Traffic Control (20%)	$	1,417,276
Pavement Restoration (T-trench)	$	138,352
Subtotal:	**$**	**10,420,820**
Mobilization/Demobilization (5% of subtotal)	$	521,041.02
Estimated Construction Cost Subtotal:	**$**	**10,941,861**
Contingencies (30% of construction subtotal)	$	3,282,558.41
Estimated Construction Cost:	**$**	**14,224,420**
Engineering and Inspection (25% of construction cost)	$	3,556,105
Estimated Capital Improvement Cost:	**$**	**17,781,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)

Project 12
GAP West Trunk

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

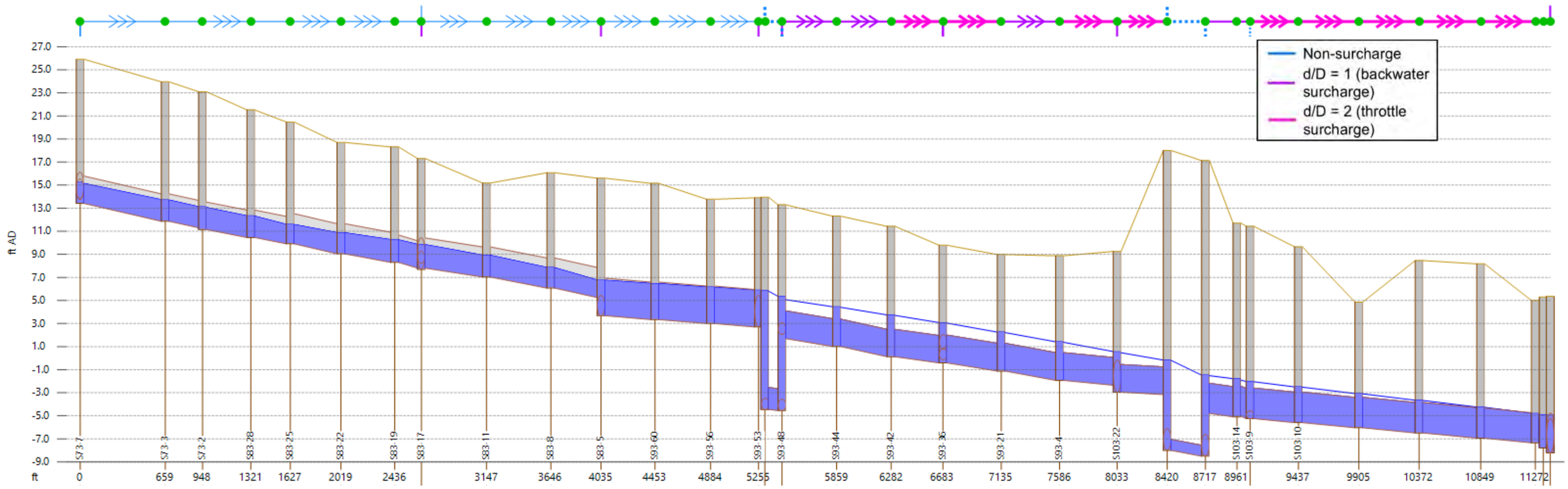
0 0.05 0.1 0.2 Miles

N

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 9/3/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

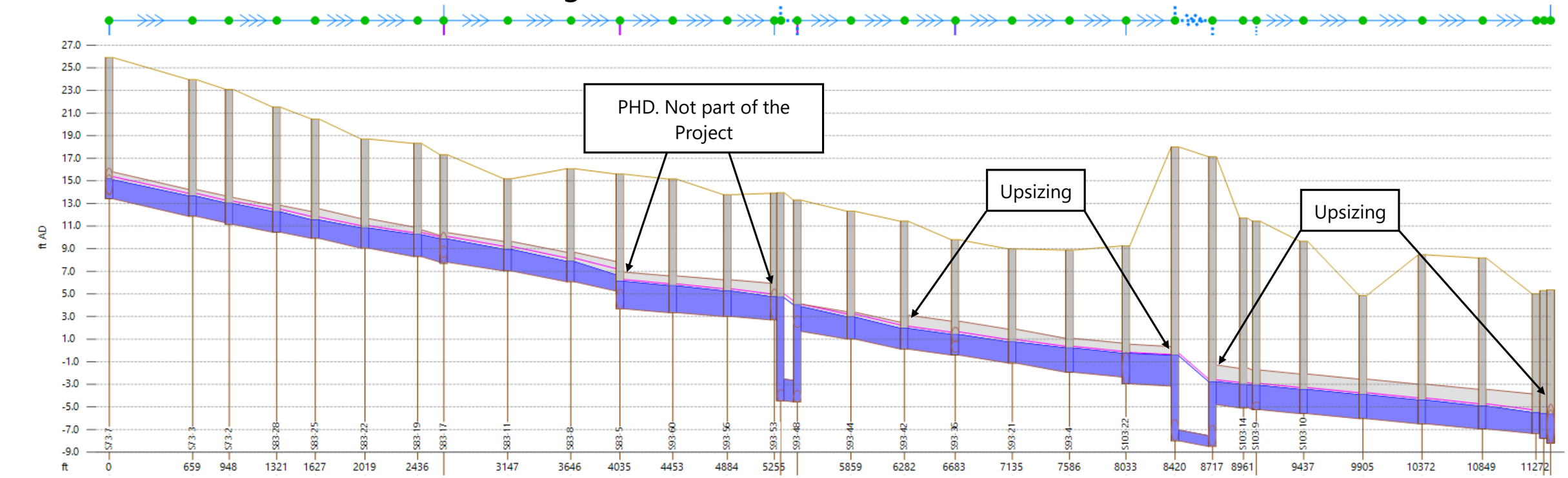
Project 12: GAP West Trunk
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S73-7.1	-	S73-2.1	-	S83-25.1	S83-22.1	-	S83-17.1	S83-11.1	S83-8.1	S83-5.1	S93-60.1	S93-56.1	-	S93-48.1	S93-44.1	S93-42.1	S93-36.1	S93-21.1	S93-4.1	-	-	-	-	S103-9.1	S103-10.1	S103-12.1	S104-24.1	S104-26.1
Conduit mate	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	UNKN	UNKN	UNKN	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	VCP	RCP	-	RCP	RCP	RCP	RCP	RCP
width (in)	28.5	28.5	28.5	28.5	31.4	31.4	28.5	31.4	31.4	31.4	39.0	39.0	39.0	-	28.9	28.5	28.5	28.9	28.9	28.9	28.8	11.4	31.4	-	31.7	31.7	31.7	31.7	31.4
length (ft)	658.7	288.9	373.8	305.7	392.1	416.7	-	503.0	499.0	389.0	418.0	431.0	371.0	-	423.0	423.0	401.0	452.0	451.0	446.6	387.5	296.2	244.7	-	375.0	467.7	467.6	476.8	423.0
pfc (MGD)	11.23	10.19	9.94	9.82	14.06	12.58	-	11.68	13.09	13.70	15.22	14.99	15.18	-	9.62	10.62	8.41	9.51	10.17	7.36	5.55	0.83	10.45	-	9.38	9.53	9.53	9.43	9.18
us inv (ft AD)	13.410	11.860	11.150	10.460	9.910	9.040	-	7.800	7.030	6.070	3.680	3.340	3.000	-	1.690	1.010	0.120	-0.410	-1.120	-1.930	-2.950	-8.000	-	-	-5.240	-5.590	-6.040	-6.490	-6.940
ds inv (ft AD)	11.860	11.300	10.460	9.910	9.040	8.300	-	7.030	6.070	5.250	3.340	3.000	2.700	-	1.010	0.120	-0.410	-1.120	-1.930	-2.350	-3.160	-8.500	-	-	-5.590	-6.040	-6.490	-6.940	-7.340
surc	0.79	0.78	0.80	0.78	0.70	0.75	0.87	0.78	0.72	0.67	0.96	0.97	0.98	-	1.00	1.00	2.00	2.00	1.00	2.00	2.00	2.00	1.00	-	2.00	2.00	2.00	2.00	2.00
DS flow (MGD)	9.7231	9.7229	9.7228	9.8966	9.8990	9.9069	-	11.4763	11.4885	11.4882	14.0521	14.1030	14.1700	-	9.2138	9.2112	9.2087	9.9604	10.0619	10.1861	9.6615	1.3291	-	-	10.5776	10.5764	10.5734	10.5684	10.5626
DS velocity (ft/s)	4.037	4.198	4.018	4.568	3.862	3.675	-	4.261	4.563	6.010	3.291	3.503	4.242	-	3.821	3.416	3.531	3.718	3.505	5.518	5.567	2.898	2.978	-	3.210	3.175	3.288	3.581	5.569

Node	S73-7	S73-3	S73-2	-	S83-25	S83-22	-	S83-17	S83-11	S83-8	S83-5	S93-60	S93-56	-	-	S93-44	S93-42	S93-36	S93-21	S93-4	S103-22	-	-	-	-	S103-10	S103-12	S104-24	S104-26	-
ground (ft AD)	-	23.950	-	21.520	20.470	18.700	-	17.300	15.180	16.070	15.600	15.150	13.770	-	-	12.310	11.420	9.790	8.980	8.870	9.250	18.000	-	-	-	9.650	4.860	8.460	8.170	-
flood dep (ft)	-	-10.225	-9.985	-9.192	-8.879	-7.827	-	-7.449	-6.255	-8.216	-8.835	-8.683	-7.612	-	-	-7.860	-7.677	-6.712	-6.727	-7.455	-8.703	-	-	-	-	-12.148	-7.938	-12.116	-12.413	-

Project 12: GAP West Trunk
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S73-7.1	-	S73-2.1	-	S83-25.1	S83-22.1	-	S83-17.1	S83-11.1	S83-8.1	S83-5.1	S93-60.1	S93-56.1	-	S93-48.1	S93-44.1	S93-42.1	S93-36.1	S93-21.1	S93-4.1	-	-	-	-	S103-9.1	S103-10.1	S103-12.1	S104-24.1	S104-26.1
Conduit mate	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	UNKN	UNKN	UNKN	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	VCP	RCP	-	RCP	RCP	RCP	RCP	RCP
width (in)	28.5	28.5	28.5	28.5	31.4	31.4	28.5	31.4	31.4	31.4	39.0	39.0	39.0	-	28.9	28.5	36.0	36.0	36.0	36.0	42.0	11.4	42.0	-	42.0	42.0	42.0	42.0	42.0
length (ft)	658.7	288.9	373.8	305.7	392.1	416.7	-	503.0	499.0	389.0	418.0	431.0	371.0	-	423.0	423.0	401.0	452.0	451.0	446.6	387.5	296.2	244.7	-	375.0	467.7	467.6	476.8	423.0
pfc (MGD)	11.23	10.19	9.94	9.82	14.06	12.58	-	11.68	13.09	13.70	15.22	14.99	15.18	-	9.62	10.62	15.67	17.09	18.27	13.22	15.14	0.83	22.77	-	19.87	20.17	20.17	19.98	20.00
us inv (ft AD)	13.410	11.860	11.150	10.460	9.910	9.040	-	7.800	7.030	6.070	3.680	3.340	3.000	-	1.690	1.010	0.120	-0.410	-1.120	-1.930	-2.950	-8.000	-	-	-5.240	-5.590	-6.040	-6.490	-6.940
ds inv (ft AD)	11.860	11.300	10.460	9.910	9.040	8.300	-	7.030	6.070	5.250	3.340	3.000	2.700	-	1.010	0.120	-0.410	-1.120	-1.930	-2.350	-3.160	-8.500	-	-	-5.590	-6.040	-6.490	-6.940	-7.340
surc	0.75	0.74	0.77	0.75	0.68	0.74	0.87	0.78	0.72	0.67	0.74	0.73	0.69	-	0.90	0.81	0.60	0.62	0.71	0.71	0.77	2.00	0.59	-	0.61	0.61	0.60	0.59	0.57
DS flow (MGD)	9.2880	9.2876	9.2868	9.4393	9.4382	9.4361	-	11.5037	11.5150	11.5148	14.3152	14.4257	14.5411	-	10.5705	10.5699	10.5684	11.3273	11.4285	11.5526	12.8451	1.7651	-	-	13.7047	13.7036	13.7017	13.6982	13.6922
DS velocity (ft/s)	4.027	4.203	3.985	4.519	3.792	3.508	-	4.263	4.566	6.014	3.417	3.660	4.367	-	4.173	4.494	3.704	3.912	3.474	5.296	5.190	3.853	3.366	-	3.476	3.505	3.578	3.866	5.626

Node	S73-7	S73-3	S73-2	-	S83-25	S83-22	-	S83-17	S83-11	S83-8	S83-5	S93-60	S93-56	-	-	S93-44	S93-42	S93-36	S93-21	S93-4	S103-22	-	-	-	-	S103-10	S103-12	S104-24	S104-26	-
ground (ft AD)	-	23.950	-	21.520	20.470	18.700	-	17.300	15.180	16.070	15.600	15.150	13.770	-	-	12.310	11.420	9.790	8.980	8.870	9.250	18.000	-	-	-	9.650	4.860	8.460	8.170	-
flood dep (ft)	-	-10.308	-	-9.261	-8.936	-7.883	-	-7.445	-6.252	-8.218	-9.491	-9.438	-8.520	-	-	-9.360	-9.483	-8.387	-8.251	-8.664	-9.519	-	-	-	-	-13.118	-8.790	-12.866	-13.102	-

Project 13: GAP East Trunk

PROJECT DESCRIPTION

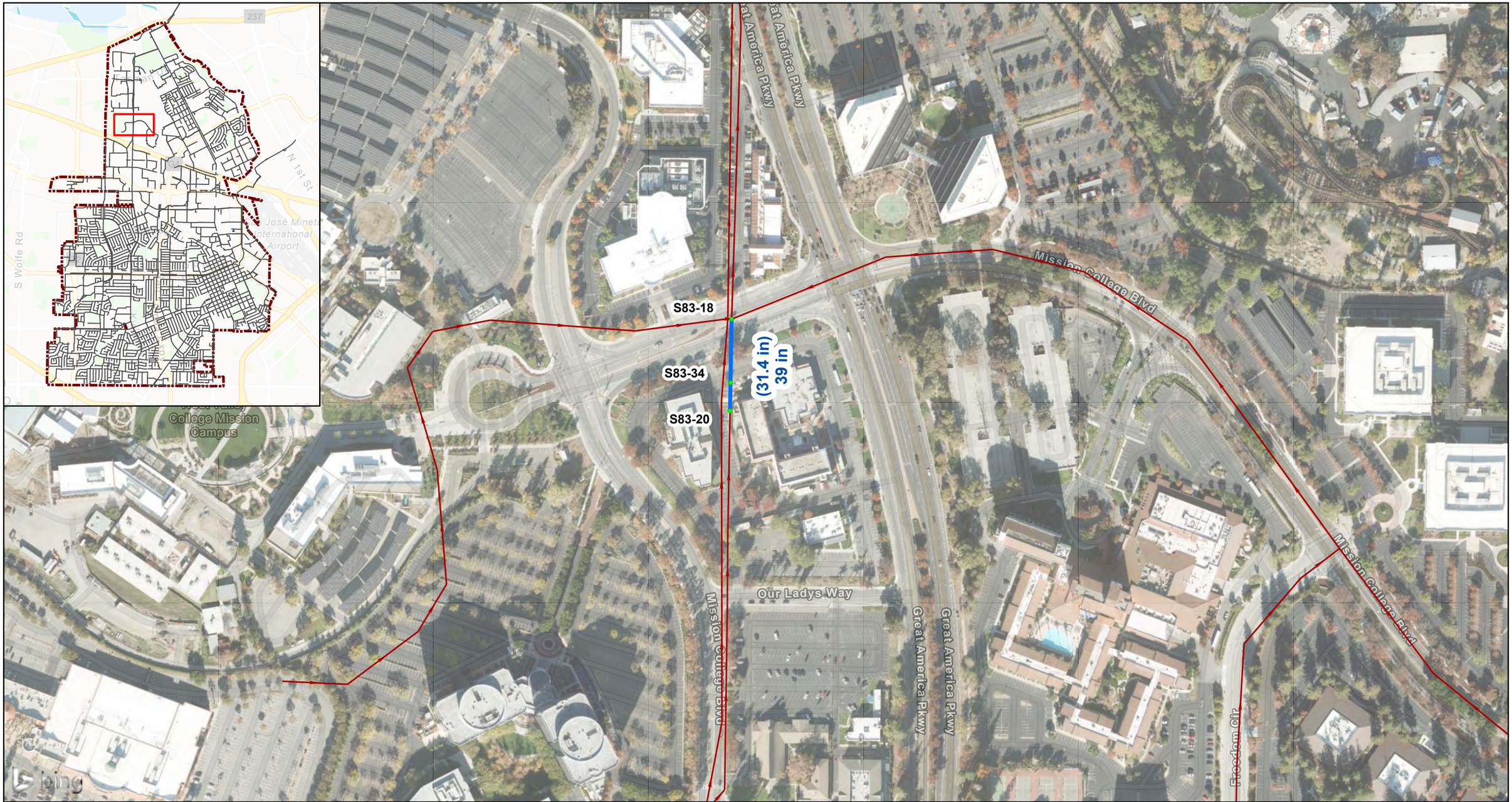
Project No.	13
Project ID	GAP East Trunk
Project Location	Old Glory Ln to S of Bunker Hill Ln; Stars and Stripes Dr
Description	231 LF of 39-inch diameter pipe
Priority	4
Flow Confidence Level	2
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Lined Model Network (LMN)
Estimated Capital Improvement Cost	$1,002,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii) Project would not include improvements to the two siphons along the GAP E Trunk that cross Hetch Hetchy and San Tomas Aquino Creeks because the upstream sewers are not deficient based on the City's no surcharge capacity deficiency criteria. Both of these siphons have already been lined by the City; therefore, the lining is reflected in both the Unlined Model Network and Lined Model Network.
	(iv) Project would be required due to assumed future lining of GAP E Trunk sewer and other trunk sewers upstream.
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	City may wish to consider evaluating alternatives during preliminary design that would replace or remove the siphons crossing under Hetch Hetchy and San Tomas Aquino Creek, if feasible.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)		Total Cost ($)
S83-20	S83-34	31	39	71	0.21	14	13.68	24.47	12.45	13.84	3.20	$1,289			$1,289	$	91,906
S83-34	S83-18	31	39	160	0.09	14	9.14	16.35	12.45	13.83	3.19	$1,289			$1,289	$	205,982

Total Baseline Pipe Construction Cost	$	297,888
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 1)	$	500
Modify Existing Manholes Cost (Approx. 9)	$	157,500
Baseline Construction Cost:	**$**	**455,888**
Dewatering	$	20,799
Bypass Pumping	$	29,789
Remove & Replace Factor	$	14,894
Traffic Control (20%)	$	59,578
Pavement Restoration (T-trench)	$	6,551
Subtotal:	**$**	**587,499**
Mobilization/Demobilization (5% of subtotal)	$	29,374.94
Estimated Construction Cost Subtotal:	**$**	**616,874**
Contingencies (30% of construction subtotal)	$	185,062.11
Estimated Construction Cost:	**$**	**801,936**
Engineering and Inspection(25% ofconstruction cost)	$	200,484
Estimated Capital Improvement Cost:	**$**	**1,002,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)



Project 13
GAP East Trunk

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter
- Other Modeled Sewers

N

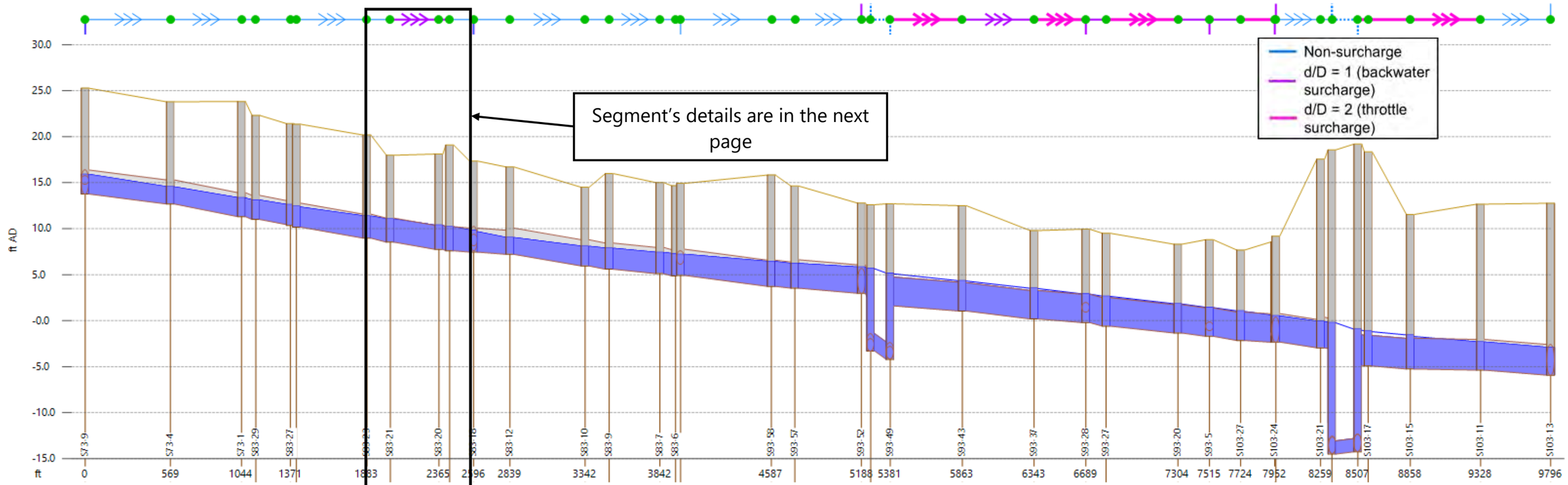
0 0.04 0.07 0.14 Miles

Project #: 0012307.00
Map Created: July 2024

Woodard & Curran

Figure Exported: 10/15/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

Project 13: GAP East Trunk
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



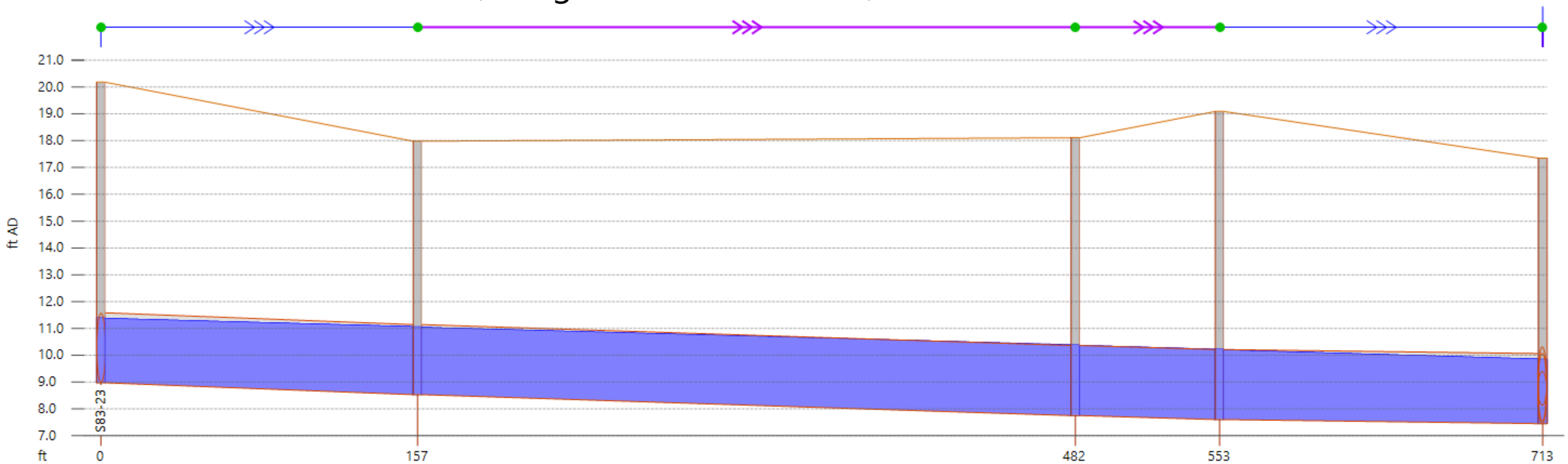
Link	S73-9.1	S73-4.1	-	-	S83-26.1	-	S83-21.1	-	-	-	S83-12.1	-	S83-9.1	-	S83-30.1	-	S93-57.1	-	S93-49.1	S93-43.1	S93-37.1	-	S93-27.1	-	-	-	-	-	-	-	S103-15.1	S103-11.1
Conduit mate	RCP	RCP	-	RCP	RCP	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	-	RCP	RCP	RCP	-	RCP	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	-	VCP	-	RCP	RCP	RCP
width (in)	31.4	31.4	-	31.4	31.4	31.4	31.4	-	31.4	31.4	34.2	34.2	34.2	-	34.2	34.2	37.1	-	37.6	37.1	37.1	-	37.1	37.1	37.1	37.1	37.1	-	17.3	-	39.9	40.1	40.1
length (ft)	569.4	474.9	-	230.4	471.3	-	325.4	-	-	243.0	503.0	-	339.0	-	607.0	-	444.0	-	482.0	480.0	346.0	-	480.0	211.0	208.9	227.6	299.4	-	-	-	281.3	469.9	468.2
pfc (MGD)	13.00	16.03	-	14.71	15.06	-	14.61	-	9.14	9.38	18.83	-	14.16	-	16.66	-	16.39	-	16.35	19.72	15.84	-	18.41	19.24	21.86	13.10	21.37	-	-	-	19.14	9.56	19.52
us inv (ft AD)	13.760	12.680	-	-	10.170	-	8.530	-	-	7.450	7.210	-	5.590	-	4.920	-	3.530	-	1.600	1.050	0.190	-	-0.590	-	-	-2.160	-2.320	-	-	-	-4.930	-5.250	-5.380
ds inv (ft AD)	12.680	11.310	-	-	8.970	-	7.750	-	-	7.210	5.950	-	5.110	-	3.730	-	2.980	-	1.050	0.190	-0.210	-	-1.340	-	-	-2.340	-2.950	-	-	-	-5.250	-5.380	-5.920
surc	0.82	0.79	-	0.84	0.93	0.97	1.00	-	0.99	0.85	0.76	0.81	0.82	-	0.95	0.94	0.92	-	2.00	1.00	2.00	-	2.00	1.00	1.00	2.00	0.94	-	1.00	-	2.00	2.00	0.92
DS flow (MGD)	13.3174	13.3081	-	-	13.2931	-	13.3136	-	-	-	13.3034	-	13.2770	-	13.4917	-	13.3924	-	18.9698	18.9485	18.9299	-	18.9708	-	-	-	19.8493	-	-	-	19.8406	19.8297	19.8143
DS velocity (ft/s)	5.006	4.843	-	5.118	4.520	-	3.796	-	-	5.149	4.171	-	4.091	-	4.008	-	5.604	-	4.344	4.221	4.636	-	4.392	4.388	4.254	4.868	5.807	-	-	-	3.416	3.909	3.938

Node	S73-9	S73-4	S73-1	-	-	-	S83-23	-	-	-	-	S83-12	S83-10	-	-	S83-30	S93-58	S93-57	-	S93-49	S93-43	S93-37	-	S93-27	S93-20	-	-	-	-	-	-	-	S103-15	S103-11	-
ground (ft AD)	-	23.790	-	-	-	-	20.180	-	-	-	-	16.710	14.500	-	-	14.920	15.830	14.630	-	12.700	12.500	9.790	-	9.510	8.310	-	-	-	-	-	-	-	11.540	12.660	-
flood dep (ft)	-9.338	-9.227	-	-	-	-	-8.788	-	-	-	-	-7.671	-6.398	-	-	-7.694	-9.389	-8.413	-	-7.531	-8.158	-6.269	-	-6.843	-6.472	-	-	-	-	-	-	-	-13.100	-14.964	-

Project 13: GAP East Trunk

Capacity Deficiency Profile View (*Zoomed-in section*)

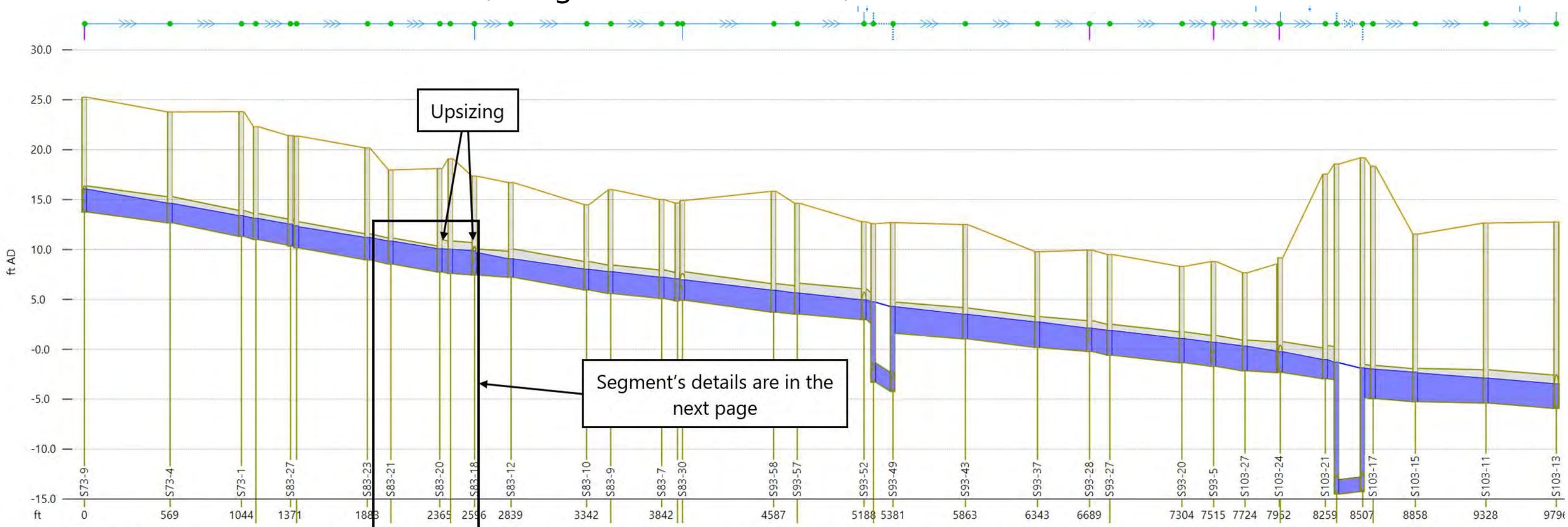
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S83-23.1	S83-21.1	S83-20.1	S83-34.1
Conduit mate	RCP	RCP	RCP	RCP
width (in)	31.4	31.4	31.4	31.4
length (ft)	156.6	325.4	71.3	159.8
pfc (MGD)	15.82	14.61	13.68	9.14
us inv (ft AD)	8.970	8.530	7.750	7.600
ds inv (ft AD)	8.530	7.750	7.600	7.450
surc	0.97	1.00	1.00	0.99
DS flow (MGD)	13.2986	13.3136	13.3133	13.3125
DS velocity (ft/s)	4.195	3.796	3.807	3.993

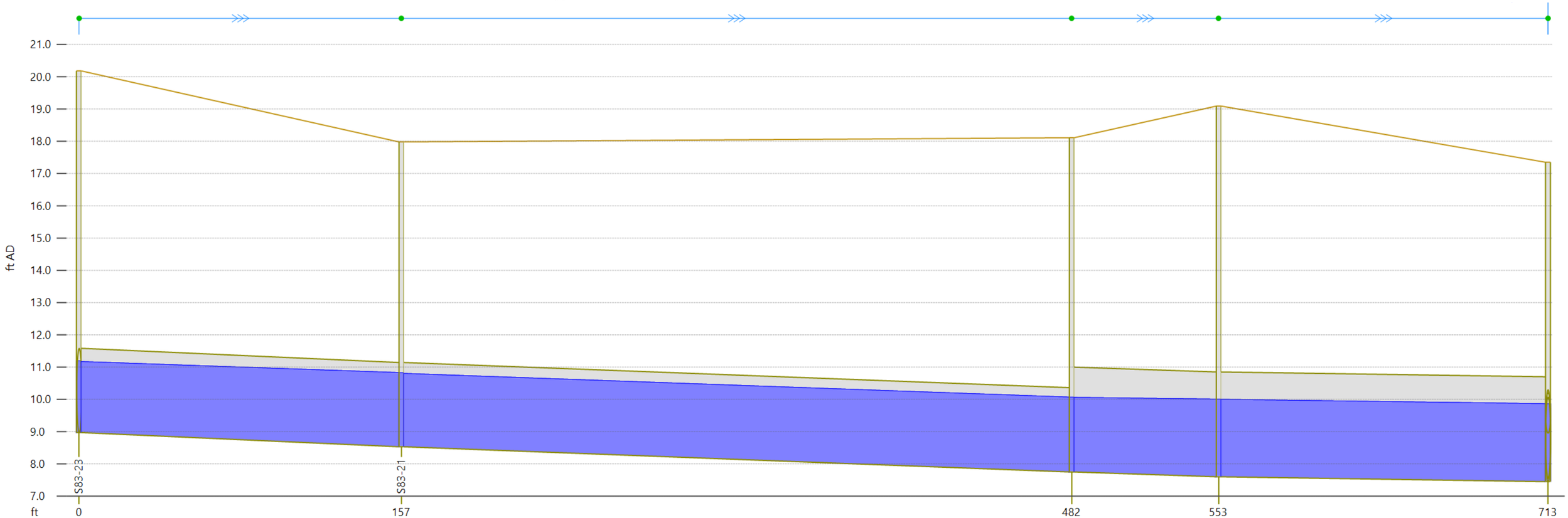
Node	S83-23	S83-21	S83-20	S83-34	S83-18
ground (ft AD)	20.180	17.980	18.110	19.090	17.350
flood dep (ft)	-8.788	-6.921	-7.723	-8.872	-7.498

Project 13: GAP East Trunk
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S73-9.1	S73-4.1	-	-	S83-26.1	-	S83-21.1	-	-	S83-12.1	-	S83-9.1	-	S83-30.1	-	S93-57.1	-	S93-49.1	S93-43.1	S93-37.1	-	S93-27.1	-	-	-	-	-	-	-	S103-15.1	S103-11.1
Conduit mate	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	-	RCP	RCP	RCP	-	RCP	RCP	RCP	-	RCP	RCP	RCP	RCP	RCP	-	VCP	RCP	RCP	RCP
width (in)	31.4	31.4	-	31.4	31.4	-	31.4	-	31.4	34.2	34.2	34.2	-	34.2	-	37.1	-	37.6	37.1	37.1	-	37.1	37.1	37.1	37.1	37.1	-	17.3	39.9	40.1	40.1
length (ft)	569.4	474.9	-	230.4	471.3	-	325.4	-	243.0	503.0	-	339.0	-	607.0	-	444.0	-	482.0	480.0	346.0	-	480.0	211.0	208.9	227.6	299.4	-	-	281.3	469.9	468.2
pfc (MGD)	13.00	16.03	-	14.71	15.06	-	14.61	-	9.38	18.83	-	14.16	-	16.66	-	16.39	-	21.97	27.53	22.11	-	25.71	19.24	21.86	13.10	21.37	-	-	31.31	15.44	19.52
us inv (ft AD)	13.760	12.680	-	-	10.170	-	8.530	-	7.450	7.210	-	5.590	-	4.920	-	3.530	-	1.600	1.050	0.190	-	-0.590	-	-	-	-2.320	-	-	-4.930	-5.250	-5.380
ds inv (ft AD)	12.680	11.310	-	-	8.970	-	7.750	-	7.210	5.950	-	5.110	-	3.730	-	2.980	-	1.050	0.190	-0.210	-	-1.340	-	-	-	-2.950	-	-	-5.250	-5.380	-5.920
surc	0.86	0.79	-	0.81	0.85	-	0.88	-	0.85	0.72	0.76	0.75	-	0.76	-	0.67	-	0.84	0.82	0.81	-	0.79	0.77	0.80	0.79	0.66	-	1.00	0.89	0.85	0.74
DS flow (MGD)	13.8302	13.8255	-	-	13.8155	-	13.8355	-	-	13.3619	-	13.3605	-	13.6553	-	13.6550	-	17.9248	17.9215	17.9195	-	18.0107	-	-	-	17.3783	-	-	-	17.3735	17.3714
DS velocity (ft/s)	5.034	4.867	-	5.121	4.712	-	4.285	-	5.159	4.183	-	4.120	-	4.079	-	5.673	-	4.346	4.225	4.652	-	4.460	4.494	4.425	5.227	5.799	-	-	3.304	3.871	3.905
Node	S73-9	S73-4	S73-1	-	-	-	S83-23	-	-	-	S83-12	S83-10	-	-	S83-30	S93-58	-	-	-	S93-43	S93-37	-	-	S93-20	-	-	-	-	-	-	S103-15	S103-11	-
ground (ft AD)	-	23.790	-	-	-	-	20.180	-	-	-	16.710	14.500	-	-	14.920	15.830	14.630	-	12.700	12.500	9.790	-	9.510	8.310	-	-	-	-	-	-	11.540	12.660	-
flood dep (ft)	-	-9.175	-	-	-	-	-8.993	-	-	-	-7.674	-6.487	-	-	-7.976	-9.929	-9.010	-	-8.422	-9.012	-7.070	-	-7.635	-7.246	-	-	-	-	-	-	-13.851	-15.571	-

Project 13: GAP East Trunk
Project Solution Profile View (*Zoomed-in section*)
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S83-23.1	S83-21.1	S83-20.1	S83-34.1
Conduit mate	RCP	RCP	RCP	RCP
width (in)	31.4	31.4	39.0	39.0
length (ft)	156.6	325.4	71.3	159.8
pfc (MGD)	15.82	14.61	24.47	16.35
us inv (ft AD)	8.970	8.530	7.750	7.600
ds inv (ft AD)	8.530	7.750	7.600	7.450
surc	0.88	0.88	0.74	0.74
DS flow (MGD)	13.8205	13.8355	13.8351	13.8341
DS velocity (ft/s)	4.508	4.285	3.322	3.318

Node	S83-23	S83-21	S83-20	S83-34	S83-18
ground (ft AD)	20.180	17.980	18.110	19.090	17.350
flood dep (ft)	-8.993	-7.160	-8.049	-9.090	-7.492

Project 14: Bunker Hill Lane East

PROJECT DESCRIPTION

Project No.	14
Project ID	Bunker Hill Lane East
Project Location	E of Great America Pkwy
Description	107 LF of 8-inch diameter pipe
Priority	7
Flow Confidence Level	N/A
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network
Estimated Capital Improvement Cost	$301,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii) Deficiency would be caused by historic entitlement flows held by parcel APNs 104-55-012 and 104-55-013 . Project should be implemented before parcels begin to discharge entitled flows.
	(iv) Prior to project implementation, the City should verify the inverts of sewers along the project alignment and at the downstream connection to the GAP East trunk sewer.
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S93-10	S93-7	6	8	107	0.71	10	0.31	0.66	0.40	0.40	3.04	$654			$654	$ 69,651

Total Baseline Pipe Construction Cost	$	69,651
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure (1)	$	45,000
Lateral Reconnection Cost (Approx. 10)	$	5,000
Modify Existing Manholes Cost (Approx. 2)	$	35,000
Baseline Construction Cost:	**$**	**154,651**
Dewatering	$	9,585
Bypass Pumping	$	-
Remove & Replace Factor	$	3,483
Traffic Control (10%)	$	6,965
Pavement Restoration (T-trench)	$	1,943
Subtotal:	**$**	**176,627**
Mobilization/Demobilization (5% of subtotal)	$	8,831.35
Estimated Construction Cost Subtotal:	**$**	**185,458**
Contingencies (30% of construction subtotal)	$	55,637.48
Estimated Construction Cost:	**$**	**241,096**
Engineering and Inspection(25% ofconstruction cost)	$	60,274
Estimated Capital Improvement Cost:	**$**	**301,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)

Project 14
Bunker Hill Lane East

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

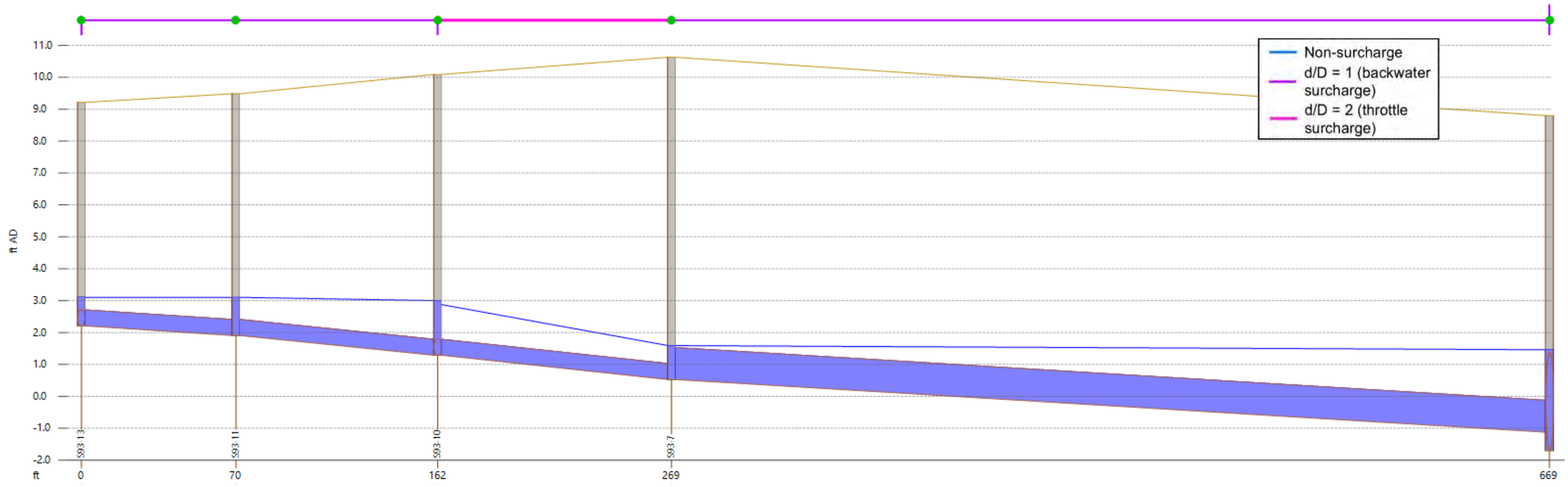
0 0.01 0.02 0.04 Miles

N

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 9/3/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

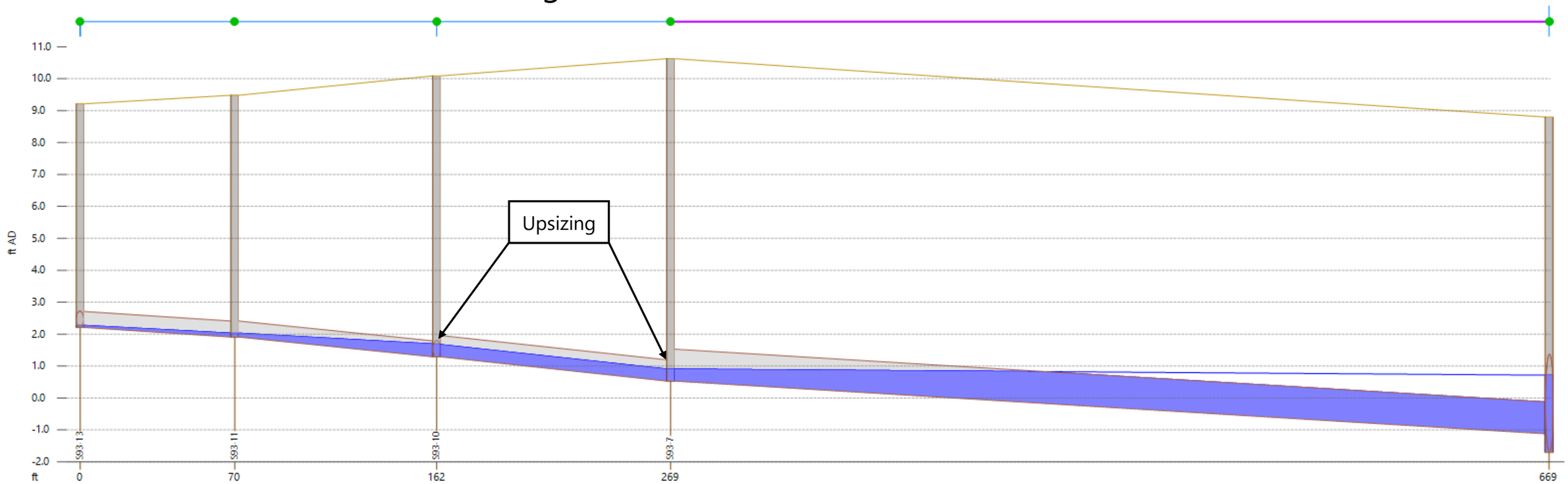
Project 14: Bunker Hill Lane East
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S93-13.1	S93-11.1	S93-10.1	S93-7.1
Conduit mate	VCP	VCP	VCP	VCP
width (in)	6.0	6.0	6.0	12.0
length (ft)	70.4	91.8	106.5	399.8
pfc (MGD)	0.24	0.30	0.31	1.48
us inv (ft AD)	2.210	1.910	1.290	0.530
ds inv (ft AD)	1.910	1.290	0.530	-1.120
surc	1.00	1.00	2.00	1.00
DS flow (MGD)	-0.0063	0.1826	0.4080	0.4641
DS velocity (ft/s)	-0.047	1.335	3.654	1.822

Node	S93-13	S93-11	S93-10	S93-7	S93-5
ground (ft AD)	9.213	9.481	10.089	10.627	8.800
flood dep (ft)	-6.108	-6.377	-7.090	-9.035	-7.341

Project 14: Bunker Hill Lane East
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S93-13.1	S93-11.1	S93-10.1	S93-7.1
Conduit mate	VCP	VCP	VCP	VCP
width (in)	6.0	6.0	8.0	12.0
length (ft)	70.4	91.8	106.5	399.8
pfc (MGD)	0.24	0.30	0.66	1.48
us inv (ft AD)	2.210	1.910	1.290	0.530
ds inv (ft AD)	1.910	1.290	0.530	-1.120
surc	0.24	0.81	0.58	1.00
DS flow (MGD)	-0.0000	0.1784	0.4023	0.4496
DS velocity (ft/s)	-0.000	1.619	3.051	1.870

Node	S93-13	S93-11	S93-10	S93-7	S93-5
ground (ft AD)	9.213	9.481	10.089	10.627	8.800
flood dep (ft)	-6.938	-7.450	-8.396	-9.717	-8.084

Project 15: Lafayette Street

PROJECT DESCRIPTION

Project No.	15
Project ID	Lafayette Street
Project Location	N of Calle del Mundo to S of Great America Wy
Description	2290 LF of 42 to 48-inch diameter pipe
Priority	3
Flow Confidence Level	2
Loads Trigger	Long-Term Future Loads (LTFL)
Design Flow Trigger	Wet Weather Flow (WWF)
Physical Network Trigger	Unlined Model Network (UMN)
Estimated Capital Improvement Cost	$7,515,000
Comments	(i) Pipes are listed in order from upstream to downstream.
	(ii) A 50/50 flow split was assumed at the Lawrence/Homestead gate structure which splits flow between the eastern sewer on Homestead Rd or the northern sewer on Lawrence Expwy.
	(iii) Project would also include some re-sloping of the existing pipe segments from manhole S104-22 to S104-14; per record information, the existing slope is minimal at approximately 0.02 percent.
	(iv) Lined model network includes assumed future lining of Lafayette Trunk.
	(v)
	(vi)
Assumptions	(i) New diameter based on pipe replacement.
	(ii) Cost estimates are based on CCI of 15367.24 from the August 2024 ENR.
Alternatives	N.A.

PROJECT COST DETAIL

U/S MH ID	D/S MH ID	Existing Diameter (inches)	New Diameter (inches)	Length (feet)	Slope (%)	Pipe Depth (feet BGL)	Existing Pipe Capacity (mgd)	Future Pipe Capacity (mgd)	Long-Term Future PDWF (mgd)	Long-Term Future PWWF (mgd)	Long-Term Future DWF Velocity (ft/sec)	Open Cut Cost	Trenchless Installation	Trenchless Casing Size	Unit Cost ($/LF)	Total Cost ($)
S104-29	S104-28	34	42	416	0.19	16	16.51	28.53	10.57	14.33	3.11	$1,369			$1,369	$ 568,956
S104-28	S104-22	34	48	436	0.15	16	14.53	35.86	10.56	14.33	2.12	$1,419			$1,419	$ 618,400
S104-22	S104-17	40	48	426	0.09	16	8.18	27.69	21.18	25.41	3.82	$1,389			$1,389	$ 591,714
S104-17	S104-16	40	48	435	0.09	15	8.18	27.69	21.17	25.40	3.91	$1,389			$1,389	$ 604,215
S104-16	S104-14	40	48	428	0.09	17	22.17	27.69	21.17	25.40	4.16	$1,419			$1,419	$ 607,332
S104-14	S104-8	40	48	150	0.09	17	22.70	27.69	21.17	25.40	4.72	$1,419			$1,419	$ 212,850

Total Baseline Pipe Construction Cost	$	3,203,468
Total Trenchless Installation Cost	$	-
No Jacking Pit	$	-
No Receiving Pit	$	-
Installation or Adjustment of Weir in Existing Manhole Structure	$	-
Lateral Reconnection Cost (Approx. 1)	$	500
Modify Existing Manholes Cost (Approx. 7)	$	122,500
Baseline Construction Cost:	**$**	**3,326,468**
Dewatering	$	206,136
Bypass Pumping	$	320,347
Remove & Replace Factor	$	160,173
Traffic Control (10%)	$	320,347
Pavement Restoration (T-trench)	$	70,897
Subtotal:	**$**	**4,404,368**
Mobilization/Demobilization (5% of subtotal)	$	220,218.40
Estimated Construction Cost Subtotal:	**$**	**4,624,586**
Contingencies (30% of construction subtotal)	$	1,387,375.90
Estimated Construction Cost:	**$**	**6,011,962**
Engineering and Inspection (25% of construction cost)	$	1,502,991
Estimated Capital Improvement Cost:	**$**	**7,515,000**

(Note: Cost estimates are based on August 2024 ENR CCI of 15367.24 for the San Francisco Area)

Project 15
Lafayette St

Santa Clara Sewer Master Plan Update

Legend

Capacity Improvement Project

- Manholes
- Other Modeled Sewers
- Project Sewers
- **(8-in)** (Existing Diameter)
- **10-in** Proposed Diameter

0 0.04 0.07 0.15 Miles

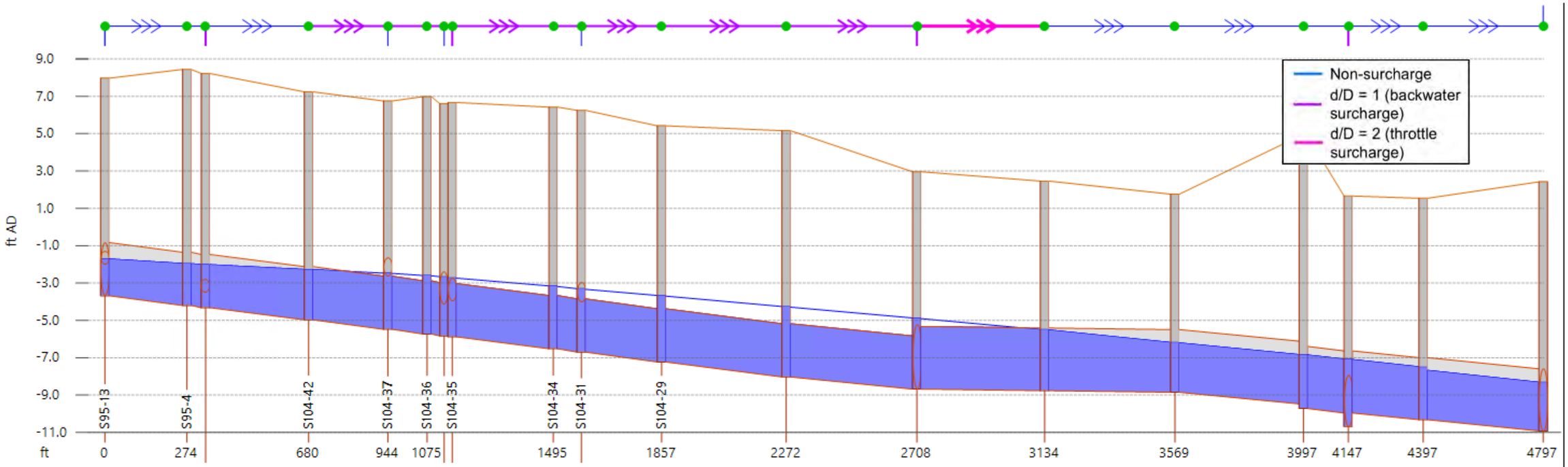
N

Woodard & Curran

Project #: 0012307.00
Map Created: July 2024

Figure Exported: 9/10/2024 By: nbarreralopez Using: \\woodardcurran.net\shared\Projects\0012307.00 Santa Clara CA Sewer Master Plan Update\wip\C. GIS\3. ArcGIS Pro\SantaClaraSewerMasterPlan2023_TMFigures.aprx

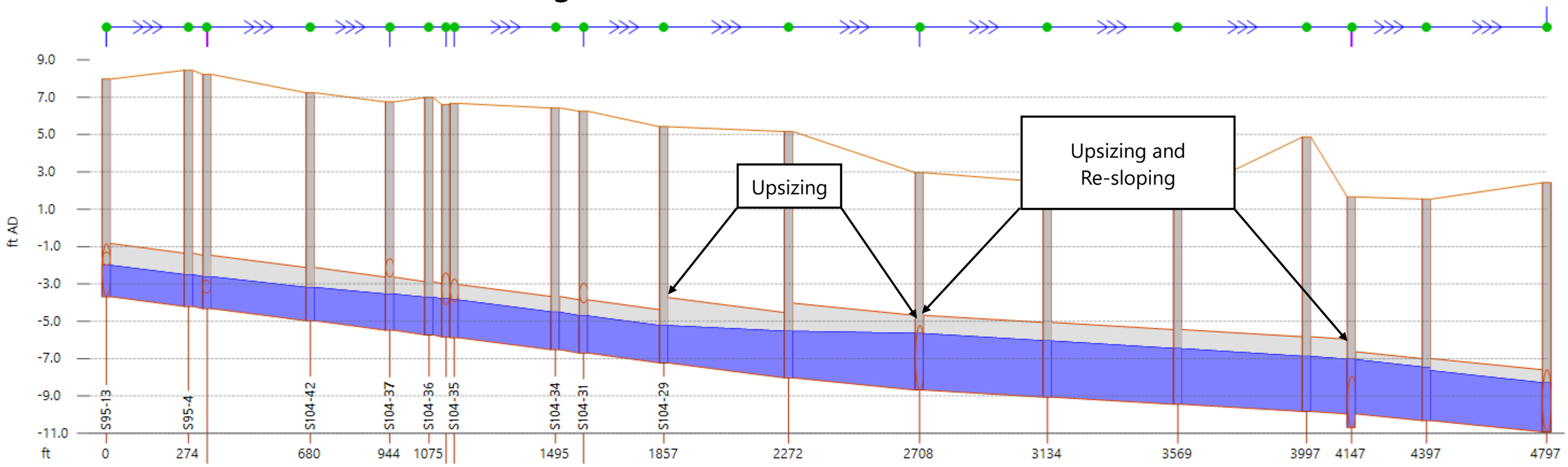
Project 15: Lafayette Street
Capacity Deficiency Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S95-13.1	-	S95-1.1	S104-42.1	-	-	S104-35.1	-	S104-31.1	S104-29.1	S104-28.1	S104-22.1	S104-17.1	S104-16.1	-	S104-8.1	S114-13.1
Conduit mate	RCP	-	RCP	RCP	RCP	-	RCP	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP
width (in)	34.2	-	34.2	34.2	34.2	-	34.2	-	34.2	34.2	34.2	40.3	40.3	40.3	39.9	39.9	39.9
length (ft)	273.5	-	343.7	263.9	131.1	-	336.8	-	267.7	415.6	435.8	426.0	435.0	428.0	150.0	250.0	400.0
pfc (MGD)	16.39	-	16.36	16.53	16.47	-	16.38	-	16.75	16.51	14.53	8.18	8.18	22.17	22.70	21.53	21.98
us inv (ft AD)	-3.681	-	-4.320	-4.970	-	-	-5.882	-	-6.700	-7.230	-8.030	-8.680	-8.764	-8.850	-9.720	-9.960	-10.320
ds inv (ft AD)	-4.200	-	-4.970	-5.479	-	-	-6.520	-	-7.230	-8.030	-8.680	-8.764	-8.850	-9.470	-9.960	-10.320	-10.920
surc	0.79	-	0.95	1.00	1.00	-	1.00	-	1.00	1.00	1.00	2.00	0.97	0.79	0.87	0.86	0.79
DS flow (MGD)	10.3970	-	10.4451	10.4600	-	-	13.7705	-	13.8106	14.3059	14.3057	21.2761	21.2757	21.2754	-	21.5626	21.5625
DS velocity (ft/s)	3.969	-	3.805	3.466	3.501	-	4.007	-	3.715	3.329	3.330	3.733	4.422	5.133	4.223	4.234	4.570

Node	-	-	S95-1	S104-42	-	-	-	-	-	S104-29	S104-28	S104-22	S104-17	S104-16	S104-14	S104-8	S114-13	-
ground (ft AD)	-	8.440	8.220	7.240	6.750	-	6.670	6.420	6.250	5.420	5.160	2.960	2.460	1.760	4.860	1.660	1.540	2.420
flood dep (ft)	-	-	-	-9.510	-9.219	-	-9.386	-9.577	-9.554	-9.089	-9.418	-7.832	-7.952	-7.946	-11.693	-8.737	-9.042	-

Project 15: Lafayette Street
Project Solution Profile View
Model Run Scenario: Wet Weather, Long-Term Future Loads, and Lined Model Network



Link	S95-13.1	-	S95-1.1	S104-42.1	-	-	S104-35.1	-	S104-31.1	S104-29.1	S104-28.1	S104-22.1	S104-17.1	S104-16.1	-	S104-8.1	S114-13.1
Conduit mate	RCP	-	RCP	RCP	RCP	-	RCP	-	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP	RCP
width (in)	34.2	-	34.2	34.2	34.2	-	34.2	-	34.2	42.0	48.0	48.0	48.0	48.0	48.0	39.9	39.9
length (ft)	273.5	-	343.7	263.9	131.1	-	336.8	-	267.7	415.6	435.8	426.0	435.0	428.0	150.0	250.0	400.0
pfc (MGD)	16.39	-	16.36	16.53	16.47	-	16.38	-	16.75	28.53	35.86	27.69	27.69	27.69	27.69	21.53	21.98
us inv (ft AD)	-3.681	-	-4.320	-4.970	-	-	-5.882	-	-6.700	-7.230	-8.030	-8.680	-9.059	-9.446	-9.827	-9.960	-10.320
ds inv (ft AD)	-4.200	-	-4.970	-5.479	-	-	-6.520	-	-7.230	-8.030	-8.680	-9.059	-9.446	-9.827	-9.960	-10.320	-10.920
surc	0.60	-	0.62	0.68	0.71	-	0.71	-	0.70	0.71	0.76	0.75	0.75	0.74	0.73	0.87	0.80
DS flow (MGD)	10.4065	-	10.4578	10.4735	-	-	13.7963	-	13.8367	14.3339	14.3304	25.4071	25.4049	25.4030	-	21.7524	21.7518
DS velocity (ft/s)	4.062	-	3.879	3.548	3.671	-	4.443	-	4.705	3.424	2.448	3.882	3.947	4.168	4.742	4.237	4.579

Node	-	-	S95-1	S104-42	-	-	-	-	-	S104-29	S104-28	S104-22	S104-17	S104-16	S104-14	S104-8	S114-13	-
ground (ft AD)	-	8.440	8.220	7.240	6.750	-	6.670	6.420	6.250	5.420	5.160	2.960	2.460	1.760	4.860	1.660	1.540	2.420
flood dep (ft)	-	-	-	-10.431	-	-	-	-10.926	-	-10.655	-10.695	-8.611	-8.508	-8.222	-11.740	-8.699	-9.011	-

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