



2018

Integrated Master Plan

APPENDICES

March 2018

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Appendix A

REFERENCES

Appendix A

REFERENCES

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Appendix B

MODEL CALIBRATION PLAN AND RESULTS

City of Banning

Sewer Flow Monitoring and Inflow/Infiltration Study



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V&A Project No. 16-0369

Table of Contents

Executive Summary	1
Scope and Purpose	1
Flow and Rainfall Monitoring Sites	1
Rainfall Monitoring.....	2
Site Flow Monitoring and Capacity Results	2
Infiltration and Inflow Analysis	4
Recommendations	4
1 Introduction	6
1.1 Scope and Purpose.....	6
1.2 Flow Monitoring Sites and Basins	6
2 Methods and Procedures	10
2.1 Confined Space Entry	10
2.2 Flow Meter Installation	11
2.3 Flow Calculation	11
2.4 Average Dry Weather Flow Determination	12
2.5 Flow Attenuation.....	13
2.6 Inflow / Infiltration Analysis: Definitions and Identification.....	14
2.6.1 Definition and Typical Sources	14
2.6.2 Infiltration Components	15
2.6.3 Impact and Cost of Source Detection and Removal.....	15
2.6.4 Graphical Identification of I/I	16
2.6.5 Analysis Metrics	16
2.6.6 Normalization Methods	17
3 Rainfall Results.....	19
3.1 Rainfall Monitoring	19
3.2 Rainfall: Storm Event Classification	20
4 Flow Monitoring Results	23
4.1 Average Flow Analysis.....	23
4.2 Capacity Analysis: Peaking Factor and d/D Ratio	24

5	Inflow and Infiltration Results	27
5.1	Preface	27
5.2	Inflow Results Summary	28
5.2.1	Combined I/I Results Summary	30
6	Recommendations	32

Tables

Table ES-1.	List of Flow Monitoring Locations	1
Table ES-2.	Capacity Analysis Summary	3
Table ES-3.	I/I Analysis Summary	4
Table 1-1.	List of Flow Monitoring Locations.....	7
Table 3-1.	Rainfall Events Used for I/I Analysis.....	19
Table 4-1.	Dry Weather Flow Summary	23
Table 4-2.	Capacity Analysis Summary	24
Table 5-1.	Inflow Analysis Summary	28
Table 5-3.	Basins Combined I/I Analysis Summary	30

Figures

Figure ES-0-1.	Map of Flow Monitoring Sites	2
Figure ES-0-2.	Peak Measured Flow (Flow Schematic).....	3
Figure 1-1.	Sanitary Map of Sites 1 and 2 from City and Carollo.....	7
Figure 1-2.	Map of Flow Monitoring Sites	8
Figure 1-3.	Map of Flow Monitoring Basins.....	9
Figure 2-1.	Typical Installation for Flow Meter with Submerged Sensor	11
Figure 2-2.	Sample ADWF Diurnal Flow Patterns	13
Figure 2-3.	Attenuation Illustration	13
Figure 2-4.	Typical Sources of Infiltration and Inflow	14
Figure 2-5.	Sample Infiltration and Inflow Isolation Graph.....	16
Figure 3-1.	Rainfall Activity over Flow Monitoring Period.....	20
Figure 3-2.	Accumulated Precipitation During Flow Monitoring Period	20
Figure 3-3.	NOAA Northern California Rainfall Frequency Map (10-Year, 24-Hour IDF)	21
Figure 3-4.	Storm Event Classification, 24-hour.....	22

Figure 3-4. Storm Event Classification, 30-Day Flow Monitoring Period	22
Figure 4-1. Average Dry Weather Flow (Flow Schematic).....	23
Figure 4-2. Capacity Summary: Peaking Factors	25
Figure 4-3. Capacity Summary: Max d/D Ratios	25
Figure 4-4. Peak Measured Flow (Flow Schematic).....	26
Figure 5-1. Inflow and RDI Isolation Graph, Site 1	27
Figure 5-2. Total I/I Isolation Graph, Site 1.....	28
Figure 5-3. Bar Graph: Inflow Analysis Summary	29
Figure 5-4. Bar Graphs: Combined I/I Analysis Summary	31

Photo Log

Photo 2-1. Confined Space Entry	10
Photo 2-2. Typical Personal Four-Gas Monitor.....	10

Appendices

Appendix A Flow Monitoring Site Reports: Data, Graphs, Information

Site 1	S1 - 1
Site 2	S2 - 1
Site 3	S3 - 1
Site 4	S4 - 1
Site 5	S5 - 1
Site 6	S6 - 1
Site 7	S7 - 1
Site 8	S8 - 1
Site 9	S9 - 1

Abbreviations and Acronyms

Abbreviations/Acronyms	Definition
ADWF	Average Dry Weather Flow
AVG.	Average
CCTV	Closed-Circuit Television
CDEC.....	California Data Exchange Center
CIP	Capital Improvement Plan
CO	Carbon Monoxide
CWOP	Citizen Weather Observing Program
DIA.....	Diameter
d/D.....	Depth/Diameter Ratio
FT.....	Feet
FM.....	Flow Monitor
GPD.....	Gallons per Day
GPM	Gallons per Minute
GWI	Groundwater Infiltration
H2S	Hydrogen Sulfide
IN.....	Inch
I/I	Inflow and Infiltration
IDM	Inch-Diameter Mile
IDW	Inverse Distance Weighting
LEL	Lower Explosive Limit
MAX.....	Maximum
MGD	Million Gallons per Day
MIN.	Minimum
NOAA.....	National Oceanic and Atmospheric Administration
N/A	Not applicable
PF.....	Peaking Factor
PS	Pump Station
Q	Flow Rate
RDI/I	Rainfall-Dependent Infiltration and Inflow
RG	Rain Gauge
SSO	Sanitary Sewer Overflow
V&A	V&A Consulting Engineers, Inc.
WEF.....	Water Environment Federation
WRCC	Western Regional Climate Center

Terms and Definitions

Term	Definition
Average dry weather flow (ADWF)	Average flow rate or pattern from days without noticeable inflow or infiltration response. ADWF usage patterns for weekdays and weekends differ and must be computed separately. ADWF is expressed as a numeric average and may include the influence of normal groundwater infiltration (not related to a rain event).
Basin	Sanitary sewer collection system upstream of a given location (often a flow meter), including all pipelines, inlets, and appurtenances. Also refers to the ground surface area near and enclosed by pipelines. A basin may refer to the entire collection system upstream from a flow meter or exclude separately monitored basins upstream.
Depth/diameter (d/D) ratio	Depth of water in a pipe as a fraction of the pipe's diameter. A measure of fullness of the pipe used in capacity analysis.
Design storm	A theoretical storm event of a given duration and intensity that aligns with historical frequency records of rainfall events. For example, a 10-year, 24-hour design storm is a storm event wherein the volume of rain that falls in a 24-hour period would historically occur once every 10 years. Design storm events are used to predict I/I response and are useful for modeling how a collection system will react to a given set of storm event scenarios.
Infiltration and inflow	Infiltration and inflow (I/I) rates are calculated by subtracting the ADWF flow curve from the instantaneous flow measurements taken during and after a storm event. Flow in excess of the baseline consists of inflow, rainfall-responsive infiltration, and rainfall-dependent infiltration. Total I/I is the total sum in gallons of additional flow attributable to a storm event.
Infiltration, groundwater	Groundwater infiltration (GWI) is groundwater that enters the collection system through pipe defects. GWI depends on the depth of the groundwater table above the pipelines as well as the percentage of the system that is submerged. The variation of groundwater levels and subsequent groundwater infiltration rates is seasonal by nature. On a day-to-day basis, groundwater infiltration rates are relatively steady and will not fluctuate greatly.
Infiltration, rainfall-dependent	Rainfall-dependent infiltration (RDI) is similar to groundwater infiltration but occurs as a result of storm water. The storm water percolates into the soil, submerges more of the pipe system, and enters through pipe defects. RDI is the slowest component of storm-related infiltration and inflow, beginning gradually and often lasting 24 hours or longer. The response time depends on the soil permeability and saturation levels.
Inflow	Inflow is defined as water discharged into the sewer system, including private sewer laterals, from direct connections such as downspouts, yard and area drains, holes in manhole covers, cross-connections from storm drains, or catch basins. Inflow creates a peak flow problem in the sewer system and often dictates the required capacity of downstream pipes and transport facilities to carry these peak instantaneous flows. Overflows are often attributable to high inflow rates.
Peaking factor (PF)	PF is the ratio of peak measured flow to average dry weather flow. This ratio expresses the degree of fluctuation in flow rate over the monitoring period and is used in capacity analysis.
Surcharge	When the flow level is higher than the crown of the pipe, then the pipeline is said to be in a surcharged condition. The pipeline is surcharged when the d/D ratio is greater than 1.0.
Synthetic hydrograph	A set of algorithms has been developed to approximate the actual I/I hydrograph. The synthetic hydrograph is developed strictly using rainfall data and response parameters representing response time, recession coefficient and soil saturation.

Executive Summary

Scope and Purpose

V&A has completed sanitary sewer flow monitoring and inflow and infiltration (I/I) analysis within the City of Banning (City). Flow monitoring and inflow and infiltration (I/I) analysis was performed over a 4-week period from January 20, 2017 to February 22, 2017 at 9 open-channel flow monitoring sites throughout the City. There were three general purposes of this study.

1. Establish the baseline sanitary sewer flows at the flow monitoring sites.
2. Estimate available sewer capacity.
3. Isolate I/I response and perform I/I analysis.

Flow and Rainfall Monitoring Sites

The flow monitoring site locations were selected and approved by the City and are listed in Table ES-1**Error! Not a valid bookmark self-reference.** and shown in Figure ES-1**Error! Reference source not found..**

Table ES-1. List of Flow Monitoring Locations

Monitoring Site	Measured Pipe Diameter (in)	Location	Basin Size (acres)	Basin Isolation Equation
Site 1	24	City of Banning Water Reclamation Facility	556	$= Q_1 - Q_3$
Site 2	30	Lot next to treatment plant	583	$= Q_2 - (Q_4 + Q_6)$
Site 3	15	S Hargrave Street and E Westward Avenue	1391	$= Q_3$
Site 4	15	S 4th Street south of W Barbour Street	96	$= Q_4 - Q_7$
Site 5	12	663 22nd Street	133	$= Q_5$
Site 6	21	2435 W Westward Avenue	645	$= Q_6 - (Q_5 + Q_8 + Q_9)$
Site 7	15	1170 W Ramsey Street	358	$= Q_7$
Site 8	12	Westward Avenue west of Sunset Avenue	882	$= Q_8$
Site 9	12	4545 W Ramsey Street	310	$= Q_9$

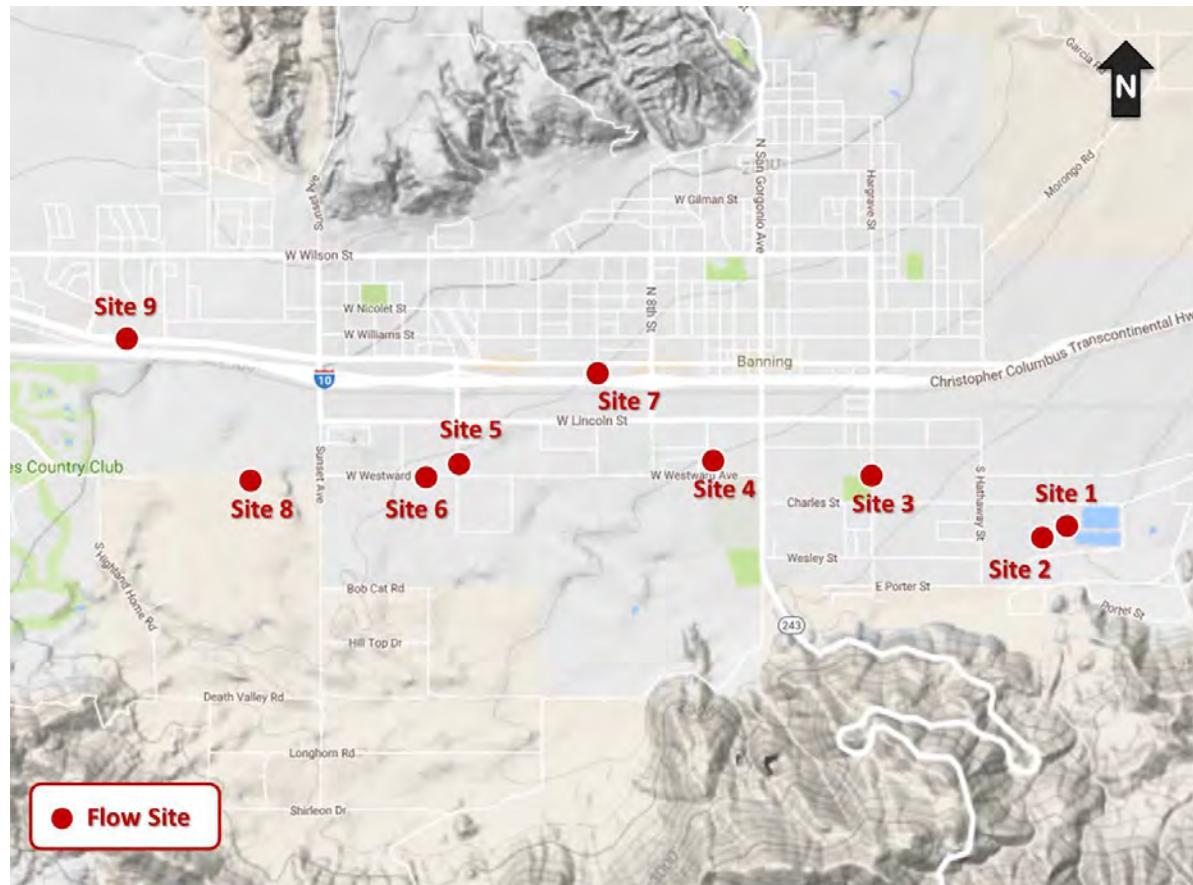


Figure ES-1. Map of Flow Monitoring Sites

Rainfall Monitoring

There were three main rainfall events that occurred over the course of the flow monitoring period. All three of the rainfall events were classified as less than 1 year, 24-hour events and the whole monitoring period was a 2-year, 7-day event or 1.5-year, 30-day event.

January 20 was also classified as a 1.5-year, 3-hour event and all meters were installed just in time to capture the peak flows which were subsequently used for inflow and RDI analysis. The January 22 – 24 rainfall event was used for combined I/I analysis.

Site Flow Monitoring and Capacity Results

Peak measured flows and the consequent hydraulic grade line data (flow depths) are important to understand the capacity limitations of a collection system. The following capacity analyses terms are defined as follows:

- **Peaking Factor:** Peaking factor is defined as the peak measured flow divided by the average dry weather flow (ADWF). Peaking factors are influenced by many factors including size and topography of tributary area and the amount and characteristics of I/I entering the collection system. Flow attenuation and flow restrictions will also affect the peaking factor.

- **d/D Ratio:** The d/D ratio is the peak measured depth of flow (d) divided by the pipe diameter (D). The d/D ratio for each site was computed based on the maximum depth of flow for the flow monitoring study.

Table ES-2 summarizes the peak recorded flows, levels, d/D ratios, and peaking factors per site during the flow monitoring period. Results of note have been shaded in **RED**. Capacity analysis data is presented on a site-by-site basis and represents the hydraulic conditions only at the site locations; hydraulic conditions in other areas of the collection system will differ. Figure ES-2 shows a schematic diagram of the peak measured flows with peak flow levels.

Table ES-2. Capacity Analysis Summary

Metering Site	ADWF (mgd)	Peak Measured Flow (mgd)	Peaking Factor	Pipe Diameter, D (in)	Max Depth, d (in)	d/D Ratio
Site 1	0.663	4.039	6.1	24	22.09	0.92
Site 2	1.347	3.717	2.8	30	26.59	0.89
Site 3	0.494	1.885	3.8	15	5.52	0.37
Site 4	0.342	1.142	3.3	15	4.43	0.30
Site 5	0.063	0.290	4.6	12	2.73	0.23
Site 6	0.853	2.259	2.6	21	10.15	0.48
Site 7	0.280	1.152	4.1	15	4.20	0.28
Site 8	0.504	1.242	2.5	12	3.46	0.29
Site 9	0.192	0.722	3.8	12	4.60	0.38

The following capacity analysis results are noted:

- **Peaking Factor:** Site 1 had a peaking factor greater than 5.
- **d/D Ratio:** Sites 1 and 2 had a maximum d/D ratio that exceeded 0.75. None of the sites surcharged during the study period.

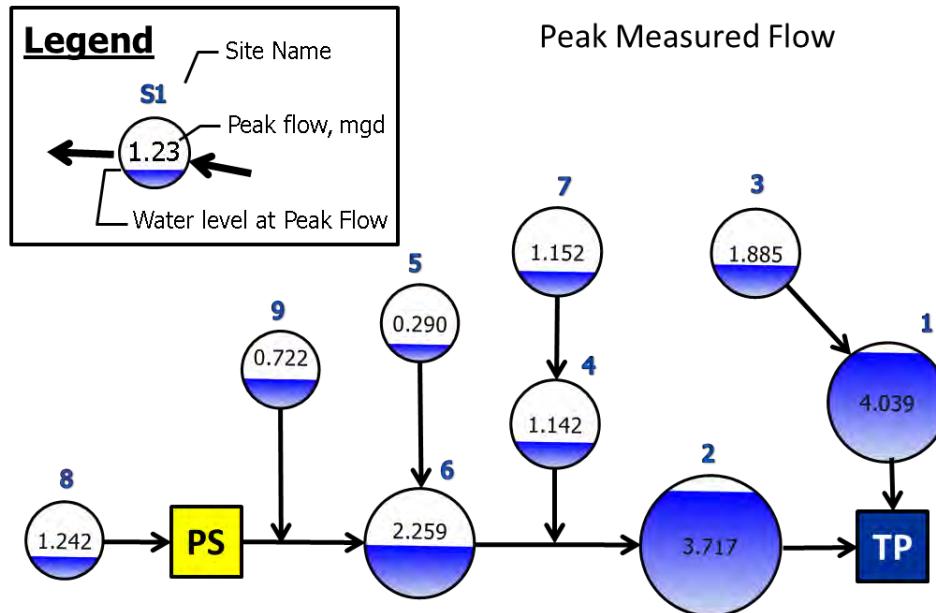


Figure ES-2. Peak Measured Flow (Flow Schematic)

Infiltration and Inflow Analysis

Table ES-3 summarizes the flow monitoring and I/I results for the flow monitoring sites that were monitored during this study. Results of note have been shaded in **RED**. Infiltration and inflow rankings are shown such that 1 represents the highest infiltration or inflow contribution and 9 represents the least. Please refer to the *I/I Methods* section for more information on inflow and infiltration analysis methods and ranking methods.

Table ES-3. I/I Analysis Summary

Metering Basin	ADWF (mgd)	Basin Acres	Peak I/I Rate (mgd)	Combined I/I (gallons)	RDI	Inflow Ranking ^A	Combined I/I Ranking
Basin 1	0.168	556	2.03	1,309,000	Suggestion	1	1
Basin 2	0.152	583	0.03	6,000	--	8	7
Basin 3	0.495	1391	1.29	581,000	--	3	2
Basin 4 ^B	0.063	96	N/A	N/A	--	N/A	N/A
Basin 5	0.063	133	0.25	6,000	--	2	6
Basin 6 ^C	0.095	645	0.22	--	--	6	8
Basin 7	0.279	358	0.44	36,000	--	5	5
Basin 8	0.503	882	0.48	137,000	--	7	4
Basin 9	0.192	310	0.38	123,000	--	4	3

^A Ranking of 1 represents most inflow after normalization.

-- Minimal

^B Small basin size relative to the flow quantity of upstream site; isolated flows after subtraction may have too much uncertainty.

^C Flows from 3 sites were subtracted to isolate the basin. Caution should be exercised when interpreting the resulting isolated flow due to additive uncertainties.

The following inflow/infiltration analysis results are noted:

- **Inflow:** Basins 1, 5, and 3 ranked highest for normalized inflow contribution.
- **Rainfall-Dependent Infiltration:** Not much RDI was apparent in the system. Basin 1 has a suggestion of RDI but was not quantifiable.
- **Combined I/I:** Basins 1, 3, and 9 ranked highest for normalized combined I/I contribution.
- Basin 1 ranked highest for all types of I/I, and was significantly above the other basins.

Recommendations

V&A advises that future I/I reduction plans consider the following recommendations:

1. **Basin 1:** Considering Basin 1 had significantly more normalized I/I than the other basins, is immediately upstream of the treatment plant, and only had one basin upstream for subtraction, the City should prioritize Basin 1 for further investigation or I/I reduction programs.
2. **Determine I/I Reduction Program:** The City should examine its I/I reduction needs to determine a future I/I reduction program.
 - a. If peak flows, sanitary sewer overflows, and pipeline capacity issues are of greater concern, then priority can be given to investigate and reduce sources of inflow within the basins with the greatest inflow problems. Basin 5 is ranked high for normalized inflow.

- b. If total infiltration and general pipeline deterioration are of greater concern, then the program can be weighted to investigate and reduce sources of infiltration within the basins with the greatest infiltration problems. Basin 9 is ranked high for normalized total I/I contribution.
3. **I/I Investigation Methods:** Potential I/I investigation methods include the following:
 - a. Smoke testing
 - b. Nighttime reconnaissance work to (1) investigate and determine direct point sources of inflow and (2) determine the areas and pipe reaches responsible for high levels of infiltration contribution.
4. **I/I Reduction Cost-Effectiveness Analysis:** The City should conduct a study to determine which is more cost-effective: (1) locating the sources of inflow and infiltration and systematically rehabilitating or replacing the faulty pipelines or (2) continued treatment of the additional rainfall-dependent I/I flow.

1 Introduction

1.1 Scope and Purpose

V&A has completed sanitary sewer flow monitoring and inflow and infiltration (I/I) analysis within the City of Banning (City). Flow monitoring and inflow and infiltration (I/I) analysis was performed over a 4-week period from January 20, 2017 to February 22, 2017 at 9 open-channel flow monitoring sites throughout the City. There were three general purposes of this study.

1. Establish the baseline sanitary sewer flows at the flow monitoring sites.
2. Estimate available sewer capacity.
3. Isolate I/I response and perform I/I analysis.

1.2 Flow Monitoring Sites and Basins

Flow monitoring sites are the manholes where the flow monitors were placed. Flow monitoring site data may include the flows of one or many drainage basins. The flow monitoring sites were selected by the City. Capacity and flow rate information is presented on a site-by-site basis. Detailed descriptions of the individual flow monitoring sites, including photographs, are included in *Appendix A*.

Flow monitoring basins are localized areas of a sanitary sewer collection system upstream of a given location (often a flow meter), including all pipelines, inlets, and appurtenances. The basin refers to the ground surface area near and enclosed by the pipelines. A basin may refer to the entire collection system upstream from a flow meter or may exclude separately monitored basins upstream. I/I analysis in this report will be conducted on a basin-by-basin basis. For this study subtraction of flows was required to isolate the drainage areas of some flow monitoring basins¹.

The flow monitoring sites and basins can be seen in Table 1-1, Figure 1-2, and Figure 1-3.

Note that Site 1 and Site 2 were found to be different than expected from the sanitary maps given. Not only were the pipe diameters different, Site 2 does not seem to flow to Site 1 as depicted in Figure 1-1, but rather flows directly to the treatment plant. This revised flow is incorporated in the following basin isolation equations and flow schematics (Figure 4-1 and Figure 4-4).

¹ There is error inherent in flow monitoring. Adding and subtracting flows increases error on an additive basis. For example, if Site A has an error of $\pm 10\%$ and Site B has an error of $\pm 10\%$, then the resulting flow when subtracting Site A from Site B would have an error of up to $\pm 20\%$.

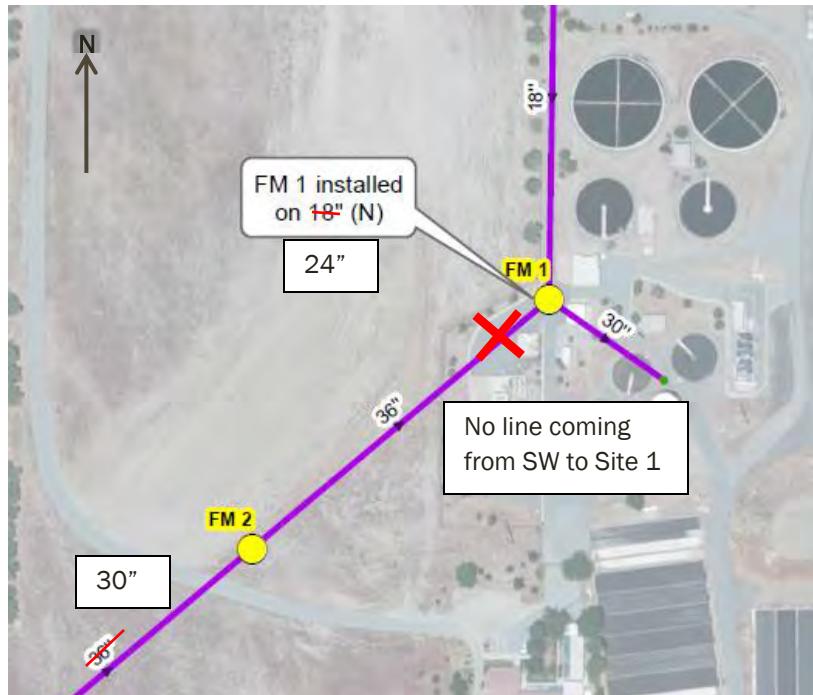


Figure 1-1. Sanitary Map of Sites 1 and 2 from City and Carollo

Table 1-1. List of Flow Monitoring Locations

Monitoring Site	Expected Pipe Diameter (in)	Measured Pipe Diameter (in)	Location	Basin Size (acres)	Basin Isolation Equation
Site 1	18	24	City of Banning Water Reclamation Facility	556	$= Q_1 - Q_3$
Site 2	36	30	Lot next to treatment plant	583	$= Q_2 - (Q_4 + Q_6)$
Site 3	15	15	S Hargrave Street and E Westward Avenue	1391	$= Q_3$
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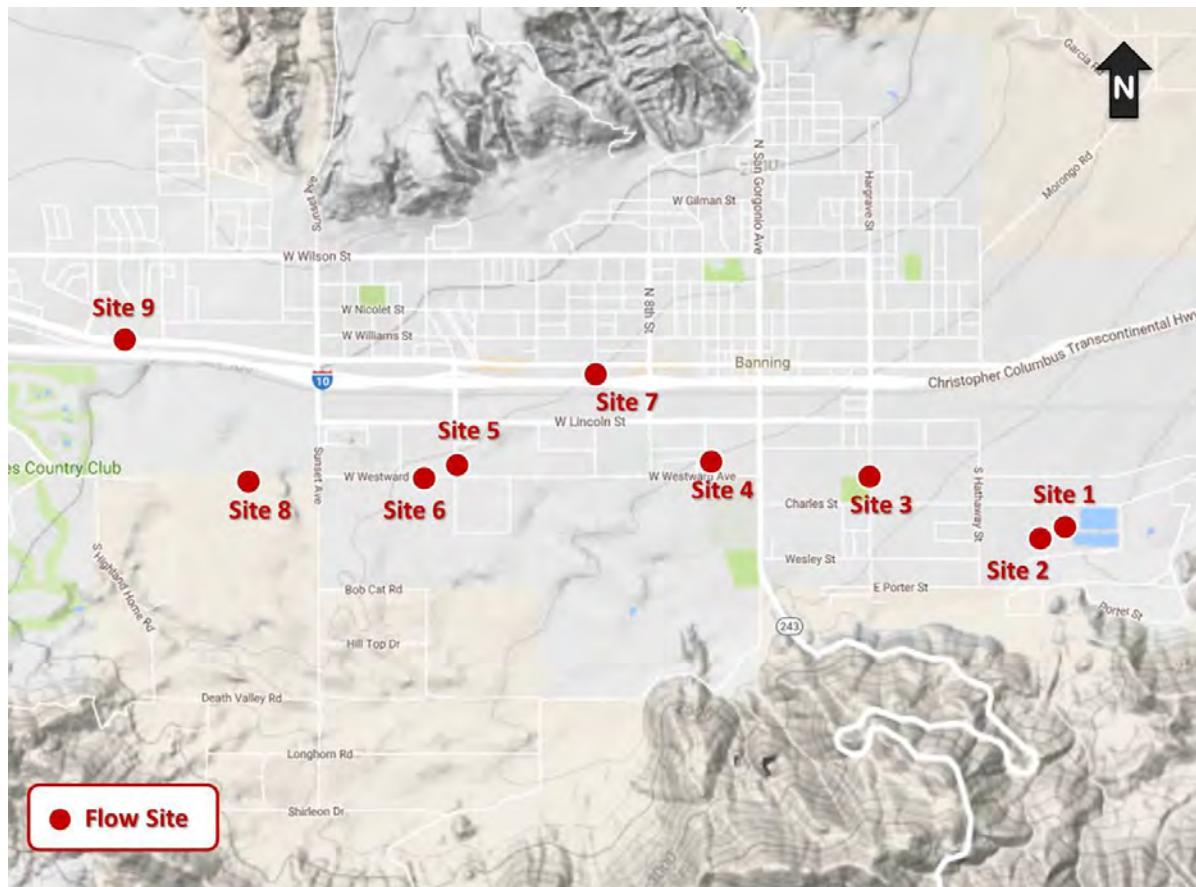


Figure 1-2. Map of Flow Monitoring Sites

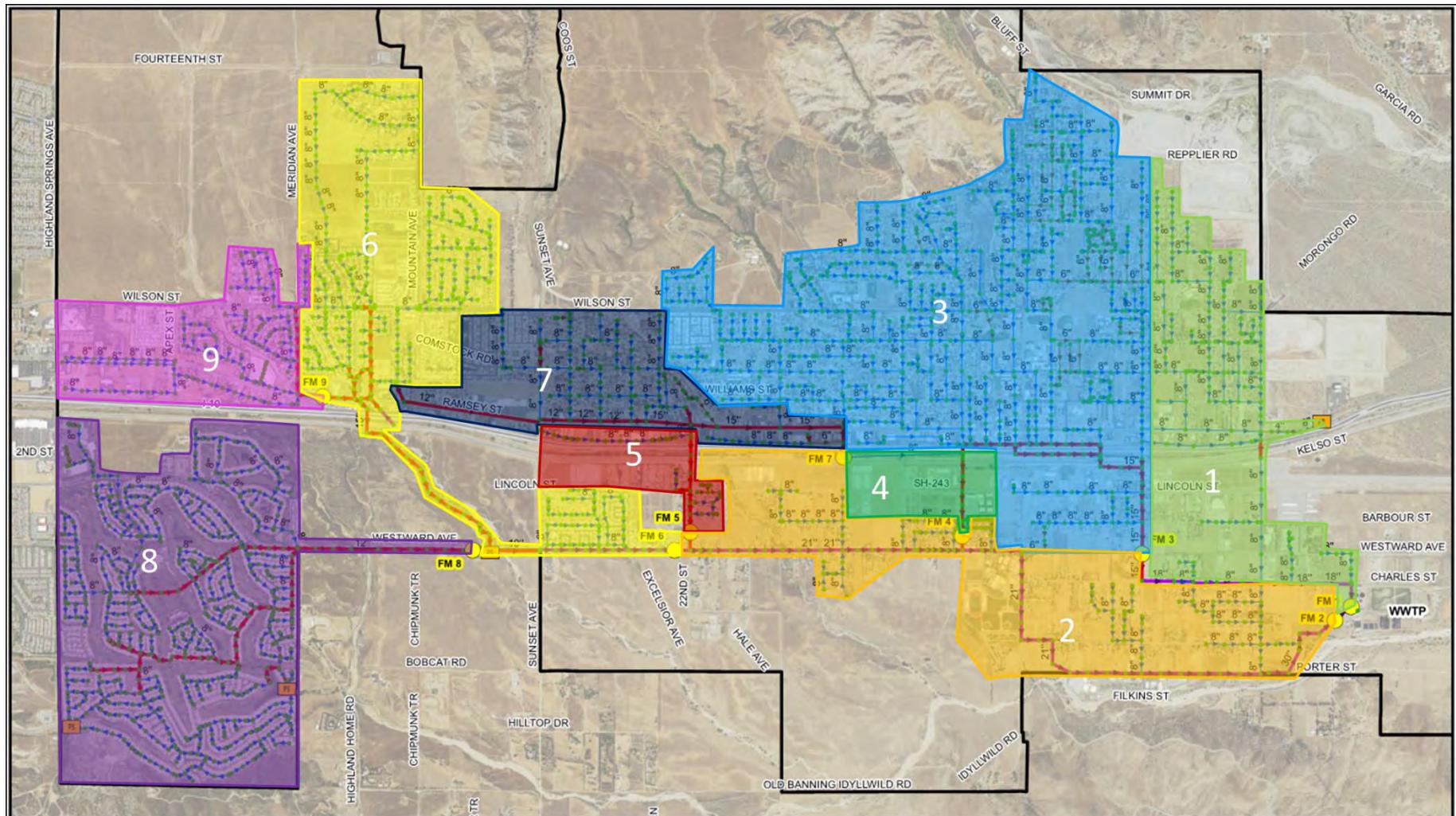


Figure 1-3. Map of Flow Monitoring Basins

2 Methods and Procedures

2.1 Confined Space Entry

A confined space (Photo 2-1) is defined as any space that is large enough and so configured that a person can bodily enter and perform assigned work, has limited or restricted means for entry or exit and is not designed for continuous employee occupancy. In general, the atmosphere must be constantly monitored for sufficient levels of oxygen (19.5% to 23.5%), and the presence of hydrogen sulfide (H₂S) gas, carbon monoxide (CO) gas, and lower explosive limit (LEL) levels. A typical confined space entry crew has members with OSHA-defined responsibilities of Entrant, Attendant and Supervisor. The Entrant is the individual performing the work. He or she is equipped with the necessary personal protective equipment needed to perform the job safely, including a personal four-gas monitor (Photo 2-2). If it is not possible to maintain line-of-sight with the Entrant, then more Entrants are required until line-of-sight can be maintained. The Attendant is responsible for maintaining contact with the Entrants to monitor the atmosphere using another four-gas monitor and maintaining records of all Entrants, if there is more than one. The Supervisor is responsible for developing the safe work plan for the job at hand prior to entering.



Photo 2-1. Confined Space Entry



Photo 2-2. Typical Personal Four-Gas Monitor

2.2 Flow Meter Installation

V&A installed nine Isco 2150 flow meters and 1 Flo-dar flow meter for temporary metering within the collection system. Isco 2150 meters use submerged sensors with a pressure transducer to collect depth readings and an ultrasonic Doppler sensor to determine the average fluid velocity. The ultrasonic sensor emits high-frequency (500 kHz) sound waves, which are reflected by air bubbles and suspended particles in the flow. The sensor receives the reflected signal and determines the Doppler frequency shift, which indicates the estimated average flow velocity. The sensor is typically mounted at a manhole inlet to take advantage of smoother upstream flow conditions. The sensor may be offset to one side to lessen the chances of fouling and sedimentation where these problems are expected to occur. Manual level and velocity measurements were taken during installation of the flow meters and again when they were removed and compared to simultaneous level and velocity readings from the flow meters to ensure proper calibration and accuracy. Figure 2-1 shows a typical installation for a flow meter with a submerged sensor.

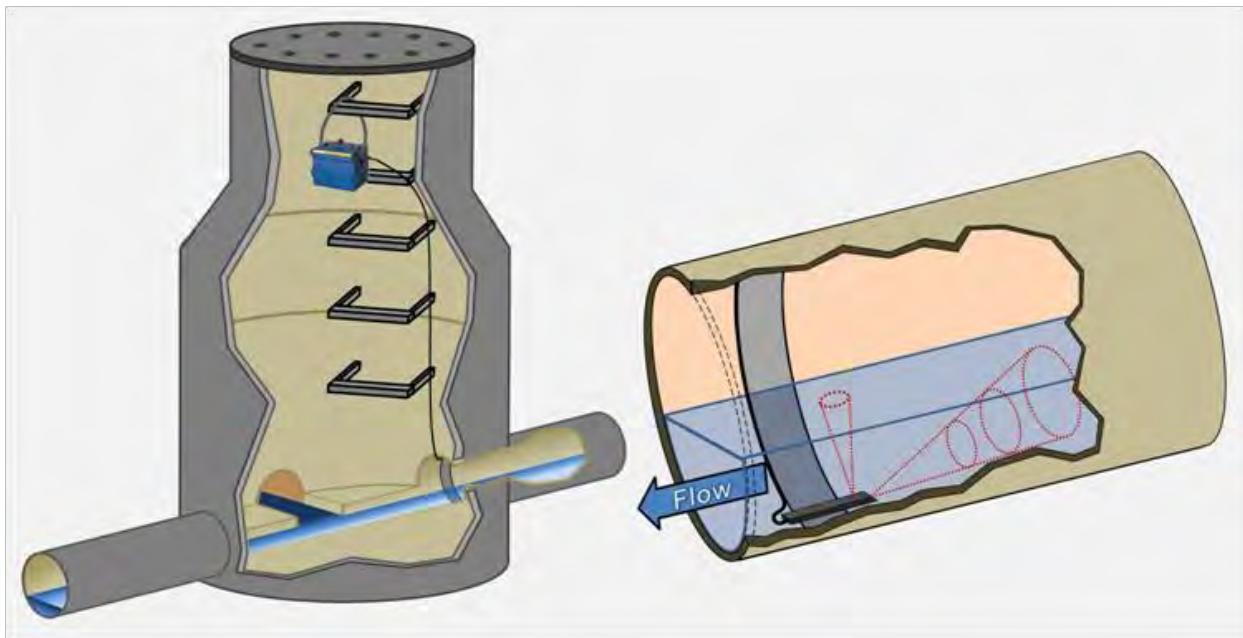


Figure 2-1. Typical Installation for Flow Meter with Submerged Sensor

2.3 Flow Calculation

Data retrieved from the flow meter was placed into a spreadsheet program for analysis. Data analysis includes data comparison to field calibration measurements, as well as necessary geometric adjustments as required for sediment (sediment reduces the pipe's wetted cross-sectional area available to carry flow).

Area-velocity flow metering uses the continuity equation,

$$Q = v \cdot A = v \cdot (A_T - A_s)$$

where
 Q: volume flow rate
 v: average velocity as determined by the ultrasonic sensor
 A: cross-sectional area available to carry flow
 A_T : total cross-sectional area with both wastewater and sediment
 A_s : cross-sectional area of sediment.

For circular pipe,

$$A_T = \left[\frac{D^2}{4} \cos^{-1} \left(1 - \frac{2d_w}{D} \right) \right] - \left[\left(\frac{D}{2} - d_w \right) \left(\frac{D}{2} \right) \sin \left(\cos^{-1} \left(1 - \frac{2d_w}{D} \right) \right) \right]$$

$$A_s = \left[\frac{D^2}{4} \cos^{-1} \left(1 - \frac{2d_s}{D} \right) \right] - \left[\left(\frac{D}{2} - d_s \right) \left(\frac{D}{2} \right) \sin \left(\cos^{-1} \left(1 - \frac{2d_s}{D} \right) \right) \right]$$

where
 d_w : distance between wastewater level and pipe invert
 d_s : depth of sediment
 D: pipe diameter

2.4 Average Dry Weather Flow Determination

For this study, four distinct average dry weather flow curves were established for each site location:

- Mondays – Thursdays
- Fridays
- Saturdays
- Sundays

Flows for many sites differ on Friday evenings compared to Mondays through Thursdays. Starting around 7 pm, the flows are often decreased (compared to Monday through Thursday). Similarly, flow patterns for Saturday and Sunday were also separated due to their unique evening flow pattern. This type of differentiation can be important when determining I/I response, especially if a rain event occurs on a Friday, Saturday or Sunday evening.

Figure 2-2 illustrates a sample of varying flow patterns within a typical week dry week.

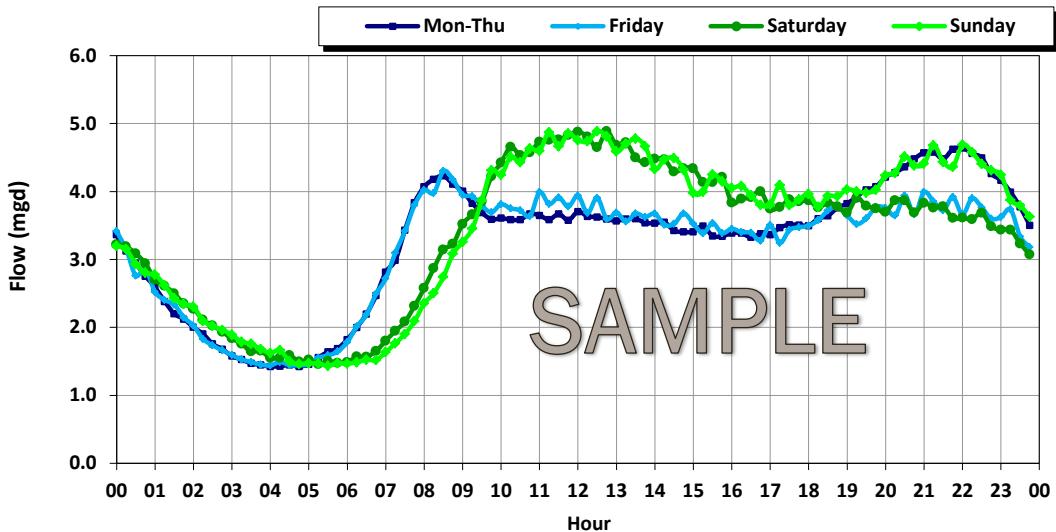


Figure 2-2. Sample ADWF Diurnal Flow Patterns

ADWF curves are taken from “Dry Days”, when RDI had the least impact on the baseline flow. The overall average dry weather flow (ADWF) was calculated per the following equation:

$$ADWF = \left(ADWF_{Mon-Thu} \times \frac{4}{7} \right) + \left(ADWF_{Fri} \times \frac{1}{7} \right) + \left(ADWF_{Sat} \times \frac{1}{7} \right) + \left(ADWF_{Sun} \times \frac{1}{7} \right),$$

2.5 Flow Attenuation

Flow attenuation in a sewer collection system is the natural process of the reduction of the peak flow rate through redistribution of the same volume of flow over a longer period of time. This occurs as a result of friction (resistance), internal storage and diffusion along the sewer pipes. Fluids are constantly working towards equilibrium. For example, a volume of fluid poured into a static vessel with no outside turbulence will eventually stabilize to a static state, with a smooth fluid surface without peaks and valleys. Attenuation within a sanitary sewer collection system is based upon this concept. A flow profile with a strong peak will tend to stabilize towards equilibrium, as shown in Figure 2-3.

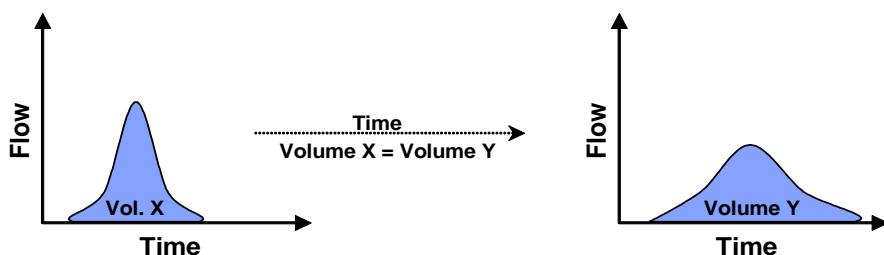


Figure 2-3. Attenuation Illustration

Within a sanitary sewer collection system, each individual basin will have a specific flow profile. As the flows from the basins combine within the trunk sewer lines, the peaks from each basin will (a) not necessarily coincide at the same time, and (b) due to the length and time of travel through the trunk sewers, peak flows will attenuate prior to reaching the treatment facility. The sum of the peak flows of the individual basins within a collection system will usually be greater than the peak flows observed at the treatment facility.

2.6 Inflow / Infiltration Analysis: Definitions and Identification

Inflow and infiltration (I/I) consists of storm water and groundwater that enter the sewer system through pipe defects and improper storm drainage connections and is defined as follows:

2.6.1 Definition and Typical Sources

- **Inflow:** Storm water inflow is defined as water discharged into the sewer system, including private sewer laterals, from direct connections such as downspouts, yard and area drains, holes in manhole covers, cross-connections from storm drains, or catch basins.
- **Infiltration:** Infiltration is defined as water entering the sanitary sewer system through defects in pipes, pipe joints, and manhole walls, which may include cracks, offset joints, root intrusion points, and broken pipes.

Figure 2-4 illustrates the possible sources and components of I/I

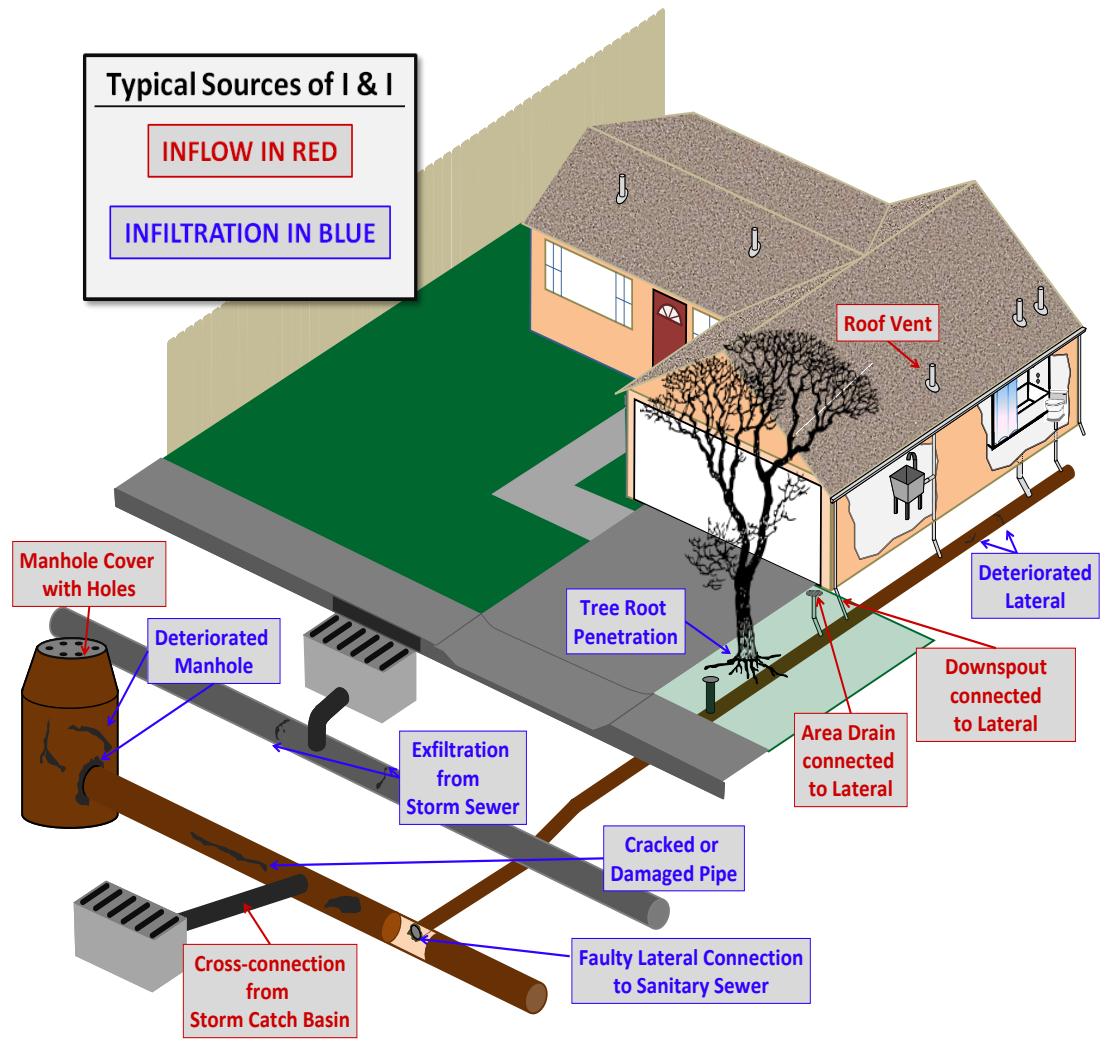


Figure 2-4. Typical Sources of Infiltration and Inflow

2.6.2 Infiltration Components

Infiltration can be further subdivided into components as follows:

- **Groundwater Infiltration:** Groundwater infiltration (GWI) depends on the depth of the groundwater table above the pipelines as well as the percentage of the system submerged. The variation of groundwater levels and subsequent groundwater infiltration rates is seasonal by nature. On a day-to-day basis, groundwater infiltration rates are relatively steady and will not fluctuate greatly.
- **Rainfall-Dependent Infiltration:** Rainfall-Dependent Infiltration (RDI) occurs as a result of storm water and enters the sewer system through pipe defects, as with groundwater infiltration. The storm water first percolates directly into the soil and then migrates to an infiltration point. Typically, the time of concentration for rainfall-related infiltration may be 24 hours or longer, but this depends on the soil permeability and saturation levels.
- **Rainfall-Responsive Infiltration** is storm water which enters the collection system indirectly through pipe defects, but normally in sewers constructed close to the ground surface such as private laterals. Rainfall-responsive infiltration is independent of the groundwater table and reaches defective sewers via the pipe trench in which the sewer is constructed, particularly if the pipe is placed in impermeable soil and bedded and backfilled with a granular material. In this case, the pipe trench serves as a conduit similar to a French drain, conveying storm drainage to defective joints and other openings in the system. This type of infiltration can have a quick response and graphically can look very similar to inflow.

2.6.3 Impact and Cost of Source Detection and Removal

- **Inflow:**
 - **Impact:** This component of I/I creates a peak flow problem in the sewer system and often dictates the required capacity of downstream pipes and transport facilities to carry these peak instantaneous flows. Because the response and magnitude of inflow is tied closely to the intensity of the storm event, the short-term peak instantaneous flows may result in surcharging and overflows within a collection system. Severe inflow may result in sewage dilution, resulting in upsetting the biological treatment (secondary treatment) at the treatment facility.
 - **Cost of Source Identification and Removal:** Inflow locations are usually less difficult to find and less expensive to correct. These sources include direct and indirect cross-connections with storm drainage systems, roof downspouts, and various types of surface drains. Generally, the costs to identify and remove sources of inflow are low compared to potential benefits to public health and safety or the costs of building new facilities to convey and treat the resulting peak flows.
- **Infiltration:**
 - **Impact:** Infiltration typically creates long-term annual volumetric problems. The major impact is the cost of pumping and treating the additional volume of water, and of paying for treatment (for municipalities that are billed strictly on flow volume).
 - **Cost of Source Detection and Removal:** Infiltration sources are usually harder to find and more expensive to correct than inflow sources. Infiltration sources include defects in deteriorated sewer pipes or manholes that may be widespread throughout a sanitary sewer system.

2.6.4 Graphical Identification of I/I

Inflow is usually recognized graphically by large-magnitude, short-duration spikes immediately following a rain event. Infiltration is often recognized graphically by a gradual increase in flow after a wet-weather event. The increased flow typically sustains for a period after rainfall has stopped and then gradually drops off as soils become less saturated and as groundwater levels recede to normal levels. Real time flows were plotted against ADWF to analyze the I/I response to rainfall events. Figure 2-5 illustrates a sample of how this analysis is conducted and some of the measurements that are used to distinguish infiltration and inflow. Similar graphs were generated for the individual flow monitoring sites and can be found in Appendix A.

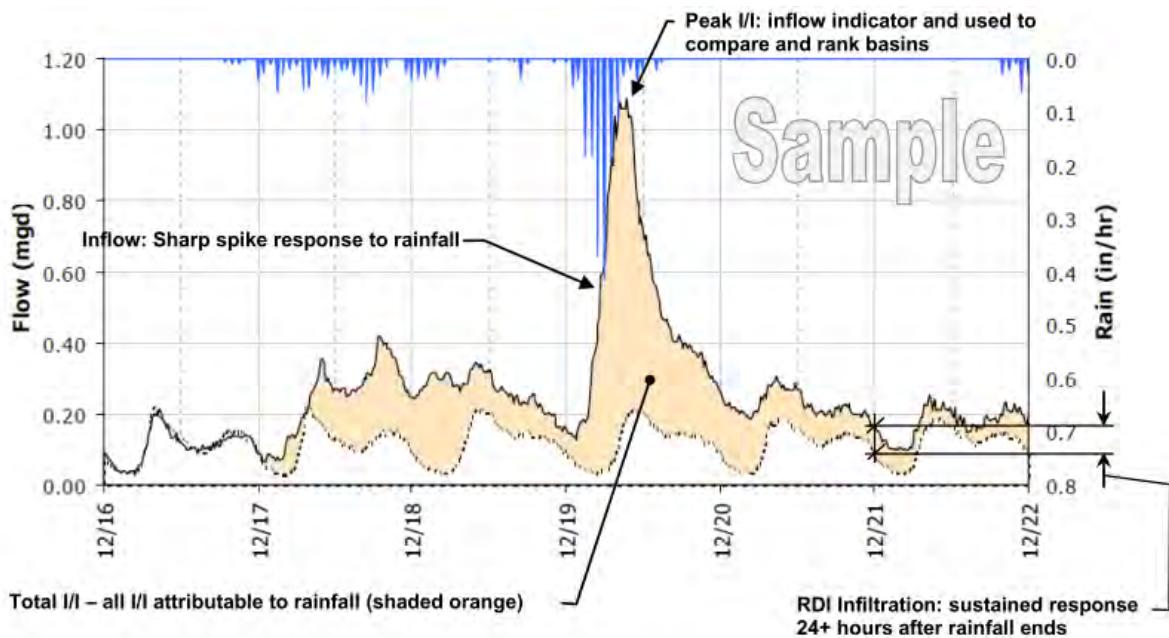


Figure 2-5. Sample Infiltration and Inflow Isolation Graph

2.6.5 Analysis Metrics

After differentiating I/I flows from ADWF flows, various calculations can be made to determine which I/I component (inflow or infiltration) is more prevalent at a particular site and to compare the relative magnitudes of the I/I components between drainage basins and between storm events:

- **Inflow – Peak I/I Flow Rate:** Inflow is characterized by sharp, direct spikes occurring during a rainfall event. Peak I/I rates are used for inflow analysis².
- **Groundwater Infiltration:** GWI analysis is conducted by looking at minimum dry weather flow to average dry weather flow ratios and comparing them to established standards to quantify the rate of excess groundwater infiltration.
- **Rainfall-Dependent Infiltration:** Infiltration occurring after the conclusion of a storm event is classified as rainfall-dependent infiltration (RDI). RDI Analysis is conducted by looking at the infiltration rates at set periods after the conclusion of a storm event. Depending on the

² I/I flow rate is the real time flow less the estimated average dry weather flow rate. It is an estimate of flows attributable to rainfall. By using peak measured flow rates (inclusive of ADWF), the I/I flow rate would be skewed higher or lower depending on whether the storm event I/I response occurs during low-flow or high-flow hours.

particular collection system and the time required for flows to return to ADWF levels, different set periods may be examined to determine the basins with the greatest or most sustained rainfall-dependent infiltration rates.

- **Total Infiltration:** The total inflow and infiltration is measured in gallons per site and per storm event. Because it is based on total I/I volume, it is an indicator of combined inflow and infiltration and is used to identify the overall volumetric influence of I/I within the monitoring basin.

2.6.6 Normalization Methods

There are three ways to *normalize* the I/I analysis metrics for an “apples-to-apples” comparison amongst the different drainage basins:

- **per-ADWF:** The metric is divided by the established average dry weather flow rate and typically expressed as a ratio. *Peaking Factors* are examples of using ADWF to normalize data from different sites.
- **per-IDM:** The metric is divided by length of pipe (IDM [inch-diameter mile]) contained within the upstream basin. Final units typically are gallons per day (gpd) per IDM.
- **per-ACRE:** The metric is divided by the acreage of the upstream basin. Final units typically are gallons per day (gpd) per ACRE.

The infiltration and inflow indicators were normalized by the per-ADWF and per-ACRE methods in this report. The GIS information with pipe diameters and length were not available. Per-ADWF method was assigned more weight for ranking the basins; per-ADWF normalizes sewer basin size by usage, but per-ACRE is also appropriate for this region as the land-use density appears to be similar.

3 Rainfall Results

3.1 Rainfall Monitoring

Rain data was obtained from the National Oceanic and Atmospheric Administration (NOAA) Citizen Weather Observer Program (CWOP). CWOP members send data from their private weather station (PWS) to the NOAA MADIS server; the data undergoes quality checking and then is distributed. While V&A has no direct control over the rain gauges, V&A performs additional QA/QC on the PWS data in the area and selects a few suitable PWS stations to use. V&A then weighted the rain data according to distance from the center of the study area.

There were three main rainfall events that occurred over the course of the flow monitoring period which are summarized in Table 3-1. Figure 3-1 illustrates the rainfall activity over the flow monitoring period.

The meters were installed during the biggest rain event on January 20; this event was used for peak I/I and RDI analysis. The January 22 – 24 rainfall event was used for total I/I analysis.

Figure 3-2 shows the rain accumulation plot of the period rainfall, as well as the historical average rainfall³ at the center of the study area during this project duration. Rainfall totals were approximately double the historical normal levels during this time period.

Table 3-1. Rainfall Events Used for I/I Analysis

Rainfall Event	Rainfall Amount (inches)
January 19 – 20, 2017	2.78
January 22 – 24, 2017	2.33
February 17 - 19, 2017	1.25
<i>Total over Monitoring Period</i>	6.85

³ Historical data taken from the WRCC (Station 40607 at Cherry/Beaumont Pump Station, Station 40609 “Beaumont #2”, and Station 41250 in Cabazon): <http://www.wrcc.dri.edu/summary/climsmnca.html>

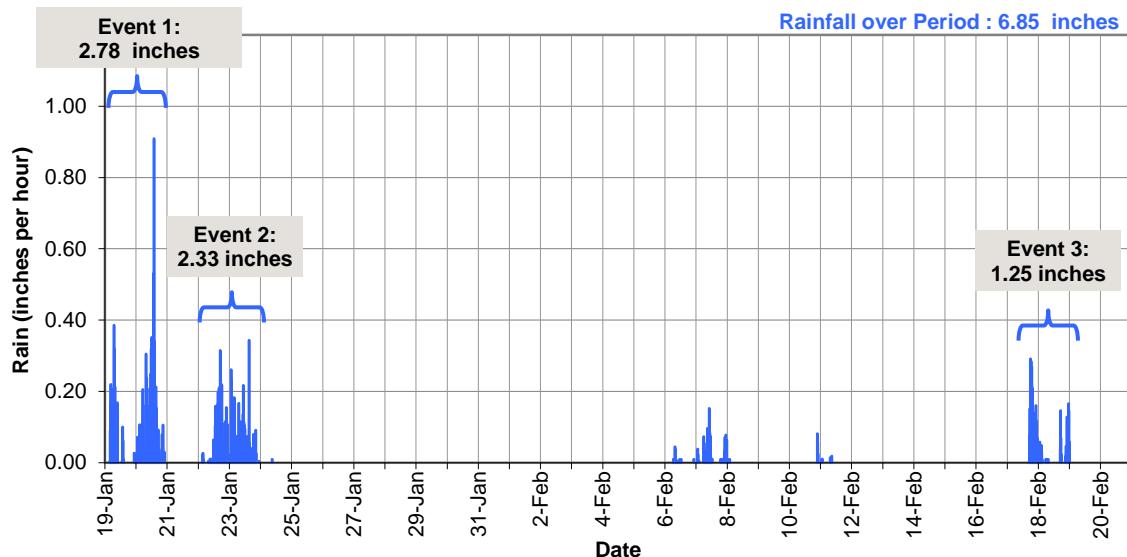


Figure 3-1. Rainfall Activity over Flow Monitoring Period

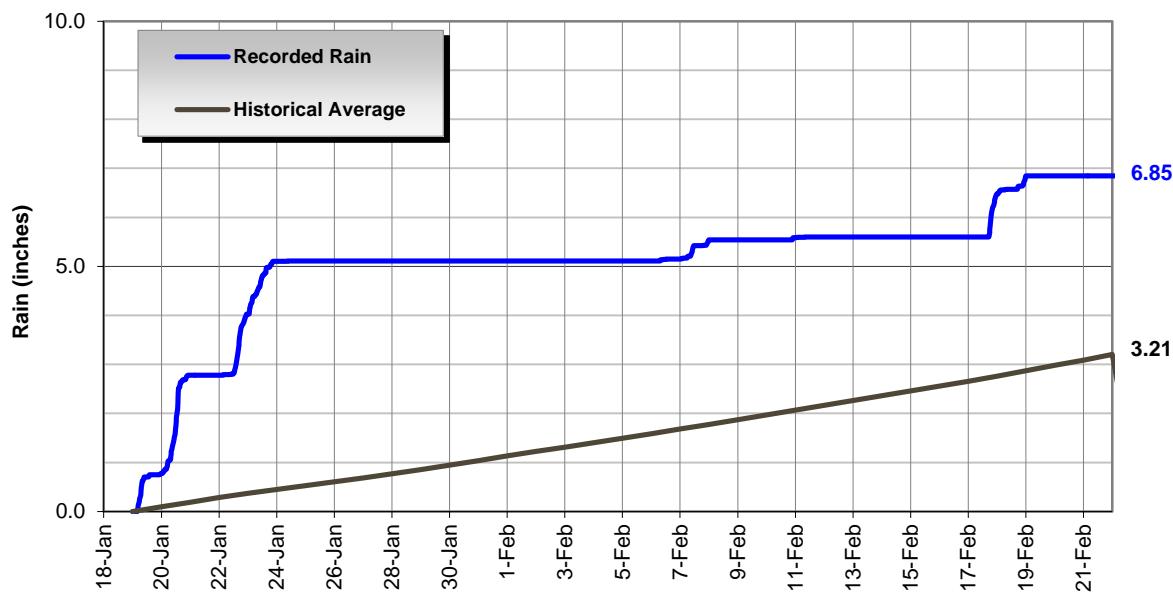


Figure 3-2. Accumulated Precipitation During Flow Monitoring Period

3.2 Rainfall: Storm Event Classification

It is important to classify the relative size of a major storm event that occurs over the course of a flow monitoring period in order to compare the observed flow response to that occurring during a design storm event (sanitary sewers are often designed to withstand I/I contribution to sanitary flows for specific-sized “design” storm events). Rainfall events are classified by intensity and duration. For example, the NOAA Rainfall Frequency Atlas⁴ shown in Figure 3-3 classifies a 10-year, 24-hour storm

⁴ “NOAA California Isopluvials of 10-year 24-hour precipitation in inches” NOAA Atlas 14, Volume 6, Version 2, April 2011: <ftp://hdsc.nws.noaa.gov/pub/hdsc/data/sw/ca10y24h.pdf>

event in the City of Banning as approximately 4.43 inches. This means that in any given year, at this specific location, there is a 10% chance that 4.43 inches of rain will fall in any 24-hour period.

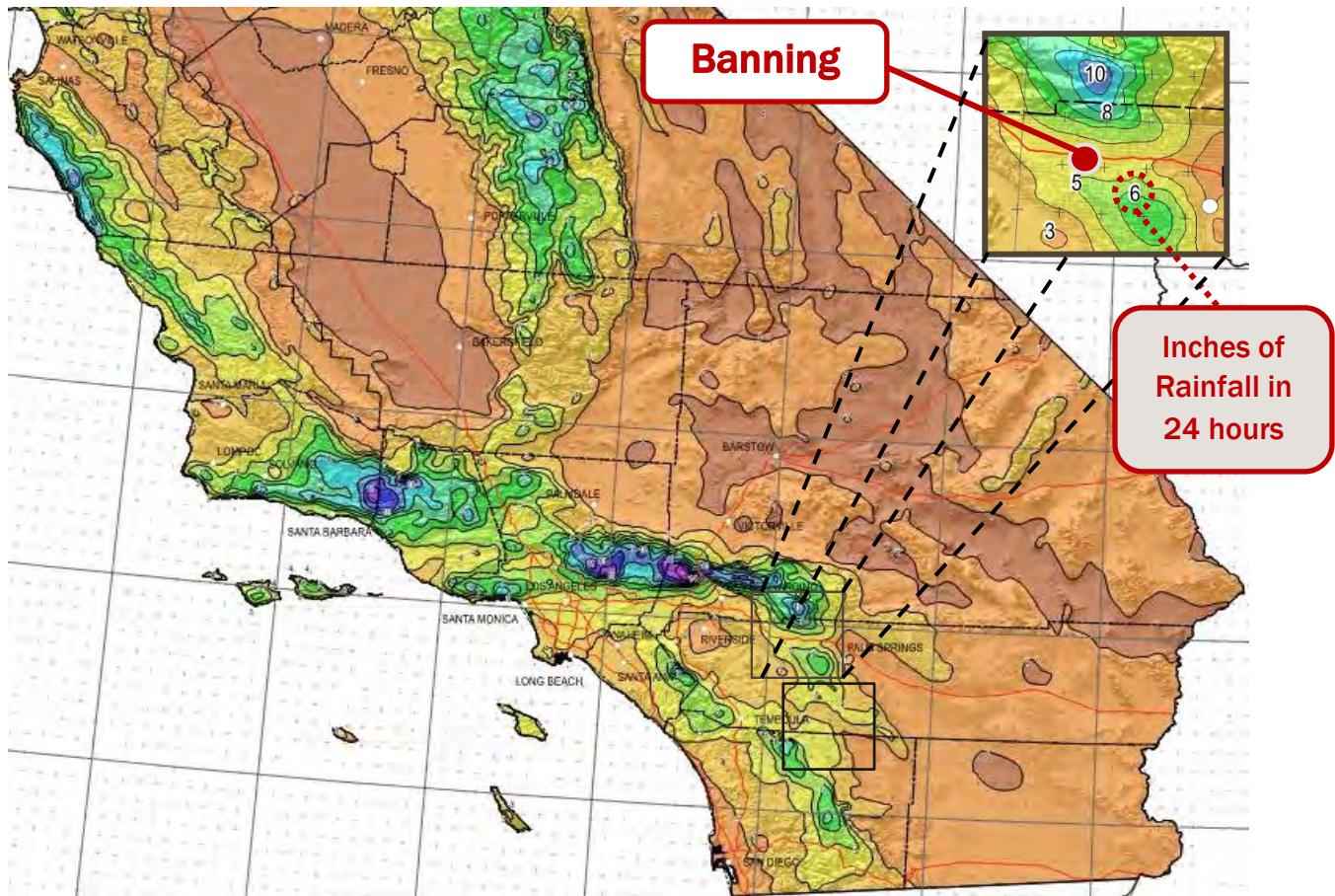


Figure 3-3. NOAA Northern California Rainfall Frequency Map (10-Year, 24-Hour IDF)

From the NOAA frequency maps, for a specific latitude and longitude, the rainfall densities for period durations ranging from 15 minutes to 60 days are known for rain events ranging from 1-year to 100-year intensities. These are plotted to develop a rain event frequency map specific to each rainfall monitoring site. Superimposing the peak measured densities for all the rainfall events on the rain event frequency plot determines the classification of the storm event, shown in Figure 3-4 and Figure 3-5.

All three of the rainfall events were classified as less than 1 year, 24-hour events. January 19 – 20 was also classified as a 1.5-year, 3-hour event and the whole monitoring period was a 2-year, 7-day event or 1.5-year, 30-day event.

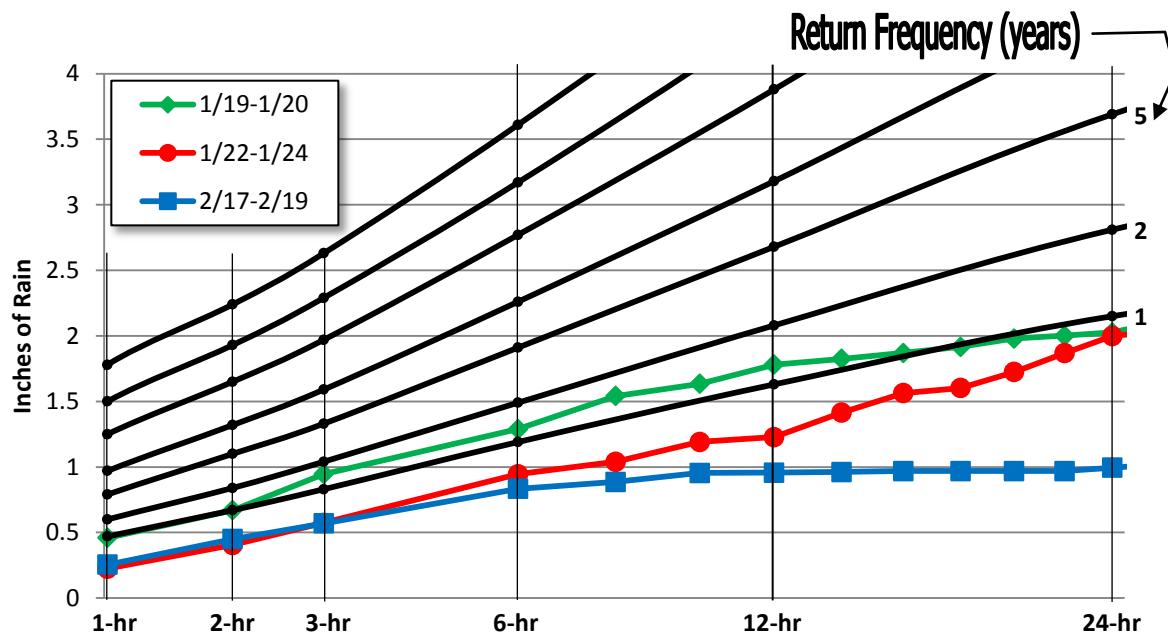


Figure 3-4. Storm Event Classification, 24-hour

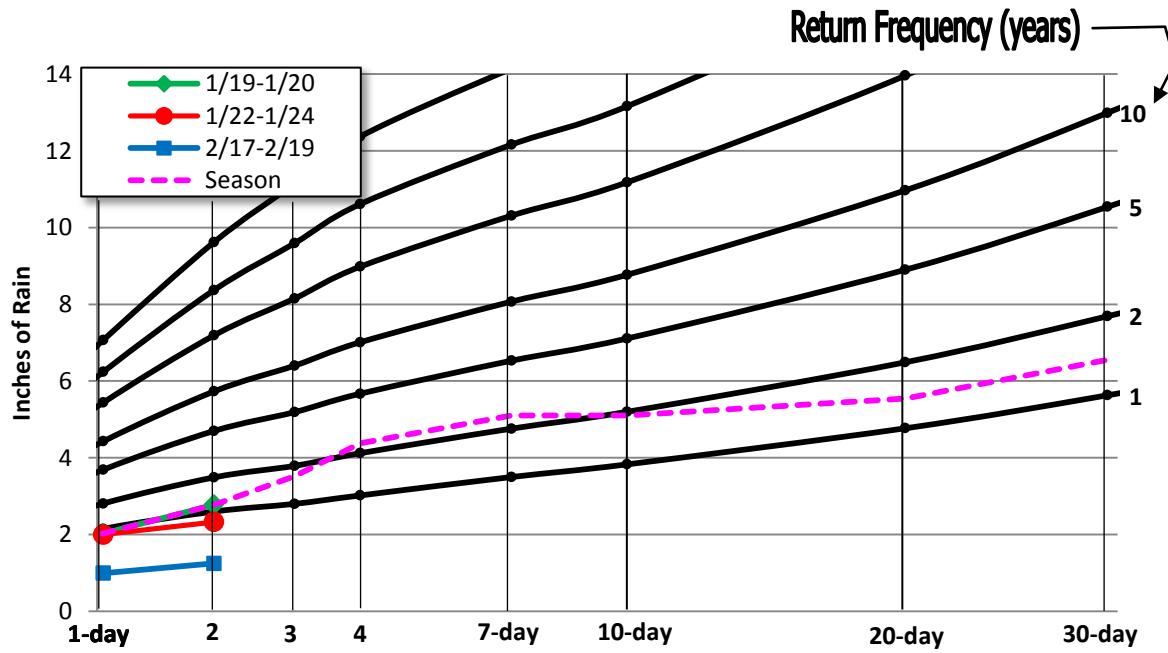


Figure 3-5. Storm Event Classification, 30-Day Flow Monitoring Period

4 Flow Monitoring Results

4.1 Average Flow Analysis

ADWF curves were established when RDI had the least impact on the baseline flow. Table 4-1 summarizes the dry weather flow data measured for this study. ADWF curves for each site can be found in Appendix A. Figure 4-1 shows a schematic diagram of the average dry weather flows and flow levels.

Table 4-1. Dry Weather Flow Summary

Monitoring Site	Sedimentation (inches)	Monday-Thursday ADWF (mgd)	Friday ADWF (mgd)	Saturday ADWF (mgd)	Sunday ADWF (mgd)	Overall ADWF (mgd)
Site 1	none	0.649	0.622	0.719	0.705	0.663
Site 2	none	0.705	1.349	1.329	1.324	1.347
Site 3	none	1.324	1.381	0.494	0.486	0.494
Site 4	none	0.486	0.496	0.503	0.342	0.342
Site 5	none	0.342	0.335	0.343	0.350	0.063
Site 6	none	0.350	0.059	0.067	0.063	0.853
Site 7	none	0.063	0.077	0.844	0.846	0.280
Site 8	none	0.846	0.859	0.891	0.281	0.504
Site 9	none	0.281	0.274	0.277	0.282	0.192

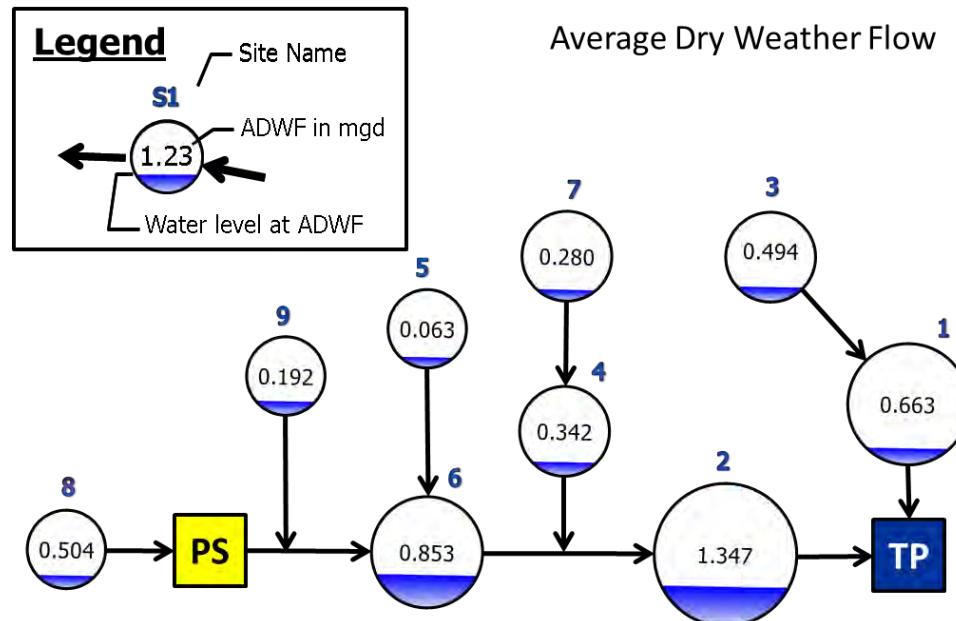


Figure 4-1. Average Dry Weather Flow (Flow Schematic)

4.2 Capacity Analysis: Peaking Factor and d/D Ratio

Peak measured flows and the corresponding flow levels (depths) are important to understand the capacity limitations of a collection system. The peak flows and flow levels reported are from the peak measurements as taken across the entirety of the flow monitoring period. Peak flows and levels may not correspond to a rainfall event or a simultaneous time.

The following capacity analysis terms are defined as follows:

- **Peaking Factor:** Peaking factor is defined as the peak measured flow divided by the ADWF. Peaking factors are influenced by many factors including size and topography of tributary area, proximity to pump stations, and the amount and characteristics of I/I entering the collection system. Flow attenuation and flow restrictions will also affect the peaking factor. A peaking factor threshold value of 3.0 is commonly used for sanitary sewer design of new pipe; however, it is noted that this value is variable and subject to attenuation and the size of the upstream collector area. The City should follow its own standards and criteria when examining peaking factors.
- **d/D Ratio:** The d/D ratio is the peak measured depth of flow (d) divided by the pipe diameter (D). Standards for d/D ratio vary from agency to agency, but typically range between $d/D \leq 0.5$ and $d/D \leq 0.75$. The d/D ratio for each site was computed based on the maximum depth of flow for the flow monitoring study.

Table 4-2 summarizes the peak recorded flows, levels, d/D ratios, and peaking factors per site during the flow monitoring period. Results of note have been shaded in **RED**. Capacity analysis data are presented on a site-by-site basis and represents the hydraulic conditions only at the site locations; hydraulic conditions in other areas of the collection system will differ.

The following capacity analysis results are noted:

- **Peaking Factor:** Site 1 had a peaking factor greater than 5.
- **d/D Ratio:** Sites 1 and 2 had a maximum d/D ratio greater than 0.75. None of the sites surcharged during the study period.

Table 4-2. Capacity Analysis Summary

Metering Site	ADWF (mgd)	Peak Measured Flow (mgd)	Peaking Factor	Pipe Diameter, D (in)	Max Depth, d (in)	d/D Ratio	Surcharge above Pipe Crown (ft)
Site 1	0.663	4.039	6.1	24	22.09	0.92	---
Site 2	1.347	3.717	2.8	30	26.59	0.89	---
Site 3	0.494	1.885	3.8	15	5.52	0.37	---
Site 4	0.342	1.142	3.3	15	4.43	0.30	---
Site 5	0.063	0.290	4.6	12	2.73	0.23	---
Site 6	0.853	2.259	2.6	21	10.15	0.48	---
Site 7	0.280	1.152	4.1	15	4.20	0.28	---
Site 8	0.504	1.242	2.5	12	3.46	0.29	---
Site 9	0.192	0.722	3.8	12	4.60	0.38	---

Figure 4-2 and Figure 4-3 show bar graphs of the capacity results. Figure 4-4 shows a schematic diagram of the peak measured flows with peak flow levels.

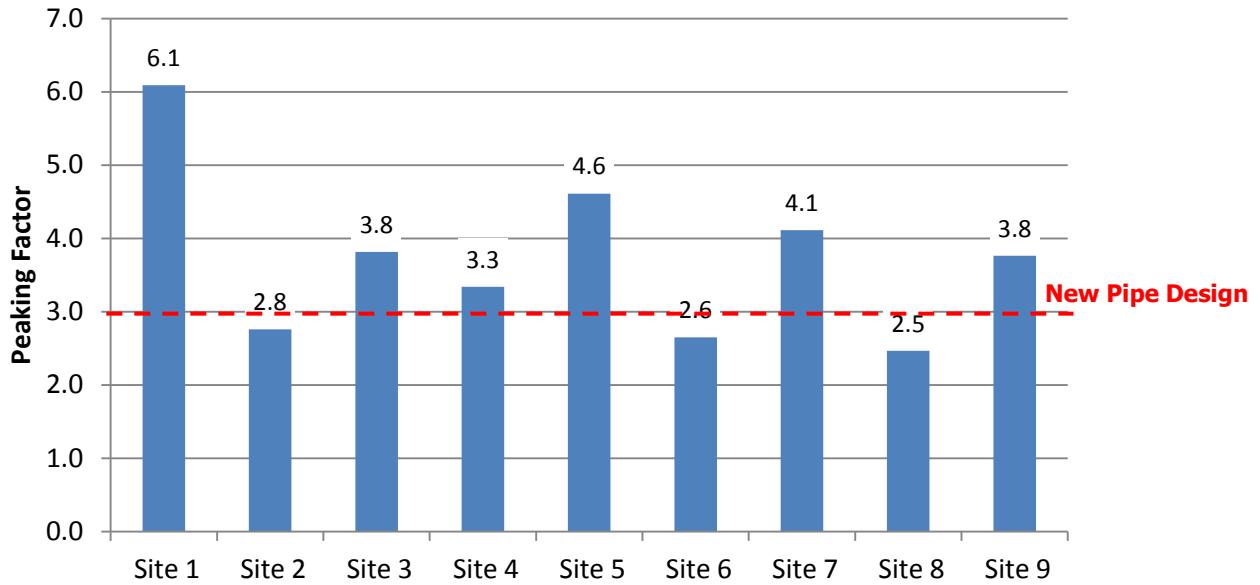


Figure 4-2. Capacity Summary: Peaking Factors

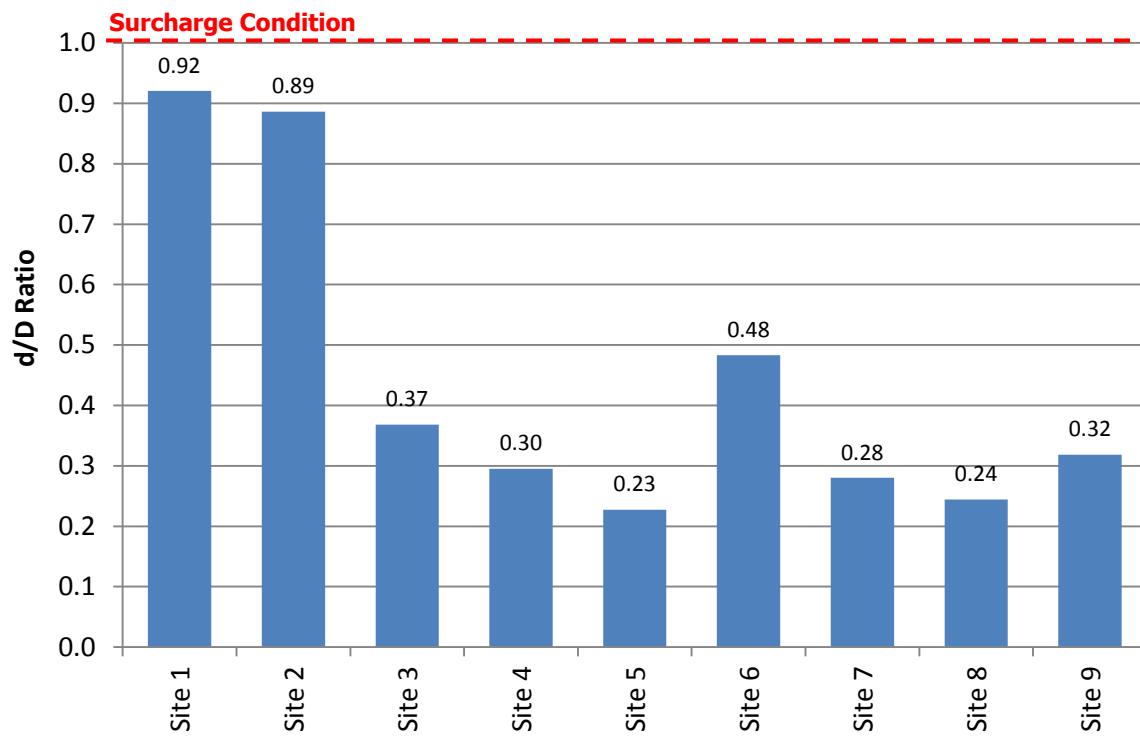


Figure 4-3. Capacity Summary: Max d/D Ratios

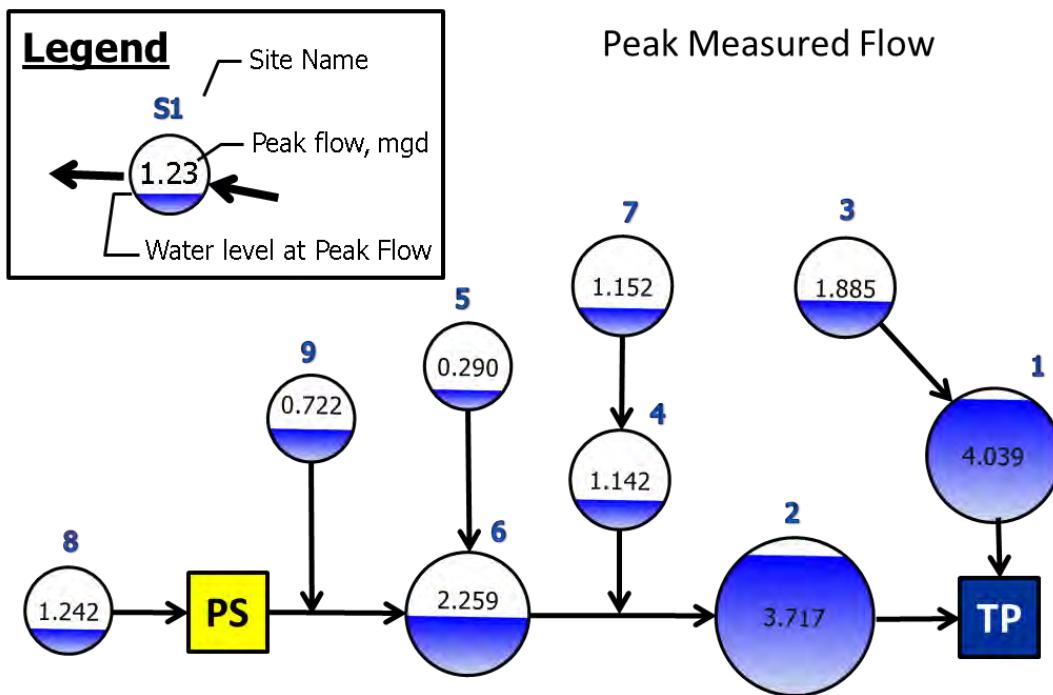


Figure 4-4. Peak Measured Flow (Flow Schematic)

5 Inflow and Infiltration Results

5.1 Preface

The two rainfall events occurring from January 19 to 20, 2017 and January 22 to 23, 2017 were used for the I/I analyses of this study (See Figure 5-1 and Figure 5-2). I/I analysis items are noted as follows:

- January 20 had an intense rainfall at approximately 2:30pm, just one hour after all the sites were installed and elicited a strong inflow response.
- A suggestion of RDI was seen for Site 1; most obvious on January 21, 9:00 to 21:00, approximately 12 hours after the January 20 rain event. The other sites had minimal RDI.
- The rainfall event on January 22 to 23 occurred during a time when soils were probably at an elevated saturation level and there was sufficient time for flows to recede to baseline levels before the next event on February 17 to 19. Total I/I was measured from the start of the rain event until flows receded to baseline levels; ranging from 3 hours to 2 days for different sites.

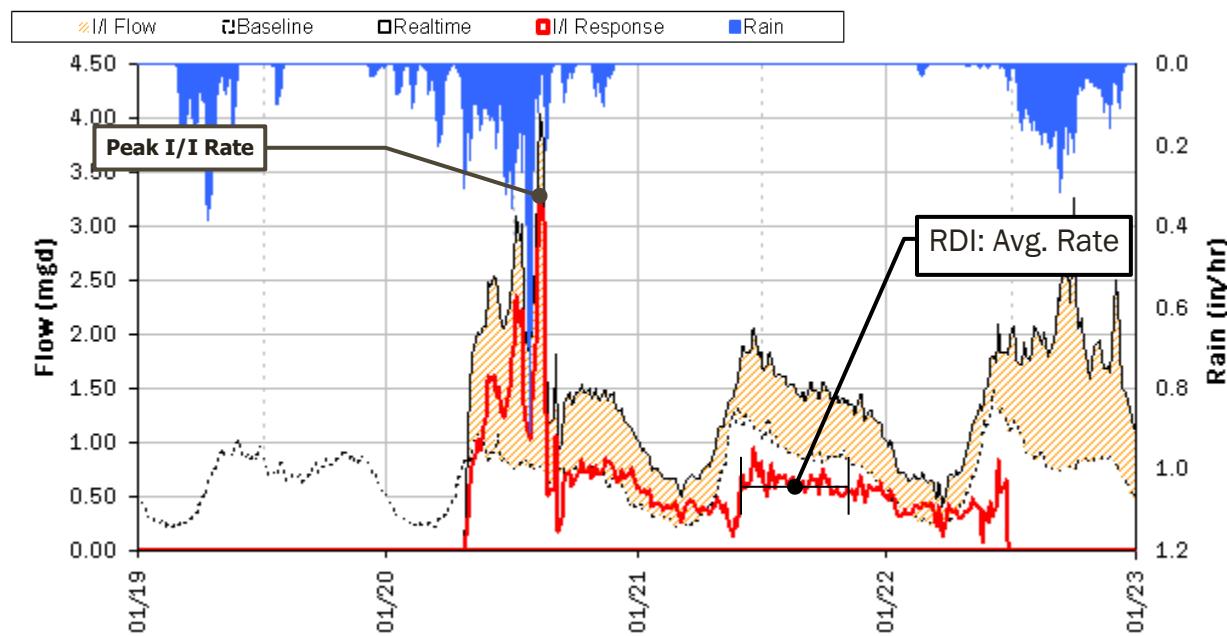


Figure 5-1. Inflow and RDI Isolation Graph, Site 1

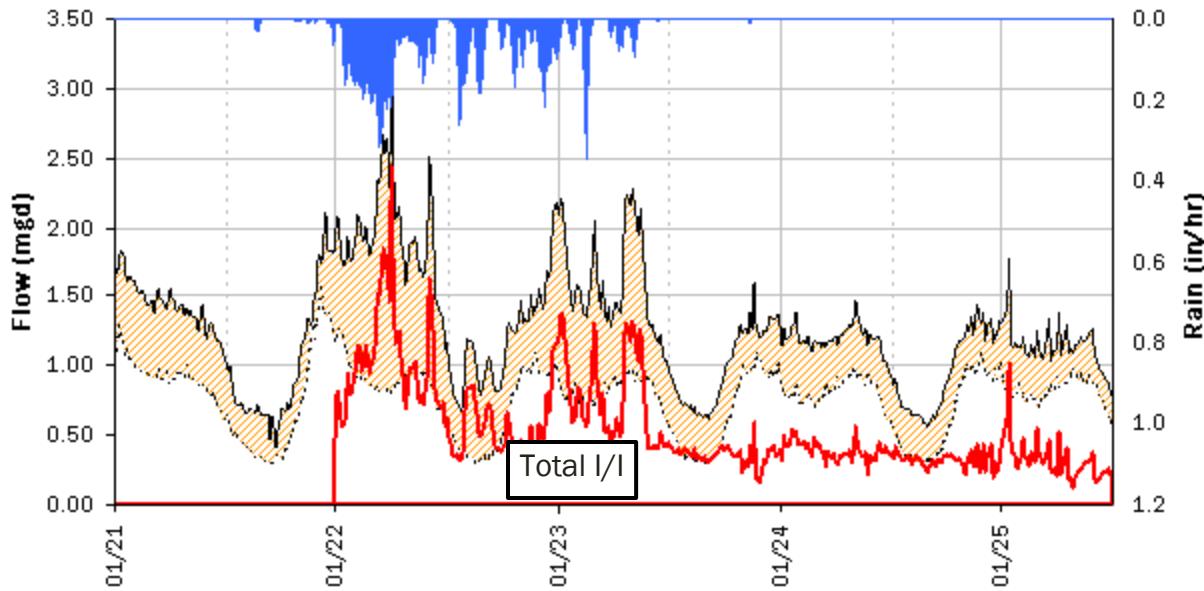


Figure 5-2. Total I/I Isolation Graph, Site 1

5.2 Inflow Results Summary

Inflow is storm water discharged into the sewer system through direct connections such as downspouts, area drains, cross-connections to catch basins, etc. These sources transport rain water directly into the sewer system and the corresponding flow rates are tied closely to the intensity of the storm. This component of I/I often causes a peak flow problem in the sewer system and often dictates the required capacity of downstream pipes and transport facilities to carry these peak instantaneous flows.

Table 5-1 summarizes the peak measured I/I flows and inflow analysis results from rainfall event January 20th, 2017. Results of note have been shaded in RED.

Table 5-1. Inflow Analysis Summary

Monitoring Basin	ADWF (mgd)	Basin Acres	Peak I/I Rate (mgd)	Peak I/I per ADWF	Peak I/I per Acre (gpd/Acre)	Inflow Ranking A
Basin 1	0.168	556	2.03	12.09	3,654	1
Basin 2	0.152	583	0.03	0.23	59	8
Basin 3	0.495	1391	1.29	2.61	928	3
Basin 4 ^B	0.063	96	N/A	N/A-	N/A	N/A
Basin 5	0.063	133	0.25	3.89	1,845	2
Basin 6	0.095	645	0.22	2.33	343	6
Basin 7	0.279	358	0.44	1.59	1,238	5
Basin 8	0.503	882	0.48	0.96	546	7
Basin 9	0.192	310	0.38	2.00	1,234	4

^A Ranking of 1 represents most inflow after normalization.

^B Small basin size relative to the flow quantity of upstream site; isolated flows after subtraction may have too much uncertainty.

The following inflow analysis results are noted:

- Basins 1, 5, and 3 are ranked highest for normalized inflow contribution.
- Basin 1 has significantly higher normalized inflow than the other basins.

Figure 5-3 shows bar graph summaries of the inflow analysis.

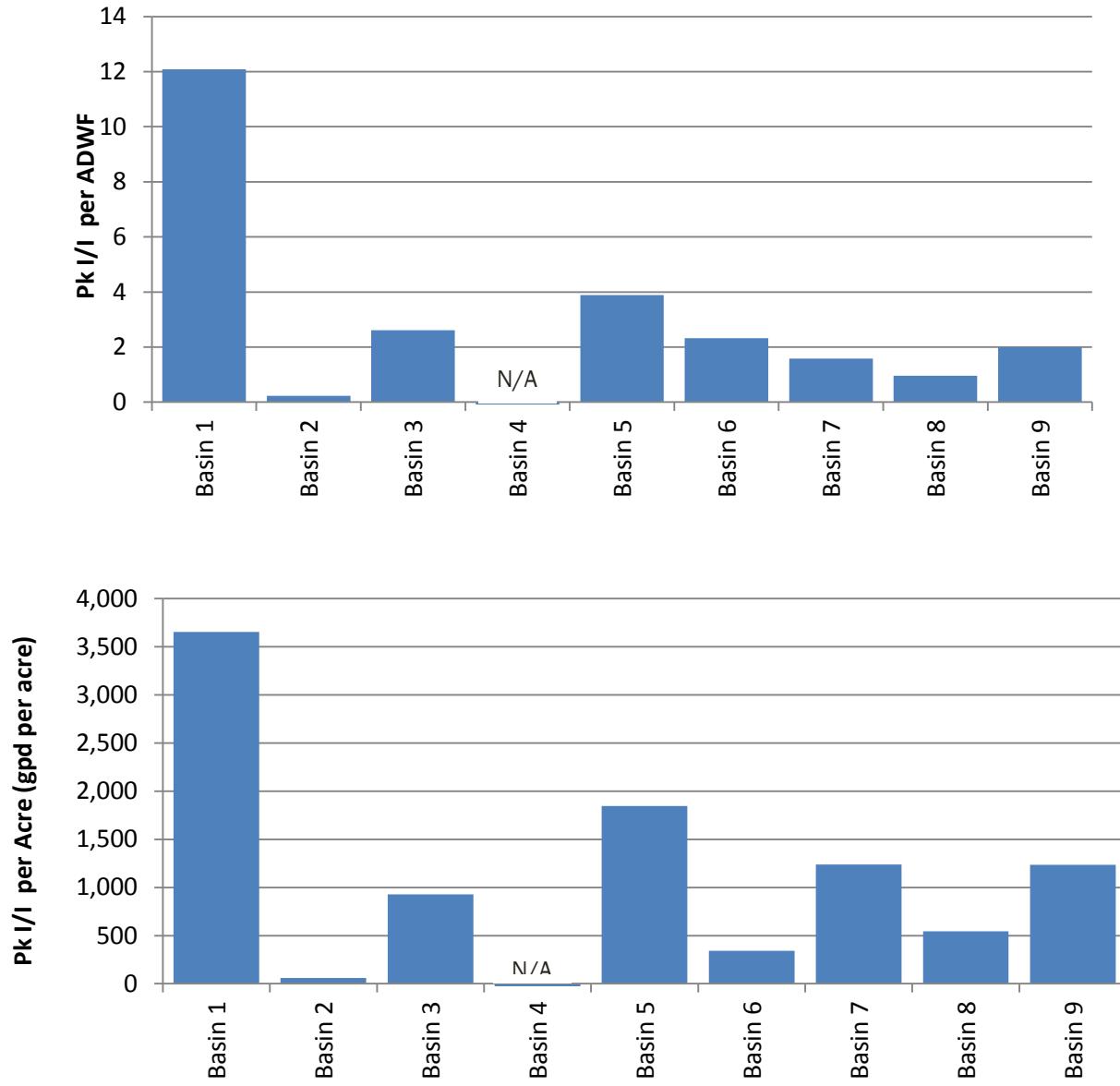


Figure 5-3. Bar Graph: Inflow Analysis Summary

5.2.1 Combined I/I Results Summary

Combined I/I analysis considers the totalized volume (in gallons) of both inflow and rainfall-dependent infiltration over the course of a storm event. Table 5-2 summarizes the combined I/I flow results for the rainfall event January 22nd to 23rd, 2017. (refer to the *I/I Methods* section for more information on combined I/I analysis methods and ranking methods). Results of note have been shaded in **RED**.

Table 5-2. Basins Combined I/I Analysis Summary

Monitoring Basin	ADWF (mgd)	Basin Acres	Combined I/I (gallons)	Combined I/I per ADWF per inch rain	Combined I/I per Acre per inch rain (gpd/Ac/in.)	Combined I/I Ranking ^A
Basin 1	0.168	556	1,309,000	3.34	1,010	1
Basin 2	0.152	583	6,000	0.02	4	7
Basin 3	0.495	1391	581,000	0.50	179	2
Basin 4 ^B	0.063	96	N/A	N/A	N/A	N/A
Basin 5	0.063	133	6,000	0.04	19	6
Basin 6 ^C	0.095	645	--	--	--	8
Basin 7	0.279	358	36,000	0.06	43	5
Basin 8	0.503	882	137,000	0.12	67	4
Basin 9	0.192	310	123,000	0.28	170	3

^A Ranking of 1 represents most combined I/I after normalization.

^B Small basin size relative to the flow quantity of upstream site; isolated flows after subtraction may have too much uncertainty.

^C 3 sites were subtracted to isolate the basin. Caution should be exercised when interpreting the resulting isolated flow due to additive uncertainties.

The following combined I/I analysis results are noted:

- Basins 1, 3, and 9 are ranked highest for normalized combined I/I contribution.
 - Basin 1 has significantly higher normalized combined I/I than the other basins.
- The combined I/I rankings were the same when normalized by ADWF or by basin acres.

Figure 5-4 shows bar graph summaries of the combined I/I analysis.

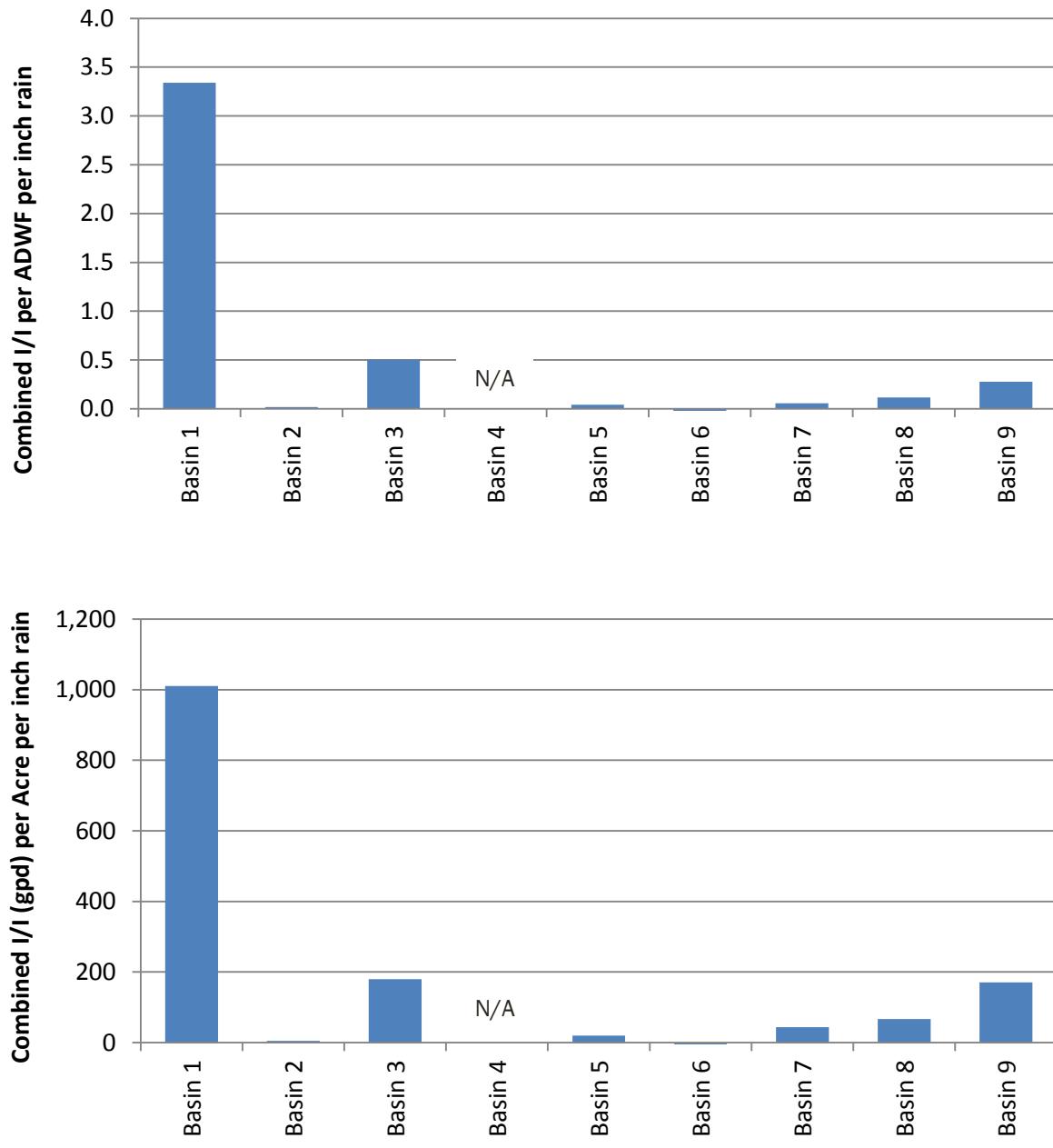


Figure 5-4. Bar Graphs: Combined I/I Analysis Summary

6 Recommendations

V&A advises that future I/I reduction plans consider the following recommendations:

1. **Basin 1:** Basin 1 was ranked highest for normalized inflow and combined I/I contribution and also had a suggestion of RDI. Considering Basin 1 had significantly more normalized I/I than the other basins, is immediately upstream of the treatment plant, and only had one basin upstream for subtraction, the City should prioritize Basin 1 for further investigation or I/I reduction programs. The next basin that was ranked high for normalized inflow and combined I/I contribution was Basin 3.
2. **Determine I/I Reduction Program:** The City should examine its I/I reduction needs to determine a future I/I reduction program.
 - a. If peak flows, sanitary sewer overflows, and pipeline capacity issues are of greater concern, then priority can be given to investigate and reduce sources of inflow within the basins with the greatest inflow problems. Basin 5 is ranked high for normalized inflow.
 - a. If total infiltration and general pipeline deterioration are of greater concern, then the program can be weighted to investigate and reduce sources of infiltration within the basins with the greatest infiltration problems. Basin 9 is ranked high for normalized total I/I contribution.
3. **I/I Investigation Methods:** Potential I/I investigation methods include the following:
 - a. Smoke testing
 - b. Nighttime reconnaissance work to (1) investigate and determine direct point sources of inflow and (2) determine the areas and pipe reaches responsible for high levels of infiltration contribution.
4. **I/I Reduction Cost-Effectiveness Analysis:** The City should conduct a study to determine which is more cost-effective: (1) locating the sources of inflow and infiltration and systematically rehabilitating or replacing the faulty pipelines or (2) continued treatment of the additional rainfall-dependent I/I flow.

Appendix A

Flow Monitoring Site

Reports: Data, Graphs, Information

City of Banning

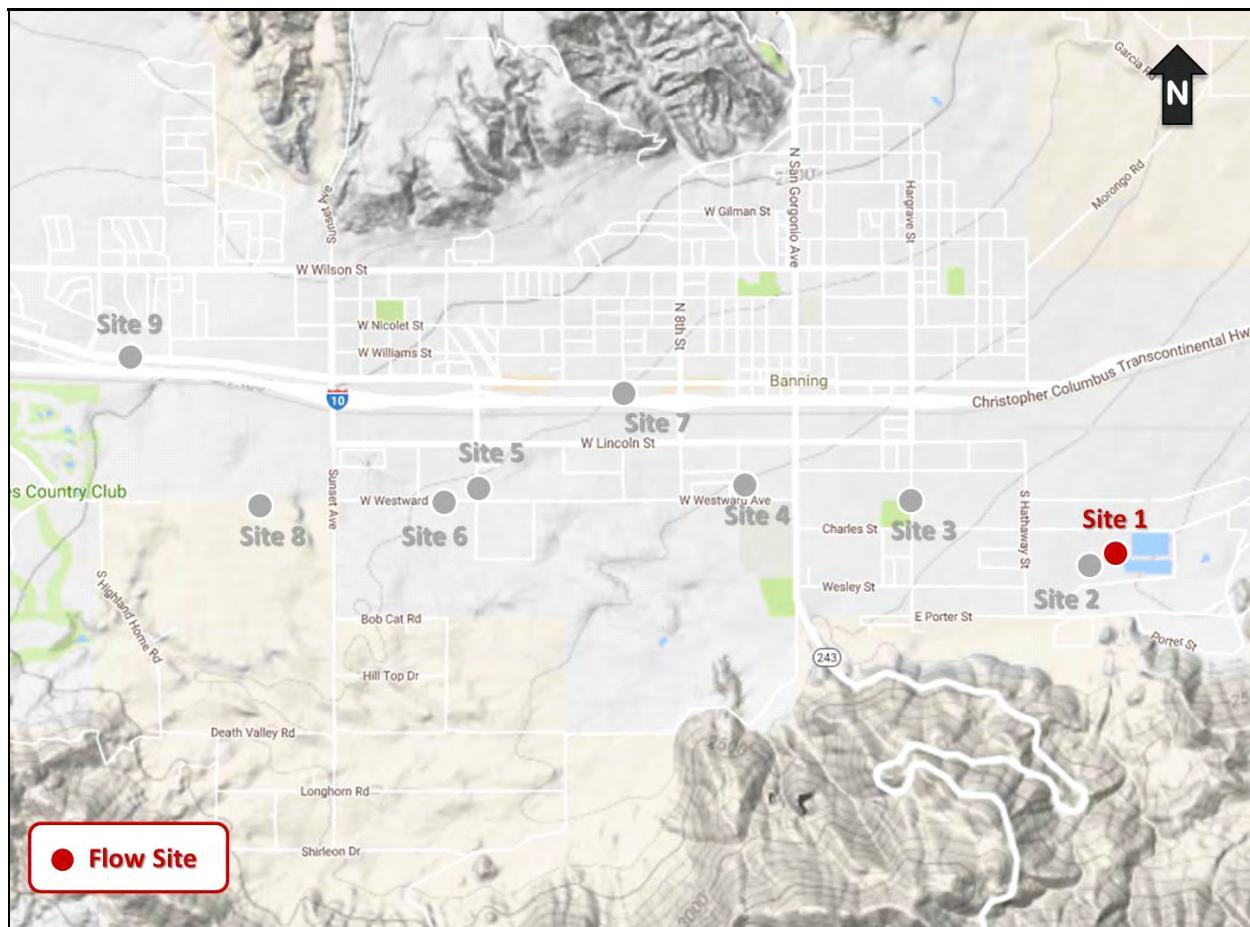
Sanitary Sewer Flow Monitoring

Temporary Monitoring: January 2017 - February 2017

Monitoring Site: Site 1

Location: City of Banning Water Reclamation Facility

Data Summary Report



Vicinity Map: Site 1

SITE 1

Site Information

Location: City of Banning Water Reclamation Facility

Coordinates: 116.8529° W, 33.9149° N

Expected Pipe Diameter: 18 inches

Measured Pipe Diameter: 24 inches

ADWF: 0.663 mgd

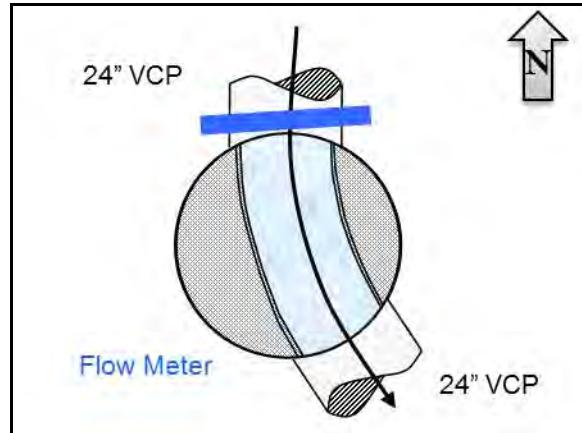
Peak Measured Flow: 4.039 mgd



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

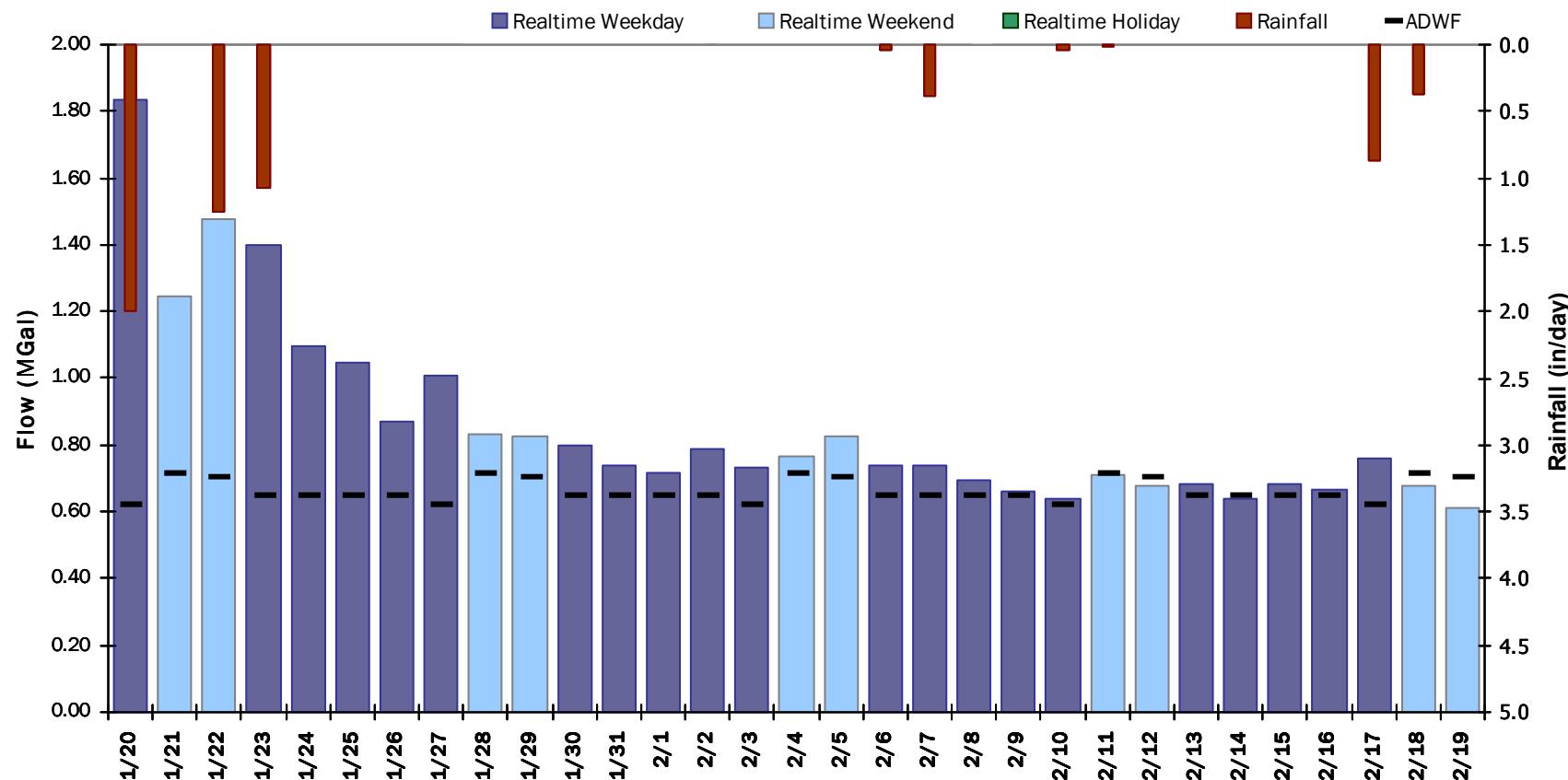
SITE 1**Additional Site Photos****Effluent Pipe****Influent Pipe**

SITE 1

Period Flow Summary: Daily Flow Totals

Avg Period Flow: 0.857 MGal Peak Daily Flow: 1.834 MGal Min Daily Flow: 0.609 MGal

Total Period Rainfall: 5.71 inches

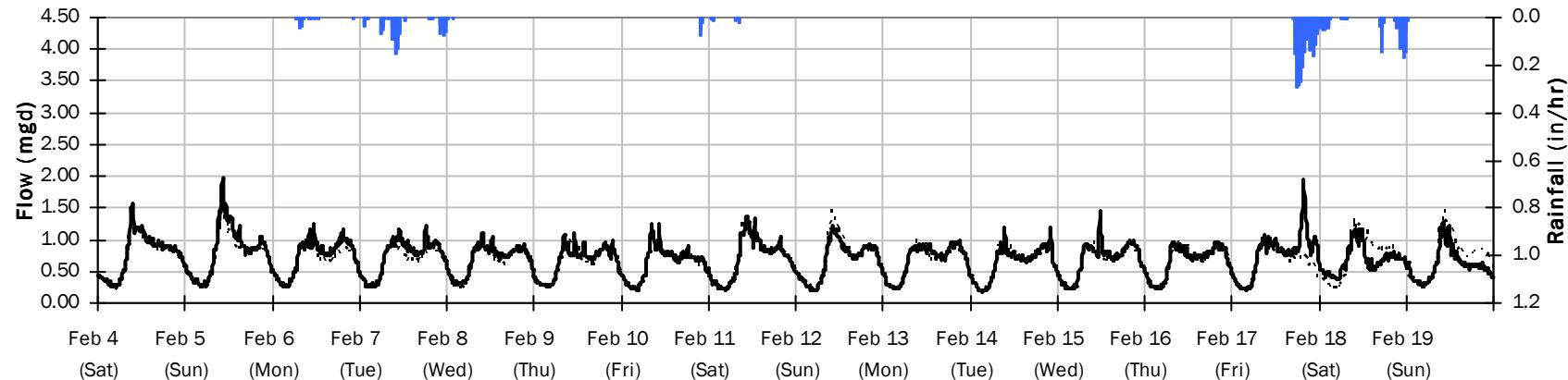
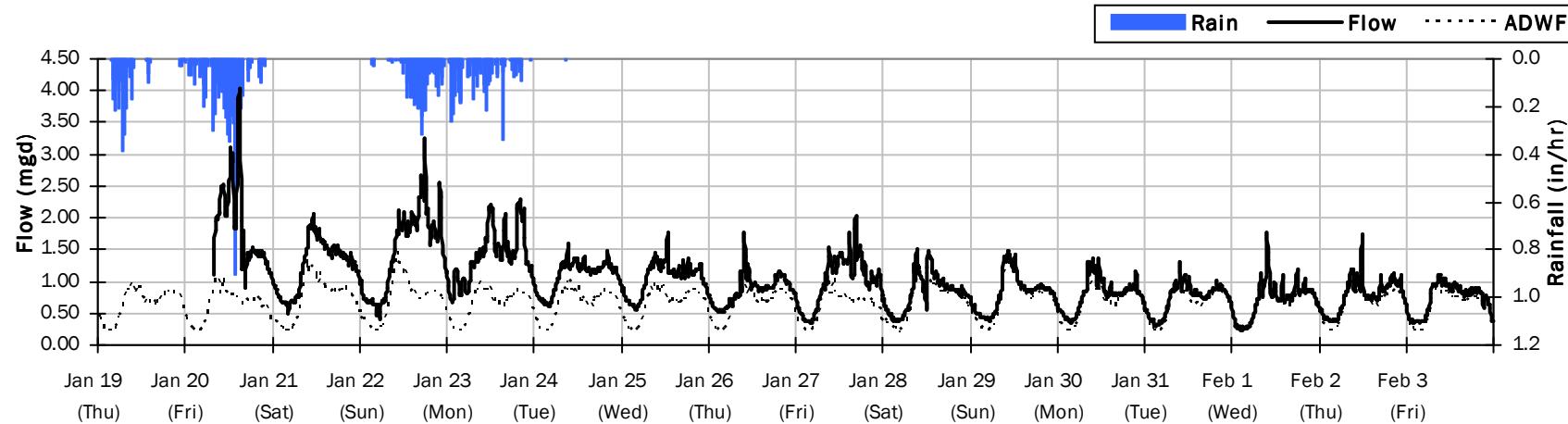


SITE 1

Flow Summary: 1/19/2017 to 2/19/2017

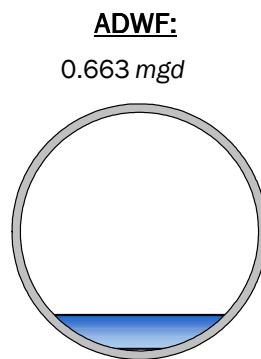
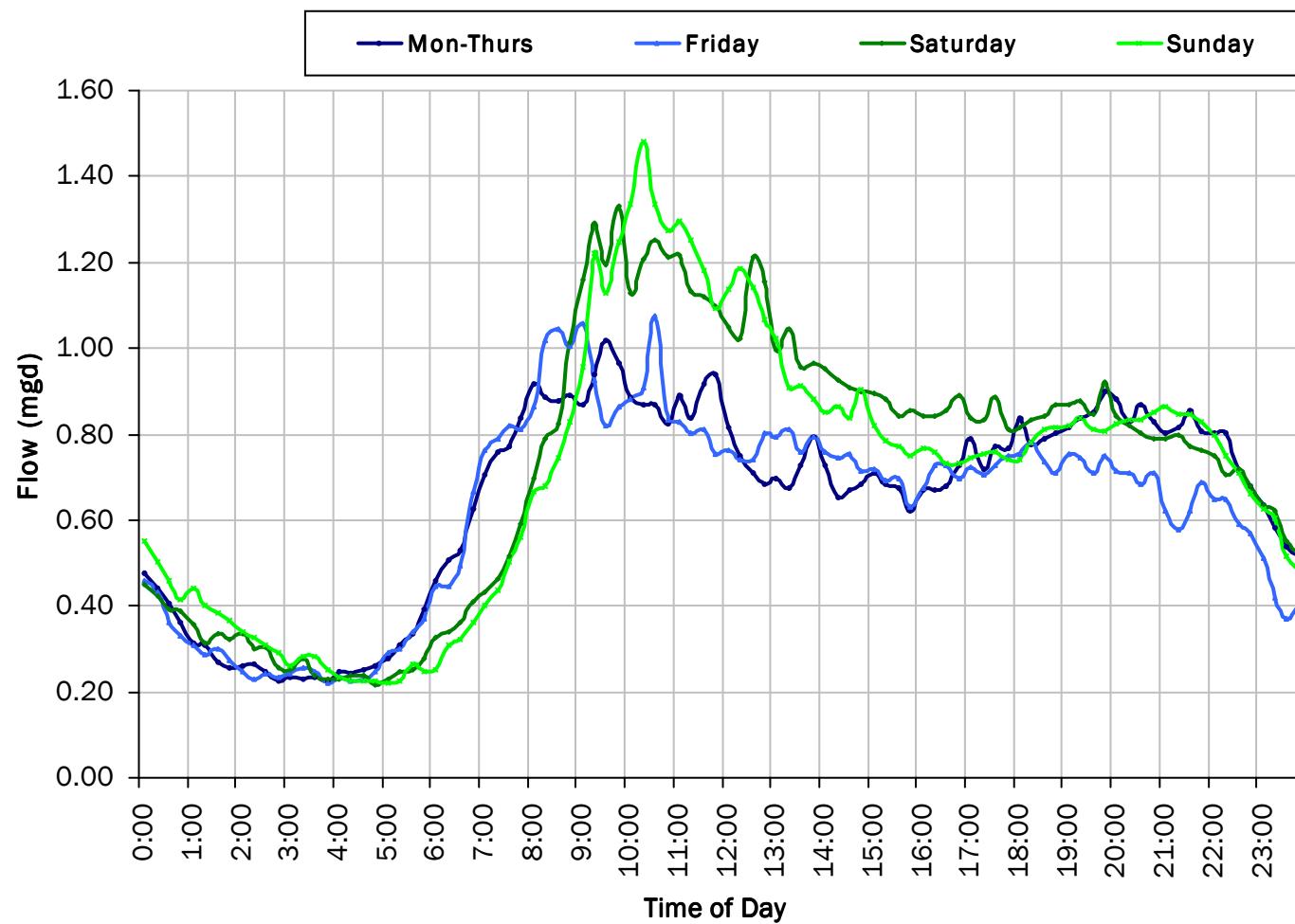
Total Period Rainfall: 6.84 inches

Avg Flow: 0.847 mgd Peak Flow: 4.039 mgd Min Flow: 0.187 mgd



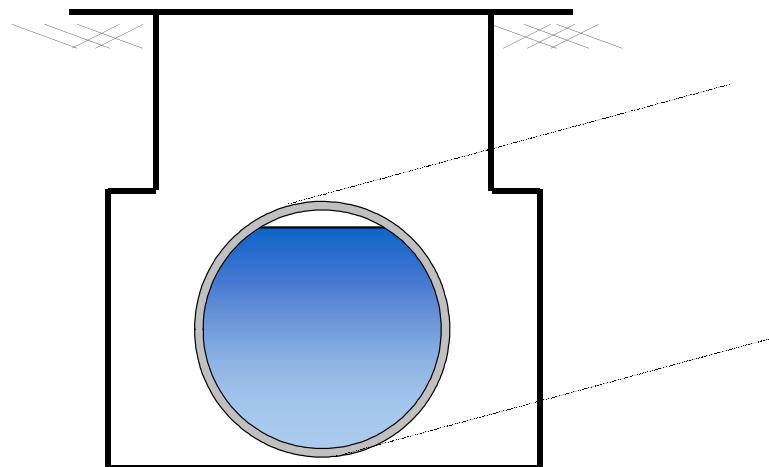
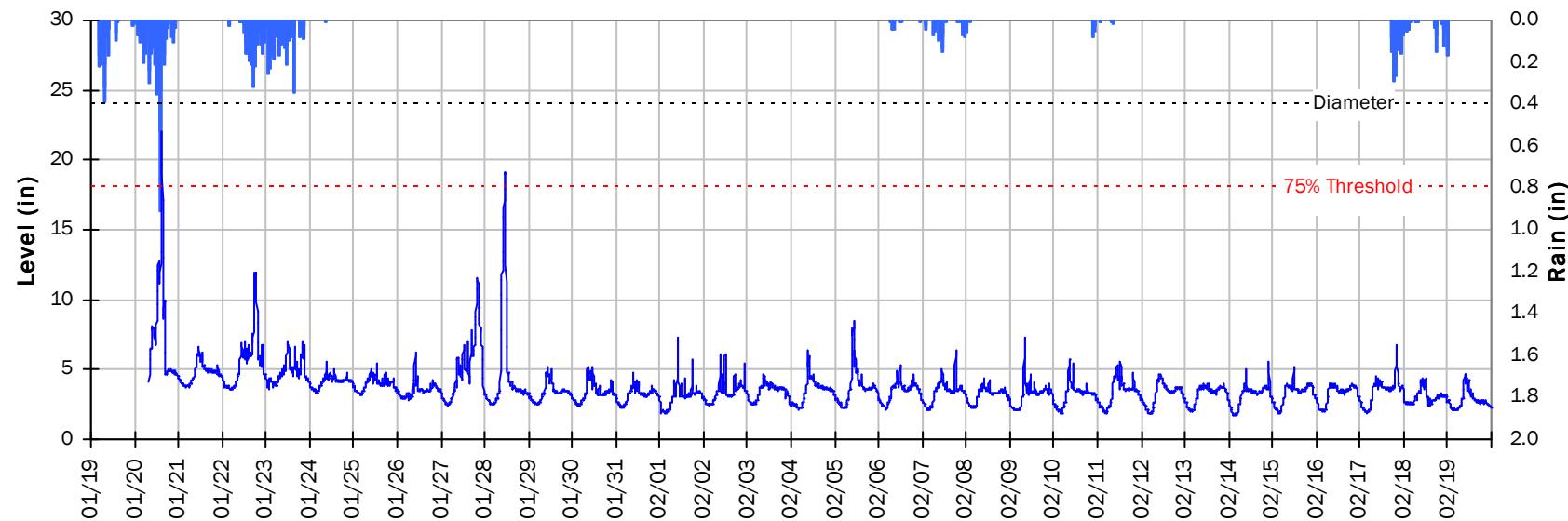
SITE 1

Average Dry Weather Flow Hydrographs



SITE 1

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Monitoring Period

Pipe Diameter: 24 inches

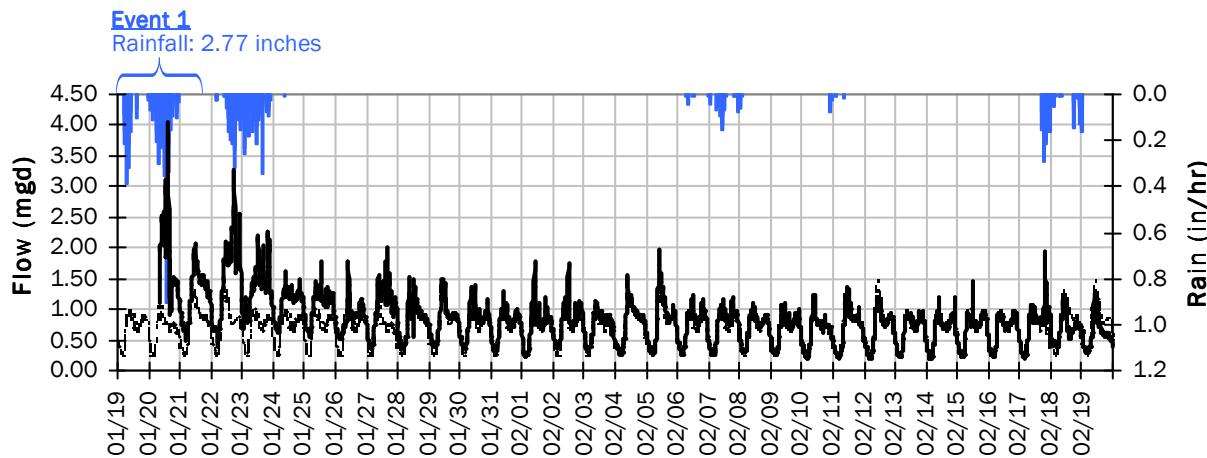
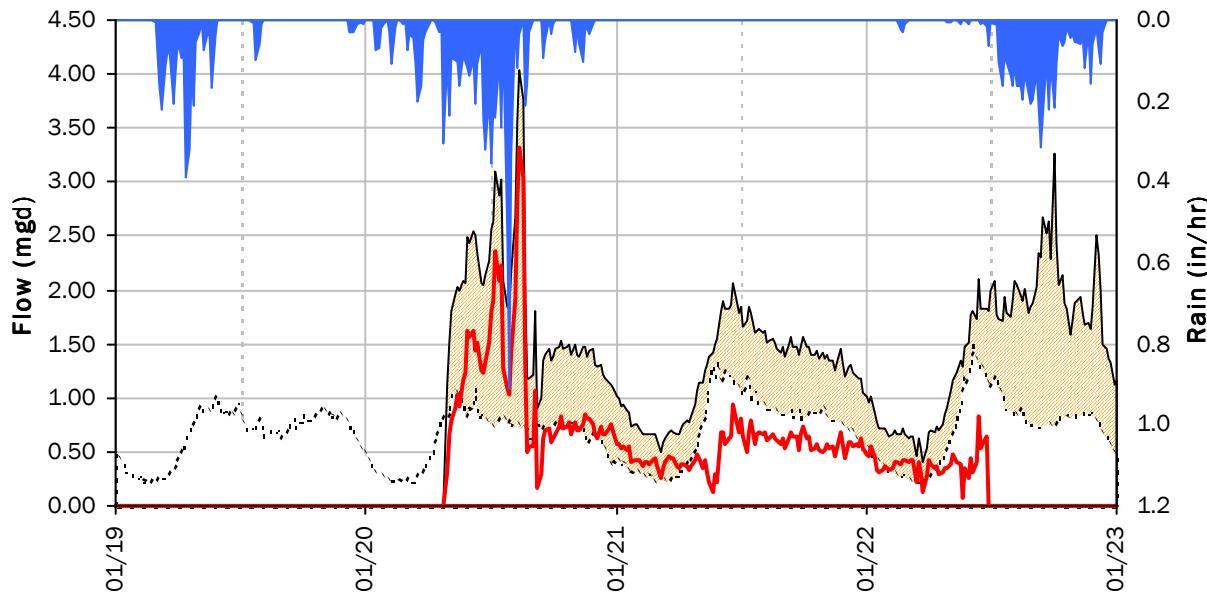
Peak Measured Level: 22.1 inches

Peak d/D Ratio: 0.92

Dry Weather Design Threshold Level: 18.0 inches

SITE 1

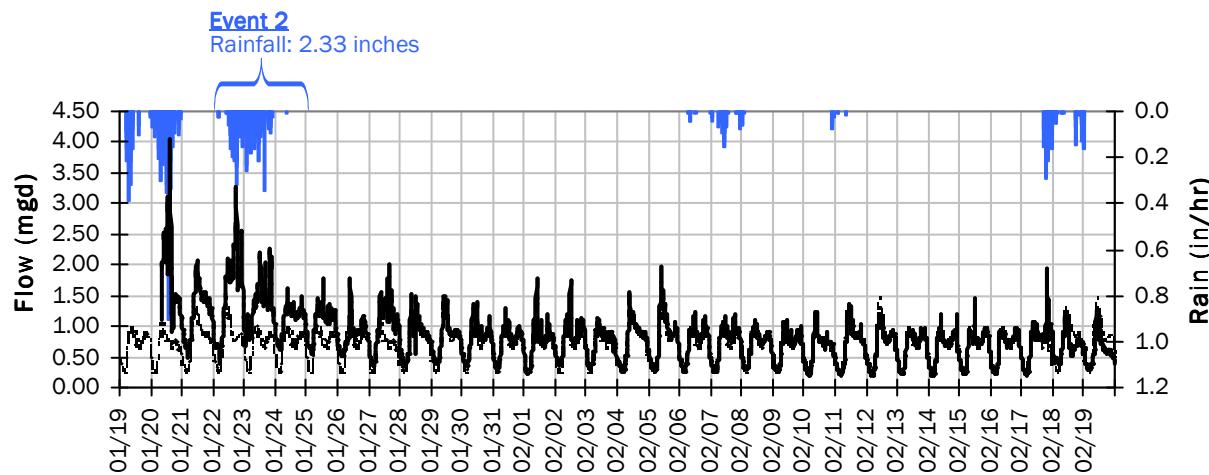
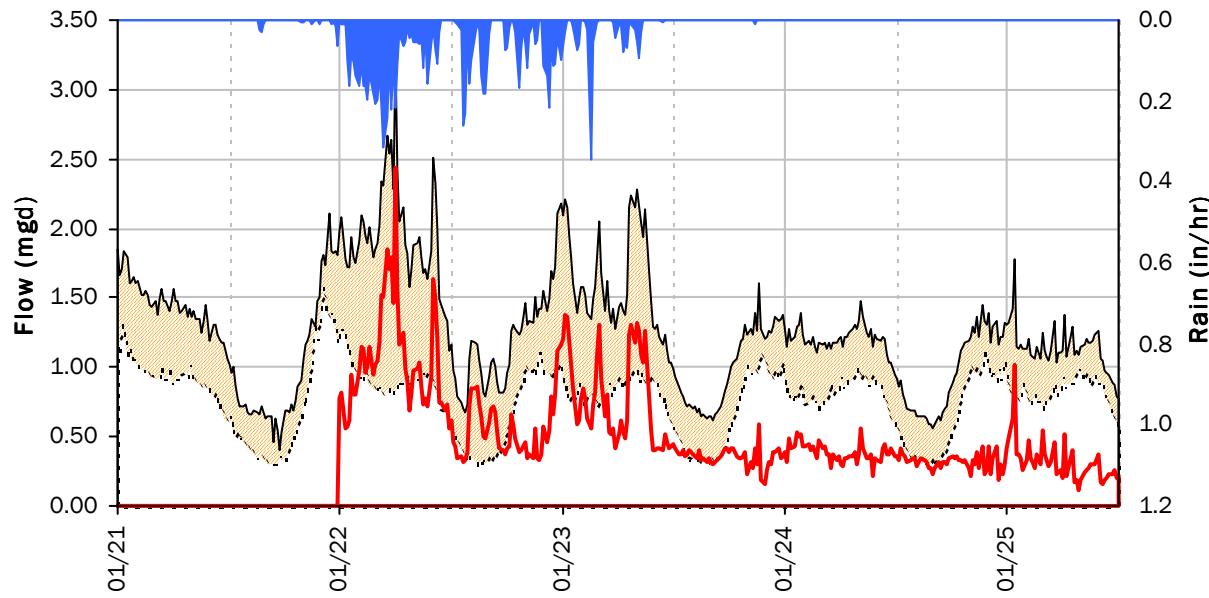
I/I Summary: Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring PeriodEvent 1 Detail GraphStorm Event I/I Analysis (Rain = 2.77 inches)

Capacity	Inflow / Infiltration		
Peak Flow:	4.04 mgd	Peak I/I Rate:	3.32 mgd
PF:	6.09	Total I/I:	1,456,000 gallons
Peak Level:	22.09 in		
d/D Ratio:	0.92		

SITE 1

I/I Summary: Event 2

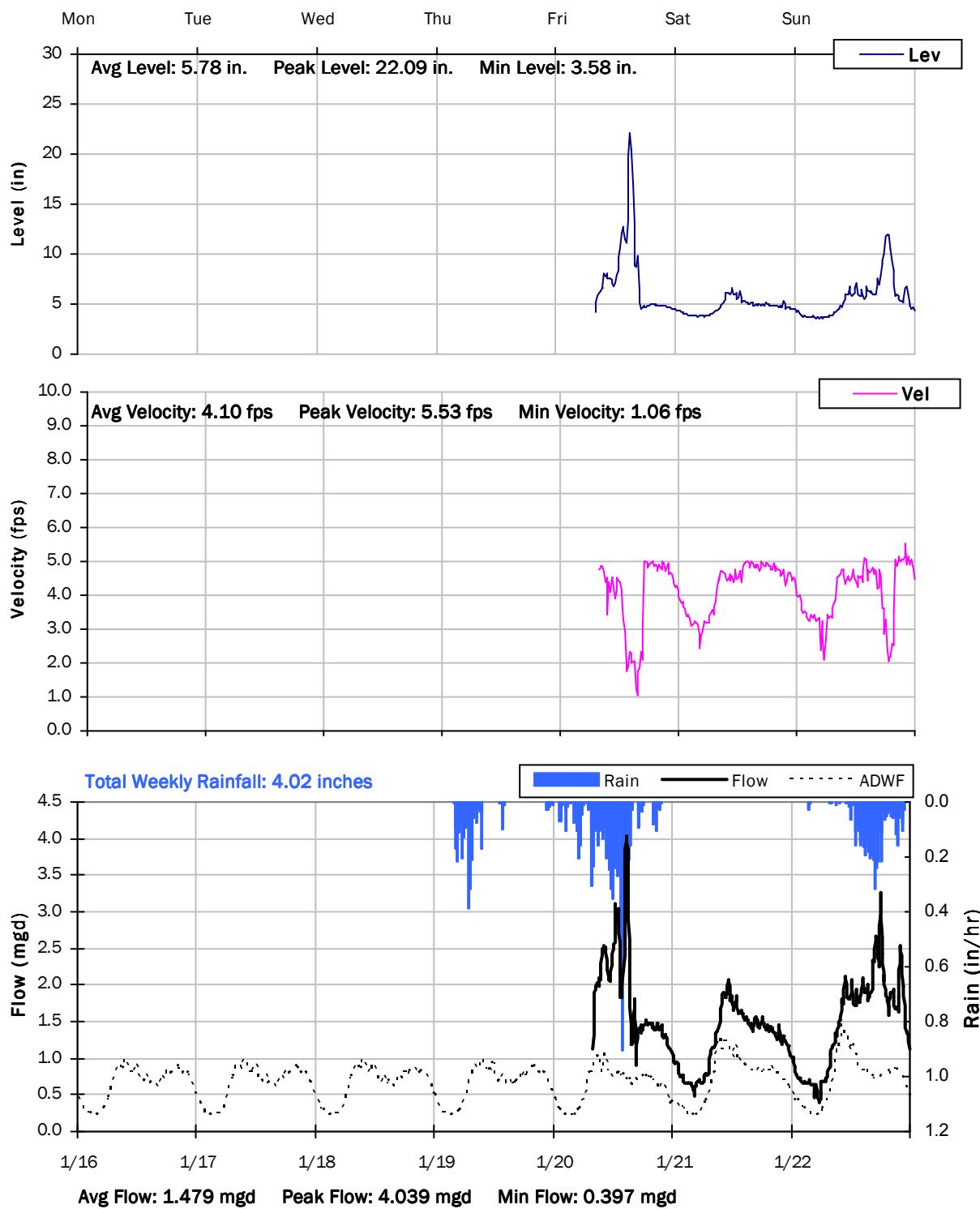
Baseline and Realtime Flows with Rainfall Data over Monitoring PeriodEvent 2 Detail GraphStorm Event I/I Analysis (Rain = 2.33 inches)

Capacity	Inflow / Infiltration		
Peak Flow:	3.26 mgd	Peak I/I Rate:	2.44 mgd
PF:	4.92	Total I/I:	1,890,000 gallons
Peak Level:	11.99 in		
d/D Ratio:	0.50		

SITE 1

Weekly Level, Velocity and Flow Hydrographs

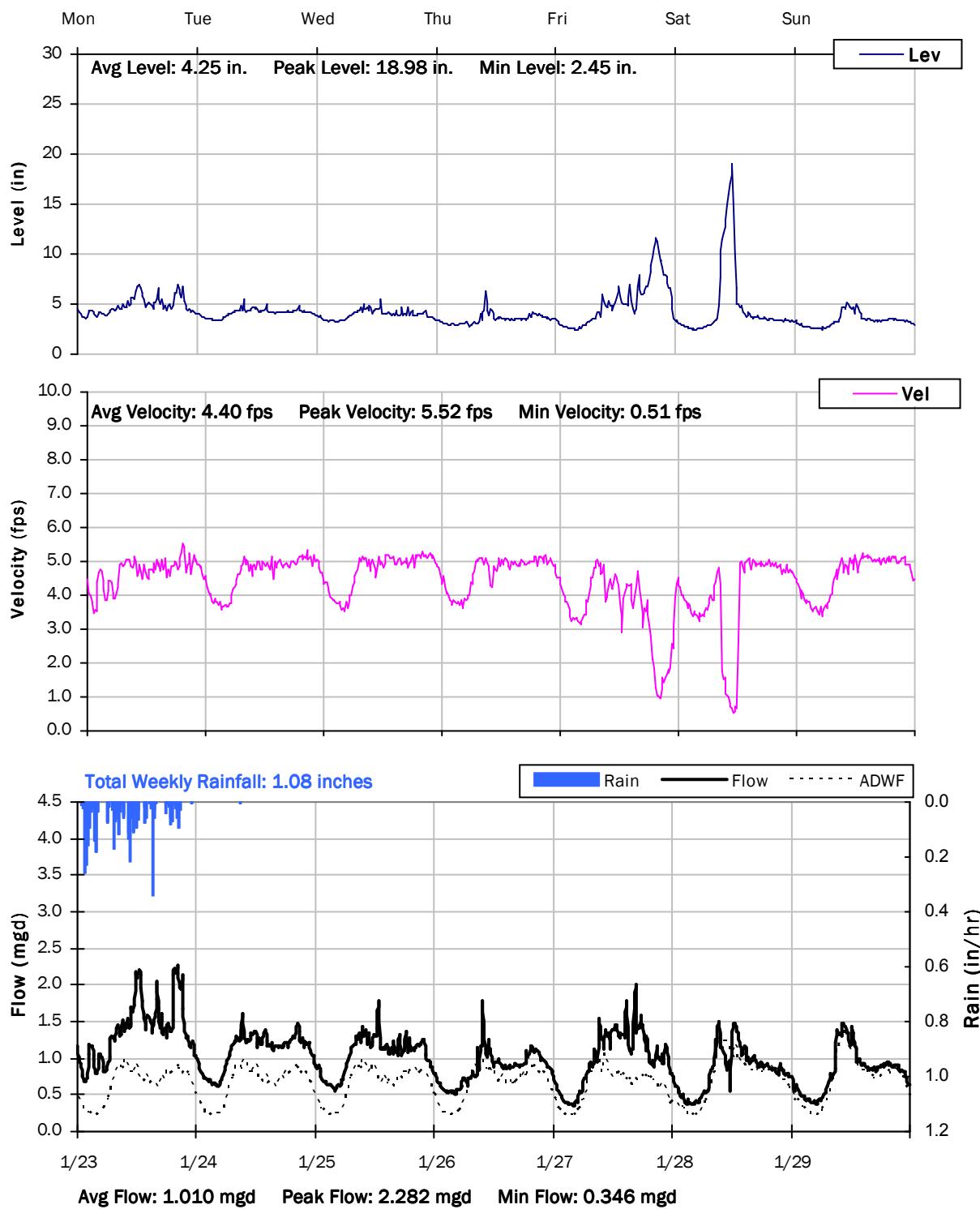
1/16/2017 to 1/23/2017



SITE 1

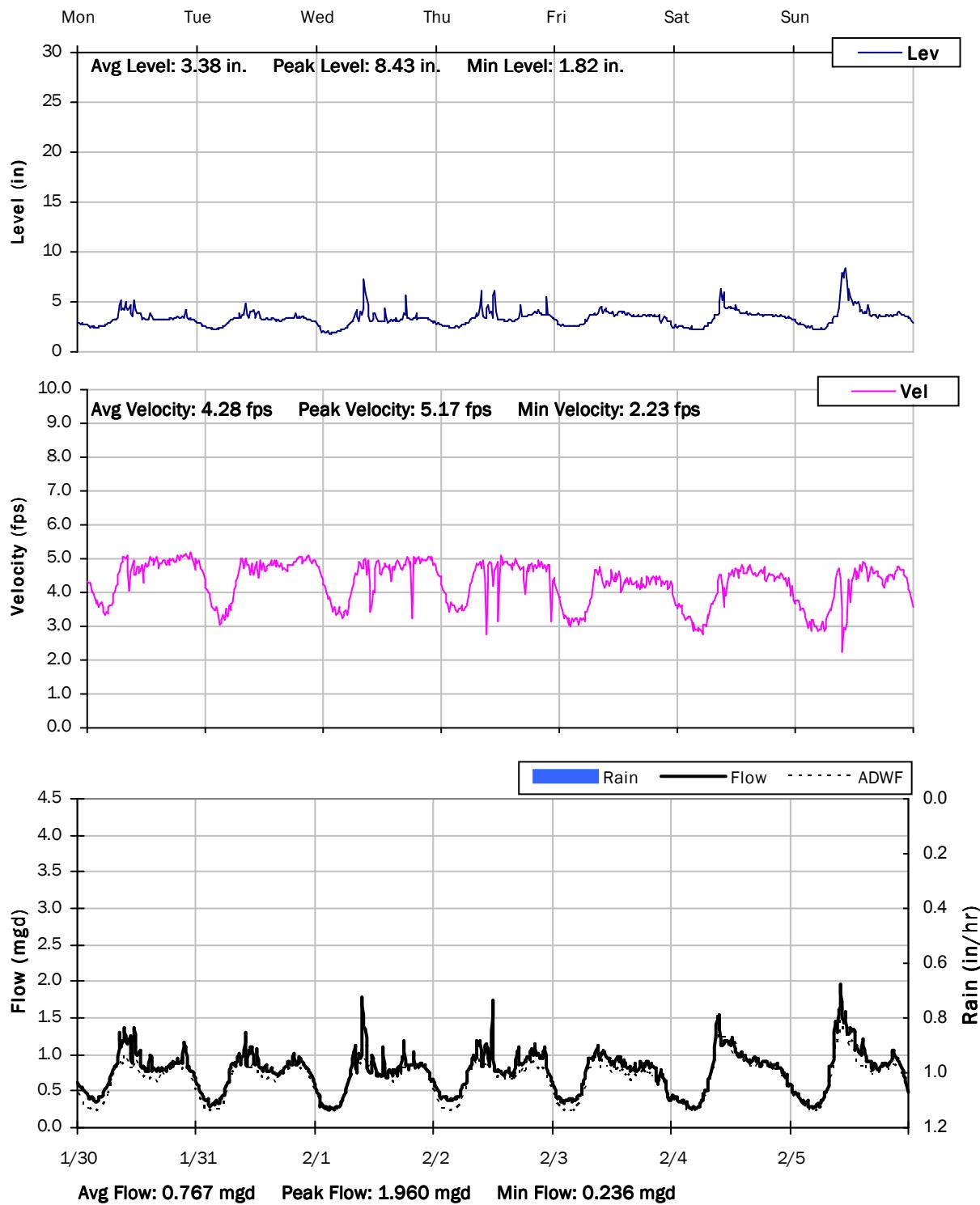
Weekly Level, Velocity and Flow Hydrographs

1/23/2017 to 1/30/2017



SITE 1
Weekly Level, Velocity and Flow Hydrographs

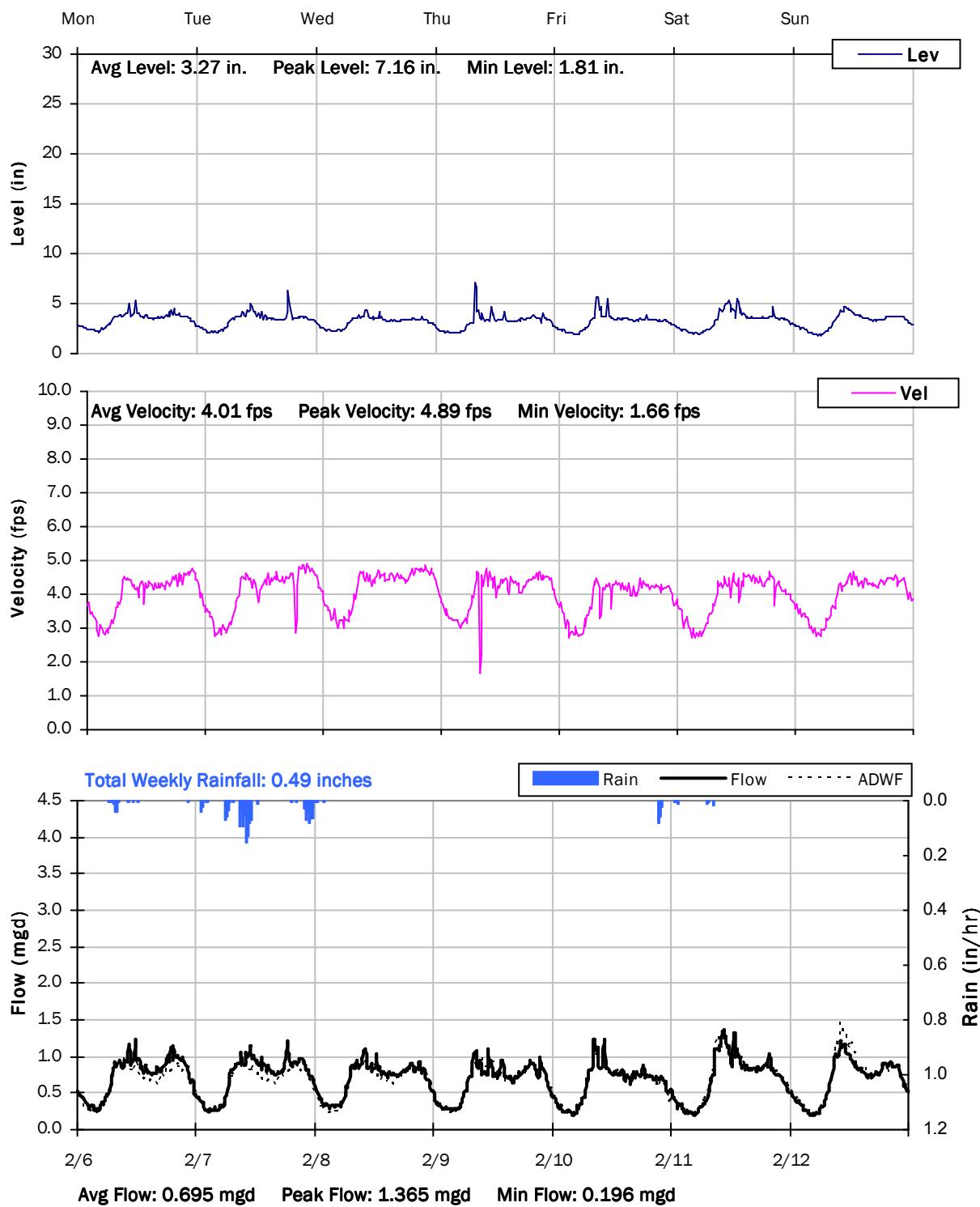
1/30/2017 to 2/6/2017



SITE 1

Weekly Level, Velocity and Flow Hydrographs

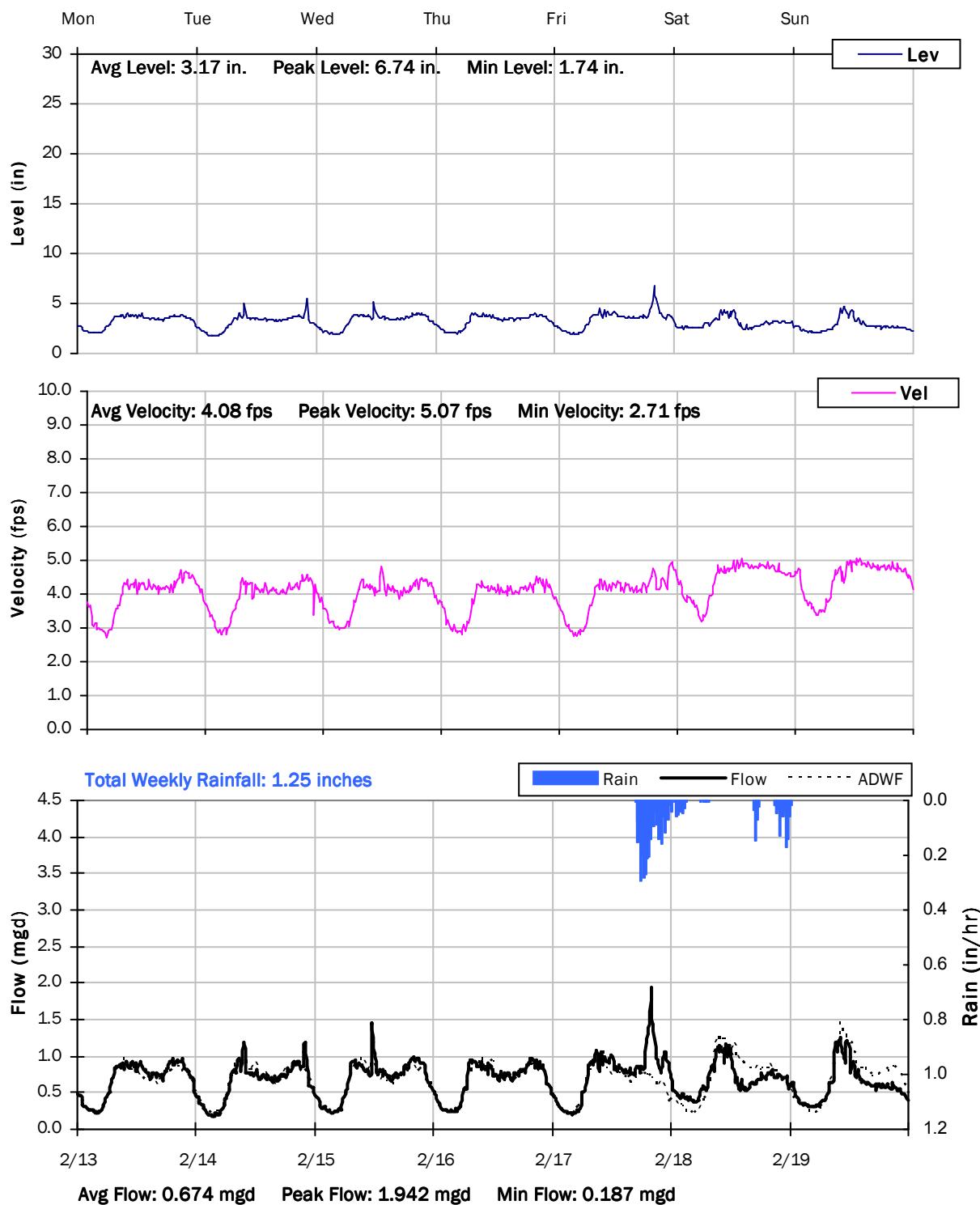
2/6/2017 to 2/13/2017



SITE 1

Weekly Level, Velocity and Flow Hydrographs

2/13/2017 to 2/20/2017



City of Banning

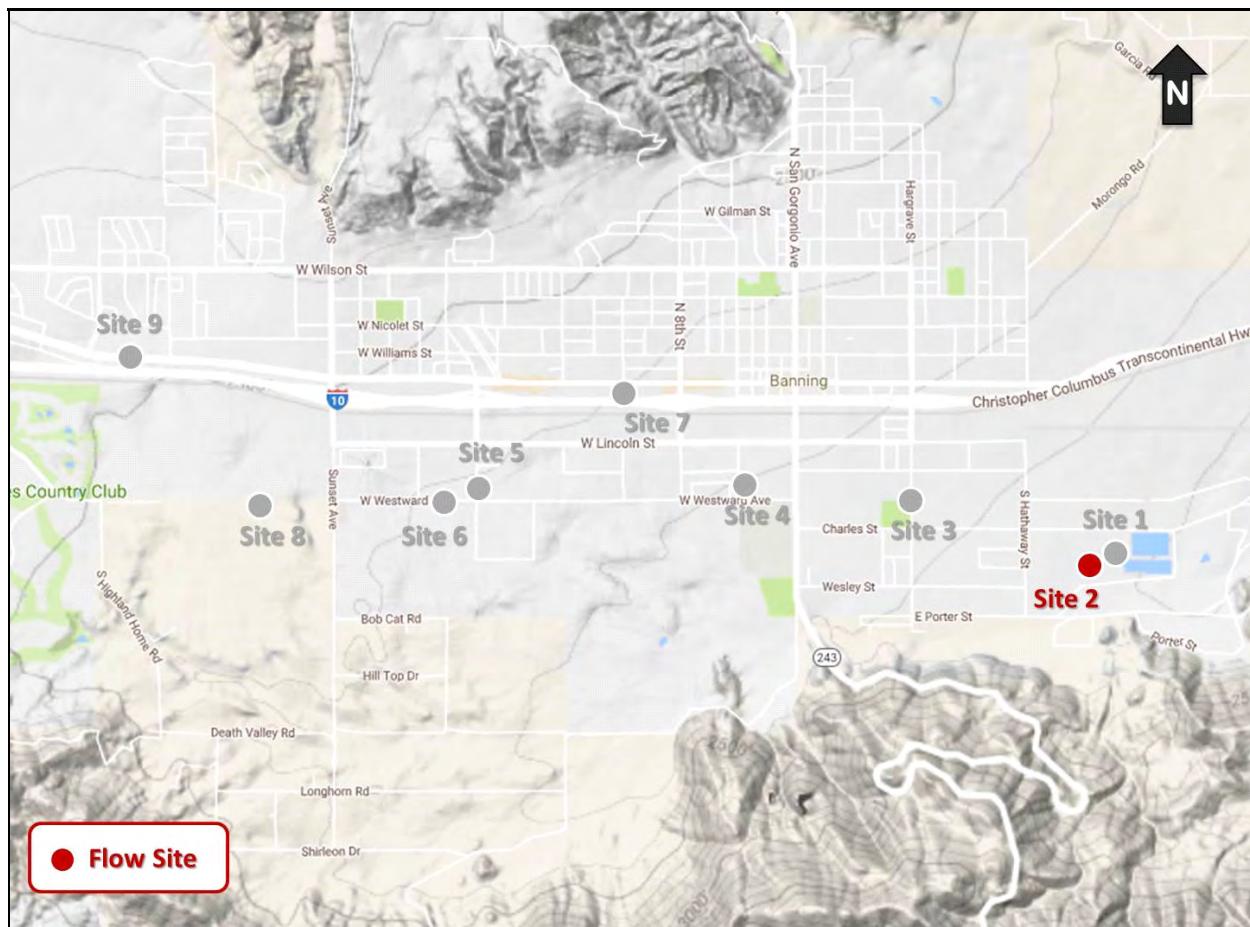
Sanitary Sewer Flow Monitoring

Temporary Monitoring: January 2017 - February 2017

Monitoring Site: Site 2

Location: in lot next to treatment plant

Data Summary Report



Vicinity Map: Site 2

SITE 2

Site Information

Location: in lot next to treatment plant

Coordinates: 116.8543° W, 33.9141° N

Expected Pipe Diameter: 36 inches

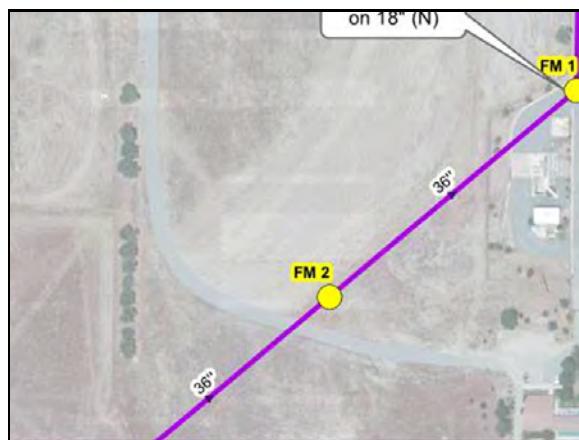
Measured Pipe Diameter: 30 inches

ADWF: 1.347 mgd

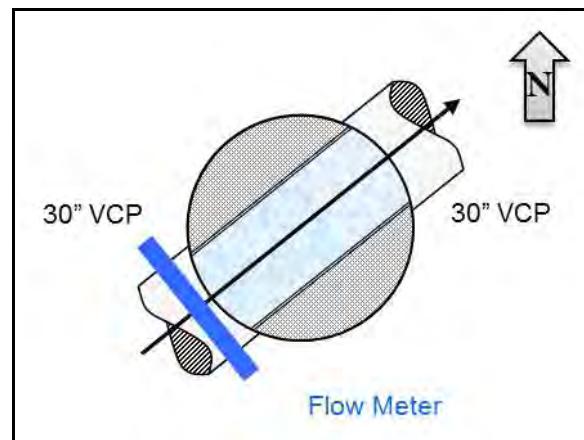
Peak Measured Flow: 3.717 mgd



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

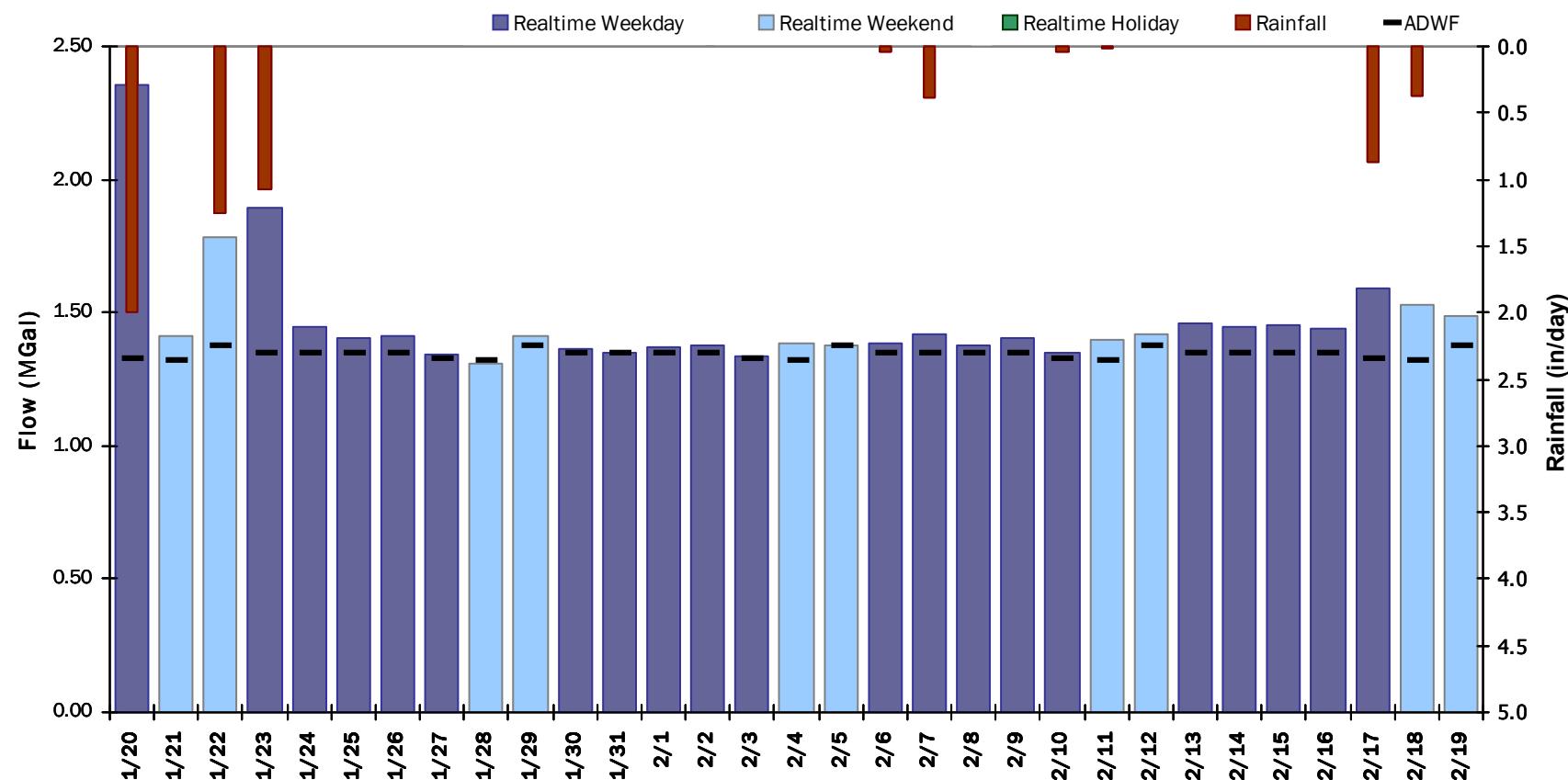
SITE 2**Additional Site Photos****Effluent Pipe****Influent Pipe**

SITE 2

Period Flow Summary: Daily Flow Totals

Avg Period Flow: 1.467 MGal Peak Daily Flow: 2.354 MGal Min Daily Flow: 1.311 MGal

Total Period Rainfall: 5.60 inches

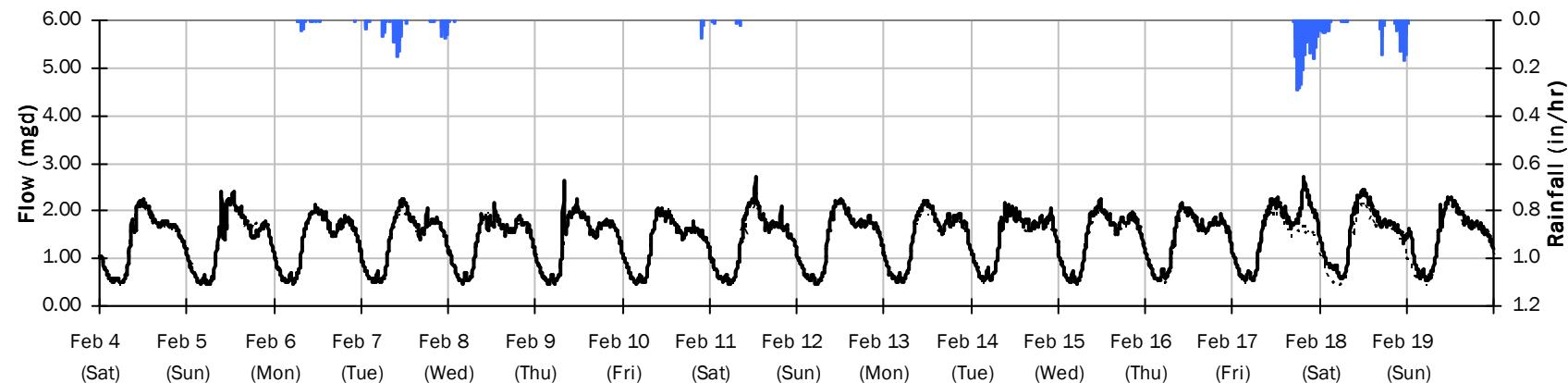
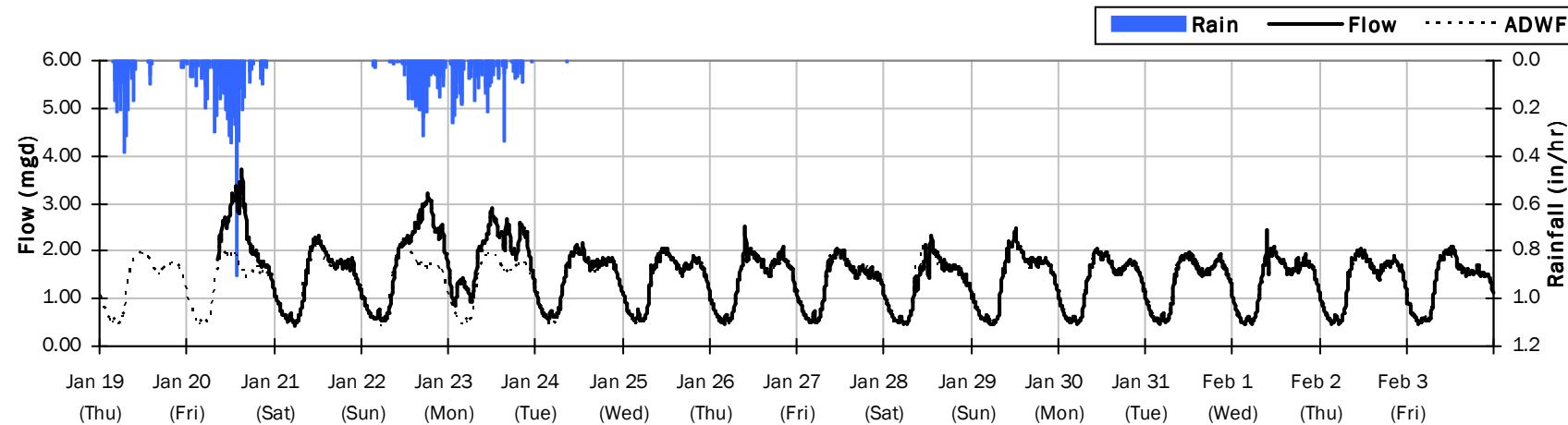


SITE 2

Flow Summary: 1/19/2017 to 2/19/2017

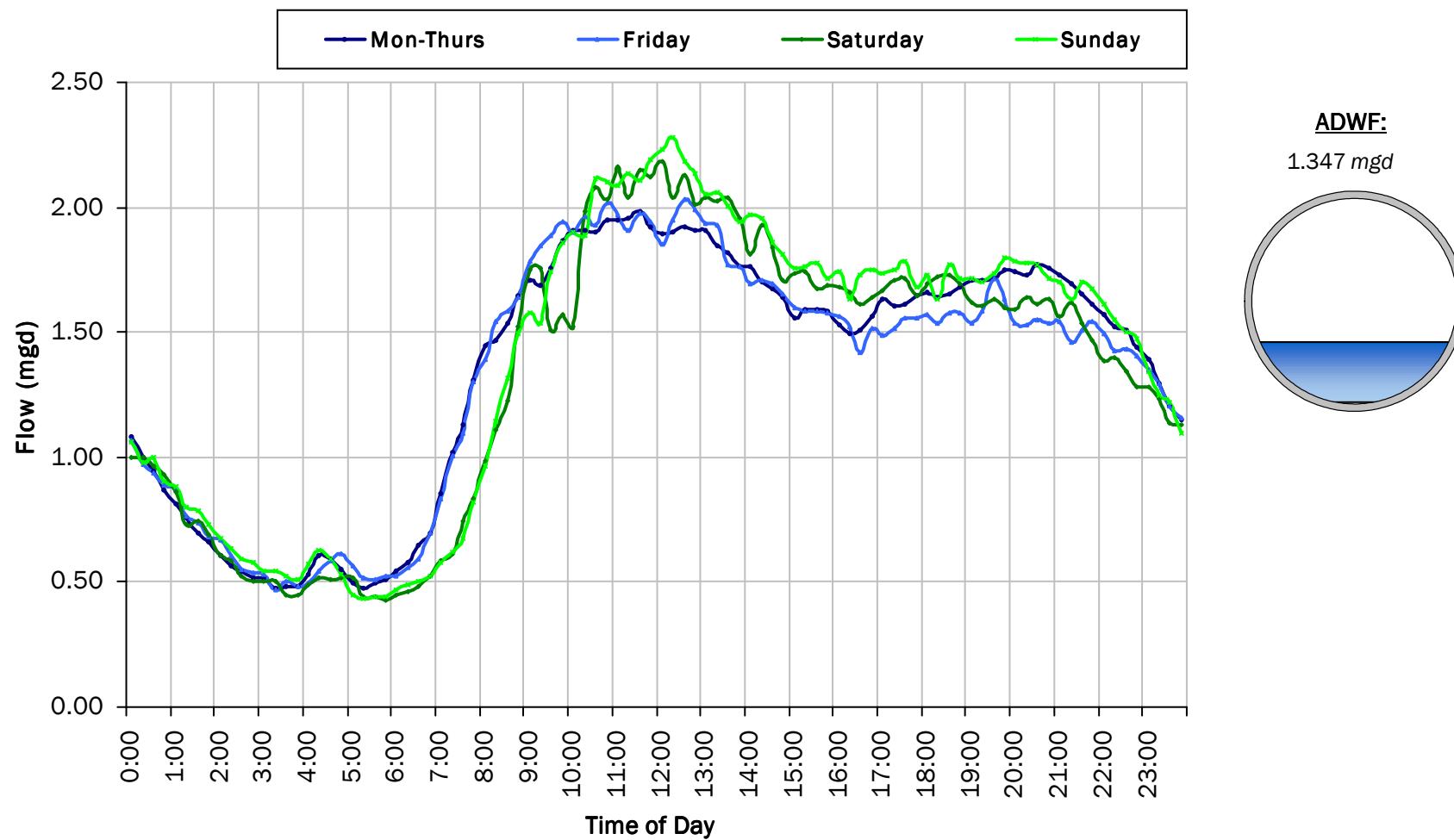
Total Period Rainfall: 6.84 inches

Avg Flow: 1.457 mgd Peak Flow: 3.717 mgd Min Flow: 0.440 mgd



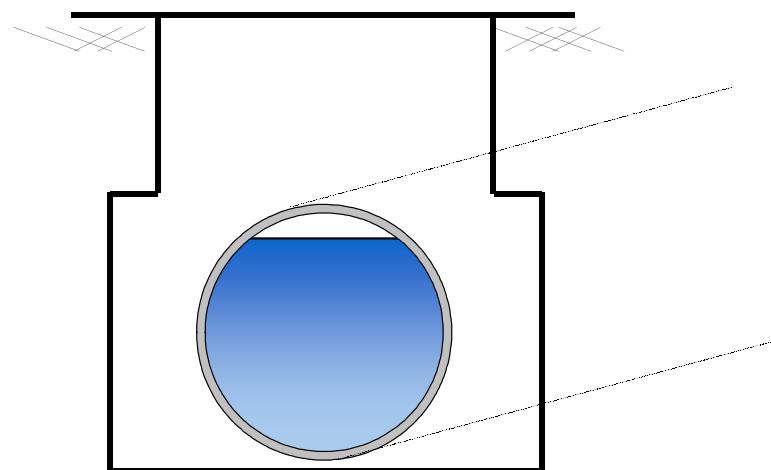
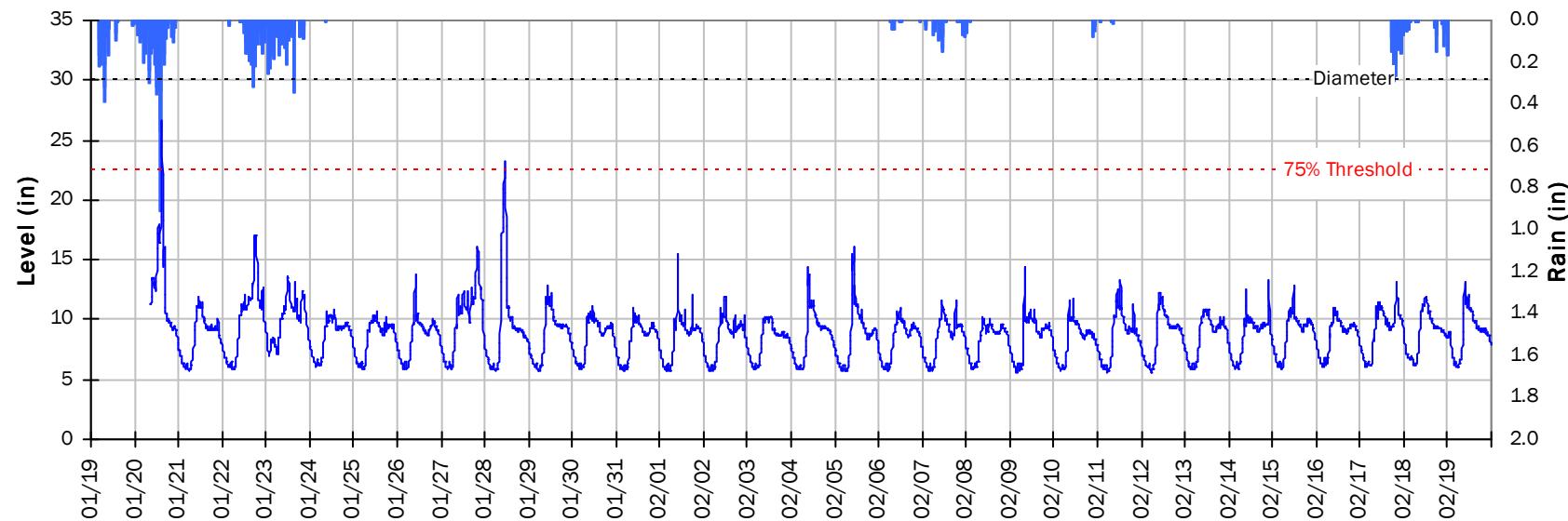
SITE 2

Average Dry Weather Flow Hydrographs



SITE 2

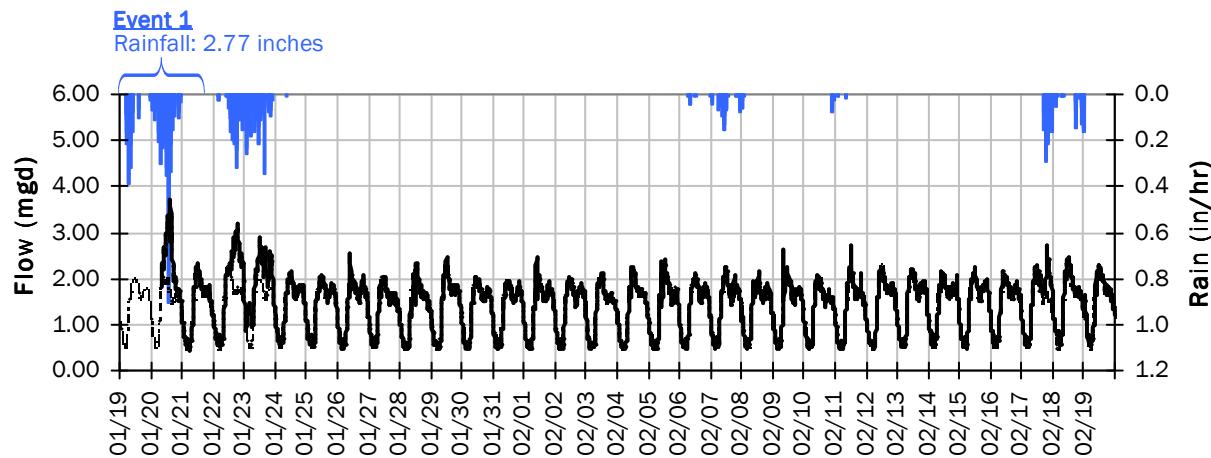
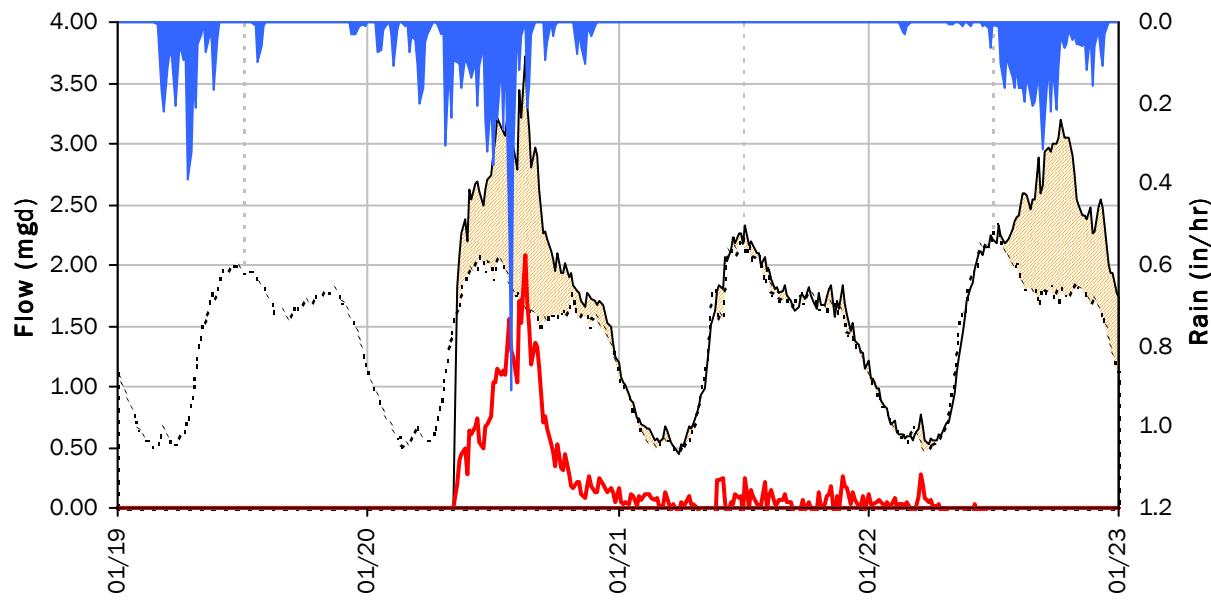
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Monitoring Period

Pipe Diameter: 30 *inches*
Peak Measured Level: 26.6 *inches*
Peak d/D Ratio: 0.89
Dry Weather Design Threshold Level: 22.5 *inches*

SITE 2

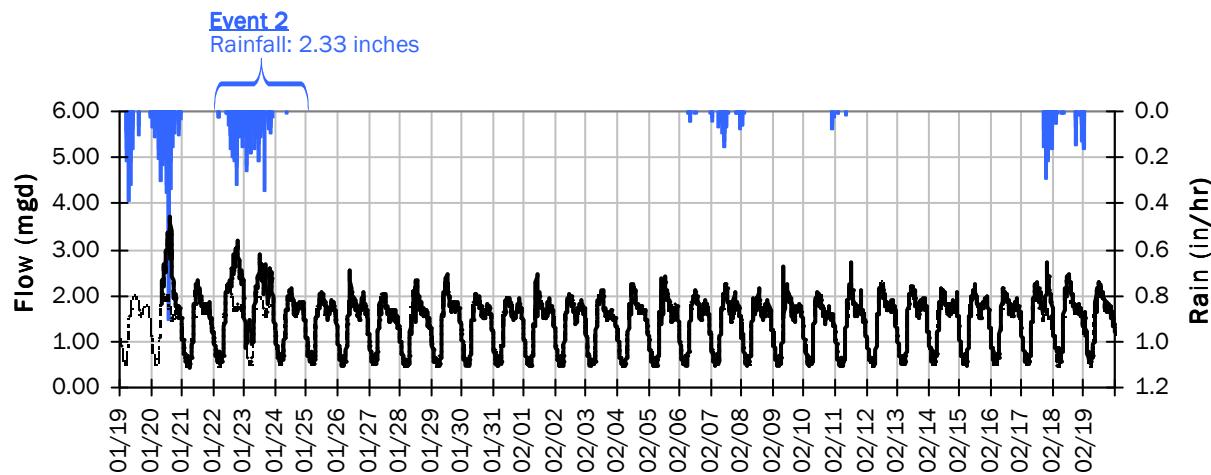
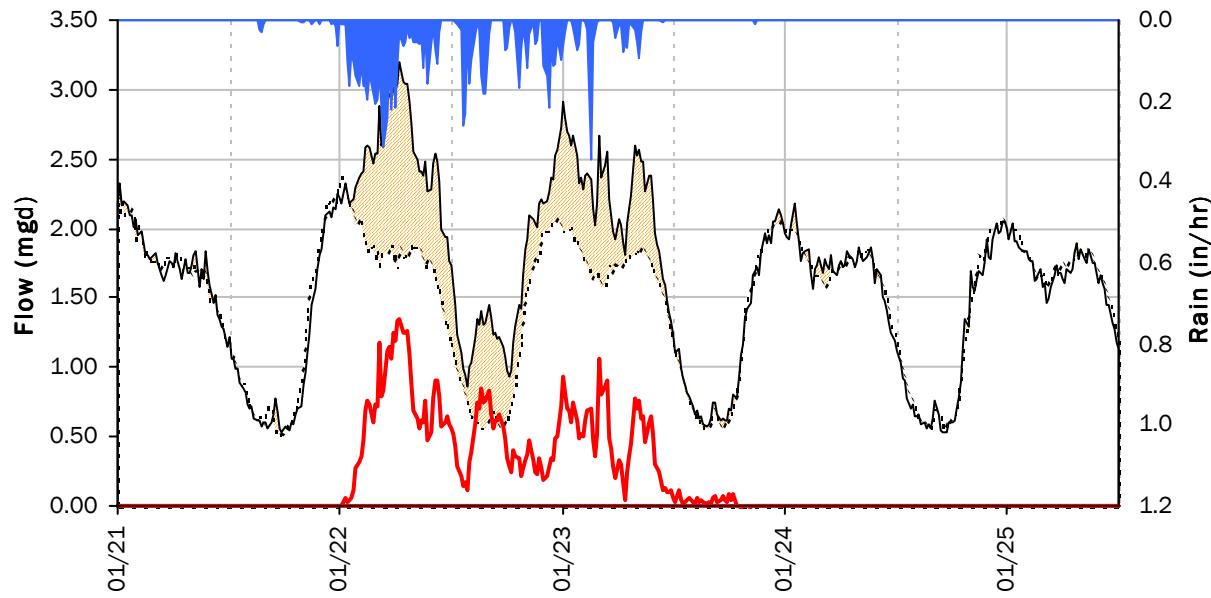
I/I Summary: Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Event 1 Detail Graph

Storm Event I/I Analysis (Rain = 2.77 inches)

Capacity	Inflow / Infiltration		
Peak Flow:	3.72 mgd	Peak I/I Rate:	2.08 mgd
PF:	2.76	Total I/I:	470,000 gallons
Peak Level:	26.59 in		
d/D Ratio:	0.89		

SITE 2

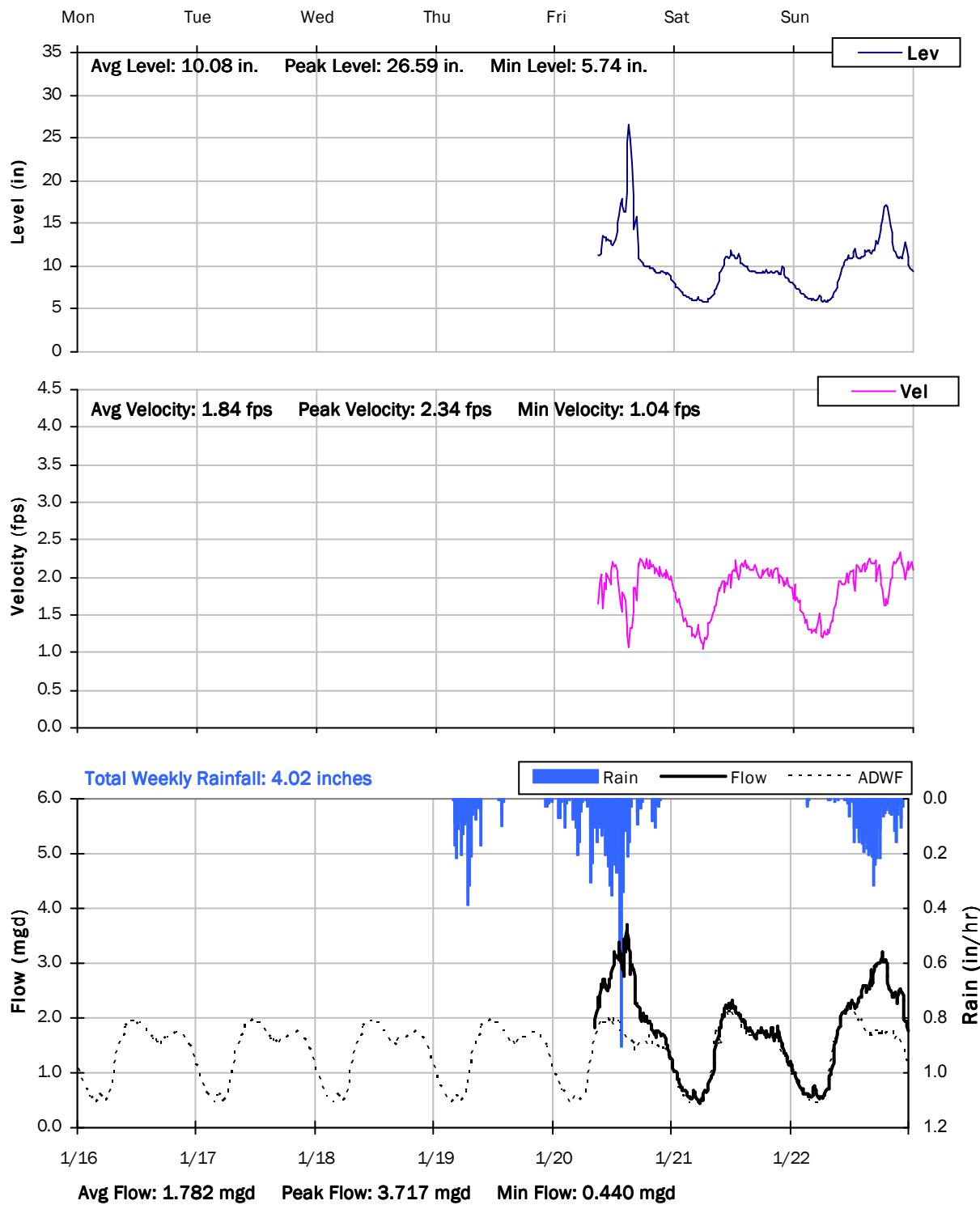
I/I Summary: Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Event 2 Detail Graph

Storm Event I/I Analysis (Rain = 2.33 inches)

Capacity	Inflow / Infiltration		
Peak Flow:	3.20 mgd	Peak I/I Rate:	1.35 mgd
PF:	2.37	Total I/I:	826,000 gallons
Peak Level: 17.09 in			
d/D Ratio: 0.57			

SITE 2
Weekly Level, Velocity and Flow Hydrographs

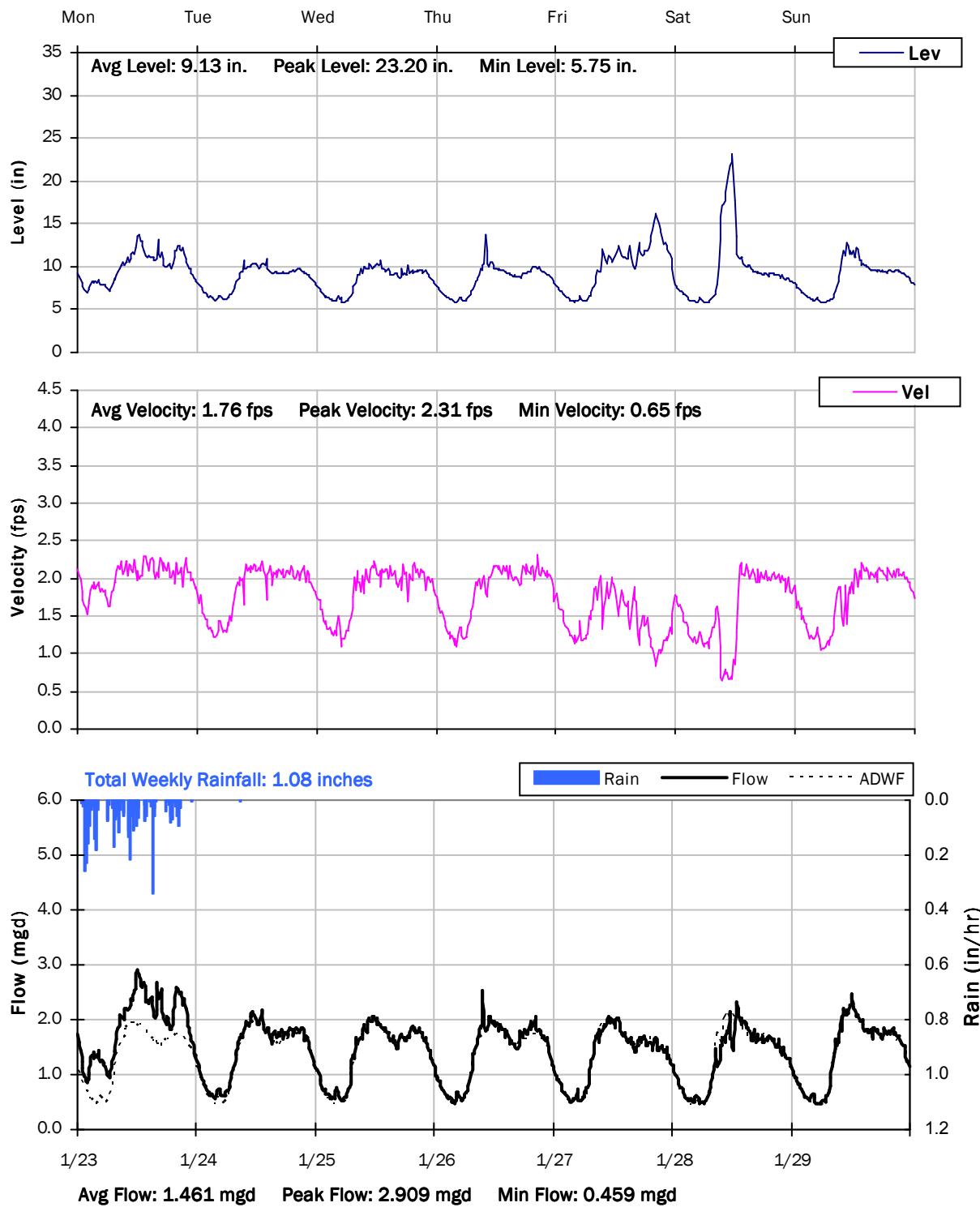
1/16/2017 to 1/23/2017



SITE 2

Weekly Level, Velocity and Flow Hydrographs

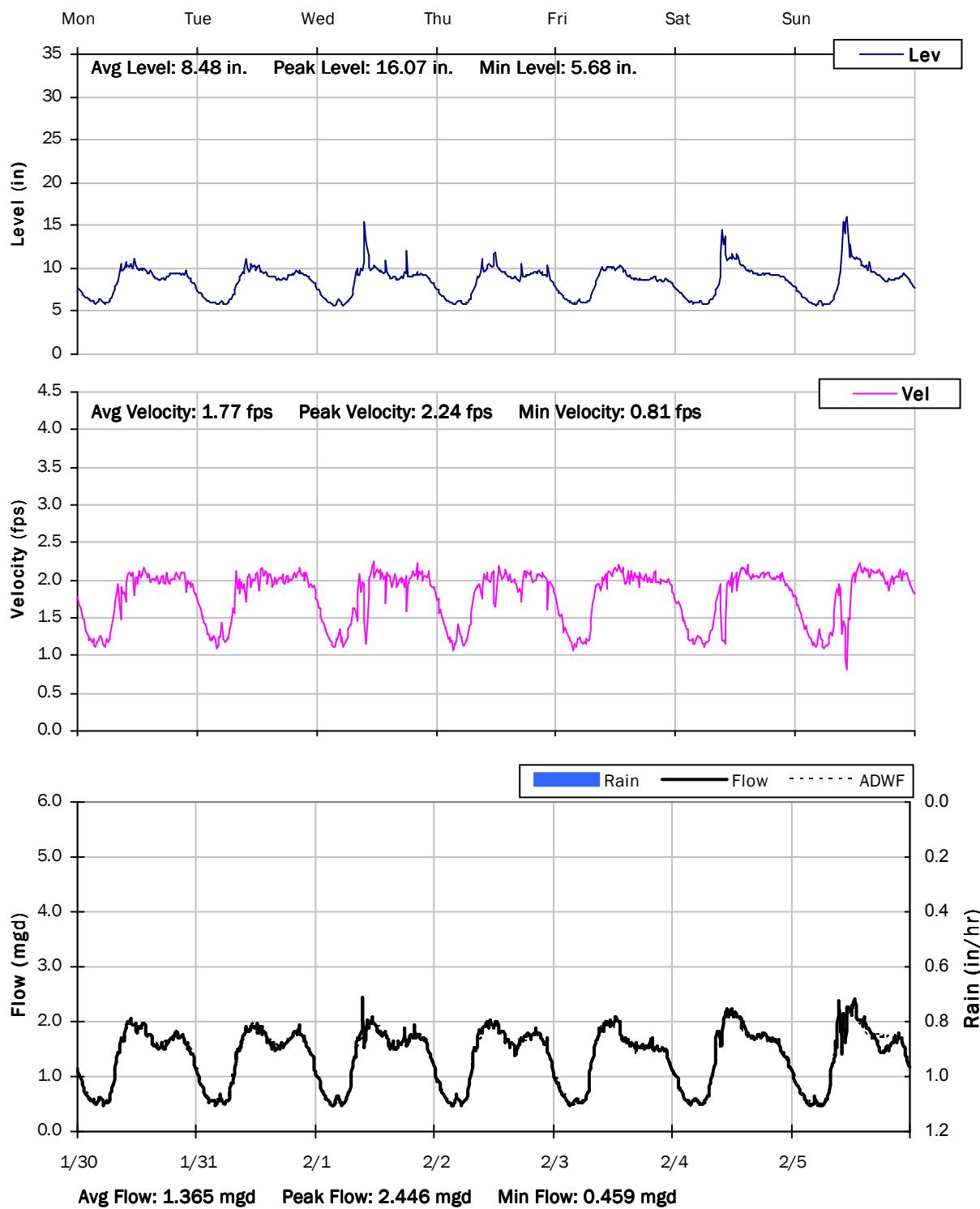
1/23/2017 to 1/30/2017



SITE 2

Weekly Level, Velocity and Flow Hydrographs

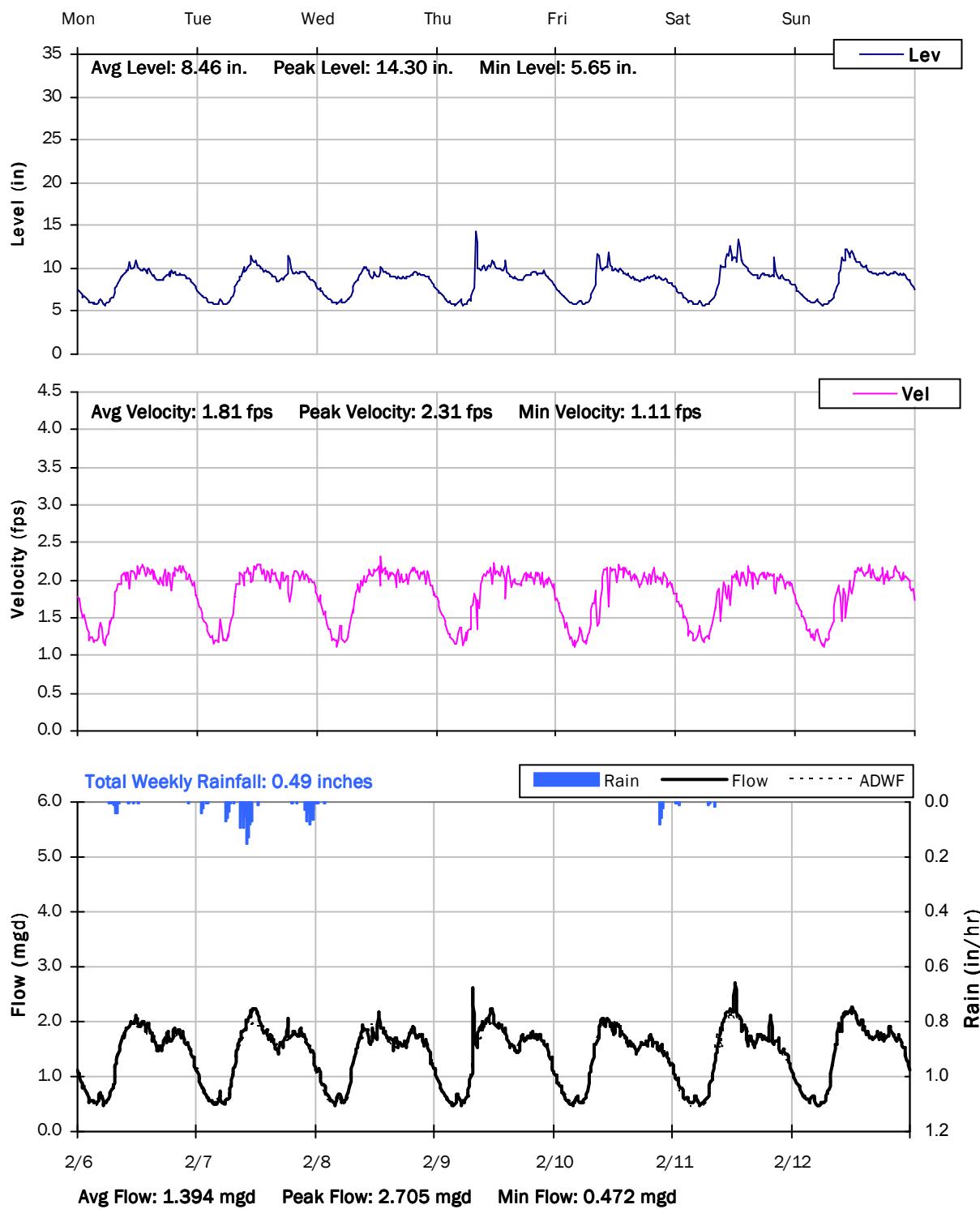
1/30/2017 to 2/6/2017



SITE 2

Weekly Level, Velocity and Flow Hydrographs

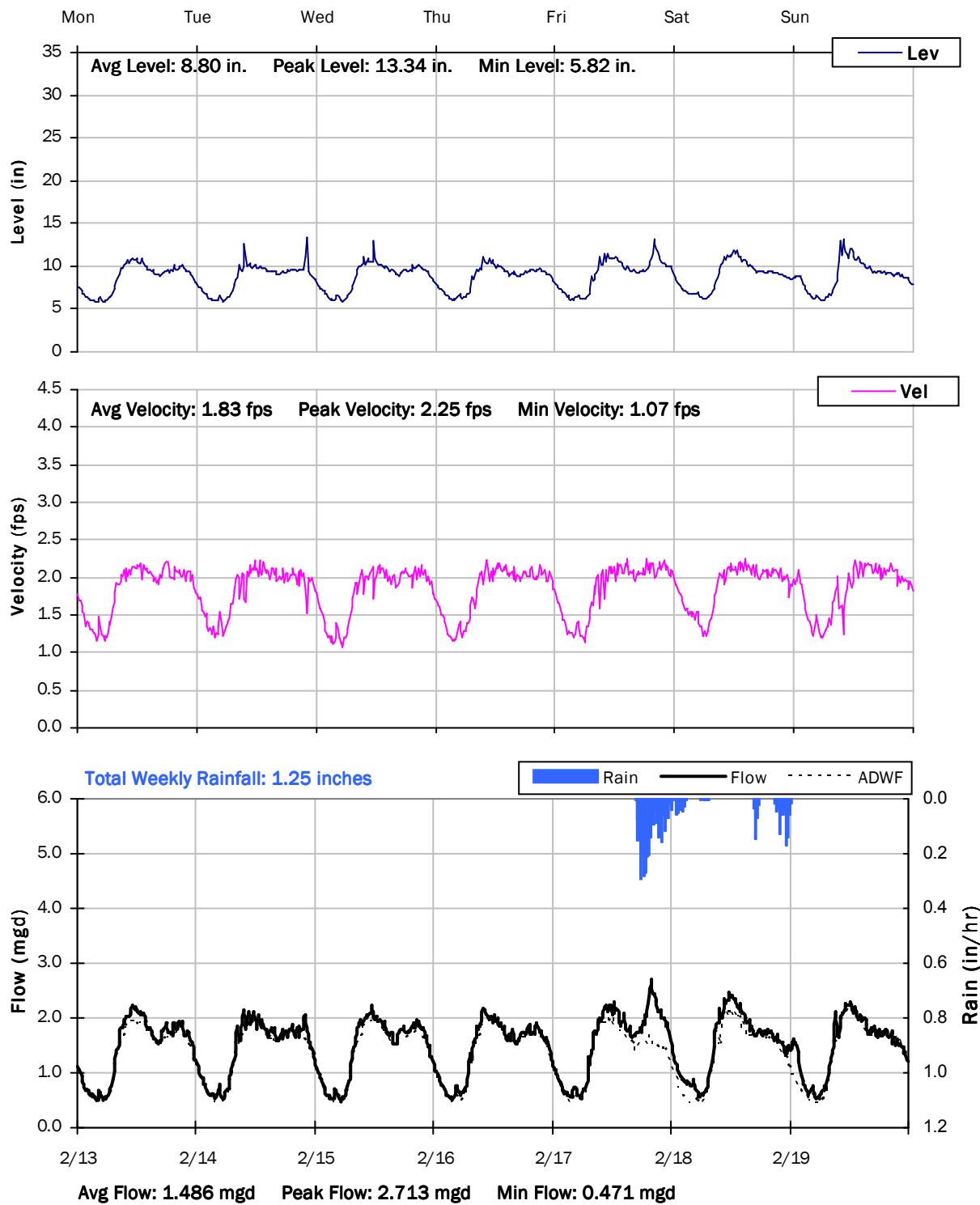
2/6/2017 to 2/13/2017



SITE 2

Weekly Level, Velocity and Flow Hydrographs

2/13/2017 to 2/20/2017



City of Banning

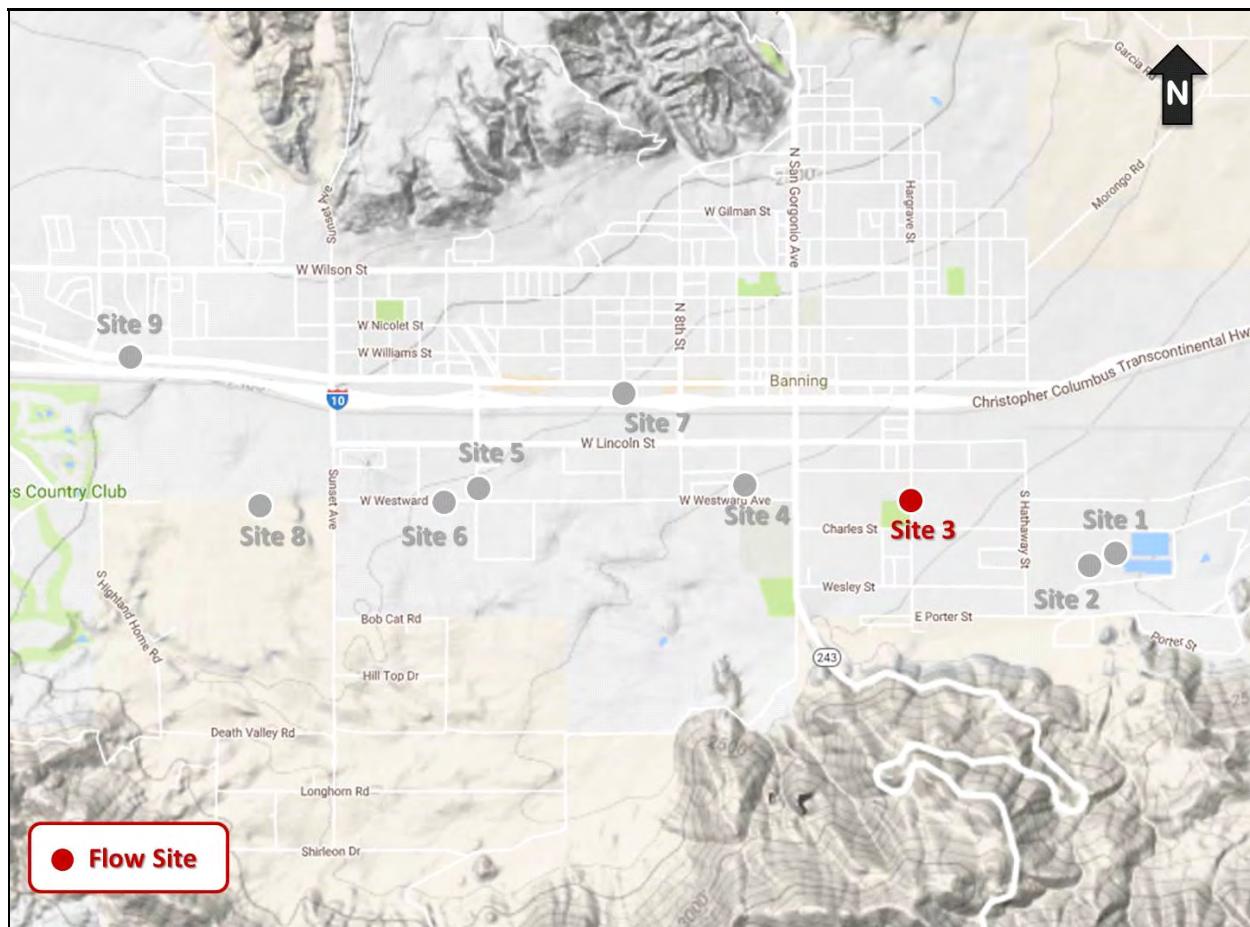
Sanitary Sewer Flow Monitoring

Temporary Monitoring: January 2017 - February 2017

Monitoring Site: Site 3

Location: S Hargrave Street and E Westward Avenue

Data Summary Report



Vicinity Map: Site 3

SITE 3

Site Information

Location: S Hargrave Street and E Westward Avenue

Coordinates: 116.8680° W, 33.9181° N

Expected Pipe Diameter: 15 inches

Measured Pipe Diameter: 15 inches

ADWF: 0.495 mgd

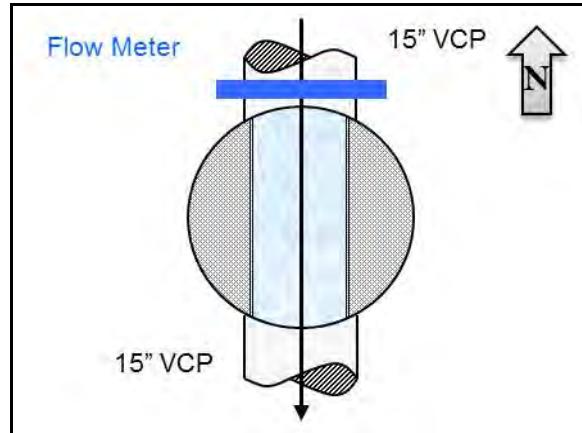
Peak Measured Flow: 1.885 mgd



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

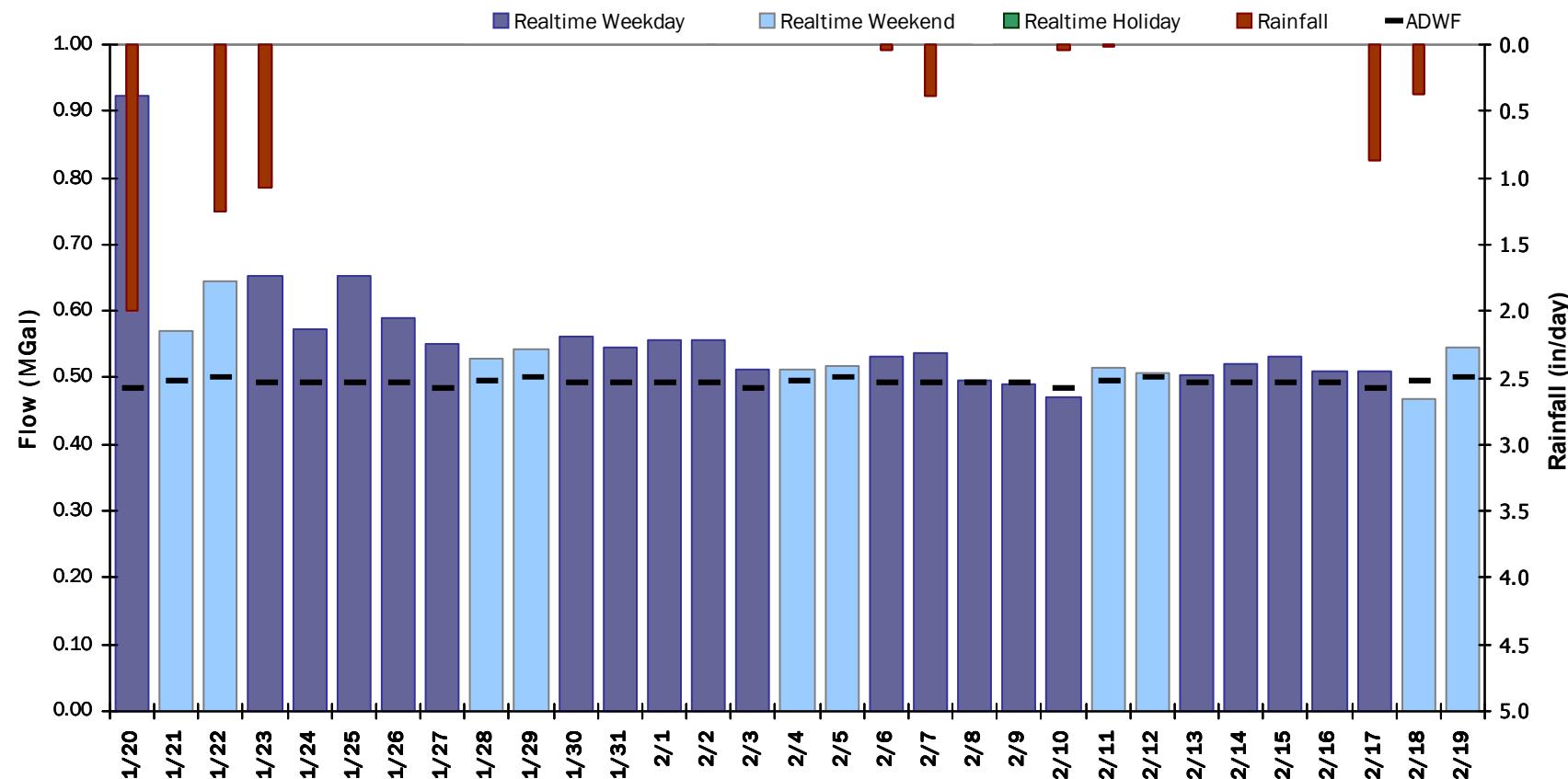
SITE 3**Additional Site Photos****Effluent Pipe****Influent Pipe**

SITE 3

Period Flow Summary: Daily Flow Totals

Avg Period Flow: 0.552 MGal Peak Daily Flow: 0.923 MGal Min Daily Flow: 0.468 MGal

Total Period Rainfall: 5.49 inches

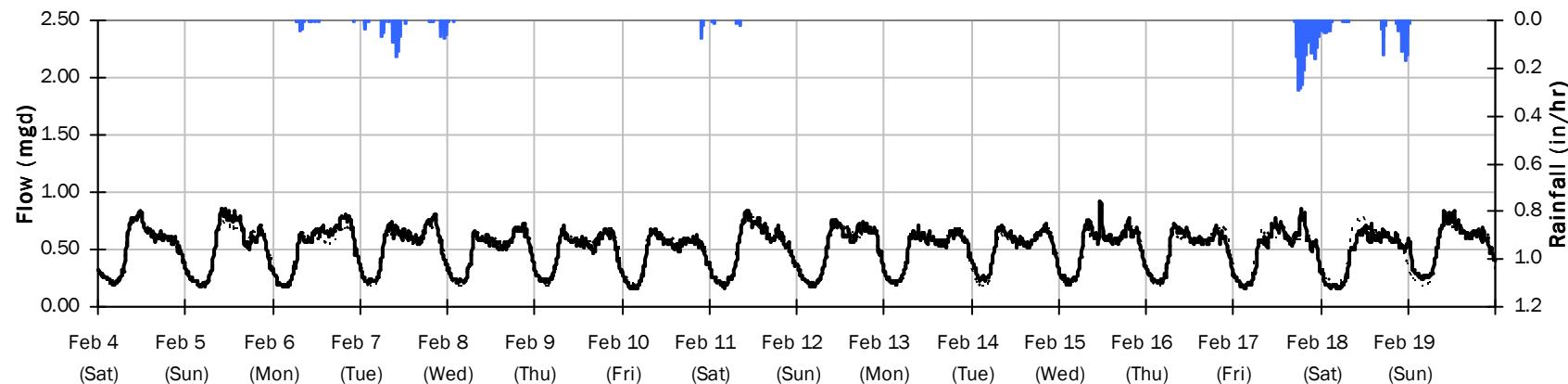
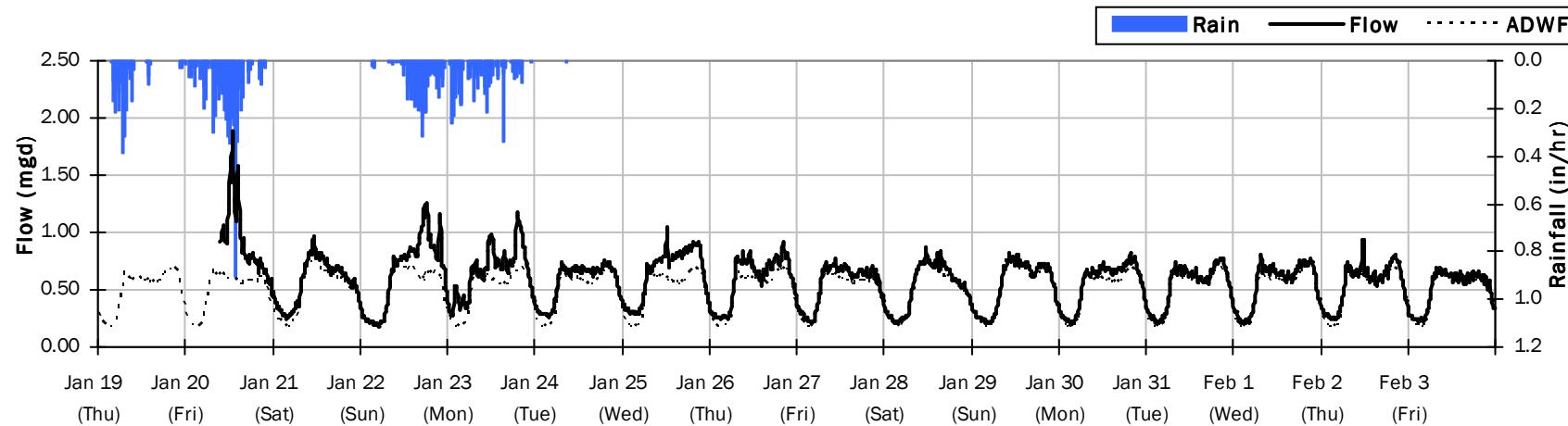


SITE 3

Flow Summary: 1/19/2017 to 2/19/2017

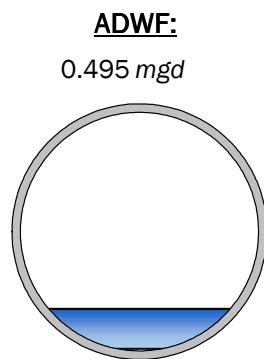
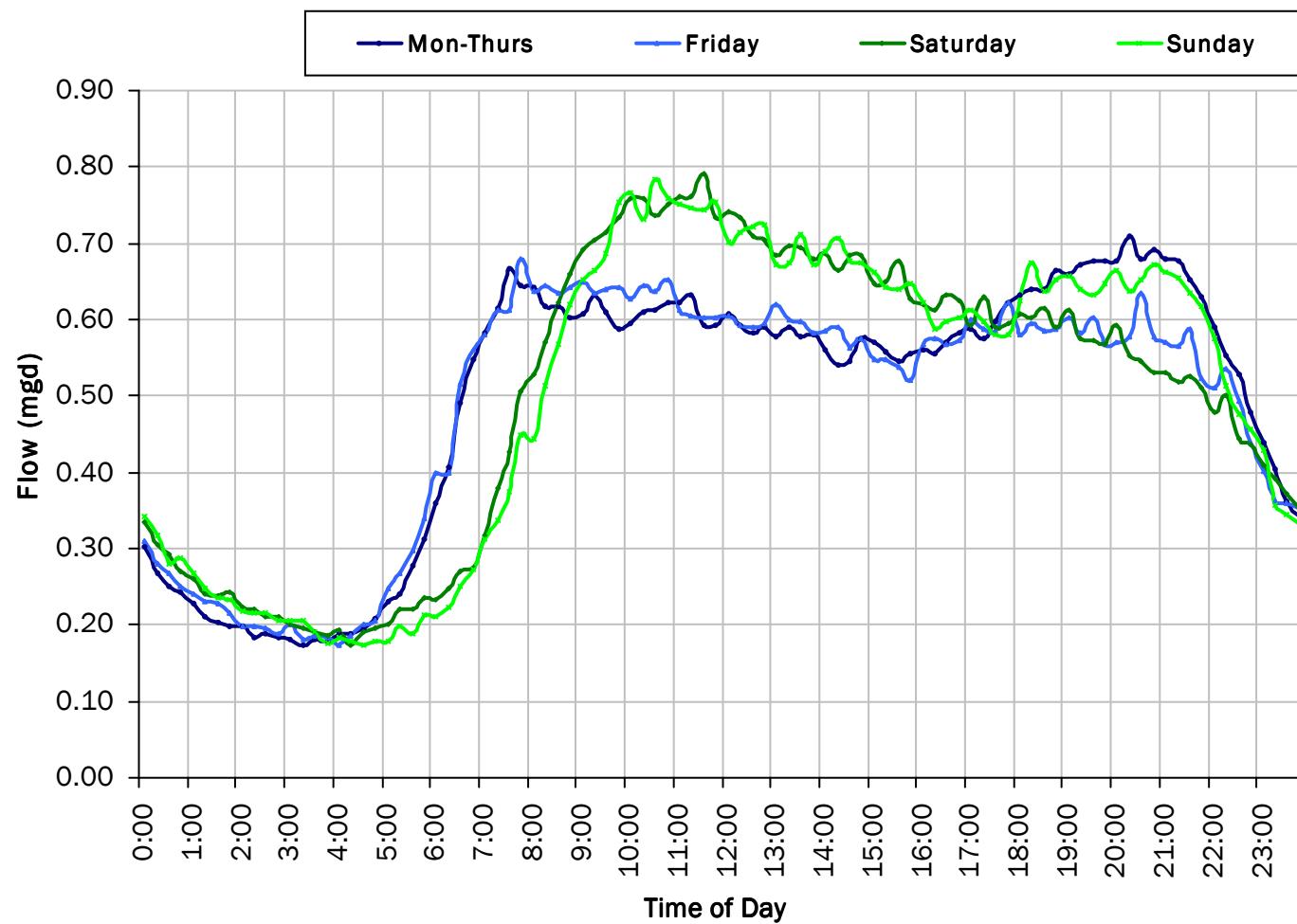
Total Period Rainfall: 6.84 inches

Avg Flow: 0.548 mgd Peak Flow: 1.885 mgd Min Flow: 0.156 mgd



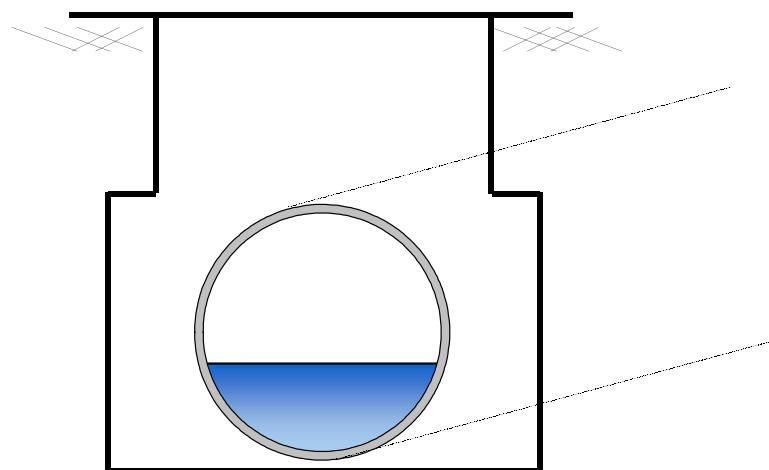
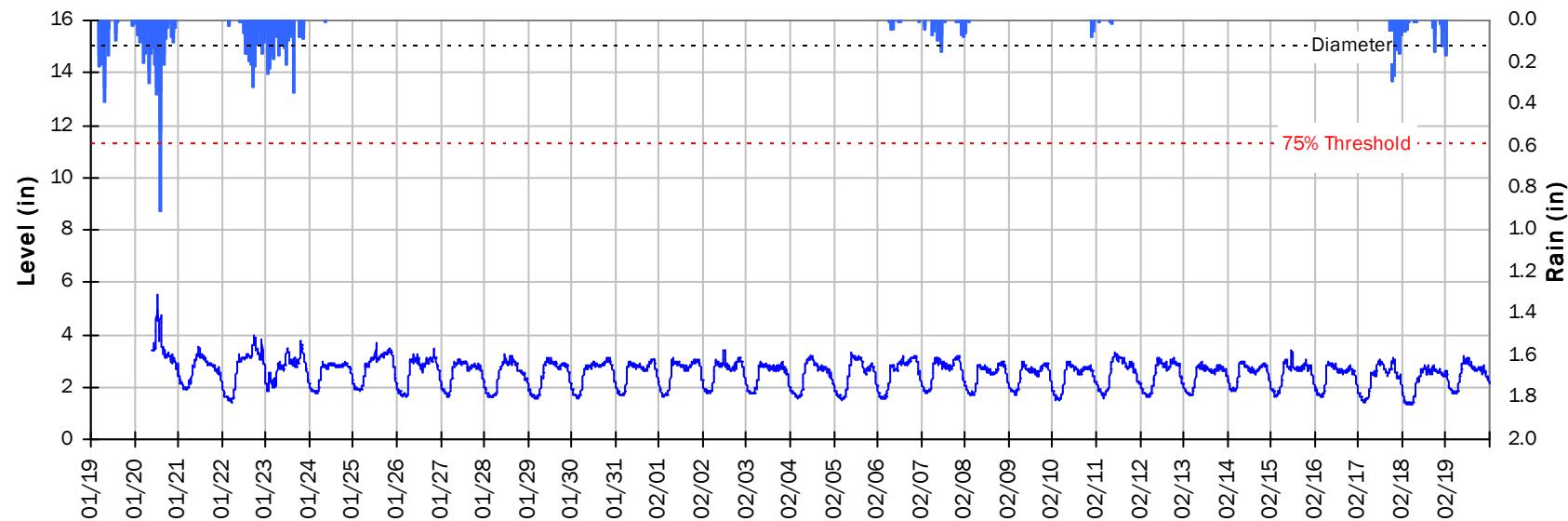
SITE 3

Average Dry Weather Flow Hydrographs



SITE 3

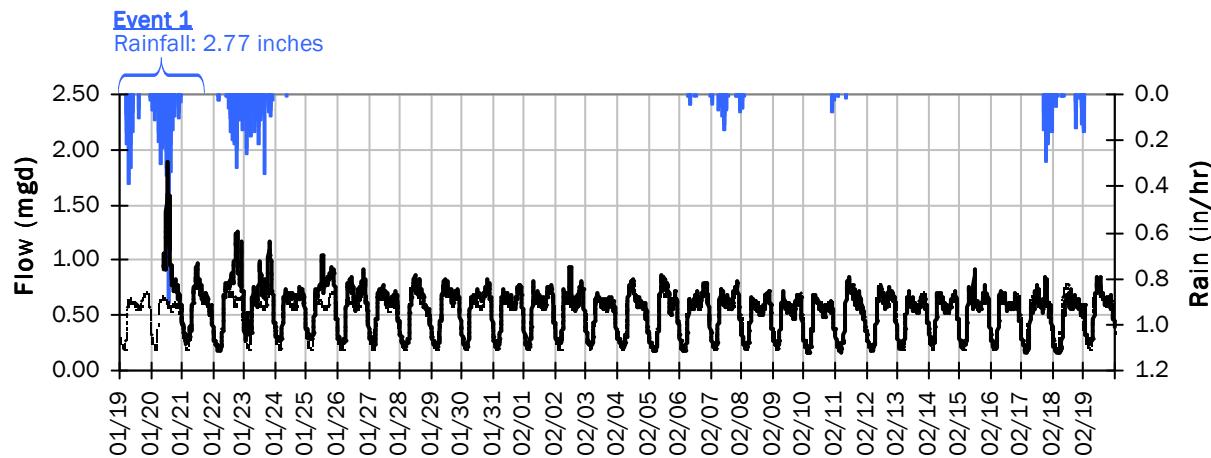
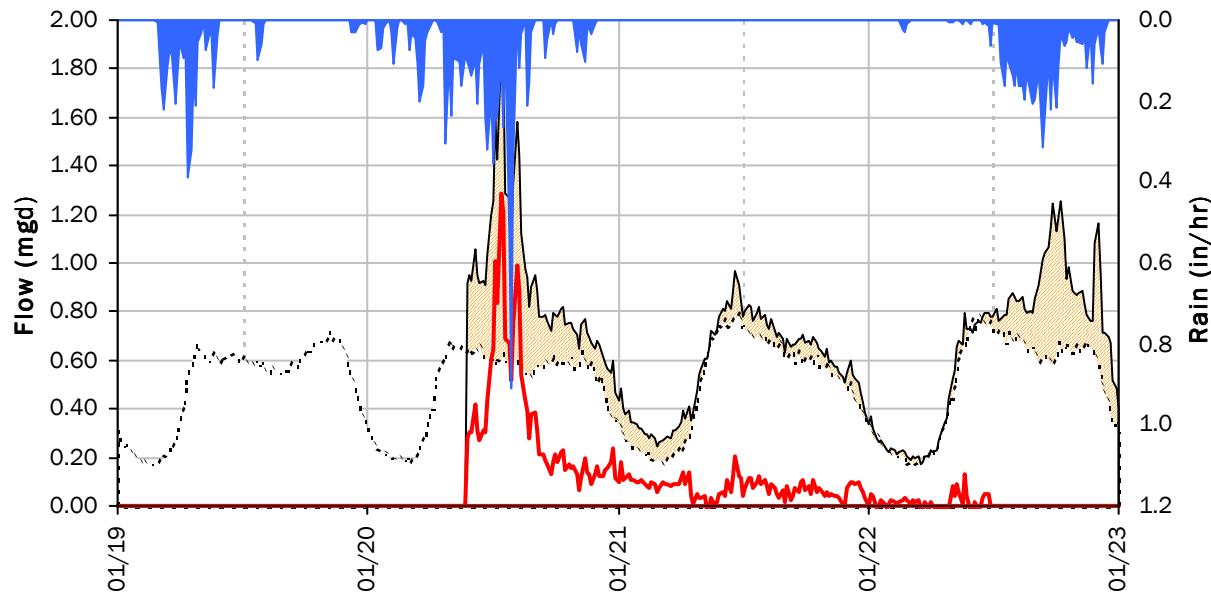
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Monitoring Period

Pipe Diameter: 15 *inches*
Peak Measured Level: 5.52 *inches*
Peak d/D Ratio: 0.37
Dry Weather Design Threshold Level: 11.2 *inches*

SITE 3

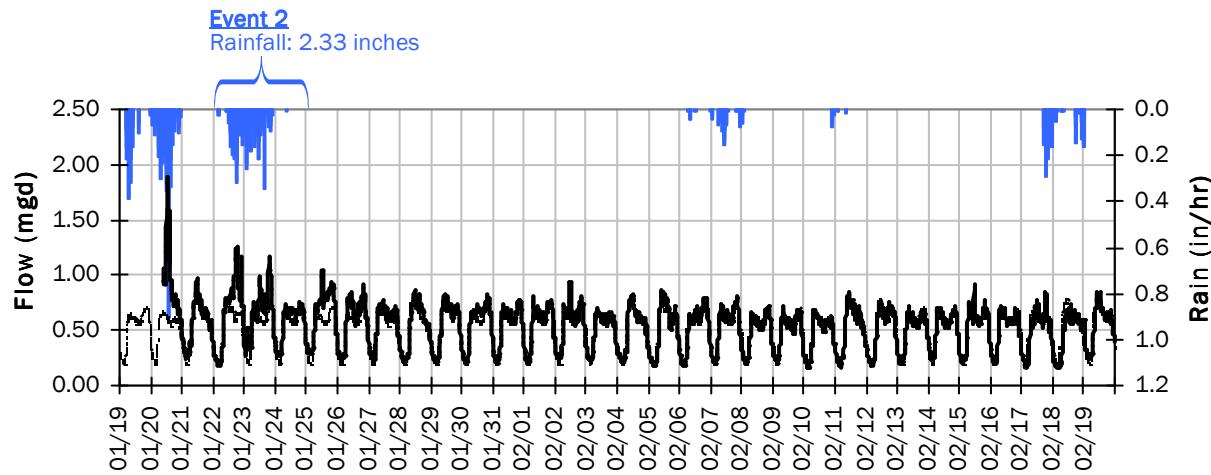
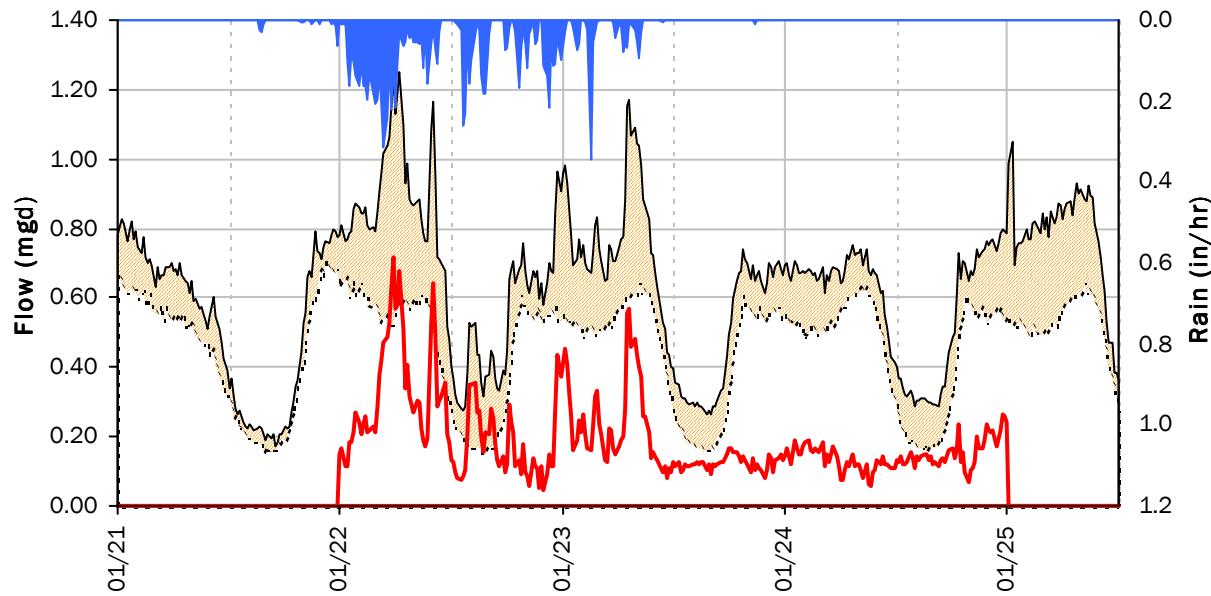
I/I Summary: Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Event 1 Detail Graph

Storm Event I/I Analysis (Rain = 2.77 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	1.89 mgd	Peak I/I Rate:	1.29 mgd
PF:	3.81	Total I/I:	297,000 gallons
Peak Level:	5.52 in		
d/D Ratio:	0.37		

SITE 3

I/I Summary: Event 2

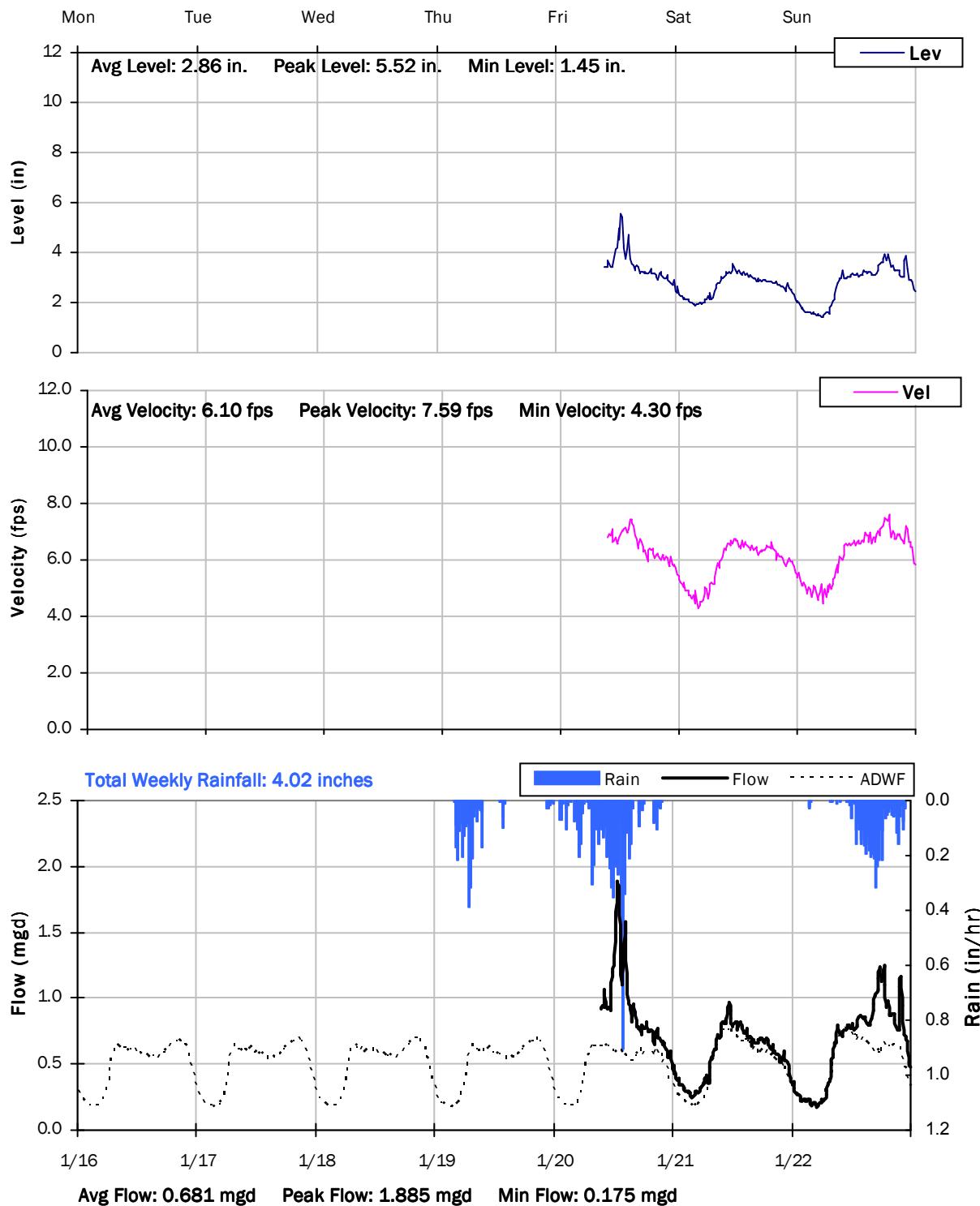
Baseline and Realtime Flows with Rainfall Data over Monitoring PeriodEvent 2 Detail GraphStorm Event I/I Analysis (Rain = 2.33 inches)

<u>Capacity</u>		<u>Inflow / Infiltration</u>	
Peak Flow:	1.25 mgd	Peak I/I Rate:	0.72 mgd
PF:	2.53	Total I/I:	581,000 gallons
Peak Level:	3.93 in		
d/D Ratio:	0.26		

SITE 3

Weekly Level, Velocity and Flow Hydrographs

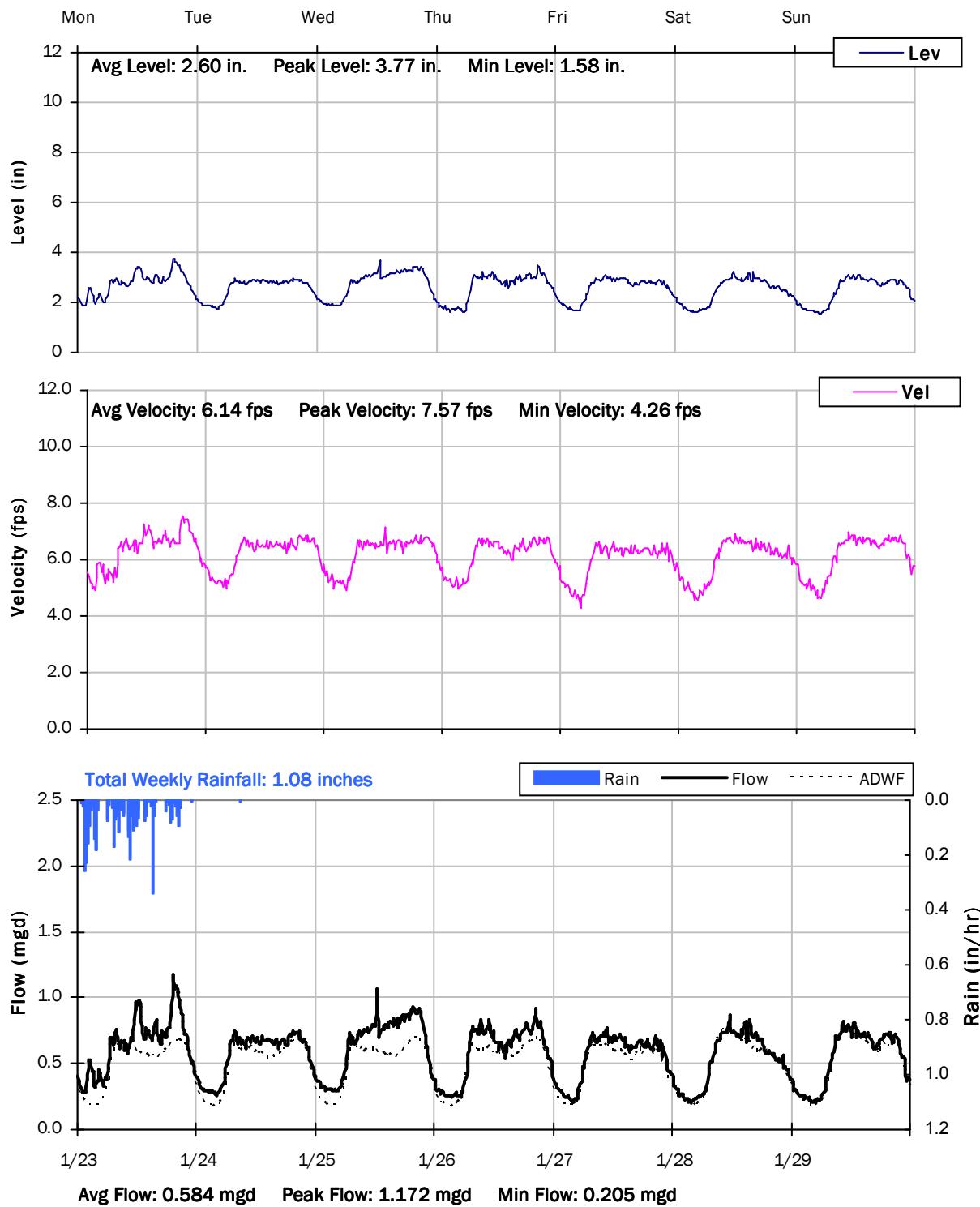
1/16/2017 to 1/23/2017



SITE 3

Weekly Level, Velocity and Flow Hydrographs

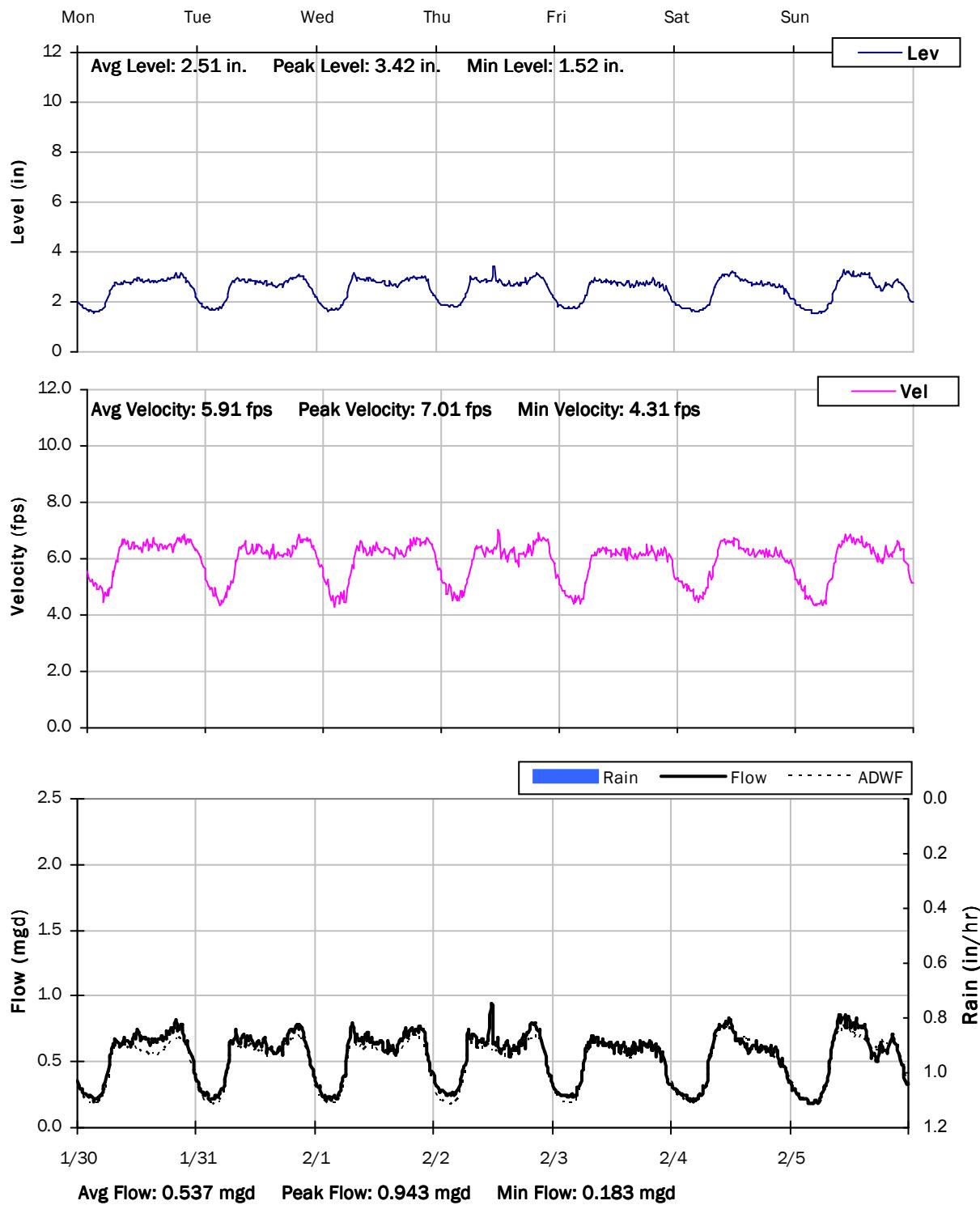
1/23/2017 to 1/30/2017



SITE 3

Weekly Level, Velocity and Flow Hydrographs

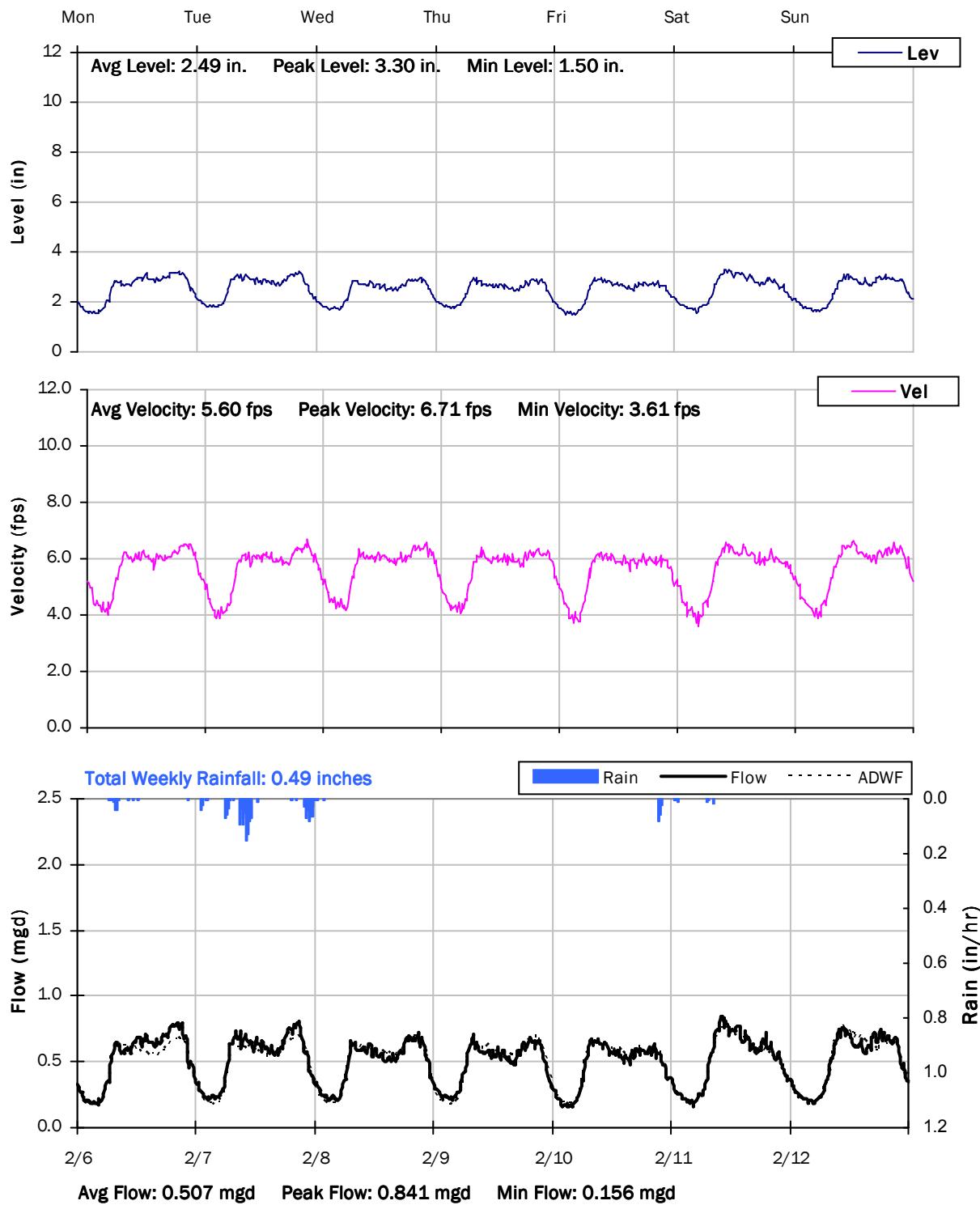
1/30/2017 to 2/6/2017



SITE 3

Weekly Level, Velocity and Flow Hydrographs

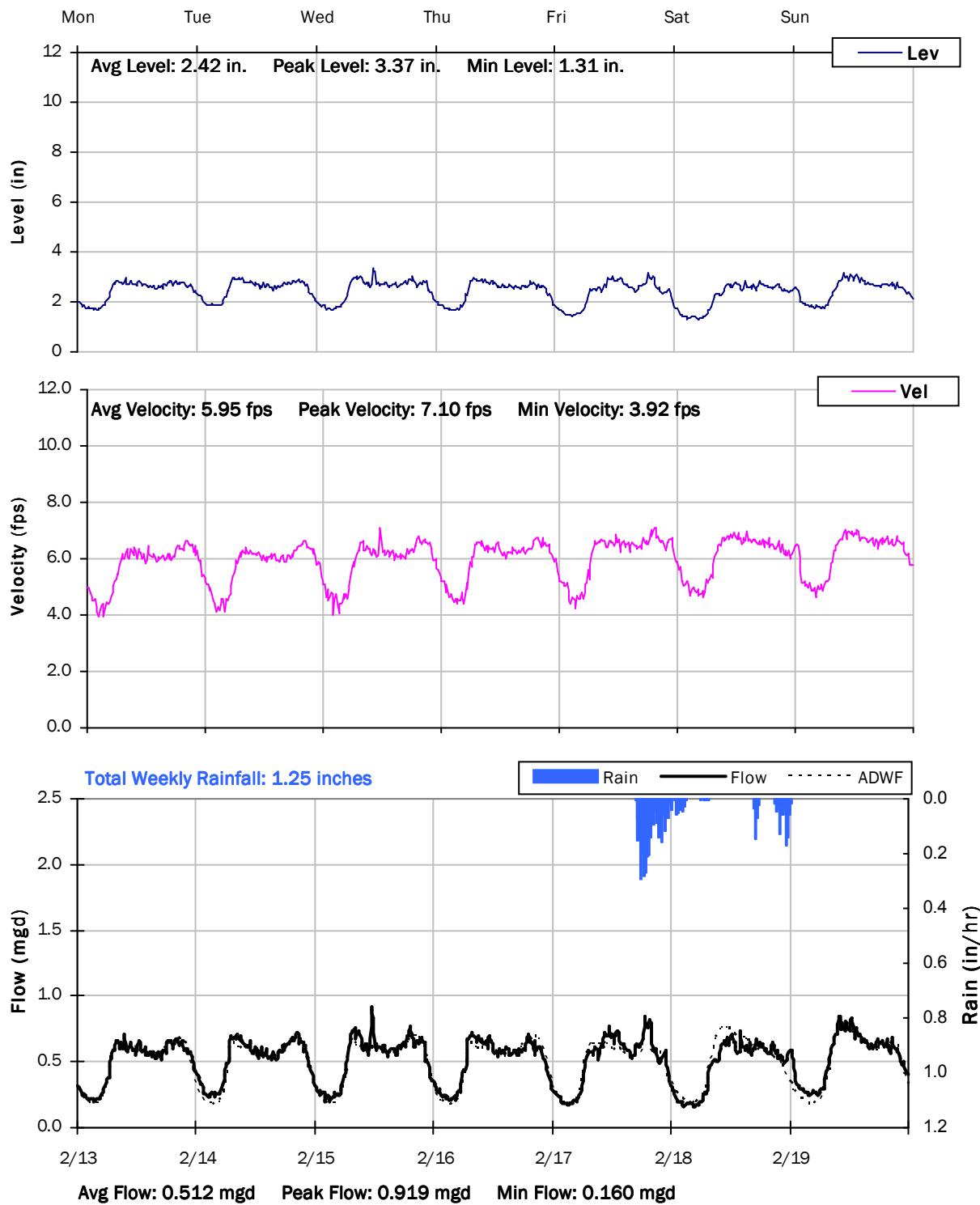
2/6/2017 to 2/13/2017



SITE 3

Weekly Level, Velocity and Flow Hydrographs

2/13/2017 to 2/20/2017



City of Banning

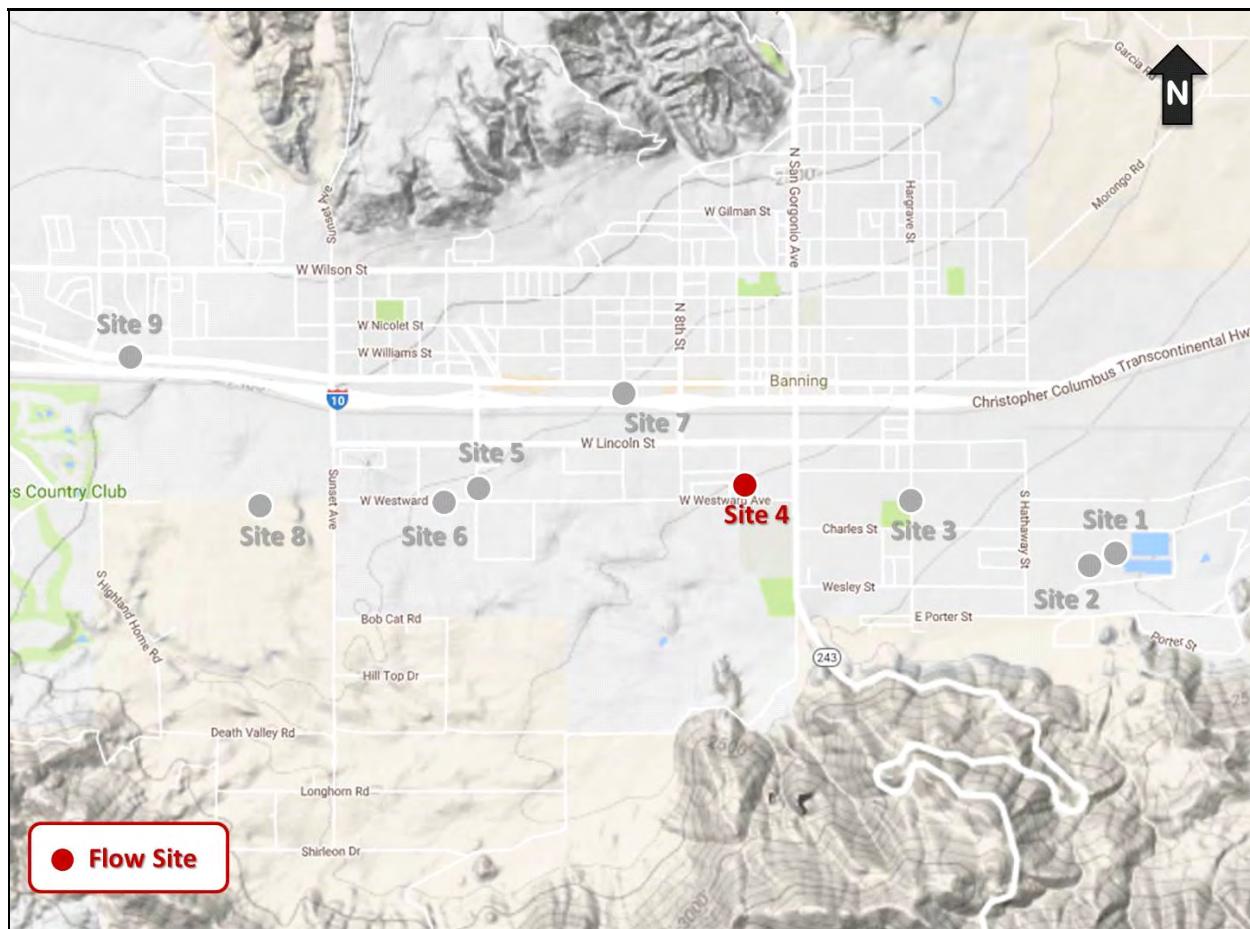
Sanitary Sewer Flow Monitoring

Temporary Monitoring: January 2017 - February 2017

Monitoring Site: Site 4

Location: S 4th Street south of W Barbour Street

Data Summary Report



Vicinity Map: Site 4

SITE 4

Site Information

Location: S 4th Street south of W Barbour Street

Coordinates: 116.8811° W, 33.9190° N

Expected Pipe Diameter: 15 inches

Measured Pipe Diameter: 15 inches

ADWF: 0.342 mgd

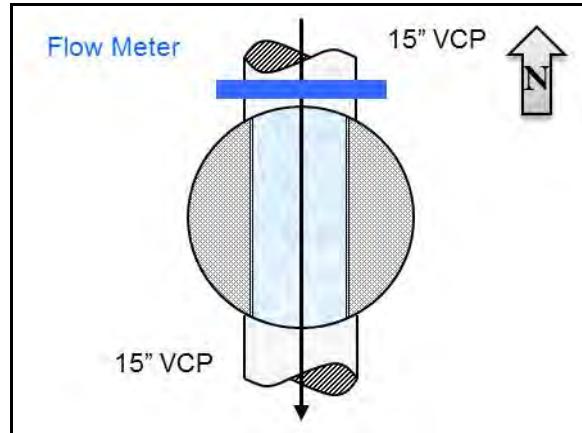
Peak Measured Flow: 1.142 mgd



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

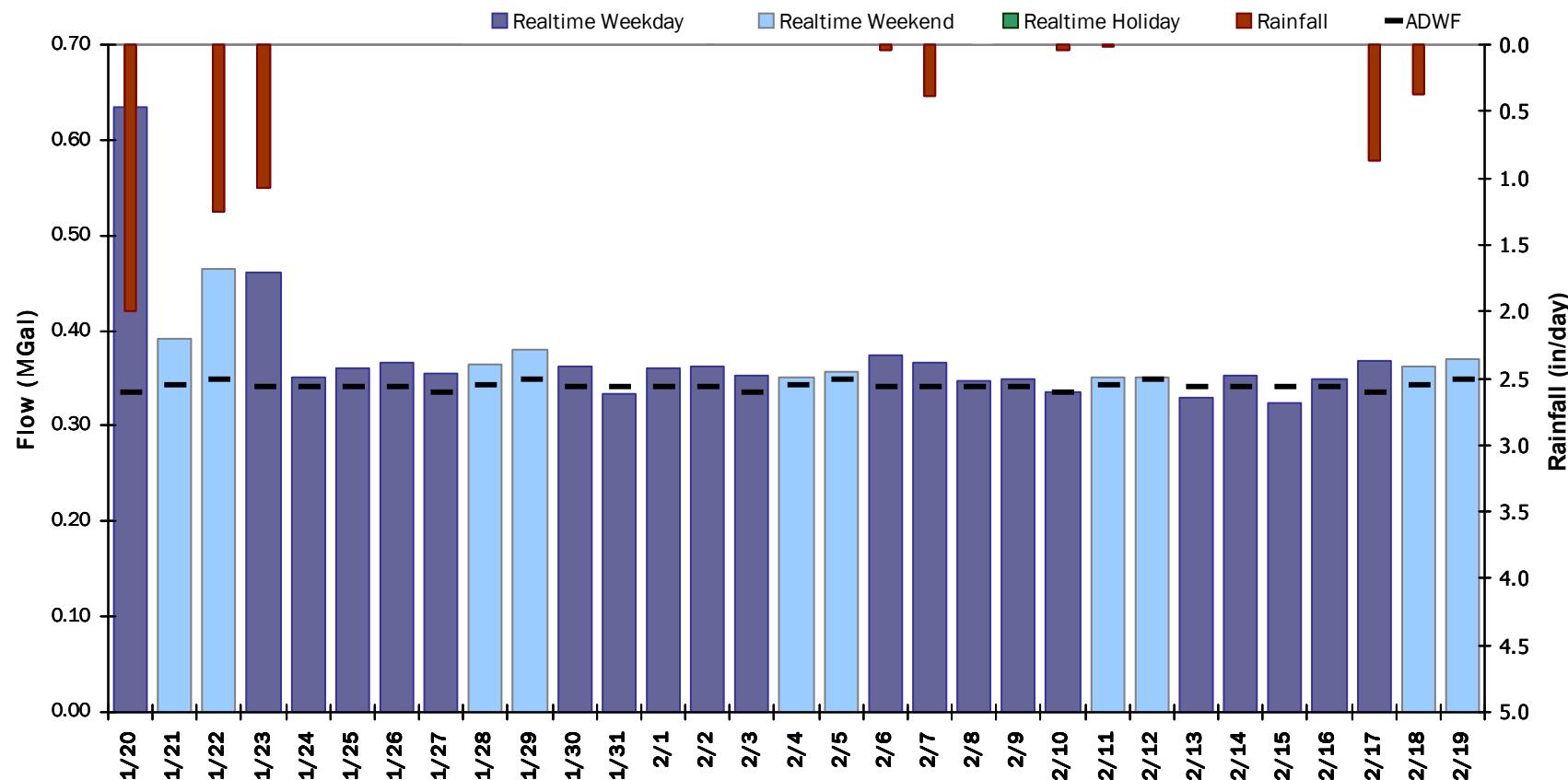
SITE 4**Additional Site Photos****Effluent Pipe****Influent Pipe**

SITE 4

Period Flow Summary: Daily Flow Totals

Avg Period Flow: 0.372 MGal Peak Daily Flow: 0.635 MGal Min Daily Flow: 0.325 MGal

Total Period Rainfall: 5.43 inches



SITE 4

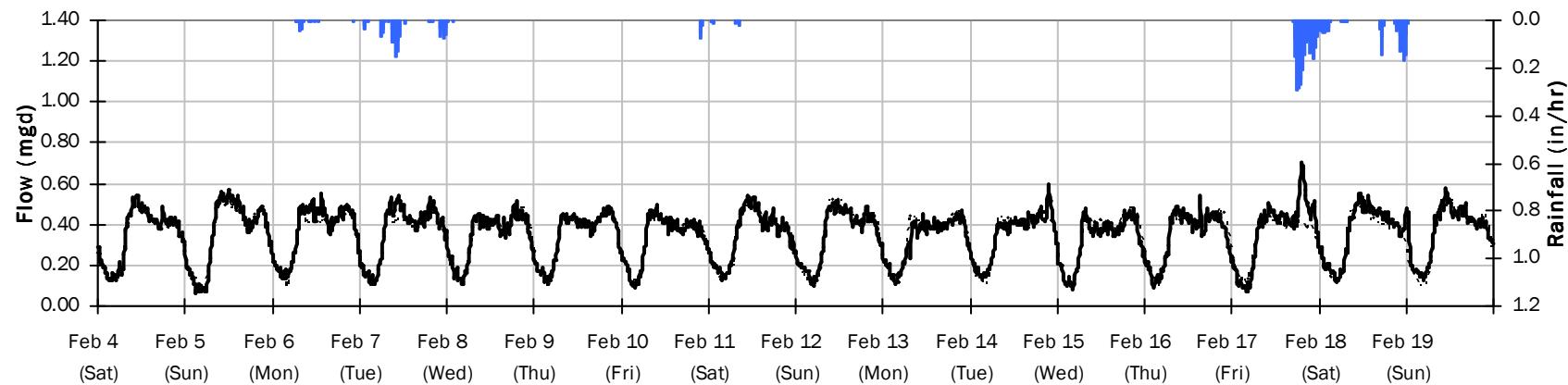
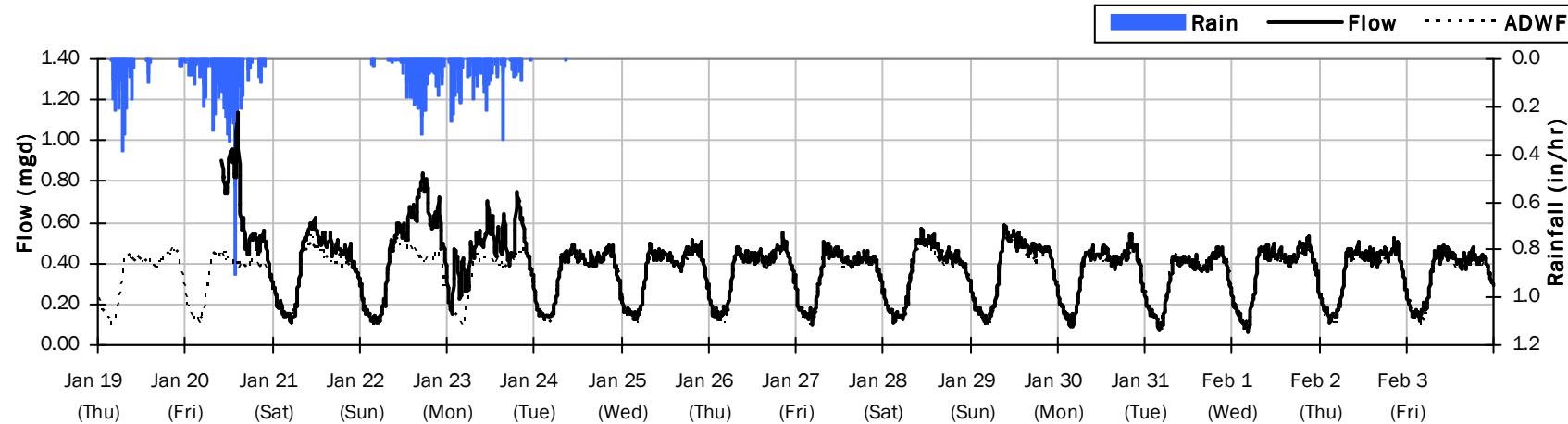
Flow Summary: 1/19/2017 to 2/19/2017

Total Period Rainfall: 6.84 inches

Avg Flow: 0.369 mgd

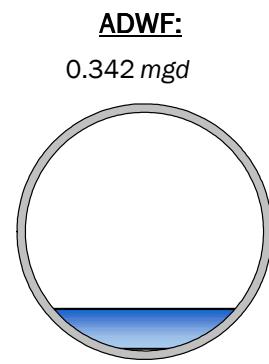
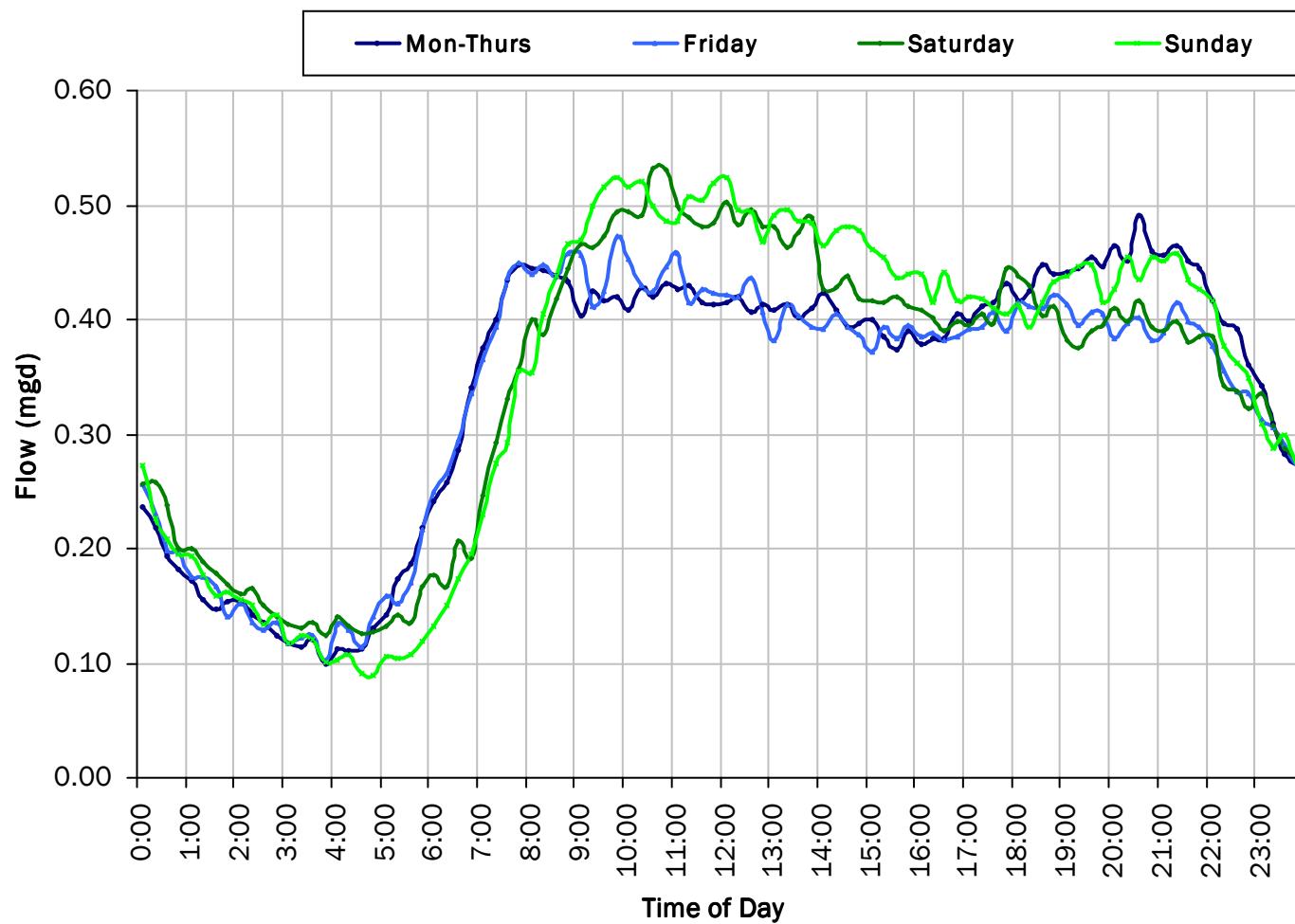
Peak Flow: 1.142 mgd

Min Flow: 0.065 mgd



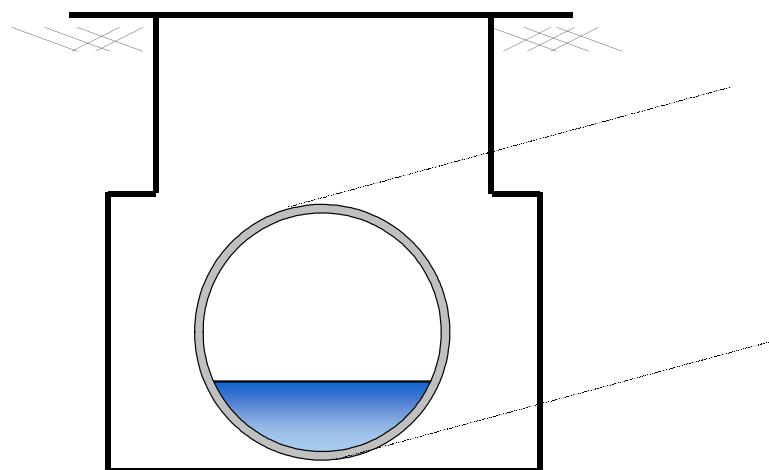
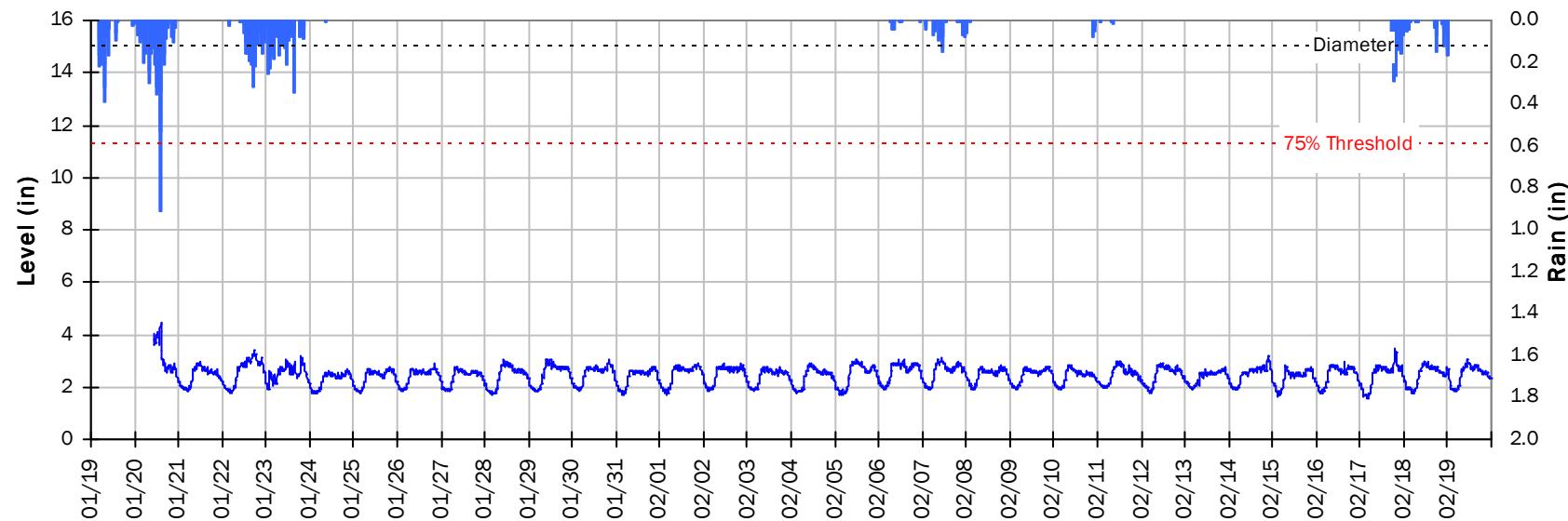
SITE 4

Average Dry Weather Flow Hydrographs



SITE 4

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Monitoring Period

Pipe Diameter: 15 inches

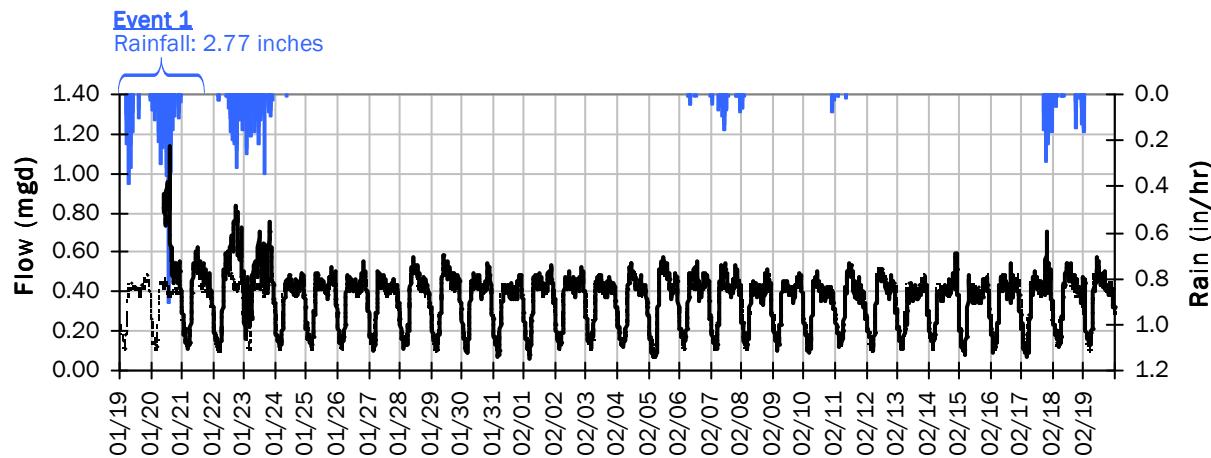
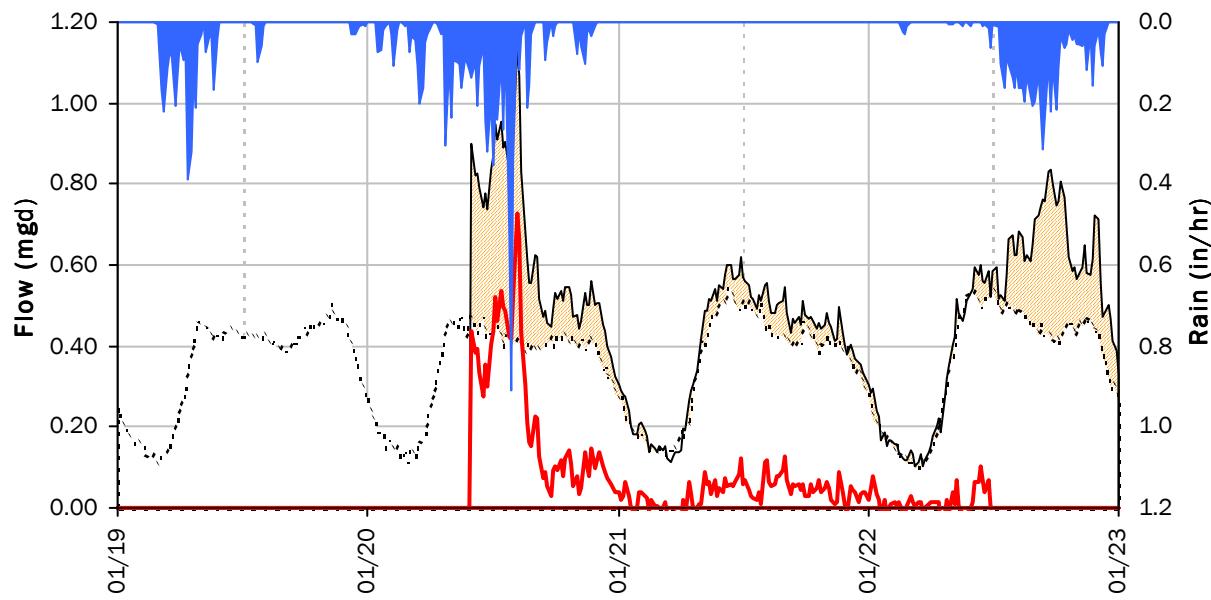
Peak Measured Level: 4.43 inches

Peak d/D Ratio: 0.30

Dry Weather Design Threshold Level: 11.2 inches

SITE 4

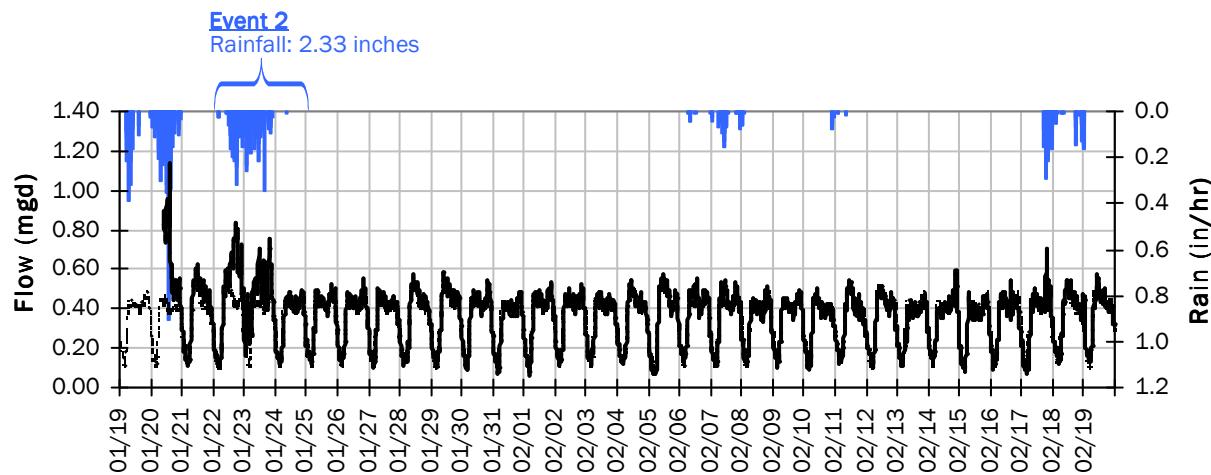
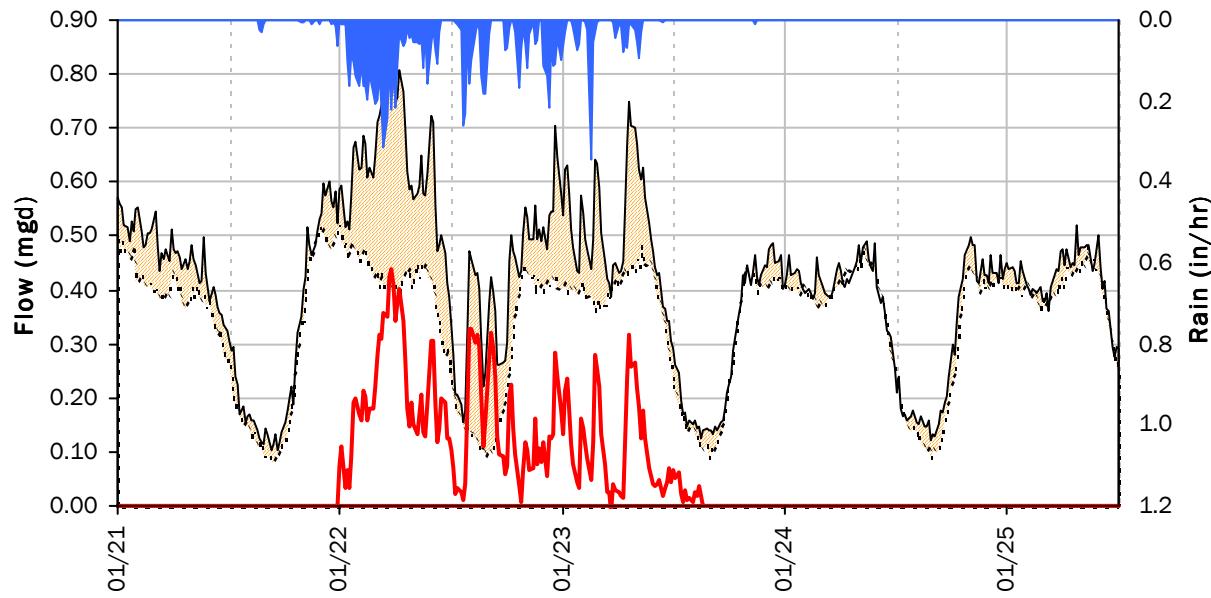
I/I Summary: Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Event 1 Detail Graph

Storm Event I/I Analysis (Rain = 2.77 inches)

<u>Capacity</u>		<u>Inflow / Infiltration</u>	
Peak Flow:	1.14 mgd	Peak I/I Rate:	0.73 mgd
PF:	3.33	Total I/I:	181,000 gallons
Peak Level:	4.43 in		
d/D Ratio:	0.30		

SITE 4

I/I Summary: Event 2

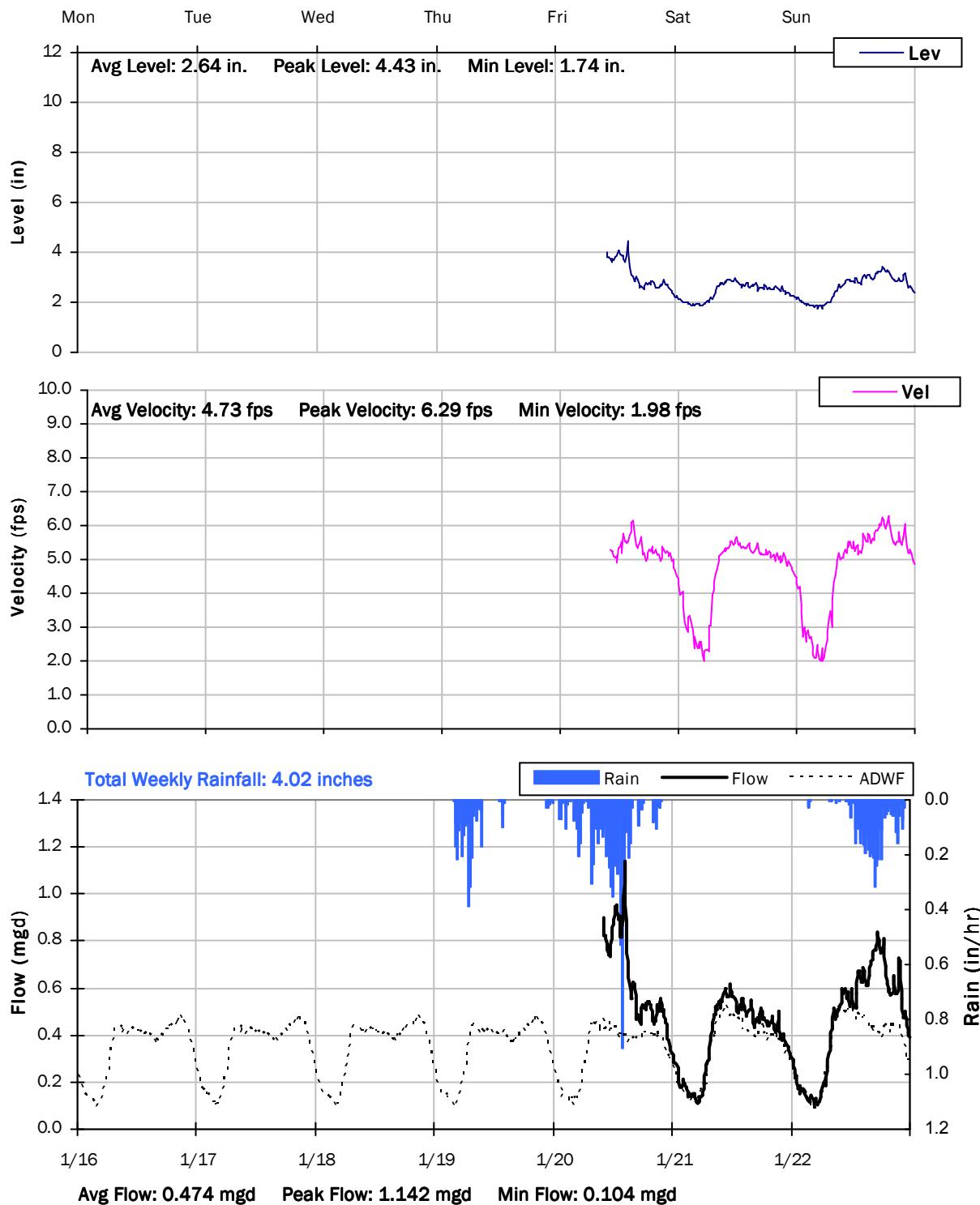
Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Event 2 Detail Graph

Storm Event I/I Analysis (Rain = 2.33 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.84 mgd	Peak I/I Rate:	0.44 mgd
PF:	2.45	Total I/I:	239,000 gallons
Peak Level:	3.43 in		
d/D Ratio:	0.23		

SITE 4

Weekly Level, Velocity and Flow Hydrographs

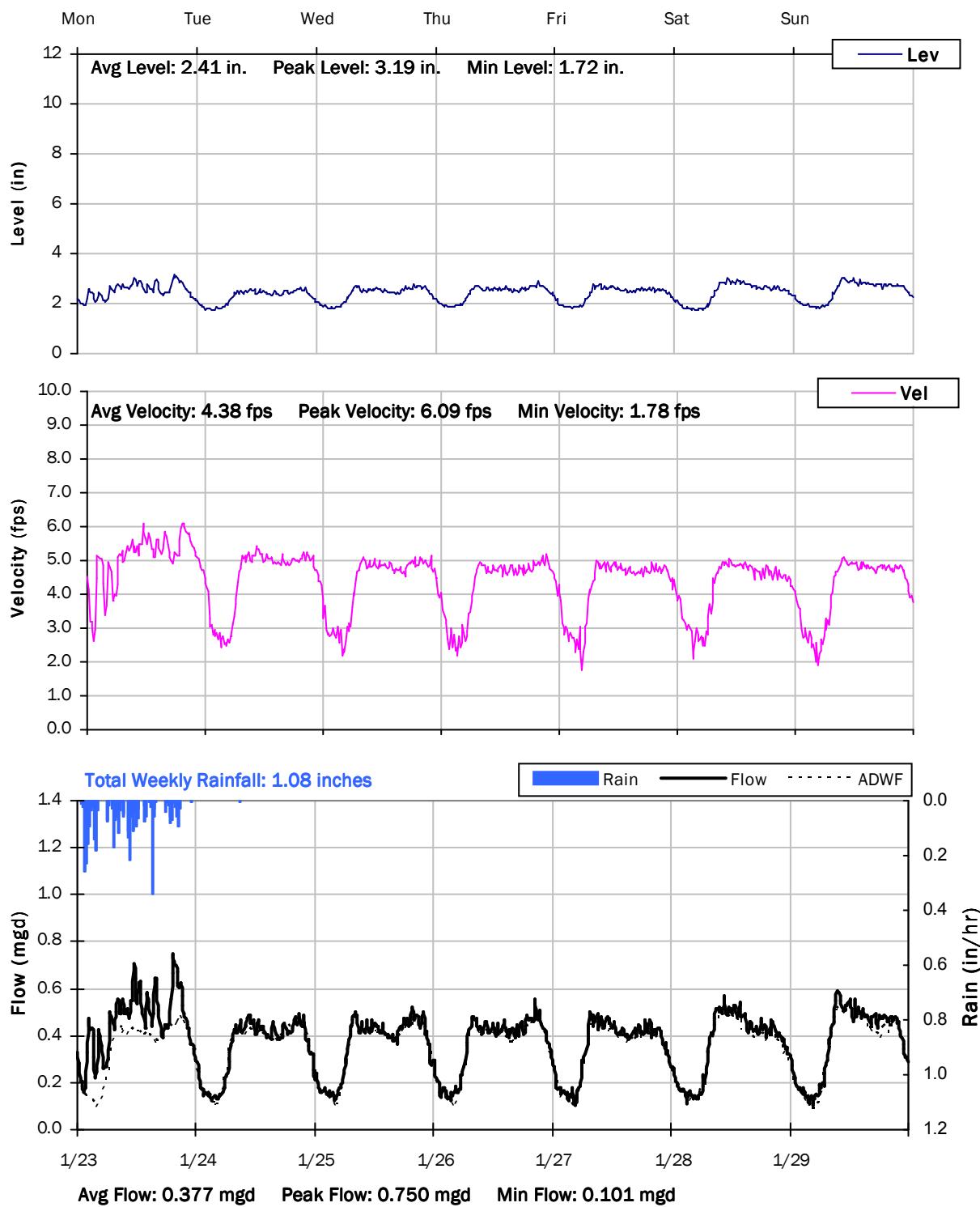
1/16/2017 to 1/23/2017



SITE 4

Weekly Level, Velocity and Flow Hydrographs

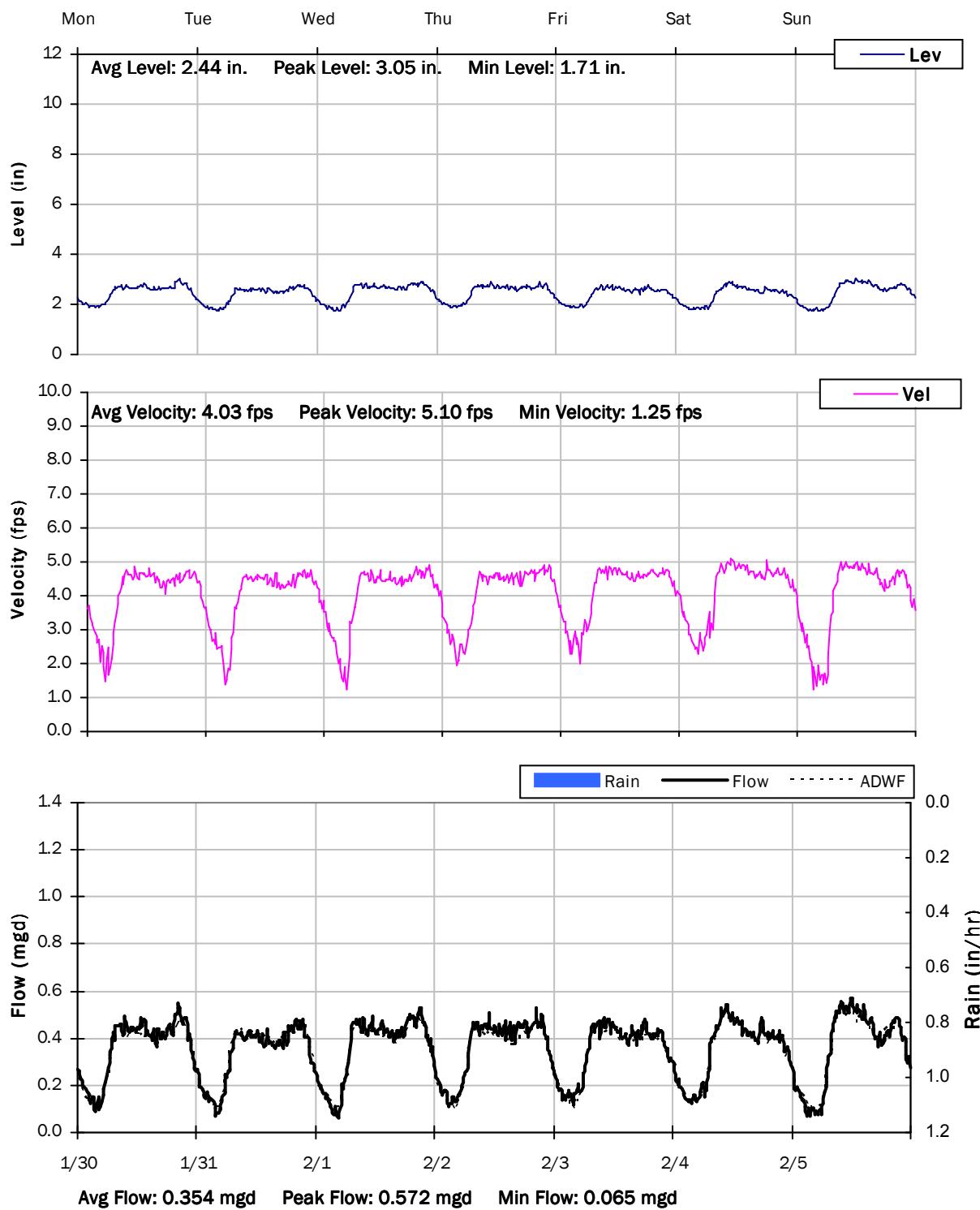
1/23/2017 to 1/30/2017



SITE 4

Weekly Level, Velocity and Flow Hydrographs

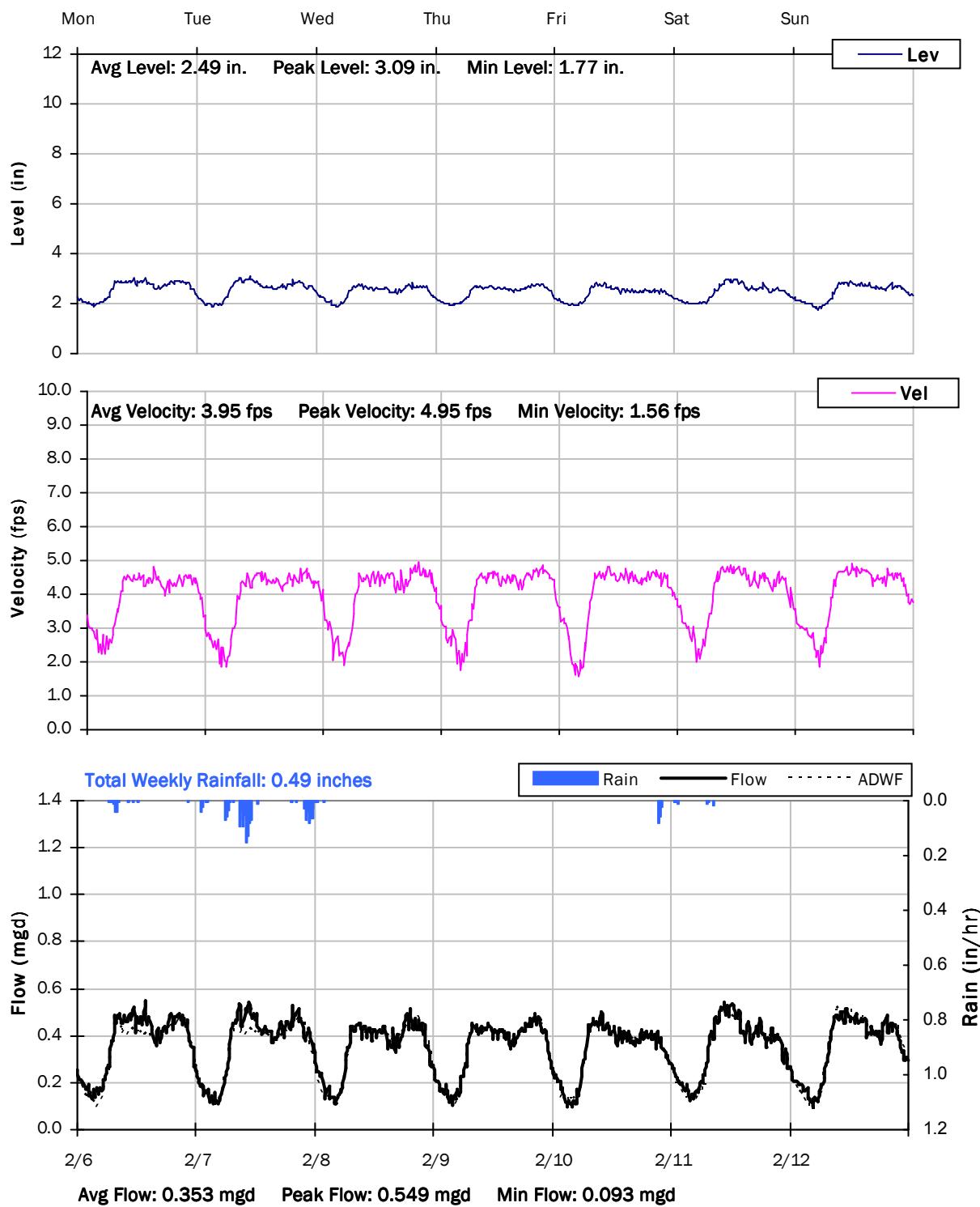
1/30/2017 to 2/6/2017



SITE 4

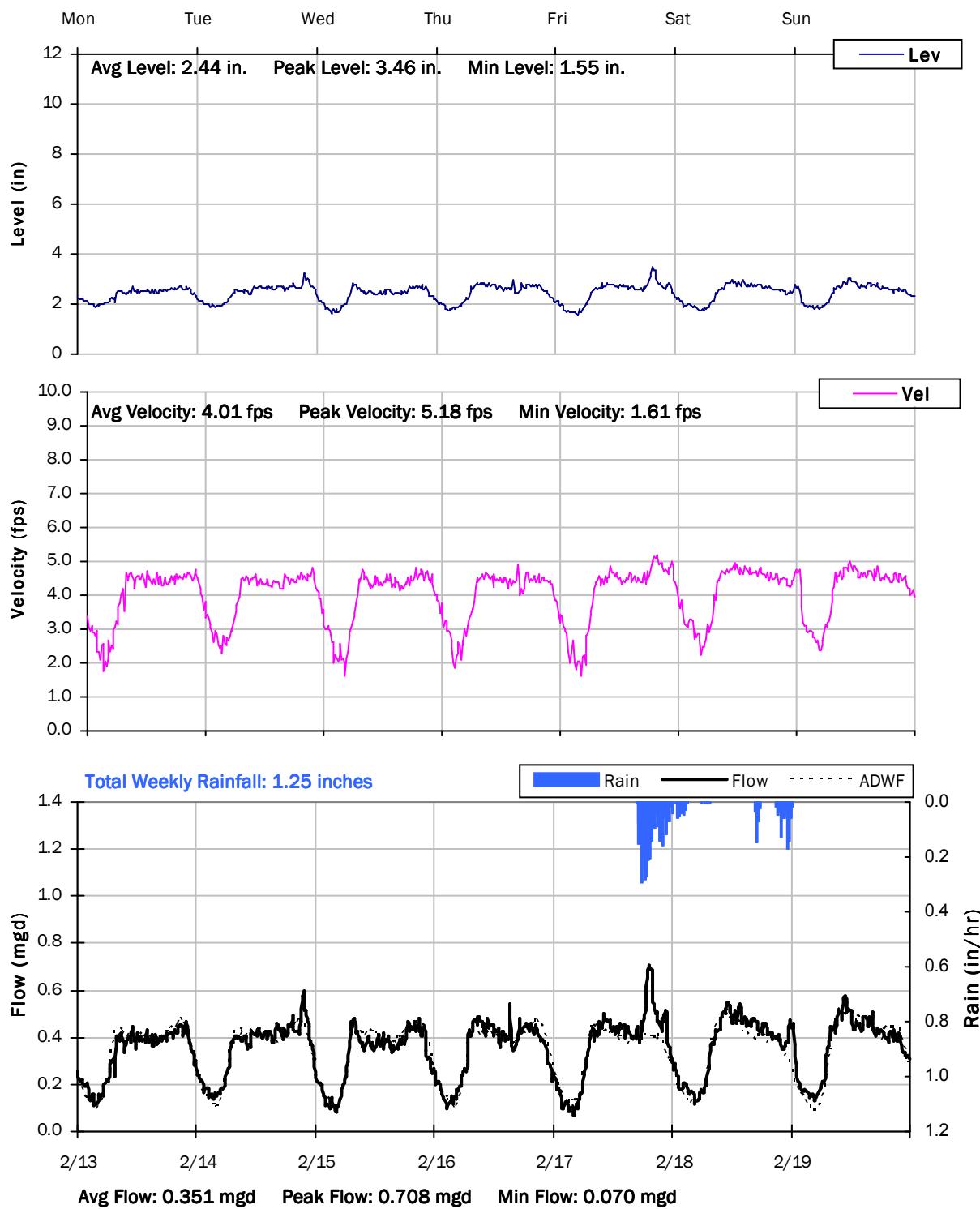
Weekly Level, Velocity and Flow Hydrographs

2/6/2017 to 2/13/2017



SITE 4
Weekly Level, Velocity and Flow Hydrographs

2/13/2017 to 2/20/2017



City of Banning

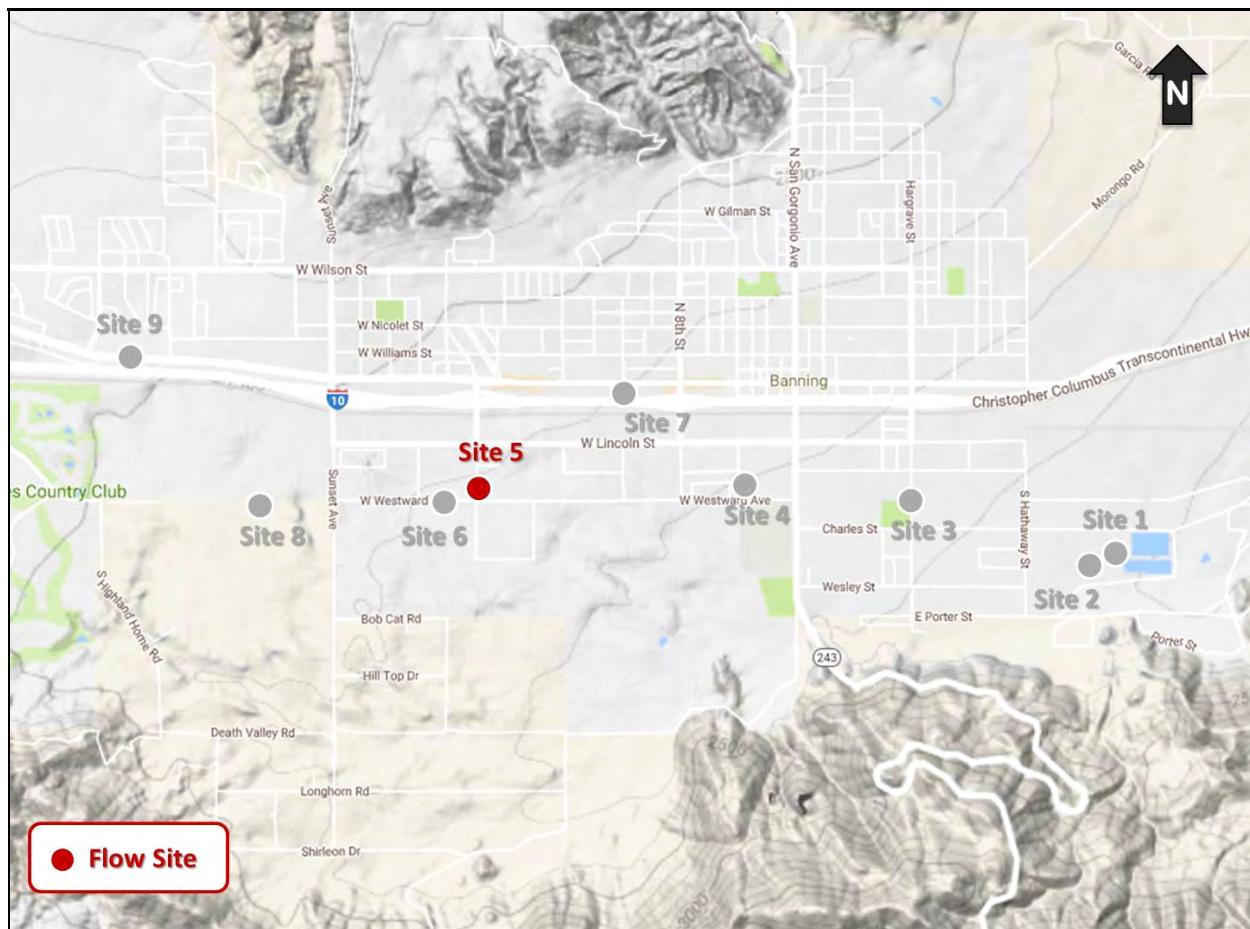
Sanitary Sewer Flow Monitoring

Temporary Monitoring: January 2017 - February 2017

Monitoring Site: Site 5

Location: 663 22nd Street

Data Summary Report



Vicinity Map: Site 5

SITE 5

Site Information

Location: 663 22nd Street

Coordinates: 116.9008° W, 33.9192° N

Expected Pipe Diameter: 12 inches

Measured Pipe Diameter: 12 inches

ADWF: 0.063 mgd

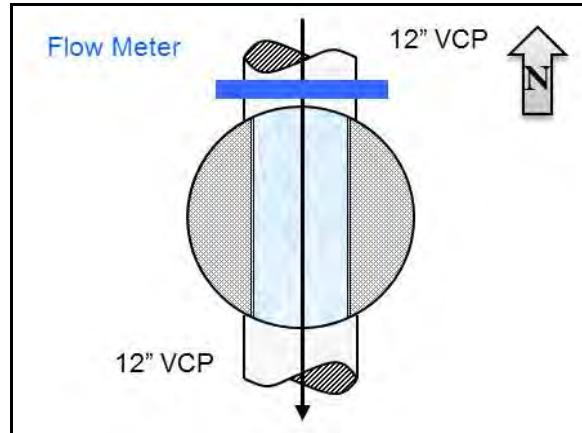
Peak Measured Flow: 0.290 mgd



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

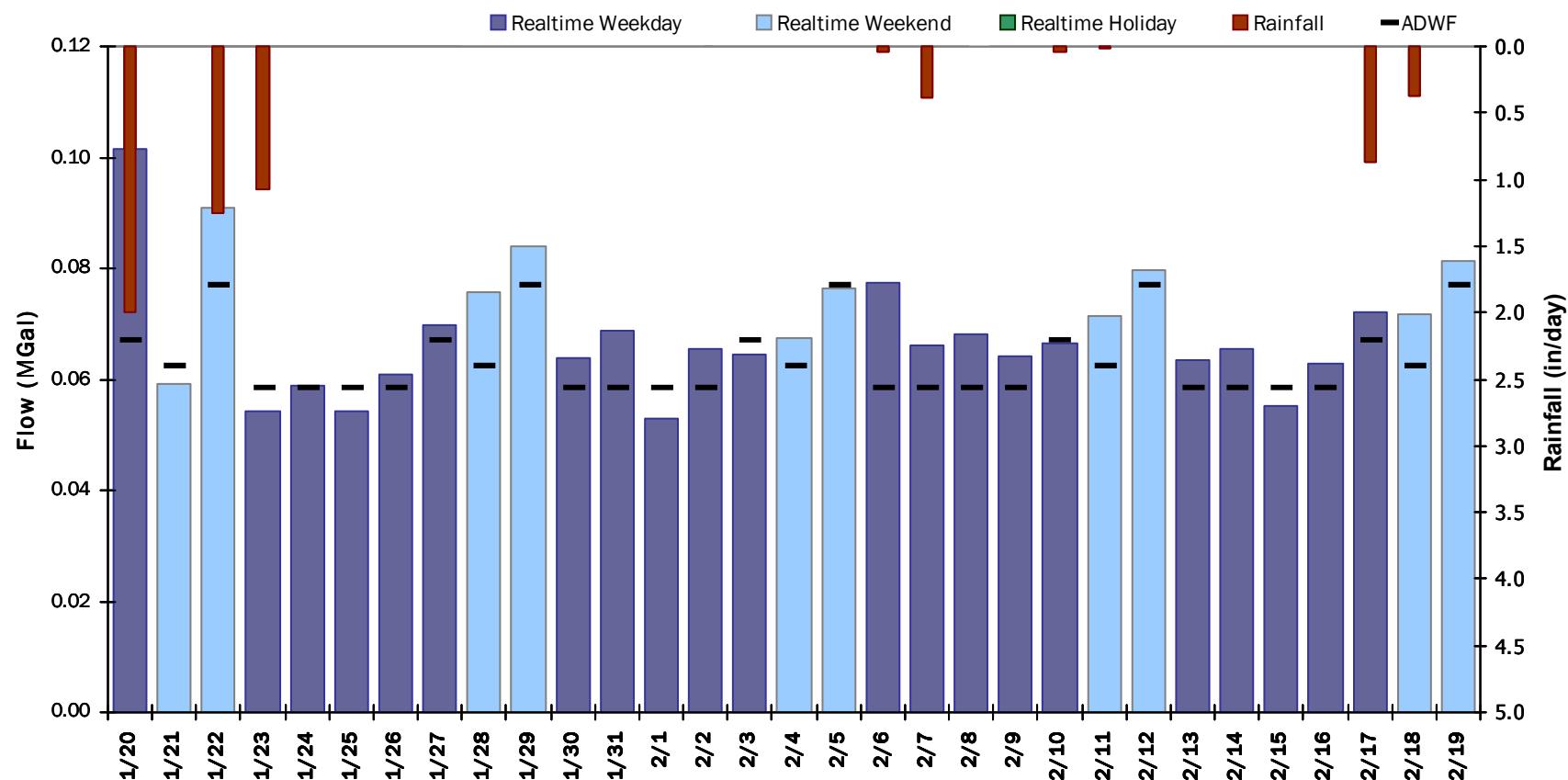
SITE 5**Additional Site Photos****Effluent Pipe****Influent Pipe**

SITE 5

Period Flow Summary: Daily Flow Totals

Avg Period Flow: 0.069 MGal Peak Daily Flow: 0.101 MGal Min Daily Flow: 0.053 MGal

Total Period Rainfall: 5.38 inches

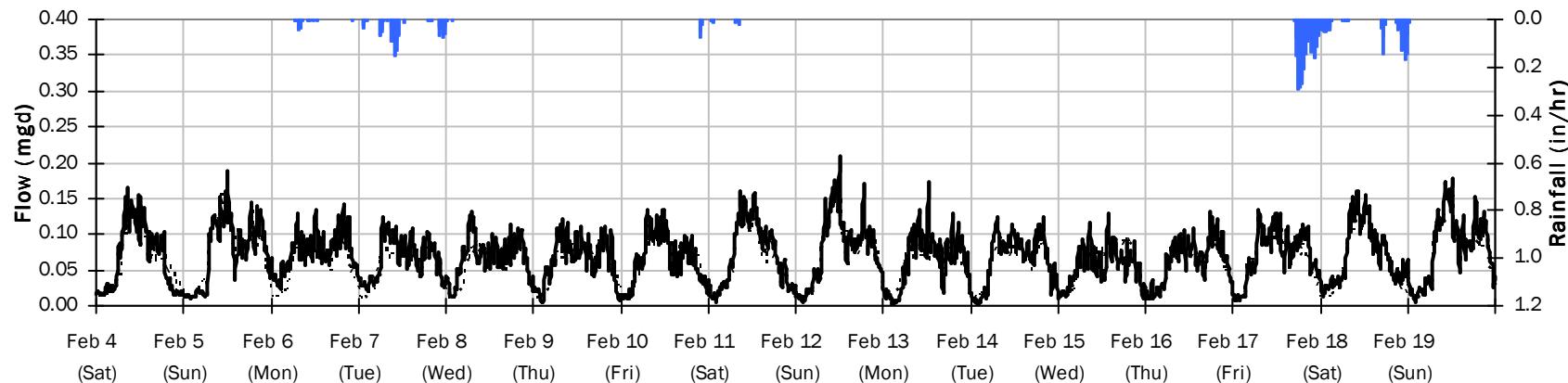
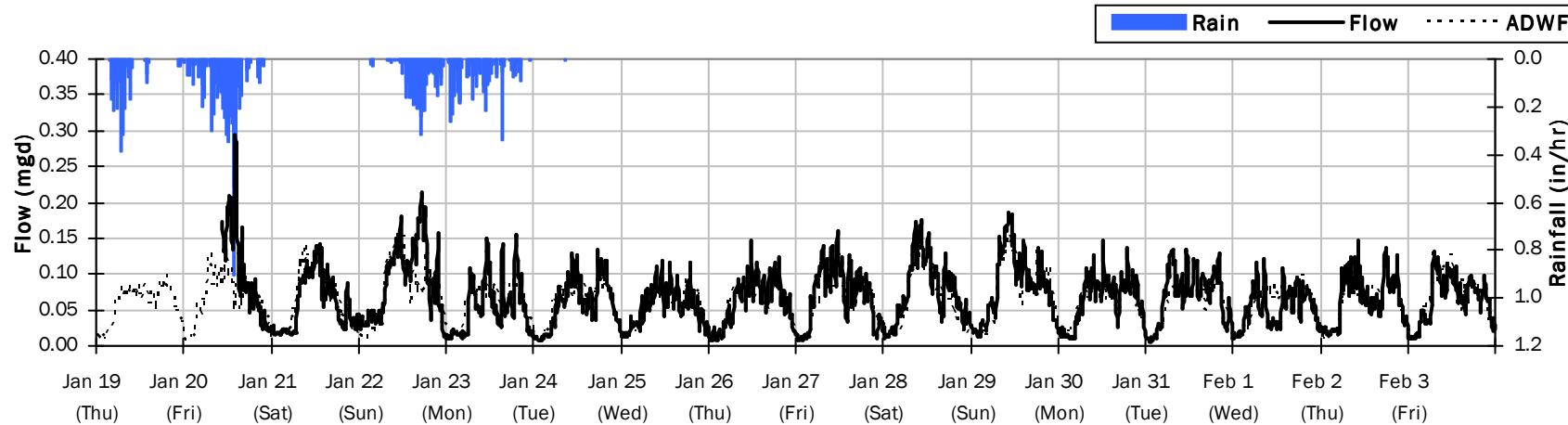


SITE 5

Flow Summary: 1/19/2017 to 2/19/2017

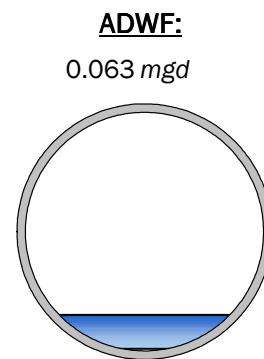
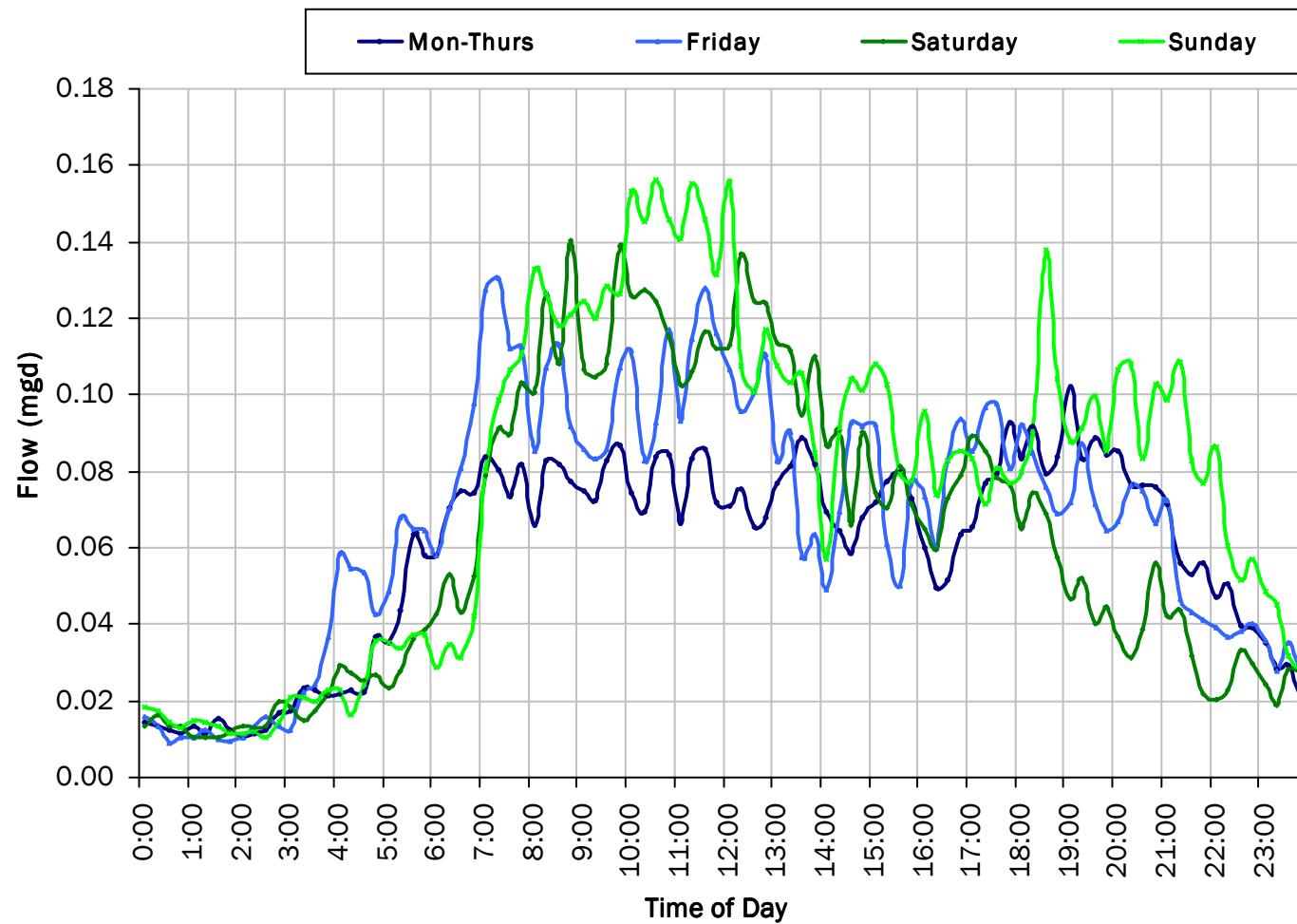
Total Period Rainfall: 6.84 inches

Avg Flow: 0.068 mgd Peak Flow: 0.290 mgd Min Flow: 0.002 mgd



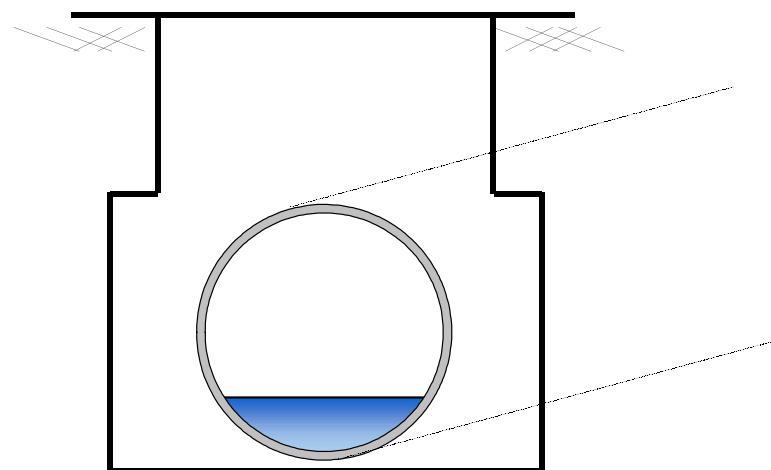
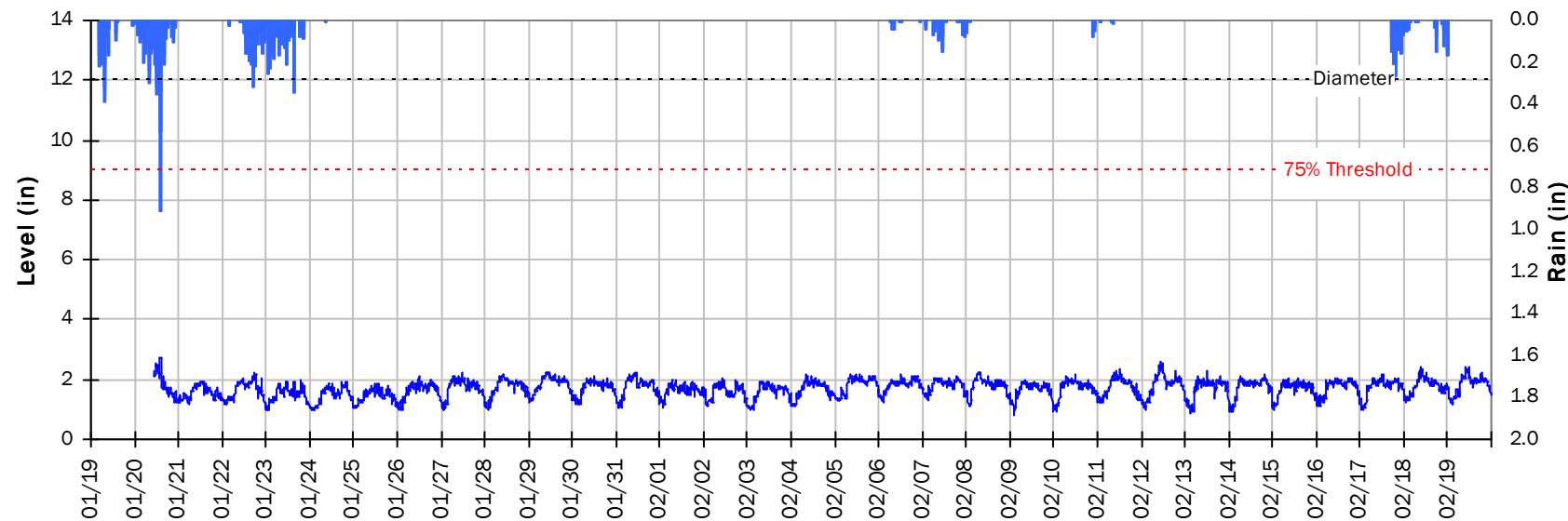
SITE 5

Average Dry Weather Flow Hydrographs



SITE 5

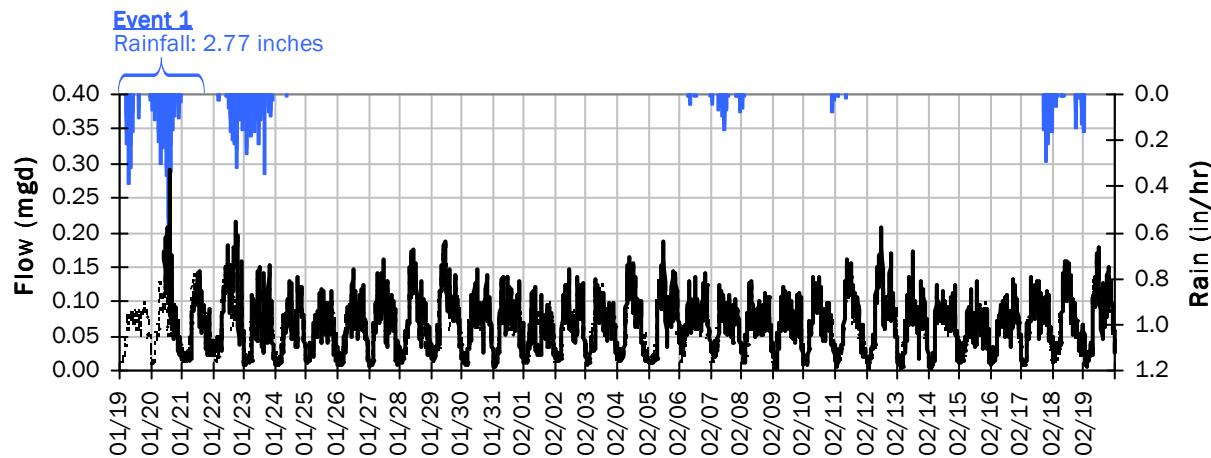
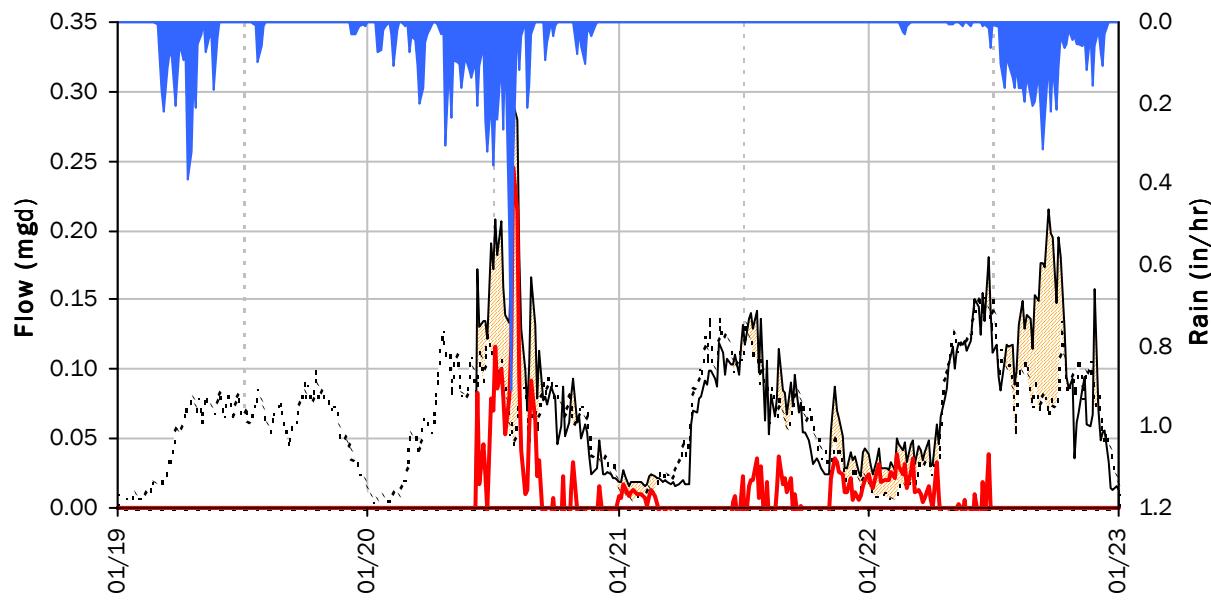
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Monitoring Period

Pipe Diameter: 12 *inches*
Peak Measured Level: 2.73 *inches*
Peak d/D Ratio: 0.23
Dry Weather Design Threshold Level: 6.00 *inches*

SITE 5

I/I Summary: Event 1

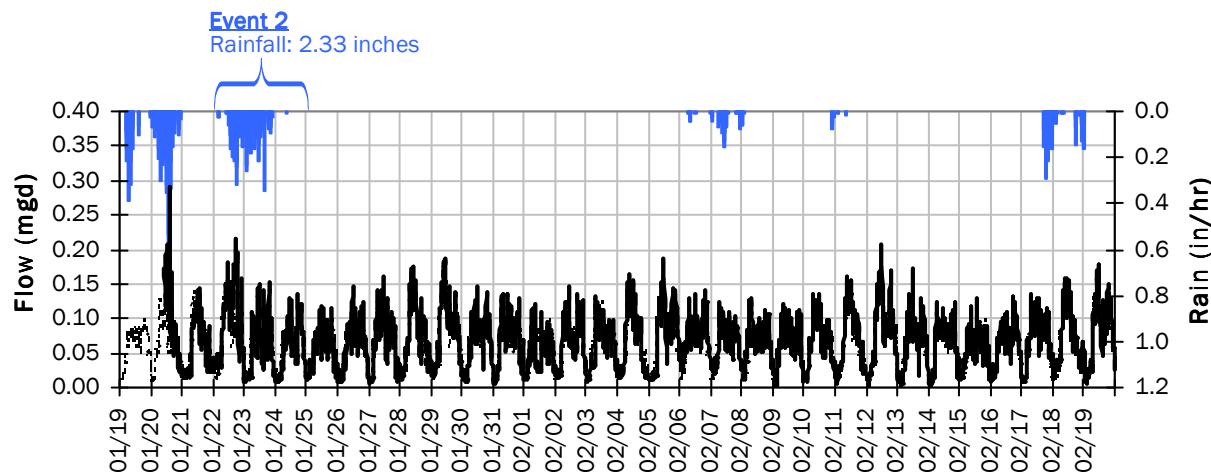
Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Event 1 Detail Graph

Storm Event I/I Analysis (Rain = 2.77 inches)

<u>Capacity</u>		<u>Inflow / Infiltration</u>	
Peak Flow:	0.29 mgd	Peak I/I Rate:	0.25 mgd
PF:	4.61	Total I/I:	23,000 gallons
Peak Level:	2.73 in		
d/D Ratio:	0.23		

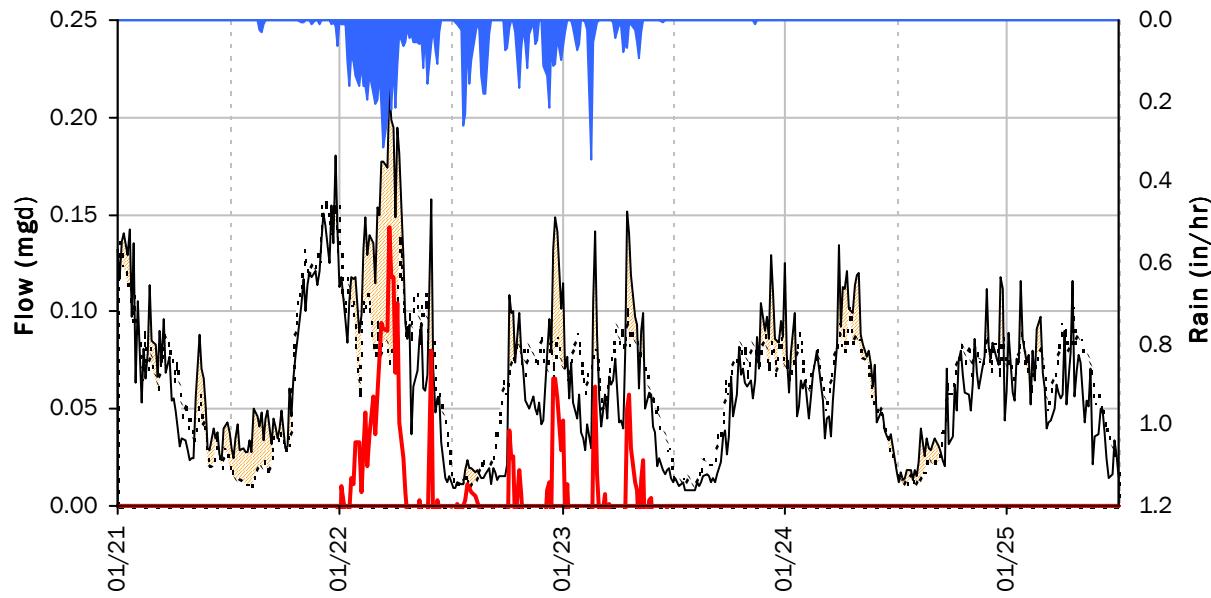
SITE 5

I/I Summary: Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Event 2 Detail Graph



Storm Event I/I Analysis (Rain = 2.33 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.21 mgd	Peak I/I Rate:	0.14 mgd
PF:	3.41	Total I/I:	6,000 gallons
Peak Level:	2.21 in		
d/D Ratio:	0.18		

SITE 5

Weekly Level, Velocity and Flow Hydrographs

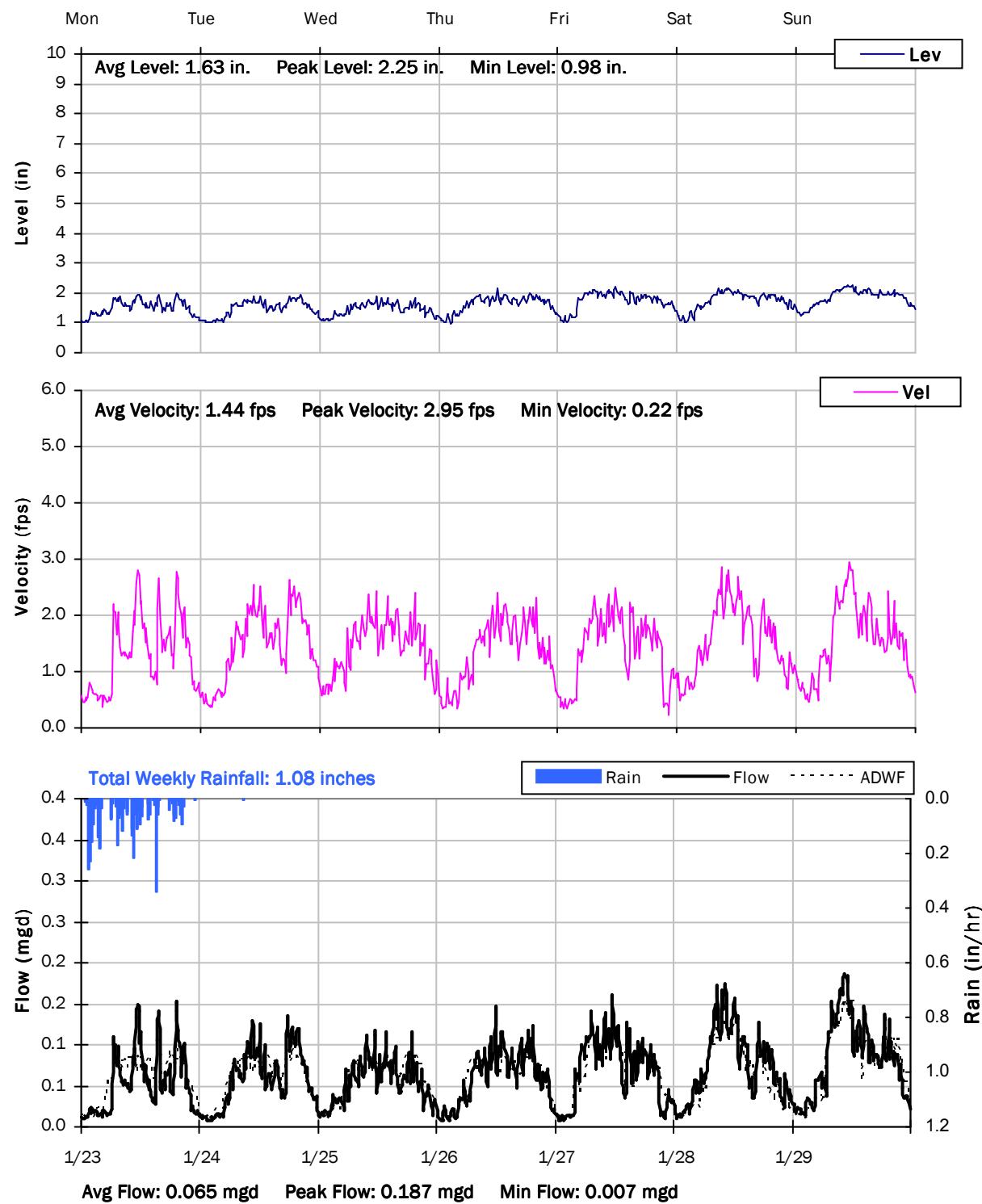
1/16/2017 to 1/23/2017



SITE 5

Weekly Level, Velocity and Flow Hydrographs

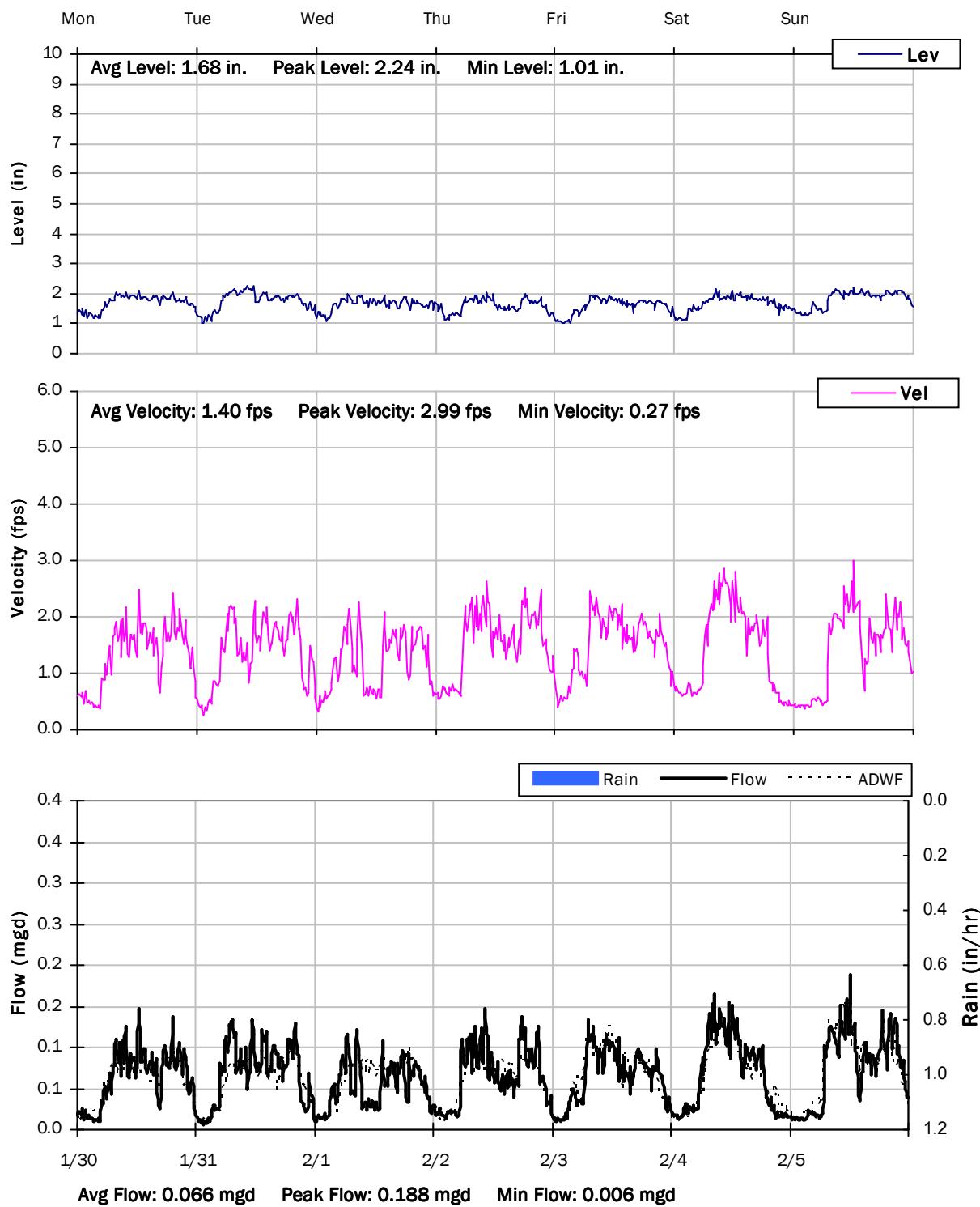
1/23/2017 to 1/30/2017



SITE 5

Weekly Level, Velocity and Flow Hydrographs

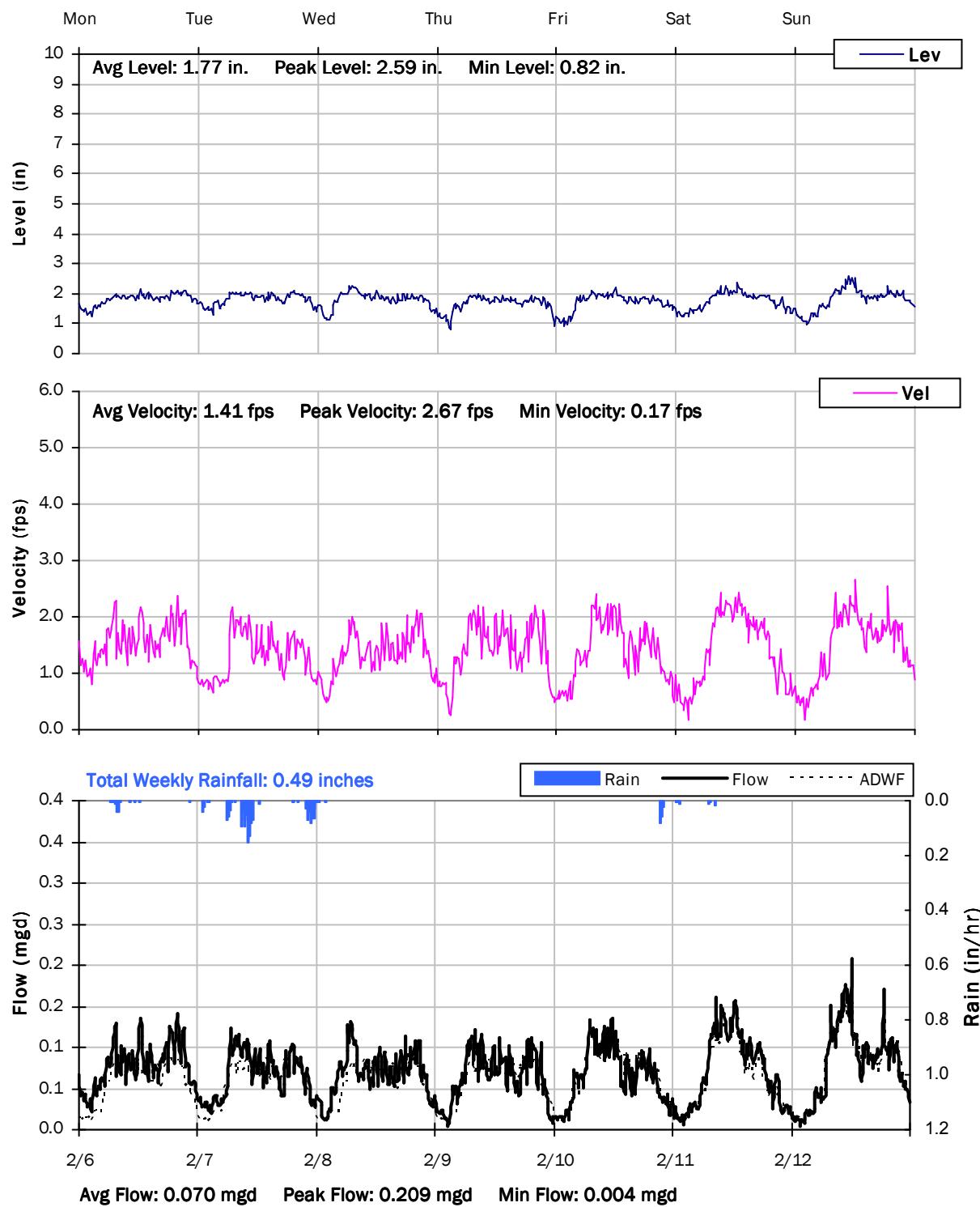
1/30/2017 to 2/6/2017



SITE 5

Weekly Level, Velocity and Flow Hydrographs

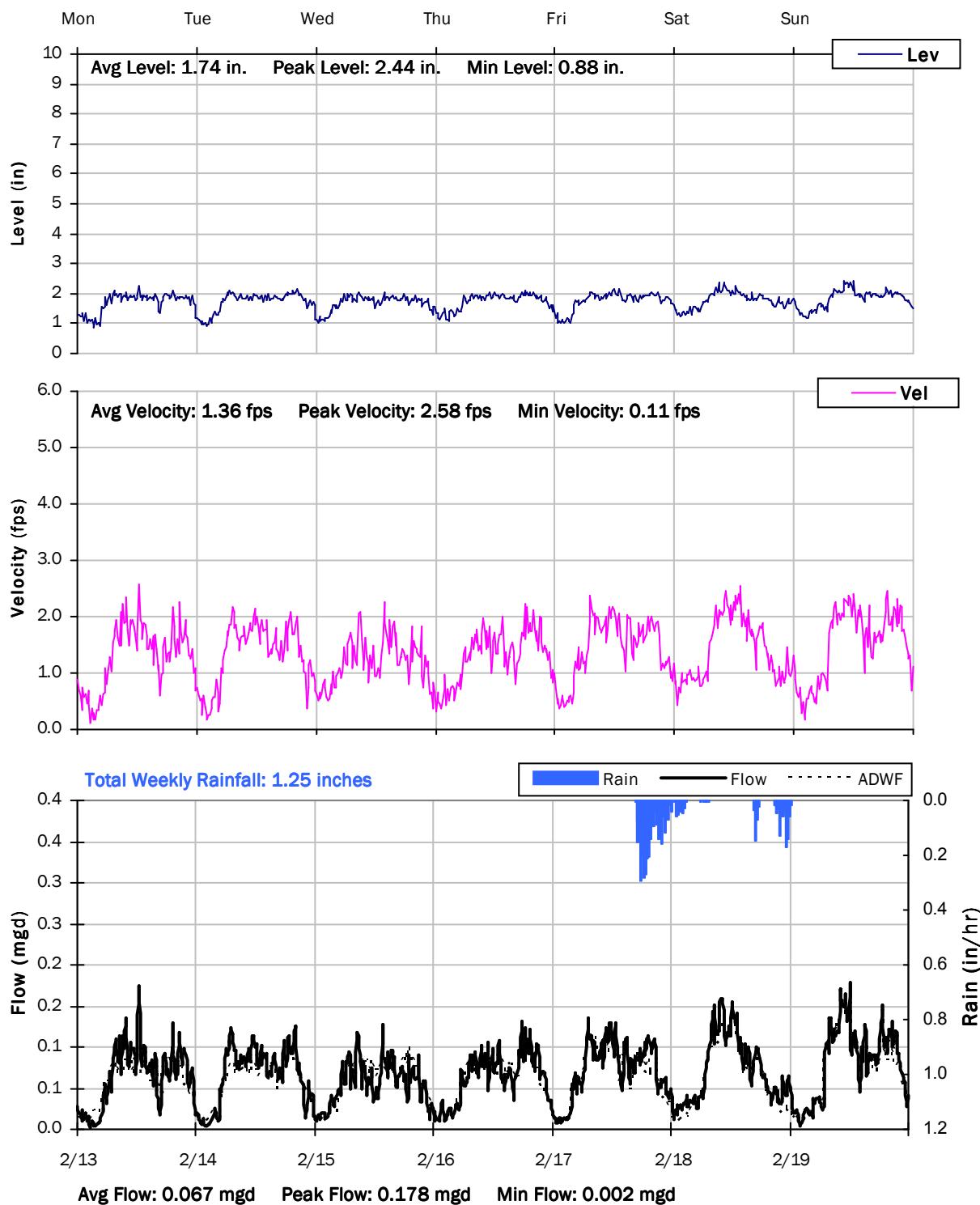
2/6/2017 to 2/13/2017



SITE 5

Weekly Level, Velocity and Flow Hydrographs

2/13/2017 to 2/20/2017



City of Banning

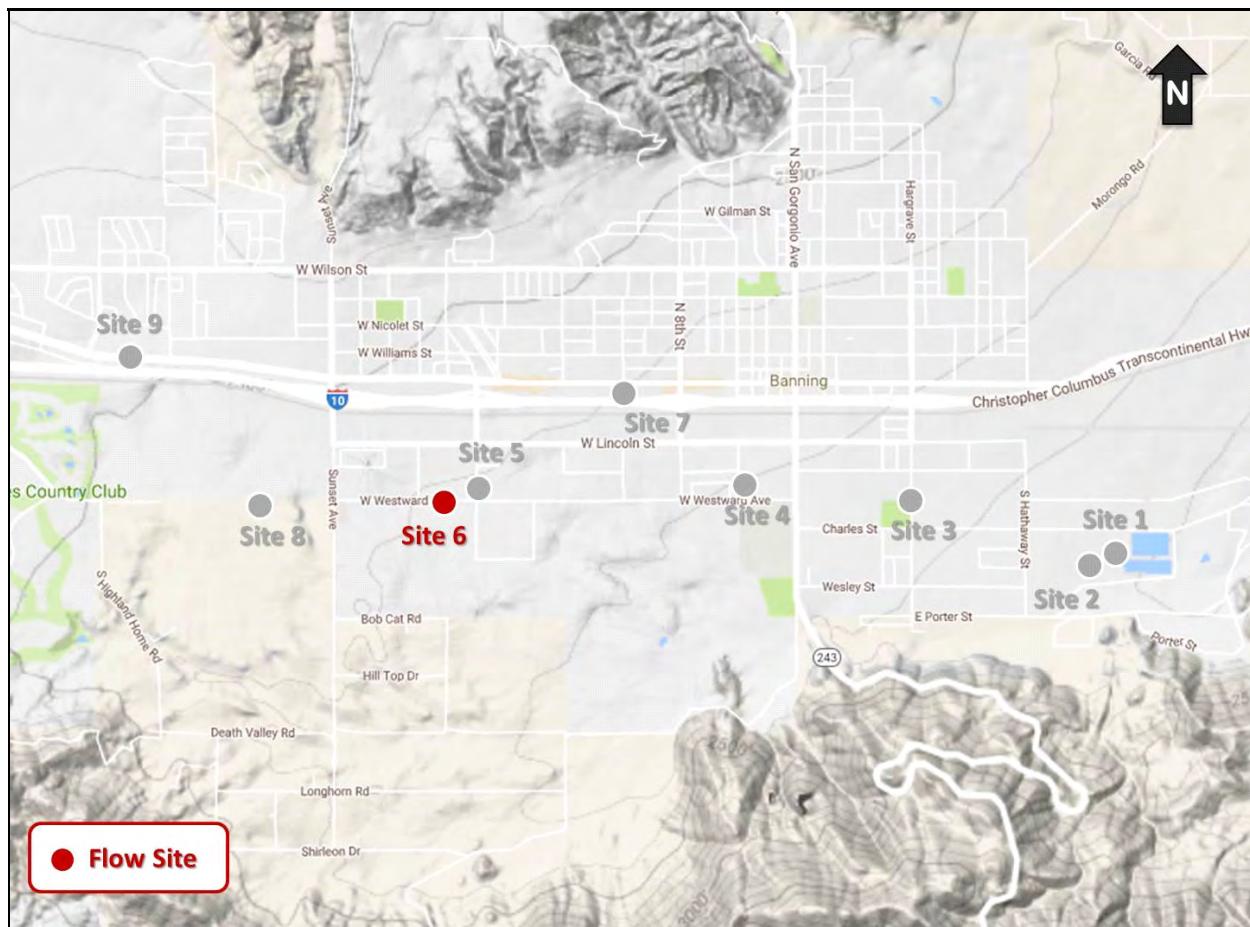
Sanitary Sewer Flow Monitoring

Temporary Monitoring: January 2017 - February 2017

Monitoring Site: Site 6

Location: 2435 W Westward Avenue

Data Summary Report



Vicinity Map: Site 6

SITE 6

Site Information

Location: 2435 W Westward Avenue



Coordinates: 116.9031° W, 33.9181° N

Expected Pipe Diameter: 21 inches

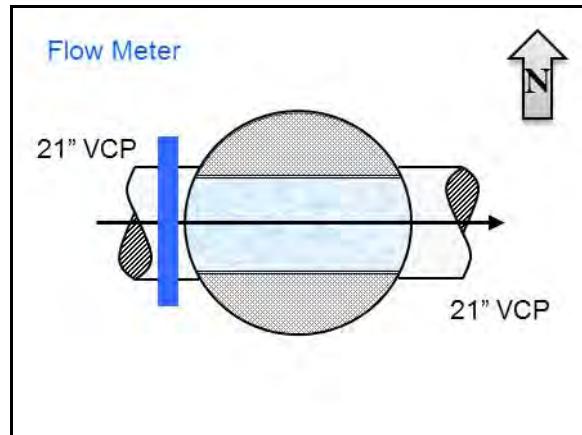
Measured Pipe Diameter: 21 inches

ADWF: 0.853 mgd

Peak Measured Flow: 2.259 mgd



Sewer Map



Flow Sketch



Street View



Plan View

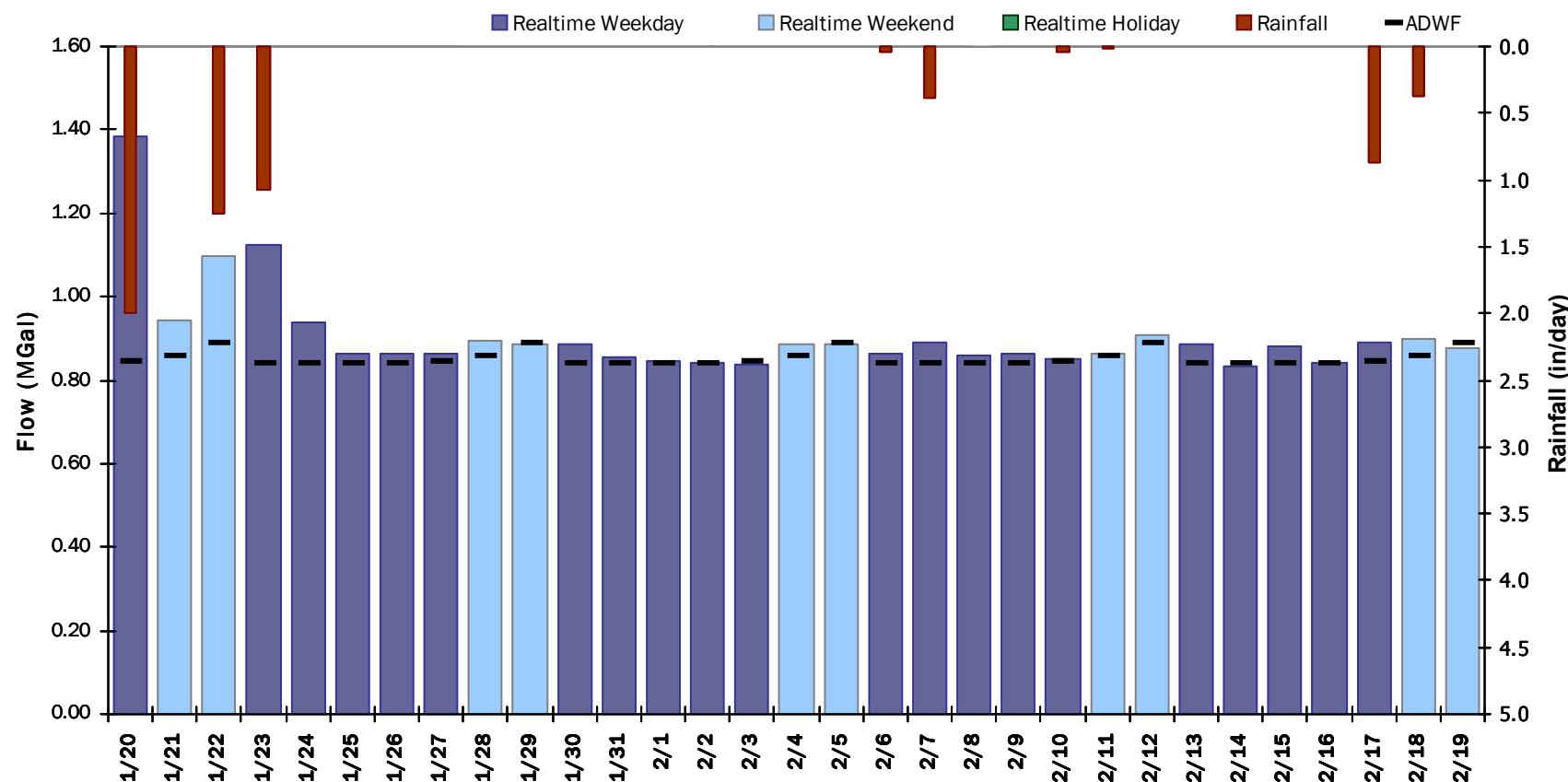
SITE 6**Additional Site Photos****Effluent Pipe****Influent Pipe**

SITE 6

Period Flow Summary: Daily Flow Totals

Avg Period Flow: 0.907 MGal Peak Daily Flow: 1.386 MGal Min Daily Flow: 0.834 MGal

Total Period Rainfall: 5.30 inches

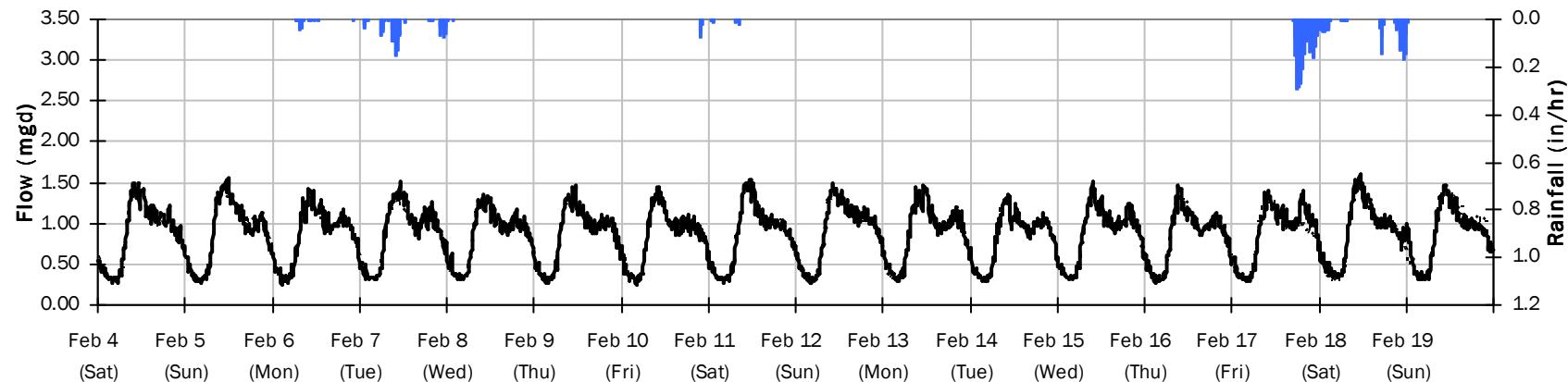
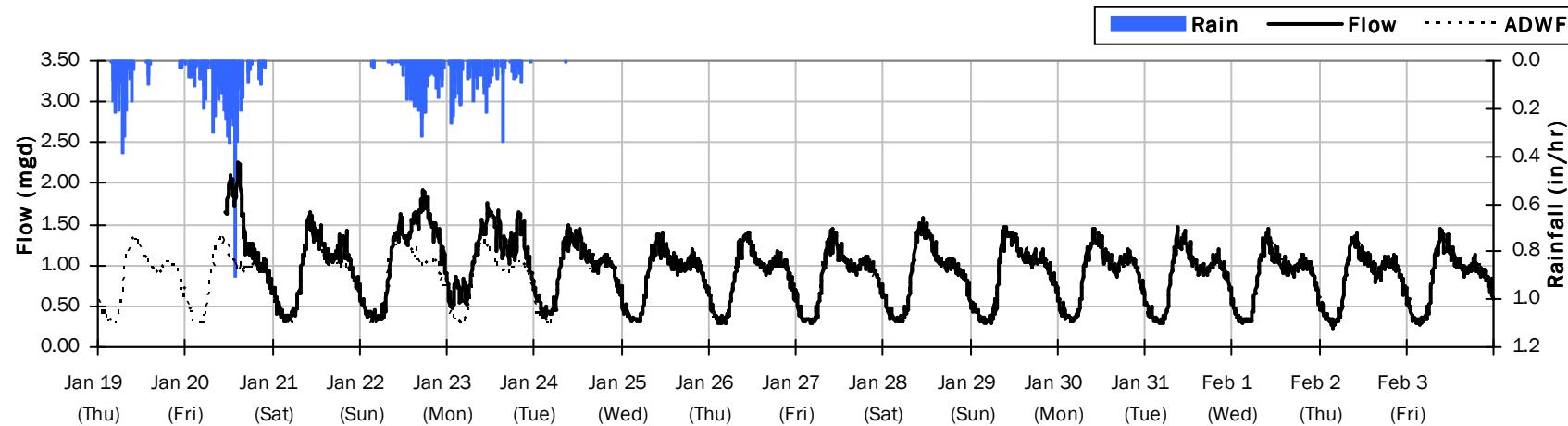


SITE 6

Flow Summary: 1/19/2017 to 2/19/2017

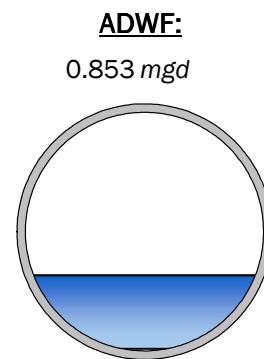
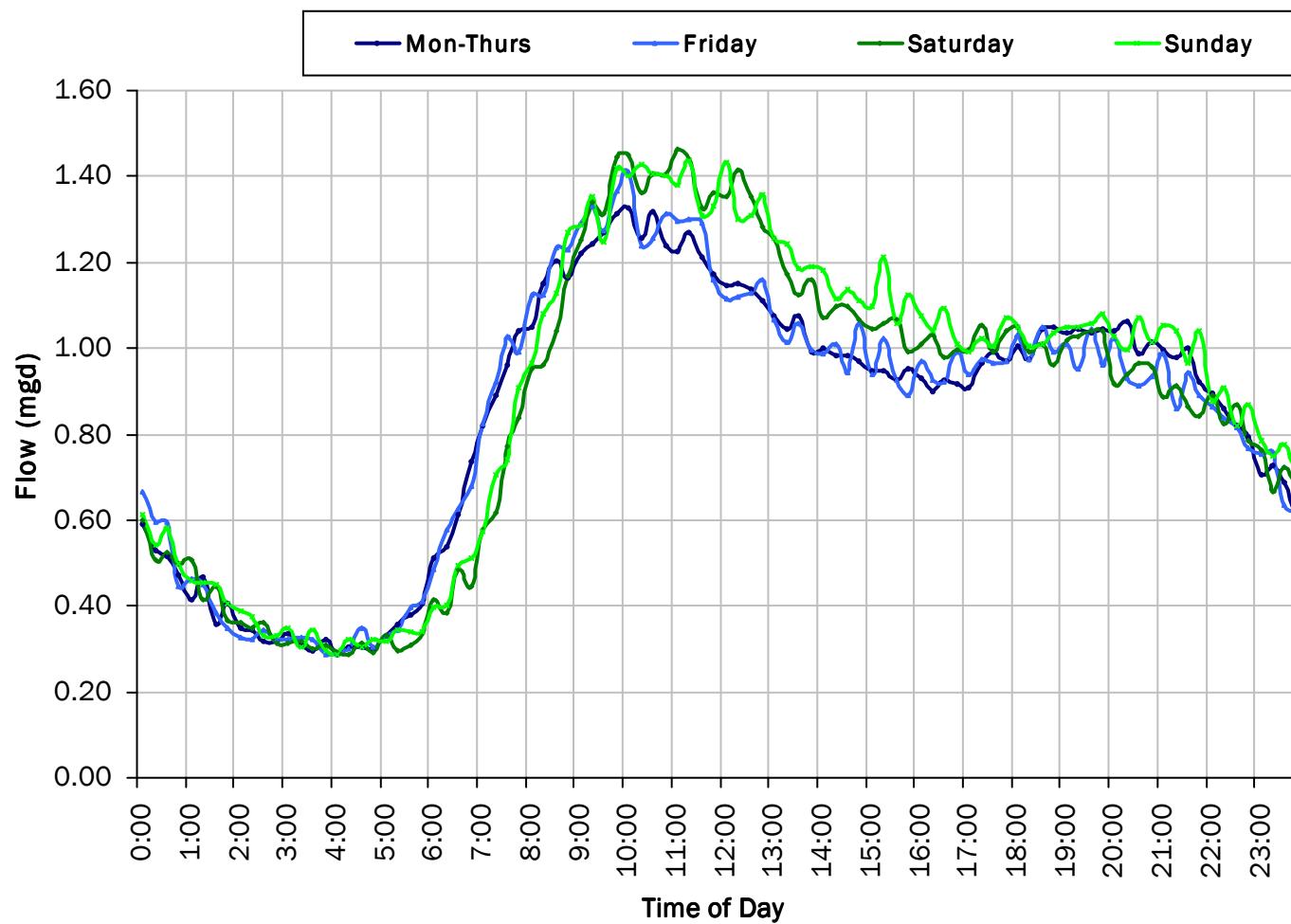
Total Period Rainfall: 6.84 inches

Avg Flow: 0.900 mgd Peak Flow: 2.259 mgd Min Flow: 0.233 mgd



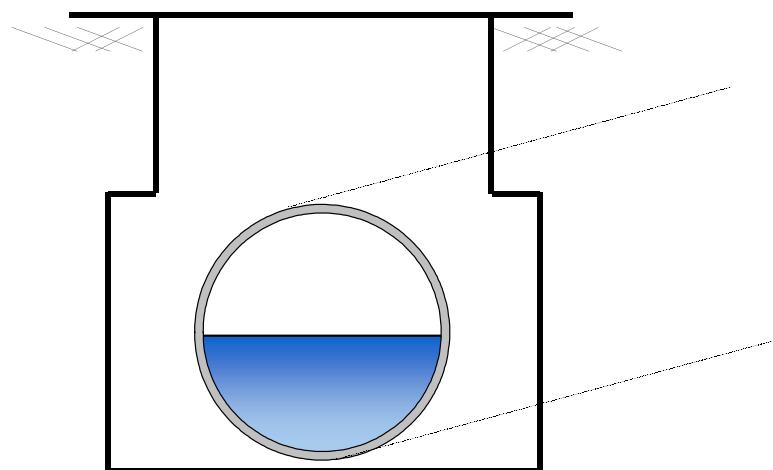
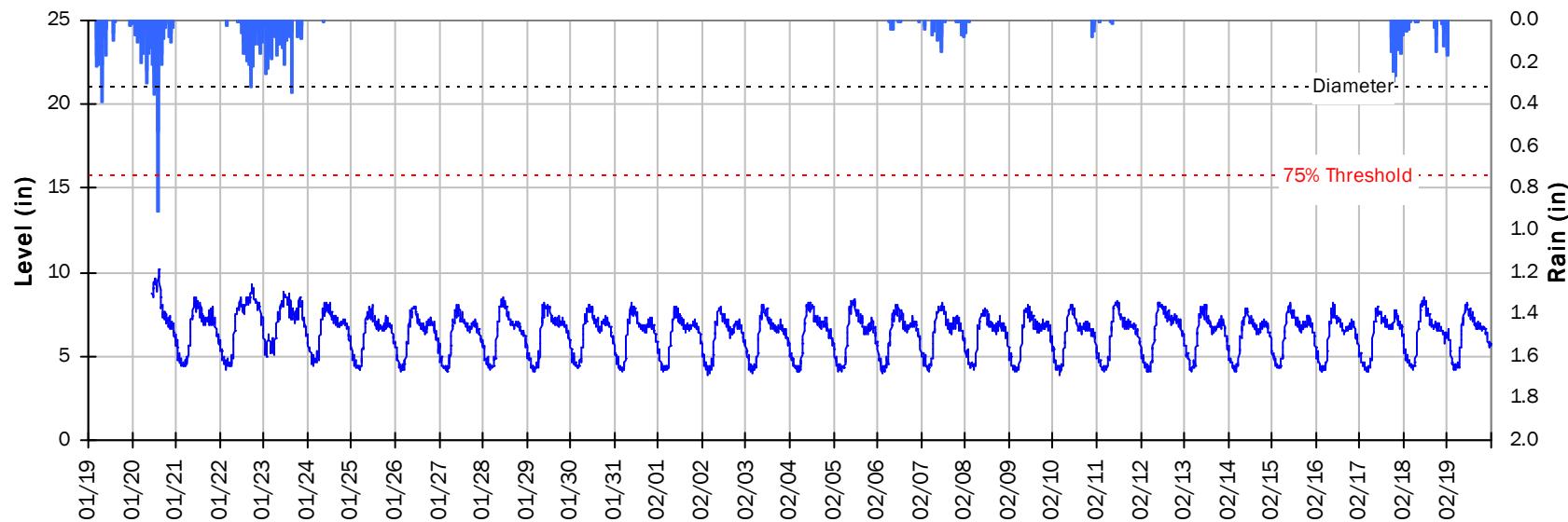
SITE 6

Average Dry Weather Flow Hydrographs



SITE 6

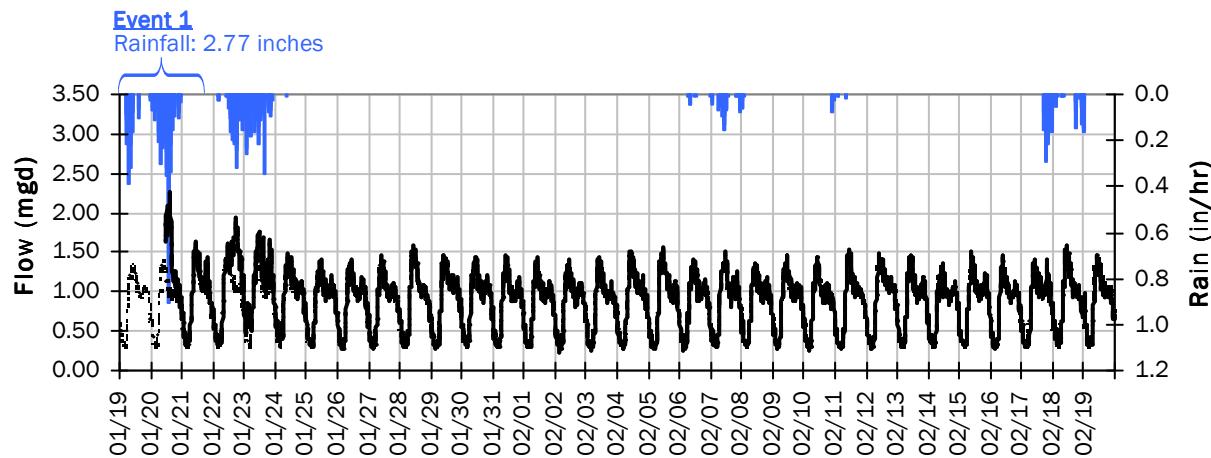
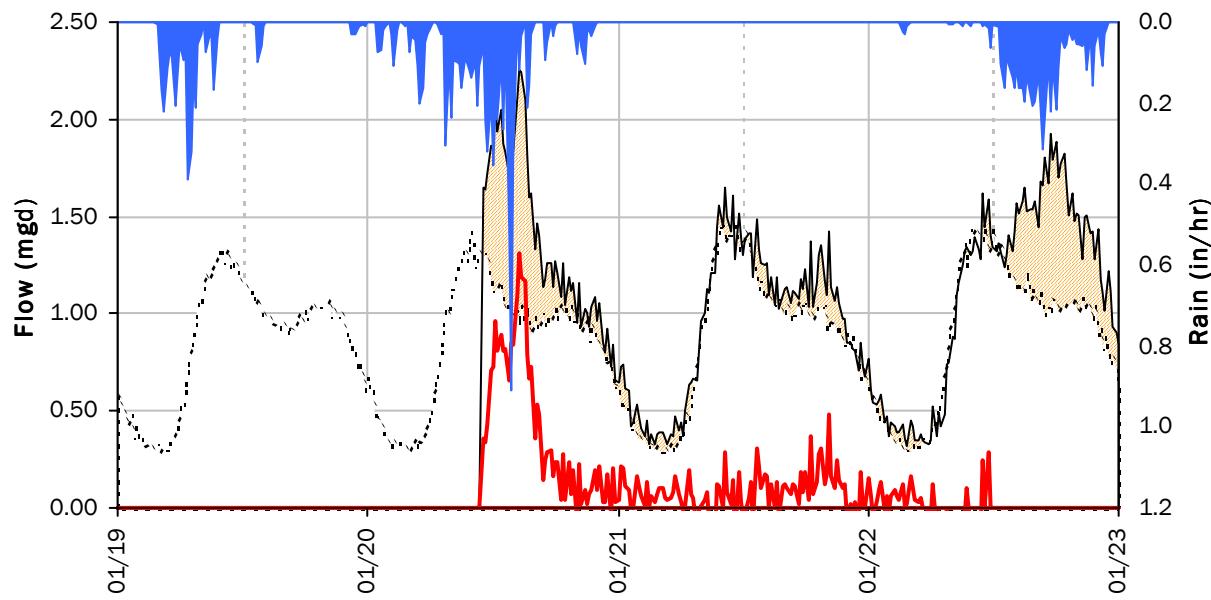
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Monitoring Period

Pipe Diameter: 21 *inches*
Peak Measured Level: 10.2 *inches*
Peak d/D Ratio: 0.48
Dry Weather Design Threshold Level: 15.7 *inches*

SITE 6

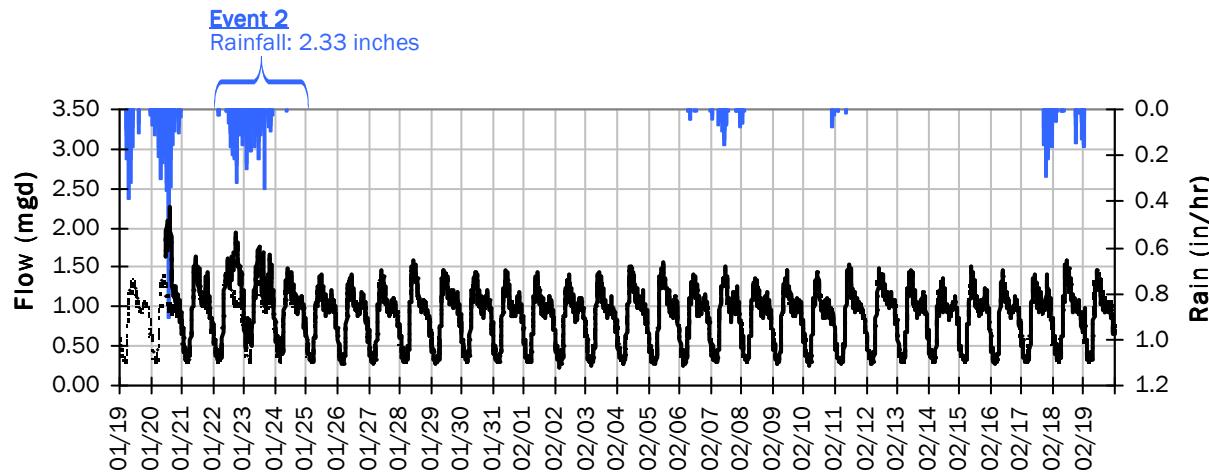
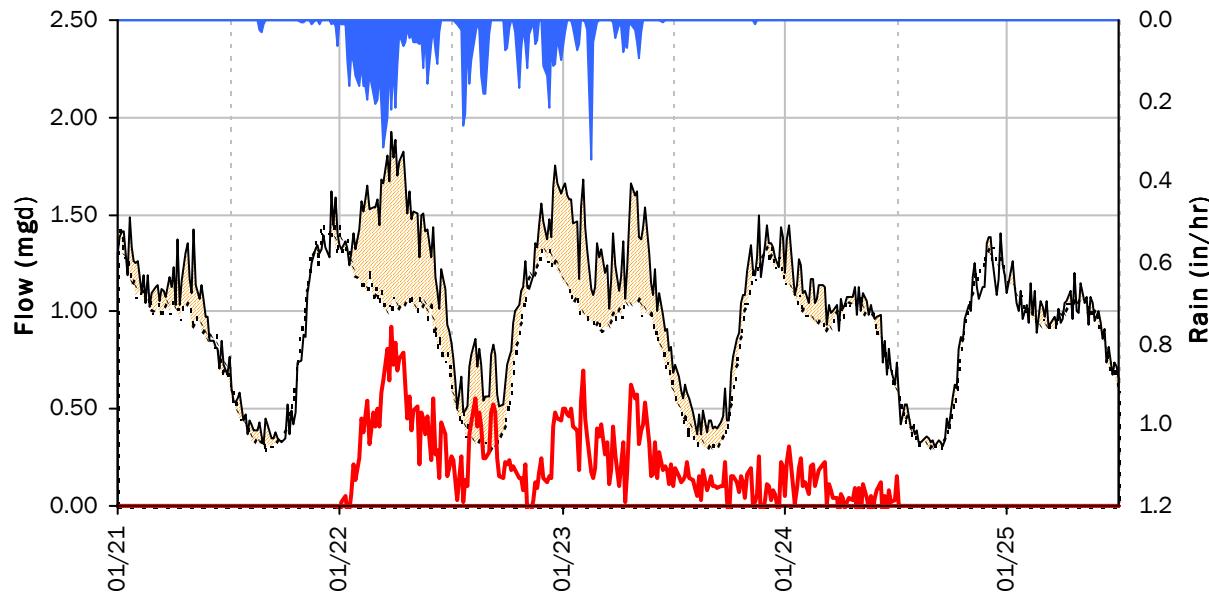
I/I Summary: Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Event 1 Detail Graph

Storm Event I/I Analysis (Rain = 2.77 inches)

Capacity	Inflow / Infiltration		
Peak Flow:	2.26 mgd	Peak I/I Rate:	1.31 mgd
PF:	2.65	Total I/I:	312,000 gallons
Peak Level: 10.15 in			
d/D Ratio: 0.48			

SITE 6

I/I Summary: Event 2

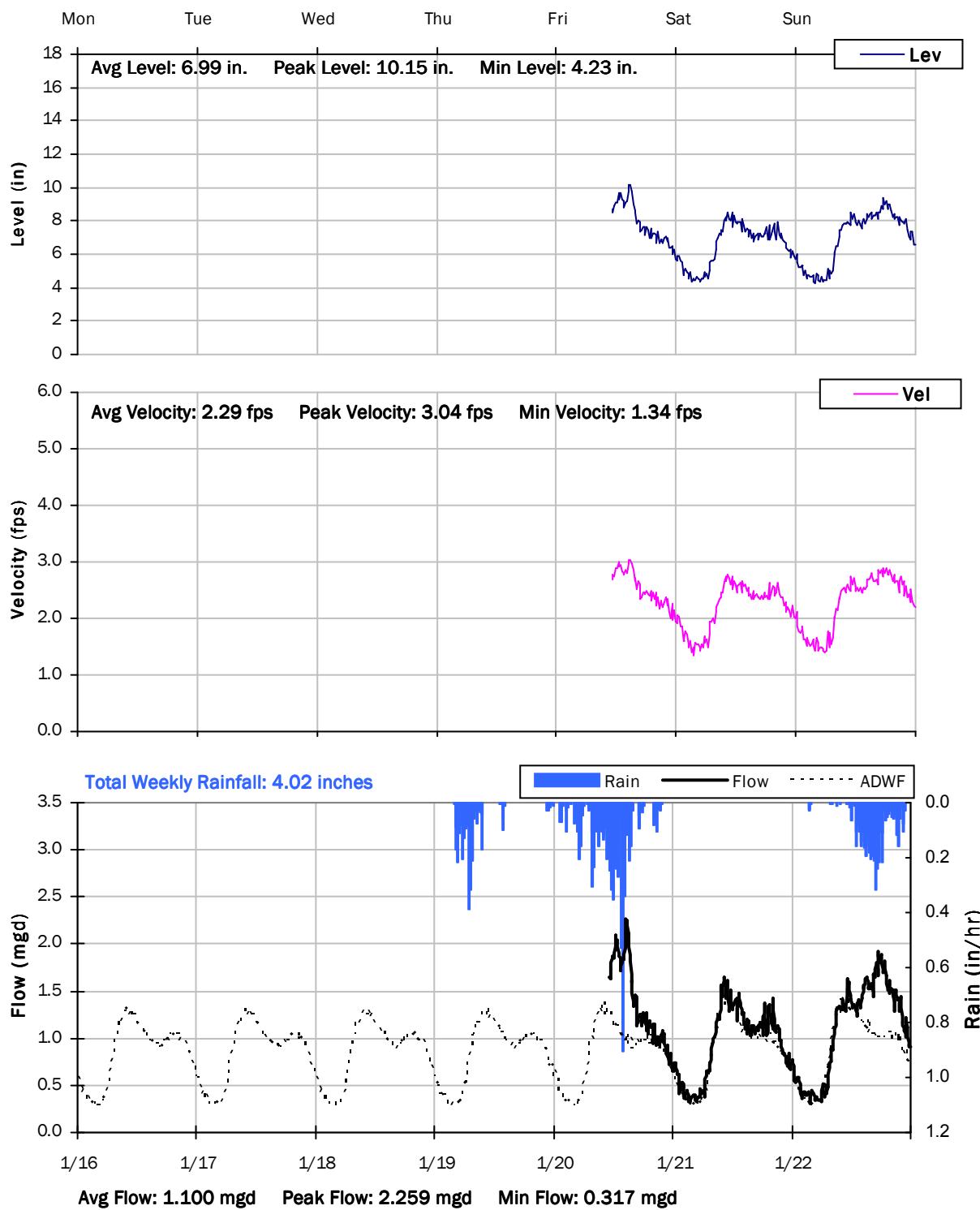
Baseline and Realtime Flows with Rainfall Data over Monitoring PeriodEvent 2 Detail GraphStorm Event I/I Analysis (Rain = 2.33 inches)

<u>Capacity</u>		<u>Inflow / Infiltration</u>	
Peak Flow:	1.93 mgd	Peak I/I Rate:	0.92 mgd
PF:	2.26	Total I/I:	581,000 gallons
Peak Level:	9.34 in		
d/D Ratio:	0.44		

SITE 6

Weekly Level, Velocity and Flow Hydrographs

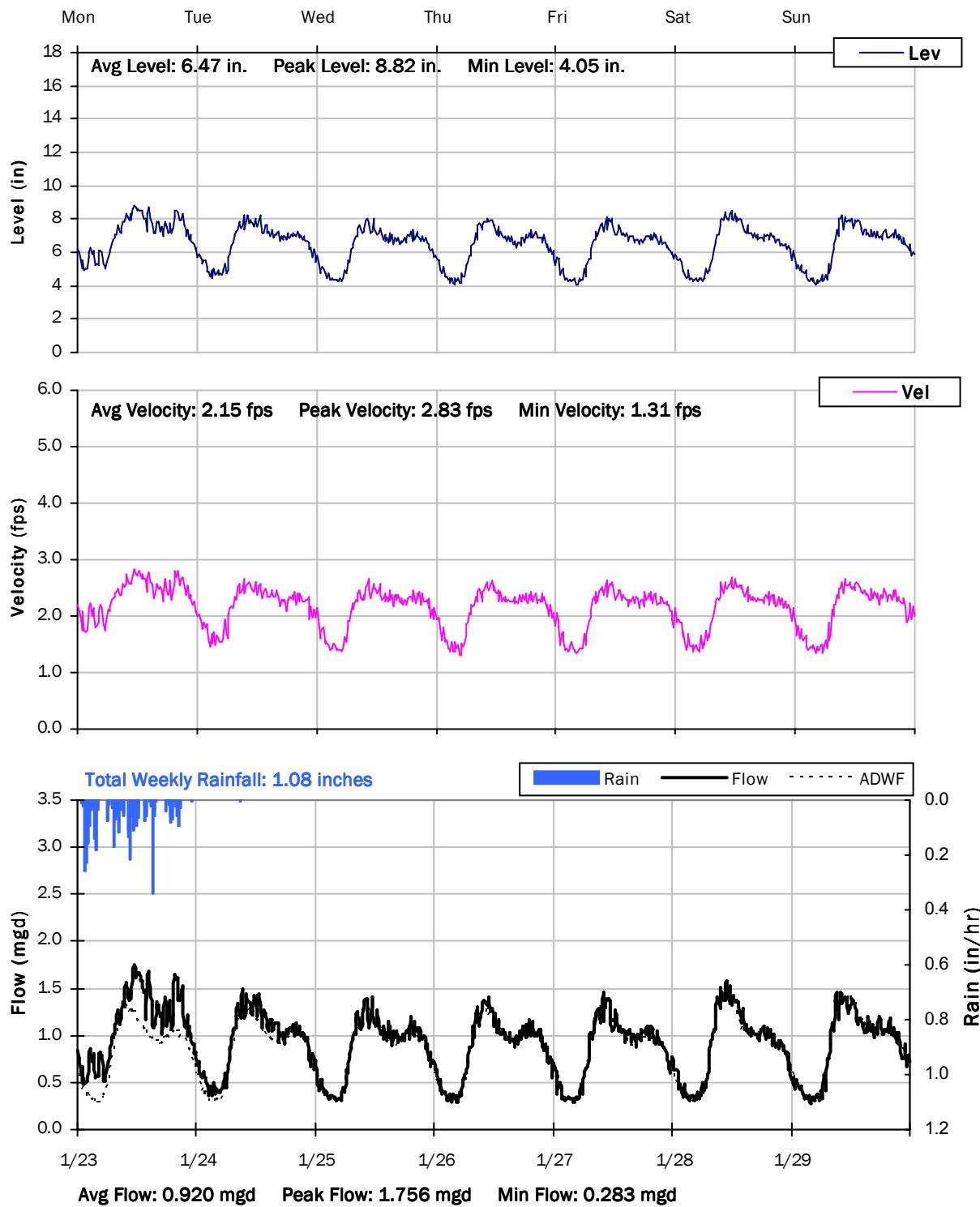
1/16/2017 to 1/23/2017



SITE 6

Weekly Level, Velocity and Flow Hydrographs

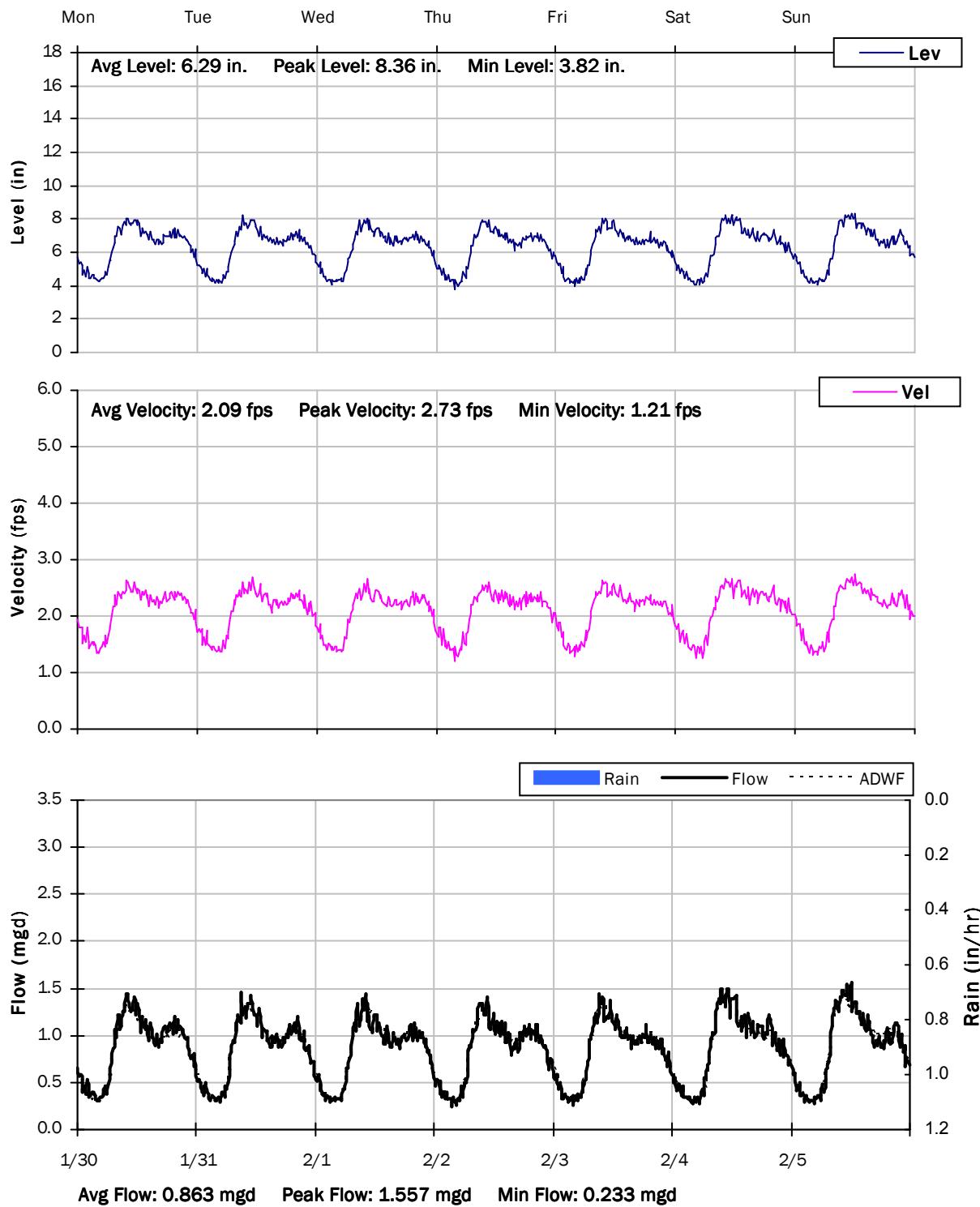
1/23/2017 to 1/30/2017



SITE 6

Weekly Level, Velocity and Flow Hydrographs

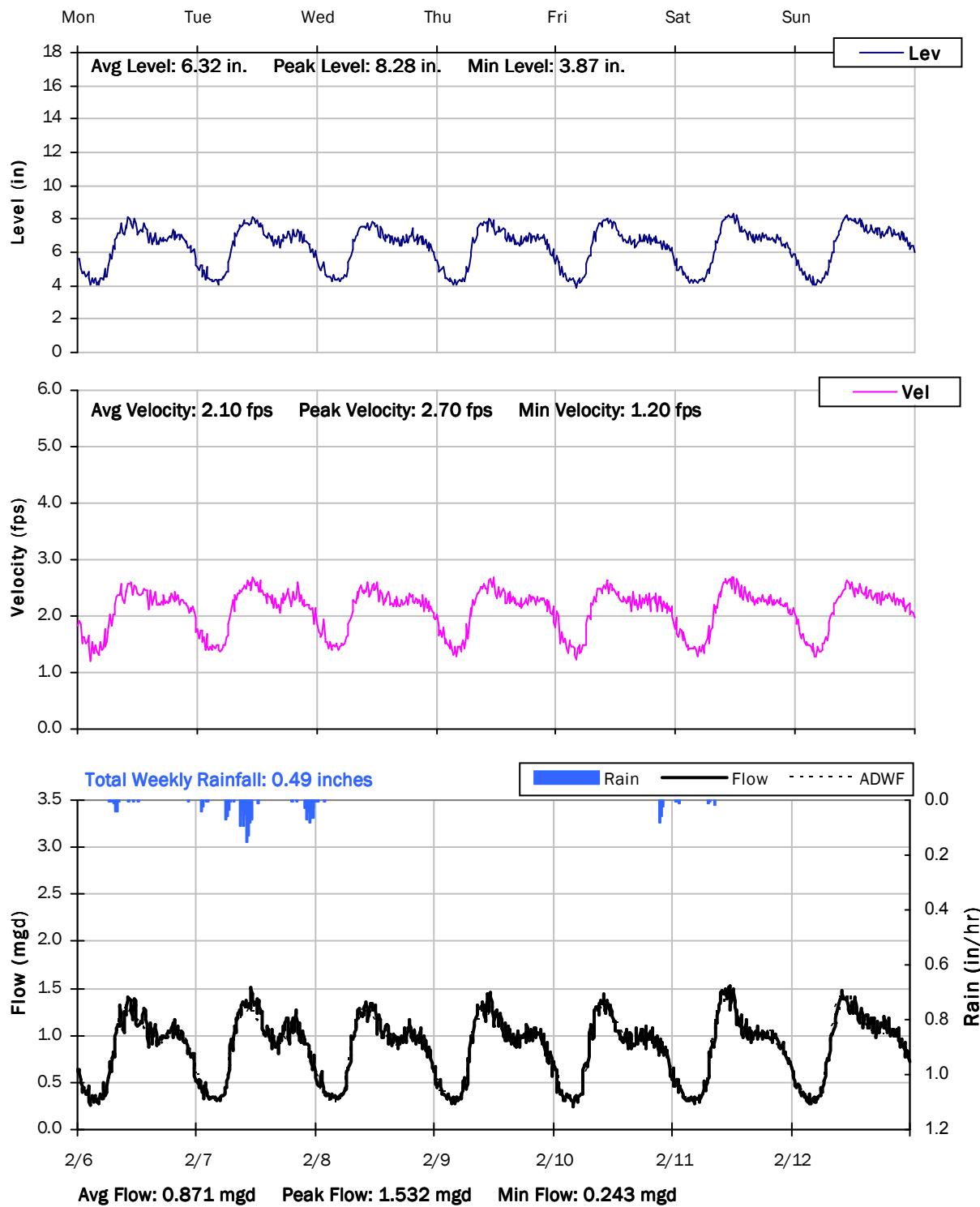
1/30/2017 to 2/6/2017



SITE 6

Weekly Level, Velocity and Flow Hydrographs

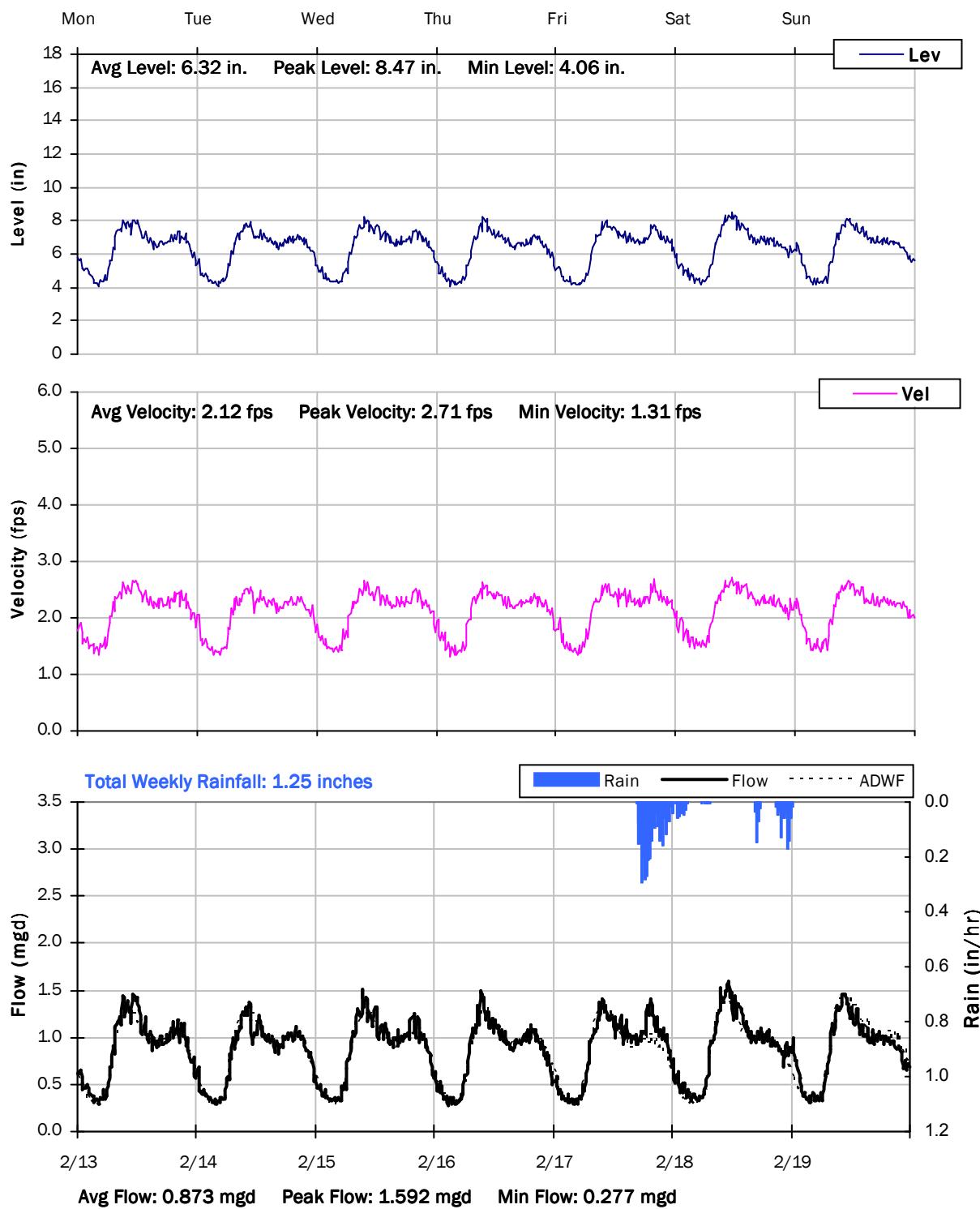
2/6/2017 to 2/13/2017



SITE 6

Weekly Level, Velocity and Flow Hydrographs

2/13/2017 to 2/20/2017



City of Banning

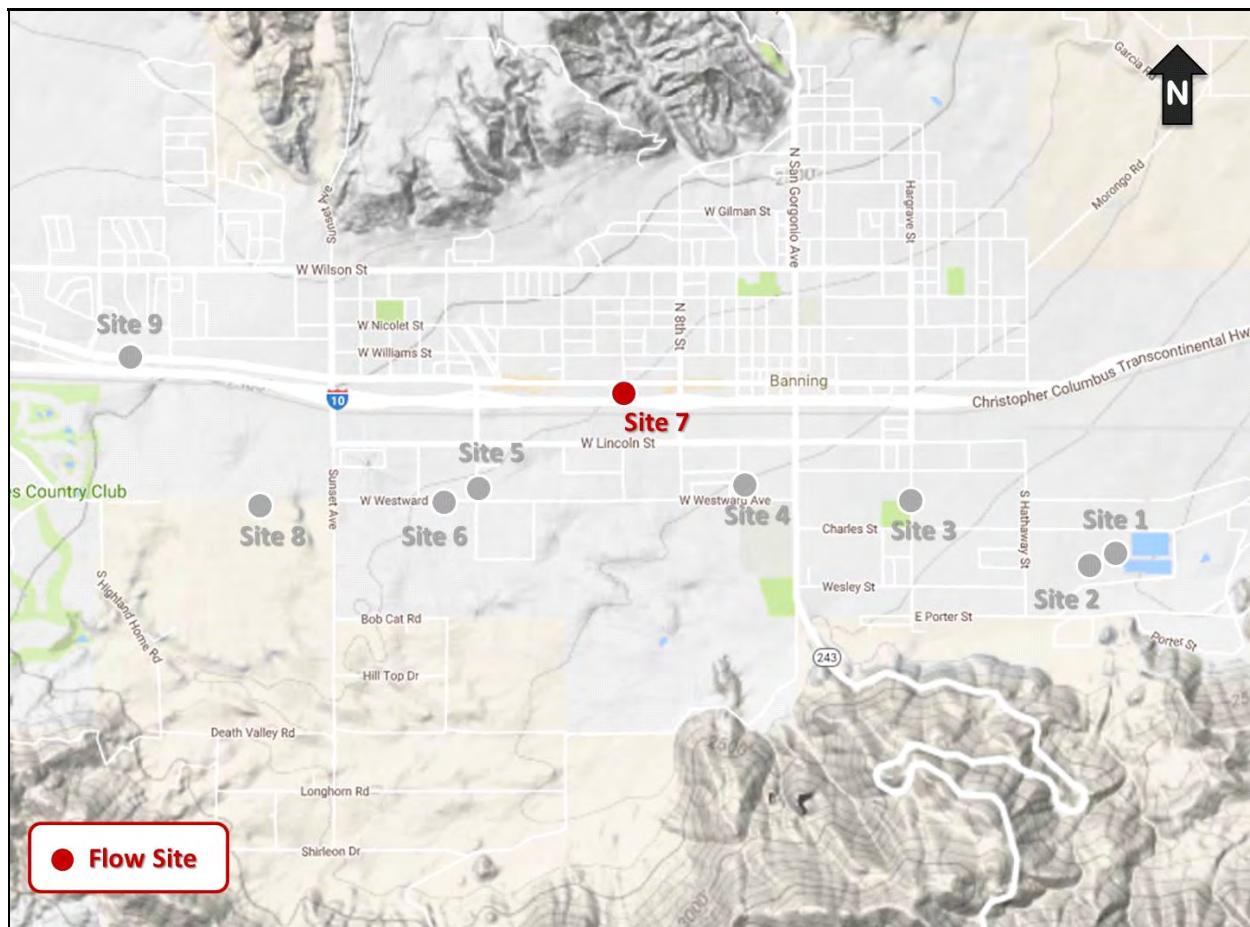
Sanitary Sewer Flow Monitoring

Temporary Monitoring: January 2017 - February 2017

Monitoring Site: Site 7

Location: 1170 W Ramsey Street

Data Summary Report



Vicinity Map: Site 7

SITE 7

Site Information

Location: 1170 W Ramsey Street

Coordinates: 116.8898° W, 33.9246° N

Expected Pipe Diameter: 15 inches

Measured Pipe Diameter: 15 inches

ADWF: 0.279 mgd

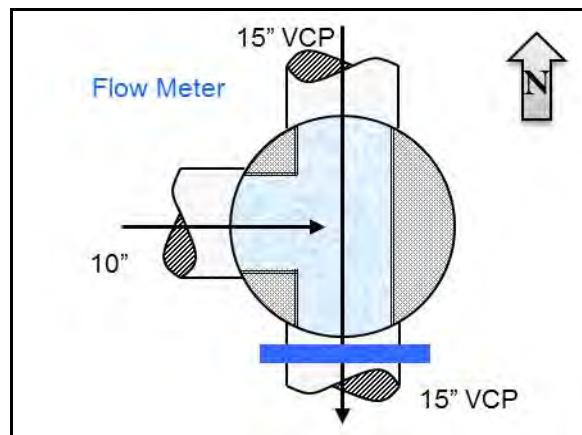
Peak Measured Flow: 1.152 mgd



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

SITE 7**Additional Site Photos****Effluent Pipe****Influent Pipe**

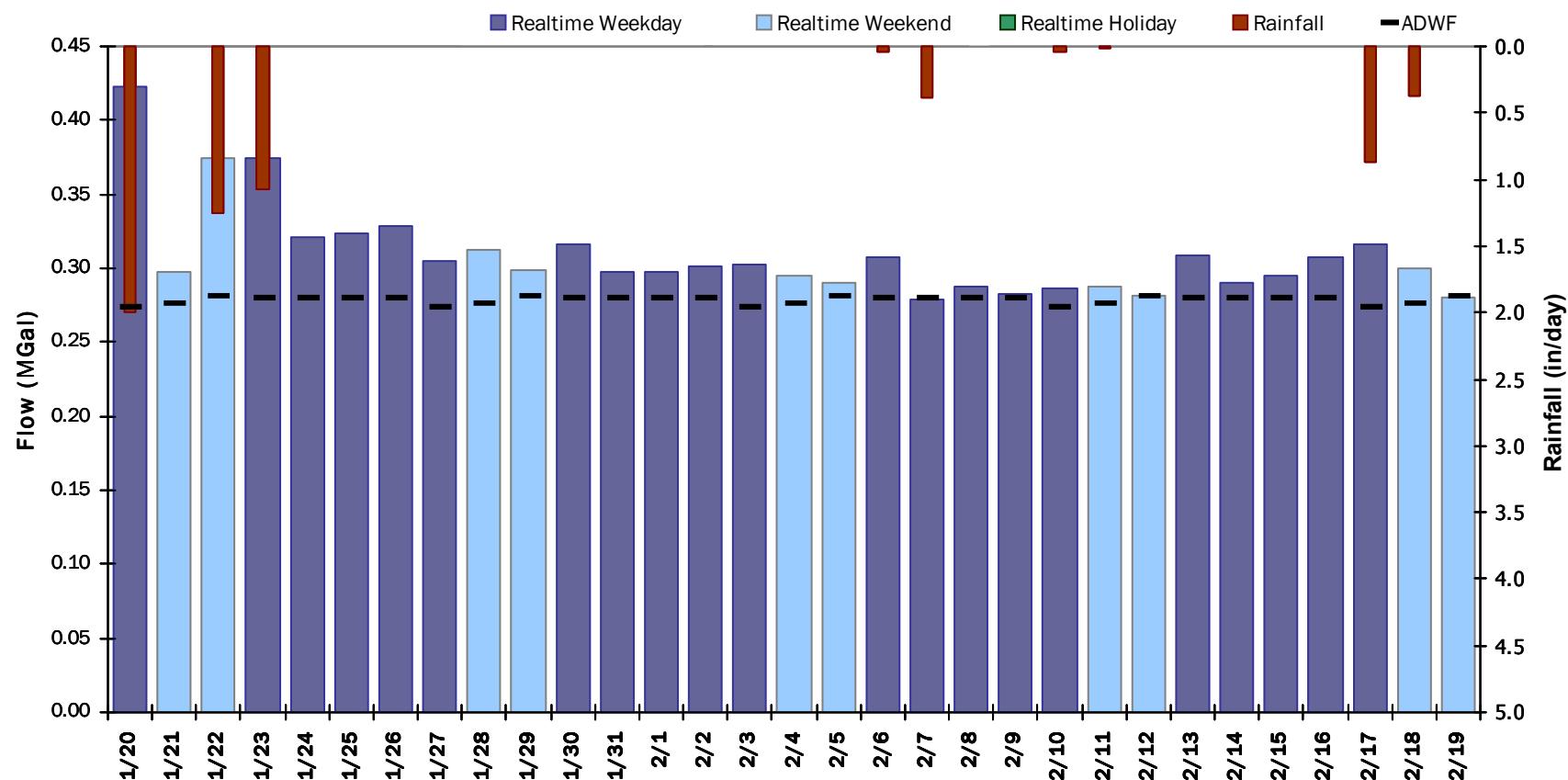
SITE 7**Additional Site Photos****Lateral Pipe**

SITE 7

Period Flow Summary: Daily Flow Totals

Avg Period Flow: 0.309 MGal Peak Daily Flow: 0.423 MGal Min Daily Flow: 0.279 MGal

Total Period Rainfall: 4.34 inches

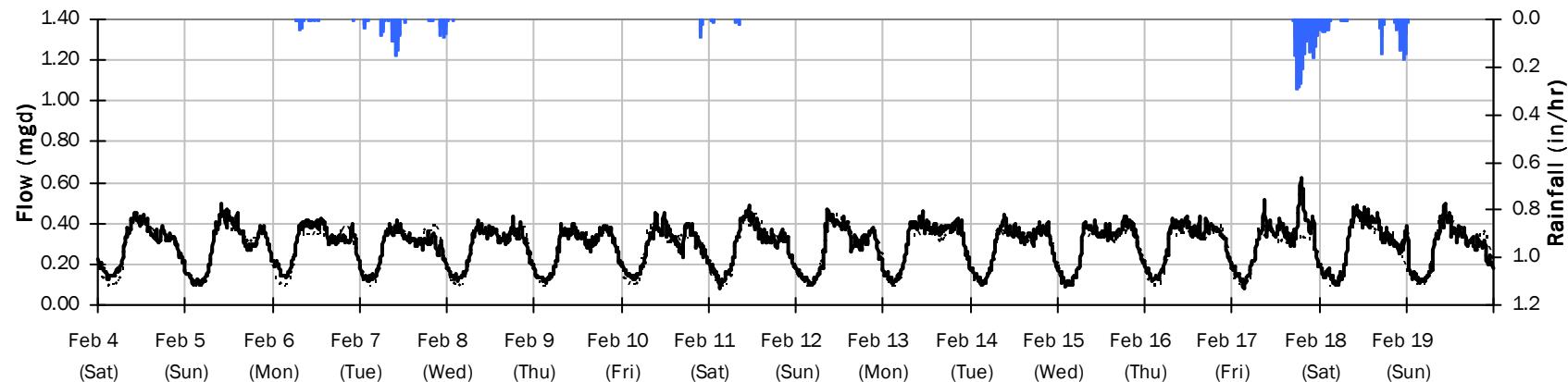
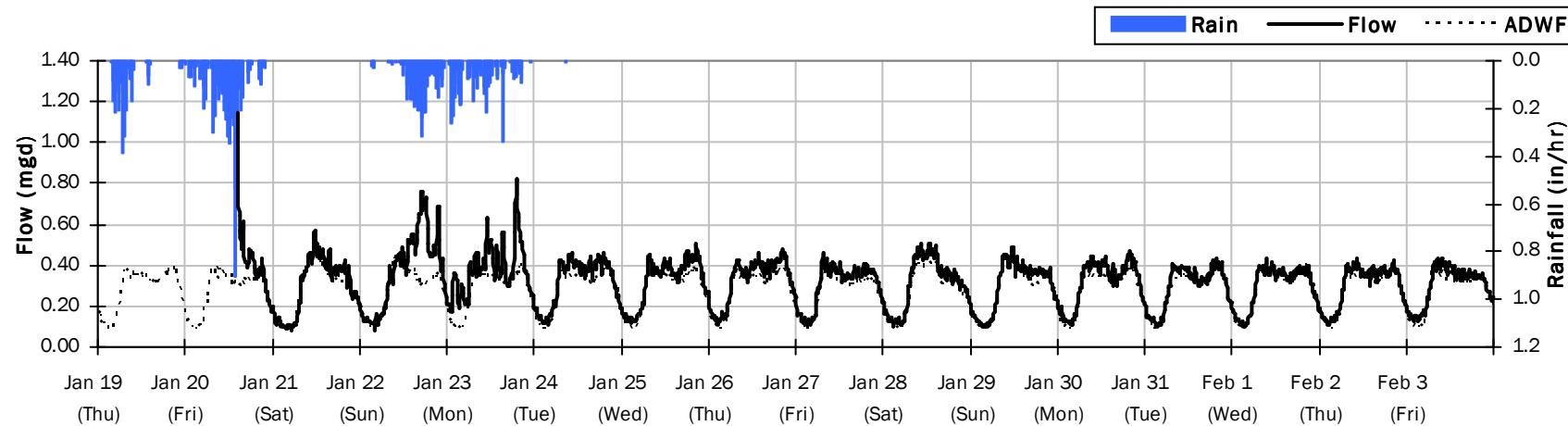


SITE 7

Flow Summary: 1/19/2017 to 2/19/2017

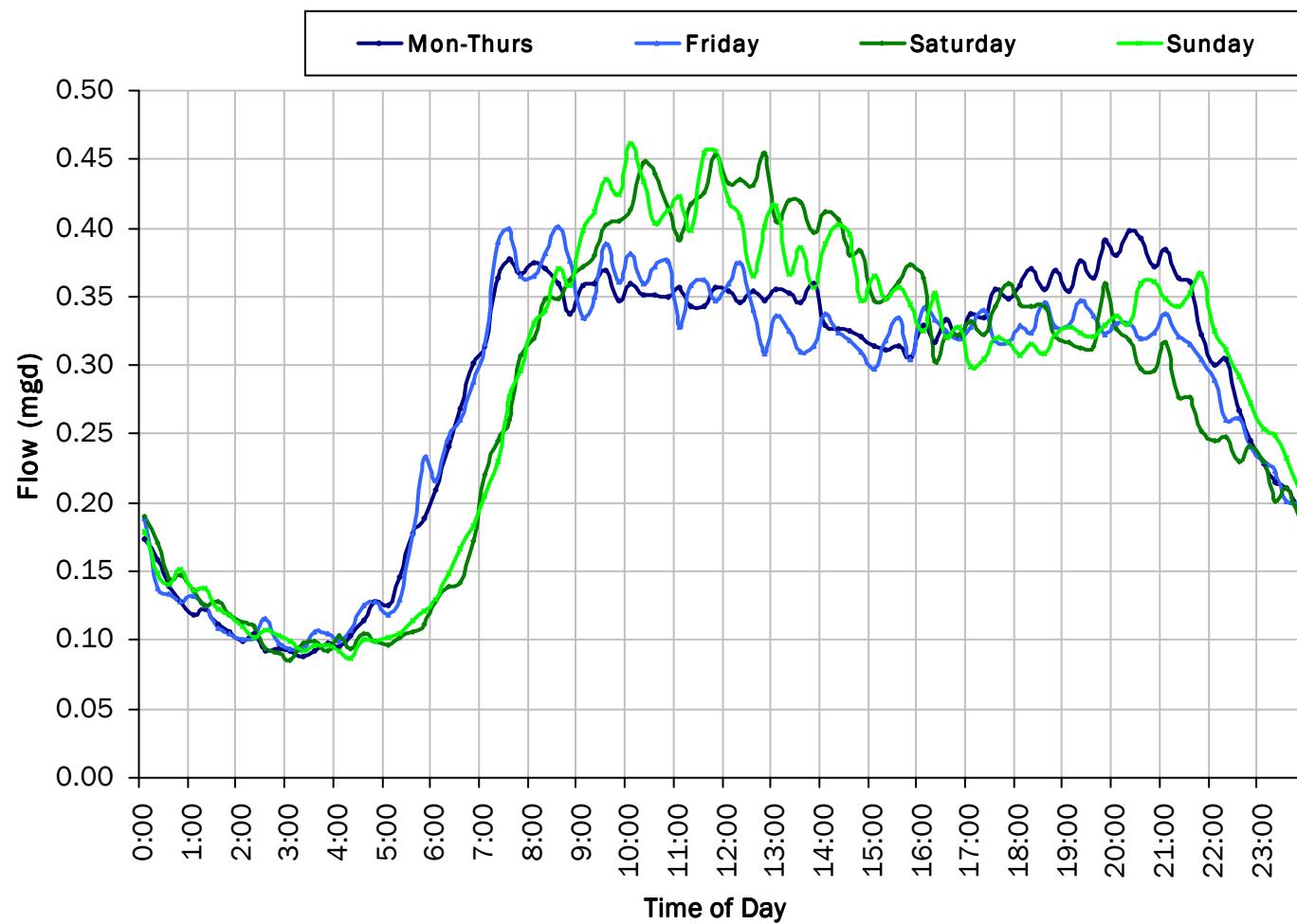
Total Period Rainfall: 6.84 inches

Avg Flow: 0.306 mgd Peak Flow: 1.152 mgd Min Flow: 0.079 mgd



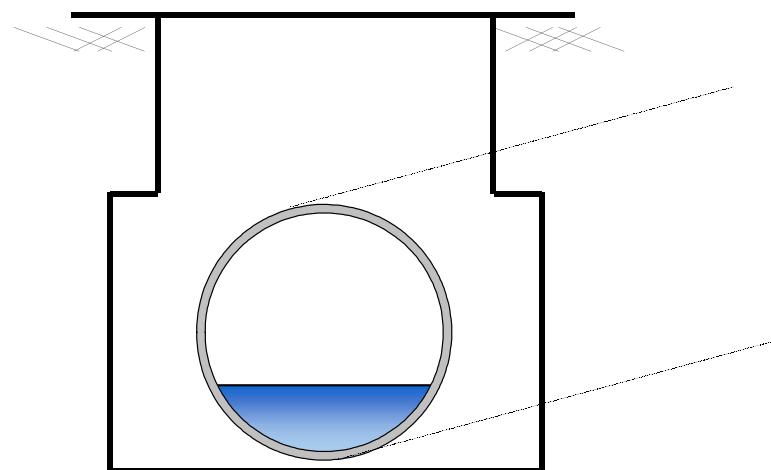
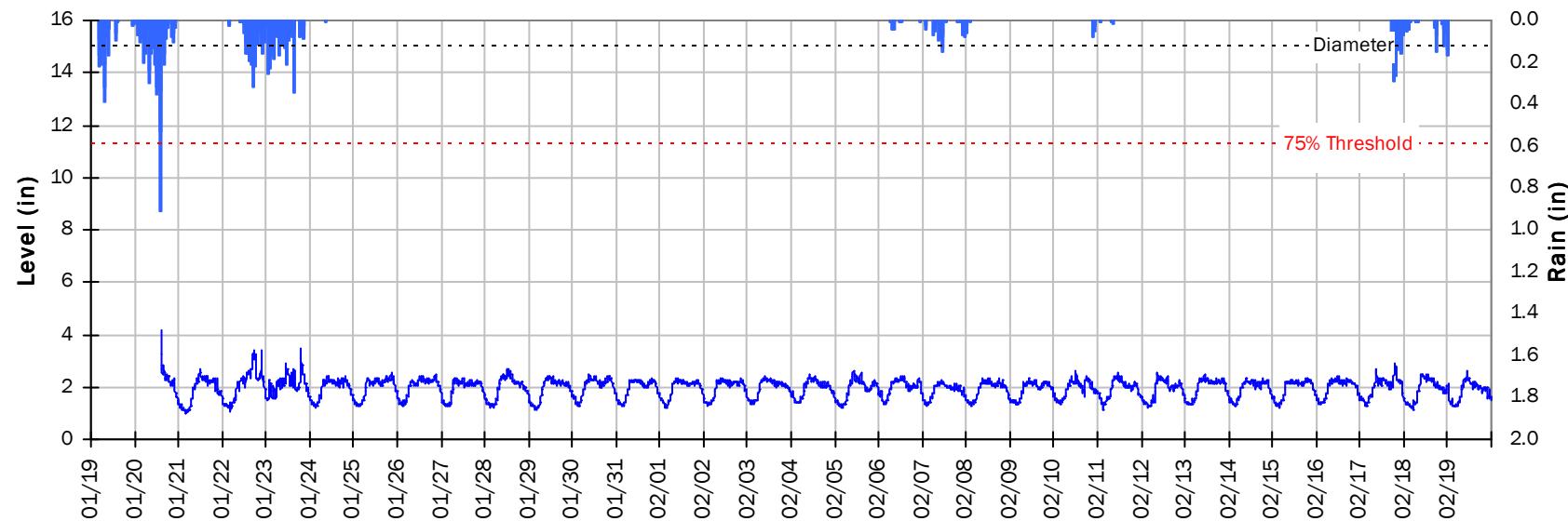
SITE 7

Average Dry Weather Flow Hydrographs



SITE 7

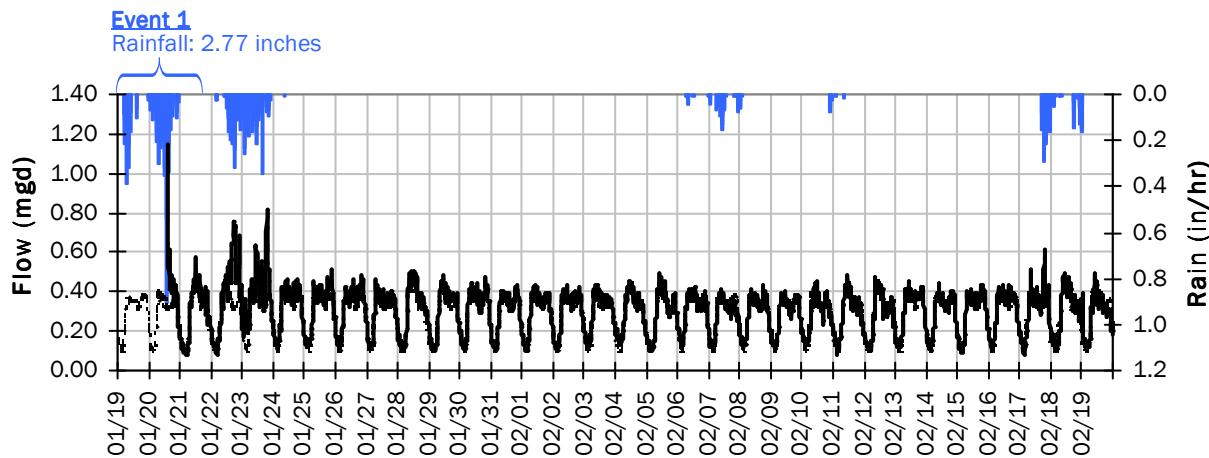
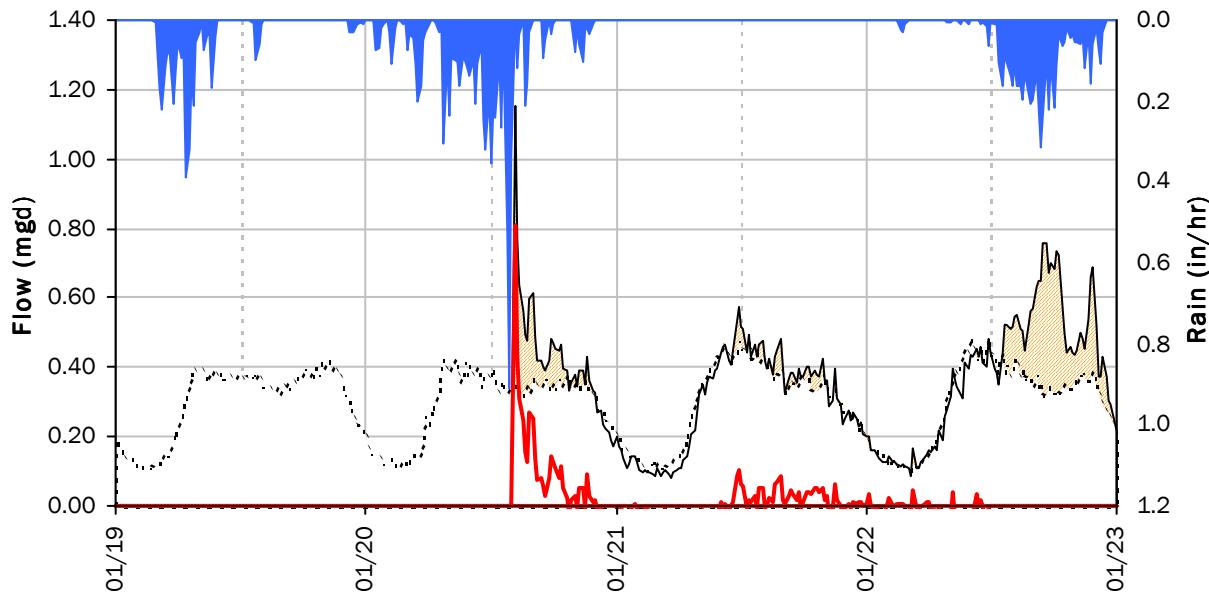
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Monitoring Period

Pipe Diameter: 15 inches
Peak Measured Level: 4.2 inches
Peak d/D Ratio: 0.28
Dry Weather Design Threshold Level: 11.2 inches

SITE 7

I/I Summary: Event 1

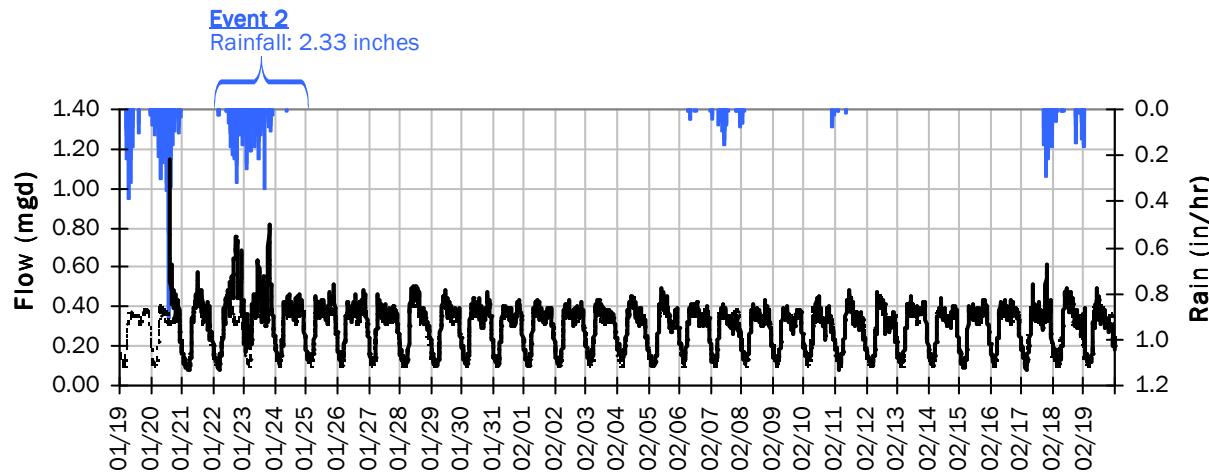
Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Event 1 Detail Graph

Storm Event I/I Analysis (Rain = 2.77 inches)

<u>Capacity</u>		<u>Inflow / Infiltration</u>	
Peak Flow:	1.15 mgd	Peak I/I Rate:	0.81 mgd
PF:	4.12	Total I/I:	36,000 gallons
Peak Level:	4.20 in		
d/D Ratio:	0.28		

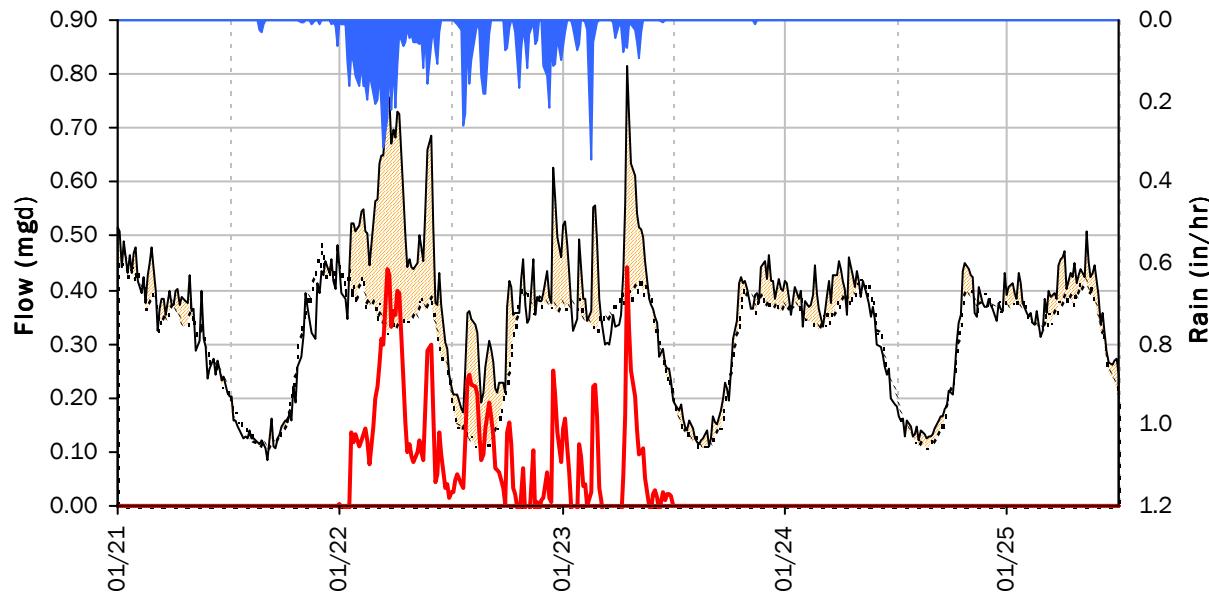
SITE 7

I/I Summary: Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Event 2 Detail Graph



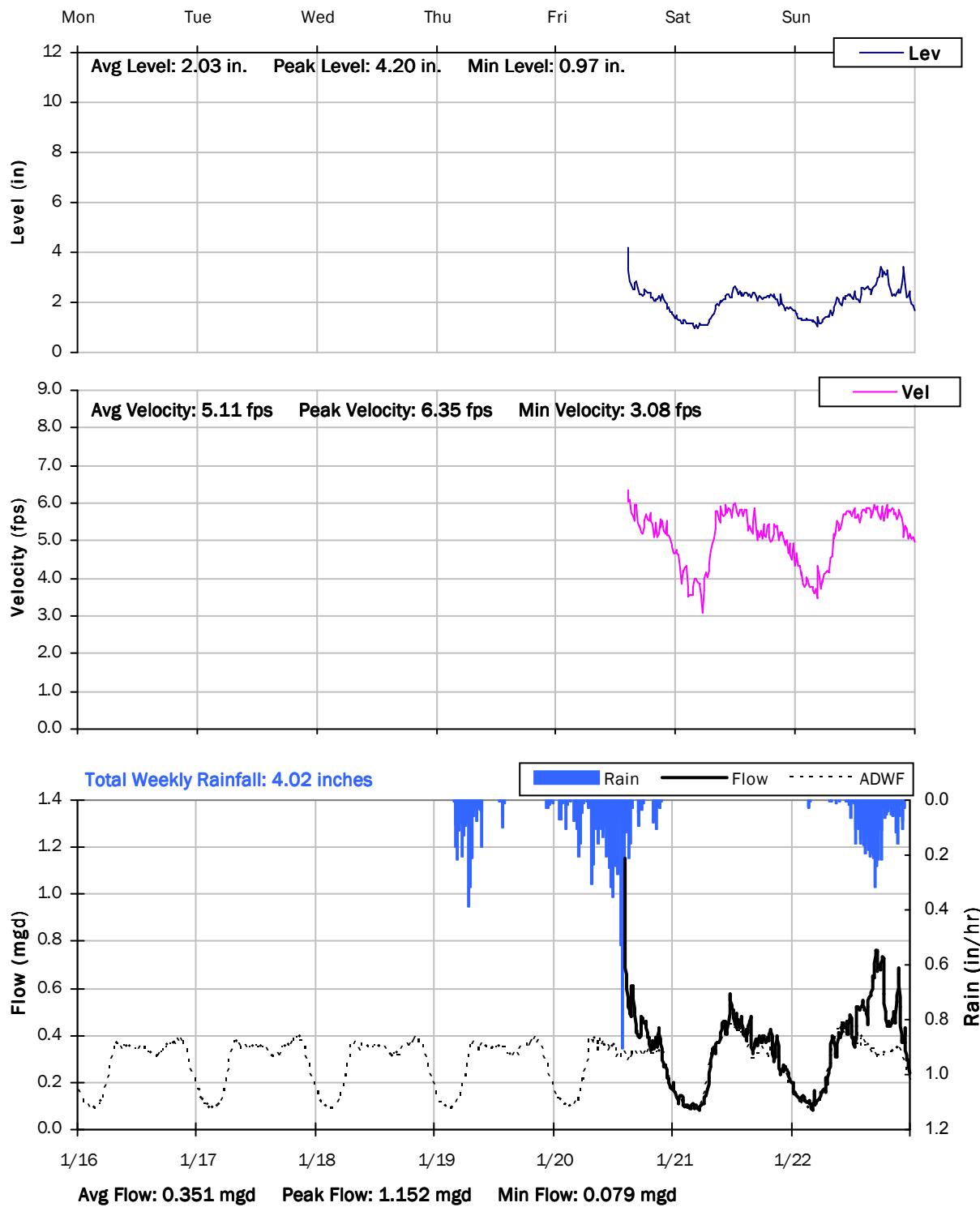
Storm Event I/I Analysis (Rain = 2.33 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.82 mgd	Peak I/I Rate:	0.44 mgd
PF:	2.92	Total I/I:	154,000 gallons
Peak Level:	3.46 in		
d/D Ratio:	0.23		

SITE 7

Weekly Level, Velocity and Flow Hydrographs

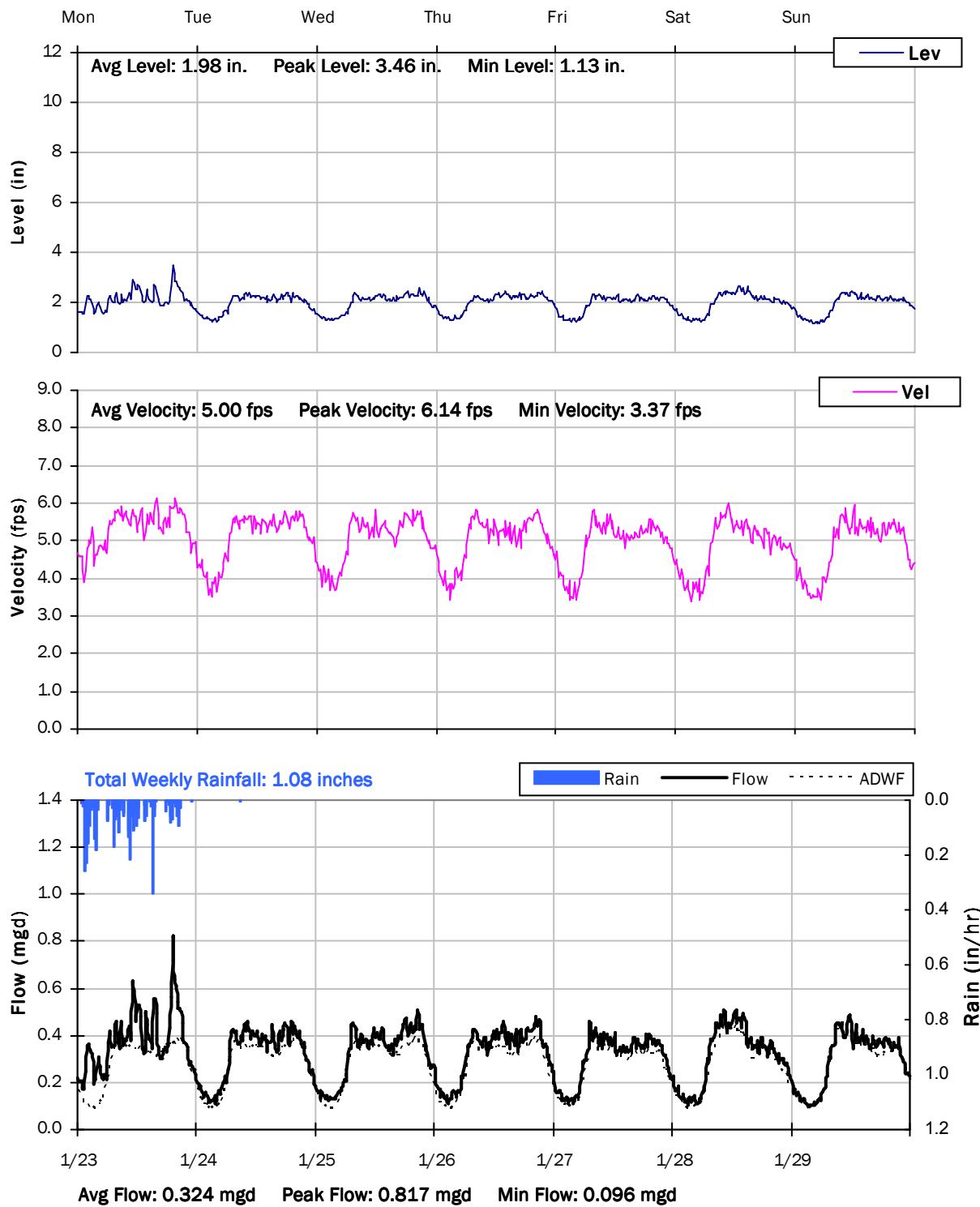
1/16/2017 to 1/23/2017



SITE 7

Weekly Level, Velocity and Flow Hydrographs

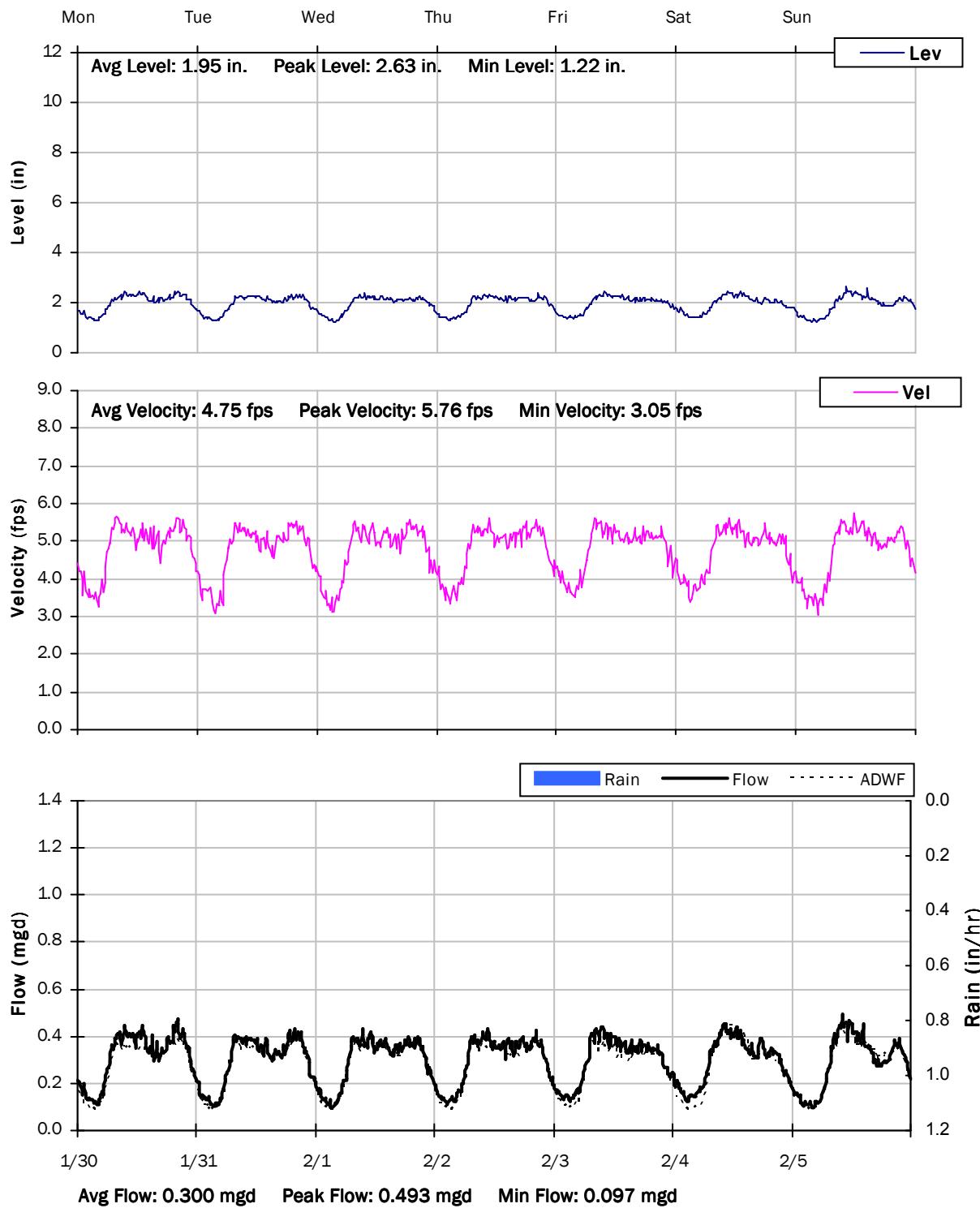
1/23/2017 to 1/30/2017



SITE 7

Weekly Level, Velocity and Flow Hydrographs

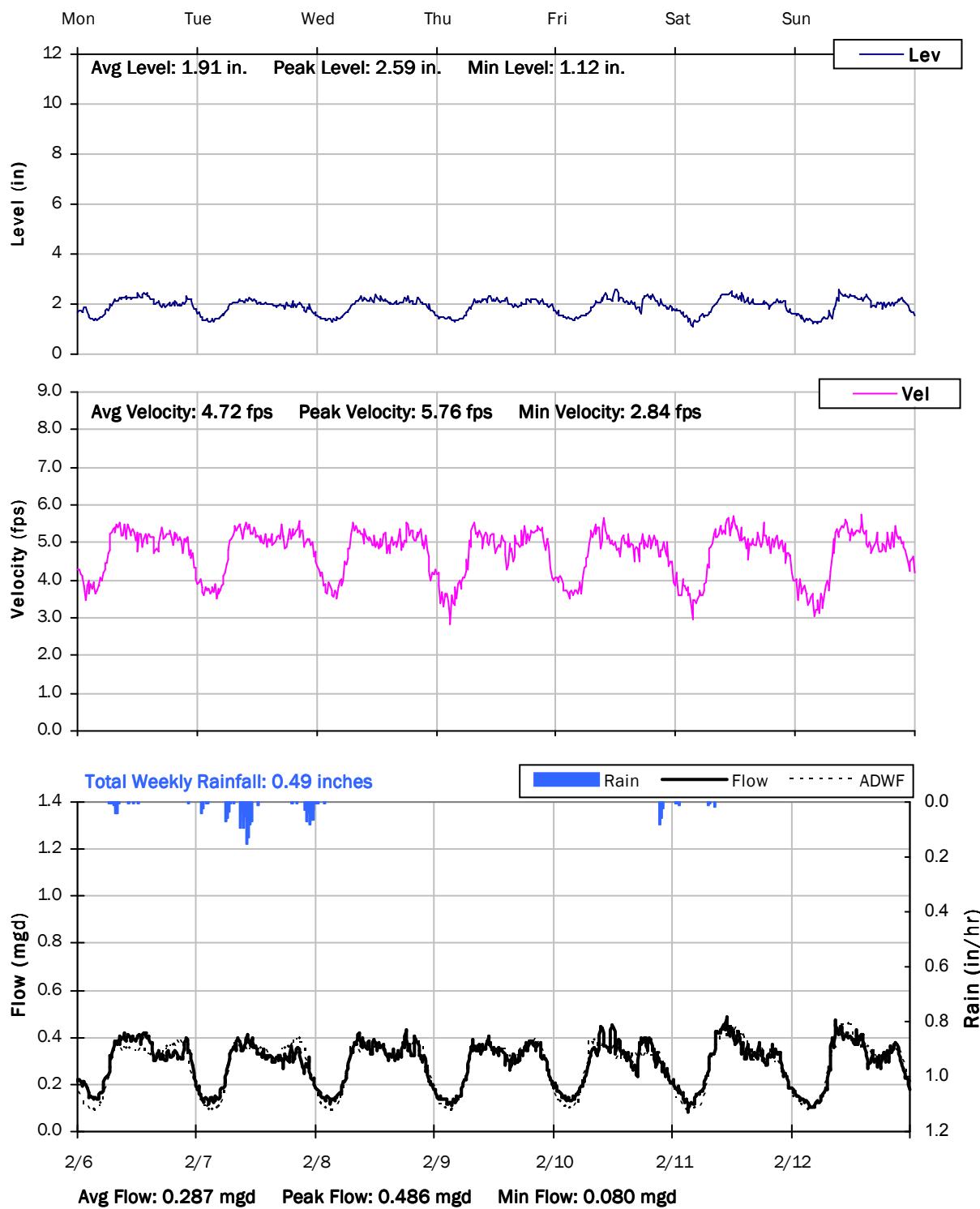
1/30/2017 to 2/6/2017



SITE 7

Weekly Level, Velocity and Flow Hydrographs

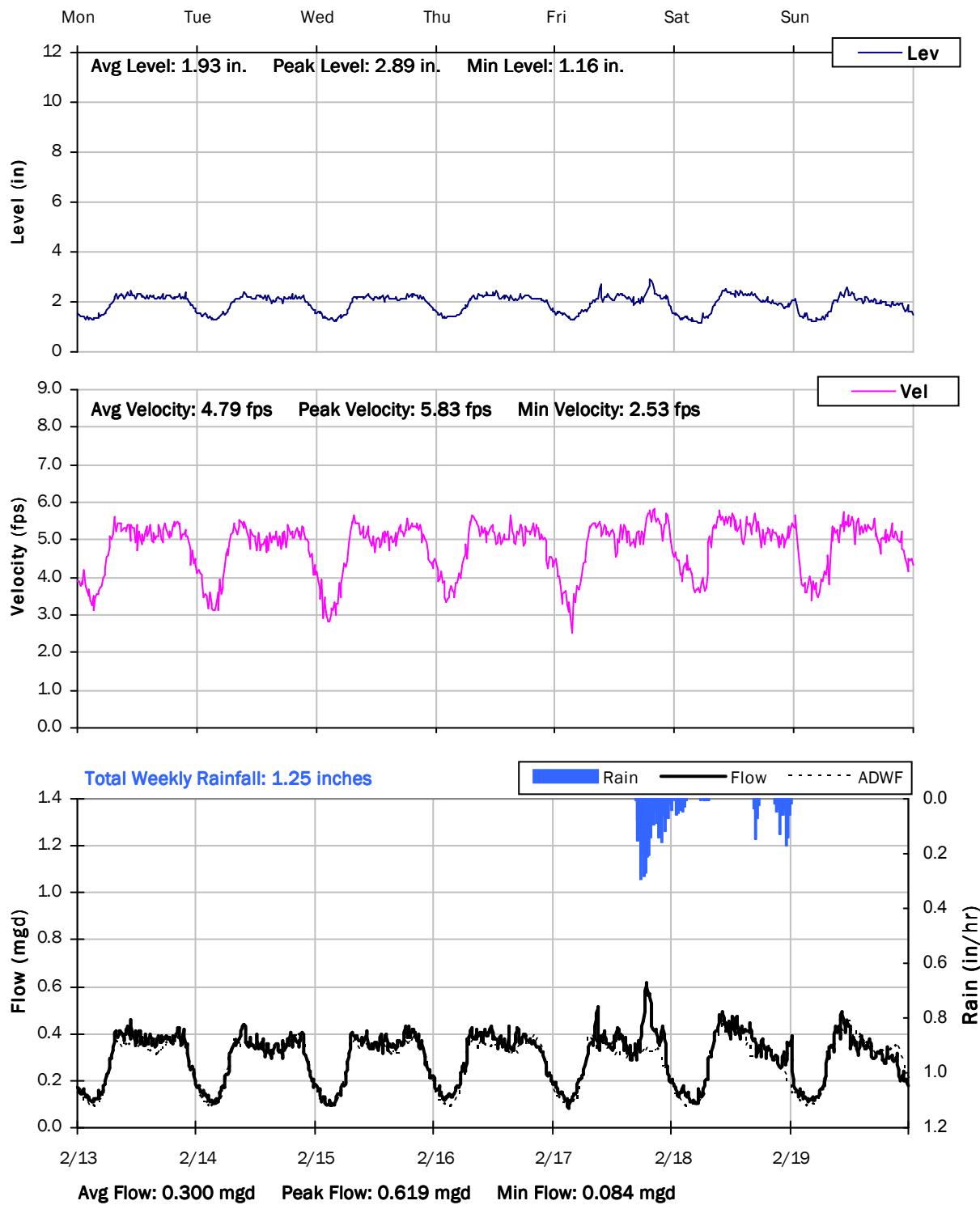
2/6/2017 to 2/13/2017



SITE 7

Weekly Level, Velocity and Flow Hydrographs

2/13/2017 to 2/20/2017



City of Banning

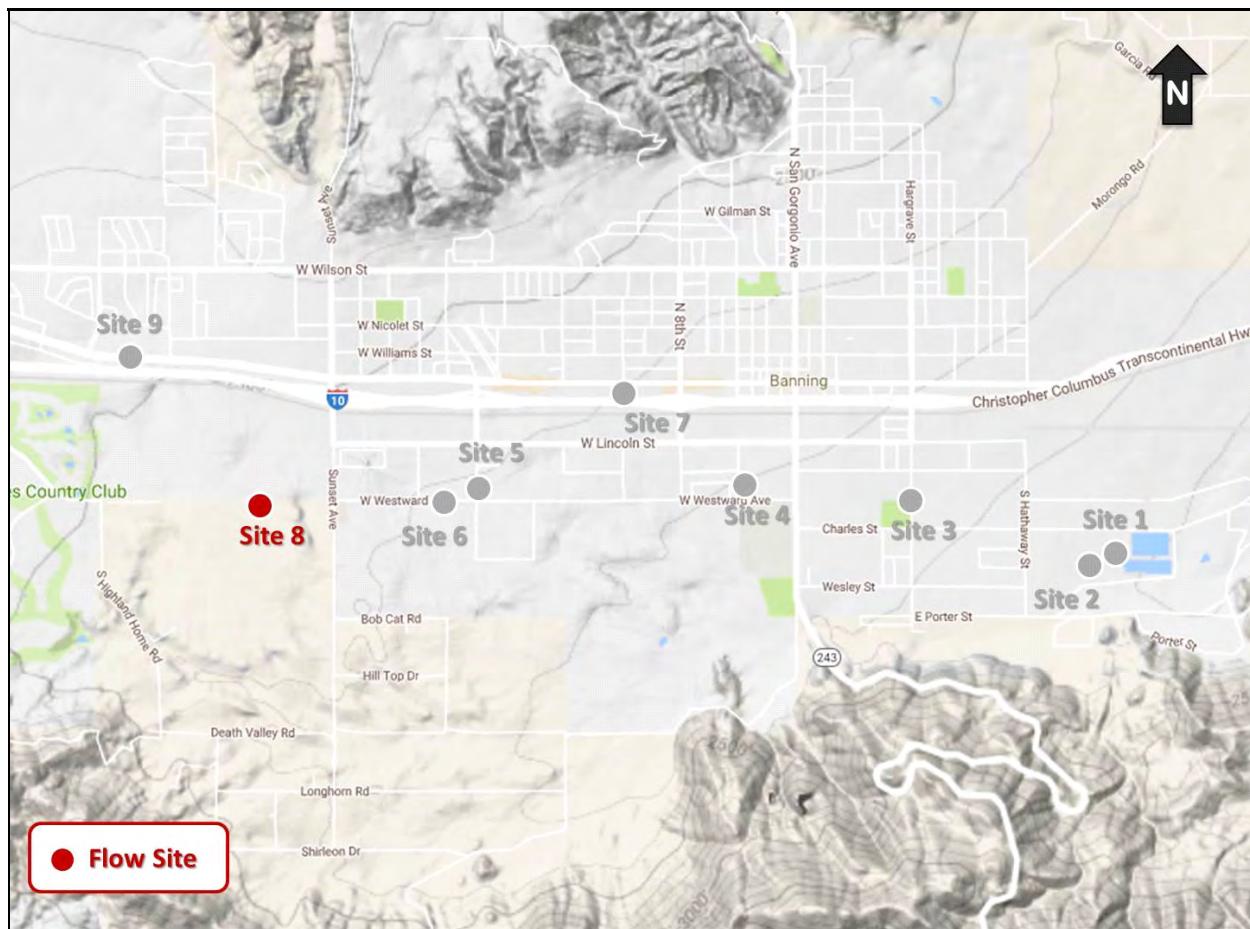
Sanitary Sewer Flow Monitoring

Temporary Monitoring: January 2017 - February 2017

Monitoring Site: Site 8

Location: Westward Avenue west of Sunset Avenue

Data Summary Report



Vicinity Map: Site 8

SITE 8

Site Information

Location: Westward Avenue west of Sunset Avenue

Coordinates: 116.9166° W, 33.9180° N

Expected Pipe Diameter: 12 inches

Measured Pipe Diameter: 12 inches

ADWF: 0.503 mgd

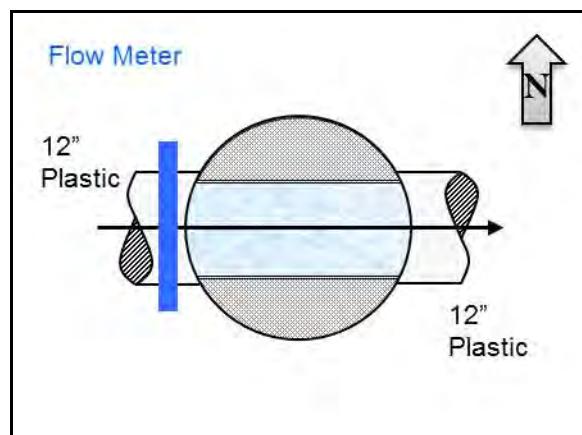
Peak Measured Flow: 1.242 mgd



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

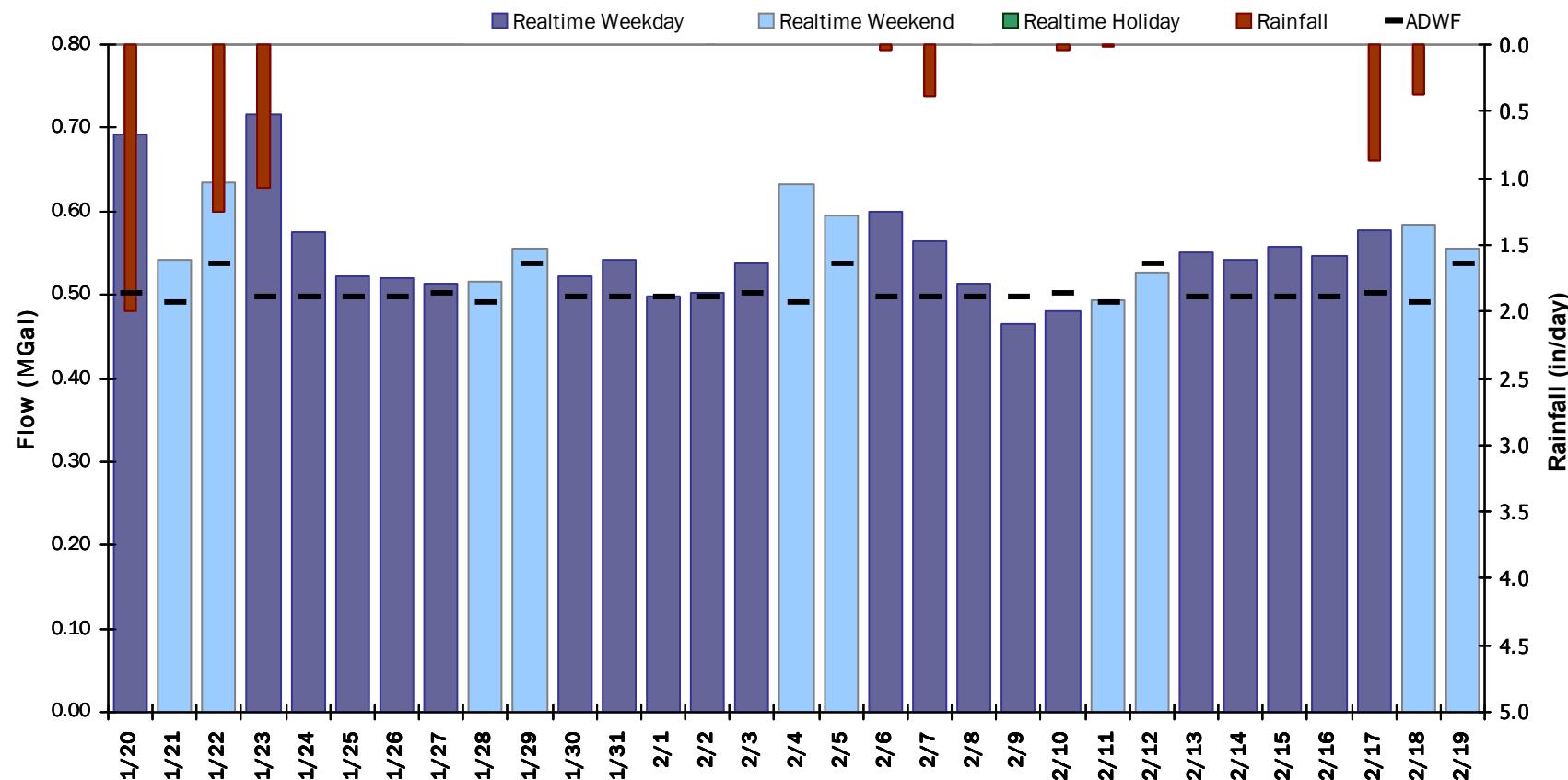
SITE 8**Additional Site Photos****Effluent Pipe****Influent Pipe**

SITE 8

Period Flow Summary: Daily Flow Totals

Avg Period Flow: 0.554 MGal Peak Daily Flow: 0.715 MGal Min Daily Flow: 0.465 MGal

Total Period Rainfall: 5.22 inches

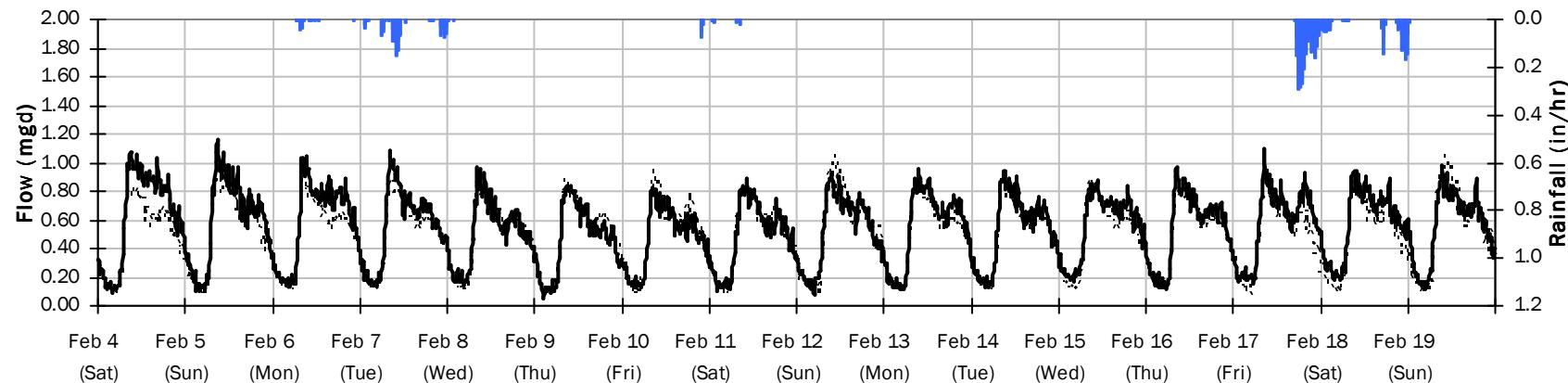
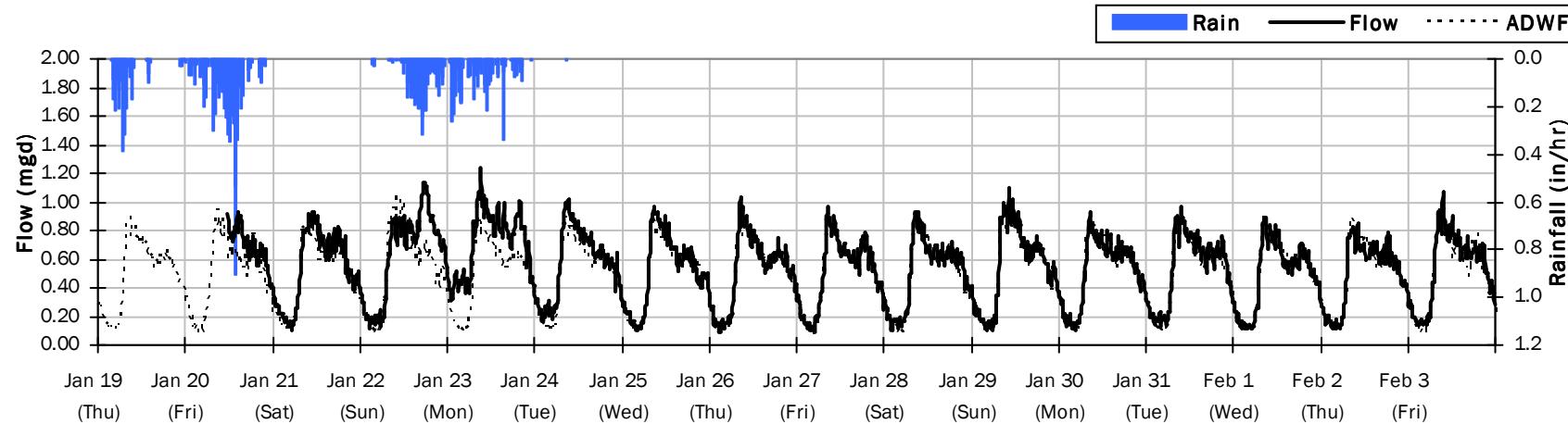


SITE 8

Flow Summary: 1/19/2017 to 2/19/2017

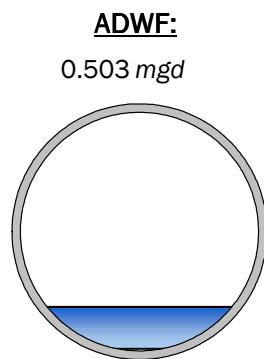
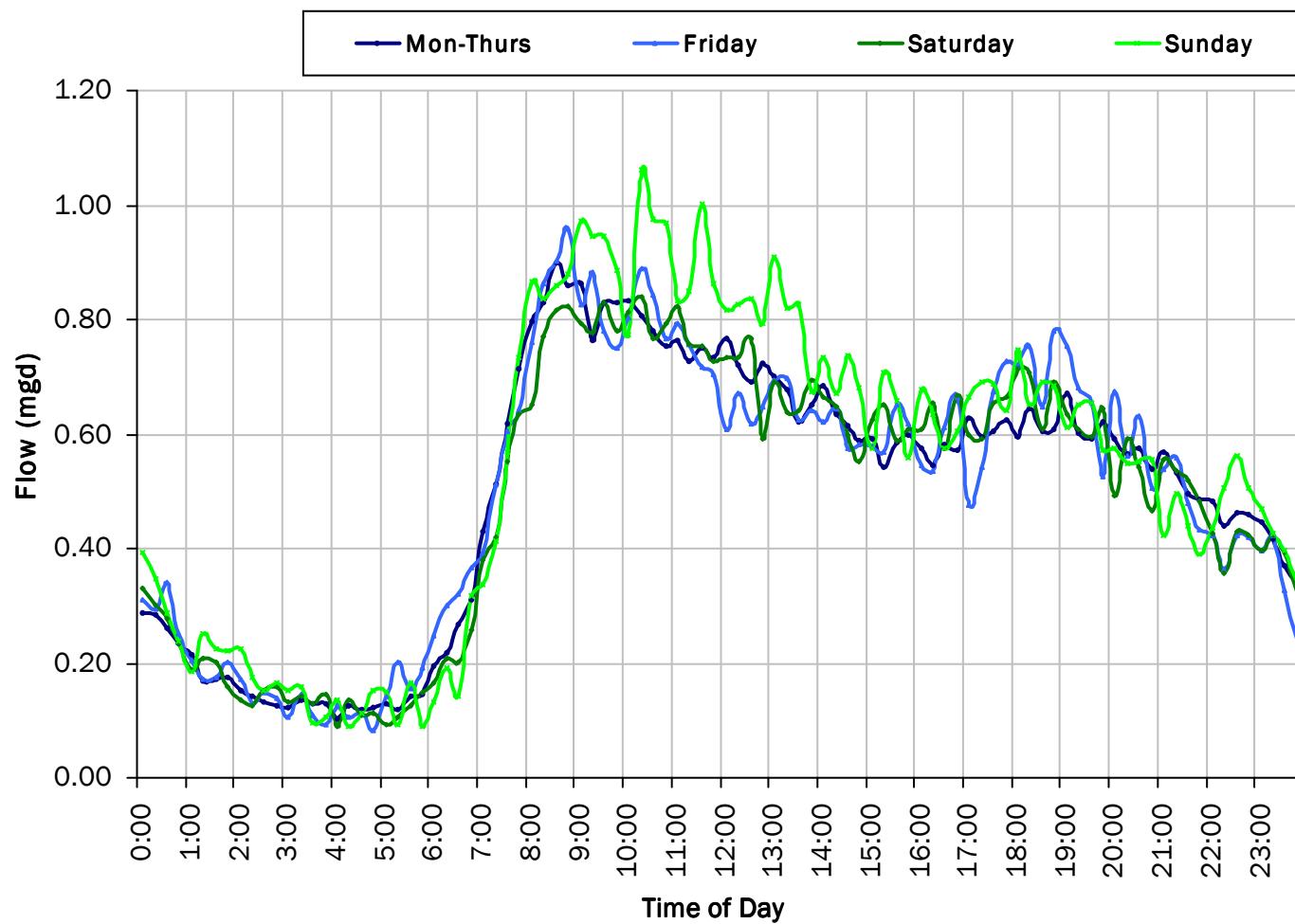
Total Period Rainfall: 6.84 inches

Avg Flow: 0.552 mgd Peak Flow: 1.242 mgd Min Flow: 0.057 mgd



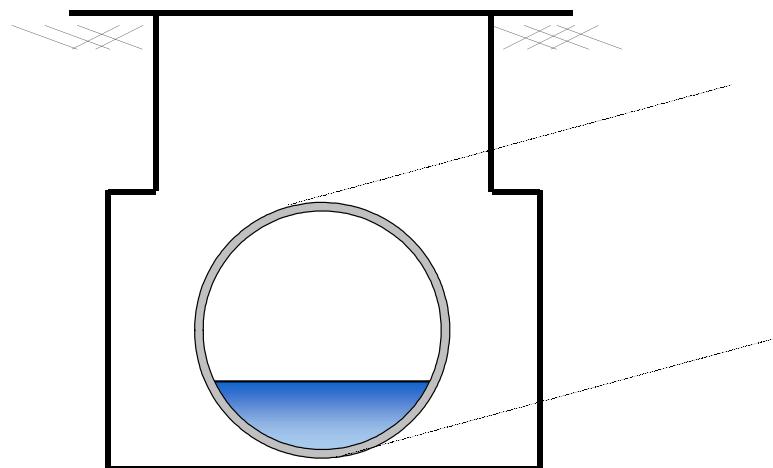
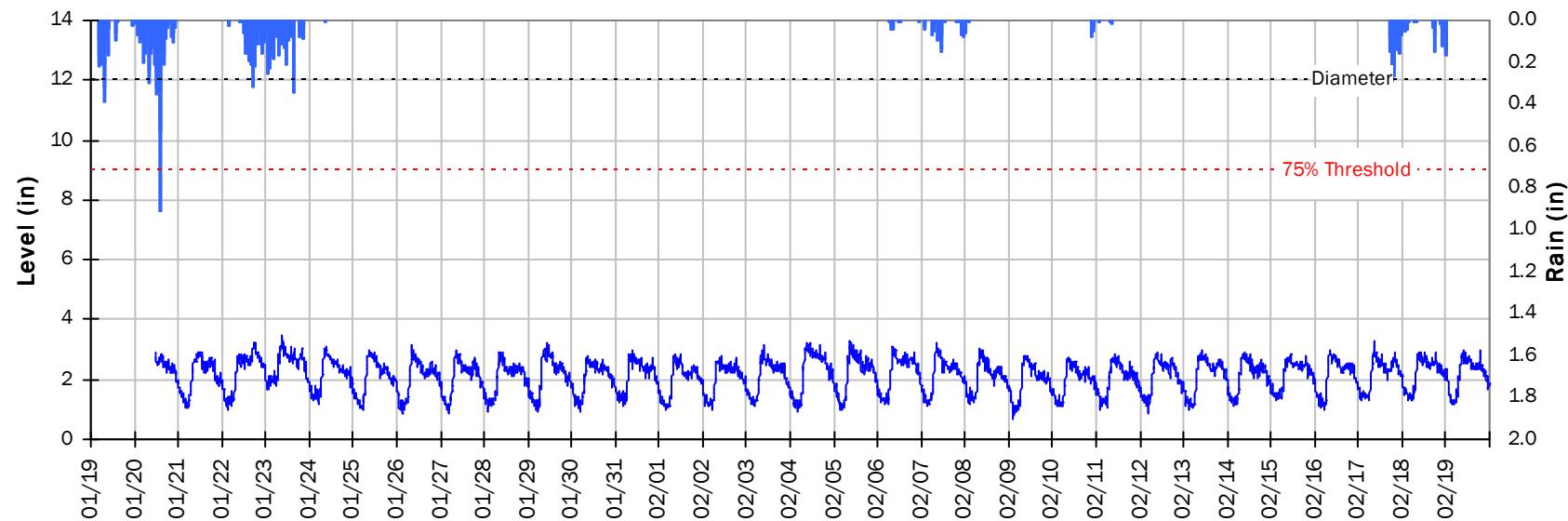
SITE 8

Average Dry Weather Flow Hydrographs



SITE 8

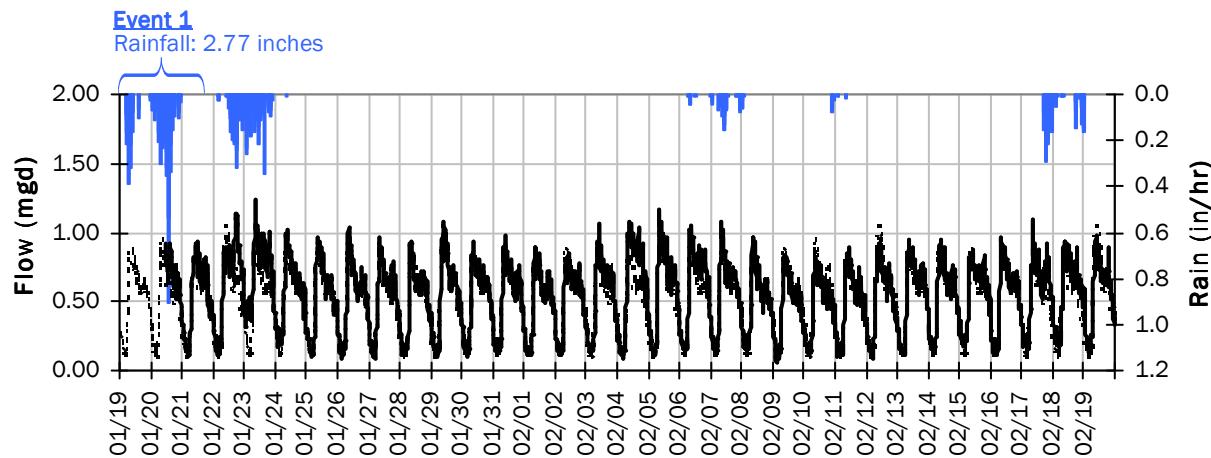
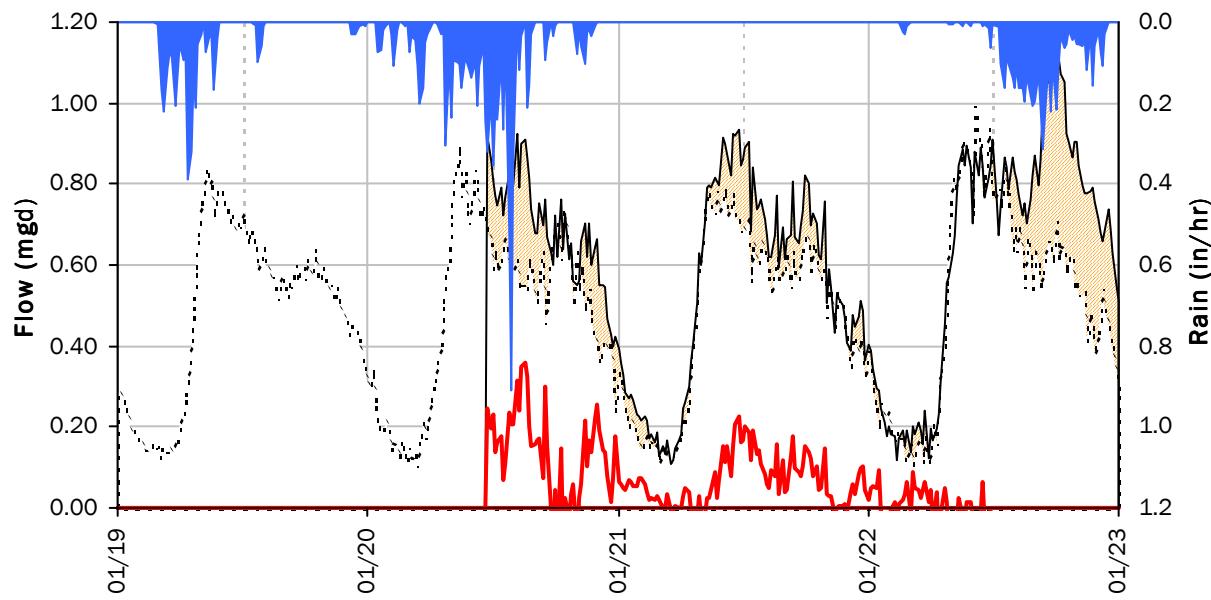
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Monitoring Period

Pipe Diameter: 12 *inches*
Peak Measured Level: 3.46 *inches*
Peak d/D Ratio: 0.29
Dry Weather Design Threshold Level: 6.00 *inches*

SITE 8

I/I Summary: Event 1

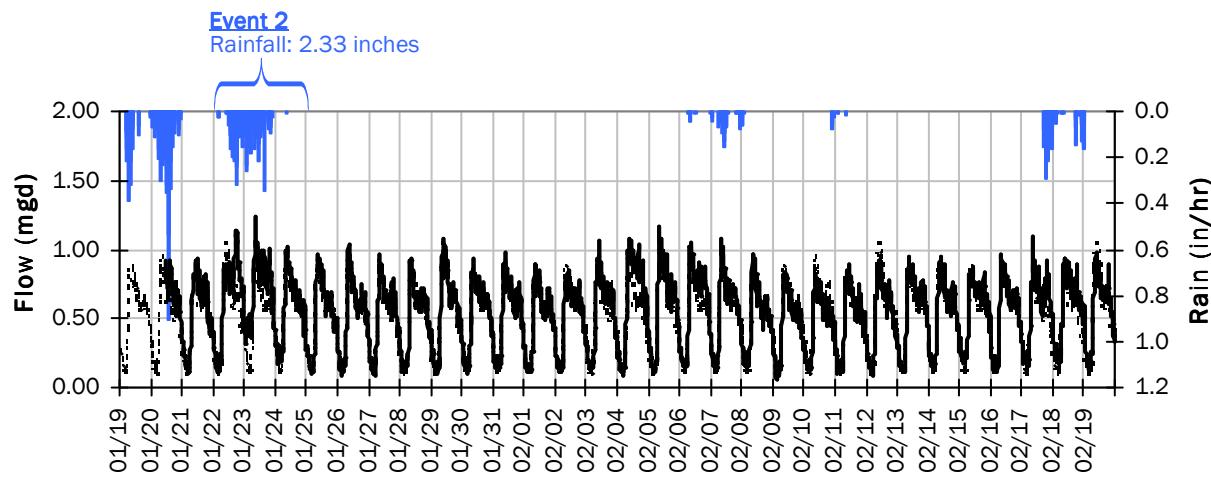
Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Event 1 Detail Graph

Storm Event I/I Analysis (Rain = 2.77 inches)

<u>Capacity</u>	<u>Inflow / Infiltration</u>		
Peak Flow:	0.93 mgd	Peak I/I Rate:	0.36 mgd
PF:	1.85	Total I/I:	137,000 gallons
Peak Level:	2.93 in		
d/D Ratio:	0.24		

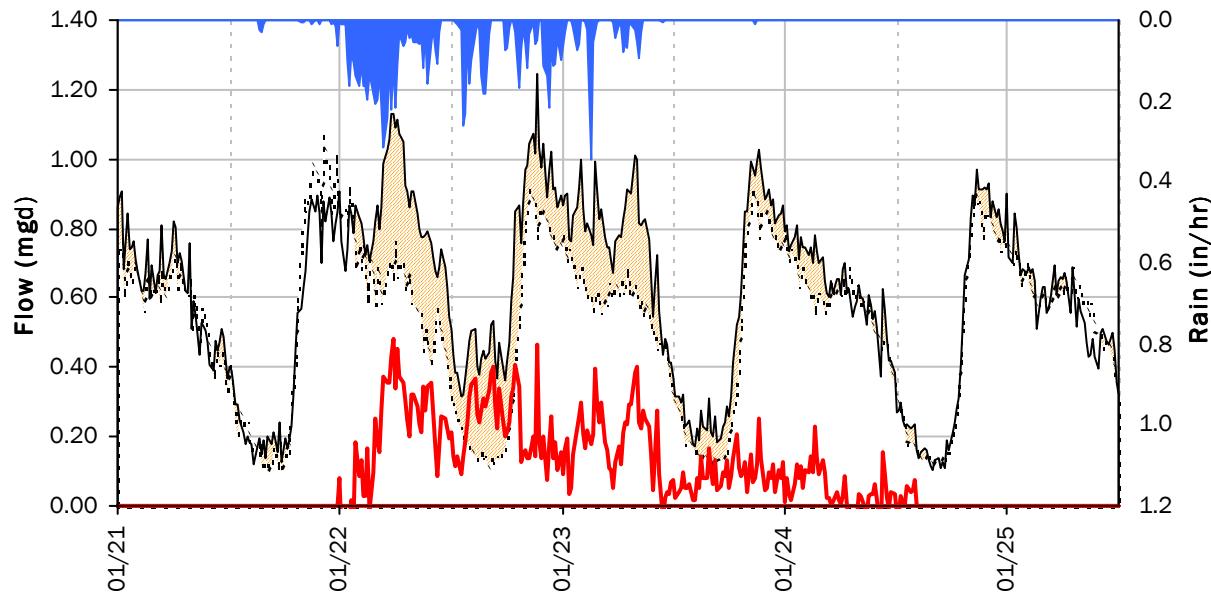
SITE 8

I/I Summary: Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Event 2 Detail Graph



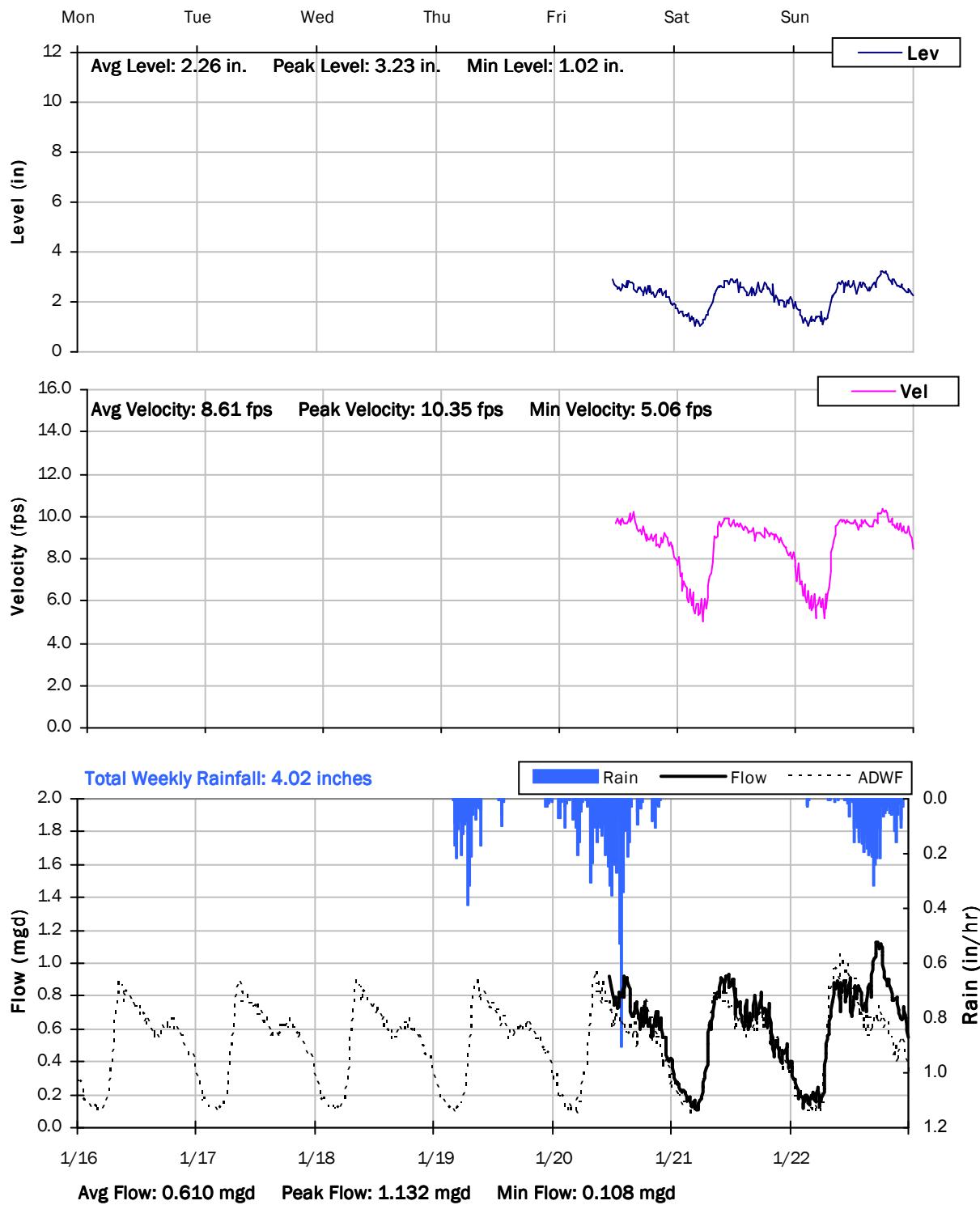
Storm Event I/I Analysis (Rain = 2.33 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	1.24 mgd	Peak I/I Rate:	0.48 mgd
PF:	2.47	Total I/I:	381,000 gallons
Peak Level:	3.46 in		
d/D Ratio:	0.29		

SITE 8

Weekly Level, Velocity and Flow Hydrographs

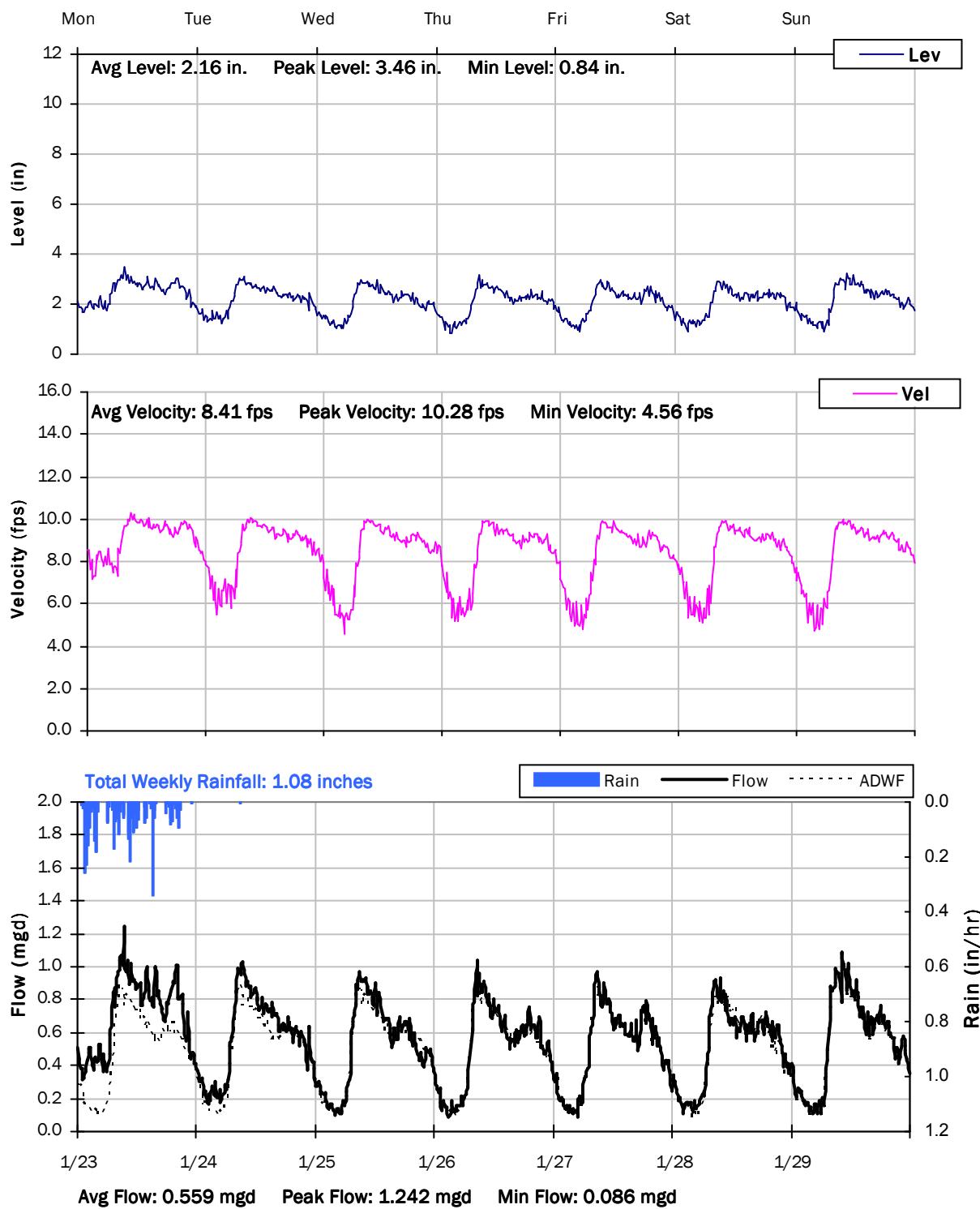
1/16/2017 to 1/23/2017



SITE 8

Weekly Level, Velocity and Flow Hydrographs

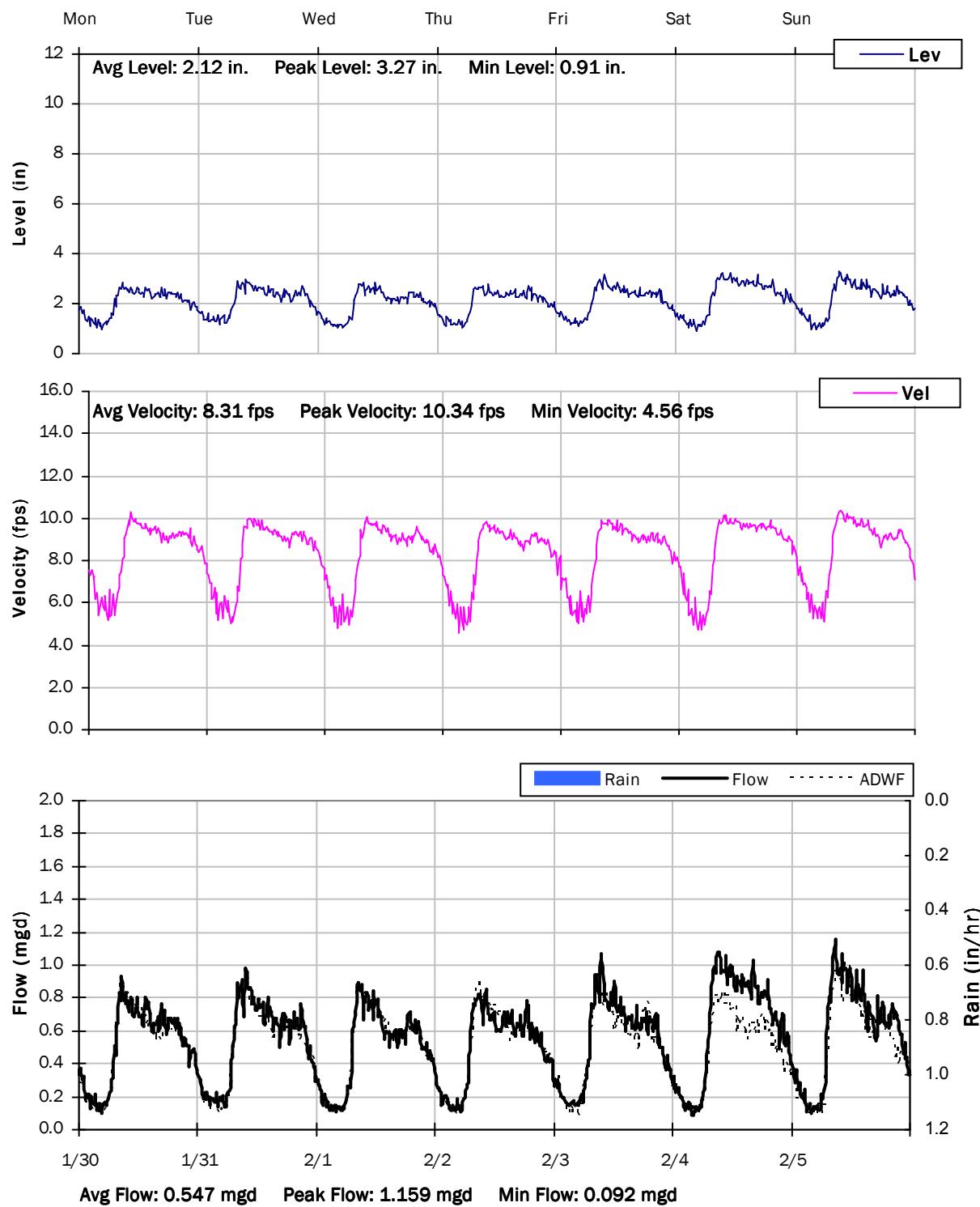
1/23/2017 to 1/30/2017



SITE 8

Weekly Level, Velocity and Flow Hydrographs

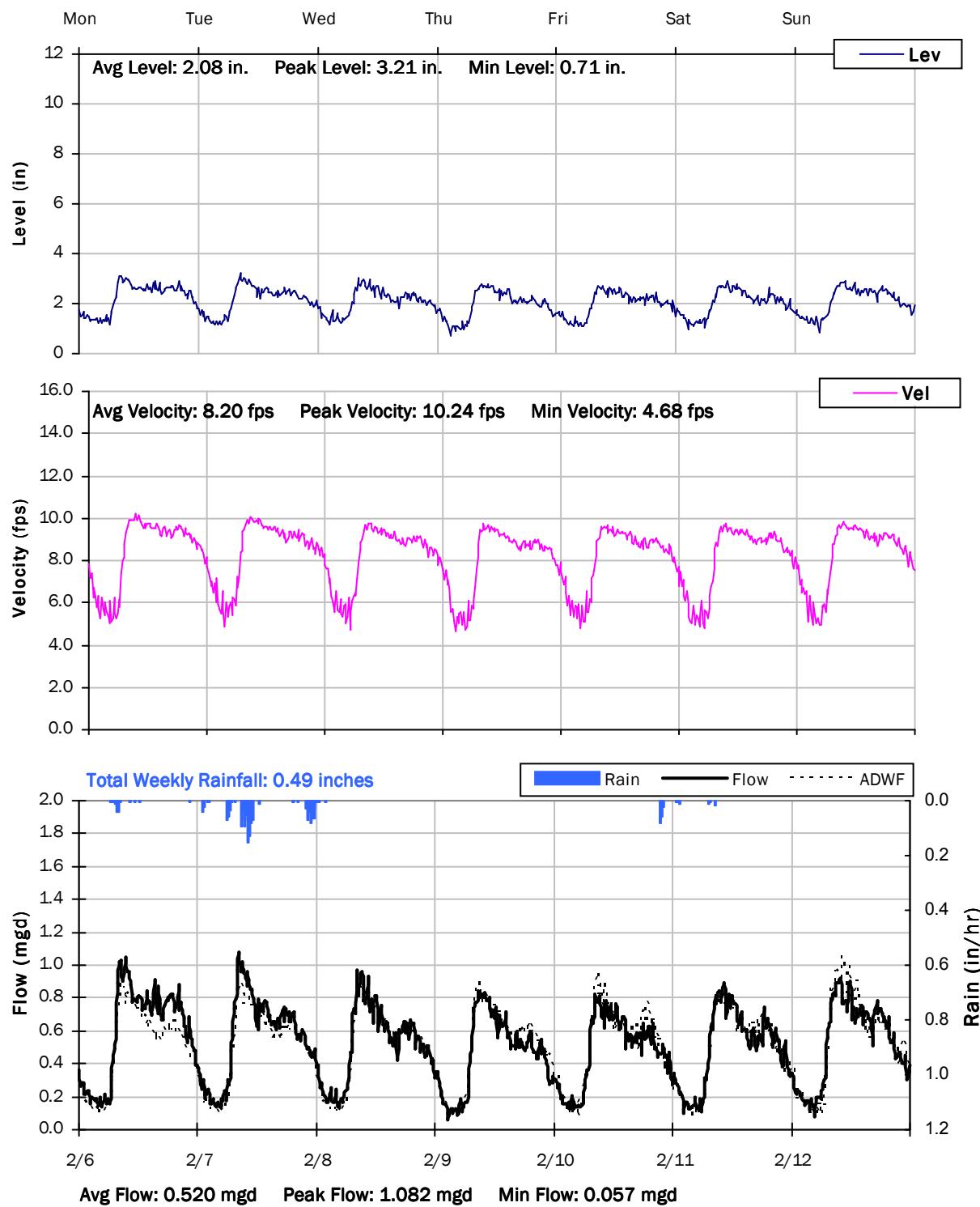
1/30/2017 to 2/6/2017



SITE 8

Weekly Level, Velocity and Flow Hydrographs

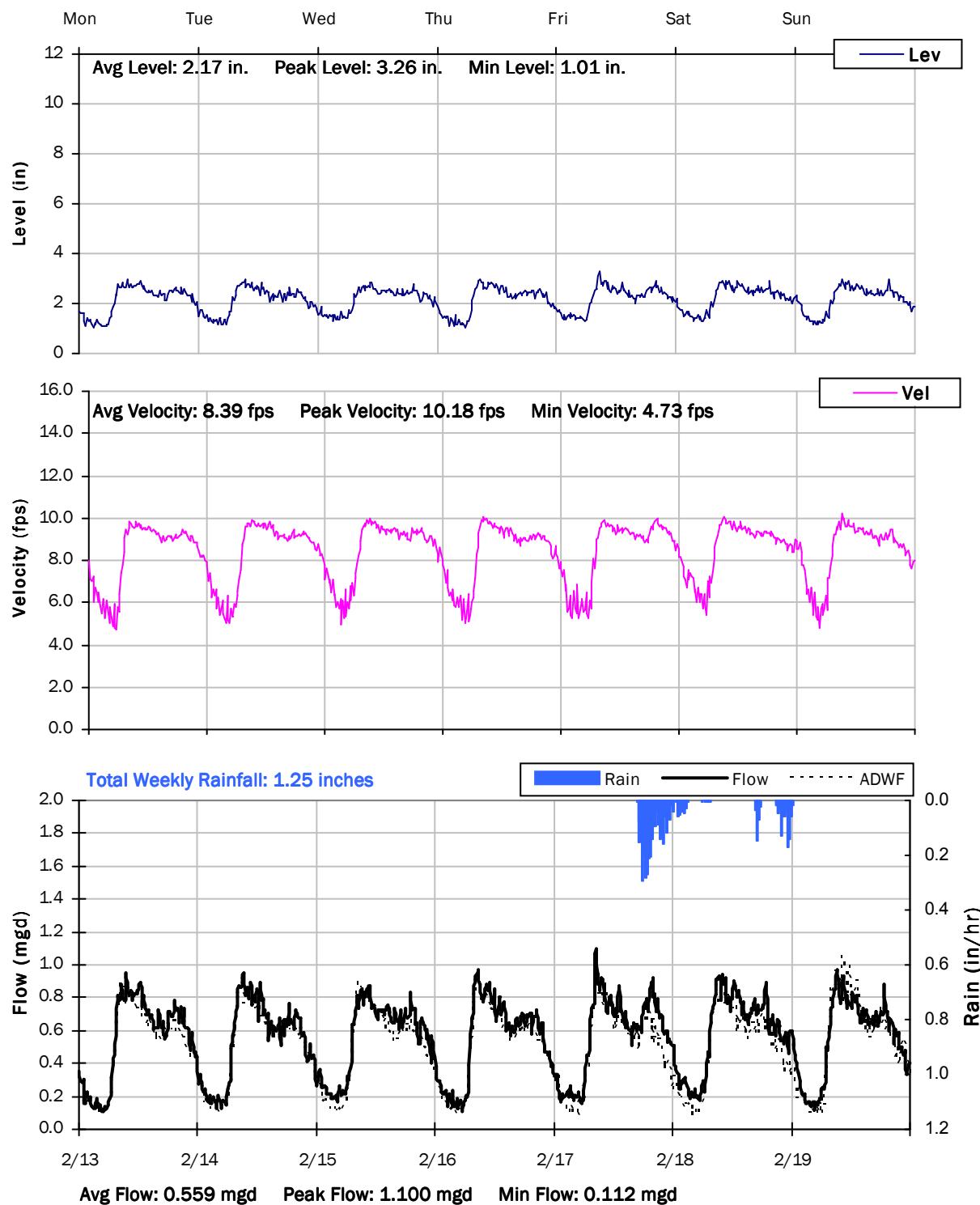
2/6/2017 to 2/13/2017



SITE 8

Weekly Level, Velocity and Flow Hydrographs

2/13/2017 to 2/20/2017



City of Banning

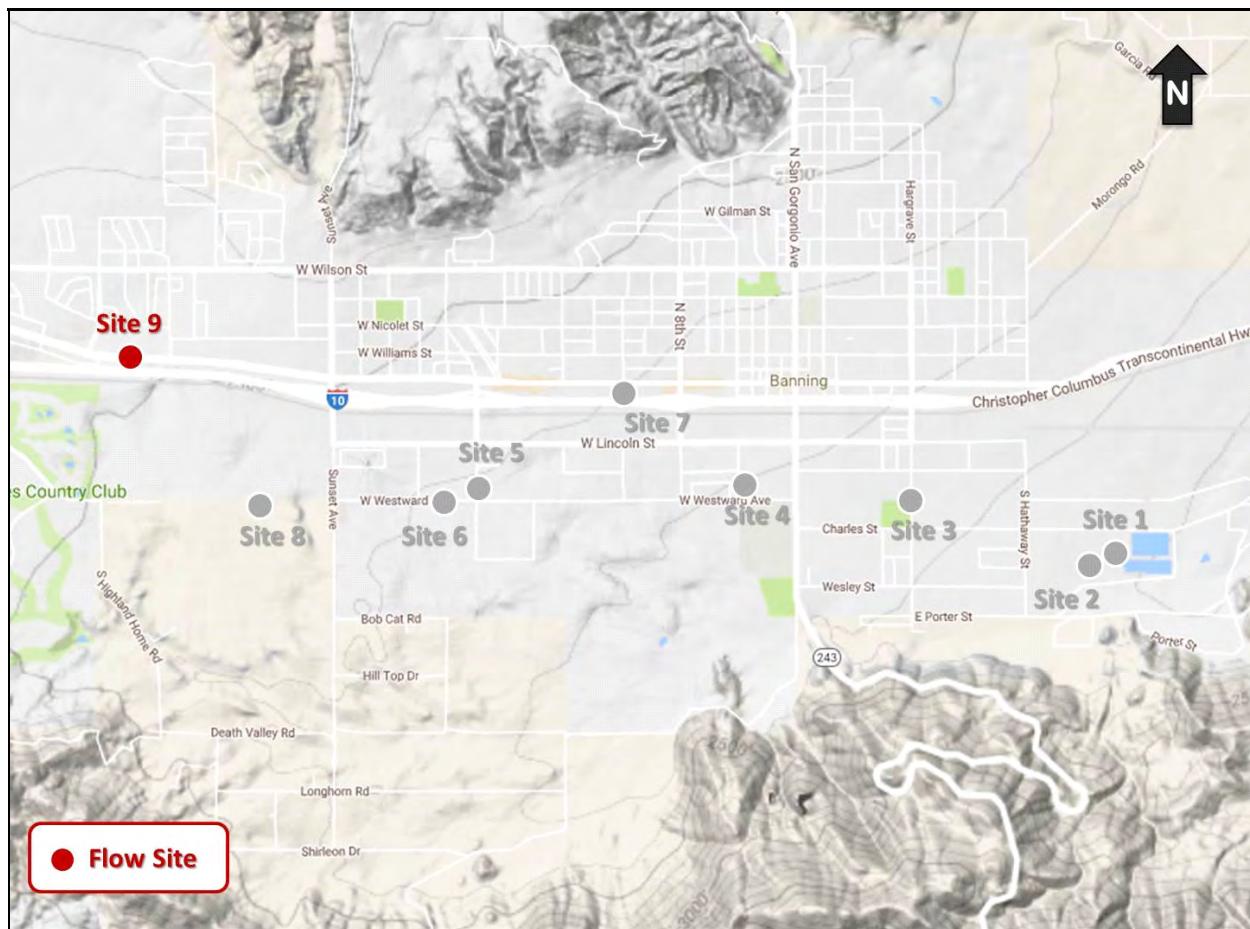
Sanitary Sewer Flow Monitoring

Temporary Monitoring: January 2017 - February 2017

Monitoring Site: Site 9

Location: 4545 W Ramsey Street

Data Summary Report



Vicinity Map: Site 9

SITE 9

Site Information

Location: 4545 W Ramsey Street

Coordinates: 116.9274° W, 33.9271° N

Expected Pipe Diameter: 12 inches

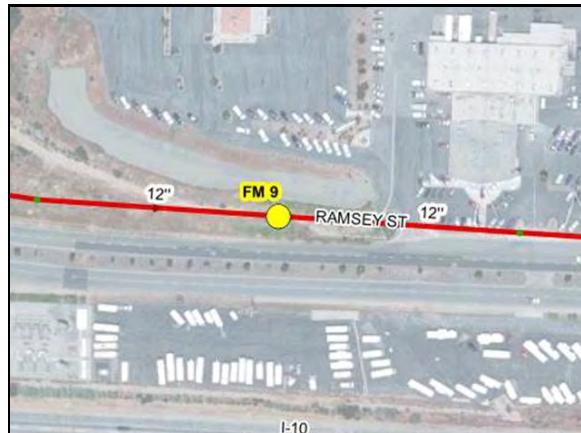
Measured Pipe Diameter: 12 inches

ADWF: 0.192 mgd

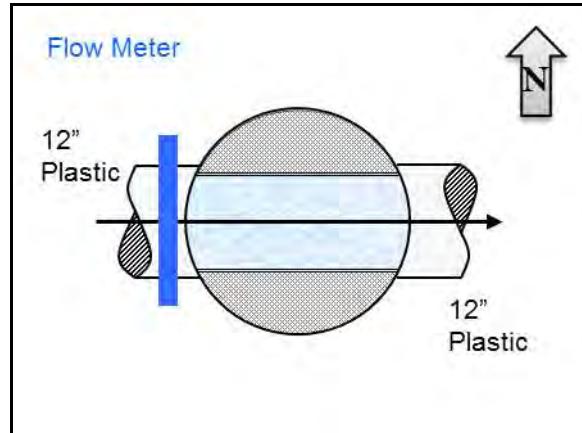
Peak Measured Flow: 0.722 mgd



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

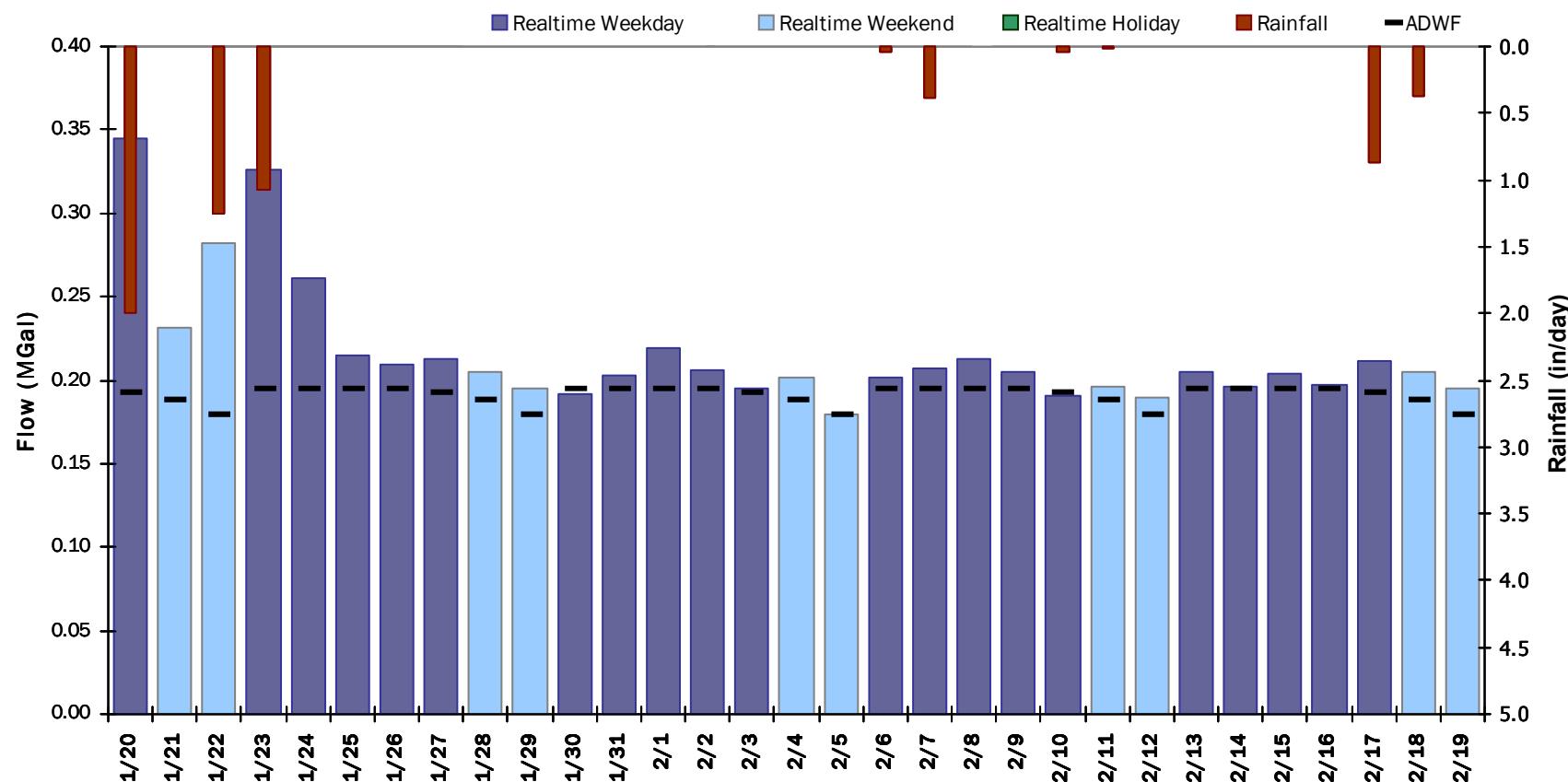
SITE 9**Additional Site Photos****Effluent Pipe****Influent Pipe**

SITE 9

Period Flow Summary: Daily Flow Totals

Avg Period Flow: 0.216 MGal Peak Daily Flow: 0.345 MGal Min Daily Flow: 0.179 MGal

Total Period Rainfall: 4.80 inches

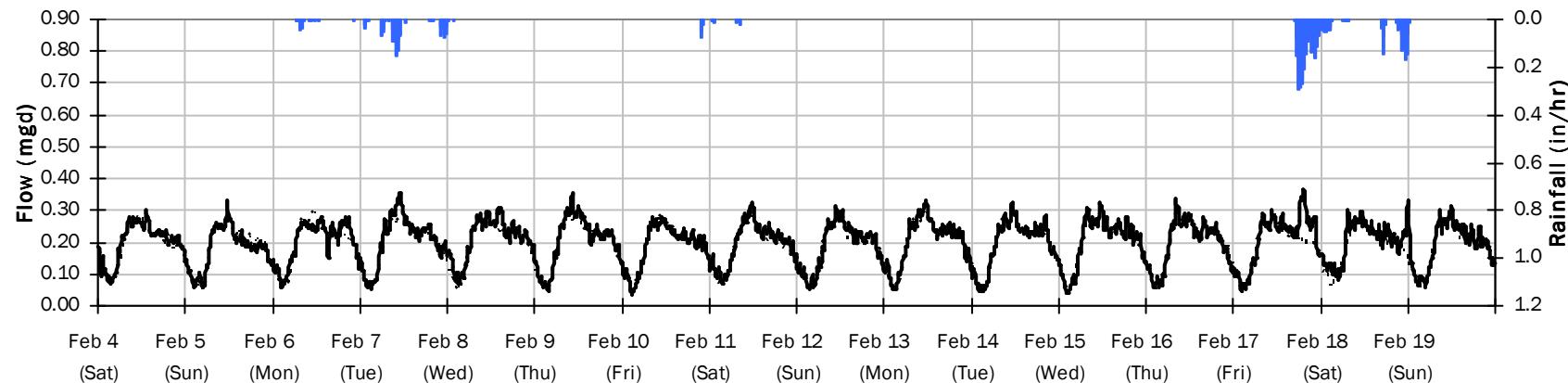
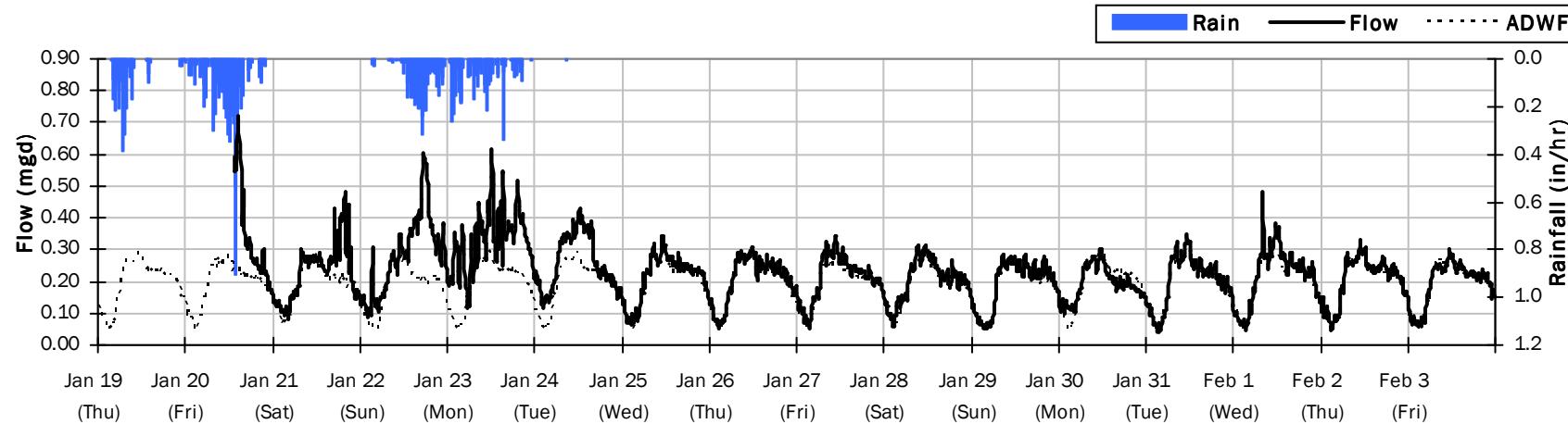


SITE 9

Flow Summary: 1/19/2017 to 2/19/2017

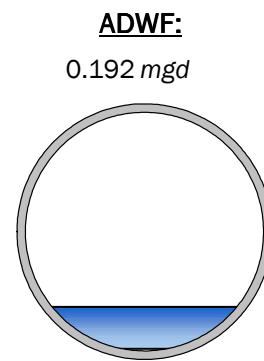
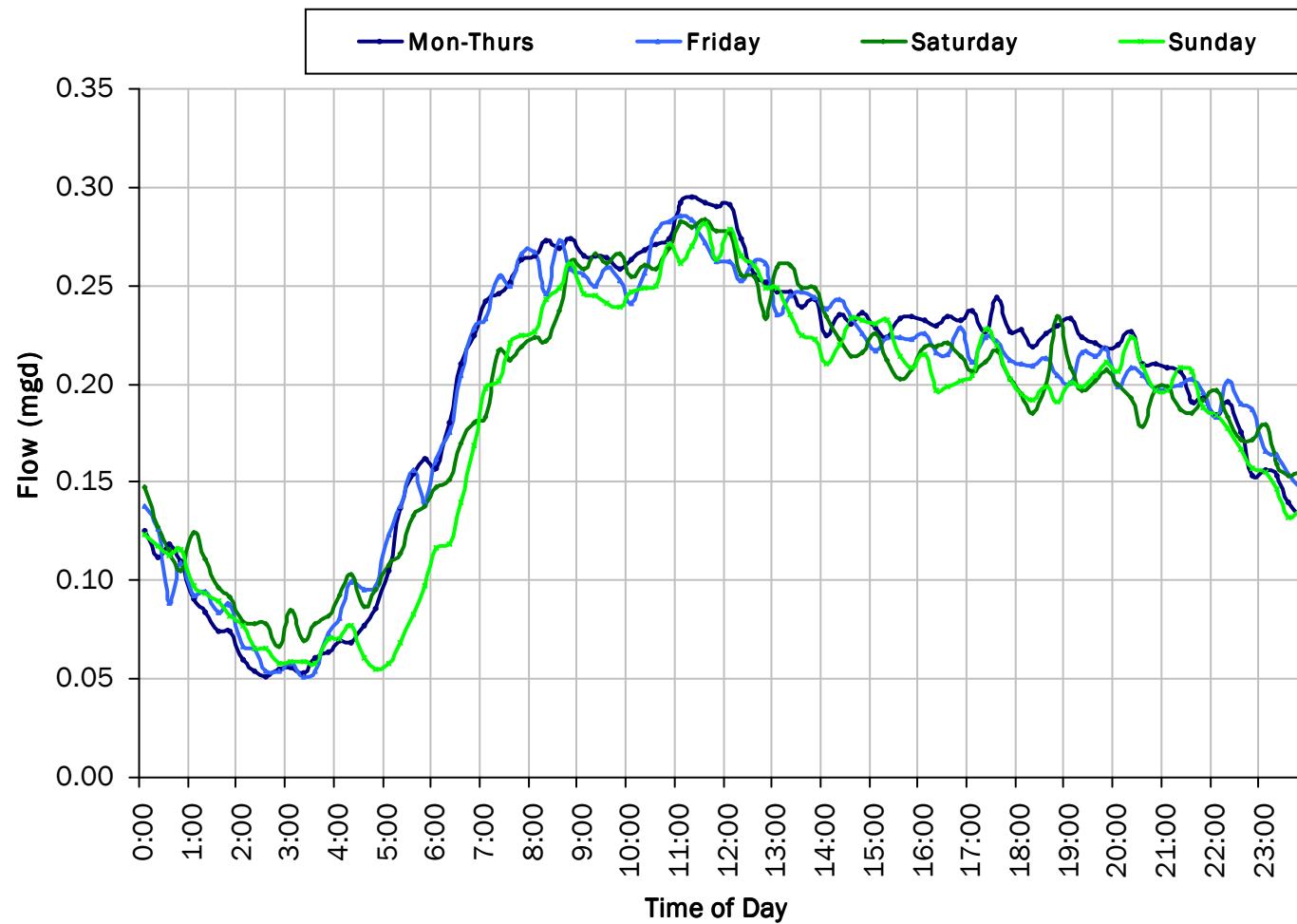
Total Period Rainfall: 6.84 inches

Avg Flow: 0.214 mgd Peak Flow: 0.722 mgd Min Flow: 0.036 mgd



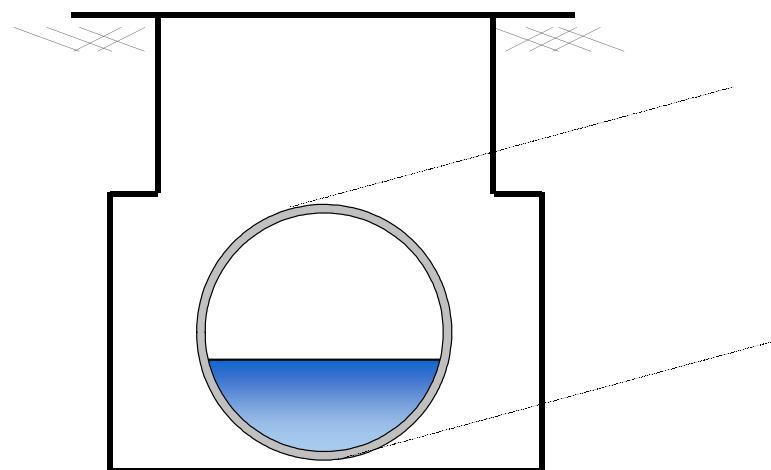
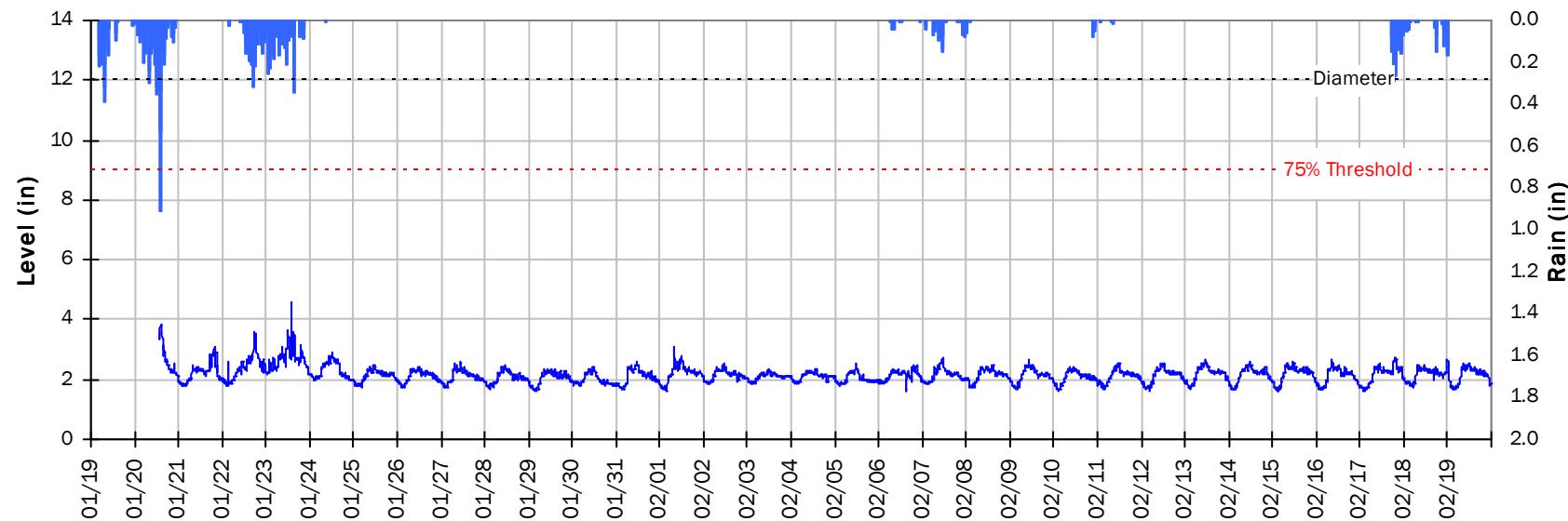
SITE 9

Average Dry Weather Flow Hydrographs



SITE 9

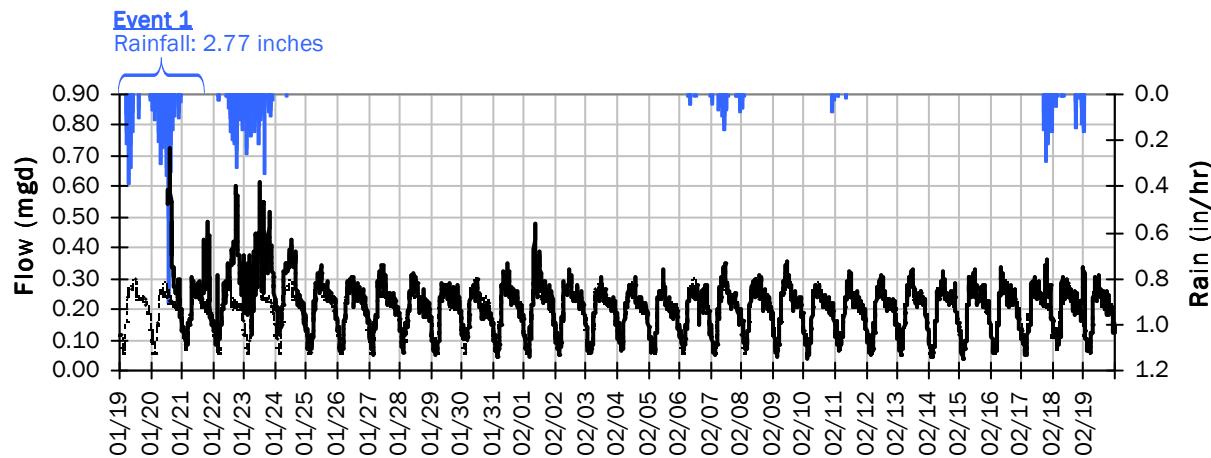
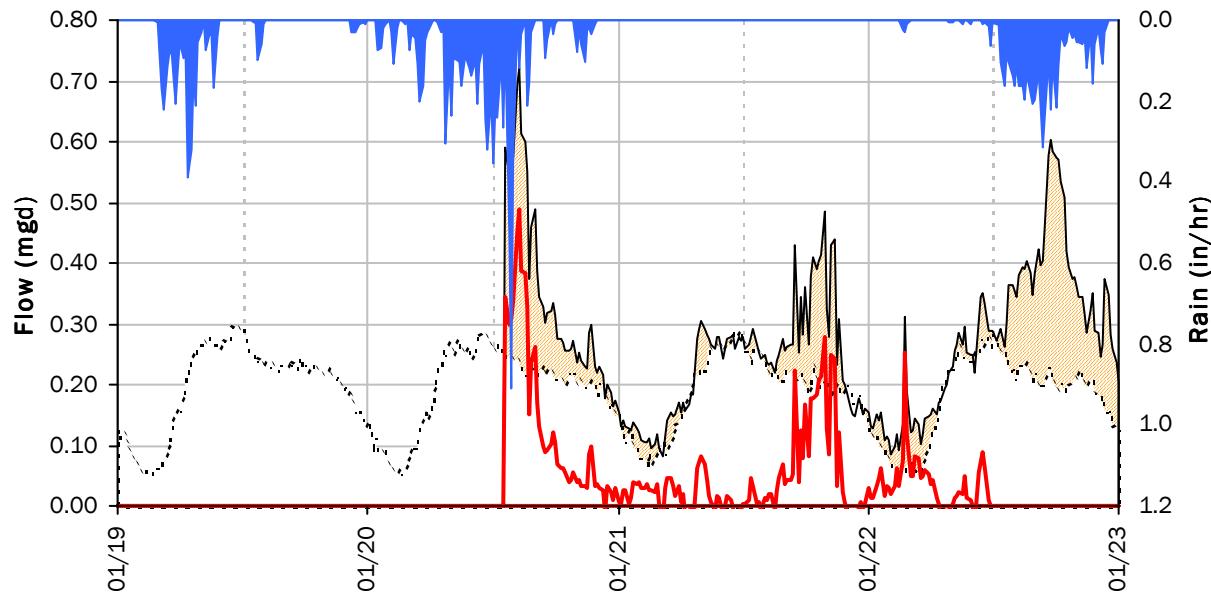
Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Monitoring Period

Pipe Diameter: 12 *inches*
Peak Measured Level: 4.6 *inches*
Peak d/D Ratio: 0.38
Dry Weather Design Threshold Level: 6.00 *inches*

SITE 9

I/I Summary: Event 1

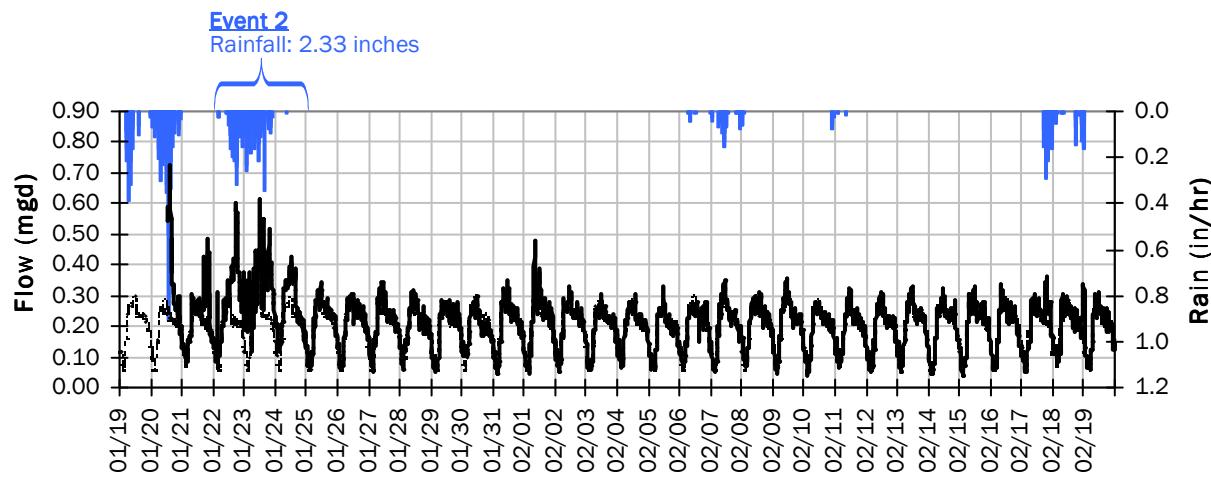
Baseline and Realtime Flows with Rainfall Data over Monitoring Period

Event 1 Detail Graph

Storm Event I/I Analysis (Rain = 2.77 inches)

Capacity	Inflow / Infiltration		
Peak Flow:	0.72 mgd	Peak I/I Rate:	0.49 mgd
PF:	3.77	Total I/I:	123,000 gallons
Peak Level:	3.82 in		
d/D Ratio:	0.32		

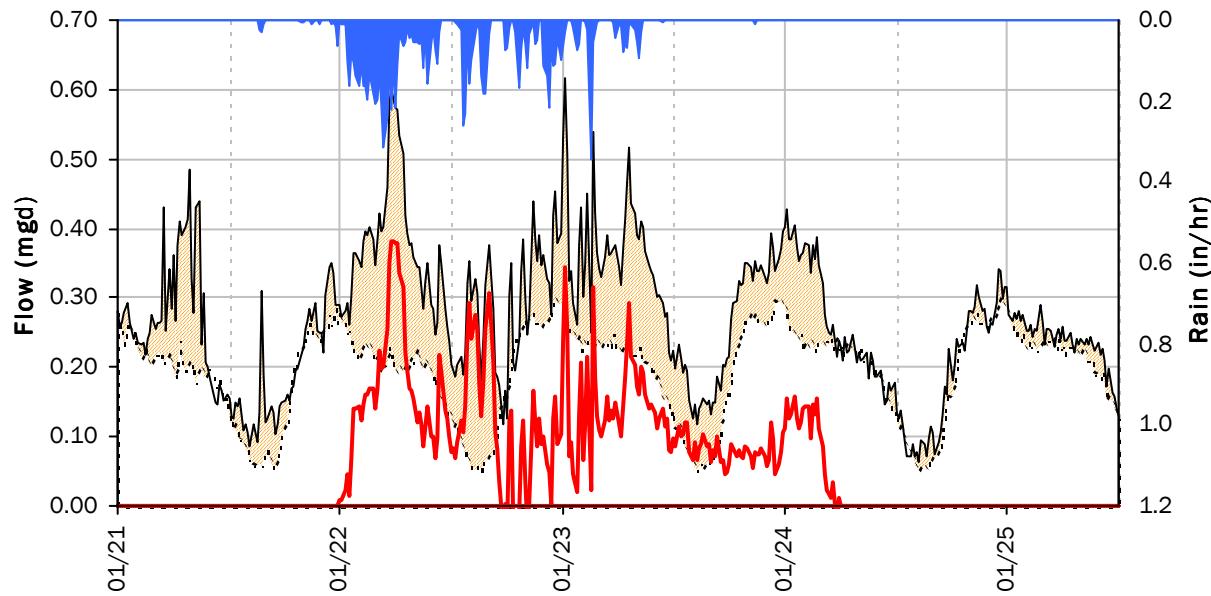
SITE 9

I/I Summary: Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Event 2 Detail Graph



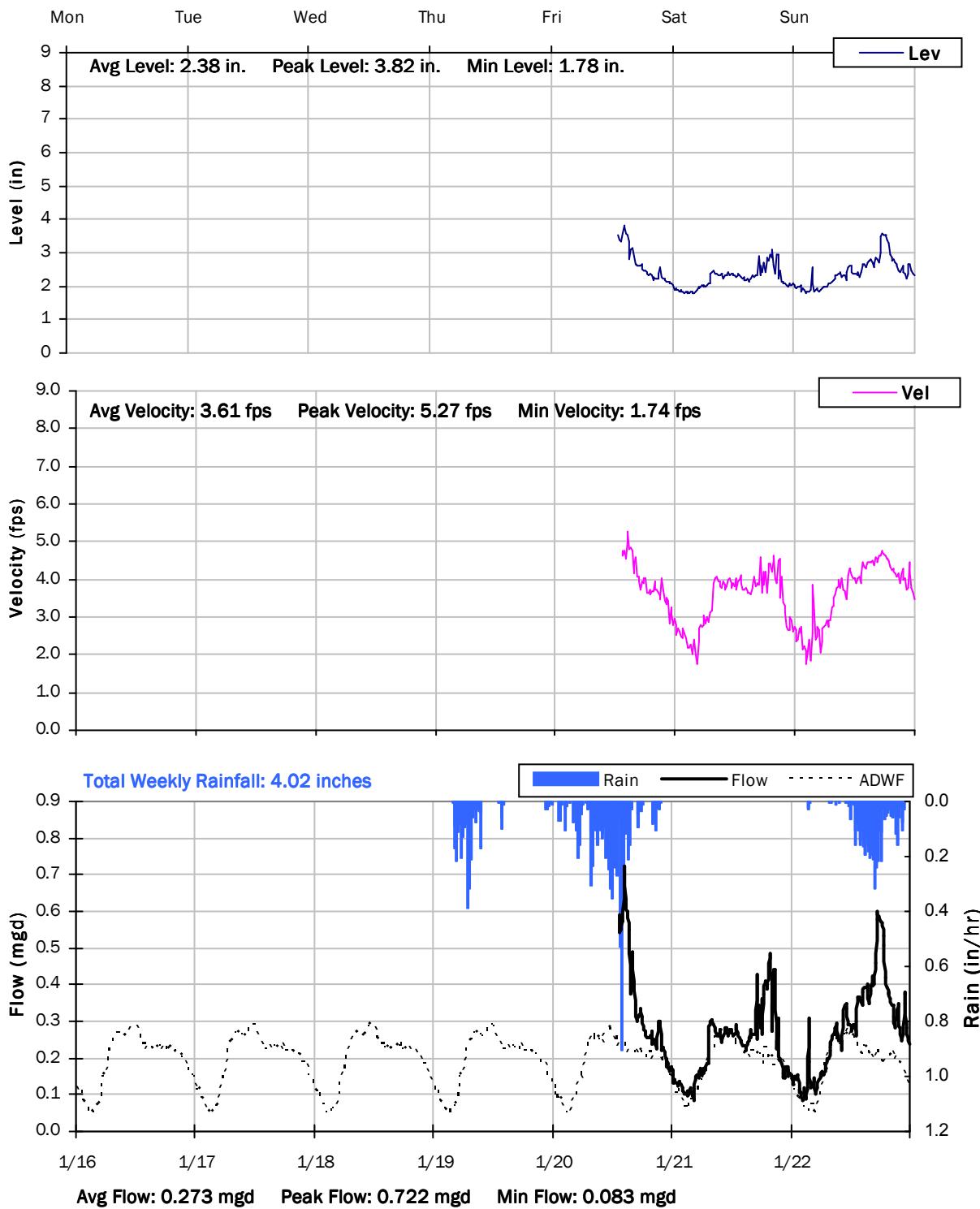
Storm Event I/I Analysis (Rain = 2.33 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.62 mgd	Peak I/I Rate:	0.38 mgd
PF:	3.22	Total I/I:	279,000 gallons
Peak Level:	4.60 in		
d/D Ratio:	0.38		

SITE 9

Weekly Level, Velocity and Flow Hydrographs

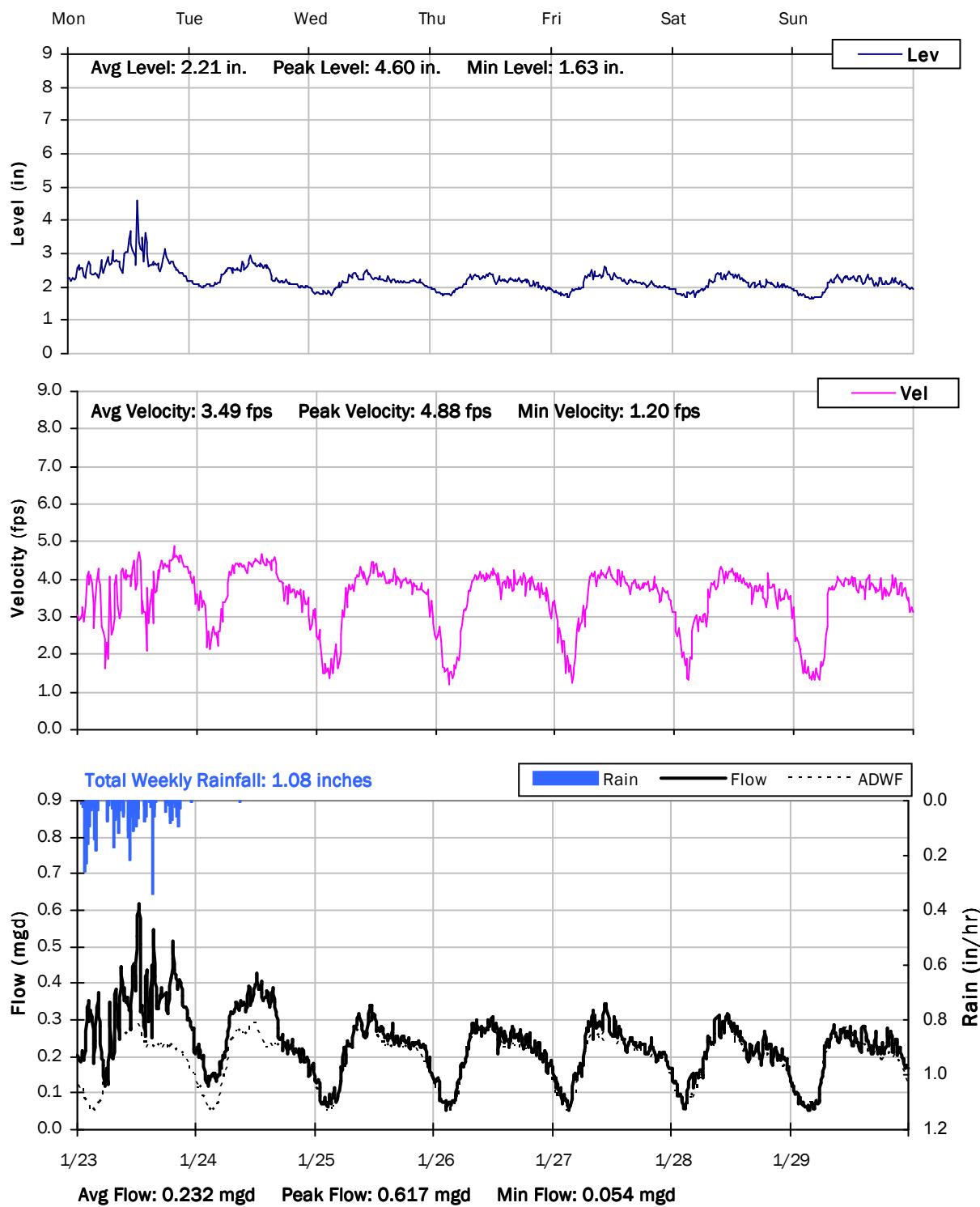
1/16/2017 to 1/23/2017



SITE 9

Weekly Level, Velocity and Flow Hydrographs

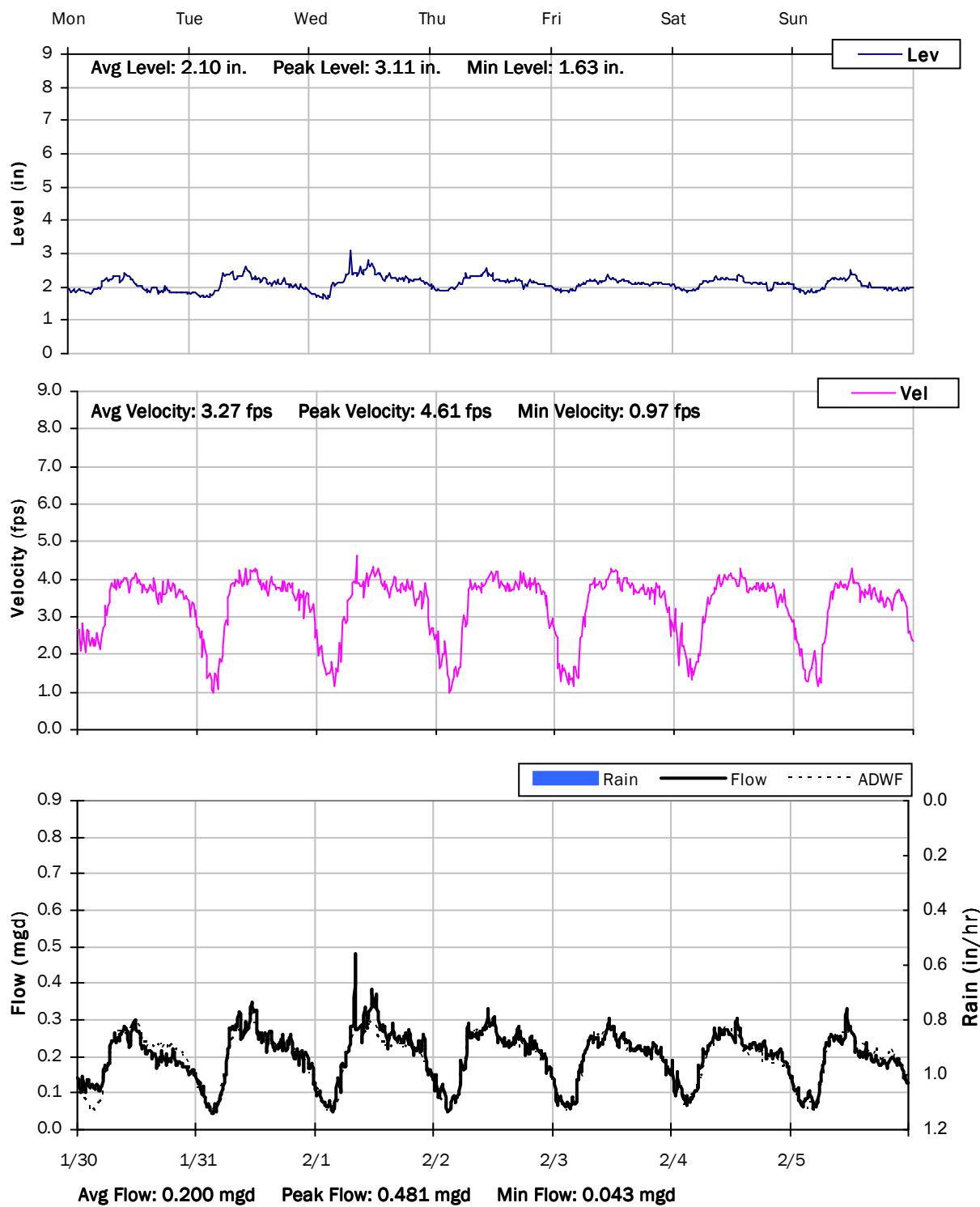
1/23/2017 to 1/30/2017



SITE 9

Weekly Level, Velocity and Flow Hydrographs

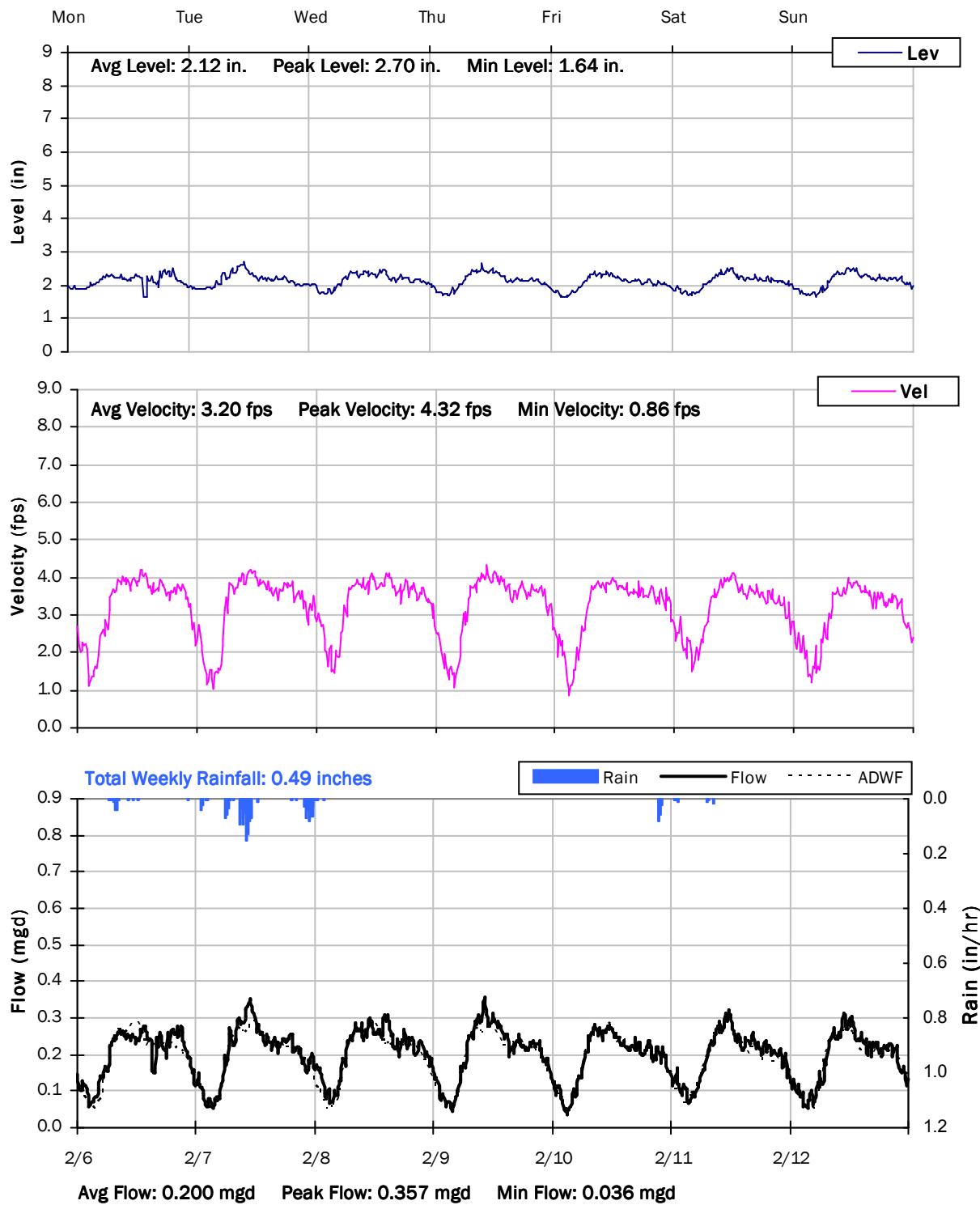
1/30/2017 to 2/6/2017



SITE 9

Weekly Level, Velocity and Flow Hydrographs

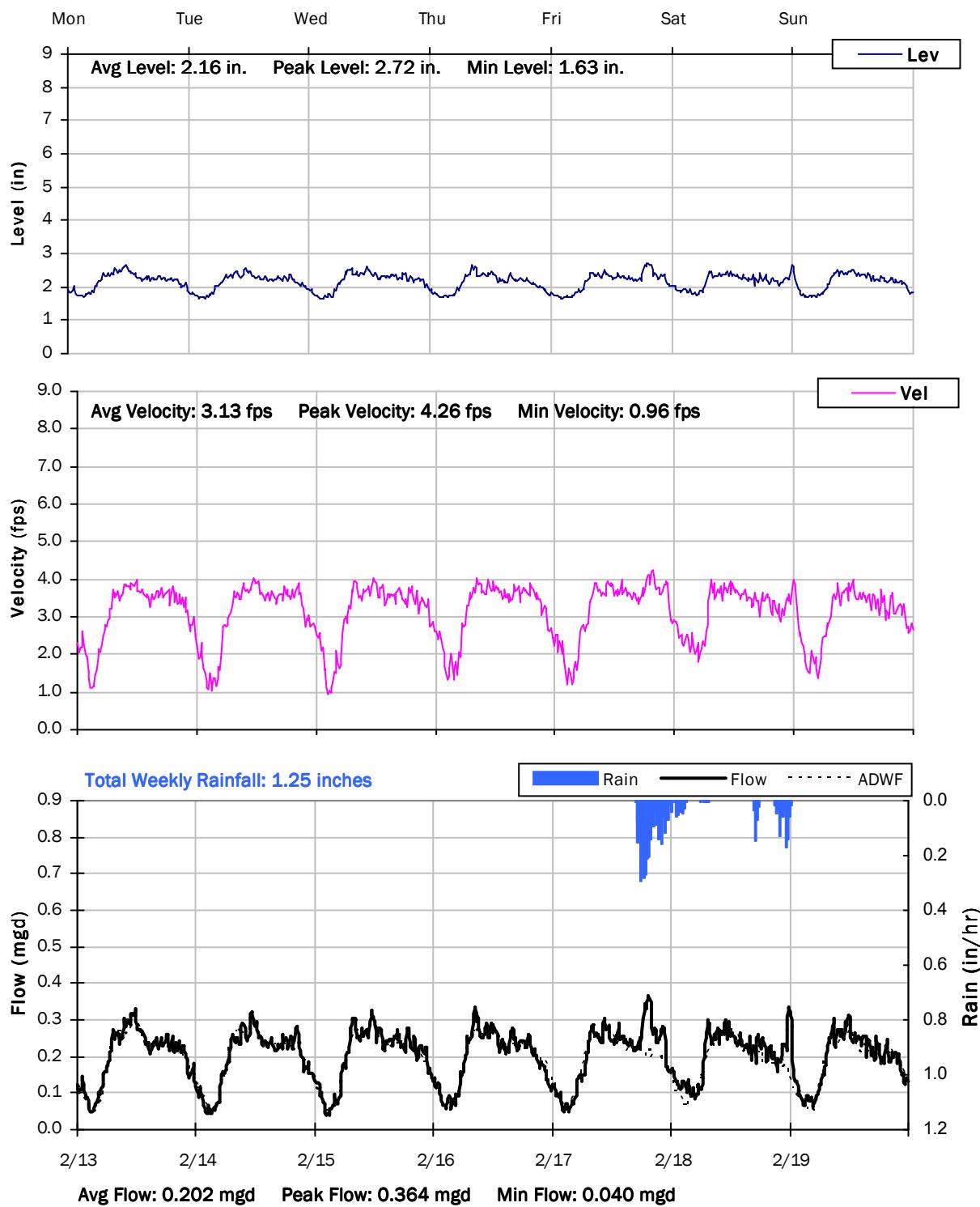
2/6/2017 to 2/13/2017



SITE 9

Weekly Level, Velocity and Flow Hydrographs

2/13/2017 to 2/20/2017



Meter Number	Pipe Diameter (in)	Weekday									Weekend									Overall ADWF		
		Measured Data ⁽¹⁾			Modeled Data ⁽²⁾			Percent Error ⁽³⁾			Measured Data ⁽¹⁾			Modeled Data ⁽²⁾			Percent Error ⁽³⁾			Measured (mgd)	Modeled (mgd)	Percent Error (%)
		Avg. Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (%)	Avg. Velocity (%)	Avg. Level (%)	Avg. Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (%)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (%)	Avg. Velocity (%)	Avg. Level (%)			
SITE 1	24	0.64	3.88	3.2	0.669	4.13	3.5	4.0%	6.5%	7.7%	0.71	3.96	3.3	0.69	4.15	3.5	-3.3%	4.6%	5.3%	0.66	0.67	1.8%
SITE 2	30	1.35	1.81	8.5	1.398	1.87	8.3	3.9%	3.3%	-2.5%	1.35	1.76	8.7	1.42	1.87	8.3	5.0%	6.3%	-4.2%	1.35	1.40	4.2%
SITE 3	15	0.49	5.94	2.5	0.491	5.83	2.4	-0.3%	-1.8%	-6.2%	0.50	5.82	2.5	0.50	5.83	2.4	-0.3%	0.2%	-3.5%	0.49	0.49	-0.3%
SITE 4	15	0.34	4.09	2.4	0.313	4.14	2.3	-8.2%	1.1%	-5.9%	0.35	4.06	2.4	0.31	4.12	2.3	-9.8%	1.3%	-7.1%	0.34	0.31	-8.7%
SITE 5	12	0.06	1.40	1.6	0.062	1.53	1.5	3.0%	9.5%	-5.3%	0.07	1.47	1.7	0.07	1.57	1.6	3.0%	6.5%	-7.1%	0.06	0.06	3.0%
SITE 6	21	0.84	2.10	6.3	0.866	2.25	6.0	2.6%	7.6%	-5.2%	0.88	2.11	6.4	0.88	2.26	6.0	0.7%	7.4%	-5.8%	0.85	0.87	2.0%
SITE 7	15	0.28	4.85	2.0	0.307	4.86	1.9	9.9%	0.3%	-1.3%	0.28	4.80	1.9	0.31	4.84	1.9	9.8%	0.8%	0.9%	0.28	0.31	9.9%
SITE 8	12	0.50	8.26	2.1	0.484	7.82	2.0	-2.9%	-5.3%	-1.5%	0.51	8.27	2.1	0.51	7.90	2.1	-1.5%	-4.5%	-2.1%	0.50	0.49	-2.5%
SITE 9	12	0.19	3.25	2.1	0.197	3.23	2.1	1.3%	-0.8%	-2.4%	0.18	3.21	2.1	0.19	3.18	2.0	1.2%	-0.8%	-3.0%	0.19	0.19	1.2%



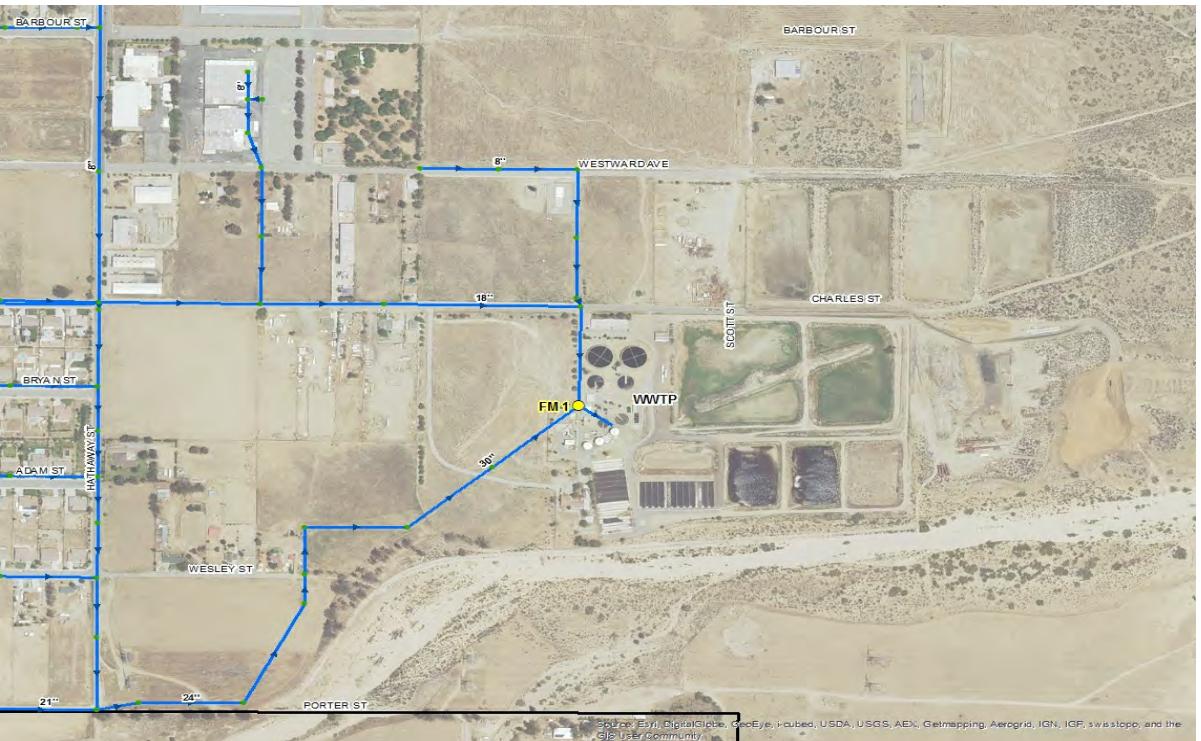
**FLOW MONITORING SITE 1 DRY WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



Location: Northern Pipeline entering WWTP.

Pipeline diameter: 24"

Site Photo

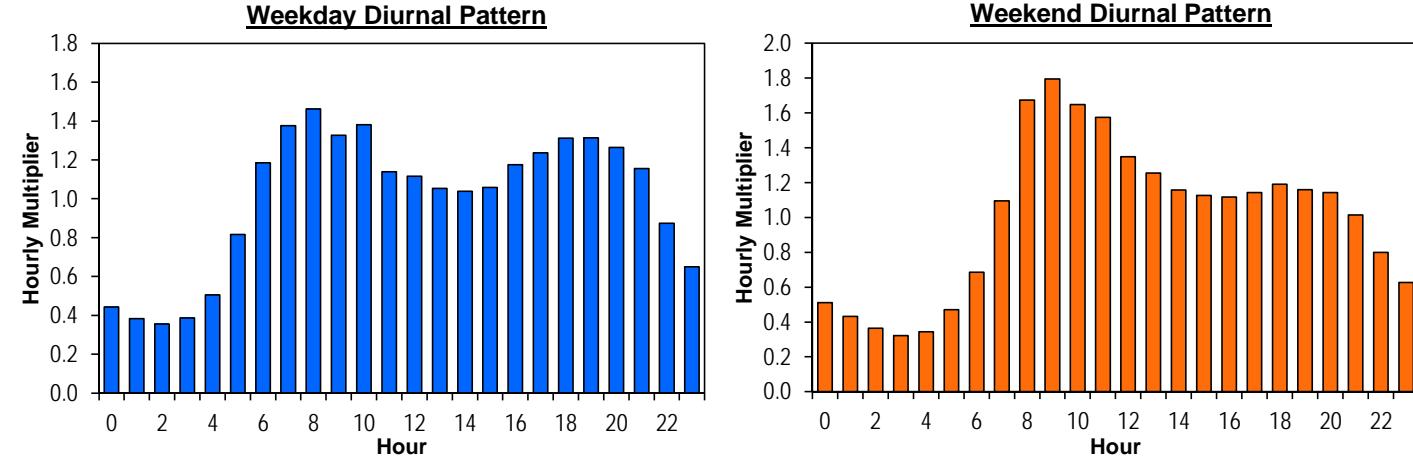
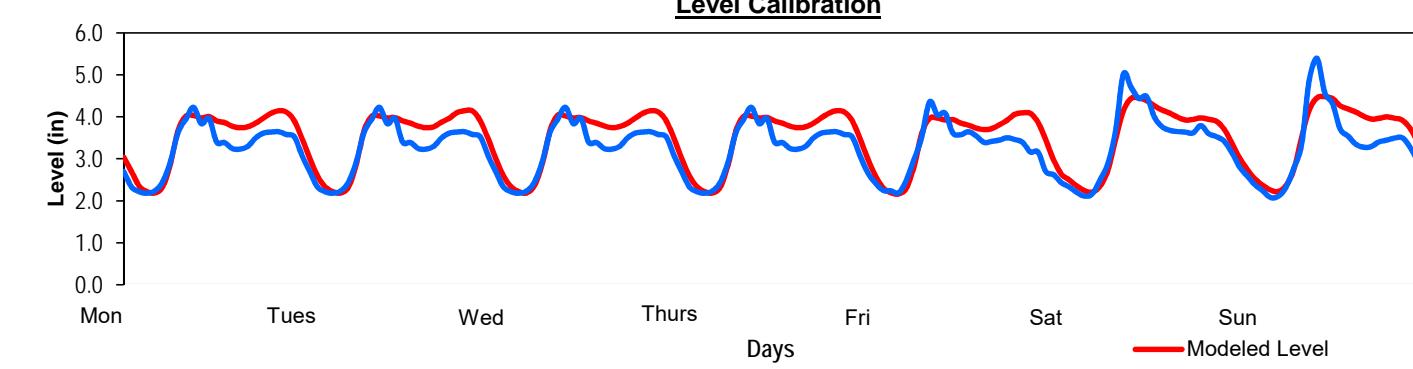
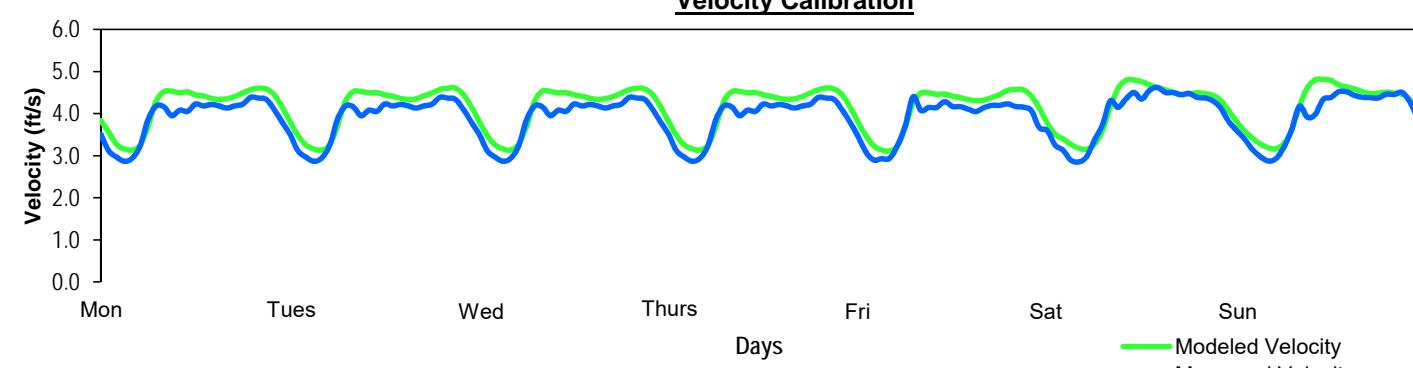
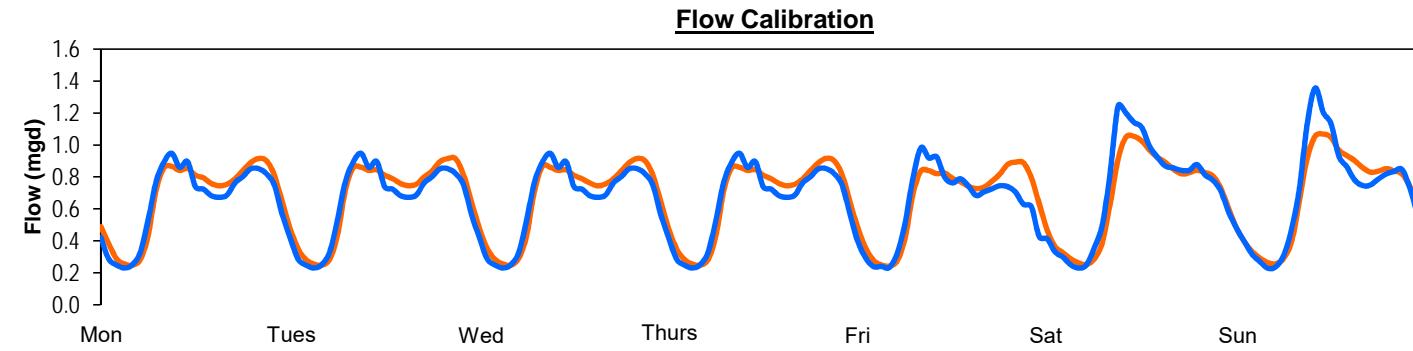


Model Calibration Summary

Day	Measured Data ⁽¹⁾				Modeled Data				Percent Error ⁽³⁾			
	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.65	0.95	3.2	3.89	0.67	0.92	3.49	4.14	3.6%	-3.3%	7.8%	6.5%
Tues.	0.65	0.95	3.2	3.89	0.67	0.92	3.49	4.14	3.6%	-3.3%	7.8%	6.5%
Wed.	0.65	0.95	3.2	3.89	0.67	0.92	3.49	4.14	3.6%	-3.3%	7.8%	6.5%
Thur.	0.65	0.95	3.2	3.89	0.67	0.92	3.49	4.14	3.6%	-3.3%	7.8%	6.5%
Fri.	0.62	0.98	3.2	3.86	0.66	0.89	3.45	4.11	5.6%	-9.1%	7.2%	6.5%
Sat.	0.72	1.24	3.4	3.98	0.68	1.05	3.50	4.14	-4.9%	-15.2%	3.3%	4.0%
Sun.	0.70	1.36	3.3	3.95	0.69	1.07	3.53	4.16	-1.6%	-21.2%	7.3%	5.3%
Summary												
Weekday	0.64	--	3.2	3.88	0.67	--	3.5	4.13	4.0%	--	7.7%	6.5%
Weekend	0.71	--	3.3	3.96	0.69	--	3.5	4.15	-3.3%	--	5.3%	4.6%
ADWF ⁽⁴⁾	0.66	--	3.3	3.90	0.67	--	3.5	4.14	1.8%	--	7.0%	6.0%

Notes:

1. Source: V&A Temporary Flow Monitoring Program
2. Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.
3. Percent Error = $(\text{Modeled} - \text{Measured}) / \text{Measured} \times 100$
4. ADWF = $(5 \times \text{Weekday Average} + 2 \times \text{Weekend Average}) / 7$





**FLOW MONITORING SITE 2 DRY WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



Location: Pipeline Entering WWTP from South.

Pipeline diameter: 30"

Site Photo



Model Calibration Summary

Day	Measured Data ⁽¹⁾				Modeled Data				Percent Error ⁽³⁾			
	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	1.35	1.95	8.5	1.81	1.40	2.13	8.27	1.87	3.7%	9.2%	-3.0%	3.1%
Tues.	1.35	1.95	8.5	1.81	1.40	2.13	8.27	1.87	3.7%	9.2%	-3.0%	3.1%
Wed.	1.35	1.95	8.5	1.81	1.40	2.13	8.27	1.87	3.7%	9.2%	-3.0%	3.1%
Thur.	1.35	1.95	8.5	1.81	1.40	2.13	8.27	1.87	3.7%	9.2%	-3.0%	3.1%
Fri.	1.33	1.96	8.3	1.80	1.39	2.11	8.25	1.87	4.8%	8.0%	-0.5%	3.9%
Sat.	1.32	2.12	8.6	1.75	1.38	2.29	8.20	1.85	4.5%	8.1%	-5.1%	6.0%
Sun.	1.38	2.21	8.7	1.77	1.46	2.41	8.39	1.89	5.5%	9.2%	-3.3%	6.7%
Summary												
Weekday	1.35	--	8.5	1.81	1.40	--	8.3	1.87	3.9%	--	-2.5%	3.3%
Weekend	1.35	--	8.7	1.76	1.42	--	8.3	1.87	5.0%	--	-4.2%	6.3%
ADWF ⁽⁴⁾	1.35	--	8.5	1.80	1.40	--	8.3	1.87	4.2%	--	-3.0%	4.1%

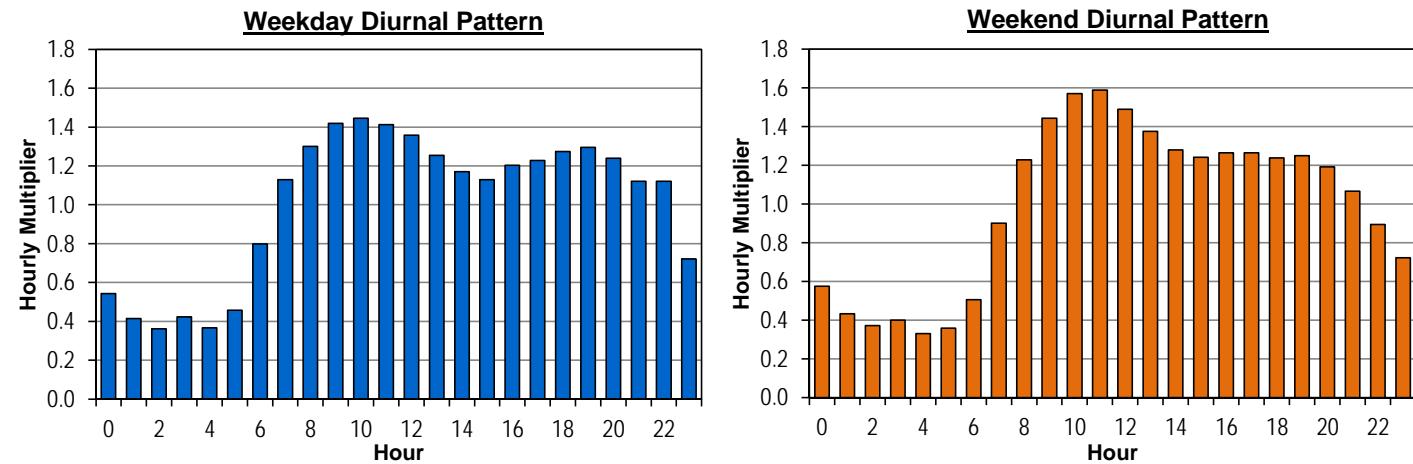
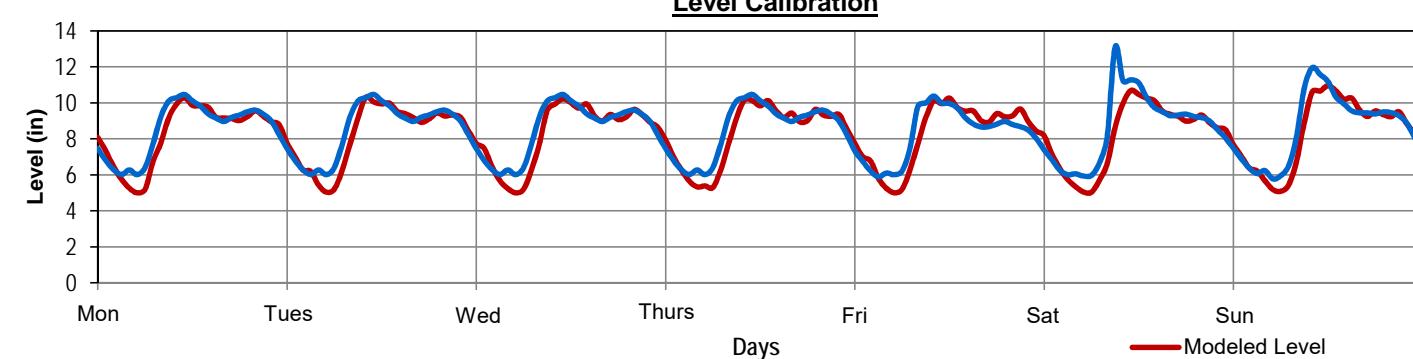
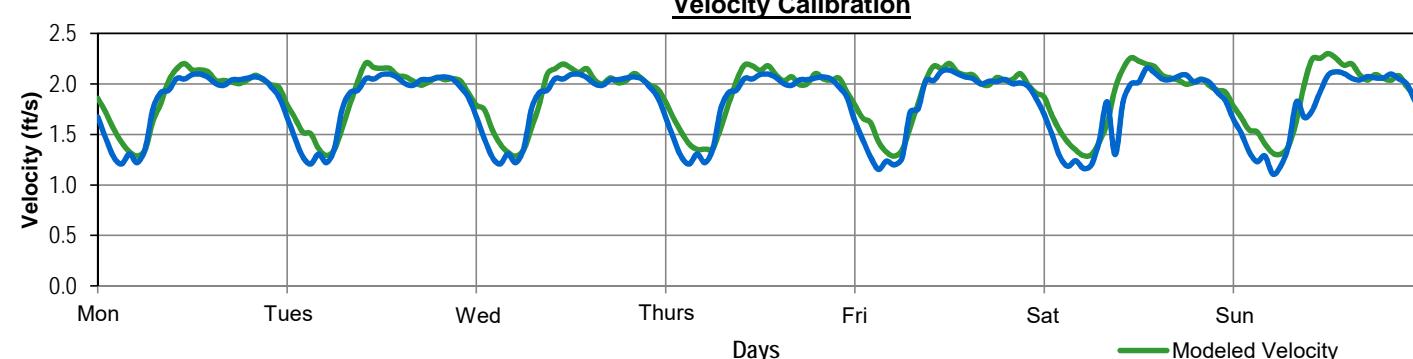
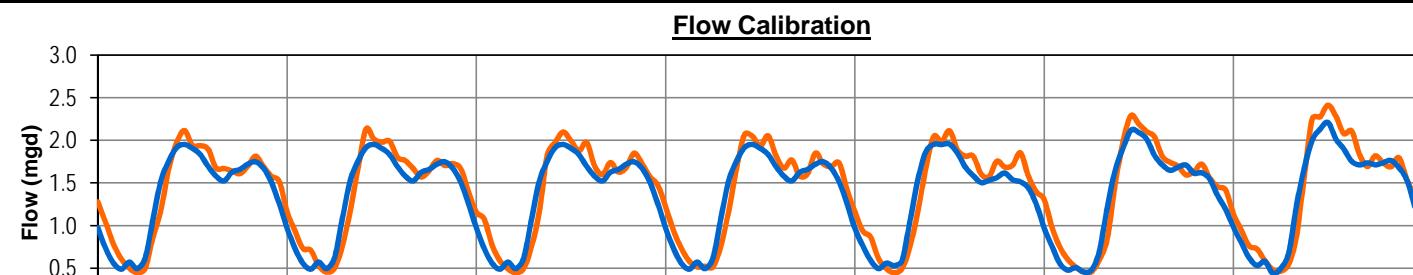
Notes:

1. Source: V&A Temporary Flow Monitoring Program

2. Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

3. Percent Error = (Modeled - Measured) / Measured x 100

4. ADWF = (5xWeekday Average + 2xWeekend Average)/7





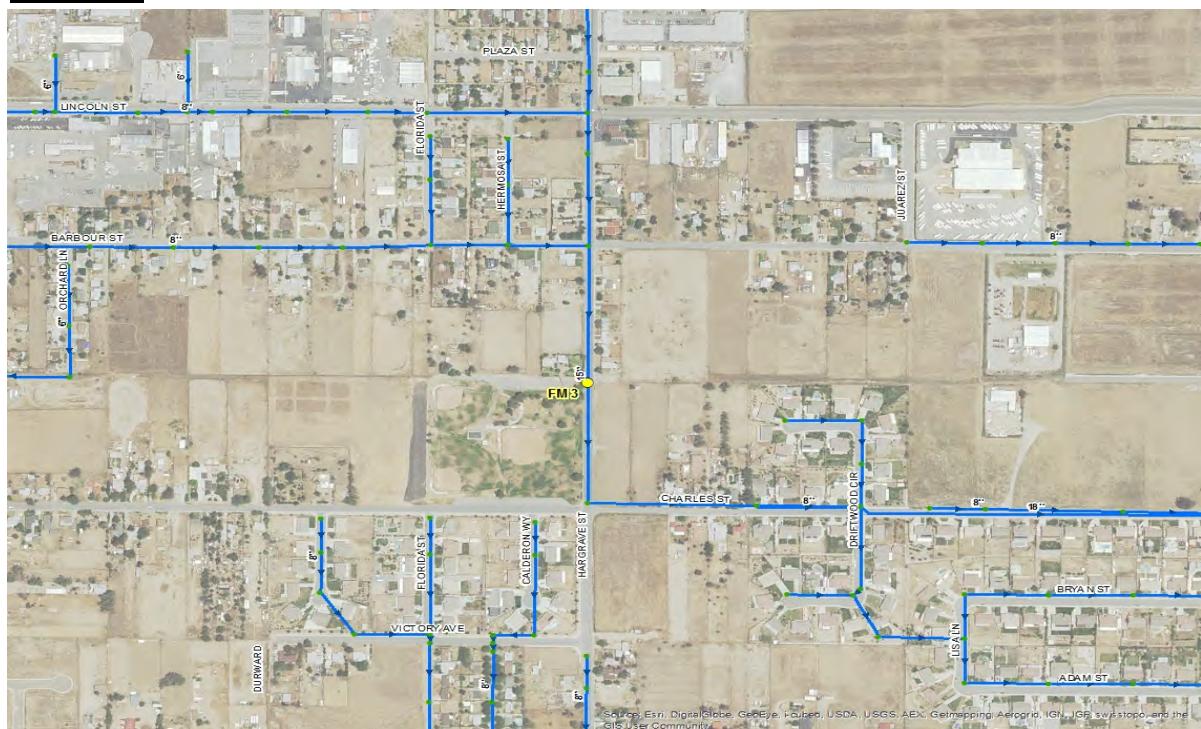
**FLOW MONITORING SITE 3 DRY WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



Location: North of Charles Street and Hargrave Street Intersection.

Pipeline diameter: 15"

Site Photo

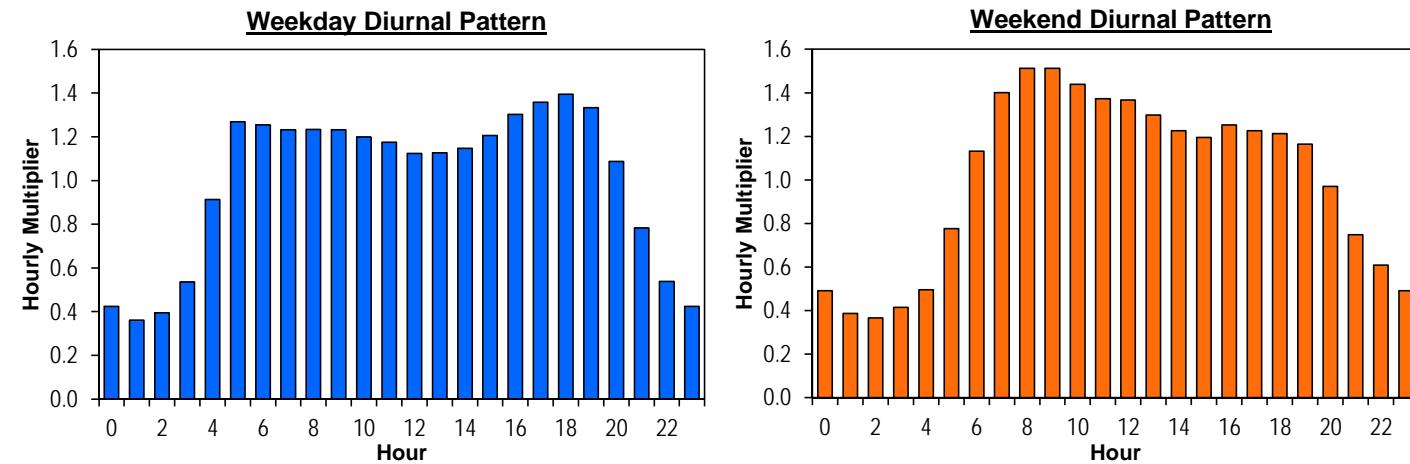
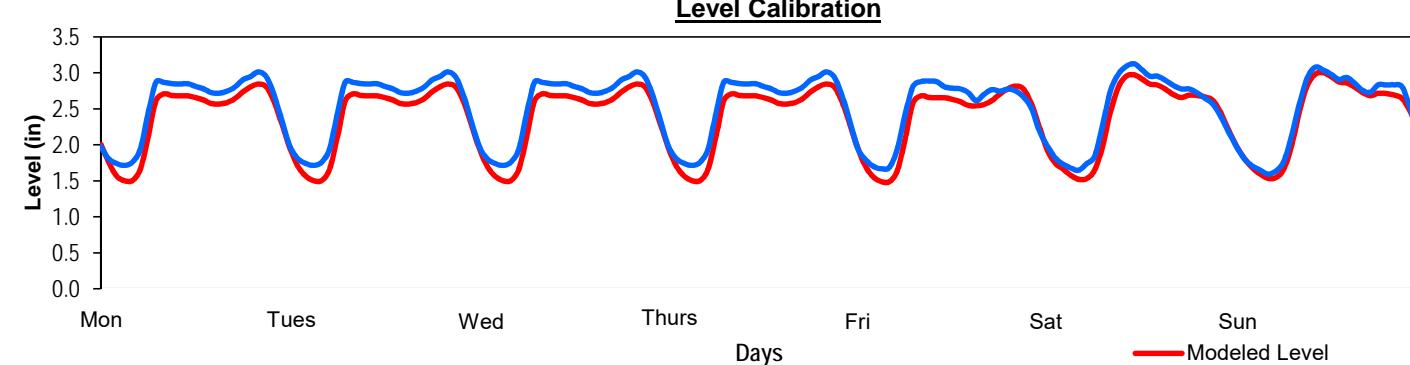
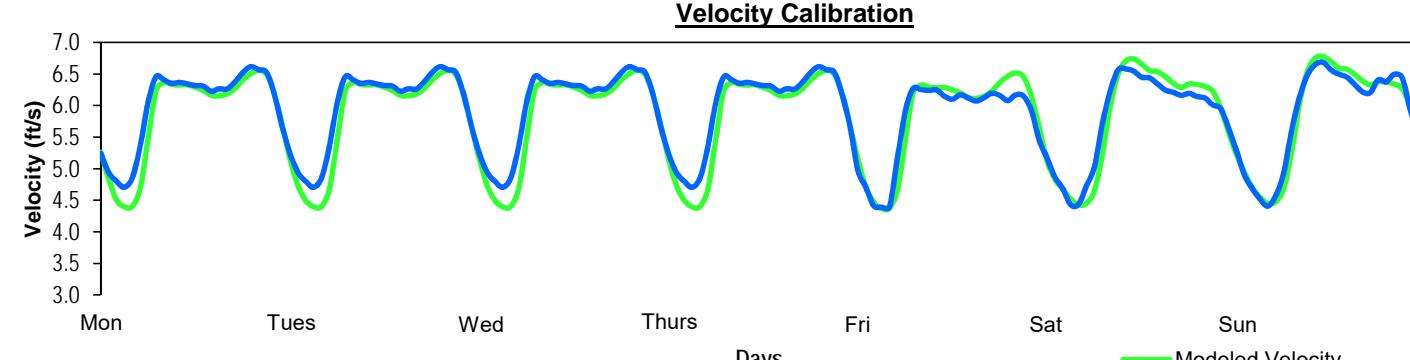
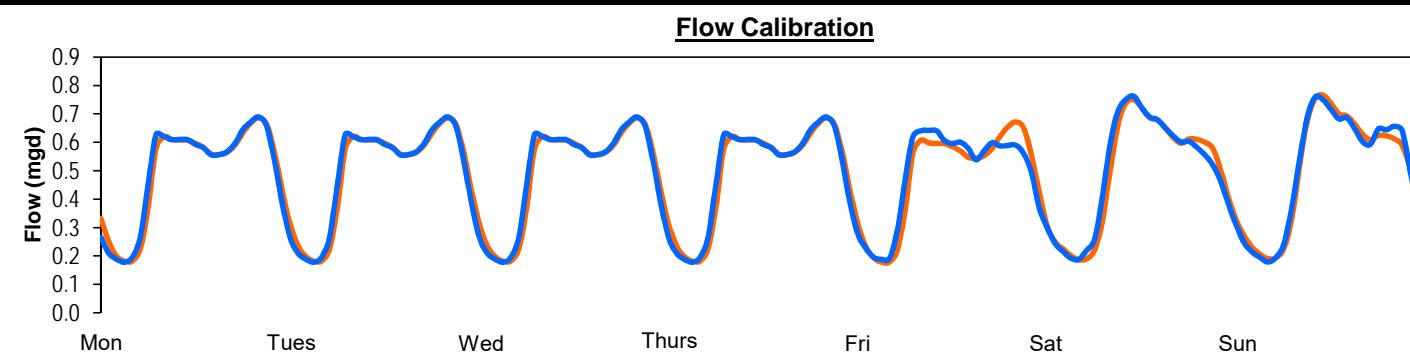


Model Calibration Summary

Day	Measured Data ⁽¹⁾				Modeled Data				Percent Error ⁽³⁾			
	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.49	0.69	2.5	5.99	0.49	0.69	2.38	5.84	-0.3%	-0.5%	-6.5%	-2.5%
Tues.	0.49	0.69	2.5	5.99	0.49	0.69	2.38	5.84	-0.3%	-0.5%	-6.5%	-2.5%
Wed.	0.49	0.69	2.5	5.99	0.49	0.69	2.38	5.84	-0.3%	-0.5%	-6.5%	-2.5%
Thur.	0.49	0.69	2.5	5.99	0.49	0.69	2.38	5.84	-0.3%	-0.5%	-6.5%	-2.5%
Fri.	0.49	0.64	2.5	5.74	0.48	0.67	2.35	5.80	-0.6%	4.7%	-4.9%	1.0%
Sat.	0.50	0.76	2.5	5.79	0.49	0.75	2.37	5.81	-0.8%	-1.6%	-4.4%	0.4%
Sun.	0.50	0.76	2.5	5.85	0.50	0.77	2.39	5.85	0.2%	0.8%	-2.7%	0.1%
Summary												
Weekday	0.49	--	2.5	5.94	0.49	--	2.4	5.83	-0.3%	--	-6.2%	-1.8%
Weekend	0.50	--	2.5	5.82	0.50	--	2.4	5.83	-0.3%	--	-3.5%	0.2%
ADWF ⁽⁴⁾	0.49	--	2.5	5.90	0.49	--	2.4	5.83	-0.3%	--	-5.4%	-1.2%

Notes:

1. Source: V&A Temporary Flow Monitoring Program
2. Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.
3. Percent Error = $(\text{Modeled} - \text{Measured}) / \text{Measured} \times 100$
4. ADWF = $(5 \times \text{Weekday Average} + 2 \times \text{Weekend Average}) / 7$





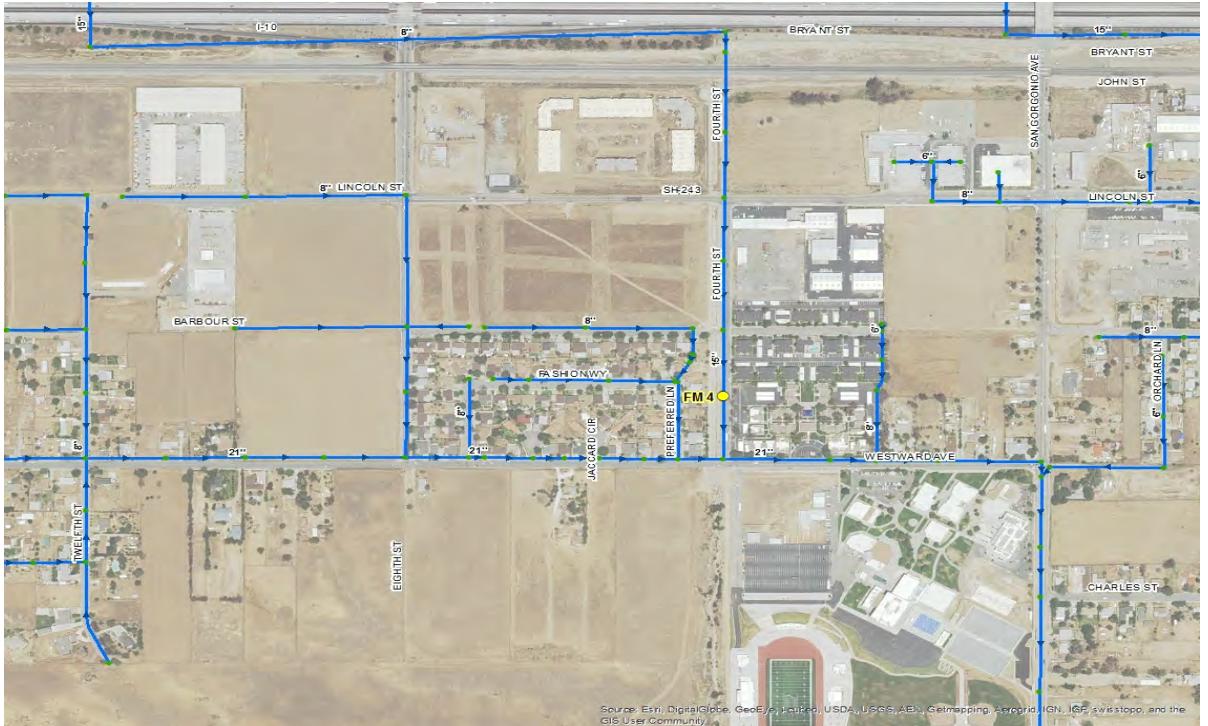
**FLOW MONITORING SITE 4 DRY WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**

carollo

Location: North of Westward Avenue and Fourth Street Intersection.

Pipeline diameter: 15"

Site Photo

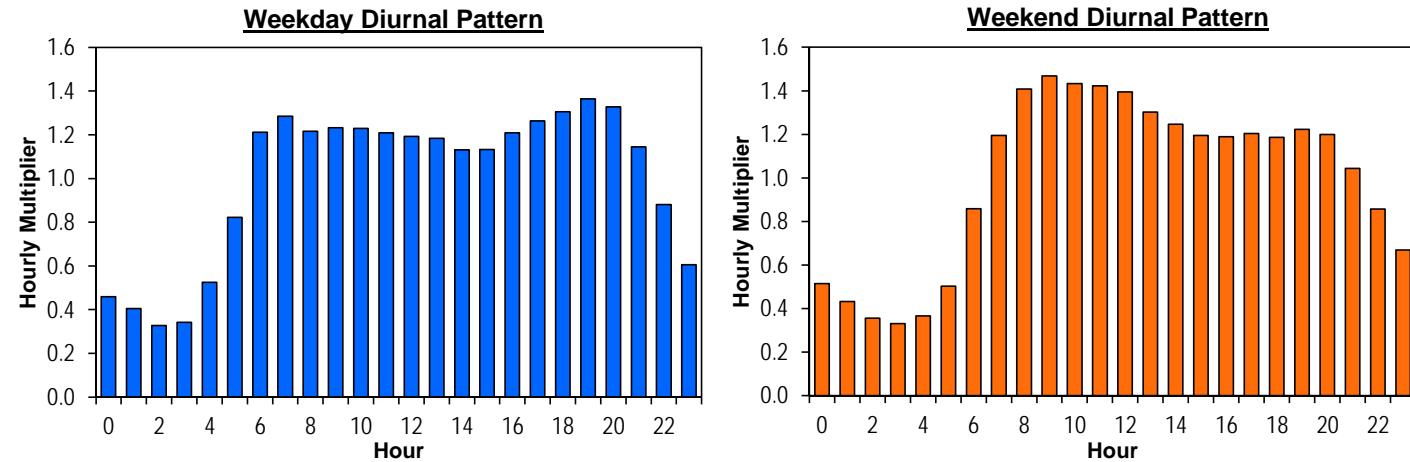
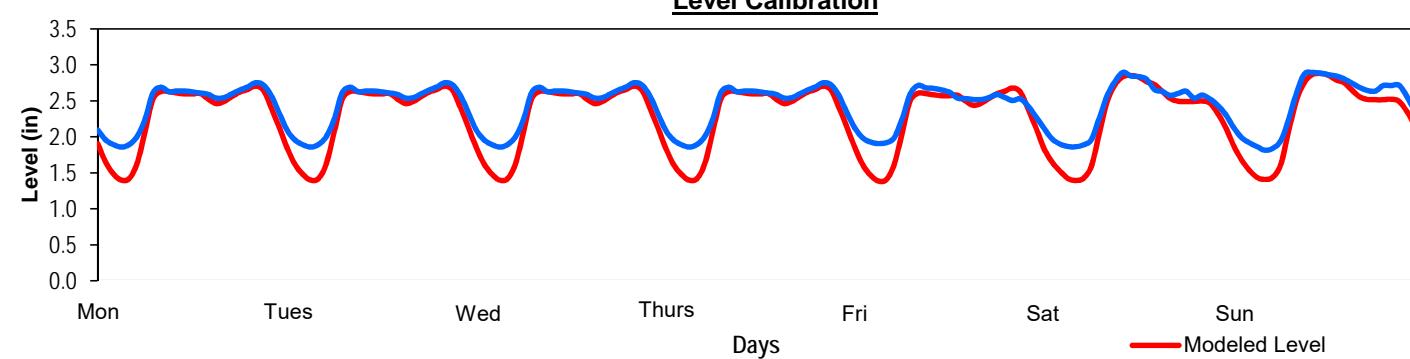
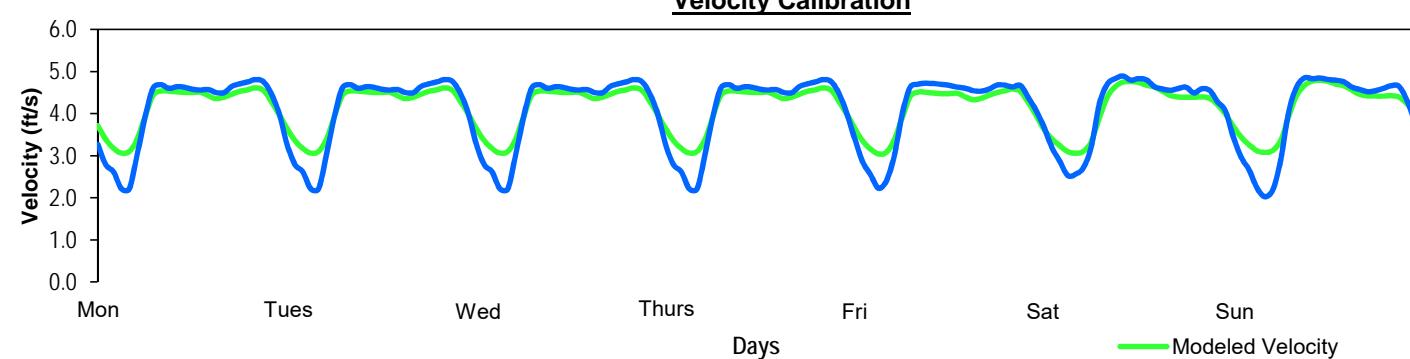
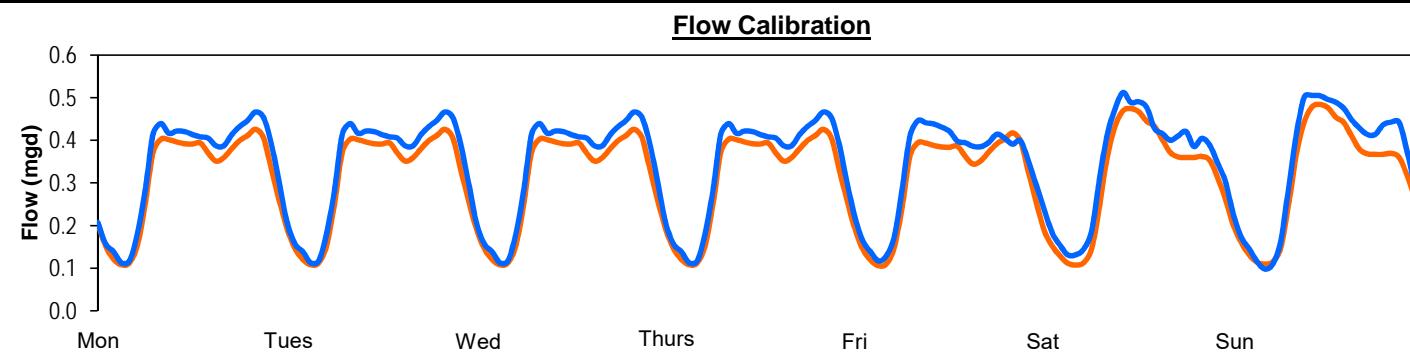


Model Calibration Summary

Day	Measured Data ⁽¹⁾				Modeled Data				Percent Error ⁽³⁾			
	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.34	0.47	2.4	4.09	0.31	0.43	2.29	4.14	-8.3%	-8.7%	-6.0%	1.3%
Tues.	0.34	0.47	2.4	4.09	0.31	0.43	2.29	4.14	-8.3%	-8.7%	-6.0%	1.3%
Wed.	0.34	0.47	2.4	4.09	0.31	0.43	2.29	4.14	-8.3%	-8.7%	-6.0%	1.3%
Thur.	0.34	0.47	2.4	4.09	0.31	0.43	2.29	4.14	-8.3%	-8.7%	-6.0%	1.3%
Fri.	0.33	0.45	2.4	4.10	0.31	0.42	2.26	4.12	-8.1%	-6.5%	-5.5%	0.3%
Sat.	0.34	0.51	2.4	4.12	0.31	0.47	2.26	4.10	-9.9%	-7.4%	-6.6%	-0.4%
Sun.	0.35	0.51	2.5	4.01	0.32	0.48	2.28	4.13	-9.8%	-4.2%	-7.6%	3.0%
Summary												
Weekday	0.34	--	2.4	4.09	0.31	--	2.3	4.14	-8.2%	--	-5.9%	1.1%
Weekend	0.35	--	2.4	4.06	0.31	--	2.3	4.12	-9.8%	--	-7.1%	1.3%
ADWF ⁽⁴⁾	0.34	--	2.4	4.08	0.31	--	2.3	4.13	-8.7%	--	-6.2%	1.2%

Notes:

1. Source: V&A Temporary Flow Monitoring Program
2. Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.
3. Percent Error = $(\text{Modeled} - \text{Measured}) / \text{Measured} \times 100$
4. ADWF = $(5 \times \text{Weekday Average} + 2 \times \text{Weekend Average}) / 7$





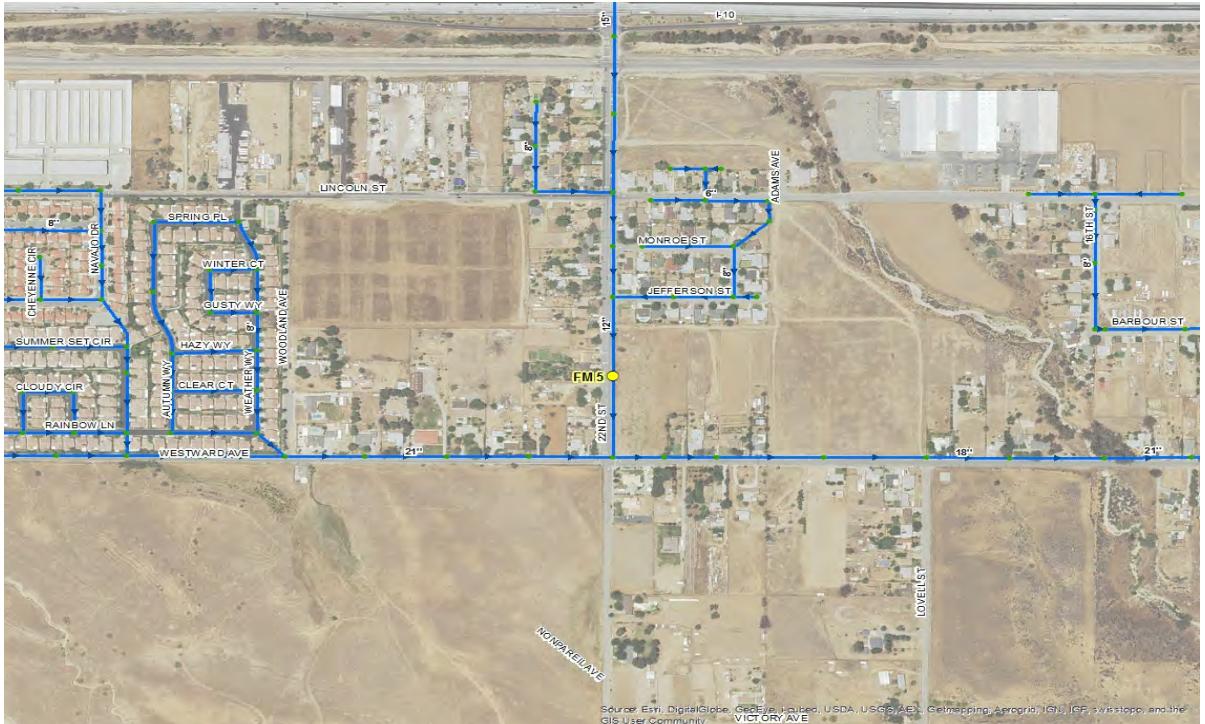
**FLOW MONITORING SITE 5 DRY WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**

carollo

Location: 22nd Street, North of Westward Avenue.

Pipeline diameter: 12"

Site Photo



Model Calibration Summary

Day	Measured Data ⁽¹⁾				Modeled Data				Percent Error ⁽³⁾			
	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.06	0.09	1.6	1.39	0.06	0.09	1.51	1.52	3.2%	2.0%	-5.9%	9.6%
Tues.	0.06	0.09	1.6	1.39	0.06	0.09	1.51	1.52	3.2%	2.0%	-5.9%	9.6%
Wed.	0.06	0.09	1.6	1.39	0.06	0.09	1.51	1.52	3.2%	2.0%	-5.9%	9.6%
Thur.	0.06	0.09	1.6	1.39	0.06	0.09	1.51	1.52	3.2%	2.0%	-5.9%	9.6%
Fri.	0.07	0.12	1.7	1.44	0.07	0.10	1.61	1.57	2.5%	-13.4%	-2.9%	8.7%
Sat.	0.06	0.12	1.7	1.45	0.06	0.12	1.54	1.53	3.3%	-0.6%	-6.9%	5.1%
Sun.	0.08	0.15	1.8	1.49	0.08	0.15	1.70	1.61	2.7%	1.9%	-7.3%	7.9%
Summary												
Weekday	0.06	--	1.6	1.40	0.06	--	1.5	1.53	3.0%	--	-5.3%	9.5%
Weekend	0.07	--	1.7	1.47	0.07	--	1.6	1.57	3.0%	--	-7.1%	6.5%
ADWF ⁽⁴⁾	0.06	--	1.7	1.42	0.06	--	1.6	1.54	3.0%	--	-5.8%	8.6%

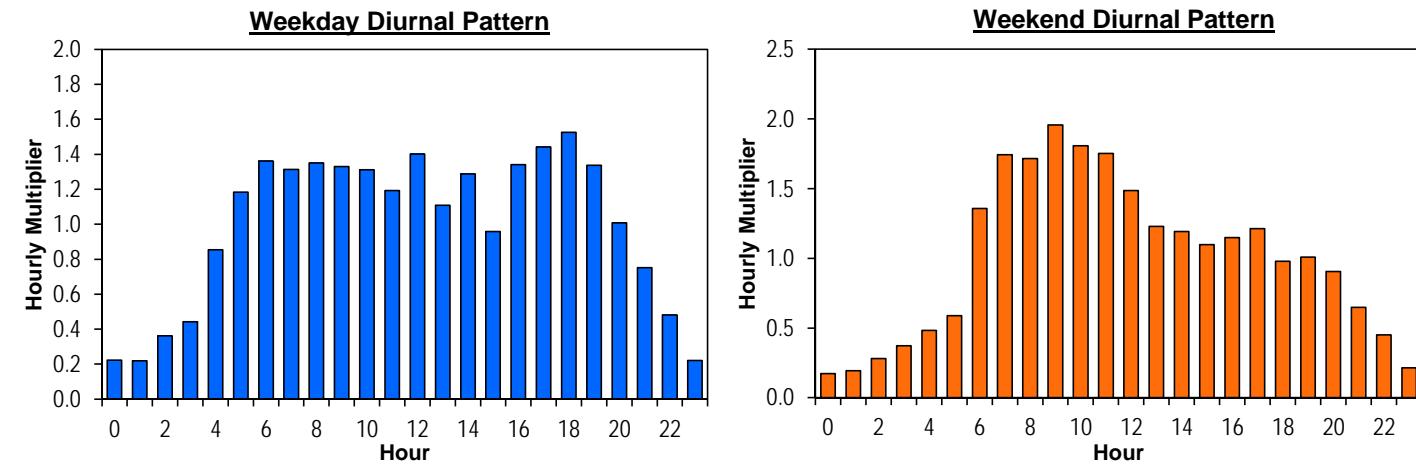
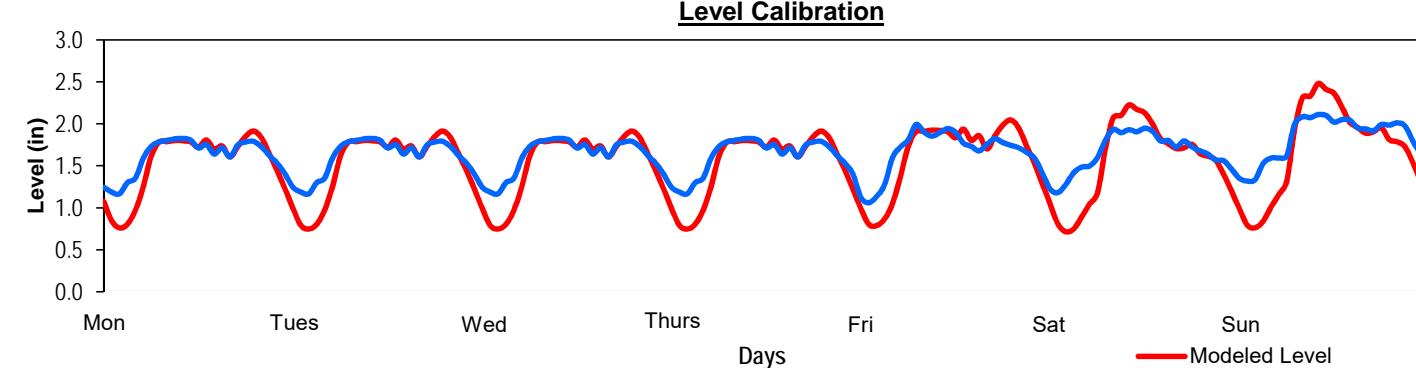
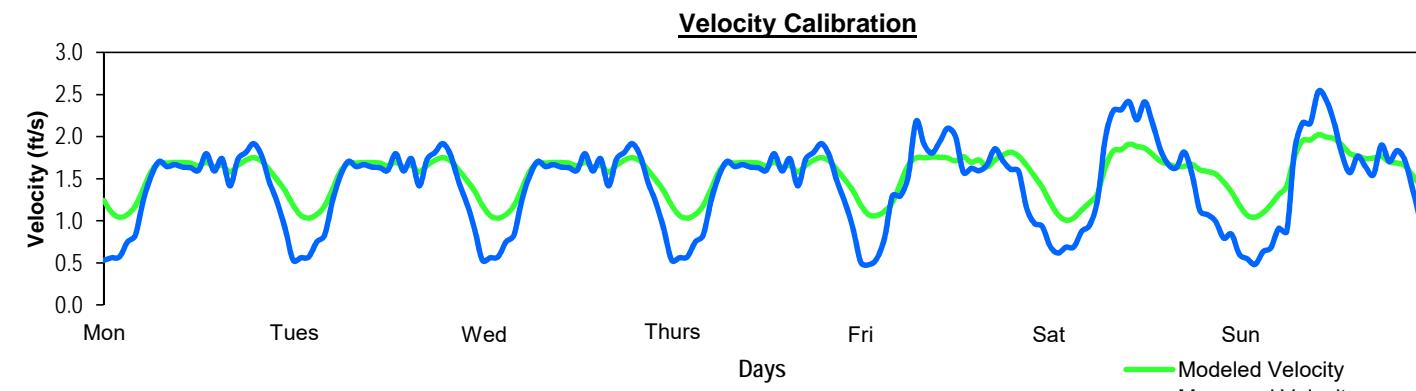
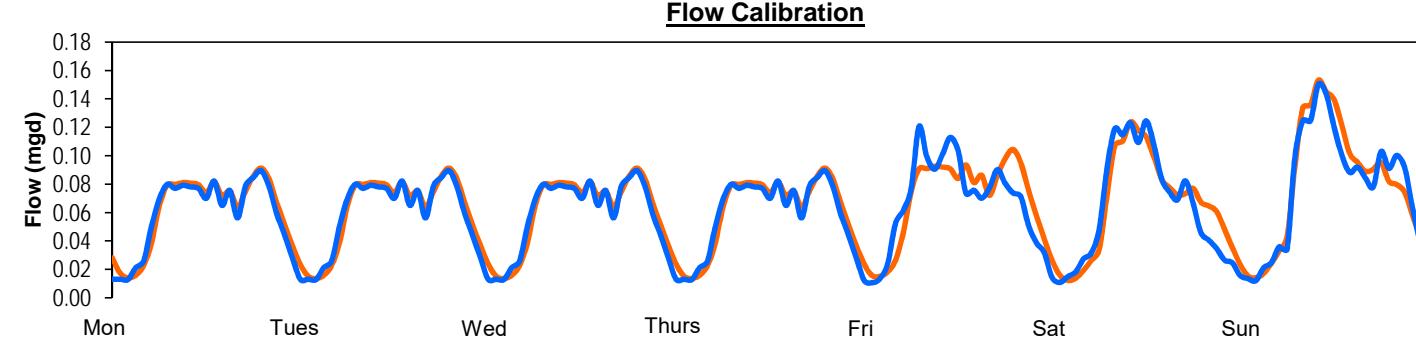
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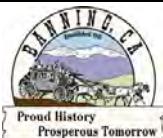
1. Source: V&A Temporary Flow Monitoring Program

2. Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.

3. Percent Error = $(\text{Modeled} - \text{Measured}) / \text{Measured} \times 100$

4. ADWF = $(5 \times \text{Weekday Average} + 2 \times \text{Weekend Average}) / 7$



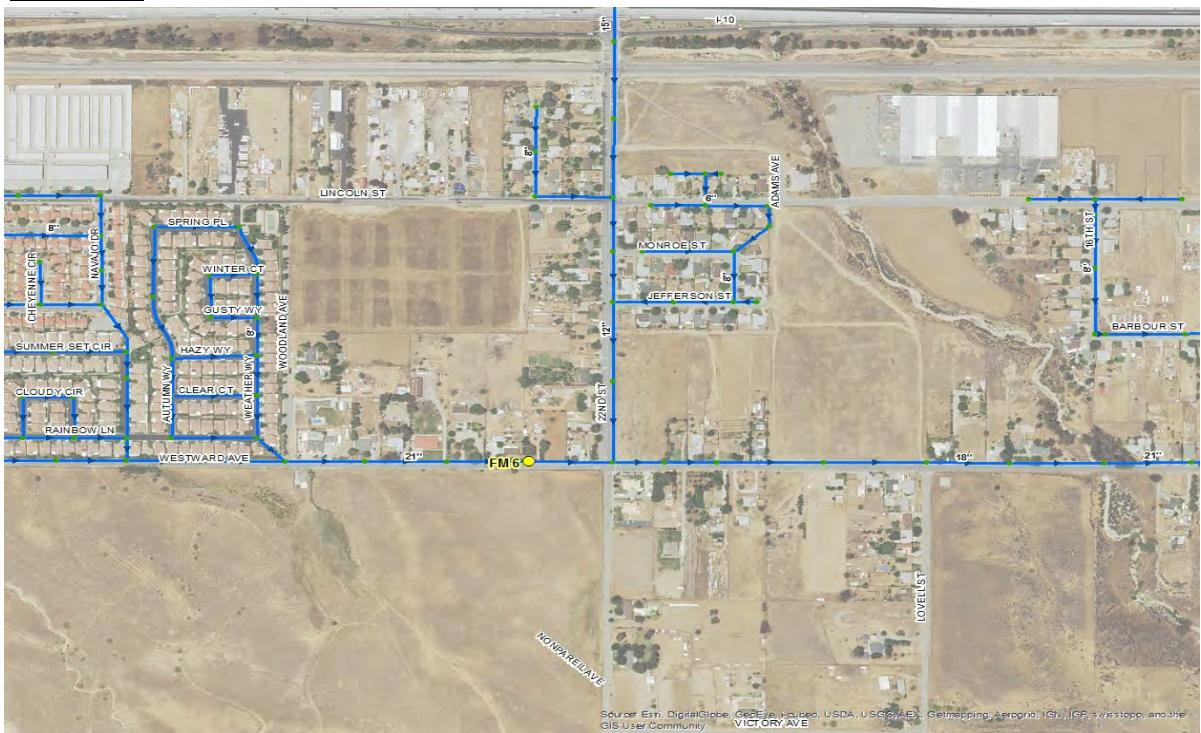


**FLOW MONITORING SITE 6 DRY WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



**Location: Westward Avenue, West of 22nd Avenue
Pipeline diameter: 21"**

Site Photo

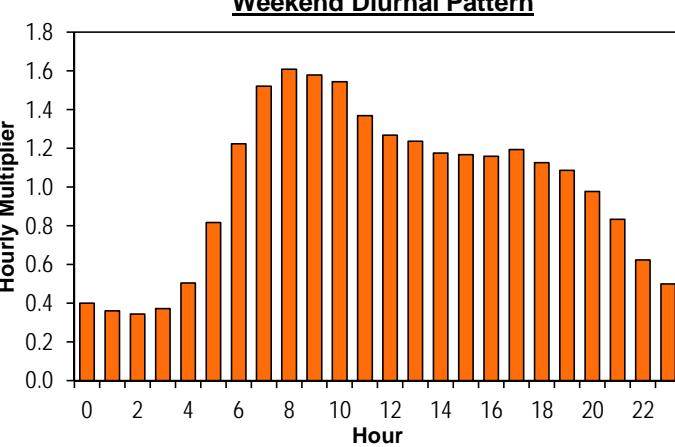
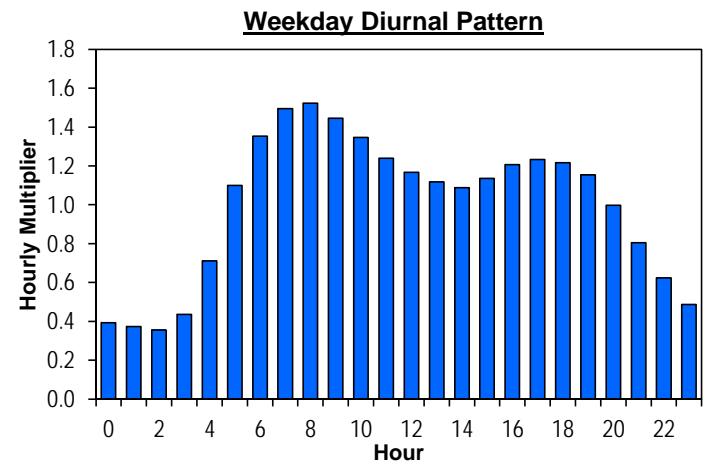
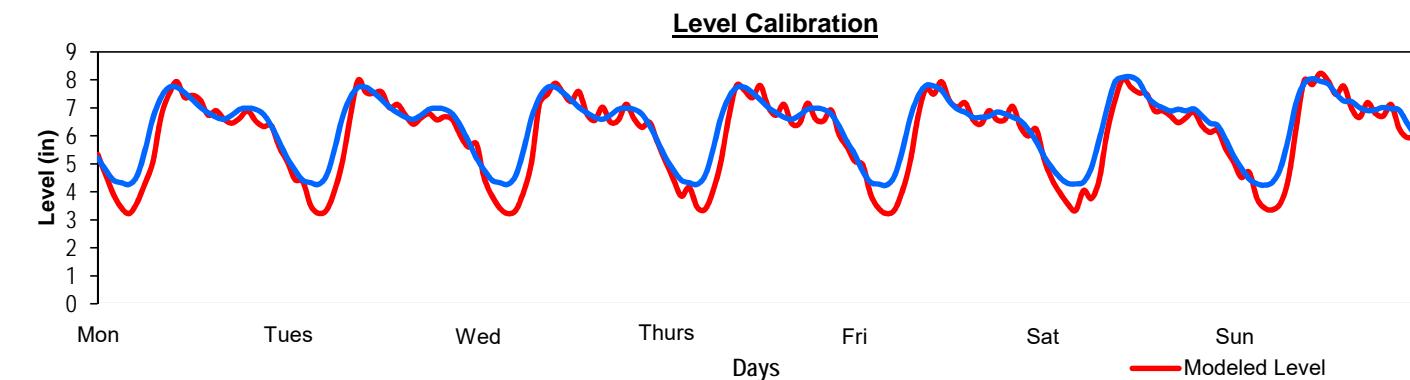
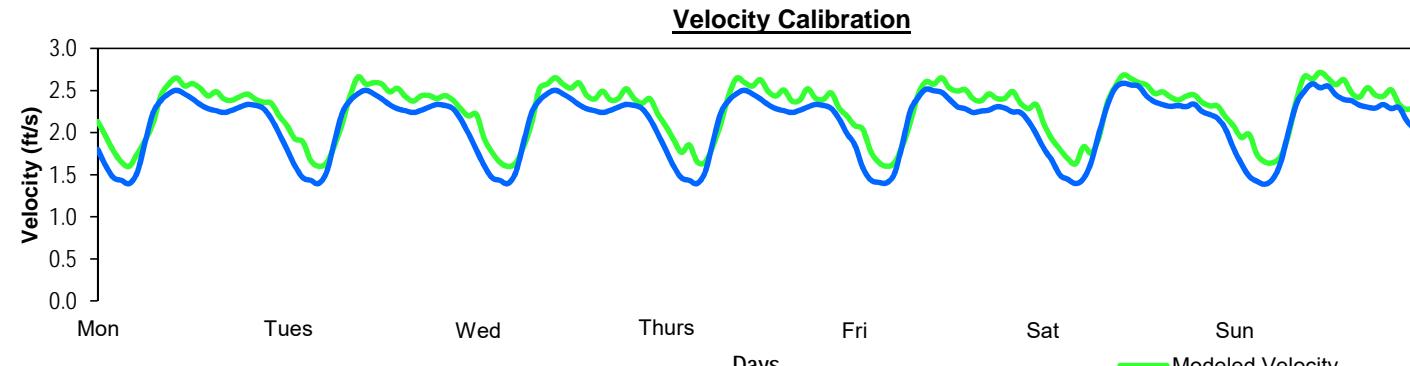
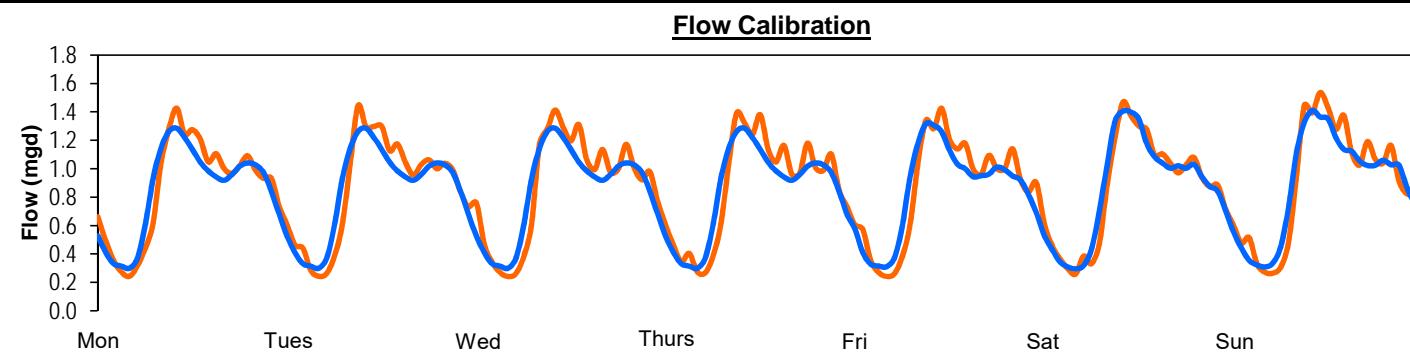


Model Calibration Summary

	Measured Data ⁽¹⁾				Modeled Data				Percent Error ⁽³⁾			
	Avg. Flow	Peak Flow ⁽²⁾	Avg. Level	Avg. Vel.	Avg. Flow	Peak Flow ⁽²⁾	Avg. Level	Avg. Vel.	Avg. Flow	Peak Flow	Avg. Level	Avg. Vel.
Day	(mgd)	(mgd)	(in)	(ft/s)	(mgd)	(mgd)	(in)	(ft/s)	(%)	(%)	(%)	(%)
Mon.	0.84	1.29	6.3	2.10	0.87	1.44	5.96	2.26	2.7%	12.3%	-5.3%	7.6%
Tues.	0.84	1.29	6.3	2.10	0.87	1.44	5.96	2.26	2.7%	12.3%	-5.3%	7.6%
Wed.	0.84	1.29	6.3	2.10	0.87	1.44	5.96	2.26	2.7%	12.3%	-5.3%	7.6%
Thur.	0.84	1.29	6.3	2.10	0.87	1.44	5.96	2.26	2.7%	12.3%	-5.3%	7.6%
Fri.	0.85	1.32	6.3	2.09	0.86	1.43	5.95	2.25	2.2%	8.4%	-4.8%	7.8%
Sat.	0.86	1.41	6.3	2.11	0.85	1.47	5.90	2.24	-0.8%	4.5%	-6.8%	6.6%
Sun.	0.89	1.41	6.4	2.11	0.91	1.54	6.09	2.28	2.1%	8.9%	-4.7%	8.2%
Summary												
Weekday	0.84	--	6.3	2.10	0.87	--	6.0	2.25	2.6%	--	-5.2%	7.6%
Weekend	0.88	--	6.4	2.11	0.88	--	6.0	2.26	0.7%	--	-5.8%	7.4%
ADWF ⁽⁴⁾	0.85	--	6.3	2.10	0.87	--	6.0	2.26	2.0%	--	-5.4%	7.5%

Note

1. Source: V&A Temporary Flow Monitoring Program
2. Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A
3. Percent Error = $\frac{\text{Modeled} - \text{Measured}}{\text{Measured}} \times 100$
4. ADWF = $\frac{(5 \times \text{Weekday Average} + 2 \times \text{Weekend Average})}{7}$



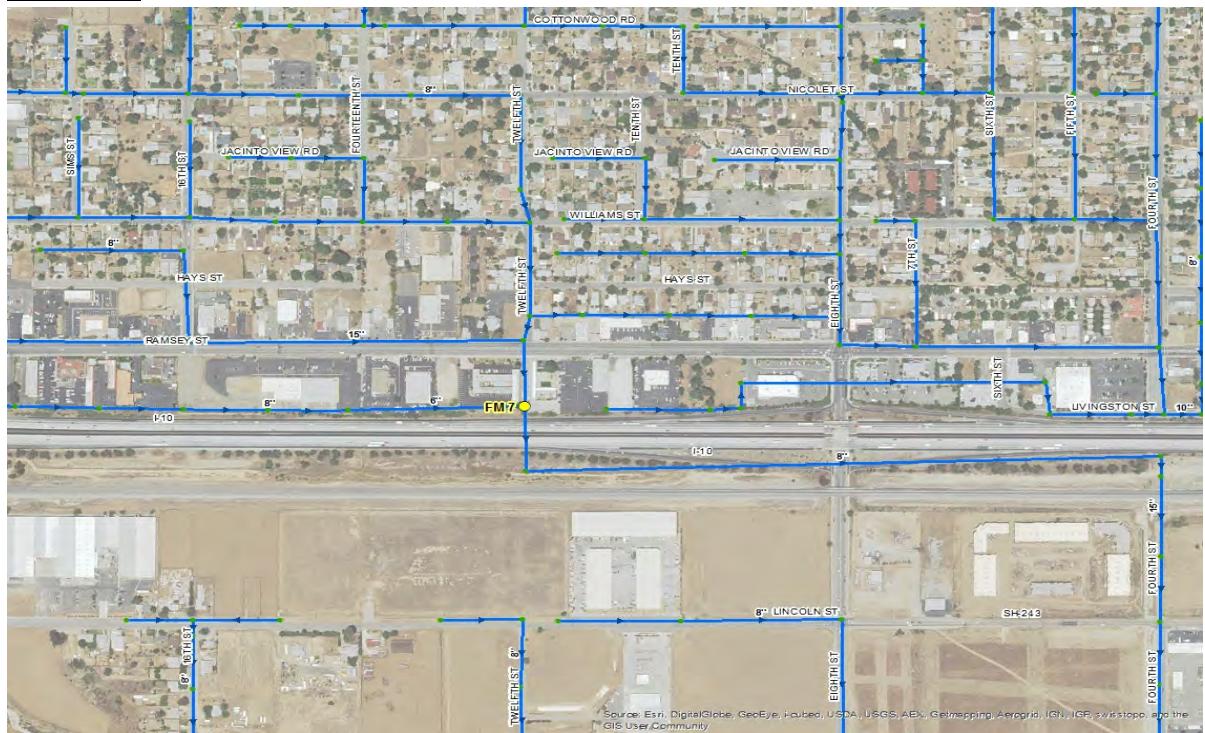


**FLOW MONITORING SITE 7 DRY WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**

carollo

Location: Open Space Southwest of Ramsey Street and Eight Street Intersection.
Pipeline diameter: 15"

Site Photo

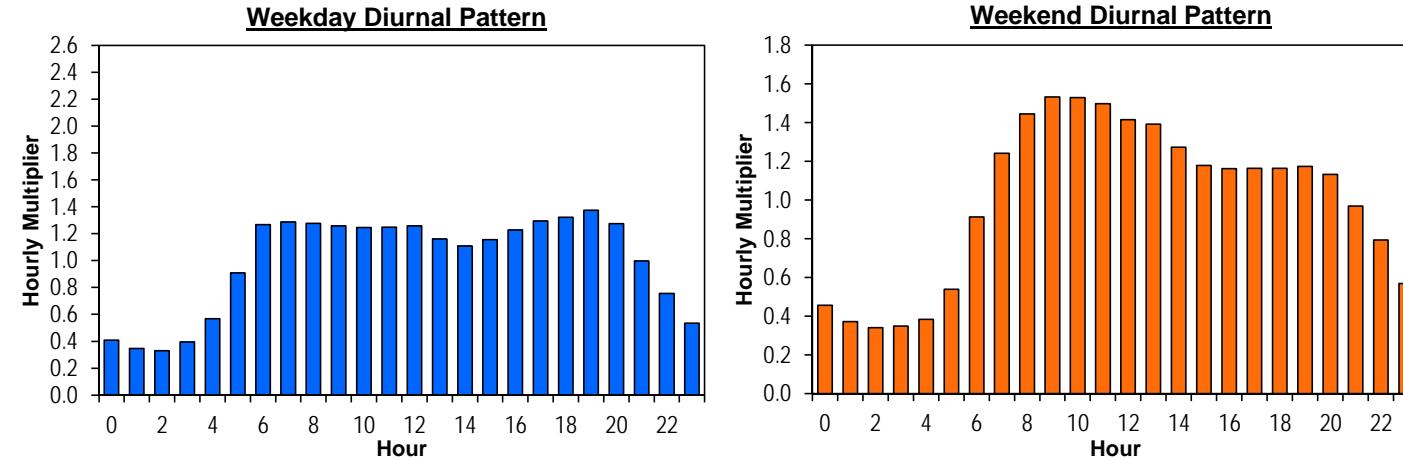
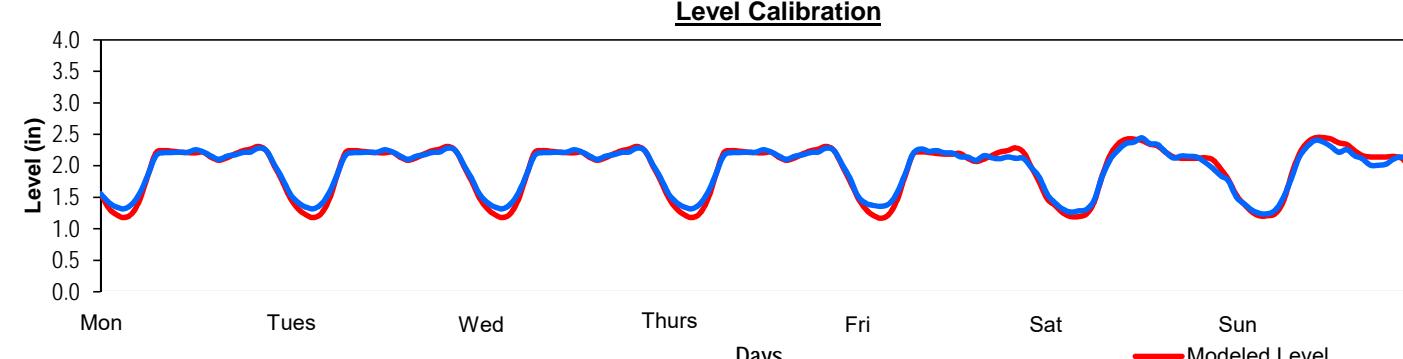
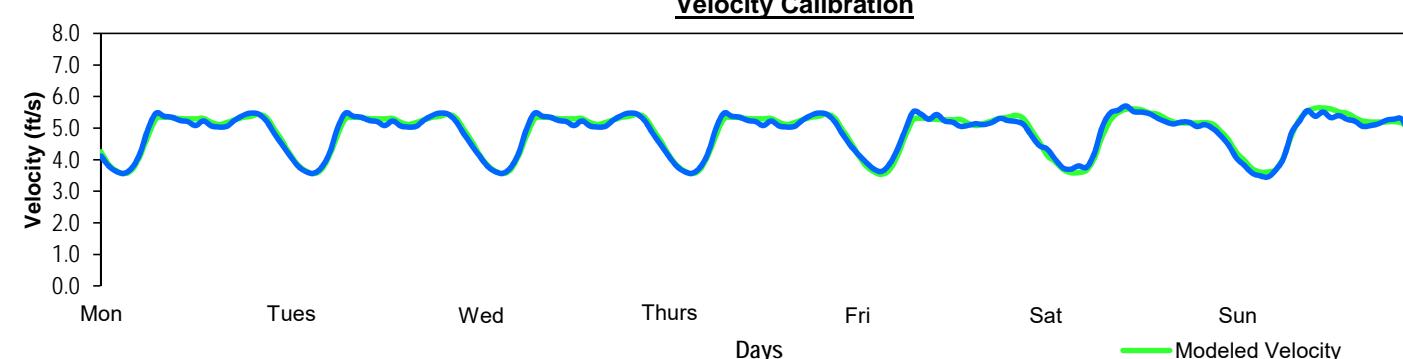
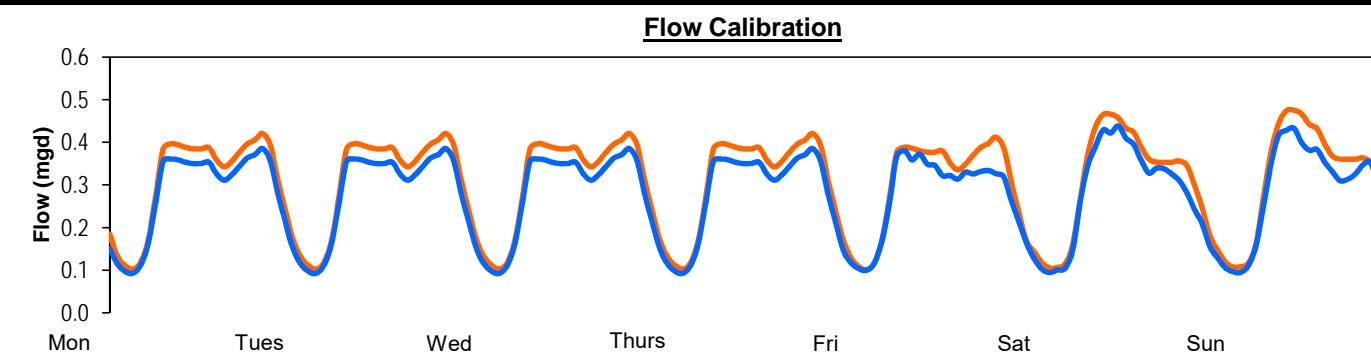


Model Calibration Summary

Day	Measured Data ⁽¹⁾				Modeled Data				Percent Error ⁽³⁾			
	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.28	0.39	2.0	4.85	0.31	0.42	1.95	4.87	9.8%	9.2%	-1.4%	0.4%
Tues.	0.28	0.39	2.0	4.85	0.31	0.42	1.95	4.87	9.8%	9.2%	-1.4%	0.4%
Wed.	0.28	0.39	2.0	4.85	0.31	0.42	1.95	4.87	9.8%	9.2%	-1.4%	0.4%
Thur.	0.28	0.39	2.0	4.85	0.31	0.42	1.95	4.87	9.8%	9.2%	-1.4%	0.4%
Fri.	0.27	0.38	1.9	4.85	0.30	0.41	1.93	4.84	10.3%	8.2%	-1.1%	-0.2%
Sat.	0.28	0.44	1.9	4.84	0.30	0.47	1.92	4.82	9.5%	6.3%	0.1%	-0.5%
Sun.	0.28	0.43	1.9	4.75	0.31	0.48	1.94	4.85	10.1%	9.8%	1.7%	2.1%
Summary												
Weekday	0.28	--	2.0	4.85	0.31	--	1.9	4.86	9.9%	--	-1.3%	0.3%
Weekend	0.28	--	1.9	4.80	0.31	--	1.9	4.84	9.8%	--	0.9%	0.8%
ADWF ⁽⁴⁾	0.28	--	2.0	4.83	0.31	--	1.9	4.85	9.9%	--	-0.7%	0.4%

Notes:

1. Source: V&A Temporary Flow Monitoring Program
2. Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.
3. Percent Error = $(\text{Modeled} - \text{Measured}) / \text{Measured} \times 100$
4. ADWF = $(5 \times \text{Weekday Average} + 2 \times \text{Weekend Average}) / 7$





**FLOW MONITORING SITE 8 DRY WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**

carollo

**Location: Westward Avenue, West of Sunset Avenue.
Pipeline diameter: 12"**

Site Photo

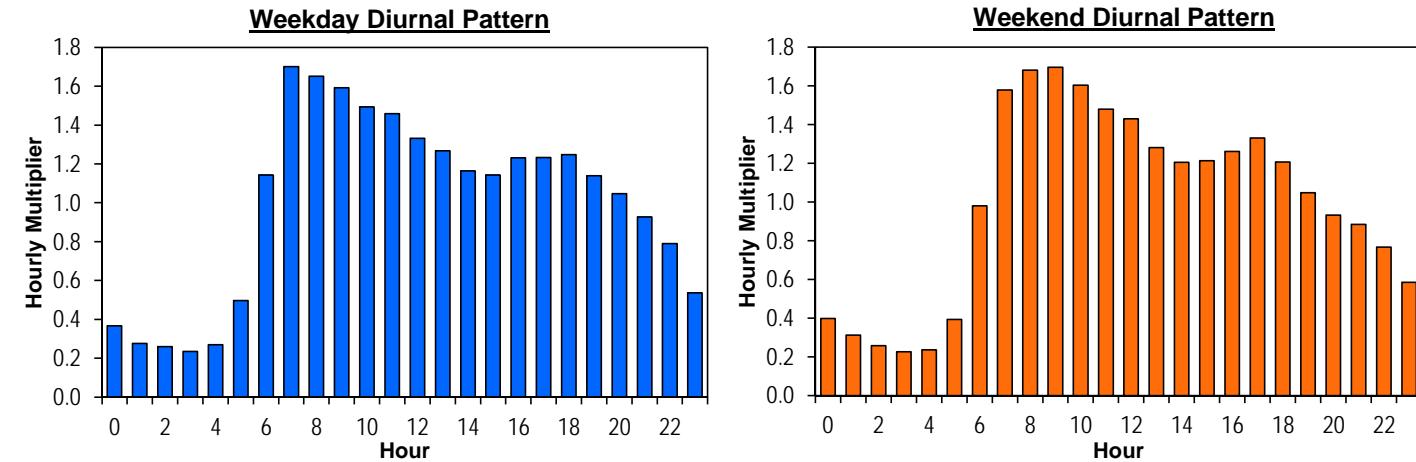
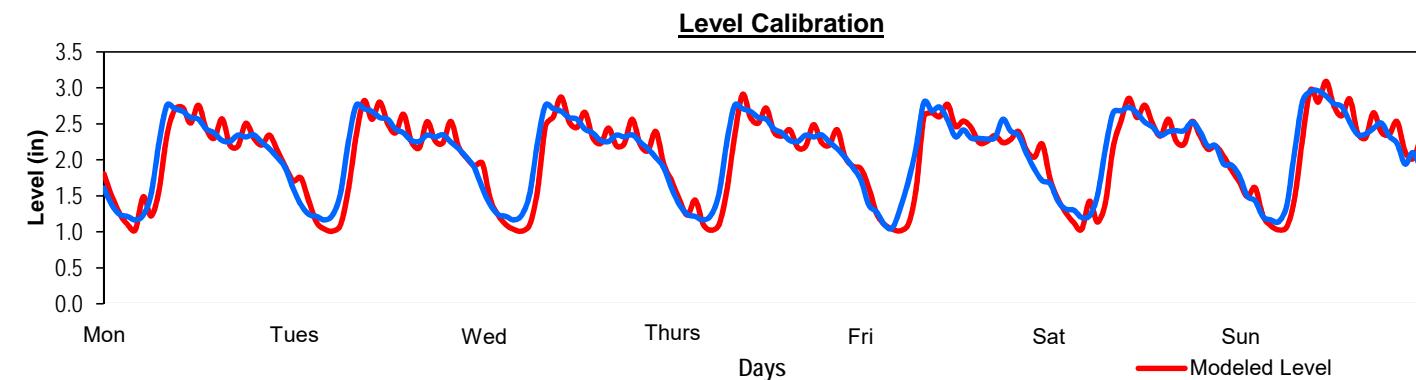
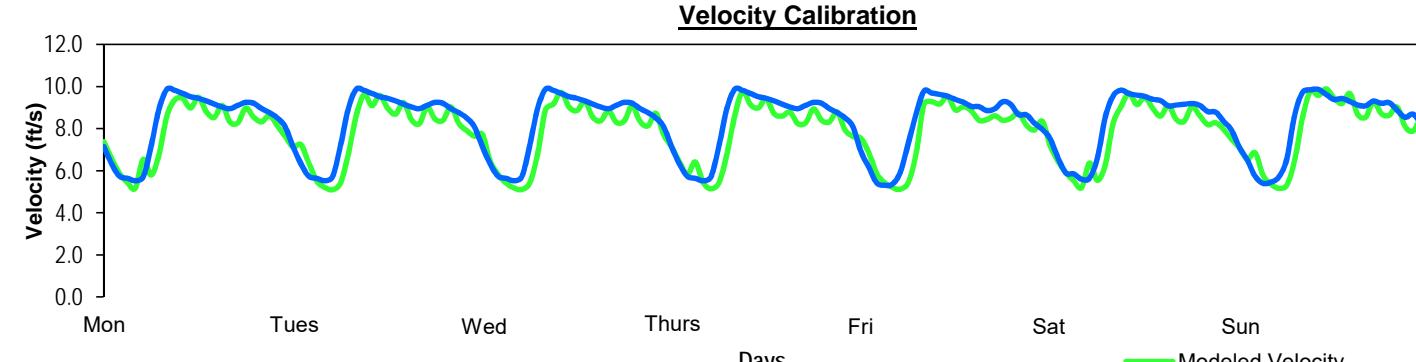
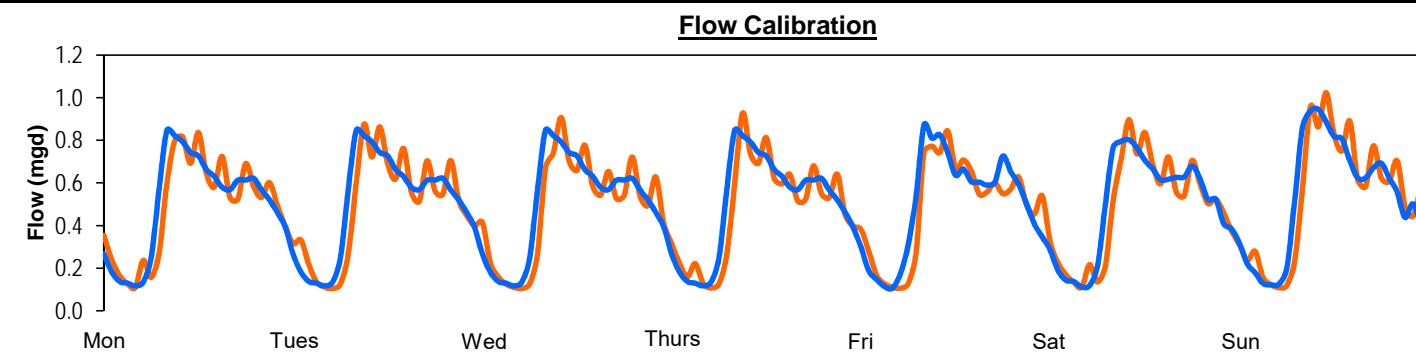


Model Calibration Summary

Day	Measured Data ⁽¹⁾				Modeled Data				Percent Error ⁽³⁾			
	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.50	0.85	2.1	8.28	0.48	0.93	2.03	7.82	-2.7%	9.5%	-1.6%	-5.6%
Tues.	0.50	0.85	2.1	8.28	0.48	0.93	2.03	7.82	-2.7%	9.5%	-1.6%	-5.6%
Wed.	0.50	0.85	2.1	8.28	0.48	0.93	2.03	7.82	-2.7%	9.5%	-1.6%	-5.6%
Thur.	0.50	0.85	2.1	8.28	0.48	0.93	2.03	7.82	-2.7%	9.5%	-1.6%	-5.6%
Fri.	0.50	0.87	2.1	8.18	0.49	0.84	2.03	7.82	-3.4%	-3.1%	-1.2%	-4.4%
Sat.	0.49	0.80	2.1	8.28	0.48	0.90	2.02	7.79	-2.8%	11.7%	-3.4%	-5.8%
Sun.	0.54	0.95	2.1	8.27	0.54	1.02	2.13	8.00	-0.3%	8.3%	-0.9%	-3.3%
Summary												
Weekday	0.50	--	2.1	8.26	0.48	--	2.0	7.82	-2.9%	--	-1.5%	-5.3%
Weekend	0.51	--	2.1	8.27	0.51	--	2.1	7.90	-1.5%	--	-2.1%	-4.5%
ADWF ⁽⁴⁾	0.50	--	2.1	8.27	0.49	--	2.0	7.84	-2.5%	--	-1.7%	-5.1%

Notes:

1. Source: V&A Temporary Flow Monitoring Program
2. Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.
3. Percent Error = $(\text{Modeled} - \text{Measured}) / \text{Measured} \times 100$
4. ADWF = $(5 \times \text{Weekday Average} + 2 \times \text{Weekend Average}) / 7$





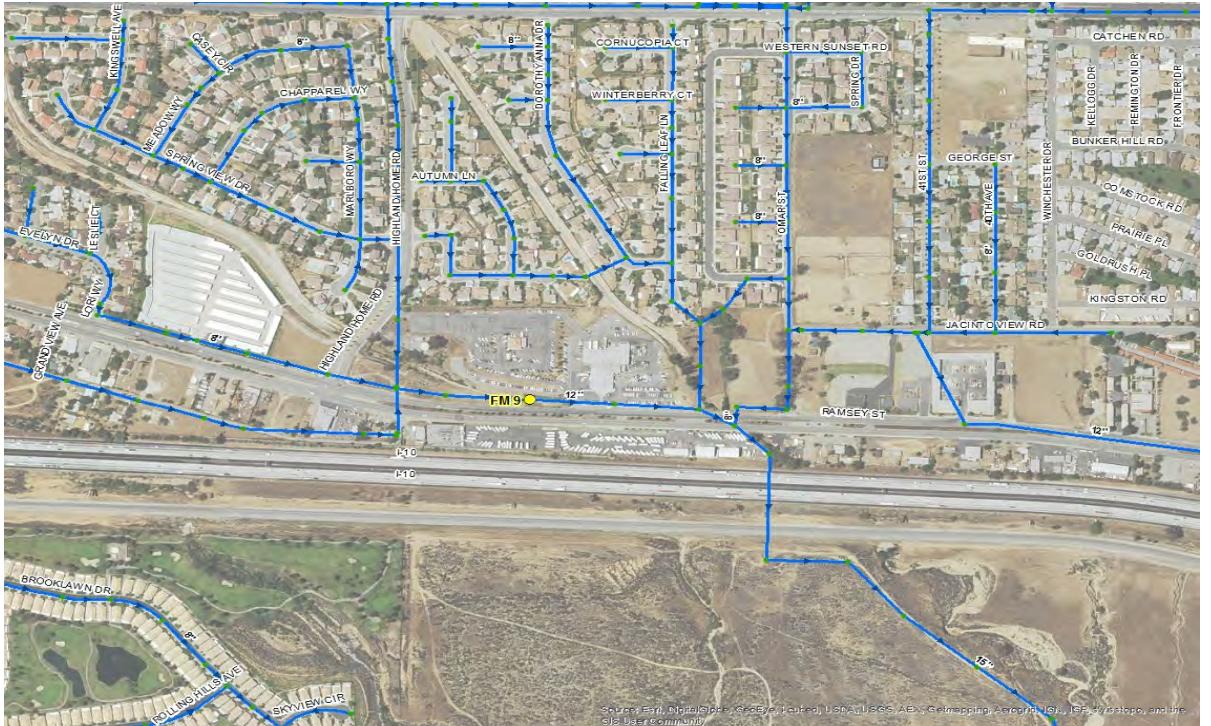
**FLOW MONITORING SITE 9 DRY WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



Location: Ramsey Street, East of Hiland Home Road.

Pipeline diameter: 12"

Site Photo

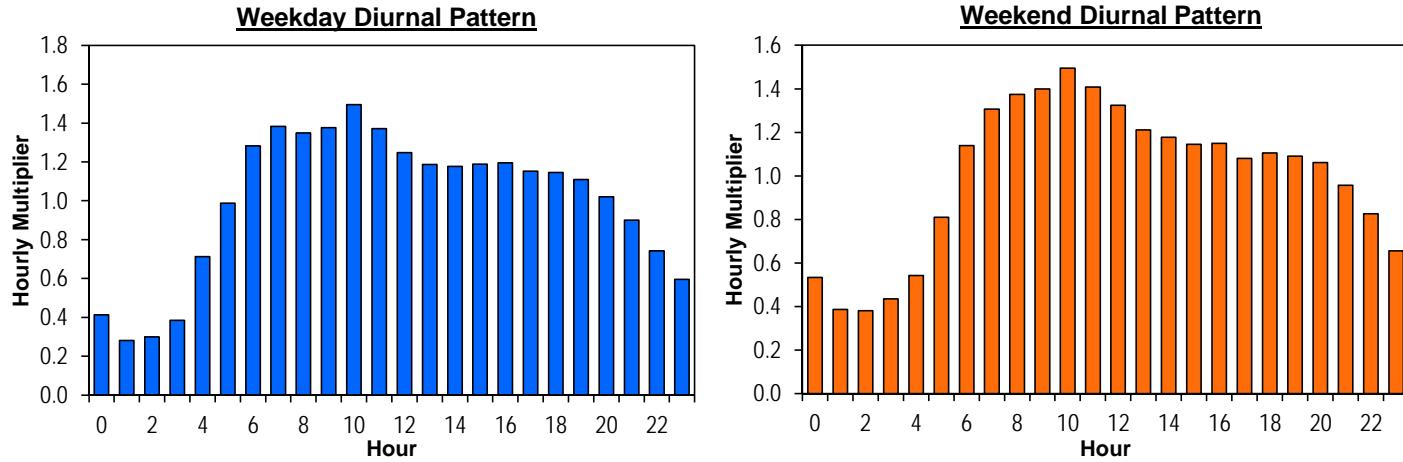
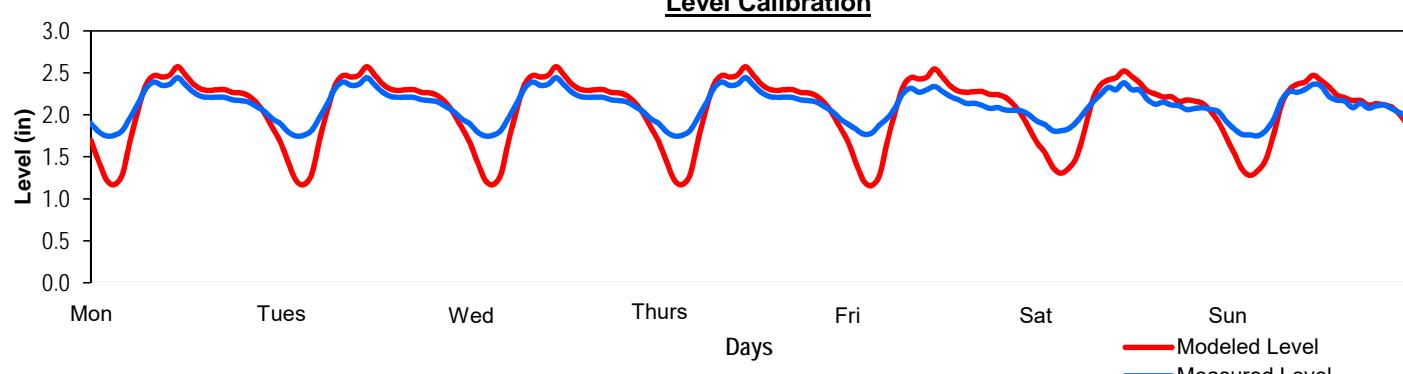
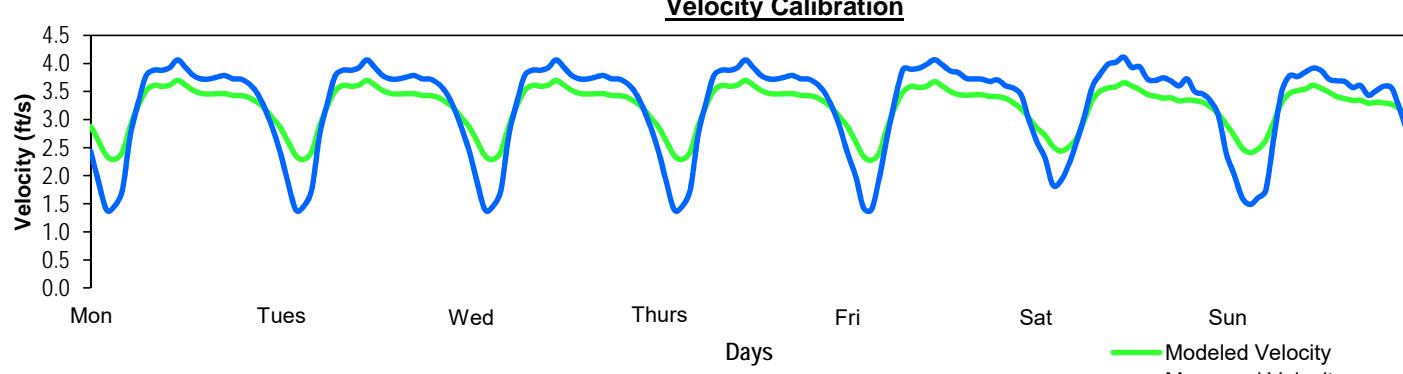
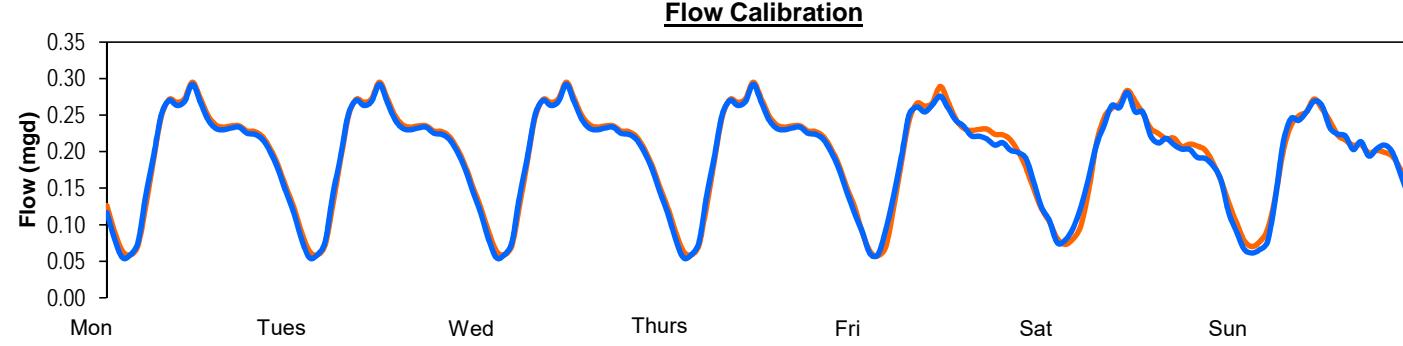


Model Calibration Summary

Day	Measured Data ⁽¹⁾				Modeled Data				Percent Error ⁽³⁾			
	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow ⁽²⁾ (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.20	0.29	2.1	3.24	0.20	0.30	2.07	3.23	1.3%	1.0%	-2.6%	-0.4%
Tues.	0.20	0.29	2.1	3.24	0.20	0.30	2.07	3.23	1.3%	1.0%	-2.6%	-0.4%
Wed.	0.20	0.29	2.1	3.24	0.20	0.30	2.07	3.23	1.3%	1.0%	-2.6%	-0.4%
Thur.	0.20	0.29	2.1	3.24	0.20	0.30	2.07	3.23	1.3%	1.0%	-2.6%	-0.4%
Fri.	0.19	0.28	2.1	3.28	0.19	0.29	2.05	3.21	0.8%	4.8%	-1.6%	-2.2%
Sat.	0.19	0.28	2.1	3.31	0.19	0.28	2.04	3.20	0.9%	1.0%	-2.7%	-3.3%
Sun.	0.18	0.27	2.1	3.10	0.18	0.27	2.00	3.16	1.6%	1.1%	-3.4%	2.0%
Summary												
Weekday	0.19	--	2.1	3.25	0.20	--	2.1	3.23	1.3%	--	-2.4%	-0.8%
Weekend	0.18	--	2.1	3.21	0.19	--	2.0	3.18	1.2%	--	-3.0%	-0.8%
ADWF ⁽⁴⁾	0.19	--	2.1	3.24	0.19	--	2.1	3.21	1.2%	--	-2.6%	-0.8%

Notes:

1. Source: V&A Temporary Flow Monitoring Program
2. Peak flow is the hourly average hourly peak flow, which was derived based on the 15-minute flow data from V&A.
3. Percent Error = $(\text{Modeled} - \text{Measured}) / \text{Measured} \times 100$
4. ADWF = $(5 \times \text{Weekday Average} + 2 \times \text{Weekend Average}) / 7$



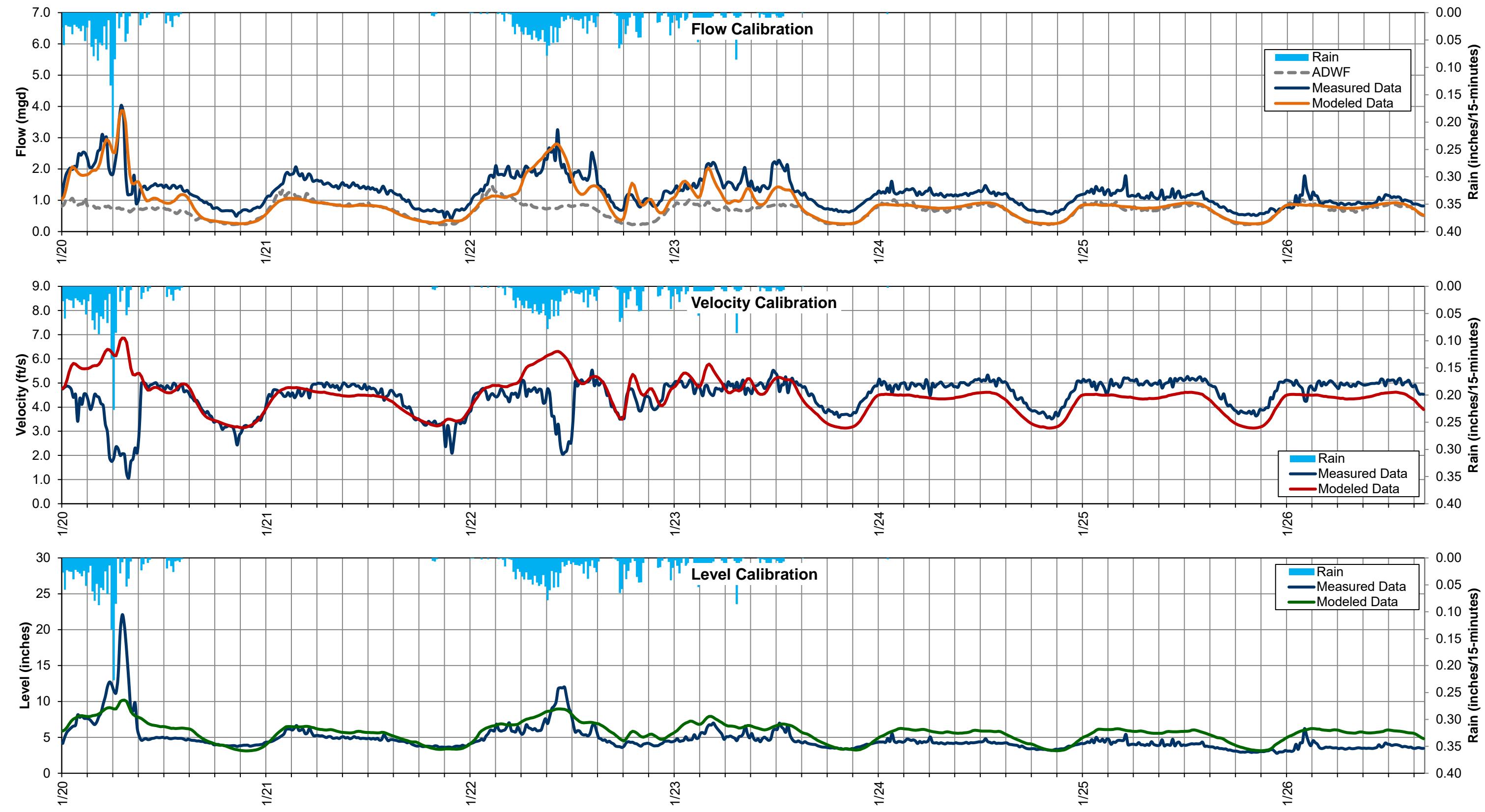
Meter Number	Pipe Diameter (in)	Storm 1 (1/20/2017-1/20/2017)								Storm 2 (1/22/2017-1/23/2017)															
		Measured Data ⁽¹⁾				Modeled Data ⁽²⁾				Percent Error ⁽³⁾				Measured Data ⁽¹⁾				Modeled Data ⁽²⁾				Percent Error ⁽³⁾			
		Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (%)	Peak Flow (%)	Avg. Velocity (%)	Avg. Level (%)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (%)	Peak Flow (%)	Avg. Velocity (%)	Avg. Level (%)
SITE 1	24	1.822	4.039	3.95	7.5	1.669	3.865	5.34	7.4	-8.4%	-4.3%	35.0%	-0.8%	1.435	3.258	4.36	5.2	1.133	2.803	4.74	6.1	-21.1%	-14.0%	8.7%	16.9%
SITE 2	30	2.336	3.717	1.93	12.6	2.105	4.047	2.12	10.0	-9.9%	8.9%	9.6%	-20.9%	1.840	3.196	1.92	10.0	1.884	3.562	2.06	9.5	2.4%	11.4%	7.1%	-4.3%
SITE 3	15	0.915	1.885	6.44	3.5	0.899	1.911	6.95	3.2	-1.7%	1.4%	7.9%	-7.2%	0.650	1.253	6.26	2.7	0.663	1.378	6.31	2.7	2.0%	10.0%	0.8%	0.3%
SITE 4	15	0.629	1.142	5.24	3.1	0.575	1.311	4.95	3.0	-8.6%	14.9%	-5.5%	-3.8%	0.462	0.838	4.86	2.6	0.422	0.863	4.49	2.5	-8.8%	2.9%	-7.7%	-1.6%
SITE 5	12	0.100	0.290	1.85	1.8	0.118	0.280	1.84	2.1	18.2%	-3.8%	-0.2%	17.5%	0.072	0.215	1.63	1.6	0.090	0.188	1.68	1.8	23.7%	-12.4%	3.1%	15.4%
SITE 6	21	1.372	2.259	2.52	7.8	1.590	2.389	2.70	8.3	15.9%	5.7%	7.1%	6.4%	1.112	1.928	2.32	7.0	1.143	2.192	2.43	6.9	2.8%	13.7%	5.0%	-2.1%
SITE 7	15	0.418	1.152	5.40	2.3	0.448	1.241	5.37	2.3	7.2%	7.8%	-0.6%	2.1%	0.375	0.817	5.23	2.1	0.403	0.796	5.24	2.2	7.4%	-2.6%	0.2%	4.1%
SITE 8	12	0.686	0.924	9.16	2.4	0.810	1.098	9.27	2.3	18.0%	18.8%	1.2%	-7.6%	0.675	1.242	8.84	2.4	0.610	1.119	8.35	2.3	-9.7%	-10.0%	-5.6%	-4.8%
SITE 9	12	0.341	0.722	3.90	2.6	0.382	0.858	3.88	2.8	12.0%	18.7%	-0.5%	7.4%	0.305	0.617	3.72	2.6	0.281	0.572	3.57	2.5	-7.6%	-7.3%	-4.0%	-4.1%



**FLOW MONITORING SITE 1 WET WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



Location: Northern Pipeline entering WWTP.
Pipeline diameter: 24"

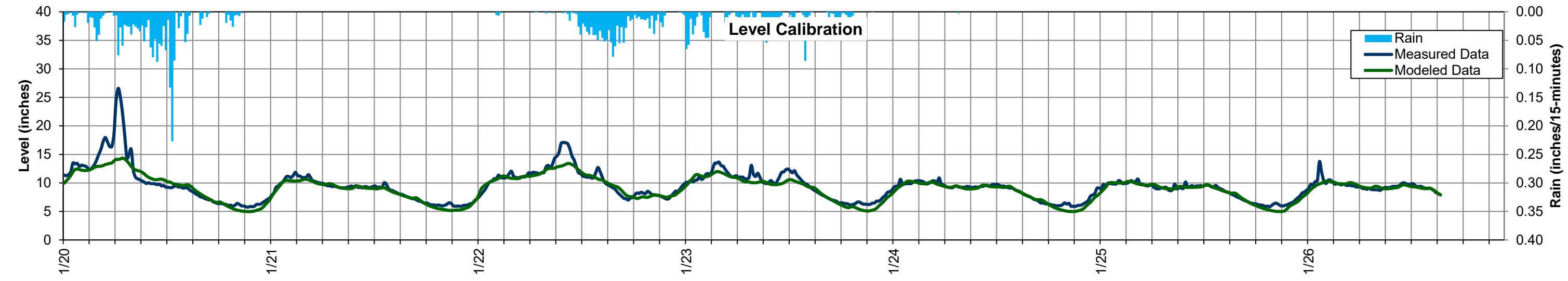
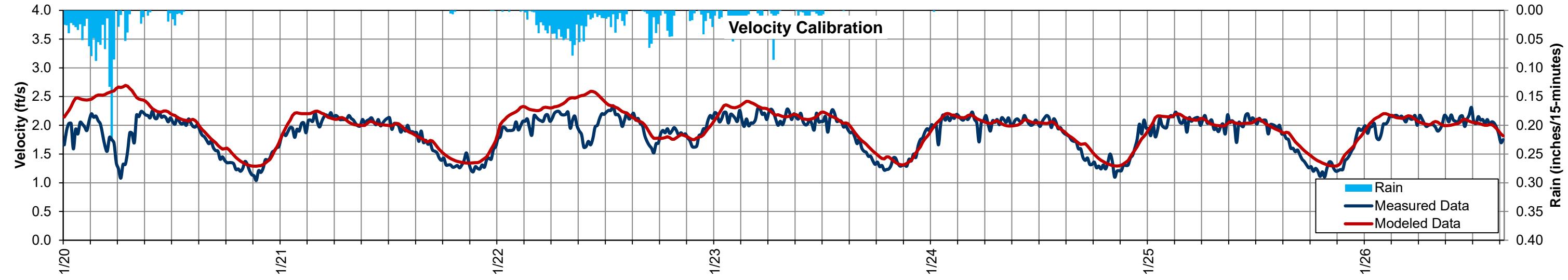
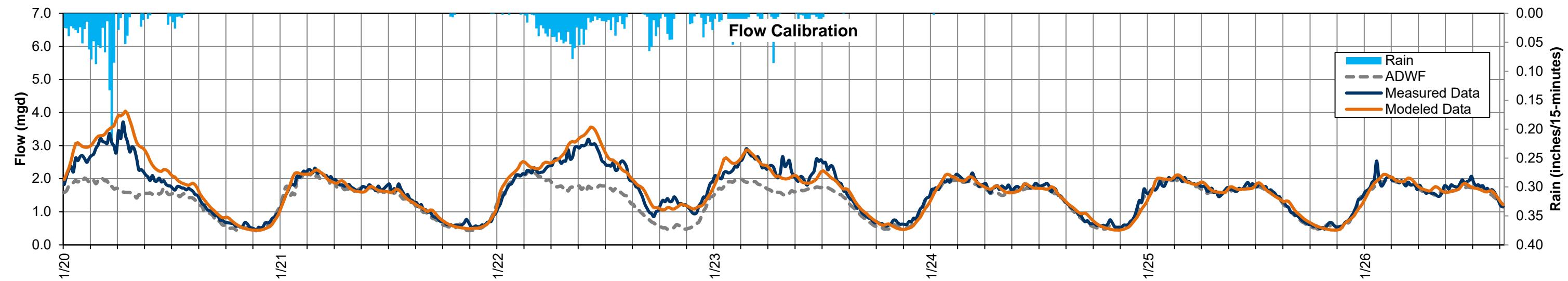




**FLOW MONITORING SITE 2 WET WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



Location: Pipeline Entering WWTP from South.
Pipeline diameter: 30"

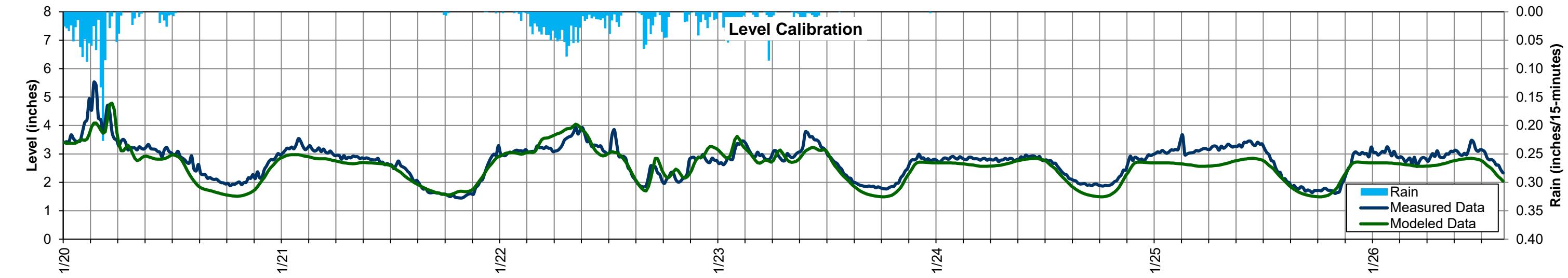
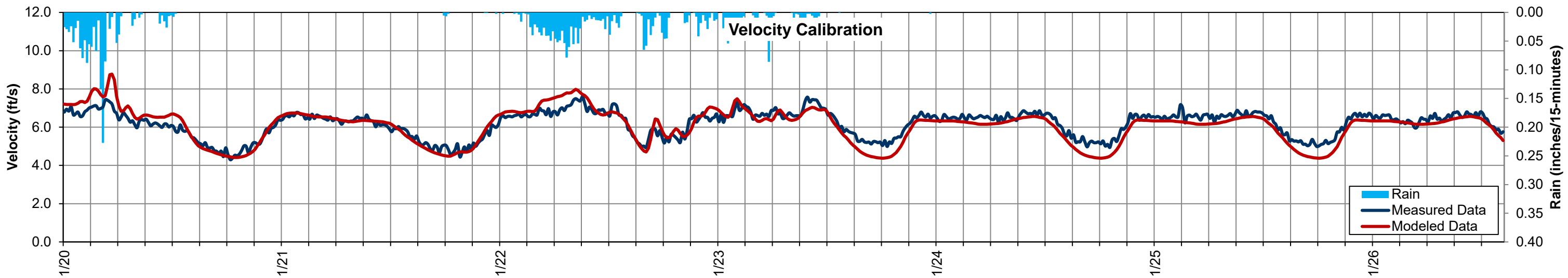
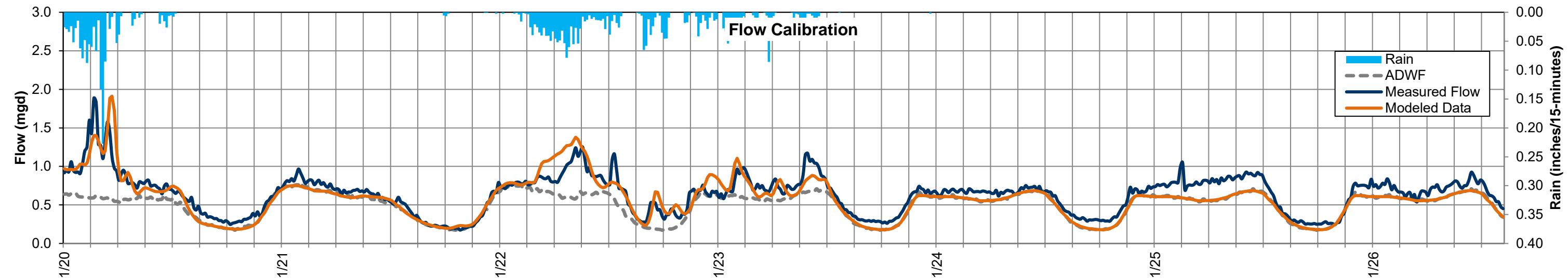




**FLOW MONITORING SITE 3 WET WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



Location: North of Charles Street and Hargrave Street Intersection.
Pipeline diameter: 15"

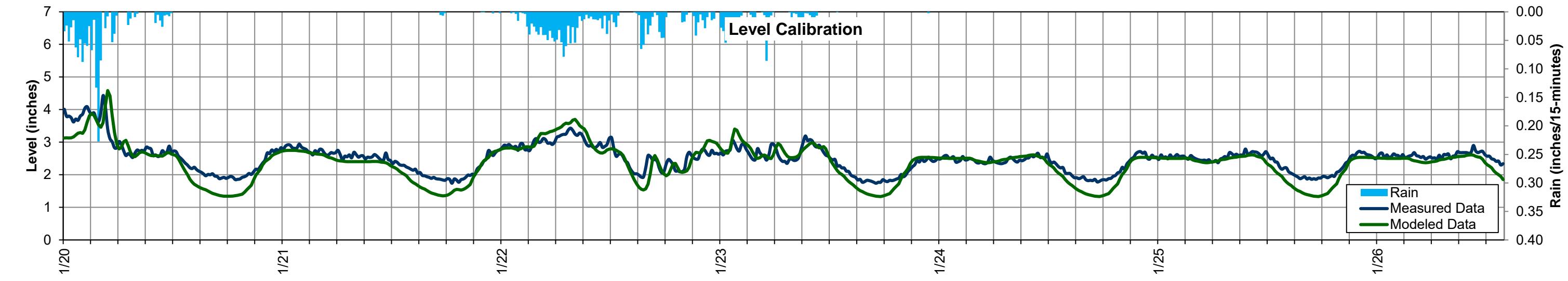
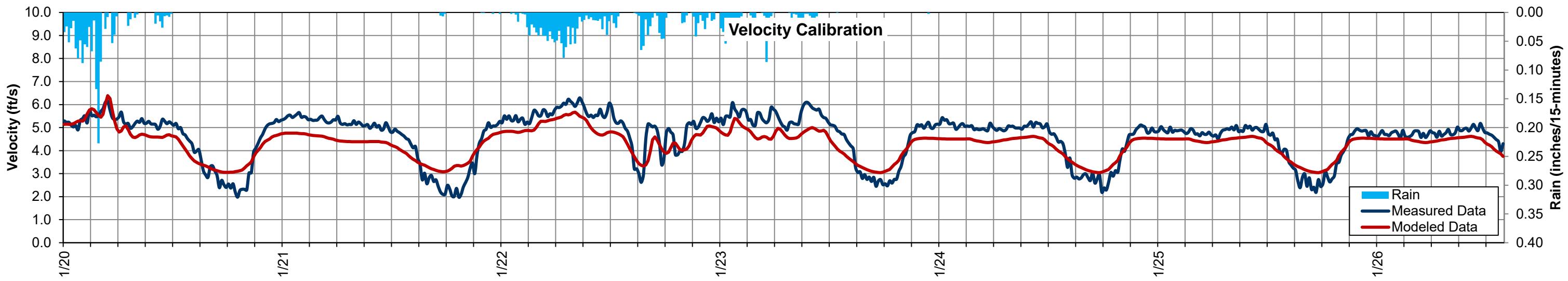
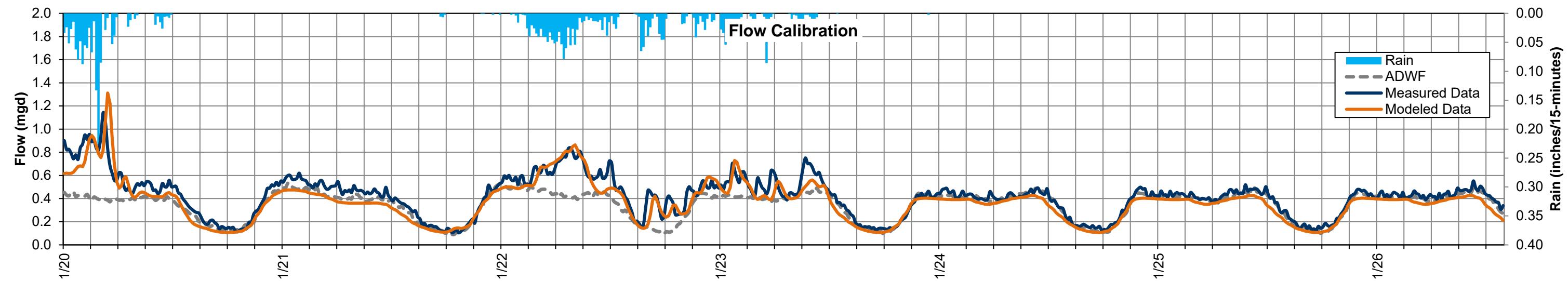




**FLOW MONITORING SITE 4 WET WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



Location: North of Westward Avenue and Fourth Street Intersection.
Pipeline diameter: 15"

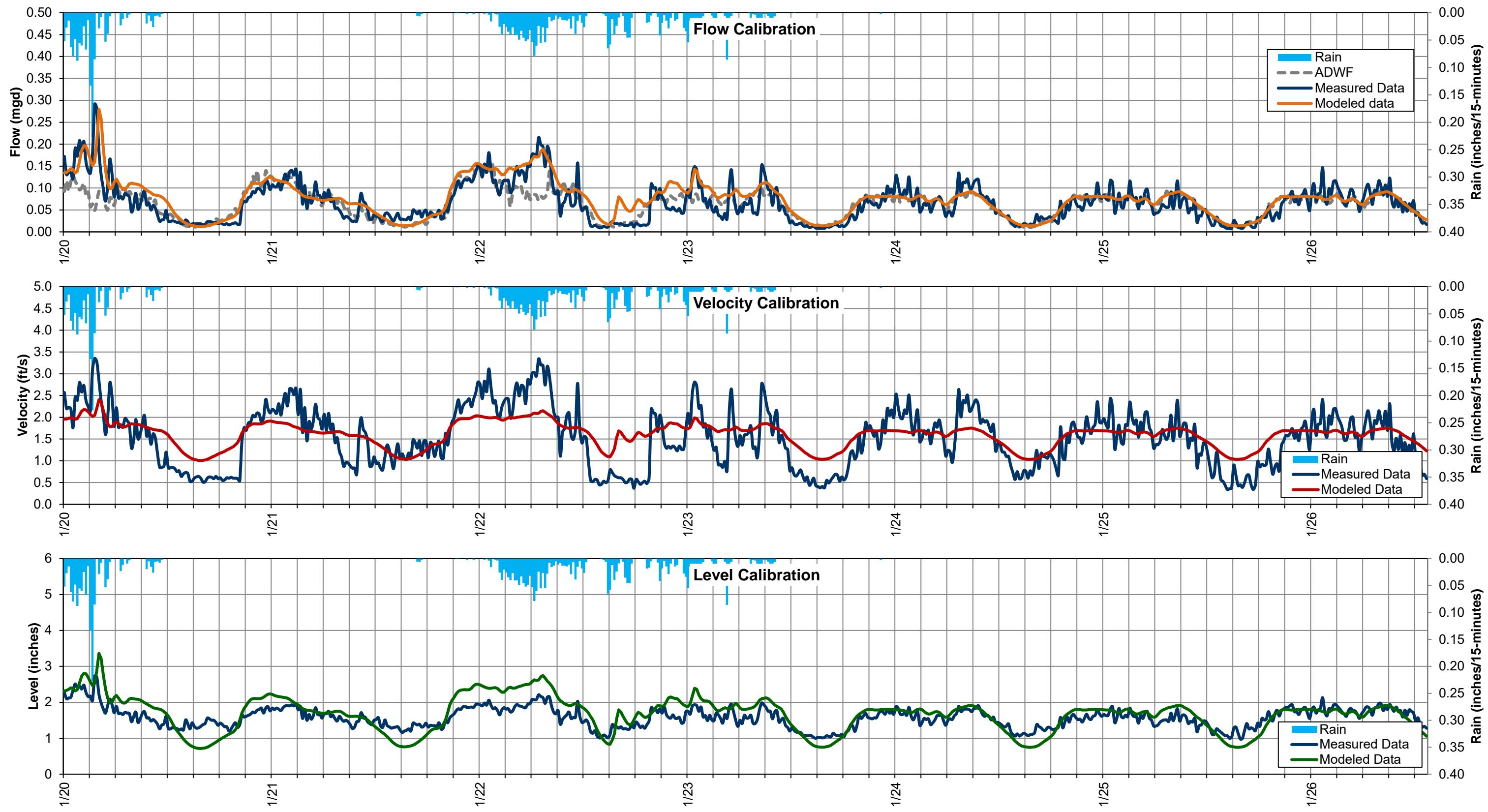


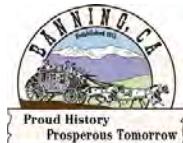


**FLOW MONITORING SITE 5 WET WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



Location: 22nd Street, North of Westward Avenue.
Pipeline diameter: 12"

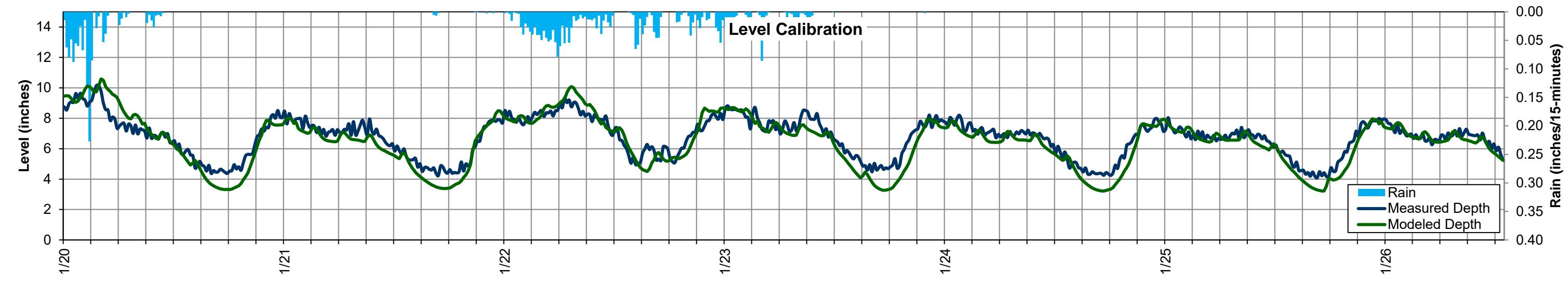
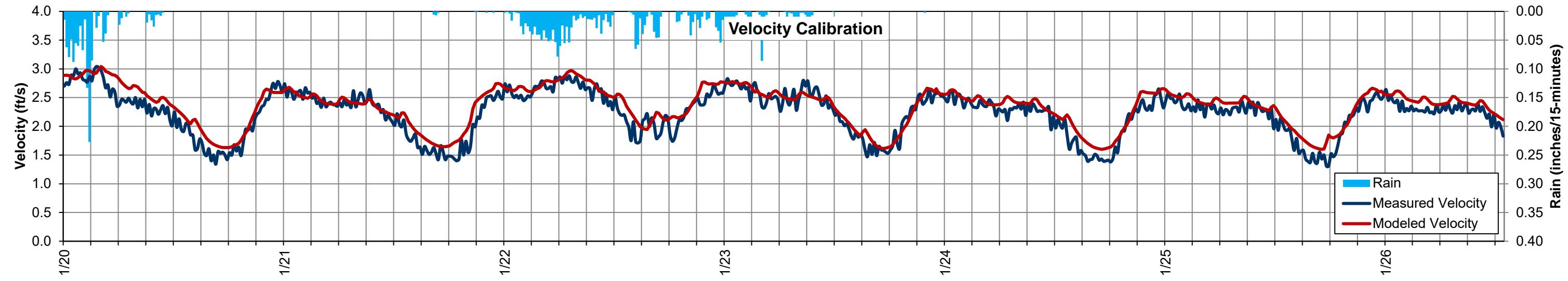
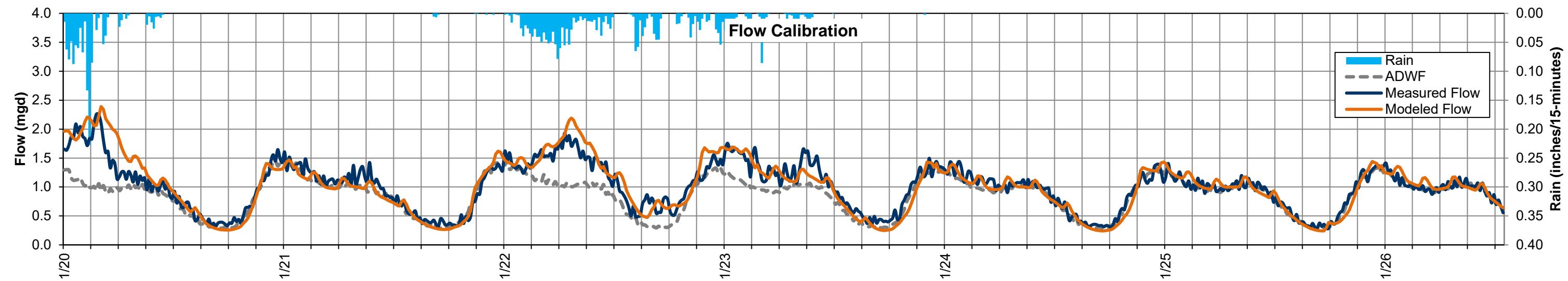




**FLOW MONITORING SITE 6 WET WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



Location: Westward Avenue, West of 22nd Avenue
Pipeline diameter: 21"

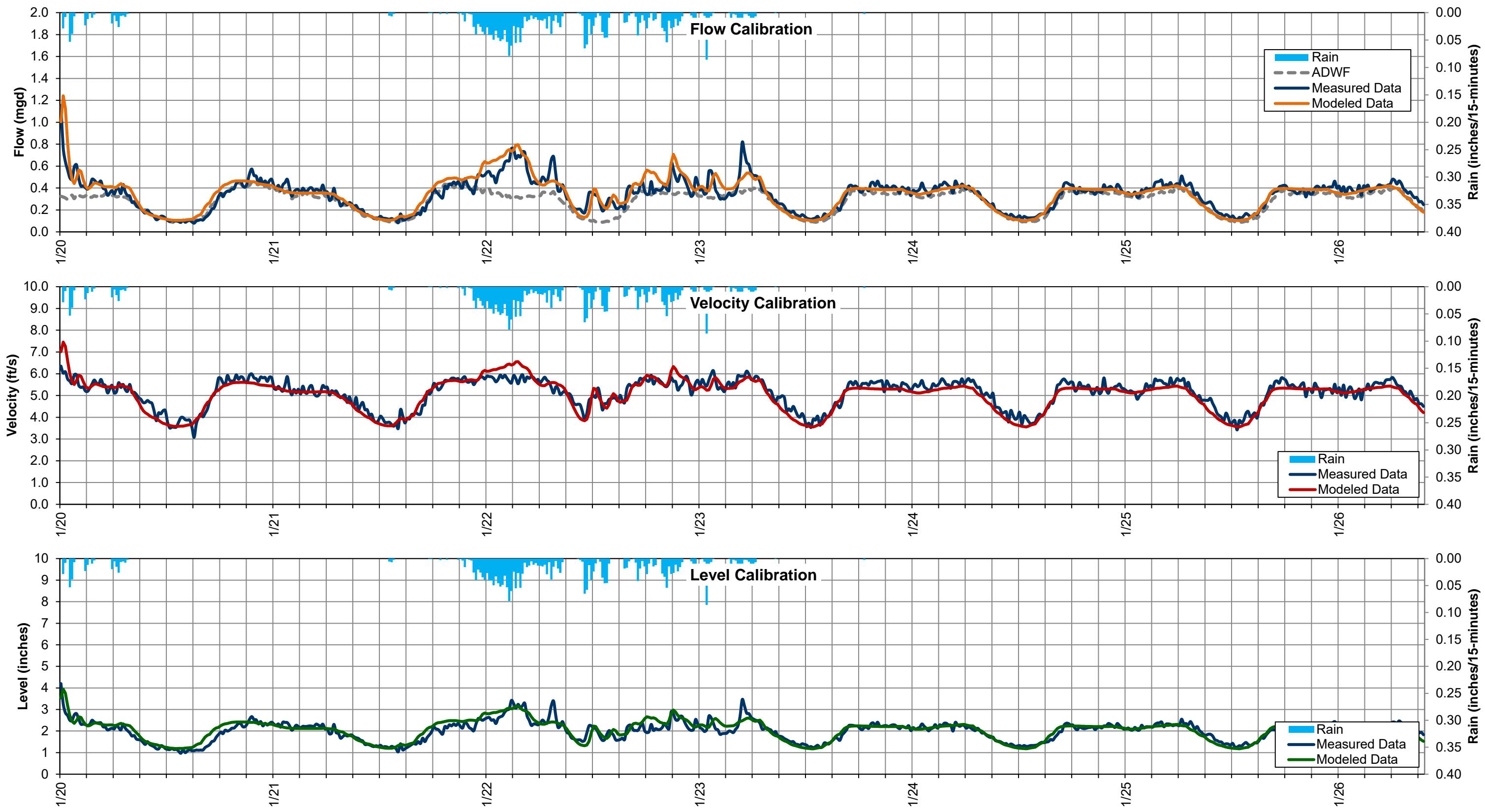




**FLOW MONITORING SITE 7 WET WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



Location: Open Space Southwest of Ramsey Street and Eight Street Intersection.
Pipeline diameter: 15"

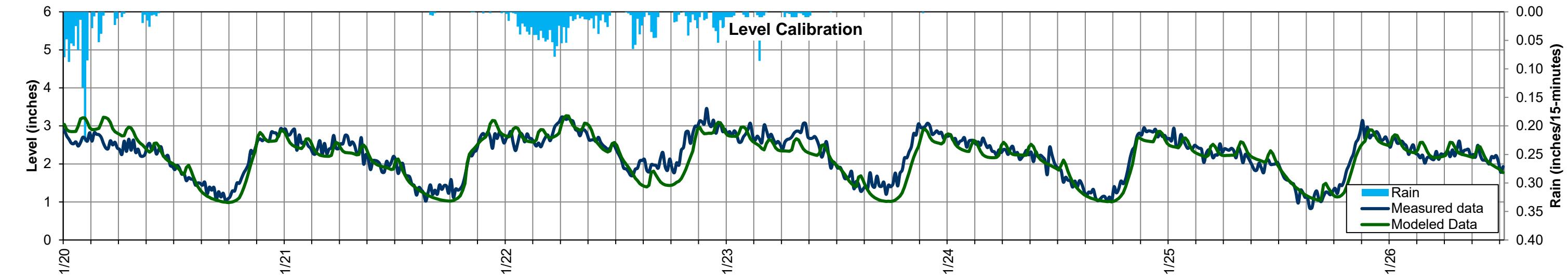
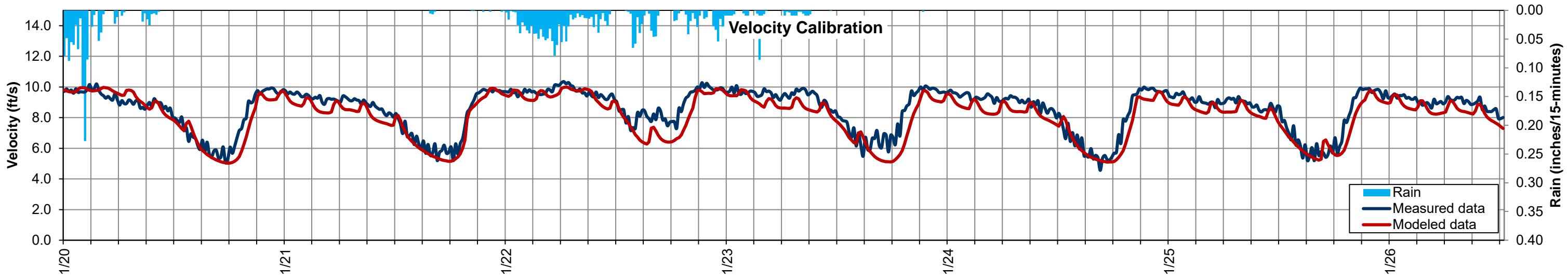
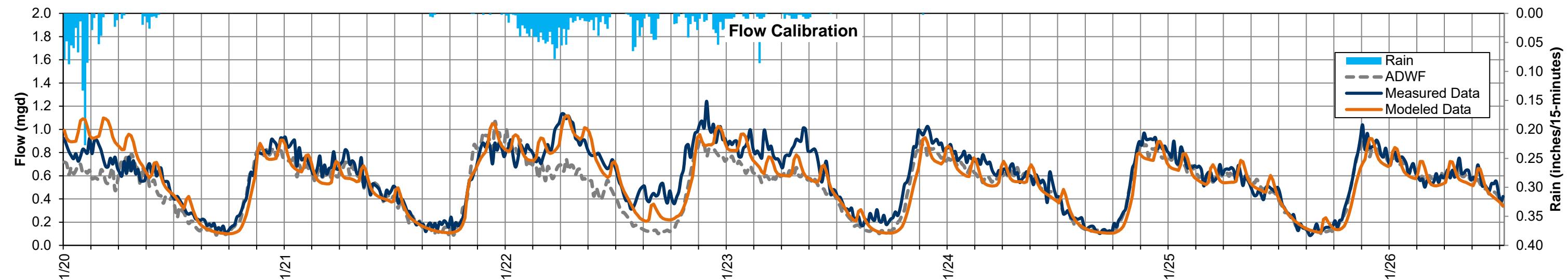


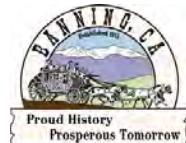


**FLOW MONITORING SITE 8 WET WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



Location: Westward Avenue, West of Sunset Avenue.
Pipeline diameter: 12"

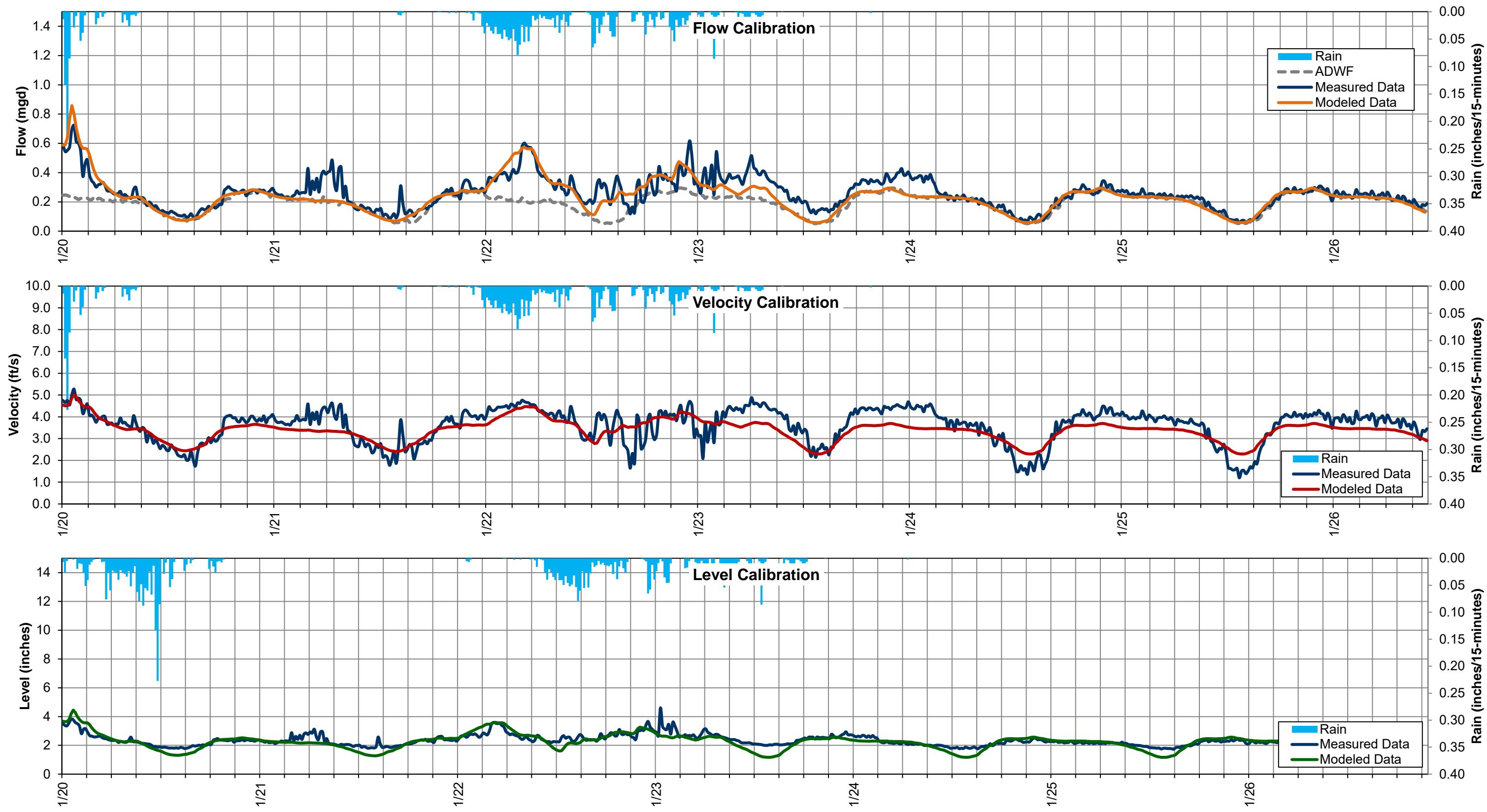




**FLOW MONITORING SITE 9 WET WEATHER FLOW CALIBRATION
INTEGRATED MASTER PLAN
CITY OF BANNING, CALIFORNIA**



Location: Ramsey Street, East of Hiland Home Road.
Pipeline diameter: 12"





**CITY OF BANNING
INTEGRATED MASTER PLAN
POTABLE WATER MODEL CALIBRATION PLAN**

FINAL
March 2017

CITY OF BANNING
INTEGRATED MASTER PLAN
POTABLE WATER MODEL CALIBRATION PLAN

TABLE OF CONTENTS

	<u>Page No.</u>
1.0 OVERVIEW	1
1.1 Schedule	1
2.0 MACRO CALIBRATION.....	2
2.1 Overview of Macro Calibration.....	2
2.2 Macro Calibration Process	2
3.0 FIRE FLOW TESTING	3
3.1 Overview of Fire Flow Calibration Process	3
3.2 Preliminary Schedule for Testing Days	4
3.3 Fire Flow Test Locations	4
3.4 Standard Fire Flow Tests	4
3.5 Required Equipment / Staff	5
3.6 Fire Flow Testing Procedure.....	5
4.0 EXTENDED PERIOD CALIBRATION	9
4.1 Overview of Extended Period Calibration Process.....	9
4.2 Data Required for Extended Period Calibration	9
4.3 Format of Data	11
4.4 Temporary Pressure Loggers	11

APPENDIX A FIRE FLOW TEST - DETAILED FIELD MAPS

LIST OF TABLES

Table 1	Calibration Data Gathering and Testing Schedule	1
Table 2	EPS Calibration Data Gathering Parameters	10
Table 3	Sample SCADA Format.....	11
Table 4	Temporary Pressure Logger Summary	12

LIST OF FIGURES

Figure 1	Preliminary Fire Flow Testing and Pressure Logger Locations.....	7
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MODEL CALIBRATION PLAN

1.0 OVERVIEW

The model calibration will consist of three parts, a macro calibration, fire flow test calibration, and an extended period simulation (EPS) calibration. This calibration plan covers each of the calibration processes, specifically focusing on data gathering needed to ensure an accurate and complete calibration.

1.1 Schedule

Field testing and data gathering for the model calibration is proposed to take place from March 7 to March 20. Table 1 presents a schedule of the duration of the field testing and dating gathering, detailing on which days each data gathering element of the calibration will take place.

Table 1 Calibration Data Gathering and Testing Schedule Model Calibration Plan City of Banning						
Sunday Mar. 5	Monday Mar. 6 PLs arrive at City	Tuesday Mar. 7 City staff to install PLs PLs Start Recording (EPS Data Gathering)	Wednesday Mar. 8 EPS	Thursday Mar. 9 EPS	Friday Mar. 10 EPS	Saturday Mar. 11 EPS
Sunday Mar. 12 EPS	Monday Mar. 13 EPS	Tuesday Mar. 14 EPS	Wednesday Mar. 15 EPS	Thursday Mar. 16 Standard FF Tests at 12 Sites	Friday Mar. 17 EPS	Saturday Mar. 18 EPS
Sunday Mar. 19 EPS	Monday Mar. 20 PL Stop Recording Remove Pressure Loggers	Tuesday Mar. 21 Send PL back to Carollo Send SCADA to Carollo	Wednesday Mar. 22	Thursday Mar. 23	Friday Mar. 24	Saturday Mar. 25

Abbreviations: EPS: Extended Period Simulation; FF: Fire Flow; PL: Pressure Loggers. .

City staff will need to install pressure loggers on Tuesday, March 7, 2017. Carollo will send the loggers to arrive by Monday, March 6, 2017 to give the City time to install the loggers. Fire flow testing will be conducted on Thursday, March 16, 2017.

The remainder of this plan details the data required for each calibration and testing procedures for each portion of the calibration test.

2.0 MACRO CALIBRATION

2.1 Overview of Macro Calibration

This initial calibration process will consist of a macro calibration, under which Carollo will run the model under existing demand conditions and make the necessary adjustments to produce reasonable system pressures and replenishing reservoirs. Possible adjustments include modifications of pipeline connectivity, operational controls, ground elevations, facility characteristics, and pump curves.

2.2 Macro Calibration Process

The macro calibration process will involve several steps to ensure that the model is producing reasonable results.

2.2.1 Transmission Main Connectivity

Carollo will use the connectivity features of the City's selected hydraulic modeling software to verify the connectivity of the transmission mains within the distribution system. Problems found using the connectivity locators will be reviewed on a case-by-case basis by the hydraulic modeler to determine whether adjustments need to be made to the connectivity of the model. Output reports of pipe flow characteristics, such as headloss (ft/kft) and velocity (ft/s) will also be used to locate problem areas to be looked at by the hydraulic modeler to determine whether additional adjustments need to be made to the connectivity of the model.

2.2.2 System Pressures

The City has provided Carollo with estimates of typical pressures throughout the distribution system. The macro calibration will compare the model output to the typical pressures observed. This process will allow Carollo to locate major errors in model creation, elevations, or GIS connectivity, as well as changes that need to be made in how operational controls of the system should be implemented in the model.

2.2.3 Facility Characteristics

If available, hydraulic model results from each pump in the system will be compared to pump tests provided by the City to verify that the facility attributes entered into the model,

such as pump power, groundwater depth, and the pump curves, are producing results comparable to what the City experiences.

3.0 FIRE FLOW TESTING

3.1 Overview of Fire Flow Calibration Process

The calibration of fire flow tests is intended to develop a steady state calibrated hydraulic model by closely matching its water model pressures to field pressures under similar demand and system boundary conditions. The primary varied parameter for this calibration will be pipeline roughness coefficients, although other parameters may be adjusted as calibration results are generated.

Hazen William roughness coefficients, or C-factors, have industry accepted value ranges based on pipeline material, diameter, and age. Characteristics specific to the City's distribution system such as water quality, temperature, construction methodologies, material suppliers, and other factors may result in roughness coefficients, which differ from the average of the industry accepted ranges. Fire Flow calibration refines the initial estimation of the value of roughness coefficients that best indicate the conditions of the City's distribution system. During average day flows, roughness coefficients have a relatively small effect on the operation of the distribution system. As the flows increase in the system on higher demand days, velocity within pipelines increase and roughness coefficients contribute more to overall system head loss. Fire Flow tests artificially create high demand events to generate more headloss, allowing a better estimation of the pipeline roughness coefficients.

It is proposed to include 12 fire flow tests using one or two flowing hydrants and two pressure hydrants. These field tests are simulated in the model to calibrate the model under steady state conditions. The fire flow tests will each stress the City's distribution system by creating a differential between the hydraulic grade line (HGL) at the point of hydrant flow and the system HGL at neighboring hydrants. This HGL differential will increase the effect of the roughness coefficients on system losses and allow adjustments to the model to match model pressures to field pressures within an acceptable tolerance. As the model is adjusted to match system pressures, roughness coefficients will be adjusted only within a tolerance of industry accepted roughness coefficient ranges. If the model is unable to match the calibration results without leaving the acceptable range of roughness coefficient values for a given pipeline material and age, there may be cause for further investigation of a previously unknown field condition. Examples of such conditions, which typically arise during hydraulic model calibration, include closed pipelines, partially closed or malfunctioning valves, extreme corrosion within pipelines, connectivity and diameter errors in GIS/as-builts, and diurnal patterns of large water users.

3.2 Preliminary Schedule for Testing Days

The equipment testing and 12 fire flow tests are scheduled for Thursday, March 16. The following schedule details the events for the period of testing.

Thursday, March 16

7:00 am	Meet at City Hall/City Yard
	<ul style="list-style-type: none">• Introductions• Record time difference between field time and SCADA clock.• Distribute packets and routing information• Check radios, if necessary (or fill in cell phone contact sheet)• Calibrate pressure gauges on a nearby hydrant (if more than one pressure gauges used)• Travel to Site 1
7:00-11:00 am	Conduct Fire Flow Tests at Sites 1 through 6
11:00-12:00 pm	Lunch
12:00-4:00 pm	Conduct Fire Flow Tests at Sites 7 through 12

3.3 Fire Flow Test Locations

Carollo has selected 12 preliminary testing sites, which are shown on Figure 1. The testing sites are distributed across the City and were selected based on location, accessibility, and representation of the various portions of the City's distribution system. It is anticipated that one test point will be taken within each smaller zone and up to four test points will be taken within larger zones. Each of the 12 testing sites is shown in detail on an individual Fire Flow Test Detail Map, which can be found in Appendix A.

The test sites have been selected such that they create a good geographical coverage of the City's entire distribution system. All tests are located away from major transmission lines and facilities to increase the chance that a substantial pressure drop (> 10 psi) is observed during the tests with the exception of Site 6, which is located on the 30-inch diameter transmission main between Brinton Reservoir and the San Gorgonio Tanks.

3.4 Standard Fire Flow Tests

On the day of fire flow testing, the 12 fire flow tests will be conducted without adjusting the configuration of the distribution system. For each of these fire flow tests, the residual will be initially measured at two hydrants (P-1 and P-2) while a single hydrant is opened (F-1). If the single hydrant is unable to generate a sufficient drop in pressure gradient, a second hydrant (F-2) will be opened according the detail sheets.

3.5 Required Equipment / Staff

3.5.1 Required Staff (City)

A minimum of 3 staff to operate hydrants will be required for the following tasks:

- One staff member at each flowing hydrant (2)
- One staff member at the residual pressure hydrants (1-2)

City staff shall be responsible for installation and removal of data loggers on hydrants, operation of valves, driving City vehicles or any other function involving City property.

3.5.2 Required Equipment (City)

- 3 pressure gauges (1 primary, 1 secondary, and 1 spare)
- 3 flow gauges (1 primary, 1 secondary, 1 spare)
- 3 diffusers to attach to the flowing hydrants (if not included as a part of the flow gauge)
- 3 hand-held radios/cell phones (1 per City staff)
- 3 clipboards
- Wrenches and equipment to open/flow each hydrant and necessary valves

3.5.3 Required Equipment (Carollo)

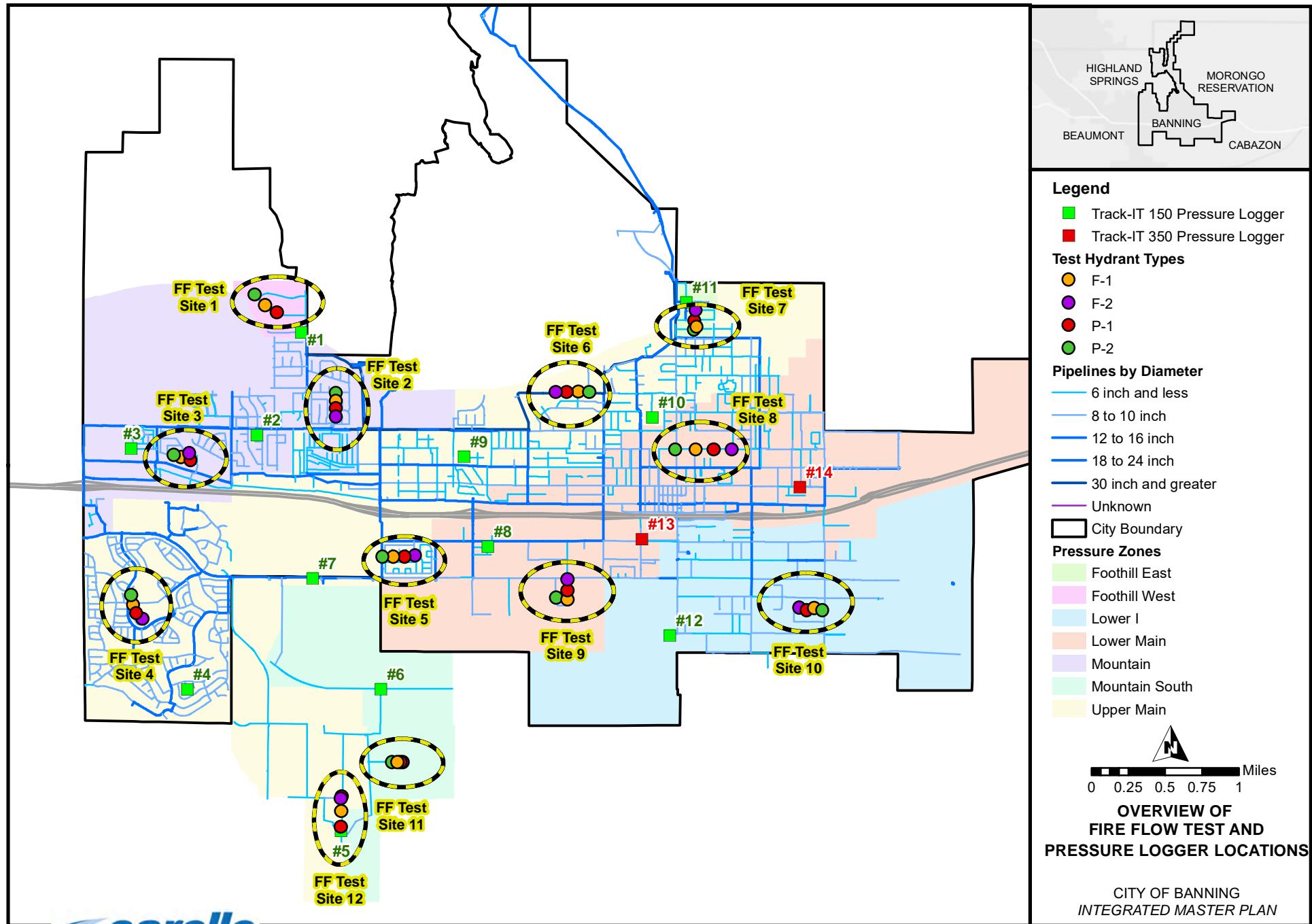
- Maps and field testing forms (including routing and order of testing)

3.6 Fire Flow Testing Procedure

On the day of fire flow testing, if multiple pressure gauges are used, all the pressure gauges should be calibrated by comparing readings when attached to the same hydrant.

1. Position everyone at their respective locations with their clipboard and field-testing forms and confirm that everyone is at their place via radio/cell phone/hand signals.
2. City staff will attach the pressure gauges to the pressure hydrants (P-1 and P-2) and flow hydrant (F-1). Carollo coordinator will remain at P-1 to read pressure during test.
3. Carollo coordinator will log the time, date and location on the testing form, along with the pressure at the pressure hydrants (P-1 and P-2).
4. City staff will attach the flow gauge to the primary flow hydrant (F-1).
5. Carollo coordinator will ask for the static pressure reading from each hydrant, one-by-one (before opening the flowing hydrant) and record in the field testing form.
6. Carollo coordinator will have a City staff open the flowing hydrant (F-1) until a steady stream is flowing (divert into gutters and dechlorinate).
7. City staff will take note of flow from flowing hydrant (F-1). Carollo coordinator will ask for the flow from the flowing hydrant (F-1) and record in the field testing form.

8. Carollo coordinator will observe pressure drop at pressure hydrant (P-1).
9. Carollo coordinator will confirm that pressure is stabilized and at least 10 psi less than static pressure.
 - a. If $\Delta P \geq 10$ psi : go to next step.
 - b. If $\Delta P < 10$ psi : Carollo coordinator will ask City staff at flowing hydrant (F-1) to close the hydrant and City staff at flow hydrant (F-2) to connect the flow gauge. Both hydrants F-1 and F-2 will be opened simultaneously and test repeated.
 - c. If $\Delta P \geq 5$ psi: go to next step (10 psi is preferred, but 5 psi is still acceptable).
 - d. If $\Delta P < 5$ psi: move on to next site (test failed).
10. Carefully and slowly close the flowing hydrant. If two hydrants are flowing, close one at a time.
11. Carollo coordinator will ask the flow from City staff at each flowing hydrant.
12. Carollo coordinator will verify data is fully recorded and check for any anomalies (such as a gauge stuck on a high pressure or consistently showing significantly higher pressure than the rest of the readings.)
13. If no anomalies are detected, Carollo coordinator will notify all field personnel to remove equipment and move on to the next hydrant flow test site.
14. If results are irregular, repeat the test one more time.



4.0 EXTENDED PERIOD CALIBRATION

4.1 Overview of Extended Period Calibration Process

The extended period calibration is intended to calibrate the extended period simulation (EPS) capabilities of the hydraulic model by closely matching the model pressures, flows, and tank levels to field conditions over a 24-hour period of similar demand and system boundary conditions. Pressure data, tank levels, and flows from wells, imported water connections, booster stations, and the pressure reducing stations will be recorded for a full week in order to create diurnal patterns and obtain EPS calibration data. The primary varied parameters for this calibration will be operational controls and pipeline roughness coefficients, although other parameters may also be adjusted as calibration results are generated.

4.2 Data Required for Extended Period Calibration

The calibration data required for the extended period calibration consists of records of system pressures, tank levels, and flows from wells, imported water connections, booster stations, and the pressure reducing stations throughout the distribution system. These system pressures will be gathered both by the City's existing sensor network and by temporary pressure loggers, which will be attached to hydrants throughout the distribution system. Additional data, including system controls and operational details, will be required to establish boundary conditions for the model. This data will be gathered over the course of the week (See Table 1 for the complete calibration schedule).

Based on conversation with City staff, a target system interval of 5 minutes will be used for data gathering. If facilities lack the capabilities for 5 minute interval data gathering (both those using circular charts and flow totalizers), assumptions will be necessary to interpolate data for the calibration.

The assumed parameters which can be collected for calibration are listed by site in Table 2.

**Table 2 EPS Calibration Data Gathering Parameters
Potable Water Model Calibration Plan
City of Banning**

Facility Name	Measurement	Unit	Interval	Source
Reservoirs				
Mountain Tank	level	ft	5 min	SCADA
San Gorgonio Tanks	level	ft	5 min	SCADA
Sunset Tanks	level	ft	5 min	SCADA
Southwest Reservoir	level	ft	5 min	SCADA
Brinton Site Tank	level	ft	5 min	SCADA
High Valleys Tank	pressure	psi	5 min	PL #11
Booster Stations				
C2 PS	flow	gpm	5 min	SCADA
C3 PS	flow	gpm	5 min	SCADA
C4 PS	flow	gpm	5 min	SCADA
C5 PS	flow	gpm	5 min	SCADA
Mountain PS	flow	gpm	5 min	SCADA
Wells				
Well 1	flow	gpm	5 min	SCADA
Well 2	flow	gpm	5 min	SCADA
Well 3	flow	gpm	5 min	SCADA
Well 4	flow	gpm	5 min	SCADA
Well 5	flow	gpm	5 min	SCADA
Well 7	flow	gpm	5 min	SCADA
Well 8	flow	gpm	5 min	SCADA
Well 9	flow	gpm	5 min	SCADA
Well 10	flow	gpm	5 min	SCADA
Well 11	flow	gpm	5 min	SCADA
Well 12	flow	gpm	5 min	SCADA
Well C2	flow	gpm	5 min	SCADA
Well C3	flow	gpm	5 min	SCADA
Well C4	flow	gpm	5 min	SCADA
Well C5	flow	gpm	5 min	SCADA
Well C6	flow	gpm	5 min	SCADA
Well M3	flow	gpm	5 min	SCADA
Well M10	flow	gpm	5 min	SCADA
Well M11	flow	gpm	5 min	SCADA
Well M12	flow	gpm	5 min	SCADA
Interconnections				
High Valleys Water District	flow	gpm	5 min	SCADA
Banning Heights Mutual Water District	flow	gpm	5 min	SCADA

4.3 Format of Data

4.3.1 SCADA Data

All SCADA data needs to be provided in MS Excel or a MS database format. Table 3 presents an acceptable sample format for the SCADA data.

Table 3 Sample SCADA Format Potable Water Model Calibration Plan City of Banning							
TANK3_LEVEL		TANK2_LEVEL		PS9_PRESSUR_SUCT		PS9_PRESSUR_DISC	
time	ft	time	ft	time	psi	time	psi
2/1/17 1:00	27.61	2/1/17 1:00	25.73	2/1/17 1:00	44.53	2/1/17 1:00	120.59
2/1/17 1:15	27.52	2/1/17 1:15	25.54	2/1/17 1:15	44.65	2/1/17 1:15	117.05
2/1/17 1:30	27.35	2/1/17 1:30	25.39	2/1/17 1:30	44.20	2/1/17 1:30	119.63
2/1/17 1:45	25.12	2/1/17 1:45	25.29	2/1/17 1:45	45.34	2/1/17 1:45	119.42
2/1/17 2:00	25.59	2/1/17 2:00	25.13	2/1/17 2:00	45.13	2/1/17 2:00	115.52
2/1/17 2:15	25.60	2/1/17 2:15	27.56	2/1/17 2:15	45.26	2/1/17 2:15	117.21
2/1/17 2:30	25.55	2/1/17 2:30	27.60	2/1/17 2:30	44.59	2/1/17 2:30	117.29
2/1/17 2:45	27.96	2/1/17 2:45	27.90	2/1/17 2:45	45.01	2/1/17 2:45	117.05
2/1/17 3:00	25.76	2/1/17 3:00	27.67	2/1/17 3:00	45.75	2/1/17 3:00	116.55
2/1/17 3:15	25.41	2/1/17 3:15	26.51	2/1/17 3:15	44.22	2/1/17 3:15	116.91
2/1/17 3:30	25.56	2/1/17 3:30	27.31	2/1/17 3:30	44.42	2/1/17 3:30	115.15
2/1/17 3:45	25.06	2/1/17 3:45	26.96	2/1/17 3:45	45.04	2/1/17 3:45	119.02
2/1/17 4:00	25.11	2/1/17 4:00	27.00	2/1/17 4:00	44.17	2/1/17 4:00	120.00

Notes:
This sample was taken from a different SCADA system and thus may not represent the exact format of the City's SCADA output.

It is assumed the SCADA system has the capability for data to be taken using 5-minute intervals. If possible, the time of each data point should be included in the output report. The City should provide Carollo with a sample SCADA reports prior to March 7 to verify that all data can be retrieved in the preferred format.

4.4 Temporary Pressure Loggers

Carollo will setup 14 temporary pressure loggers to begin logging at 12:00 pm on Tuesday, March 7, 2017 and will send the pressure loggers to the City to arrive by Monday, March 6. The City is expected to install the 14 pressure loggers on hydrants identified on Figure 1 on Tuesday, March 7. The location of the hydrant and the hydrant number corresponding to each logger ID is listed on Table 4.

Table 4 Temporary Pressure Logger Summary
Portable Water Model Calibration Plan
City of Banning

Logger Site	Hydrant ID	Logger ID	Hydrant Location
1	R04304	C-30	Evergreen Lane and Mountain Avenue
2	n/a	C-31	4" Blow-Off Valve on Cornucopia Court
3	T02301	C-32	Near Linda Vista Mobile Home Park
4	Y03332	C-33	Melbourne Circle and Singing Hills Drive
5	AA05301	C-34	Near High Valleys Tank
6	Y05301	C-35	Hilltop Drive and Sunset Avenue
7	W04300	C-36	Westward Avenue and Chipmunk Trail
8	V06301	C-37	Monroe Street and Jefferson Street
9	T06309	C-38	Cottonwood Road and Geneva Street
10	T08320	C-39	Linda Vista Drive between Gilman Street and Wilson Street
11	R08304	C-40	Summit Drive and Murray Street
12	X08302	C-41	Wesley Street and CA-243
13 ⁽¹⁾	V08304	C-42	CA-243 and Fourth Street
14 ⁽¹⁾	U10304	C-43	Evans Street between George Street and Nicolet Street

Notes:

(1) Location is anticipated to have higher pressures. Higher rated pressure loggers (Track-IT 350) needs to be installed to these locations. All other locations will use the Track-IT 150 model.

To install the loggers, attach the cap provided by Carollo to the hydrant and attach the pressure loggers to the cap. Once the loggers are installed, open the hydrant. At the end of the EPS testing, City staff shall remove the loggers and mail them to the following address:

Attn: Ryan Hejka
707 Wilshire Boulevard, Suite 3920
Los Angeles, CA 90017

4.4.1 Required Equipment / Staff

4.4.1.1 Required Staff (City)

City staff will install all of the pressure loggers in the field prior to the hydrant testing. City staff shall be responsible for installation/removal of data loggers on hydrants, driving City vehicles or any other function involving City property.

4.4.1.2 Required Equipment (City)

- Appropriate wrenches and equipment to place loggers on each hydrant

4.4.1.3 Required Equipment (Carollo)

- 12 pressure loggers - Track-IT 150 (C-30 through C-41)
- 2 pressure loggers – Track-IT 350 (C-42 and C-43)
- 14 hydrant caps
- Maps of field locations for pressure loggers

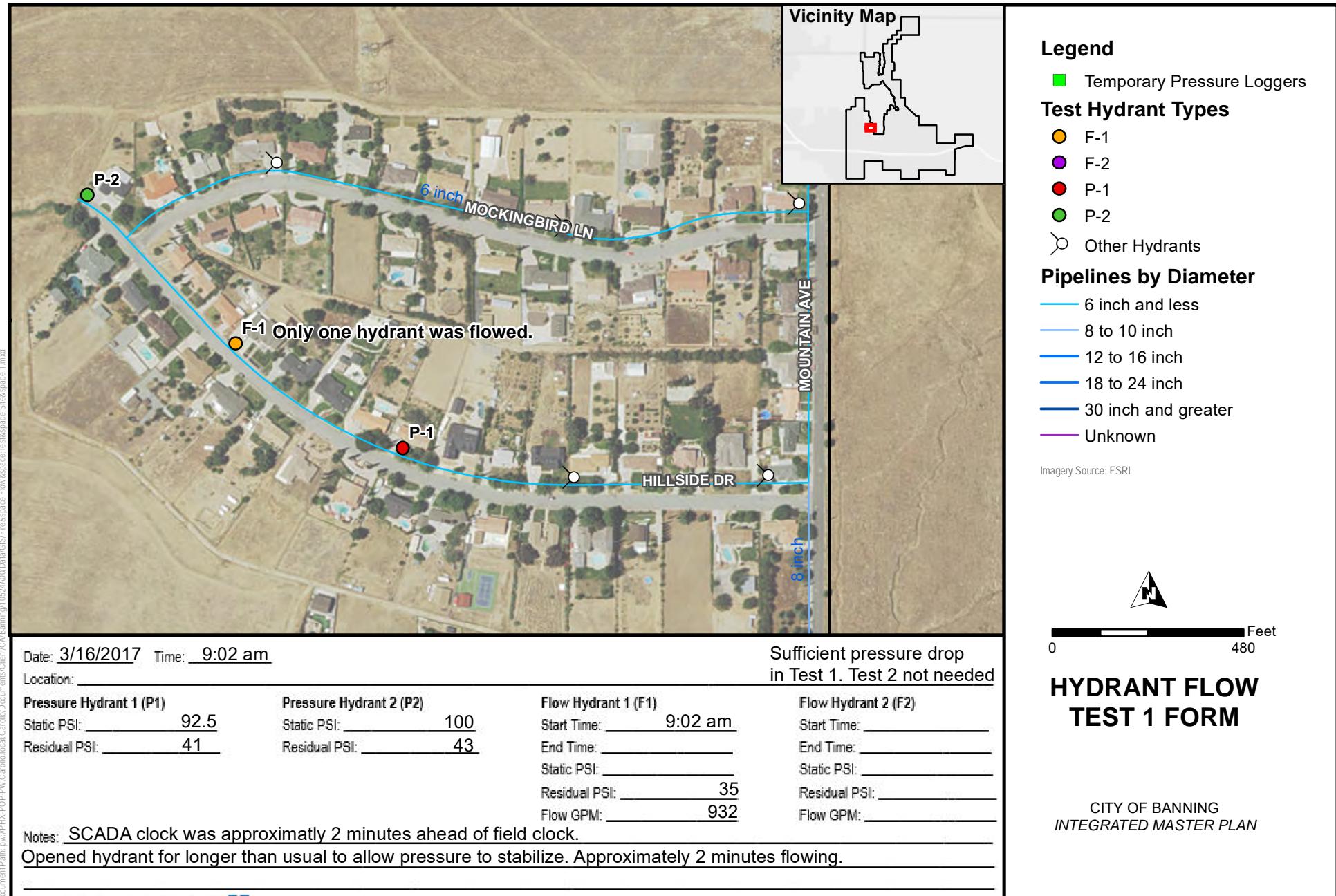
4.4.2 Models and Intermediate Readings

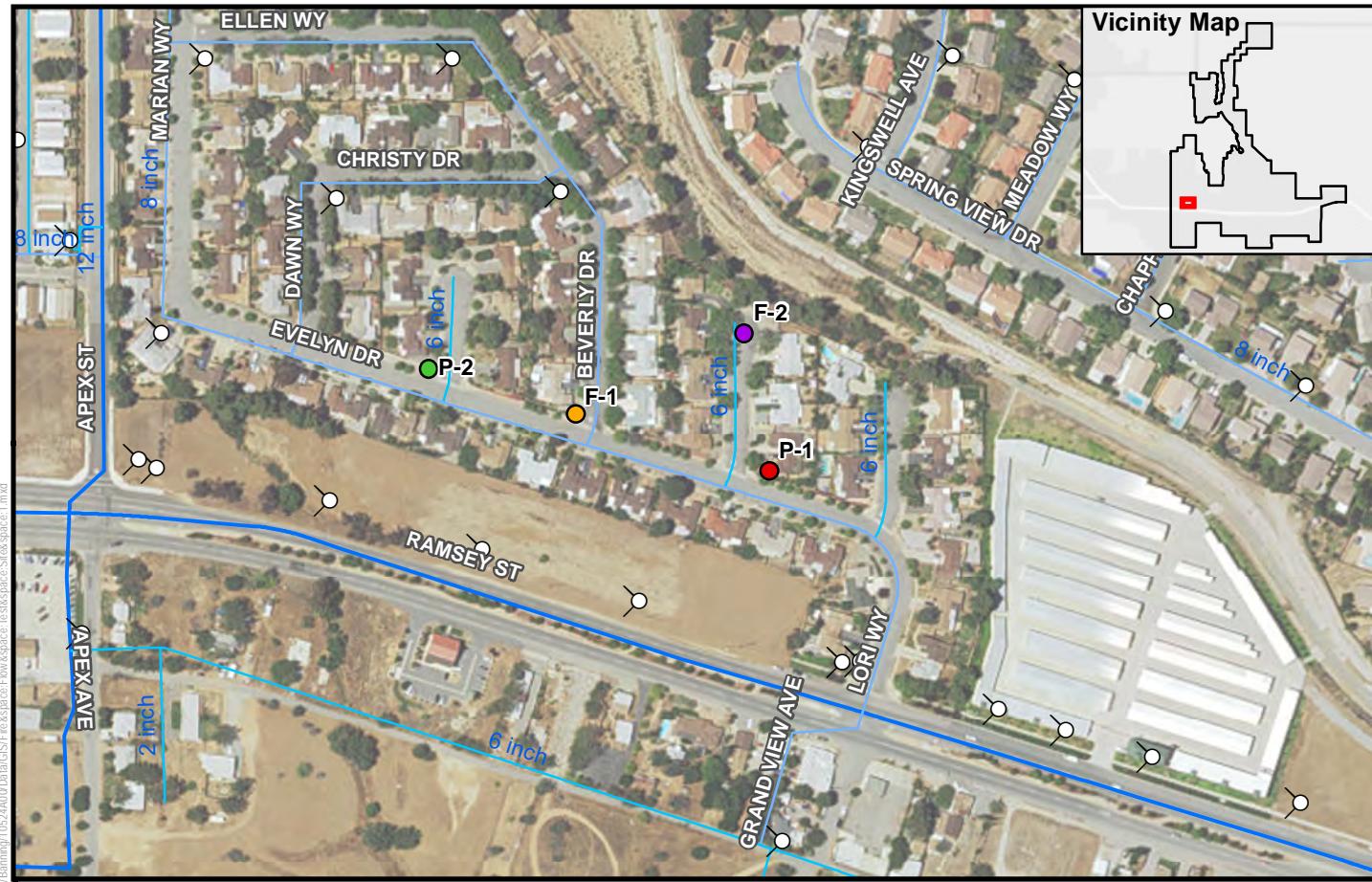
The sampling interval for all pressure loggers will be set to 1 minute. Each pressure logger will require approximately 18,720 data points (60 data points per hour over 13 days).

The internal capacity of the Track-IT 150 and Track-IT 350 pressure loggers are limited to 64,000 data points, all of which are sufficient to record thirteen days of data in 1 minute intervals.

Appendix A

FIRE FLOW TEST - DETAILED FIELD MAPS





Legend
■ Temporary Pressure Loggers

Test Hydrant Types

- F-1
- F-2
- P-1
- P-2
- Other Hydrants

Pipelines by Diameter

- 6 inch and less
- 8 to 10 inch
- 12 to 16 inch
- 18 to 24 inch
- 30 inch and greater
- Unknown

Imagery Source: ESRI

Date: 3/16/2017 Time: 12:05 pm

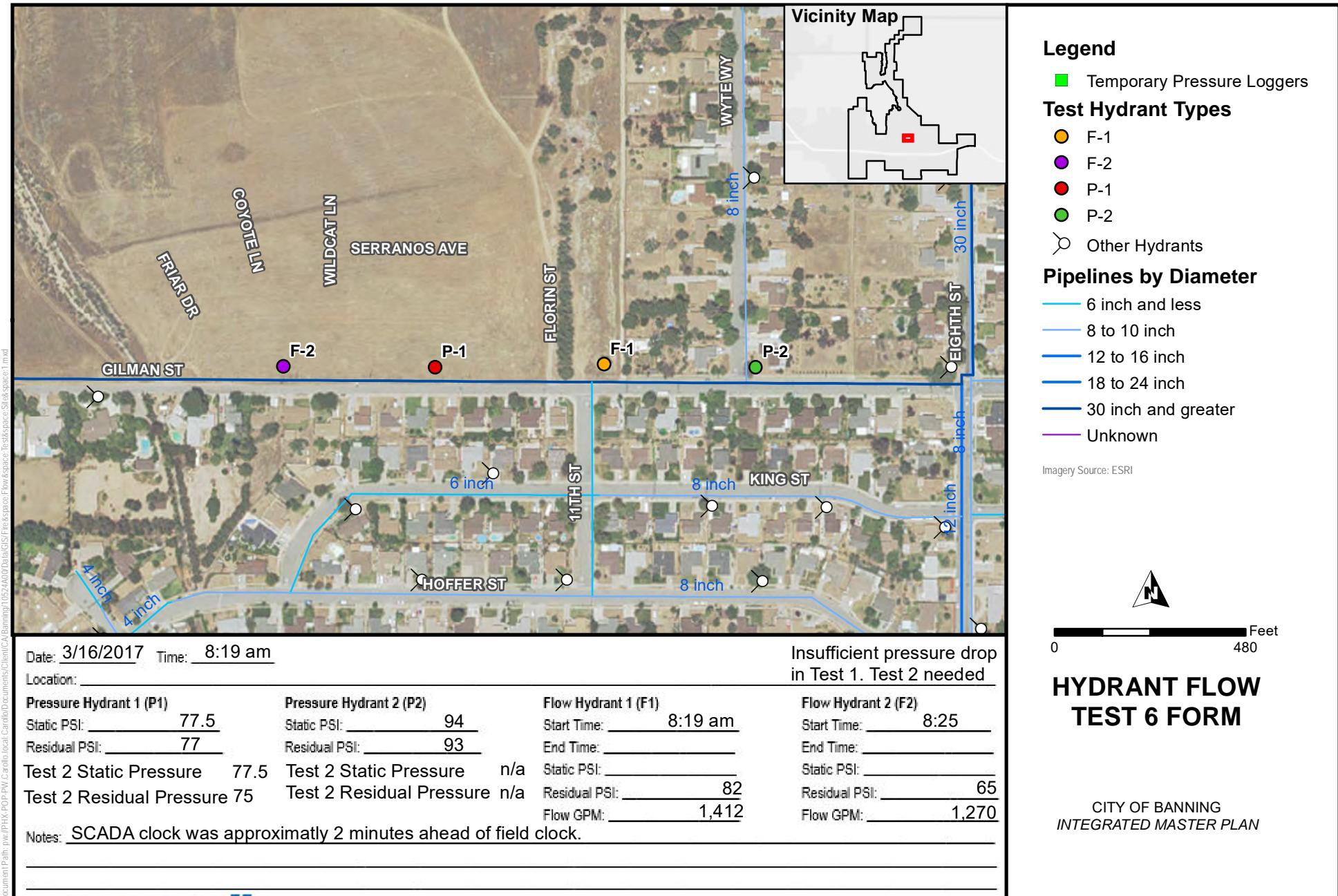
Location: _____

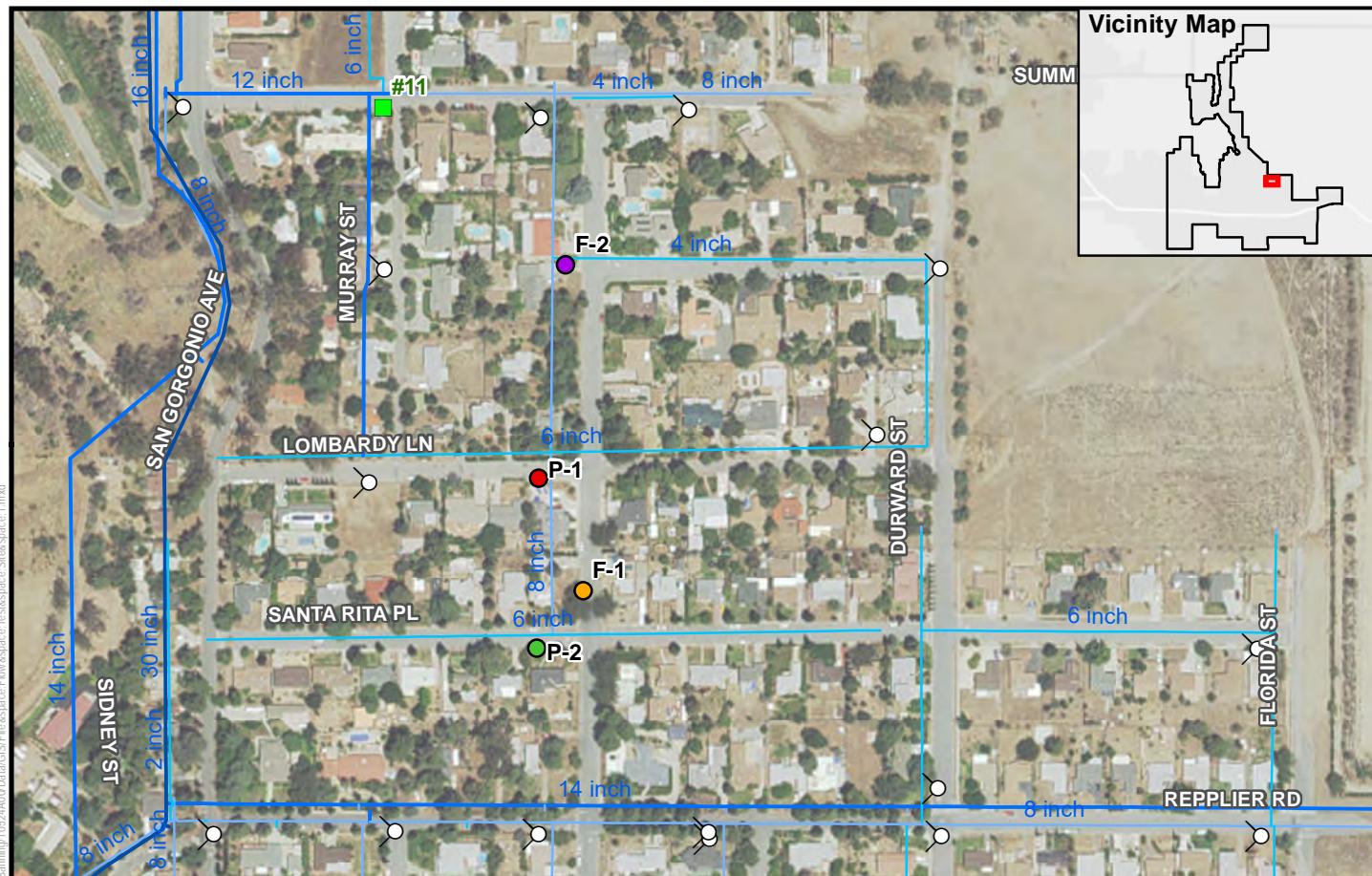
Pressure Hydrant 1 (P1) Pressure Hydrant 2 (P2) Flow Hydrant 1 (F1) Flow Hydrant 2 (F2)
 Static PSI: 112.5 Static PSI: 111 Start Time: 12:05 pm Start Time: 12:12 pm
 Residual PSI: 111 Residual PSI: 109 End Time: _____ End Time: _____
 Test 2 Static Pressure 112.5 Test 2 Static Pressure 111 Static PSI: _____
 Test 2 Residual Pressure 110 Test 2 Residual Pressure 109 Residual PSI: 106 Residual PSI: 41
 Flow GPM: 1,610 Flow GPM: 1,000

Notes: SCADA clock was approximately 2 minutes ahead of field clock.

HYDRANT FLOW TEST 3 FORM

CITY OF BANNING
 INTEGRATED MASTER PLAN





Date: 3/16/2017 Time: 7:51 am

Location: _____

Pressure Hydrant 1 (P1)
Static PSI: 101
Residual PSI: 58

Pressure Hydrant 2 (P2)
Static PSI: 108
Residual PSI: 62

Flow Hydrant 1 (F1)
Start Time: 7:51 am
End Time: _____
Static PSI: _____
Residual PSI: 52
Flow GPM: 1,118

Sufficient pressure drop
in Test 1. Test 2 not needed

Flow Hydrant 2 (F2)
Start Time: _____
End Time: _____
Static PSI: _____
Residual PSI: _____
Flow GPM: _____

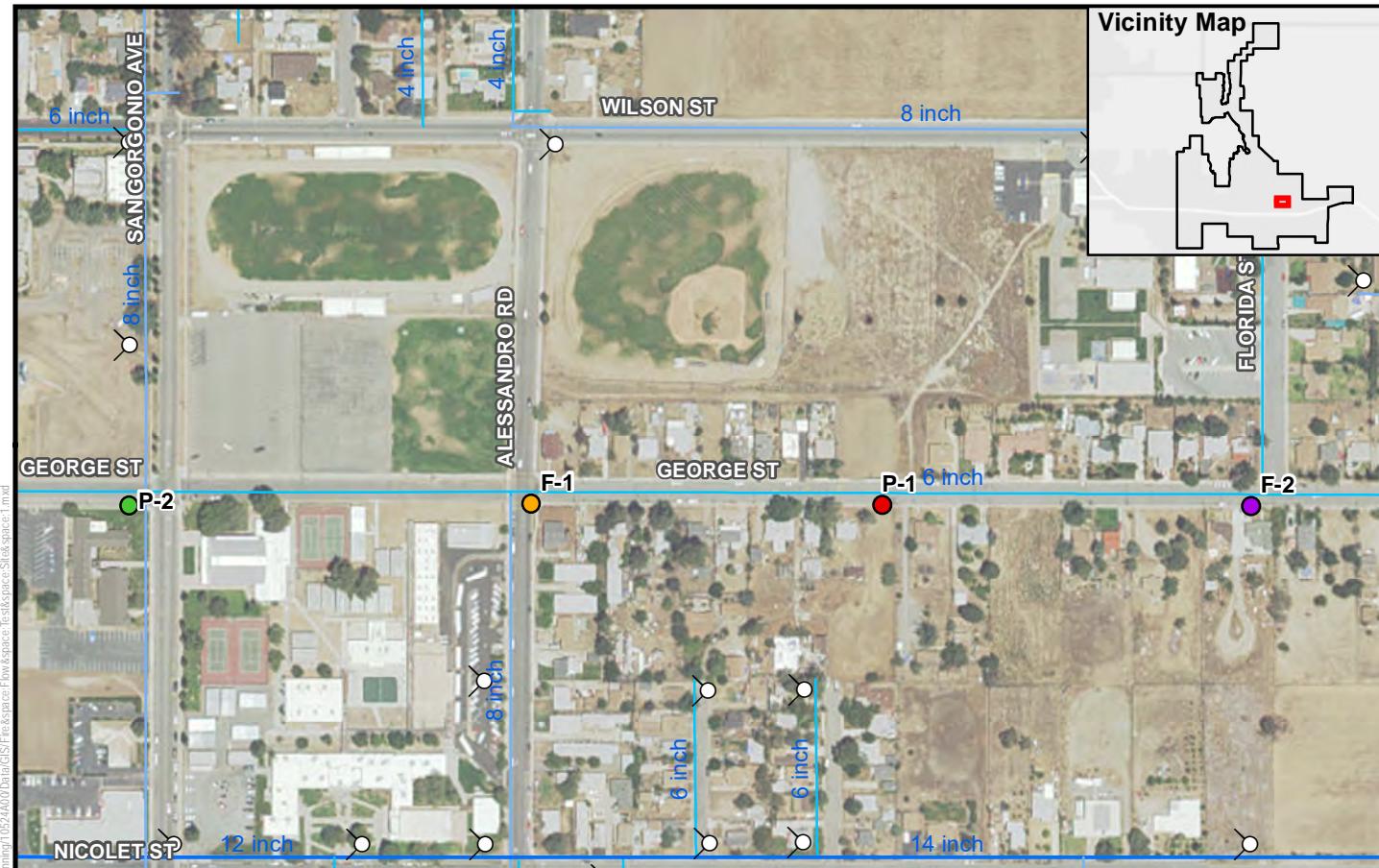
Notes: SCADA clock was approximately 2 minutes ahead of field clock.



0 480 Feet

HYDRANT FLOW TEST 7 FORM

CITY OF BANNING *INTEGRATED MASTER PLAN*



Legend
■ Temporary Pressure Loggers

Test Hydrant Types

- F-1
- F-2
- P-1
- P-2
- Other Hydrants

Pipelines by Diameter

- 6 inch and less
- 8 to 10 inch
- 12 to 16 inch
- 18 to 24 inch
- 30 inch and greater
- Unknown

Imagery Source: ESRI



Date: 3/16/2017 Time: 2:17 pm

Location: _____

Pressure Hydrant 1 (P1)

Static PSI: 141

Residual PSI: 130

Test 2 Static Pressure 130 - 141

Test 2 Residual Pressure 130 - 141

Notes: SCADA clock was approximately 2 minutes ahead of field clock.

P-1 Residual would consistently swing about 10 psi

Insufficient pressure drop in Test 1. Test 2 needed

Flow Hydrant 1 (F1)

Start Time: 2:17 pm

End Time: _____

Flow Hydrant 2 (F2)

Start Time: 2:23 pm

End Time: _____

Static PSI: _____

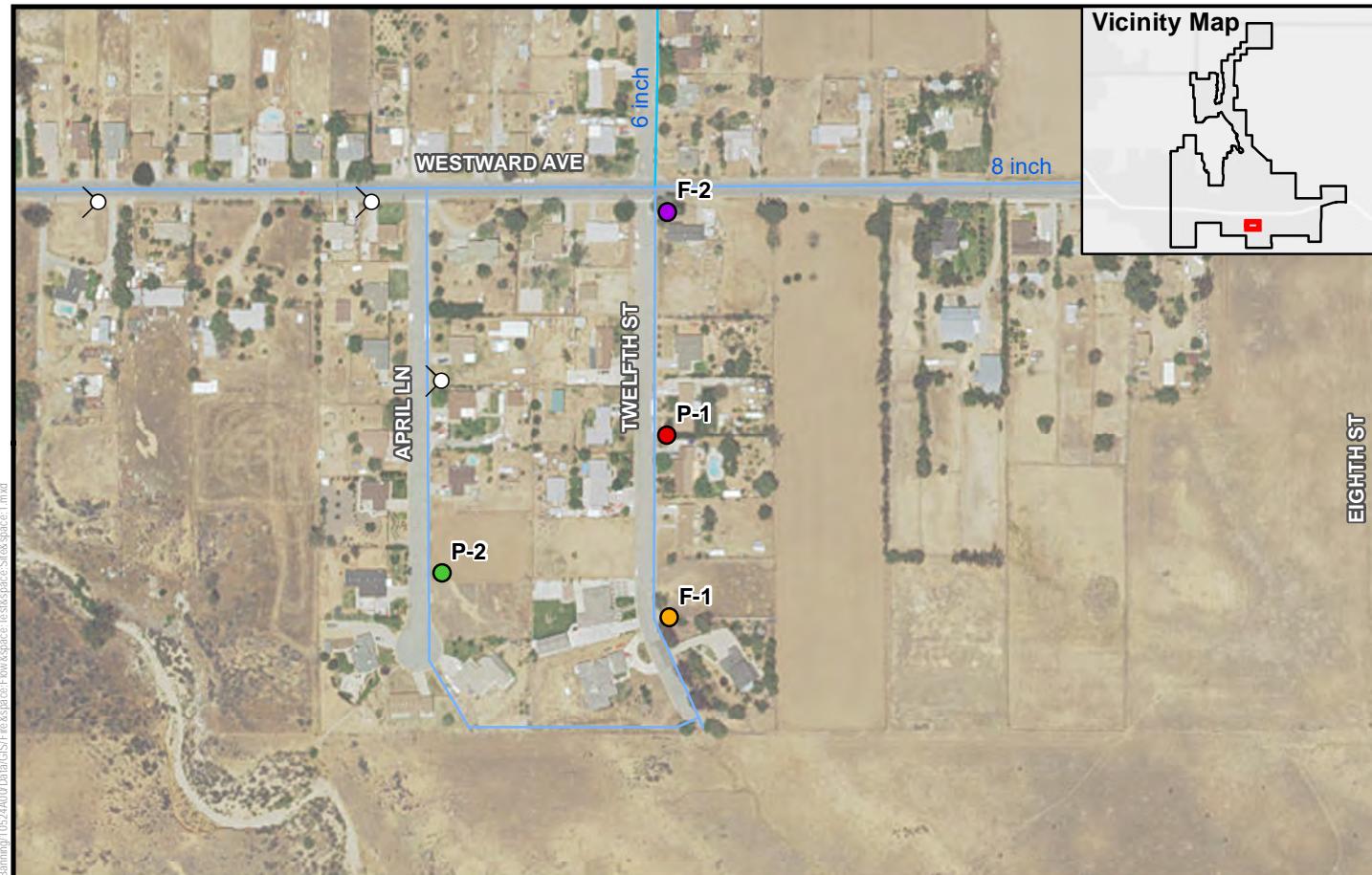
Residual PSI: 120

Flow GPM: 1,730

Flow GPM: 1,765

HYDRANT FLOW TEST 8 FORM

CITY OF BANNING
INTEGRATED MASTER PLAN



Date: 3/16/2017 Time: 1:45 pm

Location: _____

Pressure Hydrant 1 (P1)

Static PSI: 169

Residual PSI: 159

Pressure Hydrant 2 (P2)

Static PSI: n/a

Residual PSI: n/a

Flow Hydrant 1 (F1)

Start Time: 1:45 pm

End Time: _____

Static PSI: _____

Residual PSI: 147

Flow GPM: 1,890

Sufficient pressure drop
in Test 1. Test 2 not needed

Flow Hydrant 2 (F2)

Start Time: _____

End Time: _____

Static PSI: _____

Residual PSI: _____

Flow GPM: _____

Notes: SCADA clock was approximately 2 minutes ahead of field clock.

Legend

■ Temporary Pressure Loggers

Test Hydrant Types

● F-1

● F-2

● P-1

● P-2

○ Other Hydrants

Pipelines by Diameter

— 6 inch and less

— 8 to 10 inch

— 12 to 16 inch

— 18 to 24 inch

— 30 inch and greater

— Unknown

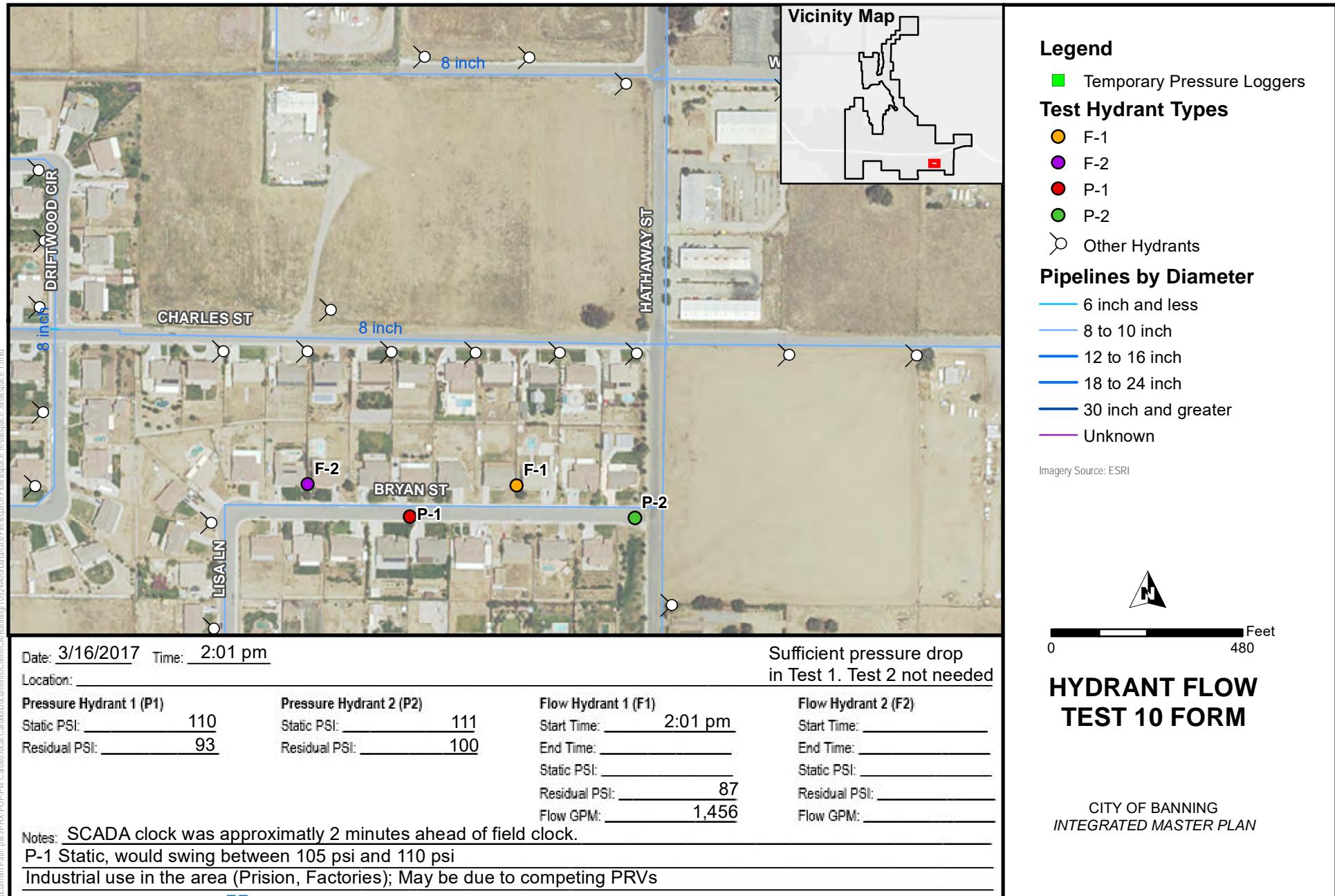
Imagery Source: ESRI



0 Feet
480

HYDRANT FLOW TEST 9 FORM

CITY OF BANNING
INTEGRATED MASTER PLAN



Document Path: pw://PHX/POP-PWCarollo.local/Carollo/Documents/Client/CA/Banning/10524AO/DatalGIS/Fire&Space/Test&space/Flow&space/Test&space/Site&space/1.mxd

Date: 3/16/2017 Time: 2:01 pm

Location:

Pressure Hydrant 1 (P1)

Static PSI: 110

Residual PSI: 93

Pressure Hydrant 2 (P2)

Static PSI: 111

Residual PSI: 100

Flow Hydrant 1 (F1)

Start Time: 2:01 pm

End Time: _____

Static PSI: _____

Residual PSI: 87

Flow GPM: 1,456

clock.

Sufficient pressure drop
in Test 1. Test 2 not needed

Flow Hydrant 2 (F2)

Start Time: _____

End Time: _____

Static PSI: _____

Residual PSI:

Flow GPM:

— 145 —

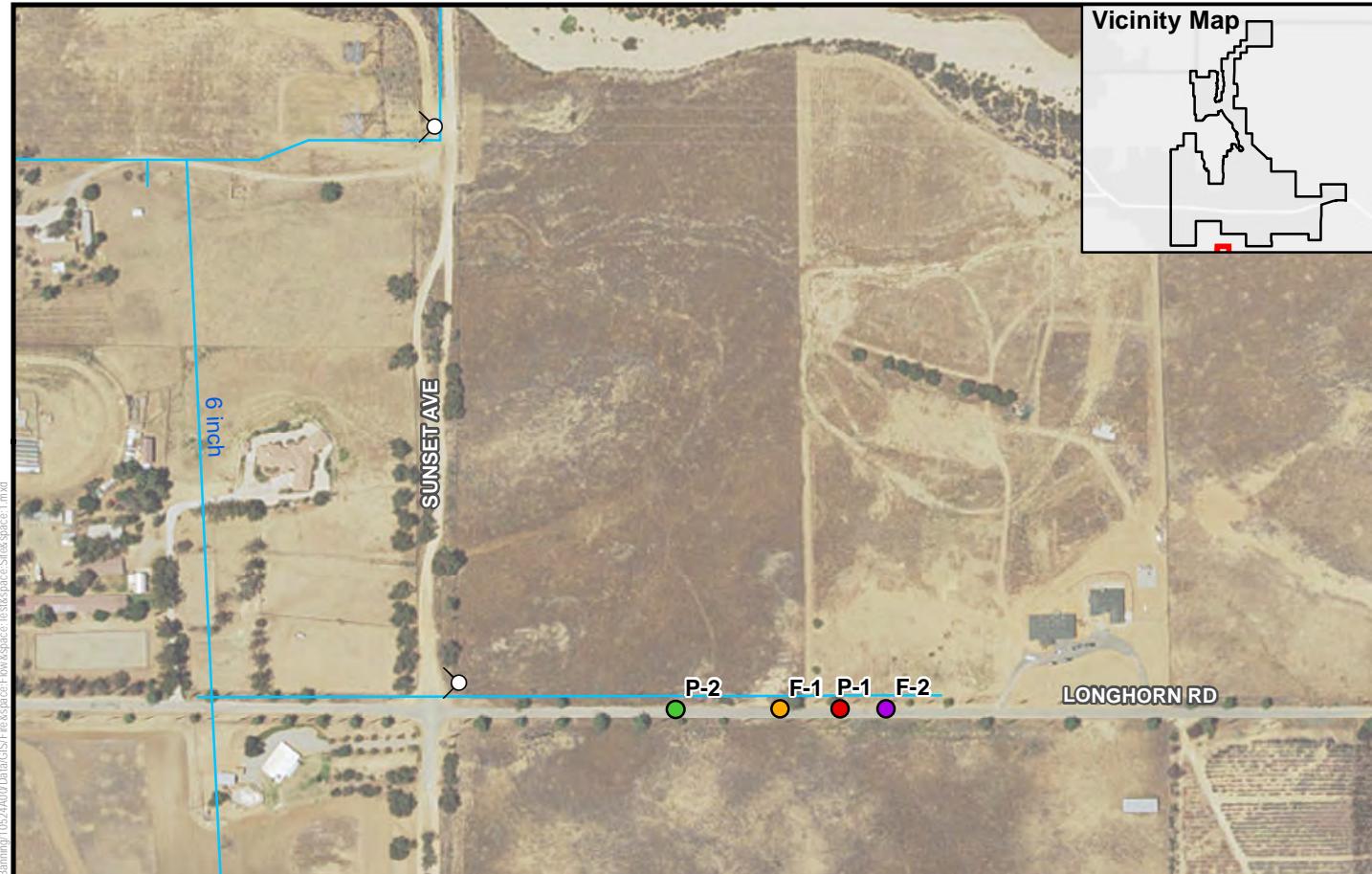
Notes: SCADA clock was approximately 2 minutes ahead of field clock.

P-1 Static, would swing between 105 psi and 110 psi

Industrial use in the area (Prision, Factories); May be due to competing PRVs

CITY OF BANNING INTEGRATED MASTER PLAN





Vicinity Map

Legend

Temporary Pressure Loggers

Test Hydrant Types

F-1

F-2

P-1

P-2

Other Hydrants

Pipelines by Diameter

6 inch and less

8 to 10 inch

12 to 16 inch

18 to 24 inch

30 inch and greater

Unknown

Imagery Source: ESRI



0 480 Feet

HYDRANT FLOW TEST 11 FORM

Date: 3/16/2017 Time: 9:34 am

Location: _____

Pressure Hydrant 1 (P1) 117.5

Residual PSI: 57.5

Pressure Hydrant 2 (P2) 91

Residual PSI: 38

Flow Hydrant 1 (F1) Start Time: 9:34 am

End Time: _____

Static PSI: _____

Residual PSI: 37

Flow GPM: 953

Sufficient pressure drop in Test 1. Test 2 not needed

Flow Hydrant 2 (F2)

Start Time: _____

End Time: _____

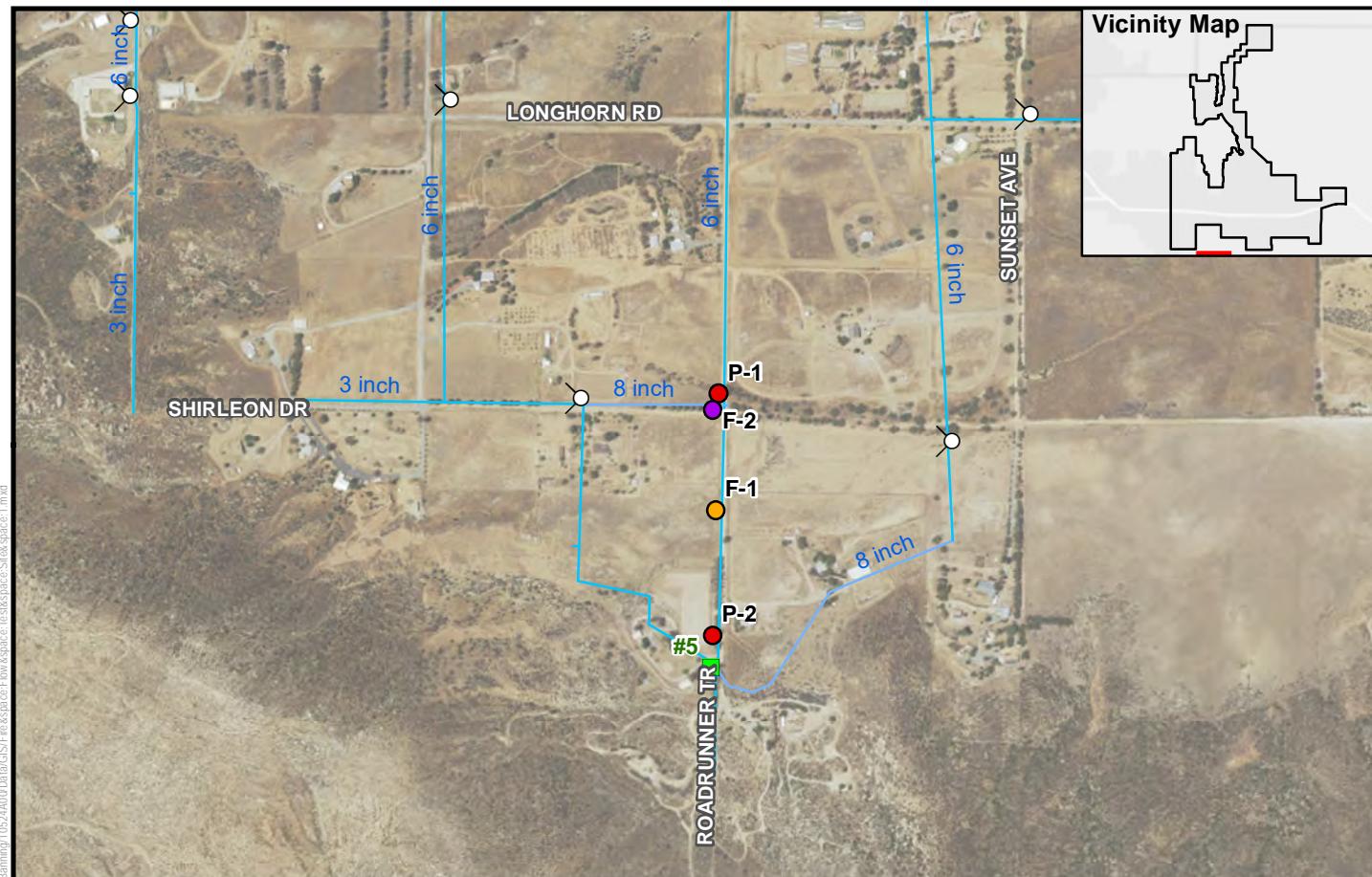
Static PSI: _____

Residual PSI: _____

Flow GPM: _____

Notes: SCADA clock was approximately 2 minutes ahead of field clock.

CITY OF BANNING
INTEGRATED MASTER PLAN



Imagery Source: ESRI



Date: 3/16/2017 Time: 9:52 am

Location: _____

Pressure Hydrant 1 (P1)

Static PSI: 72.5

Residual PSI: 72.5

Pressure Hydrant 2 (P2)

Static PSI: 111

Residual PSI: 52

Flow Hydrant 1 (F1)

Start Time: 9:52 am

End Time: _____

Static PSI: _____

Residual PSI: 23

Flow GPM: 748

Insufficient pressure drop
in Test 1. Test 2 needed

Flow Hydrant 2 (F2)

Start Time: 9:57 am

End Time: _____

Static PSI: _____

Residual PSI: _____

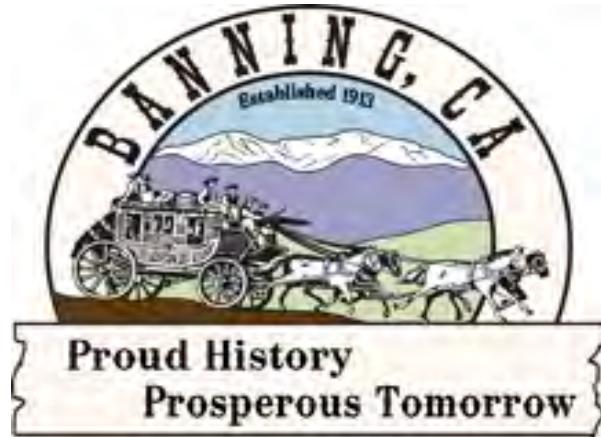
Flow GPM: 2,579

Notes: SCADA clock was approximately 2 minutes ahead of field clock.

P-1 is not connected to the same pressure zone as F-1

HYDRANT FLOW TEST 12 FORM

CITY OF BANNING
INTEGRATED MASTER PLAN



2017 Integrated Master Plan

EXTENDED PERIOD SIMULATION (EPS) CALIBRATION

Based on March 2017 Field Data

City of Banning

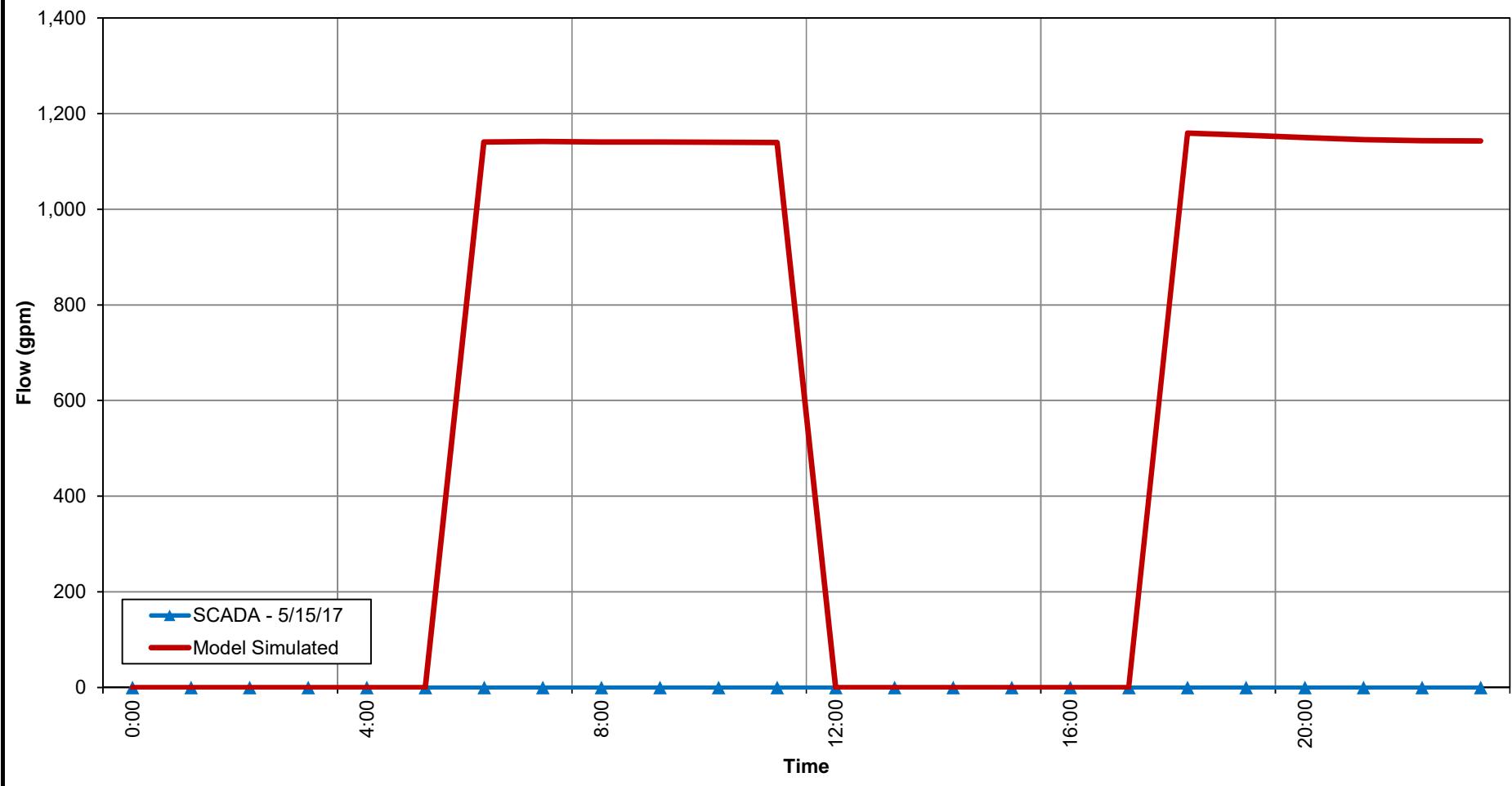
March 2017

Job No: 10524A.00





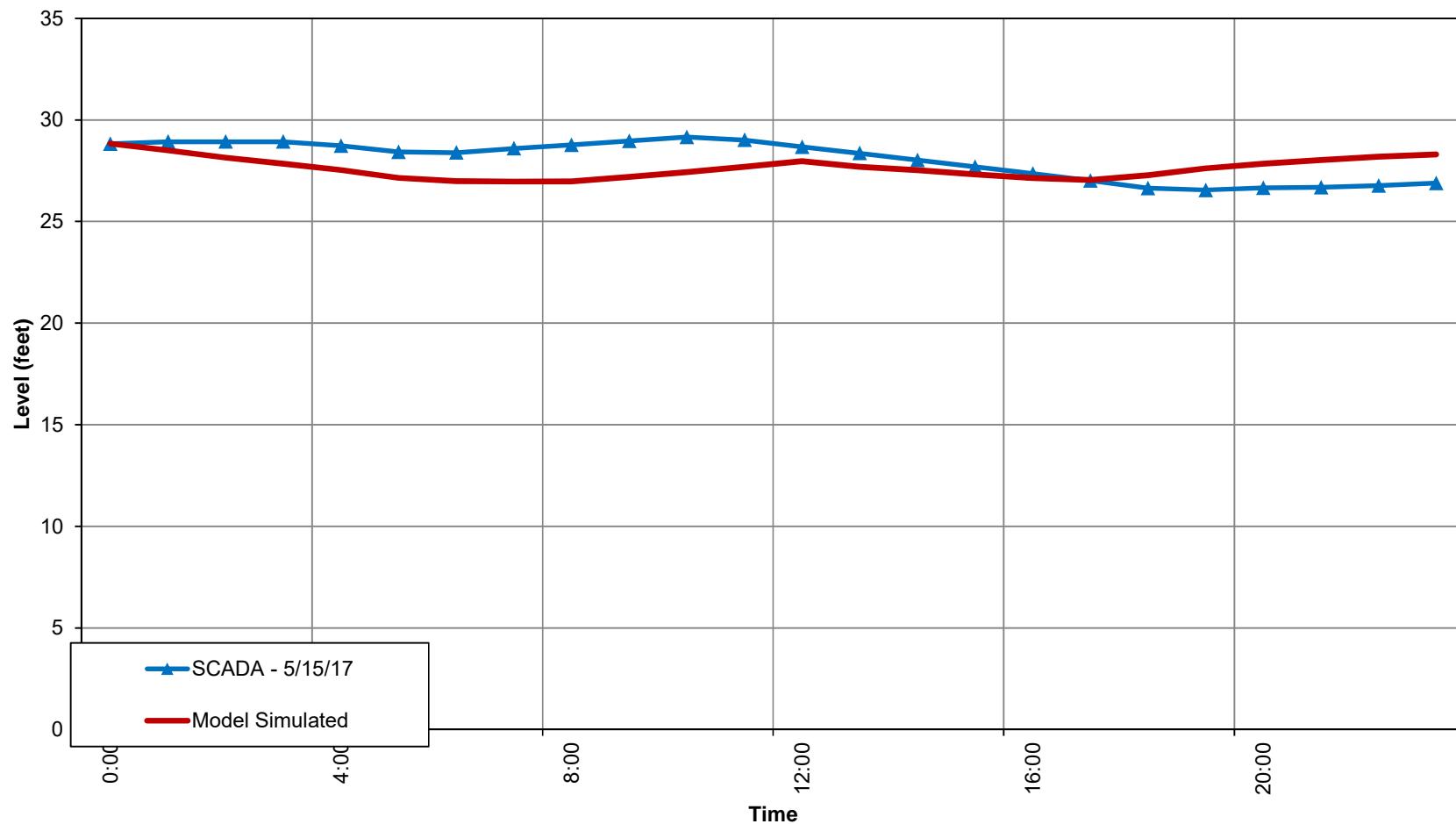
EPS Calibration - C2 from Main Flow (Zone Main)
2017 Integrated Master Plan
City of Banning





EPS Calibration - Sunset Reservoir 1 (Zone Foothill West)
2017 Integrated Master Plan
City of Banning

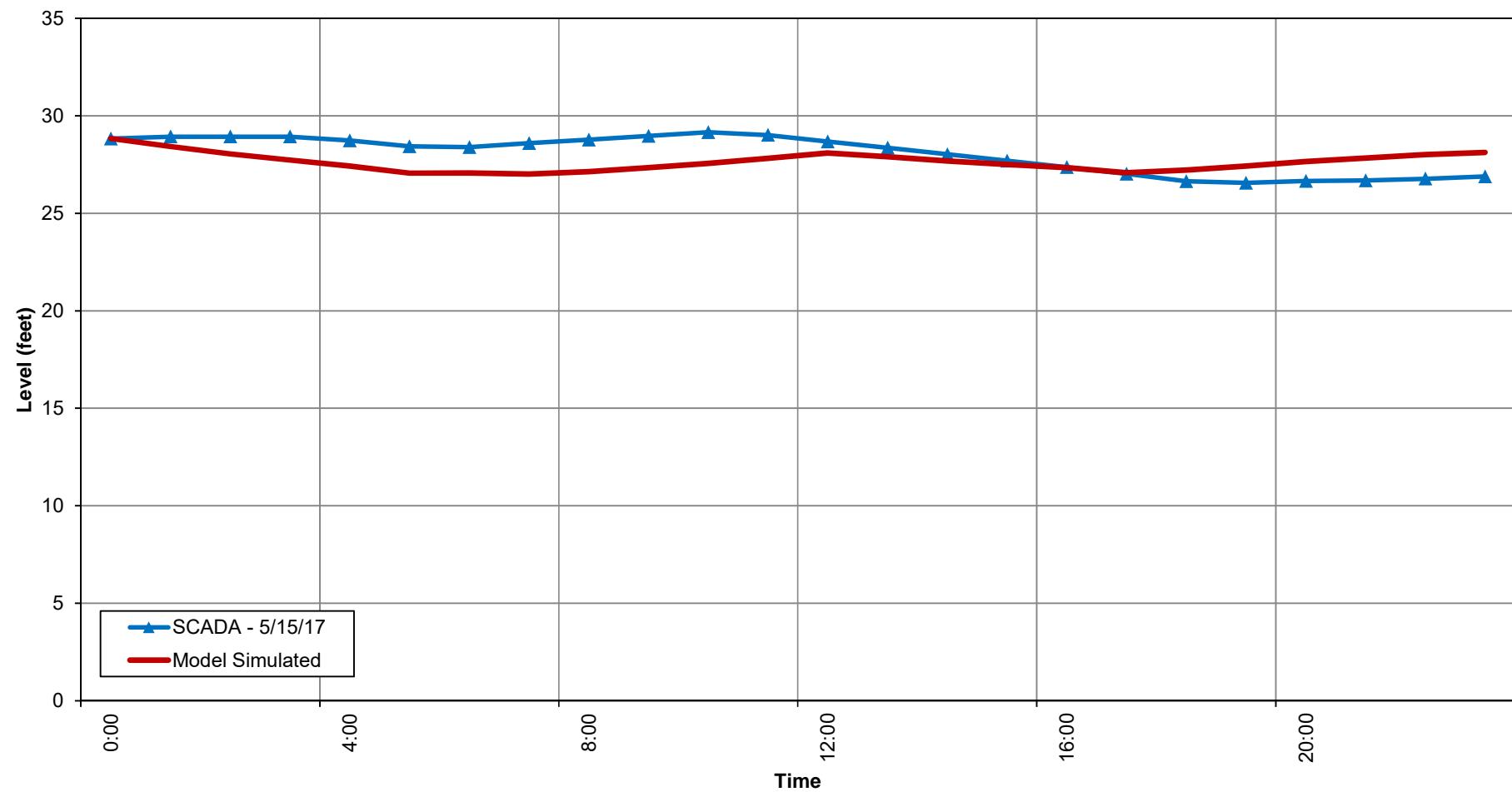
carollo





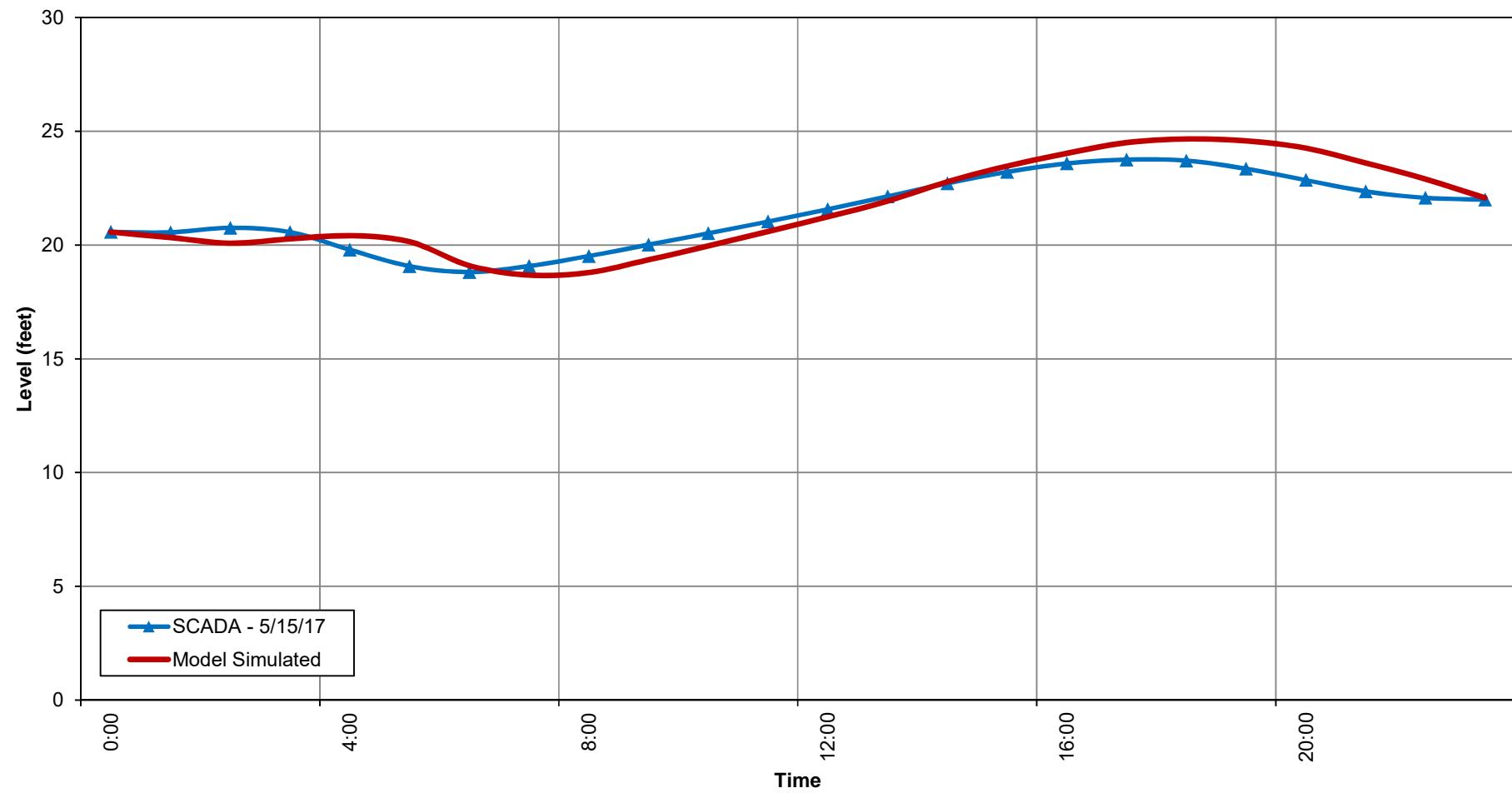
EPS Calibration - Sunset Reservoir 2 (Zone Foothill West)

2017 Integrated Master Plan
City of Banning



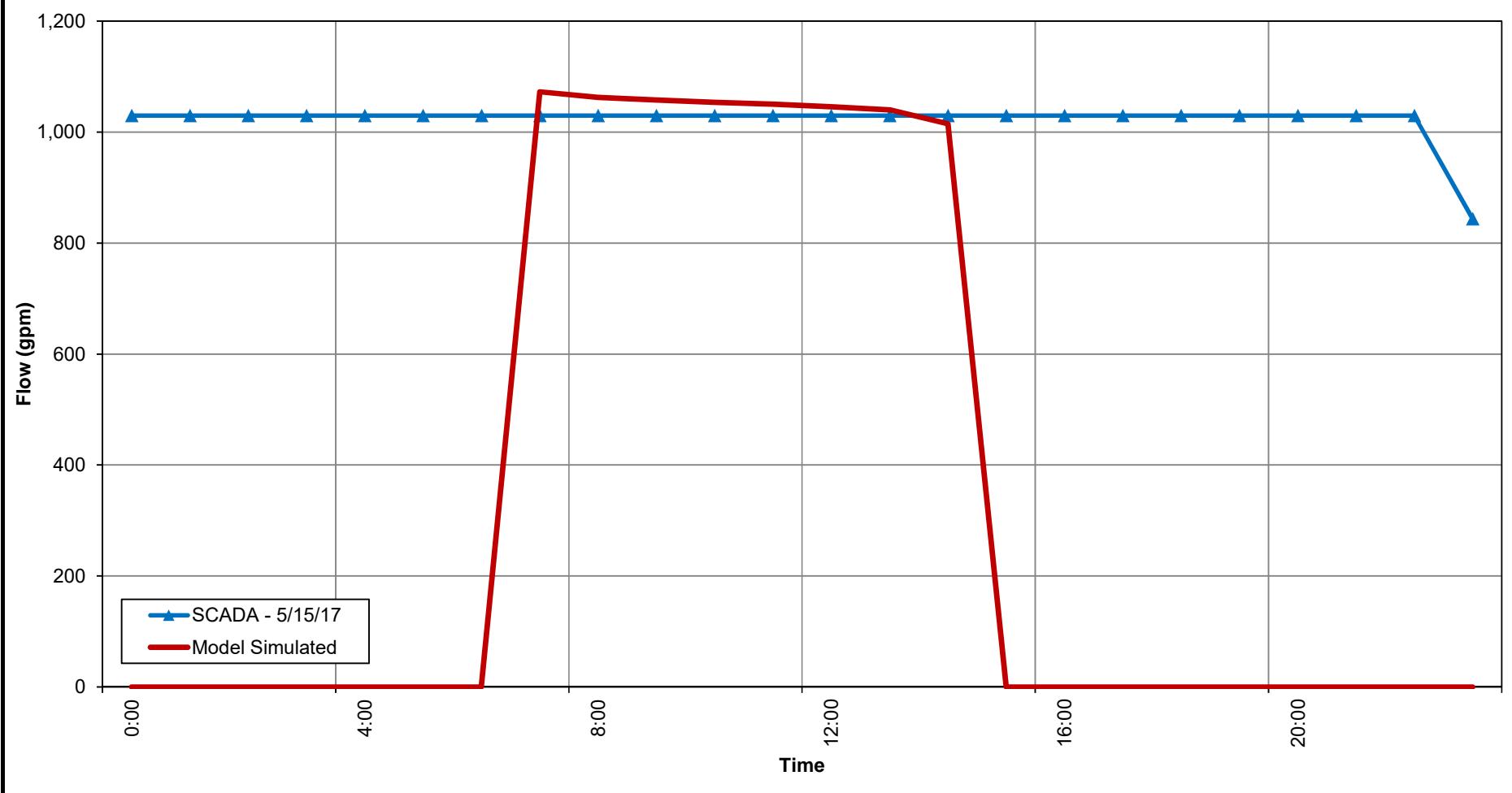


EPS Calibration - Southwest Reservoir (Zone Main)
2017 Integrated Master Plan
City of Banning



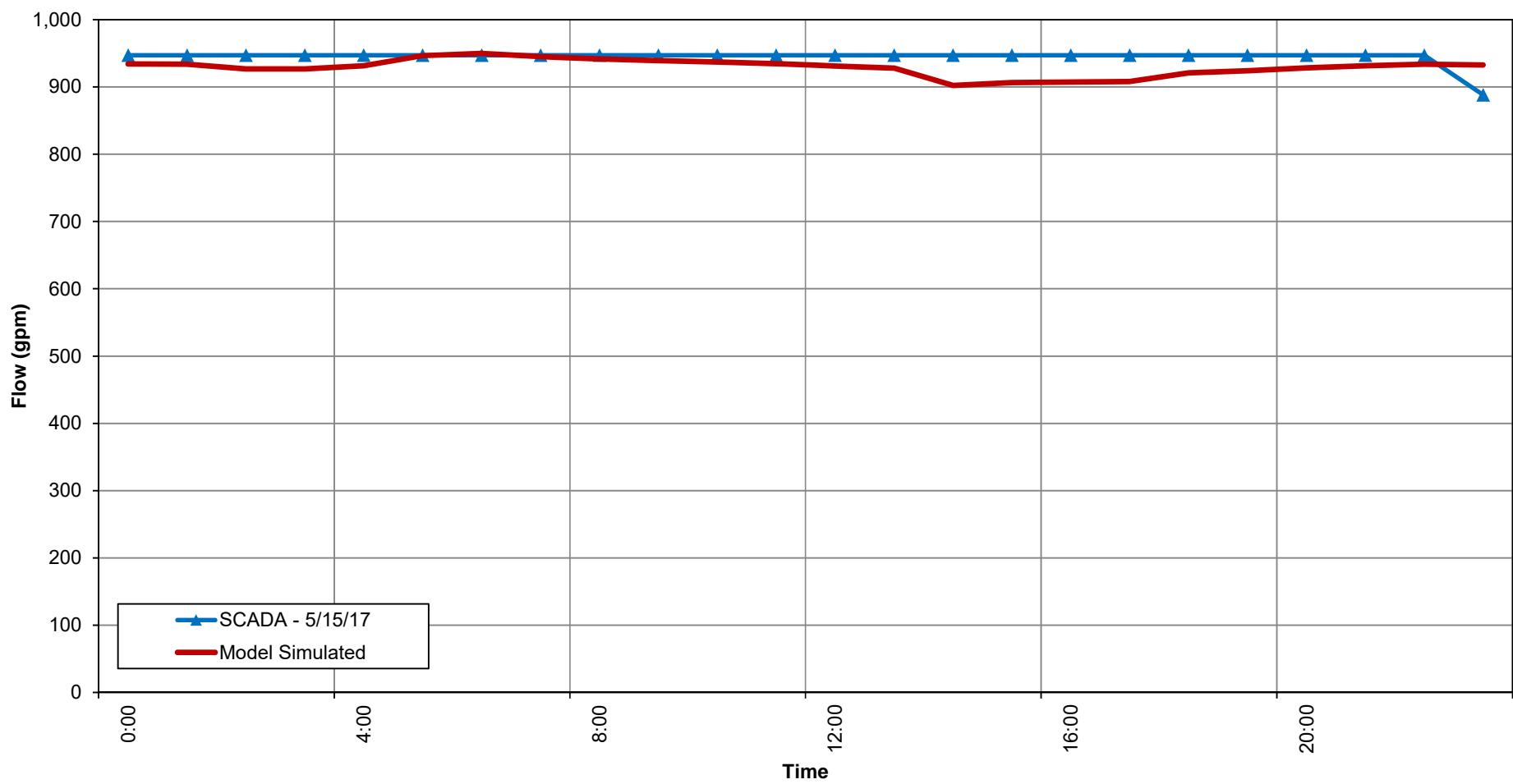


EPS Calibration - C3 to Main Flow (Zone Main)
2017 Integrated Master Plan
City of Banning



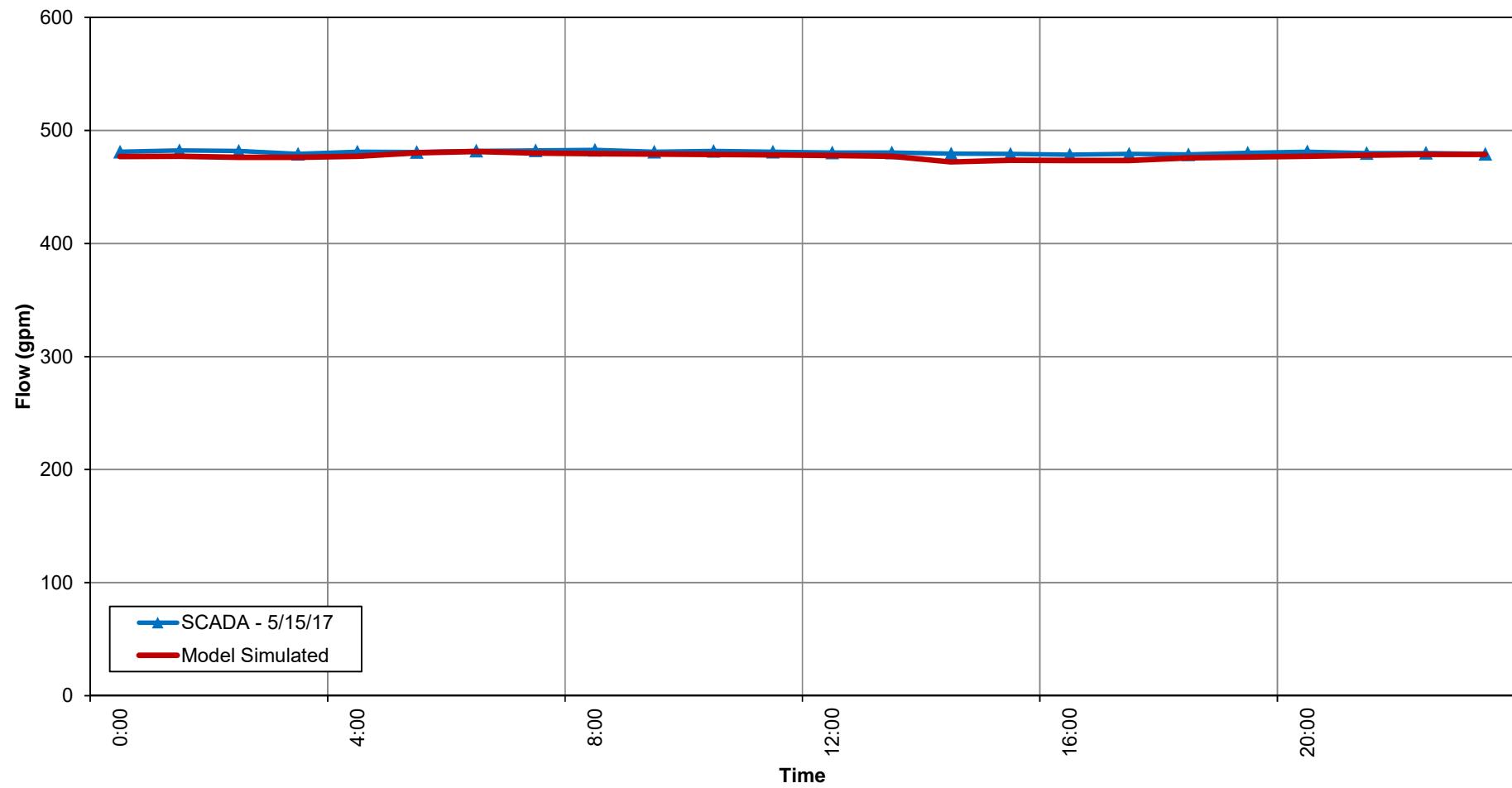


EPS Calibration - C5 to Main Flow (Zone Main)
2017 Integrated Master Plan
City of Banning



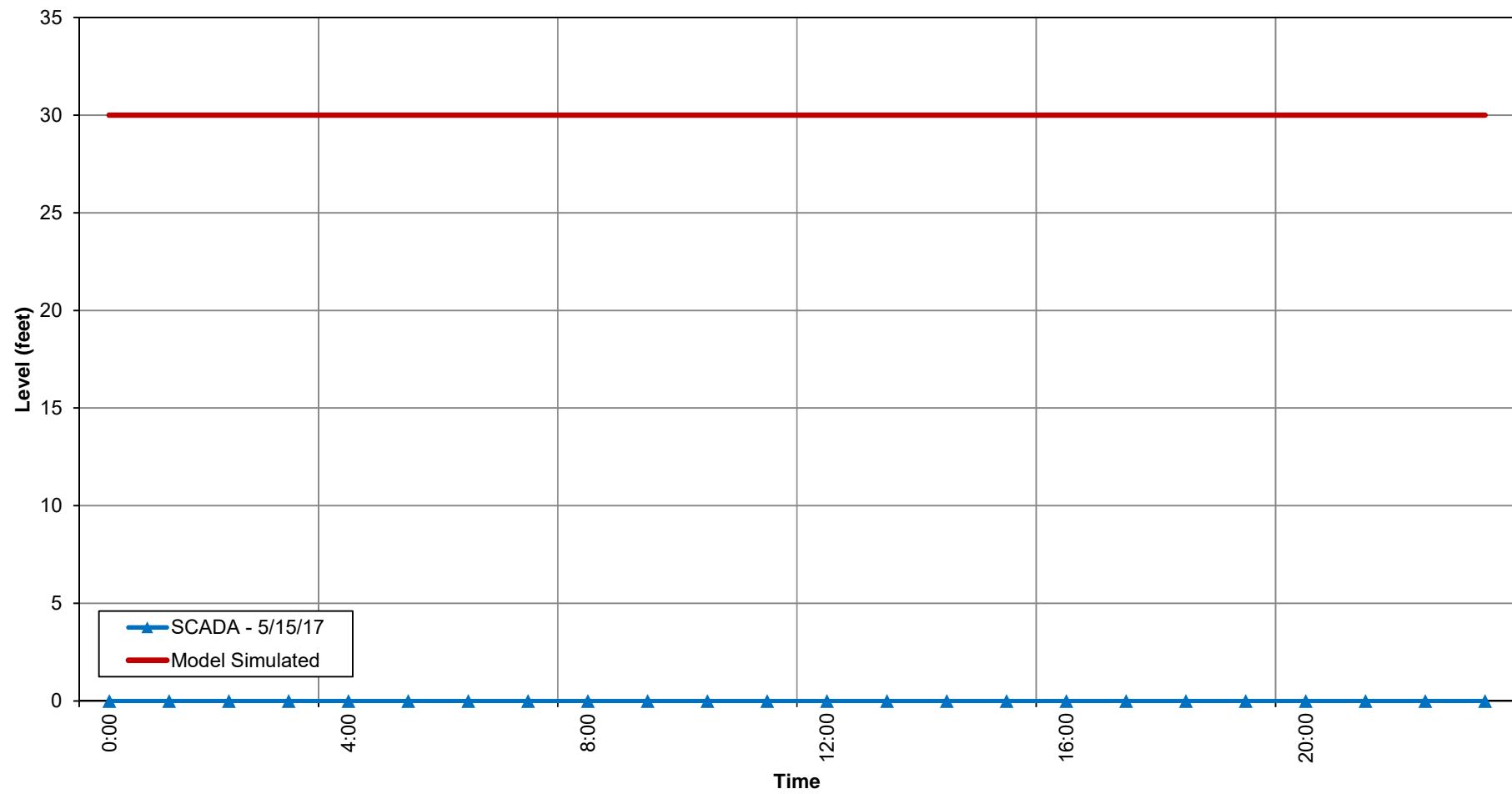


EPS Calibration - M11 to Main Flow (Zone Main)
2017 Integrated Master Plan
City of Banning



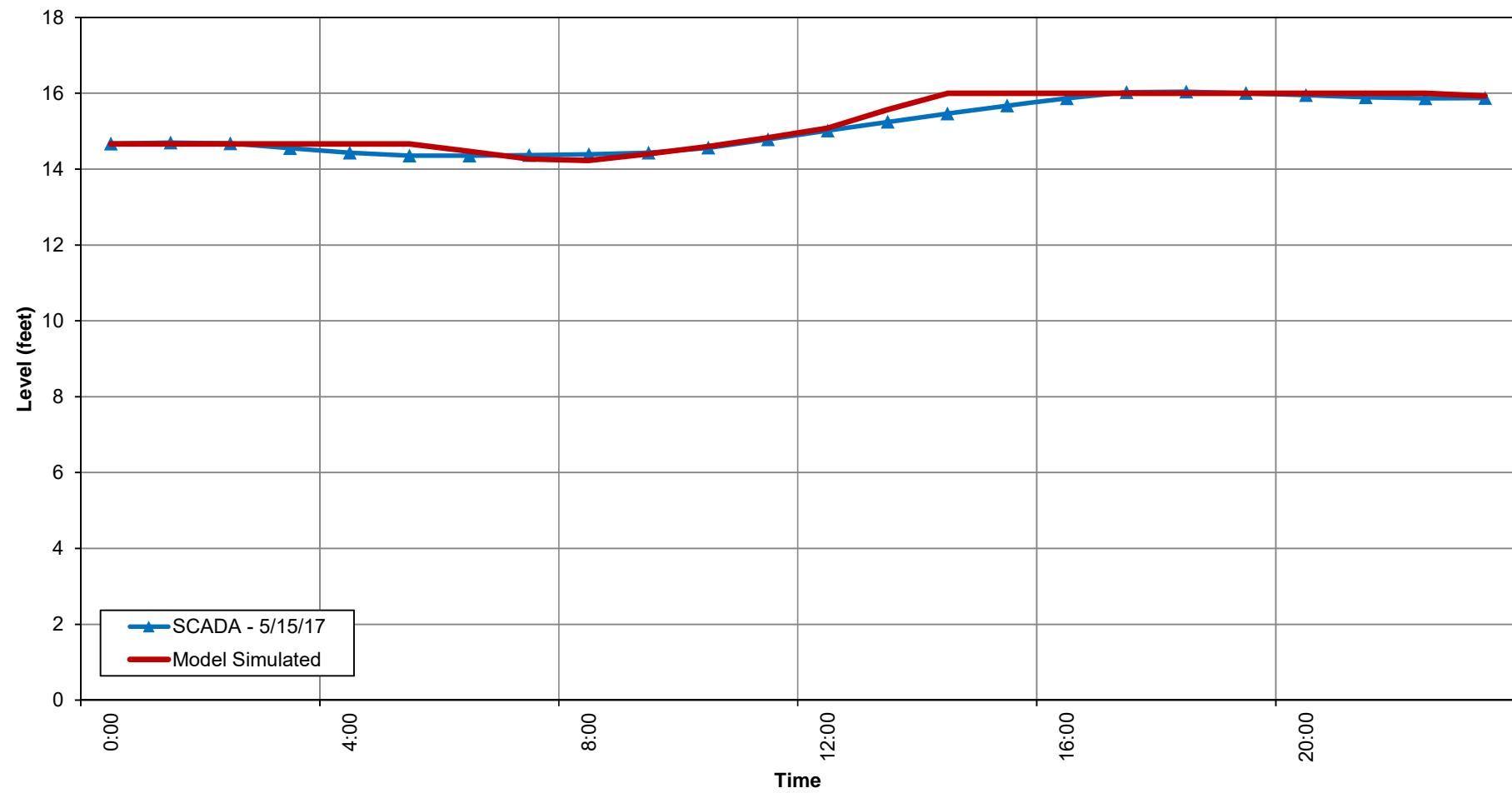


EPS Calibration - Mountain Reservoir (Zone Mountain North)
2017 Integrated Master Plan
City of Banning



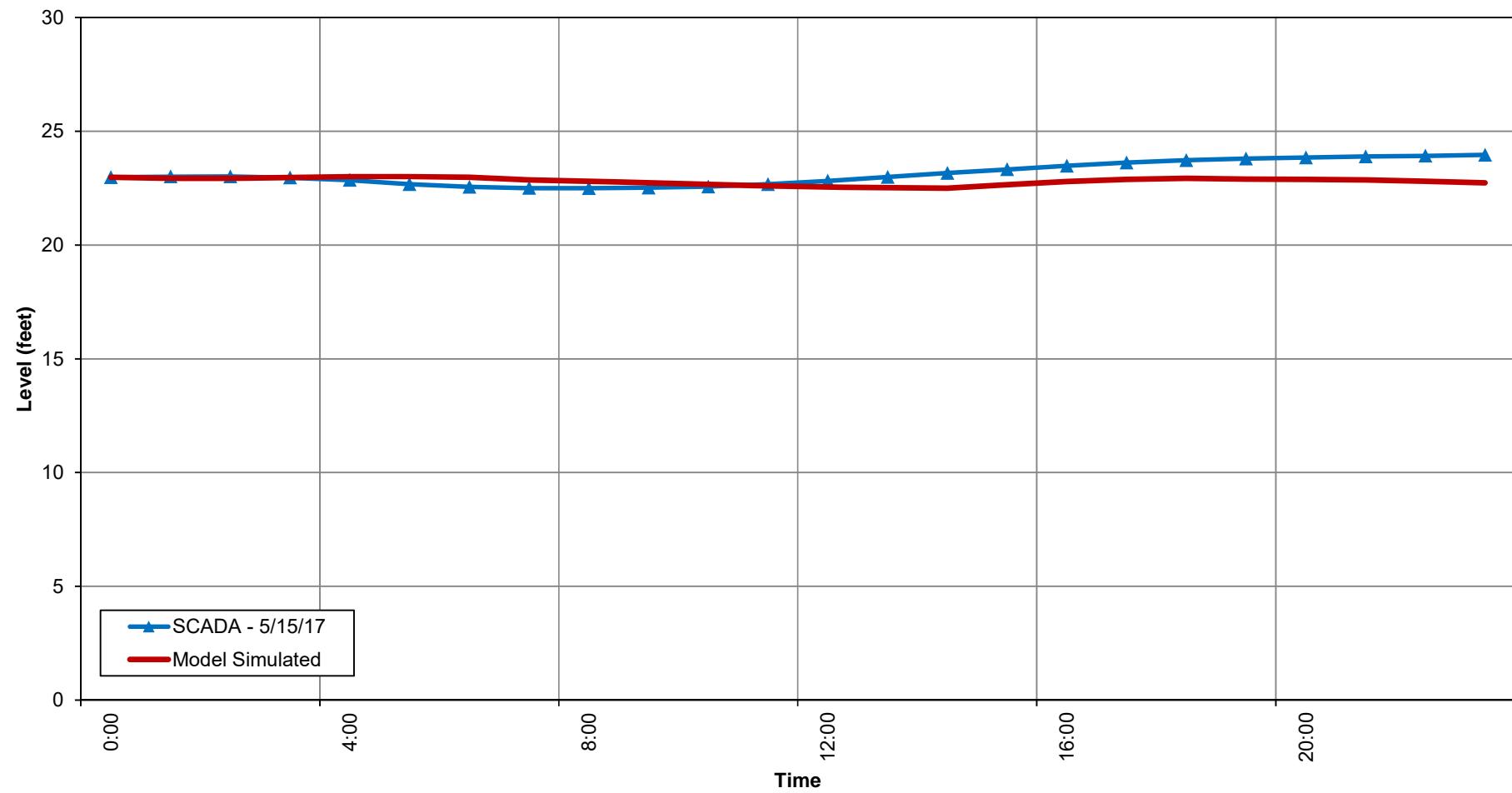


EPS Calibration - Brinton Reservoir (Zone Main)
2017 Integrated Master Plan
City of Banning



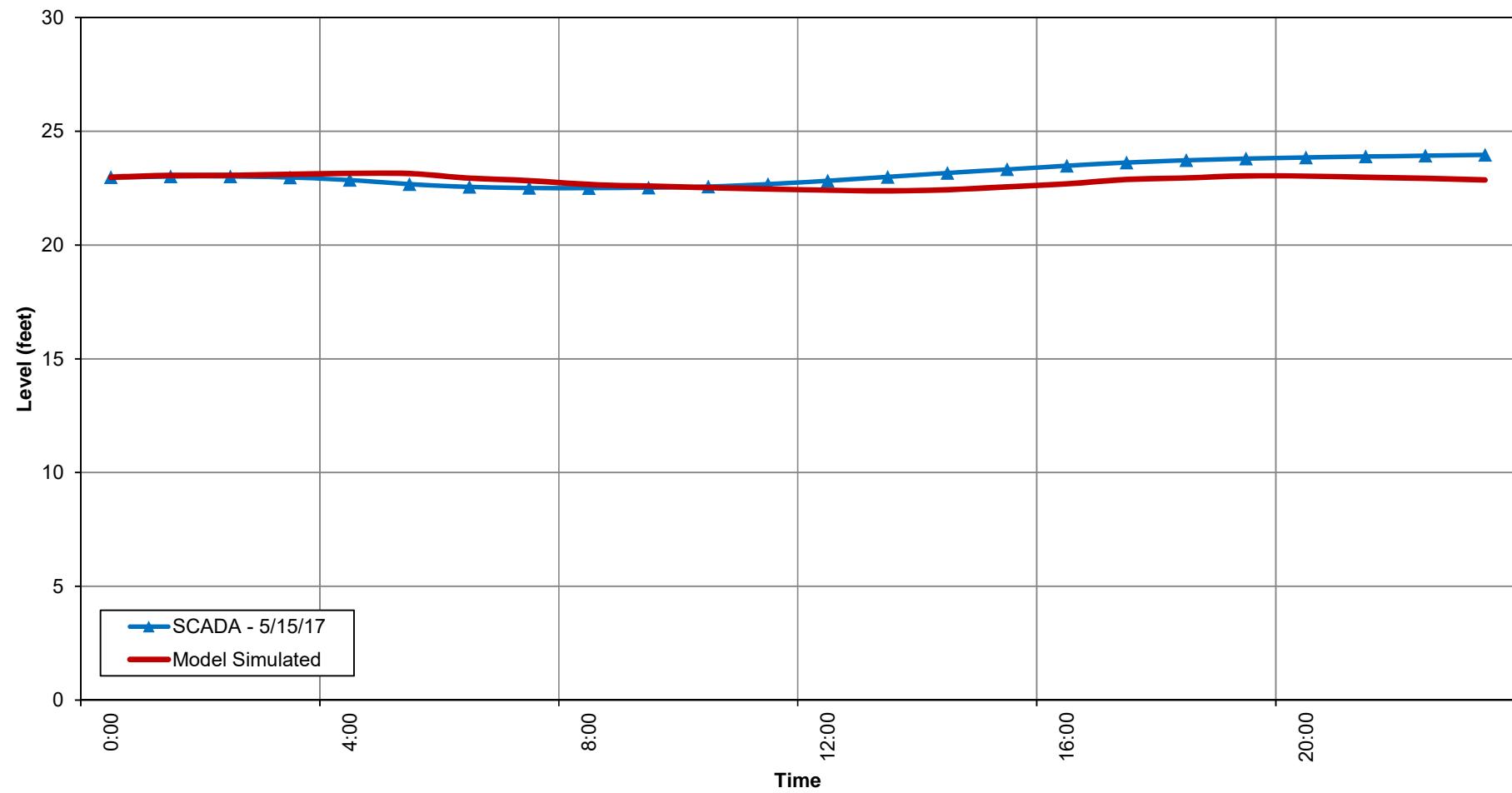


EPS Calibration - San Gorgonio Reservoir 1 (Zone Main)
2017 Integrated Master Plan
City of Banning



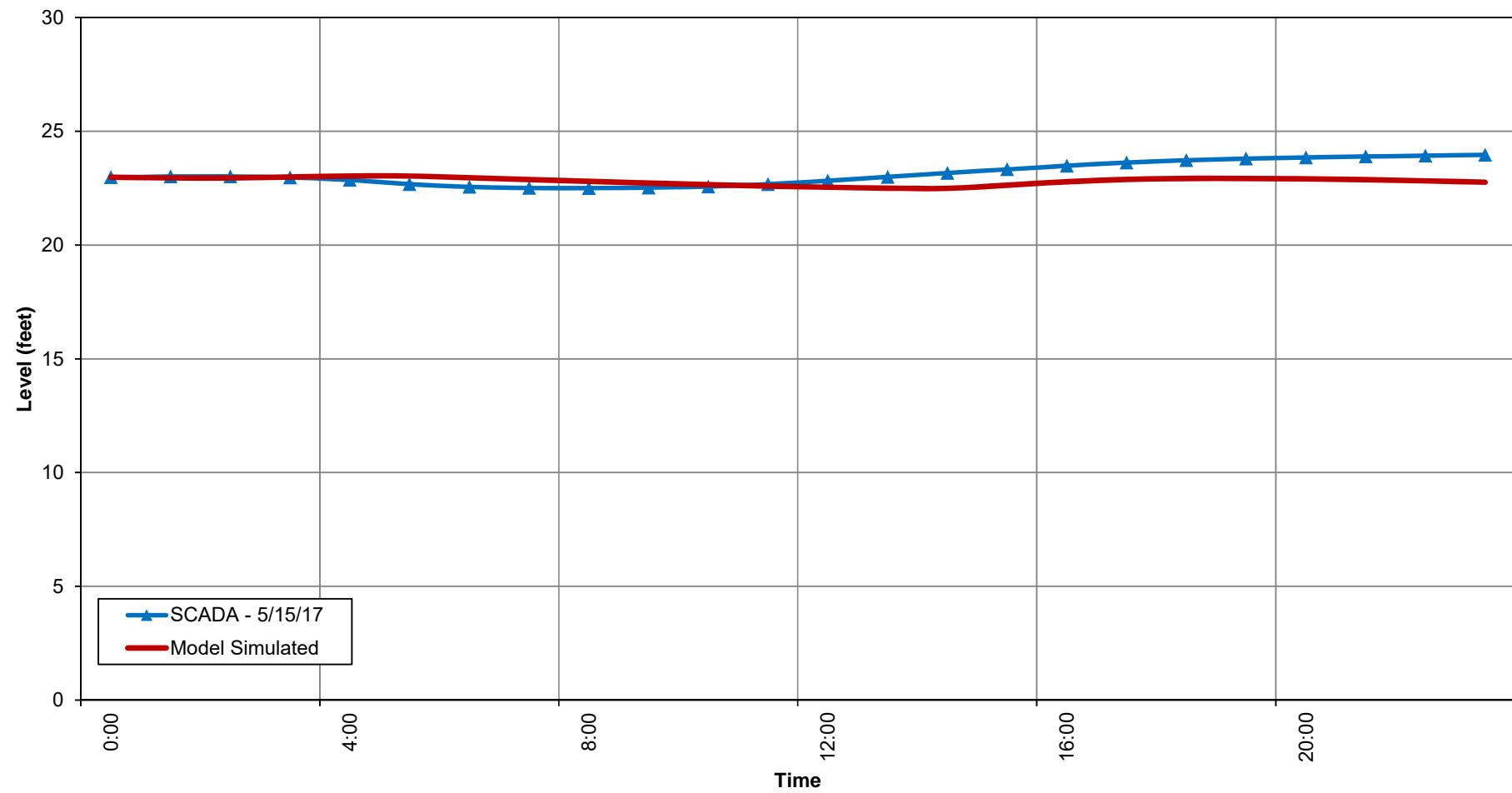


EPS Calibration - San Gorgonio Reservoir 2 (Zone Main)
2017 Integrated Master Plan
City of Banning



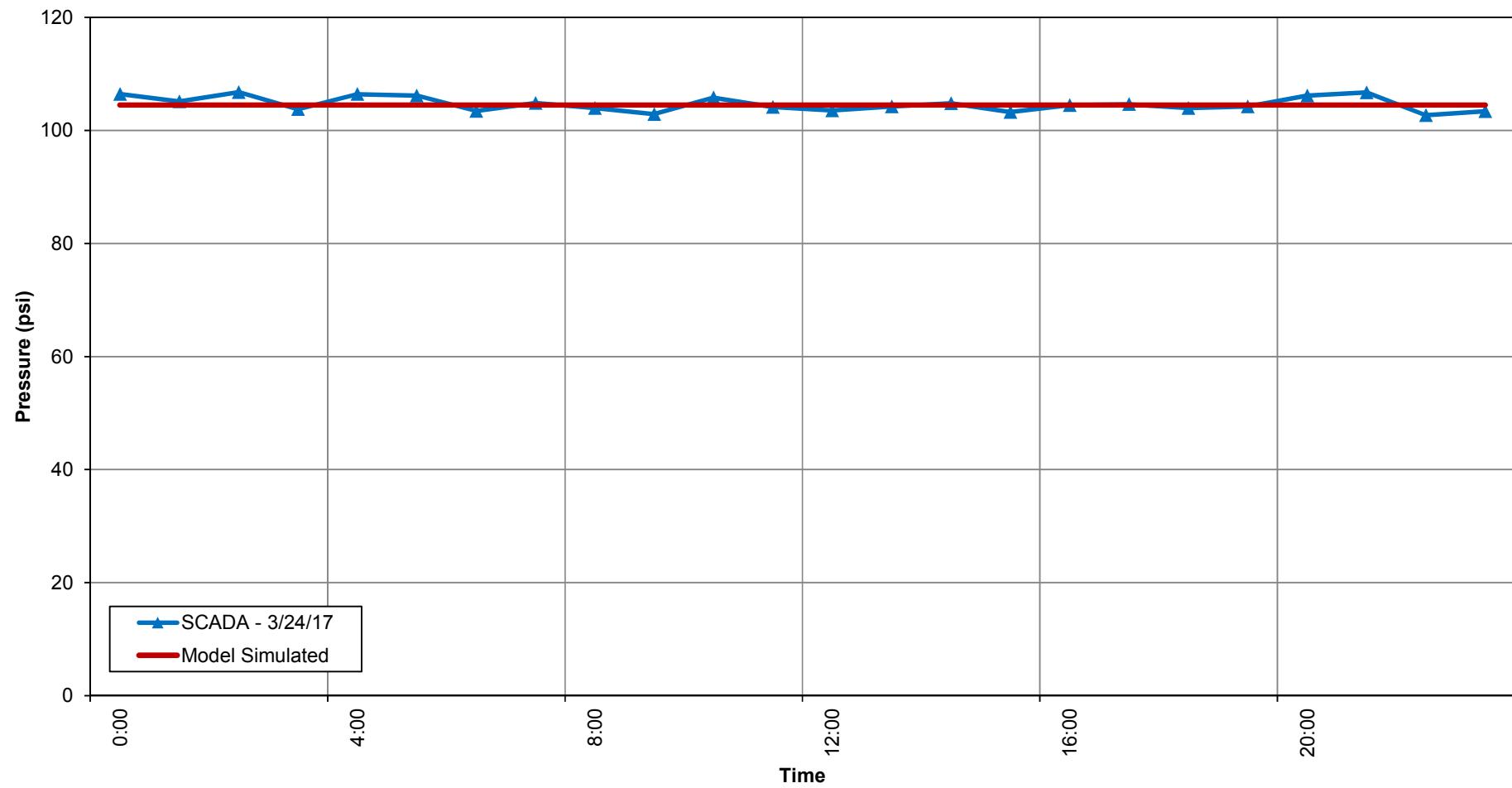


EPS Calibration - San Gorgonio Reservoir 3 (Zone Main)
2017 Integrated Master Plan
City of Banning



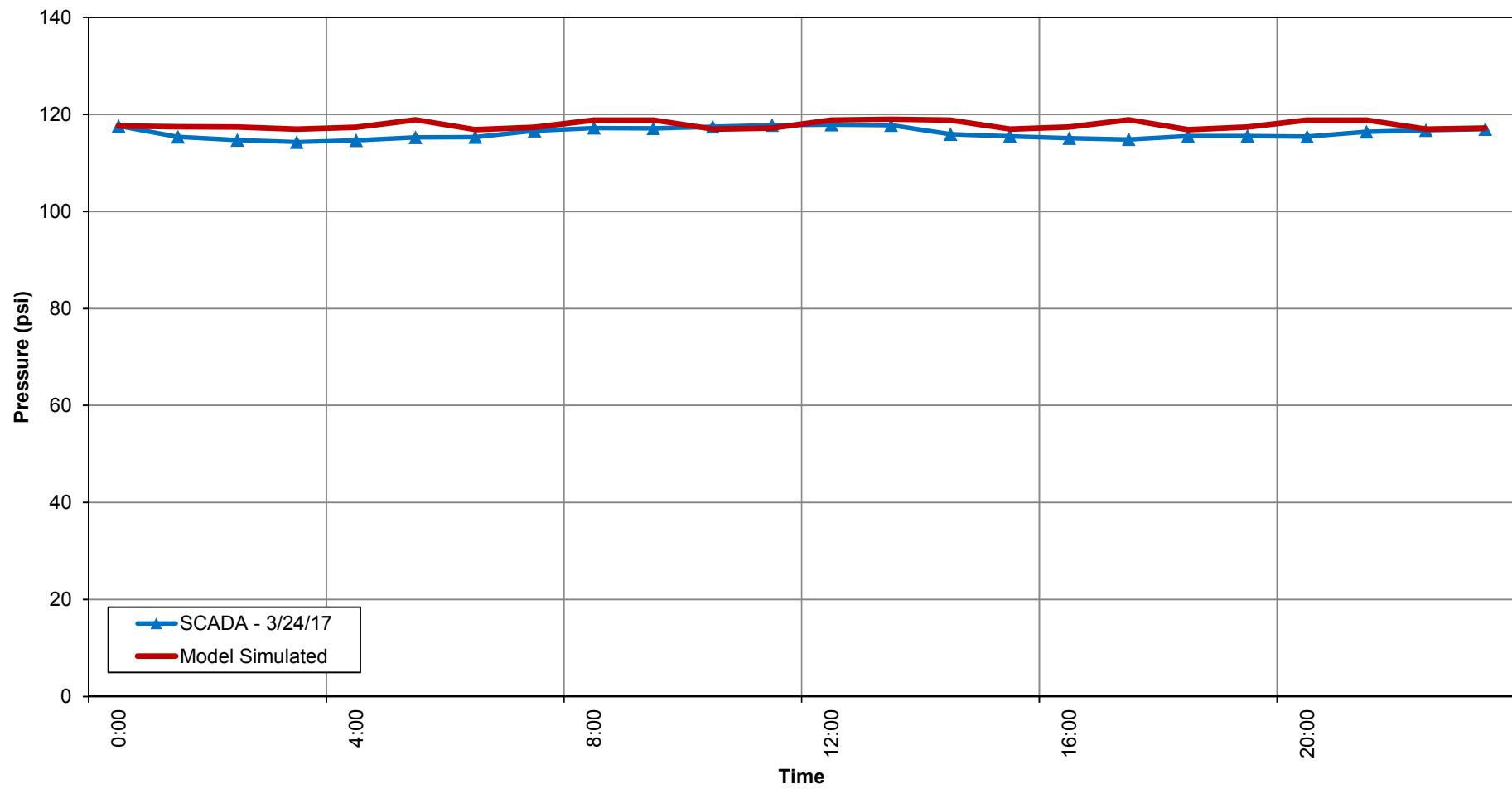


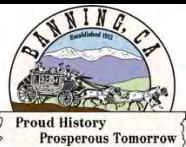
EPS Calibration - PL 30 Pressure (Zone Foothill West)
2017 Integrated Master Plan
City of Banning



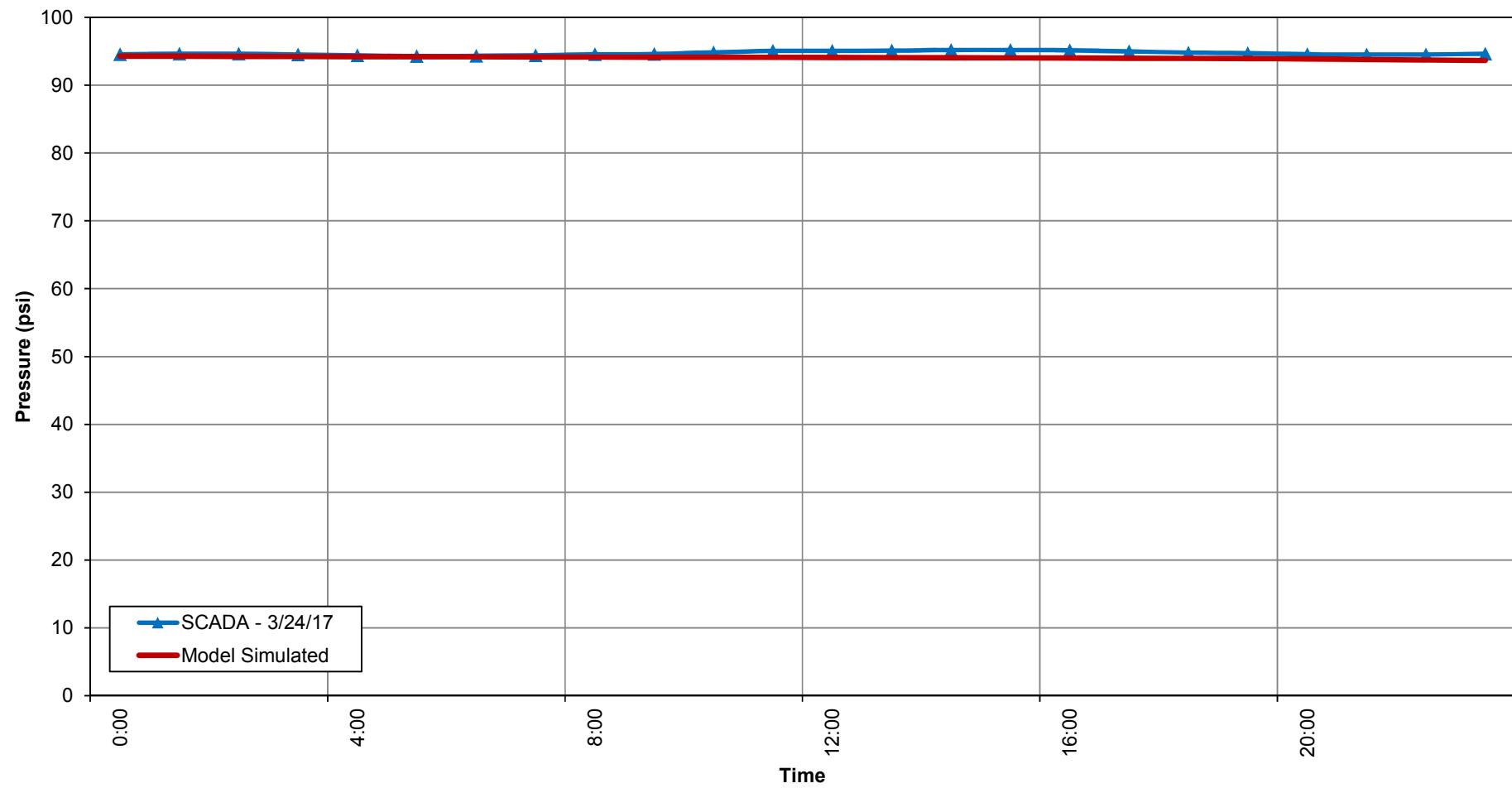


EPS Calibration - PL 31 Pressure (Zone Foothill West)
2017 Integrated Master Plan
City of Banning



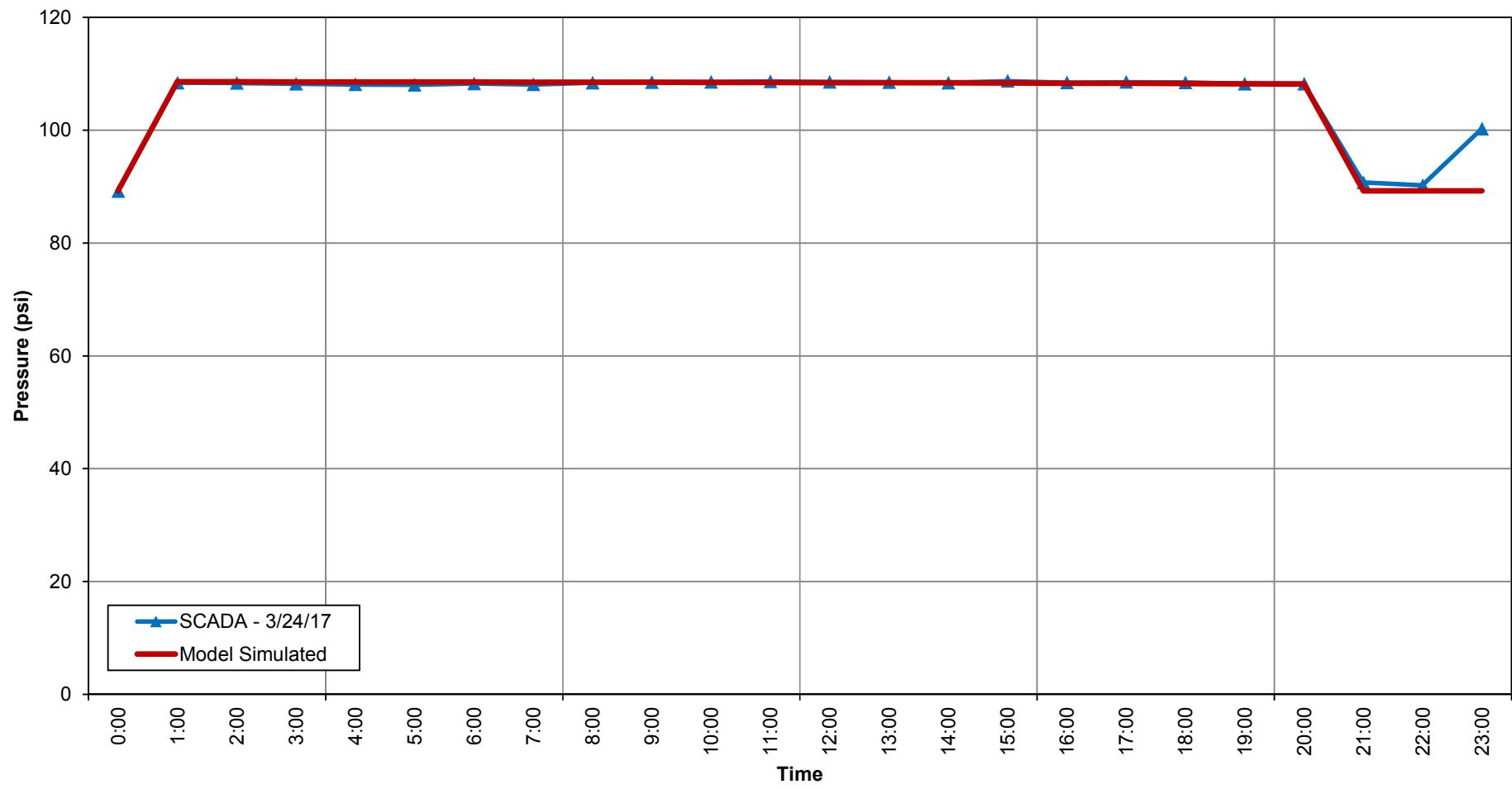


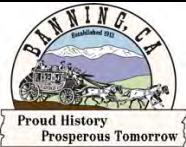
EPS Calibration - PL 33 Pressure (Zone Main)
2017 Integrated Master Plan
City of Banning



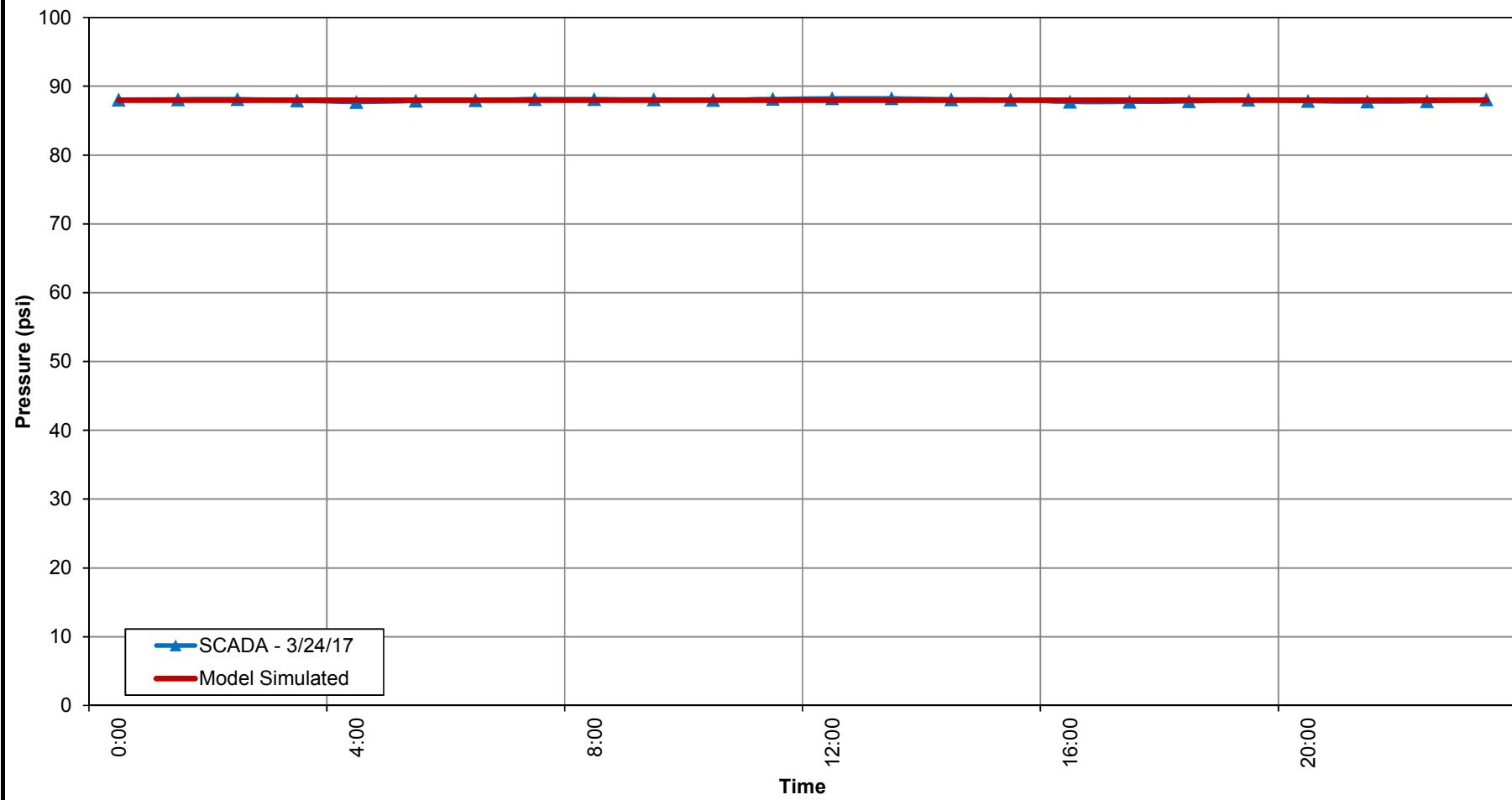


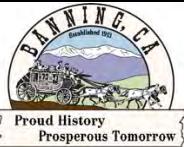
EPS Calibration - PL 34 Pressure (Zone Main)
2017 Integrated Master Plan
City of Banning



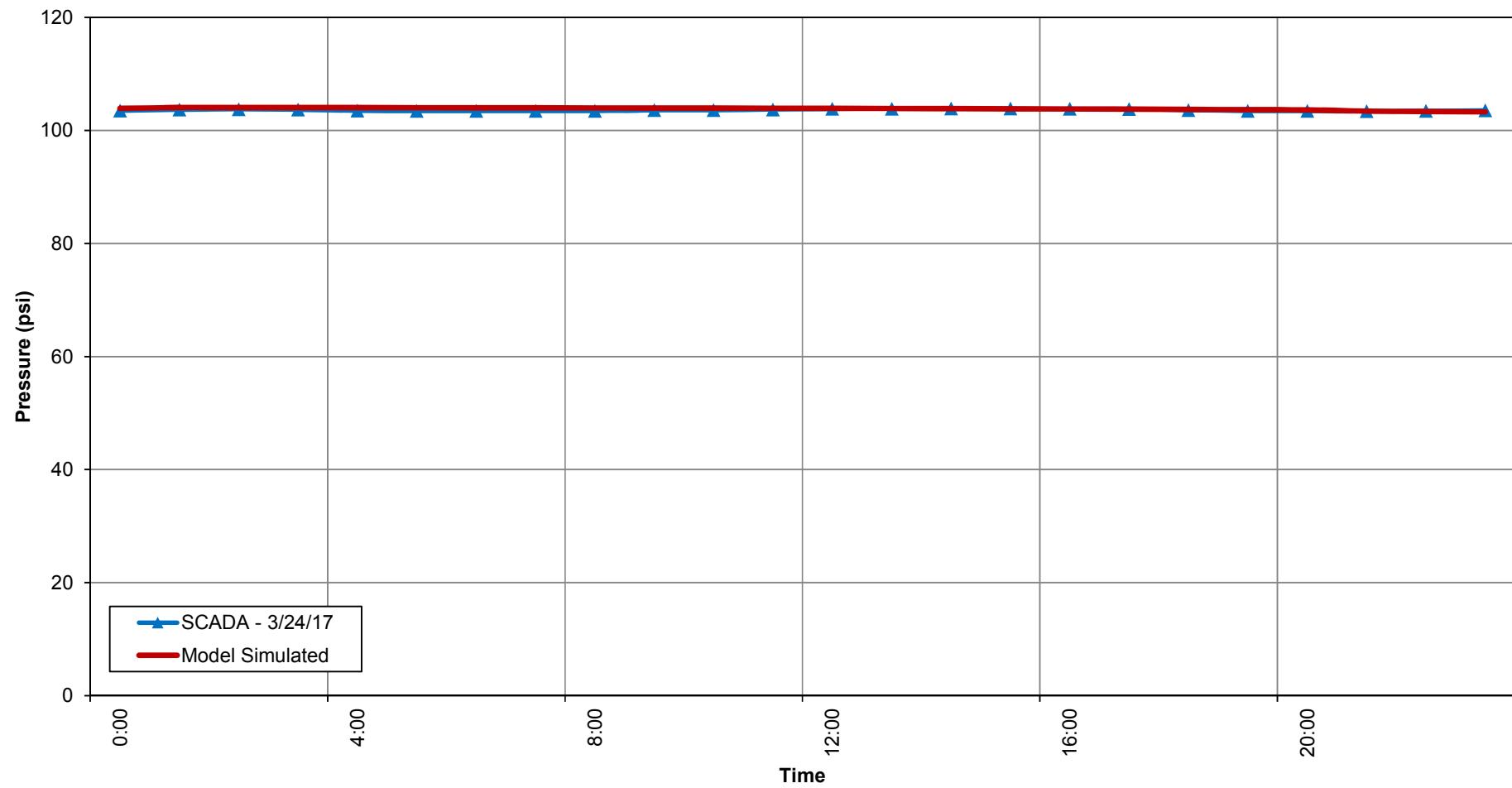


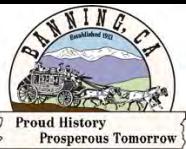
EPS Calibration - PL 35 Pressure (Zone Mountain South)
2017 Integrated Master Plan
City of Banning



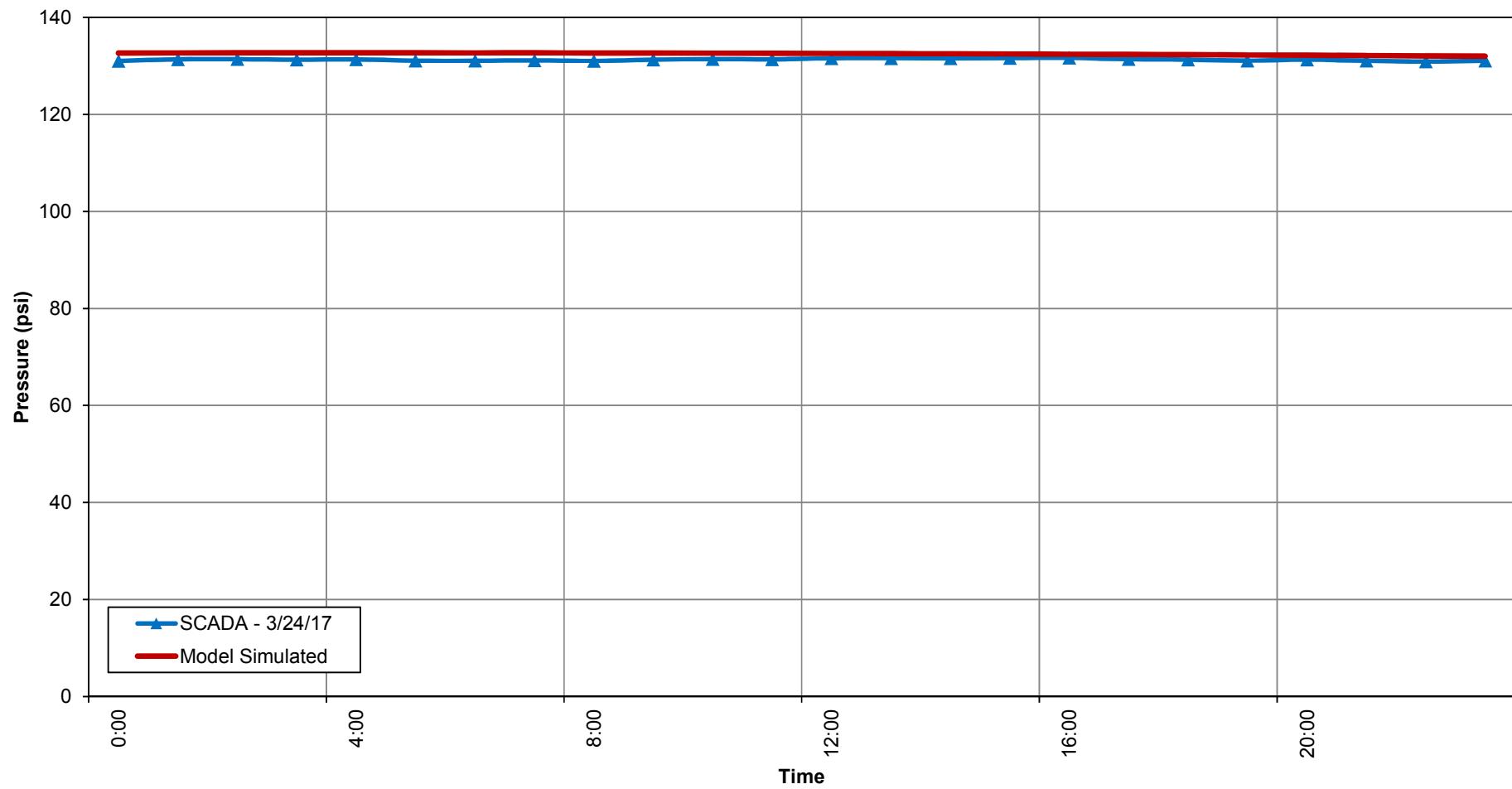


EPS Calibration - PL 36 Pressure (Zone Main)
2017 Integrated Master Plan
City of Banning



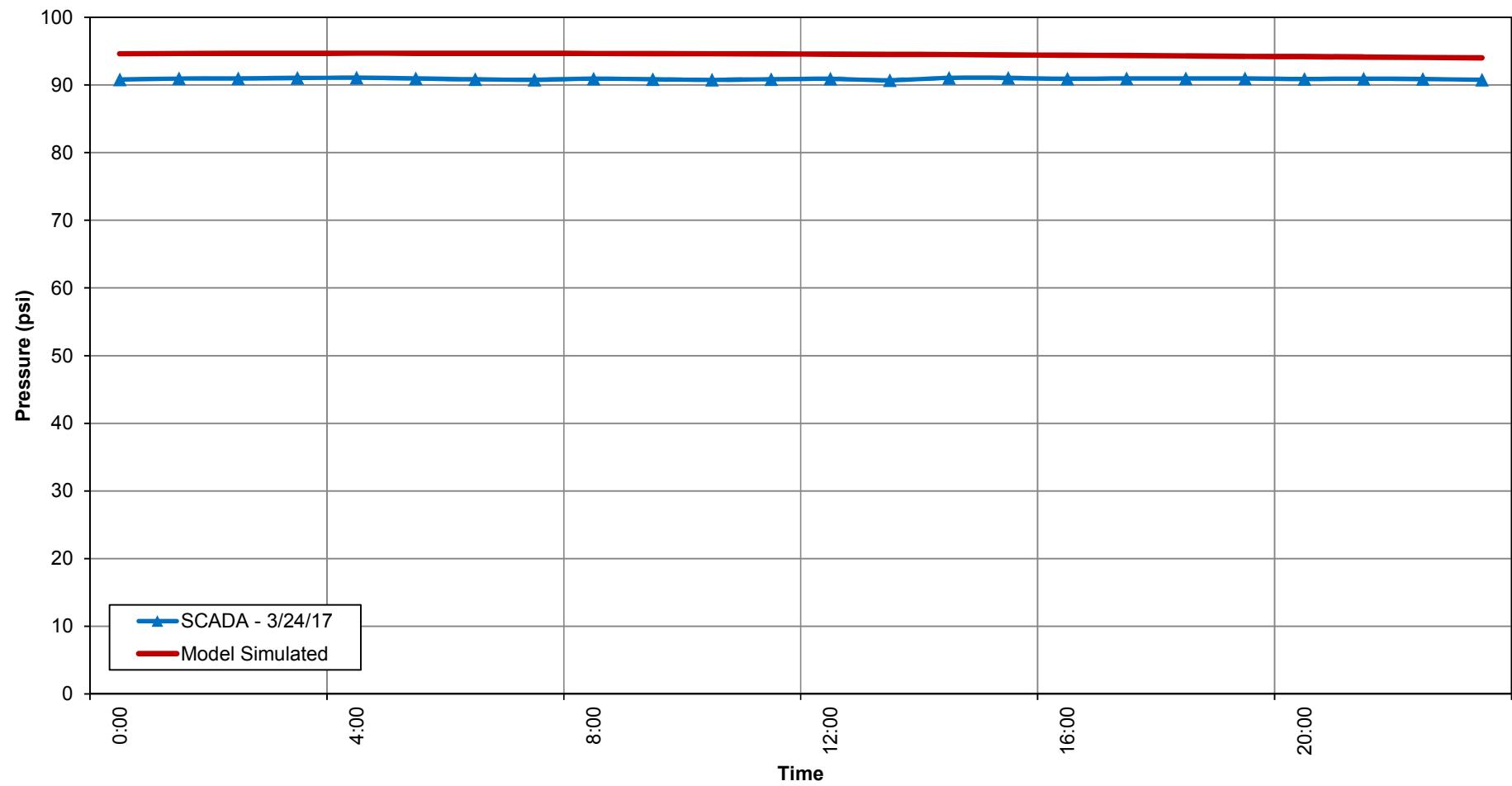


EPS Calibration - PL 37 Pressure (Zone Main)
2017 Integrated Master Plan
City of Banning



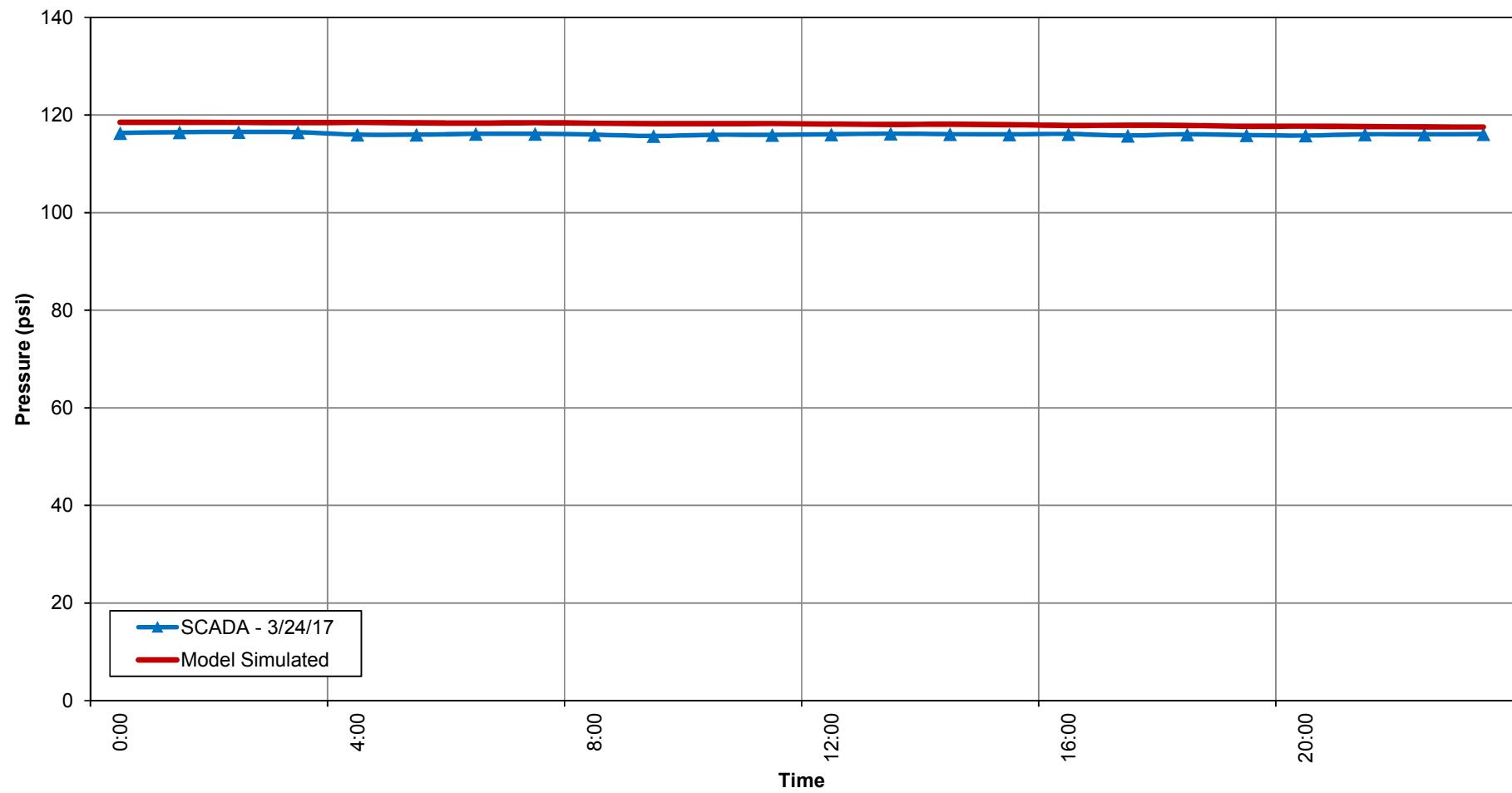


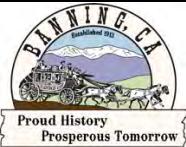
EPS Calibration - PL 38 Pressure (Zone Main)
2017 Integrated Master Plan
City of Banning





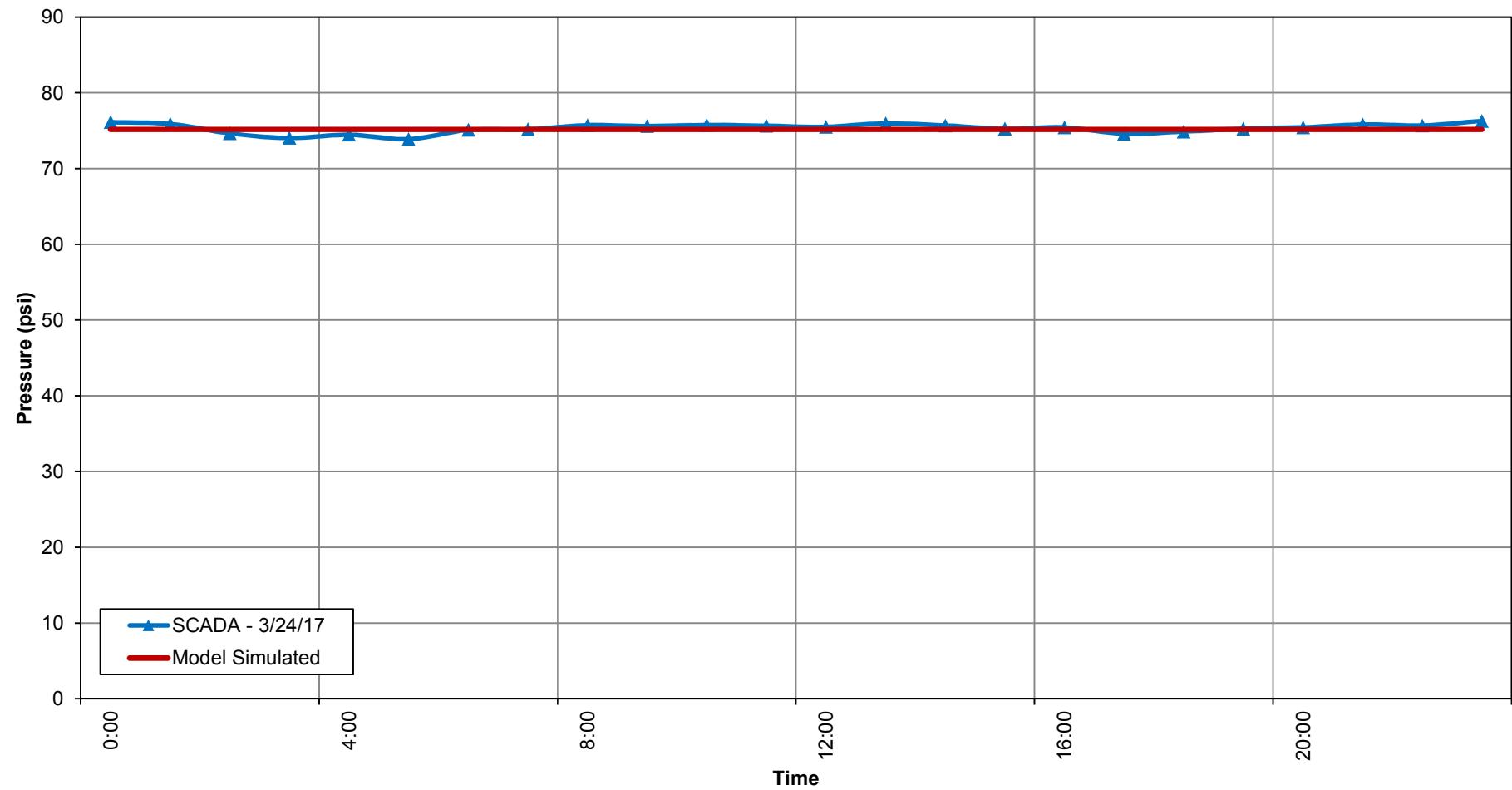
EPS Calibration - PL 39 Pressure (Zone Main)
2017 Integrated Master Plan
City of Banning





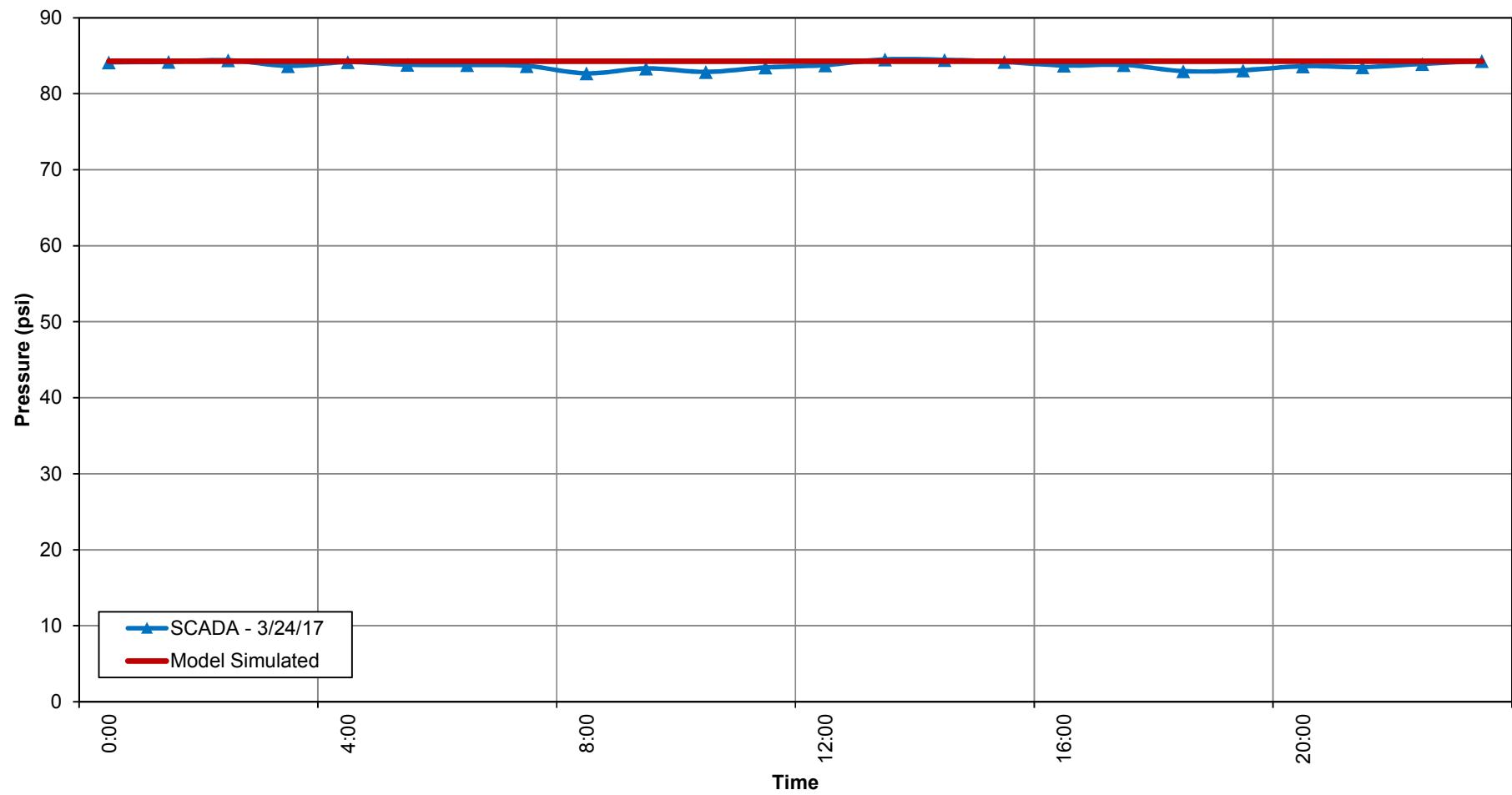
EPS Calibration - PL 40 Pressure (Zone Foothill East)

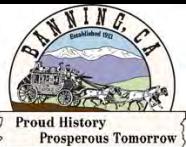
2017 Integrated Master Plan
City of Banning



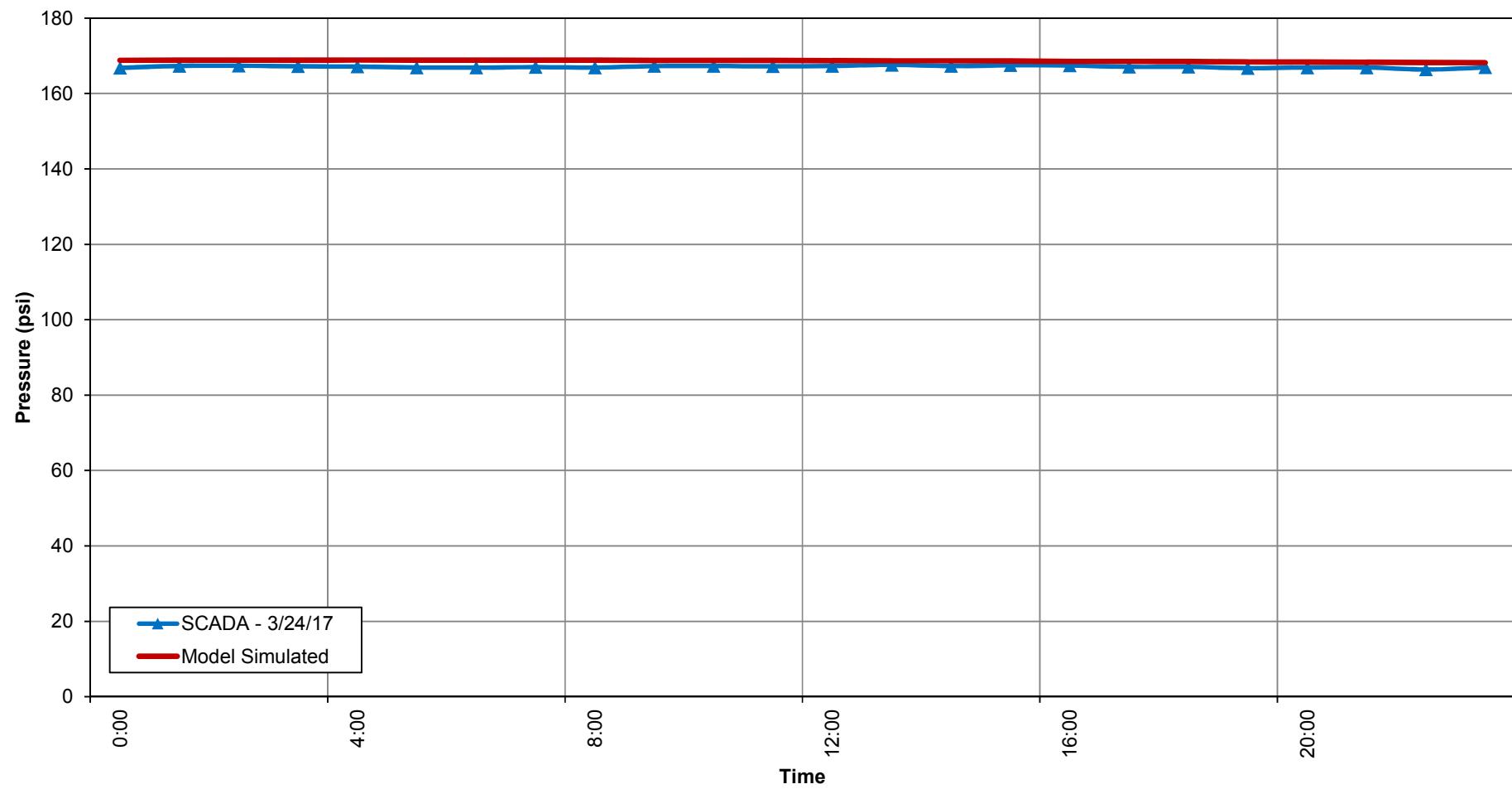


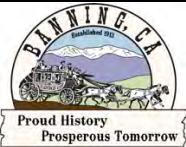
EPS Calibration - PL 41 Pressure (Zone Lower I)
2017 Integrated Master Plan
City of Banning





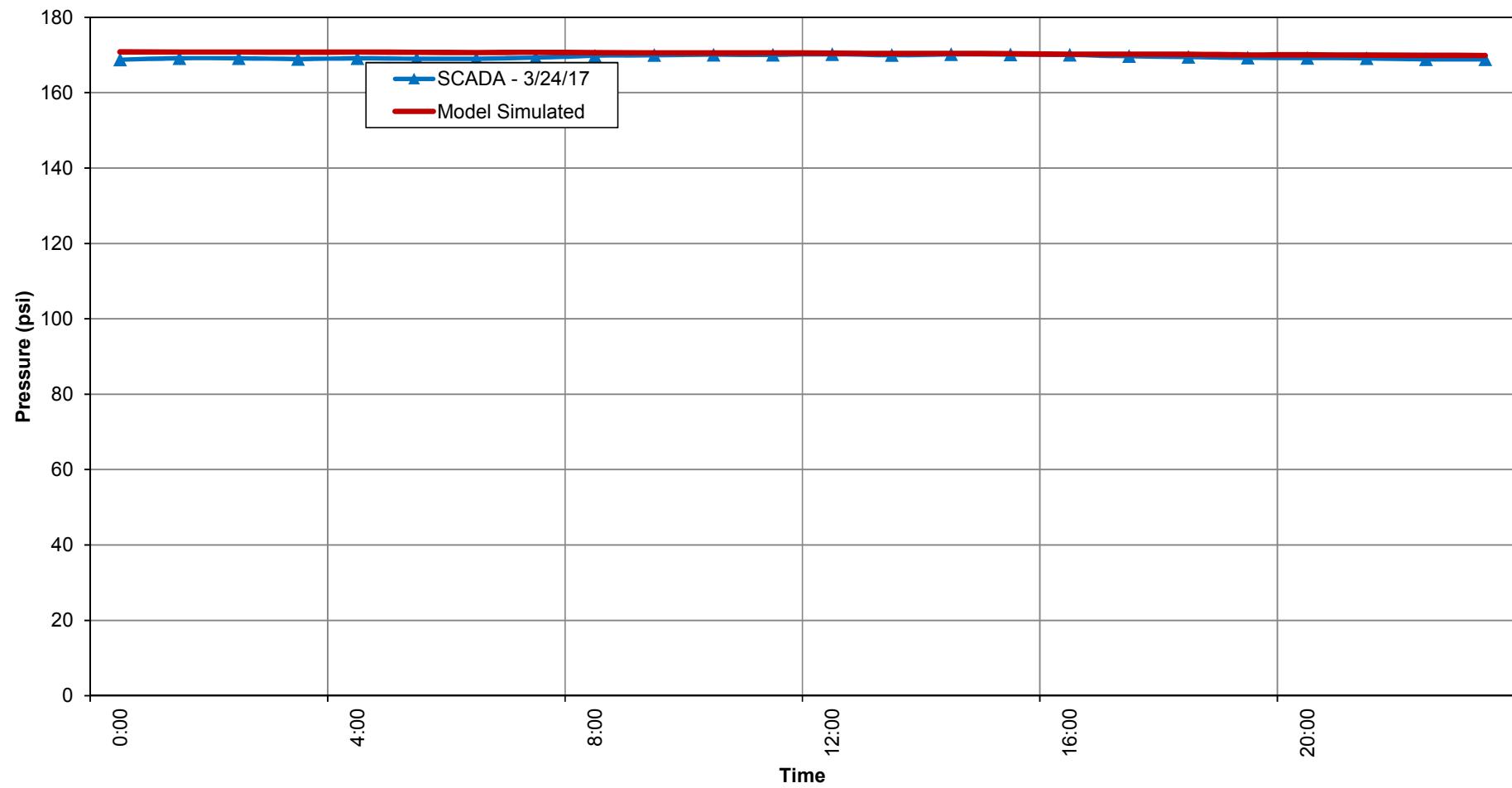
EPS Calibration - PL 42 Pressure (Zone Main)
2017 Integrated Master Plan
City of Banning





EPS Calibration - PL 43 Pressure (Zone Main)

2017 Integrated Master Plan
City of Banning



Appendix C

DEMAND AND SUPPLY DETAILS



AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0

 American Water Works Association.
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Click to access definition
 Click to add a comment

Water Audit Report for: **City of Banning**
 Reporting Year: **2016** 1/2016 - 12/2016

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: ACRE-FEET PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

Master Meter and Supply Error Adjustments

WATER SUPPLIED

Volume from own sources:	+	?	3	6,749.769	acre-ft/yr	Pcnt:	+	?	2	(radio buttons)	Value:
Water imported:	+	?	n/a	0.000	acre-ft/yr	Pcnt:	+	?	(radio buttons)	acre-ft/yr	
Water exported:	+	?	n/a	0.000	acre-ft/yr	Pcnt:	+	?	(radio buttons)	acre-ft/yr	

WATER SUPPLIED: 6,749.769 acre-ft/yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Billed metered:	+	?	5	5,835.597	acre-ft/yr
Billed unmetered:	+	?	n/a	0.000	acre-ft/yr
Unbilled metered:	+	?	n/a	0.000	acre-ft/yr
Unbilled unmetered:	+	?	5	16.874	acre-ft/yr

AUTHORIZED CONSUMPTION: 5,852.471 acre-ft/yr

Click here: ?
for help using option
buttons below

Pcnt: (radio buttons) Value: 16.874 acre-ft/yr

Use buttons to select
percentage of water
supplied
OR
value

Pcnt: 0.25% (radio buttons) Value: 0.25% acre-ft/yr

2.00% (radio buttons) acre-ft/yr
0.25% (radio buttons) acre-ft/yr

WATER LOSSES (Water Supplied - Authorized Consumption)

897.298 acre-ft/yr

Apparent Losses

Unauthorized consumption: 16.874 acre-ft/yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	+	?	3	119.094	acre-ft/yr
Systematic data handling errors:	+	?		14.589	acre-ft/yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: 150.557 acre-ft/yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 746.740 acre-ft/yr

WATER LOSSES: 897.298 acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER: 914.172 acre-ft/yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	+	?	8	172.9	miles
Number of <u>active AND inactive</u> service connections:	+	?	8	10,736	
Service connection density:	?			62	conn./mile main

Are customer meters typically located at the curbstop or property line?

Yes

(length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure: 109.3 psi

COST DATA

Total annual cost of operating water system:	+	?	7	\$11,526,558	\$/Year
Customer retail unit cost (applied to Apparent Losses):	+	?	10	\$2.21	\$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	+	?	7	\$250.07	\$/acre-ft

Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 51 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources

2: Customer metering inaccuracies

3: Billed metered



AWWA Free Water Audit Software: Determining Water Loss Standing

WAS v5.0

American Water Works Association
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Water Audit Report for:

Reporting Year:

2016

1/2016 - 12/2016

Data Validity Score:

51

Water Loss Control Planning Guide

Functional Focus Area	Water Audit Data Validity Level / Score				
	Level I (0-25)	Level II (26-50)	Level III (51-70)	Level IV (71-90)	Level V (91-100)
Audit Data Collection	Launch auditing and loss control team; address production metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations. Identify data gaps.	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs. Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc.	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or Automatic Meter Reading (AMR) system.	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process.	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon the Infrastructure Leakage Index (ILI) for performance comparisons for real losses (see below table)	Performance Benchmarking - ILI is meaningful in comparing real loss standing	Identify Best Practices/ Best in class - the ILI is very reliable as a real loss performance indicator for best in class service

For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.

Once data have been entered into the Reporting Worksheet, the performance indicators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities in gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI (without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 - 5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term plan.
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

- 1) Their location shall be near a recycled water distribution pipeline or in proximity of other potential customers.
- 2) Their ADD exceeds 10,000 gpd. Potential customers with ADD less than 10,000 gpd may be eligible if their location is near a recycled water pipeline.
- 3) All irrigation areas should be located within City limits.

Based on these criteria, 18 potential recycled water customers were identified. These users can be divided into two categories; 1) current potable water customers that could convert to recycled water for their irrigation needs, and 2) future customers such as parks and golf courses identified in the specific plans. The location of these potential customers are depicted on Figure 2.3, while their estimated recycled water demands are summarized in Table 2.7.

**Table 2.7 Potential Recycled Water Customers and Demands
Recycled Water Master Plan
City of Banning**

ID	Customer Name	Irrigation Area ⁽¹⁾ (acres)	Demand Factor (gpd/ac)	Annual Demand (afy)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
Existing Potable Water Customers						
1	Sun Lakes Development	199	4,868 ⁽²⁾	1,085	1,900	1,900
2	CalTrans along I-10	200	3,650	818	1,432	2,864
3	Gilman Historic Ranch	59	3,650	241	422	1,267
4	Banning High School	40	3,650	164	286	859
5	Dysart Park	20	3,650	82	143	430
6	Rehab & Counseling Center	20	3,650	82	143	430
7	Lions Park	9	3,650	37	65	195
8	Sylvan Park	8	3,650	32	56	168
9	Neighborhood Park	8	3,650	31	54	161
10	Repllier Park	7	3,650	28	49	146
11	Deutsch Company Park	5	3,650	20	36	107
12	Roosevelt Williams Park	5	3,650	19	34	102
13	Mountain Avenue Park	3	3,650	13	22	67
14	Banning Unified School District	3	3,650	12	21	64
Future Developments						
15	Loma Linda Development	259 ⁽⁴⁾	3,650	1,059	1,854	2,914
16	Pardee Development	272	3,686	1,123	1,967	2,723
17	Five Bridges Development	51	3,650	210	367	1,102
18	Black Bench	113	3,650	403	810	2,430
18	Black Bench - Fire Zone	42	1,217 ⁽³⁾	57	101	302
Total		1,245	1,323		5,575	9,763

(1) Source data: [6], [7], [8], and [18].

(2) Based on historical usage records.

(3) Based on drought tolerant vegetation (33% of turf water usage) in the first 50 foot of the 150 foot fire modification zone.

(4) This excludes the greenspace along the steep slopes in the southern portion of the development.

Appendix D

Total Potential Recycled Water Customers and Demands

Customer Name	Irrigation Area ⁽¹⁾	Factor (gpd/ac)	Annual Demand (AFY)	ADD (mgd)	MDD (mgd)	PHD (mgd)	Diurnal Type	Elevation	Minimum HGL	Maximum HGL
Existing Customers										
Sun Lakes Development ¹	199	3,814	850	0.76	2.14	2.14	24 hour	2,494	2,600	2,800
Caltrans (PW Meter #415407W) ²	N/A	N/A	0	0.0000	0.0000	0.0000	12 hour	2,297	2,400	2,600
Caltrans (PW Meter #163756W) ²	N/A	N/A	0	0.0000	0.0000	0.0001	12 hour	2,288	2,400	2,600
Caltrans (PW Meter #70040279W) ²	N/A	N/A	0	0.0000	0.0000	0.0001	12 hour	2,347	2,500	2,700
Caltrans (PW Meter #31975307W) ²	N/A	N/A	0	0.0000	0.0001	0.0002	12 hour	2,443	2,600	2,800
Caltrans (PW Meter #1120866W and 1)	N/A	N/A	0	0.0002	0.0006	0.0013	12 hour	2,444	2,600	2,800
Caltrans (PW Meter #31975310W) ²	N/A	N/A	0	0.0000	0.0001	0.0001	12 hour	2,535	2,700	2,900
Gilman Ranch Museum Park	59	29	2	0.00	0.00	0.01	8 hour		100	300
Banning High School	40	3,900	175	0.16	0.44	1.32	8 hour	2,279	2,400	2,600
Dysart Park	20	3,900	87	0.08	0.22	0.66	8 hour	2,363	2,500	2,700
Lions Park	18	3,900	79	0.07	0.20	0.59	8 hour	2,237	2,400	2,600
Sylvan Park	8	3,900	35	0.03	0.09	0.26	8 hour	2,531	2,700	2,900
Repplier Park	7	0	0	0.00	0.00	0.00	8 hour	2,412	2,600	2,800
Roosevelt Williams Park	5	3,900	22	0.02	0.06	0.17	8 hour	2,352	2,500	2,700
Mountain Avenue Park	3	3,900	13	0.01	0.03	0.10	8 hour	2,582	2,700	2,900
Banning Unified School District	3	3,900	13	0.01	0.03	0.10	8 hour	2,368	2,500	2,700
Future Customers										
Butterfield Development ⁴	496.5	1,798	988	0.88	2.49	7.47	8 hour	2,560	2,700	2,900
Rancho San Gorgonio ⁵	210	924	217	0.19	0.55	1.64	8 hour	2,340	2,500	2,700
Five Bridges Development	51	3,900	223	0.20	0.56	1.68	8 hour	2,460	2,600	2,800
Neighborhood Park	8	3,900	35	0.03	0.09	0.26	8 hour	2,396	2,500	2,700
Total	1,119.5	--	2,704	2.41	6.81	16.15	--	--	--	--

Notes:

¹ Sun Lakes Development demand retrieved from production data for years 2012-2014.

² Annual Demand retrieved from 2015-2016 billing data. The larger demand between the two years was used to estimate the demand.

³ 2016 Demand for this potable meter was zero. Since it was the only other meter location in the geocoded shapefile,

⁴ Butterfield demand retrieved from Specific Plan dated November 2016 and edited based on email from Greg Hohman.

⁵ Rancho San Gorgonio demand retrieved from Specific Plan dated January 2015.

6 Max pressure 150 psi 346.5 ft

Min pressure 60 psi 138.6 ft

Lake min 10 psi 23.1 ft

Appendix D

CONDITION ASSESSMENT TECHNICAL MEMO

Contents

Section 1: Introduction

1.1 Background	1-1
----------------	-----

1.2 Site Visit Overview	1-1
-------------------------	-----

Section 2: Condition Assessment Notes

2.1 Wells	2-1
-----------	-----

2.1.1 Well 1	2-2
--------------	-----

2.1.2 Well 3	2-2
--------------	-----

2.1.3 Well C-2	2-3
----------------	-----

2.1.4 Well C-5	2-5
----------------	-----

2.1.5 Well C-6	2-7
----------------	-----

2.1.6 Well M-3	2-7
----------------	-----

2.1.7 Well M-11	2-8
-----------------	-----

2.1.8 Well M-12	2-9
-----------------	-----

2.2 Reservoirs	2-9
----------------	-----

2.2.1 San Gorgonio Reservoirs 1, 2 and 3	2-10
--	------

2.2.2 Sunset Reservoir	2-11
------------------------	------

2.2.3 Mountain Reservoir & Booster	2-12
------------------------------------	------

2.2.4 Southwest Reservoir	2-14
---------------------------	------

2.2.5 High Valley Reservoir	2-15
-----------------------------	------

2.3 PRV Stations	2-16
------------------	------

2.3.1 Foothill East PRV Station	2-16
---------------------------------	------

2.3.2 Hargrave & John St PRV Station	2-17
--------------------------------------	------

2.4 Lift Stations	2-17
-------------------	------

2.4.1 Caltrans Site Lift Station	2-17
----------------------------------	------

2.4.2 Westward Lift Station	2-18
-----------------------------	------

Section 3: Capital Cost Estimates

Appendices

Appendix D.2 Detailed Cost Estimates

Tables

Table 1.1 Visited Facilities (June 7, 2017)	1-2
Table 3.1 Near-Term Capital Cost Estimate (2018-2025)	3-2
Table 3.2 Long-Term Capital Cost Estimate (2026-2040).....	3-3

Abbreviations

AC	Acre
AFY	Acre-feet per year
ATS	Automatic Transfer Switch
Carollo	Carollo Engineers, Inc.
cf	cubic feet
cfs	cubic feet per second
City	City of Banning
CIP	Capital Improvement Program or cast iron pipe
F	Fahrenheit
ft	Feet
IMP	Integrated Master Plan
µg/L	micrograms per liter
MG	million gallons
mg/L	milligrams per liter
mgd	million gallons per day
PS	Pump Station
psi	pounds per square inch
SCADA	Supervisory Control and Data Acquisition

Section 1

INTRODUCTION

The purpose of this memorandum is to document the results of a condition assessment that was performed for select City of Banning (City) facilities. The City's potable water and sewer facilities include groundwater wells, lift stations, reservoir sites, and pressure reducing valve (PRV) stations. The purpose of the cursory assessments is to identify possible existing deficiencies that may require future correction.

1.1 Background

As part of the City's Integrated Master Plan (IMP) being prepared by Carollo Engineers (Carollo), a one-day field inspection was conducted to evaluate the existing condition of a few of the most critical of the City's groundwater wells, storage reservoirs, lift stations, and PRV stations. The inspection results are a combination of the visual assessment by engineers from Carollo, a review of existing information such as record drawings, and comments from the City's staff. Other sections of the IMP focus on the hydraulic and capacity assessments of the infrastructure at these sites. Unless noted during visits to the facilities, hydraulic and capacity issues are not included in this assessment. Recommendations for repair, rehabilitation, and/or replacement of facilities and equipment are provided to aid in the preparation of the CIP budget estimate included in the IMP.

1.2 Site Visit Overview

On June 7, 2017, City employees Luis Cardenas (Civil Engineer), Perry Gerdes (Water/Wastewater Superintendent), and the City's maintenance staff led Carollo's David Baranowski, James Doering, and Pei-Shin Wu around to various City facilities for the purpose of documenting the condition of the facilities and their assets. City staff provided anecdotal information about each site as it was visited. Carollo's staff documented the condition of the sites through photographs and notes. A summary of the notes taken is provided in the next section of this memorandum.

The full-day condition assessment included 17 sites (8 wells, 5 reservoir sites, 2 lift stations, and 2 PRV stations). The visited facilities are summarized in Table 1.1 [Visited Facilities \(June 7, 2017\)](#)

Table 1.1 Visited Facilities (June 7, 2017)

Well Sites	Reservoir Sites	Lift Stations	PRV Stations
Well 1	San Gorgonio	Caltrans Site	Foothill East ⁽²⁾
Well 3	Sunset	Westward	Hargrave & John St
Well C-2	Mountain ⁽¹⁾		
Well C-5	Southwest		
Well C-6	High Valley		
Well M-3			
Well M-11			
Well M-12			

Notes:

(1) Mountain reservoir site includes a hydro-pneumatic pump station.
 (2) Foothill East PRV station is located on the San Gorgonio Reservoir site.

A map of the City of Banning and the location of the facilities are shown on Figure 6.1 in Chapter 6.

Section 2

CONDITION ASSESSMENT NOTES

This section presents an overview of the findings and recommendations for each facility. Field notes and photographs, input provided by City staff during the site visits, and supplemental information provided by the City were used as the basis for this memorandum's recommendations for repair, rehabilitation, and/or replacement of facilities and equipment. Estimated capital costs are included in Chapter 3 of this memorandum.

The recommendations were grouped into projects and identified as near-term or long-term to correspond with the IMP capital plan. Near-term projects are recommended for completion between 2018 and 2025, while long-term projects fall into the 2026 to 2040 timeframe. Near-term recommendations are based on equipment found in poor condition or health and safety concerns. Long-term recommendations include equipment currently in fair condition, but forecasted to be replaced before 2040. Notes and recommendations for each visited site are included in this section. The sites are separated into wells, reservoirs, lift stations, and PRV stations.

2.1 Wells

The City's groundwater wells are a main source of water supply. The wells pump water up to the City's reservoirs, which supply water to the customers, or directly into the distribution system. Localized water treatment varies by well site, but can include sand separation and disinfection through chemical addition.

The following recommendations are made for the entire well system. These recommendations would affect all or most well sites.

- Emergency backup power - Few well sites have backup power or the ability to receive backup power. The sites that did not have standby generators did not appear to have hookups for a portable generator. Portable generators hookups are recommended at each site that does not have a standby generator. The City should evaluate its strategy for providing power to wells during emergency situations to determine how many portable generators are needed to power enough wells to operate the water system.
- The observed well pumps did not appear to have any obvious signs of anchorage to its foundation. It is recommended to install positive anchorage for the well pump to the concrete foundation at all sites where it is not currently done. The City should review why anchor bolts are missing from well pumps to determine if there was a reason for this.
- Site lighting was lacking at nearly all of the observed well sites. Site lighting is recommended to provide ample lighting during after-hours call outs and as a means to deter intruders. Motion-activated sensors on the lights are recommended. Additionally, the City could elect to send a signal through SCADA to alert of a triggered alarm, or even cameras on the light poles to investigate the cause of the alarm.

The observations and recommendations for each visited well site are as follows.

2.1.1 Well 1

Well 1 site consists of the well and pump, a pelton wheel hydrogenerator, a bypass reservoir, a flow meter vault, and a chemical building.

Observations:

- Visible portions of the bypass reservoir are in fair to poor conditions. There are multiple leak patches at the south side and water is actively leaking to the exterior. The corrugated steel deck covering the reservoir has evidence of ponding along the south side. There is no obvious overflow piping and discharge. The reservoir is rarely out of service and has not been internally inspected in the last 11 years, according to staff knowledge.
- The concrete bypass channel at the connection to the reservoir does not have any grade support. A small leak was observed at this connection.
- Bypass pipe is lacking multiple pipe supports. It is currently deflected downwards and shows obvious signs of corrosion.
- Well pump has no obvious signs of anchorage to its foundation.
- The flow meter vault is covered by a non-locking lid.



Recommendations (near term):

- Inspect the interior of the bypass reservoir. Repair leaks in the walls of the bypass reservoir by means of an NSF 61 compliant hydrophobic injection grout. Provide watertight roofing system for the bypass reservoir, such as elastomeric coating.
- Verify bypass reservoir has an operational overflow compliant with California Title 17.
- Provide pipe supports for bypass pipe. Repaint portions of corroded bypass pipe.
- Provide locks for flow meter vault to increase operational safety.

Recommendations (long term):

- Replace the bypass reservoir with a standard buried (or partially buried) reservoir, conventional steel tank, or prestressed concrete tank.

2.1.2 Well 3

Well 3, most recently rebuilt in 1993, consists of the well and pump, a pressure relief valve (PRV), an Accu-Tab chlorination system, and a sodium hypochlorite feed system.



Observations:

- The Accu-Tab system is currently not in use, except for emergencies. The system does not have any locks and is a potential safety hazard.

- The new sodium hypochlorite feed system is the new disinfection method. However, it is not yet piped to the well and there is no pump. Staff noted this and said it would be taken care of by staff in the near future.
- Pelton wheel has now been replaced by electric motor.
- The PRV does not have a flow meter. However, the run of pipe above ground is not long enough to install a flow meter. Adding a flow meter would require extending the above-ground pipe or finding an appropriate location below ground. Staff noted a desire to monitor this flow, which they currently cannot do.
- Pipe supports at the site are typically lacking positive anchorage. The support for the PRV is placed on a block of wood and a CMU block.
- Well pump has no obvious signs of anchorage to its foundation.

Recommendations (near term):

- Provide properly sized pipe supports with anchorage down to existing concrete. Where supports are required in the yard, provide new supports with small concrete pads.
- Improve security of the Accu-Tab system or remove the system.

Recommendations (long term):

- Install flow meter on PRV line. Modify the piping to allow proper upstream and downstream straight runs of pipe.

2.1.3 Well C-2

Well C-2 consists of the well and pump, a storage tank, a booster station with 5 vertical turbine pumps, and a backup generator. The site is estimated to have been constructed around 1985.



Observations:

Well and Pump Observations:

- The well pump, motor, and piping show minor corrosion and are in need of painting. The system appears to have been installed around 1985.
- The well can be pumped directly to the storage tank, to the distribution system, or to waste. The typical valve arrangement is set up to pump to the storage tank and any changes require manual operation of three valves. According to staff, the run-to-waste line is not used on well startup. As a result, it is likely that sand and other minerals have built up inside the storage tank. Staff were not aware of any recent tank cleanings.
- Well pump has no obvious signs of anchorage to its concrete support pad.

Booster Station Observations:

- The booster station has 5 pumps that all pump to the Sunset reservoirs. Pump 1 is fed by the on-site storage tank, pumps 2 to 5 are fed by the distribution system. There is space for one additional pump to feed off the storage tank.
- According to staff, the well pump produces 900 gpm, but the booster station pump only produces 700 gpm. The difference in flows results in the well pump shutting down and having to restart when the tank level drops. No record drawings are available to confirm

the pump sizes. The addition of a VFD on the well pump or installation of the addition booster pump should resolve this issue.

- Pump 5 is in very poor condition. The pump head is covered in corrosion and scale. It is unclear if this pump will even run. According to staff, this pump never runs.
- Pump 2 was recently rehabbed.
- All booster pumps are configured with 4-inch pressure control valves (Cla-Vals) on the discharge. The discharge expands to 6-inches downstream of the valve.
- Roof framing of the booster station shows signs of dry-rot at the perimeter wood fascia. And the roof does not appear to be adequately tied to the building walls
- The air conditioning unit on the back of the station is in poor condition. The unit is covered in corrosion and scale. The metal frame is also corroded. The unit and frame are in need of replacement.

Storage Tank Observations:

- Storage tank is a bolted steel tank. The tank is unanchored and founded on gravel base with a steel containment ring. Containment ring has minor corrosion and has split open on the southeast quadrant of the tank, allowing some loss of gravel support and undermining of the tank perimeter.
- Exterior coating of the tank is in OK condition with evidence of vandalism and minor coating damage. Some areas of coating are chipped or peeling.
- A small leak (trickle) in the tank was observed at the joint between the 1st and 2nd shell ring at the southwest quadrant.
- The tank overflow pipe has an expansion joint where the overflow pipe enters the ground. The discharge end of the overflow pipe was not observed (occurs off site).
- The tank outlet pipe occurs below grade and ties to the tank at the bottom plate.
- The access ladder to the roof of the tank has a safety cage, anti-intrusion door, wire mesh on the lower cage, and guardrail at the roof. For safe access away from the access hatch on the tank roof, consider installing a horizontal lifeline system that uses lanyards and D-ring tie-offs where access to other parts of the tank roof may be required. This is optional and isn't necessarily required by regulations (and is not included in the recommendations).

Other Observations:

- The site does not have bollards to protect the well piping or storage tank from vehicles.
- Pipe supports for piping at the site are typically lacking any positive anchorage, whether they are located over existing concrete equipment pads or within the yard.
- The entrance gate has a gap that can allow unauthorized access.
- Minimal lighting is available on site. Additional lighting would improve the staff's ability to perform work during non-daylight hours.
- The standby generator is in OK condition. Parts of the enclosure have corrosion and the paint is faded. The enclosure was not opened to inspect the actual unit. The unit appears to be at least 15 years old, but may be from 1985. Staff did not indicate any issues with the generator. According to staff, the standby generator does not have an automatic transfer switch (ATS).
- Stormwater diversion v-ditch at the north side of the driveway has severe damage.

- A vault in the ground has been blocked off with CMU blocks as a temporary measure. The vault cover is not rated for traffic.

Recommendations (near term):

- Conduct a seismic and piping evaluation of the tank. Check for proper anchorage and verify pipe connections comply with AWWA D100/ASCE 7-10 between the tank and grade. Verify that the discharge end complies with California Title 17. This may require provision of a screen at the flapper valve end, assuming that there is one.
- Repair the steel containment ring joint at the SE quadrant and restore sub-base support below the tank perimeter in the SE quadrant.
- Provide touch-up coating at areas where the coating is damaged.
- Clean the storage tank and inspect the tank for internal corrosion. Investigate the observed leak and plug as required.
- Install VFD on well pump. This will allow better control of the flow to feed the booster pump. If more water production is desired than the single booster pump can produce, then an alternative is to install of a second booster pump on a VFD.
- Replace booster pump station air conditioning unit and frame.
- Rehabilitate Pump 5. Blast and coat the pump header. Repair corrosion. Replace mechanical seal. Inspect bowls and shaft.
- Provide positive wall anchors to adequately tie the booster station roof framing to the CMU walls. Replace the wood fascia on the building perimeter.
- Protect critical piping/valves from accidental vehicular impact with bollards.

Recommendations (long term):

- Install an ATS for the standby generator.
- Rehabilitate the check valve vault with a new lid and retaining wall around the top as required.
- Provide properly sized pipe supports with anchorage down to existing concrete. Where supports are located in the yard, provide new supports with small concrete pads.
- Replace the entrance gate to correct the security breach from stormwater v-ditch.

2.1.4 Well C-5

Well C-5 consists of the well and pump, a storage tank, an outdoor MCC and switch board cabinet, a one-pump booster station, and a chemical storage and feed building within a barbed wired fence.



Observations:

- The well pump feeds the storage tank, which is then fed to distribution through a booster pump(s). One booster pump is installed, with a space for a second, future pump. Both the well pump and booster pump is surrounded by block walls to minimize noise.
- The well can be pumped directly to the storage tank, to the distribution system, or to waste. The typical valve arrangement is set up to pump to the storage tank and any changes require manual operation of three valves. It does not appear that the well is run-to-waste line upon startup. It is likely that sand and other minerals have built up inside the storage tank.

- Pump sizes were not available, but it is assumed that the same tank filling/well shutdown issue occurs here are noted at Well C-2. A VFD on the well pump or booster pump would allow for greater operational control of the system.
- The well pump does not appear to be anchored down to the concrete support pad.
- Both pumps have peeling paint and corrosion on the housing and bolts. The pump discharge valves were manufactured in 1990 and it is assumed that the pumps are of the same construction year.
- According to staff, the booster pump motor burns up every few years and was last rebuilt in 2015.
- All equipment and piping shows moderate to severe corrosion and is in need of paint. Site piping is not protected from vehicular impact.
- The tank is unanchored and founded on a gravel base with a steel containment ring. Undermining of the sub-base material at the east side of the tank was observed.
- The tank has limited access around the entire perimeter, which would make recoating and tank work difficult.
- Pipe connections to the tank are rigid between the tank and the ground.
- The tank overflow pipe rests on the concrete slab at the SE quadrant and has no flapper valve. The discharge end has a small coarse screen.
- The tank coating is fair condition, with no major areas of peeling paint or paint loss.
- The access ladder to the roof of the tank does not have any anti-climb or anti-intrusion components to prevent undesired access.
- Electrical equipment was observed with anchorage down to the equipment pad on the rear side only. The electrical cabinets are worn and have areas of corrosion. New cabinets will be needed in the long-term.
- The meter vault lid was unable to be opened during the site assessment. It is likely just stuck and can be opened by a few crew members. However, the lid is corroded and will need to be replaced in the long-term.
- The site is equipped with a single light.
- The site does not have a standby generator. There did not appear to be a hookup for a portable generator to the existing MCC.

Recommendations (near term):

- Provide a seismic evaluation of the tank. Verify that pipe connections comply with AWWA D100/ASCE 7-10 between the tank and grade.
- Restore the sub-base support below the tank perimeter at the east side of the tank.
- Revise the overflow pipe to provide an air gap, catch basin, and drainage connection as required.
- Install a VFD on the well pump and/or booster pump to improve system operation.
- Protect critical piping/valves from accidental vehicular impact with bollards.
- Install an emergency generator hookup and provide positive anchorage for electrical equipment to the concrete pad.

Recommendations (long term):

- Repaint piping and tank.
- Replace meter vault lid.

- Replace electrical cabinets.

2.1.5 Well C-6

Well C-6 consists of the well and pump, an outdoor MCC and switch board cabinet, and a building for sodium hypochlorite. The pump is located on the same property as the City yard.

Observations:

- The date of well drilling was not known, but staff noted that it was not put in service immediately. The stamped date on a valve indicates the pump and piping were installed around 2001.
- A tag on the motor indicates it was last rebuilt in 2008.
- The small blowoff pressure control valve is actively leaking. This could be the result of bad internal seals or incorrect control settings.
- Site piping is not protected from vehicular impact.
- Some of the pipe supports at the site are lacking positive anchorage. and the well pump does not appear to have any obvious anchorage to its foundation.
- There are large cracks throughout the site pavement.
- The sodium hypochlorite tanks and pump in the shed are new installations.



Recommendations (near term):

- Protect critical piping/valves from accidental vehicular impact with bollards.

Recommendations (long term):

- Repair pavement cracks.

2.1.6 Well M-3

Well M-3 was rebuilt in 2003 and consists of a well and pump, a sand separator, a MCC cabinet, and a wood shed for sodium hypochlorite storage and feed.

Observations:

- The site is located within a residential neighborhood with homes immediately adjacent to the north and east property lines.
- There is no pump house to attenuate sound. Because the pump is in a residential area, a pump house would reduce noise complaints from neighbors.
- The well pump does not appear to have any obvious anchorage to its foundation.
- Pump and motor were replaced 2 years ago. The well was rebuild in 2003 after the well was acquired from Mountain Water along with a number of other wells.



- The sand separator is backwashed manually on a regular basis. Installing pressure sensors around the unit would allow this to occur automatically (based on differential pressure), rather than requiring a staff member to visit the site.
- A series of pressure control valves appear to allow the well to run to waste upon startup.
- A wooden storage shed houses a tank and pump for sodium hypochlorite. The exterior paint of the shed is peeling in some areas. This will eventually need to be repainted.
- Cracking was observed throughout the site asphalt pavement.
- Pipe supports for piping at the site are typically lacking any positive anchorage, whether they are located over existing concrete equipment pads or within the yard.
- Site piping is not protected from vehicular impact. Piping has minor corrosion and the paint is faded.

Recommendations (near term):

- Protect critical piping/valves from accidental vehicular impact with bollards.

Recommendations (long term):

- Provide properly sized pipe supports with anchorage down to existing concrete. Where supports are located in the yard, provide new supports with small concrete pads.
- Construct a building to house the well pump and chemicals. Remove the chemical shed. Potentially relocate the electrical cabinets into the building.
- Repaint sand separator and site piping.

2.1.7 Well M-11

Well M-11 was rebuilt in 2003 and is similar to Well M-3, consisting of a well and pump, a sand separator, a MCC cabinet, and a wood shed for sodium hypochlorite within a barbed wire fence.



Observations:

- There are some cracks throughout the site pavement.
- Pump and motor were rebuilt recently. Pump was rebuilt in 2015 or 2016. The motor broke soon after that and was replaced in 2017.
- Site piping shows moderate corrosion. Site piping is not protected from vehicular impact. Paint is faded on more piping and the sand strainer.
- The well pump appears to be anchored to its foundation.
- Pipe supports for piping at the site are typically lacking any positive anchorage, whether they are located over existing concrete equipment pads or within the yard.
- Electrical equipment does not appear to be anchored down to the equipment pad.
- Site lighting is minimal.

Recommendations (near term):

- Protect critical piping/valves from accidental vehicular impact with bollards.
- Provide positive anchorage of the electrical equipment down to the equipment pad.

Recommendations (long term):

- Repaint sand separator and piping.
- Repair cracks in asphalt pavement.
- Provide properly sized pipe supports with anchorage down to existing concrete. Where supports are located in the yard, provide new supports with small concrete pads.

2.1.8 Well M-12

Well M-12 is non-potable due to presence of hexavalent chromium. The water produced feeds the nearby golf course. The site consists of a well and pump, a sand separator, a MCC cabinet, a plastic shed, and a standby generator.

Observations:

- Piping has some bollards installed to protect piping from accidental impact. Pipe supports for piping have large concrete thrust blocks (This is different to other well sites).
- The well pump does not appear to have any obvious anchorage to its foundation.
- The well pump is equipped to waste to a drain vault next to the well.
- Motor was rebuilt in 2011.
- The sand separator appears to have been installed around 2002.
- The shed used to house sodium hypochlorite, but the tank has been removed. The shed now houses sampling equipment or analyzers. The floor of the shed is stained from chemicals and the floor drain is corroded.
- The standby generator appeared to be in good condition. However, staff noted that the generator is not equipped with an ATS. Additionally, the manual transfer switch is set up with a set of key locks to safeguard against having both circuit breakers engaged simultaneously.
- The site has two poles-mounted lights.



Recommendations (near term):

None

Recommendations (long term):

- Install an ATS for the standby generator.

2.2 Reservoirs

The City's Reservoirs store finished water and are filled by booster pump stations and/or wells. The observed reservoirs were above-ground tanks. The inspections of the reservoirs were limited to a ground-level visual inspection and did not inspect the roofs.

The following recommendations are made for the entire reservoir system. These recommendations would pertain to all or most of the reservoir sites.

- Nearly all of the sites visited were recommended for a seismic evaluation and installation of flexible pipe connections for all piping connections that comply with AWWA D100/ASCE 7-10 between the tank and grade. It is assumed that all reservoir

other sites also would receive the same recommendation. The City should consider performing a seismic study of their reservoir tanks and connection.

- For safe access away from the access hatch on the tank roofs, consider installing a horizontal lifeline system that uses lanyards and D-ring tie-offs where access to other parts of the tank roof may be required.

The following subsections summarize observations and recommendations for each reservoir site visited:

2.2.1 San Gorgonio Reservoirs 1, 2 and 3

The San Gorgonio reservoir site consists of 3 welded steel storage tanks, a below-grade valve structure, and the Foothill East PRV station within a barbed wire fence. Observations related to the Foothill East PRV Station will be discussed in Section 2.3.1 .



Observations:

- The site is paving has cracks throughout the site.
- Staff noted operational issues with these tanks due to the configuration of the system and the elevations of other sites. This evaluation is included as part of the modeling performed in the other tasks of this project.
- The steel tanks are unanchored and have rigid pipe connections to the ground for all piping.
- The coating is in good condition at the exterior of the tanks. The tanks were noted as being coated last in 2008.
- The nameplate for tank #3 indicates it was constructed in 1982. The nameplates for the other two tanks were painted over.
- The tanks are constructed on sand and gravel base confined within a steel plate containment ring. Tank #3 was observed with some undermining of the gravel at the perimeter (mostly at the south side).
- Tank #1 and #2 (numbered from south to north) are connected by a common pipe that has no expansion joint or flexible connections. This rigid connections between the two tanks is a risk to break during a seismic event. City staff noted that this has been flagged by the State as an issue.
- Overflow pipes go directly below grade to drainage. The discharge end of the overflow pipes were not observed, but are assumed to discharge into the adjacent creek.
- Ladder access is provided to the roof of each tank. Ladders for Tank #1 and Tank #2 do not have safety cages, but are equipped with a safety climb device and anti-intrusion door cover. The ladder for Tank #3 is elevated above grade and has a safety cage, anti-intrusion cover, and a safety climb device. All tanks have guardrail at the top of the ladder at the roof access hatch. For added safety access away from the top of the ladder, consider installing a horizontal lifeline system that uses lanyards and D-ring tie-offs where access to other parts of the tank roof may be required.
- Dive reports noted minor issues that staff hope to address during the next cleaning.

- The wires for the float assembly at Tank #3 were observed as being detached.
- The tanks did not appear to have cathodic protection system installed.
- The tank outlets combine into a 20-inch pipe that exits the site. A partially-buried valve vault is located just outside the fenced area. The vault has an above-ground wooden roof and contains a gate valve and flow meter.
- The wooden roof of the vault is vulnerable to damage during a wildfire. A non-flammable roof is recommended for this application. Consider removing or relocating the adjacent pine tree to limit potential for fire damage and improving access.
- Piping above grade is not protected with any bollards.
- The site does not contain any lights.

Recommendations (near term):

- Provide a seismic evaluation of all three welded steel tanks. Provide flexible pipe connections for all piping connections that comply with AWWA D100/ASCE 7-10 between the tank and grade and between Tank #2 and Tank #3.
- Revise the overflow for Tank #2 and Tank #3 to provide an air gap, catch basin, and drainage connection as required.
- Restore full sub-grade support below the perimeter of Tank #1 at the south side.
- Replace the wood-framed roof of the PRV station with a material that is more durable to resist wildfire damage.
- Protect critical piping/valves from accidental vehicular impact with bollards.
- Install work lights at the site.

Recommendations (long term):

- Repair cracks in site pavement.

2.2.2 Sunset Reservoir

The sunset reservoir consists of two welded steel storage tanks.

Observations:

- The tanks were constructed in 1991. In most areas the coating is in good condition on the exterior of the tanks. They were last painted 2008.
- The steel tanks are unanchored and have rigid pipe connections to the ground for all piping. The tanks are founded on a concrete ring wall footing.
- Dive inspection was last performed in 2010 and is scheduled to be performed again this year.
- Overflow pipes are located at the interior of the tank and exit about 12 inches above the bottom of the tank with a flapper valve at the discharge end. The flapper valve was not opened, but it is assumed that no screen is provided inside of the flapper valve.
- Piping above grade is not protected with any bollards.
- Ladder access is provided to the roof of each tank. Ladders have safety cages and are equipped with a safety climb device and anti-intrusion door cover. Both tanks have



guardrail at the top of the ladder at the roof access hatch. For safe access away from the access hatch on the tank roofs, consider installing a horizontal lifeline system that uses lanyards and D-ring tie-offs where access to other parts of the tank roof may be required.

- The numbering on the level gauges have faded on both tanks.
- The site has security issues. The site can be accessed in two different locations where v-ditches cross the fence line. A gap sufficient for someone to crawl through occurs between the v-ditch surface and the bottom of the fence. Tank shell has evidence of vandalism (spray-paint), which has since been painted over. Additionally, an electrical/communications box had been accessed by trespassers and a chain with a lock has been provided around the equipment to prevent it from being stolen. No intrusion alarm, motion sensors, or security cameras were observed.
- Large gaping cracks in the asphalt pavement at a few locations along the east side of the site.
- The site has a street light located between the two reservoirs and near the access gate.
- A small irrigation pump was in the process of being re-piped. The pump is located between the two reservoirs.

Recommendations (near term):

- Provide a seismic evaluation of both welded steel tanks. Provide flexible pipe connections for all piping connections that comply with AWWA D100/ASCE 7-10 between the tank and grade.
- Repair coating at 2'x2' section on tank floor where coating has failed.
- Provide an appropriate screen inside of the flapper valve on the overflow piping discharge end.
- Site security improvements. Close off access gaps at the v-ditches where they cross the fence line. Replace fence with climb-resistant fencing. Install security cameras and/or house electrical equipment in a secure structure.
- Protect critical piping/valves from accidental vehicular impact with bollards.

Recommendations (long term):

- Seal large asphalt cracks.
- Replace the exterior level gauges on the sides of the tank and replace the float assemblies.

2.2.3 Mountain Reservoir & Booster

The Mountain Reservoir and booster station site consists of a welded storage tank, three small booster pumps, and three hydro-pneumatic pressure vessels in a barbed wire fence.

Observations:

- The station provides water pressure for the adjacent homes. The site is located adjacent to residential homes. The site was acquired from the Mountain Water Company, along



with other sites, in the 1980s. Dates stamped onto equipment suggests the site dates back to the 1970s.

- The site has received a number of temporary fixes, but no major upgrades because it has been planned for eventual removal in the future. However, the site continues to be in service and the eventual timing of replacement is tied to the development of a subdivision.
- The site is covered with gravel. No asphalt.
- The steel tank is unanchored and has rigid pipe connections to the ground for all piping. According to staff, the tank was re-purposed to serve as a water storage tank (was originally used as a grain silo).
- A dive inspection of the tank was performed in 2010. Staff did not believe that any of the recommendations from the report were completed. These recommendations include recoat the entire tank floor and replace gaskets at the interior of the tank.
- The coating is in good condition at the exterior of the tank, but appears to have a gritty texture.
- The tank is assumed to be constructed over an appropriate base material that is confined with a steel containment ring. However, nearly the entire perimeter of the tank is backfilled with about 6 inches of a coarse gravel base. The containment ring was visible at the inlet connection only.
- The overflow pipe is located at the exterior of the tank and discharges just outside the site with a flapper valve at the discharge end. The flapper valve was not opened, but it is assumed that no screen is provided inside of the flapper valve. The termination of the pipe is approximately 1-foot off the ground.
- Piping above grade is not protected with any bollards, but the hydro-pneumatic pressure tanks block vehicular access to the area where the piping is above grade.
- Ladder access is provided to the roof. The ladder is equipped with a safety climb device and anti-intrusion door cover. However, no guardrail is provided at the top and access at the top is restricted to the extent that one cannot get around the safety climb device to safely remove their harness connection. For safe access away from the access hatch on the tank roofs, consider installing a horizontal lifeline system that uses lanyards and D-ring tie-offs where access to other parts of the tank roof may be required.
- The tank does not have a site level gauge at the exterior.
- The tank does not have a vent.
- The site does not have any lighting.
- The booster station consists of three hydro-pneumatic pressure vessels, three small booster pumps, piping and valving, and a control panel. The pumps frequently kicked on during the site visit. One pump is larger than the other two, designated for fire flow. The entire station is outdated and in poor condition. The efficiency of the station could be improved by modern features such as variable frequency drives (VFDs), replacing the pumps, or adding an air compressor.
- The hydro-pneumatic pressure vessels do not have any visible anchorage to their foundation. 2x4's have been placed below the bottom of each side of the tank.
- There is no air compressor on site. The pressure tanks need air to provide water pressure. It is unlikely that they tanks have been inspected in many years and it is possible that they leak air.

Recommendations (near term):

- Provide a seismic evaluation of the tank. Provide flexible pipe connections for all piping connections that comply with AWWA D100/ASCE 7-10 between the tank and grade.
- Install a properly sized vent for the tank.
- Recoat the entire tank floor (reference the 2010 dive report).
- Replace gaskets at the interior of the tank (reference the 2010 dive report).
- Revise the overflow to provide an air gap, catch basin, and drainage connection as required. Otherwise, provide a screen at the flapper valve end that complies with Title 17.
- Replace the ladder on the tank with an OSHA-compliant ladder with safety cage and wide enough access at the top to accommodate a safety climb system or equivalent. Also, provide landing and guardrail at the roof of the tank at the ladder.
- Provide appropriately designed supports and anchors to ensure pressure vessel stability for seismic loading.
- Install air compressor to supply air for pneumatic vessels.
- Inspect the pressure vessels. Inspect the internal components (bladders, seals, etc.).

Recommendations (long term):

- Provide a site level gauge on the side of the tank.
- Replace booster pumps and install VFDs.

2.2.4 Southwest Reservoir

The Southwest Reservoir site consists of a prestressed concrete tank that is partially buried, an irrigation pump, and a few electrical boxes. It is located inside the Sun Lakes Country Club. The tank was installed around 2003.

Observations:

- The tank overflow pipe is an interior overflow pipe (not visible from the exterior at any point) that discharges into a swale downhill of the site. The City indicated that the tank has overflowed a few times. The discharge of the pipe was not observed. According to staff, the overflow runs down a channel in the hillside and comes very close to residences. A large overflow could potentially flood these residences.
- The access ladder to the roof of the tank has a safety cage, anti-intrusion door, safety climb device, and guardrail at the roof. The safety cage above the anti-intrusion door is not covered to prevent access.
- There is an irrigation pump that has signs of corrosion.
- This site houses similar electrical and communications equipment as the Sunset reservoir site. However, site security is not as much of a concern at this site. Nonetheless, similar precautions should be considered for the security of these components.

Recommendations (near term):

- Provide a mesh cover at the lower portion of the safety cage to prevent access.
- Verify overflow discharge meets California Title 17 provisions.

Recommendations (long term):

- Relocate electrical and communications equipment into a secure structure to prevent tampering.

2.2.5 High Valley Reservoir

The High Valley reservoir site consists of a galvanized bolted steel tank within a barbed wire fence.

Observations:

- The City feels the tank and High Valley Water District pumps the water up the hill using an adjacent, small pump station.
- The tank is galvanized (not coated) bolted steel. The tank is unanchored and has rigid pipe connections to the ground for all piping. The age of the tank is not known.
- A dive inspection was conducted in 2010.
- The tank is constructed on a gravel base with a steel containment ring. The containment ring has minor corrosion and is uplifted at the NW quadrant that can allow undermining of the tank.
- A flowing leak (perhaps 0.5 gallons per minute) was observed at the tank joint between the 1st and 2nd shell ring at the NE quadrant. The leak has been flowing for a while based on the path the water has carved into the dirt. The flowing water attracts a large number of bees.
- The tank overflow pipe enters the ground and discharges with a flapper valve just outside the fence line. The discharge end of the overflow pipe was not opened up. The overflow terminates near ground level, lacking a true air gap.
- The access ladder to the roof of the tank is located in plan at a pipe penetration. The ladder is not continuous down to grade level.
- Site piping is not protected from vehicular impact. According to staff, much of the piping was upgraded from 2" to 6" around 10 years ago.
- The site is graded with exposed dirt and gravel. No asphalt.
- A flow meter is installed to monitor the amount of water going to the High Valley Water District pump station.
- According to staff, a single 4-inch pipe feeds this area and the tank inlet is controlled with a pressure control Cla-Val. However, if the tank demand is high, then pressure drops for the nearby residences.

Recommendations (near term):

- Provide a seismic evaluation of the tank. Verify that pipe connections comply with AWWA D100/ASCE 7-10 between the tank and grade.

- Verify that the discharge end complies with California Title 17. This may require provision of a screen inside the overflow pipe at the flapper valve end.
- Repair the leak at the tank wall joint at the NE quadrant.
- Clean and protect corroded bolts on the floor of the tank (reference the 2010 dive report).
- Install an internal ladder and install larger access hatch (reference 2010 dive report).
- Reset and/or modify the steel containment ring to ensure that the sub-base is stable.
- Replace the ladder with a OSHA-compliant one that extends down to grade level. This will require the ladder to be relocated as the existing location conflicts with tank piping.

Recommendations (long term):

- Replace the tank. The near-term repairs likely will not extend the life of the tank beyond another 20 years. It is likely that the tank will need to be replaced before the end of the planning period.

2.3 PRV Stations

PRV stations reduce the water pressure as it moves from a higher elevation pressure zone to a lower pressure zone. The following subsections summarize observations and recommendations for the two PRV stations visited:

2.3.1 Foothill East PRV Station

The Foothill East PRV station is located on the San Gorgonio reservoir site.

Observations:

- There is a 6" Cla-Val for fire flow and a 2" Cla-Val for primary flow.
- The stamp on one of the valves indicates it is from 1994.
- The PRV is rebuilt annually and has stainless steel interior components.
- According to staff, the station serves approximately 40 homes in vicinity of the site.
- Spot of minor corrosion was observed on the inlet and outlet piping.
- Overall, the station is in fair condition and has no apparent issues.
- No telecommunications are provided for the station. All instruments are analog.



Recommendations (near term):

- No recommendations.

Recommendations (long term):

- Add pressure transmitters to read upstream and downstream pressures and install antenna to send back to SCADA.

2.3.2 Hargrave & John St PRV Station

The Hargrave & John St PRV station is located within a fenced area, next to an industrial building at the corner of the streets it is named for.

Observations:

- There are a total of 3 Cla-Vals at this station: 8-inch, 6-inch, and 4-inch. A 2" Cla-Val is installed as a blow-off.
- The stamp on the 4-inch valve indicates it is from 1997.
- There are no pipe supports for piping at the site. CMU blocks are used to support piping.
- The site is not very secure, as it lacks barbed wire or other comparable deterrent at the fence line.
- According to staff, the adjacent property (industrial building) is not properly tied into the service line, but rather into the fire line. The meter is turned off for this line. The service is supposed to be relocated to the discharge side of the station and a customer meter installed.
- All Cla-Vals are tested and rebuilt annually. The valves have stainless steel internal parts.
- No telecommunications are provided on site.



Recommendations (near term):

- Provide properly sized pipe supports with anchorage down to existing concrete. Where supports are required in the yard, provide new supports with small concrete pads.
- Add pressure transmitters to read upstream and downstream pressures and install antenna to send back to SCADA.

Recommendations (long term):

- Replace fencing with new fencing or CMU wall with features that deter access.

2.4 Lift Stations

Wastewater lift stations are facilities designed to move wastewater from lower to higher elevation. The following subsections summarize observations and recommendations for the two lift stations visited:

2.4.1 Caltrans Site Lift Station

The Caltrans Lift Station, designed and built in 1989, consists of a wet well, a valve vault, and a control cabinet within a fenced area. The wet well contains two submersible pumps. The station is located in vicinity of the highway off-ramp onto East Ramsey Street.



Observations:

- There are no SCADA or automated alarms, so the lift station must be manually inspected three times a week. Connecting the alarms to SCADA would allow the City to be alerted of any issues when they happen and not have to wait for staff to make the rounds to the site. However, this is a low flow station and this may not be cost effective.
- The wet well coating is in good condition. Pump guide rail is fabricated from stainless steel and is also in good condition. Electrical conduits appeared to be sealed inside the wet well. Although pumps, check valves, and ball valves are all original, City staff indicated no current issues.
- Both wet well and valve vault do not have ladder access. In addition, both hatches do not have safety gratings underneath the hatch lid.
- The electrical cabinets are in fair condition. They appear original, but have no observed defects.
- The site lacks any lighting or security features.
- The pumps don't have any current operational issues, but they are nearly 30 years old and will likely need to be replaced during the planning period.
- The station has no emergency power supply. However, the station could probably be drained with a vactor truck during a power outage and wouldn't require continuous power.

Recommendations (near term):

- Install ladder and safety grating in wet well. Install a step ladder into the valve vault.
- Install fence around the vaults and add site lighting to increase site safety.

Recommendations (long term):

- Install SCADA system and antenna to alert City of alarms.
- Replace submersible pumps.

2.4.2 Westward Lift Station

The Westward Lift Station was built in the 1980s and is currently operated by SUEZ. The lift station is located within a fenced area consisting of two vaults, a generator, and a control panel.

Observations:

- The site has no concrete paving.
- The wet well is not coated and the concrete surface appears to have minor to moderate superficial corrosion. The ultrasonic level sensor support shows severe corrosion.
- The generator works but is currently not used due to difficulties finding replacement parts. In addition, theft of fuel and batteries from the generator has also prevented the City from using the generator.
- The three pumps in the wet well are in good condition and the City has a spare pump at the water treatment plant.



- Minor corrosion was observed on the check valves, but according to SUEZ operator, the valves are operating fine. The valve vault drains to the wet well, which provides sewer gases a path into the vault. The vault is not equipped with any ventilation, allowing the sewer gasses to build up in the vault. This is contributing to the corrosion on the valves.
- A tarp is used to cover the control panel and wet well vault, while the generator and valve vault is uncovered.
- The control panel was upgraded in 2001, but the pumps and check valves are original.
- No site lights were observed.
- The pumps don't have any current operational issues, but they are at least 30 years old and will likely need to be replaced during the planning period.

Recommendations (near term):

- Install a ventilation fan in the valve vault.
- Install an access ladder for the wet well.
- Replace the ultra-sonic level sensor support with stainless steel components and anchors.
- Coat the interior surfaces of the wet well with a protective coating.

Recommendations (long term):

- Site security can be improved by video surveillance and/or additional locks on the fence.
- Add concrete paving to site and a permanent cover.
- Replace submersible pumps.
- Replace generator.

Section 3

CAPITAL COST ESTIMATES

The recommendations from the condition assessments were used to prepare a capital improvement plan (CIP) cost estimate for the visited facilities. The recommendations, including equipment replacements, structural modifications, and studies, were identified as near-term or long-term projects (to correspond with the IMP capital plan). Near-term projects are recommended for completion between 2018 and 2025, while long-term projects fall into the 2026 to 2040 timeframe. Near-term recommendations are based on equipment found in poor condition or health and safety concerns. Long-term recommendations include equipment currently in fair condition, but forecasted to be replaced before 2040.

The costs are based on a Level 5 (Order-of-Magnitude) estimate. These are estimates made using cost-capacity curves; scale-up or scale-down factors; and an approximate ratio estimate. The level of design completion at this point usually falls into the range of 0 percent to 2 percent. The expected accuracy range for such an estimate is within +50 percent or -30 percent. This means that bids can be expected to fall within a range of 50 percent over the estimate to 30 percent under the estimate. These are often referred to as "conceptual" or "ballpark" estimates. The cost estimates are presented in current year dollars (2018) and are not inflated in future years. Detailed cost estimates for each site are included in Appendix D.2.

To match the assumptions used in the IMP, total project costs include a 28 percent factor applied to the construction cost estimate to account for engineer, management, and legal fees. An additional 30 percent contingency was applied to cover unexpected circumstances. The construction cost estimate (cost without 28 percent and 30 percent markups) and the total project costs for near-term projects are shown in Table 3.1.

The costs in the previous table are spread over the 8 year period from 2018 to 2025. This equates to an annual average of approximately \$725,000 per year.

The construction cost estimate (cost without 28 percent and 30 percent markups) and the total project costs for long-term projects are shown in Table 3.2.

Table 3.1 Near-Term Capital Cost Estimate (2018-2025)

Site	Site Type	Construction Cost	Total Project Cost ⁽¹⁾
Well 1	Well	\$72,576	\$120,766
Well 3	Well	\$9,968	\$16,587
Well C-2	Well	\$377,440	\$628,060
Well C-5	Well	\$232,960	\$387,645
Well C-6	Well	\$7,056	\$11,741
Well M-3	Well	\$7,056	\$11,741
Well M-11	Well	\$14,560	\$24,228
Well M-12	Well	\$-	\$-
San Gorgonio	Reservoir	\$451,360	\$751,063
Southwest	Reservoir	\$16,240	\$27,023
Mountain	Reservoir	\$322,375	\$536,432
High Valley	Reservoir	\$217,280	\$361,554
Sunset	Reservoir	\$350,336	\$582,959
Foothill E PRV	PRV	\$-	\$-
Hargrave & John PRV	PRV	\$20,720	\$34,478
Caltrans LS	Lift Station	\$23,520	\$39,137
Westward LS	Lift Station	\$51,296	\$85,357
Multi-Site Projects ⁽²⁾	Various	\$1,318,016	\$2,193,179
Total		\$3,492,759	\$5,811,951

Notes:

(1) Total Project Costs include markups of 28% for Engineer, Management, and Legal fees and 30% for Contingency applied to the Construction Cost

(2) Projects that apply to multiple sites, including site not visited during this project. Examples include installing emergency generator hookups at all sites and performing a seismic evaluation of each reservoir.

Table 3.2 Long-Term Capital Cost Estimate (2026-2040)

Site	Site Type	Construction Cost	Total Project Cost ⁽¹⁾
Well 1	Well	\$443,520	\$738,017
Well 3	Well	\$7,728	\$12,859
Well C-2	Well	\$89,040	\$148,163
Well C-5	Well	\$54,656	\$90,948
Well C-6	Well	\$7,280	\$12,114
Well M-3	Well	\$133,280	\$221,778
Well M-11	Well	\$24,416	\$40,628
Well M-12	Well	\$24,080	\$40,069
San Gorgonio	Reservoir	\$9,968	\$16,587
Southwest	Reservoir	\$7,056	\$11,741
Mountain	Reservoir	\$151,760	\$252,529
High Valley	Reservoir	\$229,705	\$382,229
Sunset	Reservoir	\$35,392	\$58,892
Foothill E PRV	PRV	\$16,800	\$27,955
Hargrave & John PRV	PRV	\$21,168	\$35,224
Caltrans LS	Lift Station	\$64,960	\$108,093
Westward LS	Lift Station	\$152,208	\$253,274
Multi-Site Projects ⁽²⁾	Various	\$1,803,200	\$3,000,525
Total		\$3,276,217	\$5,451,625

Notes:

(1) Total Project Costs include markups of 28% for Engineer, Management, and Legal fees and 30% for Contingency applied to the Construction Cost

(2) Projects that apply to multiple sites, including site not visited during this project. Examples include installing emergency generator hookups at all sites and performing a seismic evaluation of each reservoir.

The costs in the previous table are spread over the 15 year period from 2026 to 2040. This equates to an annual average of approximately \$365,000 per year.

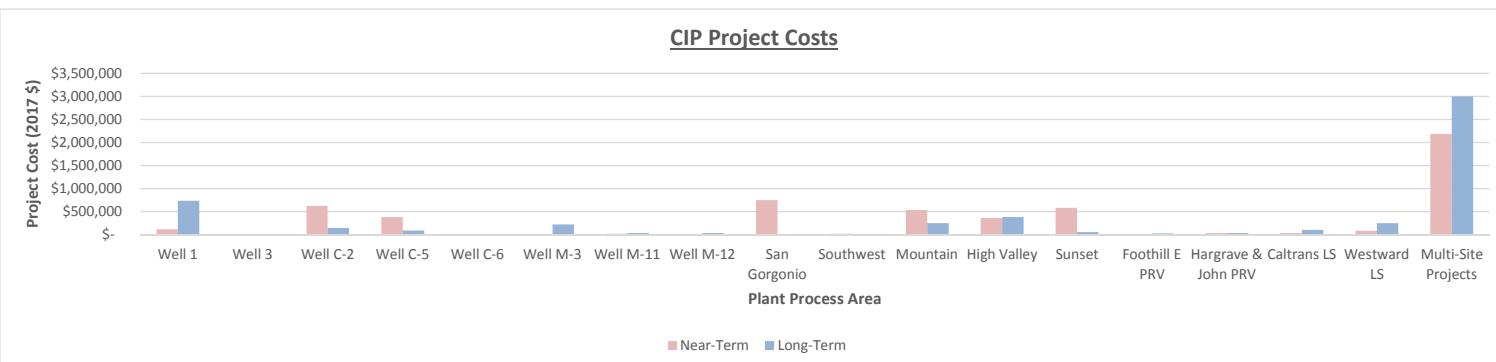
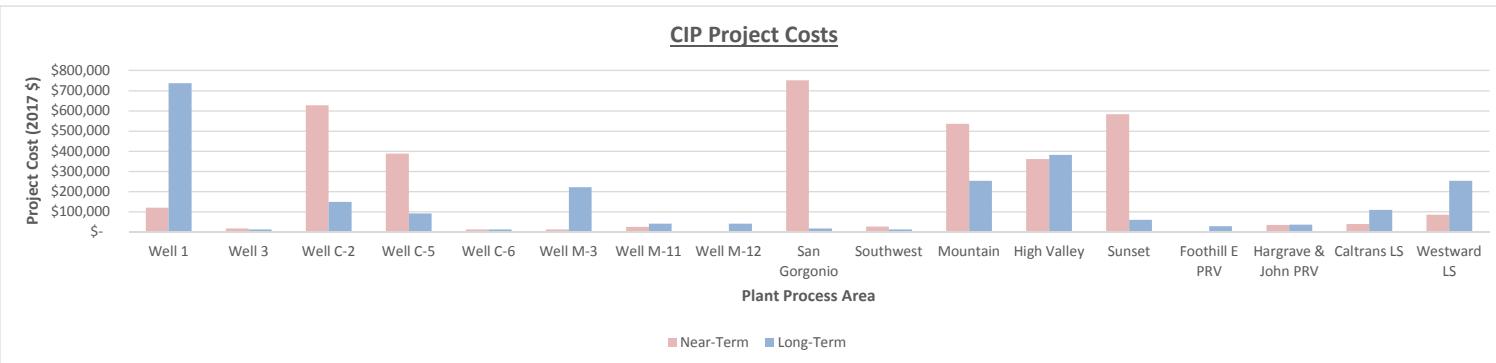
Detailed cost estimates are included in Appendix D.2.

Appendix D.2

DETAILED COST ESTIMATES

Appendix D.2 - Condition Assessment Cost Estimates

Process Area	Total	Near-Term	CONSTRUCTION COST SUBTOTAL	Engineering, Management, and Legal	Contingency	PROJECT COST (Aug 2018 Dollars)	Long-Term	CONSTRUCTION COST SUBTOTAL	Engineering, Management, and Legal	Contingency	PROJECT COST (Aug 2018 Dollars)
Well 1	\$ 858,784	\$ 120,766	\$ 72,576	\$ 20,321	\$ 27,869	\$ 120,766	\$ 738,017	\$ 443,520	\$ 124,186	\$ 170,312	\$ 738,017
Well 3	\$ 29,446	\$ 16,587	\$ 9,968	\$ 2,791	\$ 3,828	\$ 16,587	\$ 12,859	\$ 7,728	\$ 2,164	\$ 2,968	\$ 12,859
Well C-2	\$ 776,223	\$ 628,060	\$ 377,440	\$ 105,683	\$ 144,937	\$ 628,060	\$ 148,163	\$ 89,040	\$ 24,931	\$ 34,191	\$ 148,163
Well C-5	\$ 478,593	\$ 387,645	\$ 232,960	\$ 65,229	\$ 89,457	\$ 387,645	\$ 90,948	\$ 54,656	\$ 15,304	\$ 20,988	\$ 90,948
Well C-6	\$ 23,855	\$ 11,741	\$ 7,056	\$ 1,976	\$ 2,710	\$ 11,741	\$ 12,114	\$ 7,280	\$ 2,038	\$ 2,796	\$ 12,114
Well M-3	\$ 233,519	\$ 11,741	\$ 7,056	\$ 1,976	\$ 2,710	\$ 11,741	\$ 221,778	\$ 133,280	\$ 37,318	\$ 51,180	\$ 221,778
Well M-11	\$ 64,856	\$ 24,228	\$ 14,560	\$ 4,077	\$ 5,591	\$ 24,228	\$ 40,628	\$ 24,416	\$ 6,836	\$ 9,376	\$ 40,628
Well M-12	\$ 40,069	\$ -	\$ -	\$ -	\$ -	\$ 40,069	\$ 24,080	\$ 6,742	\$ 9,247	\$ 40,069	
San Gorgonio	\$ 767,650	\$ 751,063	\$ 451,360	\$ 126,381	\$ 173,322	\$ 751,063	\$ 16,587	\$ 9,968	\$ 2,791	\$ 3,828	\$ 16,587
Southwest	\$ 38,765	\$ 27,023	\$ 16,240	\$ 4,547	\$ 6,236	\$ 27,023	\$ 11,741	\$ 7,056	\$ 1,976	\$ 2,710	\$ 11,741
Mountain	\$ 788,961	\$ 536,432	\$ 322,375	\$ 90,265	\$ 123,792	\$ 536,432	\$ 252,529	\$ 151,760	\$ 42,493	\$ 58,276	\$ 252,529
High Valley	\$ 743,783	\$ 361,554	\$ 217,280	\$ 60,838	\$ 83,436	\$ 361,554	\$ 382,229	\$ 229,705	\$ 64,317	\$ 88,207	\$ 382,229
Sunset	\$ 641,851	\$ 582,959	\$ 350,336	\$ 98,094	\$ 134,529	\$ 582,959	\$ 58,892	\$ 35,392	\$ 9,910	\$ 13,591	\$ 58,892
Foothill E PRV	\$ 27,955	\$ -	\$ -	\$ -	\$ -	\$ 27,955	\$ 16,800	\$ 4,704	\$ 6,451	\$ 27,955	
Hargrave & John PRV	\$ 69,702	\$ 34,478	\$ 20,720	\$ 5,802	\$ 7,956	\$ 34,478	\$ 35,224	\$ 21,168	\$ 5,927	\$ 8,129	\$ 35,224
Caltrans LS	\$ 147,231	\$ 39,137	\$ 23,520	\$ 6,586	\$ 9,032	\$ 39,137	\$ 108,093	\$ 64,960	\$ 18,189	\$ 24,945	\$ 108,093
Westward LS	\$ 338,631	\$ 85,357	\$ 51,296	\$ 14,363	\$ 19,698	\$ 85,357	\$ 253,274	\$ 152,208	\$ 42,618	\$ 58,448	\$ 253,274
Multi-Site Projects	\$ 5,193,703	\$ 2,193,179	\$ 1,318,016	\$ 369,044	\$ 506,118	\$ 2,193,179	\$ 3,000,525	\$ 1,803,200	\$ 504,896	\$ 692,429	\$ 3,000,525



Appendix E

POTABLE WATER SYSTEM ANALYSIS DETAILS

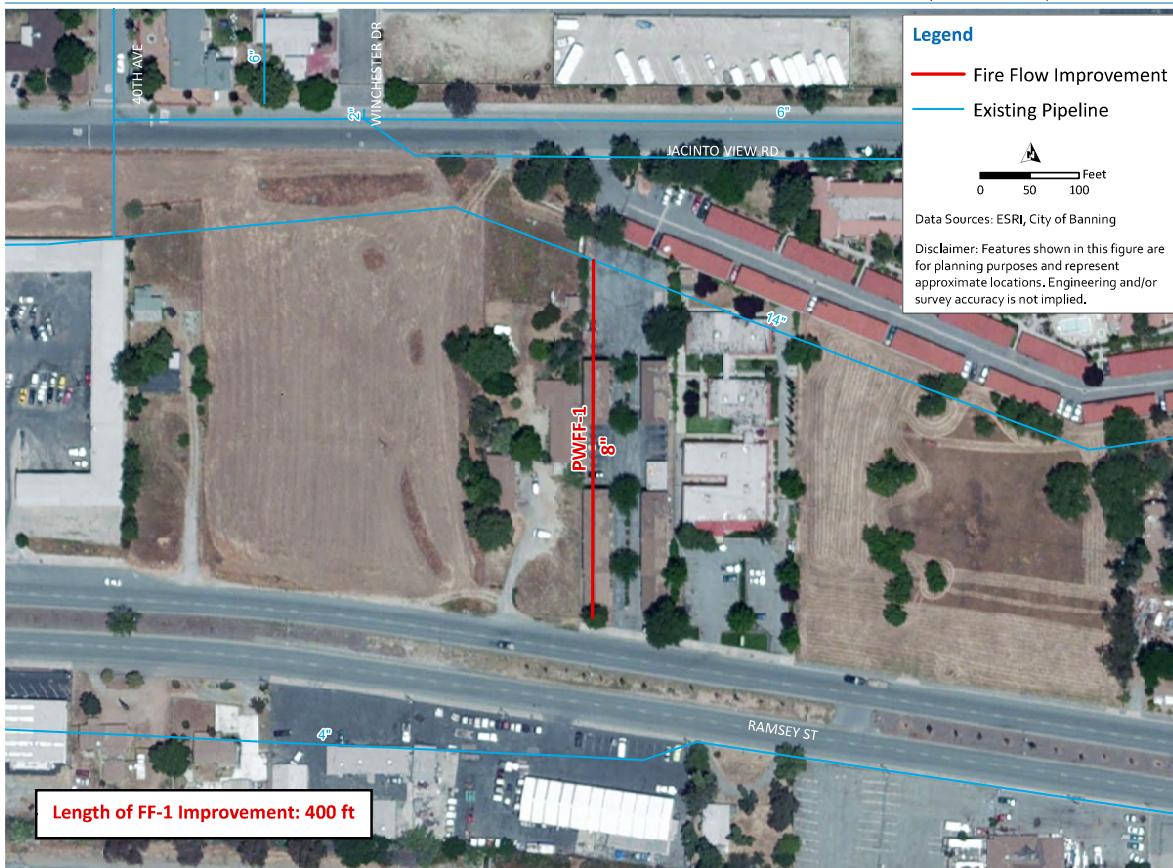


Figure 1 Recommended Fire Flow Improvement Projects



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Figure 2 Recommended Fire Flow Improvement Projects



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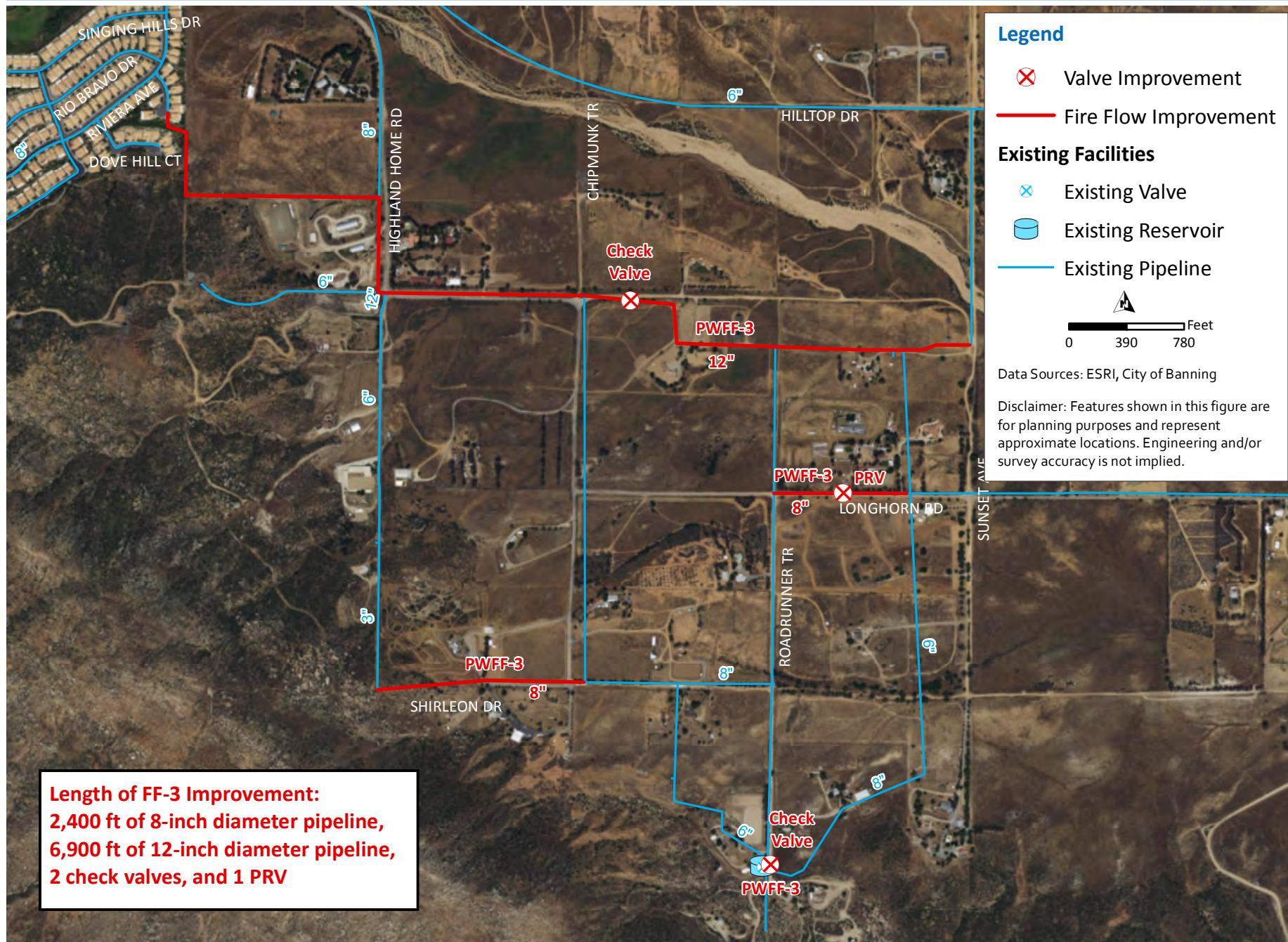


Figure 3 Recommended Fire Flow Improvement Projects

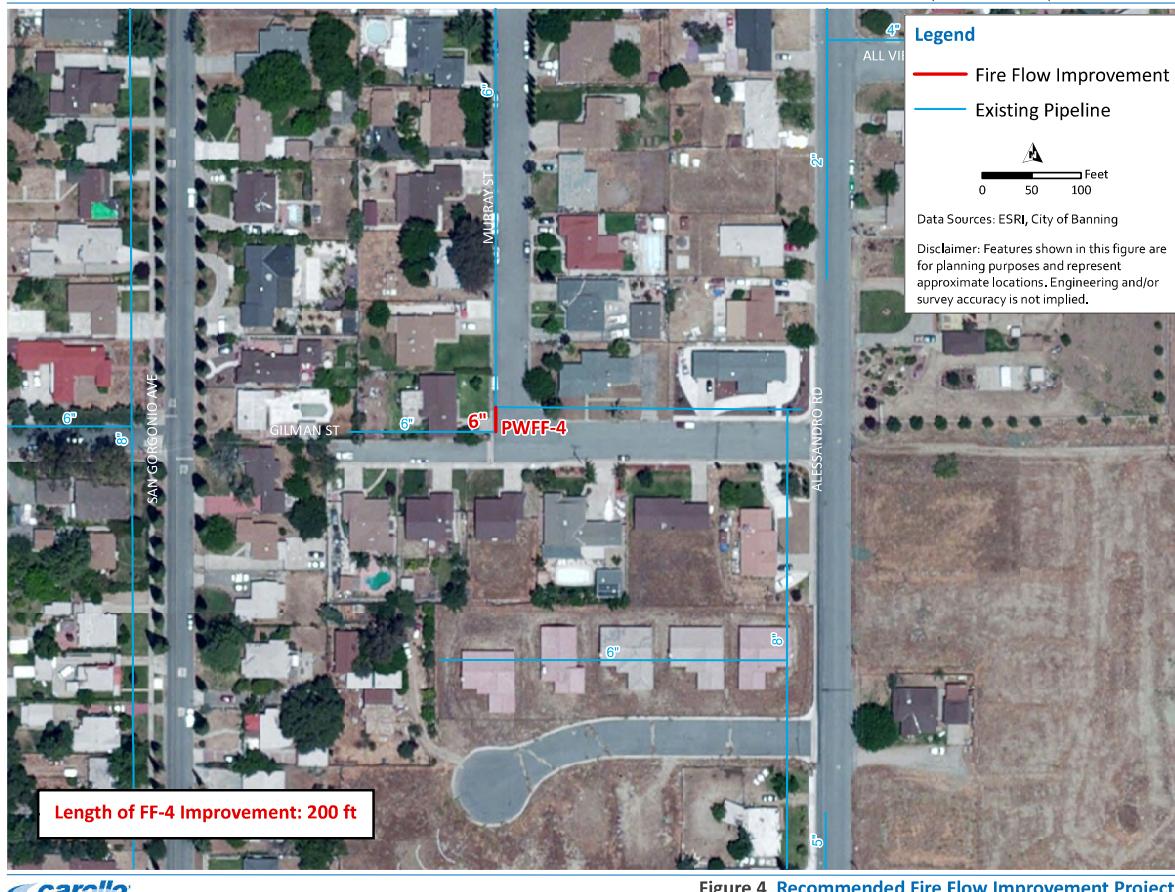


Figure 4 Recommended Fire Flow Improvement Projects



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Figure 5 Recommended Fire Flow Improvement Projects



Last Revised: December 08, 2017 pw://Carollo/Documents/Client/CA/ClientName/10524Aoo/Data/GIS/Appendix_E.1_FF_Improvements_Details.mxd



Figure 6 Recommended Fire Flow Improvement Projects



Figure 7 Recommended Fire Flow Improvement Projects

Last Revised: March 19, 2018 pw://Carollo/Documents/Client/CA/ClientName/10524Aoo/Data/GIS/Appendix_E.1_FF_Improvements_Detail.mxd



Figure 8 Recommended Fire Flow Improvement Projects



Figure 9 Recommended Fire Flow Improvement Projects

Last Revised: March 19, 2018 pwj/Carollo/Documents/Client/CA/ClientName/10524Aoo/Data/GIS/Appendix_E.1_FF_Improvements_Detail.mxd

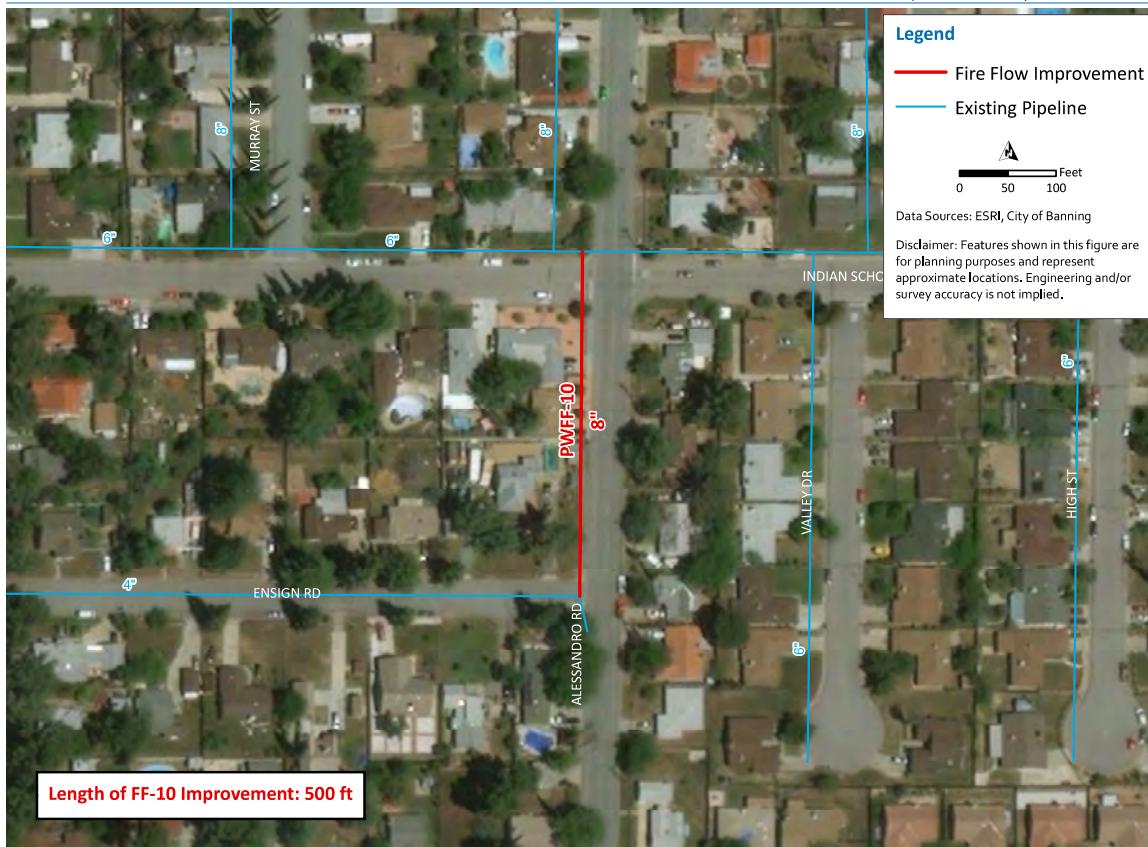


Figure 10 Recommended Fire Flow Improvement Projects

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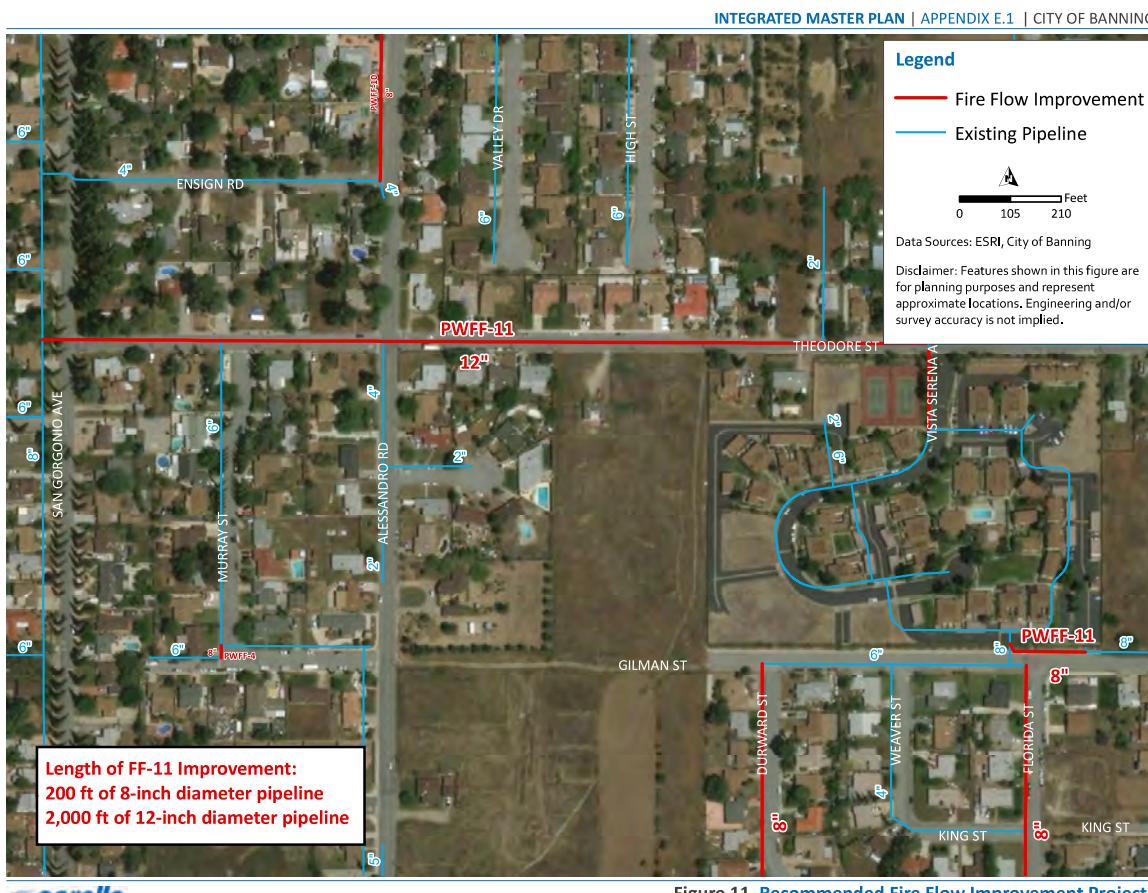


Figure 11 Recommended Fire Flow Improvement Projects

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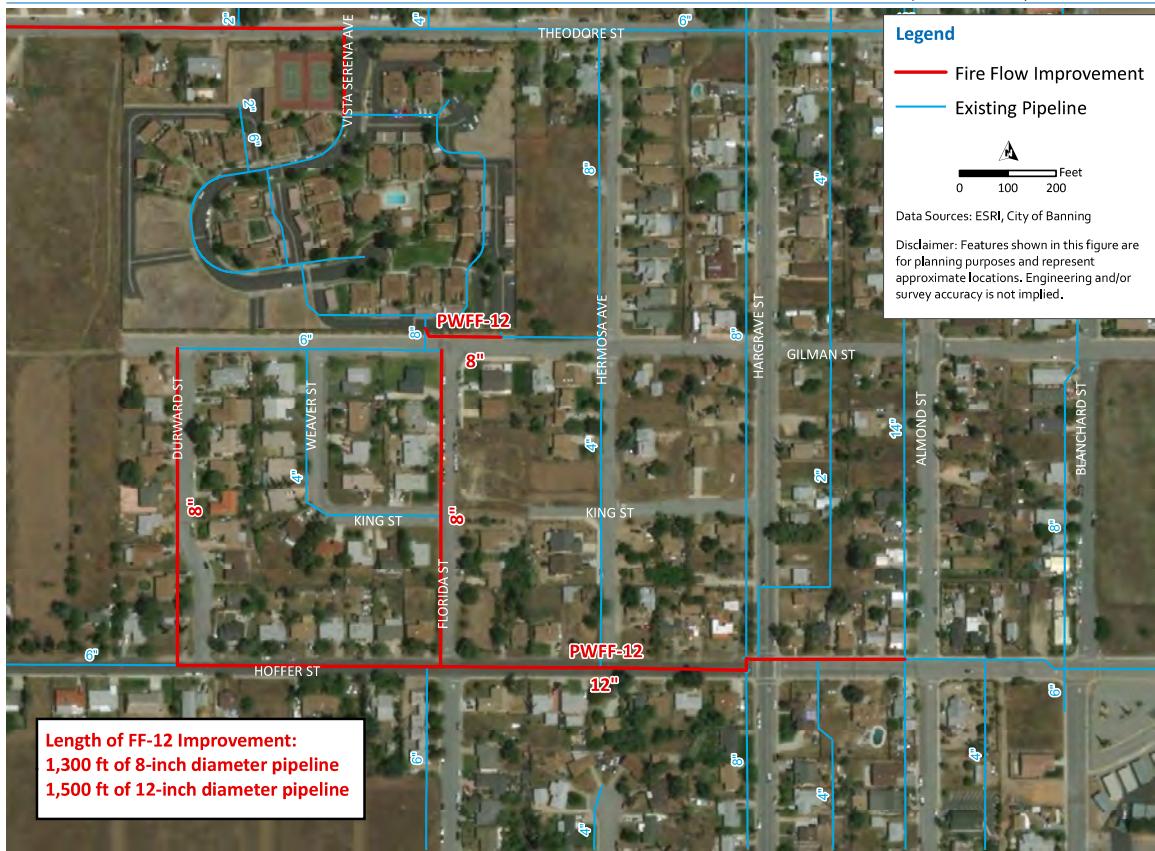


Figure 12 Recommended Fire Flow Improvement Projects

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Figure 13 Recommended Fire Flow Improvement Projects

Last Revised: March 19, 2018 pwj/Carollo/Documents/Client/CA/ClientName/10524A00/Data/GIS/Appendix_E.1_FF_Improvements_Detail.mxd



Figure 14 Recommended Fire Flow Improvement Projects

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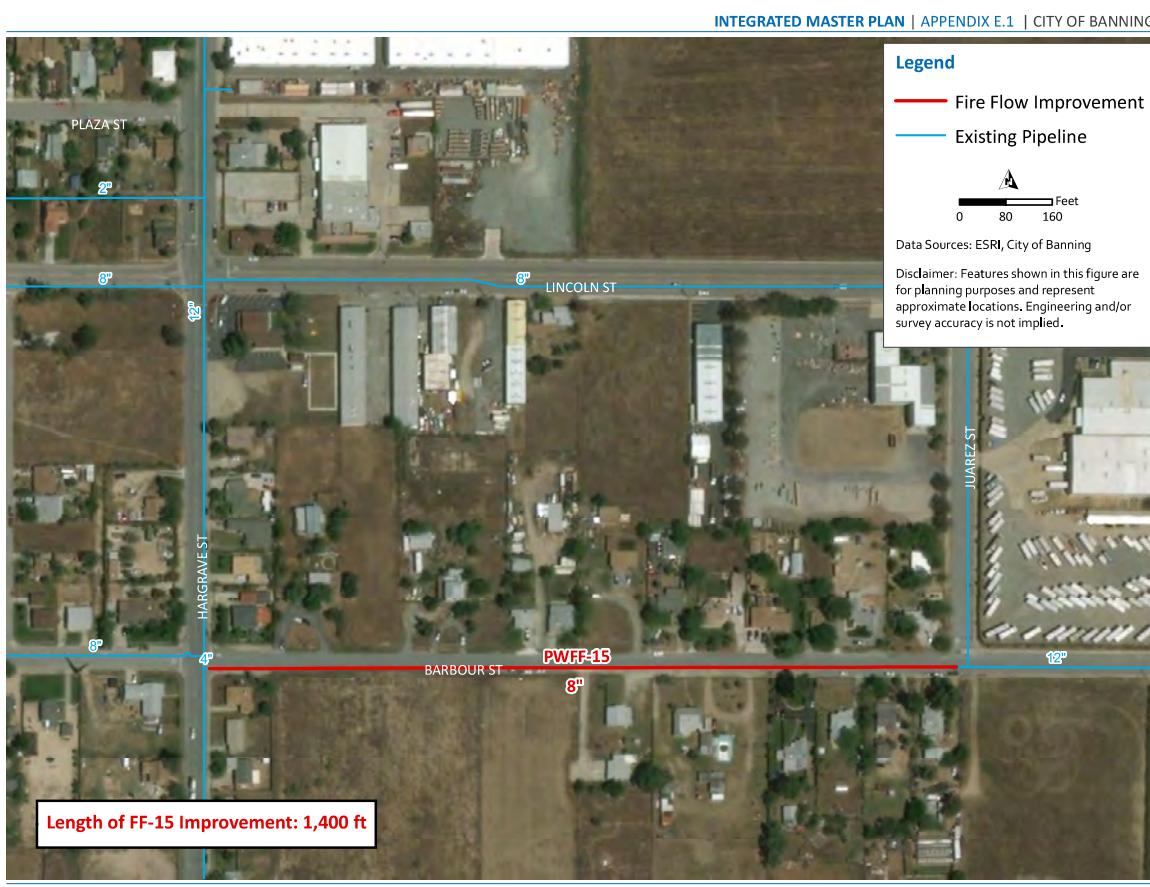


Figure 15 Recommended Fire Flow Improvement Projects

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Figure 16 Recommended Fire Flow Improvement Projects

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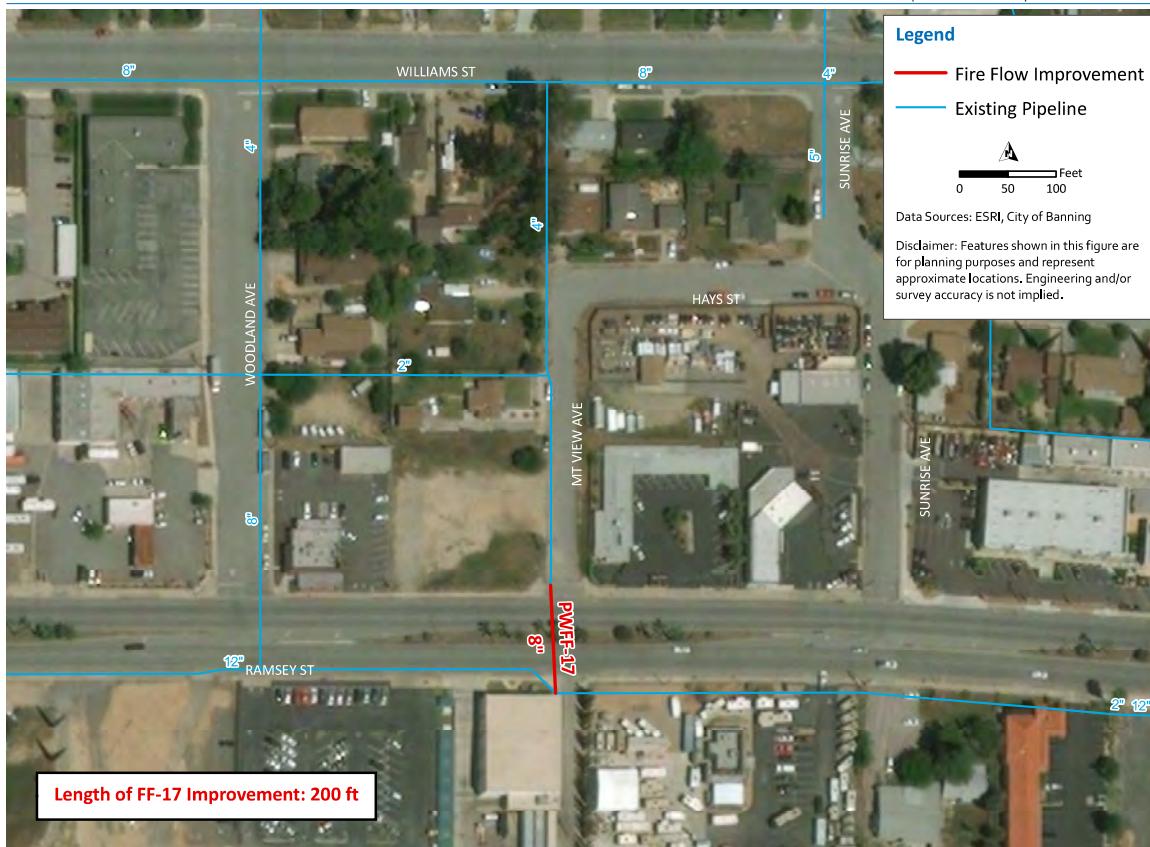


Figure 17 Recommended Fire Flow Improvement Projects

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Figure 18 Recommended Fire Flow Improvement Projects

Last Revised: March 19, 2018 pwj/Carollo/Documents/Client/CA/ClientName/10524Aoo/Data/GIS/Appendix_E.1_FF_Improvements_Detail.mxd



Figure 19 Recommended Fire Flow Improvement Projects

Last Revised: March 19, 2018 pwj/Carollo/Documents/Client/CA/ClientName/10524Aoo/Data/GIS/Appendix_E.1_FF_Improvements_Detail.mxd



Figure 20 Recommended Fire Flow Improvement Projects



Figure 21 Recommended Fire Flow Improvement Projects



Figure 22 Recommended Fire Flow Improvement Projects



Figure 23 Recommended Fire Flow Improvement Projects

Appendix E.2 - Existing System Storage Analysis



Pressure Zone	Existing Storage Facilities	Existing Storage Capacity	HGL	Existing ADD	Existing MDD ¹	Operational Storage (25% MDD)	Emergency Storage (100% MDD)	Maximum Fireflow Required In Zone	Fireflow Duration	Fire Storage	Total Storage Required	Zone Deficit/ Surplus ²	Zone Transfer Description / Recommended Storage	Zone Transfer	Proposed Storage Capacity	Surplus with Improvements and Transfers	
MG	ft	mgd	mgd	MG	MG	gpm	hours	MG	MG	MG	MG	MG	Pump from Main Zone	0.4	0.4	0.0	0.0
Foothill East	N/A	2,796															
	Zone Subtotal Foothill East	0.0	N/A	0.1	0.2	0.0	0.2	1,500	2	0.2	0.4	-0.4					
Foothill West	Sunset Reservoirs	4.2	2,822														
	Zone Subtotal Foothill West	4.2	N/A	1.2	2.0	0.5	2.0	3,500	4	0.8	3.3	0.9					
	N/A	0.0	2,932														
	Zone Subtotal Mountain North	0.0	N/A	0.1	0.2	0.0	0.2	1,500	2	0.2	0.4	-0.4					
Mountain South	N/A	0.0	2,546														
	Zone Subtotal Mountain South	0.0	N/A	0.0	0.1	0.0	0.1	1,500	2	0.2	0.3	-0.3					
Upper Main	Brinton Reservoir	8.0	2,721														
	San Gorgonio Reservoirs	5.6	2,721														
	Southwest Reservoir	1.5	2,721														
	Zone Subtotal Main	15.1	N/A	5.6	9.5	2.4	9.5	4,000	4	1.0	12.8	2.3			-3.2	4.0	3.2
Lower I	N/A	0.0	2,450														
	Zone Subtotal Lower I	0.0	N/A	0.7	1.2	0.3	1.2	4,000	4	1.0	2.5	-2.5					
	Grand Total	19.3	N/A	7.7	13.1	3.3	13.1	N/A	N/A	3.3	19.6	-0.3			0.0	4.0	3.7

Notes:

(1) MDD Peaking factor is 1.7

(2) Excess capacity from New Main Reservoir 1 to serve future customers.

Appendix E.2 - Near-term (2025) System Storage Analysis



Pressure Zone	Storage Facilities	Existing	HGL	Total	2025	2025	Operational	Emergency	Maximum	Fireflow	Fire Storage	Total Storage	Zone Deficit/	Zone Transfer Description / Recommended Storage	Zone Transfer	Proposed Storage Capacity	Surplus with Improvements	
		Storage Capacity	ft	Storage from Existing	ADD	MDD ¹	Storage (25% MDD)	(100% MDD)	Required In Zone					Surplus ²				
Foothill East	N/A	0.0	2,796															
Zone Subtotal Foothill East		0.0	N/A	0.0	0.1	0.2	0.0	0.2	1,500	2	0.2	0.4	-0.4					
Foothill West	Sunset Reservoirs	4.2	2,822															
Zone Subtotal Foothill West		4.2	N/A	0.0	1.9	3.2	0.8	3.2	3,500	4	0.8	4.9	-0.7					
Mountain North	N/A	0.0	2,932															
Zone Subtotal Mountain North		0.0	N/A	0.0	0.2	0.3	0.1	0.3	1,500	2	0.2	0.5	-0.5					
Mountain South	N/A	0.0	2,546															
Zone Subtotal Mountain South		0.0	N/A	0.0	0.1	0.1	0.0	0.1	1,500	2	0.2	0.3	-0.3					
Main	Brinton Reservoir	8.0	2,721															
	San Gorgonio Reservoirs	5.6	2,721															
	Southwest Reservoir	1.5	2,721															
	New Main Reservoir 1	2,721	4.0															
Zone Subtotal Main		15.1	N/A	4.0	7.0	11.9	3.0	11.9	4,000	4	1.0	15.9	3.2			-3.2	0.0	0.0
Lower I	N/A	0.0	2,450															
Zone Subtotal Lower I		0.0	N/A	0.0	0.8	1.4	0.4	1.4	4,000	4	1.0	2.8	-2.8					
Grand Total		19.3	N/A	4.0	10.1	17.2	4.3	17.2	N/A	N/A	3.3	24.7	-1.4			0.0	2.5	1.1

Notes:

(1) MDD Peaking factor is 1.7

(2) Green improvements represent existing system improvements, while blue improvements represent near-term improvements.

Appendix E.2 - Long-term (2040) System Storage Analysis



Pressure Zone	Storage Facilities	Existing	HGL	Total Improvements	2040	2040	Operational	Emergency	Maximum	Fireflow	Fire Storage	Total	Zone Deficit/	Zone Transfer Description / Recommended Storage	Zone Transfer	Proposed Storage Capacity	Surplus with Improvements		
		Storage Capacity	ft	from Existing and 2025	ADD	MDD ¹	Storage (25% MDD)	Storage (100% MDD)	Required In Zone	Fireflow Duration	hours	MG	Storage Required	Surplus ²					
Zone 1A	N/A																		
		MG	ft	MG	mgd	mgd	MG	MG	gpm	hours	MG	MG	MG	MG					
Zone Subtotal Zone 1A		0.0	N/A	0.0	0.3	0.5	0.1	0.5	1,500	2	0.2	0.7	-0.7	New Zone 1A Reservoir		1.0	0.3		
Foothill East	N/A	0.0													Pump from Upper Main Zone	0.4			
															Zone Subtotal Foothill East	0.0	0.0	0.0	
Foothill West	Sunset Reservoirs	4.2	2,822												PRV from Mountain North Zone	0.1			
	New Foothill West Reservoir	2,822	1.5												Pump from Upper Main Zone	0.0			
															Zone Subtotal Foothill West	4.2	N/A	1.5	
																0.1	0.0	0.0	
Mountain North	New Mountain North Reservoir	2,932	1.0												PRV to Foothill West Zone	-0.1			
															Zone Subtotal Mountain North	0.0	N/A	1.0	
Mountain South	N/A	0.0													PRV from Upper Main Zone	0.3			
															Zone Subtotal Mountain South	0.0	N/A	0.0	
Upper Main	Brinton Reservoir	8.0	2,721												PRV to Mountain South Zone	-0.3			
	San Gorgonio Reservoirs	5.6	2,721												PRV to Lower Main Zone	-10.4			
	Southwest Reservoir	1.5	2,721												Pump to Foothill East Zone	-0.4			
	New Main Reservoir 1	2,721	4.0												Pump to Foothill West Zone	0.0			
															New Upper Main Reservoir 2		4.0		
																-11.1	4.0	0.3	
Zones Subtotal Upper Main		15.1	2,721	4.0	5.0	8.6	2.1	8.6	4,000	4	1.0	11.7	7.4						
Lower Main															PRV from Upper Main Zone	10.4			
															PRV to Lower I Zone	-2.7			
	Zone Subtotal Lower Main	0.0	N/A	0.0	3.2	5.4	1.4	5.4	4,000	4	1.0	7.7	-7.7				7.7	0.0	0.0
Lower I	N/A	0.0													PRV from Lower Main Zone	2.7			
																2.7	0.0	0.0	
	Zone Subtotal Lower I	0.0	N/A	0.0	0.8	1.4	0.3	1.4	4,000	4	1.0	2.7	-2.7						
																0.0	4.0	0.4	
	Grand Total	19.3	N/A	6.5	12.1	20.6	5.1	20.6	N/A	N/A	4.4	30.2	-3.6						

Notes:

(1) MDD Peaking factor is 1.7

(2) **Green** improvements represent existing and near-term improvements, while **blue** improvements represent long-term improvements.

Appendix E.2 - Build Out System Storage Analysis



Pressure Zone	Existing Storage Facilities	Existing Storage Capacity	HGL	Total Improvements from Existing, 2025, and 2040		2040 ADD	2040 MDD ¹	Operational Storage (25% MDD)	Emergency Storage (100% MDD)	Maximum Fireflow Required In Zone	Fireflow Duration	Fire Storage	Total Storage Required	Zone Deficit/ Surplus ²	Zone Transfer Description / Recommended Storage	Zone Transfer	Proposed Storage Capacity	Surplus with Improvements	
				MG	ft	MG	mgd	mgd	MG	MG	gpm	hours	MG	MG	MG				
Zone 1A	N/A															New Zone 1A Reservoir	1.0		
	Zone Subtotal Zone 1A						0.3	0.5	0.1	0.5	1,500	2	0.2	0.7	-0.7		1.0	0.3	
Foothill East	N/A	0.0														Pump from Upper Main Zone	0.5		
	Zone Subtotal Foothill East	0.0	N/A	0.0	0.1	0.3	0.1	0.3	0.3	1,500	2	0.2	0.5	-0.5		0.5	0.0	0.0	
Foothill West	Sunset Reservoirs	4.2	2,822													Pump to Mountain North Zone	-0.2		
	New Foothill West Reservoir	2,822	1.5													Pump to Black Bench Zone	-0.1		
																Pump from Upper Main Zone	0.0		
	Zone Subtotal Foothill West	4.2	N/A	1.5	2.9	4.9	1.2	4.9	0.6	3,500	4	0.8	6.9	-1.2		New Foothill West Reservoir 2	1.5		
Mountain North	New Mountain North Reservoir	2,932	1.0													Pump from Foothill West Zone	0.2		
	Zone Subtotal Mountain North	0.0	N/A	1.0	0.3	0.6	0.1	0.6	0.6	2,500	3	0.5	1.2	-0.2		0.2	0.0	0.0	
Mountain South	N/A	0.0														PRV from Upper Main Zone	0.3		
	Zone Subtotal Mountain South	0.0	N/A	0.0	0.1	0.1	0.0	0.1	0.1	1,500	2	0.2	0.3	-0.3		0.3	0.0	0.0	
Upper Main	Brinton Reservoir	8.0	2,721													PRV to Mountain South Zone	-0.3		
	San Gorgonio Reservoirs	5.6	2,721													PRV to Lower Main Zone	-12.6		
	Southwest Reservoir	1.5	2,721													Pump to Foothill East Zone	-0.5		
	New Main Reservoir 1	2,721	4.0													Pump to Foothill West Zone	0.0		
	New Upper Main Reservoir 2	2,721	4.0													New Upper Main Reservoir 3	9.0		
	Zones Subtotal Upper Main	15.1	2,721	8.0	8.1	13.8	3.4	13.8	4,000	4	1.0	18.1	5.0			-13.4	9.0	0.5	
Lower Main																PRV from Upper Main Zone	12.6		
																PRV to Lower I Zone	-3.4		
	Zone Subtotal Lower Main	0.0	N/A	0.0	3.8	6.5	1.6	6.5	4,000	4	1.0	9.1	-9.1				9.1	0.0	0.0
Lower I	N/A	0.0														PRV from Lower Main Zone	3.4		
	Zone Subtotal Lower I	0.0	N/A	0.0	1.2	2.0	0.5	2.0	4,000	4	1.0	3.4	-3.4				3.4	0.0	0.0
Black Bench		0.0	0.0													Pump from Foothill West Zone	0.1		
	Zone Subtotal Black Bench	0.0	0.0	0.6	1.1	0.3	1.1	2,000	2	0.2	1.6	-1.6				New Black Bench Reservoir 1	1.5		
Loma Linda		0.0	0.0														New Loma Linda Reservoir 1	1.0	
	Zone Subtotal Loma Linda	0.0	0.0	0.3	0.6	0.1	0.6	2,000	2	0.2	0.9	-0.9					0.0	1.0	0.1
	Grand Total	19.3	N/A	10.5	17.8	30.2	7.5	30.2	N/A	N/A	5.2	42.9	-13.1				0.0	14.0	0.9

Notes:

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(1) MDD Peaking factor is 1.7

(2) Green improvements represent existing, near-term, and long-term improvements, while blue improvements represent build-out improvements.

Appendix E.3 - Existing System Supply Analysis with Largest Canyon Well Out of Service



Discharge Pressure Zone	Existing Supply	HGL	Supply Capacity	Supply Capacity with Largest Canyon Well O.O.S.				Existing ADD	Existing MDD ¹	Total Required Capacity	Existing Capacity Balance	Proposed Improvement	Proposed Increase in Supplies	Total Supplies with Improvements	Zone Transfers	Zone Deficit/Surplus with Improvements	
				ft	gpm	gpm	gpm										
Foothill East	Canyon Wells		3,000	2,000										2,000			
Zone Subtotal Foothill East		3,000	3,000	2,000	65	110	110	1,890					PRV Canyon Wells Supply to Main Zone	0	2,000		0
Foothill West	Well C2	2,822	1,100	1,100										1,100			
	Well C4	2,822	1,300	1,300										1,300			
	Well M3	2,822	800	800										800			
	Well 24 (BCVWD)		1,000	1,000										1,000			
Zone Subtotal Foothill West		2,822	4,200	4,200	806	1,371	1,371	2,829					FCV to Main Zone		0	4,200	0
Mountain North		2,932												Pump from Main Zone		0	107
Zone Subtotal Mountain North		2,932	0	0	63	107	107	-107						0	0		0
Mountain South		2,546												PRV from Main Zone		0	58
Zone Subtotal Mountain South		2,546	0	0	34	58	58	-58						0	0		0
Main	Well C3	2,721	1,100	1,100										1,100			
	Well C5	2,721	900	900										900			
	Well C6	2,721	900	900										900			
	Well M10	2,721	800	800										800			
	Well M11	2,721	600	600										600			
	BCVWD Interconnection	2,822	1,000	1,000										1,000			
													PRV from Canyon Wells Supply			1,890	
													FCV from Foothill West Zone			2,829	
													PRV to Mountain South Zone			-58	
													PRV to Lower I Zone			-855	
													Pump to Mountain North Zone			-107	
Zone Subtotal Main		2,721	5,300	5,300	3,862	6,566	6,566	-1,266						0	5,300		2,433
Lower I		2,450												PRV from Main Zone		0	855
Zone Subtotal Lower I		2,450	0	0	503	855	855	-855						0	0		0
Total		12,500	11,500	5,334	9,067	9,067	2,433							0	11,500	0	2,433

Notes:

(1) MDD Peaking factor is 1.7

(2) Largest Canyon Well Out of Service assumes Well 7 or Well 10 (capacity of 1,000 gpm) is out of service.

Appendix E.3 - Existing System Supply Analysis in Extreme Drought Conditions



Discharge Pressure Zone	Existing Supply	HGL	Supply Capacity	Supply Capacity in Extreme Drought	Existing ADD	Existing MDD ¹	Total Required Capacity	Existing Capacity Balance	Proposed Improvement	Proposed Increase in Supplies	New Total Supplies in Extreme Drought	Zone Transfers	Zone Deficit/Surplus with Improvements
		ft	gpm	gpm	gpm	gpm	gpm	gpm		gpm	gpm	gpm	gpm
Foothill East	Canyon Wells		3,000	1,700							1,700		
									PRV to Main Zone				-1,590
Zone Subtotal Foothill East		3,000	3,000	1,700	65	110	110	1,590		0	1,700		0
Foothill West	Well C2	2,822	1,100	1,100							1,100		
	Well C4	2,822	1,300	1,300							1,300		
	Well M3	2,822	800	800							800		
	Well 24 (BCVWD)		1,000	1,000							1,000		
									FCV to Main Zone				-696
Zone Subtotal Foothill West		2,822	4,200	4,200	806	1,371	1,371	2,829		0	4,200		2,133
Mountain North		2,932							Pump from Main Zone				
Zone Subtotal Mountain North		2,932	0	0	63	107	107	-107		0	0		0
Mountain South		2,546							PRV from Main Zone				
Zone Subtotal Mountain South		2,546	0	0	34	58	58	-58		0	0		0
Main	Well C3	2,721	1,100	1,100							1,100		
	Well C5	2,721	900	900							900		
	Well C6	2,721	900	900							900		
	Well M10	2,721	800	800							800		
	Well M11	2,721	600	600							600		
	BCVWD Interconnection	2,822	1,000	1,000							1,000		
									FCV from Foothill West Zone				696
									PRV from Canyon Wells				1,590
									PRV to Mountain South Zone				-58
									PRV to Lower I Zone				-855
									Pump to Mountain North Zone via Mountain Booster PS				-107
Zone Subtotal Main		2,721	5,300	5,300	3,862	6,566	6,566	-1,266		0	5,300		0
Lower I		2,450							PRV from Main Zone				
Zone Subtotal Lower I		2,450	0	0	503	855	855	-855		0	0		0
Total		12,500	11,200	5,334	9,067	9,067	2,133			0	11,200	0	2,133

Notes:

(1) MDD Peaking factor is 1.7

(2) Extreme drought conditions assumes the Canyon Wells can only pump 1,700 gpm of its total capacity.

Appendix E.3 - Near-Term (2025) Supply Analysis with Largest Canyon Well Out of Service



Appendix E.3 - Near-Term (2025) Supply Analysis in Extreme Drought Conditions



Discharge Pressure Zone	Existing Supply	HGL	Supply Capacity	Supply Capacity in Extreme Drought	Additional Firm Capacity from Existing Improvements	Existing ADD	Existing MDD ¹	Total Required Capacity	Existing Capacity Balance	Proposed Improvement	Proposed Increase in Supplies	New Total Supplies in Extreme Drought	Zone Transfers	Zone Deficit/Surplus with Improvements		
		ft	gpm	gpm	gpm	gpm	gpm	gpm	gpm		gpm	gpm	gpm	gpm	gpm	
Foothill East	Canyon Wells	3,000	3,000	1,700								1,700				
Zone Subtotal Foothill East		3,000	3,000	1,700	0	75	128	128	1,572	PRV Canyon Well Supply to Main Zone	0	1,700	0	-1,572		
Foothill West	Well C2	2,822	1,100	1,100								0	1,100			
	Well C4	2,822	1,300	1,300									1,300			
	Well M3	2,822	800	800									800			
	Well 24 (BCVWD)		1,000	1,000												
Zone Subtotal Foothill West		2,822	4,200	4,200	0	1,327	2,256	2,256	1,944	FCV to Main Zone				-718		
Mountain North										Pump to Mountain North				-186		
Zone Subtotal Mountain North		2,932	0	0	0	109	186	186	-186	None.	0	3,200	-904	40		
Mountain South										PRV from Main Zone				67		
Zone Subtotal Mountain South		2,546	0	0	0	40	67	67	-67		0	0	67	0		
Main	Well C3	2,721	1,100	1,100								1,100				
	Well C5	2,721	900	900								900				
	Well C6	2,721	900	900								900				
	Well M10	2,721	800	800								800				
	Well M11	2,721	600	600								600				
	BCVWD Interconnection		1,000	1,000									1,000			
										PRV Canyon Well Supply				1,572		
										FCV from Foothill West Zone				718		
										PRV to Lower I				-997		
										PRV to Mountain South				-67		
										New Main Well C8	1,400	1,400				
										Convert M7 to Potable Water	350	350				
Zone Subtotal Main		2,721	5,300	5,300	0	4,868	8,276	8,276	-2,976		1,750	7,050	1,226	0		
Lower I		2,450								PRV from Main				997		
Zone Subtotal Lower I		2,450	0	0	0	587	997	997	-997		0	0	997	0		
Total		12,500	11,200	0	7,007	11,911	11,911	-711		N/A	1,750	11,950	1,572	39		

Notes:

(1) MDD Peaking factor assumed to be 1.7

(2) Zones with deficiencies and have no recommendations are assumed to be resolved by existing pumping capacities. Existing pump station firm capacities are sufficient to supply storage deficiency if needed. No storage improvements are required to mitigate deficiency.

Appendix E.3 - Long-Term (2040) Supply Analysis with Largest Canyon Well Out of Service



Discharge Pressure Zone	Existing Supply	HGL	Supply Capacity	Supply Capacity with Largest Canyon Well O.O.S.	Additional Firm Capacity from Existing and 2025 Improvements	Existing ADD	Existing MDD ¹	Total Required Capacity	Existing Capacity Balance	Proposed Improvement	Proposed Increase in Supplies	Total Supplies with Improvements	Zone Transfers	Zone Deficit/Surplus with Improvements
ft	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm
Zone 1A										Pump from Mountain North Zone				315
	Zone Subtotal Zone 1A		0	0	0	185	315	315	-315		0	0	315	0
Foothill East	Canyon Wells	3,000	3,000	2,000									2,000	
	Zone Subtotal Foothill East	3,000	3,000	2,000	0	73	124	124	1,876	PRV Canyon Wells to Upper Main Zone				-1,876
Foothill West	Well C2	2,822	1,100	1,100									1,100	
	Well C4	2,822	1,300	1,300									1,300	
	Well M3	2,822	800	800									800	
	Well 24 (BCVWD)	1,000	1,000										1,000	
	Zone Subtotal Foothill West	2,822	4,200	4,200	0	1,607	2,733	2,733	1,467	Pump to Mountain North Zone				-705
										None.	0	4,200	-705	762
Mountain North		2,932								Pump from Foothill West Zone				705
	Zone Subtotal Mountain North	2,932	0	0	0	229	390	390	-390	Pump to Zone 1A				-315
Mountain South		2,546								PRV from Upper Main Zone				66
	Zone Subtotal Mountain South	2,546	0	0	0	38	65	65	-65		0	0	66	0
Upper Main	Well C3	2,721	1,100	1,100									1,100	
	Well C5	2,721	900	900									900	
	Well M7	2,721		350									350	
	Well M10	2,721	800	800									800	
	Well M11	2,721	600	600									600	
	BCVWD Interconnection	1,000	1,000										1,000	
	Zone Subtotal Upper Main	2,721	4,400	4,400	350	3,499	5,948	5,948	-1,198	PRV Canyon Wells to Upper Main from Foothill East Zone				1,876
										PRV to Mountain South Zone				-66
										PRV to Lower Main Zone				-2,422
										New Well C9	1,800	1,800		
										Convert Well M12	1,100	1,100		
											2,900	7,650	-612	1,090
Lower Main	Well C6	2,721		900						Install VFD on Well C6 (in Closed Zone)				900
	Well C8	2,721		1,400						Install VFD on Well C8 (in Closed Zone)				1,400
	Zone Subtotal Lower Main	2,560	0	0	2,300	2,208	3,754	3,754	-1,454	PRV to Lower I Zone				-968
										PRV from Upper Main Zone				2,422
	Zone Subtotal Lower I	2,450	0	0	0	570	968	968	-968		0	2,300	1,454	0
	Total	11,600	10,600	2,650	8,411	14,298	14,298	-1,048			2,900	16,150	0	1,852

Notes:

(1) MDD Peaking factor assumed to be 1.7

(2) Largest Canyon Well Out of Service assumes Well 7 or Well 10 (capacity of 1,000 gpm) is out of service.

(3) **Green** improvements represent near-term improvements, while **blue** improvements represent long-term improvements.

Appendix E.4 - Long-Term (2040) Supply Analysis in Extreme Drought Conditions



Discharge Pressure Zone	Existing Supply	HGL	Supply Capacity	Supply Capacity in Extreme Drought	Additional Firm Capacity from Existing and 2025 Improvements	Existing ADD	Existing MDD ¹	Total Required Capacity	Existing Capacity Balance	Proposed Improvement	Proposed Increase in Supplies	New Total Supplies in Extreme Drought	Zone Transfer	Zone Deficit/Surplus with Improvements		
		ft	gpm	gpm	gpm	gpm	gpm	gpm	gpm			gpm	gpm	gpm	gpm	
Zone 1A	N/A									Pump from Mountain North Zone				315		
	Zone Subtotal Zone 1A		0	0	0	185	315	315	-315			0	315	0		
Foothill East	Canyon Wells	3,000	3,000	1,700									1,700			
	Zone Subtotal Foothill East	3,000	3,000	1,700	0	73	124	124	1,576	PRV Canyon Well Supply to Upper Main Zone			-1,576			
Foothill West	Well C2	2,822	1,100	1,100									1,100			
	Well C4	2,822	1,300	1,300									1,300			
	Well M3	2,822	800	800									800			
	Well 24 (BCVWD)		1,000	1,000									1,000			
	Zone Subtotal Foothill West	2,822	4,200	4,200	0	1,607	2,733	2,733	1,467	Pump to Mountain North Zone				705		
Mountain North		2,822								Pump to Zone 1A			0	-315		
	Zone Subtotal Mountain North	2,932	0	0	0	229	390	390	-390	Pump from Foothill West				705		
Mountain South		2,546								PRV from Upper Main Zone			0	65		
	Zone Subtotal Mountain South	2,546	0	0	0	38	65	65	-65				0	65	0	
Upper Main	Well C3	2,721	1,100	1,100									1,100			
	Well C5	2,721	900	900									900			
	Well M7	2,721		350									350			
	Well M10	2,721	800	800									800			
	Well M11	2,721	600	600									600			
	BCVWD Interconnection	2,721	1,000	1,000									1,000			
	Zone Subtotal Upper Main	2,721	4,400	4,400	350	3,499	5,948	5,948	-1,198	PRV Canyon Well Supply				1,576		
Lower Main	Well C6	2,721	900	900						PRV to Mountain South Zone				-65		
	Well C8	2,721		1,400						PRV to Lower Main Zone				-2,422		
	Zone Subtotal Lower Main	2,560	0	0	1,400	2,208	3,754	3,754	-2,354	New Upper Main Well C9	1,800	1,800				
										Convert Well M12	1,100	1,100				
											2,900	7,650	-912	790		
Lower I		2,450								Install VFD on Well C6 (in Closed Zone)			900			
	Zone Subtotal Lower I	2,450	0	0	0	570	968	968	-968	Install VFD on Well C8 (in Closed Zone)			1,400			
	Total	11,600	10,300	1,750	8,411	14,298	14,298	-2,248		PRV to Lower I				-968		
										PRV from Upper Main				2,422		
													0	2,300	1,454	0
													0	0	968	0
													2,900	15,850	1,411	2,963

Notes:

(1) MDD Peaking factor assumed to be 1.7

(2) Zones with deficiencies and have no recommendations are assumed to be resolved by existing pumping capacities. Existing pump station firm capacities are sufficient to supply storage deficiency if needed. No storage improvements are required to mitigate deficiency.

(3) **Green** improvements represent near-term improvements, while **blue** improvements represent long-term improvements.

Appendix E.3 - Build Out System Supply Analysis with Largest Canyon Well Out of Service



Discharge Pressure Zone	Existing Pump Station(s)	HGL	Supply Capacity	Supply Capacity with Largest Canyon Well O.O.S.	Additional Firm Capacity from Existing, 2025, and 2040 Improvements				Existing ADD	Existing MDD ¹	Total Required Capacity	Existing Capacity Balance	Proposed Improvement	Proposed Increase in Supplies	New Total Supplies with Canyon Wells O.O.S.	Zone Transfers	Zone Deficit/Surplus with Improvements	
					gpm	gpm	gpm	gpm										
Zone 1A	N/A															375		
	Zone Subtotal Zone 1A				221	375	375	-375								0		
Foothill East	Canyon Wells	3,000	3,000	2,000											2,000			
	Zone Subtotal Foothill East	3,000	3,000	2,000	0	104	176	176	1,824						0	2,000		0
Foothill West	Well C2	2,822	1,100	1,100												1,100		
	Well C4	2,822	1,300	1,300												1,300		
	Well M3	2,822	800	800												800		
	Well 24 (BCVWD)		1,000	1,000												1,000		
																	-840	
																Pump from Main Zone (new Foothill West PS)	780	
																	-760	
	Zone Subtotal Foothill West	2,822	4,200	4,200	0	1,988	3,380	3,380	820						0	4,200		820
Mountain North		2,932														0	840	
	Zone Subtotal Mountain North	2,932	0	0	0	273	465	465	-465						0	0		0
Mountain South		2,546														0	93	
	Zone Subtotal Mountain South	2,546	0	0	0	55	93	93	-93						0	0		0
Upper Main	Well C3	2,721	1,100	1,100												1,100		
	Well C5	2,721	900	900												900		
	New Well C9	2,721		1,800												1,800		
	Well M7	2,721		350												350		
	Well M10	2,721	800	800												800		
	Well M11	2,721	600	600												600		
	Well M12			1,100												1,100		
	BCVWD Interconnection	2,721	1,000	1,000												1,000		
																	1,824	
																	-93	
																	-2,011	
																	-384	
																	-780	
																New Upper Main Well C10	1,800	1,800
																New Upper Main Well C11	1,800	1,800
	Zone Subtotal Upper Main	2,721	4,400	4,400	3,250	5,617	9,549	9,549	-1,899						3,600	11,250		1,701
Lower Main	Well C6	2,721		900												900		
	Well C8	2,721		1,200												1,200		
																New Upper Main Well C12	1,800	1,800
																	2,011	
																	-1,372	
	Zone Subtotal Lower Main	2,560	0	0	2,100	2,670	4,539	4,539	-2,439						1,800	3,900		-639
Lower I		2,450	0	0													1,372	
	Zone Subtotal Lower I	2,450	0	0		807	1,372	1,372	-1,372						0	0		0
Black Bench		TBD	0	0												Pump from Foothill West Zone	0	760
	Zone Subtotal Black Bench	TBD	0	0		447	760	760	-760						0	0		0
Loma Linda		TBD	0	0												Pump from Upper Main Zone	0	384
	Zone Subtotal Loma Linda	0	0	0		226	384	384	-384						0	0		0
Total		11,600	10,600	5,350	12,187	20,718	20,718	-4,768							5,400	21,350		1,882

Notes:

(1) MDD Peaking factor assumed to be 1.7

(2) Largest Canyon Well Out of Service assumes Well 7 or Well 10 (capacity of 1,000 gpm) is out of service.

Appendix E.3 - Build Out System Supply Analysis in Extreme Drought Conditions



Discharge Pressure Zone	Existing Pump Station(s)	HGL	Supply Capacity	Supply Capacity in Extreme Drought	Additional Firm Capacity from Existing, 2025, and 2040 Improvements		Existing ADD	Existing MDD ¹	Total Required Capacity	Existing Capacity Balance	Proposed Improvement	Proposed Increase in Supplies	New Total Supplies in Extreme Drought	Zone Deficit/Surplus with Improvements	
					ft	gpm									
Zone 1A	N/A													375	
	Zone Subtotal Zone 1A						221	375	375	-375				0	
Foothill East	Canyon Wells	3,000	3,000	1,700										1,700	
	Zone Subtotal Foothill East	3,000	3,000	1,700	0	104	176	176	1,524					-1,524	
Foothill West	Well C2	2,822	1,100	1,100										1,100	
	Well C4	2,822	1,300	1,300										1,300	
	Well M3	2,822	800	800										800	
	Well 24 (BCVWD)		1,000	1,000										1,000	
														-840	
														780	
	Zone Subtotal Foothill West	2,822	4,200	4,200	0	1,988	3,380	3,380	820					-760	
Mountain North		2,932												840	
	Zone Subtotal Mountain North	2,932	0	0	0	273	465	465	-465					-375	
Mountain South		2,546												0	
	Zone Subtotal Mountain South	2,546	0	0	0	55	93	93	-93					93	
Upper Main	Well C3	2,721	1,100	1,100										1,100	
	Well C5	2,721	900	900										900	
	New Well C9	2,721		1,800										1,800	
	Well M7			350										350	
	Well M10	2,721	800	800										800	
	Well M11	2,721	600	600										600	
	Well M12			1,100										1,100	
	BCVWD Interconnection		1,000	1,000										1,000	
														1,524	
														-93	
														-780	
														-1,811	
														-384	
	Zone Subtotal Upper Main	2,721	4,400	4,400	3,250	5,617	9,549	9,549	-1,899					157	
Lower Main	Well C6	2,721		900										900	
	Well C8	2,721		1,400										1,400	
														New Upper Main Well C12	
														1,800	
														1,800	
														1,811	
	Zone Subtotal Lower Main	2,560	0	0	2,300	2,670	4,539	4,539	-2,239					-1,372	
Lower I		2,450	0	0										1,372	
	Zone Subtotal Lower I	2,450	0	0		807	1,372	1,372	-1,372					0	
Black Bench		TBD	0	0										760	
	Zone Subtotal Black Bench	TBD	0	0		447	760	760	-760					0	
Loma Linda		TBD	0	0										384	
	Zone Subtotal Loma Linda	0	0	0		226	384	384	-384					0	
Total		11,600	10,300			12,187	20,718	20,718	-4,868				5,400	21,250	157

Notes:

(1) MDD Peaking factor assumed to be 1.7

(2) Zones with deficiencies and have no recommendations are assumed to be resolved by existing pumping capacities. Existing pump station firm capacities are sufficient to supply storage deficiency if needed. No storage improvements are required to mitigate deficiency.

Appendix E.4 - Existing System Pump Station Analysis



Discharge Pressure Zone	Existing Facility	HGL	Pump Station Capacity	Firm Pump Station Capacity	Existing ADD	Existing MDD ¹	Capacity Required Including Upstream Zones	Max Zone Fire Flow (MFF)	Fire Flow Duration	Governing Size Criteria	Total Required Capacity	Existing Capacity Balance	Proposed Improvement ^(2,3)		Future Total Capacity	Future Total Firm Capacity	Zone Deficit/Surplus with Improvements	
													gpm	gpm	gpm	gpm	gpm	
Foothill East	Foothill East PRV		2,010	210											2,010	210		
Zone Subtotal Foothill East		3,000	2,010	210	65	110	110	1,500	2	MDD+MFF	1,610	-1,400		New Foothill East 2 PRV	1,800	1,800		
Foothill West																3,810	2,010	400
	Well C4	2,822	1,300	1,300											1,300	1,300		
	Well M3	2,822	800	800											800	800		
	C2 Booster (Well C2)	2,822	1,040	1,040											1,040	1,040		
	C2 Booster (Main Zone)	2,822	1,980	910											1,980	910		
	Well 24 (BCVWD)		1,000	1,000											1,000	1,000		
Zone Subtotal Foothill West		2,822	6,120	5,050	806	1,371	1,957	3,500	4	MDD	1,957	3,093			6,120	5,050	3,093	
Mountain North	Mountain Booster	2,932	900	400											2,350	1,625		
Zone Subtotal Mountain North		2,932	900	400	63	107	107	1,500	3	MDD+MFF	1,607	-1,207			2,350	1,625	18	
Mountain South	Mountain South PRV	2,546	1,800	0											1,800	0		
Zone Subtotal Mountain South		2,546	1,800	0	34	58	58	1,500	2	MDD+MFF	1,558	-1,558		New 8-inch Mountain South 2 PRV (PWFF-3)	3,100	3,100		
Main	Well C3	2,721	1,100	1,100											1,100	1,100		
	Well C5	2,721	900	900											900	900		
	Well C6	2,721	900	900											900	900		
	Well M10	2,721	800	800											800	800		
	Well M11	2,721	600	600											600	600		
	BCVWD Interconnection	1,000	1,000												1,000	1,000		
	Well 1 Site ⁽⁴⁾	3,000	1,700												3,000	1,700		
Zone Subtotal Main		2,721	8,300	7,000	3,862	6,566	7,586	4,000	4	MDD	7,586	-586		Sun Lakes FCV from Foothill West Zone	586	586	0	
Lower I	San Gorgonio & Lincoln St. PRV	2,450	4,110	1,010											4,110	1,010		
	Hargrave & John St. PRV	2,450	5,700	5,700											5,700	5,700		
Zone Subtotal Lower I		2,450	9,810	6,710	503	855	855	4,000	4	MDD+MFF	4,855	1,855			9,810	6,710	1,855	
Total		28,940	19,370	5,334	9,067	10,673	16,000	19	0		19,173	197			35,876	26,081	6,908	

Notes:

(1) MDD Peaking factor is 1.7

(2) Blue projects indicate proposed projects from supply analysis.

(3) Red projects indicate proposed projects from fire flow analysis.

(4) Well 1 Site includes a PRV, pelton wheel, and hydrogenerator.

Appendix E.4 - Future (2025) System Pump Station Analysis



Discharge Pressure Zone	Facility ^(4,5,6)	HGL	Pump Station Capacity	Firm Pump Station Capacity	Existing System Firm Capacity	Future ADD	Future MDD ⁽¹⁾	Capacity Required Including Upstream Zones ⁽²⁾	Max Zone Fire Flow (MFF)	Governing Size Criteria	Total Required Capacity	Future Capacity Balance	Proposed Improvement ^(4,5,6)	Future Total Capacity ⁽²⁾	Future Total Firm Capacity ⁽²⁾	Zone Deficit/Surplus with Improvements	
			ft	gpm	gpm	gpm	gpm							gpm	gpm	gpm	
Foothill East	Foothill East PRV		2,010	210											2,010	210	
	New Foothill East 2 PRV				1,800										1,800	1,800	
	Zone Subtotal Foothill East	3,000	2,010	210	1,800	75	128	128	1,500	MDD+MFF	1,628	382			3,810	2,010	382
Foothill West	Well C4	2,822	1,300	1,300											1,300	1,300	
	Well M3	2,822	800	800											800	800	
	C2 Booster (Well C2)	2,822	1,040	1,040											1,040	1,040	
	C2 Booster (Main Zone)	1,980	910												1,980	910	
	Well 24 (BCVWD)	1,000	1,000												1,000	1,000	
														New Foothill West PS (3 pumps @ 950 gpm + 1 SB)	3,800	2,850	
	Zone Subtotal Foothill West	2,822	6,120	5,050	0	1,327	2,256	2,443	3,500	MDD	2,443	2,607			6,120	5,050	2,607
Mountain North	Mountain Booster	2,932	900	400	725										2,350	1,625	
	Zone Subtotal Mountain North	2,932	900	400	725	109	186	186	2,500	MDD	186	939			2,350	1,625	1,439
Mountain South	Mountain South PRV	2,546	1,800	0											1,800	0	
	New 8-inch Mountain South 2 PRV (PWFF-3)				3,100										3,100	3,100	
	Zone Subtotal Mountain South	2,546	1,800	0	3,100	40	67	67	1,500	MDD+MFF	1,567	1,533			4,900	3,100	1,533
Main	Well C3	2,721	1,100	1,100											1,100	1,100	
	Well C5	2,721	900	900											900	900	
	Well C6	2,721	900	900											900	900	
	Well M10	2,721	800	800											800	800	
	Well M11	2,721	600	600											600	600	
	BCVWD Interconnection	1,000	1,000												1,000	1,000	
	Well 1 Site ⁽³⁾	3,000	1,700												3,000	1,700	
														Sun Lakes FCV from Foothill West Zone	884	884	
														New Well C8	1,400	1,400	
														Convert Well M7 to Potable Water	350	350	
	Zone Subtotal Main	2,721	8,300	7,000	0	4,868	8,276	8,643	4,000	MDD	8,643	-1,643			10,934	9,634	990
Lower I	San Gorgonio & Lincoln St. PRV	2,450	4,110	1,010											4,110	1,010	
	Hargrave & John St. PRV	2,450	5,700	5,700											5,700	5,700	
	Zone Subtotal Lower I	2,450	9,810	6,710	0	587	997	997	4,000	MDD+MFF	4,997	1,713			9,810	6,710	1,713
Total		28,940	19,370	5,625	7,007	11,911	12,465	17,000	N/A	19,465	5,530				37,924	28,129	8,664

Notes:

(1) MDD Peaking factor is 1.7

(2) Reliability Projects are not included in totals to prevent double counting of supply.

(3) Well 1 Site includes a PRV, pelton wheel, and hydrogenerator.

(4) Blue projects indicate proposed projects from supply analysis.

(5) Red projects indicate proposed projects from fire flow analysis.

(6) Green projects indicate proposed projects from pump station analysis.

Appendix E.4 - Future (2040) System Pump Station Analysis



Discharge Pressure Zone	Facility ^(5,6,7)	HGL	Pump Station Capacity ⁽²⁾	Firm Pump Station Capacity ⁽²⁾	Existing System Improvement Firm Capacity	Future ADD	Future MDD ⁽¹⁾	Capacity Required Including Upstream Zones ⁽²⁾	Max Zone Fire Flow (MFF)	Governing Size Criteria ⁽⁴⁾	Total Required Capacity	Existing Capacity Balance	Proposed Improvement ^(5,6,7)	Future Total Capacity ⁽²⁾	Future Total Firm Capacity ⁽²⁾	Zone Deficit/Surplus with Improvements	
			ft	gpm	gpm	gpm	gpm										
Zone 1A	N/A													New Zone 1A PS 1 pump @ 400 gpm + 1 SB)	800	400	
	Zone Subtotal Zone 1A					185	315	315	1,500	MDD	315	-315			800	400	85
Foothill East	Foothill East PRV		2,010	210											2,010	210	
	New Foothill East 2 PRV				1,800										1,800	1,800	
	Zone Subtotal Foothill East	3000	2,010	210	1,800	73	124	124	1,500	MDD+MFF	1,624	386			3,810	2,010	386
Foothill West	Well C4	2822	1,300	1,300											1,300	1,300	
	Well M3	2822	800	800											800	800	
	C2 Booster (Well C2)	2822	1,040	1,040											1,040	1,040	
	C2 Booster (Main Zone)	2822	1,980	910											1,980	910	
	Well 24 (BCVWD)		1,000	1,000											1,000	1,000	
	New Foothill West PS (3 pumps @ 950 gpm + 1 SB)		3,800	2,850											4,650	3,800	
	Zone Subtotal Foothill West	2822	6,120	5,050	0	1,607	2,733	3,438	3,500	MDD	3,438	1,612	None.		6,120	5,050	1,612
Mountain North	Mountain Booster (Abandon)	2932	0	0	0								Abandon and Demolish		0	0	
	Zone Subtotal Mountain North	2932	0	0	0	229	390	705	2,500	MDD	705	-705			1,700	850	145
Mountain South	Mountain South PRV	2546	1,800	0											1,800	0	
	New 8-inch Mountain South 2 PRV (PWFF-3)			3,100											3,100	3,100	
	Zone Subtotal Mountain South	2546	1,800	0	3,100	38	65	65	1,500	MDD+MFF	1,565	1,535			4,900	3,100	1,535
Upper Main	Well C3	2721	1,100	1,100											1,100	1,100	
	Well C5	2721	900	900											900	900	
	Well M10	2721	800	800											800	800	
	Well M11	2721	600	600											600	600	
	BCVWD Interconnection		1,000	1,000											1,000	1,000	
	Well 1 Site ⁽³⁾	3,000	1,700												3,000	1,700	
	Convert Well M7 to Potable Water			350											350	350	
													New Well C9		1,800	1,800	
													Convert Well M12		1,100	1,100	
													New Well C10		1,800	1,800	
	Zone Subtotal Upper Main	2721	7,400	6,100	350	3,499	5,948	10,134	4,000	MDD	10,134	-3,684			12,450	11,150	1,016
Lower Main	Well C6	2721	900	900											900	900	
	8th St. & George PRV		3,900	800											3,900	800	
	8th St & Jacinto View PRV		5,025	5,025											5,025	5,025	
	16th St. & Hays PRV		8,925	8,925											8,925	8,925	
	Theodore & Almond Way PRV		6,700	1,800											6,700	1,800	
	New Well C8			1,400													
	Zone Subtotal Lower Main	2721	25,450	17,450	1,400	2,208	3,754	4,722	4,000	MDD+MFF	8,722	10,128			25,450	17,450	8,728
Lower I	San Gorgonio & Lincoln St. PRV	2450	4,110	1,010											4,110	1,010	
	Hargrave & John St. PRV	2450	5,700	5,700											5,700	5,700	
	Zone Subtotal Lower I	2450	9,810	6,710	0	570	968	968	4,000	MDD+MFF	4,968	1,742			9,810	6,710	1,742
Total		52,590	35,520	6,650	8,225	13,983	20,157	21,000	0		31,157	11,013			64,240	46,320	15,163

Notes:

(1) MDD Peaking factor is 1.7

(2) Reliability Projects are not included in totals to prevent double counting of supply.

(3) Well 1 Site includes a PRV, pelton wheel, and hydrogenerator.

(4) Mountin North Zone governing size criteria changes to MDD in the Long-Term due to the construction of a new reservoir.

(5) Blue projects indicate proposed projects from supply analysis.

(6) Red projects indicate proposed projects from fire flow analysis.

(7) Green projects indicate proposed projects from pump station analysis.

Appendix E.4 - Build-out System Pump Station Analysis



Discharge Pressure Zone	Facility ^(5,6,7)	HGL	Pump Station Capacity ⁽²⁾	Firm Pump Station Capacity ⁽²⁾	Existing System Improvement Firm Capacity ⁽²⁾	Future ADD	Future MDD ⁽¹⁾	Capacity Required Including Upstream Zones ⁽²⁾	Max Zone Fire Flow (MFF)	Governing Size Criteria ⁽⁴⁾	Total Required Capacity	Existing Capacity Balance	Proposed Improvement ^(5,6,7)	Future Total Capacity ⁽²⁾	Future Total Firm Capacity ⁽²⁾	Zone Deficit/Surplus with Improvements
		ft	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm	gpm
Zone 1A	New Zone 1A PS 1 pump @ 400 gpm + 1 SB)				400									800	400	
	Zone Subtotal Zone 1A					221	375	375	1,500	MDD	375	-375		800	400	25
Foothill East	Foothill East PRV	2,010	210											2,010	210	
	New Foothill East 2 PRV				1,800									1,800	1,800	
	Zone Subtotal Foothill East	3000	2,010	210	1,800	104	176	176	1,500	MDD+MFF	1,676	334		3,810	2,010	334
Foothill West	Well C4	2822	1,300	1,300										1,300	1,300	
	Well M3	2822	800	800										800	800	
	C2 Booster (Well C2)	2822	1,040	1,040										1,040	1,040	
	C2 Booster (Main Zone)	2822	1,980	910										1,980	910	
	Well 24 (BCVWD)		1,000	1,000										1,000	1,000	
	New Foothill West PS (3 pumps @ 950 gpm + 1 SB)		3,800	2,850										4,400	3,450	
	Zone Subtotal Foothill West	2822	6,120	5,050	0	1,988	3,380	4,220	3,500	MDD	4,220	830		6,120	5,050	830
Mountain North	New Mountain 2 Booster (1 pump @ 850 gpm + 1SB)				850									1,700	850	
	Zone Subtotal Mountain North	2932	0	0	850	273	465	840	2,500	MDD	840	10		1,700	850	10
Mountain South	Mountain South PRV	2546	1,800	0				3,100						1,800	0	
	New 8-inch Mountain South 2 PRV (PWFF-3)				3,100									3,100	3,100	
	Zone Subtotal Mountain South	2546	1,800	0	3,100	38	65	65	1,500	MDD+MFF	1,565	1,535		4,900	3,100	1,535
Upper Main	Well C3	2721	1,100	1,100										1,100	1,100	
	Well C5	2721	900	900										900	900	
	Well M10	2721	800	800										800	800	
	Well M11	2721	600	600										600	600	
	BCVWD Interconnection		1,000	1,000										1,000	1,000	
	Well 1 Site ⁽³⁾		3,000	1,700										3,000	1,700	
	Convert Well M7 to Potable Water				350									350	350	
	Convert Well M12				1,100									1,100	1,100	
	New Well C9				1,800									1,800	1,800	
	New Well C10				1,800									1,800	1,800	
	Zone Subtotal Upper Main	2721	7,400	6,100	5,050	3,499	5,948	9,516	4,000	MDD	9,516	1,634		12,450	11,150	1,634
Lower Main	Well C6	2721	900	900										900	900	
	8th St. & George PRV		3,900	3,900										3,900	3,900	
	8th St & Jacinte View PRV		5,025	5,025										5,025	5,025	
	16th St. & Hays PRV		8,925	8,925										8,925	8,925	
	Theodore & Almond Way PRV		6,700	1,800										6,700	1,800	
	New Well C8				1,400											
	Zone Subtotal Lower Main	2721	25,450	20,550	0	2,208	3,754	4,722	4,000	MDD+MFF	8,722	11,828		25,450	20,550	11,828
Lower I	San Gorgonio & Lincoln St. PRV	2450	4,110	1,010										4,110	1,010	
	Hargrave & John St. PRV	2450	5,700	5,700										5,700	5,700	
	Zone Subtotal Lower I	2450	9,810	6,710	0	570	968	968	4,000	MDD+MFF	4,968	1,742		9,810	6,710	1,742
Total		52,590	38,620	10,800	8,680	14,757	20,508	21,000	0	31,508	17,912			65,040	49,820	17,936

Notes:

(1) MDD Peaking factor is 1.7

(2) Reliability Projects are not included in totals to prevent double counting of supply.

(3) Well 1 Site includes a PRV, pelton wheel, and hydrogenerator.

(4) Mountain North Zone governing size criteria changes to MDD in the Long-Term due to the construction of a new reservoir.

(5) Blue projects indicate proposed projects from supply analysis.

(6) Red projects indicate proposed projects from fire flow analysis.

(7) Green projects indicate proposed projects from pump station analysis.

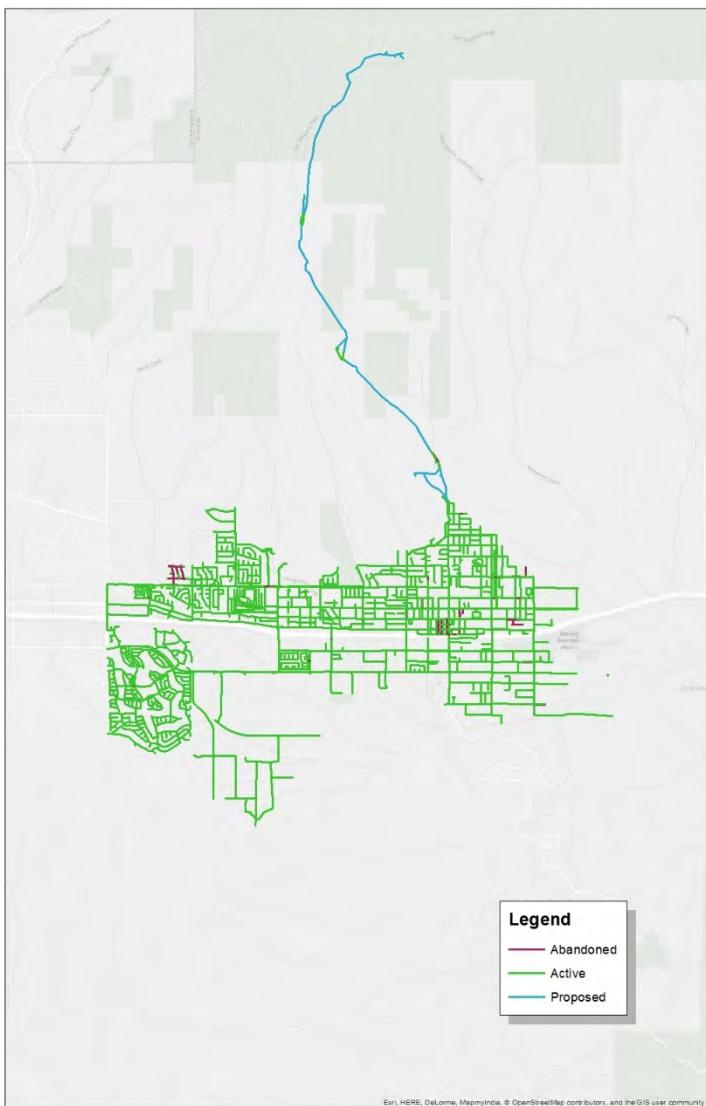
Appendix E.5

Pipeline Replacement Program – Annual Cost Estimate

THE FOLLOWING DOCUMENTATION, DATED DECEMBER 2016, WAS PROVIDED BY CITY STAFF. ASSUMPTIONS WERE REFINED FOR THIS IMP AND ARE NOTED IN THE DOCUMENT.

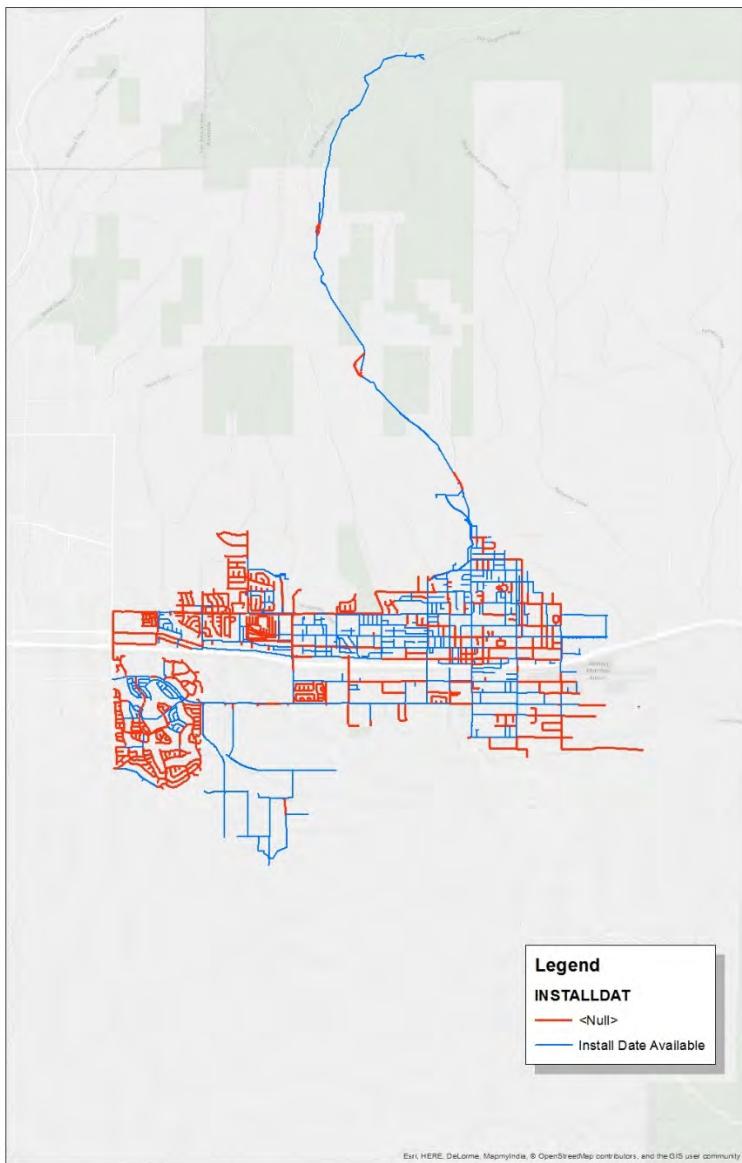
Methodology:

1. Started with GIS shapefile from Nobel for all pipes (7139 total pipeline segments).
2. Considered filtering out “Abandoned” and “Proposed” pipes using the ‘STATUS’ field. Only “Active” were to be kept (6898 segments). However, after a visual check, it appeared the “Proposed” pipelines should have had an “Active” ‘STATUS’:



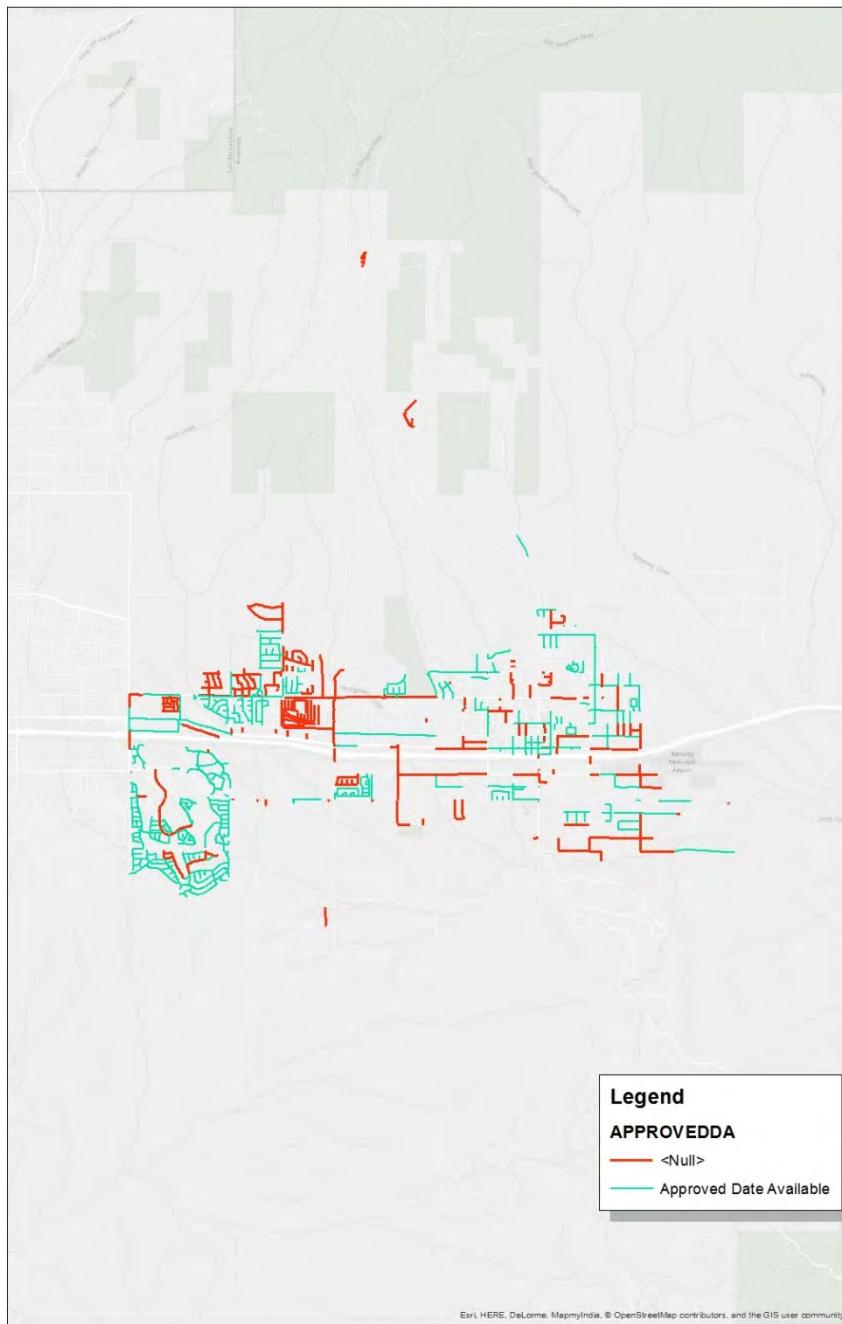
Only the “Abandoned” pipelines were filtered out and kept a total of 6979 segments.

3. Looking at the 'INSTALLDAT' field, 4118 segments did not have an installation date (NULL). Visually, these pipelines can be seen below in red:



These pipelines without an installation date were queried out for further inspection. The pipelines with an installation date were set aside for now (2861 segments).

4. Upon further inspection of the pipelines without an installation date, there is an 'APPROVEDDA' field that appears populated for many (2800 out of 4118), which can be used as an approximation for the installation date.

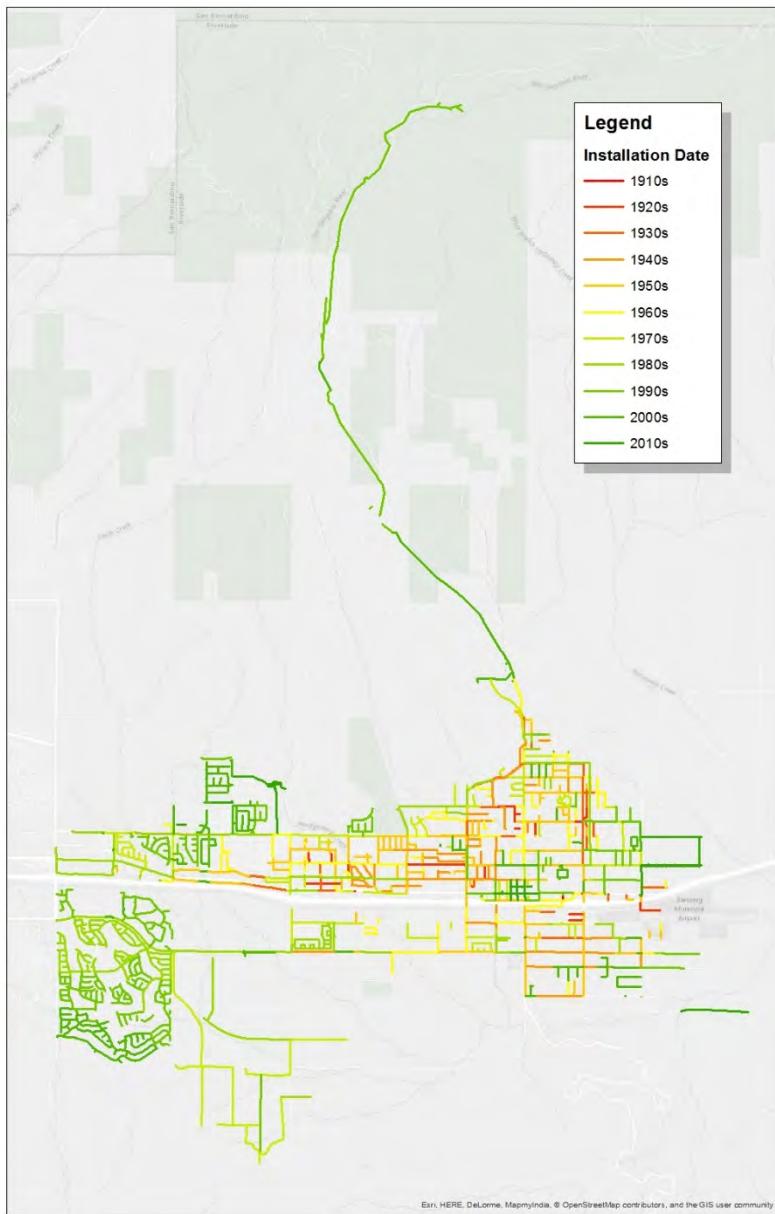


This left 1318 "Active" pipe segments without an installation or approved date. Visually, they appear to be spread out throughout the City and over time can be assigned an installation date based on field observations and the age of surrounding pipelines.

The total length of active pipelines with unknown installation date is 167,992 feet (31.8 miles). The total length of all active pipelines is 871,991 feet (165.1 miles). Since approximately 19.3% of total pipelines do not have age information available, an adjustment factor will be used once replacement costs are determined from pipelines that do have age information. The formula used to make the adjustment will be:

$$\text{Adjusted Cost} = \text{Estimated Cost} / (1 - 0.193)$$

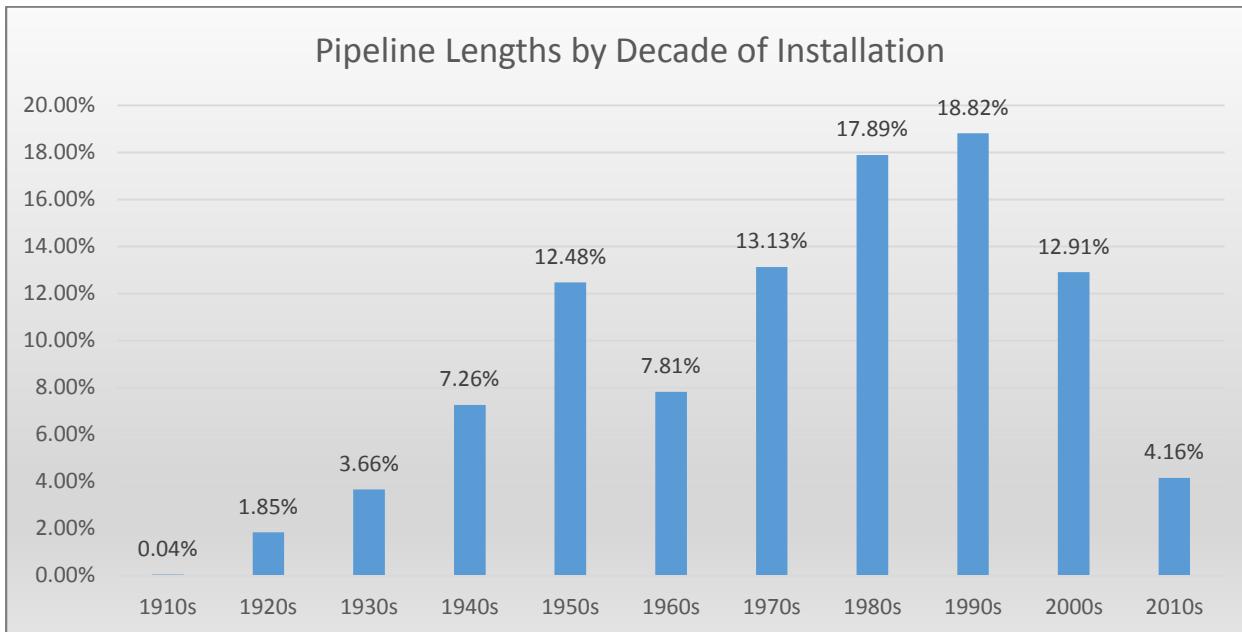
5. The two date fields ('INSTALLDAT' and 'APPROVEDA') were used to categorize the pipelines by decade:



Visually it appears that there is a balanced distribution in the age of pipes, rather than mostly old or mostly new pipes. The data from the shapefile was then exported to Excel for further analysis.

6. Using Excel to quantify the lengths of pipe by decade of installation yields the following information:

DECade	MILES	% OF TOTAL
1910s	0.1	0.04%
1920s	2.5	1.85%
1930s	4.9	3.66%
1940s	9.7	7.26%
1950s	16.6	12.48%
1960s	10.4	7.81%
1970s	17.5	13.13%
1980s	23.9	17.89%
1990s	25.1	18.82%
2000s	17.2	12.91%
2010s	5.5	4.16%
	264.2	100.00%



As can be seen from the graph, pipes installed pre-1940 make up a small fraction of the distribution system. However, the percentages climb steeply thereafter meaning that City of Banning will need to have a robust plan in place for funding increasing replacement costs as time goes on.

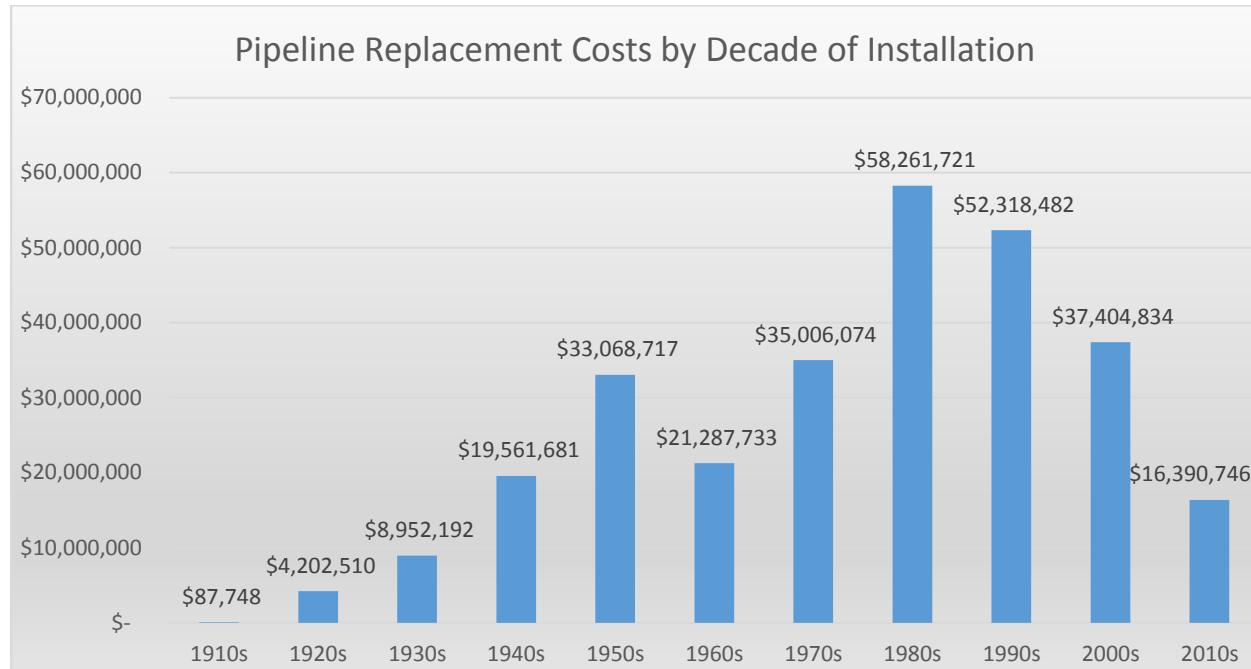
Under one possible scenario, the City would aim to replace all pipes installed pre-1950 by the year 2030. Because many of the older pipes in the City are undersized, were installed very shallow and/or in alleyways, they are assigned an 80-year expected service life. A second phase of the pipeline replacement program could then take a more nuanced approach that utilizes main break history, concurrent street rehab projects, undesirable materials, zone operating pressures, pipe criticality, and other data analytics to prioritize replacements after the initial age-based approach. Because of improved construction methods, standards, and materials, it may be possible to assign a 100-year expected service life to pipes installed post-1950, and should be confirmed as part of the Integrated Master Plan.

SINCE THE ACCURACY OF THE AGE AND MATERIAL DATA IS UNKNOWN, THIS IMP ASSUMES AN 80-YEAR EXPECTED SERVICE LIFE TO ESTIMATE PIPELINE REPLACEMENT. THEREFORE, ALL NUMBERS AND FIGURES HEREAFTER DO NOT ALIGN WITH THE IMP AND NEED TO BE UPDATED.

Assuming such a scenario is adopted, the next step would be to develop cost estimates.

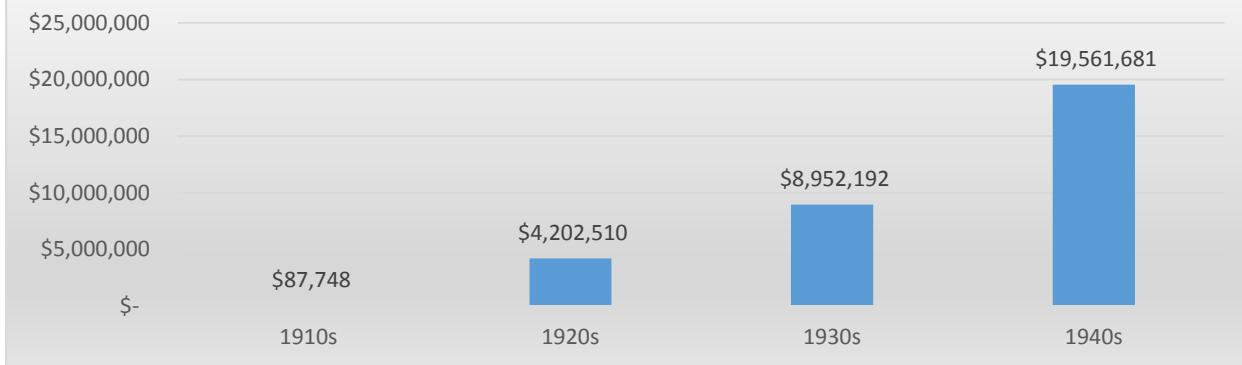
7. An industry rule of thumb used to estimate pipeline construction costs for ductile iron pipe including trenching and pavement repair per lineal foot is to multiply the diameter of the pipe in inches by a factor of 20. In the case of pipeline replacement, there are additional costs for relocating services, replacing old fire hydrants, and the abandonment of existing pipes. Each project will differ in the number of services and hydrants needing replacement and the method of abandonment required for existing pipe. To estimate an average of these additional costs, the typical factor of 20 was increased to 25. At this point, the pipelines without installation date information were accounted for by using the adjustment formula discussed in number 4 above.

Lastly, planning-level estimates typically include a safety factor of about 30% for budgeting purposes to account for unforeseen conditions. Using the methodology described, the following cost estimates were developed for replacing existing pipelines grouped by decade of installation, in present-day dollars.

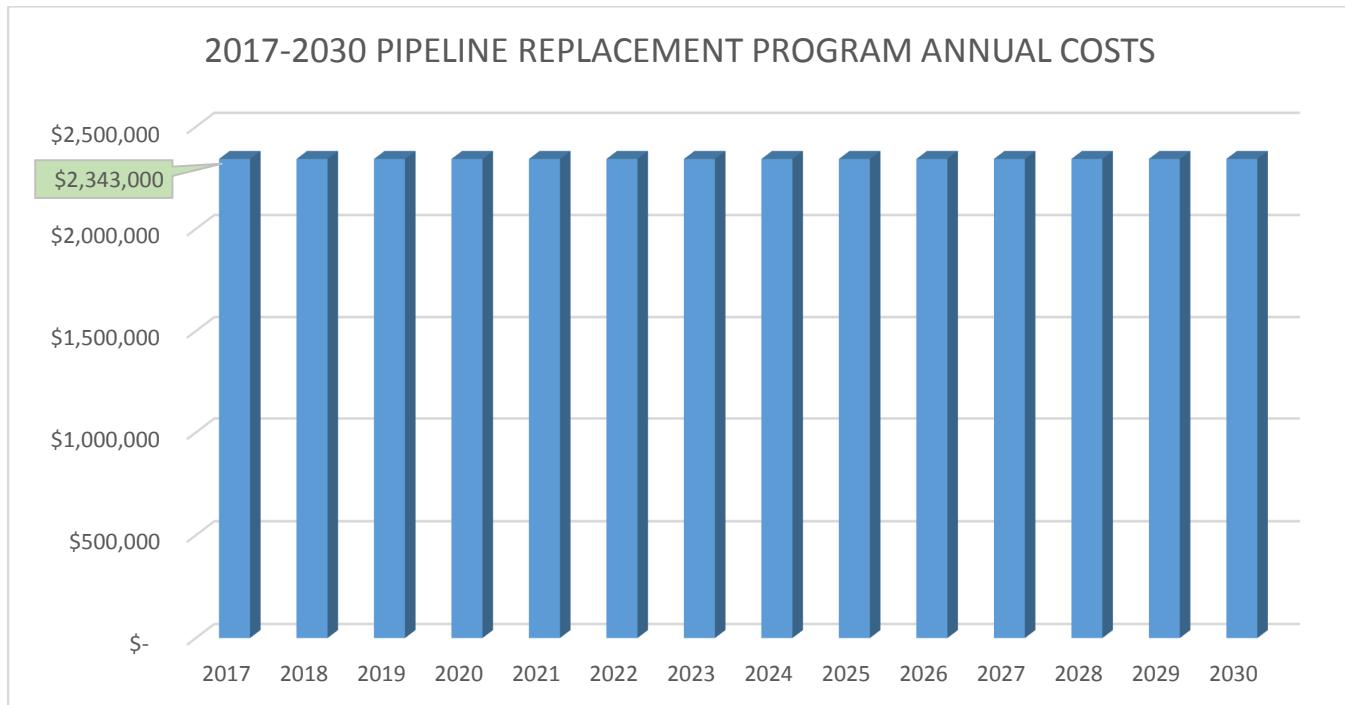


Focusing on the first phase of the Pipeline Replacement Program to replace all pre-1950's pipelines yields the following graph:

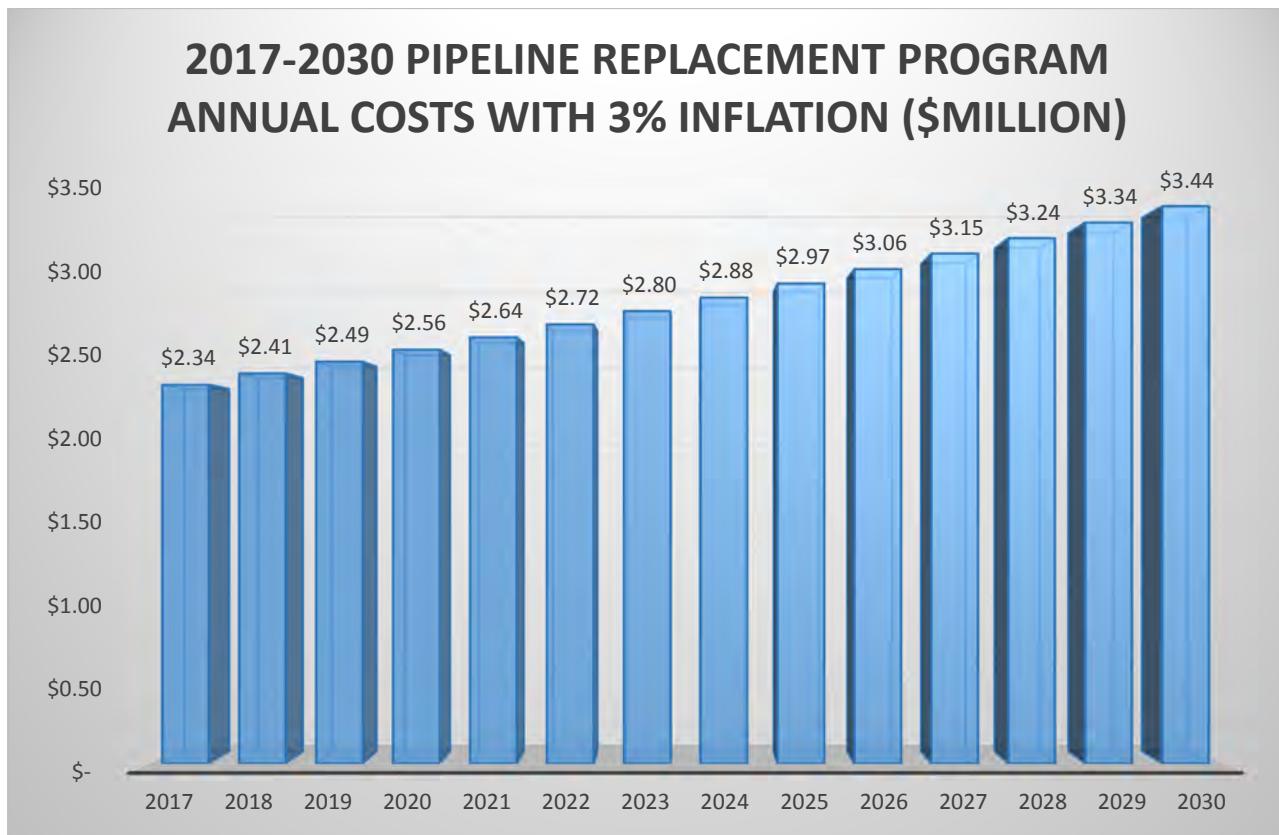
Costs of Replacing Pre-1950s Pipelines



To better manage and finance the Pipeline Replacement Program, it would be best to spread the costs of replacement over time. To replace all pre-1950 pipelines by 2030, the following annual expenditures would be required:

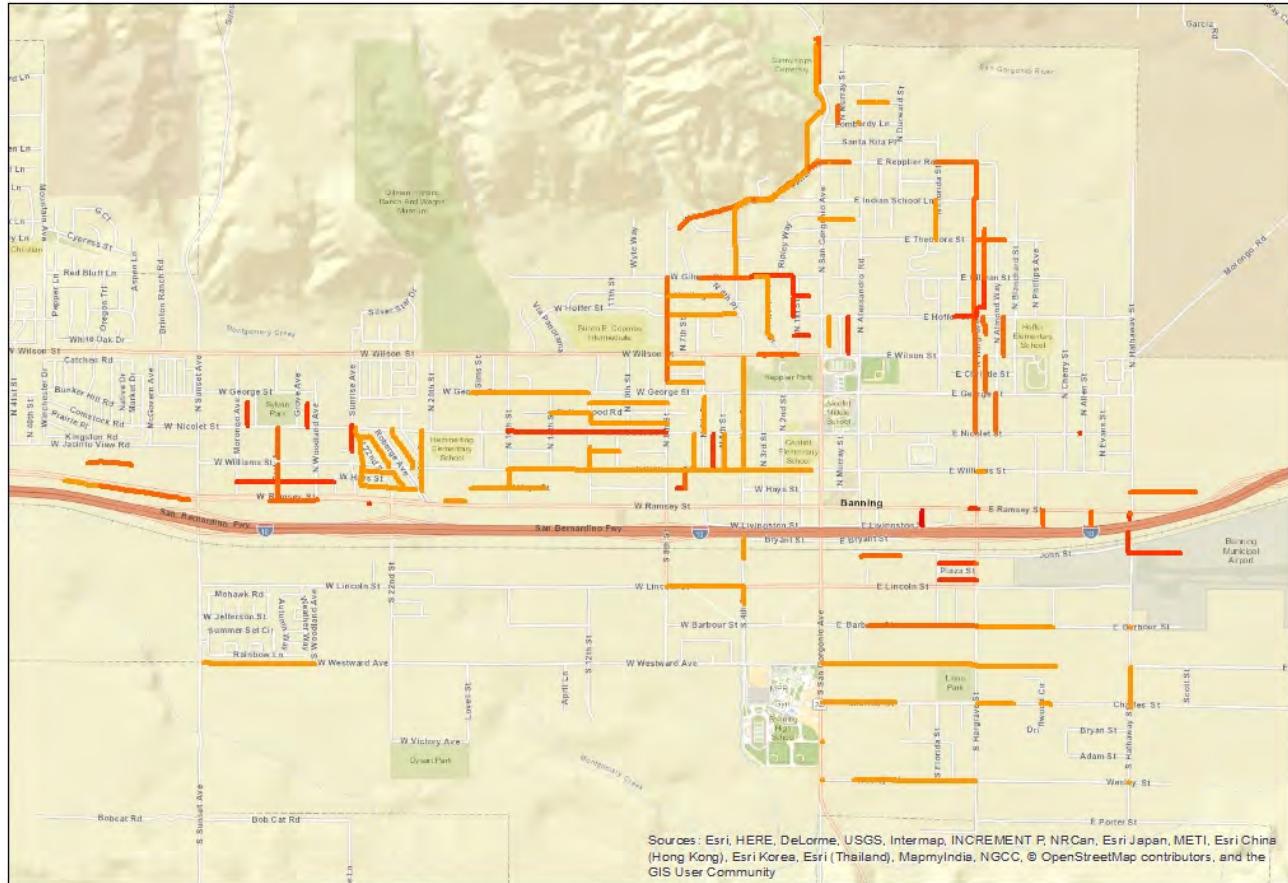


If material and labor costs are assumed to increase at an annual rate of 3%, the budgeted amounts should likewise be increased. The graph below is in millions of dollars:



The pipelines identified for replacement during the first phase of the Pipeline Replacement Program can be found throughout the City's service area and would benefit all customers with increased reliability, decreased water losses, and better fire protection due to upsizing undersized pipes:

IDENTIFIED PIPELINE REPLACEMENTS 2017-2030



Appendix F

RECYCLED WATER SYSTEM ANALYSIS DETAILS

Table 8.1 **Butterfield Development Demand and Supply Balance**

Customer/Supply	Near-term (2025)	Long-term (2040)	Build-out
MDD	gpm	gpm	gpm
Butterfield Development ⁽¹⁾	284	1,575	1,511
Demand Subtotal	284	1,575	1,511
Supply⁽²⁾	gpm	gpm	gpm
BCVWD Well 1	1,000	1,000	1,000
BCVWD Well 2	1,000	1,000	1,000
Supply Subtotal	2,000	2,000	2,000
Excess	1,716	425	489

Notes:

(1) Butterfield Development demand provided by developer. MDD estimated based on a PF of 2.82.

(2) BCVWD Well capacities estimated by City staff.

Table 8.2 **Main System Demand and Supply Balance**

Customer/Supply	Pipeline Length (ft)	Pipeline Diameter (in)	Near-term (2025)	Long-term (2040)	Build-out
MDD			gpm	gpm	gpm
Banning High School			306	306	306
Dysart Park			153	153	153
Five Bridges Development			0	0	390
Lions Park			138	138	138
Neighborhood Park			0	0	61
Rancho San Gorgonio Development			233	380	380
Sun Lakes Development			1,487	1,487	1,487
Demand Subtotal			2,316	2,463	2,914
Supply⁽²⁾			gpm	gpm	gpm
WWTP			1,444	1,462	3,174
Well M12			1,000	0	0
Well M7			0	0	0
Well R-1			1,150	1,150	1,150
Supply Subtotal			3,594	2,612	4,324
Excess			1,278	150	1,411

Appendix F.2 - Alternative 1 Cost Estimates by Phase and Facility Type

Phase	Customer	Potential Demand	Facility Type	Pipe Diam./ Facility Size	Unit	Length/ Quantity ¹	Unit Cost	Baseline Construction Cost	Capital Improvement Cost ^{2,3}	Amortized Value ⁵	Operations & Maintenance Cost	Amortized Value with O&M	Unit Cost (\$/AF)
		(afy)				(ft)	(\$)	(\$)	(\$)		(\$)	(\$)	
1	Sun Lakes Development	850	Pipe	24	in.	18,000	\$ 565	\$ 10,170,000	\$ 16,857,000	\$ 558,000	\$ 424,000	\$ 982,000	\$ 1,200
	Rancho San Gorgonio Development	217	Pipe	12	in.	500	\$ 305	\$ 153,000	\$ 254,000	\$ 8,000	\$ 88,000	\$ 96,000	\$ 400
	Banning High School	175	Pipe	6	in.	1,500	\$ 165	\$ 248,000	\$ 411,000	\$ 14,000	\$ 72,000	\$ 86,000	\$ 500
	Dysart Park	87	Pipe	6	in.	3,500	\$ 165	\$ 578,000	\$ 958,000	\$ 32,000	\$ 40,000	\$ 72,000	\$ 800
	Lions Park	79	Pipe	6	in.	1,500	\$ 165	\$ 248,000	\$ 411,000	\$ 14,000	\$ 34,000	\$ 48,000	\$ 600
	Butterfield ⁽⁸⁾	N/A	PRV	8	in.	2	\$ 200,000	\$ 400,000	\$ 663,000	\$ 22,000	\$ 7,000	\$ 29,000	N/A
	N/A	N/A	Treatment Plant Pump	700	hp	N/A	\$ 2,500	\$ 1,750,000	\$ 2,901,000	\$ 96,000	\$ 242,000	\$ 338,000	N/A
	N/A	N/A	Well R-1 Equipping	1	well	N/A	\$ 1,000,000	\$ 1,000,000	\$ 1,658,000	\$ 55,000	\$ 33,000	\$ 88,000	N/A
	N/A	N/A	Well R-1 Forebay	1	MG	N/A	\$ 2,500,000	\$ 2,500,000	\$ 4,144,000	\$ 137,000	\$ 41,000	\$ 178,000	N/A
	N/A	N/A	Well R-1 Transmission	12	in.	2,500	\$ 305	\$ 762,500	\$ 1,264,000	\$ 42,000	\$ 6,000	\$ 48,000	N/A
Phase 1 Subtotal		1,408	N/A	N/A	N/A	27,500	N/A	\$ 17,809,500	\$ 29,521,000	\$ 978,000	\$ 987,000	\$ 1,965,000	\$ 1,400
2	Neighborhood Park	35	Pipe	6	in.	500	\$ 165	\$ 83,000	\$ 138,000	\$ 5,000	\$ 15,000	\$ 20,000	\$ 600
Phase 2 Subtotal		35	N/A	N/A	N/A	500	N/A	\$ 83,000	\$ 138,000	\$ 5,000	\$ 15,000	\$ 20,000	\$ 600
3	Five Bridges Development	223	Pipe	10	in.	500	\$ 260	\$ 130,000	\$ 215,000	\$ 7,000	\$ 90,000	\$ 97,000	\$ 400
Phase 3 Subtotal		223	N/A	N/A	N/A	500	N/A	\$ 130,000	\$ 215,000	\$ 7,000	\$ 90,000	\$ 97,000	\$ 400
Grand Total		1,666	N/A	N/A	N/A	28,500	N/A	\$ 18,022,500	\$ 29,874,000	\$ 990,000	\$ 1,092,000	\$ 2,082,000	\$ 1,200

Notes:

(1) Pipe lengths only include pipes up to connection point of each customer and does not include necessary internal pipes.

(2) Does not include costs for pressure regulating stations and pump stations.

(3) Capital Cost includes a total mark up of 165%, which includes a construction cost contingency (30%), engineering (10%), environmental and legal services (7.5%), and construction management (10%).

(6) Annual cost assumes a useful life of 15 years for pump stations and 50 years for pipelines at 3.0 percent interest.

(7) Recycled Water Treatment Cost (\$/AF): **400**

(8) Butterfield will be served with BCVWD Wells and not connected into the main system. The estimated recycled water demand is 864 afy.

Alternative 2: IPR - WWTP to WWTP Spreading Basin

Facility Type	Diam. (in)	Length (ft)	Unit Cost (\$)	Baseline Construction Cost (\$)	Capital Improvement Cost (\$)	Operations and Maintenance Cost (\$/yr)
Potable and Recycled Water Pipelines						
Conveyance Pipeline	16"	1,000	\$ 395	\$ 395,000	\$ 655,000	\$ 2,000
<i>Subtotal for Pipelines</i>				\$ 395,000	\$ 655,000	\$ 2,000
Recycled Water Pump Station						
PS (100-500 hp)	100	hp	\$ 3,000	\$ 300,000	\$ 497,000	\$ 32,000
<i>Subtotal for Pump Stations</i>				\$ 300,000	\$ 497,000	\$ 32,000
Basin Improvements						
Recharge Basin Maintenance (O&M)			\$	- \$	- \$	\$ 234,000
Site Improvements			\$	\$ 248,000	\$ 411,000	N/A
<i>Subtotal for Basin Improvements</i>			\$	\$ 248,000	\$ 411,000	\$ 234,000
Others						
Hydrogeological Study	1	study	\$ 150,000	\$ 150,000	\$ 150,000	N/A
Monitoring Wells and Lysimeters	3	well	\$ 300,000	\$ 900,000	\$ 1,492,000	\$ 15,000
<i>Subtotal for Others</i>			\$	\$ 1,050,000	\$ 1,642,000	\$ 15,000
TOTAL			\$	\$ 1,993,000	\$ 3,205,000	\$ 283,000
Net Yield (afy)			3,900			
Treatment Cost			\$1,560,000			
Amortized Value (\$/af)			\$139,000			
Amortized Value w/ O&M (\$/af)			\$1,982,000			
Unit Cost (\$/af)			\$508			

Notes:

(1) Site Improvements include piping, control building, valves, maintenance access ramp, and security.
 (2) Underflow is assumed for diluent blending
 (3) Hydrogeological study assumes model is developed.

Alternative 3: IPR - WWTP to North Spreading Basin

Facility Type	Diam. (in)	Length (ft)	Unit Cost (\$)	Baseline Construction Cost (\$)	Capital Improvement Cost (\$)	Operations and Maintenance Cost (\$)
Potable and Recycled Water Pipelines						
Conveyance Pipeline	16"	15,000	\$ 395	\$ 5,925,000	\$ 9,821,000	\$ 30,000
<i>Subtotal for Pipelines</i>				\$ 5,925,000	\$ 9,821,000	\$ 30,000
Water and Recycled Water Pump Station						
PS (500-1,000 hp)	500	hp	\$ 2,500	\$ 1,250,000	\$ 2,072,000	\$ 156,000
<i>Subtotal for Pump Stations</i>				\$ 1,250,000	\$ 2,072,000	\$ 156,000
Basin Improvements						
Land Lease (Recharge Basin)	15	acre	\$	- \$	- \$	\$ 98,000
Recharge Basin Maintenance (O&M)			\$	- \$	- \$	\$ 234,000
Site Improvements			\$	\$ 1,003,000	\$ 1,662,000	N/A
<i>Subtotal for Basin Improvements</i>			\$	\$ 1,003,000	\$ 1,662,000	\$ 332,000
Others						
Hydrogeological Study	1	study	\$ 150,000	\$ 150,000	\$ 150,000	N/A
Monitoring Wells and Lysimeters	3.0	well	\$ 300,000	\$ 900,000	\$ 1,492,000	\$ 15,000
<i>Subtotal for Others</i>			\$	\$ 1,050,000	\$ 1,642,000	\$ 15,000
TOTAL			\$	\$ 9,228,000	\$ 15,197,000	\$ 533,000
Net Yield (afy)			3,900			
Treatment Cost			\$1,560,000			
Amortized Value (\$/af)			\$572,000			
Amortized Value w/ O&M (\$/af)			\$2,665,000			
Unit Cost (\$/af)			\$683			

Notes:

(1) Site Improvements include earthwork, piping, control building, valves, maintenance access ramp, and security.
 (2) Underflow is assumed for diluent blending
 (3) Hydrogeological study assumes model is developed.

Alternative 4: IPR - WWTP to Five Bridges Spreading Basin

Facility Type	Diam. (in)	Length (ft)	Unit Cost (\$)	Baseline Construction Cost (\$)	Capital Improvement Cost (\$)	Operations and Maintenance Cost (\$)
Recycled Water Pipelines						
Conveyance Pipeline	16"	20,000	\$ 395	\$ 7,900,000	\$ 13,094,000	\$ 40,000
<i>Subtotal for Pipelines</i>				\$ 7,900,000	\$ 13,094,000	\$ 40,000
Water and Recycled Water Pump Station						
PS (500-1,000 hp)	300	hp	\$ 2,500	\$ 750,000	\$ 1,243,000	\$ 94,000
<i>Subtotal for Pump Stations</i>				\$ 750,000	\$ 1,243,000	\$ 94,000
Basin Improvements						
Recharge Basin Maintenance (O&M)				\$ -	\$ -	\$ 234,000
Site Improvements				\$ 1,927,000	\$ 3,194,000	N/A
<i>Subtotal for Basin Improvements</i>				\$ 1,927,000	\$ 3,194,000	\$ 234,000
Others						
Hydrogeological Study	1	study	\$ 150,000	\$ 150,000	\$ 150,000	N/A
Monitoring Wells and Lysimeters	3	well	\$ 300,000	\$ 900,000	\$ 1,492,000	\$ 15,000
404 Permitting	1		\$ 200,000	\$ 200,000	\$ 200,000	N/A
<i>Subtotal for Others</i>				\$ 3,250,000	\$ 1,842,000	\$ 15,000
TOTAL				\$ 11,827,000	\$ 19,373,000	\$ 383,000

Net Yield (afy)	3,900
Treatment Cost	\$1,560,000
Amortized Value (\$/af)	\$697,000
Amortized Value w/ O&M (\$/af)	\$2,640,000
Unit Cost (\$/af)	\$677

Notes:

(1) Site Improvements include earthwork, piping, control building, valves, maintenance access ramp, and security.

(2) Underflow is assumed for diluent blending

(3) Hydrogeological study assumes model is developed.

Alternative 5: IPR - WWTP to Five Bridges Spreading Basin and WWTP Basin

Facility Type	Diam. (in)	Length (ft)	Unit Cost (\$)	Baseline Construction Cost (\$)	Capital Improvement Cost (\$)	Operations and Maintenance Cost (\$)
Recycled Water Pipelines						
Pipeline	6"	7,000	\$ 165	\$ 1,155,000	\$ 1,914,000	\$ 6,000
Pipeline	10"	500	\$ 260	\$ 130,000	\$ 215,000	\$ 1,000
Pipeline	12"	500	\$ 305	\$ 153,000	\$ 254,000	\$ 1,000
Pipeline	16"	4,000	\$ 395	\$ 1,580,000	\$ 2,619,000	\$ 8,000
Pipeline	24"	18,000	\$ 565	\$ 10,170,000	\$ 16,857,000	\$ 51,000
<i>Subtotal for Pipelines</i>	<i>N/A</i>	<i>30,000</i>	<i>N/A</i>	<i>\$ 13,188,000</i>	<i>\$ 21,859,000</i>	<i>\$ 67,000</i>
Basin Improvements						
Five Bridges Recharge Basin Maintenance (O&M)				\$ -	\$ -	\$ 234,000
Five Bridges Site Improvements				\$ 1,927,000	\$ 3,194,000	N/A
WWTP Basin Maintenance (O&M)					\$	\$ 234,000
WWTP Site Improvements				\$ 248,000	\$ 411,000	N/A
<i>Subtotal for Basin Improvements</i>				<i>\$ 2,175,000</i>	<i>\$ 3,605,000</i>	<i>\$ 468,000</i>
Supply Facilities						
Treatment Plant Pump	1,400	hp	\$ 2,500	\$ 3,500,000	\$ 5,801,000	\$ 438,000
Well R-1 Equip	1	well	\$ 1,000,000	\$ 1,000,000	\$ 1,658,000	N/A
Well R-1 Forebay	1	MG	\$ 2,500,000	\$ 2,500,000	\$ 4,144,000	\$ 25,000
Well R-1 Transmission	12"	2,500	\$ 305	\$ 763,000	\$ 1,265,000	\$ 4,000
<i>Subtotal for Non-Potable Reuse Facilities</i>				<i>\$ 7,763,000</i>	<i>\$ 12,868,000</i>	<i>\$ 467,000</i>
Others						
Hydrogeological Study	1	study	\$ 150,000	\$ 150,000	\$ 150,000	N/A
Monitoring Wells and Lysimeters	6	well	\$ 300,000	\$ 1,800,000	\$ 2,984,000	\$ 30,000
404 Permitting	1		\$ 200,000	\$ 200,000	\$ 200,000	N/A
<i>Subtotal for Others</i>				<i>\$ 2,150,000</i>	<i>\$ 3,334,000</i>	<i>\$ 30,000</i>
TOTAL				\$ 25,276,000	\$ 41,666,000	\$ 1,032,000

Net Yield (afy)	5,800
Treatment Cost	\$2,320,000
Amortized Value (\$/af)	\$1,188,000
Amortized Value w/ O&M (\$/af)	\$4,540,000
Unit Cost (\$/af)	\$783

Notes:

- (1) Site Improvements include earthwork, piping, control building, valves, maintenance access ramp, and security.
- (2) Underflow is assumed for diluent blending
- (3) Hydrogeological study assumes model is developed.

Concept 6: IPR - WWTP to Five Bridges Spreading Basin and North Basin

Facility Type	Diam. (in)	Length (ft)	Unit Cost (\$)	Baseline Construction Cost (\$)	Capital Improvement Cost (\$)	Operations and Maintenance Cost (\$)
Recycled Water Pipelines						
Pipeline	6"	7,000	\$ 165	\$ 1,155,000	\$ 1,914,000	\$ 6,000
Pipeline	10"	500	\$ 260	\$ 130,000	\$ 215,000	\$ 500
Pipeline	12"	500	\$ 305	\$ 153,000	\$ 254,000	\$ 1,000
Pipeline	16"	10,500	\$ 395	\$ 4,148,000	\$ 6,875,000	\$ 20,500
Pipeline	24"	18,000	\$ 565	\$ 10,170,000	\$ 16,857,000	\$ 51,000
<i>Subtotal for Pipelines</i>	<i>N/A</i>	<i>36,500</i>	<i>N/A</i>	<i>\$ 15,756,000</i>	<i>\$ 26,115,000</i>	<i>\$ 79,000</i>
Basin Improvements						
Five Bridges Recharge Basin Maintenance (O&M)			\$	- \$	- \$	\$ 234,000
Five Bridges Site Improvements			\$	\$ 1,927,000	\$ 3,194,000	N/A
North Basin Land Lease	9.6	acre	\$ -	\$ -	\$ -	\$ 98,000
North Basin Maintenance (O&M)			\$	- \$	- \$	\$ 348,000
North Basin Site Improvements			\$	\$ 2,930,000	\$ 4,856,000	N/A
<i>Subtotal for Basin Improvements</i>			\$	<i>\$ 4,857,000</i>	<i>\$ 8,050,000</i>	<i>\$ 680,000</i>
Supply Facilities						
Treatment Plant Pump	1,400	hp	\$ 2,500	\$ 3,500,000	\$ 5,801,000	\$ 438,000
Well R-1 Equip	1		\$ 1,000,000	\$ 1,000,000	\$ 1,658,000	N/A
Well R-1 Forebay	1	MG	\$ 2,500,000	\$ 2,500,000	\$ 4,144,000	\$ 25,000
Well R-1 Transmission	12"	2,500	\$ 305	\$ 763,000	\$ 1,265,000	\$ 4,000
<i>Subtotal for Non-Potable Reuse Facilities</i>			\$	<i>\$ 7,763,000</i>	<i>\$ 12,868,000</i>	<i>\$ 467,000</i>
Others						
Hydrogeological Study	1	study	\$ 150,000	\$ 150,000	\$ 249,000	N/A
Monitoring Wells and Lysimeters	3	well	\$ 300,000	\$ 900,000	\$ 1,492,000	\$ 15,000
404 Permitting	1		\$ 200,000	\$ 200,000	\$ 200,000	N/A
<i>Subtotal for Others</i>			\$	<i>\$ 1,250,000</i>	<i>\$ 1,942,000</i>	<i>\$ 15,000</i>
TOTAL			\$	\$ 29,626,000	\$ 48,974,000	\$ 1,241,000

2040 Net Yield (afy)	5,800
Treatment Cost	\$2,320,000
Amortized Value (\$/af)	\$1,426,000
Amortized Value w/ O&M (\$/af)	\$4,987,000
Unit Cost (\$/af)	\$860

Notes:

- (1) Site Improvements include earthwork, piping, control building, valves, maintenance access ramp, and security.
- (2) Underflow is assumed for diluent blending
- (3) Hydrogeological study assumes model is developed.



San Gorgonio Pass Water Agency

A California State Water Project Contractor
1210 Beaumont Avenue • Beaumont, CA 92223
Phone (951) 845-2577 • Fax (951) 845-0281

April 19, 2017

President:

John Jeter

Vice President:

Bill Dickson

Treasurer:

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Subject: Notice of Election to Jointly Form and Become a Groundwater Sustainability Agency in the San Gorgonio Pass Subbasin

Dear Mr. Nordberg:

Pursuant to California Water Code Section 10723.8 of the Sustainable Groundwater Management Act (SGMA), the San Gorgonio Pass Water Agency (SGPWA), on behalf of itself, the City of Banning (Banning), Cabazon Water District (CWD), and the Banning Heights Mutual Water Company (BHMWC), hereby provides notice to the Department of Water Resources (DWR) regarding the joint formation of the Groundwater Sustainability Agency (GSA) referred to as the San Gorgonio Pass GSA (“SGP-GSA”) pursuant to a Memorandum of Agreement (MOA) as expressly authorized by SGMA Section 10723.6. A copy of the MOA is included as **Attachment A**. As further described below and as set forth in the documentation and electronic files submitted herewith, the boundaries of the SGP-GSA cover almost the entire portion of the San Gorgonio Pass Subbasin (Basin), designated by DWR as Subbasin No. 7-21.04 of the Coachella Valley Groundwater Basin in Riverside County. Also described below, the remaining portions of the Basin subject to SGMA are being covered by two other GSAs. Pursuant to SGMA, Banning, CWD, BHMWC, and SGPWA intend to ensure sustainable groundwater management within the boundaries of the SGP-GSA and coordinated groundwater management throughout the Basin.

The joint formation of the SGP-GSA will ensure that the entire portion of the Basin that is subject to SGMA is covered by one or more GSAs. As reflected in the MOA and information submitted herewith, the boundaries of the SGP-GSA include the entire Basin except: (i) that portion of the Basin covered by the Desert Water Agency GSA (the “DWA-GSA”), wherein DWA is the exclusive GSA pursuant to SGMA Section 10723(c)(1)(C); (ii) that portion of the Basin to be covered by the GSA that is being established by SGPWA and the Mission Springs Water District (MSWD) for an approximately one-square mile of the Basin (the “Verbenia-GSA”); and (iii) that portion of the Basin that is subject to the Beaumont Basin adjudication and Judgment

in the case referred to as *San Timoteo Watershed Management Authority v. City of Banning, et al.*, Riverside County Superior Court Case No. RIC 389197, which pursuant to SGMA Section 10720.8(a)(1) generally is not subject to the requirements of SGMA. Notably, the boundaries of the SGP-GSA, the DWA-GSA, and the Verbenia-GSA will not overlap, and as set forth in the MOA the three GSAs will coordinate and cooperate with each other in preparing and implementing one or more Groundwater Sustainability Plans to carry out the policy, purposes, and requirements of SGMA to sustainably manage the Basin. To this end, the parties to the MOA are particularly thankful for the cooperative and ongoing voluntary efforts of the Morongo Band of Mission Indians to discuss and plan for sustainable groundwater management throughout the tribal lands within the Basin.

As indicated above, this notice pertains specifically to the joint formation of the SGP-GSA, the members of which are Banning, CWD, BHMWC, and SGPWA. Each of these entities has followed the requirements of SGMA and other applicable law to adopt a Resolution and enter the MOA to jointly form the SGP-GSA.

Boundaries of the SGP-GSA. In accordance with guidance materials published by DWR, various GIS shape files are being submitted electronically with this notice to depict (i) the respective service area boundaries of Banning, CWD, BHMWC, and SGPWA, (ii) the portion of the Basin to be covered and managed within the boundaries of the SGP-GSA, and (iii) the portions of the Basin to be covered and managed by GSAs formed and to be formed in the Basin by other agencies, as further described in the MOA. In addition to the GIS shape files submitted herewith, the respective service area boundaries of Banning, CWD, BHMWC, and SGPWA are depicted in the materials included as **Attachment B** hereto. The materials in **Attachment B** also depict (i) the overall boundaries of the Basin, (ii) the portion of the Basin that is covered by the SGP-GSA, and (iii) the boundaries of the SGP-GSA relative to the boundaries of the DWA-GSA and the Verbenia-GSA that is being established. As noted above, the collective boundaries of the SGP-GSA, the DWA-GSA, and the Verbenia-GSA will cover the entire portion of the Basin that is subject to SGMA.

City of Banning Process. Banning is a municipal agency, organized and operating under the Banning Municipal Code. Banning overlies a portion of the Basin and has water supply, water management, and land use responsibilities within its jurisdictional boundaries, and is a local agency as defined by SGMA Section 10721(n). In accordance with SGMA Section 10723(b) and Government Code Section 6066, Banning caused notices of its public hearing to be published in a newspaper of general circulation regarding Banning's consideration to approve a Resolution to enter the MOA and jointly form the SGP-GSA as specified in the MOA. Proof of the notices published by Banning are included herewith in **Attachment C**. On March 28, 2017, the Banning City Council held its public hearing. No written comments were received prior to the public hearing, and no written comments or objections were received at the public hearing. Following the public hearing, the Banning City Council adopted Resolution No. 2017-35, electing to enter the MOA and jointly form and establish the SGP-GSA as specified in the MOA. A copy of Banning's Resolution No. 2017-35 is included herewith in **Attachment C**.

CWD Process. CWD is a County Water District organized and operating under the County Water District Law, California Water Code section 30000 et seq. CWD overlies a portion of the

Basin and has water supply and water management responsibilities within its jurisdictional boundaries, and is a local agency as defined by SGMA Section 10721(n). In accordance with SGMA Section 10723(b) and Government Code Section 6066, CWD caused notices of its public hearing to be published in a newspaper of general circulation regarding CWD's consideration to approve a Resolution to enter the MOA and jointly form the SGP-GSA as specified in the MOA. Proof of the notices published by CWD are included herewith in **Attachment D**. On March 21, 2017, the CWD Board of Directors held its public hearing. No written comments were received prior to the public hearing, and no written comments or objections were received at the public hearing. Following the public hearing, the CWD Board of Directors adopted Resolution No. 01-2017, electing to enter the MOA and jointly form and establish the SGP-GSA as specified in the MOA. A copy of CWD's Resolution No. 01-2017 is included herewith in **Attachment D**.

BHMWC Process. BHMWC is a mutual water company organized and operating under the BHMWC Articles of Incorporation and Bylaws. BHMWC overlies a portion of the Basin and has water supply and water management responsibilities within its water service boundaries. BHMWC is not a local agency as defined by SGMA Section 10721(n), however BHMWC is authorized by SGMA Section 10723.6(b) to participate in the SGP-GSA through the MOA. On March 13, 2017, BHMWC conducted a general business meeting during which it duly considered and approved a Resolution to enter the MOA and jointly form the SGP-GSA as specified in the MOA. A copy of BHMWC's Resolution No. 2017-01 is included herewith in **Attachment E**.

SGPWA Process. SGPWA is a special act agency of the State of California, organized and operating under the San Gorgonio Pass Water Agency Act, California Water Code Appendix, Chapter 101. The boundaries of SGPWA encompass virtually the entire Basin. SGPWA has water supply and water management responsibilities within its jurisdictional boundaries, and is a local agency as defined by SGMA Section 10721(n). In accordance with SGMA Section 10723(b) and Government Code Section 6066, SGPWA caused notices of its public hearing to be published in a newspaper of general circulation regarding SGPWA's consideration to approve a Resolution to enter the MOA and jointly form the SGP-GSA as specified in the MOA. Proof of the notices published by SGPWA are included herewith in **Attachment F**. On March 20, 2017, the SGPWA Board of Directors held its public hearing. No written comments were received prior to the public hearing, and no written comments or objections were received at the public hearing. Following the public hearing, the SGPWA Board of Directors adopted Resolution No. 2017-02, electing to enter the MOA and jointly form and establish the SGP-GSA as specified in the MOA. A copy of SGPWA's Resolution No. 2017-02 is included herewith in **Attachment F**.

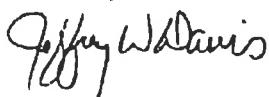
The SGP-GSA is not proposing any new bylaws, ordinances, or other authorities at this time in connection with the formation of the SGP-GSA.

Pursuant to SGMA Section 10723.8, an initial list of interested parties developed pursuant to SGMA Section 10723.2 and an explanation of how their interests will be considered in the development and operation of the SGP-GSA and the development and implementation of a Groundwater Sustainability Plan that will be adopted by the SGP-GSA is provided in **Attachment G**. As specifically provided in the MOA, the parties to the SGP-GSA and other

parties to the MOA have agreed to work together in ensuring public outreach and involvement of the public and other interested stakeholders throughout the SGMA process, including but not limited to all beneficial uses and users of groundwater, and those responsible for implementing Groundwater Sustainability Plans in the Basin, as provided in SGMA Section 10723.2. The parties to the SGP-GSA have been actively engaged in SGMA-related discussions with each other and with many of the stakeholders and entities listed in Attachment G, and will continue to consider and involve the interests of all entities and stakeholders to the extent practicable, including those already identified and others that may be identified in the future, by establishing a collaborative, open, and inclusive process for implementing SGMA throughout the Basin. Among other things, in accordance with SGMA Section 10723.4, the SGP-GSA will establish and maintain a list of persons interested in receiving notices regarding the preparation of any Groundwater Sustainability Plan for the Basin, meeting announcements, and the availability of draft plans, maps, and other relevant documents.

If you have any questions or require additional information, please contact me immediately at (951) 845-2577.

Sincerely,



Jeff Davis
General Manager

Attachments A-G
Electronic Submittals: GIS Shape Files

cc: John Covington, Morongo Band of Mission Indians (via email)
Art Vela, City of Banning (via email)
Perry Gerdes, City of Banning (via email)
Calvin Louie, Cabazon Water District (via email)
Ellie Lemus, Cabazon Water District (via email)
Julie Hutchinson, Banning Heights Mutual Water Company (via email)
Larry Ellis, Banning Heights Mutual Water Company (via email)
Mark Krause, Desert Water Agency (via email)
Aaron Carlsson, Desert Water Agency (via email)
Arden Wallum, Mission Springs Water District (via email)
Stan Houghton, High Valleys Water District (via email)

Notice of Election to Jointly Form and Become a
Groundwater Sustainability Agency in the San
Gorgonio Pass Subbasin

ATTACHMENT A

MEMORANDUM OF AGREEMENT TO FORM A GROUNDWATER SUSTAINABILITY AGENCY FOR A PORTION OF THE SAN GORGONIO PASS SUBBASIN AND TO COORDINATE WITH OTHER GROUNDWATER SUSTAINABILITY AGENCIES

This 2017 Memorandum of Agreement (MOA) is entered into by and among Cabazon Water District (CWD), City of Banning (Banning), Banning Heights Mutual Water Company (BHMWC), San Gorgonio Pass Water Agency (SGPWA), Mission Springs Water District (MSWD), and Desert Water Agency (DWA), which may be referred to herein individually as a "Party" and collectively as the "Parties."

Pursuant to the Sustainable Groundwater Management Act (SGMA) and as further set forth herein, the purposes of this MOA are to form a Groundwater Sustainability Agency (GSA) for a portion of the San Gorgonio Pass Subbasin, as described in greater detail below (Basin), the members of which GSA shall be CWD, Banning, BHMWC, and SGPWA (herein, the SGP-GSA), and to establish that the SGP-GSA will coordinate and cooperate with other GSAs that already exist and will be formed in the Basin.

WHEREAS, on September 16, 2014, Governor Jerry Brown signed into law Senate Bills 1168 and 1319, and Assembly Bill 1739, collectively known as the Sustainable Groundwater Management Act (SGMA), codified in certain provisions of the California Government Code, commencing with Section 65350.5, and in Part 2.74 of Division 6 of the California Water Code, commencing with Section 10720; and

WHEREAS, SGMA went into effect on January 1, 2015; and

WHEREAS, various clarifying amendments to SGMA were signed into law in 2015, including Senate Bills 13 and 226, and Assembly Bills 617 and 939, allowing, among other things, mutual water companies and water corporations regulated by the Public Utilities Commission to participate in a GSA through a memorandum of agreement or other legal agreement; and

WHEREAS, the San Gorgonio Pass Subbasin (Basin), as further depicted in **Exhibit A** to this MOA, is identified by the California Department of Water Resources (DWR) Bulletin 118 as Subbasin No. 7-21.04 of the Coachella Valley Groundwater Basin, and is designated by DWR as medium priority, and therefore, except as provided by SGMA, the Basin is subject to the requirements of SGMA; and

WHEREAS, the Parties recognize and agree that a portion of the Basin (the "Adjudicated Area") is subject to the Beaumont Basin adjudication and Judgment in the case referred to as *San Timoteo Watershed Management Authority v. City of Banning, et al.*, Riverside County Superior Court Case No. RIC 389197, and that pursuant to SGMA Section 10720.8(a)(1), said portion of the Basin generally is not subject to the requirements of SGMA and will not be managed by the SGP-GSA; and

WHEREAS, SGMA Section 10720.7 requires the Basin, as a medium priority basin which is not designated by DWR as being subject to critical conditions of overdraft, to be managed by a Groundwater Sustainability Plan (GSP) or coordinated GSPs by January 31, 2022; and

WHEREAS, SGMA Section 10727(b) authorizes (1) a single GSP covering the entire Basin developed and implemented by one GSA, (2) a single GSP covering the entire Basin developed and

implemented by multiple GSAs, or (3) multiple GSPs developed and implemented by multiple GSAs and coordinated pursuant to a single coordination agreement that covers the entire Basin; and

WHEREAS, SGMA Section 10735.2 requires the formation of a GSA or multiple GSAs for the Basin by June 30, 2017; and

WHEREAS, SGMA Section 10723.6(a) authorizes a combination of local agencies to form a GSA pursuant to a joint powers agreement, a memorandum of agreement, or other legal agreement, and SGMA Section 10723.6(b) authorizes a water corporation regulated by the Public Utilities Commission or a mutual water company to participate in a GSA through a memorandum of agreement or other legal agreement; and

WHEREAS, for purposes of forming the SGP-GSA, as further depicted in **Exhibit B** to this MOA, CWD, Banning, and SGPWA are local agencies as defined by SGMA, and BHMWC is a mutual water company, wherein each overlies at least a portion of the Basin and each has respective water supply, water management, and/or land use responsibilities within the Basin, and thus each is authorized by SGMA to become part of the SGP-GSA; and

WHEREAS, pursuant to SGMA Section 10723(c)(1)(C), DWA has been established as the exclusive GSA for a certain portion of the Basin (herein, the DWA-GSA), as further specified and depicted in **Exhibit C** to this MOA; and

WHEREAS, on or about September 28, 2016, MSWD filed an amended notice of intent to be a GSA for an approximately one-square mile area in the northeastern portion of the Basin that lies within the service areas of MSWD and SGPWA, which one-square mile area is further specified and depicted in **Exhibit D** to this MOA and is referred to herein as the “Verbenia Area”; and

WHEREAS, on or about January 10, 2017, SGPWA also filed a notice of intent to be a GSA for the Verbenia Area, as further specified and depicted in **Exhibit D** to this MOA; and

WHEREAS, on or about January 13, 2017, DWR designated the Verbenia Area to be in overlap for purposes of the competing GSA notices filed by MSWD and SGPWA, and thus MSWD and SGPWA are working together to establish a separate GSA for the Verbenia Area (herein, the Verbenia-GSA); and

WHEREAS, in accordance with the terms of this MOA, and in furtherance of the shared intent of the Parties to maximize funding opportunities for the Basin and avoid potential intervention in the Basin by the State Water Resources Control Board, the Parties agree that the SGP-GSA formed by this MOA will cover the entire Basin except (A) that portion of the Basin covered by the DWA-GSA wherein DWA is the exclusive GSA, (B) that portion of the Basin to be covered by the Verbenia-GSA to be established by MSWD and SGPWA, and (C) the Adjudicated Area portion of the Basin, and the Parties mutually desire and intend that the SGP-GSA, the DWA-GSA, and the Verbenia-GSA will cooperate and coordinate in subsequently preparing and implementing one or more GSPs for sustainable management of the Basin; and

WHEREAS, the Parties mutually desire and intend to work with local stakeholders and interested entities in the Basin that are not Parties to this MOA, including but not limited to the Morongo Band of Mission Indians (MBMI), the County of Riverside, High Valleys Water District,

overlying landowners, and others, and as further specified in this MOA, to carry out the policy, purposes, and requirements of SGMA in the Basin; and

WHEREAS, in accordance with SGMA Section 10720.3 and other applicable law, the Parties mutually understand and agree that nothing in SGMA and nothing in this MOA grants or confers any new or additional authority, discretion, or jurisdiction to any of the Parties over any Tribal lands or activities of the MBMI, and that any ongoing or continued participation by MBMI in relation to this MOA or the Parties' implementation of SGMA in the Basin is completely voluntary on the part of MBMI.

NOW, THEREFORE, in consideration of the promises, terms, conditions, and covenants contained herein, it is mutually understood and agreed as follows:

I. Incorporation of Recitals

The Recitals stated above are incorporated herein by reference.

II. Purposes

The purposes of this MOA are as follows:

- A. To form the SGP-GSA for a portion of the Basin as specified herein and as depicted in **Exhibit B** to this MOA pursuant to applicable provisions and requirements of SGMA, including but not limited to SGMA Sections 10723 and 10723.6; and
- B. To establish initial terms for the SGP-GSA, the DWA-GSA, and the Verbenia-GSA to cooperate and coordinate with each other in preparing and implementing one or more GSPs for the Basin and carrying out the policy, purposes, and requirements of SGMA in the Basin.

III. Approval of MOA and Formation of the SGP-GSA

Approval of this MOA and formation of the SGP-GSA shall be accomplished as follows:

- A. CWD, Banning, and SGPWA each will hold its own noticed public hearing pursuant to SGMA Section 10723(b) and Government Code Section 6066 and at such hearing will consider approval of a Resolution by its governing board to enter this MOA and jointly form the SGP-GSA as specified in this MOA;
- B. BHMWC will conduct an official meeting in accordance with any articles of incorporation, bylaws, or other laws applicable to BHMWC and at such meeting will consider approval of a Resolution by its governing board to enter this MOA and jointly form the SGP-GSA as specified in this MOA;
- C. DWA and MSWD each will hold its own regular or special meeting and at such meeting will consider approval of a Resolution by its governing board to enter this MOA;

D. Upon the foregoing approvals by CWD, Banning, BHMWC, and SGPWA, there shall be established the San Gorgonio Pass Subbasin Groundwater Sustainability Agency (SGP-GSA), the members of which shall be CWD, Banning, BHMWC, and SGPWA as provided in this MOA.

IV. Definitions

The following terms, whether used in the singular or plural, and when used with initial capitalization, shall have the meanings specified herein. The Parties agree that any definitions set forth herein are intended to be consistent with SGMA, and in the event of any discrepancy between a defined term in this MOA and a defined term in SGMA, the terms of SGMA shall control.

- A. **Adjudicated Area** refers to that portion of the Basin that is subject to the Beaumont Basin adjudication and Judgment in the case referred to as *San Timoteo Watershed Management Authority v. City of Banning, et al.*, Riverside County Superior Court Case No. RIC 389197.
- B. **Basin** refers to the San Gorgonio Pass Subbasin, designated by the California Department of Water Resources Bulletin 118 as Subbasin No. 7-21.04, as further specified and depicted in **Exhibit A** to this MOA.
- C. **Banning** means the City of Banning.
- D. **BHMWC** means the Banning Heights Mutual Water Company.
- E. **CWD** means the Cabazon Water District.
- F. **DWA** means the Desert Water Agency.
- G. **DWR** means the California Department of Water Resources.
- H. **DWA-GSA** refers to the GSA that has been established for a certain portion of the Basin pursuant to SGMA Section 10723(c)(1)(C), wherein DWA has been designated as the exclusive GSA, as further specified and depicted in **Exhibit C** to this MOA.
- I. **GSA** means Groundwater Sustainability Agency, as defined by SGMA.
- J. **GSP** means Groundwater Sustainability Plan, as defined by SGMA.
- K. **MBMI** means the Morongo Band of Mission Indians.
- L. **Memorandum of Agreement** or **MOA** refers to this Memorandum of Agreement.
- M. **MSWD** means the Mission Springs Water District.
- N. **Party or Parties** refers individually or collectively to Cabazon Water District, City of Banning, Banning Heights Mutual Water Company, Mission Springs Water District, San Gorgonio Pass Water Agency, and Desert Water Agency, as signatories to this MOA.

- O. **SGMA** refers to the Sustainable Groundwater Management Act.
- P. **SGP-GSA** refers to the San Gorgonio Pass Subbasin GSA formed under this MOA, the members of which GSA are CWD, Banning, BHMWC, and SGPWA.
- Q. **SGPWA** means the San Gorgonio Pass Water Agency.
- R. **Verbenia-GSA** refers to a GSA to be formed by MSWD and SGPWA for an approximately one-square mile area in the northeastern portion of the Basin that lies within the service areas of MSWD and SGPWA, as further specified and depicted in **Exhibit D** to this MOA.

V. **Boundaries of GSAs**

- A. The boundaries of the SGP-GSA shall be the entire Basin except (A) that portion of the Basin covered by the DWA-GSA wherein DWA is the exclusive GSA, as further specified and depicted in **Exhibit C** to this MOA, (B) that portion of the Basin to be covered by the Verbenia-GSA to be established by MSWD and SGPWA, as further specified and depicted in **Exhibit D** to this MOA, and (C) that portion of the Basin constituting the Adjudicated Area.
- B. The boundaries of DWA-GSA are that portion of the Basin within which DWA is the exclusive GSA pursuant to SGMA Section 10723(c)(1)(C), as further specified and depicted in **Exhibit C** to this MOA.
- C. The boundaries of the Verbenia-GSA are the approximately one-square mile area in the northeastern portion of the Basin that lies within the service areas of MSWD and SGPWA, as further specified and depicted in **Exhibit D** to this MOA.
- D. The Parties understand and agree that pursuant to SGMA Section 10720.8, the portion of the Basin which is subject to the Beaumont Basin adjudication and Judgment in the case referred to as *San Timoteo Watershed Management Authority v. City of Banning, et al.*, Riverside County Superior Court Case No. RIC 389197, generally is not subject to the requirements of SGMA.
- E. The Parties understand and agree in accordance with SGMA Section 10720.3 and other applicable law that nothing in SGMA and nothing in this MOA grants or confers any new or additional authority, discretion, or jurisdiction to any of the Parties over any Tribal lands or activities of the MBMI, and that any ongoing or continued participation by MBMI in relation to this MOA or the Parties' implementation of SGMA in the Basin is completely voluntary on the part of MBMI.

VI. **Coordination and Cooperation**

- A. Continued Cooperation. The Parties to this MOA will continue to meet, confer, coordinate, and collaborate to discuss and develop technical, managerial, financial, and other criteria and procedures for the preparation, governance, and implementation of a GSP or coordinated GSPs in the Basin and to carry out the policy, purposes, and requirements of SGMA in the Basin.

- B. Points of Contact. Each Party shall designate a principal contact person for that Party, who may be changed from time to time at the sole discretion of the designating Party. The principal contact person for each Party shall be responsible for coordinating with the principal contact persons for the other Parties in scheduling meetings and other activities under this MOA.
- C. Management Areas. The Parties acknowledge that SGMA, and provisions of the SGMA regulations promulgated by DWR, including but not limited to Section 354.20 (23 C.C.R. § 354.20), authorize the establishment of management areas for the development and implementation of sustainable groundwater management within the Basin, and accordingly the Parties acknowledge and agree that the establishment of management areas within the Basin is a governance alternative that the Parties may explore.

VII. Roles and Responsibilities

- A. The Parties agree to jointly establish their roles and responsibilities for implementing a GSP or coordinated GSPs for the Basin in accordance with SGMA.
- B. The Parties agree to work in good faith and coordinate all activities to carry out the purposes of this MOA in implementing the policy, purposes, and requirements of SGMA in the Basin.
- C. CWD, Banning, BHMWC, and SGPWA, as members of the SGP-GSA, shall coordinate with each other to cause all applicable noticing and submission of required information to DWR regarding formation of the SGP-GSA.
- D. SGPWA shall continue to undertake ongoing CASGEM reporting activities in the Basin as provided by terms outside of this MOA.
- E. As provided in this MOA, the Parties will continue to meet, confer, coordinate, and collaborate to discuss and develop governance, management, technical, financial, and other matters, including respective roles and responsibilities for activities such as, but not limited to, the following:
 - i. Modeling;
 - ii. Metering;
 - iii. Monitoring;
 - iv. Hiring consultants;
 - v. Developing and maintaining list of interested persons under SGMA Section 10723.4;
 - vi. Budgeting; and
 - vii. Other initial tasks as determined by the Parties.

VIII. Funding and Budgeting

The Parties agree to cooperate and coordinate in pursuing state and/or federal grant and loan funding opportunities that may apply to carrying out SGMA in the Basin. The Parties shall mutually develop reasonable budgets and cost sharing agreements or arrangements for work to be undertaken in carrying out SGMA in the Basin.

IX. Stakeholder Access

- A. The Parties agree to work together in ensuring public outreach and involvement of the public and other interested stakeholders throughout the SGMA process, including but not limited to all beneficial uses and users of groundwater as provided in SGMA Section 10723.2.
- B. The Parties acknowledge, agree, and desire that the preparation, adoption, and implementation of one or more GSPs for the Basin, and the ongoing process of ensuring compliance with the requirements of SGMA in the Basin, will involve close coordination and cooperation with the Morongo Band of Mission Indians.

X. Term, Termination, and Withdrawal

- A. Term. This MOA shall continue and remain in effect unless and until terminated by the unanimous written consent of the Parties, or as otherwise provided in this MOA or as authorized by law.
- B. Withdrawal. Any Party may decide, in its sole discretion, to withdraw from this MOA by providing ninety (90) days written notice to the other Parties. A Party that withdraws from this MOA shall remain obligated to pay its share of costs and expenses incurred or accrued under this MOA and any related cost sharing agreement or arrangement up to the date the Party provides its notice of withdrawal as provided herein. Withdrawal by a Party shall not cause or require the termination of this MOA or the existence of the SGP-GSA with respect to the non-withdrawing Parties.
 1. In the event of withdrawal by BHMWC from this MOA and the SGP-GSA, CWD, Banning, and SGPWA, as the local agency parties to the SGP-GSA, shall meet and confer regarding: (i) whether the SGP-GSA wishes to retain its GSA status over the affected portion of the Basin; (ii) whether one or more of the local agency parties of the SGP-GSA wishes to retain GSA status over the affected portion of the Basin; or (iii) whether to address the GSA issues in a different manner. Any resolution of such and other GSA issues shall be undertaken in a manner that satisfies all requirements of SGMA and DWR, including any requirement to file new GSA notices.
 2. In the event of withdrawal by CWD, Banning, or SGPWA from this MOA and the SGP-GSA, said three local agency parties shall meet and confer regarding whether the withdrawing local agency party wishes to seek GSA status for a portion of the Basin underlying the service area or management area of the withdrawing party. Said three local agency parties also shall meet and confer regarding: (i) whether the SGP-GSA, or one or both of the non-withdrawing

local agency parties, wishes to retain GSA status over the affected portion of the Basin; (ii) whether to enter a co-GSA management or other arrangement with the withdrawing party; or (iii) whether to address the GSA issues in a different manner. Any resolution of such and other GSA issues shall be undertaken in a manner that satisfies all requirements of SGMA and DWR, including any requirement to file new GSA notices.

3. Any decision by DWA or MSWD not to execute this MOA, or any decision by DWA or MSWD to withdraw after executing this MOA shall not cause or require the termination of this MOA and shall not affect the formation or continued existence of the SGP-GSA.

XI. Notice Provisions

All notices required by this MOA shall be made in writing and delivered to the respective representatives of the Parties at their respective addresses as follows:

Banning Heights Mutual Water Company
President
7091 Bluff Street
Banning, CA 92220, Fax: 951-849-6068

Desert Water Agency
General Manager
1200 S Gene Autry Trail
Palm Springs, CA 92264, Fax: 760-325-6505

City of Banning
City Manager
99 East Ramsey Street
Banning, CA 92220, Fax: 951-922-3128

San Gorgonio Pass Water Agency
General Manager
1210 Beaumont Avenue
Beaumont, CA 92223, Fax: 951-845-0281

Cabazon Water District
General Manager
14618 Broadway
P.O. Box 297
Cabazon, CA 92230, Fax: 951-849-2519

Mission Springs Water District
General Manager
66575 Second Street
Desert Hot Springs, CA 92240, Fax: 760-329-2482

Any Party may change the address to which notices are to be given under this MOA by providing the other Parties with written notice of such change at least fifteen (15) calendar days prior to the effective date of the change. All notices shall be effective upon receipt and shall be deemed received upon confirmed personal service, confirmed facsimile delivery, confirmed courier service, or on the fifth (5th) calendar day following deposit of the notice in registered first class mail.

XII. General Terms

- A. Amendments. Amendments to this MOA require unanimous written consent of all Parties and approval by the Parties' respective governing boards; provided, however, that amendments to this MOA pertaining to the SGP-GSA only require unanimous written consent and board approval of the members of the SGP-GSA.
- B. Successors and Assigns. The terms of this MOA shall be binding upon all successors in interest and assigns of each Party; provided, however, that no Party shall assign its

rights or obligations under this MOA without the signed written consent of all other Parties to this MOA.

- C. Waiver. No waiver of any provision of this MOA by any Party shall be construed as a further or continuing waiver of such provision or any other provision of this MOA by the waiving Party or any other Party.
- D. Authorized Representatives. Each person executing this MOA on behalf of a Party hereto affirmatively represents that such person has the requisite authority to sign this MOA on behalf of the respective Party.
- E. Exemption from CEQA. The Parties recognize and agree that, pursuant to SGMA Section 10728.6 and Public Resources Code Section 21065, neither this MOA nor the preparation or adoption of a GSP constitutes a “project” or approval of a project under the California Environmental Quality Act (CEQA) or the State CEQA Guidelines, and therefore this MOA is expressly exempt from CEQA review.
- F. Governing Law and Venue. This MOA shall be governed by and construed in accordance with the laws of the State of California. Any suit, action, or proceeding brought under the scope of this MOA shall be brought and maintained to the extent allowed by law in the County of Riverside, California.
- G. Attorney's Fees, Costs, and Expenses. In the event of a dispute among any or all of the Parties arising under this MOA, each Party shall assume and be responsible for its own attorney's fees, costs, and expenses.
- H. Entire Agreement/Integration. This MOA constitutes the entire agreement among the Parties regarding the specific provisions of this MOA, and the Parties hereto have made no agreements, representations or warranties relating to the specific provisions of this MOA which are not set forth herein.
- I. Construction and Interpretation. The Parties agree and acknowledge that this MOA has been developed through a negotiated process among the Parties, and that each Party has had a full and fair opportunity to review the terms of this MOA with the advice of its own legal counsel and to revise the terms of this MOA, such that each Party constitutes a drafting Party to this MOA. Consequently, the Parties understand and agree that no rule of construction shall be applied to resolve any ambiguities against any particular Party as the drafting Party in construing or interpreting this MOA.
- J. Force Majeure. No Party shall be liable for the consequences of any unforeseeable force majeure event that (1) is beyond its reasonable control, (2) is not caused by the fault or negligence of such Party, (3) causes such Party to be unable to perform its obligations under this MOA, and (4) cannot be overcome by the exercise of due diligence. In the event of the occurrence of a force majeure event, the Party unable to perform shall promptly notify the other Parties in writing to the extent practicable. It shall further pursue its best efforts to resume its obligations under this MOA as quickly as possible and shall suspend performance only for such period of time as is necessary as a result of the force majeure event.

- K. Execution in Counterparts. This MOA may be executed in counterparts, each of which shall be deemed an original and all of which when taken together shall constitute one and the same instrument.
- L. No Third Party Beneficiaries. This MOA is not intended, and will not be construed, to confer a benefit or create any right on a third party or the power or right of any third party to bring an action to enforce any of the terms of this MOA.
- M. Timing and Captions. Any provision of this MOA referencing a time, number of days, or period for performance shall be measured in calendar days. The captions of the various articles, sections, and paragraphs of this MOA are for convenience and ease of reference only, and do not define, limit, augment, or describe the scope, content, terms, or intent of this MOA.

IN WITNESS WHEREOF, the Parties hereto have approved and executed this MOA as of the respective dates specified in the adopting Resolution of each Party as provided above in Article III of this MOA.

[Signature Pages to Follow]

IN WITNESS WHEREOF, the Parties hereto have approved and executed this MOA as of the respective dates specified in the adopting Resolution of each Party as provided above in Article III of this MOA.

CITY OF BANNING

By:



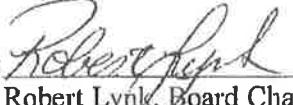
Michael Rock, City Manager

Dated:

4-13-17

IN WITNESS WHEREOF, the Parties hereto have approved and executed this MOA as of the respective dates specified in the adopting Resolution of each Party as provided above in Article III of this MOA.

CABAZON WATER DISTRICT

By: 
Robert Link, Board Chair

IN WITNESS WHEREOF, the Parties hereto have approved and executed this MOA as of the respective dates specified in the adopting Resolution of each Party as provided above in Article III of this MOA.

BANNING HEIGHTS MUTUAL WATER COMPANY

By: Julie L. Hutchinson
Julie L. Hutchinson
Board President

By: Lawrence E. Ellis
Lawrence E. Ellis
Director

IN WITNESS WHEREOF, the Parties hereto have approved and executed this MOA as of the respective dates specified in the adopting Resolution of each Party as provided above in Article III of this MOA.

SAN GORGONIO PASS WATER AGENCY

By: Jeffrey W Davis

IN WITNESS WHEREOF, the Parties hereto have approved and executed this MOA as of the respective dates specified in the adopting Resolution of each Party as provided above in Article III of this MOA.

DESERT WATER AGENCY

By: Mark S. Krause

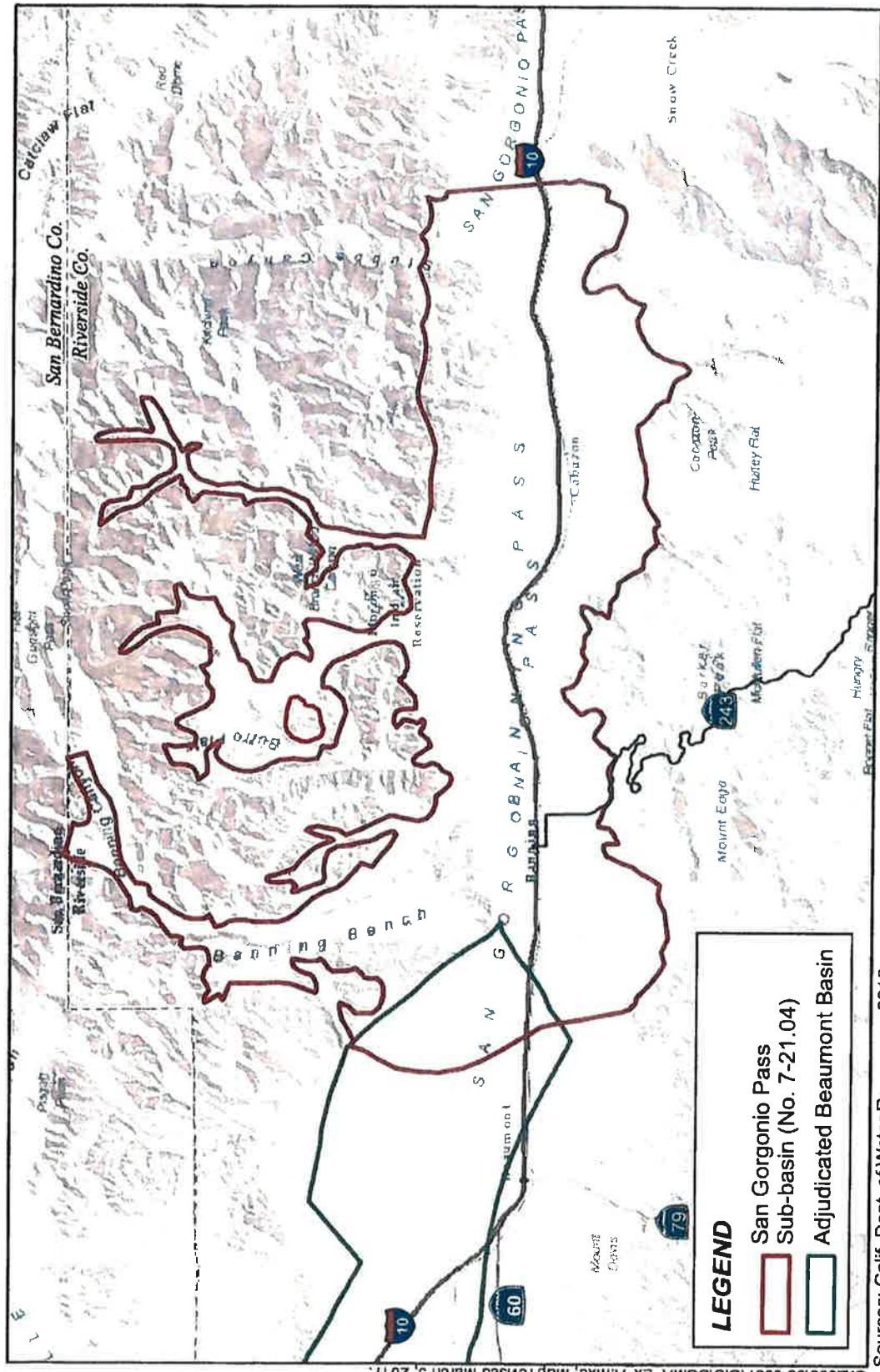
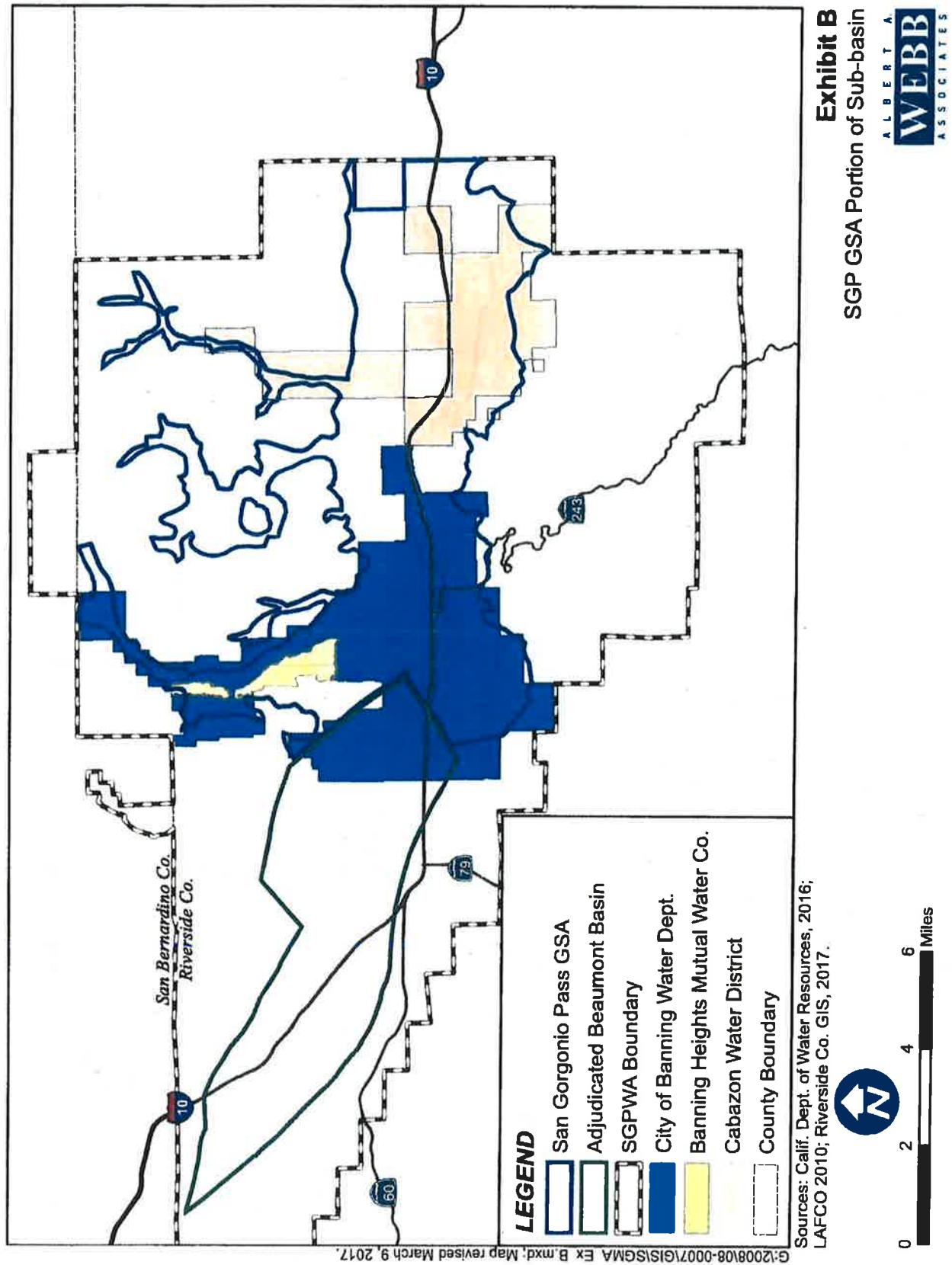
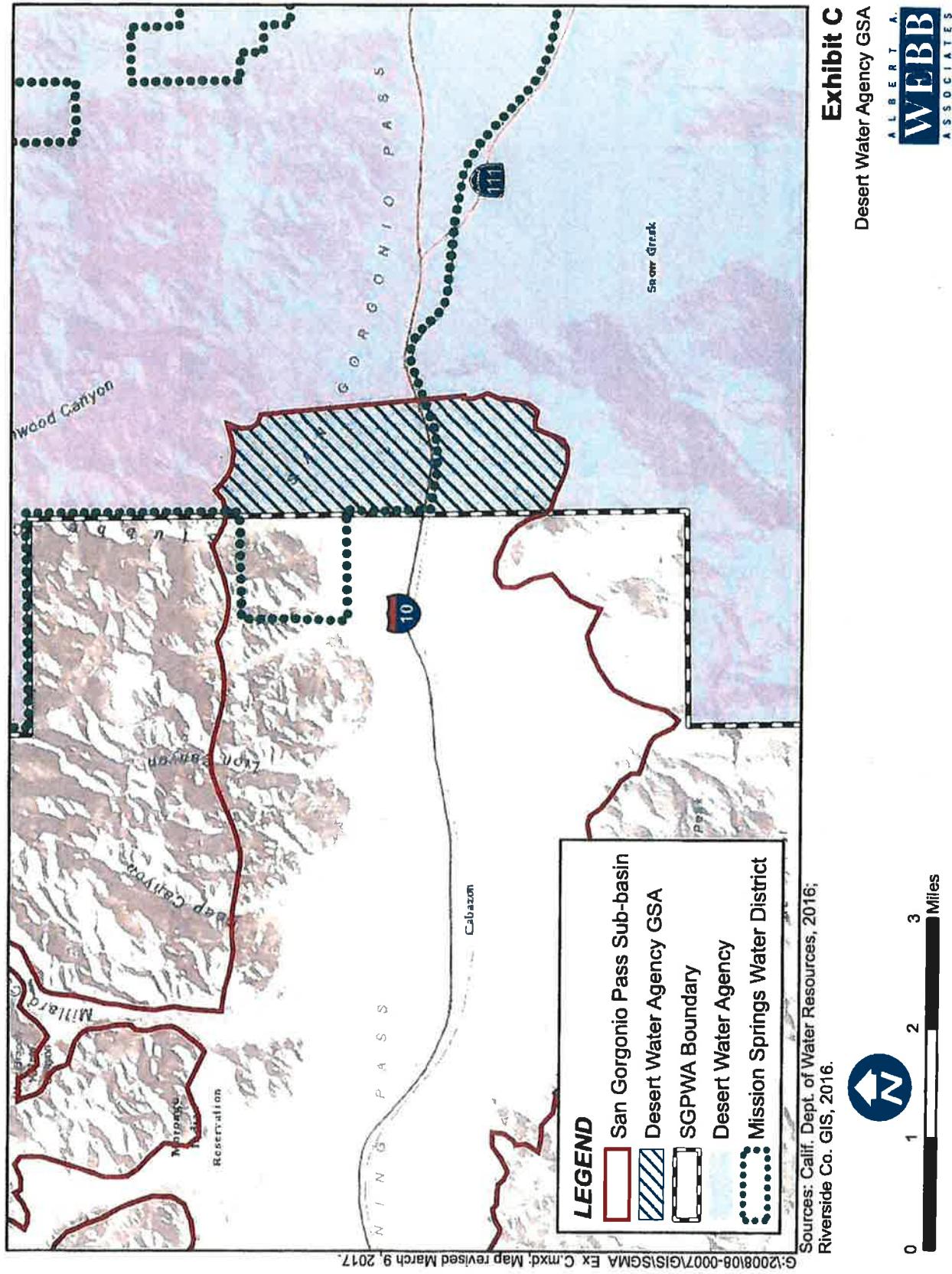


Exhibit A
San Gorgonio Pass Sub-basin

Sources: Calif. Dept. of Water Resources, 2016;
Riverside Co. GIS, 2016.







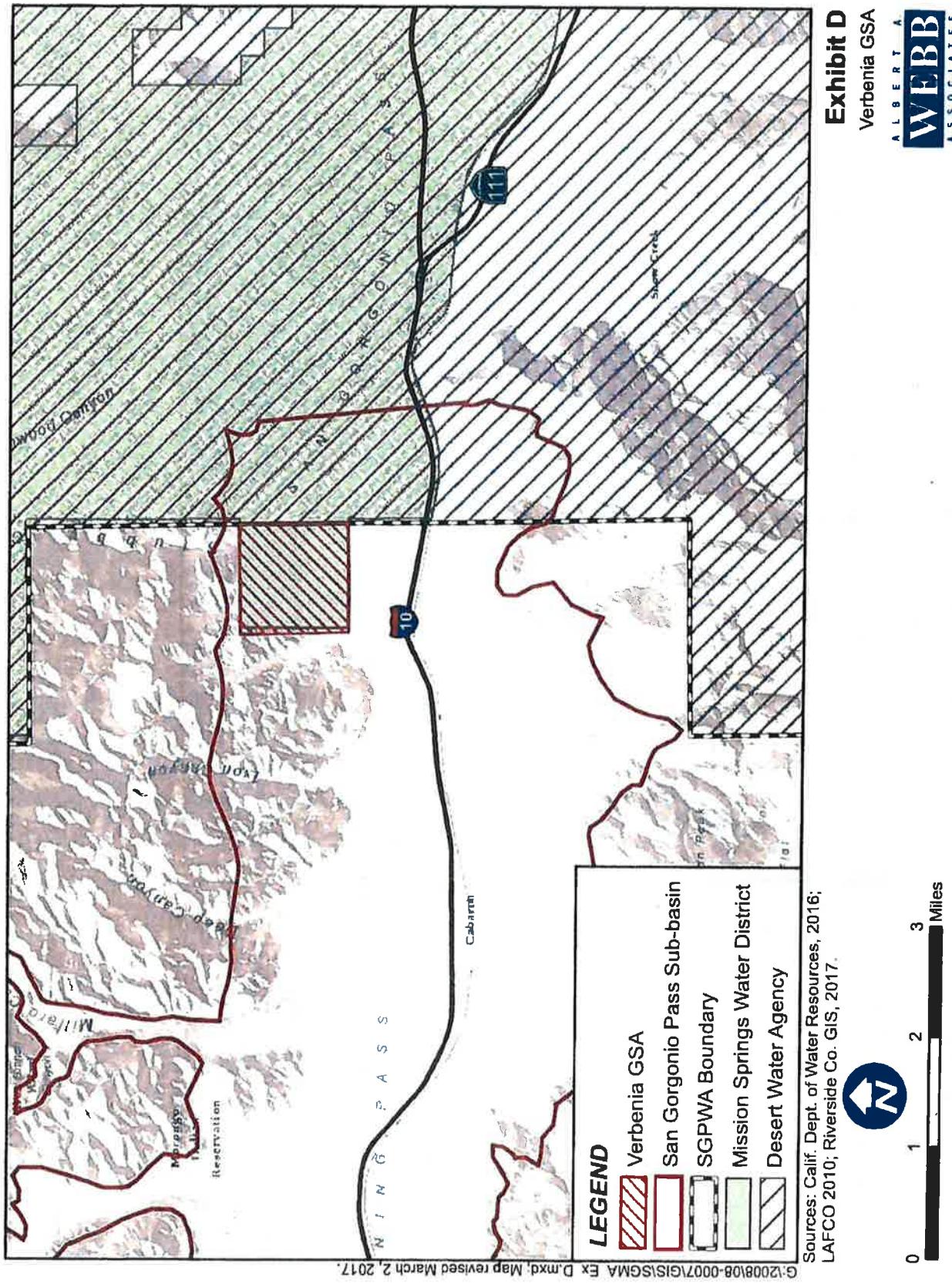
Sources: Calif. Dept. of Water Resources, 2016;
Riverside Co. GIS, 2016.



Exhibit C

Desert Water Agency GSA

The logo for Albert A. Webb & Associates. It features the name 'ALBERT A. WEBB' in a bold, serif font, with 'ALBERT A.' above 'WEBB'. To the right of 'WEBB' is a vertical line, and to the right of the line is the word 'ASSOCIATES' in a smaller, serif font.



Notice of Election to Jointly Form and Become a
Groundwater Sustainability Agency in the San
Gorgonio Pass Subbasin

ATTACHMENT B

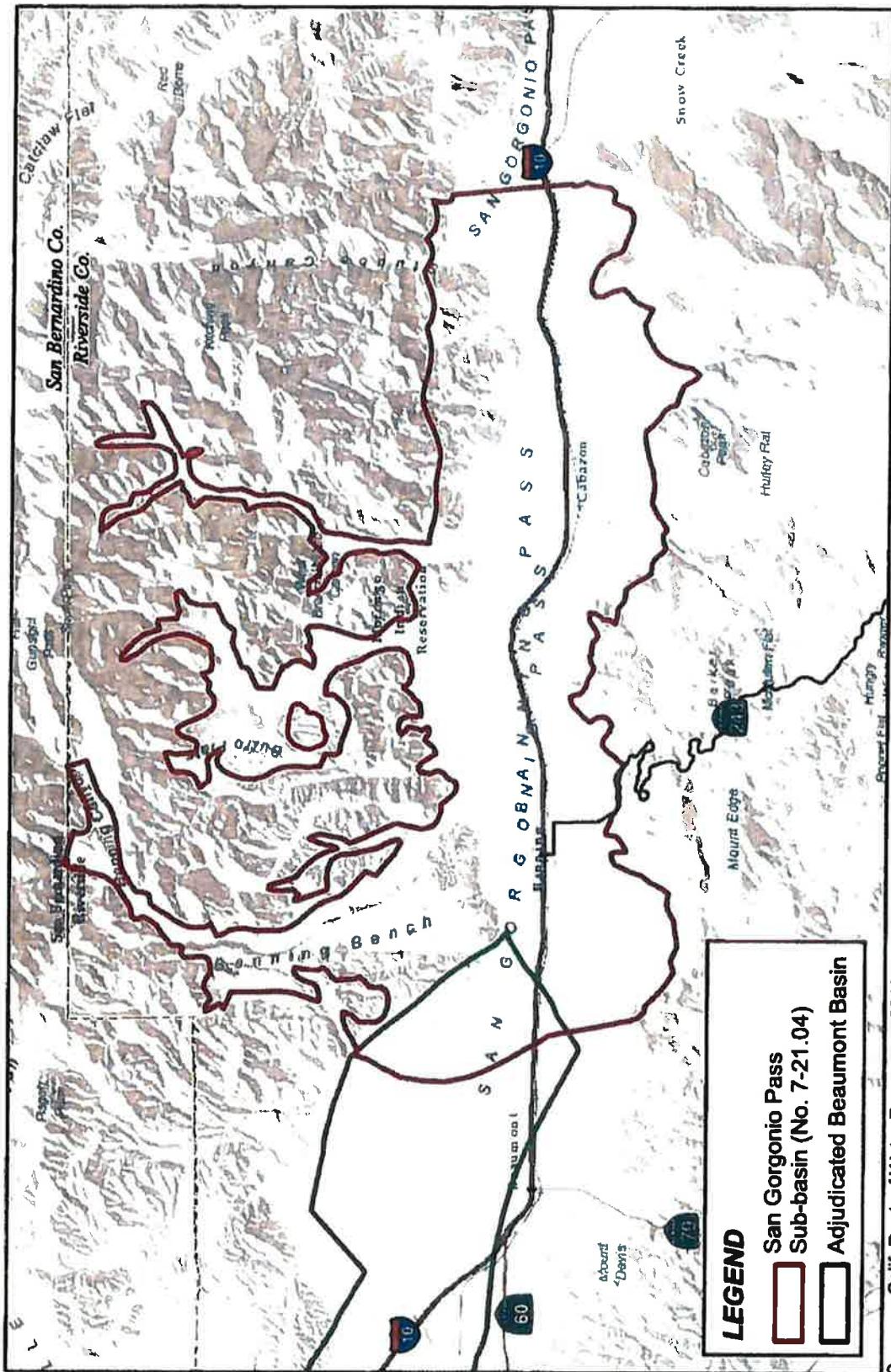


Exhibit A
San Gorgonio Pass Sub-basin

WEBB
ASSOCIATES
ALBERTA

Sources: Calif. Dept. of Water Resources, 2016;
Riverside Co. GIS, 2016.



0 2 4 6 Miles

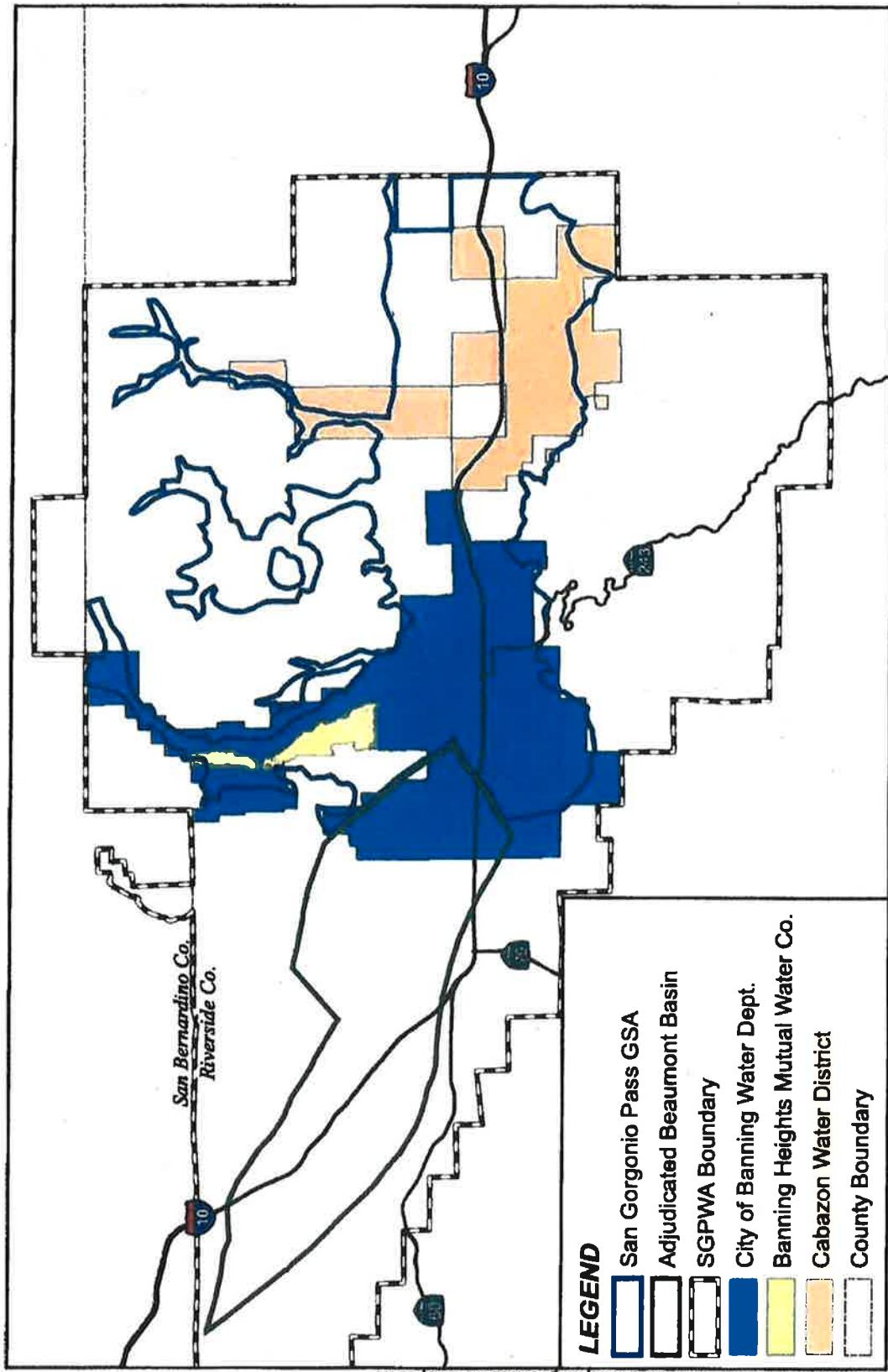


Exhibit B
SGP GSA Portion of Sub-basin

WEBB
ASSOCIATES

Sources: Calif. Dept. of Water Resources, 2016;
LACFO 2010; Riverside Co. GIS, 2017.



0 2 4 6 Miles

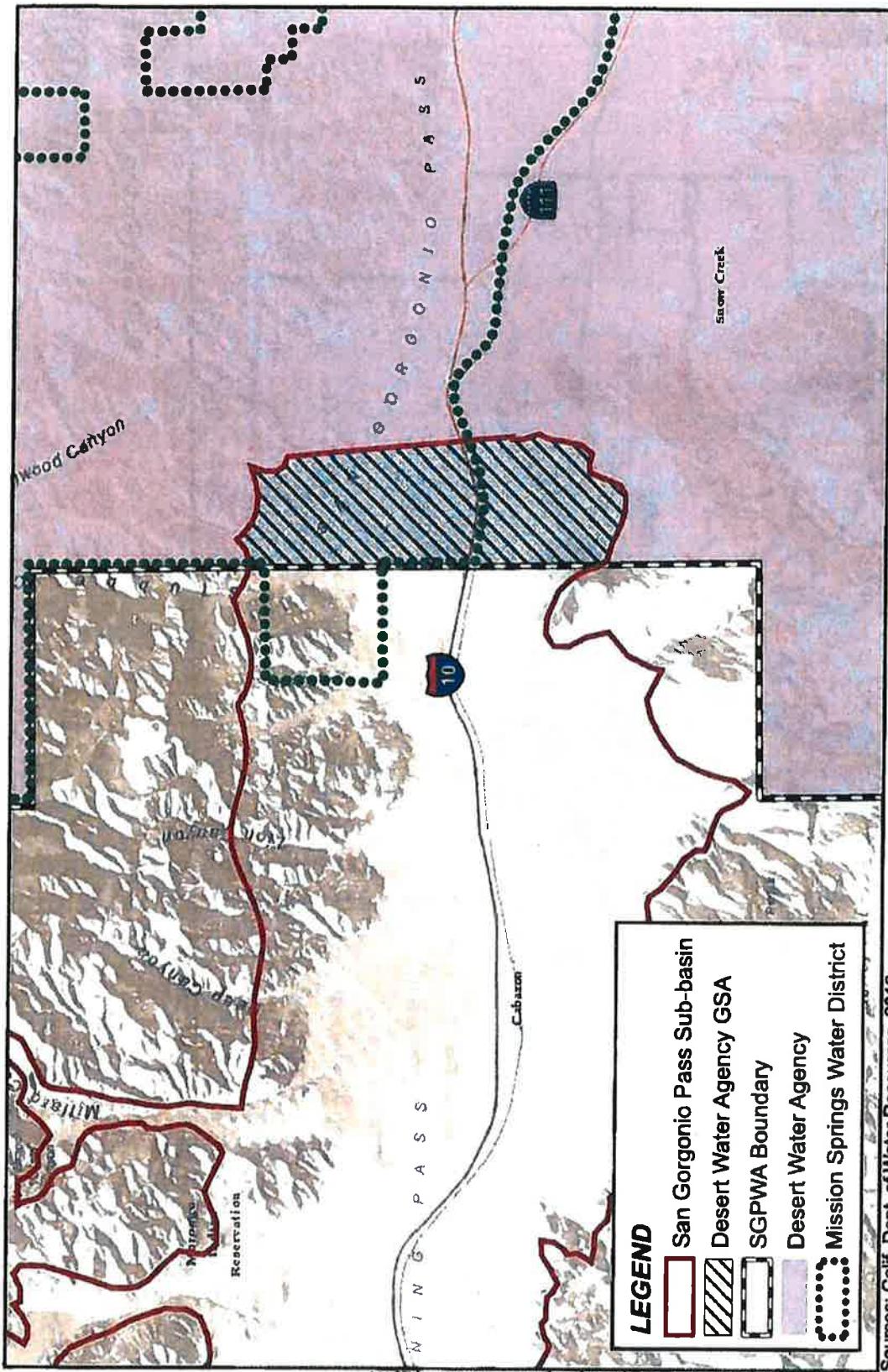
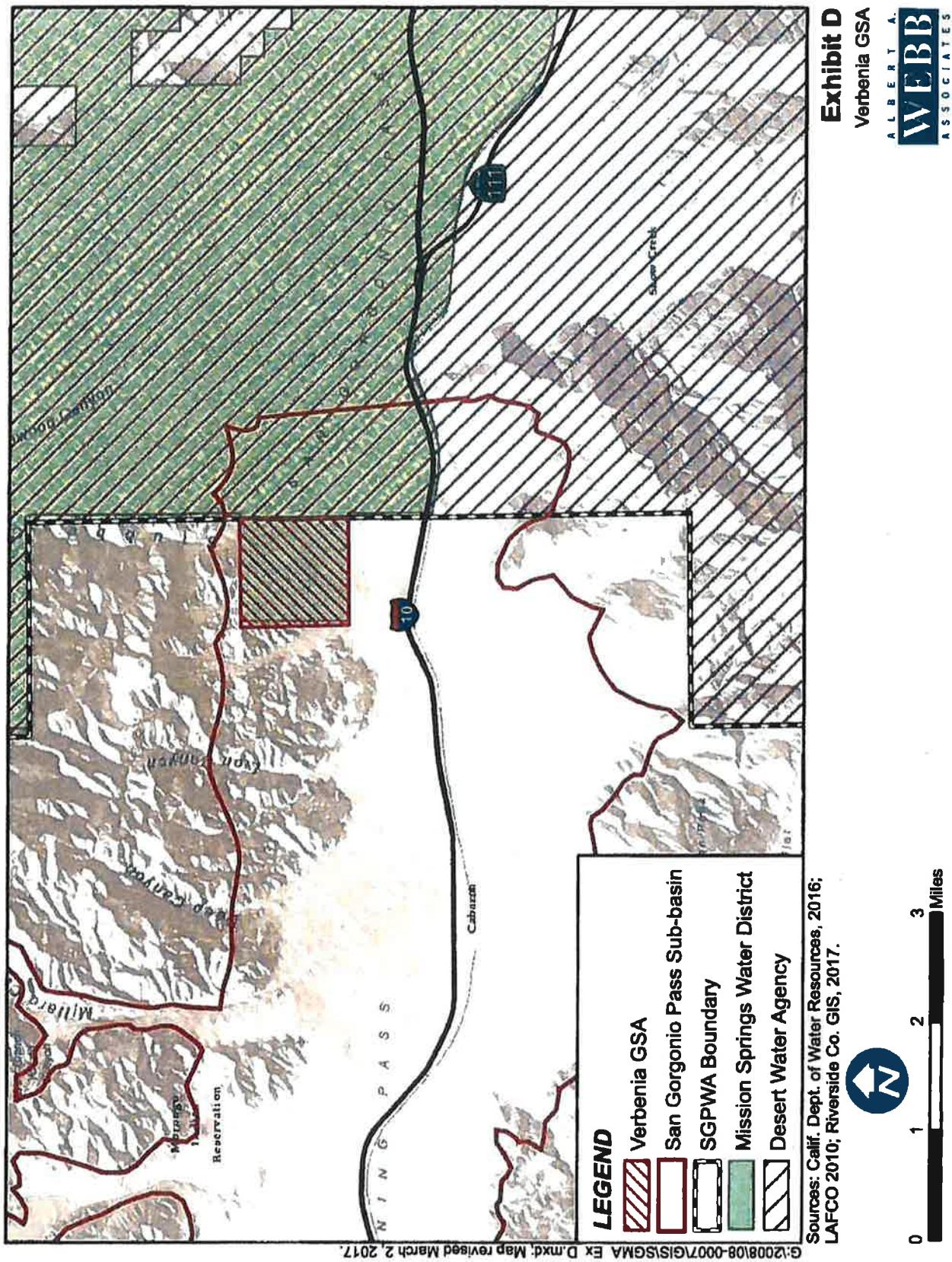


Exhibit C
Desert Water Agency GSA



Notice of Election to Jointly Form and Become a
Groundwater Sustainability Agency in the San
Gorgonio Pass Subbasin

ATTACHMENT C

RESOLUTION 2017-35

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF BANNING, CALIFORNIA, APPROVING THE MEMORANDUM OF AGREEMENT TO FORM A GROUNDWATER SUSTAINABILITY AGENCY FOR A PORTION OF THE SAN GORGONIO PASS SUB-BASIN AND TO COORDINATE WITH OTHER GROUNDWATER SUSTAINABILITY AGENCIES

WHEREAS, the Sustainable Groundwater Management Act of 2014 (SGMA) was signed into law on September 16, 2014 and went into effect on January 1, 2015; and

WHEREAS, SGMA provides for the sustainable management of groundwater basins at the local level through the formation of Groundwater Sustainability Agencies (GSAs) and through preparation and implementation of Groundwater Sustainability Plans (GSPs); and

WHEREAS, the San Gorgonio Pass Subbasin (Basin) is identified by the California Department of Water Resources (DWR) Bulletin 118 as Subbasin No. 7-21.04 of the Coachella Valley Groundwater Basin, and is designated by DWR as medium priority, and therefore, except as provided by SGMA, the Basin is subject to the requirements of SGMA; and

WHEREAS, SGMA authorizes a combination of local agencies as defined by SGMA to form a GSA pursuant to a joint powers agreement, a memorandum of agreement, or other legal agreement, and SGMA also authorizes a water corporation regulated by the California Public Utilities Commission or a mutual water company to participate in a GSA through a memorandum of agreement or other legal agreement; and

WHEREAS, the City of Banning, Cabazon Water District, Banning Heights Mutual Water Company, San Gorgonio Pass Water Agency, Mission Springs Water District, and Desert Water Agency have prepared a Memorandum of Agreement (MOA), attached hereto, for a cooperative process to form and coordinate multiple GSAs for the Basin, and to carry out the policy, purposes, and requirements of SGMA in the Basin, including the City of Banning's ability to protect and effectively manage its interests and obligations with groundwater management. Toward that end, the City requests that the San Gorgonio Pass Water Agency, as a wholesale importer of water supplies, be designated an ex-officio member of the GSA with non-voting rights; and

WHEREAS, among other things, the MOA establishes the San Gorgonio Pass GSA (SGP-GSA) for a portion of the Basin, as further set forth and depicted in the MOA, the members of which SGP-GSA are the City of Banning, the Cabazon Water District, the Banning Heights Mutual Water Company, and the San Gorgonio Pass Water Agency; and

WHEREAS, the MOA further establishes that efforts of the SGP-GSA will be coordinated with the efforts of the Desert Water Agency GSA (DWA-GSA) that already has been established for a portion of the Basin, and the efforts of the Verbenia Area GSA (Verbenia-GSA) that is being established for another portion of the Basin; and

WHEREAS, the Parties to the MOA mutually desire and intend that the SGP-GSA, the DWA-GSA, and the Verbenia-GSA will cooperate and coordinate in subsequently preparing and implementing one or more GSPs for sustainable management of the Basin in accordance with SGMA; and

WHEREAS, the City of Banning is committed to the sustainable management of groundwater resources within the Basin in accordance with SGMA; and

WHEREAS, pursuant to the requirements of SGMA, the City of Banning held a public hearing on this date after publications of notice pursuant to California Government Code section 6066 to consider adoption of this Resolution; and

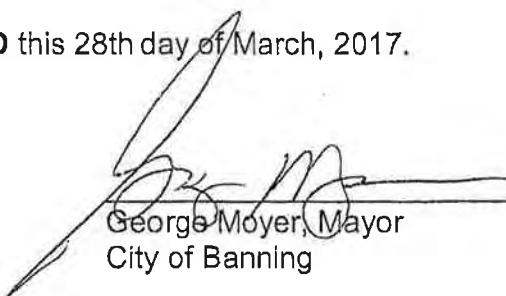
WHEREAS, pursuant to SGMA Section 10728.6 and Public Resources Code Section 21065, neither this Resolution, nor the MOA, nor the preparation or adoption of a GSP constitutes a project or approval of a project under the California Environmental Quality Act (CEQA) or the State CEQA Guidelines.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Banning as follows:

SECTION 1. The City Council hereby approves the Memorandum of Agreement (MOA) to form a Groundwater Sustainability Agency for a portion of the San Gorgonio Pass Subbasin and to coordinate with other Groundwater Sustainability Agencies (GSAs).

SECTION 2. The City Manager is hereby authorized to execute the MOA and directed to coordinate with the other members of the SGP-GSA to submit a copy of this Resolution and other applicable information to the California Department of Water Resources regarding the formation of the SGP-GSA.

PASSED, APPROVED AND ADOPTED this 28th day of March, 2017.



George Moyer, Mayor
City of Banning

ATTEST:



Marie A. Calderon, City Clerk
City of Banning

CERTIFIED TO BE A TRUE AND CORRECT
COPY OF THE ORIGINAL DOCUMENT ON
FILE IN THE OFFICE OF THE CITY CLERK.

BY 
TITLE ~~CITY CLERK~~
DATE 4-10-17

APPROVED AS TO FORM AND
LEGAL CONTENT:



John C. Cotti, Interim City Attorney
Jenkins & Hogin, LLP

Reso. 2017-35

CERTIFICATION:

I, Marie A. Calderon, City Clerk of the City of Banning, California, do hereby certify that the foregoing Resolution 2017-35, was duly adopted by the City Council of the City of Banning, California, at a regular meeting thereof held on the 28th day of March, 2017, by the following vote, to wit:

AYES: Councilmembers Andrade, Franklin, Welch, Mayor Moyer

NOES: None

ABSTAIN: None

ABSENT: Councilmember Peterson



Marie A. Calderon, City Clerk
City of Banning, California

Advertising Order Confirmation

The Press Enterprise

03/09/17 10:47:56AM
Page 2

Ad Number 201094721-01
Ad Size 3 X 68 Li

Color
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External Ad Number
Ad Attributes
Ad Type
Legal Liner
Production Method
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Released for Publication

NOTICE OF PUBLIC HEARING TO CONSIDER CITY OF BANNING APPROVAL OF A MEMORANDUM OF AGREEMENT TO FORM A GROUNDWATER SUSTAINABILITY AGENCY WITH OTHER AGENCIES FOR A PORTION OF THE SAN GORGONIO PASS SUB-BASIN AND TO COORDINATE WITH OTHER GROUNDWATER SUSTAINABILITY AGENCIES

NOTICE IS HEREBY GIVEN pursuant to Section 10723(b) of the California Water Code and Section 406 of the California Government Code that the City of Banning City Council will hold a public hearing to consider approving a Memorandum of Agreement (MOA) between the City of Banning, Cabazon Water District, Banning Heights Mutual Water Company and San Gorgonio Pass Water Agency for the establishment of the San Gorgonio Pass Groundwater Sustainability Agency (SGP-GSA) pursuant to The Sustainable Groundwater Management Act (SGMA). If the City of Banning City Council and the other SGP-GSA entities approve the MOA, the SGP-GSA will be authorized to be formed over a certain portion of the San Gorgonio Pass Subbasin (the Coachella Valley Groundwater Basin Subbasin). The MOA will also include Mission Springs Water District and Desert Water Agency as parties because those agencies have established or intend to establish separate groundwater sustainability agencies in the eastern portion of the Subbasin with whom the SGP-GSA will coordinate under SGMA. The public hearing of the City of Banning to consider approving the MOA will take place on March 28, 2017 at 5:00 PM in the City Council Chambers located at City Hall, 99 East Ramsey Street, Banning, California, 92220.

ALL INTERESTED PARTIES are invited to attend said hearing and present oral or written testimony on the matter or send their written comments to the City Clerk, P.O. Box 996, Banning, California 92220.

Information regarding the foregoing can be obtained by contacting the Engineering Division of the Public Works Department of the above address or by telephone at 951-922-3130. Dated relevant to this manner will be available for public viewing at Banning City Hall, 99 E. Ramsey Street, Banning, California for the period of 14 days prior to the Public Hearing.

If you challenge any decision regarding the above proposal in court, you may be limited to raising only those issues you or someone else raised in written correspondence delivered to the City Clerk or, prior to the time the City Council makes its decision on the proposal, all or, if a public hearing is held on the proposal, you or someone else must have raised those issues at the public hearing or in written correspondence delivered to the hearing body or, prior to the hearing (California Government Code, Section 6809).

BY ORDER OF THE CITY CLERK of the City of Banning, California.

/s/ Marie A. Calderon, City Clerk
City of Banning, California

DATED: March 9, 2017

PUBLISHED: March 14, 2017 and May 21, 2017

Product PE Riverside-Full Run
Requested Placement Legals CLS
Run Dates 03/14/17, 03/21/17
Net Amount 428.40
Tax Amount 0.00
Total Amount 428.40
Payment Amount 0.00
Amount Due \$428.40
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Order Charges:

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Please note: To meet our printer's deadline, we must have your proof returned by the published deadline, and as indicated by your sales rep.

Advertising Order Confirmation

The Press Enterprise

03/09/17 10:47:56AM
Page 1

<u>Ad Order Number</u> 0010914721	<u>Customer</u> BANNING, CITY OF	<u>PO Number</u>
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<u>Order Taker</u> Nick Eller	<u>Customer Address</u> 99 E RAMSEY ST BANNING, CA 92220	<u>Customer Fax</u>
<u>Order Source</u> Select Source	<u>Customer Phone</u> 951-922-3130	<u>Customer EMail</u>
<u>Current Queue</u> Ready	<u>Invoice Text</u> SGMA Banning	<u>Ad Order Notes</u>
<u>Tear Sheets</u> 0	<u>Bind Box</u> 0	<u>Materials</u> <u>Promo Type</u>
		<u>Special Pricing</u>

Notice of Election to Jointly Form and Become a
Groundwater Sustainability Agency in the San
Gorgonio Pass Subbasin

ATTACHMENT D

RESOLUTION NO. 01-2017

**A RESOLUTION OF THE BOARD OF DIRECTORS
OF THE CABAZON WATER DISTRICT
TO APPROVE THE MEMORANDUM OF AGREEMENT TO FORM A
GROUNDWATER SUSTAINABILITY AGENCY FOR A PORTION OF THE SAN
GORGONIO PASS
SUB-BASIN AND TO COORDINATE WITH OTHER GROUNDWATER
SUSTAINABILITY AGENCIES**

WHEREAS, the Sustainable Groundwater Management Act of 2014 (SGMA) was signed into law on September 16, 2014 and went into effect on January 1, 2015; and

WHEREAS, SGMA provides for the sustainable management of groundwater basins at the local level through the formation of Groundwater Sustainability Agencies (GSAs) and through preparation and implementation of Groundwater Sustainability Plans (GSPs); and

WHEREAS, the San Gorgonio Pass Subbasin (Basin) is identified by the California Department of Water Resources (DWR) Bulletin 118 as Subbasin No. 7-21.04 of the Coachella Valley Groundwater Basin, and is designated by DWR as medium priority, and therefore, except as provided by SGMA, the Basin is subject to the requirements of SGMA; and

WHEREAS, SGMA authorizes a combination of local agencies as defined by SGMA to form a GSA pursuant to a joint powers agreement, a memorandum of agreement, or other legal agreement, and SGMA also authorizes a water corporation regulated by the California Public Utilities Commission or a mutual water company to participate in a GSA through a memorandum of agreement or other legal agreement; and

WHEREAS, the Cabazon Water District, City of Banning, Banning Heights Mutual Water Company, San Gorgonio Pass Water Agency, Mission Springs Water District, and Desert Water Agency have prepared a Memorandum of Agreement (MOA), attached hereto as **Exhibit A**, for a cooperative process to form and coordinate multiple GSAs for the Basin, and to carry out the policy, purposes, and requirements of SGMA in the Basin; and

WHEREAS, among other things, the MOA establishes the San Gorgonio Pass GSA (SGP-GSA) for a portion of the Basin, as further set forth and depicted in the MOA, the members of which SGP-GSA are the Cabazon Water District, the City of Banning, the Banning Heights Mutual Water Company, and the San Gorgonio Pass Water Agency; and

WHEREAS, the MOA further establishes that efforts of the SGP-GSA will be coordinated with the efforts of the Desert Water Agency GSA (DWA-GSA) that already has been established for a portion of the Basin, and the efforts of the Verbenia Area GSA (Verbenia-GSA) that is being established for another portion of the Basin; and

WHEREAS, the Parties to the MOA mutually desire and intend that the SGP-GSA, the DWA-GSA, and the Verbenia-GSA will cooperate and coordinate in subsequently preparing and implementing one or more GSPs for sustainable management of the Basin in accordance with SGMA; and

WHEREAS, the Cabazon Water District is committed to the sustainable management of groundwater resources within the Basin in accordance with SGMA; and

WHEREAS, pursuant to the requirements of SGMA, Cabazon Water District held a public hearing on this date after publications of notice pursuant to California Government Code section 6066 to consider adoption of this Resolution; and

WHEREAS, pursuant to SGMA Section 10728.6 and Public Resources Code Section 21065, neither this Resolution, nor the MOA, nor the preparation or adoption of a GSP constitutes a project or approval of a project under the California Environmental Quality Act (CEQA) or the State CEQA Guidelines,

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE CABAZON WATER DISTRICT THAT:

1. Cabazon Water District hereby approves the Memorandum of Agreement to Form a Groundwater Sustainability Agency for a Portion of the San Gorgonio Pass Subbasin and to Coordinate with Other Groundwater Sustainability Agencies (MOA), a copy of which is attached hereto as **Exhibit A**.
2. Pursuant to the MOA and as authorized by SGMA, Cabazon Water District elects to jointly form and participate as a member of the San Gorgonio Pass Groundwater Sustainability Agency (SGP-GSA) for a portion of the Basin as further set forth and depicted in the MOA.
3. The General Manager of Cabazon Water District is hereby authorized and directed to coordinate with the other members of the SGP-GSA to submit a copy of this Resolution and other applicable information to the California Department of Water Resources regarding the formation of the SGP-GSA.

PASSED AND ADOPTED at a Meeting of the Board of Directors of the Cabazon Water District held this 21 st day of March, 2017.



Robert Link
Chair, Board of Directors
Cabazon Water District

ATTEST:



Elizabeth Lemus
Secretary, Board of Directors
Cabazon Water District

Record Gazette
218 N. Murray St.
Proof of Publication
(2015.5 C.C.P.)

141443 PUBLIC HEARING GSA MOA

State of California }
County of Riverside } ss.

I am a citizen of the United States and a resident of the State of California; I am over the age of eighteen years, and not a party to or interested in the above matter. I am the principal clerk of the printer and publisher of Record Gazette, a newspaper published in the English language in the City of Banning, County of Riverside, and adjudicated a newspaper of general circulation as defined by the laws of the state of California by the Superior Court of the County of Riverside, under the date October 14, 1966, Case No. 54737. That the notice, of which the annexed is a copy, has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to-wit:

March 3, 10, 2017

NOTICE OF PUBLIC HEARING TO CONSIDER CABAZON WATER DISTRICT APPROVAL OF A MEMORANDUM OF AGREEMENT TO FORM A GROUNDWATER SUSTAINABILITY AGENCY WITH OTHER AGENCIES FOR A PORTION OF THE SAN GORGONIO PASS SUB-BASIN AND TO COORDINATE WITH OTHER GROUNDWATER SUSTAINABILITY AGENCIES

NOTICE IS HEREBY GIVEN pursuant to Section 10723(b) of the California Water Code and Section 8066 of the California Government Code that the Board of Directors of Cabazon Water District (CWD) will hold a public hearing to consider approving a memorandum of agreement (MOA) with the City of Banning, Banning Heights Mutual Water Company, and San Gorgonio Pass Water Agency approving the establishment of the San Gorgonio Pass Groundwater Sustainability Agency (GSA). If the governing boards of CWD and the other public entities approve the MOA, the GSA will be authorized to be formed over a designated portion of the San Gorgonio Pass Subbasin of the Coachella Valley Groundwater Basin (the Subbasin). The MOA will also include Mission Springs Water District and Desert Water Agency as parties because those agencies have established or intend to establish separate groundwater sustainability agencies in the eastern portion of the Subbasin with whom the GSA will coordinate. The meeting of CWD to consider approving the MOA will take place on March 21, 2017 at 6:00 p.m., in the Boardroom of its headquarters, located at 14618 Broadway St., Cabazon, CA 92230.

The purpose of the public hearing will be to hear and receive comments from the public regarding CWDs proposed approval of the MOA.

The draft MOA and related documentation are on file with the Secretary to the Board of Directors of CWD and are available for inspection during regular business hours at the office of the CWD at 14618 Broadway St., Cabazon, CA 92230.

To publish March 3, 2017 and March 10, 2017.

Published in
The Record Gazette
No. 141443
03/03/10 2017

RECEIVED
MAR 13 2017

BY: [王海峰](#) | [高级工程师](#) | [中国科学院计算技术研究所](#)

Executed on: 03/10/2017

At Banning .CA

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Signature

Notice of Election to Jointly Form and Become a
Groundwater Sustainability Agency in the San
Gorgonio Pass Subbasin

ATTACHMENT E

RESOLUTION 2017 - 01

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE BANNING HEIGHTS MUTUAL WATER COMPANY TO APPROVE THE MEMORANDUM OF AGREEMENT TO FORM A GROUNDWATER SUSTAINABILITY AGENCY FOR A PORTION OF THE SAN GORGONIO PASS SUB-BASIN AND TO COORDINATE WITH OTHER GROUNDWATER SUSTAINABILITY AGENCIES

WHEREAS, the Sustainable Groundwater Management Act of 2014 (SGMA) was signed into law on September 16, 2014 and went into effect on January 1, 2015; and

WHEREAS, SGMA provides for the sustainable management of groundwater basins at the local level through the formation of Groundwater Sustainability Agencies (GSAs) and through preparation and implementation of Groundwater Sustainability Plans (GSPs); and

WHEREAS, the San Gorgonio Pass Subbasin (Basin) is identified by the California Department of Water Resources (DWR) Bulletin 118 as Subbasin No. 7-21.04 of the Coachella Valley Groundwater Basin, and is designated by DWR as medium priority, and therefore, except as provided by SGMA, the Basin is subject to the requirements of SGMA; and

WHEREAS, SGMA authorizes a combination of local agencies as defined by SGMA to form a GSA pursuant to a joint powers agreement, a memorandum of agreement, or other legal agreement, and SGMA also authorizes a water corporation regulated by the California Public Utilities Commission or a mutual water company to participate in a GSA through a memorandum of agreement or other legal agreement; and

WHEREAS, the Cabazon Water District, City of Banning, Banning Heights Mutual Water Company, San Gorgonio Pass Water Agency, Mission Springs Water District, and Desert Water Agency have prepared a Memorandum of Agreement (MOA), attached hereto as **Exhibit A**, for a cooperative process to form and coordinate multiple GSAs for the Basin, and to carry out the policy, purposes, and requirements of SGMA in the Basin; and

WHEREAS, among other things, the MOA establishes the San Gorgonio Pass GSA (SGP-GSA) for a portion of the Basin, as further set forth and depicted in the MOA, the members of which SGP-GSA are the Cabazon Water District, the City of Banning, the Banning Heights Mutual Water Company, and the San Gorgonio Pass Water Agency; and

WHEREAS, the MOA further establishes that efforts of the SGP-GSA will be coordinated with the efforts of the Desert Water Agency GSA (DWA-GSA) that already has been established for a portion of the Basin, and the efforts of the Verbenia Area GSA (Verbenia-GSA) that is being established for another portion of the Basin; and

WHEREAS, the Parties to the MOA mutually desire and intend that the SGP-GSA, the DWA-GSA, and the Verbenia-GSA will cooperate and coordinate in subsequently preparing and

implementing one or more GSPs for sustainable management of the Basin in accordance with SGMA; and

WHEREAS, the Banning Heights Mutual Water Company is committed to the sustainable management of groundwater resources within the Basin in accordance with SGMA; and

WHEREAS, pursuant to SGMA Section 10728.6 and Public Resources Code Section 21065, neither this Resolution, nor the MOA, nor the preparation or adoption of a GSP constitutes a project or approval of a project under the California Environmental Quality Act (CEQA) or the State CEQA Guidelines,

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE BANNING HEIGHTS MUTUAL WATER COMPANY that:

1. Banning Heights Mutual Water Company hereby approves the Memorandum of Agreement to Form a Groundwater Sustainability Agency for a Portion of the San Gorgonio Pass Subbasin and to Coordinate with Other Groundwater Sustainability Agencies (MOA), a copy of which is attached hereto as **Exhibit A**.
2. Pursuant to the MOA and as authorized by SGMA, Banning Heights Mutual Water Company elects to jointly form and participate as a member of the San Gorgonio Pass Groundwater Sustainability Agency (SGP-GSA) for a portion of the Basin as further set forth and depicted in the MOA.
3. Banning Heights Mutual Water Company will coordinate with the other members of the SGP-GSA to submit a copy of this Resolution and other applicable information to the California Department of Water Resources regarding the formation of the SGP-GSA.

PASSED, APPROVED, AND ADOPTED this 13th day of March, 2017.

Julie L. Hutchinson
Julie L. Hutchinson, President
Banning Heights Mutual Water Company

ATTEST

Lawrence E. Ellis
Lawrence E. Ellis, Director
Banning Heights Mutual Water Company

CERTIFICATION

I, Terri Farris, Company Secretary of the Banning Heights Mutual Water Company, do hereby certify that the foregoing Resolution Number 2017-01 as duly adopted by the Board of Directors of the Banning Heights Mutual Water Company at the general business meeting thereof held on the 13th day of March, 2017, by the following vote, to wit:

AYES: 4

NOES: 0

ABSTAIN: 0

ABSENT: 1

Terri Farris
Terri Farris, Company Secretary
Banning Heights Mutual Water Company

**Notice of Election to Jointly Form and Become a
Groundwater Sustainability Agency in the San
Gorgonio Pass Subbasin**

ATTACHMENT F

RESOLUTION 2017 - 02

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE SAN GORGONIO PASS WATER AGENCY TO APPROVE THE MEMORANDUM OF AGREEMENT TO FORM A GROUNDWATER SUSTAINABILITY AGENCY FOR A PORTION OF THE SAN GORGONIO PASS SUB-BASIN AND TO COORDINATE WITH OTHER GROUNDWATER SUSTAINABILITY AGENCIES

WHEREAS, the Sustainable Groundwater Management Act of 2014 (SGMA) was signed into law on September 16, 2014 and went into effect on January 1, 2015; and

WHEREAS, SGMA provides for the sustainable management of groundwater basins at the local level through the formation of Groundwater Sustainability Agencies (GSAs) and through preparation and implementation of Groundwater Sustainability Plans (GSPs); and

WHEREAS, the San Gorgonio Pass Subbasin (Basin) is identified by the California Department of Water Resources (DWR) Bulletin 118 as Subbasin No. 7-21.04 of the Coachella Valley Groundwater Basin, and is designated by DWR as medium priority, and therefore, except as provided by SGMA, the Basin is subject to the requirements of SGMA; and

WHEREAS, SGMA authorizes a combination of local agencies as defined by SGMA to form a GSA pursuant to a joint powers agreement, a memorandum of agreement, or other legal agreement, and SGMA also authorizes a water corporation regulated by the California Public Utilities Commission or a mutual water company to participate in a GSA through a memorandum of agreement or other legal agreement; and

WHEREAS, the Cabazon Water District, City of Banning, Banning Heights Mutual Water Company, San Gorgonio Pass Water Agency, Mission Springs Water District, and Desert Water Agency have prepared a Memorandum of Agreement (MOA), attached hereto as **Exhibit A**, for a cooperative process to form and coordinate multiple GSAs for the Basin, and to carry out the policy, purposes, and requirements of SGMA in the Basin; and

WHEREAS, among other things, the MOA establishes the San Gorgonio Pass GSA (SGP-GSA) for a portion of the Basin, as further set forth and depicted in the MOA, the members of which SGP-GSA are the Cabazon Water District, the City of Banning, the Banning Heights Mutual Water Company, and the San Gorgonio Pass Water Agency; and

WHEREAS, the MOA further establishes that efforts of the SGP-GSA will be coordinated with the efforts of the Desert Water Agency GSA (DWA-GSA) that already has been established for a portion of the Basin, and the efforts of the Verbenia Area GSA (Verbenia-GSA) that is being established for another portion of the Basin; and

WHEREAS, the Parties to the MOA mutually desire and intend that the SGP-GSA, the DWA-GSA, and the Verbenia-GSA will cooperate and coordinate in subsequently preparing and implementing one or more GSPs for sustainable management of the Basin in accordance with SGMA; and

WHEREAS, the San Gorgonio Pass Water Agency is committed to the sustainable management of groundwater resources within the Basin in accordance with SGMA; and

WHEREAS, pursuant to the requirements of SGMA, the San Gorgonio Pass Water Agency held a public hearing on this date after publications of notice pursuant to California Government Code section 6066 to consider adoption of this Resolution; and

WHEREAS, pursuant to SGMA Section 10728.6 and Public Resources Code Section 21065, neither this Resolution, nor the MOA, nor the preparation or adoption of a GSP constitutes a project or approval of a project under the California Environmental Quality Act (CEQA) or the State CEQA Guidelines,

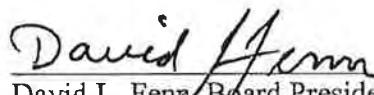
NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE SAN GORGONIO PASS WATER AGENCY that:

1. The San Gorgonio Pass Water Agency hereby approves the Memorandum of Agreement to Form a Groundwater Sustainability Agency for a Portion of the San Gorgonio Pass Subbasin and to Coordinate with Other Groundwater Sustainability Agencies (MOA), a copy of which is attached hereto as **Exhibit A**.

2. Pursuant to the MOA and as authorized by SGMA, the San Gorgonio Pass Water Agency elects to jointly form and participate as a member of the San Gorgonio Pass Groundwater Sustainability Agency (SGP-GSA) for a portion of the Basin as further set forth and depicted in the MOA.

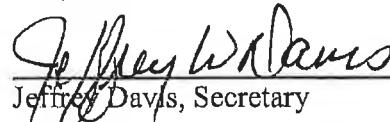
3. The General Manager of the San Gorgonio Pass Water Agency is hereby authorized and directed to coordinate with the other members of the SGP-GSA to submit a copy of this Resolution and other applicable information to the California Department of Water Resources regarding the formation of the SGP-GSA.

I HEREBY CERTIFY that the foregoing is a true, full and correct copy of Resolution 2017-02 that was duly introduced, passed and adopted at a regular meeting of the Board of Directors of the San Gorgonio Pass Water Agency, at its regular meeting on March 20, 2017.



David L. Feng, Board President
San Gorgonio Pass Water Agency

ATTEST:



Jeffrey W. Davis, Secretary

Notice of Election to Jointly Form and Become a
Groundwater Sustainability Agency in the San
Gorgonio Pass Subbasin

ATTACHMENT G

Pursuant to Section 10723.8(a)(4) of the Sustainable Groundwater Management Act (SGMA), following is an initial list of interested parties in the San Gorgonio Pass Subbasin (Basin) developed pursuant to SGMA Section 10723.2 and an explanation of how their interests will be considered in the development and operation of the SGP-GSA and the development and implementation of a Groundwater Sustainability Plan that will be adopted by the SGP-GSA. This supplements the information provided in the accompanying Notice of Election to Jointly Form and Become a Groundwater Sustainability Agency in the San Gorgonio Pass Subbasin (Notice Letter).

1. Holders of overlying groundwater rights

- a. Agricultural users – Very little documented overlying agricultural use occurs in the Basin. Most land uses in the Basin are municipal and industrial in nature. A more comprehensive survey of overlying agricultural users in the Basin and steps to actively involve them as stakeholders will be undertaken throughout the SGMA process.
- b. Domestic well owners – Very few domestic users in the Basin are served by individual overlying wells. Instead, most domestic users are served by municipal and other public water systems in the Basin. A more comprehensive survey of overlying domestic well owners in the Basin and steps to actively involve them as stakeholders will be undertaken throughout the SGMA process.
- c. Other well users – A few well users exist in the Basin that produce groundwater for irrigation, industrial, and other purposes, including but not limited to Robertson Ready Mix and the Summit Cemetery District. A more comprehensive survey of such other groundwater users in the Basin and steps to actively involve them as stakeholders will be undertaken throughout the SGMA process.

2. Municipal well operators – The City of Banning (Banning) is the only municipal well operator in the unadjudicated portion of the Basin. As set forth in the Notice Letter, Banning is a member agency of the San Gorgonio Pass Groundwater Sustainability Agency (SGP-GSA) that has been formed in the Basin pursuant to the Memorandum of Agreement (MOA).
3. Public water systems – Several public water systems provide water service in unadjudicated portion of the Basin, including the Banning Heights Mutual Water Company (BHMWC), Cabazon Water District (CWD), Mission Springs Water District (MSWD), Desert Water Agency (DWA), and High Valleys Water District (HVWD). In addition, the San Gorgonio Pass Water Agency (SGPWA) is a wholesale water supplier within the Basin. As set forth in the Notice Letter, BHMWC, CWD, and SGPWA are additional member agencies of the SGP-GSA that has been formed for most of the Basin. DWA is the exclusive GSA for a certain portion of the Basin, and MSWD and SGPWA are coordinating to establish the Verbenia-GSA for the remaining portion of the Basin. HVWD is an active stakeholder in the SGP-GSA as provided in the MOA.

4. Local land use planning agencies – Land use planning agencies that overlie the unadjudicated portion of the Basin include Banning, the County of Riverside, and the County of San Bernardino. As further noted below, the Morongo Band of Mission Indians (MBMI) also overlies a portion of the Basin and carries out land use planning for MBMI lands.
5. Environmental users of groundwater – Currently no environmental users of groundwater have been identified in the Basin. A more comprehensive survey of any such users and steps to actively involve them as stakeholders will be undertaken throughout the SGMA process.
6. Surface water users, if there is a hydrologic connection between surface and groundwater bodies – Currently no surface water users with a hydrologic connection to groundwater have been identified in the Basin. A more comprehensive survey of any such users and steps to actively involve them as stakeholders will be undertaken throughout the SGMA process.
7. The federal government, including, but not limited to, the military and managers of federal lands – As noted below, the federal government may have interests in the Basin vis-à-vis its relationship to the MBMI.
8. California Native American tribes – As noted above, the MBMI overlies a portion of the Basin and carries out various activities related to groundwater resources, including but not limited to land use planning for MBMI lands, domestic water service, and a land lease to a water bottling operation.
9. Disadvantaged communities, including, but not limited to, those served by private domestic wells or small community water systems – Certain areas within the Basin have been designated as disadvantaged communities, including but not limited to areas within Cabazon and the City of Banning.
10. Entities listed in Section 10927 that are monitoring and reporting groundwater elevations in all or a part of the basin managed by the groundwater sustainability agency – The San Gorgonio Pass Water Agency is the CASGEM monitoring and reporting agency for the Basin.

As described in the Notice Letter and the MOA, a portion of the Basin is subject to the Beaumont Basin adjudication and Judgment in the case referred to as *San Timoteo Watershed Management Authority v. City of Banning, et al.*, Riverside County Superior Court Case No. RIC 389197, which pursuant to SGMA Section 10720.8(a)(1) generally is not subject to the requirements of SGMA and accordingly will not be managed under SGMA by the SGP-GSA. Notwithstanding, parties to the Beaumont Basin adjudication and Judgment and groundwater users in that portion of the Basin will be considered in the development and operation of the SGP-GSA and the development and implementation of a Groundwater Sustainability Plan that will be adopted by the SGP-GSA.

As specifically provided in the MOA, the parties to the SGP-GSA and other parties to the MOA have agreed to work together in ensuring public outreach and involvement of the public and other interested stakeholders throughout the SGMA process, including but not limited to all beneficial uses and users of groundwater, and those responsible for implementing Groundwater Sustainability Plans in the Basin, as provided in SGMA Section 10723.2. The parties to the SGP-GSA have been actively engaged in SGMA-related discussions with each other and with many of the above-listed stakeholders and entities, and will continue to consider and involve the interests of all entities and stakeholders to the extent practicable, including those identified above and others that may be identified in the future, by establishing a collaborative, open, and inclusive process for implementing SGMA throughout the Basin. Among other things, in accordance with SGMA Section 10723.4, the SGP-GSA will establish and maintain a list of persons interested in receiving notices regarding the preparation of any Groundwater Sustainability Plan for the Basin, meeting announcements, and the availability of draft plans, maps, and other relevant documents.

Pardee Demand from Developer

Demand Type	Phase 1 2019-2022	Phase 2 2022-2025	Phase 3 2025-2029	Phase 4 2029-2032	Phase 5 2024-2027	Phase 6 2027-2031	Phase 7 2032-2036	Phase 8 2036-2039	Total
Open Space	1,356,343	932,398	1,692,294	1,915,073	3,195,366	1,858,828	3,441,660	2,159,885	16,551,847
Parks	360,877	305,817	197,963	458,378	1,201,197	413,601	513,761	428,919	3,880,513
Paseos/Streetscape	1,986,935	346,300	1,344,318	1,227,863	2,013,399	2,336,136	4,165,098	446,120	13,866,169
Multi-Family	556,031			835,890	835,890	528,652			2,756,463
SCE		284,471	284,471	247,329					816,271
Habitat Restoration	138,704	403,151	201,162	822,025	737,832	520,433	1,350,318	436,000	4,609,625
Habitat Restoration in place of Lake	796,167								796,167
Total (cf/year)	5,195,057	2,272,137	4,556,098	5,506,558	7,147,794	5,657,650	9,470,837	3,470,924	43,277,055
Total (afy)	119	52	105	126	164	130	217	80	994
Total (mgd)	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.9

Demand Summary by Near-term and Long-term phase

	ADD			MDD			
	Near-Term	Long-Term	Build-out	Near-Term	Long-Term	Build-out	
	2025	2040		2025	2040		
cf/year	7,064,043	39,221,581	37,637,613	19,927,665	110,644,080	106,175,706	
afy	162	900	864	457	2,540	2,437	
mgd	0.1	0.8	0.8	0.4	2.3	2.2	
gpm	101	558	536	284	1,575	1,511	

Pardee Wastewater Flows

	ADWF ⁽¹⁾			93% Scalping ⁽²⁾			Available Flow after WW Treatment Losses			Available Flow after RW Treatment Losses		
	Near-Term	Long-Term	Build-out	Near-Term	Long-Term	Build-out	Near-Term	Long-Term	Build-out	Near-Term	Long-Term	Build-out
	2025	2040		2025	2040		2025	2040		2025	2040	
gpd	250,800	722,000	760,000	233,244	671,460	706,800	209,920	604,314	636,120	188,928	543,883	572,508
mgd	0.3	0.7	0.8	0.2	0.7	0.7	0.2	0.6	0.6	0.2	0.5	0.6
afy	281	809	851	261	752	792	235	677	712	212	609	641
gpm	174	501	528	162	466	491	146	420	442	131	378	398

(2) Scalping Percentage (minimum amount needed to reach velocity of 2 fps):

93%

(3) Assumed losses in WW Treatment and RW Treatment:

10%

Projected Satellite Treatment Plant flows are insufficient to meet Butterfield ADD or MDD recycled water demands at build-out.

Appendix G

CIP DETAILS

