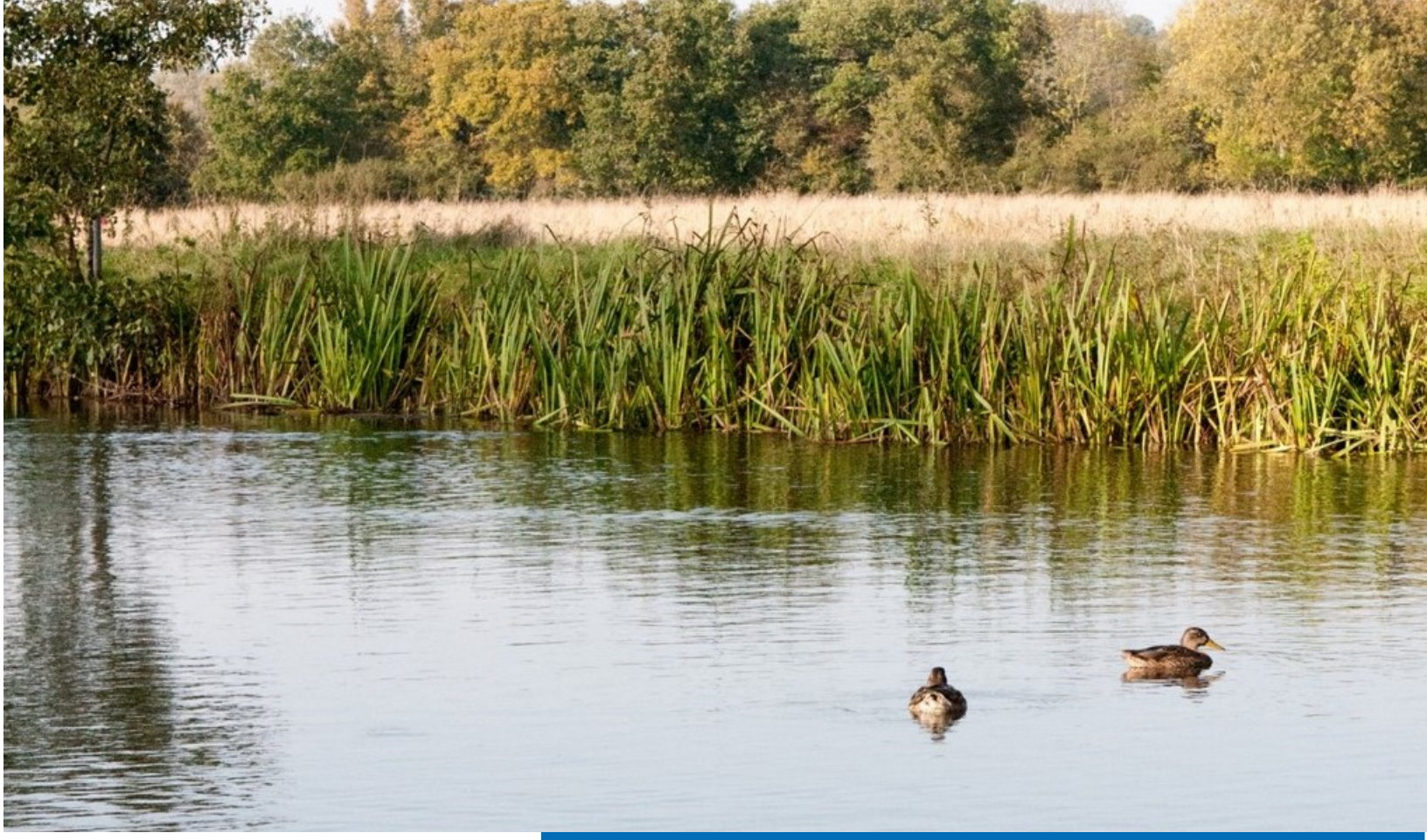


City of Hercules
Sycamore Avenue Trunk Sewer Replacement

INITIAL STUDY/MITIGATED NEGATIVE DECLARATION

September 2020

SMB ENVIRONMENTAL

City of Hercules

Sycamore Avenue Trunk Sewer Replacement Project

Initial Study/Mitigated Negative Declaration

Prepared by:

SMB Environmental, Inc.

September 2020

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List of Abbreviations

ABWF	average base wastewater flow
ACP	asbestos cement pipe
ADWF	average dry weather flow
ARB	Air Resources Board
BAAQMD	Bay Area Air Quality Management District
Basin	Bay Area Air Basin
BWF	base wastewater flow
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
Cal EPA	California Environmental Protection Agency
Cal/OSHA	State of California Occupational Safety and Health Administration
CALTRANS	California Department of Transportation
CAP	Clean Air Plan
CARB	California Air Resources Board
CCAA	California Clean Air Act
CCCFCD	Contra Costa County Flood Control and Conservation District
CCCSD	Central Contra Costa Sanitary District
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CEQA- Plus	California Environmental Quality Act, Plus Federal Requirements
CESA	California Endangered Species Act
CIIP	Cured-in-place pipe
CGS	California Geological Survey
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society's
CWA	Federal Clean Water Act
dBA	Outdoor Ambient Sound levels
DPM	Diesel particulate matter
DTSC	Department of Toxics Substances Control
EA	Environmental Assessment

EBRPD	East Bay Regional Parks District
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
gpd	gallons per day
gpm	gallons per minute
GWI	groundwater infiltration
HCP	Habitat Conservation Plan
HOA	homeowner's association
I/I	infiltration/inflow
ISA	International Society of Arboriculture Standards
IS/MND	Initial Study/Mitigated Negative Declaration
Leq	Equivalent Sound Level
LU	Landscape Unit
mgd	million gallons per day
MH	manhole
MND	Mitigated Negative Declaration
MRZ	Mineral Resource Zone 4
NAAQS	National Ambient Air Quality Standards
NBWRP	North Bay Water Recycling Program
ND	Negative Declaration
NEPA	National Environmental Quality Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NMFS	National Marine Fisheries Service
NOx	Nitrous Oxides
NPDES	National Pollutant Discharge Elimination System
OHWM	Ordinary High-Water Mark
PDR	preliminary design report
psi	pounds per square inch
PWWF	Peak wet weather flow

RCP	reinforced concrete pipe
ROG	reactive organic gases
RWQCB	Regional Water Quality Control Board
SF BCDC	San Francisco Bay Conservation and Development Commission
SR	State Route
SRF	State Revolving Funds
SWPPP	Stormwater Pollution Prevention Permit
SWRCB	State Water Resources Control Board
TAZ	Traffic Analysis Zones
TSP	Total Suspended Particles
UPRR	Union Pacific Railroad
USACE	United States Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service
VOC	Volatile Organic Compounds
WOUS	Waters of the United States
WOS	Waters of the State
WPCP	Water Pollution Control Plant
WWTP	Wastewater Treatment Plant

Chapter 1 Introduction

Pursuant to the California Environmental Quality Act (CEQA), this document is an Initial Study/Mitigated Negative Declaration (IS/MND) that addresses the potential environmental impacts of the City of Hercules' (City) proposed Sycamore Avenue Sewer Trunk Replacement Project (Proposed Project). The City is the CEQA Lead Agency.

The purpose of this document is to provide project-level CEQA environmental analysis of the City's Proposed Project to improve reliability of the system, provide capacity to meet future development flows and wet weather flows without surcharging the system, and to improve access to the sewer for maintenance. What follows is a review and analysis of the major state and federal environmental issues that may be a factor as a result in the construction and/or operation of the Proposed Project. For this analysis, we have reviewed prior and relevant existing environmental documentation and have used a modified CEQA environmental checklist to assess the potential impacts on endangered/threatened species, public health or safety, natural resources, regulated waters, and cultural resources, among others to include and address specific issues associated with CEQA requirements. Based on our experience with evaluating these kinds of projects in California, most of the potential environmental issues appear to be short-term/temporary impacts due to construction activities, which can be avoided and/or mitigated to less-than-significant levels. For any potentially significant impact(s) identified, we have identified appropriate mitigation measures and strategies to attempt to avoid and/or reduce those impacts to less-than-significant levels. The information developed is designed to assist the City determine what the major potential environmental impacts are to comply with CEQA requirements.

1.1 Project Location, Setting, and Background

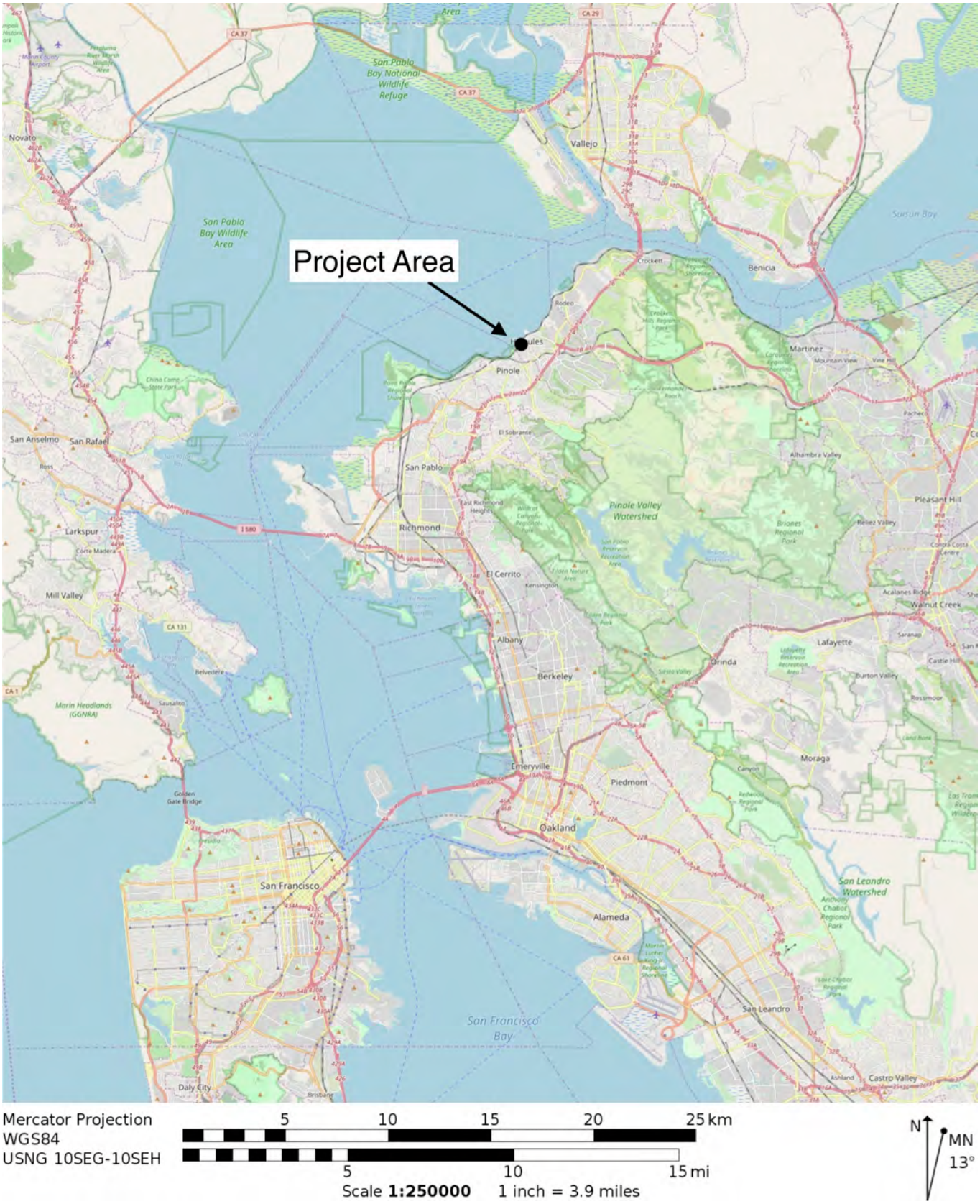
The Proposed Project is located in the City of Hercules, which was established as a dynamite factory in the 1800s and incorporated in 1900. As shown on Figure 1, the City is located on the northeastern shore of the San Pablo Bay, conveniently located along the I-80 corridor and within minutes of both San Francisco and Napa. The City has a population of approximately 25,000 residents and is primarily a suburban, family-oriented community. The City maintains an abundance of open space areas and trails throughout the community, providing the opportunity for spotting various types of wildlife and offering views of the bay.

The existing Sycamore Avenue Trunk Sewer consists of approximately 5,200-linear feet (LF) of 24-inch asbestos cement pipe and 200-LF of 24-inch welded steel pipe constructed in 1972 that conveys sewage from Sycamore Avenue to the Pinole/Hercules Water Pollution Control Plant (WPCP). In addition, there are 21 associated manholes and vaults along the existing alignment.

1.2 Goal and Objective and Purpose and Need

The purpose of the Proposed Project is to replace and/or rehabilitate the existing Sycamore Avenue Trunk Sewer with the following goals in mind:

- To improve reliability of the system;
- To provide capacity to meet future development flows and wet weather flows without;
- surcharging the system; and
- To improve access to the sewer for maintenance.



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Figure 1
General Project Location Map

1.3 Document Organization and Review Process

This document is intended to provide a preliminary environmental investigation of the Proposed Project to determine if it may have a significant adverse impact on the environment. This document is organized into the following chapters:

- Chapter 1, Introduction. Chapter 1 describes the background, goals and objectives of the Proposed Project, and document contents.
- Chapter 2, Proposed Project Description and Alternatives. Chapter 2 describes the major components of the Proposed Project and describes the No Project Alternative.
- Chapter 3, Environmental Review and Consequences. Chapter 3 discusses the potential environmental impacts associated with the construction and operation of the Proposed Project. Each resource section of a modified CEQA checklist is followed by a discussion of each potential impact listed in that section. It also presents corresponding mitigation measures proposed to avoid or reduce potentially significant impacts to a less-than-significant level. This checklist has been modified to include additional topics to meet CEQA requirements.
- Chapter 4, Determination. Chapter 4 provides the proposed determination as a result of this IS/MND.
- Chapter 5, Bibliography. Chapter 5 provides a list of reference materials and persons consulted during the preparation of the environmental issues and constraints evaluation.

This document will be available for a 30-day public review period, during which written comments may be submitted to the following address:

Mr. Mike Roberts, Public Works Director/City Engineer
City of Hercules
111 Civic Center Drive
Hercules, CA 94547

MikeRoberts@ci.hercules.ca.us
Phone: (510) 799-8241

Responses to written comments received by the end of the 30-day public review period will be prepared and included in the final document to be considered by the City prior to taking any discretionary decision/action on the Proposed Project.

Chapter 2 Proposed Project Description and Alternatives

This chapter provides a detailed description of the Proposed Project including a discussion of the construction considerations and potential approvals and permits that may be necessary. In addition, this section also describes the No Project Alternative.

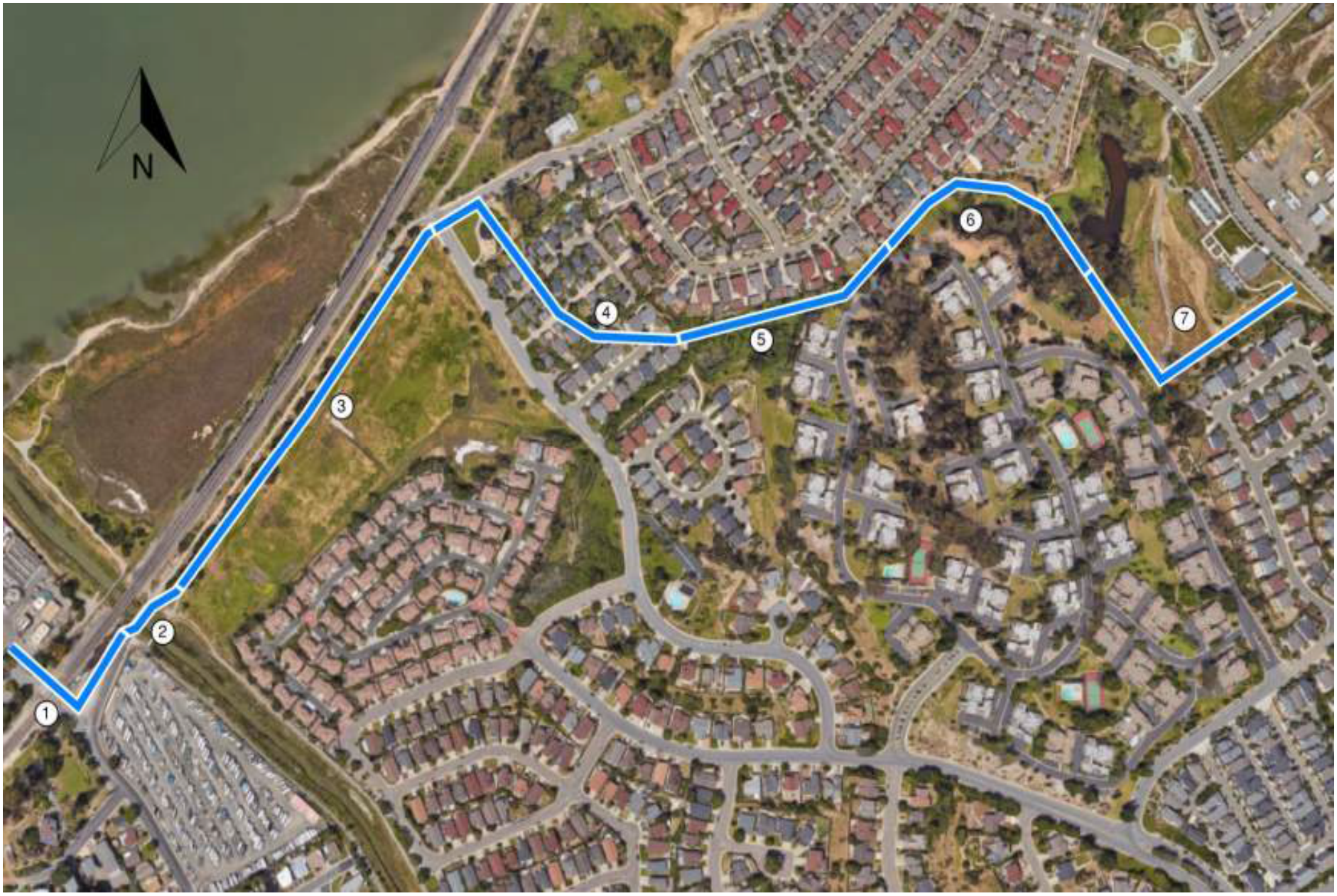
2.1 Proposed Project Description

As shown on Figure 2 and more fully explained in Appendix A – the Sycamore Avenue Trunk Sewer Replacement Preliminary Design Report, the Proposed Project would consist of the replacement of approximately 5,500 linear feet of existing 20- to 24-inch diameter sewer trunk main with new 27- to 36-inch diameter pipelines. The existing alignment of the trunk sewer is generally located out of the public street right-of-way in City easements, private roads, and City parklands within narrow, sometimes curved corridors. The existing pipeline and proposed replacement line are adjacent to a private residential area, borders a known wetlands area, and crosses Pinole Creek and a Union Pacific Rail line. The trunk sewer was split into seven different segments as shown on Figure 2.

The purpose of the Proposed Project is to replace or rehabilitate the trunk sewer while meeting capacity requirements and allowing for future maintenance. In general, due to physical constraints such as property ownership, wetland locations, deep pipe and adjacent trees and retaining walls, the trunk sewer will be replaced in the existing horizontal alignment except where this is not feasible or practical. Table 1 below provides a summary of the Proposed Project by pipeline segment.

Table 1
Sycamore Avenue Trunk Sewer Replacement Project by Pipeline Segment

Location	Pipe Size	Pipe Material	Construction Method
Pinole/Hercules WPCP (Segment 1)	30-inch pipe	HDPE or FPVC in 42-inch Steel Casing within UPRR ROW	Open Cut in WPCP and parallel to UPRR; Guided Auger Bore under UPRR tracks
Pinole Creek Crossing (Segment 2)	10-inch dry weather pipe; 24-inch wet weather pipe; 4-inch air jumper at siphon	HDPE or FPVC in 60-inch Steel Casing with 4-inch air jumper	Microtunnel under creek and Open Cut outside of riparian zone
Chelsea Wetlands (Segment 3)	30-inch pipe	HDPE or FPVC	Open Cut
Historic Homes (Segment 4)	30-inch pipe	HDPE or FPVC	Open Cut
Unnamed Path (Segment 5)	30-inch pipe	HDPE or FPVC	Open Cut
Unnamed Path (Segment 6)	8-inch parallel pipe and lined 24-inch ACP	HDPE or FPVC	Open Cut and CIPP
Unnamed Path (Segment 7)	30-inch pipe	HDPE or FPVC	Open Cut
Reroute Pinole St Sewer Lateral	8-inch pipe	PVC or FPVC	Open Cut
Reroute Railroad Avenue Sewer Lateral	8-inch pipe	HDPE or FPVC	Slipline existing trunk sewer



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Figure 2
Proposed Project Pipeline Segments

There are three locations where horizontal alignment will need to be changed: 1) The UPRR railroad crossing will be parallel to the existing crossing in order to keep the line in service during construction; 2) the Pinole Creek crossing will change from an above ground pipe on an abandoned bridge below the 100-year flood elevation to an underground siphon upstream of the current location; and 3) the sewer located within easement through residential backyards in the Historic Homes Development will be relocated to private roads to improve maintenance access.

In addition, a fourth segment of the pipe in Segment 6, from manhole (MH) 17 to MH 15, is located up to 30-feet below the ground surface in an unnamed path that is approximately 10-feet wide with retaining walls, wetlands, curved pipe, a parallel force main and mature eucalyptus trees with expansive root systems posing access issues. The rest of the rehabilitation/replacement will be done with conventional cut and cover techniques.

A discussion of the special construction methods for these four specific segment areas is as follows.

- **UPPR Railroad Crossing (Segment 1).** The existing trunk sewer crosses the railroad tracks approximately 60-feet northeast of the WPCP entrance. Since there will be no practical method to bypass pump across the active railroad, a parallel trunk sewer will be installed just north of the current alignment to allow continuous service to the Pinole/Hercules Water Pollution Control Plant (WPCP). The standard UPRR encroachment agreement requires that a pipe crossing the railroad be installed within a steel casing generally perpendicular to the railroad tracks from 30-feet beyond one side of the railroad tracks to 30-feet beyond the other side with a cover of 4-feet beneath tracks. Just east of the railroad tracks, there are two fuel lines and two fiber optic conduit that run parallel to the railroad that may set the vertical depth of the crossing. The 12-inch Kinder Morgan gas and Shell oil lines each require 2-feet of clearance to the top of casing. With the relatively flat sewer in this area and grade already set within the WPCP, these lines will need to be potholed in advance to ensure adequate pipe slope into the WPCP. For the second UPRR parcel, the new sewer will run parallel to the railroad tracks and approximately parallel to the existing trunk sewer. This alignment is set by the Pinole Creek crossing as discussed below. It has been assumed that UPRR will permit a longitudinal encroachment agreement for the new trunk sewer alignment within this parcel since the City has an existing agreement with the railroad.
- **Pinole Creek Crossing (Segment 2).** Micro tunneling is the recommended construction method for the Pinole Creek crossing due to space and environmental constraints. Micro tunneling is a remote-controlled, guided, pipe-jacking method that provides continuous face support and shaft-to-shaft construction. The micro tunneling boring machine's (MTBM) guidance system is a laser that's mounted in the jacking shaft and projects onto a target in the shield. In addition, slurry is used to counterbalance earth and groundwater pressures and stabilize the face in front of the MTBM. Micro tunneling is feasible in unstable soils, loose to dense sands, soft to hard clays, soft rock, and high groundwater. As this segment will be crossing underneath a tidally influenced creek directly adjacent to San Pablo Bay, groundwater will be encountered. For a 60-inch casing, a 20-foot wide by 30-foot long jacking shaft is required on one side of the creek, and a 20-foot wide by 15-foot long receiving shaft is required on the other.
- **Historic Homes Development/Camden Lane Alignment (Segment 4).** For Segment 4, both Pinole Street and Camden Lane are feasible alignment alternatives are feasible. However, the Camden Lane alignment alternative was chosen as it would avoid relocating a 6-inch water main which would require obtaining an additional permanent easement from the East Bay Municipal Utility District (EBMUD) that would take a minimum of 18-months. The Pinole Street alignment would also likely require the complete removal of several large trees. The Camden Lane alignment option would divert sewage away from the backyard easements between Railroad Avenue and the

top of Camden Lane by going down Camden Lane and along Santa Fe Avenue to meet the existing alignment at the intersection of Santa Fe Avenue and Railroad Avenue. Camden Lane is a private street, and permanent easement will be required from the home owner's association (HOA). Due to existing topography and required sewer slope, this alignment would require that the downstream sewer be deepened slightly to eliminate shallow pipe with less than 3-feet of cover at the intersection of Camden Lane and Santa Fe Avenue. Camden Lane is narrow and there is limited space in the street for a large pipe. There is only 5- to 6-inches of space available between the face of curb and centerline of the existing 8-inch ACP sewer. Replacement of sidewalk and curb and gutter will be required. There would be two feet of clearance from an existing 8-inch sewer main that currently serves the residences along Camden Lane. The 8-inch sewer main laterals may need to be relocated to avoid conflicts. While bypass piping is not required for the trunk sewer, it may be required for the sewer main. There is also an existing sewer main connection to the trunk sewer at the top of Pinole Street that would need to be reconnected to the new trunk sewer. A new 20-foot length of sewer can be installed to make the connection to the existing sewer main in Pinole Street by replacing an existing rodding inlet with a sewer manhole.

- **Deep Trunk Sewer (Segment 6).** Roughly half a mile of the trunk sewer to be rehabilitated/replaced is located along the unnamed path that runs adjacent to Promenade St., Apollo, and Duck Pond Park. The majority of this path is approximately 10-feet wide with retaining walls, wetlands, curved pipe, a parallel force main, and mature eucalyptus trees with expansive root systems providing access issues. Furthermore, the existing trunk sewer in this area is located up to 30-feet below the ground surface from MH 17 to MH 15.

  The selected construction method for this segment of pipe is to line the existing 24-inch asbestos cement pipe (ACP) pipe with cured-in-place pipe (CIPP). CIPP lining is a system that involves the placement of a soft felt material, impregnated with thermosetting resin, inside the existing sewer line to provide a fully structural rehabilitated pipeline. However, due to the smaller pipe, the design criteria would not be achieved during wet weather flows, and surcharging is not allowed. As a result, a second 8-inch wet weather pipeline would be located immediately above the existing trunk sewer with 1-foot of clearance between the pipes. During dry season, the CIPP lined trunk sewer will convey the wastewater. During periods of peak wet weather flow, the sewer manholes will begin to surcharge, and flow will enter the 3-inch-diameter wet weather pipe. The 8-inch pipe will be installed using open-cut construction after completion and testing of the CIPP liner. An 8-inch pipe is easier to handle in areas with limited access, and a narrower trench is feasible. Since the current condition of the ACP is unknown, there is too much risk associated with excavating before lining the pipe.

2.2 Construction Considerations

Construction of the Proposed Project is expected to begin in the spring/summer of 2021 and will likely continue for 6- to 8-months into the fall of 2021. Construction work will typically be done within normal working hours, weekdays between the hours of 7 a.m. and 4 p.m., and possibly on Saturdays between the hours of 7 a.m. and 4 p.m. However, once the installation process is started in Segment 6, work cannot be interrupted and working hours may require working during the night and weekend. Detailed below is a summary of the major construction techniques and activities.

- The majority of the replacement pipeline would be installed using conventional cut and cover construction techniques and installing pipe in open trenches. It is assumed that up to a 12-foot wide construction corridor would be used to help maximize the efficiency during construction. However, in most places a 3-to-5-foot construction corridor could be realized, especially for the smaller

diameter pipelines. It is anticipated that excavation would typically be no more than 3-5 feet wide and up to 35-feet deep.

- All creeks, drainages, wetlands, and/or riparian areas will be avoided and/or will be crossed using trenchless construction techniques[1]. No construction activities will occur during rainy weather nor between October 15 and April 1.
- Dewatering of the pipeline as a result of hydrostatic testing during construction as well as any dewatering as a result of operations and maintenance activities shall be discharged to land and not into any creeks, drainages, or waterways and shall require prior approval from the San Francisco Bay Regional Water Quality Control Board (San Francisco RWQCB).

Construction activities for this kind of project will typically occur with periodic activity peaks, requiring brief periods of significant effort followed by longer periods of reduced activities. In order to characterize and analyze potential construction impacts, the City has assumed that each phase of the project would be constructed by two (2) crews of 10 to 15 workers each and would proceed at a rate of approximately 500–1,000 feet per day. However, specific details may change or vary slightly. Staging areas for storage of pipe, construction equipment, and other materials would be placed at locations that would minimize hauling distances and long-term disruption.

Excavation and grading activities would be necessary for construction of the Proposed Project. Excavated materials resulting from site preparation would either be used on-site during construction or disposed of at a fill area authorized by the City. It is not anticipated that any soils would be imported for this project. Additional truck trips would be necessary to deliver materials, equipment, and asphalt-concrete to the site. During peak excavation and earthwork activities, the Proposed Project could generate up to 10 round-trip truck trips per day. In support of these activities and for the assumptions for this document, the types of equipment that may be used at any one-time during construction may include, but are not limited to:

- Track-mounted excavator
- Backhoe
- Grader
- Crane
- Dozer
- Compactor
- Trencher/boring machine
- End and bottom dump truck
- Front-end loader
- Water truck

[1] Trenchless technology is a type of subsurface construction work that requires few trenches or no continuous trenches. It is a rapidly growing sector of the construction and civil engineering industry. Trenchless technology can be defined as "a family of methods, materials, and equipment capable of being used for the installation of new or replacement or rehabilitation of existing underground infrastructure with minimal disruption to surface traffic, business, and other activities." Trenchless construction includes such construction methods as tunneling, micro-tunneling (MTM), horizontal directional drilling (HDD) also known as directional boring, pipe ramming (PR), pipe jacking (PJ), moling, horizontal auger boring (HAB) and other methods for the installation of pipelines and cables below the ground with minimal excavation. Large diameter tunnels such as those constructed by a tunnel boring machine (TBM), and drilling and blasting techniques are larger versions of subsurface construction. The difference between trenchless and other subsurface construction techniques depends upon the size of the passage under construction. Trenchless construction requires considering soil characteristics and the loads applied to the surface. In cases where the soil is sandy, the water table is at shallow depth, or heavy loads like that of urban traffic are expected, the depth of excavation has to be at a depth such that the pressure of the load on the surface does not affect the bore, otherwise there is danger of surface caving in.

- Flat-bed delivery truck
- Forklift
- Compressor/jack hammer
- Asphalt paver & roller
- Street sweeper

It is recognized that details of the construction activities and methods may change slightly as the specific details will be developed during final design and by the selected contractor. However, this description provides sufficient information to base the conclusions regarding probable environmental impacts associated with construction activities for this kind of project. Therefore, as long as the construction methods are generally consistent with these methods and do not conflict with any of the City's design standards or established ordinances, and do not create any new potential environmental impacts that are not described within this document, then no new environmental analyses will likely be required for any minor change in construction activities, timing, and/or schedule.

Based on the accessor parcel maps and surveyor research, the existing trunk sewer passes through land owned by the City of Pinole, Contra Costa County, UPRR, the City, and easements through private land. Table 2 provides a summary of the estimates of permanent and temporary easements that will be required for the Proposed Project.

Table 2
Estimates of Permanent and Temporary Easement Requirements

Location	Permanent Easement Size	Temporary Easement Size	Owner
Adjacent to WPCP	40 ft x 55ft	100 ft x 55 ft	CCCFCD
Railroad Avenue	N/A	155 ft x 120 ft	UPRR
Pinole Creek Crossing	40 ft x 55 ft	N/A	CCCFCD
Santa Fe Avenue and Camden lane	20 ft x 1,000 ft	Up to 20 ft x 1,000 ft	Historic Homes HOA
Unnamed path from the Reserve to Duck Pond Park	N/A	Up to 20 ft x 1,800 ft	Promenade or Olympian Hills #2 HOA

During construction, approximately 5-10 people would be working on the Proposed Project. The City will employ appropriate construction best management practices (BMPs). As a final step of construction activities, the construction site would be cleaned up and restored to previous conditions. Construction trash and debris would be collected and disposed of properly. Once constructed, the City would resume existing day-to-day operations and maintenance procedures. No new permanent City employees are anticipated to be required for the Proposed Project.

2.3 Responsible Agencies, Permits and Approvals

Table 3 below summarizes the potential permits and/or approvals that may be required prior to construction of the Proposed Project. Additional local approvals and permits may also be required.

Table 3
Regulatory Requirements, Permits, and Authorizations for Project Facilities

Agency	Type of Approval
California Division of Occupational Safety and Health Administration	Construction activities in compliance with CAL/OSHA safety requirements
California State Water Resources Control Board	401 Water Quality Certification
California Fish and Wildlife	Streambed Alteration Agreement
City of Hercules	Encroachment Permit
	Tree Trimming/Removal Permit
City of Pinole	Encroachment Permit
Contra Costa County	Encroachment Permit
Contra Costa County Flood Control District	Encroachment Permit
East Bay Regional Park District	Encroachment Permit
San Francisco Regional Water Quality Control Board	National Pollutant Discharge Elimination System
	General Permit for Stormwater Discharge Associated with Construction Activities
San Francisco Bay Area Air Quality Management District	Authority to Construct
	Permit to Operate
San Francisco Bay Conservation and Development Commission	Region Wide Permit #2 (preauthorized permit for replacing an existing pipeline)
U.S. Army Corps of Engineers	Section 404 (Pinole Creek Crossing; Wetlands)
	Nationwide Permit Pre-construction Permit

2.4 No Project Alternative

Under the No Project Alternative, the City's Proposed Project would not be constructed and therefore impacts as a result of this specific Proposed Project as described here within this document would not be encountered. For this analysis, it is assumed that the existing baseline condition and the future No Project condition are the same. This No Project Alternative assumes that none of the Proposed Project would be constructed. As a result, the impact description and summary compare the Proposed Project to the No Project.

Chapter 3 Environmental Review and Consequences

This chapter evaluates the potential for the Proposed Project to have a significant effect on the environment. Using the CEQA Environmental Checklist Form as presented in Appendix G of the CEQA Guidelines as a framework, the checklist identifies the potential environmental impacts of the Proposed Project pursuant to both CEQA. This document compares the Proposed Project against the No Project Alternative as is required by CEQA.

Environmental Impact Designations

For this checklist, the following designations are used to distinguish between levels of significance of potential impacts to each resource area:

Potentially Significant Impact. Adverse environmental consequences that have the potential to be significant according to the threshold criteria identified for the resource, even after mitigation strategies are applied and/or an adverse effect that could be significant and for which no mitigation has been identified. If any resultant potentially significant impacts are identified, an EIR/EIS may need to be prepared to meet CEQA requirements.

Less-than-Significant Impact with Mitigation. Adverse environmental consequences that have the potential to be significant, but can be reduced to less-than-significant levels through the application of identified mitigation strategies that have not already been incorporated into the Proposed Project description.

Less-than-Significant Impact. Potential adverse environmental consequences have been identified. However, they are not so adverse as to meet the significance threshold criteria for that resource. Therefore, no mitigation measures are required.

No Impact. No adverse environmental consequences have been identified for the resource or the consequences are negligible or undetectable. Therefore, no mitigation measures are required.

Environmental Resources Evaluated

The following are the key environmental resources that were evaluated in this document.

- ☒ Aesthetics
- ☒ Agriculture Resources
- ☒ Air Quality
- ☒ Biological Resources
- ☒ Cultural Resources
- ☒ Geology / Soils
- ☒ Hazards/Hazardous Materials
- ☒ Hydrology / Water Quality
- ☒ Land Use / Planning
- ☒ Mineral Resources
- ☒ Noise
- ☒ Public Services
- ☒ Population and Housing
- ☒ Recreation
- ☒ Socioeconomics
- ☒ Transportation/Traffic
- ☒ Tribal Cultural Resources
- ☒ Utilities and Service Systems
- ☒ Mandatory Findings of Significance

3.1 Aesthetics

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☒	☐	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☒	☐	☐
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☒	☐	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☒	☐	☐

Discussion

(a) **Less-than-Significant Impact with Mitigation.** The Proposed Project is located near the San Pablo Bay. San Pablo Bay is a part of San Francisco Bay, and each is a major scenic resource, with broad vistas of water, islands, urban skylines, bridges, and mountains available from many parts of the Bay Area. The shoreline of the bay is characterized by a mix of open land and commercial, maritime, industrial, residential, and recreational land uses. Hills and mountains surround the bay, creating both scenic backdrops to views from the lowlands or water and extensive viewing locations of the bay and surroundings from higher elevations. Visual conditions during construction activities would include various types of construction equipment, materials staging areas, construction-force parking areas, construction fencing, and construction-related debris. Although this would represent a temporary visual condition and would be mostly limited to the site itself, it could be considered an unsightly condition for nearer receptors. Although temporary, such conditions represent an impact on visual quality of the Project Area. However, with implementation of the mitigation measure below, the Proposed Project's construction-related impacts would be further reduced to less-than-significant levels.

> **Mitigation Measure AES-1: Implement Visual Construction Best Management Practices.** The City and/or its contractor shall remove construction debris and dispose of it at a licensed facility on a daily basis. In the event daily disposal is not determined to be practical, it must be stored on site as far from residential receptors as feasible and be screened from view. The contractor would also be required to remove any debris, mud or other soils from the site that was deposited on public roadways by construction-related traffic. Construction equipment and crew parking areas are to be staged in an orderly manner and as far as possible from existing residences. Site conditions are to be left in a clean and orderly manner at the end of each working day.

Once constructed, the entire Proposed Project would be located underground and would not be visible. As a result, no long-term or permanent impacts are anticipated and no specific mitigation measures are required.

(b) **Less-than-Significant Impact with Mitigation.** As noted above, the Proposed Project is located near the San Pablo Bay. San Pablo Bay is a part of San Francisco Bay, and each is a major scenic resource, with broad vistas of water, islands, urban skylines, bridges, and mountains available from many parts of the Bay Area. The shoreline of the bay is characterized by a mix of open land and commercial, maritime, industrial, residential, and recreational land uses. Hills and mountains surround the bay, creating both scenic backdrops to views from the lowlands or water and extensive viewing locations of the bay and surroundings from higher elevations. Visual conditions during construction activities would include various types of construction equipment, materials staging areas, construction-force parking areas, construction fencing, and construction-related debris. Although this would represent a temporary visual condition and would be mostly limited to the site itself, it could be considered an unsightly condition for nearer receptors. Although temporary, such conditions represent an impact on visual quality of the Project Area. However, with implementation of **Mitigation Measure AES-1** above, the Proposed Project's construction-related impacts would be further reduced to less-than-significant levels.

The Proposed Project would have no impact on scenic resources within a State scenic highway, as there are no scenic routes located within the vicinity of the project site, and no scenic routes on the project site that would be affected by the proposed project. Since there would be no Project specific impacts related to State scenic highways or routes, no impacts are anticipated and no specific mitigation measures are required.

Once constructed, the entire Proposed Project would be located underground and would not be visible. As a result, no long-term or permanent impacts are anticipated and no specific mitigation measures are required.

(c) **Less-than-Significant Impact with Mitigation.** Construction of the Proposed Project's facilities would be visible and could involve temporary negative aesthetic effects, including the presence of construction equipment and materials. However, with implementation of **Mitigation Measure AES-1** above, the Proposed Project's construction-related impacts would be further reduced to less-than-significant levels. Once constructed, the entire Proposed Project would be located underground and would not be visible. As a result, no long-term or permanent impacts are anticipated and no specific mitigation measures are required.

(d) **Less-than-Significant Impact with Mitigation.** The Proposed Project would not involve the creation of permanent lights or facilities that would create a new source of substantial light or glare that would adversely affect day or nighttime views in the area. However, the construction of the CIIP pipe facilities in Segment 6 cannot be interrupted once it begins and therefore could require a short period of temporary nighttime construction, which could be a new source of temporary construction lighting and/or glare. However, with the following mitigation measure, any impacts would be considered to be less-than-significant.

> **Mitigation Measure AES-2: Minimize Light and Glare During Nighttime Construction Activities.** The city and/or its contractor shall minimize light glare during nighttime construction activities by taking measures to direct the light inward toward the construction site and minimize glare for residences in the vicinity of the construction site.

Once constructed, the entire Proposed Project would be located underground and would not be visible. As a result, no long-term or permanent impacts are anticipated and no specific mitigation measures are required.

3.2 Agricultural Resources

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The construction and operation of the Proposed Project would not convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use. The Proposed Project would not be located on any existing agricultural fields or farmlands. As a result, the Proposed Project would not convert any farmland to non-agricultural usage. No mitigation is required or necessary.

(b) **No Impact.** The construction and operation of the Proposed Project would not conflict with existing zoning for agricultural use or a Williamson Act contract. As stated above, the Proposed Project would not be located on any existing agricultural fields or farmlands. As a result, the Proposed Project would not conflict with agricultural practices and/or a Williamson Act Contract. No mitigation is required or necessary.

(c) **No Impact.** As mentioned above, the construction and operation of the Proposed Project would not involve changes to the existing agricultural environment, and which, due to their location or nature, would not result in the conversion of farmland or agricultural practices to non-agricultural use. No mitigation is required or necessary.

3.3 Air Quality

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☒	☐	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the Project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☒	☐	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☒	☐	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☒	☐
f) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☒	☐	☐
g) Conflict with an application plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☒

Discussion

(b) **Less-than-Significant Impact.** The Proposed Project is located within the jurisdiction of the San Francisco Bay Area Air Quality Management District (BAAQMD), the regional agency empowered to regulate air pollutant emissions from stationary sources in the Bay Area. BAAQMD regulates air quality through its permit authority over most types of stationary emission sources and through its planning and review process. The Project site is located in the San Francisco Bay Area Air Basin. This Basin is currently designated "non-attainment" for the state 1-hour ozone standard. To meet planning requirements related to this standard, the BAAQMD developed a regional air quality plan, the Bay Area 2000 Clean Air Program (CAP), the BAAQMD's most recent triennial update of the 1991 Clean Air Plan. A significant impact would occur if a project conflicted with the plan by not mirroring assumptions of the plan regarding population growth and vehicle-miles-traveled. The construction and/or operation of the Proposed Project would not contribute to population growth and/or any significant increase in vehicle-miles traveled that would conflict with

the Plan. Any impacts are considered to be less-than-significant. No mitigation is required or necessary.

(c) **Less-than-Significant Impact with Mitigation.** The entire San Francisco Bay Area is currently designated "non-attainment" for the state PM_{10} and $PM_{2.5}$ standards, and the state 1-hour ozone standard. The Bay Area is in "attainment" or "unclassified" with respect to the other ambient air quality standards. As part of the effort to reach attainment of these standards, the BAAQMD has established thresholds of significance for several criteria air pollutants associated with both the construction and operation of projects[2]. Specifically, a project is considered to have a significant regional air quality impact if it would result in an increase in emissions of 80 pounds per day or 15 tons per year of PM_{10}, and/or of reactive organic gases (ROG) or nitrogen oxides (NO_X). ROG and NO_X are both ozone precursors.

Construction activities at the project site would begin in the Spring/Summer of 2021 and end in the fall of 2021 and would include excavation and grading activities. Overall construction work would require the use of various types of mostly diesel-powered equipment, including bulldozers, wheel loaders, excavators, and various kinds of trucks.

Construction activities typically result in emissions of particulate matter, usually in the form of fugitive dust from activities such as trenching and grading. Emissions of particulate matter vary day-to-day, depending on the level and type of activity, silt content of the soil, and the prevailing weather. Estimated construction emissions for the pipeline construction were generated using the Sacramento Metropolitan Air Quality Management District's i.e. URBEMIS Construction Emissions Model (See Appendix A). Please note that this model was used because it has been recommended by BAAQMD. The URBEMIS Construction Emissions Model is a Microsoft Excel worksheet available to assess the emissions of linear construction projects. The estimated construction equipment fleet-mix and the acreage and soil volume were put into the URBEMIS model in order to determine potential emissions. Table 4 summarizes the Proposed Project's estimated construction-related emissions output from the URBEMIS model in maximum pounds per day as well as in estimated tons for the entire construction duration and compares that data with BAAQMD's daily and project/year thresholds. This estimate assumes the worst-case scenario where the maximum pipeline length and the largest storage tank would be built. As shown in Table 4, the Proposed Project's construction emissions would not exceed BAAQMD's daily and/or annual significance thresholds.

BAAQMD's approach to analyses of construction impacts (as noted in their BAAQMD CEQA Guidelines) is to emphasize implementation of effective and comprehensive basic construction control measures rather than detailed quantification of emissions. With implementation of the

[2] BAAQMD's CEQA Guidelines were developed to assist local jurisdictions and lead agencies in complying with the requirements of CEQA regarding potentially adverse impacts to air quality. These CEQA Guidelines were updated in June 2010 to include reference to thresholds of significance ("Thresholds") adopted by the Air District Board on June 2, 2010. The Guidelines were further updated in May 2011. On March 5, 2012 the Alameda County Superior Court issued a judgment finding that the Air District had failed to comply with CEQA when it adopted the Thresholds. The court did not determine whether the Thresholds were valid on the merits, but found that the adoption of the Thresholds was a project under CEQA. The court issued a writ of mandate ordering the District to set aside the Thresholds and cease dissemination of them until BAAQMD had complied with CEQA. In view of the court's order, BAAQMD is no longer recommending that the Thresholds be used as a generally applicable measure of a project's significant air quality impacts. Lead agencies will need to determine appropriate air quality thresholds of significance based on substantial evidence in the record. Although lead agencies may rely on BAAQMD's CEQA Guidelines (updated May 2011) for assistance in calculating air pollution emissions, obtaining information regarding the health impacts of air pollutants, and identifying potential mitigation measures, BAAQMD has been ordered to set aside the Thresholds and is no longer recommending that these Thresholds be used as a general measure of a project's significant air quality impacts. Lead agencies may continue to rely on the Air District's 1999 Thresholds of Significance and they may continue to make determinations regarding the significance of an individual project's air quality impacts based on the substantial evidence in the record for that project.

mitigation measures below, the Proposed Project's construction-related impacts would be further reduced to less-than-significant levels.

Table 4
Estimated Proposed Project Construction Emissions

Construction Phase		Construction Emissions (lbs/day)			
	ROG	CO	NOx	PM_{10}	$PM_{2.5}$*
Grubbing/Land Clearing	1.3	10.3	11.6	1.5	0.7
Grading/Excavation	5.6	44.5	54.9	3.5	2.5
Drainage/Utilities/Subgrade	4.7	36.0	43.1	3.1	2.1
Paving	1.9	16.9	16.3	0.9	0.8
Maximum (lbs/day)**	**5.8**	**44.5**	**54.9**	**3.5**	**2.5**
Total Tons Project/ Year	**0.4**	**3.0**	**3.6**	**0.2**	**0.2**
BAAQMD's Thresholds of Significance***					
Pounds per Day	80	550	80	80	80
Tons per Project/Year	15	100	15	15	15
Potentially Significant Impact?	**No**	**No**	**No**	**No**	**No**
Notes					

* BAAQMD does not have a threshold for $PM_{2.5}$; however, the same threshold for PM_{10} is used herein.
**Maximum daily emissions refer to the maximum emissions that would occur in one day. Not all phases will be occurring concurrently; therefore, the maximum daily emissions are not a summation of the daily emission rates of all phases.
*** BAAQMD's May 2011 Thresholds were invalidated by Alameda County Superior Court and BAAQMD recommends using its 1999 Thresholds.

Mitigation Measure AIR-1: Basic Construction Mitigation Measures Recommended for ALL Proposed Projects. During all phases of construction, the following procedures shall be implemented:

- All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.
- All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
- All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
- All vehicle speeds on unpaved roads shall be limited to 15 mph.
- All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible.
- Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points.
- All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator.
- Post a publicly visible sign with the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action

within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

Mitigation Measure AIR-2: Additional Construction Mitigation Measures for Projects with Emissions over the Thresholds. During all phases of construction, the following procedures shall be implemented as appropriate:

- All exposed surfaces shall be watered at a frequency adequate to maintain minimum soil moisture of 12 percent. Moisture content can be verified by lab samples or moisture probe.
- All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 mph.
- Windbreaks (e.g., trees, fences) shall be installed on the windward side(s) of actively disturbed areas of construction. Windbreaks should have at maximum 50 percent air porosity.
- Vegetative ground cover (e.g., fast-germinating native grass seed) shall be planted in disturbed areas as soon as possible and watered appropriately until vegetation is established.
- The simultaneous occurrence of excavation, grading, and ground-disturbing construction activities on the same area at any one time shall be limited. Activities shall be phased to reduce the amount of disturbed surfaces at any one time.
- All trucks and equipment, including their tires, shall be washed off prior to leaving the site.
- Site accesses to a distance of 100 feet from the paved road shall be treated with a 6- to 12-inch compacted layer of wood chips, mulch, or gravel.
- Sandbags or other erosion control measures shall be installed to prevent silt runoff to public roadways from sites with a slope greater than one percent.
- Minimizing the idling time of diesel-powered construction equipment to five (5) minutes.
- The Project shall develop a plan demonstrating that the off-road equipment (more than 50 horsepower) to be used in the construction project (i.e., owned, leased, and subcontractor vehicles) would achieve a project-wide fleet-average 20 percent NOx reduction and 45 percent PM reduction compared to the most recent Air Resources Board (ARB) fleet average. Acceptable options for reducing emissions include the use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available.
- Use low volatile organic compounds (VOC) (i.e., ROG) coatings beyond the local requirements (i.e., Regulation 8, Rule 3: Architectural Coatings).
- Requiring that all construction equipment, diesel trucks, and generators be equipped with Best Available Control Technology for emission reductions of NOx and PM.
- Requiring all contractors use equipment that meets the California Air Resources Board's (CARB) most recent certification standard for off-road heavy-duty diesel engines.

Once operational, emission sources resulting from the Proposed Project's operations would be associated with primarily regular maintenance and inspection work. BAAQMD does not have any specific criteria for operations for these kinds of projects. Operational impacts would be negligible

and well below the less-than-significant impacts of the construction impacts and would be considered less-than-significant. With respect to project conformity with the federal Clean Air Act, the Proposed Project's potential emissions are well below minimum thresholds and are below the area's inventory specified for each criteria pollutant designated non-attainment or maintenance for the Bay Area. As such, further general conformity analysis is not required.

(c) **Less-than-Significant Impact with Mitigation.** As stated above, the entire San Francisco Bay Area is currently designated "non-attainment" for the state PM_{10} and $PM_{2.5}$ standards, and the state 1-hour ozone standard. The Bay Area is in "attainment" or "unclassified" with respect to the other ambient air quality standards. The BAAQMD is active in establishing and enforcing air pollution control rules and regulations in order to attain all state and federal ambient air quality standards and to minimize public exposure to airborne toxins and nuisance odors. Air emissions would be generated during construction of the Proposed Project, which could increase criteria air pollutants, including PM_{10}. However, construction activities would be temporary and would incorporate the implementation of **Mitigation Measure AIR-1 and AIR-2** as identified above.

As mentioned above, upon completion of construction activities, emission sources resulting from Project operations would be associated with regular maintenance and inspection work. Given the limited number of trips that would be required, only limited emissions would be generated; these emissions would be expected to be well below BAAQMD guidelines. See Table 4 above. As such, the Proposed Project would not result in a cumulatively considerable net increase of any criteria air pollutants, and the impacts would be even less-than-significant with implementation of **Mitigation Measure AIR-1 and AIR-2** as identified above.

(d) **Less-than-Significant Impact with Mitigation.** Diesel emissions would result both from diesel-powered construction vehicles and any diesel trucks associated with project operation. Diesel particulate matter (DPM) has been classified by the California Air Resources Board as a toxic air contaminant for the cancer risk associated with long-term (i.e., 70 years) exposure to DPM. Given that construction would occur for a limited amount of time and that only a limited number of diesel trucks would be associated with operation of the project, localized exposure to DPM would be minimal. As a result, the cancer risks from the project associated with diesel emissions over a 70-year lifetime are very small. Therefore, the impacts related to DPM would be less-than-significant. Likewise, as noted above, the Proposed Project would not result in substantial emissions of any criteria air pollutants either during construction or operation. Therefore, the Proposed Project would not expose sensitive receptors, including residents in the project vicinity, to substantial pollutant concentrations. With the implementation of **Mitigation Measure AIR-1 and AIR-2**, impacts to sensitive receptors would be further reduced and considered to be less-than-significant. No additional mitigation measures are required.

(e) **Less-than-Significant Impact.** During construction of the Proposed Project, the various diesel-powered vehicles and equipment in use on-site could create minor odors. These odors are not likely to be noticeable beyond the immediate area and, in addition, would be temporary and short-lived in nature. Once constructed, the operations of the Proposed Project would not result in any odor issues. Therefore, odor impacts would be less-than-significant. No specific mitigation measures are required.

(f) **Less-than-Significant Impact with Mitigation.** BAAQMD does not have an adopted threshold of significance for construction and/or operational-related GHG emissions for projects like this. Operation of the Proposed Project is not expected to generate any significant amounts of GHG emissions. During construction of the Proposed Project, the various diesel-powered vehicles and equipment in use on-site could generate greenhouse gas emissions. However, the Proposed Project

would not exceed the thresholds for NOx, which is an indicator for generating GHG emissions. BAAQMD's approach to analyses of construction impacts as noted in their BAAQMD CEQA Guidelines is to emphasize implementation of effective and comprehensive basic construction control measures rather than detailed quantification of emissions. As a result, with implementation of **Mitigation Measure AIR-1 and AIR-2,** any potential to generate greenhouse gas emissions would be reduced to less-than-significant levels. No additional mitigation measures are required.

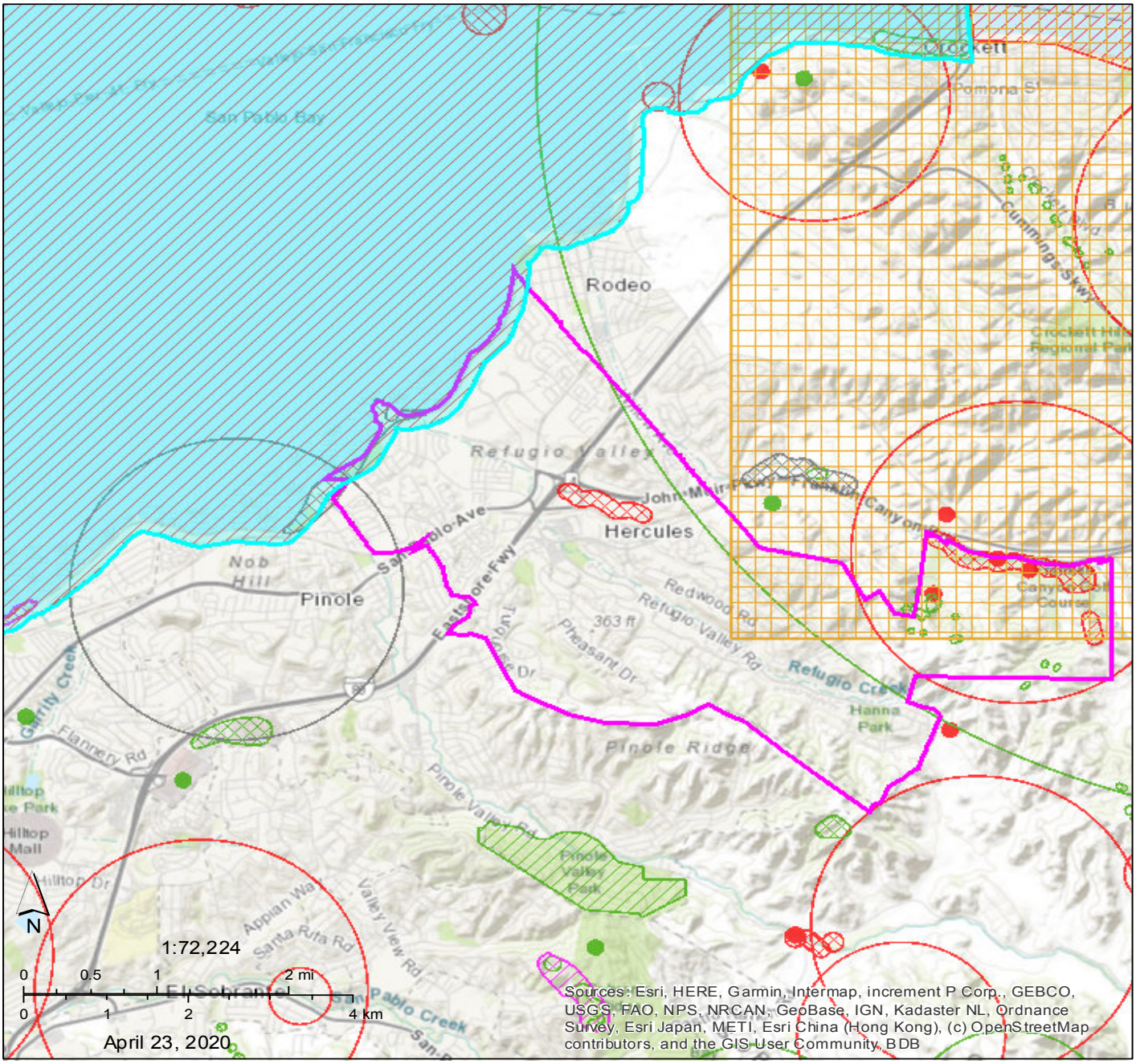
(g) **No Impact.** The construction and/or the operation of the Proposed Project would not conflict with an application plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases. No mitigation is necessary or required.

3.4 Biological Resources

Would the Proposed Project:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife (CDFW) or U.S. Fish and Wildlife Service (USFWS)?	☐	☒	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFW or USFWS?	☐	☒	☐	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☒	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☒	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☒	☐	☐
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

Discussion

As shown in Appendix C, a record search of CDFW's California Natural Diversity Database (CNDDB) and USFWS' Species List was conducted for the area within a five-mile radius of the Project area to identify previously reported occurrences of state and federal special-status plants and animals. Figure 3 shows the location of known state and federal listed special-status species within the Project Area. Figure 4 provides a summary of pictures along portions of the pipeline alignment. In addition, field visits for the Proposed Project was conducted on March 26, 2020, to determine the potential for special-status species to occur within the general vicinity of the Proposed Project Study Area (i.e., Construction Area) as described in



California Natural Diversity Database (CNDDB) Commercial [ds85]

- Plant (80m)
- Plant (specific)
- Plant (non-specific)
- Plant (circular)
- Animal (80m)
- Animal (specific)
- Animal (non-specific)
- Animal (circular)
- Terrestrial Comm. (80m)
- Terrestrial Comm. (specific)
- Terrestrial Comm. (non-specific)
- Terrestrial Comm. (circular)
- Aquatic Comm. (80m)
- Aquatic Comm. (specific)
- Aquatic Comm. (non-specific)
- Aquatic Comm. (circular)
- Multiple (80m)
- Multiple (specific)
- Multiple (non-specific)
- Multiple (circular)
- Sensitive EO's (Commercial only)

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SMB ENVIRONMENTAL

Figure 3
Special Status Species in Project Vicinity Map








Upper: Pipeline Segment 2 crossing at Pinole Creek, looking north (left); Segment 3 Bay Trail, looking east (right).
Center: Playground at Santa Fe and Railroad Ave (left); at Pinole St, looking northwest (right).0
Lower: trail near Apollo Drive; note manhole to sewer (left); west side of Duck Pond Park (right)

SMB ENVIRONMENTAL

Figure 4
Pictures Along Pipeline Alignment

Chapter 2 – Project Description. This field visit was not intended to be a protocol-level survey to determine the actual absence or presence of special-status species, but was conducted to determine the potential for special-status species to occur within the Proposed Project Area. During the field visit a white-tailed kite (*Elanus leucurus*) (California Fully Protected) foraging was observed near the grassland area next to Pinole Creek. However, a nesting location was not observed. In addition, a Western bumble bee (*Bombus occidentalis*) was observed foraging and going into a ground burrow. No other special status species including special status plant species were observed in the Project Study Area. In addition, Table 5 provides a summary of the potential for state and federal special status species to occur within the Proposed Project Study Area.

(a) **Less-than-Significant Impact with Mitigation.** The Proposed Project would be constructed entirely within paved surfaces and once constructed would not likely have an adverse effect on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFW and USFWS. However, construction of the Proposed Project could have a temporary, but substantial adverse effect, either directly or through disturbances to several species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFW and USFWS. Table 5 below provides a list of the potential for special status species to occur within the Project Study area. As a result, the following mitigation measures and procedures are proposed to reduce any impacts to less-than-significant levels:

Mitigation Measure BIO-1: Conduct A Preconstruction Survey for Special Status Wildlife Species. A qualified biologist shall conduct a pre-construction survey for state and federal special status wildlife species no more than 10-days prior to construction. A combination of visual and trapping surveys may be performed with authorization from CDFW and/or USFWS. If a wildlife special species is found near any proposed construction areas, impacts on individuals and their habitat shall be avoided to the extent feasible. If occupied habitat can be avoided, an exclusion zone shall be established around the habitat and temporary suitable/authorized fencing shall be installed around the buffer area with "Sensitive Habitat Area" signs posted and clearly visible on the outside of the fence. If avoidance is not possible and the species is determined to be present in work areas, the qualified biologist with prior approval from CDFW and/or USFWS may capture the wildlife special status species prior to construction activities and relocate them to nearby, suitable habitat a minimum of 300-feet from the work area. Exclusion fencing shall then be installed if feasible to prevent them from reentering the work area. For the duration of work in these areas, the biologist should conduct regular follow-up visits to monitor effectiveness.

Mitigation Measure BIO-2: Conduct Bird Breeding and Nesting Surveys. For construction activities that occur between February 1 and August 31, preconstruction breeding and nesting bird surveys shall be conducted by a qualified biologist prior to and within 10 days of any initial ground-disturbance activities. Surveys shall be conducted within all suitable nesting habitat within 250-feet of the activity. All active, non-status passerine nests identified at that time shall be protected by a 50-foot radius minimum exclusion zone. Active raptor or special-status species nests shall be protected by a buffer with a minimum radius of 200-feet. CDFW and USFWS recommend that a minimum 500-foot exclusion buffer be established around active special status species nests. The following considerations apply to this mitigation measure:

- Survey results are valid for 14-days from the survey date. Should ground disturbance commence later than 14-days from the survey date, surveys should be repeated. If no breeding birds are encountered, then work may proceed as planned.
- Exclusion zone sizes may vary, depending on habitat characteristics and species, and are generally larger for raptors and colonial nesting birds. Each exclusion zone would remain in place until the nest is abandoned or all young have fledged.

Table 5
Potential for Special-Status Species to Occur in the Proposed Project Study Area

Species	Status	Habitat	Potential for Occurrence	Recommendations
Plants				
Cordylanthus mollis ssp. *mollis* soft bird's-beak	FE, SR, List 1B	Coastal salt marshes and swamps. 0-3 m. Blooms July- November.	**Moderate.** Suitable habitat may be present in Study Area.	Conduct pre-construction surveys.
Danaus plexippus pop. 1 monarch - California overwintering population	None	Habitat contained within the "coastal zone"; an area defined by the Coastal Zone Management Act to be 1,000 yards inland from the high tide mark.	**Moderate.** Suitable habitat may be present in Study Area.	Conduct pre-construction surveys.
Fritillaria liliacea fragrant fritillary	1B.2	Native to the temperate regions of the Northern hemisphere, from the Mediterranean and North Africa through Eurasia and southwest Asia to western North America. Many are endangered due to enthusiastic picking.	**Moderate.** Suitable habitat may be present in Study Area.	Conduct pre-construction surveys.
Isocoma arguta Carquinez goldenbush	1B.2	It has been found only in Solano and Contra Costa Counties in California, where it grows in the Sacramento-San Joaquin River Delta. It is a resident of Suisun Marsh. It thrives on alkali flats and other mineral-rich soils.	**Moderate.** Suitable habitat may be present in Study Area.	Conduct pre-construction surveys.
Lasthenia conjugens Contra Costa goldfields	FE, RP, List 1B	Mesic sites in cismontane woodland, alkaline playas, valley and foothill grassland. Vernal pools, swales, or low depressions. 1-445 m. Blooms March-June.	**Moderate.** Suitable habitat may be present in Study Area.	Conduct pre-construction surveys.
Lathyrus jepsonii var. *jepsonii* Delta tule pea	List 1B	Brackish to freshwater marshes and swamps. 0-4 m. Blooms May-July (can extend through September).	Unlikely. No suitable habitat occurs within the Study Area.	No further actions are recommended for this species.

Table 5
Potential for Special-Status Species to Occur in the Proposed Project Study Area

Species	Status	Habitat	Potential for Occurrence	Recommendations
Lilaeopsis masonii Mason's lilaeopsis	SR, List 1B	Brackish to freshwater marshes and swamps, or riparian scrub. Occurs in tidal zones, in muddy or silty soils formed through river deposition or river bank erosion. 0-10 m. Blooms April- November.	Unlikely. No suitable habitat occurs within the Study Area.	No further actions are recommended for this species.
Northern Coastal Salt Marsh Northern Coastal Salt Marsh	None	Highly productive, herbaceous and suffrutescent, salt-tolerant hydrophytes forming moderate to dense cover and up to 1m tall. Most species are active in summer, dormant in winter. Usually segregated horizontally with Spartina nearer the open water, Salicornia at mid-littoral elevations, and a richer mixture closer to high ground.	Unlikely. No suitable habitat occurs within the Study Area.	No further actions are recommended for this species.
Senecio aphanactis chaparral ragwort	List 2B.2	Occurs in dry coastal areas, particularly coastal sage scrub, foothill oak woodland, and alkali flats.	Unlikely. No suitable habitat occurs within the Study Area.	No further actions are recommended for this species.
Mammals				
Sorex ornatus sinuosus Suisun Ornate Shrew	SSC	Requires dense low-lying cover and driftwood and other litter above the mean hightide line for nesting and foraging.	**Moderate.** Suitable habitat may be present in Study Area.	Conduct pre-construction surveys.
Antrozous pallidus Pallid Bat	SSC, WBWG	Usually roosts in rock crevice or building, less often in cave, tree hollow or mine.	**Moderate.** Suitable habitat may be present in Study Area.	Conduct pre-construction surveys.
Reithrodontomys raviventris Salt-marsh Harvest Mouse	FE, SE	Primary habitat in pickleweed dominated saline emergent marshes of San Francisco Bay. Require adjacent upland areas for escape from high tides.	**Moderate.** Suitable habitat may be present in Study Area.	Conduct pre-construction surveys.
Birds				
Ardea herodias great blue heron	None	Found in fresh and saltwater marshes, mangrove swamps, flooded meadows, lake edges, or shorelines.	**Moderate.** Proposed construction could extend into the breeding/nesting	If construction does occur within the breeding/nesting season (February 1

Table 5
Potential for Special-Status Species to Occur in the Proposed Project Study Area

Species	Status	Habitat	Potential for Occurrence	Recommendations
			season (February 1 and August 31).	and August 31) conduct pre-construction surveys.
Charadrius alexandrinus nivosus Western Snowy Plover	FT, SSC, BCC, RP	(Nesting) Federal listing applies only to the Pacific coastal population. Found on sandy beaches, salt pond levees and shores of large alkali lakes. Requires sandy, gravelly or friable soils for nesting.	Unlikely. Suitable open nesting habitat is not present in the Study Area.	No further actions are recommended for this species.
Elanus leucurus White-tailed kite	FP	Common in the Central Valley and readily seen patrolling or hovering over lowland scrub or grassland looking for rodents.	**Present.** Was observed foraging near pinole Creek. Proposed construction could extend into the breeding/nesting season (February 1 and August 31).	If construction does occur within the breeding/nesting season (February 1 and August 31) conduct pre-construction surveys.
Geothlypis trichas sinuosa Yellowthroat	BCC, SSC	Frequents low, dense vegetation near water including fresh to saline emergent wetlands. Brushy habitats used in migration. Forages among wetland herbs and shrubs for insects primarily. Prefers willows for nesting.	**Moderate.** Proposed construction could extend into the breeding/nesting season (February 1 and August 31).	If construction does occur within the breeding/nesting season (February 1 and August 31) conduct pre-construction surveys.
Laterallus jamaicensis coturniculus Black Rail	ST, CFP	Rarely seen resident of saline, brackish, and fresh emergent wetlands in the San Francisco Bay area. Nest in dense stands of Pickleweed.	**Moderate.** Proposed construction could extend into the breeding/nesting season (February 1 and August 31).	If construction does occur within the breeding/nesting season (February 1 and August 31) conduct pre-construction surveys.
Melospiza melodia samuelis San Pablo Song Sparrow	BCC, SSC	Resident of salt marshes along the north side of San Francisco and San Pablo Bays. Inhabits tidal sloughs in *Salicornia* marshes; nests in *Grindelia* bordering slough channels.	**Moderate.** Proposed construction could extend into the breeding/nesting season (February 1 and August 31).	If construction does occur within the breeding/nesting season (February 1 and August 31) conduct pre-construction surveys.
Pandion haliaetus osprey	None, WL	Tolerates a wide variety of habitats, nesting in any location near a body of water providing an adequate food supply.	**Moderate.** Proposed construction could extend into the breeding/nesting season (February 1 and August 31).	If construction does occur within the breeding/nesting season (February 1 and August 31) conduct pre-construction surveys.
Rallus longirostris obsoletus California Clapper Rail	FE, SE	Found in tidal salt marshes of the San Francisco Bay.	**Moderate.** Proposed construction could extend	If construction does occur within the

Table 5
Potential for Special-Status Species to Occur in the Proposed Project Study Area

Species	Status	Habitat	Potential for Occurrence	Recommendations
		Requires mudflats for foraging and dense vegetation on higher ground for nesting.	into the breeding/nesting season (February 1 and August 31).	breeding/nesting season (February 1 and August 31) conduct pre-construction surveys.
Strix occidentalis caurina Northern Spotted owl	FT	Primarily inhabits old growth forests in the northern part of its range (Canada to southern Oregon) and landscapes with a mix of old and younger forest types in the southern part of its range (Klamath region and California).	Unlikely. No suitable habitat occurs within the Study Area.	No further actions are recommended for this species.
Xanthocephalus xanthocephalus yellow-headed blackbird	SSC	They nest in colonies, often sharing their habitat closely with the red-winged blackbird (*Agelaius phoeniceus*).	**Moderate**. Proposed construction could extend into the breeding/nesting season (February 1 and August 31).	If construction does occur within the breeding/nesting season (February 1 and August 31) conduct pre-construction surveys.
Amphibians				
Rana aurora draytonii California Red-legged Frog	FT, SSC	Associated with quiet perennial to intermittent ponds, stream pools and wetlands. Prefers shorelines with extensive vegetation. Documented to disperse through upland habitats after rains.	**Moderate.** Suitable habitat may be present in Study Area.	Conduct pre-construction surveys.
Fish				
Hypomesus transpacificus Delta smelt	FT	Found in large, main channels and open areas of the Bay. Occur from tidal freshwater reaches of the Delta west to eastern San Pablo Bay.	**Moderate.** Suitable habitat may be present in Study Area in Pinole Creek.	None. Micro-tunneling under Pinole creek will avoid affecting this species.
Pogonichthys macrolepidotus Sacramento Splittail	SSC	Found in the lower delta; spawns in Sacramento and San Joaquin Rivers. Documented to occur in the Napa River by the Napa RCD. Flooded vegetation is used for spawning and foraging for juveniles.	**Moderate.** Suitable habitat may be present in Study Area.	None. Micro-tunneling under Pinole creek will avoid affecting this species.
Spirinchus thaleichthys Longfin smelt	FC/ST	Found in several estuaries and lakes along the northern Pacific coast of North America.	**Moderate.** Suitable habitat may be present in Study Area.	None. Micro-tunneling under Pinole creek will avoid affecting this species.
Reptiles				

Table 5
Potential for Special-Status Species to Occur in the Proposed Project Study Area

Species	Status	Habitat	Potential for Occurrence	Recommendations
Masticophis lateralis euryxanthus Alameda whipsnake	FT, ST	Known to utilize a wide range of habitat types including open desert, California oak woodland, pine forest, chaparral, and associated open landscape habitats.	**Moderate.** Suitable habitat may be present in the Study Area.	Conduct Pre-construction surveys.
Crustaceans				
Branchinecta conservation Conservancy Fairy Shrimp	FE	Inhabit highly turbid water in vernal pools. Known from six populations in the northern central valley.	**Moderate.** Suitable habitat may be present in the Study Area.	Conduct Pre-construction surveys.
Syncaris pacifica California freshwater shrimp	FE, SE	Endemic to Marin, Napa, and Sonoma Counties. Found in shallow pools away from streamflow in low gradient streams where riparian cover is moderate to heavy.	**Moderate.** Suitable habitat may be present in the Study Area.	Conduct Pre-construction surveys.
Insects				
Bombus occidentalis western bumble bee	SLC	Has three basic habitat requirements: suitable nesting sites for the colonies, nectar and pollen from floral resources available throughout the duration of the colony period (spring, summer and fall), and suitable overwintering sites for the queens.	**Present.** Species was observed in the Project Area.	Not protected. No further actions are recommended for this species.
Callophrys mosii bayensis San Bruno Elfin butterfly	FE	Inhabits rocky outcrops and cliffs in coastal scrub on the San Francisco Peninsula, endemic to this habitat in California.	Unlikely. No suitable habitat occurs within the Study Area.	No further actions are recommended for this species.
Speyeria callippe callippe Callippe silverspot butterfly	FE	Historically inhabited grasslands ranging over much of the northern San Francisco Bay region, but eventually was known to occur on the east and western sides of San Francisco Bay.	Unlikely. The only known colony now is on San Bruno Mountain on the San Francisco Peninsula.	No further actions are recommended for this species.

Key to status codes:
FE Federal Endangered
FT Federal Threatened
FC Federal Candidate
FD Federal De-listed
FPD Federal Proposed for De-listing

Table 5
Potential for Special-Status Species to Occur in the Proposed Project Study Area

Species	Status	Habitat	Potential for Occurrence	Recommendations
FPT Federal Proposed Threatened NMFS Species under the Jurisdiction of the National Marine Fisheries Service BCC USFWS Birds of Conservation Concern RP Sensitive species included in a USFWS Recovery Plan or Draft Recovery Plan SE State Endangered ST State Threatened SR State Rare SSC CDFW Species of Special Concern Draft SSC 4 April 2000 Draft CDFG Species of Special Concern CFP CDFW Fully Protected Animal WBWG Western Bat Working Group High Priority species SLC Species of Local Concern List 1A CNPS List 1A: Plants presumed extinct in California List 1B CNPS List 1B: Plants rare, threatened or endangered in California and elsewhere List 2 CNPS List 2: Plants rare, threatened, or endangered in California, but more common elsewhere List 3 CNPS List 3: Plants about which CNPS needs more information (a review list)				

- The non-breeding season is defined as September 1 to January 31. During this period, breeding is not occurring and surveys are not required. However, if nesting birds are encountered during work activities in the non-breeding season, disturbance activities within a minimum of 50-feet of the nest should be postponed until the nest is abandoned or young birds have fledged.

Mitigation Measure BIO-3: Environmental Awareness Training. All construction personnel shall be given environmental awareness training by the Proposed Project's environmental inspector or biological monitor before the start of construction. The training will familiarize all construction personnel with the federally listed species that may occur in the Project Area, their habitats, general provisions and protections afforded by the Endangered Species Act, measures to be implemented to protect these species, and the project boundaries. This training will be provided to any new worker before they are authorized to perform project work. As part of the environmental awareness training, construction personnel will be notified that no dogs or any other pets under control of construction personnel will be allowed in the Project Area, and that no firearms will be permitted in the Project Area, unless carried by authorized security personnel or law enforcement.

Mitigation Measure BIO-4: Biological Monitor. A CDFW and/or USFWS-approved Biological Monitor will be present on-site for all construction activities that occur within 100-feet of any identified suitable habitats for state and/or federally listed species that may be present during the construction of the Proposed Project. The City will submit the Biological Monitor's qualifications to the CDFW and the USFWS for approval 30-days prior to project construction. The Biological Monitor will ensure that all applicable avoidance and minimization measures are implemented during project construction. The Biological Monitor will also ensure that all vehicles entering the site are free of debris that may harbor organisms that could be introduced to the site, such as vegetation or mud from other areas.

The Biological Monitor will also ensure that turbidity, sedimentation, and the release of materials such as dust or construction runoff are controlled, and that spill control measures are enacted properly.

The Biological Monitor will oversee construction activities to ensure that no state or federally listed species and/or their habitats experience unintended effects. The Biological Monitor will have the authority to stop any work activities that could result in unintended adverse effects to covered species and/or their habitats.

Mitigation Measure BIO-5: Staging Areas and Access Routes. When working on habitats that support state and/or federally listed species, disturbance to existing grades and vegetation will be limited to the actual site of the Proposed Project and necessary access routes. Placement of all roads, staging areas, and other facilities will avoid and limit disturbance-sensitive habitats (e.g., riparian habitat, suitable habitats) as much as possible. All staging and material storage areas, including the locations where equipment and vehicles are parked overnight, will be placed outside of the flood zone of a watercourse, away from riparian habitat or wetland habitat, and away from any other sensitive habitats. When possible, staging and access areas will be situated in areas that are previously disturbed, such as developed areas, paved areas, parking lots, areas with bare ground or gravel, and areas clear of vegetation.

The implementation of the above mitigation measures would reduce impacts associated with the Proposed Project to a level of less-than-significant. No additional mitigation measures are required.

Once constructed, the entire Proposed Project would be located underground and would not have an adverse effect on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFW and USFWS. As a result, no long-term or permanent impacts are anticipated and no specific mitigation measures are required.

(b) **Less-than-Significant Impact with Mitigation.** The Proposed Project is located within the Refugio Creek and Pinole Creek watershed (USFWS 2020). The Contra Costa County General Plan defines wetlands as "lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water. For the purposes of this classification, wetlands must have one or more of the following attributes: (1) at least periodically, the land supports predominately hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year."

Existing documents and resources pertinent to aquatic resources in the vicinity of the Proposed Project were compiled, reviewed, and analyzed. This included a review of U.S. Fish and Wildlife Service's (USFWS) National Wetland Inventory (NWI) (USFWS 2020), the Contra Costa County General Plan (Contra Costa County 2005), and the "Water Quality Control Plan for the San Francisco Bay Basin" (Basin Plan) (San Francisco Bay Regional Water Quality Control Board (SFBRWQCB), revised May 4, 2017).

As shown on Figure 5, ten (10) aquatic resources, including ponds, wetlands, riparian habitat, vernal pools, and Pinole Creek, were mapped during the surveys. A description of each resource is provided below. Refer to Table 6 for a list of each resource, its NWI and field-assessed classification, and whether it is considered a WOUS or WOS. Each are discussed below:



pricegeographic.com

Maps & GIS

PGC

N

0 200 400 Feet

SMB ENVIRONMENTAL

Figure 5
Wetland Features in Project Vicinity

City of Hercules - Sycamore Sewer Trunk Replacement Project

Table 6 Jurisdictional Waters of the U.S./Waters of the State in the Project Area					
				Jurisdiction	
Feature	NWI Classification	Field Assessed NWI Classification	Explanation for Change in Classification	Water of US	Water of State
Pinole Creek	E2SBNx – Estuarine and Marine Wetland	R1EM – Emergent Tidal Riverine	Directional flow observed, emergent vegetation along shore, alkali specialized plants indicate tidal influence	X	X
Vernal Pool 1	Not identified	A7CA – Western vernal pools in California	Evidence of recent inundation and vernal pool associated plants	X	X
Vernal Pool 2	R4SBA – Intermittent Streambed	A7CA – Western vernal pools in California	Hydrology indicators for vernal pool and vernal pool associated plants, no bed and bank.	X	X
Vernal Pool 3	Not identified	A7CA – Western vernal pools in California	Evidence of recent inundation and vernal pool associated plants	X	X
Vernal Pool 4	Not identified	A7CA – Western vernal pools in California	Evidence of recent inundation and vernal pool associated plants	X	X
Wetland 1	R4SBA – Intermittent Streambed	PEM1Ch – Freshwater Emergent Wetland	No bed and bank was observed within the feature.	X	X
Wetland 2	PEM1Ch – Freshwater Emergent Wetland	PEM1Ch – Freshwater Emergent Wetland	—	X	X
Freshwater Pond	PEM1Ch – Freshwater Emergent Wetland	PUBHh - Freshwater Pond	Hydrology signs indicate standing water is present year round at a depth of 2-3 feet.	—	X
Duck Pond	PUBHh - Freshwater Pond	PUBHh - Freshwater Pond	—	X	X

Sources:

National Oceanic and Atmospheric Administration (NOAA). 2019. Coastal Flood Hazard Composite Layer for the Coastal Flood Exposure Mapper. Online Dataset. Updated November 27, 2019. Available at https://catalog.data.gov/dataset/coastal-flood-hazard-composite-layer-for-the-coastal-flood-exposure-mapper

State Water Resources Control Board (SWRCB). 2019. State Wetland Definition and Procedures for Discharges of Dredged or Fill Material to Waters of the State. Adopted April 2, 2019.

- ***Pinole Creek.*** Pinole Creek is a perennial brackish estuarine stream that connects into San Pablo Bay to the northwest of the Project area. NWI initially classified this feature as an estuarine/marine wetland. However, based on the field assessment, it is better described as an emergent tidal riverine feature. In the Project area, Pinole Creek features a defined bed and bank, is tidally influenced, and contains emergent vegetation, mostly dominated by alkali bulrush (*Bolboschoenus maritimus*) and on its banks by pickleweed. Railroad Avenue crosses the creek via a bridge at the western end of the pipeline alignment. The existing pipeline is attached to/crosses the creek via this bridge. The proposed Project will cross the Pinole Creek via micro-tunneling under Pinole Creek.

- ***Vernal Pools.*** Vernal pools are defined by the Environmental Protection Agency (EPA) as seasonal depressional wetlands that occur under the Mediterranean climate conditions of the West Coast and in glaciated areas of northeastern and midwestern states. They are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall. These wetlands range in size from small puddles to shallow lakes and are usually found in a gently sloping plain of grassland. Western vernal pools are sometimes connected to each other by small drainages known as vernal swales, forming complexes. Beneath vernal pools lies either bedrock or a hard clay layer in the soil that helps keep water in the pool.

  Four vernal pools (Vernal Pools 1–4) are located with annual grasslands south of Railroad Avenue and are within 100-feet of the existing sewer trunk alignment. Vernal Pool 1 is 0.11-acres and is dominated by alkali Russian thistle (*Salsola soda*) and spike rush (*Eleocharis* spp.). There was no standing water, but soil cracks were observed. Vernal Pool 2 (0.40-acres) was initially identified in the NWI as an intermittent streambed. However, based on the fact that it lacks a defined bed and bank, and the fact that it supports vernal pool/wetland species such as alkali Russian thistle and spike rushes along the edges, and pickleweed (*Salicornia pacifica*) and smooth goldfields (*Lasthenia glaberrima*) in the center, this feature is better described as a vernal pool. Evidence of recent saturation and soil cracks were observed during the time of the survey. Vernal Pool 3 is 0.21-acres and is dominated by pickleweed and spike rush, and soil cracks were observed during the time of the survey. Vernal Pool 4 is 0.01-acres and is dominated by alkali Russian thistle and spike rush. Each of these vernal pools showed a clear vegetation transition from the surrounding grasslands, which were mostly dominated by non-native grasses.

- ***Wetlands 1 and 2.*** Two wetlands connect to the southern end of the Duck Pond. Both wetlands are dominated by the non-native Himalayan blackberry (*Rubus armeniacus*). Wetland 1 is approximately 0.14-acres and lies immediately adjacent to the existing trunk sewer alignment. Saturated soil conditions were observed within Wetland 1.

  Wetland 2 is approximately 0.33-acres, and, while it is dominated by non-native Himalayan blackberry, also includes more open areas that support rushes (*Juncus* spp.) and miner's lettuce (*Claytonia perfoliata*). An existing paved pedestrian footpath crosses through this wetland. In addition, the trunk sewer alignment passes through the wetland via an existing culvert located underneath the pedestrian footpath.

- ***Cattail (Freshwater) Pond.*** A second freshwater pond is 0.24-acres and is dominated by cattails (*Typha* spp.). The pond is located approximately 50-feet south of the existing sewer trunk alignment near its intersection with Camden Lane. Deep open

surface water was observed during the time of the survey. This Cattail (Freshwater) Pond connects to a 0.54-acre riparian area supporting willows (*Salix* spp.) and Himalayan blackberry. This area was initially identified as a wetland in NWI. However, vegetation type and slope indicate that this is an upland riparian area. This willow/blackberry riparian area is within 20-feet of the existing sewer trunk alignment. The freshwater pond and the riparian area are isolated and are not connected to other streams or waters.

- ***Duck Pond.*** The Duck Pond is a 1.14-acre pond with cattails (*Typha* spp.) around the borders and contains deep open water in the center. Two blackberry drainages (Wetlands 1 and 2, describedabove) connect to the Duck Pond at the southern end. The southern perimeter of the Duck Pond is approximately 30-feet from the existing trunk sewer alignment. The northern portion of the Duck Pond connects to an intermittent stream that eventually feeds into Refugio Creek.

As shown on Figure 5, the Project area supports riparian habitats and vernal pools which are considered sensitive by CDFW and Contra Costa County. Riparian habitat borders the cattail pond within the Project area. There are four vernal pools south of the sewer trunk alignment along Railroad Avenue. Implementation of the Project would require ground disturbance within Wetland/Blackberry Drainage Area 2 in order to replace the existing sewer trunk line, but would not require removal of riparian vegetation, because work would take place within an existing pedestrian walkway. Implementation of the Proposed Project would not require work within any of the other riparian features. With the implementation of the following mitigation measures and procedures, any impacts would be reduced to less-than-significant levels:

Mitigation Measure BIO-6: Clean Water Act Permitting and California Fish and Game Code Compliance. The City of Hercules will obtain relevant CWA permits (e.g., Sections 401 and 404), and a California Fish and Game Code Section 1602 Streambed Alteration Agreement prior to implementation of work within Waters of the U.S. and Waters of the State (WOUS/WOS) (e.g., Pinole Creek and Wetland/Blackberry Drainage Area 2). All conditions identified in the permits will be implemented as part of the Project.

Mitigation Measure BIO-7: Protection of Riparian Habitats and Vernal Pools. Prior to implementation of staging and construction or ground-disturbing activities, the City or its contractor shall install protective fencing around all riparian areas and vernal pools that could potentially be affected by Project activities. At no point will fencing be moved or removed during construction. No Project activities will be implemented within the protective fencing. No riparian vegetation will be removed as part of the Project.

Mitigation Measure BIO-8: Water Quality Best Management Practices. Prior to commencement of ground disturbing activities, the City shall identify site-specific BMPs to effectively control erosion and sediment loss and to protect water quality. During the project, these BMPs for erosion and sediment control shall be implemented by the project contractor. These BMPs will include, but are not limited to:

- Erosion control structures (e.g., coir rolls, plastic sheeting, rubber mats) will be placed: in areas where high surface runoff is expected; around spoil piles; and at channel entrances or adjacent to drainage channels. If straw wattles or straw bales are used, all straw will be certified weed-free.
- Prior to the initiation of Project activities, the City or its contractor shall prepare a Spill Prevention and Control Plan that will be implemented during Project activities.

- To reduce potential contamination by spills, all refueling, storage, servicing, and maintenance of equipment will be performed at designated sites and not within 50-feet of wetted areas (including the vernal pools and blackberry drainages) or other sensitive environmental resources. Absorbent material or drip pans will be used during refueling or servicing of trucks or other equipment. Any fluids drained from the machinery during servicing will be collected in leak-proof containers and taken to an appropriate disposal or recycling facility. If such activities result in spills or accumulation of a product on the soil, the contaminated soil will be disposed of properly.
- All maintenance materials (i.e., oils, grease, lubricants, antifreeze) will be stored at staging areas in appropriate storage containers. If these materials are required during Project implementation, they will be placed in a designated area away from site activities and sensitive resources.

(c) **Less-than-Significant Impact with Mitigation.** Please refer to discussion item (b) above. Once constructed, the Proposed Project would not have an adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means. However, construction activities associated with the proposed micro-tunneling/crossing of Pinole Creek could potentially require work within the Ordinary High-Water Mark (OHWM) and/or the bed and bank of Pinole Creek. In addition, replacement of the pipeline may also require ground disturbance within Wetland/Vernal Pool Area 2. However, with the implementation of **Mitigation Measures BIO-6, BIO-7, and BIO-8**, any impacts would be reduced to less-than-significant levels:

(d) **Less-than-Significant Impact with Mitigation.** There are numerous mature trees within and adjacent to the Proposed Project construction activities. Mature trees can serve as perching or nesting sites for migratory birds, and their removal can adversely affect breeding behavior. These species may occur within the area, which are protected under the U.S. Fish and Wildlife Service, the California Fish and Wildlife Code, and/or the Federal Migratory Bird Treaty Act of 1918 as migratory insectivorous birds and as such are protected by state and federal regulations. As a result, the potential exists that construction activities could adversely affect special status bird species if they happen to be nesting in the mature trees and/or blackberry bushes adjacent to the Proposed Project site. Many special status bird species are sensitive to loud construction noise. Such activities could cause nest abandonment or destruction of individual active nests. Because all special status bird species and their nests are protected under 3503.5 of the California Fish and Wildlife Code, construction of the Proposed Project could result in a significant impact to these species if they happen to be nesting in one or some of these mature trees and/or blackberry bushes adjacent to the Project area. However, with the implementation of **Mitigation Measures BIO-1 and BIO-2,** these potential impacts would be reduced to less-than-significant levels.

(e) **Less-than-Significant Impact with Mitigation.** The Proposed Project is not expected to conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance. While no trees are expected to be removed, construction of the Proposed Project could require trimming of tree branches of several eucalyptus, pine, and/or redwood trees as well as cutting into root systems of trees, which could adversely affect trees. However, with the implementation of the following mitigation, any impacts would be considered less-than-significant.

Mitigation Measure BIO-9: Adherence to the City's Tree Preservation, Removal, and Trimming Ordinance. The City or its contractor shall have an arborist survey the trees that may be affected by the Proposed Project's construction activities. Any tree removal,

tree trimming, and/or cuts into the major root systems of any trees shall be done in accordance with the City's tree preservation, removal, and trimming ordinance.

(f) **No Impact.** The Proposed Project would not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan. Therefore, there is no impact, and no mitigation measures are required.

3.5 Cultural Resources

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☐	☒
b) Cause a substantial adverse change in the significance of a unique archaeological resource pursuant to §15064.5?	☐	☒	☐	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☒	☐	☐
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☒	☐	☐

Discussion

On March 19, 2020, a records search was conducted by staff at the Northwest Information Center, Sonoma State University, Rohnert Park, California (NWIC No: 19-1600). The record search included the Project Area of Potential Effect (APE) and a 0.50-mile radius outside the project boundaries. The record search included current inventories of National Register of Historic Places (NRHP), the California Register of Historical Resources (CRHR), California State Historic Landmarks, and the California Points of Historical Interest. Due to the sensitive nature of the information, this information is not available to the general public and is on a need-to-know basis. As a result, this public document will only summarize those resources and findings.

In addition, a pedestrian archeological survey was conducted of the Project area on March 27, 2020. All open areas were inspected for cultural evidence such as historic structures, artifacts, and features; and indicators of prehistoric archaeological deposits like midden soil, flaked lithics, groundstone, and shell. No cultural resources were observed during the survey.

(a) **No Impact.** The Proposed Project would not cause a substantial adverse change in the significance of a historical resource. No listed or historical properties exist within the Proposed Project Area. As a result, there is no impact associated with the construction and/or operation of the Proposed Project and no specific mitigation is required.

(b) **Less-than-Significant Impact with Mitigation.** No known significant archaeological resources are known to exist within the Project area. Therefore, the Proposed Project is not likely to cause a substantial adverse change in the significance of unique archaeological resources. Once constructed,

the Proposed Project would not have any effect on archeological resources. Nevertheless, there is a slight chance that construction activities of the Proposed Project could result in accidentally discovering unique archaeological resources during construction. However, to further reduce this less-than-significant impact, the following mitigation measures are recommended:

> **Mitigation Measure CR-1: Halt Work if Cultural Resources are Discovered.** In the event that any prehistoric or historic subsurface cultural resources are discovered during ground disturbing activities, all work within 100-feet of the resources shall be halted and after notification, the City shall consult with a qualified archaeologist to assess the significance of the find. If any find is determined to be significant (CEQA Guidelines 15064.5[a][3] or as unique archaeological resources per Section 21083.2 of the California Public Resources Code), representatives of the City and a qualified archaeologist shall meet to determine the appropriate course of action. In considering any suggested mitigation proposed by the consulting archaeologist in order to mitigate impacts to historical resources or unique archaeological resources, the lead agency shall determine whether avoidance is necessary and feasible in light of factors such as the nature of the find, project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) shall be instituted. Work may proceed on other parts of the project site while mitigation for historical resources or unique archaeological resources is carried out.

With the implementation of the above mitigation measure, the Proposed Project would not result in impacts to archeological resources.

(c) **Less-than-Significant Impact with Mitigation.** Paleontological resources are the fossilized evidence of past life found in the geologic record. Despite the tremendous volume of sedimentary rock deposits preserved worldwide, and the enormous number of organisms that have lived through time, preservation of plant or animal remains as fossils is an extremely rare occurrence. Because of the infrequency of fossil preservation, fossils – particularly vertebrate fossils – are considered to be nonrenewable resources. Because of their rarity, and the scientific information they can provide, fossils are highly significant records of ancient life.

No known significant paleontological resources exist within the Project area. Once constructed, the Proposed Project would not have any effect on paleontological resources. Also, because the Proposed Project would result in minimal, if any, excavation in bedrock conditions, significant paleontological discovery would be unlikely. However, fossil discoveries can be made even in areas of supposed low sensitivity. In the event a paleontological resource is encountered during project activities, implementation of the following mitigation measure would reduce potential impacts to less-than-significant.

> **Mitigation Measure CR-2: Stop Work if Paleontological Resources are Discovered.** If paleontological resources, such as fossilized bone, teeth, shell, tracks, trails, casts, molds, or impressions are discovered during ground-disturbing activities, work will stop in that area and within 100-feet of the find until a qualified paleontologist can assess the significance of the find and, if necessary, develop appropriate treatment measures in consultation with the City.

With the implementation of the above mitigation measure, the Proposed Project would not result in impacts to unique paleontological or geological resources.

(d) **Less-than-Significant Impact with Mitigation.** There are no known burial sites within the project area. Once constructed, the Proposed Project would not have any effect on human remains.

Nonetheless, the possibility exists that subsurface construction activities may encounter undiscovered human remains. Accordingly, this is a potentially significant impact. Mitigation is proposed to reduce this potentially significant impact to a level of less-than-significant.

> **Mitigation Measure CR-3: Halt Work if Human Remains are Found.** If human remains are encountered during excavation activities conducted for the Proposed Project, all work in the adjacent area shall stop immediately and the Contra Costa County Coroner's office shall be notified. If the Coroner determines that the remains are Native American in origin, the Native American Heritage Commission shall be notified and will identify the Most Likely Descendent, who will be consulted for recommendations for treatment of the discovered human remains and any associated burial goods.

3.6 Geology and Soils

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☒	☐
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
ii) Strong seismic ground shaking?	☐	☐	☒	☐
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
iv) Landslides?	☐	☐	☒	☐
b) Result in substantial soil erosion or the loss of topsoil?	☐	☒	☐	☐
c) Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☒	☐	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☒	☐	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☐	☐	☒

Discussion

a) **Less-than-Significant Impact.** The Proposed Project would not expose people to substantial adverse risks of loss, injury, or death since the Proposed Project does not include construction of habitable structures. The Proposed Project would not expose people or structures to substantial adverse effects, including the risk of loss and injury due to a seismic event. Therefore, construction

and operation of the Proposed Project would have a less-than-significant impact. No mitigation is required or necessary.

(c) **Less-than-Significant Impact with Mitigation.** The operation of the Proposed Project would not result in any excavation and earthmoving that would cause erosion or loss of topsoil. Construction activities would involve excavation, moving, filling, and the temporary stockpiling of soil. Earthwork associated with development construction could expose soils to erosion. As a result, the following mitigation is proposed as a precautionary measure:

> **Mitigation Measure GEO-1: Erosion and Sedimentation Prevention Procedures.** The City shall prepare an Erosion Control Plan. The Erosion Control Plan will detail the erosion and sedimentation prevention measures to be implemented. As part of this plan, the Subrecipient will ensure that sediment-control devices are installed and maintained correctly. For example, sediment will be removed from engineering controls once the sediment has reached one-third of the exposed height of the control. The devices will be inspected frequently (i.e., daily or weekly, as necessary) to ensure that they are functioning properly; controls will be immediately repaired or replaced, or additional controls will be installed as necessary. Sediment that is captured in these controls may be disposed of on site in an appropriate, safe, approved area; or off site at an approved disposal site. Areas of soil disturbance, including temporarily disturbed areas, will be seeded with a regionally appropriate erosion control seed mixture. On soil slopes with an angle greater than 30 percent, erosion control blankets will be installed or a suitable and approved binding agent will be applied. Runoff will be diverted away from steep or denuded slopes. Where habitat for federally listed species is identified in, or adjacent to, the project footprint, all disturbed soils at the site will undergo erosion control treatment before the rainy season starts and after construction is terminated. Treatment may include temporary seeding and sterile straw mulch.

With the incorporation of this mitigation measure, any resulting impacts would be considered to be less-than-significant.

(c) **Less-than-Significant Impact with Mitigation.** The Proposed Project is located in an area that has moderate to high liquefaction potential. As such, the soil in the area may have a high susceptibility to liquefaction during seismic shaking. Lateral spreading, often associated with liquefaction, is less likely because there are no steep banks or hard ground bordering the Proposed Project area, but could still potentially be a hazard. As a result, the following mitigation is proposed as a precautionary measure:

> **Mitigation Measure GEO-2: Conduct Geotechnical Investigation.** The City shall conduct a design-level geotechnical study/investigation to project implementation to determine proper design and construction methods, including design of any soil remediation measures as required to reduce hazards caused by landslides, liquefaction, and/or lateral spreading.

With the incorporation of this mitigation measure, any resulting impacts would be considered to be less-than-significant.

(d) **Less-than-Significant Impact with Mitigation.** The Proposed Project could be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994). However, with the incorporation of **Mitigation Measures GEO-2** above, any impacts would be less-than-significant.

(e) **No Impact.** The Proposed Project would not include the use of septic tanks or alternative wastewater disposal systems. Therefore, no adverse effects to soil resources are expected. No mitigation is required.

3.7 Hazards and Hazardous Materials

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☒	☐	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☒	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a Project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project result in a safety hazard for people residing or working in the Project area?	☐	☐	☐	☒
f) For a Project within the vicinity of a private airstrip, would the Project result in a safety hazard for people residing or working in the Project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☒	☐	☐

Discussion

(a) **Less-than-Significant Impact with Mitigation.** Operation of the Proposed Project would not involve the routine transportation, use, storage, and/or disposal of hazardous materials. However,

construction of the Proposed Project could temporarily increase the transport of materials generally regarded as hazardous materials that are used in construction activities. It is anticipated that limited quantities of miscellaneous hazardous substances, such as gasoline, diesel fuel, hydraulic fluids, paint, and other similarly related materials would be brought onto the project site, used, and stored during the construction period. The types and quantities of materials to be used could pose a significant risk to the public and/or the environment. In addition, construction of the Proposed Project could result in the exposure of construction workers and residents to potentially contaminated soils. As a result the following mitigation measures are proposed:

Mitigation Measure HAZ-1: Store, Handle, Use Hazardous Materials in Accordance with Applicable Laws. The City shall ensure that all construction-related and operational hazardous materials and hazardous wastes shall be stored, handled, and used in a manner consistent with relevant and applicable federal, state, and local laws. In addition, construction-related and operational hazardous materials and hazardous wastes shall be staged and stored away from stream channels and steep banks to keep these materials a safe distance from near-by residents and prevent them from entering surface waters in the event of an accidental release.

Mitigation Measure HAZ-2: Properly Dispose of Contaminated Soil and/or Groundwater. If contaminated soil and/or groundwater is encountered or if suspected contamination is encountered during project construction, work shall be halted in the area, and the type and extent of the contamination shall be identified. A contingency plan to dispose of any contaminated soil or groundwater will be developed through consultation with appropriate regulatory agencies.

Mitigation Measure HAZ-3: Equipment Inspection and Maintenance. The City shall ensure that well-maintained equipment will be used to perform the work, and except in the case of a failure or breakdown, equipment maintenance will be performed off-site. Equipment will be inspected daily by the operator for leaks or spills. If leaks or spills are encountered, the source of the leak will be identified, leaked material will be cleaned up, and the cleaning materials will be collected and properly disposed. Spills, leaks, and other problems of a similar nature will be resolved immediately to prevent unnecessary effects on state and federally listed species and their habitats. A plan for the emergency cleanup of any spills of fuel or other material will be available on site, and adequate materials for spill cleanup will be maintained on site.

Mitigation Measure HAZ-4: Fueling Activities. The City will protect state and federally listed species and their habitats from pollution due to fuels, oils, lubricants, and other harmful materials. Vehicles and equipment that are used during the Proposed Project will be fueled and serviced in a manner that will not affect federally listed species or their habitats. Machinery and equipment used will be serviced, fueled, and maintained on uplands in a "safe" area (i.e., outside of sensitive habitats) and will be located outside of suitable habitats for federally listed species, to prevent contamination. Fueling equipment and vehicles will be kept more than 200-feet away from aquatic habitats (i.e., waters of the U.S.), and more than 100-feet away from suitable terrestrial habitats for federally listed species. Exceptions to this distance requirement may be allowed for large cranes, pile drivers, and drill rigs, if they cannot be easily moved. The City will establish a temporary fuel containment basin if these buffers cannot be maintained. Fueling will be conducted in accordance with procedures to be developed in a Spill Prevention and Pollution Control Plan.

Mitigation Measure HAZ-5: Equipment Staging. The City shall ensure that no staging of construction materials, equipment, tools, buildings, trailers, or restroom facilities will occur in a floodplain during flood season, even if staging is only temporary.

(b) **Less-than-Significant Impact with Mitigation.** The operation of the Proposed Project would not create an additional significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. However, as with all construction activities, the potential exists for accidents to occur, which could result in the release of hazardous materials into the environment. With the incorporation of **Mitigation Measures HAZ-1 through HAZ-5** identified above, potential impacts are considered to be less-than-significant.

(c) **No Impact.** The Proposed Project is not located within a quarter-mile of an existing or proposed school and therefore would not emit hazardous emissions or handle hazardous or acutely hazardous material, substances, or waste within a quarter-mile of an existing or proposed school. No Mitigation is required or necessary.

(d) **No Impact.** The Proposed Project is not located on a site that is known to be included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and therefore would not create a significant hazard to the public or the environment. As a result, no impact is expected, and no specific mitigation is required.

(e) **No Impact.** The Proposed Project is not located within two-miles of any public airports. As a result, the construction and/or operation of the Proposed Project would not adversely affect an airport or airport operations, including, noise, take-offs, landings, flight patterns, safety, light, navigation, or communications between aircraft and the control tower within the Project area. No specific mitigation is required.

(f) **No Impact.** The Proposed Project is not located within two-miles of any public airports. As a result, the construction and/or operation of the Proposed Project would not adversely affect an airport or airport operations, including, noise, take-offs, landings, flight patterns, safety, light, navigation, or communications between aircraft and the control tower within the Project area. No specific mitigation is required.

(g) **No Impact.** The Proposed Project would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. As a result, no impacts are anticipated, and no mitigation is required.

(h) **Less-than-Significant Impact with Mitigation.** Operation of the Proposed Project would not expose people or structures to a significant risk of loss, injury, or death involving wildland fires. However, the potential exists that construction activities could cause a fire, especially in a drought situation or in the dry season. Specifically, a records search of the California Department of Forestry and Fire Protection Fire Severity mapping system regards the Proposed Project Area to be in an area of low to moderate risk to wildfires. As a result, there is potential to expose people or structures to a significant risk of loss, injury or death involving wildland fires. With the incorporation of the following mitigation measure, any potential impacts are considered to be less than significant.

Mitigation Measure HAZ-6 Fire Prevention and Control: The City shall comply with all federal, state, county and local fire regulations pertaining to burning permits and the prevention

of uncontrolled fires. The following measures shall be implemented to prevent fire hazards and control of fires:

- The City shall develop and implement a fire prevention and suppression plan for the Proposed Project for those activities that have a risk of starting a wildfire.
- A list of relevant fire authorities and their designated representative to contact shall be maintained on site by City and/or construction personnel.
- Adequate firefighting equipment shall be available on site in accordance with the applicable regulatory requirements.
- The level of fire hazard shall be posted at the construction office (where visible for workers) and workers shall be made aware of the hazard level and related implications.
- The City or its contractor shall provide equipment to handle any possible fire emergency. This shall include, although not be limited to, water trucks; portable water pumps; chemical fire extinguishers; hand tools such as shovels, axes, and chain saws; and heavy equipment adequate for the construction of fire breaks when needed. Specifically, the City or its contractor shall supply and maintain in working order an adequate supply of fire extinguishers for each crew engaged in potentially combustible work such as welding, cutting, and grinding.
- All equipment shall be equipped with spark arrestors.
- In the event of a fire, the City or its contractor shall immediately use resources necessary to contain the fire. The City or contractor shall then notify local emergency response personnel.
- Any and all tree-clearing activities (if any) are to be carried out in accordance with local rules and regulations for the prevention of forest fires.
- Burning shall be prohibited.
- Flammable wastes shall be removed from the construction site on a regular basis.
- Flammable materials kept on the construction site must be stored in approved containers away from ignition sources.
- Smoking shall be prohibited on the construction site, except at designated safe areas with proper cigarette disposal containers.

3.8 Hydrology and Water Quality

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☒	☐	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☒
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion of siltation on- or off-site?	☐	☐	☐	☒
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☒	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☒
f) Otherwise substantially degrade water quality? (erosion potential)	☐	☒	☐	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒

j) Inundation of seiche, tsunami, or mudflow? ☐ ☐ ☐ ☒

Discussion

(a) **Less-than-Significant Impact with Mitigation.** Excavation, grading, and construction activities associated with the Proposed Project could violate water quality as those activities would expose and disturb soils, resulting in potential increases in erosion and siltation in the Project area. Construction during inclement weather could result in increases in erosion, siltation, and water quality issues. Generally, excavation, grading, paving, and other construction activities would expose disturbed and loosened soils to erosion by wind and runoff. Construction activities could therefore result in increased erosion and siltation, including nutrient loading and increasing the total suspended solids concentration. Erosion and siltation from construction have the potential to impact Pinole Creek, therefore posing a potentially significant impact to water quality. With the incorporation of the following mitigation measures, any potential impacts to water quality as a result of construction are reduced to less-than-significant levels.

Mitigation Measure HWQ-1: Implement Construction Best Management Practices. To reduce potentially significant erosion and siltation, the City and/or its selected contractor(s) shall obtain a Stormwater Pollution Prevention Permit (SWPPP) and implement Best Management Practices and erosion control measures as required by the San Francisco RWQCB. Best Management Practices to reduce erosion and siltation shall include the following measures:

- Avoidance of construction activities during inclement weather;
- Limitation of construction access routes and stabilization of access points; stabilization of cleared, excavated areas by providing vegetative buffer strips, providing plastic coverings, and applying ground base on areas to be paved;
- Protection of adjacent properties by installing sediment barriers or filters, or vegetative buffer strips; stabilization and prevention of sediments from surface runoff from discharging into storm drain outlets;
- Use of sediment controls and filtration to remove sediment from water generated by dewatering; and
- Returning all drainage patterns to pre-existing conditions.

Mitigation Measure HWQ-2: Avoid Cutting Through Creeks/Drainages. As described in the Proposed Project description, all creek and drainage crossings—including the crossing of Pinole Creek in Segment 2—will be crossed by using trenchless technologies such as micro tunneling. Micro tunneling is the recommended construction method for the Pinole Creek crossing due to space and environmental constraints. Micro tunneling is a remote-controlled, guided, pipe-jacking method that provides continuous face support and shaft-to-shaft construction. The micro tunneling boring machine's (MTBM) guidance system is a laser that's mounted in the jacking shaft and projects onto a target in the shield. In addition, slurry is used to counterbalance earth and groundwater pressures and stabilize the face in front of the MTBM. Micro tunneling is feasible in unstable soils, loose to dense sands, soft to hard clays, soft rock, and high groundwater. As this segment will be crossing underneath a tidally influenced creek directly adjacent to San Pablo Bay, groundwater will be encountered. For a 60-inch casing, a 20-foot wide by 30-foot long jacking shaft is required on one side of the creek, and a 20-foot wide by 15-foot long receiving shaft is required on the other.

Construction crews shall avoid entering the stream channels during installation. With these mitigation measures in place, the Proposed Project is unlikely to have a direct and/or indirect adverse effect on water quality standards and/or waste discharge requirements. Once constructed, the operation and maintenance of the Proposed Project will not adversely affect water quality standards and/or waste discharge requirements.

Once constructed, the entire Proposed Project would be located underground and would not violate any water quality standards or waste discharge requirements. As a result, no long-term or permanent impacts are anticipated, and no specific mitigation measures are required.

(b) **No Impact.** Construction and/or operation of the Proposed Project would not use groundwater supplies nor interfere with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level. Shallow groundwater in the project area is not used as a source for drinking water. The Proposed Project would not increase groundwater demand. During construction, dewatering is anticipated to be of limited duration and would only affect the local, shallow aquifer. Groundwater in deeper aquifers used for municipal water supplies would not be affected by construction dewatering within utility trenches, if required. Therefore, the project would not deplete groundwater supplies or interfere substantially with groundwater recharge. Therefore, no adverse impacts are anticipated and no mitigation is required.

(c) **No Impact.** Construction and/or operation of the Proposed Project would not **s**ubstantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion of siltation on- or off-site. Therefore, no adverse impacts are anticipated and no mitigation is required.

(d) **No Impact.** Construction and/or operation of the Proposed Project would not **s**ubstantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in flooding on- or off-site. Therefore, no adverse impacts are anticipated and no mitigation is required.

(e) **No Impact.** The Proposed Project would not result in any new significant impervious surfaces and would not create new areas of low permeability. No additional runoff would be generated by the Proposed Project. Therefore, the Proposed Project would not result in exceeding the capacity of existing or planned storm water drainage systems. No impacts would occur and no mitigation is necessary.

(f) **Less-than-Significant Impact with Mitigation.** The Proposed Project would not substantially affect water quality. As discussed earlier, the construction of the Proposed Project could result in minor, temporary, and highly localized soil erosion and siltation issues. However, with the incorporation of **Mitigation Measure HWQ-1 and HWQ-2** above, potential impacts to water quality would be reduced to less-than-significant levels.

(g) **No Impact.** The Proposed Project would not place housing within a 100-year flood hazard area. No impact is expected and no mitigation is required or necessary.

(h) **No Impact.** The Proposed Project would not place exposed structures within a 100-year flood hazard area that would impede or redirect flows causing flooding. No impact is expected and no mitigation is required or necessary.

(i) **No Impact.** The Proposed Project would not expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of a failure of a levee or dam. No impact is expected, and no mitigation is required or necessary.

(j) **No Impact.** The Proposed Project would not expose people or structures to a significant risk of loss, injury, or death involving a seiche or tsunami. In addition, the Proposed Project area is essentially level, with minimal to no potential hazards from mudflows. No impact is expected, and no mitigation is required or necessary.

3.9 Land Use and Planning

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project would not physically divide an established community. The Proposed Project would be constructed within the City's existing pumping plant. The Proposed Project would not result in a disruption, physical division, or isolation of existing residential or open space areas. As a result, no impact is expected and no mitigation is required or necessary.

(b) **No Impact.** The Proposed Project would not conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project area. Therefore, no impacts are anticipated, and no mitigation is required.

(c) **No Impact.** The Proposed Project would not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan. No impacts are expected and no mitigation is required or necessary.

3.10 Mineral Resources

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project site is not located on a site that is identified as a significant source of mineral resources. Specifically, the Proposed Project is not located in an area identified as containing mineral resources classified MRZ-2 by the State Geologist that would be of value to the region and the residents of the state. The Proposed Project would not affect any sources of significant mineral resources. As a result, the Proposed Project would not result in the loss of availability of known mineral resources; therefore, no impact is expected. No mitigation is required.

(b) **No Impact.** As discussed in (a) above, the Proposed Project would be unlikely to result in the loss of availability of a mineral resource deposit that has been identified as a mineral resource of value. Therefore, no adverse impacts are anticipated and no mitigation is required.

3.11 Noise

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project Result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☒	☐	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☒	☐	☐
c) A substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project?	☐	☐	☐	☒
d) A substantial temporary or periodic increase in ambient noise levels in the Project vicinity above levels existing without the Project?	☐	☒	☐	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project expose people residing or working in the Project area to excessive noise levels?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the Project expose people residing or working in the Project area to excessive noise levels?	☐	☐	☐	☒

Discussion

(a) **Less-than-Significant Impact with Mitigation.** The Proposed Project has the potential to generate noise during the construction phase through the use of equipment and construction vehicle trips. Construction of the Proposed Project would generate temporary and intermittent noise. Noise levels would fluctuate depending on the particular type, number, and duration of use of various pieces of construction equipment. Back-up beepers associated with trucks and equipment used for material loading and unloading at the staging areas and along the whole pipeline alignment would generate significantly increased noise levels over the ambient noise environment in order to be discernable and protect construction worker safety as required by OSHA (29 CFR 1926.601 and 29 CFR 1926.602). Residences and/or businesses in the vicinity of the staging areas and along the whole pipeline alignment would thus be exposed to these elevated noise levels.

Construction activities associated with the Proposed Project would be temporary in nature and related noise impacts would be short-term. However, since construction activities could

substantially increase ambient noise levels at noise-sensitive locations, construction noise could result in potentially significant, albeit temporary, impacts to sensitive receptors. Compliance with the City noise ordinance and implementation of the following mitigation measures is expected to reduce impacts related to construction noise, to a less-than-significant level. The following mitigation measures are proposed:

> **Mitigation Measure NOI-1**: **Limit Construction Hours.** Construction activities will be limited to the least noise-sensitive times and will comply with the City's noise ordinances. Construction, alteration, and other related activities shall be allowed on weekdays between the hours of 7 a.m. and 7 p.m., and on Saturdays between the hours of 10 a.m. and 6 p.m. Construction activities shall not exceed the outdoor ambient sound level (dBA) of 86 dBA. If any nighttime construction activities are required for Segment 6, the local residents within 100-feet will be notified in writing, with a designated City liaison and phone number to respond to any noise complaints.
>
> **Mitigation Measure NOI-2: Locate Staging Areas away from Sensitive Receptors.** The City's construction specification shall require that the contractor select staging areas as far as feasibly possible from sensitive receptors. Currently, planned staging areas are located in front of the Pinole/Hercules WPCP and along the UPRR.
>
> **Mitigation Measure NOI-3: Maintain Mufflers on Equipment.** The City's construction specifications shall require the contractor to maintain all construction equipment with manufacturer's specified noise-muffling devices.
>
> **Mitigation Measure NOI-4: Idling Prohibition and Enforcement.** The City shall prohibit and enforce unnecessary idling of internal combustion engines. In practice, this would mean turning off equipment if it will not be used for five or more minutes.
>
> **Mitigation Measure NOI-5: Equipment Location and Shielding.** Locate all stationary noise-generating construction equipment such as air compressors and standby power generators as far as possible from homes and businesses.

With the incorporation of the above mitigation measures, noise impacts as a result of construction-related activities of the Proposed Project would be considered less-than-significant.

Once constructed, the Proposed Project would not create any new sources of operational noise. Therefore, operation of the pipeline would not result in any significant noise impacts. No mitigation is required.

(b) **Less-than-Significant Impact with Mitigation.** Operation of the Proposed Project would not result in exposing people to or generating excessive groundborne vibration or noise impacts. Construction of the Proposed Project could likely result in minor and temporary increases in groundborne vibration or noise. However, construction activities would be temporary. With the incorporation of **Mitigation Measures NOI-1 through NOI-5,** impacts associated with the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels would be reduced to a less-than-significant level.

(c) **No Impact.** The operation of the Proposed Project would not increase noise in and around the Project area. Once constructed, the operation of the Proposed Project would not result in any increased noise. The Proposed Project would not cause a permanent increase in ambient noise levels in the project vicinity above levels existing without the Project. Therefore, no impacts would occur and no mitigation is required.

(d) **Less-than-Significant Impact with Mitigation.** Project construction activities may lead to a temporary increase in ambient noise levels in the project vicinity above levels existing without the project. With the implementation of **Mitigation Measures NOI-1 through NOI-5,** impacts resulting in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project would be reduced to a less-than-significant level.

(e) **No Impact.** The Proposed Project is not located within two miles of any public airports. As a result, the construction and/or operation of the Proposed Project would not adversely affect an airport or airport operations, including, noise, take-offs, landings, flight patterns, safety, light, navigation, or communications between aircraft and the control tower within the Project area. No specific mitigation is required.

(f) **No Impact.** The Proposed Project is not located within two miles of any public airports. As a result, the construction and/or operation of the Proposed Project would not adversely affect an airport or airport operations, including, noise, take-offs, landings, flight patterns, safety, light, navigation, or communications between aircraft and the control tower within the Project area. No specific mitigation is required.

3.12 Population and Housing

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project would not affect additional population growth either directly or indirectly. In addition, construction, operation, and maintenance would not result in any substantial increase in numbers of permanent workers/employees. Therefore, no impacts are anticipated, and no mitigation is required.

(b) **No Impact.** The Proposed Project would not result in displacing substantial numbers of existing housing or necessitating the construction of replacement housing elsewhere. Construction of the Proposed Project would avoid the need to demolish any existing houses and would not affect any other housing structures. As a result, the Proposed Project would not displace existing housing, and therefore, no impacts are anticipated.

(c) **No Impact.** The Proposed Project would not displace substantial numbers of people necessitating the construction of replacement housing elsewhere. Construction of the Proposed Project would not result in the demolition of existing housing and other housing structures. As a result, the Proposed Project would not displace people from their homes. Therefore, no impacts are anticipated, and no mitigation is required.

3.13 Public Services

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
a) Would the Project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☐	☒
Police protection?	☐	☐	☐	☒
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project will not generate population growth and the operation and maintenance of the Proposed Project would not be labor intensive, requiring significant numbers of temporary workers to relocate to the area. In addition, the Proposed Project would not increase the demand for the kinds of public services that would support new residents, such as schools, parks, fire, police, or other public facilities. As a result, no impacts are anticipated, and no mitigation is required.

3.14 Recreation

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
a) Would the Project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☒	☐
b) Does the Project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☒	☐

Discussion

(a) **Less-than-Significant Impact.** The Proposed Project will not contribute to population growth. Therefore, the Proposed Project will not increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated. The construction of the Proposed Project would temporarily prohibit the use of portions of the unnamed bike/walking trail path during construction activities. However, this would be temporary and is not considered to be a significant impact to recreational users as there are alternative roads and paths to take. Once constructed, the Proposed Project would not affect use of the unnamed bike/trail path. As a result, no impact is expected and no mitigation is required.

(b) **Less-than-Significant Impact.** The Proposed Project will not contribute to population growth. Therefore, the Proposed Project will not increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated. The construction of the Proposed Project would temporarily prohibit the use of portions of the unnamed bike/walking trail path during construction activities. However, this would be temporary and is not considered to be a significant impact to recreational users as there are alternative roads and paths to take. Once constructed, the Proposed Project would not affect use of the unnamed bike/trail path. As a result, no impact is expected and no mitigation is required.

3.15 Socioeconomics

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Project:				
a) Result in any adverse socioeconomic effects?	☐	☐	☐	☒
b) Conflict with Executive Order 12898 (Environmental Justice) policies?	☐	☐	☐	☒
c) Affect Indian Trust Assets?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project would not have any adverse socioeconomic effects. The City is pursuing several funding mechanisms that would include applying for state and federal grants and loans to help reduce the cost of the project. In addition, the City would repay any loans by its existing rate structure for replacement projects. Any additional project costs would not adversely affect any minority or low-income populations and/or adversely alter the socioeconomic conditions of populations that reside within the City. As a result, the Proposed Project would not have any adverse socioeconomic effects.

(b) **No Impact.** Executive Order 12898 requires each federal agency to achieve environmental justice as part of its mission, by identifying and addressing disproportionately high and adverse human health or environmental effects, including social and economic effects of its programs, policies, and activities or minority populations and low-income populations of the United States. The Proposed Project does not propose any features that would result in disproportionate adverse human health or environmental effects, have any physical effects on minority or low-income populations, and/or alter socioeconomic conditions of populations that reside or work within the City and vicinity.

(c) **No Impact.** The Proposed Project would not have any adverse effects on Indian Trust Assets (ITA). ITAs are legal interests in property or rights held by the United States for Indian Tribes or individuals. Trust status originates from rights imparted by treaties, statutes, or executive orders. Examples of ITAs are lands, including reservations and public domain allotments, minerals, water rights, hunting and fishing rights, or other natural resources, money or claims. Assets can be real property, physical assets, or intangible property rights. ITAs cannot be sold, leased, or otherwise alienated without federal approval. ITAs do not include things in which a tribe or individuals have no legal interest such as off-reservation sacred lands or archaeological sites in which a tribe has no legal property interest. No ITAs have been identified within the Proposed Project site. As a result, the Proposed would have no adverse effects on ITAs.

3.16 Traffic and Transportation

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Cause an increase in traffic, which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, vehicle miles traveled, the volume-to-capacity ratio on roads, or congestion at intersections)?	☐	☒	☐	☐
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☐	☒	☐	☐
c) Result in a change in air traffic patterns, including either an increase in vehicle miles traveled, traffic levels or a change in location which results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☒	☐	☐
f) Result in inadequate parking capacity?	☐	☐	☒	☐
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☒	☐

Discussion

(a) **Less-than-Significant Impact with Mitigation.** Construction would temporarily disrupt transportation and circulation patterns in the vicinity of the project, thus disrupting local vehicle, bicycle, and pedestrian traffic along the haul routes and the planned pipeline alignment. Although construction-generated traffic would be temporary during peak excavation and earthwork activities, average daily truck trips would not likely exceed 10 round-trip truck trips per day. The primary impacts from the movement of trucks would include short-term and intermittent lessening of roadway capacities due to slower movements and larger turning radii of the trucks compared to passenger vehicles and temporary lane closures and possible detours during certain times. The following mitigation measures are proposed:

Mitigation Measure TRA-1: Prepare and Implement Traffic Control Plan. As is consistent with existing policy, the City shall require the contractor to prepare and

implement effective traffic control plans to show specific methods for maintaining traffic flows. Examples of traffic control measures to be considered include: 1) use of flaggers to maintain alternating one-way traffic while working on one-half of the street; 2) use of advance construction signs and other public notices to alert drivers of activity in the area; 3) use of "positive guidance" detour signing on alternate access streets to minimize inconvenience to the driving public; 4) provisions for emergency access and passage; and 5) designated areas for construction worker parking.

Mitigation Measure TRA-2: Return Roads and Paths to Pre-construction Condition. Following construction, the City shall ensure that road and the unnamed path surfaces that are damaged during construction are returned to their pre-construction condition or better.

With the incorporation of the above mitigation measures, potential temporary impacts are considered to be less-than-significant.

Once constructed, the Proposed Project would not have any long-term impacts to traffic and transportation.

(b) **Less-than-Significant Impact with Mitigation.** As discussed above in (a), construction activities of the Proposed Project may result in increased vehicle trips and vehicle miles traveled. This could temporarily exceed, either individually or cumulatively, existing level of service standards. However, the Proposed Project would not result in any long-term degradation in operating conditions, vehicle miles traveled, and/or level of service on any Project roadways. With the implementation of **Mitigation Measure TRA-1** impacts associated with exceeding level of service standards would be reduced to a less-than-significant level.

(c) **No Impact.** The Proposed Project does not involve use of air transit, nor is it expected to cause any change in air traffic patterns. No impact is expected and no mitigation is required.

(d) **No Impact.** The Proposed Project does not propose to make changes to roadways that would create road hazards (e.g., sharp curves or dangerous intersections) or alter design features developed to mitigate such hazards. No impacts are expected and no mitigation is required.

(e) **Less-than-Significant Impact with Mitigation.** The Proposed Project would have temporary effects on traffic flow, due to added truck traffic during construction that could result in delays for emergency vehicle access in the vicinity of the project. Implementation of **Mitigation Measure TRA-1** would require the contractor to establish methods for maintaining traffic flow in the project vicinity and minimizing disruption to emergency vehicle access to land uses along the truck route and/or pipeline alignment. Implementation of **Mitigation Measure TRA-1** would also ensure potential impacts associated with temporary effects on emergency access would be mitigated to a less-than-significant level.

(f) **Less-than-Significant Impact.** Project-related construction activities would require additional parking for workers and equipment on a temporary basis. However, sufficient space exists within the construction easement and/or staging areas to accommodate parking needs for construction workers and equipment. As a result, no impacts are anticipated, and no mitigation is required.

(g) **Less-than-Significant Impact.** The construction activities associated with the Proposed Project would be short term and would not conflict with adopted policies, plans, or programs supporting alternative transportation. Also once constructed, the Proposed Project would not conflict with

adopted policies, plans, or programs supporting alternative transportation. Any short-term effects would be considered less-than-significant.

3.17 Tribal Cultural Resources

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is: i. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or ii. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	☐	☒	☐	☐

Discussion

a) Less-than-Significant with Mitigation. The Proposed Project would not cause a substantial adverse change in the significance of a known tribal cultural resource, as defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American Tribe, and that is either: (1) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k); and/or (2) is a resource determined by the City or its archeological consultant, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1.

As documented in Appendix D, on March 3, 2020, a letter was sent to the Native American Heritage Commission (NAHC), requesting a listing of local Native American tribes in the area and any information regarding sacred lands within the area in order to be compliant with Assembly Bill 52 (AB52). On March 6, 2020, NAHC sent the City a list of the Native American Tribes to request a government-to-government consultation to determine the potential of the Proposed Project to affect Tribal Cultural Resources. On April 7, 2020, the City sent a government-to-government letter to each Native American Tribe requesting consultation regarding how the Proposed Project could potentially affect any known tribal cultural resources. To date, none of the tribes have responded and the 30-day AB-52 consultation has been completed.

In addition, and as documented in Section 3.5 - Cultural Resources, on March 19, 2020, a records search was conducted by staff at the Northwest Information Center, Sonoma State University, Rohnert Park, California (NWIC No: 19-1600). The record search included the Project Area of Potential Effect (APE) and a 0.50-mile radius outside the project boundaries. The record search included current inventories of National Register of Historic Places (NRHP), the California Register of Historical Resources (CRHR), California State Historic Landmarks, and the California Points of Historical Interest. However, due to the sensitive nature of the information, this information is not available to the general public and is on a need-to-know basis. As a result, this public document will only summarize those resources and findings.

In addition, a pedestrian archeological survey was conducted of the Project area on March 27, 2020. All open areas were inspected for cultural evidence such as historic structures, artifacts, and features; and indicators of prehistoric archaeological deposits like midden soil, flaked lithics, groundstone, and shell. No cultural resources were observed during the survey.

As a result, there are no tribal cultural resources that are known to exist within the Project area. Therefore, the Proposed Project is not likely to cause a substantial adverse change in the significance of known or unique tribal cultural resources. Nevertheless, there is always a chance that construction activities of the Proposed Project could result in accidentally discovering unique tribal cultural resources. However, to further reduce this less-than-significant impact, the following mitigation measures shall be implemented along with and in combination with the **Mitigation Measures: CR-1, CR-2, and CR-3** as identified in Section 3.5 - Cultural Resources:

> **Mitigation Measure TCR-1: Halt Work if Tribal Cultural Resources are Discovered.** In the event that any tribal cultural resources are discovered during ground disturbing activities, all work within 100-feet of the resources shall be halted and after notification, the City shall consult with a qualified archaeologist and local tribes to assess the significance of the find. If any find is determined to be significant as a unique tribal cultural resource, the City shall treat the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including to, but not limited to, the following:
>
> - Protecting the cultural character and integrity of the resource;
> - Protecting the traditional use of the resource; and
> - Protecting the confidentiality of the resource.
>
> In considering any suggested mitigation proposed by the consulting archaeologist and/or the appropriate tribe in order to mitigate impacts to any tribal cultural resources find, the City shall determine whether avoidance is feasible in light of factors such as the nature of the find, project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) shall be instituted and coordinated with the appropriate tribe(s). Work may proceed on other parts of the project site while mitigation

measures for tribal cultural resources or other unique archaeological resources are carried out.

With the implementation of the above mitigation measure, the Proposed Project would not result in impacts to tribal cultural resources.

3.18 Utilities and Service Systems

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
d) Have sufficient water supplies available to serve the Project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒
e) Result in a determination by the wastewater treatment provider which serves or may serve the Project that it has adequate capacity to serve the Project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
f) Be served by a landfill with sufficient permitted capacity to accommodate the Project's solid waste disposal needs?	☐	☐	☐	☒
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project would not exceed wastewater treatment requirements of the San Francisco Regional Water Quality Control Board. Therefore, no impacts are anticipated, and no mitigation is required.

(b) **No Impact.** The Proposed Project would not result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause

significant environmental effects. Therefore, no impacts are anticipated, and no mitigation is required.

(c) **No Impact.** The Proposed Project would not require or result in the construction of additional off-site storm water drainage facilities. Therefore, no impacts are expected, and no mitigation is required.

(d) **No Impact.** No new or expanded water supplies or entitlements are needed or required under or as a result of the Proposed Project. Therefore no impacts are expected, and no mitigation is required.

(e) **No Impact.** The Proposed Project would not increase the demand for wastewater treatment. No impacts are expected, and no mitigation is required.

(f) **No Impact.** Construction and operation of the Proposed Project would not generate a significant amount of solid wastes. No impacts are expected to existing landfills, and no mitigation is required.

(g) **No Impact.** The Proposed Project will comply with all relevant federal, state, and local statutes and regulations related to solid waste. Therefore, there are no anticipated impacts, and no mitigation is required.

3.19 Mandatory Findings of Significance

	Potentially Significant Impact	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project:				
a) Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐
b) Have impacts that would be individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☒	☐	☐
c) Have environmental effects that would cause substantial adverse effects on human beings, either directly or indirectly?	☐	☒	☐	☐

Discussion

(a) Less-than-Significant Impact with Mitigation. With the incorporation of the previously identified mitigation measures, the Proposed Project will not substantially degrade the quality of the environment, reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory. Any impacts from the Proposed Project in these areas are considered here to be less-than-significant with the implementation and incorporation of the above-mentioned mitigation measures.

(b) Less-than-Significant Impact with Mitigation. No direct project-specific significant effects were identified that could not be mitigated to a less-than-significant level. Mitigation Measures incorporated herein mitigate any potential contribution to cumulative (as well as direct) impacts associated with these environmental issues. Therefore, the Proposed Project does not have impacts that are individually limited, but cumulatively considerable.

(c) Less-than-Significant Impact with Mitigation. As a result of mitigation included in this environmental document, the Proposed Project would not result in substantial adverse effects to humans, either directly or indirectly.

Chapter 4 Determination

On the basis of this initial evaluation for the City of Hercules' Sycamore Avenue Trunk Sewer Replacement Project:

☐ I find that the Proposed Project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the Proposed Project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the Project have been made by or agreed to by the City. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the Proposed Project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the Proposed Project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the Proposed Project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the Proposed Project, nothing further is required.

Signature — Date: 9/10/20

Mike Roberts — Printed Name

Public Works Director/City Engineer — Title

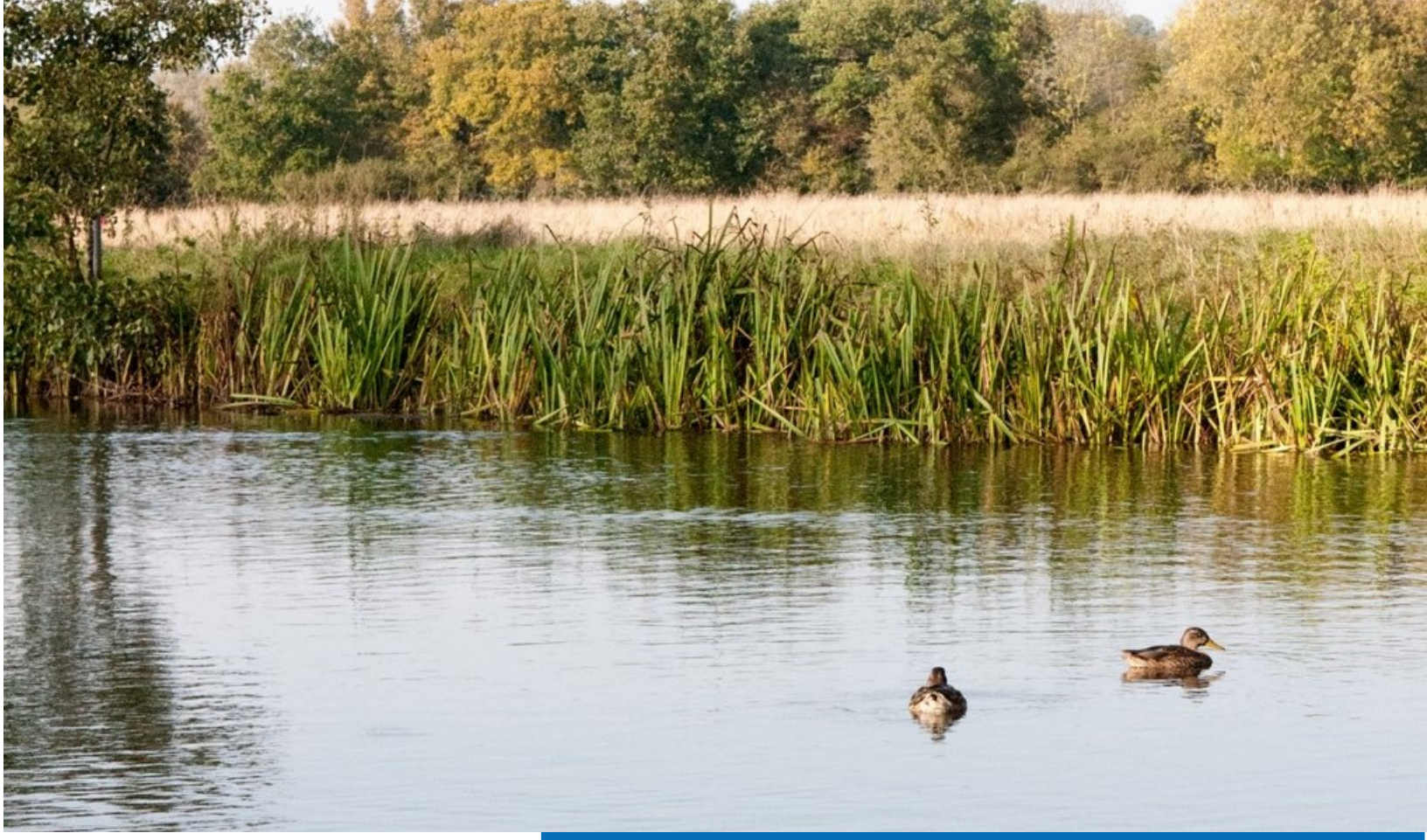
Chapter 5 Bibliography

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Appendix A

Sycamore Avenue Trunk Sewer Replacement Preliminary Design Report



City of Hercules
Sycamore Avenue Trunk Sewer Replacement

VOLUME 1 OF 2
PRELIMINARY DESIGN REPORT

DRAFT | January 2020

City of Hercules
Sycamore Avenue Trunk Sewer Replacement

VOLUME 1 OF 2
PRELIMINARY DESIGN REPORT

DRAFT | January 2020

This document is released for the purpose of information exchange review and planning only under the authority of Anne E. Prudhel, January 6, 2020, California PE License No 66246.

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Abbreviations

ACP	asbestos cement pipe
ADWF	average dry weather flow
BWF	base wastewater flow
Carollo	Carollo Engineers, Inc.
CCES	Carollo Cost Estimating System
CCCFCD	Contra Costa County Flood Control and Conservation District
CCCSD	Central Contra Costa Sanitary District
CCTV	closed-circuit television video
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
EBRPD	East Bay Regional Parks District
EPA	Environmental Protection Agency
FM	Force main
ft	feet
ft/s	feet per second
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
GWI	groundwater infiltration
HOA	homeowner's association
IS/MND	Initial Study/Mitigated Negative Declaration
I/I	infiltration and inflow
mgd	million gallons per day
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NPDES	National Pollutant Discharge Elimination System
PDR	preliminary design report
psi	pounds per square inch(1)
PWWF	peak wet weather flow
RCP	reinforced concrete pipe
RWQCB	Regional Water Quality Control Board
SF BCDC	San Francisco Bay Conservation and Development Commission
SWRCB	State Water Resources Control Board
UPRR	Union Pacific Railroad
USACE	United States Army Corps of Engineers
WPCP	Water Pollution Control Plant

Section 1

INTRODUCTION

The City of Hercules (City) is evaluating options to replace and/or rehabilitate the existing Sycamore Avenue Trunk Sewer with the following goals in mind:

- To improve reliability of the system,
- To provide capacity to meet future development flows and wet weather flows without surcharging the system , and
- To improve access to the sewer for maintenance.

The existing Sycamore Avenue Trunk Sewer consists of approximately 5,200 LF of 24-inch asbestos cement pipe and 200 LF of 24-inch welded steel pipe constructed in 1972 that conveys sewage from Sycamore Avenue to the Pinole/Hercules Water Pollution Control Plant (WPCP). In addition, there are 21 associated manholes and vaults along the existing alignment. An overview of the project area is shown in Figure 1.



Figure 1 Site Area Overview

Section 2

PURPOSE

The purpose of this Preliminary Design Report (PDR) is to examine the condition of the existing trunk sewer based on existing City closed-circuit television video (CCTV) data, determine the required capacity and optimal pipe size, look at constructible and cost effective construction methods to replace or rehabilitate the trunk sewer, and ultimately, determine which combination of alternatives best meets the project goals.

Section 3

EXISTING CONDITIONS

3.1 Alignment

The existing alignment of the trunk sewer is generally located out of the public street right-of-way in City easements, private roads, and City parklands within narrow, sometimes curved corridors. The trunk sewer was split into seven different segments as shown on Figure 2 .



Figure 2 Project Segment Overview

3.1.1 Pinole/Hercules WPCP (Segment 1)

The first sewer segment begins at the connection point to the existing 30-inch ductile iron (DI) pipe that was installed in 2018 at the Pinole/Hercules WPCP as part of the recent WPCP upgrade. The City's influent flow is measured downstream of this segment at WPCP MH H1, before combining with the City of Pinole's 30-inch reinforced concrete pipe (RCP) trunk sewer at WPCP MH 2. Combined influent is conveyed to the headworks pump station where there is a hydraulic drop into the wetwell. Directly upstream from the connection point, the existing trunk sewer crosses through the WPCP, across Contra Costa County Flood Control and Water Conservation District (CCCFCD) property, and underneath Union Pacific's railroad (UPRR) in a 100-foot wide right-of-way. The existing 24-inch trunk sewer is located inside a 90-foot long x 36-inch diameter x 3/8-inch thick steel casing that was auger bored under the railroad tracks approximately 20 feet north of the parallel Pinole 24-inch force main crossing. On the east side of the railroad tracks the sewer alignment falls within a second 100 foot wide UPRR parcel, and the City has an existing longitudinal encroachment agreement with the railroad.

3.1.2 Pinole Creek Crossing (Segment 2)

The second trunk sewer segment consists of the Pinole Creek crossing. The existing trunk sewer crosses Pinole Creek hanging on the Railroad Avenue Bridge upstream from the UPRR Bridge and downstream from the San Pablo Bay Trail pedestrian bridge. This segment of the trunk sewer, which is constructed of welded steel pipe, is attached to the eastern side of the 90-foot long vehicular bridge. The bridge is over 50 years old and is closed to public vehicular and pedestrian traffic due to concerns over weight capacity limitations. The City of Pinole has indicated that they will require that the existing pipeline be removed from the bridge and that construction work from the bridge will be limited to workers and a pickup truck.

This segment is located within the 100-year flood plain. During periods of high flow in the creek, water reaches the bottom of the existing pipe and bridge. Pinole Creek is located within CCCFCD property and an easement. Over the past few years, the CCCFCD has been rehabilitating Pinole Creek to accommodate the higher flows experienced during severe storm events. One particular area that continues to limit creek flow is the Railroad Avenue Bridge. As the bridge is no longer used for vehicles, CCCFCD is hoping to remove the bridge to alleviate bottlenecking of creek flow. Existing utilities located on the bridge, like the trunk sewer, is one of the main reasons that the bridge hasn't been demolished to date. A subsurface crossing will allow for future removal of the bridge and eliminate the chances of sanitary sewer overflows into Pinole Creek.

Options for horizontal alignment for this crossing are limited due to the location of the existing force main crossing that is centered between the existing pedestrian bridge and Railroad Avenue Bridge. The proposed alignment is to locate the trunk sewer between the force main and the Railroad Avenue Bridge footings. There are no as-built drawings available for Railroad Avenue Bridge, so GPR investigation may be prudent to determine the extent of the bridge foundation. There are also limited surface features that can be used to determine the exact crossing of the force main, and CCCFCD installed storm drains adjacent to the creek that do not have record drawings, so utility locate is recommended in this area. In addition, this area also has an overhead electrical line, and temporary relocation or support will be required during construction.

3.1.3 Chelsea Wetlands (Segment 3)

The third segment of the trunk sewer is located on City property on a berm that also has East Bay Regional Park District's (EBRPD) San Pablo Bay Trail. The sewer alignment runs adjacent to the Chelsea Wetlands, an environmentally sensitive area located east of the UPRR. Pinole Creek is to the south of this segment and Santa Fe Avenue is to the north. The existing sewer is relatively shallow in this area, so possibility of wet weather sanitary sewer overflows are a concern. The 24" ACP/RCP force main, owned by the City of Pinole, runs parallel to the existing trunk sewer throughout this entire segment. The force main is offset 6 feet to the north of the existing trunk sewer. Because the wetlands and force main are located directly adjacent to the existing trunk sewer, work space is limited. Construction access to this segment of pipe is limited to the 10 foot wide trail with truck access north at the intersection of Santa Fe Avenue and Railroad Avenue or it may be possible to use CCCFCD's maintenance road that runs parallel to the creek.

3.1.4 Historic Homes Development (Segment 4)

The fourth segment includes approximately 370 feet of trunk sewer that is located in a City easement through private residential property and a public park area. The trunk sewer was built in 1972. In 1989, the Historic Homes Development was built in this area, with a few structures constructed directly on top of the trunk sewer. Several of the manholes located along this segment of the trunk sewer are located in the yards of private residences, making access to the sewer difficult. The City has also mentioned concerns regarding settlement in this area. It was decided to abandon this segment of existing sewer and to relocate the new sewer to neighboring streets to improve City maintenance access.

3.1.5 Unnamed Path/Reserve (Segment 5)

The fifth segment of trunk sewer, which is located northeast of Camden Lane, has very limited access with the pipe's alignment running between a parallel retaining wall to the north and a nature reserve with wetlands to the south. The trunk sewer is located underneath an unnamed path behind residences on Promenade Street. The Pinole force main continues to run directly parallel to the trunk sewer. There will likely be environmental mitigation and monitoring measures that need to be incorporated into construction documents for work within this area.

3.1.6 Unnamed Path between Apollo and Promenade Street (Segment 6)

Segment 6 is located between Apollo and Promenade Street. An embankment borders the path to the south and residences border the path to the north along this curved section. This segment contains sewer pipe that is extremely deep below the ground surface, with some areas of pipe having over 30 feet of cover. However, one end of the pipe curve has only 3 feet of cover. Manholes along this segment vary from quite deep to shallow, the deepest being approximately 25 feet and the shallowest at 6 feet. In addition, the pipe is curved in this segment with overhanging mature eucalyptus trees to either side of the trail. Down the hill from the trail, is the duck pond which is a delineated wetland. The Pinole force main continues to parallel the trunk sewer along this segment approximately 6 feet to the north.

3.1.7 Unnamed Path between Embankment and Duck Pond Park (Segment 7)

The final segment, Segment 7, is located along the same unnamed path, upstream of Segments 5 and 6. Like a majority of the upper reaches of the trunk sewer, access is along the existing path,

with the existing parallel force main approximately 6 feet away. Access to this section is better than Segments 5 and 6 since there are fewer trees and less vegetation. Additionally, pipe in this segment is straight and pipe cover, varying from 3 to 14 feet, is not as deep.

3.2 CCTV Data

In 2016, Pipe & Plant Solutions conducted CCTV of the entire 5,400 foot length of trunk sewer in order to identify the existing condition of the pipe. CCTV data reports were provided, including structural and maintenance ratings. CCTV inspection of the pipeline allows for review of the internal condition of the pipe. More particularly, CCTV inspection provides footage that verifies existing pipe material and condition, pipe connections, and whether the pipe has any visible defects. Defects that can be identified include cracks, fractures, holes, collapses, joint offsets, sags, solids and grease deposits, root intrusion, water infiltration, and more. Once existing defects have been identified, the repair method required for the pipeline can be determined.

Upon review of the CCTV footage and reports, it was determined that the majority of the existing trunk sewer is in fair condition. As mentioned previously, the trunk sewer consists of asbestos cement pipe and welded steel pipe. A number of areas do exist where significant structural defects are present. Table 1 provides a summary of all defects identified from the CCTV footage. Manholes were not inspected as part of this effort, so condition of existing manholes is unknown.

Light to moderate corrosion of the pipe is common in many areas. Additionally, significant amounts of salt have accumulated along the interior walls of the pipe. Figure 3 is a screen capture from CCTV that shows the corrosion and salt build up frequently seen throughout the trunk sewer.



Figure 3 Existing Pipe Condition

Table 1 CCTV Summary

From MH	To MH	Length (feet)	Size (inches)	Material	Defects	Connections	Notes
MH 2	Vault 1	231.8	24	RCP	23 m – Soil Visible 43 m – Longitudinal Fracture	N/A	N/A
Vault 5	MH 4	185.7	24	RCP	N/A	N/A	45 m – Video stops
Vault 7	MH 6	248.1	24	RCP	N/A	N/A	74 m – Video stops
Vault 7	Vault 8	0.2	24	RCP	N/A	N/A	No video
Vault 8	Vault 7	272.7	24	RCP	83 m – Offset Medium Defect	N/A	N/A
Vault 10	Vault 9	260.7	24	RCP	79 m – Object in Joint	N/A	N/A
MH 11	Vault 10	4.6	24	RCP	N/A	@ Vault 10	N/A
MH 12	MH 11	364.2	24	RCP	N/A	N/A	N/A
MH 13	MH 12	167.7	24	RCP	N/A	N/A	N/A
MH 14	MH 13	257.2	24	RCP	N/A	N/A	N/A
MH 15	MH 14	196.7	24	RCP	N/A	N/A	N/A
MH 16	MH 15	202.1	24	RCP	7 m – Water Level Sag	N/A	N/A
MH 17	MH 16	455	24	RCP	N/A	N/A	N/A
Vault 18	MH 17	512.2	24	RCP	N/A	N/A	N/A
MH 21	MH 20	403.7	24	RCP	N/A	@ MH 20	N/A
MH 22	MH 21	22.3	24	RCP	N/A	N/A	N/A
MH 23	MH 22	9.2	24	RCP	N/A	N/A	N/A

3.3 Collection System Tie-Ins

There are eight collection system tie-in points (connections) located along the 5,400-foot stretch of trunk sewer. These connections allow for sewage from various areas of the collection system to be fed into the trunk sewer and conveyed to the WPCP. All of these connections occur at manholes. Any rehabilitation or replacement alternative, must consider how to convey flow from the existing connection points. Figure 4 shows the trunk sewer, each connection location and its tributary area. The connection points are discussed further in the following sections.



Figure 4 Collection System Tie-Ins

3.3.1 Industrial Lift Station

A 10-inch force main conveys sewage from Industrial Lift Station into the trunk sewer at MH #19. Industrial Lift Station is equipped with two submersible variable speed pumps rated at 2.0 mgd each. The lift station provides service to approximately 1,129 residential units and 38.8 acres of industrial and commercial area. Based on the temporary flow monitoring program conducted in 2019, the average dry weather flow coming into the lift station is approximately 0.257 mgd. Existing PWWF is estimated to be 1.215 mgd, while with future improvements PWWF is estimated to increase to 1.902 mgd.

3.3.2 Duck Pond Park

An 8-inch gravity sewer conveys sewage from a restroom in Duck Pond Park into the trunk sewer at MH #18A. The restroom is the only source of flow; therefore flow via this 8-inch sewer is minimal. Design PWWF is 0.003 mgd.

3.3.3 Olympian Hills #1 and #2

Two separate 8-inch gravity sewer connections convey sewage from the Olympian Hills development into the Sycamore Avenue Trunk Sewer. Connections are located at MH #15 (Olympian Hills #2) and MH #18 (Olympian Hills #1). Based on the temporary flow monitoring program conducted in 2019, the average dry weather flow generated by the Olympian Hills #2 development (MH#15) is approximately 0.05 mgd. Olympian Hills #1 and #2 each have a PWWF of 0.058 mgd.

3.3.4 Promenade Lift Station

An 8-inch force main conveys sewage from Promenade Lift Station into the trunk sewer at MH #14. Promenade Lift Station is equipped with two submersible variable speed pumps (1+1) rated at 0.43 mgd each. The lift station provides service to approximately 129 residential units and 2.08 acres of industrial and commercial area. The lift station influent average dry weather flow is approximately 0.03 mgd, based on data collected during the 2019 temporary flow monitoring program. Existing PWWF is estimated to be 0.167 mgd. Future plans to redirect flow from this basin to the Industrial Lift Station will decrease the PWWF to 0.055 mgd.

3.3.5 Historic Homes

An 8-inch inch gravity sewer connection conveys sewage from the Historic Homes development into the Sycamore Avenue Trunk Sewer, at MH #13. This connection only serves 3 residences; therefore flow from this 8-inch sewer is negligible. Design PWWF is 0.002 mgd.

3.3.6 Civic Arts

An 8-inch gravity sewer connection conveys sewage from a restaurant, Leila by the Bay, into the Sycamore Avenue Trunk Sewer, at MH #11A. Flow from this 8-inch sewer is minimal. Design PWWF is 0.005 mgd.

3.3.7 Bayside Lift Station

An 8-inch force main conveys sewage from Bayside Lift Station into the trunk sewer at MH #5A. Bayside Lift Station is equipped with two submersible variable speed pumps rated at 0.5 mgd each. The lift station provides service to approximately 367 residential units and 11.2 acres of industrial and commercial area. Based on data collected during the 2019 temporary flow monitoring program, the estimated influent average dry weather flow at this lift station is 0.11 mgd. Existing PWWF is estimated to be 0.507 mgd, while with future improvements PWWF is estimated to increase to 0.552 mgd.

3.4 WPCP Operations and Restrictions

While there is no flow storage within the WPCP, overflows within the plant have not been an issue. The plant does not backup into the collection system for storage. The WPCP influent pump station has a firm capacity of 20 mgd with one pump out of service. Operations staff indicated that, historically, the influent pumps have been able to keep up with flows and they have never seen the level in the influent wet well rise high enough to surcharge the upstream collection system. However, the 30-inch Pinole influent line does have potential for surcharging under peak wet weather conditions. There are several bolted manholes along the Pinole trunk sewer to prevent overflows.

The maximum historical influent flow from Hercules was recorded in 1988 at approximately 10 mgd. Staff noted that historical flow measurements collected prior to February 2019 are not reliable and include combined flows from the Cities of Hercules and Pinole.

Section 4

DESIGN CRITERIA

The City of Hercules requested that sewer capacity design adhere to Central Contra Costa Sanitary District's (CCCSD) design standards. The design criteria used is summarized below and was used to evaluate the existing system capacity and to size the proposed Sycamore Avenue Trunk Sewer Replacement.

4.1 Design Flow

The components of design wastewater flows include base wastewater flow (BWF), groundwater infiltration (GWI), and rainfall-dependent infiltration and inflow (I/I).

4.1.1 Base Wastewater Flow

BWF is the flow generated by the City's customers independent of wet weather influences. BWF has a diurnal pattern that varies depending on the type of use (residential versus commercial and industrial) as well as the day (weekday versus weekend). For example, commercial and industrial uses typically have more consistent higher flows during business hours. Furthermore, the diurnal flow pattern experienced during a weekend may vary from that of a weekday.

The BWF and diurnal patterns for the Sycamore Avenue Trunk Sewer were estimated based on the following:

- The BWF provided in the City's collection system model (developed and calibrated by West Yost).
- Flow data provided by the Pinole WWTP.
- Dry weather flow data collected during the 2019 temporary flow monitoring program.

4.1.2 Groundwater Infiltration

GWI is the result of extraneous water entering the sewer system through defects in pipes and manholes. GWI is related to the condition of the sewer pipes, manholes, and groundwater levels. Dry weather GWI (or base infiltration) cannot easily be separated from BWF by flow measurement techniques and is, therefore, typically grouped with BWF.

4.1.3 Rainfall-Dependent Infiltration and Inflow (RDII)

Infiltration and inflow (I/I) is defined as storm water that enters through the collection system through defects in pipelines, manholes, and joints (infiltration) or via storm drain cross connections, leaky manhole covers, or cleanouts (inflow). The adverse effects of I/I entering the collection system is that it increases both the flow volume and peak flows.

Estimated RDII hydrograph parameters for the Sycamore Avenue Trunk Sewer were developed based on the following:

- Existing RDII hydrograph parameters were developed based on the flow data collected during the 2019 temporary flow monitoring program, and are based on the collection system's response to two storm events (February 12-17, 2019 and February 25- March 11, 2019).
- Partial flow data provided for the Pinole WWTP.
- Future RDII flows were developed based on information provided in the City's full collection system model, which was developed by West Yost.

4.2 Design Storm Event

Design storms are rainfall events used to analyze the performance of a collection system under extreme wet weather events. In addition to defining the design flow factors for BWF, GWI, and RDII, peak design flow criteria must also specify the design storm rainfall and timing with respect to seasonal GWI and diurnal BWF. The first step in the development of a design storm is to define the storm's return interval (the probability that the design flow will be exceeded in any given year) and duration (length of time in which the rainfall occurs).

The selected design storm event was the one used in the most recent CCCSD wastewater collection system master plan update (Carollo, 2017), which was a 10-year, 24-hour storm event. This 10-year design storm volume for the City of Hercules equates to a total of 3.52 inches of rain (distributed over a 24-hour period). The distribution pattern for this design event was based on the historical event from December 30-31, 2005. This storm was approximately 24 hours in duration with the rainfall increasing gradually up to a relatively high peak hour intensity and then receding toward the end of the storm. The design storm is shown on Figure 5. As shown on Figure 5, the total volume is 3.52 inches with a peak rainfall intensity of 0.54 inches/hour.

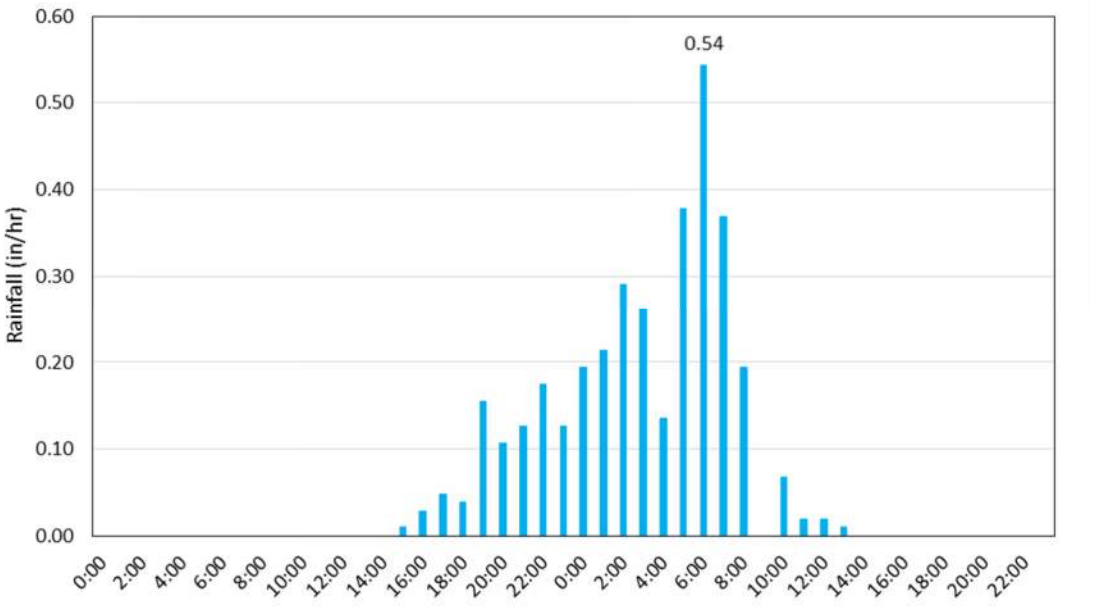


Figure 5 10-Year, 24-hour Design Storm

4.2.1 Peak Wet Weather Flow

The peak wet weather flow (PWWF) is the highest observed hourly flow that occurs following the design storm event. The existing and future PWWF was derived by routing the 10-year, 24-hour design storm through the hydraulic model.

4.3 Maximum Flow Depth Criteria (d/D)

The maximum flow depth ratio (d/D) for a pipe is the ratio of the maximum flow depth (d) to the pipe diameter (D). The City requires that the maximum flow depth criteria be consistent with the CCCSD master plan (Carollo, 2017), which includes the following:

- Allow surcharging to 5 feet below the manhole rim during the 10-year, 24-hour design storm event (i.e. maintain 5 feet of freeboard).
- No surcharging allowed for areas with less than 5 feet of available freeboard.

Figure 6 illustrates the maximum flow depth criteria.

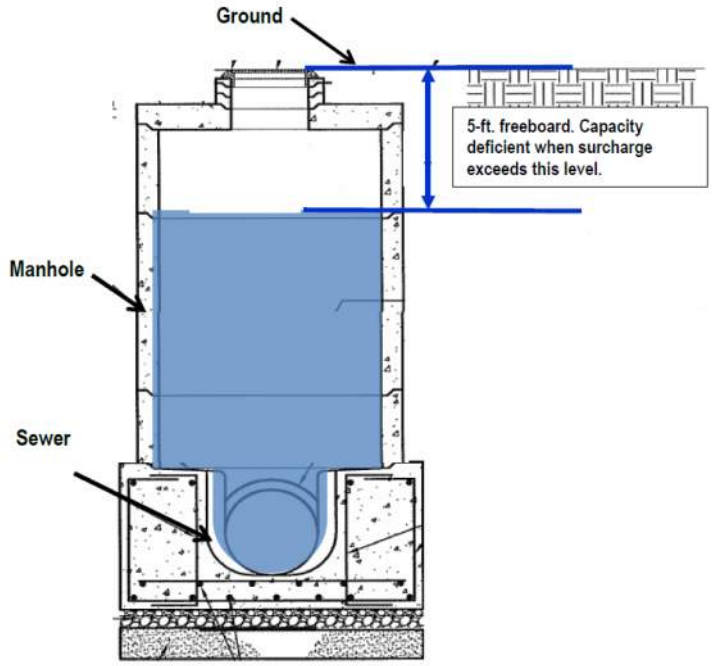


Figure 6 Maximum Allowable Flow Depth

4.4 Manning's Coefficient

The Manning's coefficient "n" is a friction coefficient that varies with respect to pipe material, size of pipe, depth of flow, smoothness of joints, root intrusion, and other factors. Per CCCSD standards, pipeline design shall use a Manning's coefficient of 0.013 or the pipe manufacturer's recommendation, whichever is greater. The manufacturer's recommended coefficients for the recommended pipe materials (HDPE or FPVC) range from 0.009 to 0.012. As a conservative approach, a coefficient of 0.013 was used to match CCCSD's standard.

4.5 Minimum Velocity/Slope

Per CCCSD standards, the minimum acceptable slope for sewer pipe is based on a velocity of two feet per second (fps) for trunk sewers, when flowing full. The minimum and maximum design flows for each pipe size at the minimum acceptable slope is provided in Table 2.

Table 2 Minimum Velocity / Slope

Nominal Pipe Size (Inches)	Minimum Velocity (fps)	Design Flow with Full Pipe (cfs)	Design Flow with Full Pipe (mgd)	Minimum Slope (fps)
15	2	2.45	1.58	0.0015
18	2	3.53	2.28	0.0012
21	2	4.81	3.11	0.0010
24	2	6.28	4.06	0.0008
27	2	7.95	5.14	0.0007
30	2	9.81	6.34	0.0006
36	2	14.13	9.13	0.0005

4.6 Relief Sewer Facilities

The hydraulic design of relief sewer facilities required to address capacity deficiencies are based on CCCSD design standards, as outlined in the CCCSD Master Plan, and include the following:

- Minimum pipe size of 8 inches.
- Manning's "n" of 0.013 or pipe manufacturer's recommendation, whichever is greater.
- Slope to provide a minimum velocity of 3 fps for main sewers (8-10 inch pipes) and 2 fps for trunk sewers (generally 12-inch and larger pipes) at full pipe flow.
- Capacity such that the maximum d/D is 0.67 for main sewers and 1.0 for trunk sewers at peak design flow.
- Minimum pipe cover typically 6 feet, with exceptions based on pipe material, size, and location.

It is recommended that the peak design flow for relief sewer facilities be based on a 10-year design storm event.

4.7 Pipe Material

The City of Hercules does not have a standard material requirement for a sewer of this size. CCCSD's standard pipe cover limitation table also does not cover 30-inch diameter pipe. Based on the given restrictions along the project alignment, either fusible polyvinyl chloride (FPVC) or high density polyethylene (HDPE) will be used. Both of these materials are relatively light weight flexible materials that allow for some bending of the pipe. FPVC and HDPE are both installed by fusing together segments. Fusing is typically done above ground, prior to placing the pipe into the ground. Fusing together the various pipe segments eliminates all joints in the pipe, greatly reducing root intrusion and leakage.

Section 5

FLOW MONITORING PROGRAM

Carollo contracted with V&A Consulting Engineers Inc. (V&A) to conduct a temporary, three-month flow monitoring program (from January 14, 2019 to April 21, 2019) at 11 sewer metering sites located within the City of Hercules. V&A prepared the stand-alone 2019 Sewer Flow Monitoring and Inflow/Infiltration Study, which is included in Appendix A. Figure 7 shows a schematic of the flow monitoring locations.

As part of the temporary flow monitoring program, V&A received rainfall data from three public weather stations throughout the City. The rainfall data collected by V&A was used to correlate the I/I response observed in the collection system to specific storm recurrence intervals. There were five main rainfall events that elicited a solid I/I response over the flow monitoring period. The rainfall event from February 12-17, 2019 was the highest classified rainfall event, ranging between a 4.5 to 9.5 year, 2-day storm event (based on NOAA Atlas 14 storm classifications).

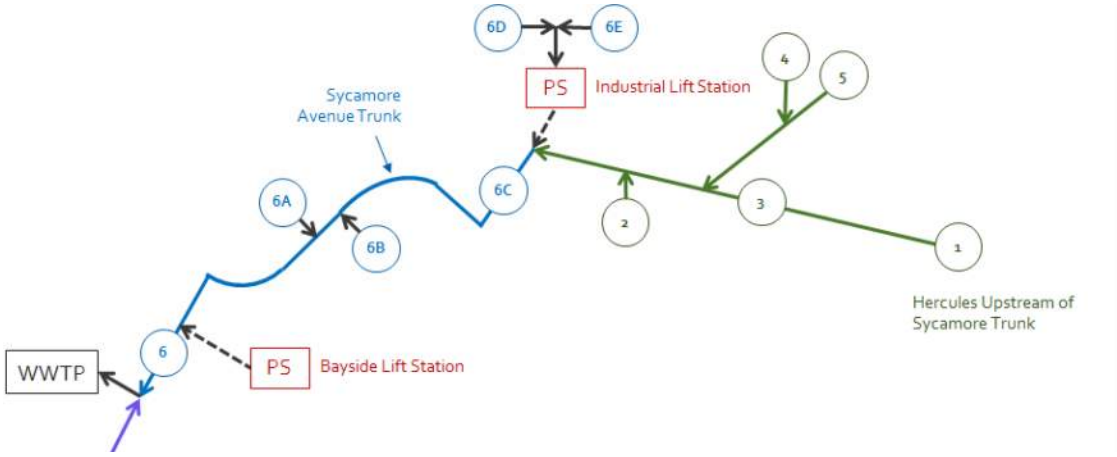


Figure 7 Flow Monitoring Schematic

Section 6

HYDRAULIC MODEL DEVELOPMENT

The City has a wastewater collection system hydraulic model for the entire collection system, developed by West Yost. For this evaluation, a separate hydraulic model of the Sycamore Avenue Trunk Sewer was developed. The modeled system includes approximately 5,400 LF of pipeline, including several mains that tie into the trunk as well as the Industrial Lift Station. Several data sources were used in the construction of the hydraulic model, including:

- Survey data provided by LCC Engineering & Surveying (including manhole rim elevations, pipe invert elevations, and diameters).
- Record drawings.

The hydraulic model developed for the Sycamore Avenue Trunk sewer was constructed based on several data sources:

- Record drawings for the Sycamore Trunk.
- Pinole/Hercules WPCP drawings.
- Record drawings for Industrial/Bayside Lift Stations.
- 2019 surveyed manhole data by LCC Engineering & Surveying that located the center of the manhole, provided rim elevations, influent and effluent invert elevations and sewer diameters.

The hydraulic model combined information on the physical and operational characteristics of the wastewater collection system, and performed calculations to solve a series of mathematical equations to simulate flows in pipes.

Section 7

HYDRAULIC MODEL CALIBRATION

After the hydraulic model was developed, model calibration, a crucial component of the hydraulic modeling effort, was performed. Calibrating the model to match data collected during the flow-monitoring period ensures the most accurate results possible. The calibration process consisted of calibrating to both dry and wet weather conditions. Dry weather flow (DWF) calibration ensures an accurate depiction of the base wastewater flow generated within the study area. The wet weather flow (WWF) calibration consists of calibrating the hydraulic model to a specific storm event or events to accurately simulate the peak and volume of infiltration/inflow (I/I) into the sewer system. The amount of I/I is essentially the difference between the WWF and DWF components.

7.1 Dry Weather Flow Calibration

As discussed above, calibration of the dry weather flow ensures an accurate depiction of base wastewater flows. Calibration was performed by inputting the wastewater loads to match the measured flows determined from the flow monitoring period. These loads were taken from periods of time where no appreciable precipitation was measured.

From this flow monitoring data, diurnal curves that accurately represent the daily dry weather flow can be developed. The diurnal curve is a pattern of 15-minute increment multipliers that are applied to the average dry weather flow to simulate the variation in flow that occurs throughout the day for average weekday and weekend flow. Two diurnal curves based on the flow monitoring data were created for each flow monitoring point, one representing weekday flows and the other representing weekend flows.

The calibration process compared the flow meter data (flow, level, and velocity) with the modeled output. Comparisons were made for average, maximum and minimum flows as well as the temporal distribution of flow. It is industry standard practice to consider a hydraulic model to be satisfactorily calibrated when the model simulated values are within ten-percent (10%±) of the field measured data. All of the meter sites were within 10%± of the field measured data for the daily average, maximum and minimum flows.

7.2 Wet Weather Flow Calibration

Wet weather flow calibration enables the hydraulic model to accurately simulate infiltration/inflow (I/I) entering a sewer system during a storm event. Wet weather flow calibration consists of two steps: 1) determining a rainfall event that characterizes the most significant impact on the sewer system facilities, preferably during wet antecedent soil moisture conditions; and 2) creating a database of I/I parameters for this rainfall event.

During the flow monitoring period, a number of fairly significant rainfall events occurred. As monitoring occurred during the end of winter/spring, the ground was fairly saturated during all monitoring. Figure 8 shows the measured rainfall and associated infiltration and inflow for Flow Monitoring Point 6 from January 15, 2019 to March 11, 2019.

The wet weather period between January 15 and March 11, 2019 was used to calibrate the hydraulic model, as this provided good representation of the system I/I response to several storms.

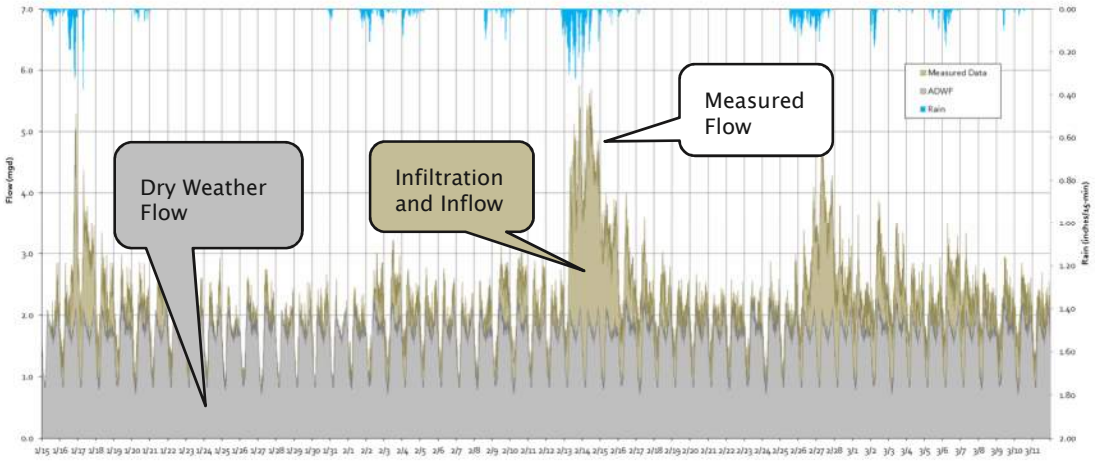


Figure 1 Infiltration and Inflow

In order to assess the I/I entering the system, a couple of the most significant storm events were chosen to be analyzed. The model parameters for I/I were then adjusted for the model so that the projected flows for each event aligned with what was measured. These same parameters included in the model were then used to project flows during other measured events. Once the model provided accurate and precise estimates of independently measured flow events, the model was considered to be adequately calibrated.

Section 8

SYCAMORE TRUNK DESIGN FLOWS

Design flows for the Sycamore Trunk Sewer were developed based on the following sources:

- Existing average and peak design flows were developed by Carollo based on the results of the hydraulic computer model developed by Carollo.
- Future average and peak flows were added into the Carollo model based on the projected flows provided in West Yost's hydraulic model.

Table 3 summarizes the existing and projected average dry weather flow (ADWF) and peak wet weather flow (PWWF). These flows are also shown on Figure 9 for reference.

Table 3 Sycamore Trunk Design Flow (at the WWTP)

Flow Condition	Average Dry Weather Flow (mgd)			Peak Wet Weather Flow (mgd)
	Minimum Hour	Average	Maximum Hour	
Existing[(1)]	0.75	1.63	2.40	7.61[(3)]
Future[(2)]	1.08	2.22	3.12	8.18[(3)] 9.05[(4)]

Notes:
(1) Existing flows based on hydraulic model of Sycamore Trunk, developed by Carollo.
(2) Future flows were added to Carollo's Sycamore Trunk model based on information provided in the West Yost systemwide hydraulic model.
(3) Peak flows that can be conveyed are based on existing Sycamore Trunk sizing.
(4) When the Sycamore Trunk Sewer is upsized, peak wet weather flow will increase due to the elimination of the hydraulic bottleneck. No decrease in I&I flow has been made based on tighter pipe joints, since the exact location of the I&I is unknown.

As shown in Table 3, the existing Sycamore Trunk ADWF is estimated to be 1.63 mgd. The average flow is expected to increase to 2.22 mgd in the future. The existing PWWF is estimated to be 7.61 mgd (this is the flow that reaches the WWTP based on a 10-year, 24-hour event, and the current sizing of the Sycamore Trunk). In the future, the PWWF is expected to increase to up to 9.05 mgd (with the proposed Sycamore Trunk improvements identified in Section 15). Without improvements, the future PWWF would be 8.18 mgd.

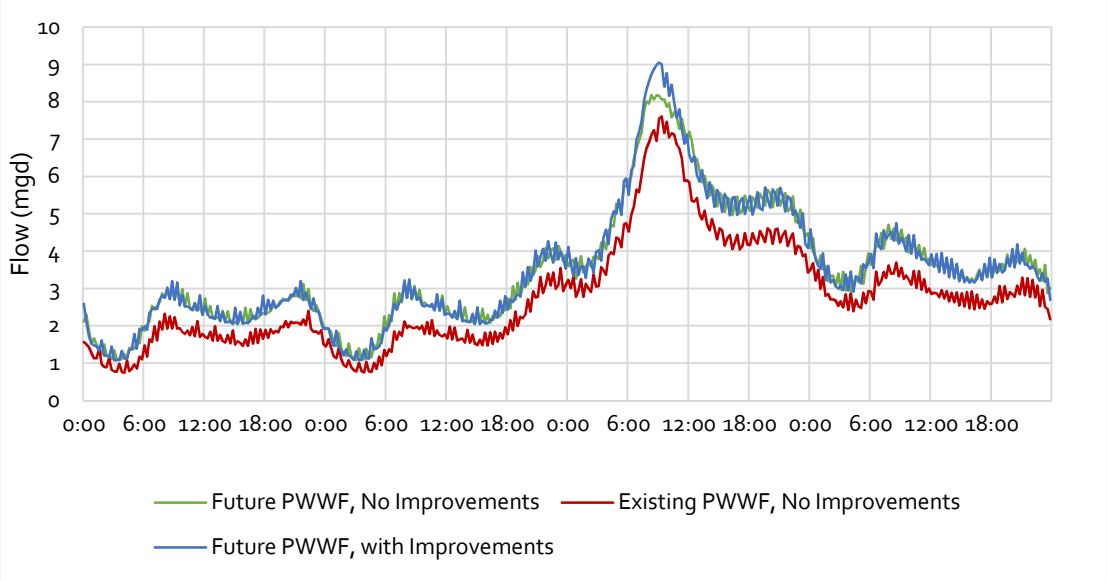


Figure 9 Existing and Projected Sycamore Trunk PWWF

Section 9

EXISTING SYSTEM DEFICIENCIES

9.1 Infiltration & Inflow

Carollo's hydraulic modeling effort, including flow monitoring, dry weather calibration and wet weather calibration allowed for a model of the Sycamore Avenue Trunk Sewer to be created that accurately reflects dry weather and wet weather flow conditions through the trunk sewer. This model was calibrated to accurately predict the amount of infiltration and inflow into the sewer system during rainfall events. This calibrated model allows the City to determine the maximum projected I/I into the Sycamore Ave. trunk sewer during any sized rainfall events.

9.2 Capacity Restraints

As mentioned previously, the City follows CCCSD standards for sizing of sewer pipelines. CCCSD standards require that sewers be sized to handle 10-year, 24-hour design storms. As such, the existing 24-inch Sycamore Ave. trunk sewer does not provide sufficient capacity. The entire 5,400 foot segment of trunk sewer must be upsized to meet CCCSD standards and more effectively handle the projected maximum design flows.

9.3 Recommended Pipe Size

The recommended pipe size for the Sycamore Avenue trunk sewer, as determined by the hydraulic model, is 30-inches. At a diameter of 30-inches, the design d/D was found to be less than 0.85, providing a factor of safety to help prevent the trunk sewer from surcharging during peak wet weather events. This will provide sufficient capacity in the trunk sewer to keep the trunk sewer from surcharging in areas with less than 5-feet of freeboard under the projected PWWF.

Section 10

SEWER ALIGNMENT ALTERNATIVES ANALYSIS

The purpose of the project was look at constructible and cost effective methods to replace or rehabilitate the trunk sewer while meeting capacity requirements and allowing for future maintenance. In general, due to physical constraints such as property ownership, wetland locations, deep pipe and adjacent trees and retaining walls, the trunk sewer will be replaced in the existing horizontal alignment except where this is not feasible or practical. There are three locations where horizontal alignment will need to be changed: 1) The UPRR railroad crossing will be parallel to the existing crossing in order to keep the line in service during construction; 2) the Pinole Creek crossing will change from an above ground pipe on an abandoned bridge below the 100-year flood elevation to an underground siphon upstream of the current location; and 3) the sewer located within easement through residential backyards in the Historic Homes Development will be relocated to private roads to improve maintenance access. A discussion of options investigated for these three areas follows.

To meet the increased capacity required for the trunk sewer, there are two viable options for a gravity system: 1) increase the sewer slope or 2) increase pipe size. With a relatively flat existing grade, and shallow pipe along the berm parallel to Railroad Avenue, there were limited opportunities for increasing sewer slope within the existing alignment to meet future flow requirements. In addition, there was the constraint of having to pick up flow from existing gravity sewer mains along the alignment. Optimizing the pipe velocity for scour; maintaining a d/D<.85 to prevent sanitary sewer overflows, and increasing slope were investigated within the constraints given. For the majority of the trunk sewer, this resulted in replacing the existing 24-inch sewer with a 30-inch sewer from manhole to manhole with a slightly increased slope. There was one area where alternatives were investigated to determine the most constructible manner to meet future wet weather flows: the deep, curved pipe from manhole 17 to 15. A discussion of construction options investigated follows.

10.1 Pinole Creek Crossing Construction Method Alternatives

One of the design goals of the Pinole Creek crossing was to protect the pipe from future floods while removing it from the Railroad Avenue Bridge. An elevated crossing to increase clearance above flood waters and debris is not feasible due to the existing grade of the gravity system. Crossing under Pinole creek will require a siphon system that will consist of a smaller pipe for dry weather flows, a larger overflow pipe for wet weather flows, an air jumper pipe, and siphon splitter vaults at either end. The dry weather flow pipe will be sized to achieve scour velocity during average day flow, while the wet weather pipe will be sized for the peak wet weather flow. Due to alignment restrictions and the desire to keep the line in service during construction at this location, the siphon vaults will not be located in the same place as existing manholes. The two siphon pipelines (10" and 24") and a 4" air jumper will all be installed within a casing. All siphon systems must have one pipe that is solely dedicated to providing an air jump – this allows hydrogen sulfide gas that gets trapped on the upstream side due to a pipeline flowing full to pass through to the downstream side. **Error! Reference source not found.**0 shows a plan and profile

schematic of a siphon system located underneath a body of water. Once the siphon pipelines are in place, the annular space between the casing pipe and the carrier pipes will be filled with grout. The remaining section of pipe to the north and south of the casing pipe will be installed via open-cut trenching.

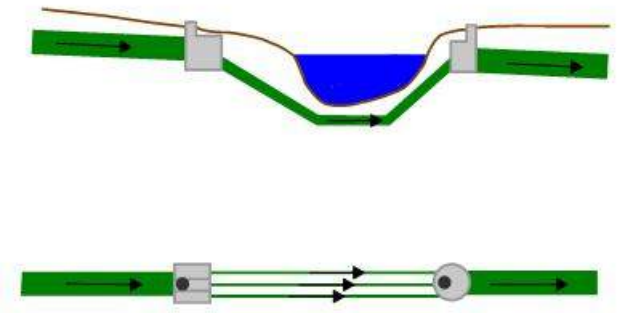


Figure 10 Inverted Siphon Schematic

Two construction methods were considered for installing the siphon: horizontal directional drilling (HDD) and microtunneling. Auger boring was eliminated from consideration since it is not a feasible construction method in areas with a high groundwater table.

10.1.1 HDD

Horizontal directional drilling is the preferred option from a cost standpoint. However, the pipe crossing will be through Bay Mud and a minimum cover of 30 feet below the creek bottom is recommended for any trenchless method. When the HDD crossing was laid out using a 60-inch casing pipe, 30-foot minimum cover beneath the creek, 17 degree entry and exit angles, and 600 foot bending radii. The minimum HDD crossing length would be approximately 500 feet long and must be centered on the creek (Figure 11). In addition, there needs to be adequate laydown area to string the 500 feet of pipe at the exit shaft and space for the drill rig and trucks at the entry shaft. The berm on the northeast side of the creek has adequate space for fusing the pipe string in the trail, but it is not in line with the crossing location. The crossing would require that the pipe be moved to the vegetated area adjacent to the trail and raised to a 17 degree angle. This is not practical. The entry pit on the south side of the creek would be near Tennent Avenue at the entrance to Pinole-Hercules WPCP. Although this is acceptable, this entry pit location does not have sufficient space for the work area without blocking the roadway during construction. If the exit pit were located in Railroad Avenue, the pipe string would block ingress and egress to the WPCP during construction and would possibly encroach on the UPRR.

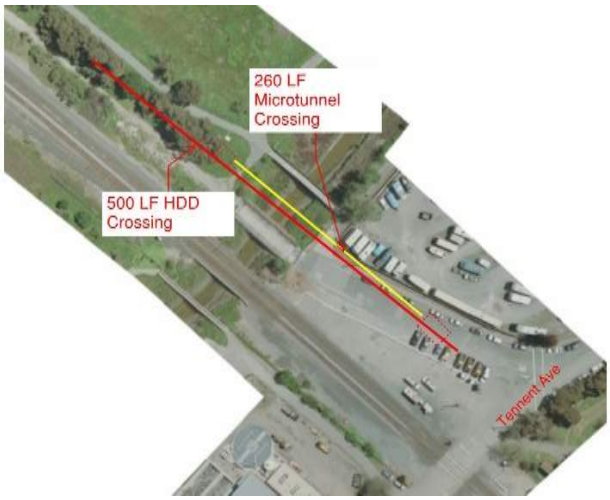


Figure 11 HDD and Microtunneling Layout at Pinole Creek Crossing

10.1.2 Microtunneling

Microtunneling is a remote-controlled, guided, pipe-jacking method that provides continuous face support and shaft-to-shaft construction. The microtunneling boring machine's (MTBM) guidance system is a laser that's mounted in the jacking shaft and projects onto a target in the shield. In addition, slurry is used to counterbalance earth and groundwater pressures and stabilize the face in front of the MTBM. Microtunneling is feasible in unstable soils, loose to dense sands, soft to hard clays, soft rock, and high groundwater. As this segment will be crossing underneath a tidally influenced creek directly adjacent to San Pablo Bay, groundwater will be encountered. For a 60-inch casing, a 20'W x 30'L jacking shaft is required on one side of the creek, and a 20'W x 15'L receiving shaft is required on the other.

Microtunneling is the recommended construction method for the Pinole Creek crossing due to space and environmental constraints.

10.2 UPRR Alignment

The existing trunk sewer crosses the railroad tracks approximately 60 feet northeast of the WPCP entrance. Since there will be no practical method to bypass pump across the active railroad, a parallel trunk sewer will be installed just north of the current alignment to allow continuous service to the WPCP. The standard UPRR encroachment agreement requires that a pipe crossing the railroad be installed within a steel casing generally perpendicular to the railroad tracks from 30 feet beyond one side of the railroad tracks to 30 feet beyond the other side with a cover of 4 feet beneath tracks. Just east of the railroad tracks, there are two fuel lines and two fiber optic conduit that run parallel to the railroad that may set the vertical depth of the crossing. The 12-inch Kinder Morgan gas and Shell oil lines each require 2-feet of clearance to the top of casing. With the relatively flat sewer in this area and grade already set within the WPCP, these lines will need to be potholed in advance to ensure adequate pipe slope into the WPCP.

For the second UPRR parcel, the new sewer will run parallel to the railroad tracks and approximately parallel to the existing trunk sewer. This alignment is set by the Pinole Creek crossing as discussed below. It has been assumed that UPRR will permit a longitudinal

encroachment agreement for the new trunk sewer alignment within this parcel since the City has an existing agreement with the railroad.

10.3 Historic Homes Alternative Alignments

Once survey of the existing manhole rims and inverts was complete, an evaluation of alternative horizontal alignments through the Historic Homes development was made to reduce the amount of pipeline located out of the street in easements in order to improve maintenance access and still meet capacity requirements. While initially diverting sewage away from the unnamed path at MH 15 to Promenade Avenue by building a new trunk sewer along Promenade Avenue and down Railroad Avenue to meet the existing alignment at the intersection of Santa Fe Avenue and Railroad Avenue seemed feasible. It was quickly eliminated when the depth of sewer was determined to be 35 feet deep through the residential street. Two more feasible alternatives were investigated in greater depth and are shown in Figure 12:

1. Divert sewage away from the backyard easements between Railroad Avenue and the top of Camden Lane by going down Camden Lane and along Santa Fe Avenue to meet the existing alignment at the intersection of Santa Fe Avenue and Railroad Avenue.
2. Divert sewage away from the backyard easements between Railroad Avenue and the top of Camden Lane by going down and along Santa Fe Avenue to meet the existing alignment at the intersection of Santa Fe Avenue and Railroad Avenue.



Figure 12 Alternative Alignments through Historic Homes

10.3.1 Camden Lane

The Camden Lane option would divert sewage away from the backyard easements between Railroad Avenue and the top of Camden Lane by going down Camden Lane and along Santa Fe Avenue to meet the existing alignment at the intersection of Santa Fe Avenue and Railroad Avenue. Both Camden Lane and Santa Fe Avenue are private streets, and permanent easement will be required from the home owner's association (HOA). Due to existing topography and

required sewer slope, this alignment would require that the downstream sewer be deepened slightly to eliminate shallow pipe with less than 3 feet of cover at the intersection of Camden Lane and Santa Fe Avenue. Camden Lane is narrow and there is limited space in the street for a large pipe. There is only 5'-6" of space available between the face of curb and centerline of the existing 8" ACP sewer. Replacement of sidewalk and curb and gutter will be required. There would be two feet of clearance from an existing 8-inch sewer main that currently serves the residences along Camden Lane. The 8-inch sewer main laterals may need to be relocated to avoid conflicts. While bypass piping is not required for the trunk sewer, it may be required for the sewer main. There is also an existing sewer main connection to the trunk sewer at the top of Pinole Street that would need to be reconnected to the new trunk sewer. A new 20-foot length of sewer can be installed to make the connection to the existing sewer main in Pinole Street by replacing an existing rodding inlet with a sewer manhole.

10.3.2 Pinole Street

The Pinole Street option would route flow west approximately 280 feet from the top of Camden Lane to an alley that connects to Pinole Street. The pipe would be installed in the existing City easement between Camden Lane and Pinole Street, and would require additional permanent easement along Pinole Street and Santa Fe Avenue. This alignment would require relocation of an existing 6-inch water main that serves residences along Pinole Street. Project planning discussions with the East Bay Municipal Utility District (EBMUD), who own the 6-inch water main, indicate that their design and permitting for relocation could take up to 18 months. Additionally, this option would likely require significant tree limb and root trimming of large overhanging trees, and may require the complete removal of several large trees. Sewer bypass piping for this segment is not anticipated to be required as construction of new facilities can take place while the existing line remains in service.

While both the Pinole Street and Camden Lane alternatives are feasible, the Camden Lane alternative is recommended since there will only be required with the HOA and there will not an 18-month time requirement for water main replacement.

10.4 MH 17 to MH 15 Deep Sewer Alternatives

Roughly half a mile of the trunk sewer to be rehabilitated / replaced is located along the unnamed path that runs adjacent Promenade St., Apollo and Duck Pond Park. The majority of this path is approximately 10 feet wide with retaining walls, wetlands, curved pipe, a parallel force main and mature eucalyptus trees with expansive root systems providing access issues. Furthermore, the existing trunk sewer in this area is located up to 30 feet below the ground surface from MH 17 to MH 15. Alternatives proposed for rehabilitation / replacement considered all these factors. Three alternatives were investigated: pipe replacement using tunneling; CIPP of the existing pipe with a parallel relief sewer; and open cut pipe replacement.

10.4.1 Tunneling

The first sewer replacement option investigated was to construct a single tunnel that eliminated the curved pipe; deep open cut trenches; and avoided the eucalyptus grove (Figure 13) and provided the shortest alignment. However, this option was quickly eliminated because the alignment would pass beneath existing housing developments; the City did not own easement along the route; and maintenance access would be more limited. Similarly, the two shorter tunnels shown in Figure 13 from MH 15 to MH 16 and from MH 16 to MH 17 were looked at but

again maintenance access would be more restricted than the existing alignment, and tunneling was eliminated from further consideration.



Figure 13 MH 17 to MH 15 Alternative Alignments

10.4.2 CIPP

The second option for this segment of pipe is to line the existing 24-inch asbestos cement pipe (ACP) pipe with cured-in-place pipe (CIPP). CIPP lining is a system that involves the placement of a soft felt material, impregnated with thermosetting resin, inside the existing sewer line to provide a fully structural rehabilitated pipeline. With the following assumptions:

- full structural strength liner;
- 20 feet of groundwater head;
- 25 feet of cover;
- 5 percent existing pipe ovality;
- and H-20 loading

The CIPP liner would be relatively thin with a wall thickness of approximately 1/2 inch.

Significant cleaning of the host pipe must take place prior to installation to remove build-up and debris and to ensure adequate mechanical joining of the two pipes. Jetting of the line with water is typically used to accomplish this. Bypass pumping is necessary and installation requires access shafts at a maximum distance of 800-feet. The longest distance between existing manholes in this area is 516 feet, and manholes will be replaced as part of the project so this requirement will

be met. Truck access is required to the site and is available from Apollo Street for MH 15, and from the trail for MHs 16 and 17. Tree trimming of overhead branches is likely to be required. Once the installation process is started, work cannot be interrupted and working hours often include nights and weekends. The impregnated liner is then filled with hot water or steam and held at a temperature above 180° F until the felt and resin chemically react, curing to form a new pipe inside the old pipe.

This construction method would be much less costly than tunneling or open cut replacement. Consequently, the hydraulic model was run to see if the project design criteria could be met with a smaller pipe in this area. Unfortunately, the d/D criteria was exceeded during wet weather flows and since MH17 is only 4 feet deep, surcharging is not allowed. To meet d/D criteria, we modeled installing a parallel, 12-inch wet weather sewer directly above the trunk sewer, but found that an 8-inch wet weather pipe would be sufficient (Figure 14). Utilizing dual pipelines is an effective way to increase capacity while decreasing cost by using existing facilities. The new 8-inch pipeline would be located immediately above the existing trunk sewer with 1 foot of clearance between pipes. During dry season, the CIPP lined trunk sewer will convey the wastewater. During periods of peak wet weather flow, the sewer manholes will begin to surcharge, and flow will enter the 8-inch diameter wet weather pipe. The 8-inch pipe will be installed using open-cut construction after completion and testing of the CIPP liner. An 8-inch pipe is easier to handle in areas with limited access and a narrower trench is feasible. Since the current condition of the ACP is unknown, there is too much risk associated with excavating before lining the pipe.

Upstream sewer segments from MH 19 to MH17 were also modeled, but it was determined that the higher cost of CIPP lining a pipe plus constructing a parallel pipe was not warranted since sufficient construction access existed, the pipe was shallower, and it was better for long term maintenance access to replace the existing sewer with 30-inch pipe. After adjusting the downstream pipe slope, d/D could be met in these areas. A profile view of the modeled profile is shown in **Error! Reference source not found.**4.

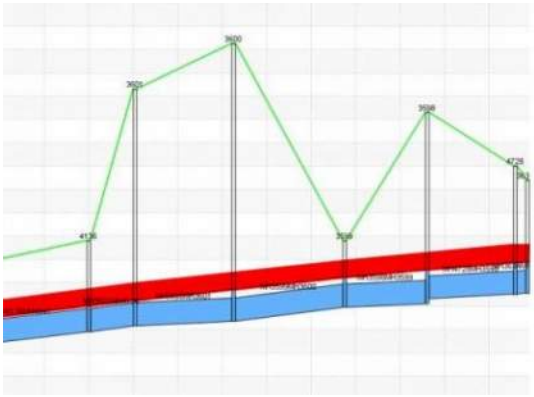


Figure 14 Profile of CIPP Lined Trunk Sewer and Wet Weather Overflow from MH 19 to MH14

10.4.3 Open Cut

The final alternative explored was to replace the existing 24-inch trunk sewer pipe with 30-inch pipe in place using open-cut construction. In order to maintain the necessary slope, this pipe would be need to be located just as deep as the existing trunk sewer.

Numerous constructability issues are anticipated in this area. Due to the deep pipe and limited horizontal work space, trench boxes are the only practical shoring system. In addition, there is concern regarding worker safety and difficulty of construction with deep excavations adjacent to large trees with significant roots. To perform this deep excavation, excavators and other machinery will be needed to remove dirt from up to 30 feet below the ground surface. Unfortunately, in most areas, large machinery typically used for excavation of this scale will not be able to be used due to access restrictions – as such, small machinery will be used to move the large amounts of dirt thereby increasing cost and construction time. Because the available work area is so small, bypass piping and pumping will need to be designed to minimize impact to the construction effort. Additional consideration will be needed to ensure bypass piping containment, in order to prevent any leaks or spillage to the surrounding environmentally sensitive area. There was also concern that construction in a quiet residential neighborhood with 24-hour bypass pumping will generate noise complaints from the neighbors.

While each of these concerns apply to all three alternatives looked at for this area, larger pipe will exacerbate each of these issues relative to installation of an 8-inch pipe. For this reason, it is recommended that the City move forward with the CIPP lined trunk sewer with a parallel 8" wet weather overflow pipe.

Section 11

ENVIRONMENTAL CONSIDERATIONS

Preliminary analysis of the proposed alignment shows several areas of environmental concern. Figure 15 shows the delineated wetlands that are known to occur in the project area. This GIS data is taken from the US Fish and Wildlife Service database and does not reflect all wetlands in the area nor is the location shown accurate enough to use as a basis for work restrictions. It can be used to mark areas that should be looked at more closely during the CEQA process for possible endangered species; time of year restrictions for work; and additional erosion control measures may be required to minimize impact to those wetlands. Additionally containment measures will need to be taken along those portion of the alignment, including prevention of run-off, dust control and double containment piping for the bypass pipe.

Pinole Creek and the area immediately north of the berm the trunk sewer (shown in red) runs along is considered an estuarine and marine wetland. To the south of the berm there is potential for riverine wetlands. In addition, there is a planned project to develop the Chelsea wetlands in this location. At the top of Camden Lane, to the east of the unnamed path, is a freshwater emergent wetland. The pond located below the sewer alignment in Duck Pond Park is considered both a freshwater emergent wetland and freshwater pond. As part of the CEQA documentation, our environmental consultant will delineate the wetlands along the project alignment for use in the permitting process and for developing the mitigation and monitoring plan that will provide contractor work restrictions. Once the proposed alignment and construction methods have been approved by the City, that effort can begin.

In addition to wetlands, another area of environmental consideration is the number of mature trees along the alignment. A large number of trees along the unnamed path, particularly the large eucalyptus trees in Duck Pond Park, will require either removal or branch and root trimming. As a rule of thumb, construction work within the root zone may require consultation with an arborist prior to removal of any vegetation or trees.

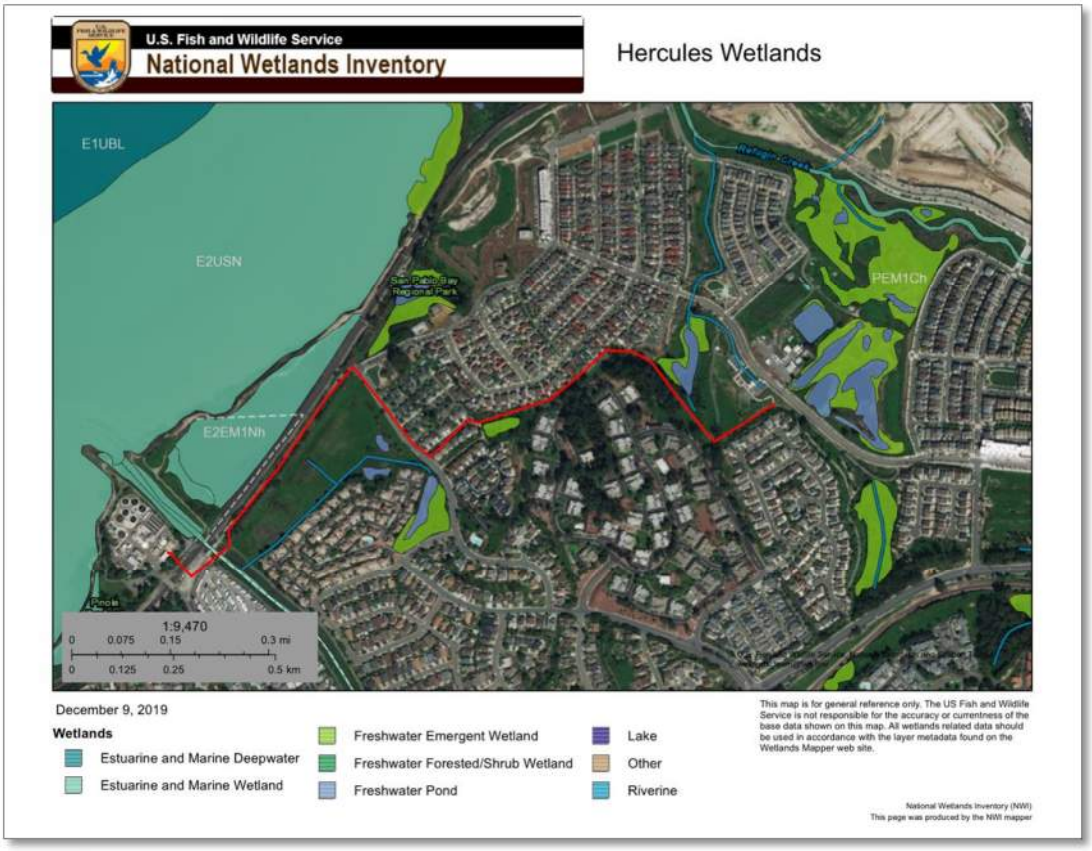


Figure 15 Delineated Wetlands Overview

Section 12

PROPERTY OWNERSHIP AND EASEMENTS

Based on the accessor parcel maps and surveyor research, the existing trunk sewer passes through land owned by the City of Pinole, Contra Costa County, UPRR, the City, and easements through private land. See Figure 16.

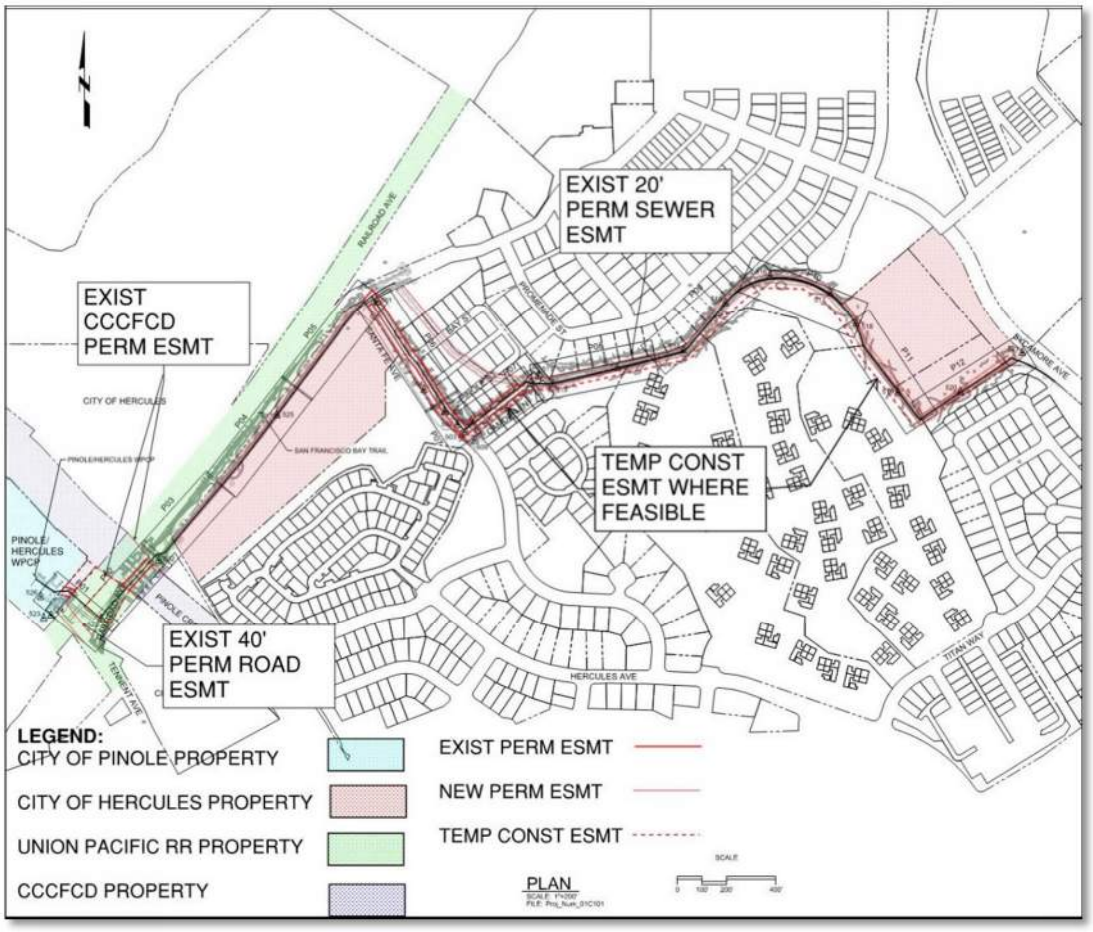


Figure 16 Property Ownership Overview

From the Pinole/Hercules WPCP, the existing trunk sewer enters the plant running through a 55 foot wide CCCFCD parcel, after passing through two 100 foot wide UPRR parcels. Permanent easement will be required to cross the CCCFCD parcel, and temporary easement could be requested to provide the contractor with a laydown area between the WPCP and the railroad. The City has an encroachment agreement for the existing trunk sewer alignment from UPRR that runs from the City limit to the CCCFCD parcel. It is assumed that an encroachment agreement will be used again rather than permanent easement for all work within the railroad's parcels for both pipe crossing the railroad and for pipe running from the creek to the crossing.

Landownership and utility easements are not completely clear around Pinole Creek and Railroad Avenue. In 2007, Contra Costa County performed title report research and wrote a memo titled "Summary of Title Issues and Utility Information at Railroad Ave in Pinole" that summarizes the known easements, existing utilities and the title discrepancies. This report has been included in Appendix D for reference.

In a discussion with Contra Costa County, the County determined that the City of Pinole owns the Railroad Avenue Bridge. Railroad Avenue to the southwest of Pinole Creek lies within land owned by UPRR. During the recent WPCP upgrades, the City of Pinole purchased a permanent easement for land between the creek and the railroad for use as construction parking. A copy of the easement documents has been requested from the City of Pinole, and it may be feasible to use their easement for temporary construction use.

Contra Costa County owns part of the property that Pinole Creek lies in and owns a permanent easement from UPRR for the remainder. A new approximately 55 foot wide permanent easement will be required to cross Pinole Creek through CCCFCD land south of the Railroad Ave bridge.

From the Pinole/Hercules city limits near Pinole Creek north to Santa Fe Avenue, the City owns the land with the San Francisco Bay Trail passing through their property. EBRPD does not have an easement for the trail, but owns concessions with the Cities of Hercules and Pinole that allows the trail to pass through their property. We have requested a copy of the concession agreement from EBRPD, but have not received it to date.

There does not appear to be permanent easements for sewer facilities in Railroad Avenue, so we assumed the road is publically owned north of Santa Fe Avenue. Farther northeast, the existing trunk sewer lies within a 20 foot existing easement through the Historic Homes, Promenade, and Olympian Hill #2 developments until it reaches the City Duck Pond Park property near Sycamore Avenue.

Preliminary estimates of permanent and temporary easements that will be required for the proposed project are shown in Table 4. Temporary easements will not be feasible along the entire path length due to constraints of existing wetlands and retaining walls so the width and length shown are the maximum temporary construction easement that would be provided.

Table 4 Sycamore Trunk Sewer Replacement Permit Requirements

Location	Permanent Easement Size	Temporary Easement Size	Owner
Adjacent to WPCP	40 ft x 55 ft	100 ft x 55 ft	CCCFCD
Railroad Avenue	N/A	155 ft x 120 ft	UPRR
Pinole Creek Crossing	40 ft x 55 ft	N/A	CCCFCD
Santa Fe Avenue and Camden Lane	20 ft x 1000 ft	Up to 20 ft x 1000 ft	Historic Homes HOA
Unnamed Path from the reserve to Duck Pond Park	N/A	Up to 20 ft x 1880 ft	Promenade or Olympian Hills #2 HOA

Section 13

PERMIT REQUIREMENTS

Based on the recommended project alignment and construction methods, permit requirements are shown in Table 5 below. During the investigation into property ownership, it was discovered that Union Pacific owns the land the Railroad Bridge is owned by the City of Pinole.

Table 5 Sycamore Trunk Sewer Replacement Permit Requirements

Agency	Permit	Location	Permit Time Required
City of Pinole	Encroachment Permit	Pinole Creek Bridge; WPCP; Easement in Railroad Ave?; Truck traffic along Pinole Valley Road	6 weeks
UPRR	Encroachment Agreement	Railroad crossing and work along Railroad Avenue; Construction parking	3 to 6 months
Contra Costa County	Encroachment Permit	Construction parking in Railroad Avenue?	6 weeks
CCCFCD	Encroachment Permit	Pinole Creek crossing and Railroad Avenue against WWTP	8 weeks + time for USACE review
EBRPD	Encroachment Permit? (City owns land, EBRPD has concession agreement)	Work impacting San Francisco Bay Trail	8 weeks
USACE	Section 404 Permit; NWP-12 Preconstruction Notification	Pinole Creek crossing; Wetlands	45 days for acceptance of Pre Construction Notification under NWP
California Fish and Wildlife Service	Streambed Alteration Agreement	Pinole Creek Crossing	30 days for determination of regular permit; 60 days for permit; 30 days to sign agreement

Agency	Permit	Location	Permit Time Required
State Water Resources Control Board	401 Water Quality Certification	Wetlands impacted by construction	
SF BCDC	Region Wide Permit #2 (preauthorized permit for replacing an existing pipeline)	Pinole Creek crossing; pipe removal from bridge;	30 days for determination of completeness; 14 day review (after Section 404 permit and CF&WS approval)
CalOSHA Mining & Tunneling Unit	Tunnel Classification	Pilot Tube Auger Bore Crossing of Railroad and Microtunnel Crossing of Pinole Creek	5 work days

Section 14

COST

14.1 Basis for Estimate

The project is currently in the preliminary design phase and the design has been developed in some detail. The construction cost estimates are consistent with an AACE International Class 3 budget estimate with an accuracy range of +30 percent to -15 percent of the actual project cost.

14.1.1 ENR Benchmark

Providing a cost benchmark for construction estimates is useful in documenting the time of estimate preparation and in allowing for projections and escalations to later dates using the equivalent index value.

The preliminary design cost estimate is benchmarked to the Construction Cost Indices (CCI) published by the Engineering News Record (ENR) for November 2019, which is the most current ENR. The ENR San Francisco CCI for the Bay Area region was 12723 for November 2019.

14.1.2 Unit Costs

Unit costs have been researched and used for the major pipeline and structure components of the Project. These major components include sewer pipe, trenchless pipe installations, access structures, and appurtenances. Unit costs have also been developed using preliminary quotations received from equipment and material manufacturers supplemented with installation costs based on past experience with similar projects, available recent bid data, or cost estimating guidelines derived from estimating guides such as the 2019 RS Means Heavy Construction Data publication, the most current publication to date.

14.1.3 Contingencies

Contingencies are typically applied to a construction estimate at the design development phase to account for construction items not yet identified, and construction design unknowns. As the design is refined and finalized, the contingency, typically expressed as a percent of the raw construction cost, will be reduced. At the completion of the design, the contingency should represent only a reasonable construction change order allowance. Agencies typically retain contingency within their project budgets, even when construction contract award values are known, to cover the cost or deal with unforeseen conditions.

A 20 percent contingency, calculated based on the direct construction cost, has been included in the cost estimate. This is in alignment with the recommendations for a project at an AACE Class 3 level of development.

14.2 Cost Estimate

The total estimated construction cost is estimated at $12.6M for the Project for the City of Hercules. This cost estimate includes a +30 / -15 percent accuracy and the cost ranges from $10.7 M to $16.4M. Cost for major work elements are shown in Table 6. Appendix C provides a summary of the construction cost estimate.

Table 6 Estimated Construction Cost

Work Element	Direct Cost	Total Estimated Construction Cost[1]
Mobilization/Demobilization	$0.32 M	$0.53 M
Open Cut Pipelines	$2.10 M	$3.51 M
Railroad Auger Bore Crossing	$0.55 M	$0.92 M
Creek Microtunnel Crossing	$2.31 M	$3.86 M
24" CIPP Lining and Wet Weather Overflow Pipe	$1.05 M	$1.75 M
8" Sliplining	$0.02 M	$0.03 M
Manholes	$0.38 M	$0.63 M
Bypass Pumping	$0.83 M	$1.39 M
Total	**$7.55 M**	**$12.61 M**

Notes:
(1) Construction cost is based on direct cost times the following multipliers:
General Conditions 12%
Estimating Contingency 20%
General Contractor Overhead, Profit, & Risk 15%
Escalation to Mid-Point of Construction (Oct 2020) 3.5%
Sales Tax (based on 50% of Total Direct Cost) 8.75%

14.3 Assumptions

1. No dewatering required for pipe with bottom of trench above sea level.
2. Remove and replace existing pipe from manhole to manhole with bypass pumping.
3. Removed and replace existing trunk sewer manholes.
4. Remove existing sewer and supports on bridge.
5. Cap and fill with CLSM all pipe to be abandoned in place including pipe under railroad.
6. Replace existing EBRPD park trail with new 10 foot wide trail with 2" AC over 8" AB.
7. Manholes for existing 8" connection on Railroad Avenue are in good condition and will not require replacement.
8. Trunk sewer can be sliplined with an 8" PVC sewer main on Railroad Avenue.

Section 15

RECOMMENDED PROJECT

An overview of the construction method, pipe size(s), pipe material, and location for the recommended project are provided in Table 7.

Table 7 Sycamore Trunk Sewer Replacement Permit Requirements

Location	Pipe Size	Pipe Material	Construction Method
WPCP (Segment 1)	30" pipe	HDPE or FPVC in 42" Steel Casing within UPRR ROW	Open Cut in WPCP and parallel to UPRR; Guided Auger Bore under UPRR tracks
Pinole Creek Crossing (Segment 2)	10"dry weather pipe; 24" wet weather pipe; 4" air jumper at siphon	HDPE or FPVC in 60" Steel Casing with 4" air jumper	Microtunnel under creek and Open Cut outside of riparian zone
Chelsea Wetlands (Segment 3)	30" pipe	HDPE or FPVC	Open Cut
Historic Homes (Segment 4)	30" pipe	HDPE or FPVC	Open Cut
Unnamed Path (Segment 5)	30" pipe	HDPE or FPVC	Open Cut
Unnamed Path (Segment 6)	8" parallel pipe and lined 24" ACP	HDPE or FPVC	Open Cut and CIPP
Unnamed Path (Segment 7)	30" pipe	HDPE or FPVC	Open Cut
Reroute Pinole St Sewer Lateral	8" pipe	PVC or FPVC	Open Cut
Reroute Railroad Avenue Sewer Lateral	8" pipe	HDPE or FPVC	Slipline existing trunk sewer

Section 16

NEXT STEPS

The following items are the recommended next steps for the project:

- Proceed with geotechnical investigation;
- Pothole fuel and fiber optic lines at railroad crossing;
- Utility locate force main to either side of the creek and locate bridge footings.
- Obtain a copy of City of Pinole easement near Railroad Avenue;
- Obtain a copy of EBRPD concession documentation from the City of Hercules or EBRPD;
- Complete the CEQA documentation based on City's input;
- Delineate wetlands along the alignment;
- Schedule constructability walk;
- Invite permitting agencies to an alignment walk.

Appendix A

V&A FLOW MONITORING REPORT

City of Hercules

2019 Sycamore Avenue Trunk Sewer Flow Monitoring and Inflow/Infiltration Study



Prepared for:

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100 West Liberty Street,
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Report Date:

November 2019

Prepared by:

V&A consulting engineers

V&A Project No. 18-0220

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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
PWS	Private Weather Station
Q	Flow Rate
RDI	Rainfall-Dependent Infiltration
RG	Rain Gauge
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)	The 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 the fullness of the pipe used in the capacity analysis.
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 are 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.
Peak Wet Weather Flow	The highest daily flow during and immediately after a significant storm event. Includes sanitary flow, infiltration, and inflow.
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 the 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.

Executive Summary

Scope and Purpose

V&A Consulting Engineers (V&A) was retained by Carollo Engineers (Carollo) to perform sanitary sewer flow monitoring and rainfall monitoring with I/I analysis within the City of Hercules (City) collection system. Flow and rainfall monitoring were performed over a period of over 3 months from January 14, 2019 to April 22, 2019. Open-channel flow monitoring was performed at 11 sites. There were three general purposes of this study.

1. Establish the baseline sanitary sewer flows at the flow monitoring sites
2. Establish the peak flow condition during the rainfall events and estimate available sewer capacity.
3. Quantify inflow/ infiltration (I/I) at the applicable flow monitoring sites.

Monitoring Sites

The flow monitoring site locations and rain gauge locations were selected and approved by Carollo and the City and are listed in Table ES-1 and Table ES-2 and shown in Figure ES-1.

Note: The original Site 6A was removed and relocated within 2 days.

Table ES-1. List of Flow Monitoring Sites

Monitoring Site	Monitored Pipe	Measured Pipe Diameter (in)	Location
Site 1	Southeast Inlet	10	Refugio Valley Road North of Falcon Way
Site 2	Southwest Inlet	8	1307 Forest Run, covered parking area
Site 3	Southeast Inlet	15	Sycamore Avenue north of Creekside Center driveway
Site 4	North Inlet	10	Willow Avenue at freeway entrance
Site 5	East Inlet	15	Willow Avenue at freeway entrance
Site 6	East Inlet	22.5	Railroad Avenue east of Tennent Avenue
Site 6A	Southeast Effluent	8	Promenade Street at Park Street
Site 6B	Northwest Effluent	8	Apollo north of Zephyr
Site 6C	Northeast Inlet	24	Duck Pond Park, 997 Sycamore Ave
Site 6D	Northwest Inlet	14	Open space southeast of Willet Street ant Sanderling Drive
Site 6E	Southeast Inlet	12	Open space southeast of Willet Street ant Sanderling Drive

Table ES-2. List of Rain Gauge Monitoring Sites

Rain Gauge	Name	Latitude	Longitude
RG North	38.029° N	122.276° W	RG North
RG South	38.004° N	122.299° W	RG South
RG East	37.982° N	122.256° W	RG East



Figure ES-1. Map of Flow Monitoring Sites – Overall

Rainfall Monitoring

The cumulative precipitation over the flow monitoring period was 41% higher than the historical average. Five rainfall events were defined as shown in Figure ES-2, noting the following items:

- Event 3 was the highest classified rainfall event during this study, ranging between a 4.5 and 9.5 year, 2-day storm event.

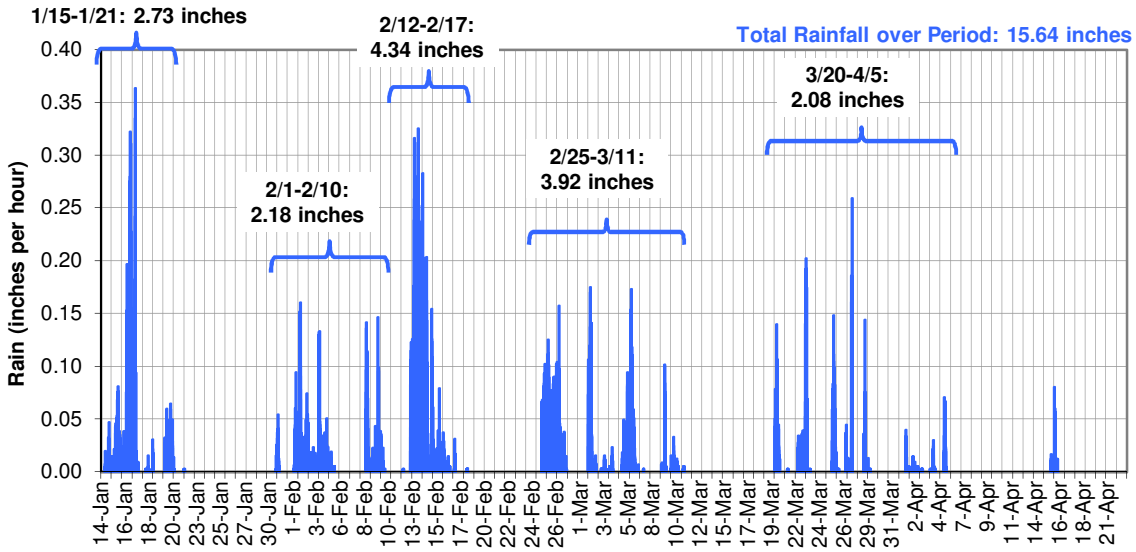


Figure ES-2. Rainfall Monitoring – Triangulated to City Hall

The following items are noted relevant to the storm events used for I/I analyses:

- Events 3 and 4 elicited the strongest I/I responses in this study. Events 1, 2, and 5 were not used for analysis.
- **Inflow**: Event 3 was used to evaluate inflow.
- **RDI and Total I/I**: Events 3 and 4 were used to evaluate RDI and Total I/I.

Site Flow Monitoring and Capacity Results

Peak measured flows and the 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 the tributary area, flow attenuation, flow restrictions, characteristics of I/I entering the collection system, and hydraulic features such as pump stations.
  - For this report, peaking factors are reported and PF > 6 are highlighted in RED[1]; however, the City should refer to City standards when evaluating peaking factors. Site 6D and 6E are in close proximity to, and influenced by, pump stations, which has a direct impact on peaking factors. Peaking factor data should be used at the discretion of the City Engineer
- **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 study. Standards for d/D ratio vary from agency to agency, but typically range between d/D ≤ 0.5 and d/D ≤ 0.75
  - For this report, d/D ratios > 0.75 are highlighted in RED; however, the City should refer to City standards when evaluating d/D ratios, to be used at the discretion of the City Engineer.

Table ES-3 summarizes the peak recorded flows, levels, d/D ratios, and peaking factors per site during the flow monitoring period. 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.

Table ES-3. Capacity Analysis Summary

Monitored Site	ADWF (MGD)	Peak Measured Flow (MGD)	Peaking Factor	Pipe Diameter, *D* (IN)	Max Depth, *d* (IN)	*Max d/D* Ratio	Surcharge above pipe crown (FT)
Site 1	0.083	0.62	7.4	10	3.1	0.31	n/a
Site 2	0.141	0.60	4.2	8	4.0	0.50	n/a
Site 3	0.474	2.54	5.4	15	6.5	0.43	n/a
Site 4	0.106	0.57	5.3	10	7.9	0.79	n/a
Site 5	0.260	1.30	5.0	15	11.7	0.78	n/a
Site 6	1.625	5.75	3.5	22.5	42.3	1.88	1.65
Site 6A	0.030	0.17	5.7	8	2.2	0.27	n/a
Site 6B	0.050	0.34	6.8	8	2.7	0.34	n/a
Site 6C	1.437	4.52	3.1	24	18.8	0.78	n/a
Site 6D	0.137	0.68	5.0	14	18.7	1.34	0.39
Site 6E	0.121	0.45	3.8	12	8.4	0.70	n/a

The following capacity analysis results are noted:

[1] WEF Manual of Practice FD-6 and ASCE Manual No. 62 suggests typical peaking factor ratios range between 3 and 4, with higher values possibly indicative of pronounced I/I flows.

- **Peak flows**: Peak flows and peak levels occurred during Event 3 for most sites, except Sites 6D and 6E which occurred one day after Event 1, possibly due to Industrial Lift Station operations.
- **Peaking Factors**: Sites 1 and 6B had peaking factors greater than 6. Site 1 had the largest peaking factor of all sites at 7.4.
- **d/D Ratio**: Sites 6 and 6D surcharged during the study; flow levels for both sites were less than two feet above the pipe crown when surcharged
  - **Site 6**: High levels even during ADWF conditions were already identified at Site 6. Site 6 is located downstream from a pump station discharge, and immediately upstream from the treatment facility. Flow levels may be influenced by treatment plant operations.
  - **Site 6D**: The Site 6D surcharge was likely due to pump station operations.

Figure ES-3 shows a schematic diagram of the peak measured flows with peak flow levels.

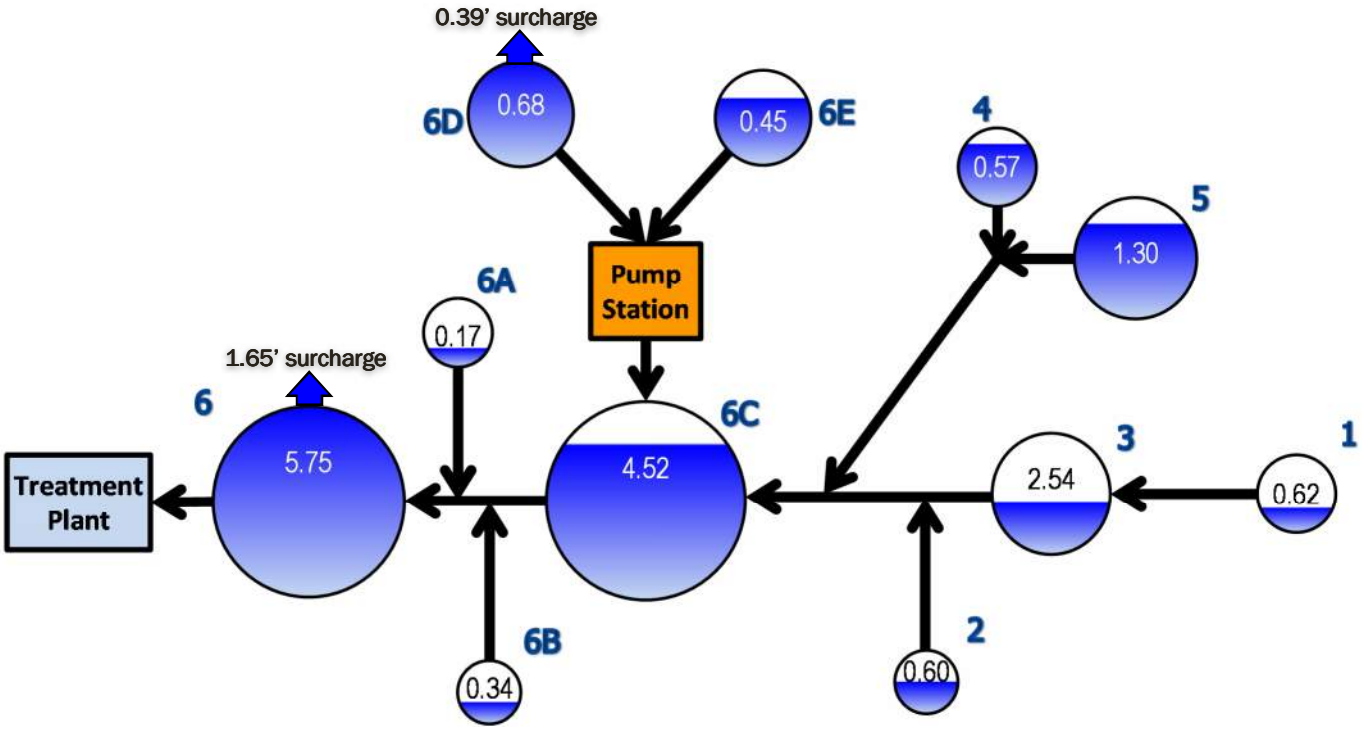


Figure ES-3. Peak Measured Flow (Flow Schematic)

Infiltration and Inflow Analysis

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 basins. The flow monitoring basins and basin isolation equations used to define the limits of the basin boundaries can be referenced in Table 1-3.

Note: Basins 6 and 6C could not be used for I/I analysis due to the phenomena of inflating uncertainties. Please reference Section 1.2 and Section 2.4 for information on this subject. Table ES-4. summarizes the I/I results for this study. The "Top 3" basins for each category have been shaded in RED. Please refer to the I/I Methods section for more information on inflow and infiltration analysis methods and ranking methods. Figure ES-4, Figure ES-5, Figure ES-6, and Figure ES-7 illustrate temperature map summaries of the I/I results. The following inflow/infiltration analysis results are noted:

- Per-Acre rankings should be reviewed with caution given disproportional densities basin-to-basin; normalized rankings should be used at the discretion of the City Engineer.
- **Inflow**: Basins 1, 6A, and 6B ranked highest for nrmalized inflow contribution.
- **Rainfall-Dependent Infiltration**: Basins 1, 5, and 6E ranked highest for normalized RDI.
- **Combined I/I**: Basins 1, 5, and 6B ranked highest for normalized total I/I contribution.
- **Groundwater Infiltration**: Basins 6A and 6E showed evidence of GWI rates that were above the WEF typical low-to-average ratio.

Table ES-4. I/I Analysis Summary

Monitoring Basin	Inflow Rate (mgd)	RDI Rate (mgd)	Combined I/I (MG)	Overall Inflow Rank	Overall RDI Rank	Combined I/I Rank	Evidence of high GWI?
Basin 1	0.541	0.098	1.227	3	1	2	No
Basin 2	0.477	0.041	0.606	4	4	5	No
Basin 3	1.445	0.187	2.713	8	6	8	No
Basin 4	0.392	0.041	0.521	6	7	4	No
Basin 5	1.095	0.179	2.852	5	2	1	No
Basin 6	ND	ND	ND	ND	ND	ND	ND
Basin 6A	0.149	0.004	0.164	2	9	9	Yes
Basin 6B	0.298	0.026	0.283	1	8	3	No
Basin 6C	ND	ND	ND	ND	ND	ND	ND
Basin 6D	0.429	0.063	0.888	9	5	7	No
Basin 6E	0.106	0.018	0.273	7	3	6	Yes

ND = not determined, RDI = average of Event 3 and 4. Combined I/I = Total of Event 3 and 4.

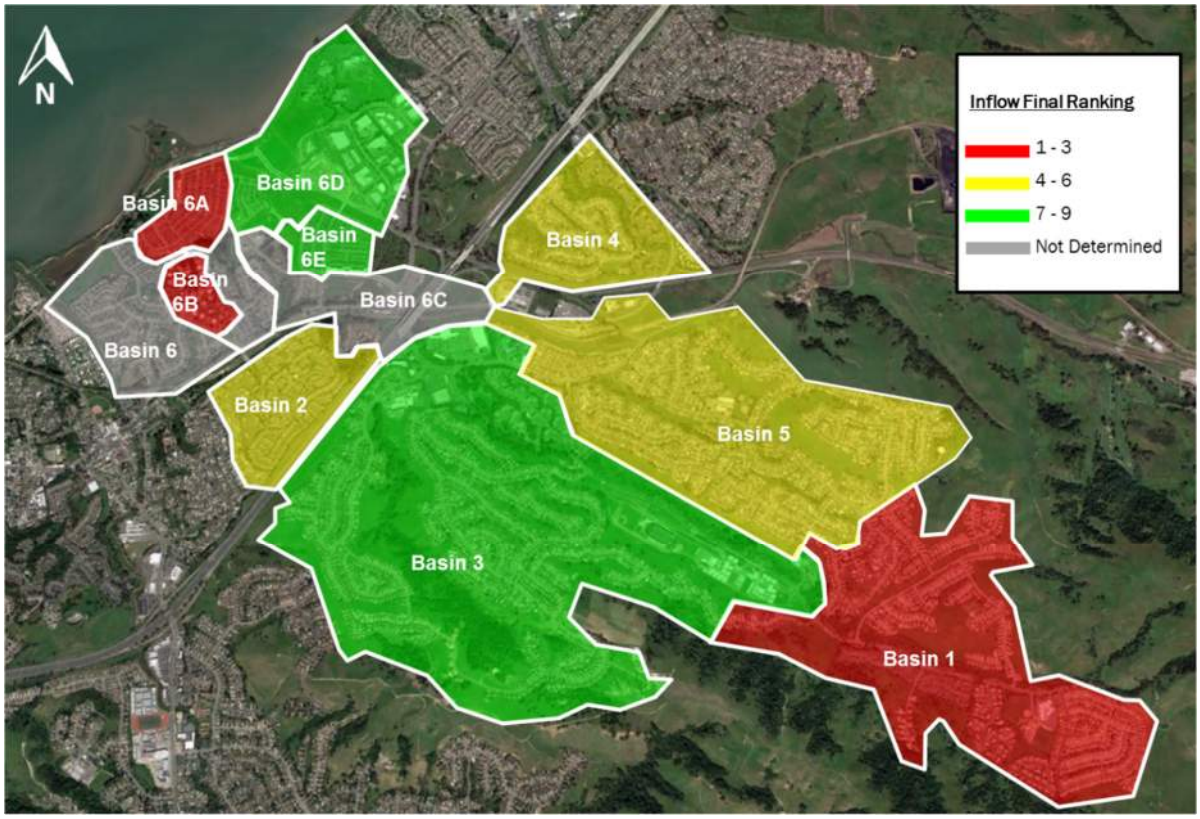


Figure ES-4. Temperature Map: Inflow Rankings

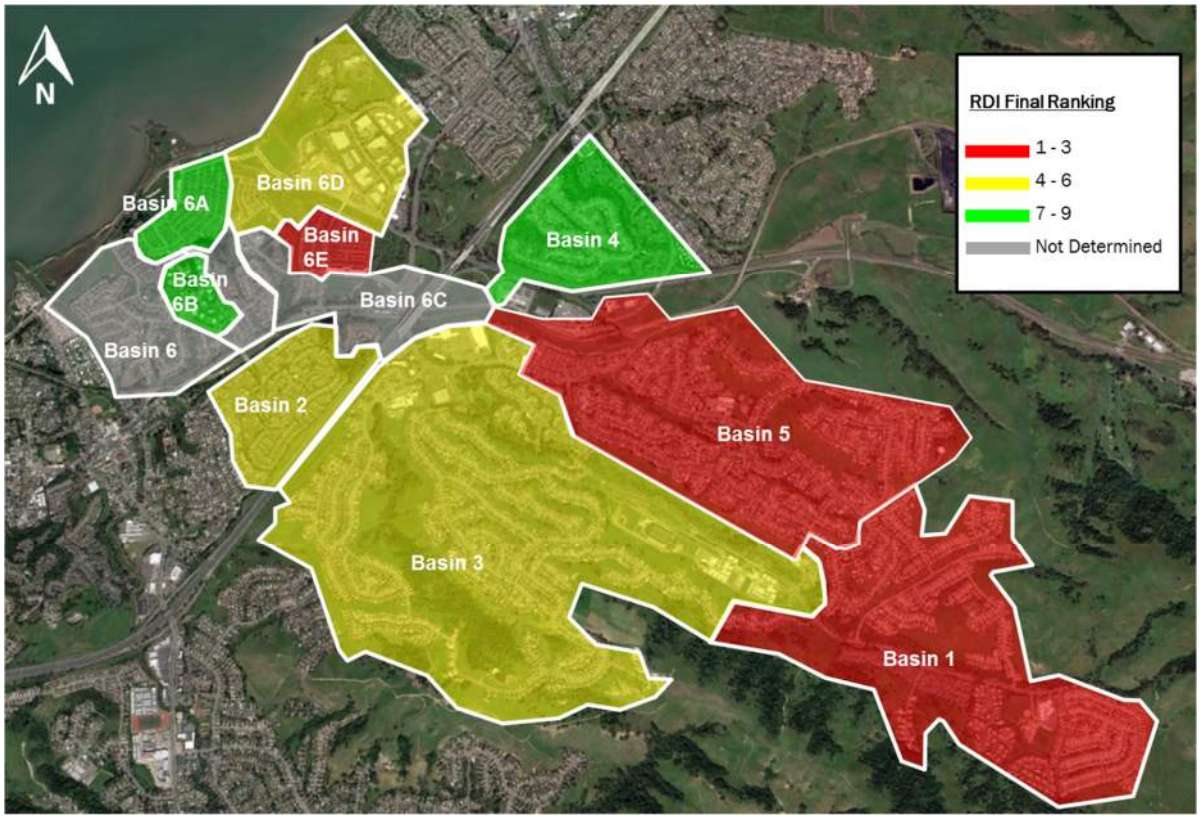


Figure ES-5. Temperature Map: RDI Rankings

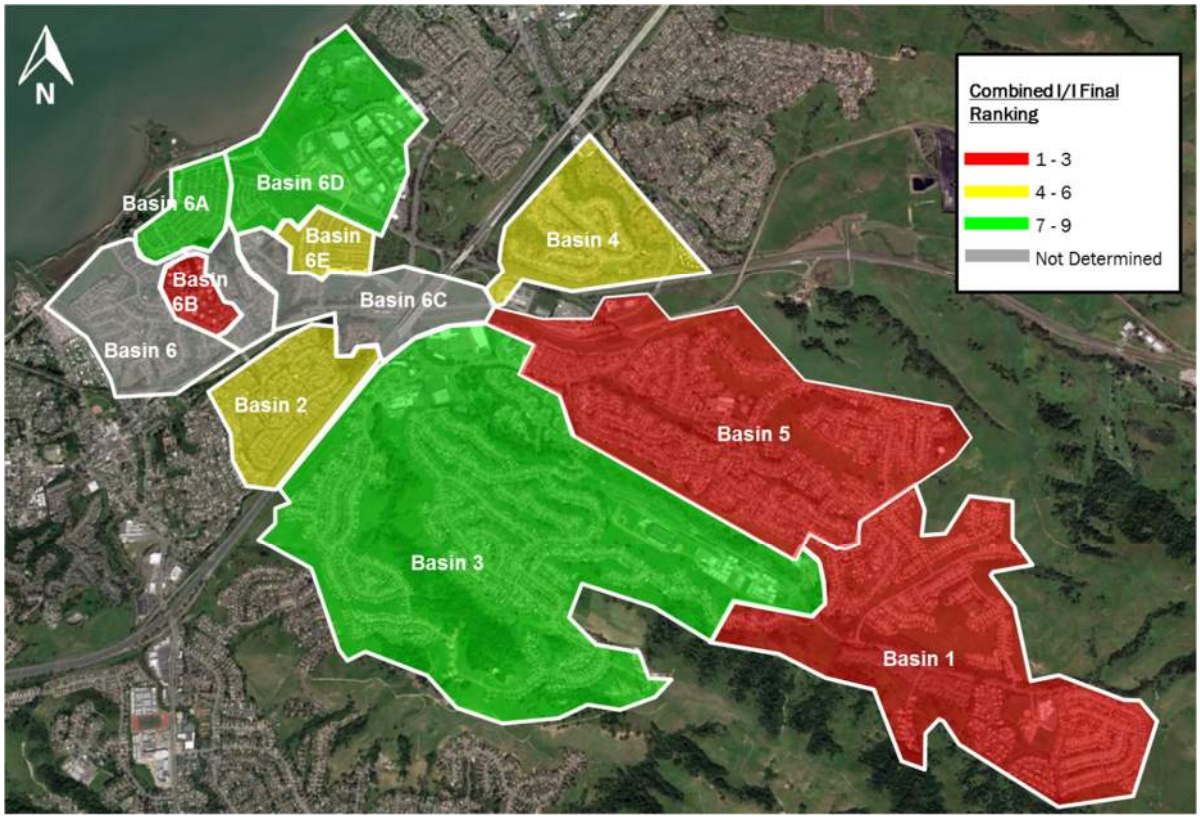


Figure ES-6. Temperature Map: Total I/I Rankings



Figure ES-7. Temperature Map: GWI Rankings

Recommendations

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

1. **Master Plan and Model Implementation**: It is our understanding that this study is to be used for calibrating the hydraulic model and a master plan study to determine the overall needs of the City relative to I/I.
2. **Capacity Analysis:** Site 6 had a high average dry weather level and surcharged during the monitoring period. The City may want to analyze the capacity constraints in the updated master plan for the Sycamore Avenue trunk line.
3. **Determine I/I Reduction Program**: The City should examine its I/I reduction needs to determine their needs and goals for a future I/I reduction program.
    a. **Preface**: Per-Acre rankings should be reviewed with caution given disproportional densities basin-to-basin; normalized rankings should be used at the discretion of the City Engineer.
    b. 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. The highest inflow occurs in Basins 1, 6A, and 6B.
    c. 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. The highest combined I/I and RDI occurs in Basins 1, 5, and 6E, and Basins 6A and 6E show evidence of GWI.
4. **I/I Investigation Methods**: Potential I/I investigation methods include the following:
    a. **Smoke testing:** Basin 6A and 6B are recommended for smoke testing due to the small area but high normalized inflow rates.
    b. **Mini-basin Flow Monitoring:** Basin 1 is recommended for mini basin flow monitoring due to the high normalized inflow and infiltration and pipe arrangement allows for easy isolation of mini-basins.
    c. **Night-time reconnaissance:** Night-time I/I work can be implemented in future high I/I sub-basins to (1) investigate and determine direct point sources of inflow, and (2) determine the areas and/or pipe reaches responsible for high levels of infiltration contribution.
    d. CCTV inspection.
5. **I/I Reduction Cost Effective Analysis**: The City should conduct a study to determine which is more cost-effective: (1) locating the sources of inflow/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 Consulting Engineers (V&A) was retained by Carollo Engineers (Carollo) to perform sanitary sewer flow monitoring and rainfall monitoring with I/I analysis within the City of Hercules (City) collection system. Flow and rainfall monitoring were performed over a period of over 3 months from January 14, 2019 to April 22, 2019. Open-channel flow monitoring was performed at 11 sites. There were three general purposes of this study.

1. Establish the baseline sanitary sewer flows at the flow monitoring sites
2. Establish the peak flow condition during the rainfall events and estimate available sewer capacity.
3. Quantify inflow/ infiltration (I/I) at the applicable flow monitoring sites.

1.2 Flow Monitoring Sites

Flow monitoring sites are identified as the manholes where the flow monitors were secured and the pipelines wherein the flow sensors were placed. Capacity analysis and flow rate information is presented on a site-by-site basis.

The flow monitoring sites were selected and approved by Carollo and the City. Information regarding the flow monitoring locations are listed in Table 1-1, and Table 1-2 is the list of rain gauge monitoring sites. Figure 1-1 and Figure 1-2 illustrates the locations. Detailed descriptions of the individual flow monitoring sites, including photographs, are included in *Appendix A*.

Table 1-1. List of Monitoring Locations

Monitoring Site	Monitored Pipe	Pipe Diameter (in)	Location
Site 1	SE Inlet	10	Refugio Valley Road North of Falcon Way
Site 2	SW Inlet	8	1307 Forest Run, covered parking area
Site 3	SE Inlet	15	Sycamore Avenue north of Creekside Center driveway
Site 4	North Inlet	10	Willow Avenue at freeway entrance
Site 5	East Inlet	15	Willow Avenue at freeway entrance
Site 6	East Inlet	22.5	Railroad Avenue east of Tennent Avenue
Site 6A	SE Effluent	8	Promenade Street at Park Street
Site 6B	NW Effluent	8	Apollo north of Zephyr
Site 6C	NE Inlet	24	Duck Pond Park, 997 Sycamore Ave
Site 6D	NW Inlet	14	Open space southeast of Willet Street ant Sanderling Drive (same manhole as Site 6E)
Site 6E	SE Inlet	12	Open space southeast of Willet Street ant Sanderling Drive (same manhole as Site 6D)

Table 1-2. List of Rain Gauge Monitoring Sites

Rain Gauge	Latitude	Longitude
RG North	38.029° N	122.276° W
RG South	38.004° N	122.299° W
RG East	37.982° N	122.256° W



Figure 1-1. Map of Flow Monitoring Sites – Overall

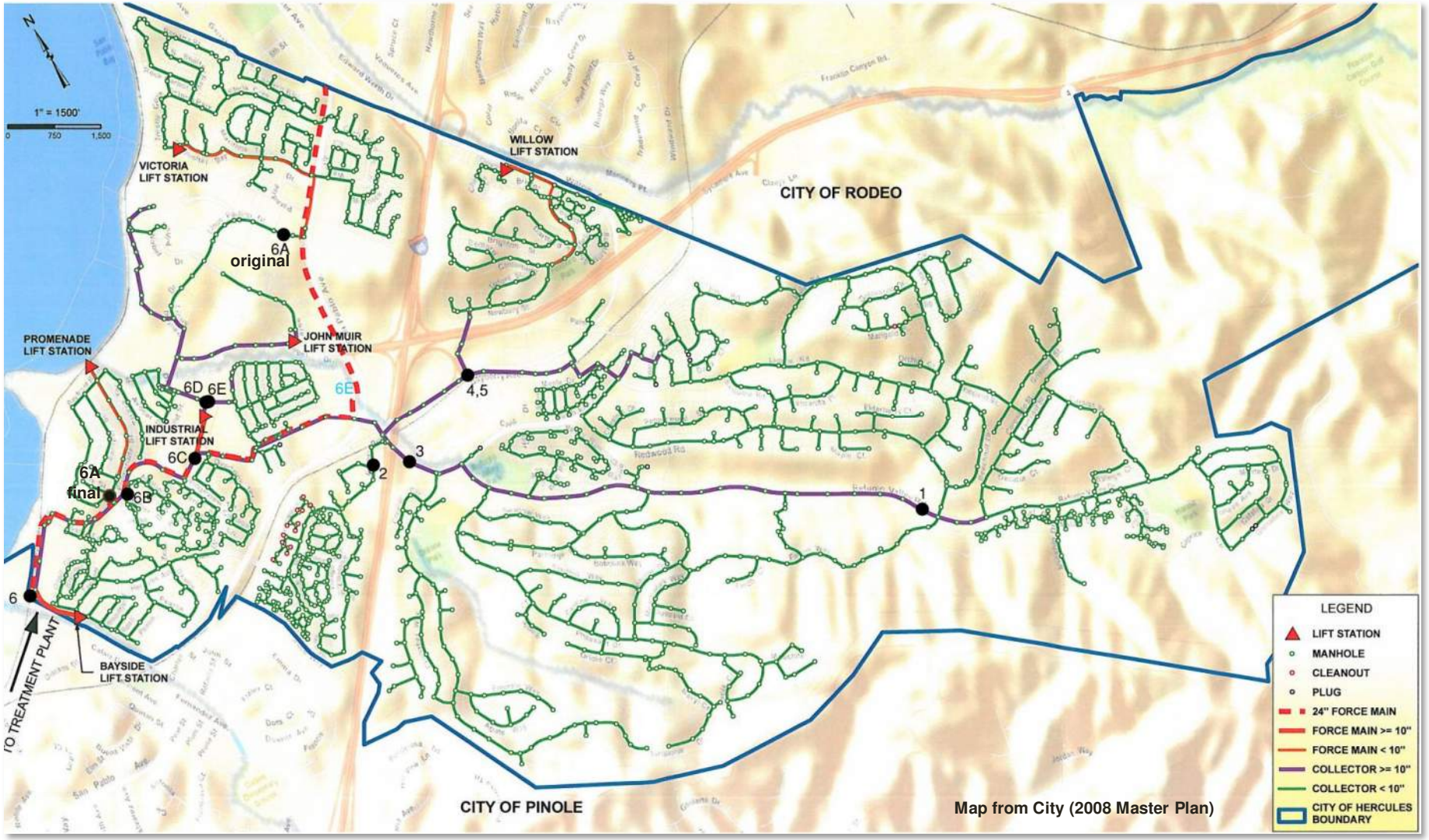


Figure 1-2. Sanitary Map of Flow Monitoring Sites

Note: Site 6A was originally proposed and installed on 1/14/2019 on the southeast inlet of Linus Pauling Drive, approximately 300 feet east of San Pablo Avenue (See Figure 1-3). Site 6A was requested to be relocated to the southeast effluent of promenade street at Park Street. This was performed as soon as possible (1/16/2019, approximately 1:00 pm) so as to capture the occurring rainfall event. The two days of data for the original Site 6A was sent in a separate EXCEL file for use by Carollo.

The remainder of the report will only refer to the "Final" Site 6A.

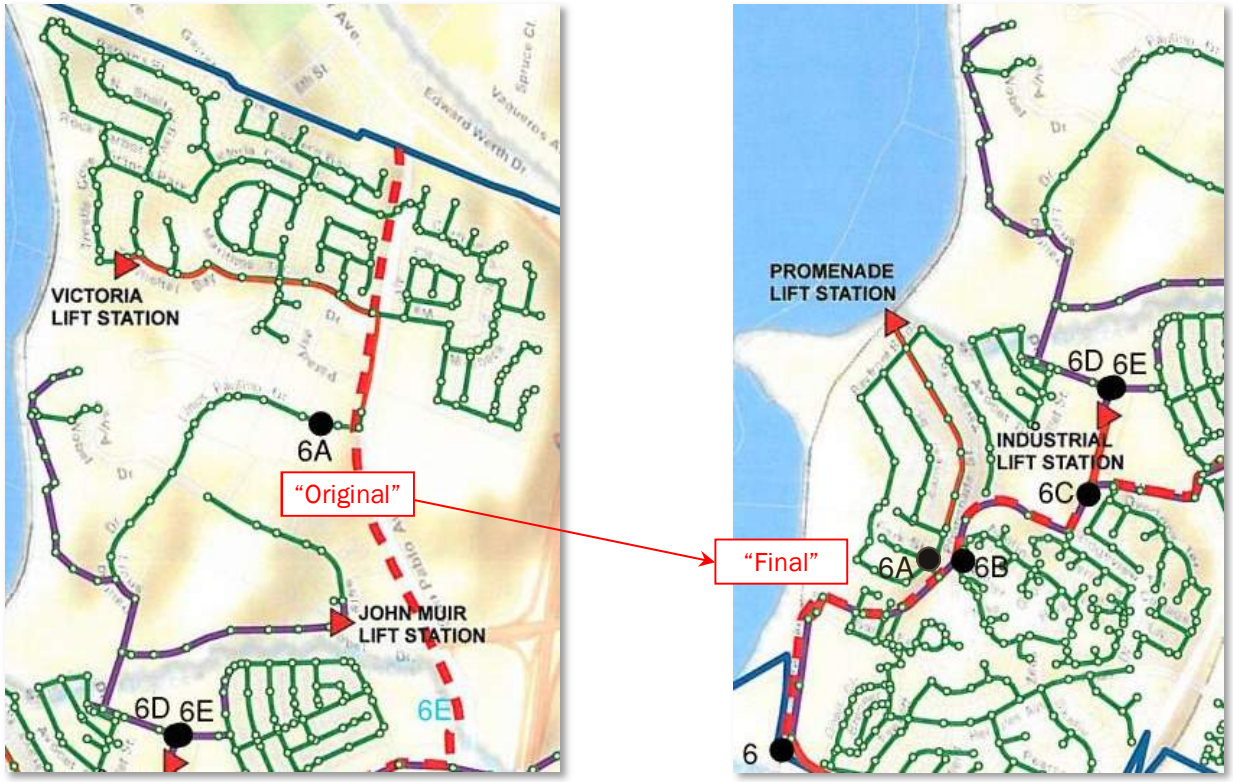


Figure 1-3. Map of Original and Final Site 6A

1.3 Flow Monitoring Basins

Flow monitoring site data may include the flows of one or many drainage basins. 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, requiring basin isolation (subtraction of upstream flows). The I/I analysis results will be presented on an isolated basin basis. The basins, basin attributes, and basin isolation equations are listed in Table 1-3 and shown in Figure 1-4. There were two basins that could not be used for I/I analysis due to the phenomena of inflating uncertainties.

- Basin 6: Site 6 captures nearly all of the City's flows and is useful for totalizing flows. However, the isolated basin size is small relative to the upstream basins and cannot be used for I/I analysis. Site 6 total flows (not isolated flows) can be used to determine overall I/I for the City.
- Basin 6C: This basin would require the subtraction of 6 major contributing pipelines (Site 6D, Site 6E, Site 2, Site 3, Site 4, and Site 5) and is downstream of a pump station. There is too much uncertainty with these flow subtractions and with the pump station; this site is useful for hydraulic analysis of the Sycamore Avenue Trunk Sewer, but will not be used for I/I analysis.

Table 1-3. Isolated Flow Monitoring Basin Characteristics

Isolated Basin	Flow Isolation Calculation	Area (Acres)
Basin 1	= Q_1	400
Basin 2	= Q_2	110
Basin 3	= Q_3- Q_1	825
Basin 4	= Q_4	157
Basin 5	= Q_5	478
Basin 6	= Q_6 - Q_{6A} - Q_{6B} - Q_{6C}	157
Basin 6A	= Q_{6A}	52
Basin 6B	= Q_{6B}	31
Basin 6C	= Q_{6C} - Q_{6D} - Q_{6E} - Q_2 - Q_3 - Q_4 - Q_5	119
Basin 6D	= Q_{6D}	477
Basin 6E	= Q_{6E}	38

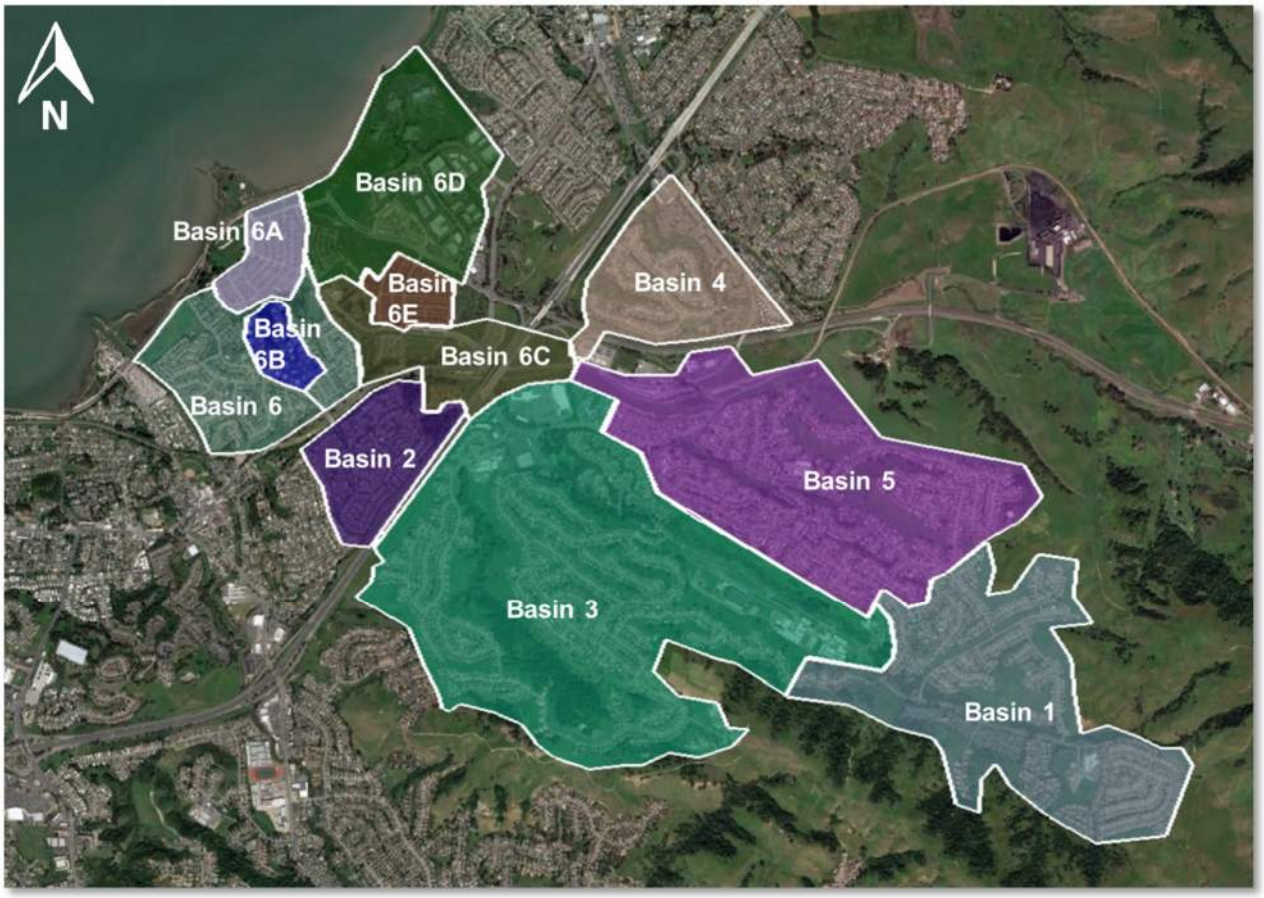


Figure 1-4. Map of Flow Monitoring Basins

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 (H_2S) 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 (10) Teledyne ISCO 2150 and (1) Hach Flo-Dar area-velocity flow meters for temporary monitoring 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 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 the 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.

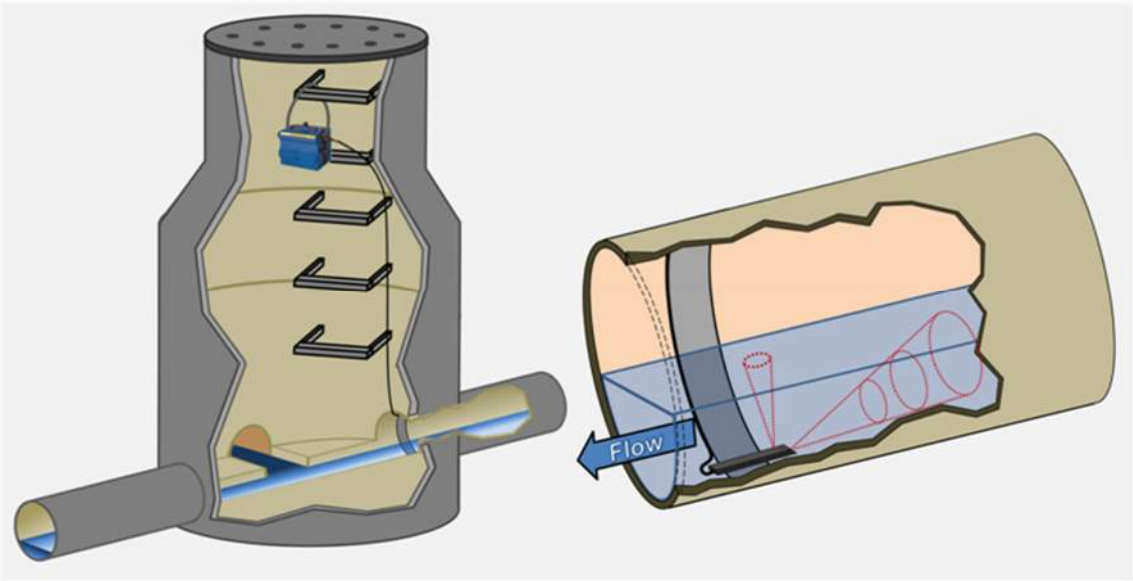


Figure 2-1. Typical Installation for ISCO 2150 Flow Meter with Submerged Sensor

There are cases where a submerged sensor meter is not the most appropriate technology for a given hydraulic scenario. In the low-flow/high-velocity scenario submerged sensor technologies may interfere with and/or alter the flow stream as it passes over the submerged sensor (refer to).

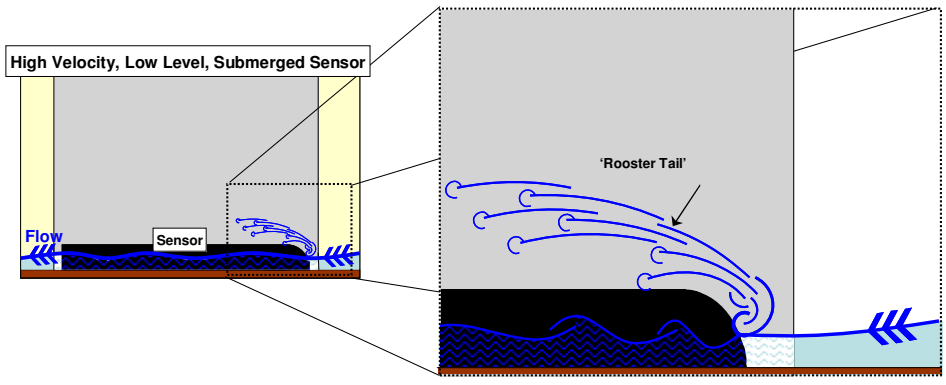


Figure 2-2. Sensor Interference for Low Level/High Velocity Hydraulic Condition

This interference may create a number of unfavorable conditions that decrease the ability of the sensors to record quality data, including, but not limited to air entrainment, air cavitation, hydraulic jump, etc. In this case, V&A opted to utilize radar or laser metering technology (non-contact sensors) for Site 1 as the best available option to capture dependable flow data.

A HACH Flo-Dar flow meter is a non-contact flow meter that uses radar to measure velocity and a down-looking ultrasonic sensor to measure depth. Figure 2-3 illustrates a typical non-contact flow meter installation.



Figure 2-3. Typical Flo-Dar Flow Meter Installation

2.3 Flow Calculation

Data retrieved from the flow meters were 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 the 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 Measurement Error and Uncertainty

For traditional engineering applications, measurement "error" is explained as a difference between a computed, estimated, or measured value and the generally accepted true or theoretically correct value. It can also be thought of as a difference between the desired and the actual performance of equipment. For equipment, error is usually expressed as a percentage relative to accuracy (i.e., "…the velocity sensor has an accuracy of ±2% of the reading…").

However, for this study and flow monitoring applications, the cause of the measurement difference is important, and a distinction will be made between the equipment not performing to industry standards ("error") and expected inaccuracies ("uncertainty") associated with monitoring technology limitations.

Gauging **"error"** occurs when the equipment is not performing to industry standards. This can occur as a result of the following common categories of conditions that can be encountered at a wastewater monitoring site.

- Malfunctioning equipment (i.e. a sensor is damaged, battery life ends, or a desiccant canister becomes saturated)
- Improper equipment choice or maintenance (i.e. the selected gauging equipment technologies are incompatible with hydraulic conditions within the sewer, or excessive gravel deposits are allowed to accumulate around the sensors without being removed)
- Improper equipment calibration (i.e. depth and/or velocity measurements are incorrectly taken within the sewer, or equipment is allowed to drift out of calibration)
- Field conditions within the sewer, (i.e. foaming at the water surface that "blinds" an ultrasonic depth sensor, or toilet paper catching and accumulating on a combination sensor, blinding the acoustic Doppler velocity meter)

For flow monitoring applications, gauging **"uncertainty"** is used to describe and quantify the expected inaccuracies that result from the limitations of the technologies that utilize indirect measurements to quantify wastewater flow.

It is important to try and install flow meters in "ideal" flow conditions. Ideal flow conditions are generally defined by as laminar flow in a straight-through, constant-slope pipeline with no disturbances (elbows, tees, hydraulic shifts, etc.) 10 diameters upstream and 5 diameters downstream from the flow monitoring location. If ideal flow conditions are met, then an expected uncertainty of final flow calculation from an open-channel flow meter may be approximately ±5%. For many situations, ideal flow conditions cannot be met, and uncertainties increase.

2.4.1 Flow Addition versus Flow Subtraction

Due to the uncertainties involved in subtracting flows of similar magnitudes, the addition of flows at multiple monitoring sites is usually preferred over subtraction of flows. Subtraction becomes an issue especially when the flow difference from the subtraction falls within the measurement uncertainty range of the two larger flow data sets (i.e. subtracting a large flow from another large flow to obtain a small difference).

This concept is best demonstrated per the following example:

1. Meter A measures 2.00 MGD of flow and has an expected uncertainty of ±5%, thus the uncertainty range of the flow measurement is ±0.10 MGD.
2. Meter B measures 2.50 MGD of flow and has an expected uncertainty of ±6%, thus the uncertainty range of the flow measurement is ±0.15 MGD.

3. Meter C measures 0.50 MGD of flow and has an expected uncertainty of ±8%, thus the uncertainty range of the flow measurement is ±0.04 MGD.

    - Scenario 1 – Flow Addition
        - Meter A + Meter B = 2.00 MGD (±0.10) + 2.50 MGD (±0.15) = 4.50 MGD (±0.25)
        - Overall uncertainty = ±0.25 / 4.50 = ±5.6%
        - For flow addition, the final uncertainty is essentially a weighted average of the component uncertainties.

    - Scenario 2 – Flow Subtraction, Large Flow less Small Flow
        - Meter B - Meter C = 2.50 MGD (±0.15) - 0.50 MGD (±0.04) = 2.00 MGD (±0.19)
        - Overall uncertainty = ±0.19 / 2.00 = ±9.5%
        - For flow subtraction, the final uncertainty will always be greater than the component uncertainties.
        - When subtracting a small flow from a large flow, the resulting uncertainties can still be manageable.

    - Scenario 3 – Flow Subtraction, Large Flow less a similarly Large Flow
        - Meter B - Meter A = 2.50 MGD (±0.15) – 2.00 MGD (±0.10) = 0.50 MGD (±0.25)
        - Overall uncertainty = ±0.25 / 0.50 = ±50%
        - When subtracting similarly sized flow rates, the resulting uncertainties may not be manageable. In this example, an uncertainty of ±50% may be considered unacceptable for confident analyses.

Scenario 3 is a very "real-world" situation. The uncertainties for Meter A and Meter B are extremely reasonable (indeed, most flow monitoring service providers would be extremely pleased with true meter uncertainties of ±5% to ±6%). However, the reality of the math is clear, and the above example demonstrates the concept of flow subtraction and compounding or inflating uncertainty ranges.

The following points are emphasized in relation to the items of this section:

- For subtraction of flows, the overall uncertainty can be an inflated value that far exceeds the component uncertainties.
- The smaller the resultant flow from the subtraction equation, the larger the percentage uncertainty.
- Whenever possible, basins flows should be directly measured, rather than calculated as a subtraction of two or more flow meters.
- If flow subtraction cannot be avoided, it is better to have the magnitudes of the component flows be as dissimilar as possible.

Basin 6 and Basin 6C could not be analysis for I/I due to the phenomena of inflating uncertainties.

2.5 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 2-4 illustrates a sample of varying flow patterns within a typical week dry week.

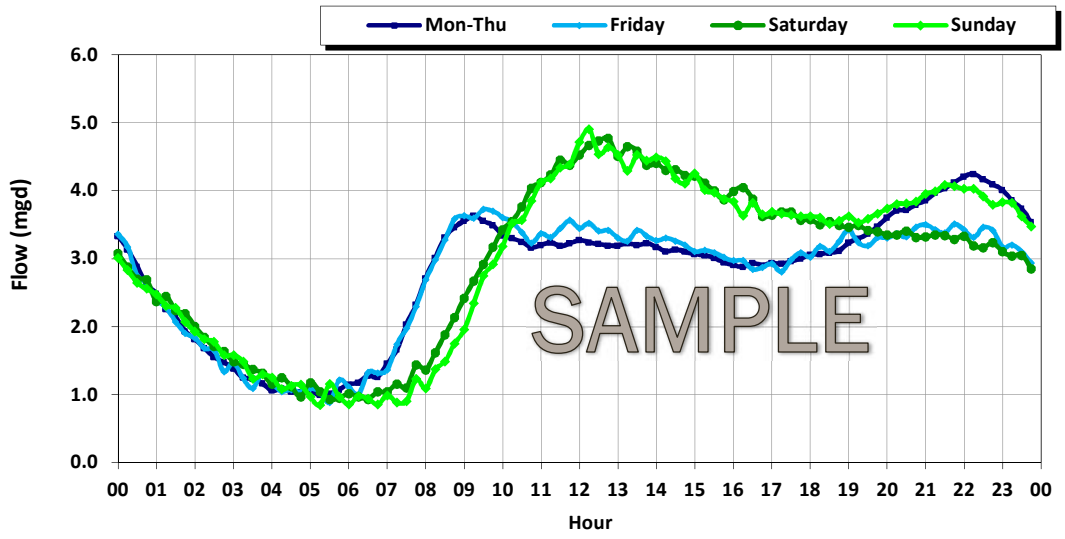


Figure 2-4. Sample ADWF Diurnal Flow Patterns

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:

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

2.6 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 2-5.

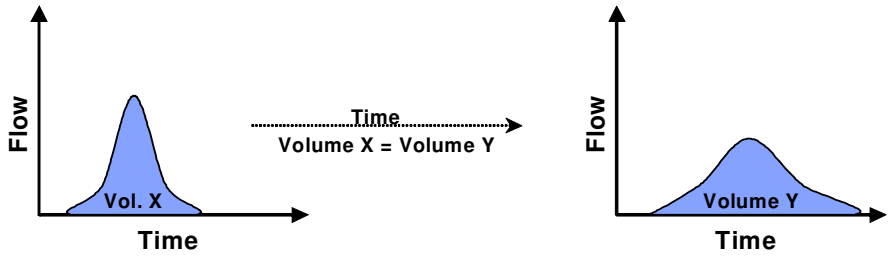


Figure 2-5. Attenuation Illustration

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.

2.7 Inflow / Infiltration Analysis: Definitions and Identification

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

2.7.1 Inflow / Infiltration Analysis: Definitions and Identification

- **Inflow**: Storm water inflow is defined as water discharged into the sewer system, including private sewer laterals, from direct connections such as downspouts, yard, 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 2-6 illustrates the possible sources and components of I/I.

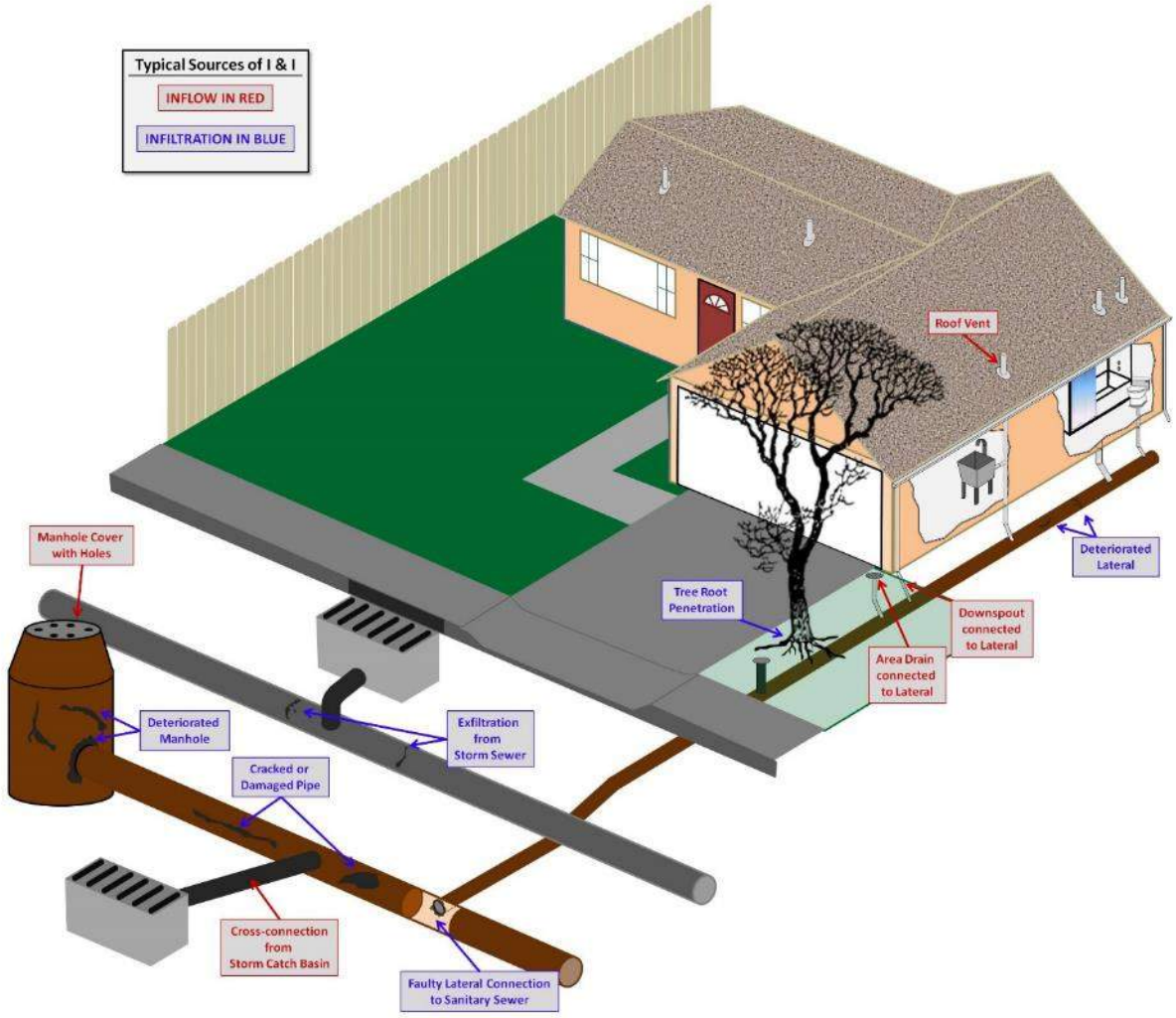


Figure 2-6. Typical Sources of Infiltration and Inflow

2.7.2 Infiltration Components

Infiltration can be further subdivided into components as follows:

- **Groundwater Infiltration**: Groundwater infiltration 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 are seasonal by nature. On a day-to-day basis, groundwater infiltration rates are relatively steady and will not fluctuate greatly.
- **Rainfall-Dependent Infiltration**: This component 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.

2.7.3 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 are 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.

2.7.4 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 2-7 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.

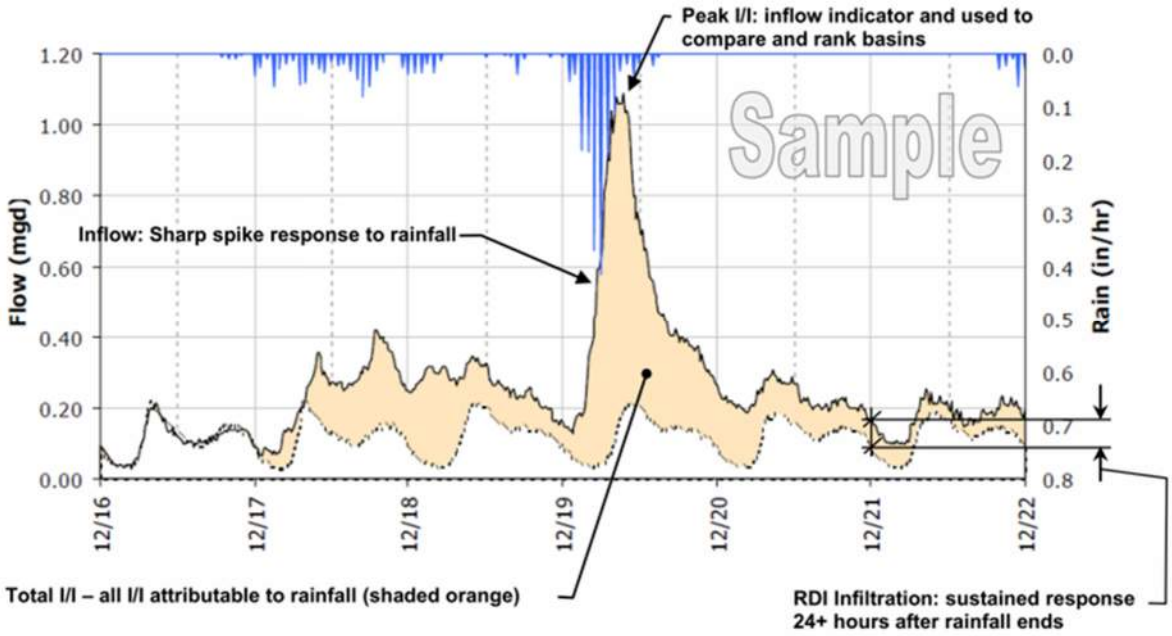


Figure 2-7. Sample Infiltration and Inflow Isolation Graph

2.7.5 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 analysis. 4
- **Groundwater Infiltration (GWI)**: 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 (RDI)**: RDI Analysis is conducted by looking at the infiltration rates at set periods after the conclusion of a storm event. Depending on the particular collection system

[4] 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.

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

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

2.7.6 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 the 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 and these results will be shown in the following I/I analysis results sections. For the purposes of basin rankings, the following weighting decisions are given:

- **per-ADWF:** Most of the basins were primarily residential and had typical ADWF patterns. The ADWF established were valid and based on actual data. Per-ADWF metrics will be assigned 51% weighting towards final rankings.
- **per-IDM:** IDM values were not known at the time of publication of this report; per-IDM analysis was not performed.
- **per-ACRE:** The basin extents were known from the sanitary map given. Some of the basins were in mountainous areas and did not have many sewage pipes that may collect the I/I from the mountains. These basins could capture a disproportionate amount of rain compared to the pipe system size. Per-ACRE values will be assigned 49% weighting towards final rankings.
- **ADWF/Acre Ratio:** Basin 1 and 6D had lower ADWF/ Acres ratios, probably due to a less populated assigned drainage area with more open space. Basin 6E had a typically high ADWF/Acres ratio compared to the rest of the system, either due to a more densely populated area and/or higher groundwater infiltration rates. The resultant normalized values using the per-ADWF and per-ACRE methods will thus be quite different for these sites. Normalized rankings should be used at the discretion of the City Engineer.

3 Results and Analysis

3.1 Rainfall Monitoring

3.1.1 Flow Study Rainfall Data

V&A captured rainfall data from three publicly available private weather station (PWS[5]), allowing for good coverage over the flow monitoring area. Refer to Figure 3-1 for the location of the rain gauges and Figure 1-1 for a detailed map of the project rain gauges relative to the sites.

There was significantly more rain in the east, as expected for higher elevation mountainous areas. V&A quality checked the data against multiple other PWSs that were in the area and a rain gauge that V&A had installed at the Rodeo Sewage Treatment Plant.

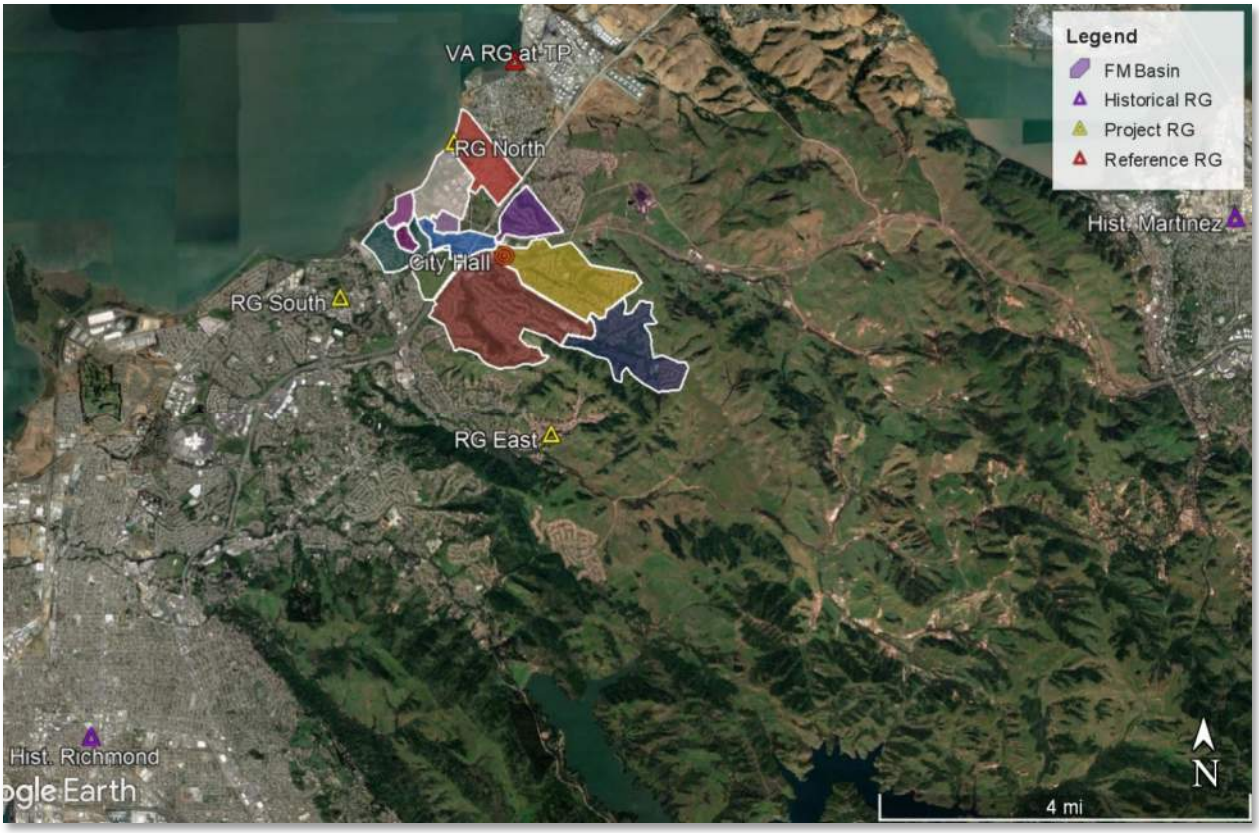


Figure 3-1. Rain Gauge Locations

[5] National Oceanic and Atmospheric Administration (NOAA) Citizen Weather Observer Program (CWOP) members send data from their 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 data to ensure its suitability for use.

There were five main rainfall events that elicited a solid I/I response over the flow monitoring period. Figure 3-2 illustrates the rainfall data triangulated to City Hall (see Section 3.1.3 regarding the triangulation method). Table 3-1 shows the duration and precipitation of each rainfall event for each rain gauge. Figure 3-3 shows the rain accumulation plot of the period rainfall triangulated to City Hall, as well as the estimated historical average rainfall[6] in the City during this project duration. The cumulative precipitation for this period was 41% higher than the historical precipitation for the duration of the flow monitoring.

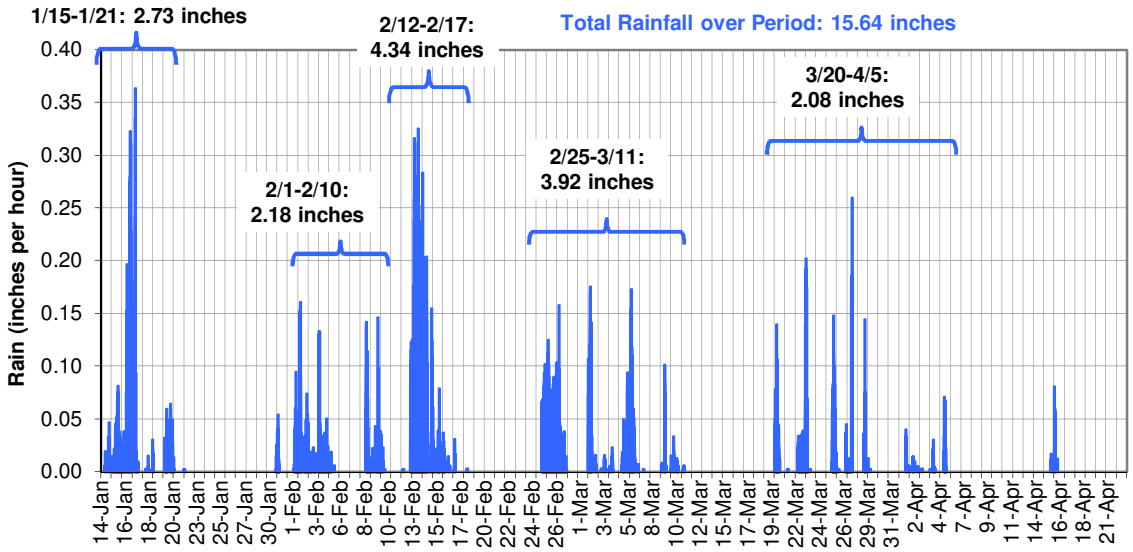


Figure 3-2. Rainfall Monitoring – Triangulated to City Hall

Table 3-1. Summary of Rainfall Data

Rainfall Event	Date(s)	North (in)	South (in)	East (in)	*Triangulated Rainfall (in)*
Event 1	Jan 15 – 21, 2019	2.28	3.09	3.24	*2.73*
Event 2	Feb 1 – 10, 2019	1.94	2.24	2.62	*2.18*
Event 3	Feb 12 – 17, 2019	3.87	4.95	5.03	*4.34*
Event 4	Feb 25 – Mar 11, 2019	3.65	3.59	4.90	*3.92*
Event 5	Mar 20 – Apr 5, 2019	1.90	2.46	2.01	*2.08*
Total over Monitoring Period: 97 days		13.90	16.64	18.17	*15.64*

[6] Historical data taken from the WRCC (triangulated to Hercules City Hall from nearest Station 47414 in Richmond and Station 45378 in Martinez): http://www.wrcc.dri.edu/summary/climsmnca.html

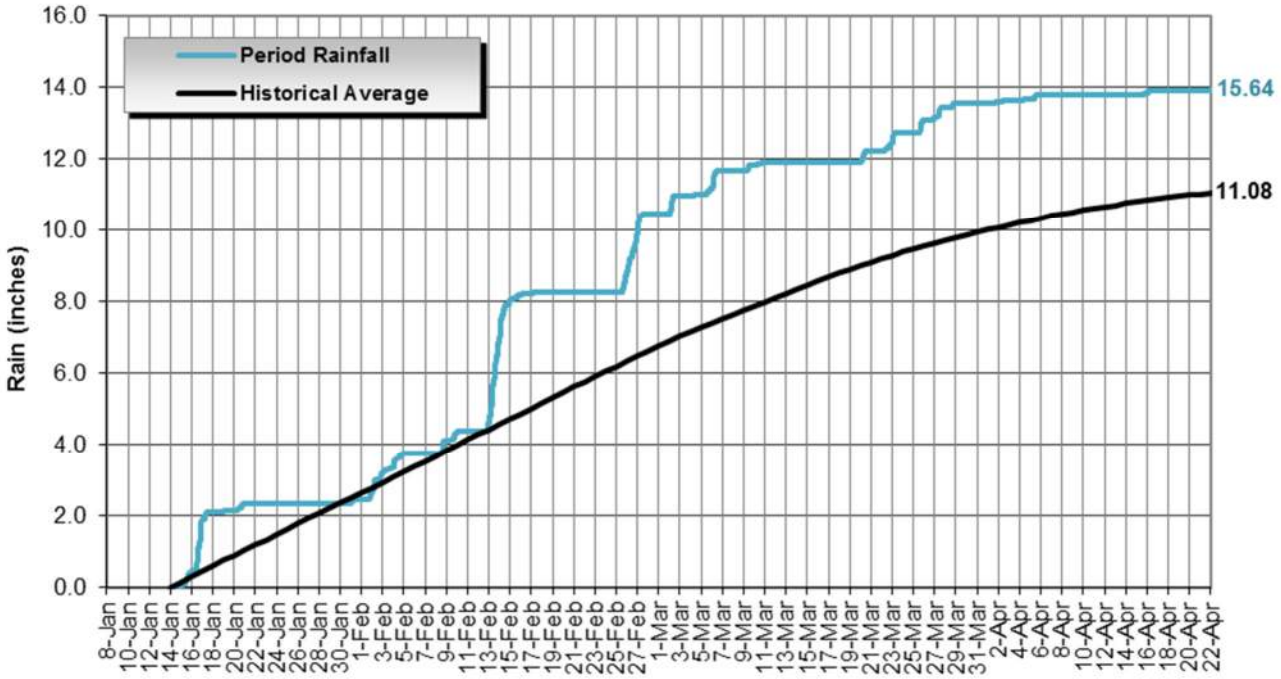


Figure 3-3. Rainfall Accumulation Plot – Triangulated to City Hall

3.1.2 Regional Rainfall 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[7]. Rainfall events are classified by intensity and duration. Based on historical data, frequency contour maps for storm events of given intensity and duration have been developed by the NOAA for all areas within the continental United States (Figure 3-4).

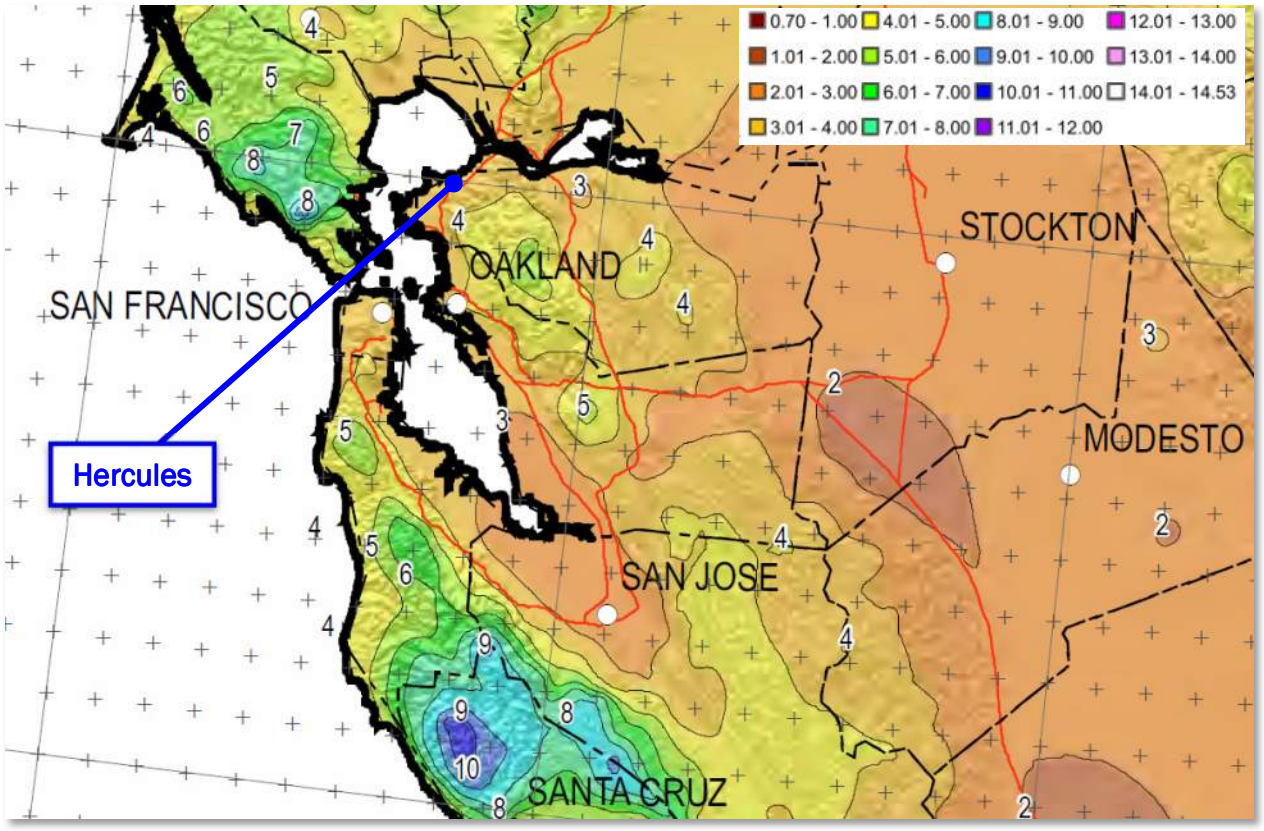


Figure 3-4. NOAA Northern California Rainfall Frequency Map

For example, the NOAA Rainfall Frequency Atlas[8] classifies a 10-year, 24-hour storm event at the South rain gauge location as **3.57** inches. This means that in any given year, at this specific location, there is a 10% chance that 3.57 inches of rain will fall in any 24-hour period.

From the NOAA frequency maps, for a specific latitude and longitude, the rainfall densities for period durations ranging from 1 hour to 20 days are known for rain events ranging from 1-year to 10-year intensities. These are plotted to develop a rain event frequency map specific to each rainfall monitoring site. Superimposing the peak measured densities for the rainfall events on the rain event frequency plot determines the classification of the rainfall event. Table 3-2 shows the peak classifications for each rain event at each rain gauge location. Figure 3-5 through Figure 3-9 illustrate various rain event classification plots per each rain gauge location.

[7] Sanitary sewers are often designed to withstand I/I contribution to sanitary flows for specific-sized "design" storm events.

[8] NOAA Western U.S. Precipitation Frequency Maps Atlas 14, Volume 6, 2011: ftp://hdsc.nws.noaa.gov/pub/hdsc/data/sw/ca10y24h.pdf

The following items are noted:

- Event 3 was the highest classified rainfall event during this study, ranging between a 4.5 and 9.5 year, 2-Day storm event.

Table 3-2. Rainfall Event Classification

Rainfall Event	Date(s)	North	South	East
Event 1	Jan 15 – 21, 2019	1-year, 12-hour	5-year, 1-hour	2-year, 10-hour
Event 2	Feb 1 – 10, 2019	< 1-year event	< 1-year event	< 1-year event
Event 3	Feb 12 – 17, 2019	4.5-year, 2-day	9.5-year, 2-Day	8-year, 2-day
Event 4	Feb 25 – Mar 11, 2019	< 1-year event	< 1-year event	1-year, 10-day
Event 5	Mar 20 – Apr 5, 2019	< 1-year event	2-year, 30-min	< 1-year event
Seasonal (long-term)	Jan 14 – Apr 22, 2019	2-year, 60-day	4-year, 45-day	5-year, 45-day

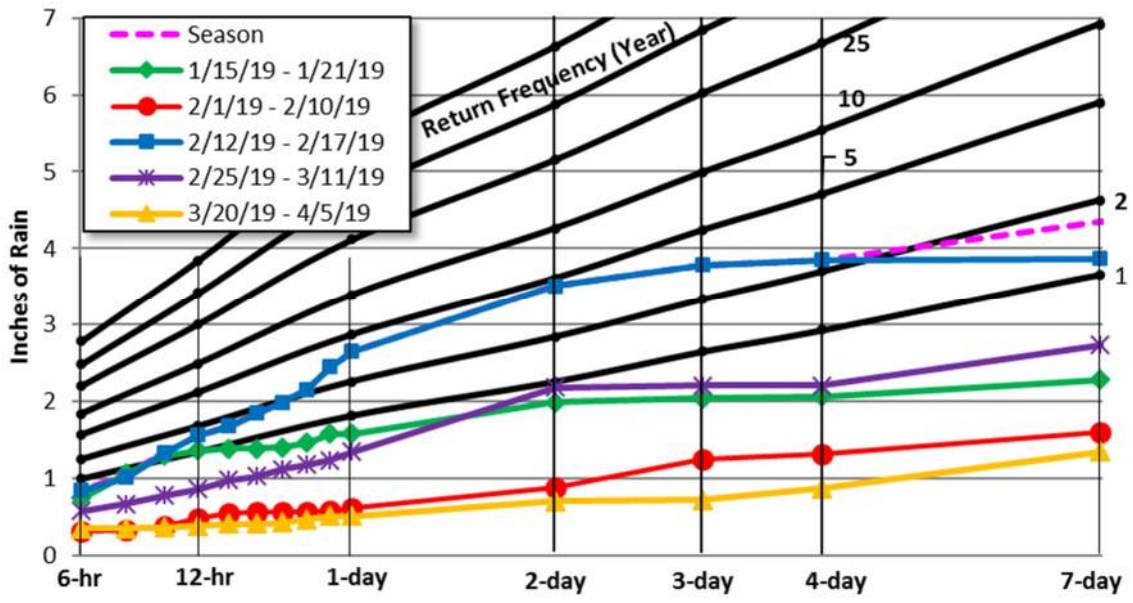


Figure 3-5. Rainfall Event Classification – 7-day Period (North RG)

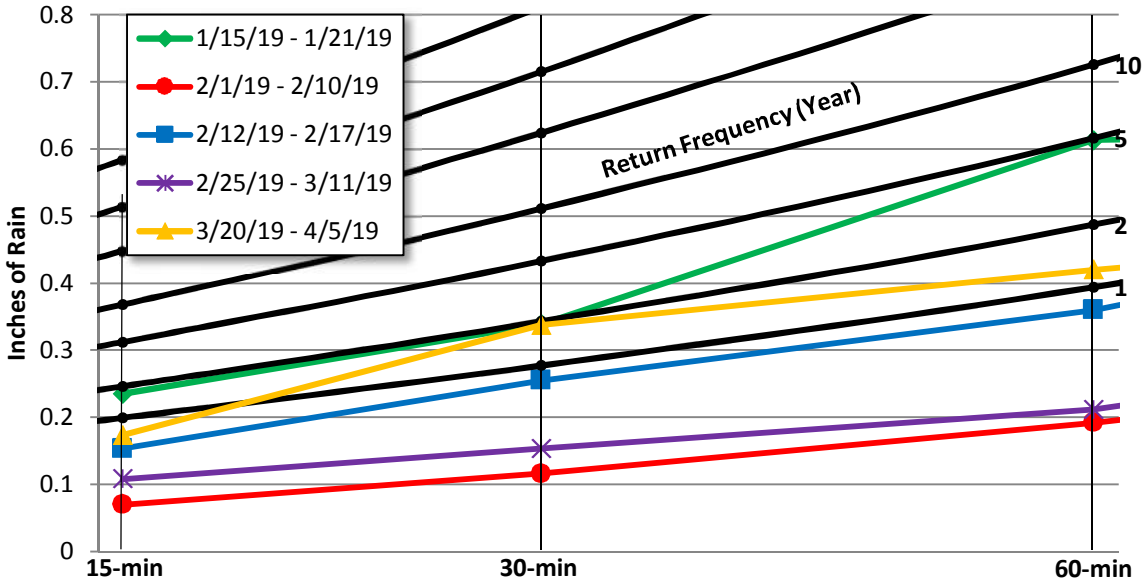


Figure 3-6. Rainfall Event Classification – 60-min Period (South RG)

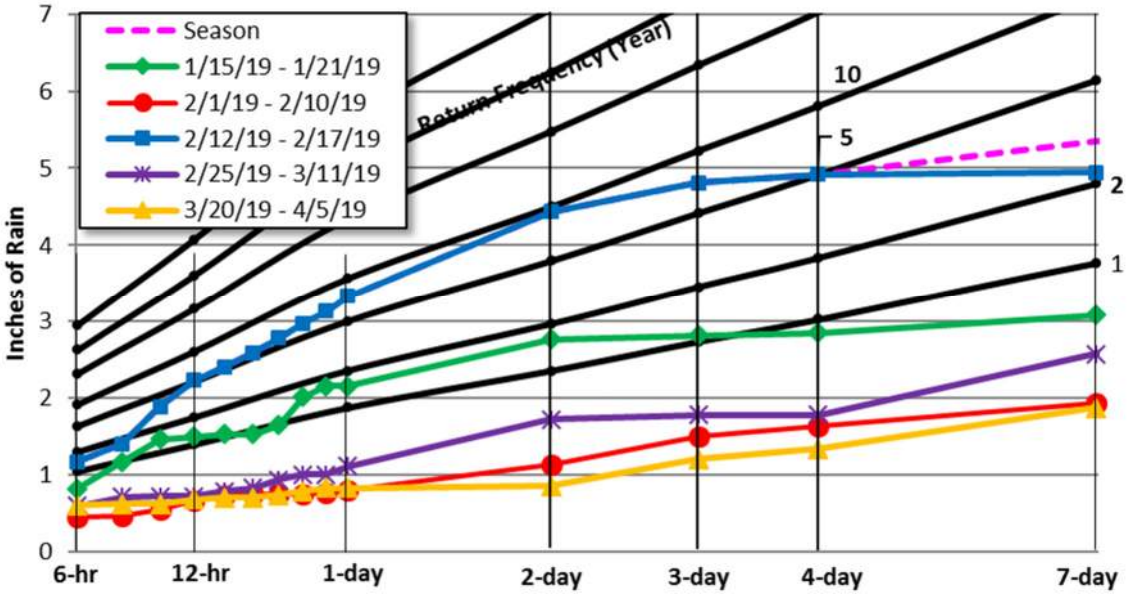


Figure 3-7. Rainfall Event Classification – 7-day Period (South RG)

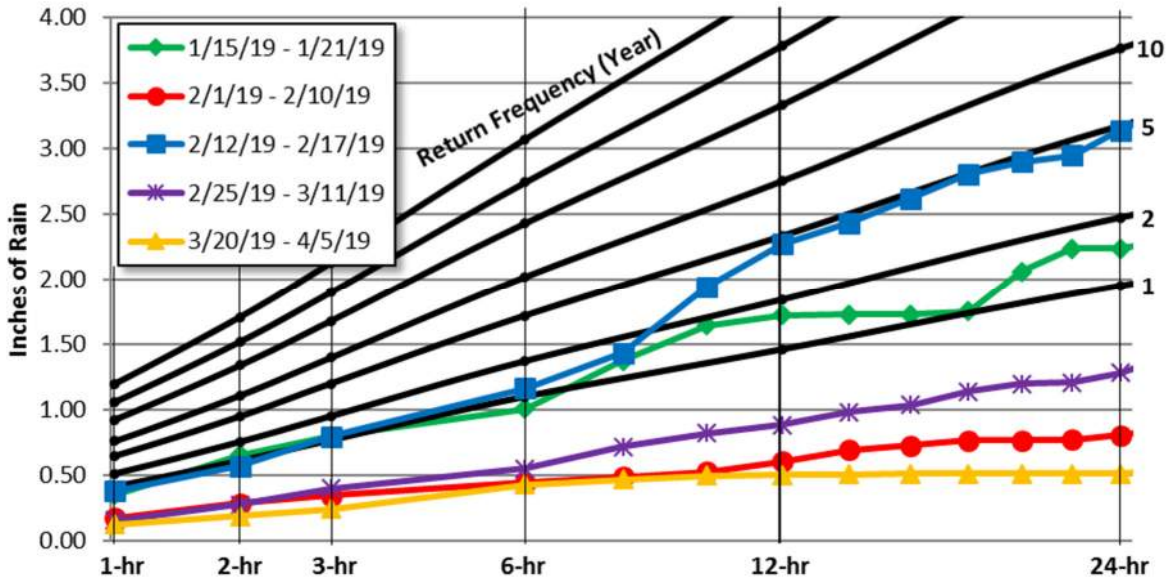


Figure 3-8. Rainfall Event Classification – 7-day Period (East RG)

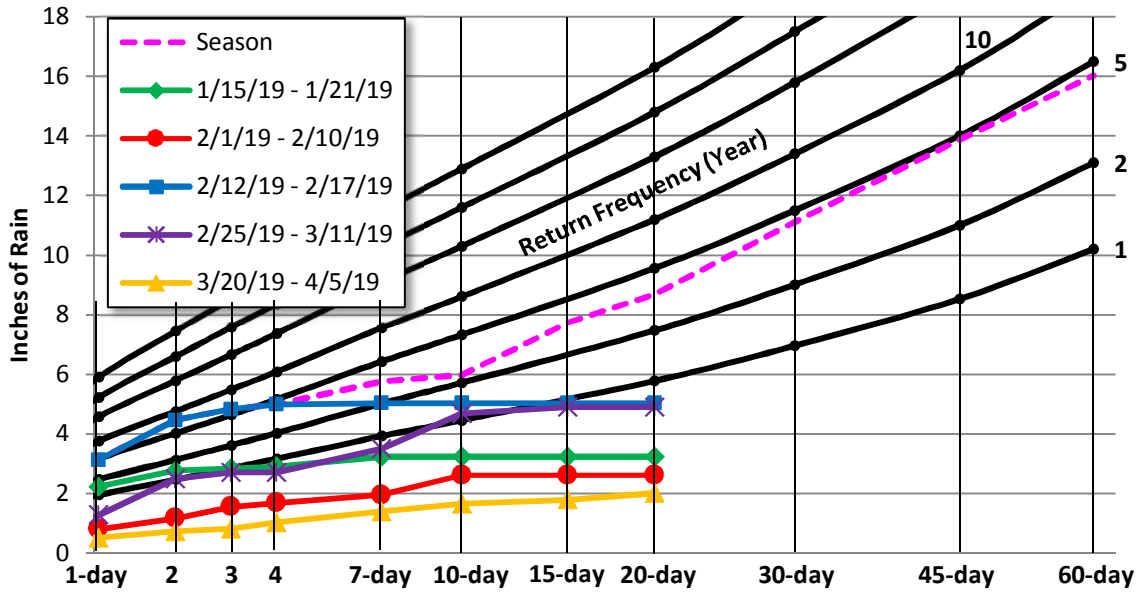


Figure 3-9. Rainfall Event Classification – 60-day Period (East RG)

3.1.3 Rain Gauge Triangulation Distribution

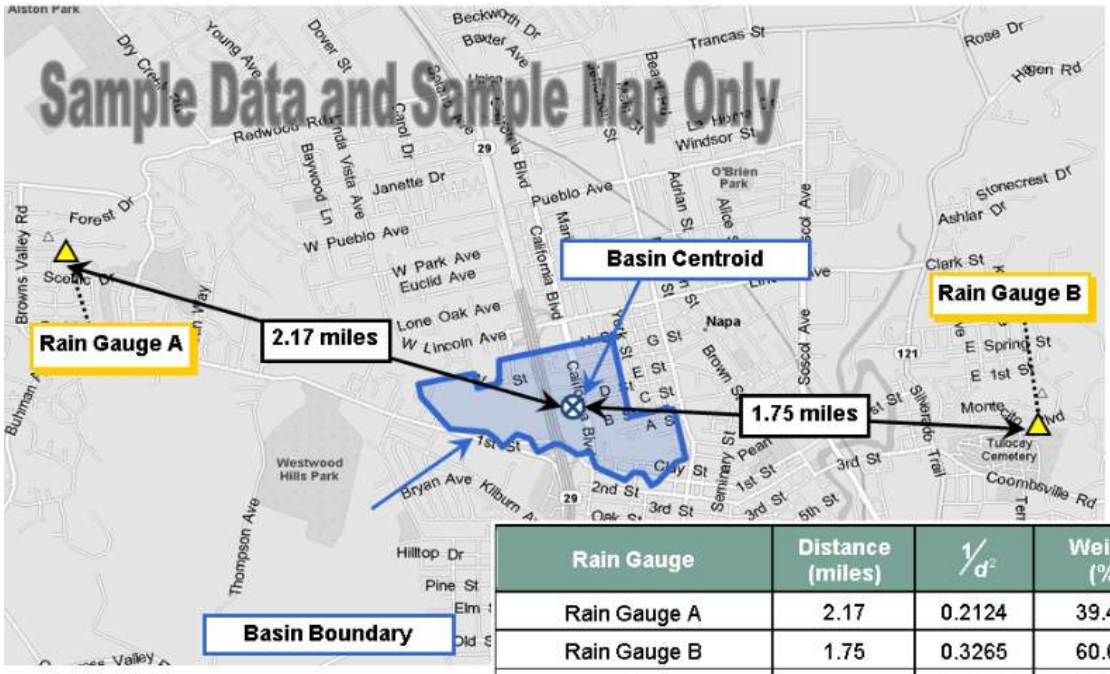
The rainfall affecting the sanitary sewer collection system basins must be calculated based on the proximity to the rain gauge locations. The mean precipitation for each sites' upstream basin was calculated by taking data from the rain gauges and using the inverse distance weighting (IDW) method. IDW is an interpolation method that assumes the influence of each rain gauge location diminishes with distance. The centroid of an upstream basin is identified, and a weighted triangulated average is taken of the precipitation data from nearby rain gauge locations.

The IDW function is as follows:

$$weight(d) = \frac{1/d^{p}}{\sum 1/d^{p}}, \quad \text{where:} \quad d = \text{distance} \quad p = \text{power } (p > 0)$$

The value of p is user defined. The most common choice for hydrological studies of watershed areas is $p = 2$.

Figure 3-8 illustrates the IDW method with sample data. The rain gauge distribution as calculated for each flow monitoring basin is shown in Table 3-3.



Rain Gauge	Distance (miles)	$1/d^2$	Weight (%)
Rain Gauge A	2.17	0.2124	39.4%
Rain Gauge B	1.75	0.3265	60.6%
Totals		**0.5389**	**100%**

Figure 3-10. Rainfall Inverse Distance Weighting Method

Table 3-3. Rain Gauge Distribution per Monitoring Site

Flow Monitoring Site	North RG	South RG	East RG
Site 1	14.7%	12.2%	73.2%
Site 2	33.2%	53.4%	13.5%
Site 3	22.6%	26.6%	50.8%
Site 4	69.0%	16.8%	14.2%
Site 5	33.5%	20.3%	46.2%
Site 6	43.0%	25.3%	31.8%
Site 6A	61.0%	39.0%	0.0%
Site 6B	39.1%	60.9%	0.0%
Site 6C	43.5%	22.2%	34.3%
Site 6D	95.5%	4.5%	0.0%
Site 6E	72.4%	27.6%	0.0%
City Hall	*49.6%*	*23.0%*	*27.4%*

3.2 Flow Monitoring

3.2.1 Average Flow Analysis

Average dry weather flow (ADWF) curves were established during dry days when I/I had the least impact on the baseline flow. Table 3-4 summarizes the dry weather flow data measured for this study. ADWF curves for each site can be found in *Appendix A*.

Table 3-4. Dry Weather Flow

Monitored Site	Sediment (in.)	Mon-Thu ADWF (MGD)	Friday ADWF (MGD)	Saturday ADWF (MGD)	Sunday ADWF (MGD)	Overall ADWF (MGD)
Site 1	0	0.079	0.078	0.090	0.097	0.083
Site 2	0	0.137	0.135	0.150	0.153	0.141
Site 3	0	0.456	0.459	0.503	0.530	0.474
Site 4	0	0.102	0.105	0.114	0.115	0.106
Site 5	0	0.253	0.254	0.274	0.275	0.260
Site 6	0	1.628	1.589	1.649	1.626	1.625
Site 6A	0	0.029	0.032	0.030	0.034	0.030
Site 6B	0	0.049	0.046	0.052	0.056	0.050
Site 6C	**0.5**	1.420	1.400	1.470	1.508	1.437
Site 6D	0	0.138	0.136	0.131	0.136	0.137
Site 6E	0	0.118	0.119	0.125	0.128	0.121

Figure 3-11 shows a flow schematic of the average daily flows and average daily flow levels. The following ADWF analysis results are noted:

- All sites except Site 6 were less than 40% full (less than 0.40 d/D) during ADWF conditions.
- Site 6 had a d/D of 0.87 during ADWF conditions. This may be a capacity or operations issue. Site 6 is located across the railroad tracks from the Pinole-Hercules Wastewater Treatment Plant. It is immediately downstream from a force main discharge manhole, but may also be influenced by treatment plant operations.
- Site 6C had approximately 0.5-inch sediment measured during visits.

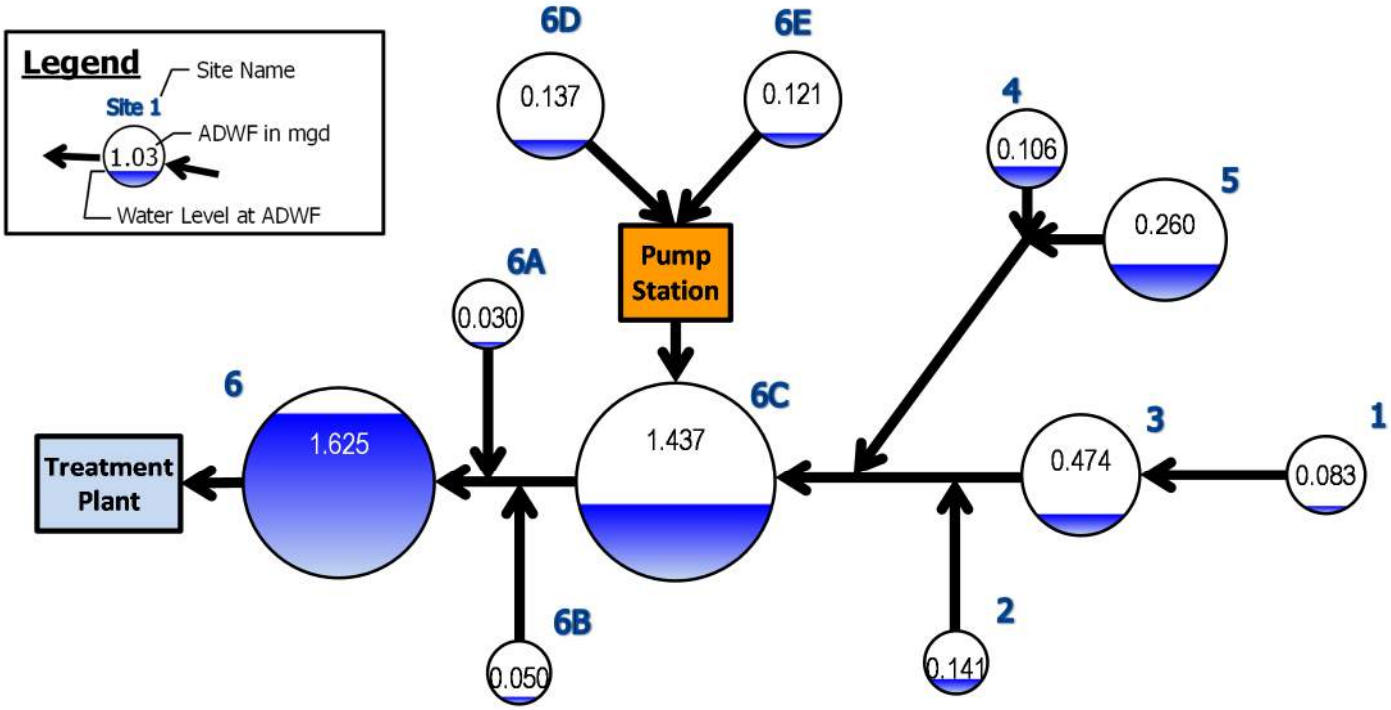


Figure 3-11. Average Dry Weather Flow (Flow Schematic)

3.2.2 Peak Measured Flows and Pipeline Capacity Analysis

Peak measured flows and the hydraulic grade line data (flow 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 occur at the same time. The following capacity analysis 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 the tributary area, flow attenuation, flow restrictions, characteristics of I/I entering the collection system, and hydraulic features such as pump stations.
  - For this report, peaking factors are reported and PF > 6 are highlighted in RED[10]; however, the City should refer to City standards when evaluating peaking factors. Site 6D and 6E are in close proximity to, and influenced by, pump stations, which has a direct impact on peaking factors. Peaking factor data should be used at the discretion of the City Engineer
- **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 study. Standards for d/D ratio vary from agency to agency, but typically range between d/D ≤ 0.5 and d/D ≤ 0.75
  - For this report, d/D ratios > 0.75 are highlighted in RED; however, the City should refer to City standards when evaluating d/D ratios, to be used at the discretion of the City Engineer.

Table 3-5 summarizes the peak flows, levels, *d/D* ratios, and peaking factors during the flow monitoring period. Capacity analysis data are presented on a site-by-site basis and represents the hydraulic conditions only at the site nodes; hydraulic conditions in other areas of the collection system will differ.

Table 3-5. Capacity Analysis Summary

Monitored Site	ADWF (MGD)	Peak Measured Flow (MGD)	Peaking Factor	Pipe Diameter, *D* (IN)	Max Depth, *d* (IN)	*Max d/D* Ratio	Surcharge above pipe crown (FT)
Site 1	0.083	0.62	7.4	10	3.1	0.31	n/a
Site 2	0.141	0.60	4.2	8	4.0	0.50	n/a
Site 3	0.474	2.54	5.4	15	6.5	0.43	n/a
Site 4	0.106	0.57	5.3	10	7.9	0.79	n/a
Site 5	0.260	1.30	5.0	15	11.7	0.78	n/a
Site 6	1.625	5.75	3.5	22.5	42.3	1.88	1.65
Site 6A	0.030	0.17	5.7	8	2.2	0.27	n/a
Site 6B	0.050	0.34	6.8	8	2.7	0.34	n/a
Site 6C	1.437	4.52	3.1	24	18.8	0.78	n/a
Site 6D	0.137	0.68	5.0	14	18.7	1.34	0.39
Site 6E	0.121	0.45	3.8	12	8.4	0.70	n/a

[10] WEF Manual of Practice FD-6 and ASCE Manual No. 62 suggests typical peaking factor ratios range between 3 and 4, with higher values possibly indicative of pronounced I/I flows.

The following capacity analysis results are noted:

- **Peak flows**: Peak flows and peak levels occurred during Event 3 for most sites, except Sites 6D and 6E which occurred one day after Event 1, possibly due to Industrial Lift Station operations.
- **Peaking Factors**: Sites 1 and 6B had peaking factors greater than 6. Site 1 had the largest peaking factor of all sites at 7.4.
- **d/D Ratio**: Sites 6 and 6D surcharged during the study; flow levels for both sites were less than two feet above the pipe crown when surcharged
  - **Site 6**: High levels even during ADWF conditions were already identified at Site 6. Site 6 is located downstream from a pump station discharge, and immediately upstream from the treatment facility. Flow levels may be influenced by treatment plant operations.
  - **Site 6D**: The Site 6D surcharge was likely due to pump station operations.

shows the schematic diagram of the peak measured flows with peak flow levels of the whole monitoring period. Figure 3-13 and Figure 3-1 show bar graph summaries of the peaking factors and d/D ratios, respectively.

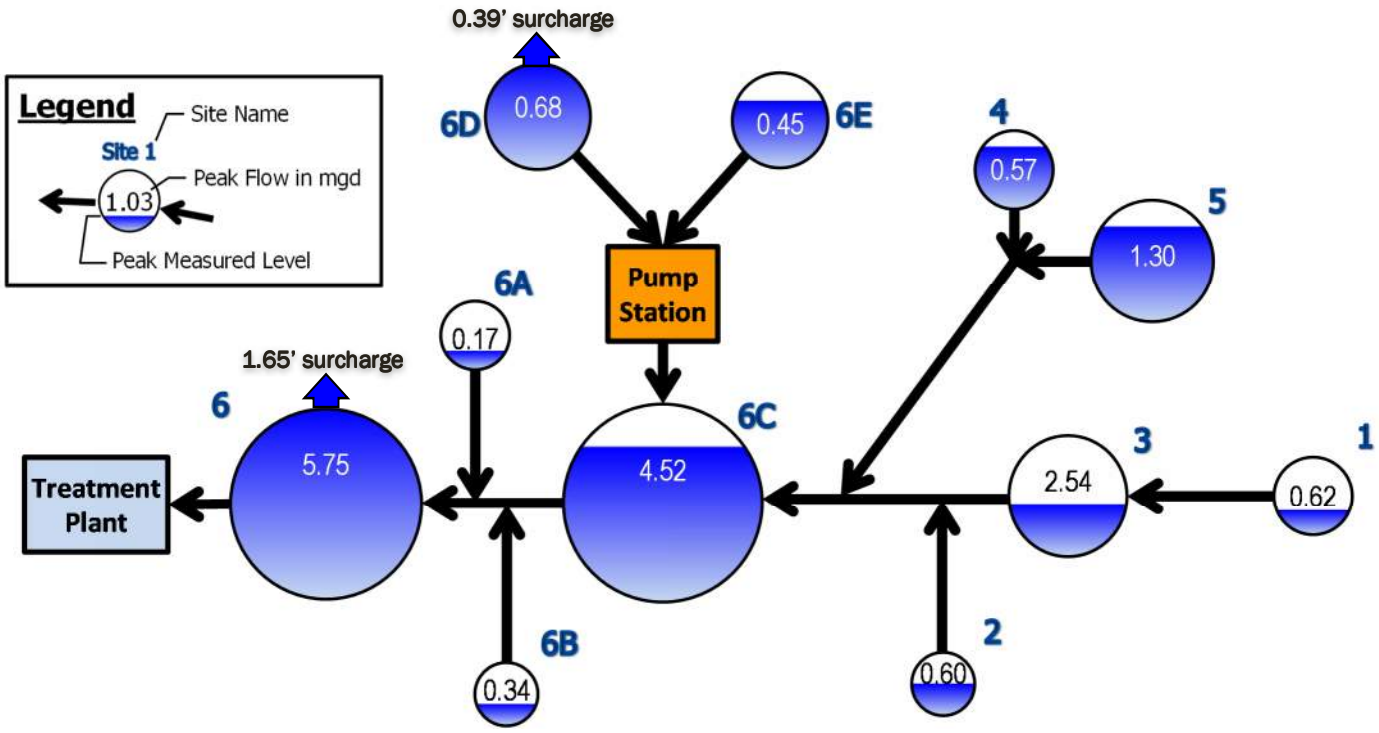


Figure 3-12. Peak Measured Flow (Flow Schematic)

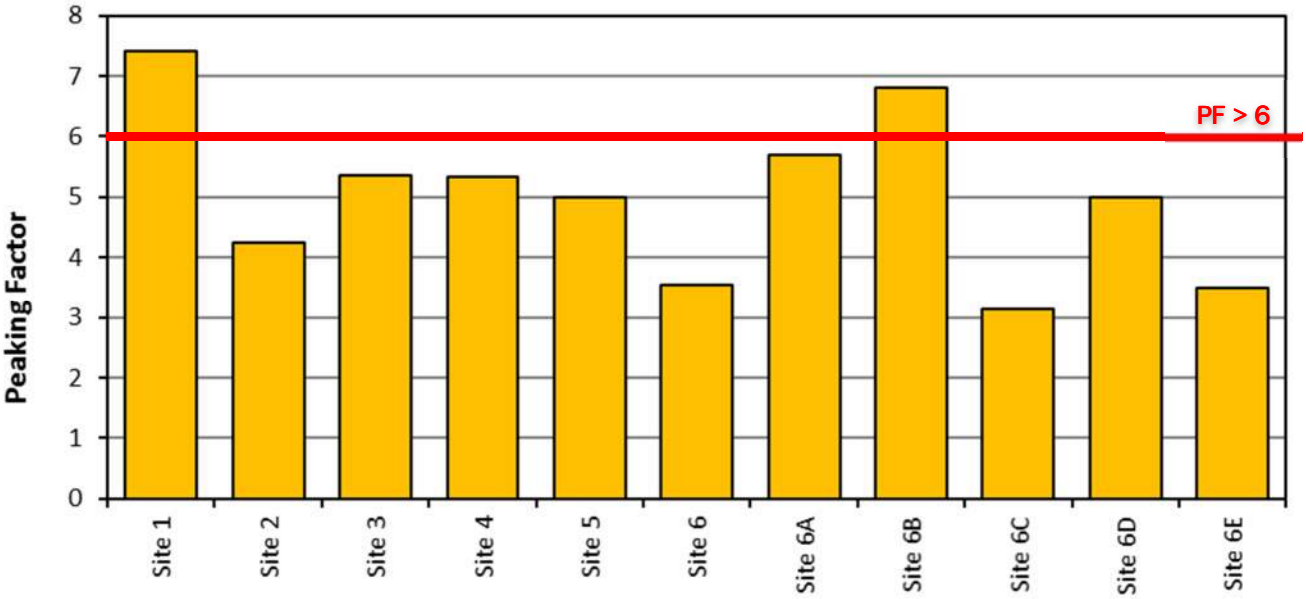


Figure 3-13. Peaking Factors

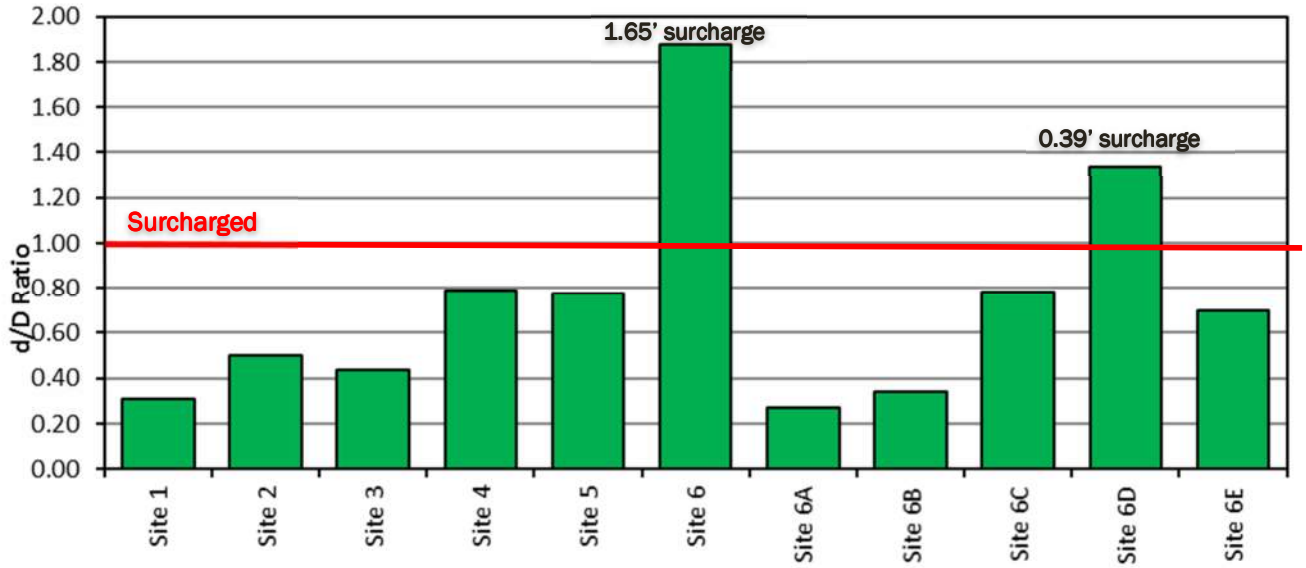


Figure 3-1. Capacity Summary: Max d/D Ratios

3.3 Inflow and Infiltration: Results

3.3.1 Preface

I/I analyses are presented on a basin-by-basin basis. Items relevant to the analysis in this study are noted below and referenced in Figure 3-14:

- **I/I Isolation**: The I/I flow rate is the real-time flow less the estimated average dry weather flow rate (shown below as the RED line).
- **Inflow**: Inflow is usually recognized graphically by large-magnitude, short-duration spikes immediately following a rain event. The peak inflow rate is the highest spike in the isolated I/I hydrograph during the evaluated rainfall event.
- **RDI**: RDI is typically taken as the average I/I flow rate measured approximately 24 to 36 hours after the rainfall event has concluded.
- **Combined I/I**: the totalized volume (in gallons) of both inflow and RDI over the course of a rainfall event (shown below as the orange area).
- I/I analysis was conducted on a basins-by-basin basis. To isolate the drainage areas of some flow monitoring basins, a subtraction of flow was required. *Basins* 6 and 6C could not be used for I/I analysis due to the phenomena of inflating uncertainties. Please reference Section 1.2 and Section 2.4 for information on this subject.
- Site 6 was assumed to capture most flows from the collection system and the normalized I/I rate was considered the system average, presented for reference.

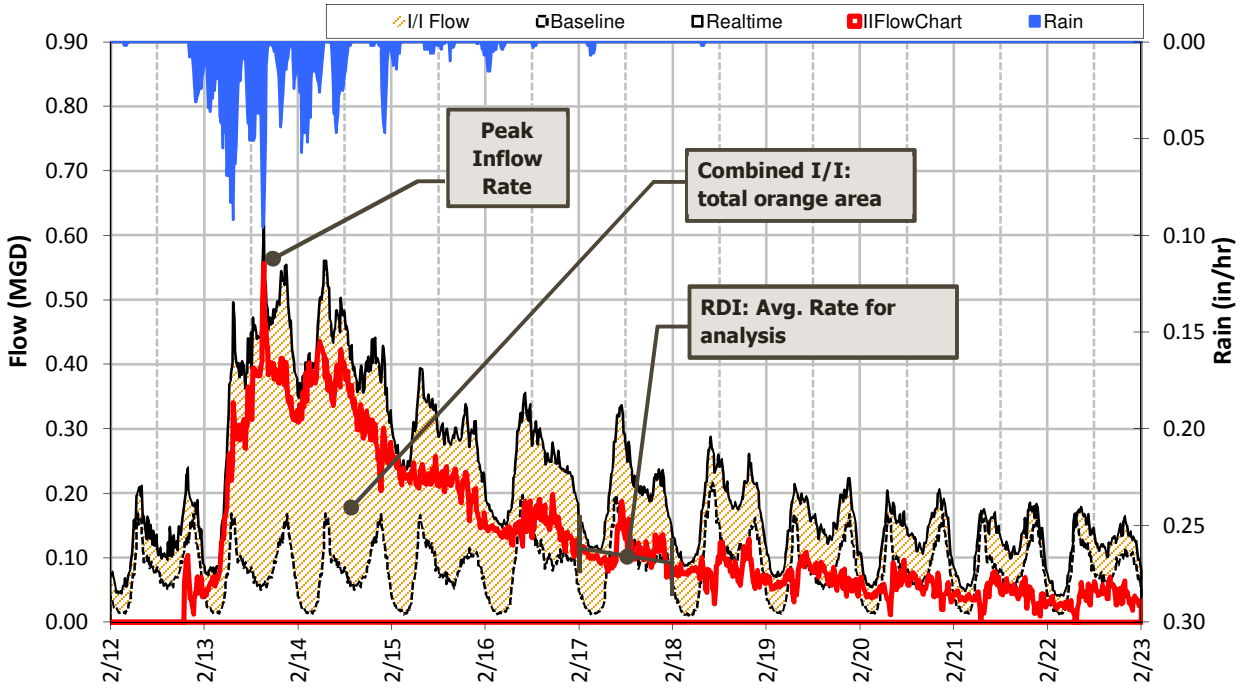


Figure 3-14. I/I Isolation, Site 3, Storm Event 3

3.3.2 Storm Events used for I/I Analyses

The following items are noted relevant to the storm events used for I/I analyses:

- Events 3 and 4 clearly elicited the strongest I/I responses in this study. Events 1, 2, and 5 were not used for analysis.
- **Holidays:** Martin Luther King Day January 21, 2019 and President's Day February 18, 2019 occurred during the receding flows of Event 1 (January 15- 21, 2019) and Event 3 (February 12-17, 2019). Hercules flow data suggested that these days' base flow matches a Sunday diurnal pattern; Sunday ADWF patterns were applided to these holidays for the purposes of I/I analysis.
- **Inflow**: Inflow results were taken from Event 3; typically occurring on February 13 or 14, 2019. Event 3 was the highest classified and most intensive short-term rainfall event.
- **RDI and Combined I/I**: For this study, metrics for RDI and Combined I/I were averaged across Events 3 and 4. Both events had smooth receding I/I patterns for most sites.
  - The average I/I rate from Rainfall Event 3 was taken from February 17, 2019. This time period was after the last significant rainfall and avoided the uncertainty of February 18 President's Day flows.
  - The average I/I rate from Rainfall Event 4 was taken from March 8, 2019.

3.3.3 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.

Inflow results were taken from Rainfall Event 3 (February 12 to 18, 2019). Event 3 was the highest classified and most intensive short-term rainfall event. Table 3-6 and Figure 3-15 summarize the peak measured inflow and inflow analysis results for the relevant flow monitoring basins.

Figure 3-16 shows a temperature map summary of the inflow analysis results per basin. The "Top 3" basins for each category have been shaded in RED. The following inflow results are noted:

- Site 6D and 6E had a flow spike during Event 1 (not used for I/I analysis). The flow spike was probably due to the nearby Industrial Lift Station or Join Muir Lift Station influence rather than inflow from the respective basins.
- Basin 1, 6B, and 6A ranked the highest for normalized inflow ranking.
- Per-Acre rankings should be reviewed with caution given disproportional densities basin-to-basin; normalized rankings should be used at the discretion of the City Engineer.

Table 3-6. Results and Rankings of Inflow Analysis

Monitoring Basin	ADWF (mgd)	Basin Acreage	Inflow Rate (mgd)	Inflow per-ADWF Ranking	Inflow per-Acre Ranking	Final Inflow Ranking
Basin 1	0.083	400	0.541	1	8	3
Basin 2	0.141	110	0.477	7	2	4
Basin 3	0.391	825	1.445	6	7	8
Basin 4	0.106	157	0.392	5	5	6
Basin 5	0.260	478	1.095	4	6	5
Basin 6	0.108	157	ND	ND	ND	ND
Basin 6A	0.030	52	0.149	3	4	2
Basin 6B	0.050	31	0.298	2	1	1
Basin 6C	0.211	119	ND	ND	ND	ND
Basin 6D	0.137	477	0.429	8	9	9
Basin 6E	0.108	38	0.106	9	3	7

ND = not determined due to inflating uncertainties of flow subtractions.

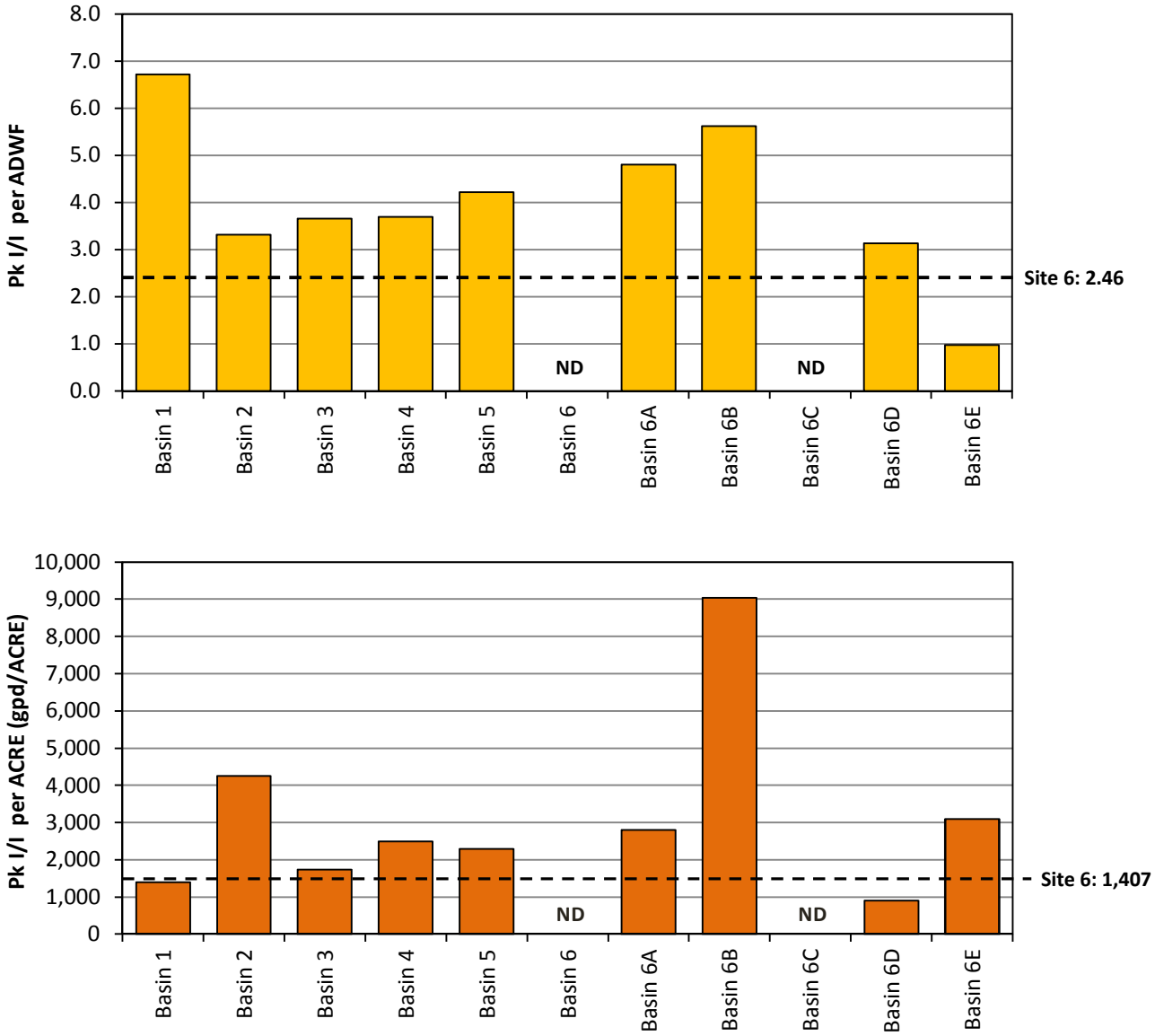


Figure 3-15. Bar Graphs: Inflow Analysis Summary

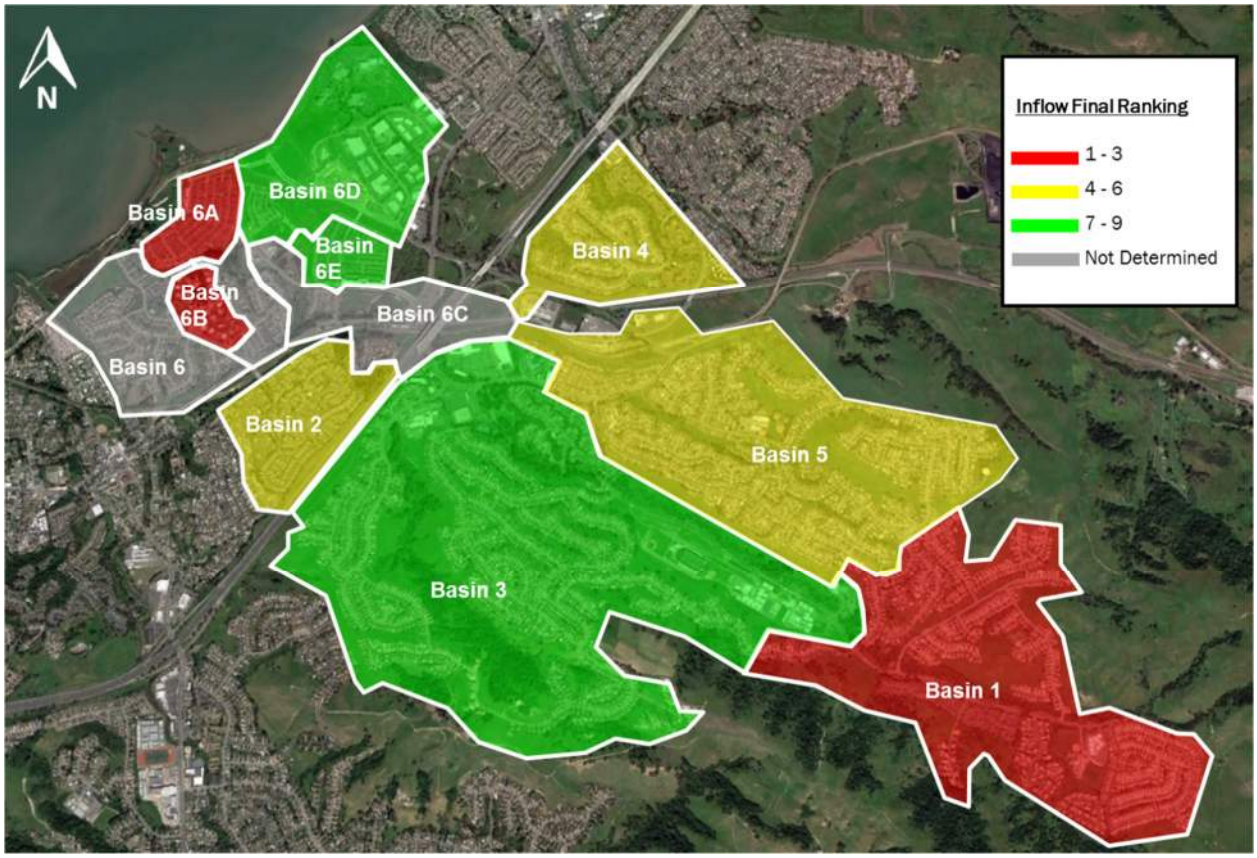


Figure 3-16. Temperature Map: Inflow Final Ranking

3.3.4 Rainfall Dependent Infiltration Results Summary

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. Increased flows into the sanitary sewer system are usually tied to groundwater levels and soil saturation levels. Infiltration sources transport rain water into the system indirectly; flow levels in the sanitary system increase gradually, are typically sustained for a period after rainfall has stopped, and then gradually decrease as soils become less saturated and as groundwater levels recede to normal.

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).

Table 3-7 and Figure 3-17 summarize the captured RDI flow rates for Events 3 and 4. Figure 3-18 shows a temperature map. The "Top 3" basins for each category have been shaded in **RED**. The following RDI results are noted:

- Basins 1, 5, and 6E had the highest weighted, normalized RDI rates, an indicator of high RDI upstream from the flow monitoring basin.
- Per-Acre rankings should be reviewed with caution given disproportional densities basin-to-basin; normalized rankings should be used at the discretion of the City Engineer.

Table 3-7. Results and Rankings of RDI Analysis

Basin	RDI Rate (mgd)			RDI Normalizers		RDI Rankings		
	Ev 3	Ev 4	Avg	per ADWF	per ACRE	per ADWF	per ACRE	Overall
Basin 1	0.104	0.103	0.103	1.24	258	1	3	1
Basin 2	0.027	0.027	0.027	0.19	242	6	4	4
Basin 3	0.152	0.128	0.140	0.36	170	4	7	6
Basin 4	0.029	0.031	0.030	0.29	193	5	6	7
Basin 5	0.210	0.076	0.143	0.55	299	2	2	2
Basin 6	ND	ND	ND	ND	ND	ND	ND	ND
Basin 6A	0.002	0.000	0.001	0.03	15	9	9	9
Basin 6B	0.000	0.015	0.007	0.15	240	7	5	8
Basin 6C	ND	ND	ND	ND	ND	ND	ND	ND
Basin 6D	0.056	0.043	0.049	0.36	104	3	8	5
Basin 6E	0.020	0.013	0.016	0.13	425	8	1	3

Ev = Rain Event; Avg = Average; Units: per-ADWF is a ratio, per-ACRE is in gpd/acre
ND = not determined.

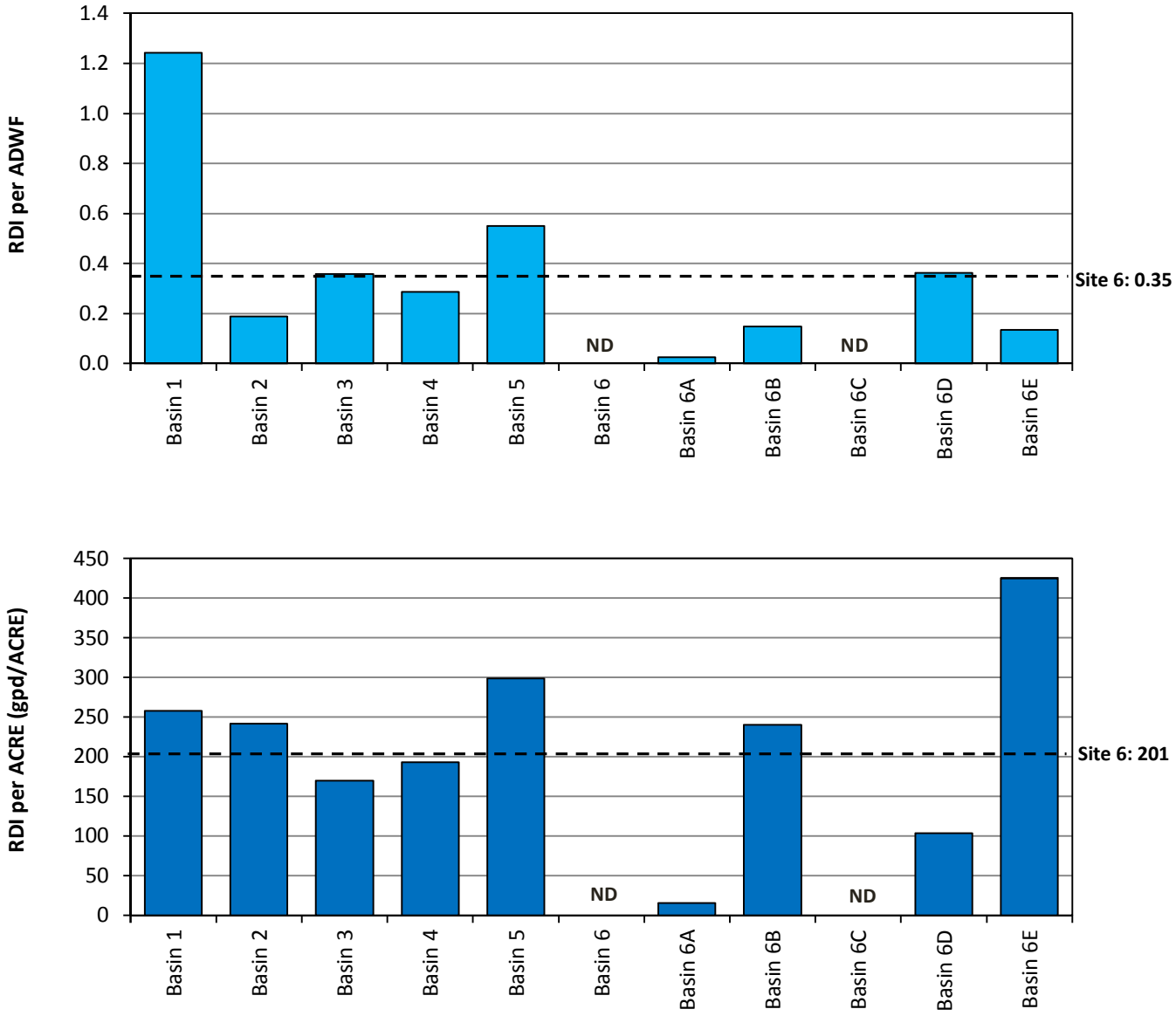


Figure 3-17. Bar Graphs: RDI Analysis Summary

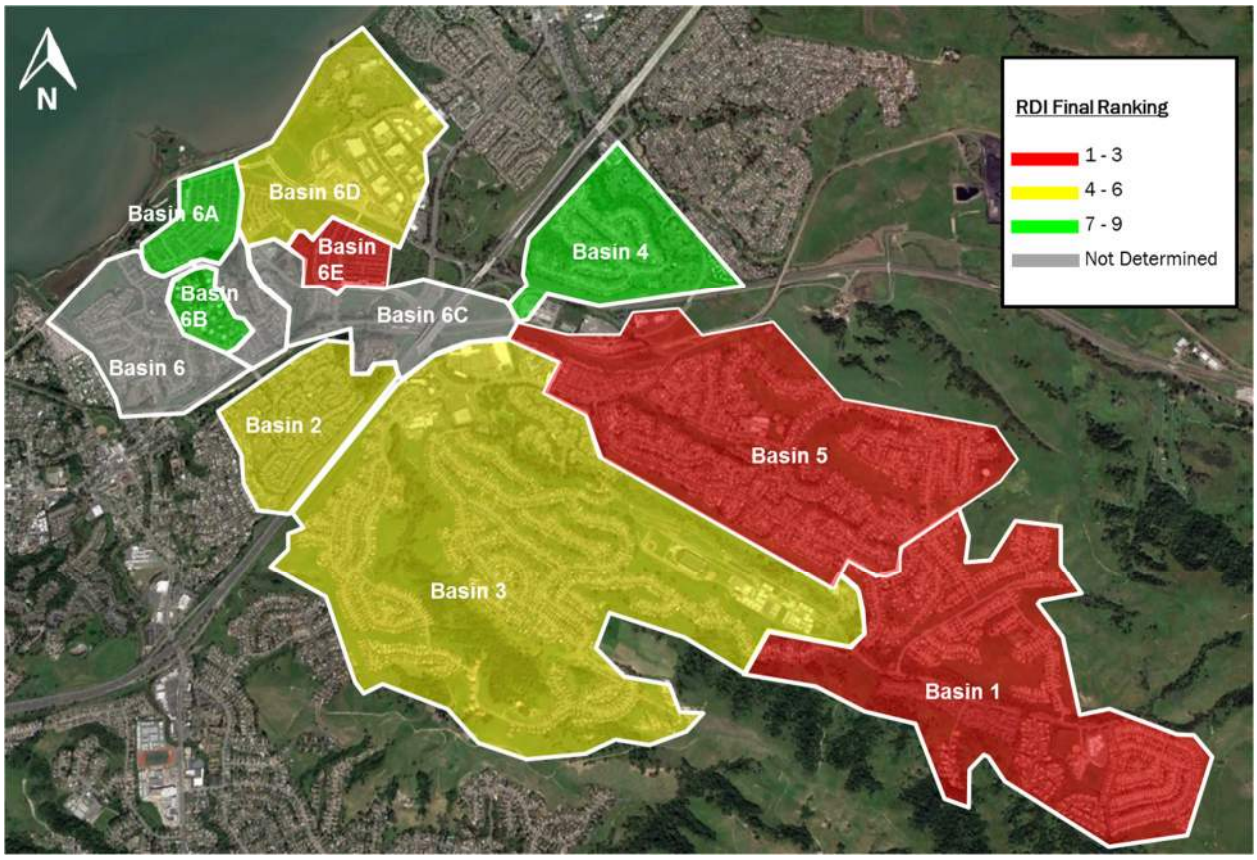


Figure 3-18. Temperature Map: RDI Final Ranking

3.3.5 Combined I/I Results

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 3-8 summarizes the combined I/I flow results for Events 3 and 4. The normalized combined I/I values (per event basin rain and per ADWF/ ACRE) were then averaged to obtain the final rankings. The "Top 3" overall rankings for this analysis have been shaded in RED. Figure 3-19 shows the bar graph results of the per Basin combined I/I analysis. A temperature map is shown in .

The following combined I/I results are noted:

- Basin 6B, 5, and 1 had the highest weighted, normalized total I/I rates.
- Per-Acre rankings should be reviewed with caution given disproportional densities basin-to-basin; normalized rankings should be used at the discretion of the City Engineer.

Table 3-8. Combined I/I Analysis Summary

Basin	Combined I/I (MG)		Combined I/I Normalizers		Combined I/I Rankings		
	Ev 3	Ev 4	per ADWF Avg	Per-ACRE Avg (R-Value)	per ADWF	per ACRE	Overall
Basin 1	1.40	1.87	4.20	3.2%	1	6	2
Basin 2	0.55	0.62	1.00	4.7%	7	3	5
Basin 3	2.53	2.73	1.53	1.8%	5	9	8
Basin 4	0.56	0.85	1.68	4.2%	4	5	4
Basin 5	2.80	2.18	2.16	4.3%	2	4	1
Basin 6	ND	ND	ND	ND	ND	ND	ND
Basin 6A	0.13	0.11	0.99	2.1%	8	7	9
Basin 6B	0.18	0.23	1.03	6.1%	6	2	3
Basin 6C	ND	ND	ND	ND	ND	ND	ND
Basin 6D	0.87	1.09	1.92	2.0%	3	8	7
Basin 6E	0.30	0.31	0.65	7.6%	9	1	6

Ev = Rain Event; Avg = Average; Units: per-ADWF is in MG/in(rain)/MGD, per-ACRE is a percentage-ratio (percent of rain that falls that enters the system), commonly referred to as R-Value
ND = not determined.

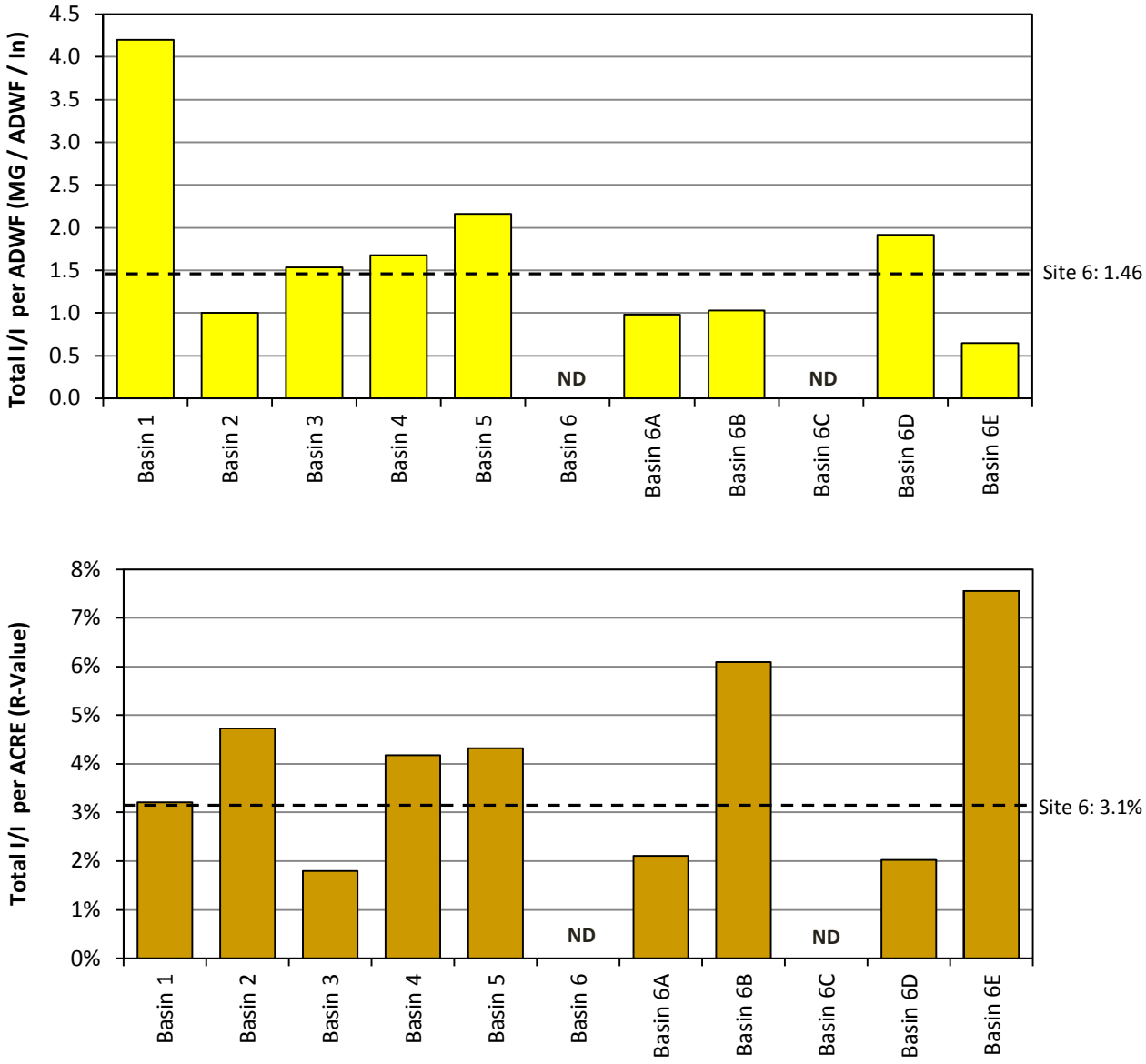


Figure 3-19. Bar Graphs: Total I/I Analysis Summary

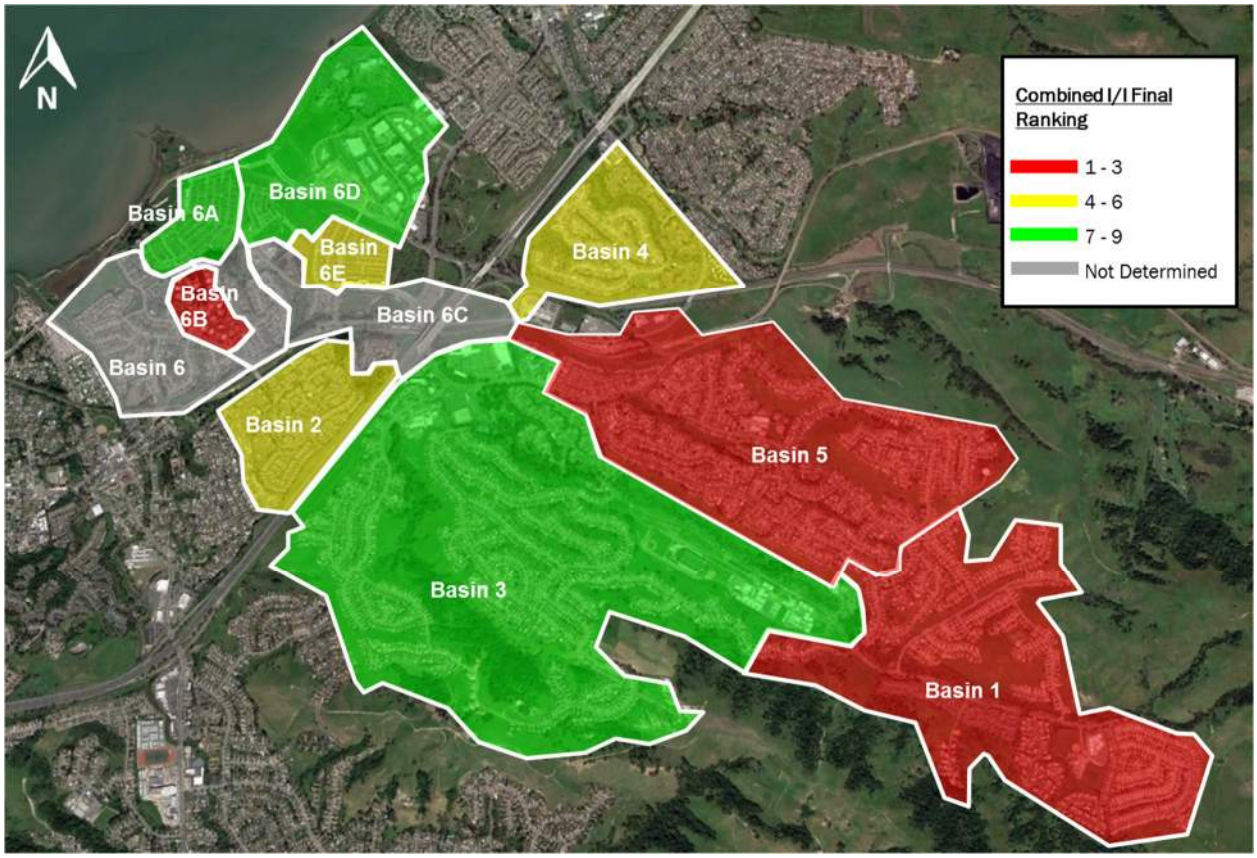


Figure 3-16. Temperature Map: Combined I/I Final Basin Rankings

3.3.6 Groundwater Infiltration Results Summary

Dry weather (ADWF) flow can be expected to have a predictable diurnal flow pattern. While each site is unique, experience has shown that, given a reasonable volume of flow and typical loading conditions, the daily flows fall into a predictable range when compared to the daily average flow. If a site has a large percentage of groundwater infiltration occurring during the periods of dry weather flow measurement, the amplitudes of the peak and low flows will be dampened[11]. Figure 3-20 shows a sample of two flow monitoring sites, both with nearly the same average daily flow, but with considerably different peak and low flows. In this *sample* case, Site B1 may have a considerable volume of groundwater infiltration.

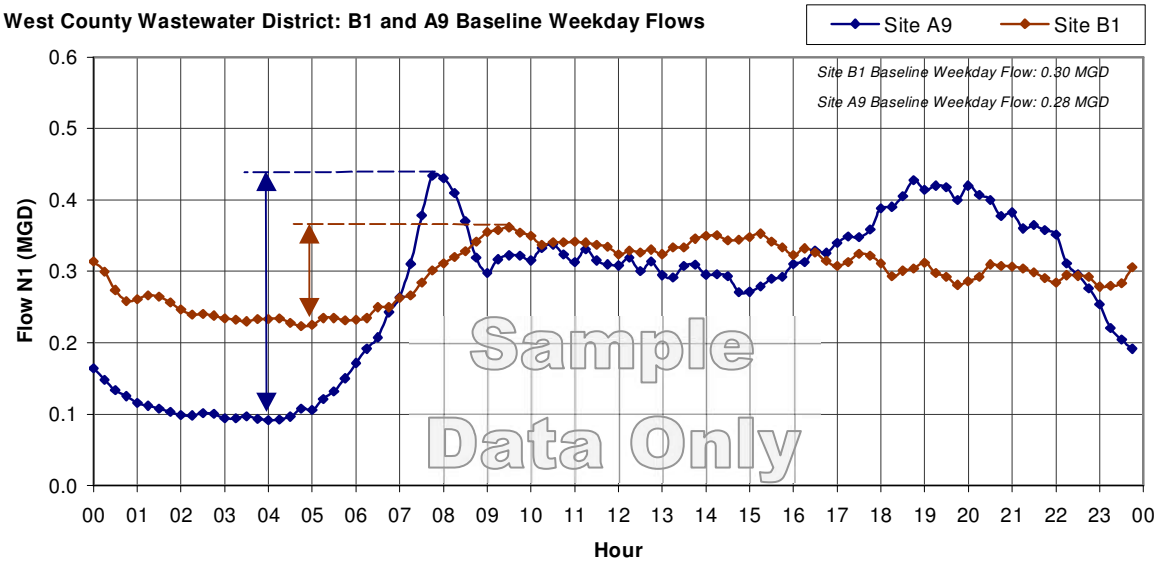


Figure 3-20. Groundwater Infiltration Sample Figure

It can be useful to compare the low-to-ADWF flow ratios for the flow monitoring sites. A site with abnormal ratios, and with no other reasons to suspect abnormal flow patterns (such as proximity to a pump station, treatment facilities, etc.), has a possibility of higher levels of groundwater infiltration in comparison to the rest of the collection system.

Figure 3-21 plots the low-to-ADWF flow ratios[12] against the ADWF flows for the relevant flow monitoring sites. The brown dashed line shows "typical" low-to-ADWF ratios per the Water Environment Federation (WEF). Figure 3-22 shows a color-coded map of the basins with rates of groundwater infiltration considerably above typical groundwater infiltration standards (as set forth by WEF).

The following GWI results are noted:

- Basins 6A and 6E had GWI rates higher-than typical standards.

[11] In an extreme case, perhaps 0.2 mgd of ADWF flow and 2.0 mgd of groundwater infiltration, the peaks and lows would be barely recognizable; the ADWF flow would be nearly a straight line.

[12] The Minimum to Average flow ratio is calculated by taking the minimum flow and dividing by the ADWF value (using the Mon-Thu ADWF curve).

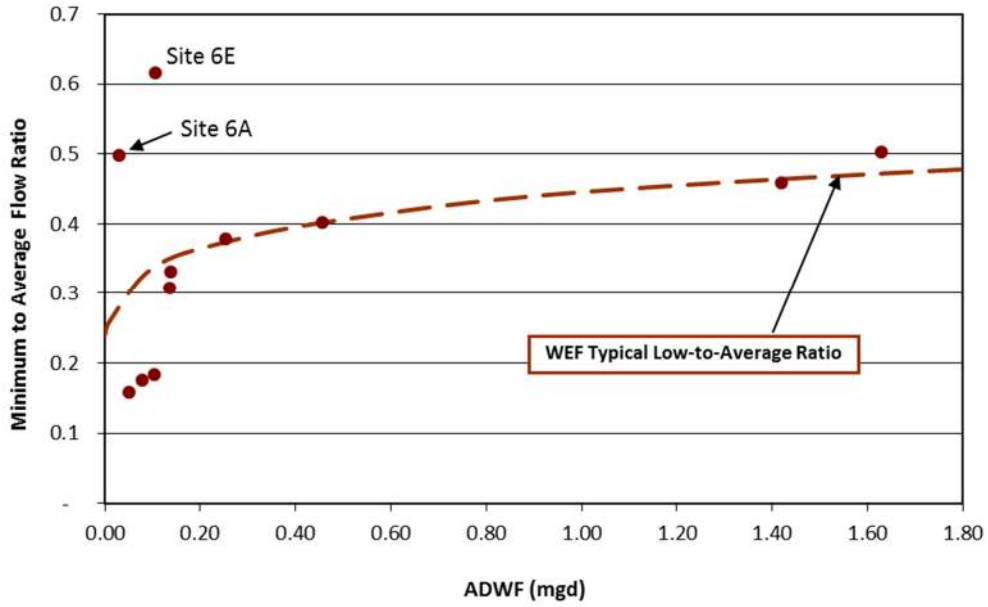


Figure 3-21. Minimum Flow Ratios vs ADWF[13]



Figure 3-22. Basins with Groundwater Infiltration

[13] Due to attenuation, it should be expected that sites with larger flow volumes should not have quite the peak-to-average and low-to-average flow ratios as sites with lesser flow volumes. This is why the WEF typical trend line's slope is closer to 1.0 as the ADWF increases, as shown in the figure.

4 Recommendations

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

1. **Master Plan and Model Implementation**: It is our understanding that this study is to be used for calibrating the hydraulic model and a master plan study to determine the overall needs of the City relative to I/I.
2. **Capacity Analysis:** Site 6 had a high average dry weather level and surcharged during the monitoring period. The City may want to analyze the capacity constraints in the updated master plan for the Sycamore Avenue trunk line.
3. **Determine I/I Reduction Program**: The City should examine its I/I reduction needs to determine their needs and goals for a future I/I reduction program.
    a. **Preface**: Per-Acre rankings should be reviewed with caution given disproportional densities basin-to-basin; normalized rankings should be used at the discretion of the City Engineer.
    b. 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. The highest inflow occurs in Basins 1, 6A, and 6B.
    c. 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. The highest combined I/I and RDI occurs in Basins 1, 5, and 6E, and Basins 6A and 6E show evidence of GWI.
4. **I/I Investigation Methods**: Potential I/I investigation methods include the following:
    a. **Smoke testing:** Basin 6A and 6B are recommended for smoke testing due to the small area but high normalized inflow rates.
    b. **Mini-basin Flow Monitoring:** Basin 1 is recommended for mini basin flow monitoring due to the high normalized inflow and infiltration and pipe arrangement allows for easy isolation of mini-basins.
    c. **Night-time reconnaissance:** Night-time I/I work can be implemented in future high I/I sub-basins to (1) investigate and determine direct point sources of inflow, and (2) determine the areas and/or pipe reaches responsible for high levels of infiltration contribution.
    d. CCTV inspection.
5. **I/I Reduction Cost Effective Analysis**: The City should conduct a study to determine which is more cost-effective: (1) locating the sources of inflow/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 Sites: Data, Graphs, Information

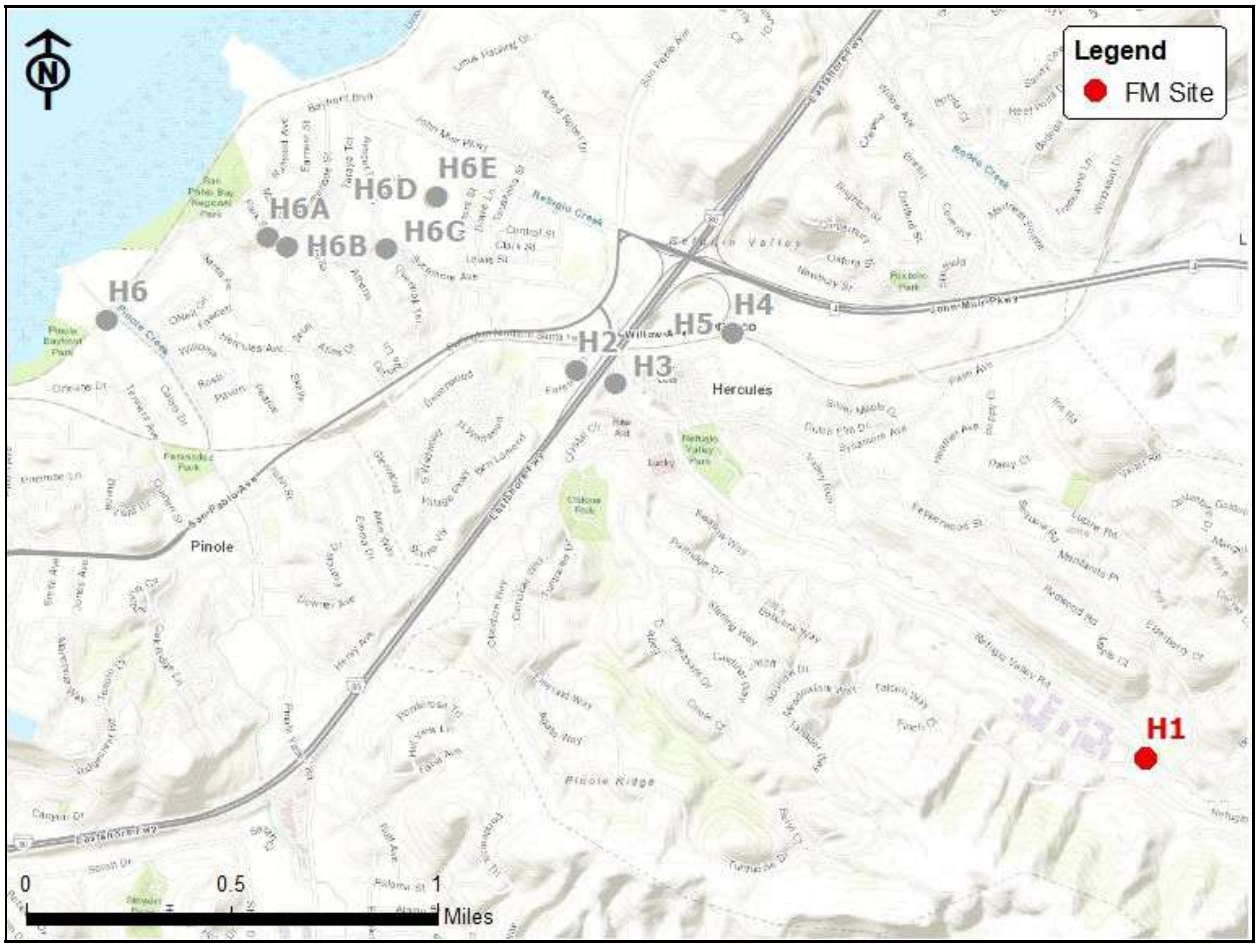
City of Hercules, California

Sanitary Sewer Flow Monitoring
January 14 - April 21, 2019

Monitoring Site: Site 1

Location: Refugio Valley Road North of Falcon Way

Data Summary Report



Vicinity Map: Site 1

SITE 1

Site Information

Location: Refugio Valley Road North of Falcon Way

Coordinates: 122.2486° W, 37.9977° N

Rim Elevation (Earth): 169 feet

Measured Pipe Diameter: 10 inches

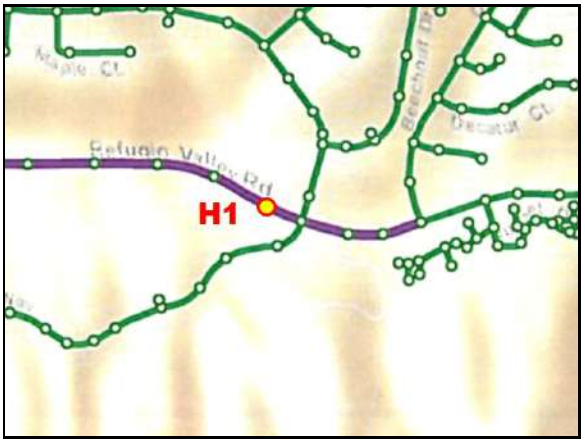
ADWF: 0.083 mgd

Peak Measured Flow: 0.616 mgd

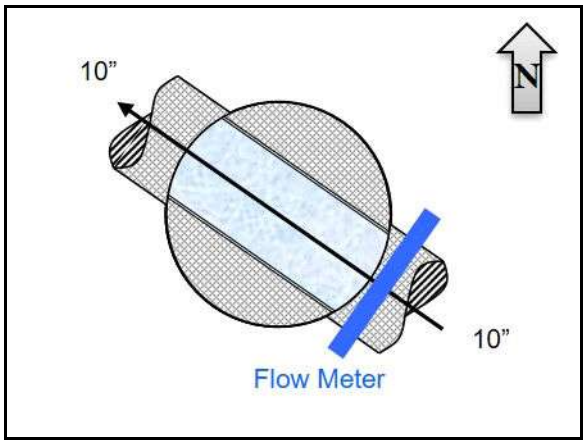
Sediment: None



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

SITE 1

Additional Site Photos

Effluent Pipe



Monitored Influent Pipe

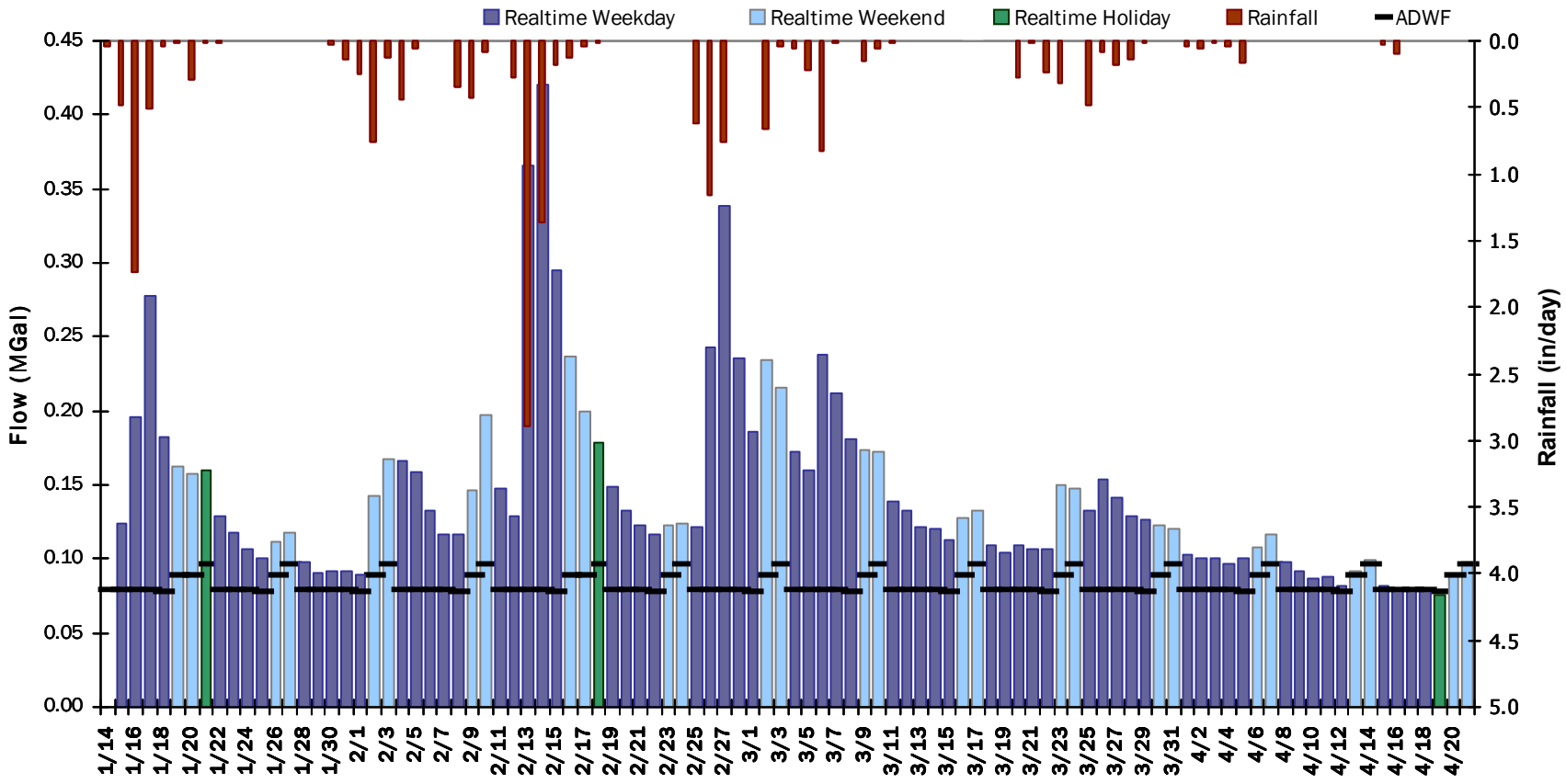


SITE 1

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.144 MGal Peak Daily Flow: 0.420 MGal Min Daily Flow: 0.076 MGal

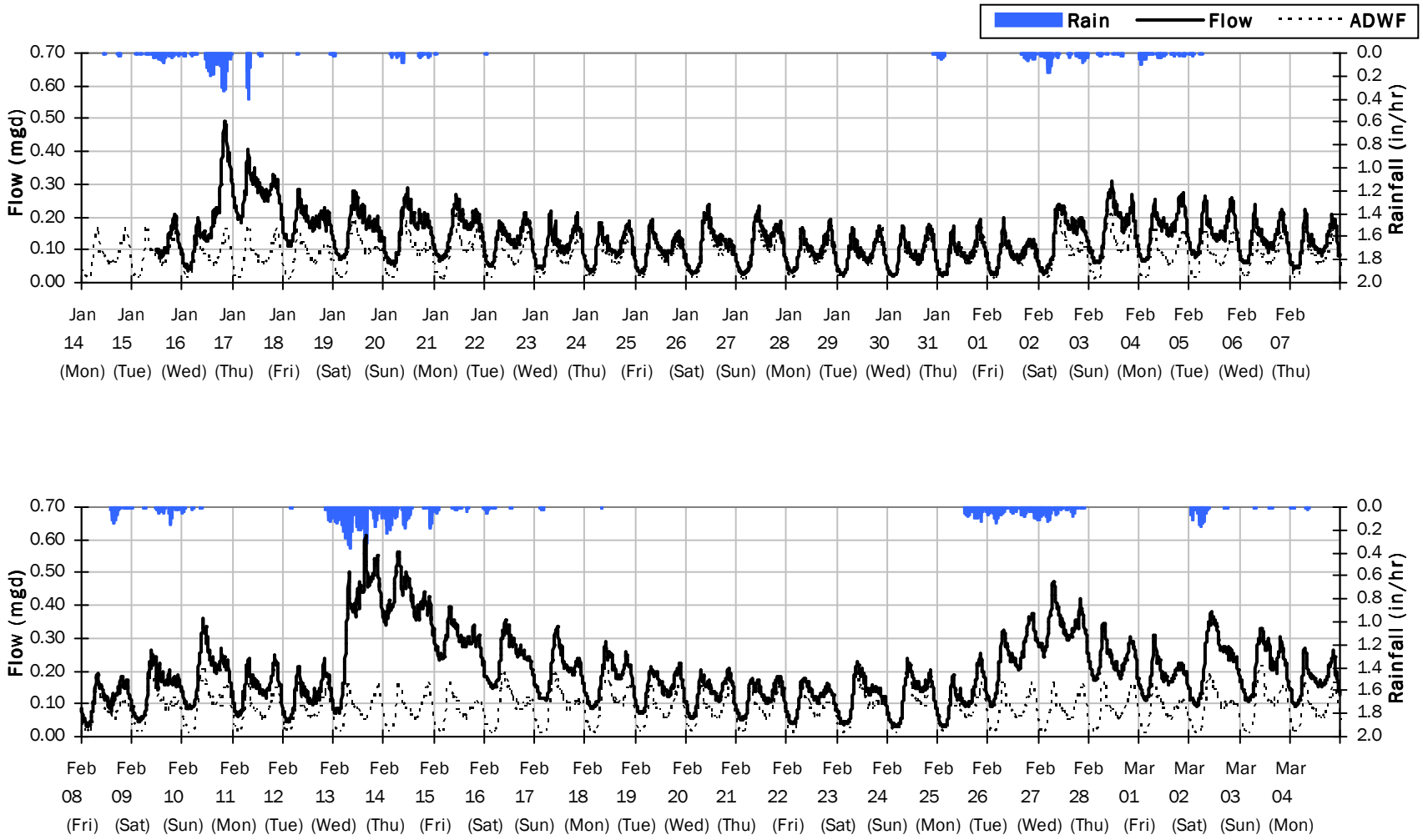
Total Rainfall: 17.20 inches



SITE 1

Flow Summary: 1/14/2019 to 3/4/2019

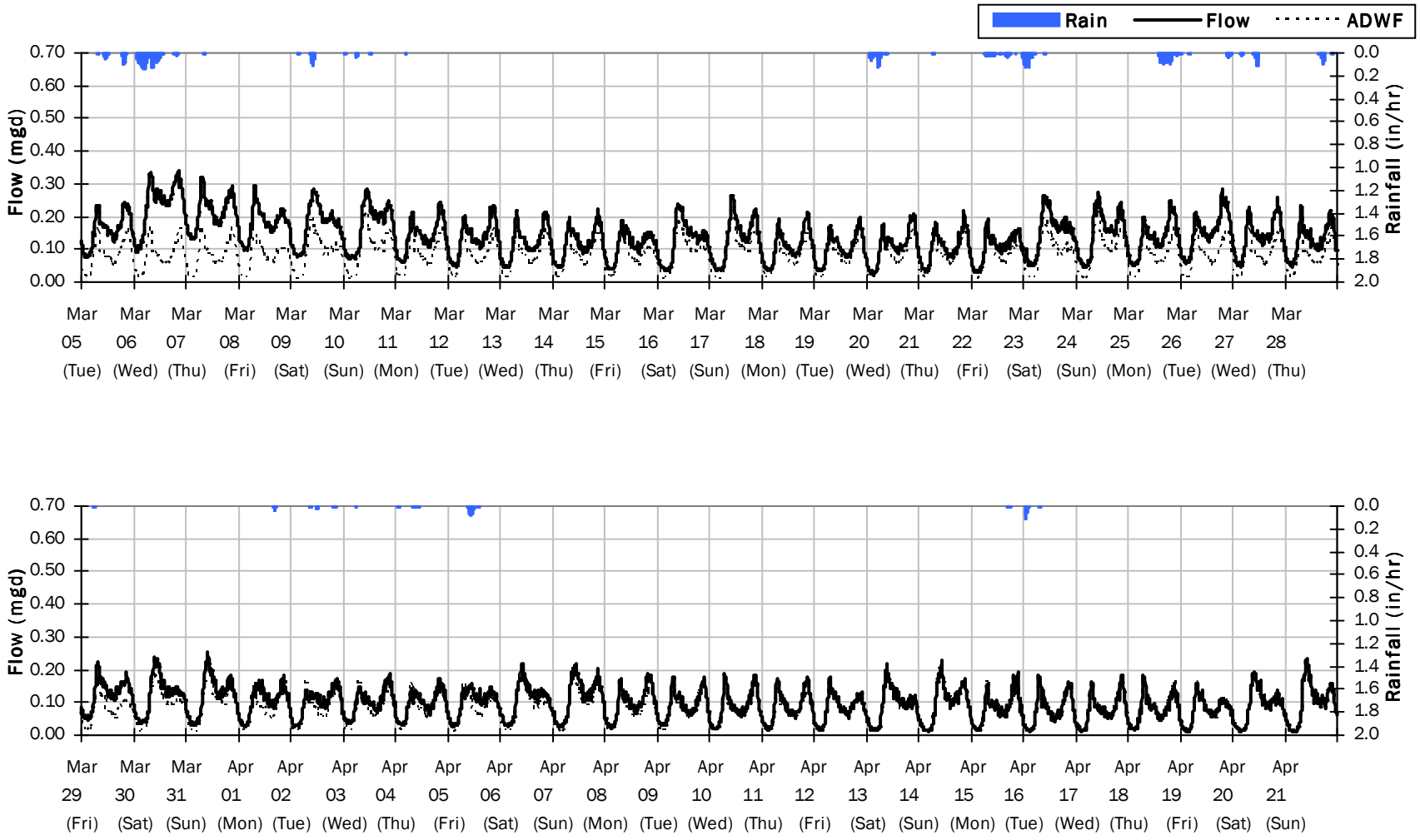
Period Rainfall: 13.90 inches Period Avg Flow: 0.168 mgd Period Peak Flow: 0.616 mgd Period Min Flow: 0.021 mgd



SITE 1

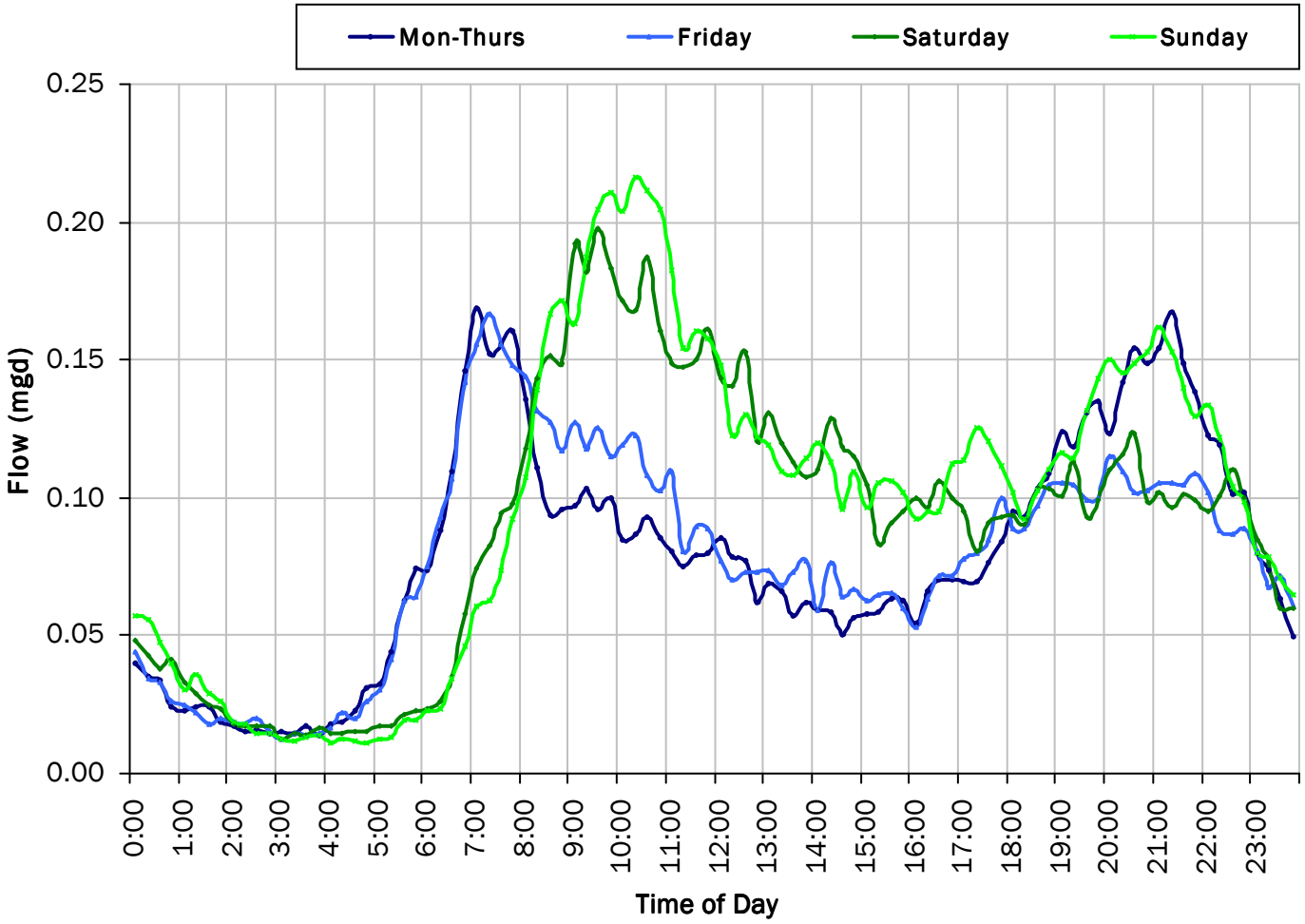
Flow Summary: 3/5/2019 to 4/21/2019

Period Rainfall: 3.45 inches Period Avg Flow: 0.119 mgd Period Peak Flow: 0.339 mgd Period Min Flow: 0.009 mgd



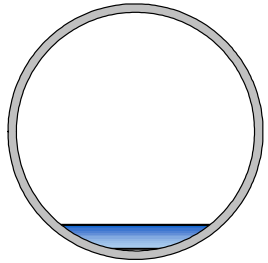
SITE 1

Average Dry Weather Flow Hydrographs



ADWF:

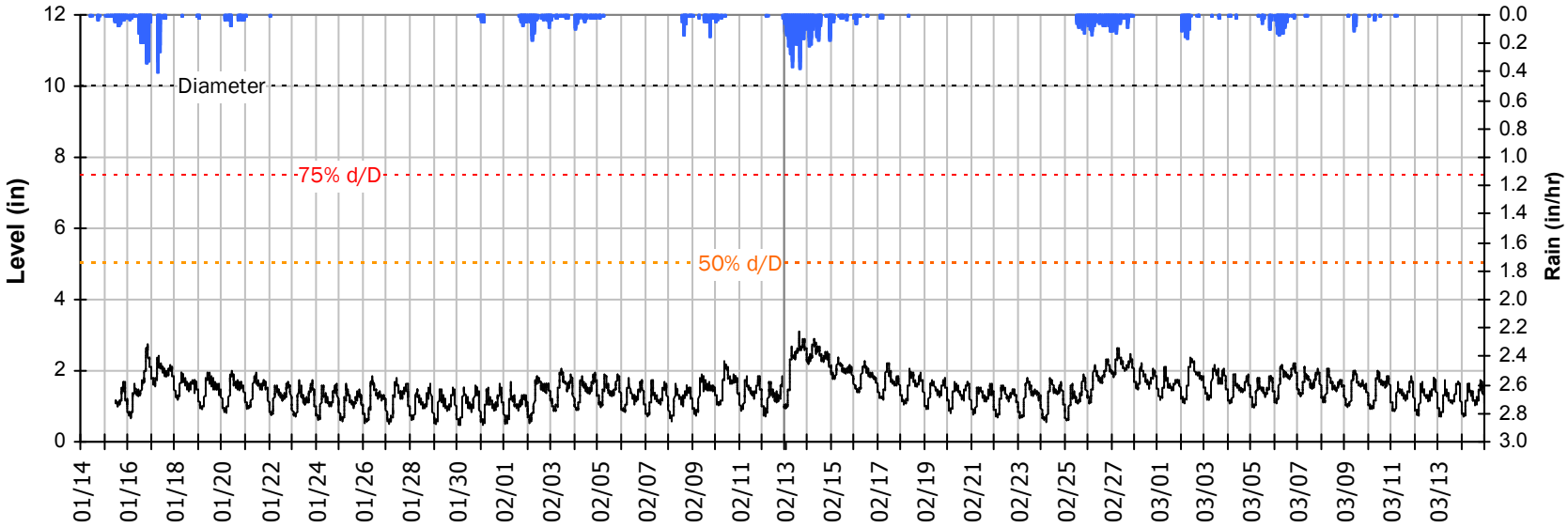
0.083 *mgd*

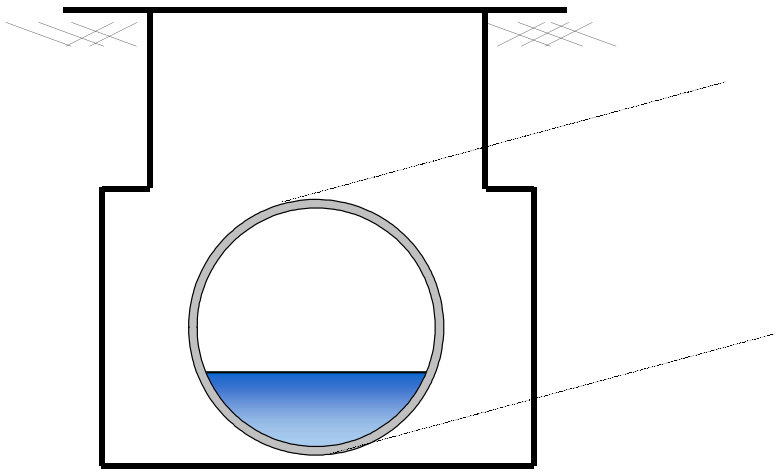


SITE 1

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

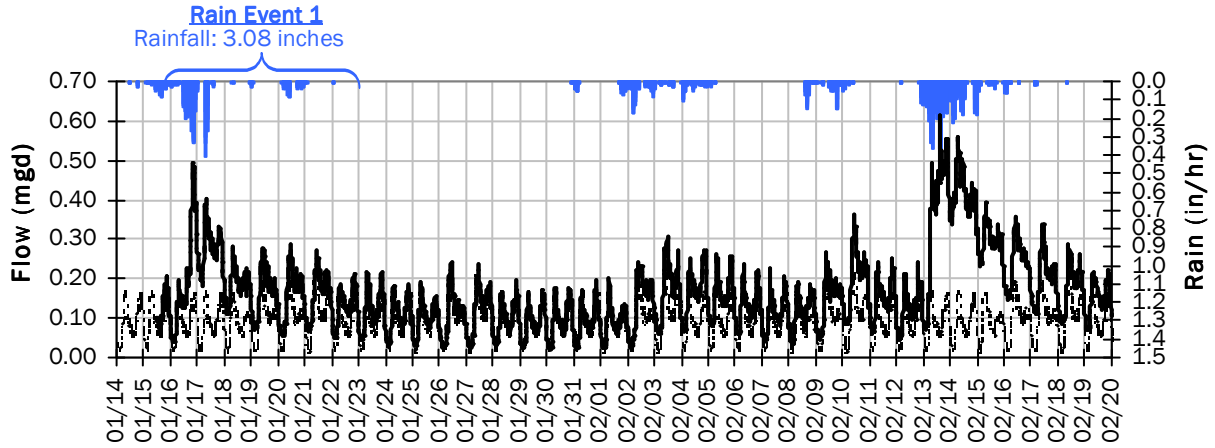




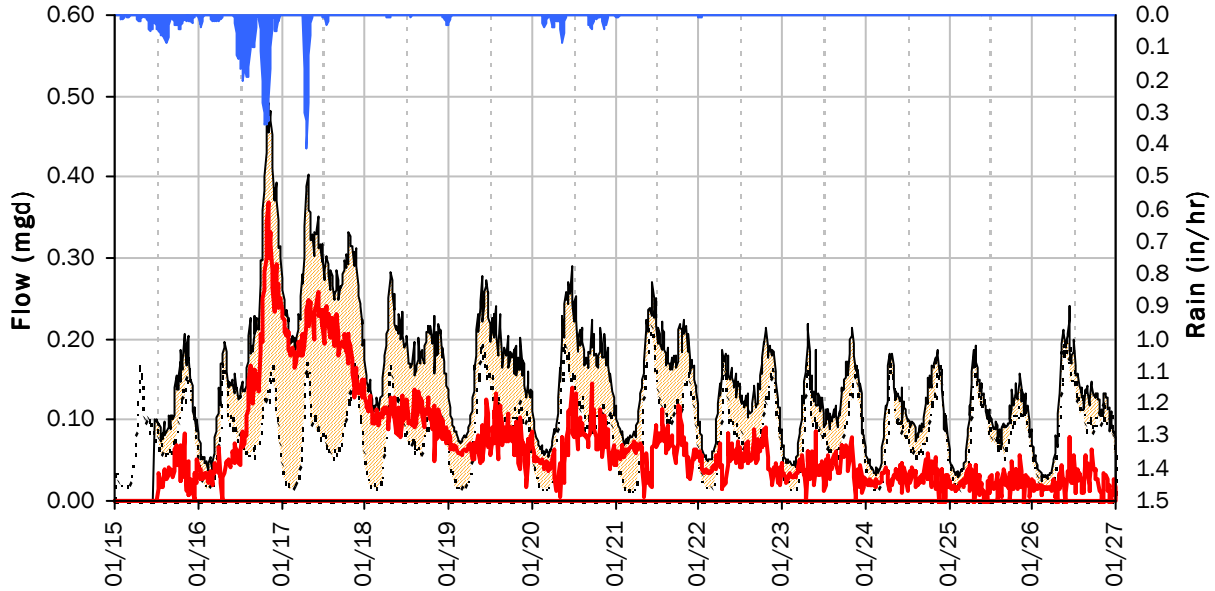
Pipe Diameter:	10	*inches*
Peak Measured Level:	3.08	*inches*
Peak d/D Ratio:	0.31	

SITE 1
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph

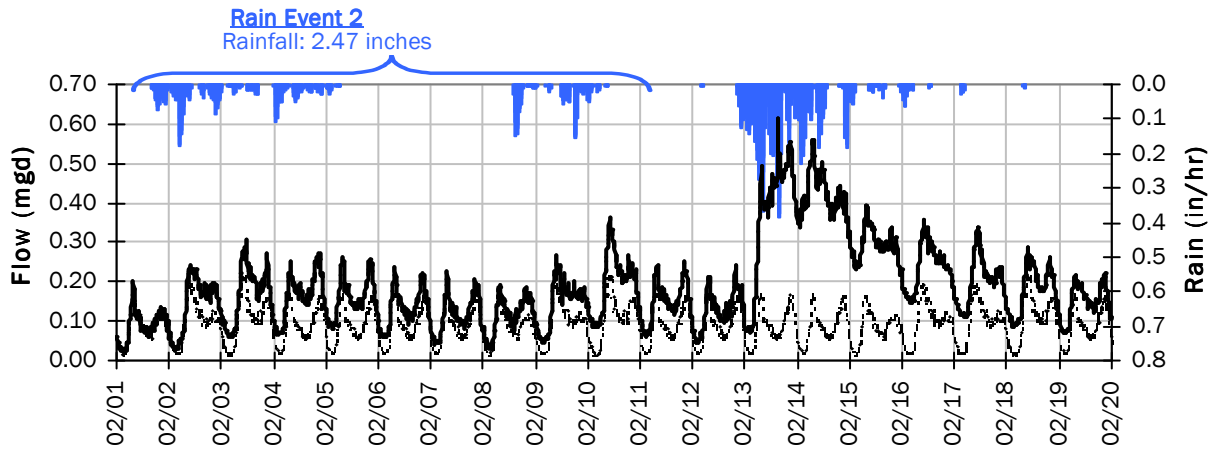


Storm Event I/I Analysis (Rain = 3.08 inches)

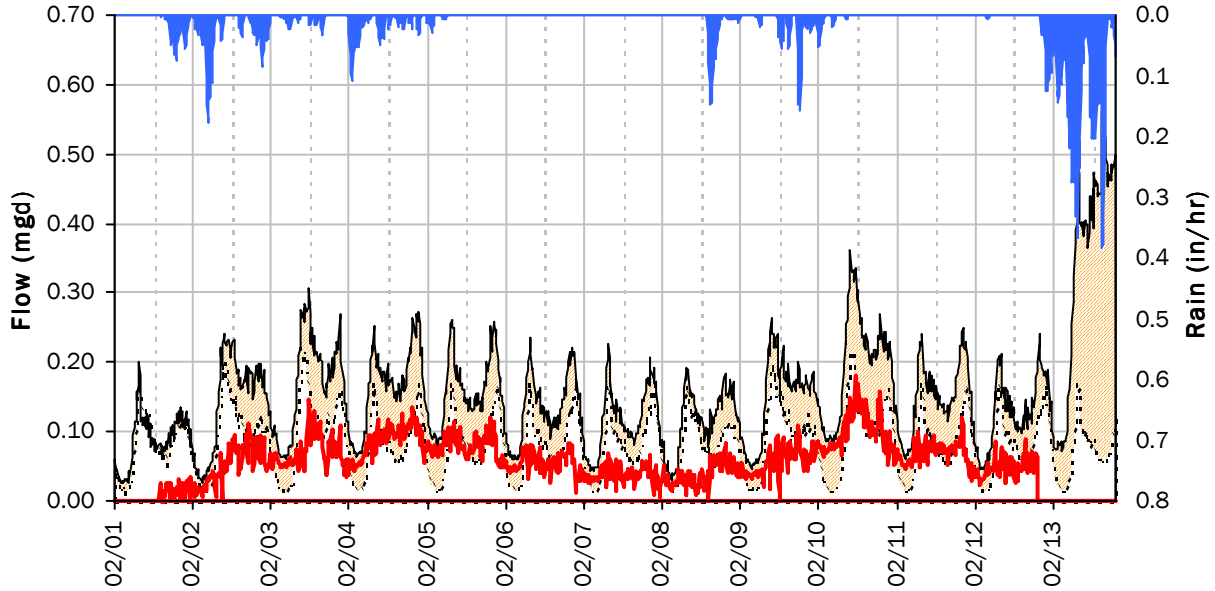
Capacity		Inflow / Infiltration	
Peak Flow:	0.492 *mgd*	**Peak I/I Rate:**	0.368 *mgd*
PF:	5.92	**Total I/I:**	779,000 *gallons*
Peak Level:	2.73 *in*		
d/D Ratio:	0.27		

SITE 1
I/I Summary: Rain Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 2 Detail Graph

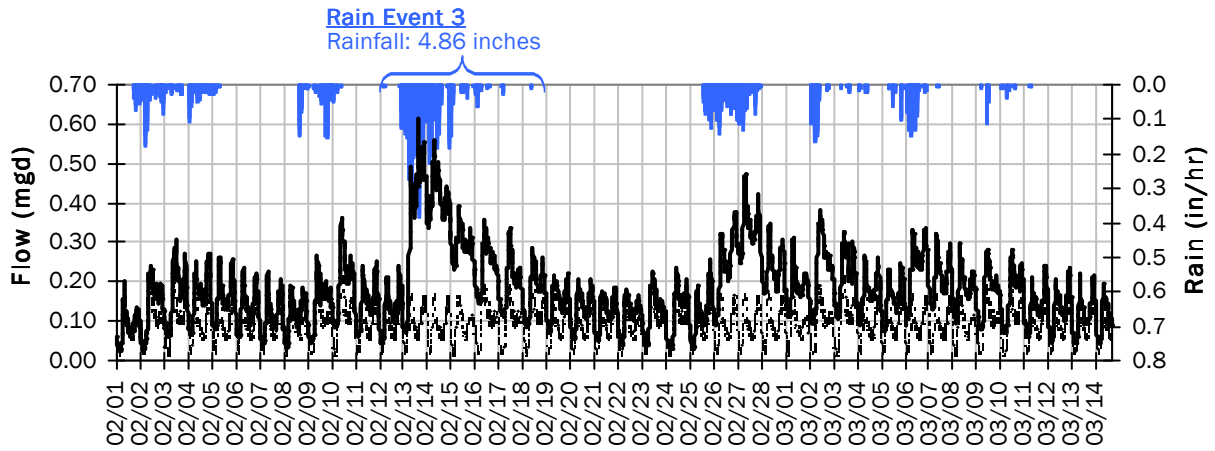


Storm Event I/I Analysis (Rain = 2.47 inches)

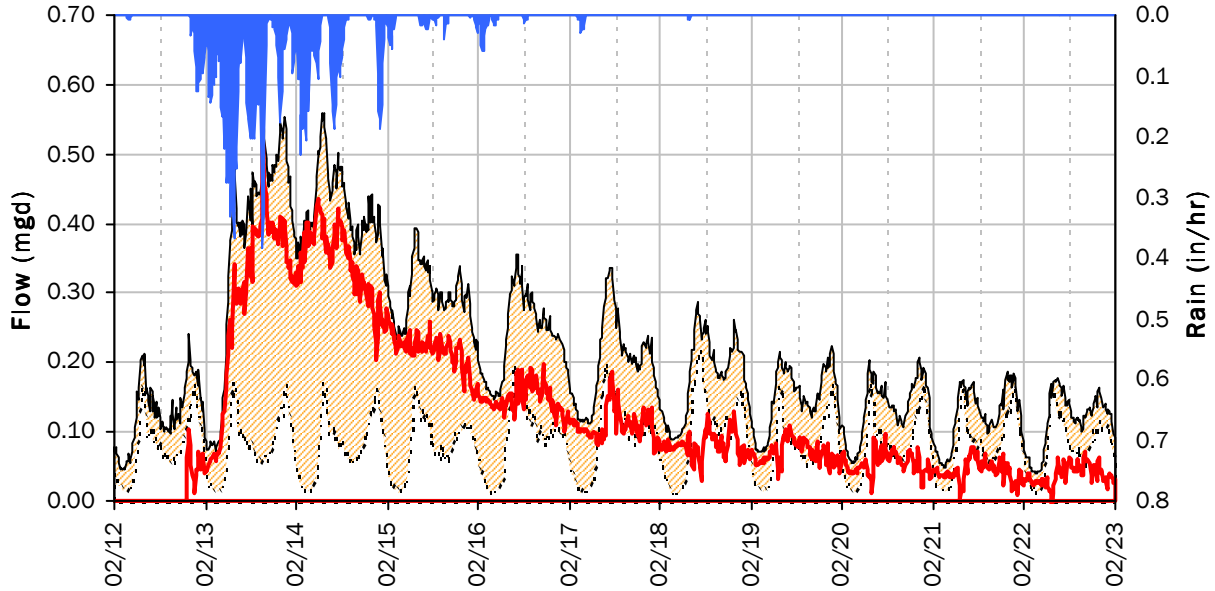
Capacity		Inflow / Infiltration	
Peak Flow:	0.361 *mgd*	**Peak I/I Rate:**	0.180 *mgd*
PF:	4.34	**Total I/I:**	689,000 *gallons*
Peak Level:	2.27 *in*		
d/D Ratio:	0.23		

SITE 1
I/I Summary: Rain Event 3

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3 Detail Graph

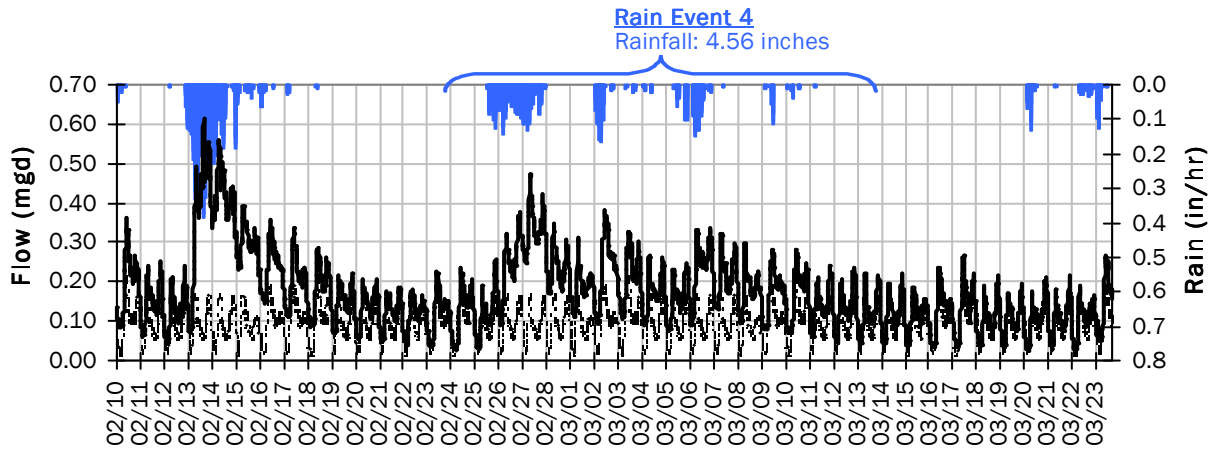


Storm Event I/I Analysis (Rain = 4.86 inches)

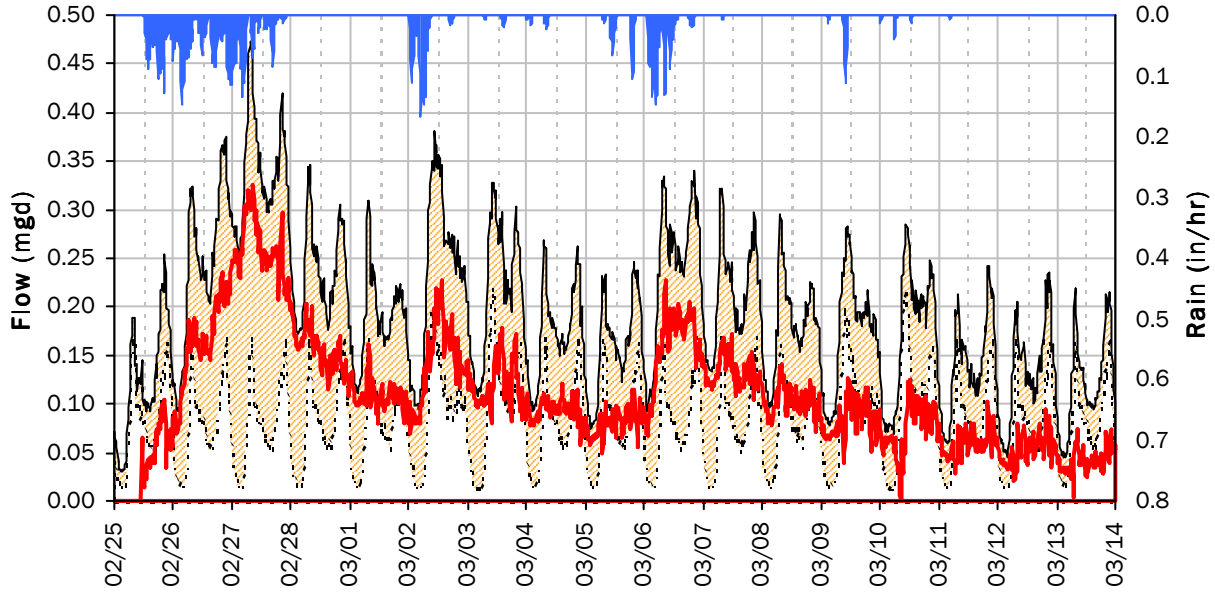
Capacity		Inflow / Infiltration	
Peak Flow:	0.62 *mgd*	**Peak I/I Rate:**	0.56 *mgd*
PF:	7.40	**Total I/I:**	1,400,000 *gallons*
Peak Level:	3.08 *in*		
d/D Ratio:	0.31		

SITE 1
I/I Summary: Rain Event 4

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 4 Detail Graph

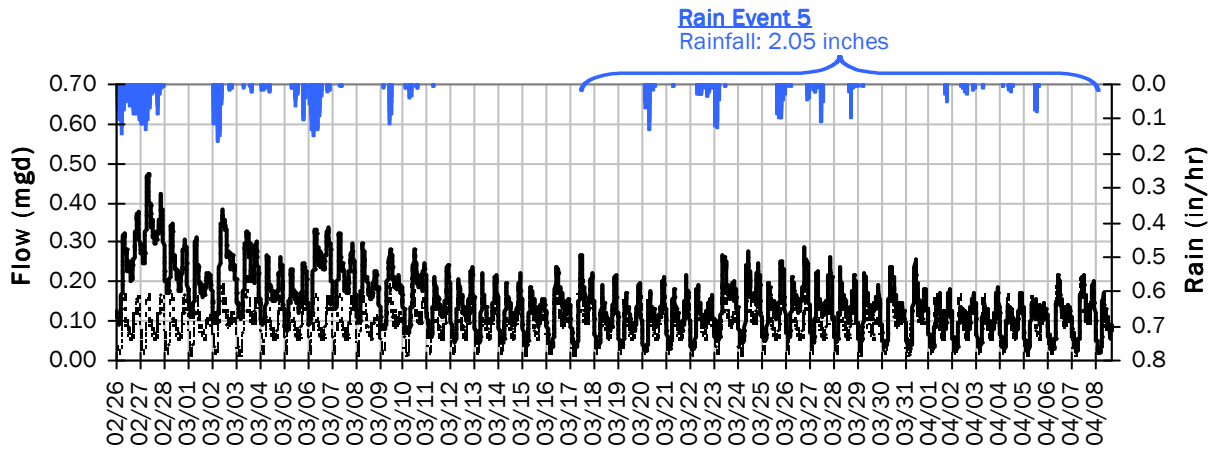


Storm Event I/I Analysis (Rain = 4.56 inches)

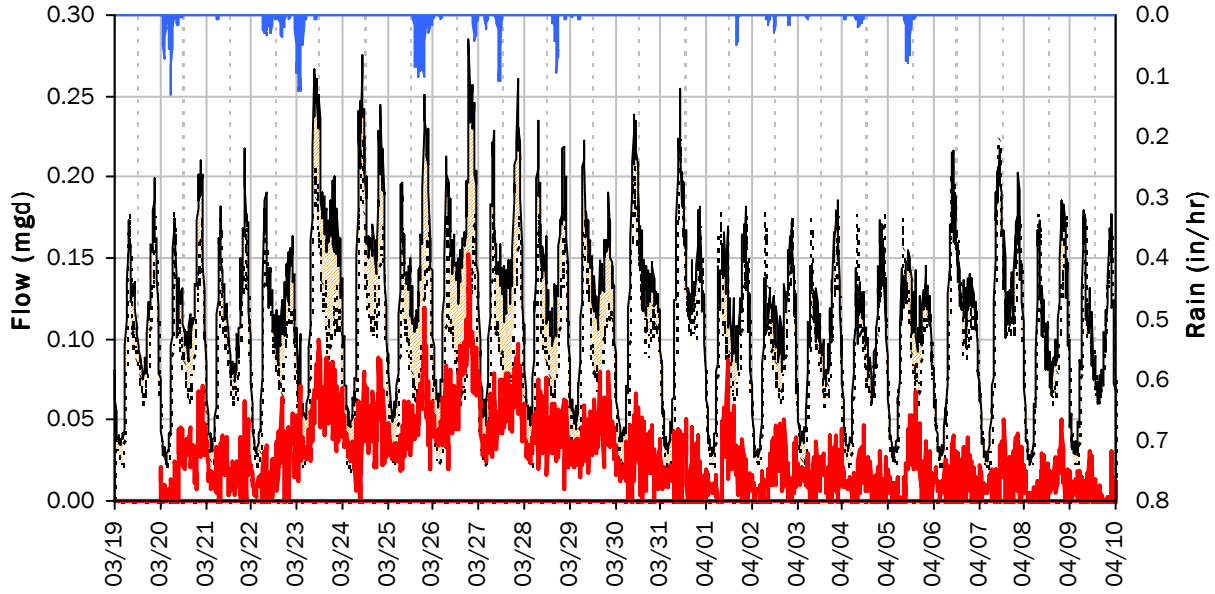
Capacity		Inflow / Infiltration	
Peak Flow:	0.47 *mgd*	**Peak I/I Rate:**	0.33 *mgd*
PF:	5.70	**Total I/I:**	1,866,000 *gallons*
Peak Level:	2.64 *in*		
d/D Ratio:	0.26		

SITE 1
I/I Summary: Rain Event 5

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 5 Detail Graph



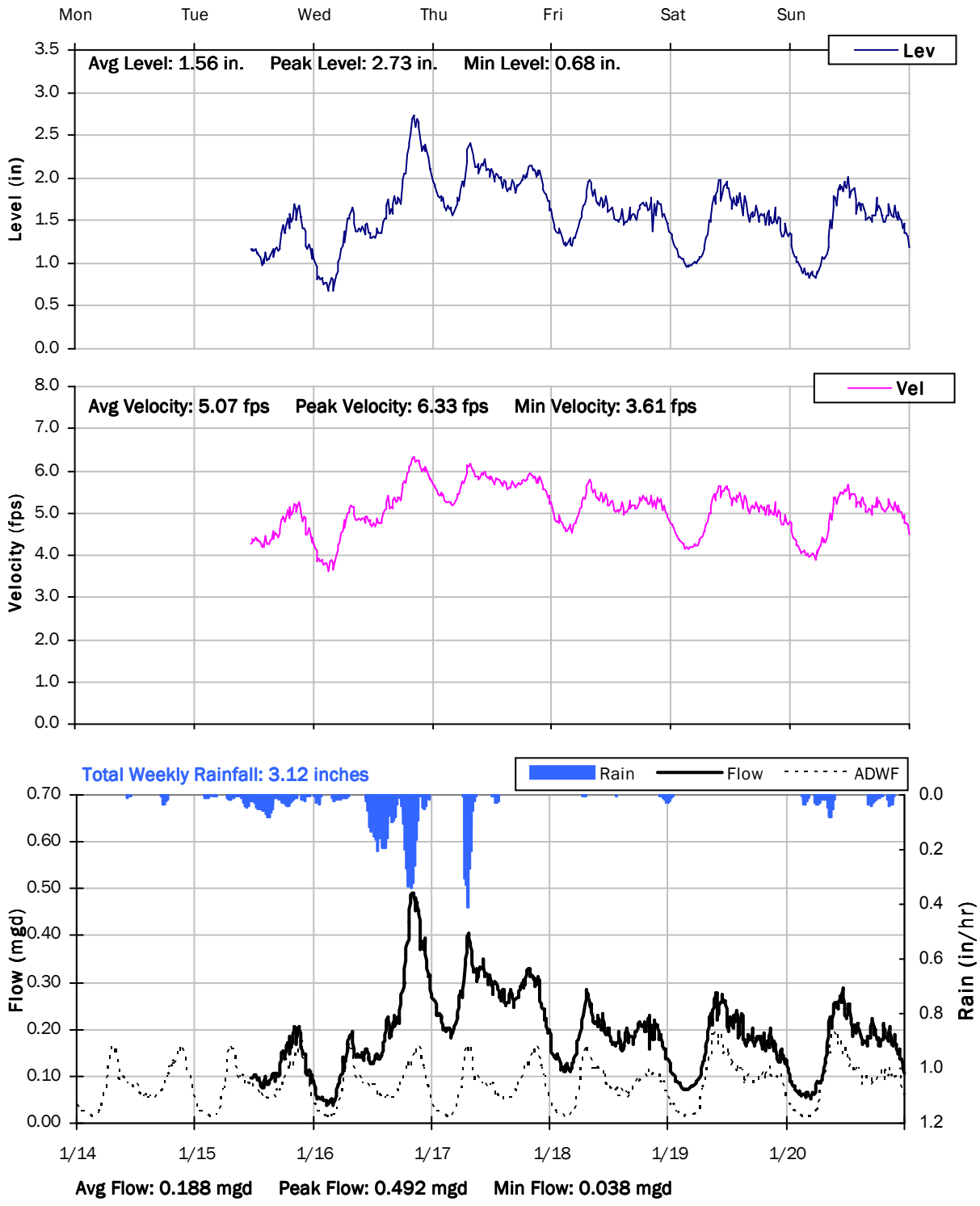
Storm Event I/I Analysis (Rain = 2.05 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.29 *mgd*	**Peak I/I Rate:**	0.15 *mgd*
PF:	3.42	**Total I/I:**	550,000 *gallons*
Peak Level:	1.97 *in*		
d/D Ratio:	0.20		

SITE 1

Weekly Level, Velocity and Flow Hydrographs

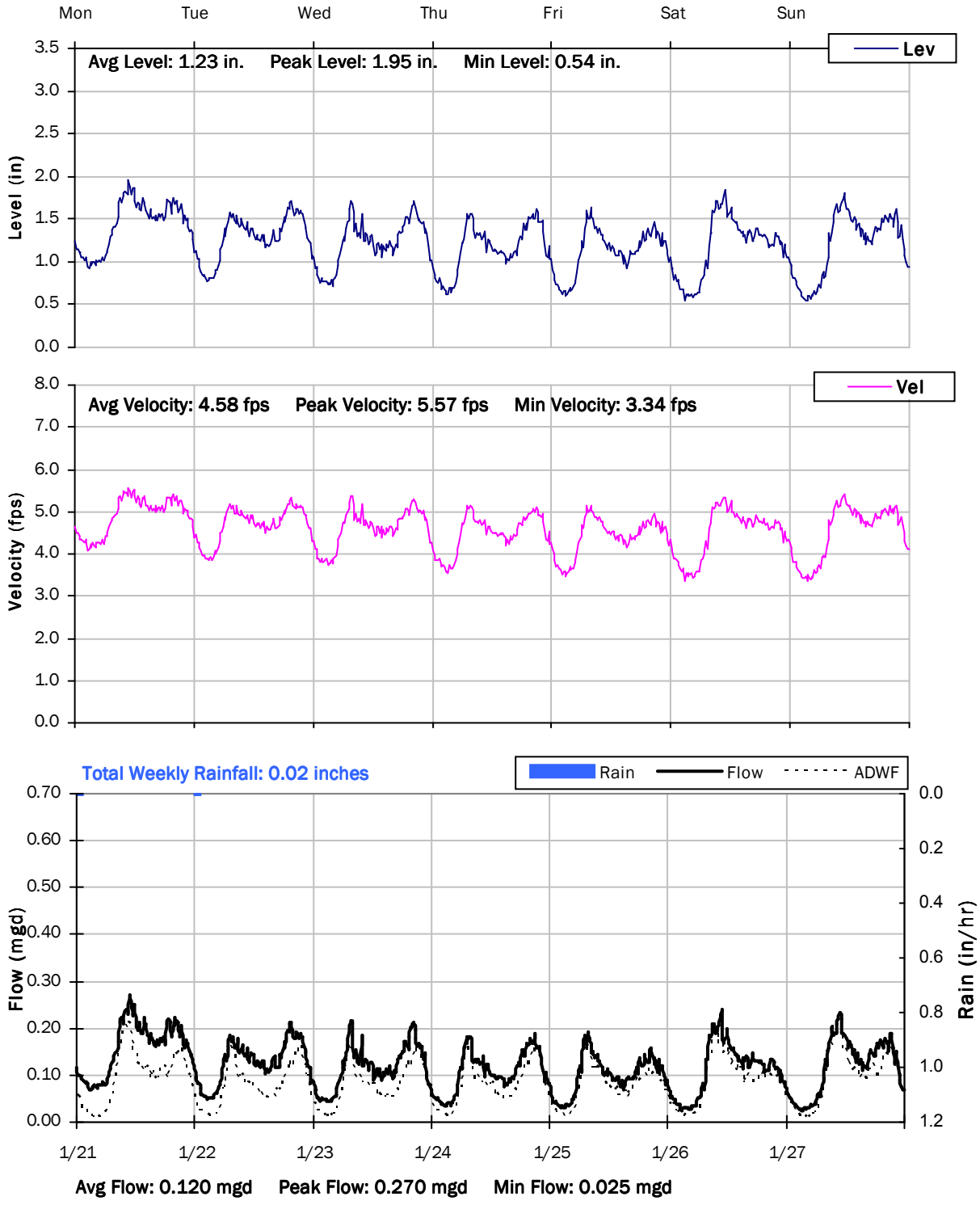
1/14/2019 to 1/21/2019



SITE 1

Weekly Level, Velocity and Flow Hydrographs

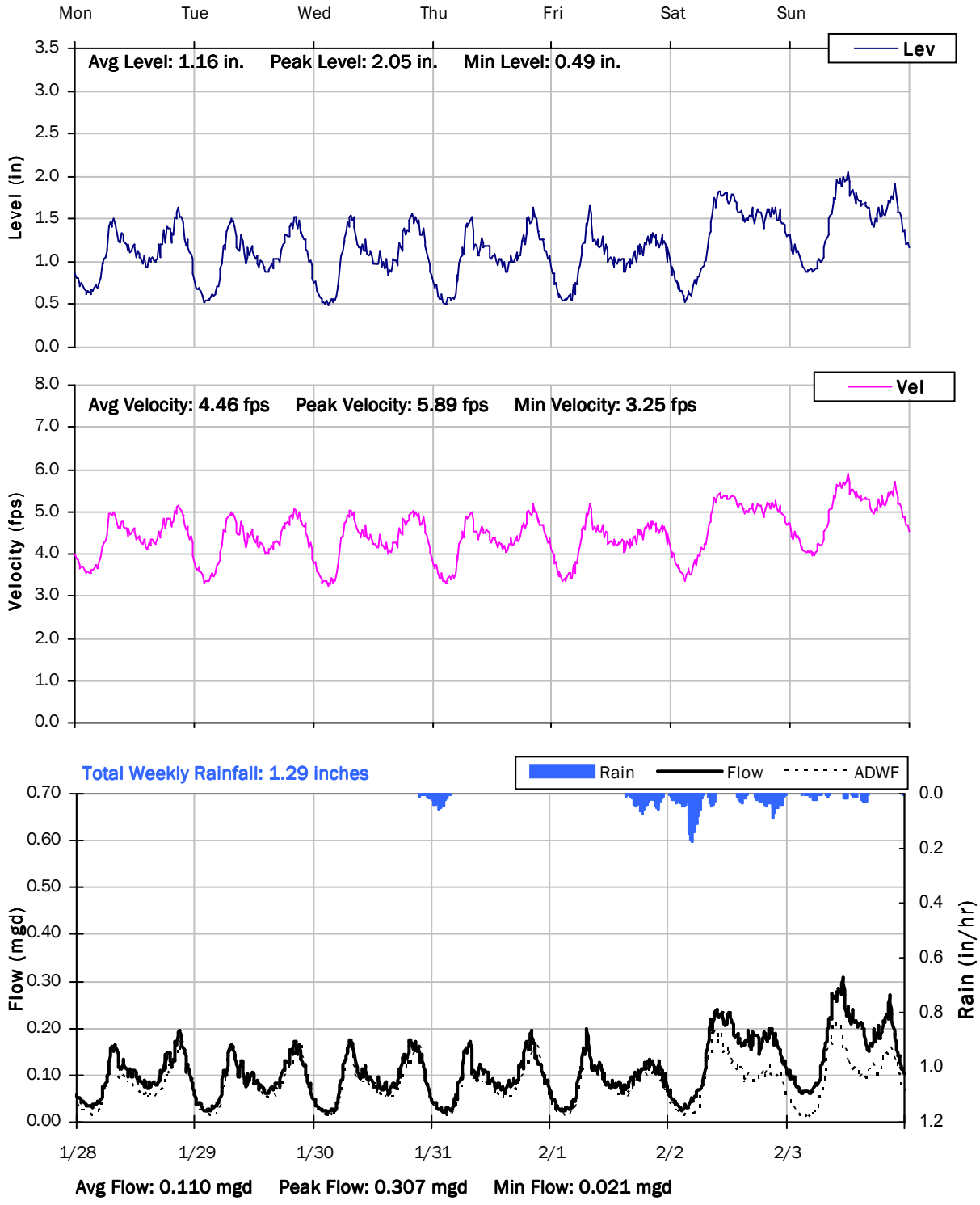
1/21/2019 to 1/28/2019



SITE 1

Weekly Level, Velocity and Flow Hydrographs

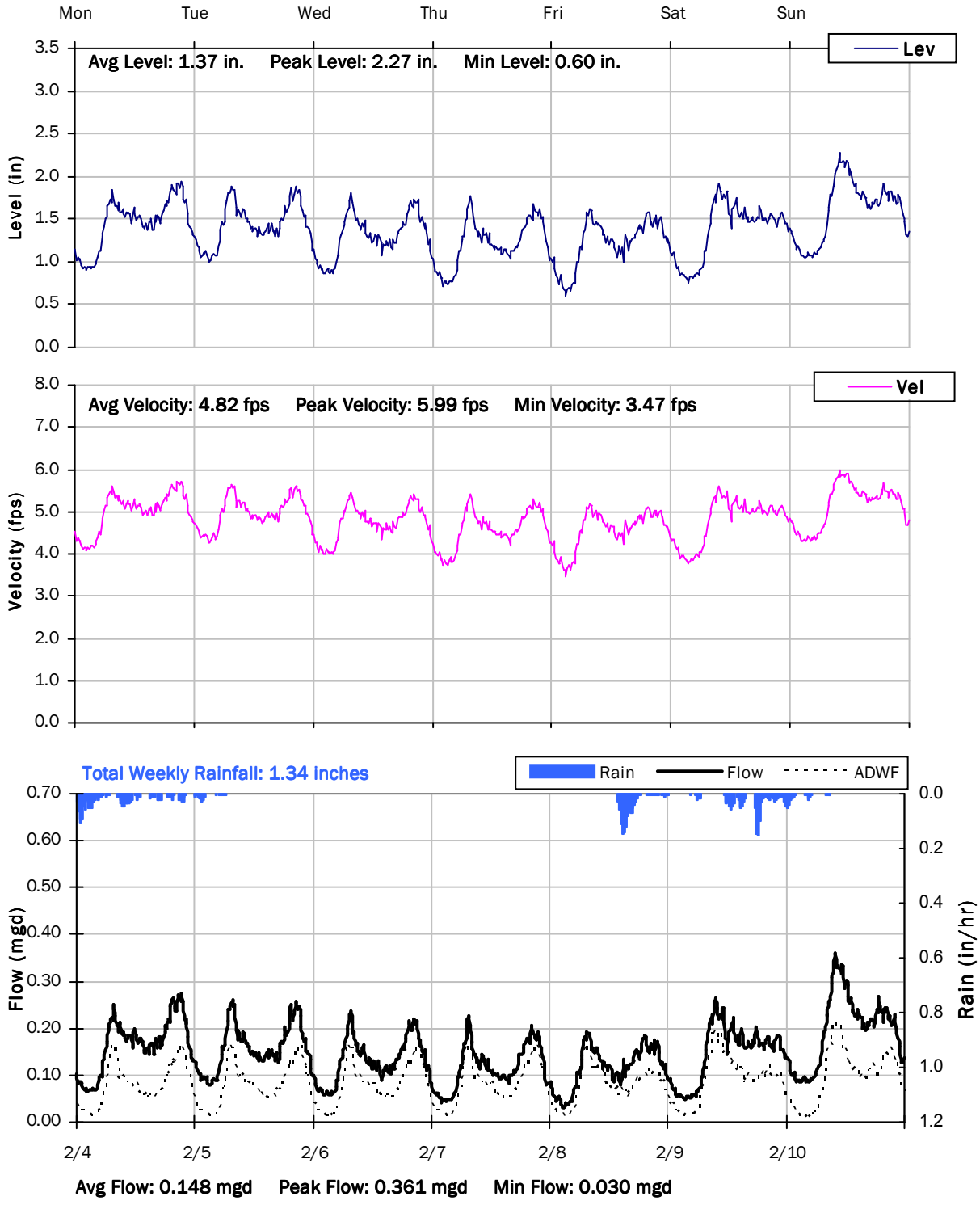
1/28/2019 to 2/4/2019



SITE 1

Weekly Level, Velocity and Flow Hydrographs

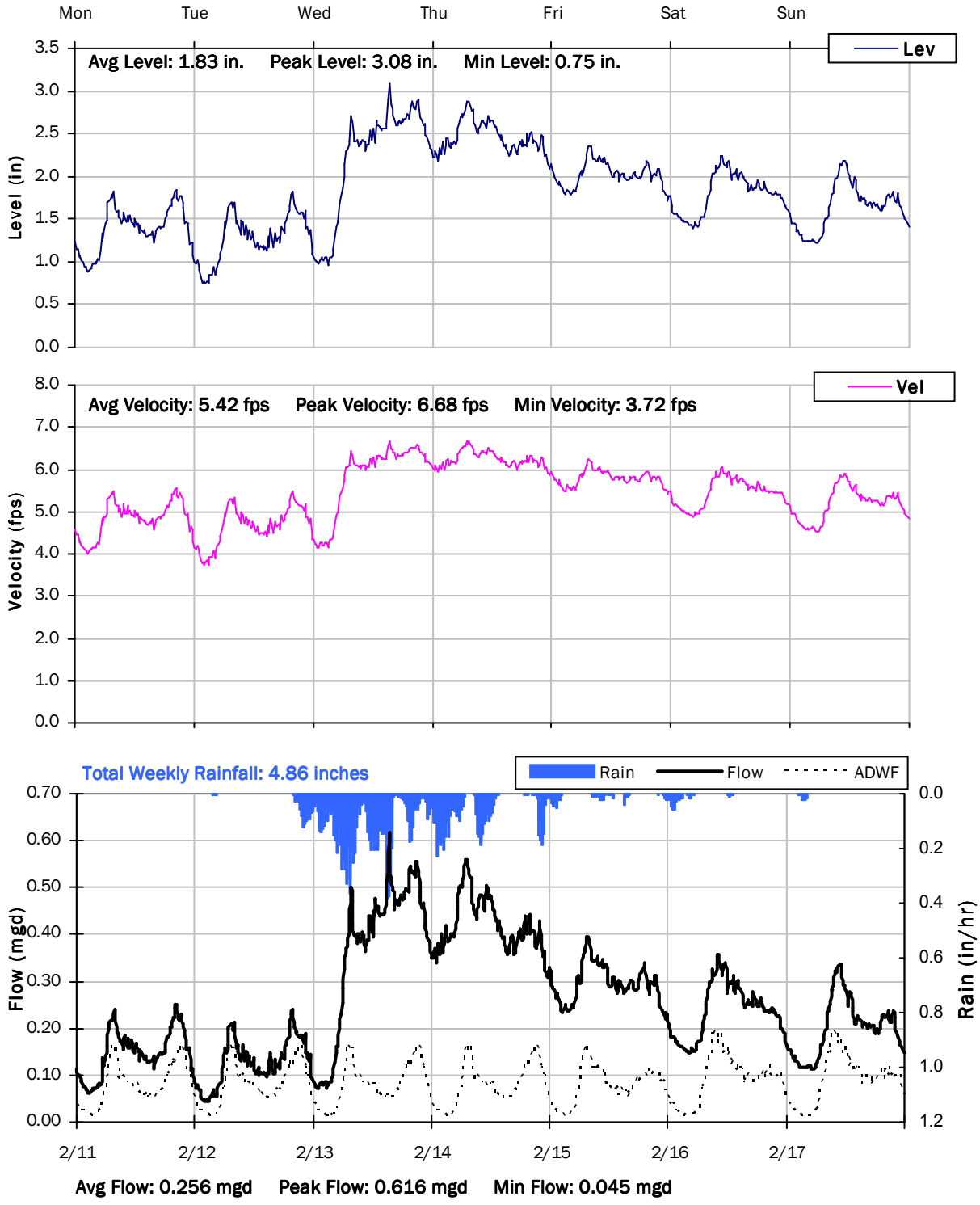
2/4/2019 to 2/11/2019



SITE 1

Weekly Level, Velocity and Flow Hydrographs

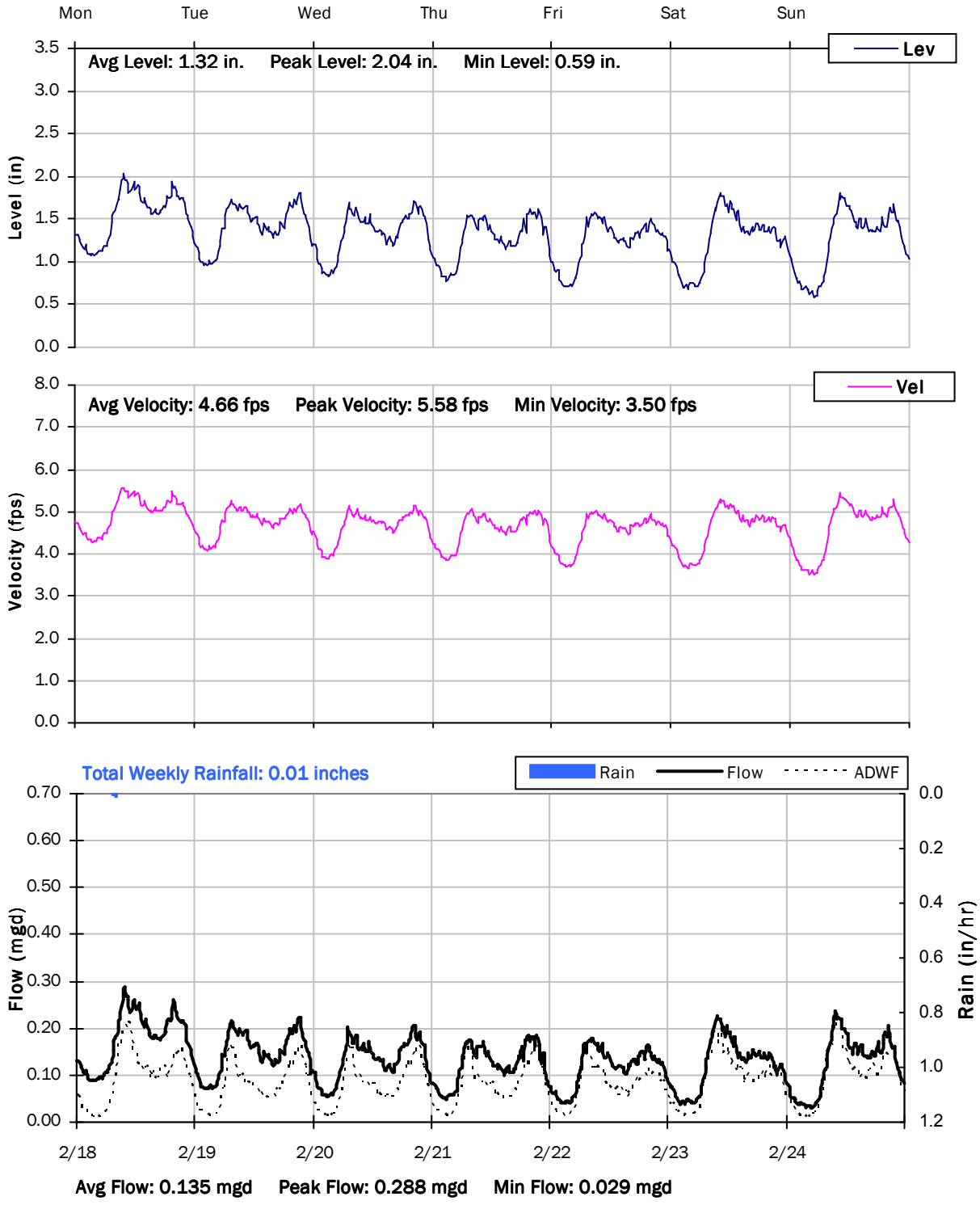
2/11/2019 to 2/18/2019



SITE 1

Weekly Level, Velocity and Flow Hydrographs

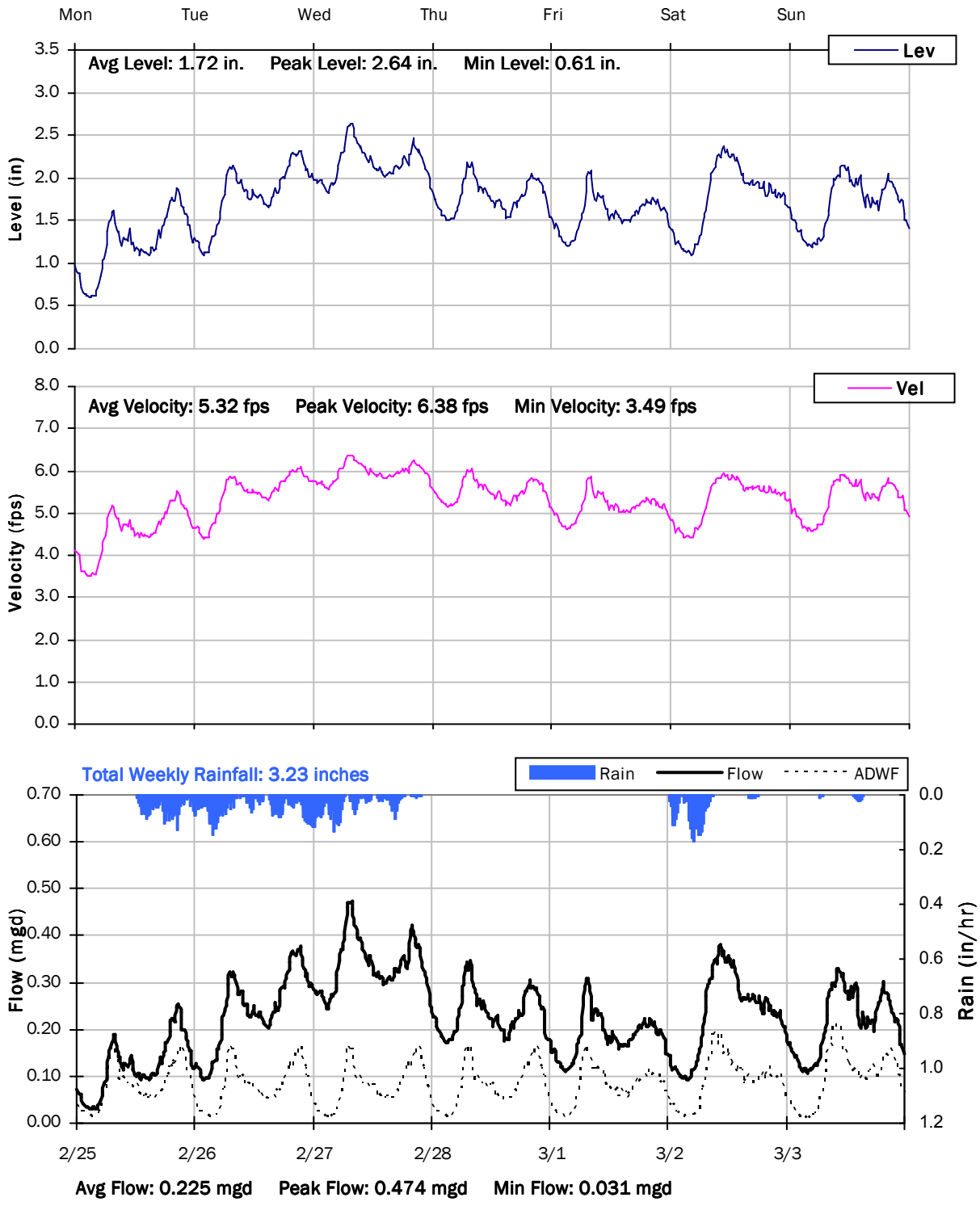
2/18/2019 to 2/25/2019



SITE 1

Weekly Level, Velocity and Flow Hydrographs

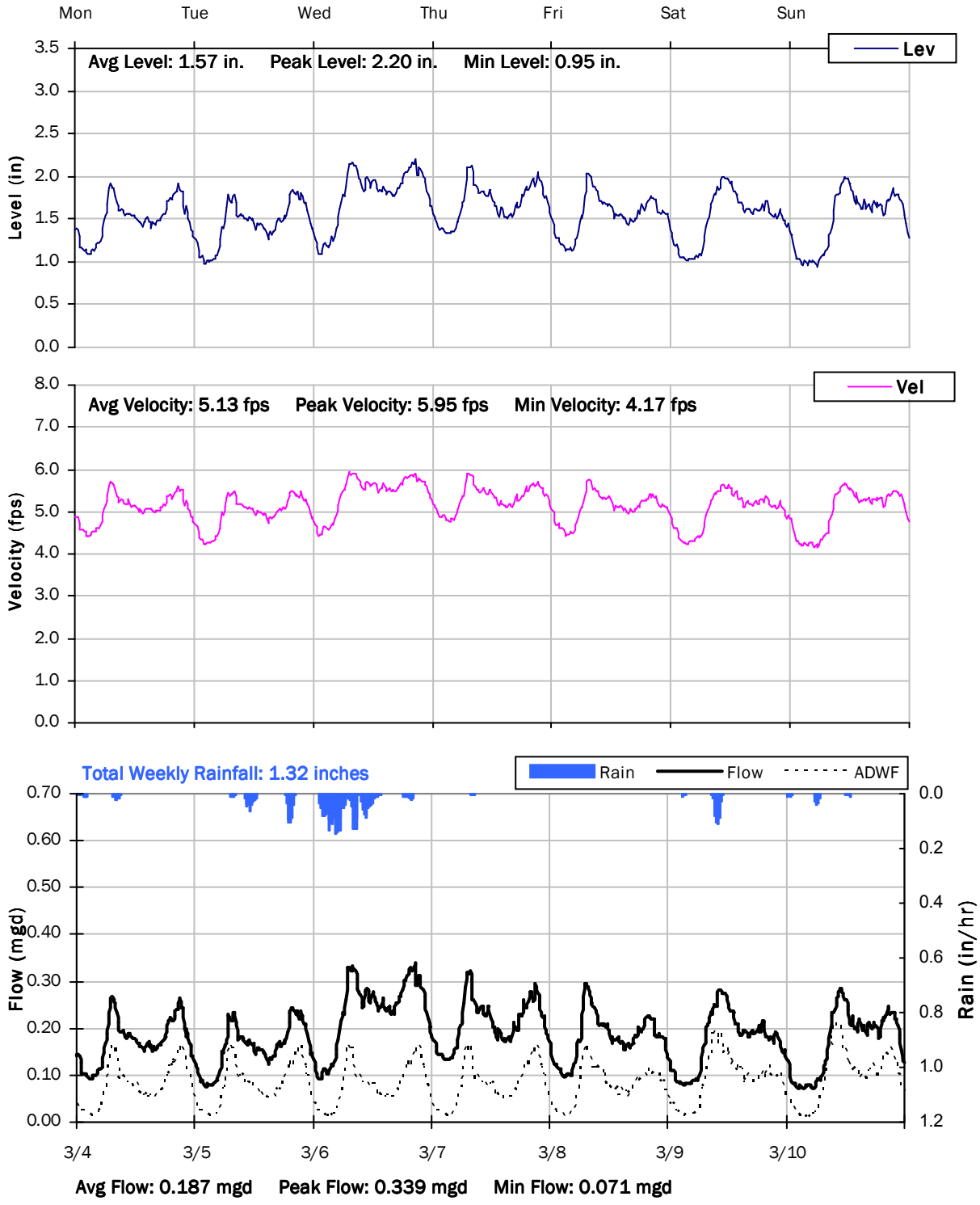
2/25/2019 to 3/4/2019



SITE 1

Weekly Level, Velocity and Flow Hydrographs

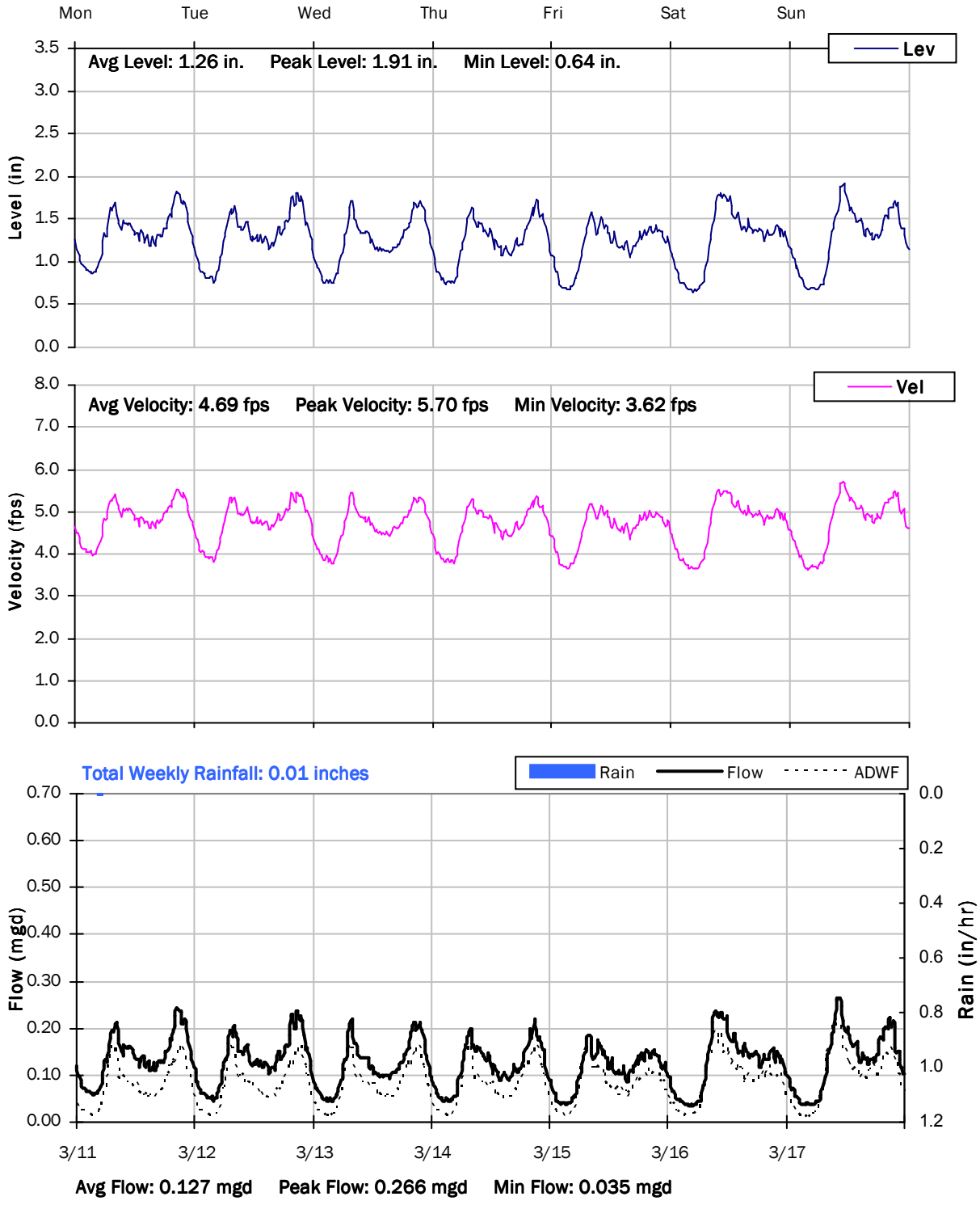
3/4/2019 to 3/11/2019



SITE 1

Weekly Level, Velocity and Flow Hydrographs

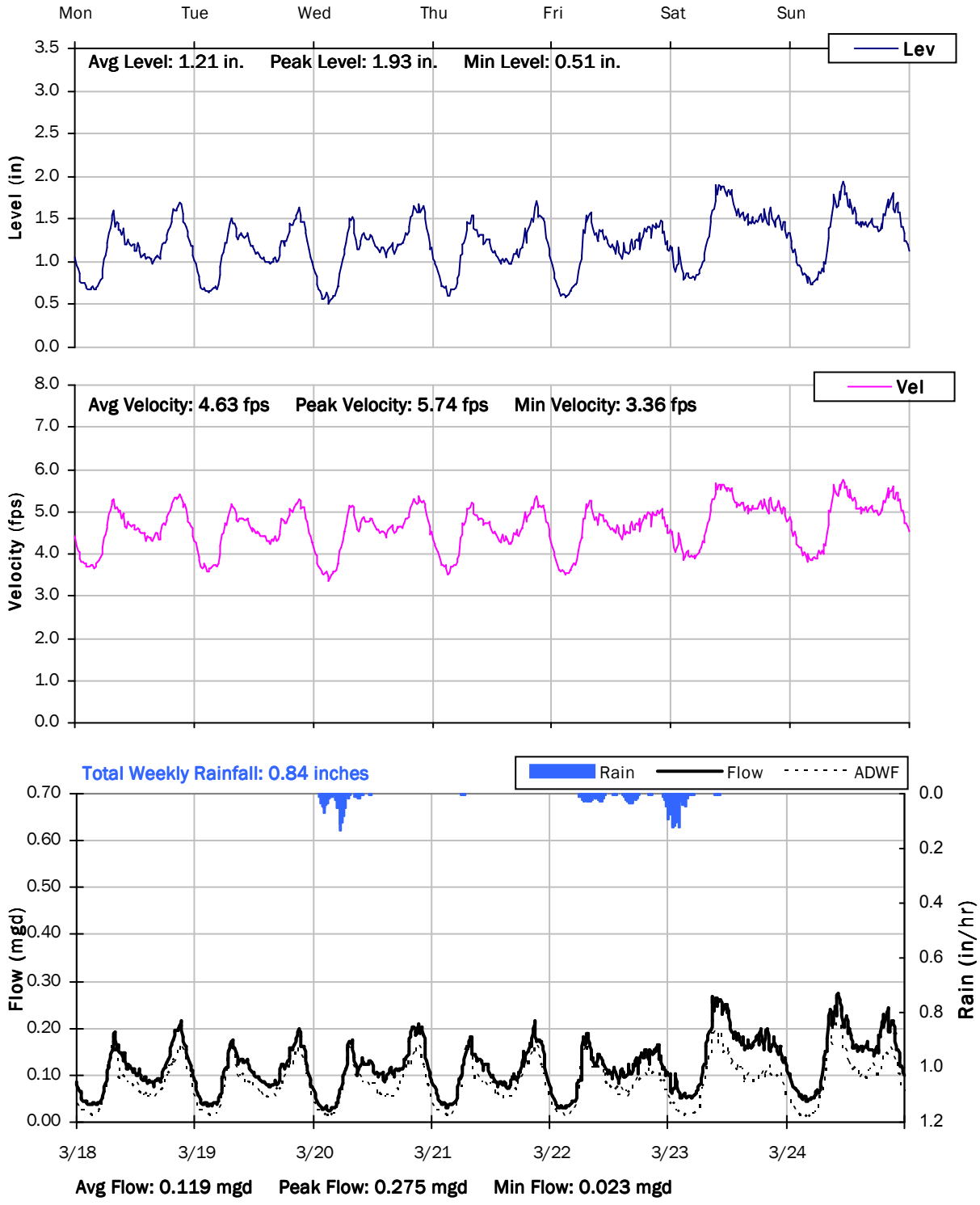
3/11/2019 to 3/18/2019



SITE 1

Weekly Level, Velocity and Flow Hydrographs

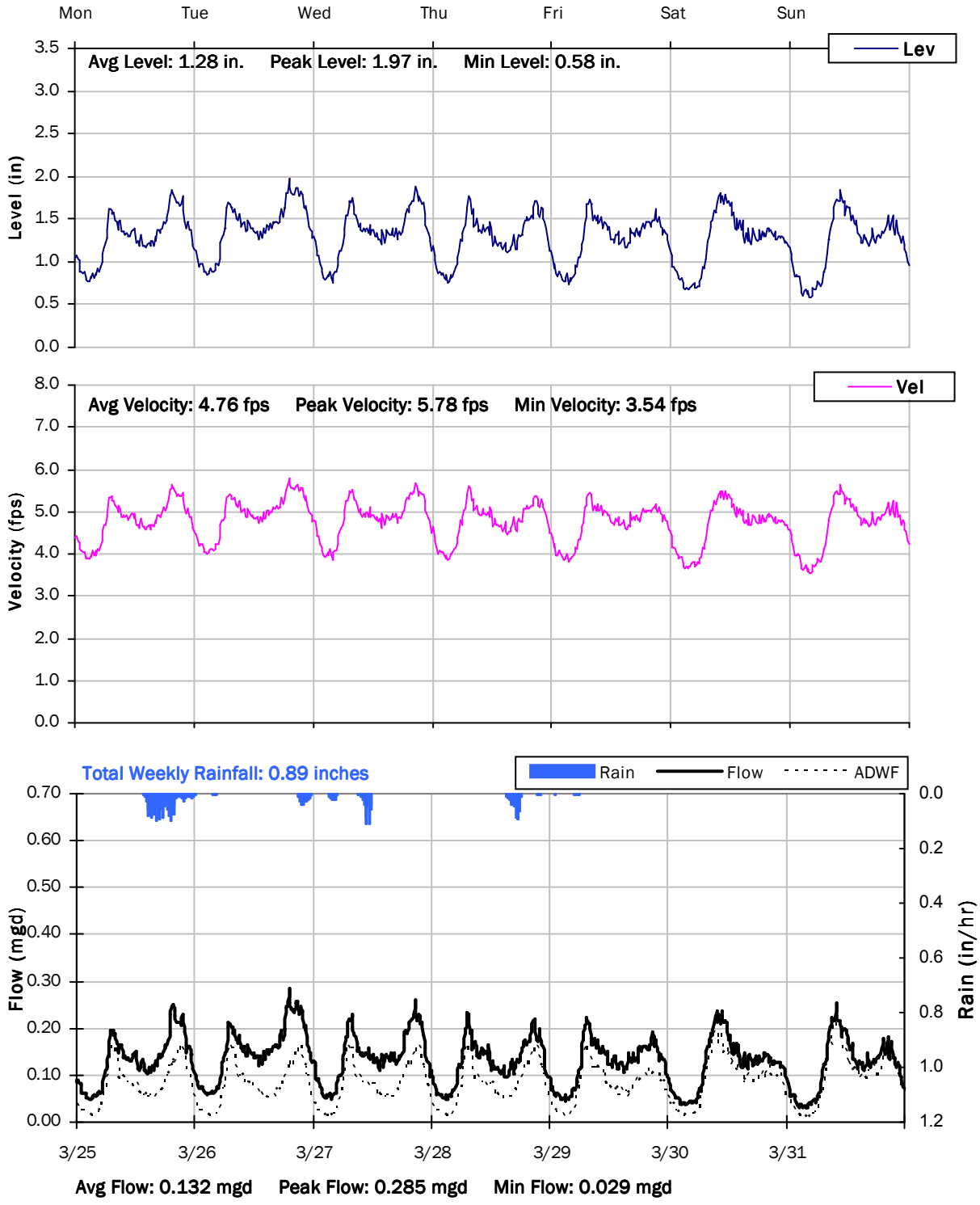
3/18/2019 to 3/25/2019



SITE 1

Weekly Level, Velocity and Flow Hydrographs

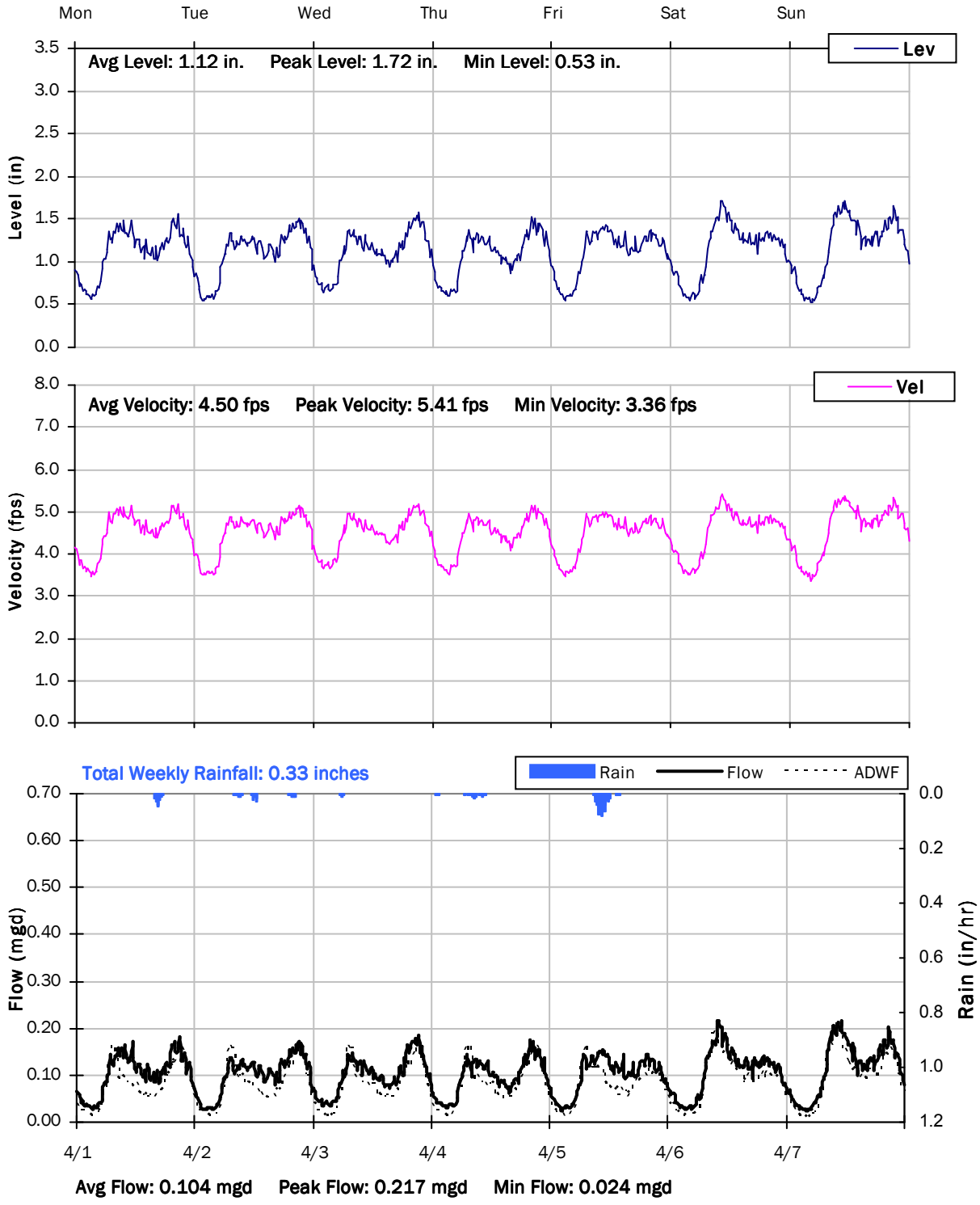
3/25/2019 to 4/1/2019



SITE 1

Weekly Level, Velocity and Flow Hydrographs

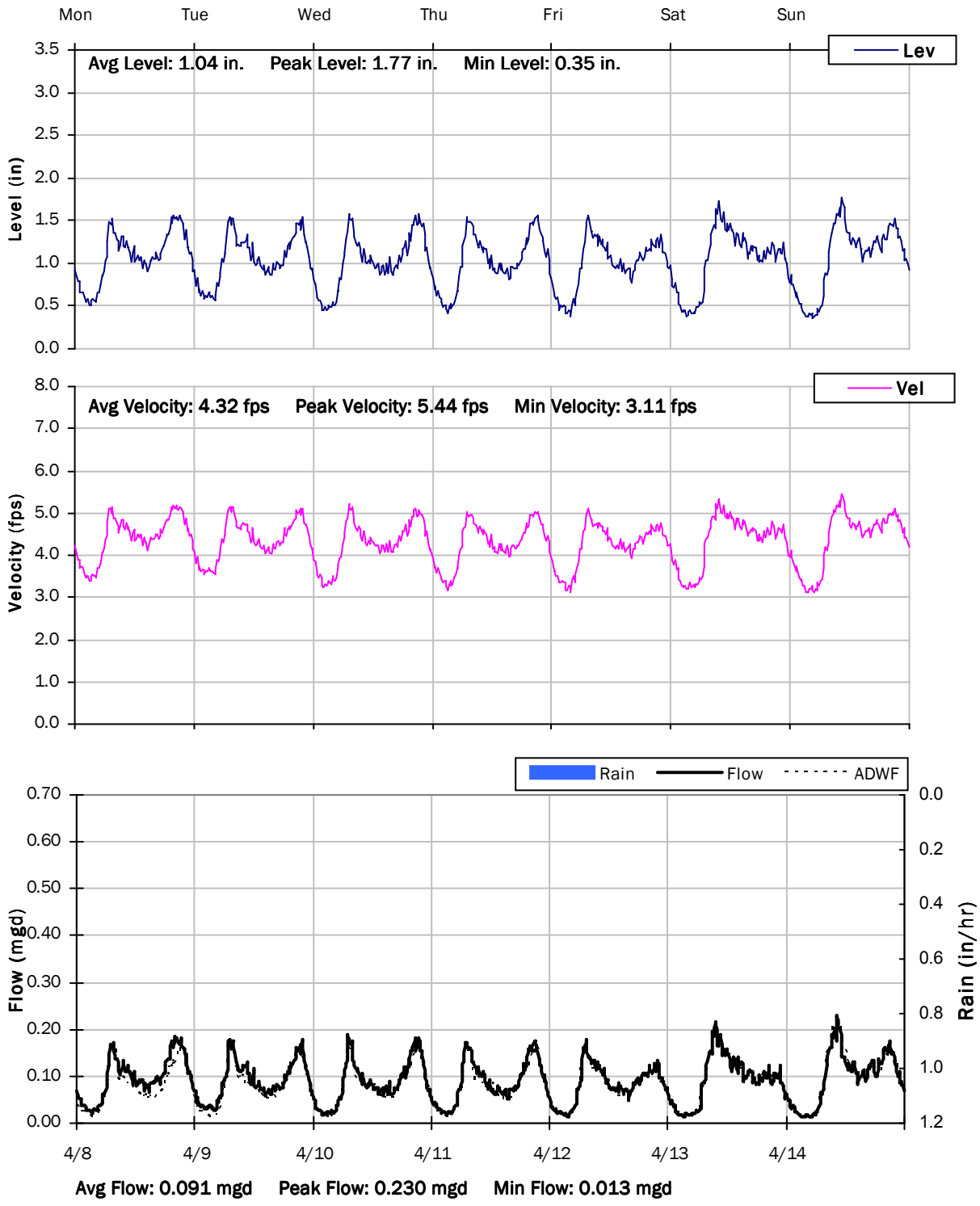
4/1/2019 to 4/8/2019



SITE 1

Weekly Level, Velocity and Flow Hydrographs

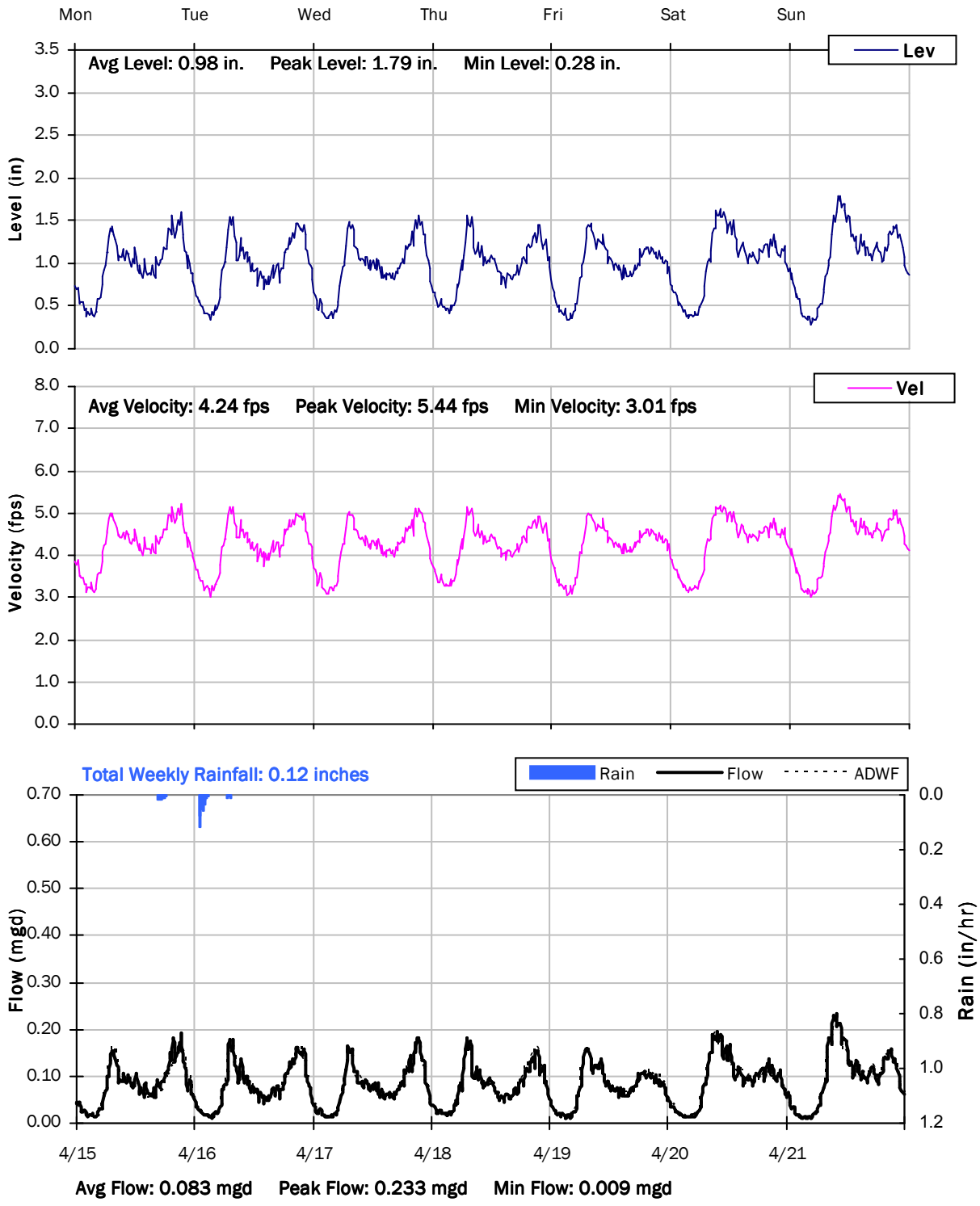
4/8/2019 to 4/15/2019



SITE 1

Weekly Level, Velocity and Flow Hydrographs

4/15/2019 to 4/22/2019



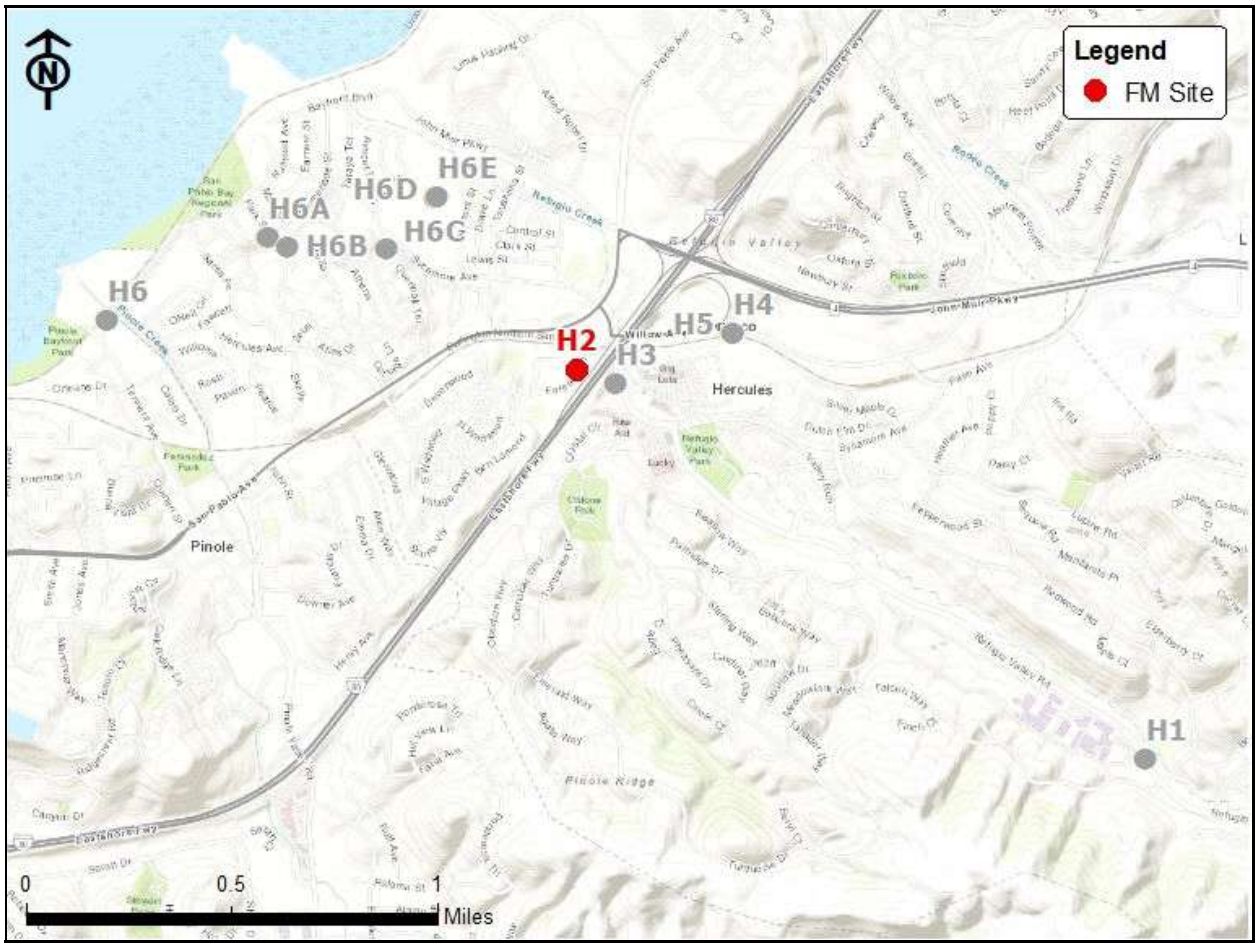
City of Hercules, California

Sanitary Sewer Flow Monitoring
January 14 - April 21, 2019

Monitoring Site: Site 2

Location: 1307 Forest Run, covered parking area

Data Summary Report



Vicinity Map: Site 2

SITE 2

Site Information

Location: 1307 Forest Run, covered parking area

Coordinates: 122.2742° W, 38.0110° N

Rim Elevation (Earth): 47 feet

Measured Pipe Diameter: 8 inches

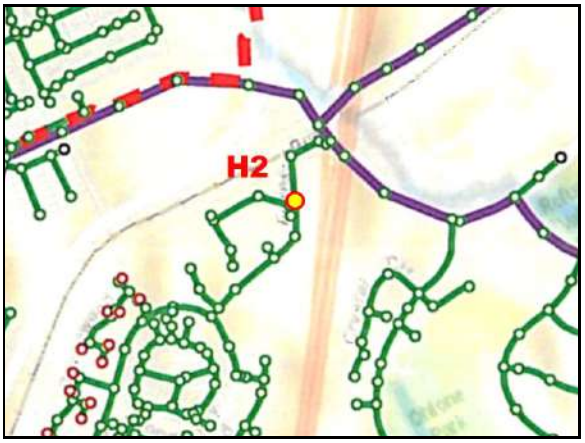
ADWF: 0.141 mgd

Peak Measured Flow: 0.598 mgd

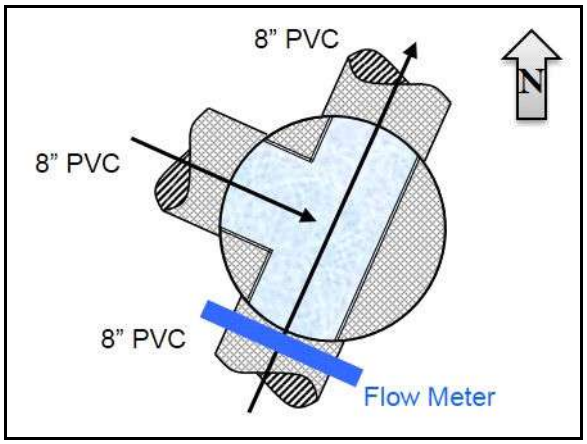
Sediment: None



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

SITE 2

Additional Site Photos

Effluent Pipe



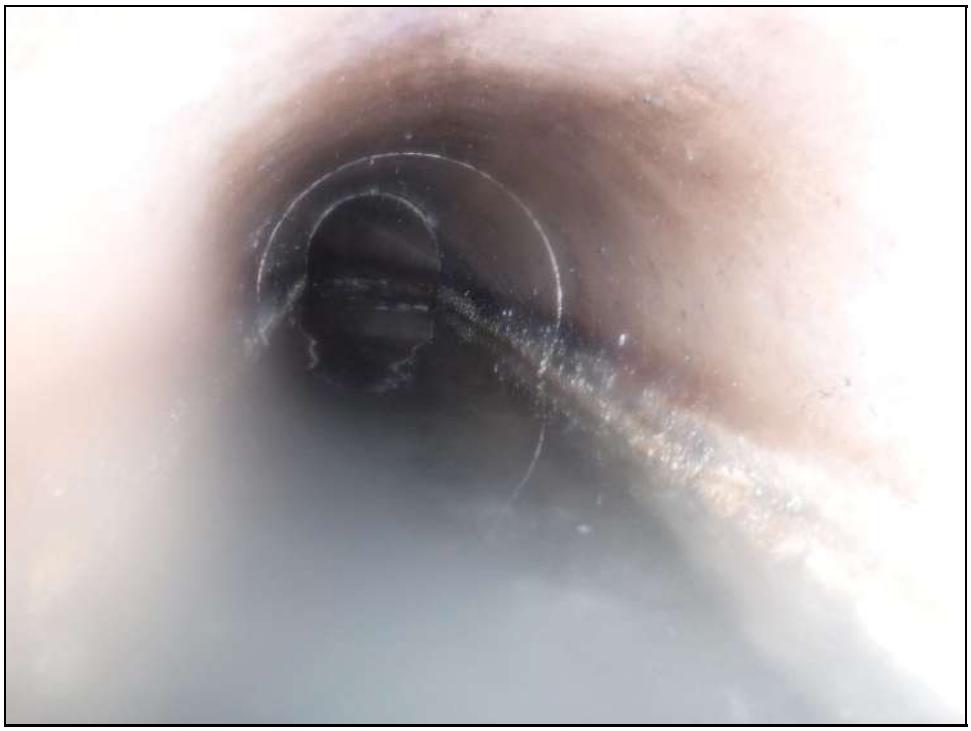
Monitored Southwest Influent Pipe



SITE 2

Additional Site Photos

Northwest Influent Pipe

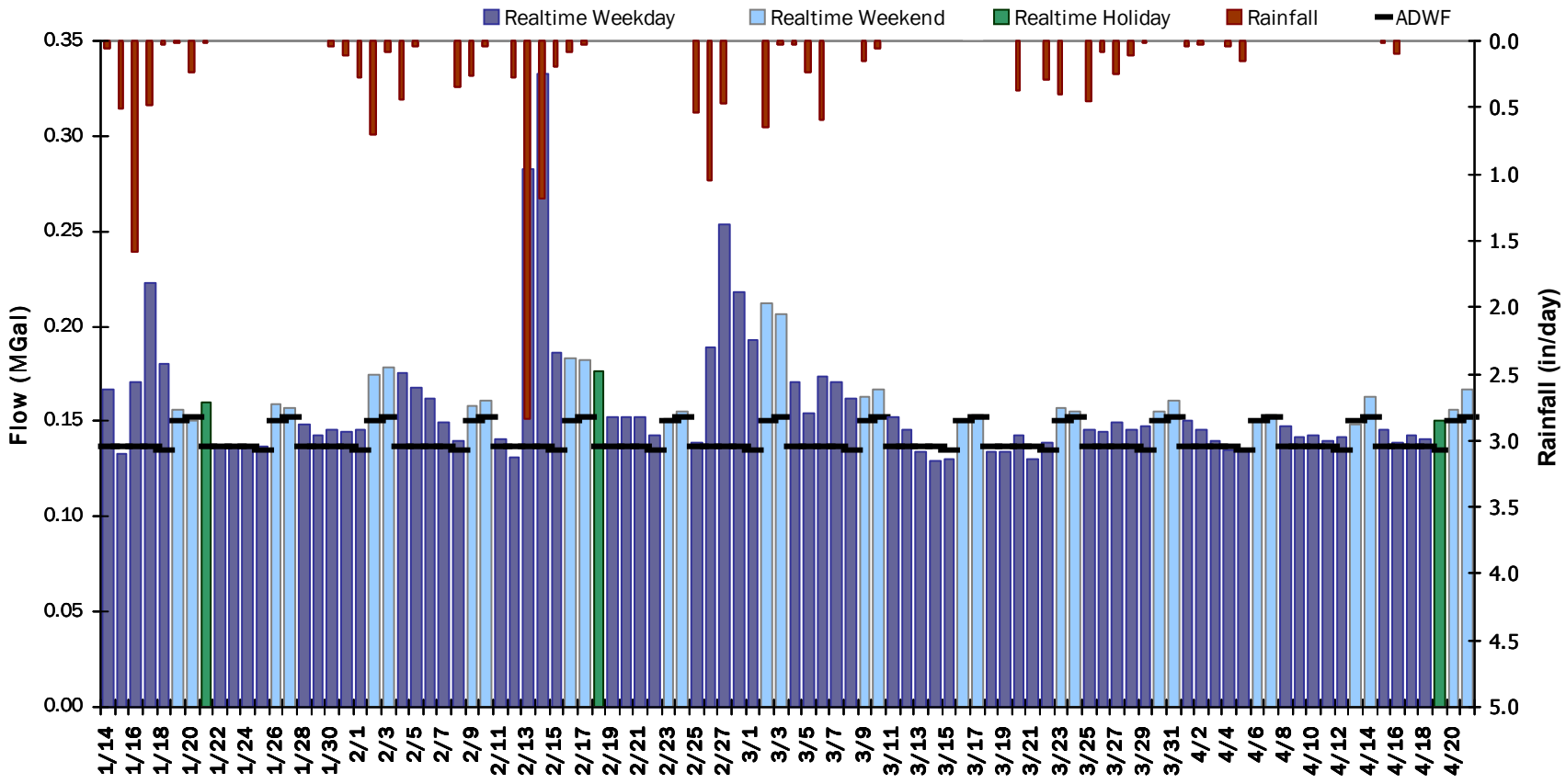


SITE 2

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.159 MGal Peak Daily Flow: 0.333 MGal Min Daily Flow: 0.130 MGal

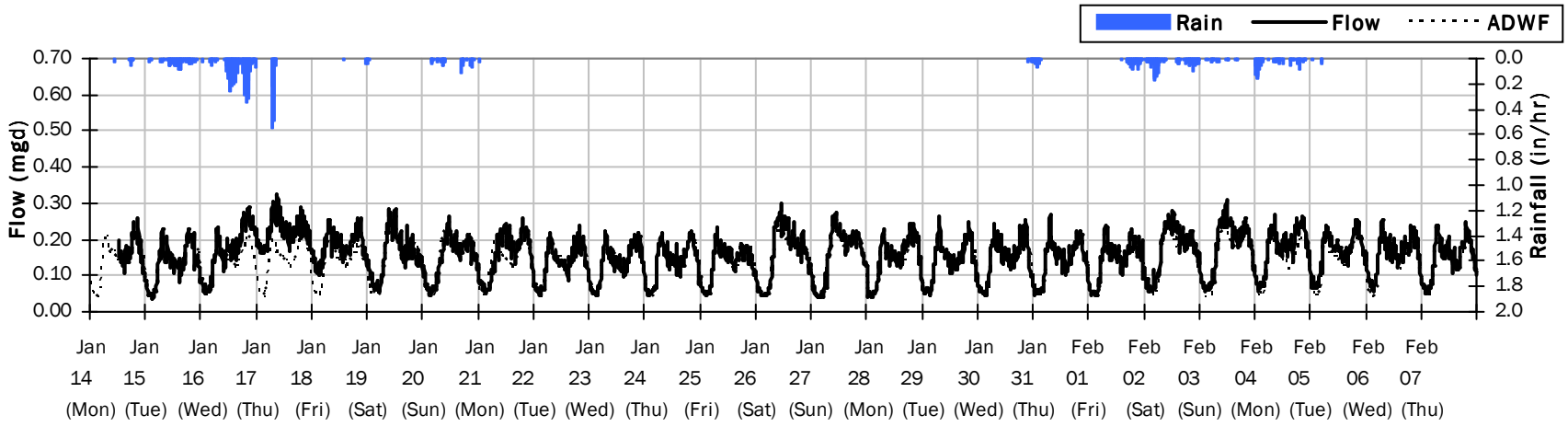
Total Rainfall: 15.93 inches

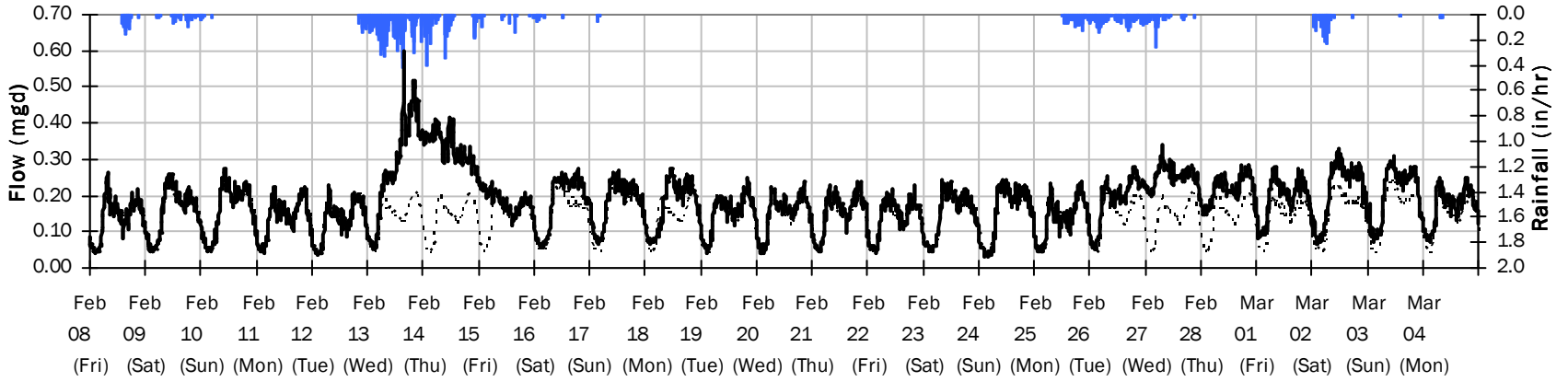


SITE 2

Flow Summary: 1/14/2019 to 3/4/2019

Period Rainfall: 12.58 inches Period Avg Flow: 0.170 mgd Period Peak Flow: 0.598 mgd Period Min Flow: 0.031 mgd

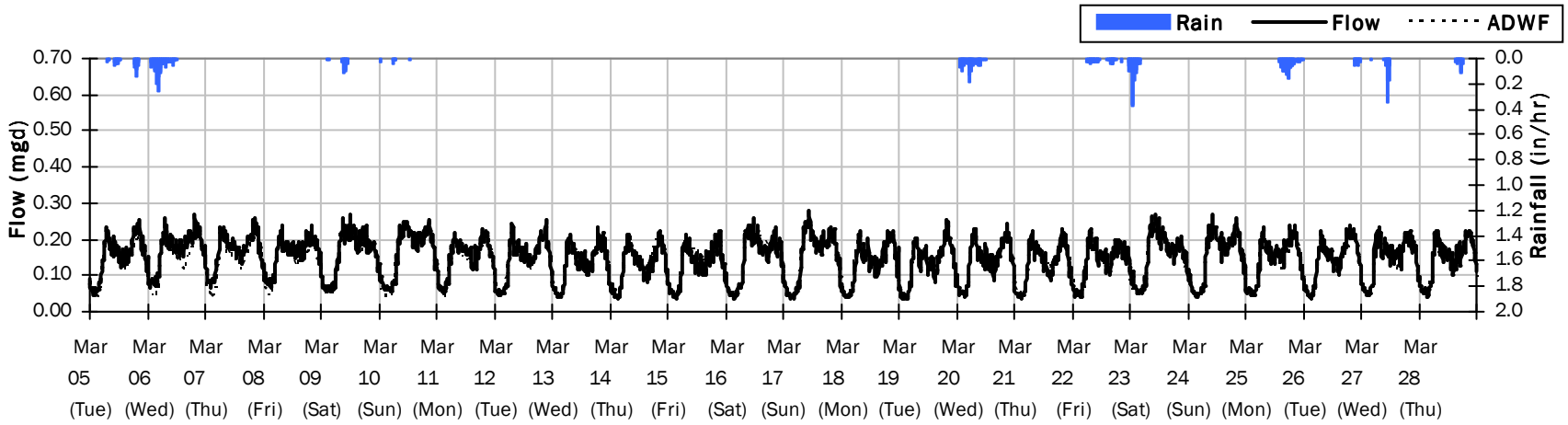


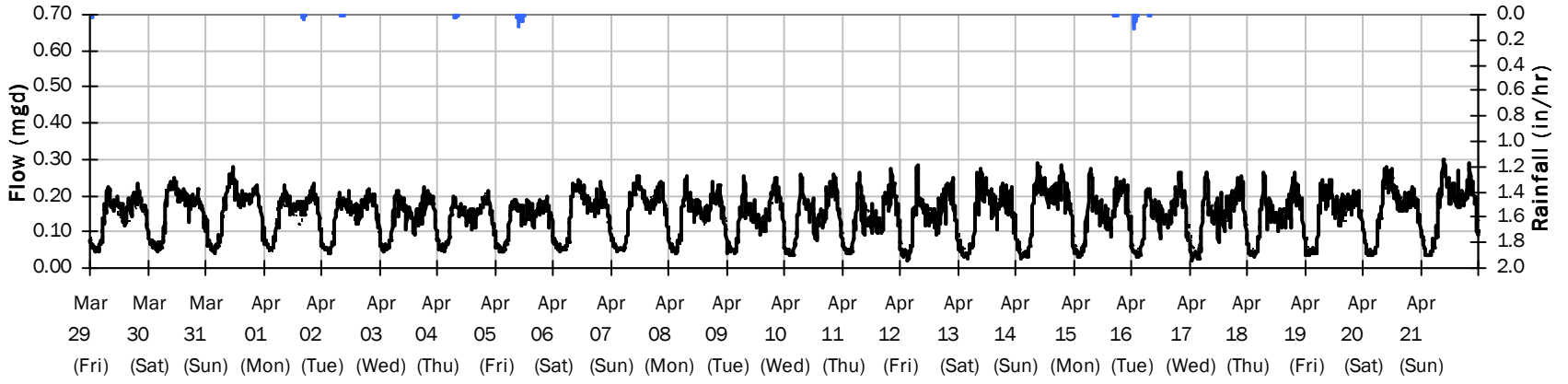


SITE 2

Flow Summary: 3/5/2019 to 4/21/2019

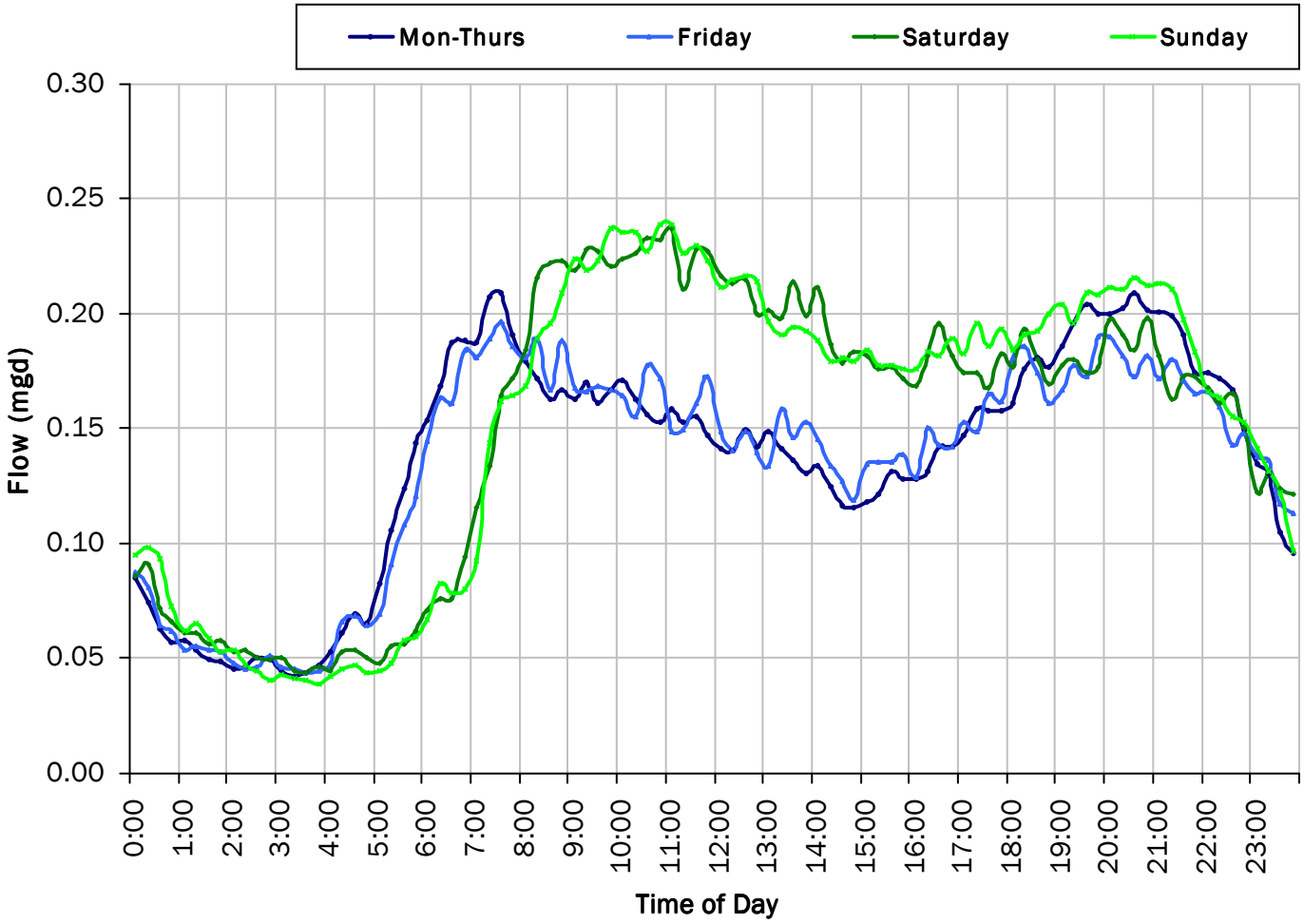
Period Rainfall: 3.36 inches Period Avg Flow: 0.148 mgd Period Peak Flow: 0.301 mgd Period Min Flow: 0.022 mgd





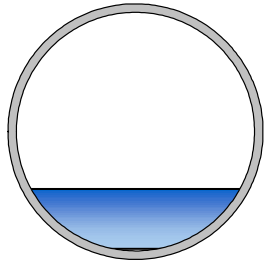
SITE 2

Average Dry Weather Flow Hydrographs



ADWF:

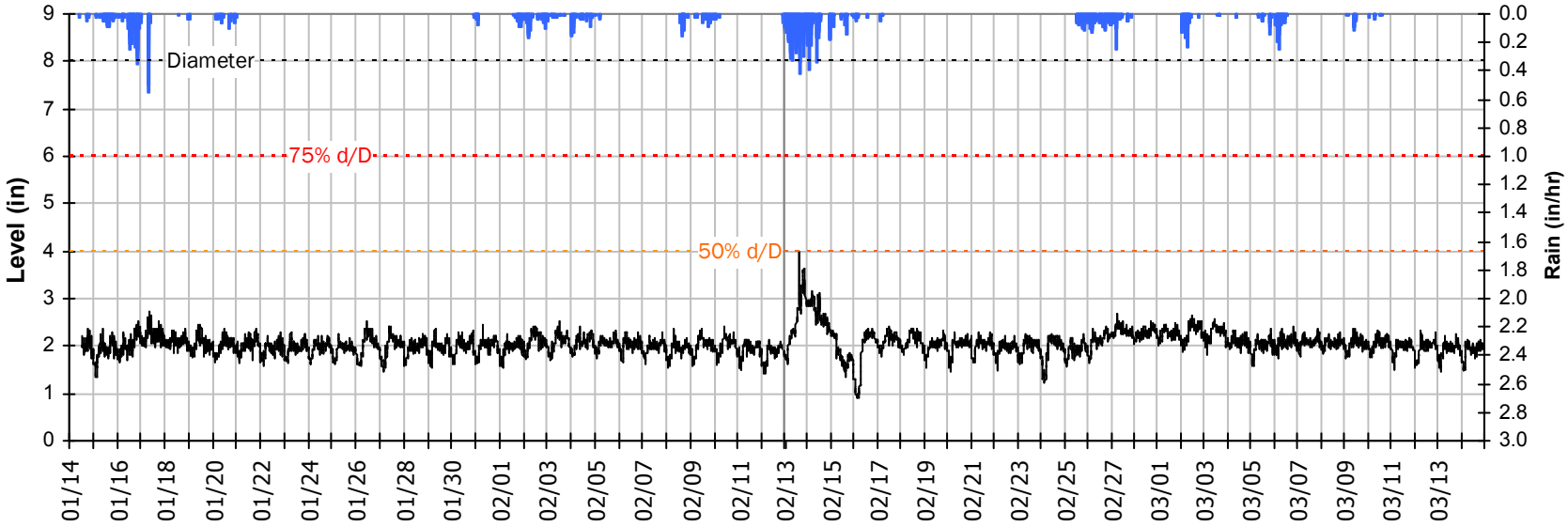
0.141 *mgd*

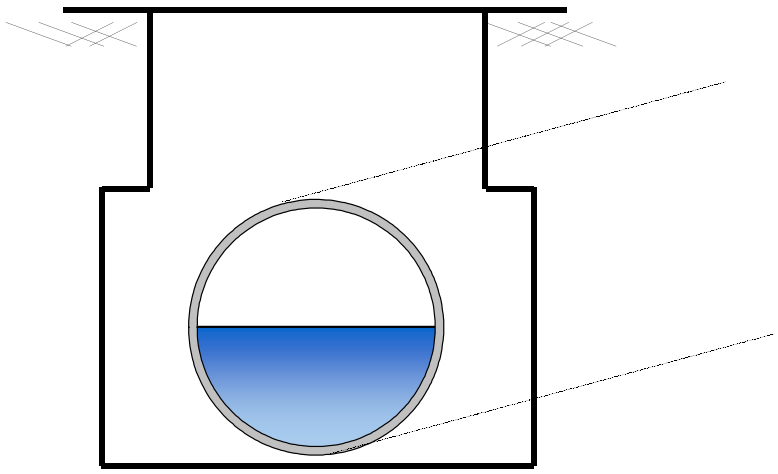


SITE 2

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

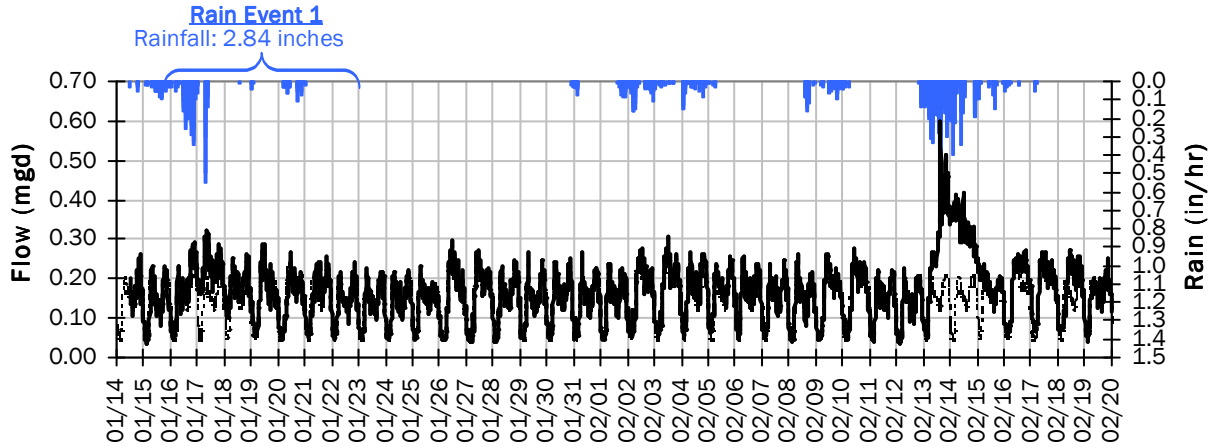




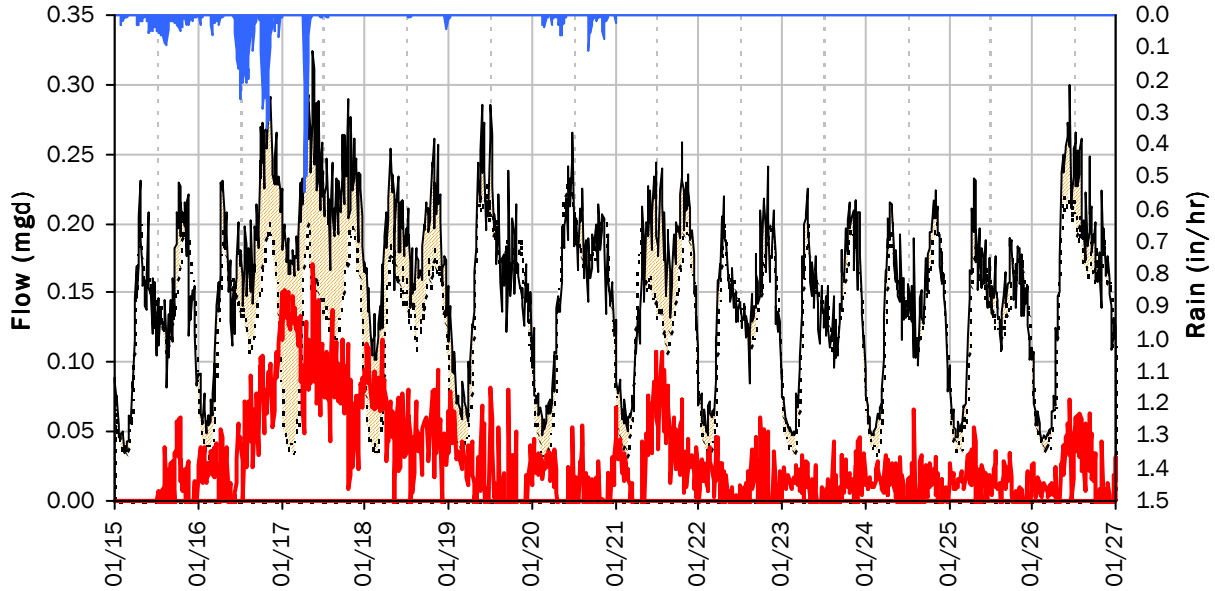
Pipe Diameter:	8	*inches*
Peak Measured Level:	4	*inches*
Peak d/D Ratio:	0.50	

SITE 2
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph

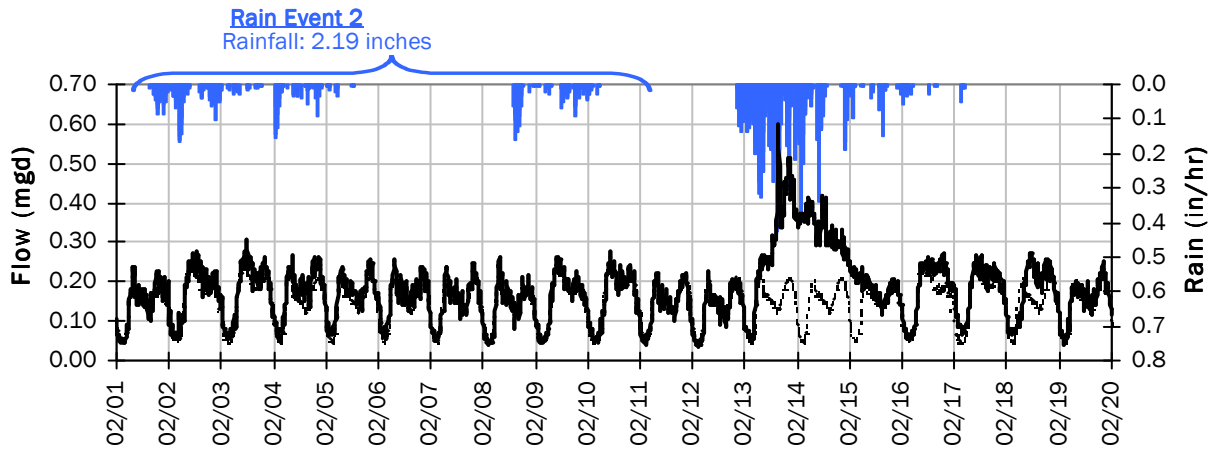


Storm Event I/I Analysis (Rain = 2.84 inches)

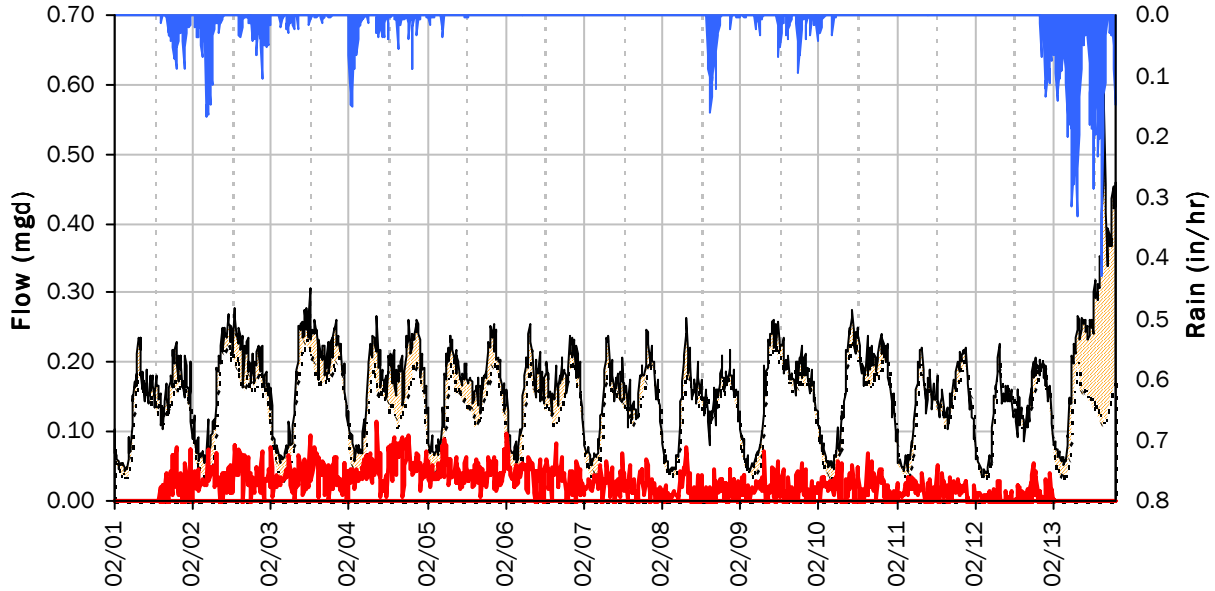
Capacity		Inflow / Infiltration	
Peak Flow:	0.324 *mgd*	**Peak I/I Rate:**	0.171 *mgd*
PF:	2.30	**Total I/I:**	277,000 *gallons*
Peak Level:	2.71 *in*		
d/D Ratio:	0.34		

SITE 2
I/I Summary: Rain Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 2 Detail Graph

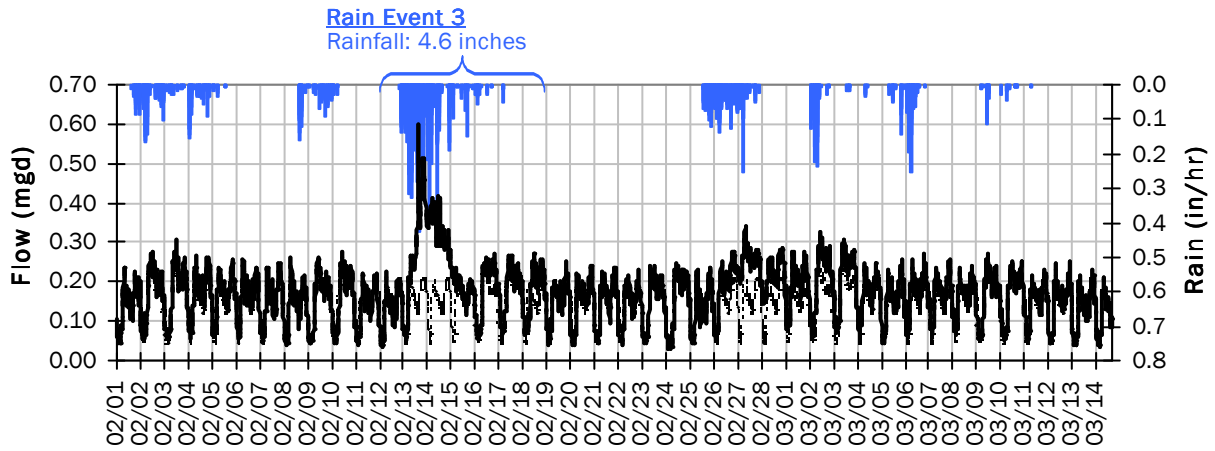


Storm Event I/I Analysis (Rain = 2.19 inches)

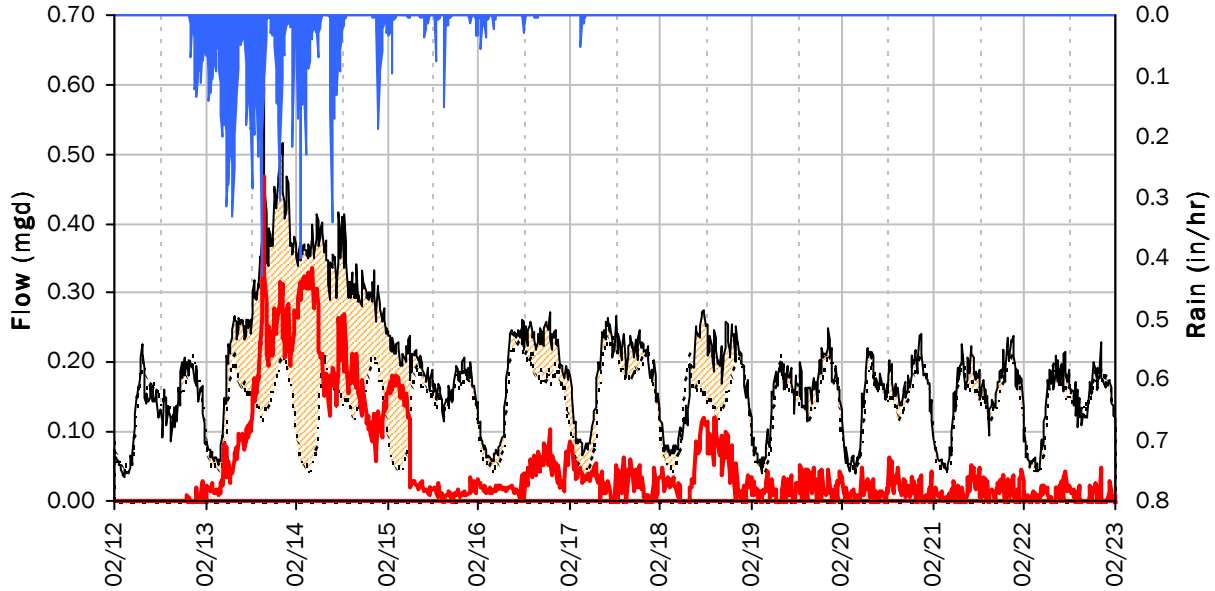
Capacity		Inflow / Infiltration	
Peak Flow:	0.307 *mgd*	**Peak I/I Rate:**	0.114 *mgd*
PF:	2.18	**Total I/I:**	292,000 *gallons*
Peak Level:	2.54 *in*		
d/D Ratio:	0.32		

SITE 2
I/I Summary: Rain Event 3

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3 Detail Graph

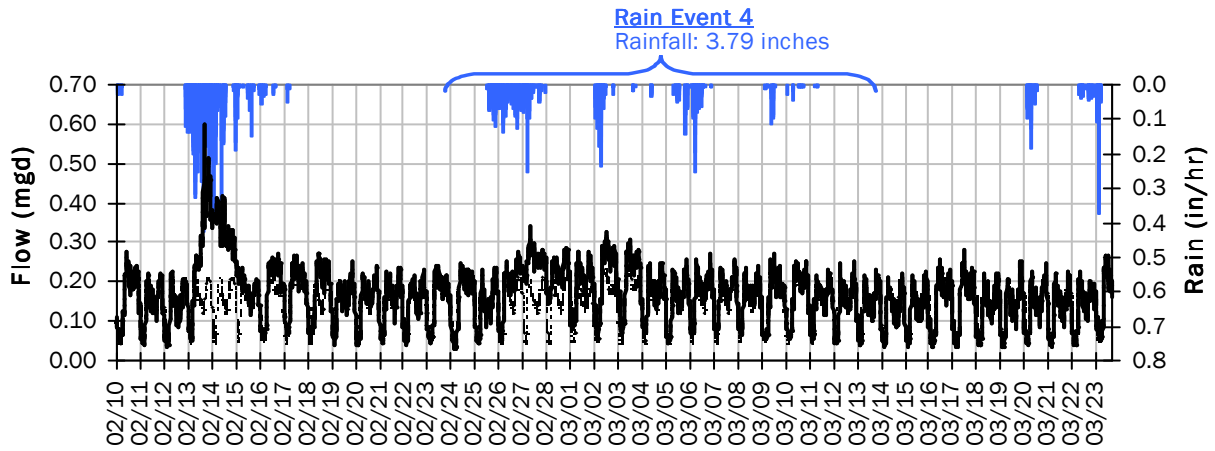


Storm Event I/I Analysis (Rain = 4.60 inches)

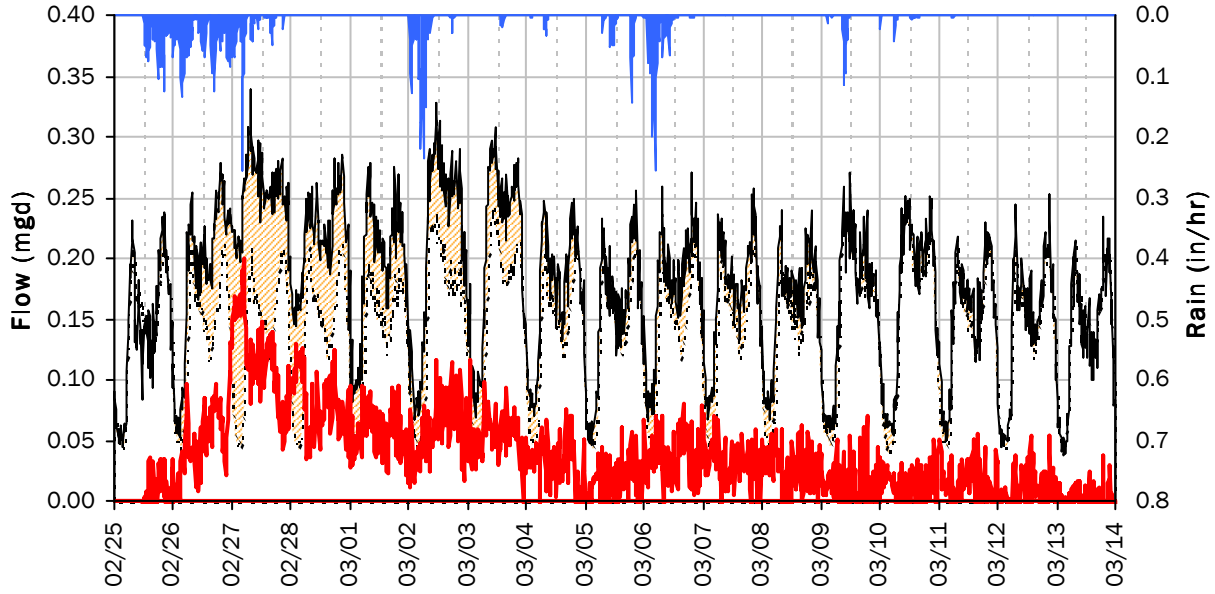
Capacity		Inflow / Infiltration	
Peak Flow:	0.60 *mgd*	**Peak I/I Rate:**	0.47 *mgd*
PF:	4.25	**Total I/I:**	545,000 *gallons*
Peak Level:	4.00 *in*		
d/D Ratio:	0.50		

SITE 2
I/I Summary: Rain Event 4

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 4 Detail Graph

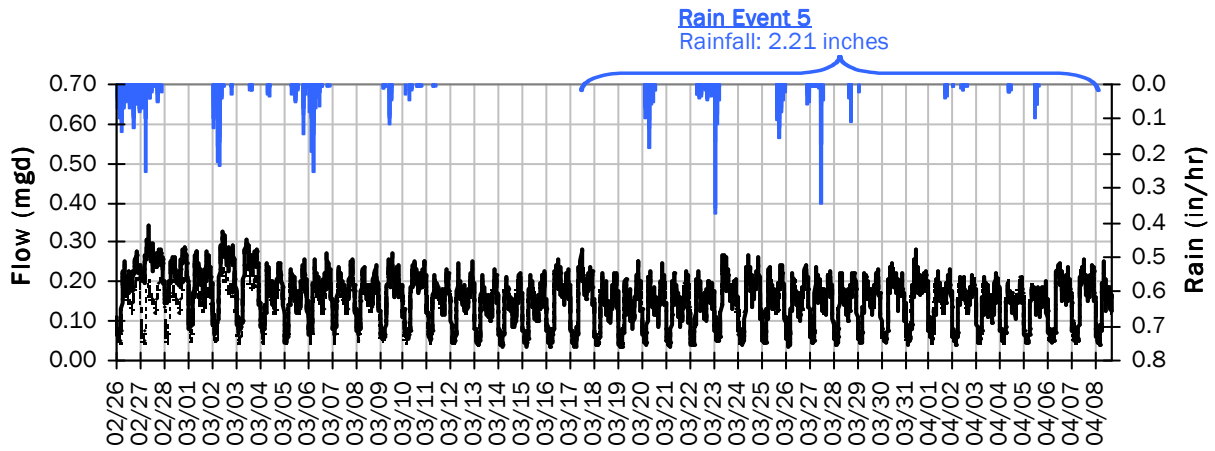


Storm Event I/I Analysis (Rain = 3.79 inches)

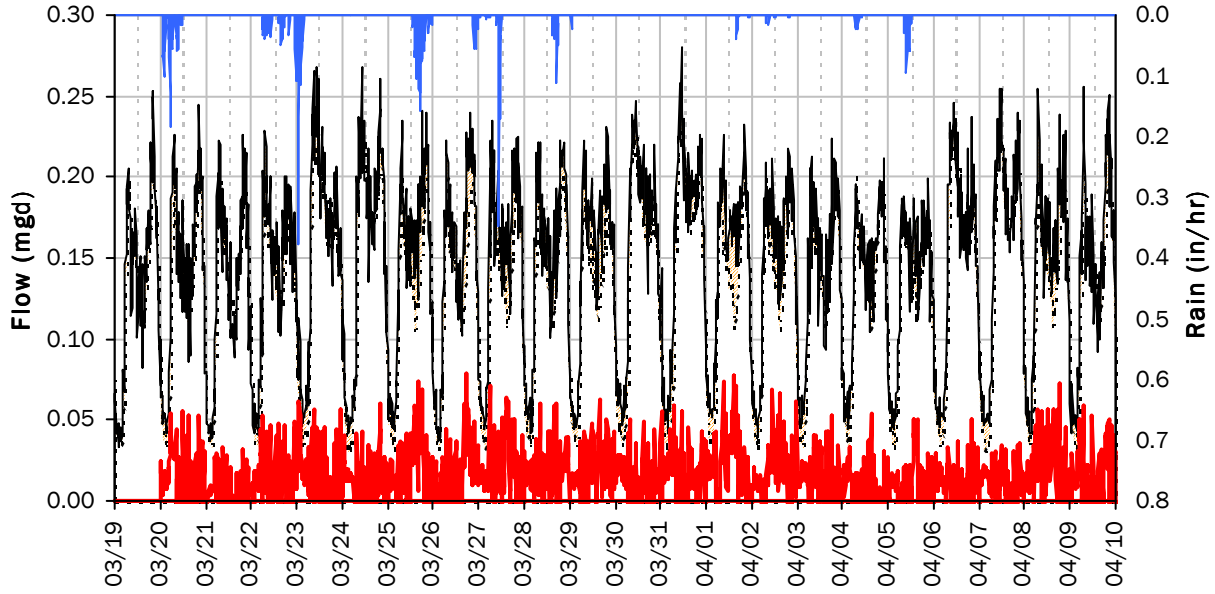
Capacity		Inflow / Infiltration	
Peak Flow:	0.34 *mgd*	**Peak I/I Rate:**	0.20 *mgd*
PF:	2.42	**Total I/I:**	622,000 *gallons*
Peak Level:	2.69 *in*		
d/D Ratio:	0.34		

SITE 2
I/I Summary: Rain Event 5

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 5 Detail Graph



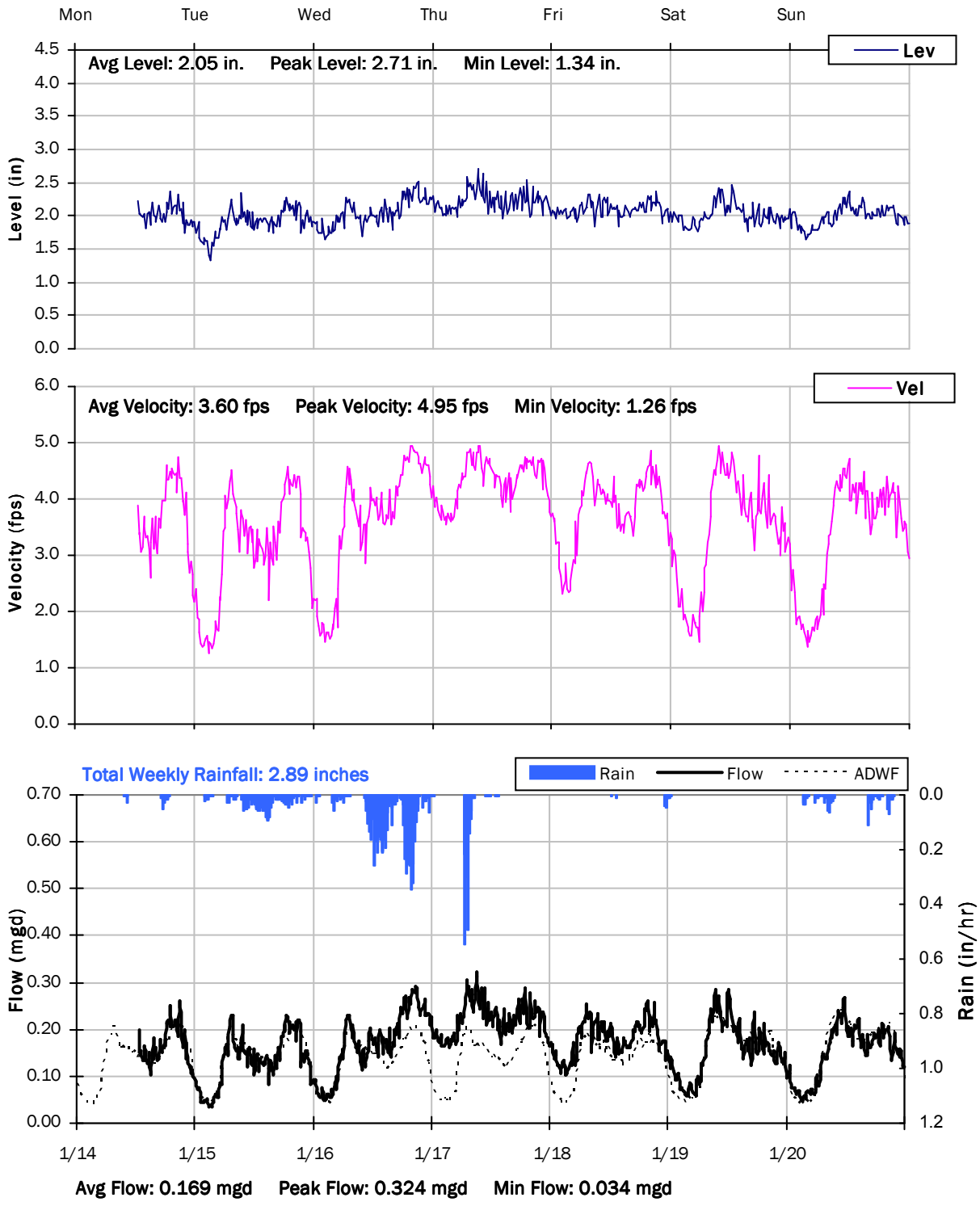
Storm Event I/I Analysis (Rain = 2.21 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.28 *mgd*	**Peak I/I Rate:**	0.08 *mgd*
PF:	1.99	**Total I/I:**	323,000 *gallons*
Peak Level:	2.35 *in*		
d/D Ratio:	0.29		

SITE 2

Weekly Level, Velocity and Flow Hydrographs

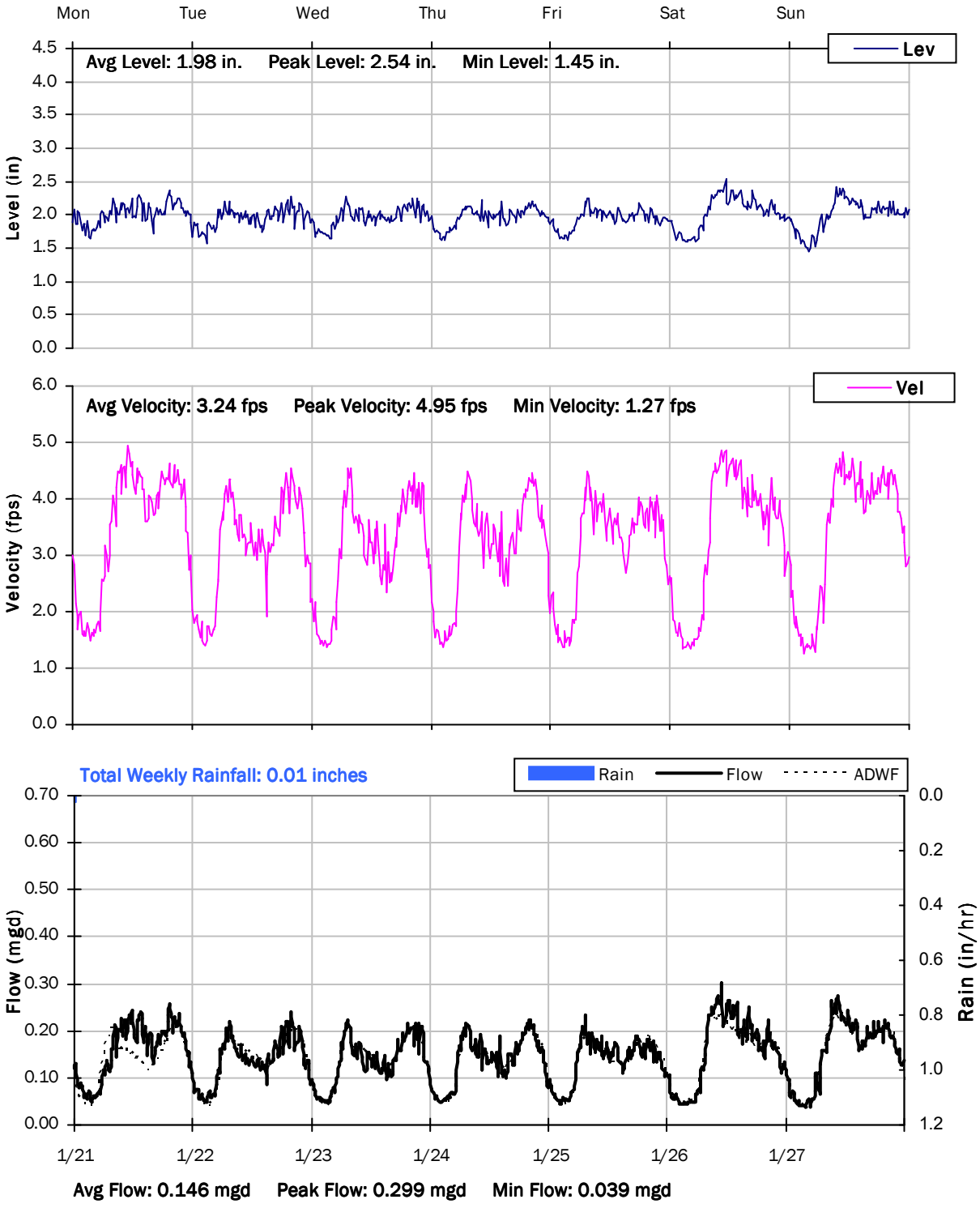
1/14/2019 to 1/21/2019



SITE 2

Weekly Level, Velocity and Flow Hydrographs

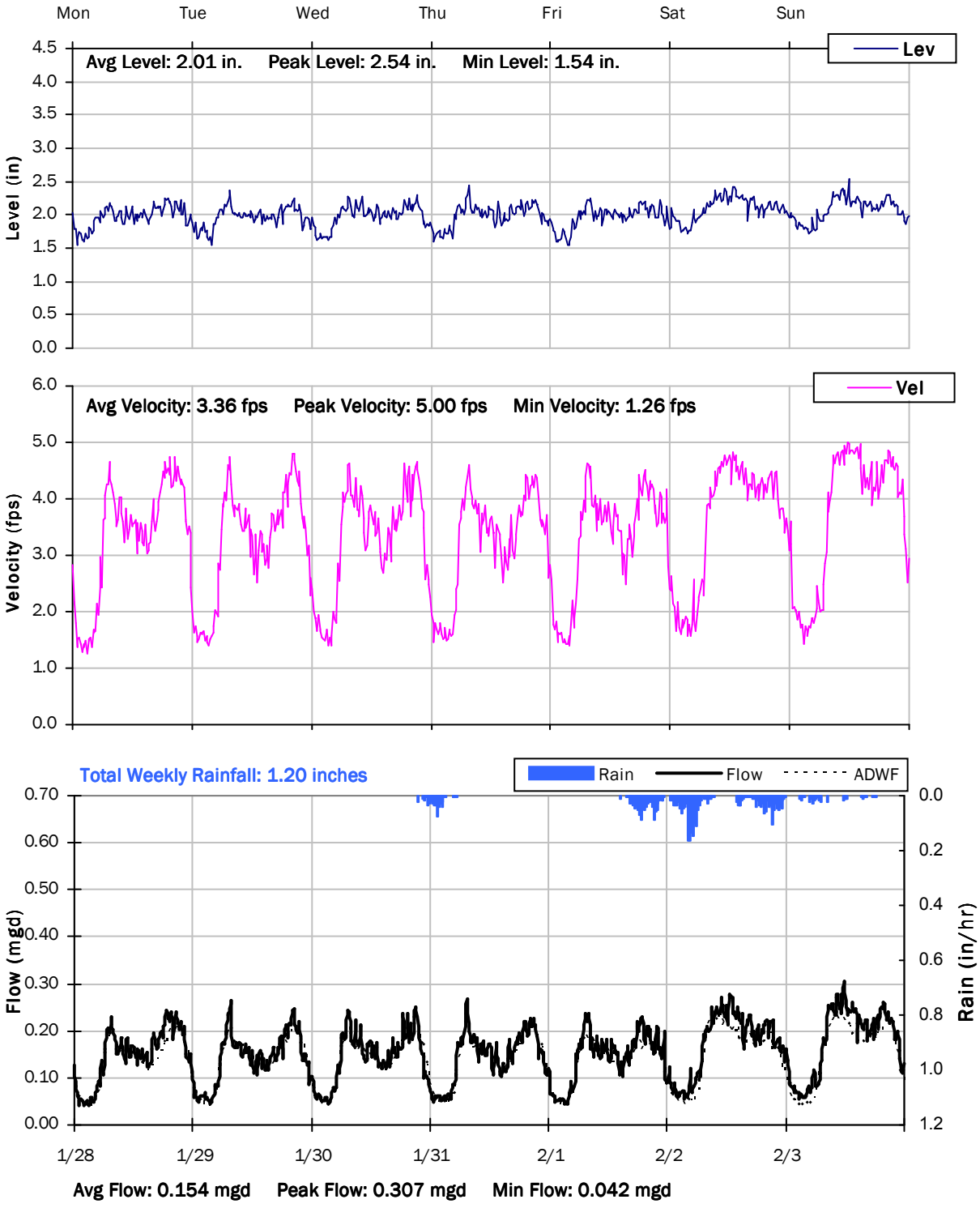
1/21/2019 to 1/28/2019



SITE 2

Weekly Level, Velocity and Flow Hydrographs

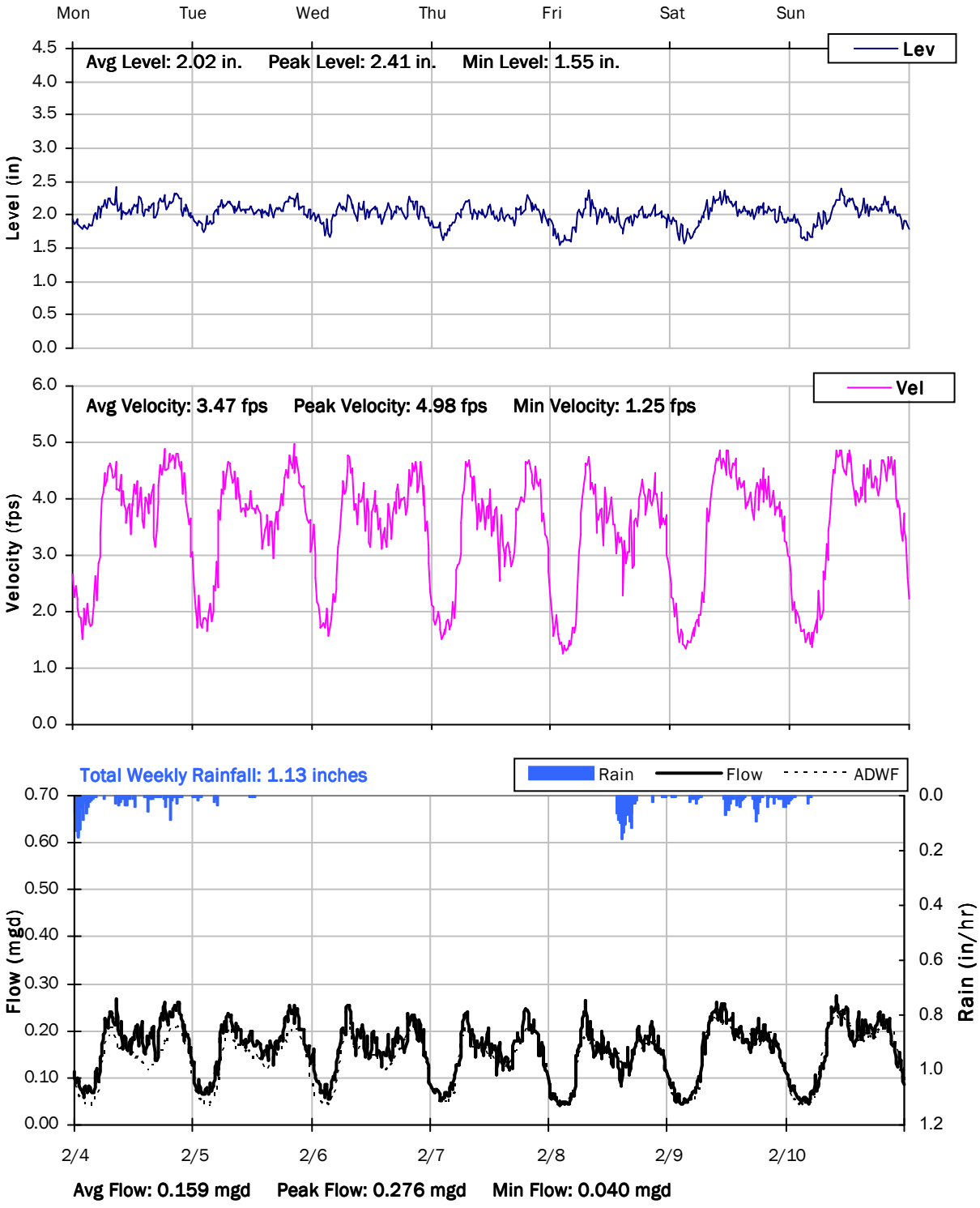
1/28/2019 to 2/4/2019



SITE 2

Weekly Level, Velocity and Flow Hydrographs

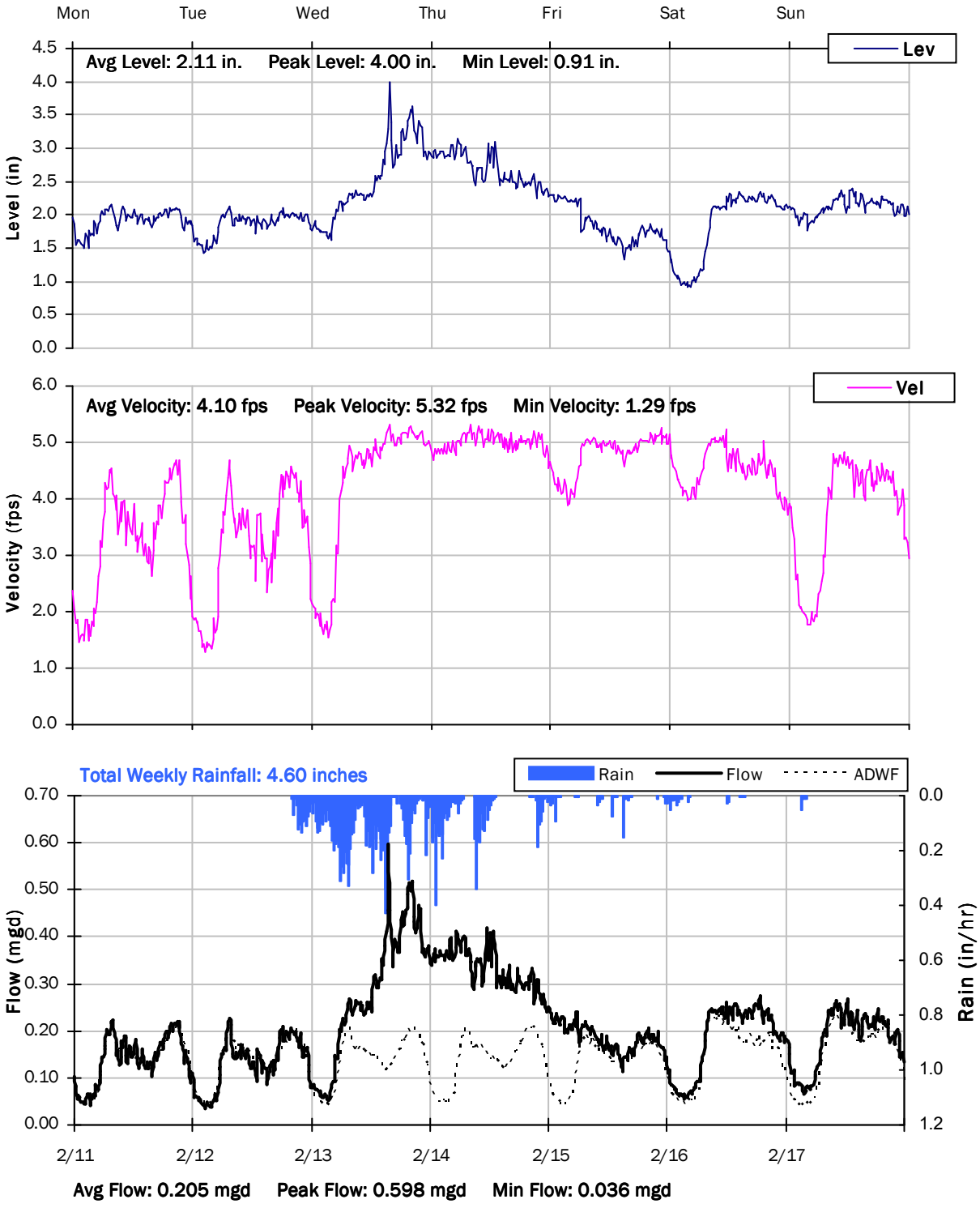
2/4/2019 to 2/11/2019



SITE 2

Weekly Level, Velocity and Flow Hydrographs

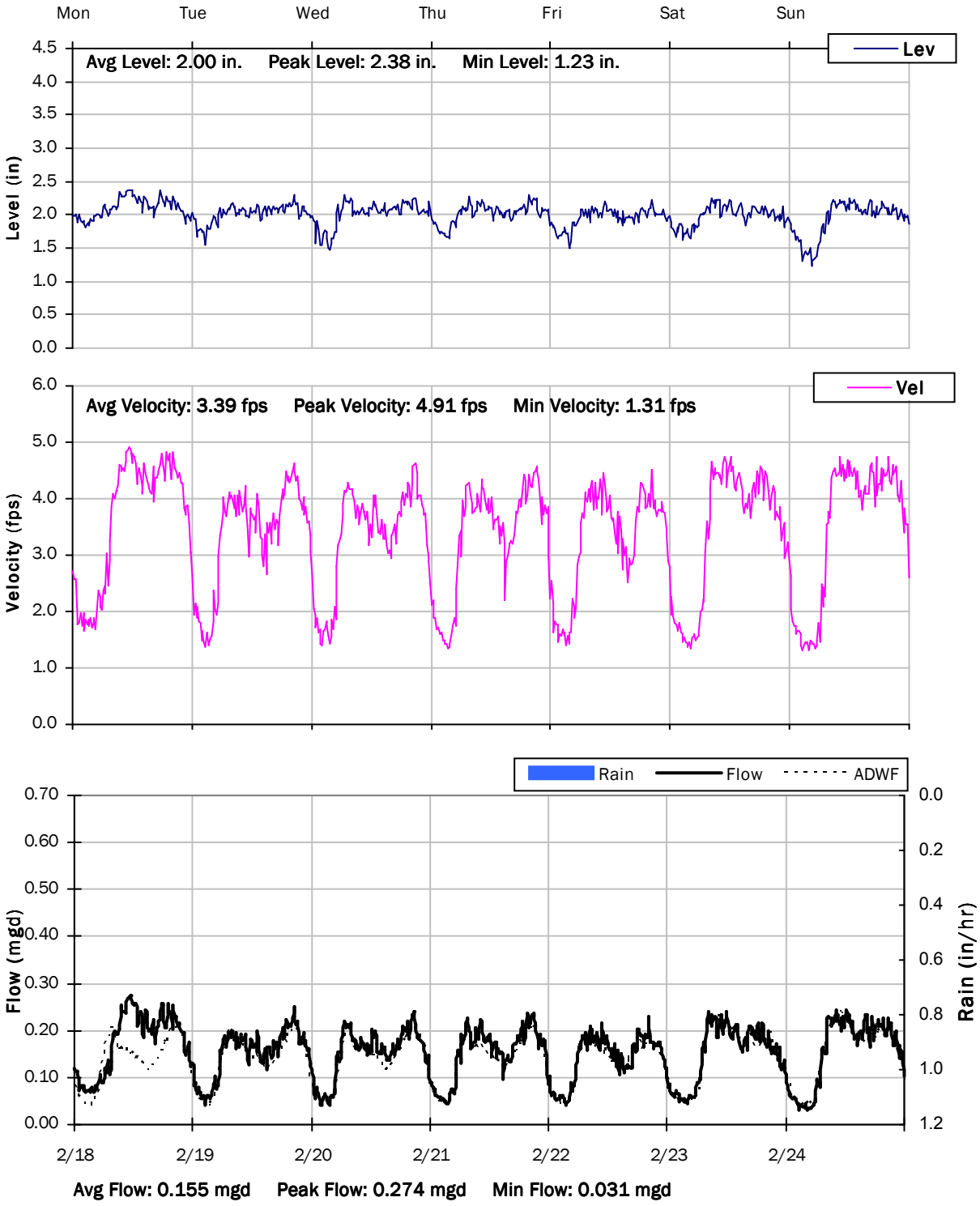
2/11/2019 to 2/18/2019



SITE 2

Weekly Level, Velocity and Flow Hydrographs

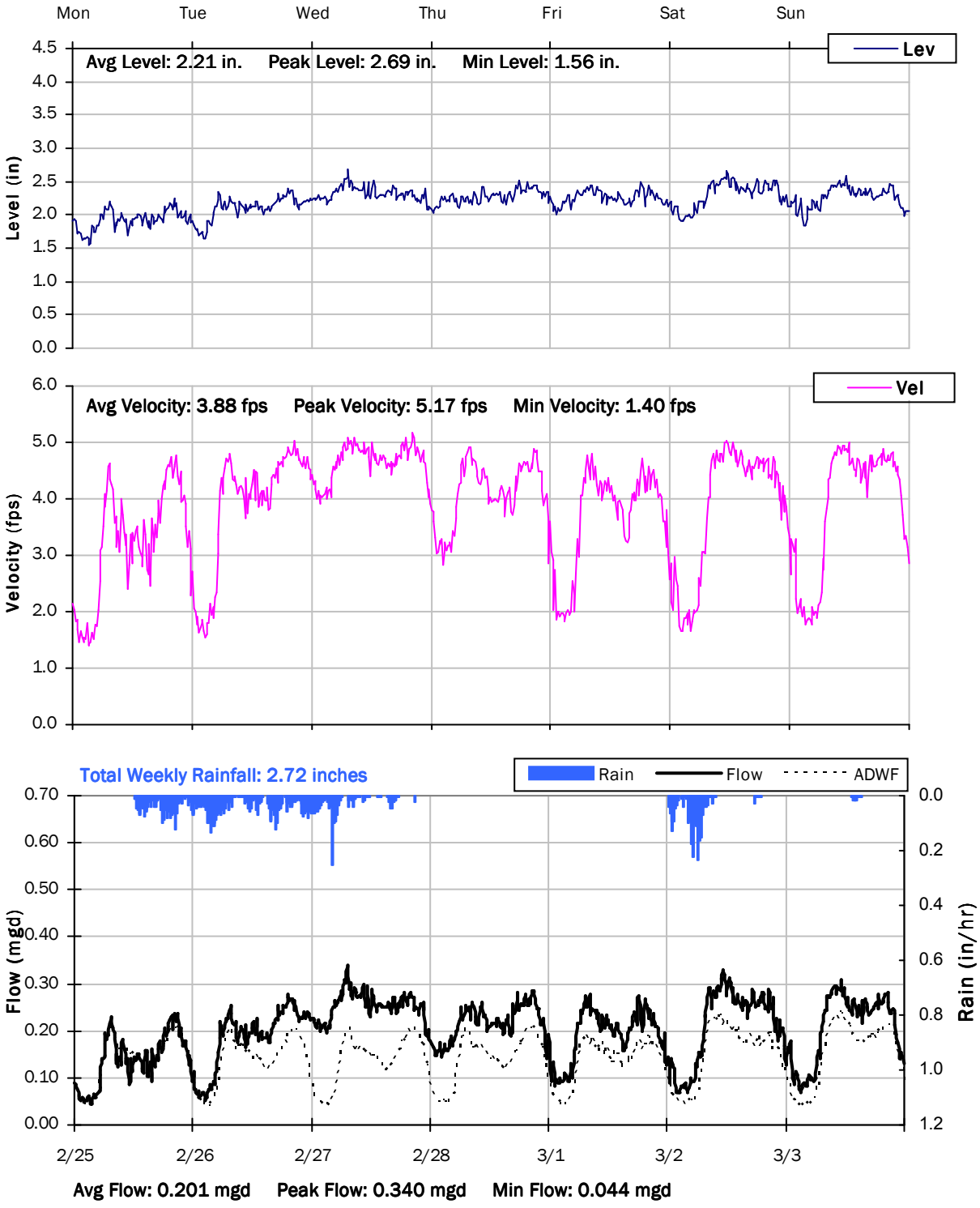
2/18/2019 to 2/25/2019



SITE 2

Weekly Level, Velocity and Flow Hydrographs

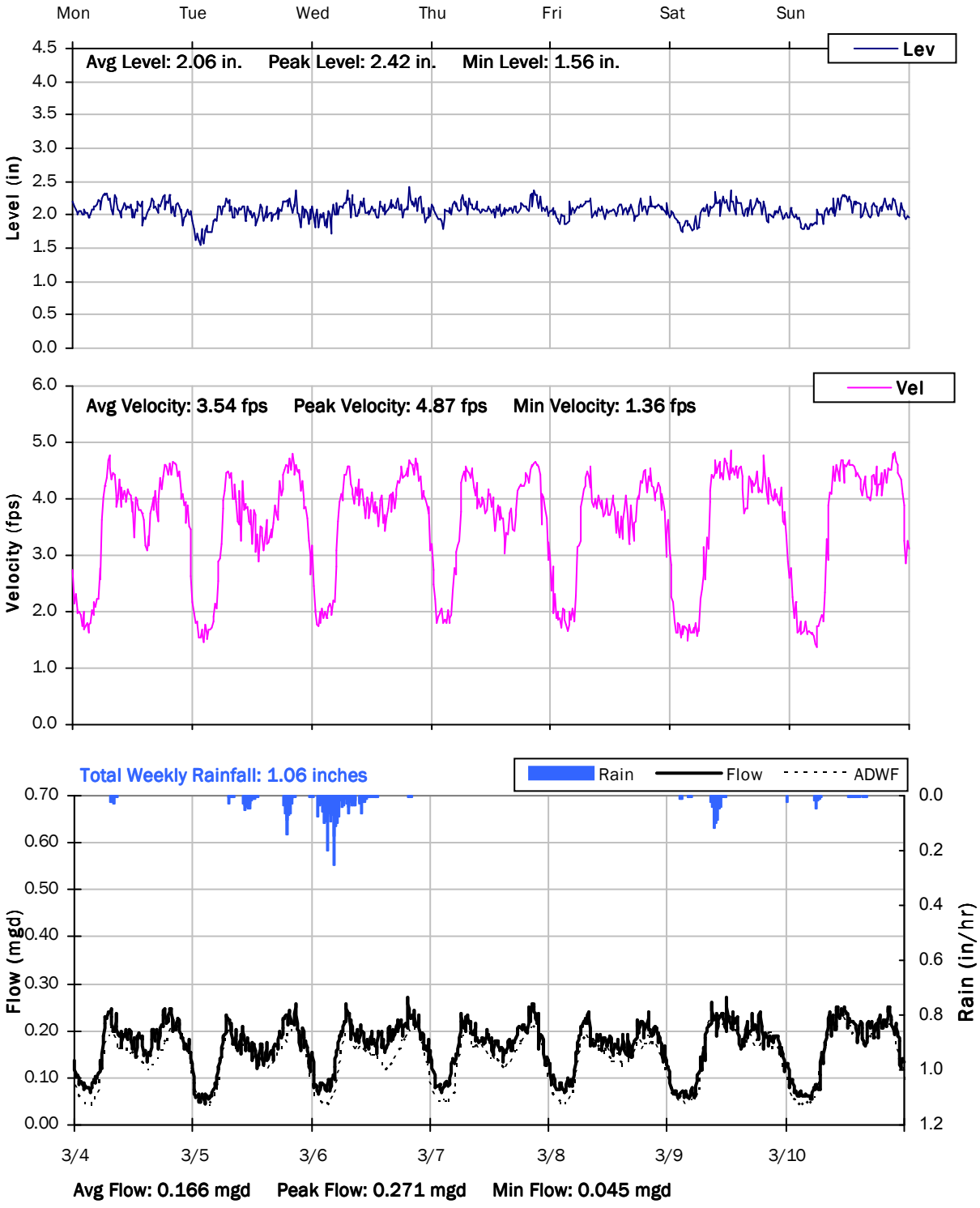
2/25/2019 to 3/4/2019



SITE 2

Weekly Level, Velocity and Flow Hydrographs

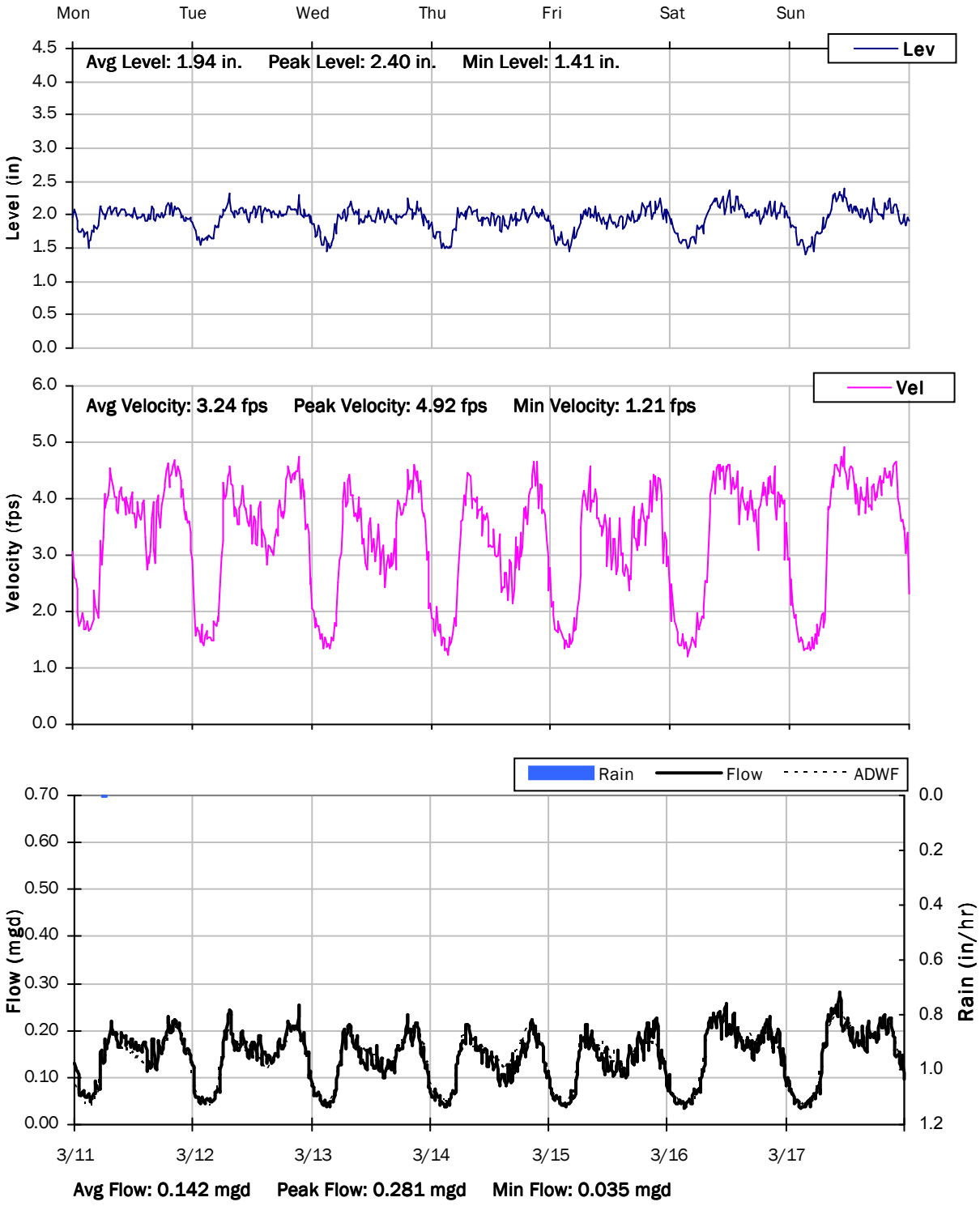
3/4/2019 to 3/11/2019



SITE 2

Weekly Level, Velocity and Flow Hydrographs

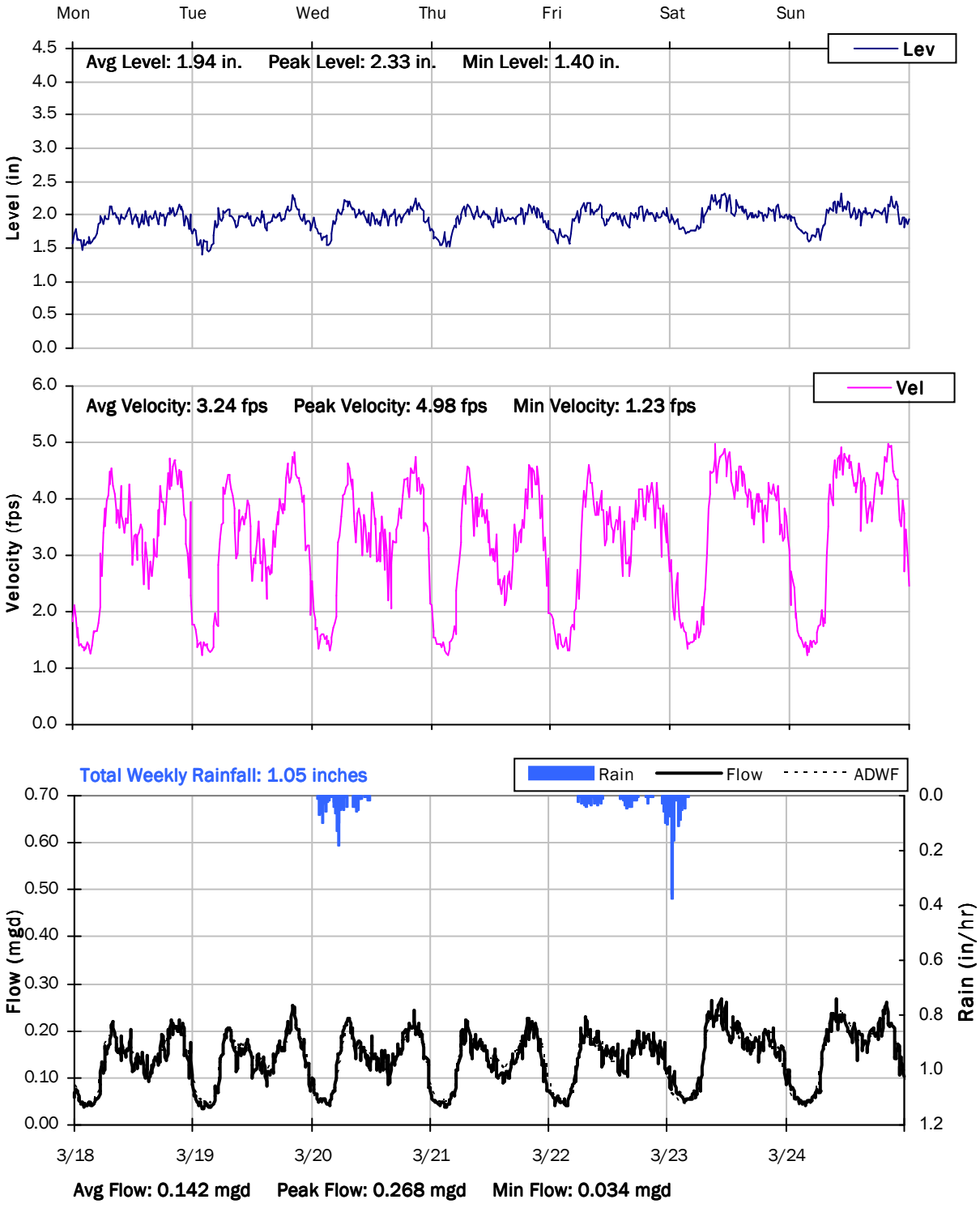
3/11/2019 to 3/18/2019



SITE 2

Weekly Level, Velocity and Flow Hydrographs

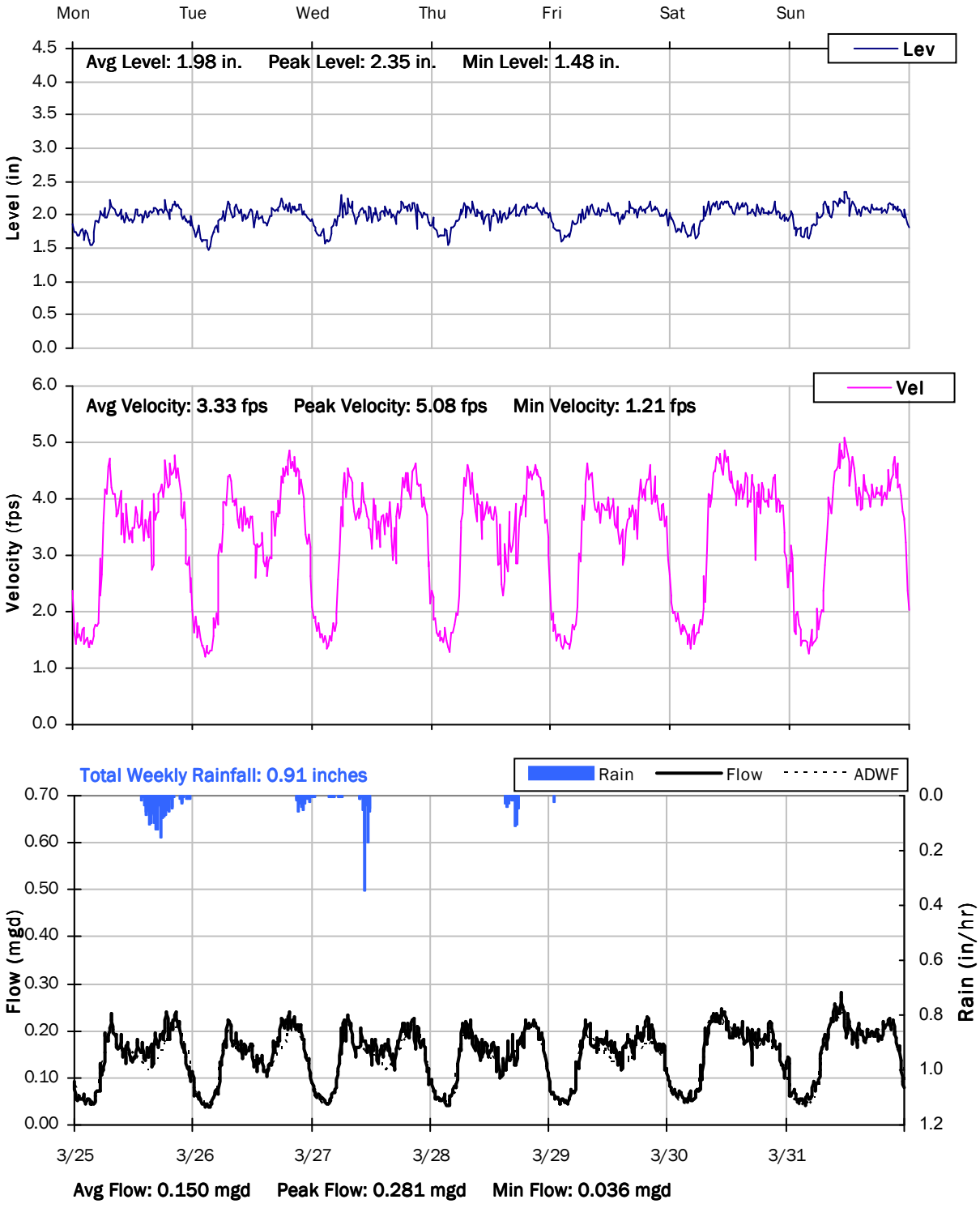
3/18/2019 to 3/25/2019



SITE 2

Weekly Level, Velocity and Flow Hydrographs

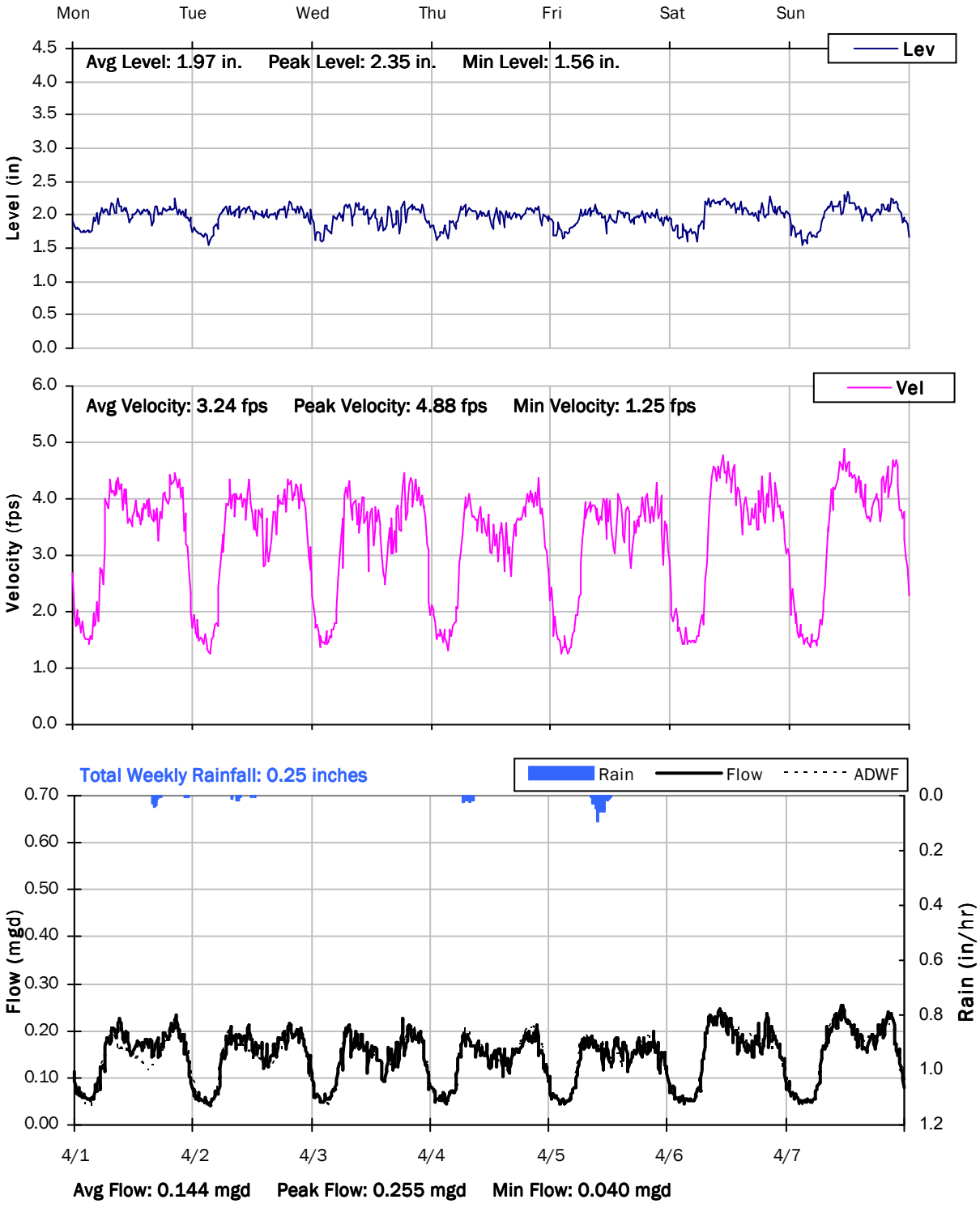
3/25/2019 to 4/1/2019



SITE 2

Weekly Level, Velocity and Flow Hydrographs

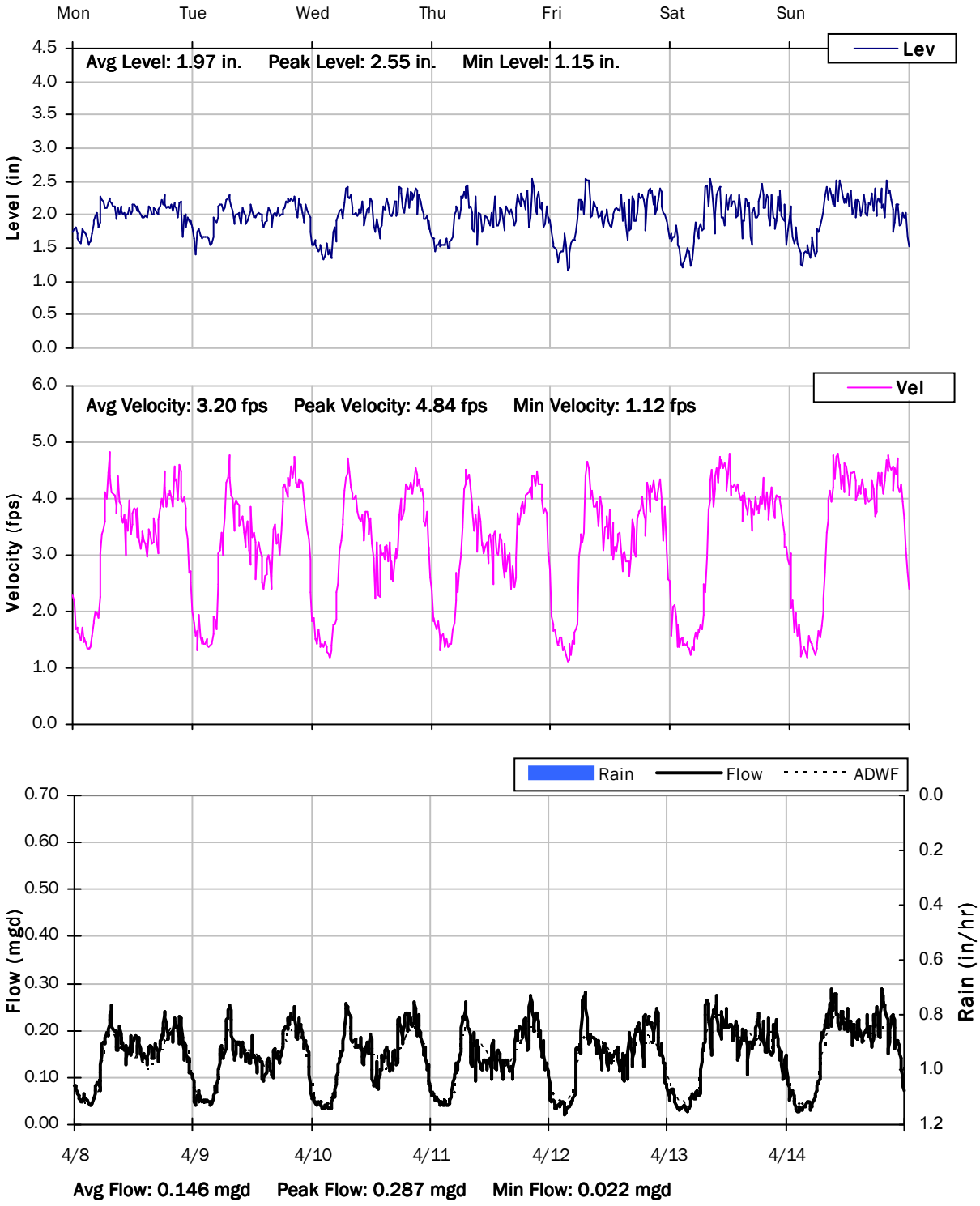
4/1/2019 to 4/8/2019



SITE 2

Weekly Level, Velocity and Flow Hydrographs

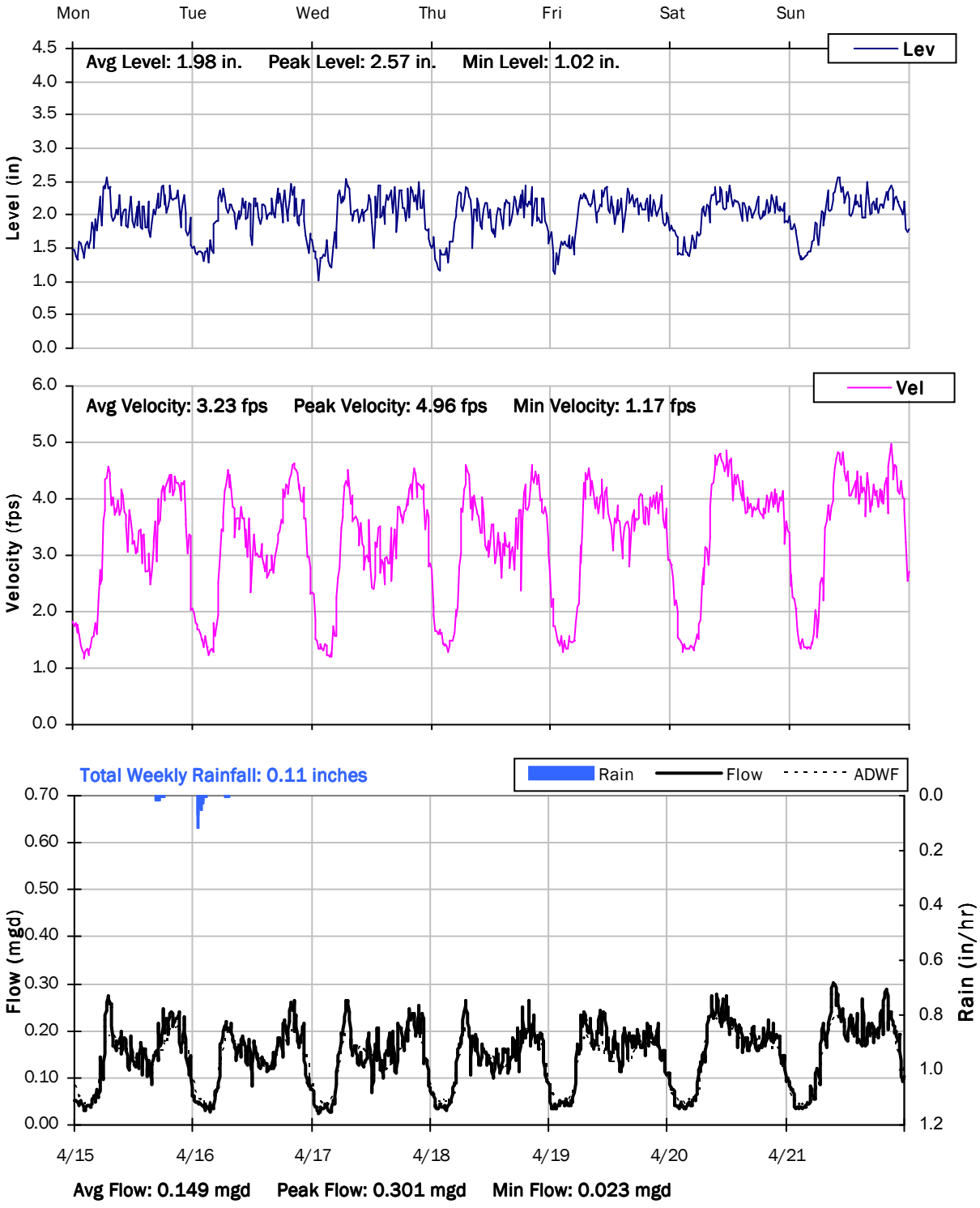
4/8/2019 to 4/15/2019



SITE 2

Weekly Level, Velocity and Flow Hydrographs

4/15/2019 to 4/22/2019



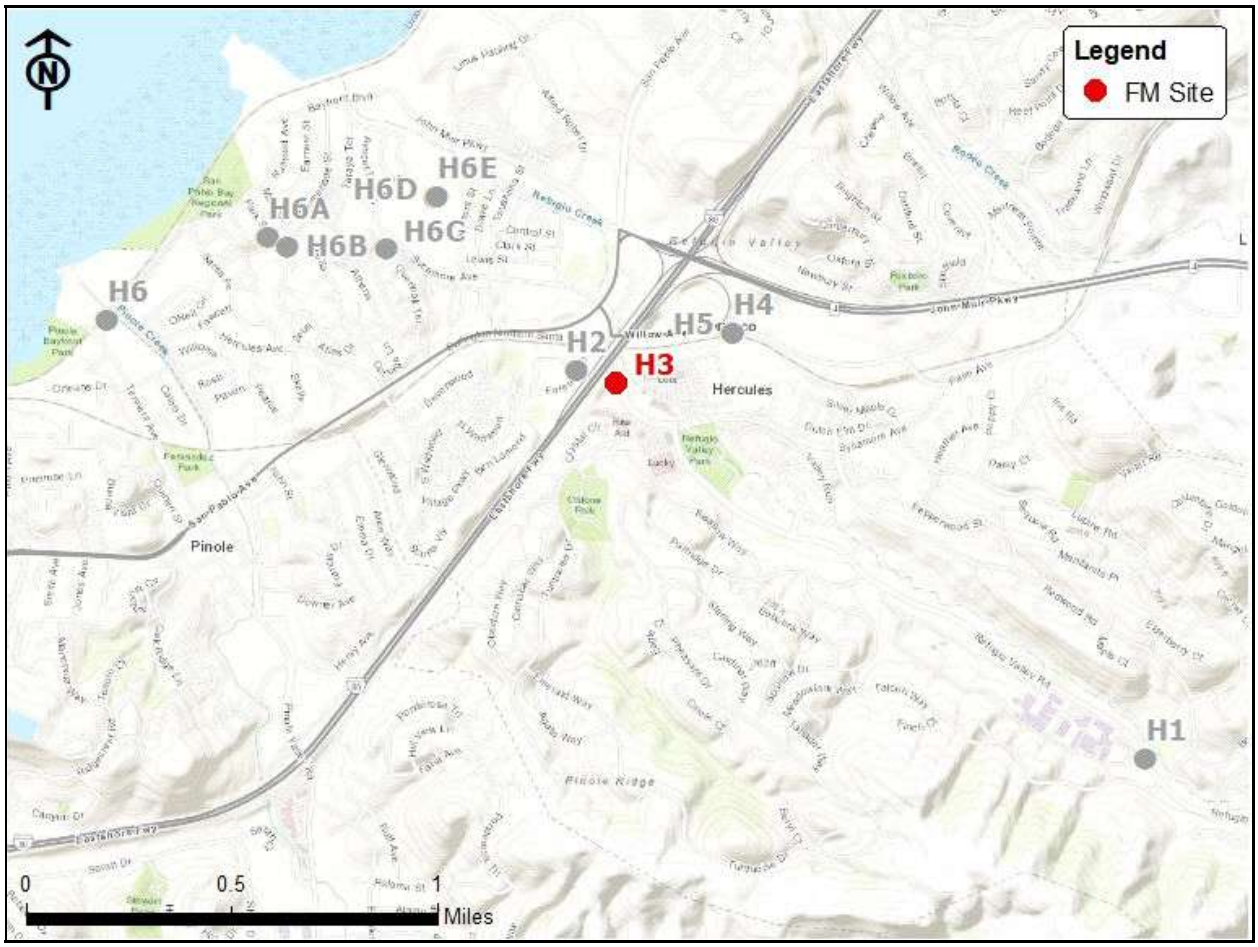
City of Hercules, California

Sanitary Sewer Flow Monitoring
January 14 - April 21, 2019

Monitoring Site: Site 3

Location: Sycamore Avenue north of Creekside Center driveway

Data Summary Report



Vicinity Map: Site 3

SITE 3

Site Information

Location: Sycamore Avenue north of Creekside Center driveway

Coordinates: 122.2724° W, 38.0106° N

Rim Elevation (Earth): 43 feet

Measured Pipe Diameter: 15 inches

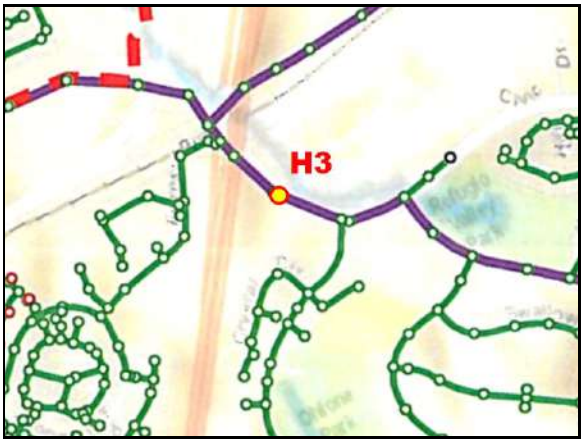
ADWF: 0.474 mgd

Peak Measured Flow: 2.539 mgd

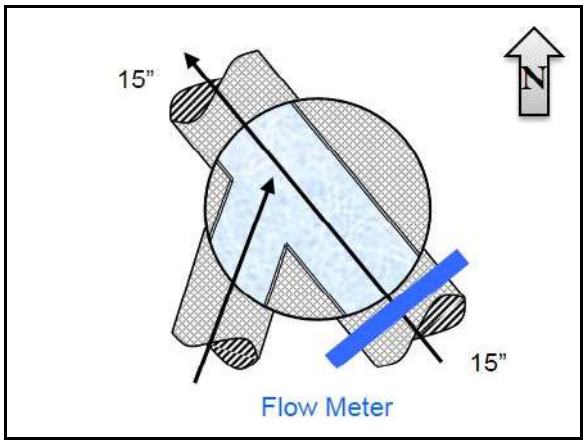
Sediment: None



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

SITE 3

Additional Site Photos

Effluent Pipe



Monitored Southeast Influent Pipe



SITE 3

Additional Site Photos

South Influent Pipe

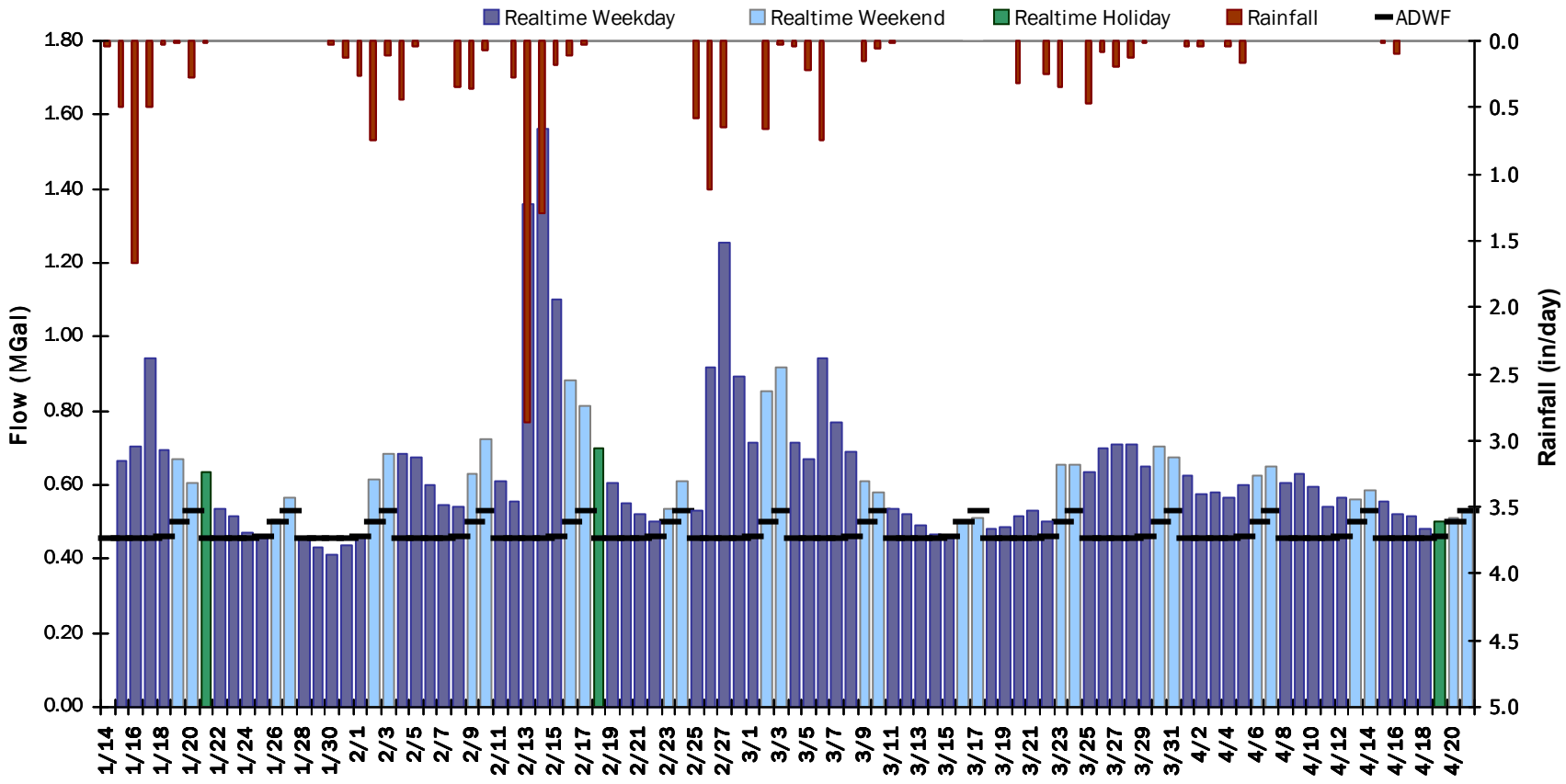


SITE 3

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.637 MGal Peak Daily Flow: 1.562 MGal Min Daily Flow: 0.411 MGal

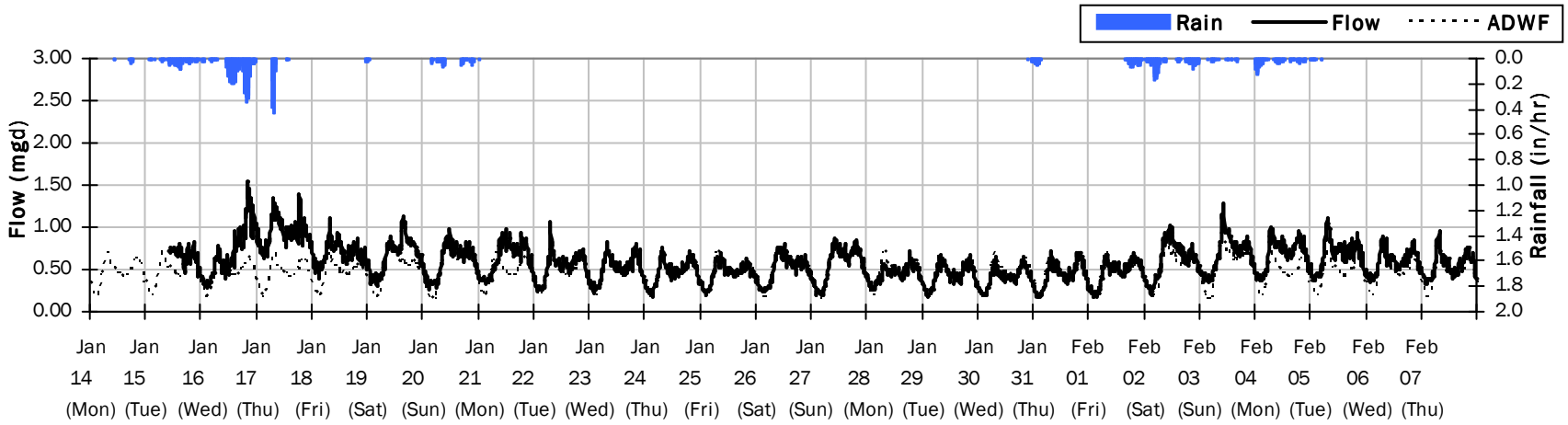
Total Rainfall: 16.67 inches

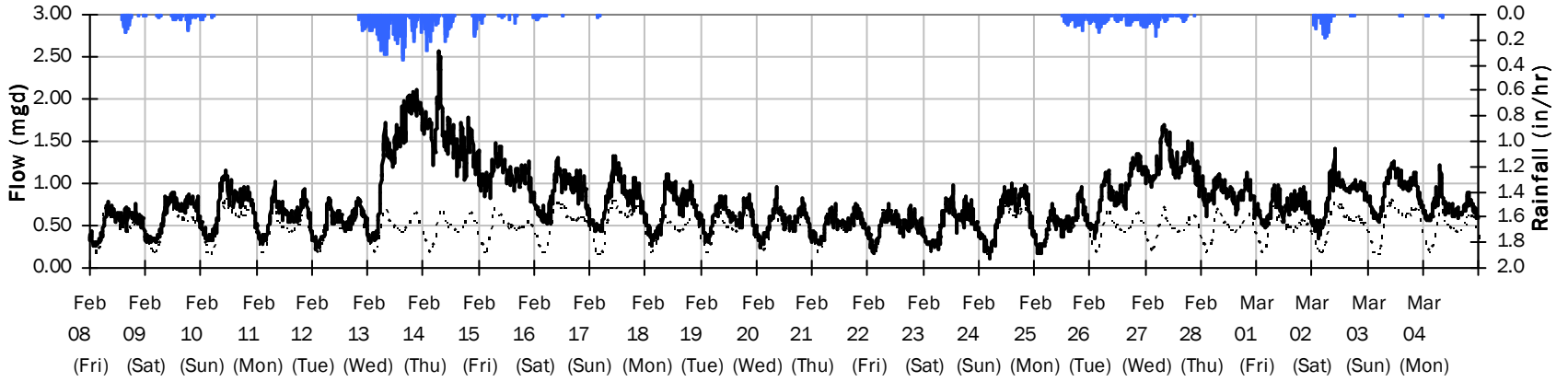


SITE 3

Flow Summary: 1/14/2019 to 3/4/2019

Period Rainfall: 13.39 inches Period Avg Flow: 0.685 mgd Period Peak Flow: 2.539 mgd Period Min Flow: 0.118 mgd

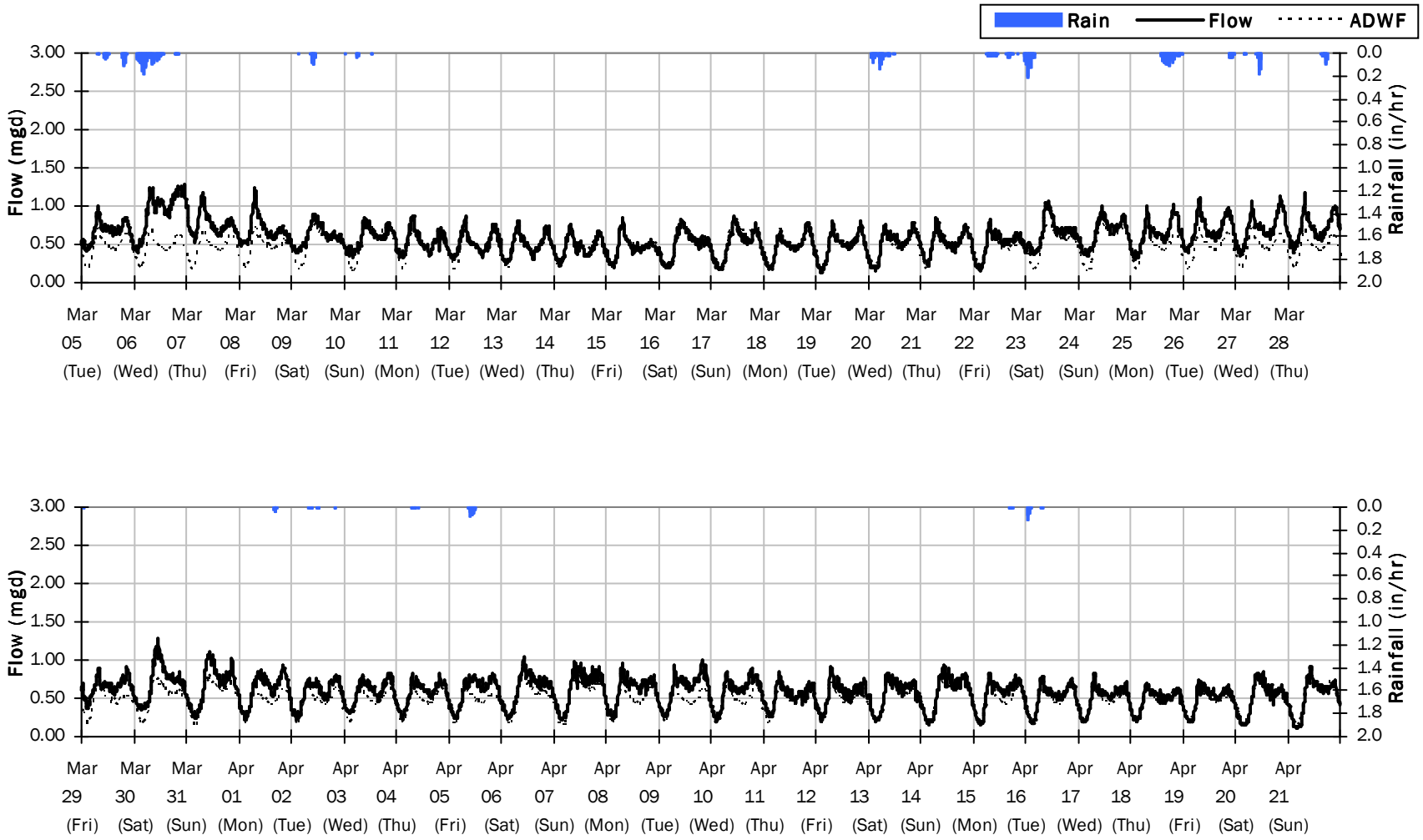




SITE 3

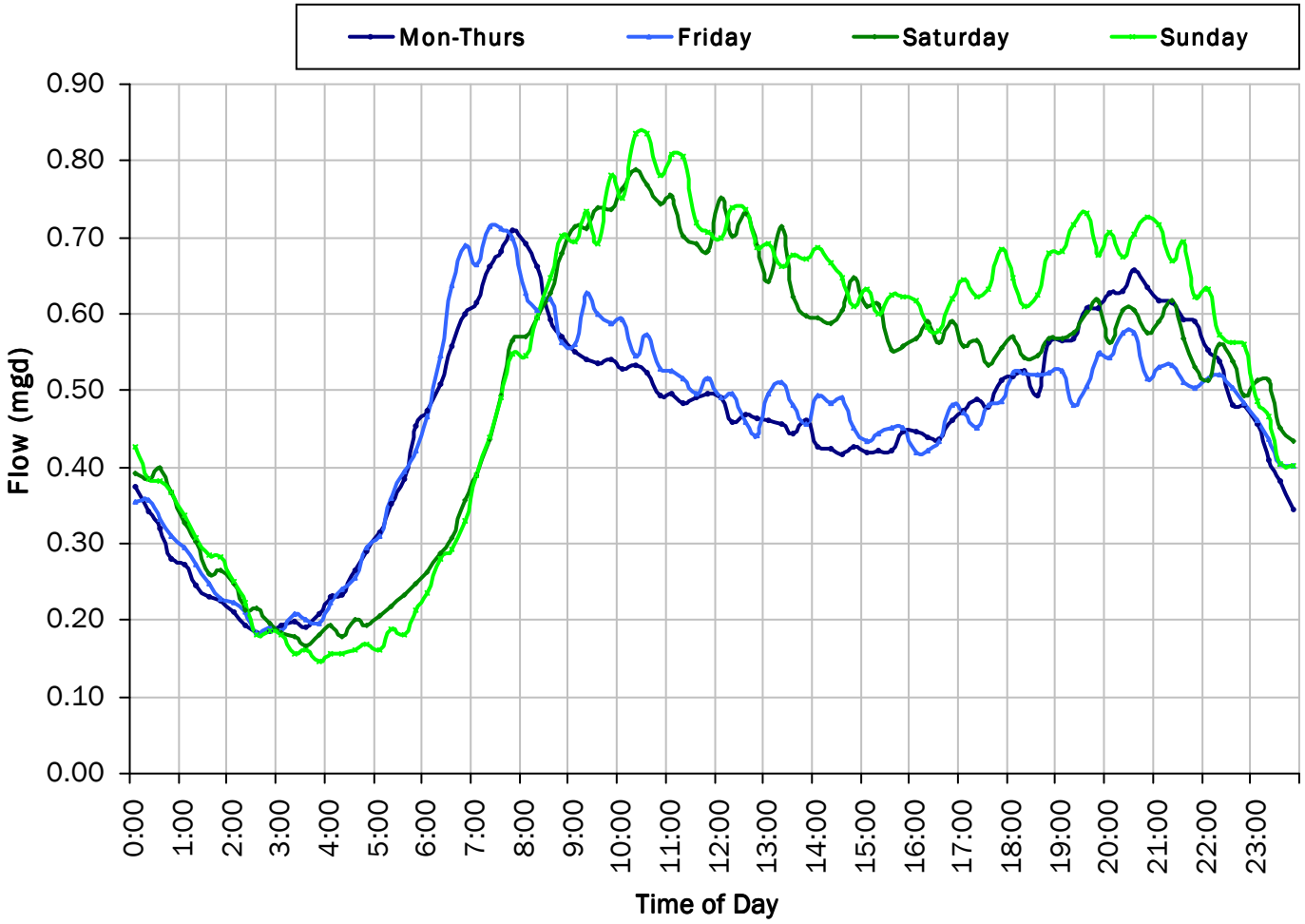
Flow Summary: 3/5/2019 to 4/21/2019

Period Rainfall: 3.41 inches Period Avg Flow: 0.589 mgd Period Peak Flow: 1.285 mgd Period Min Flow: 0.116 mgd



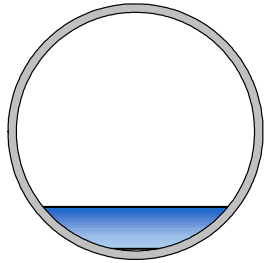
SITE 3

Average Dry Weather Flow Hydrographs



ADWF:

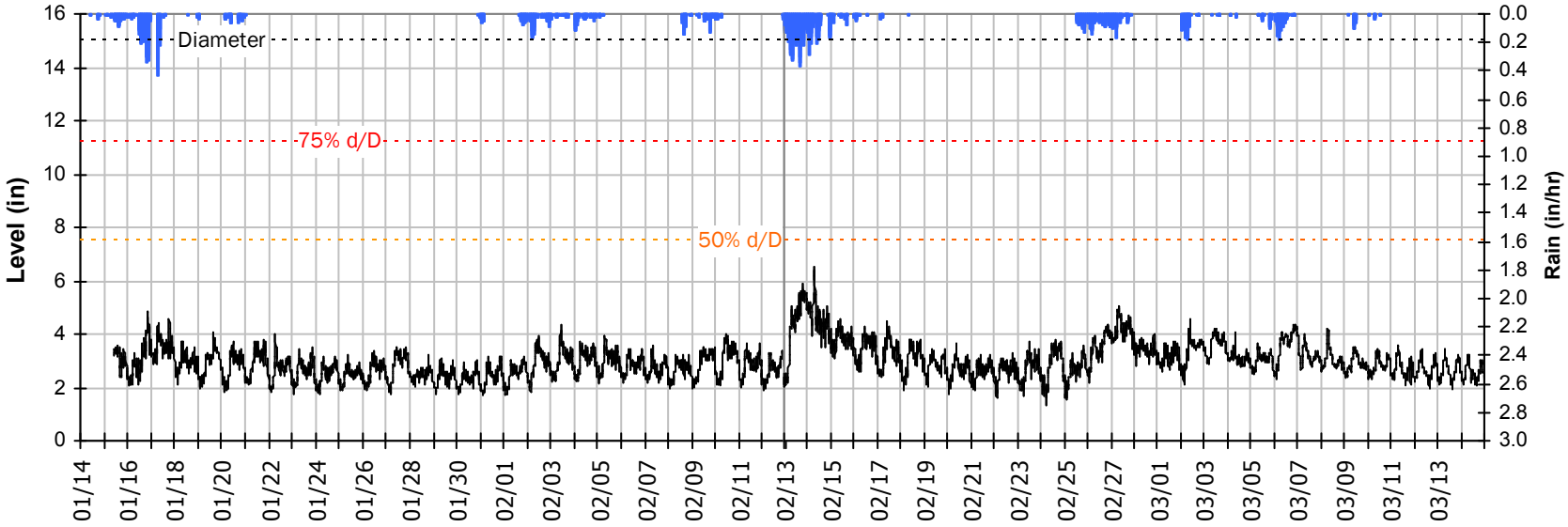
0.474 *mgd*

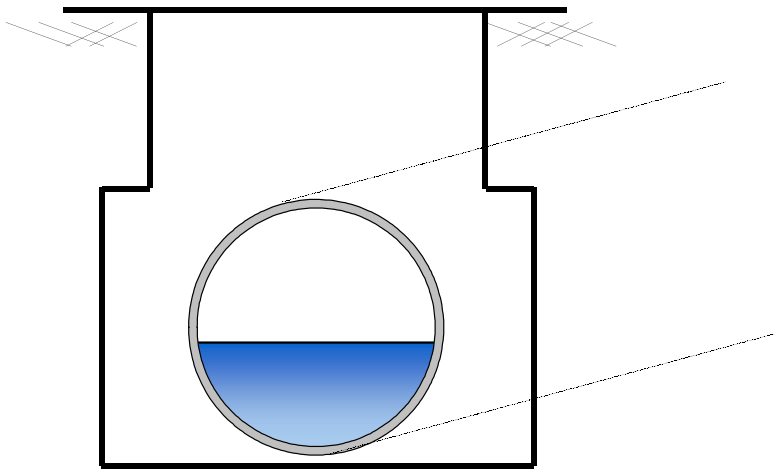


SITE 3

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

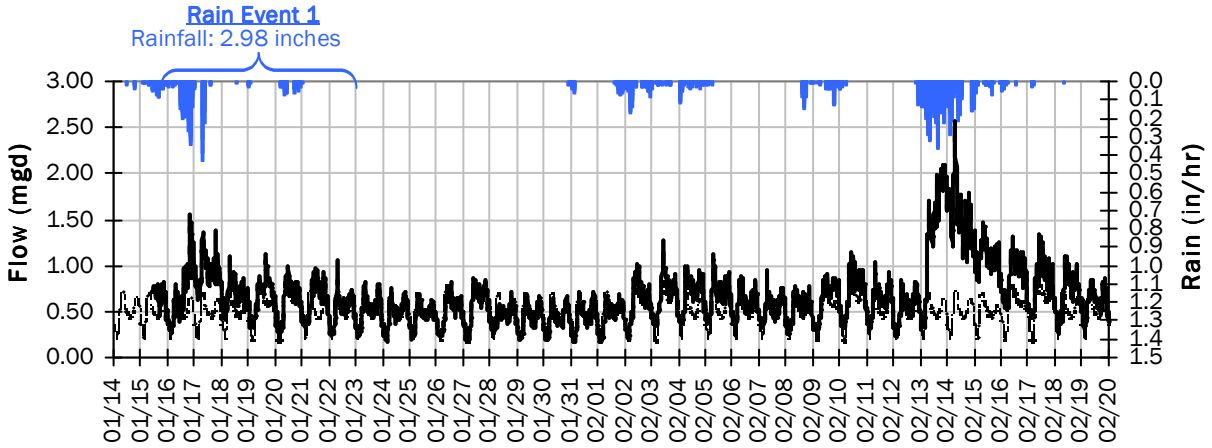




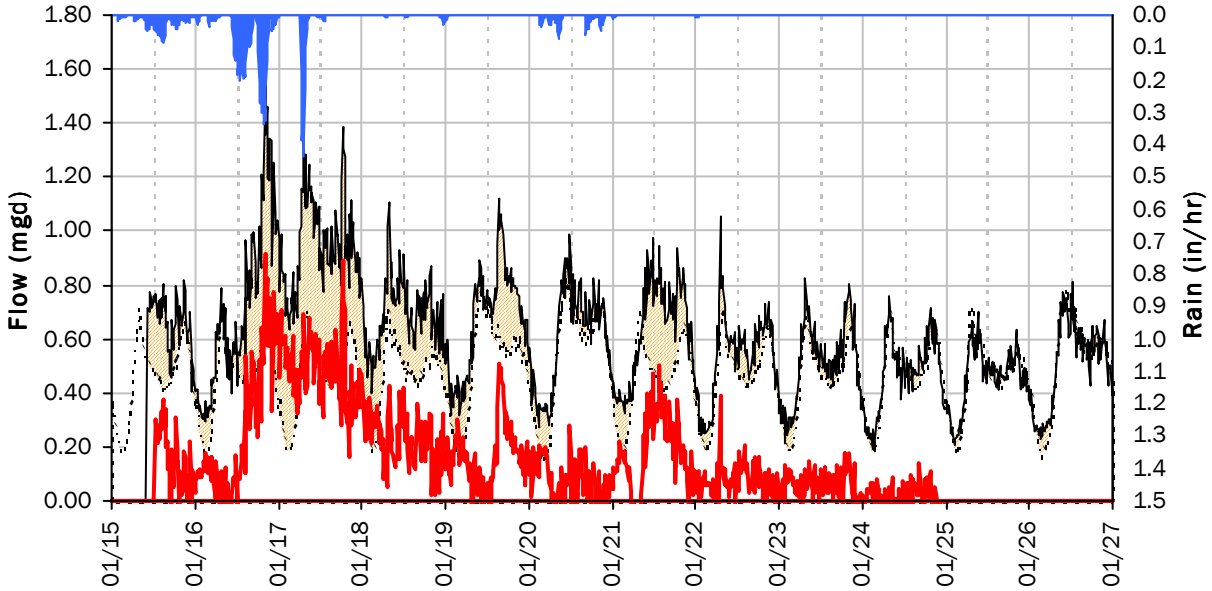
Pipe Diameter:	15	*inches*
Peak Measured Level:	6.52	*inches*
Peak d/D Ratio:	0.43	

SITE 3
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph

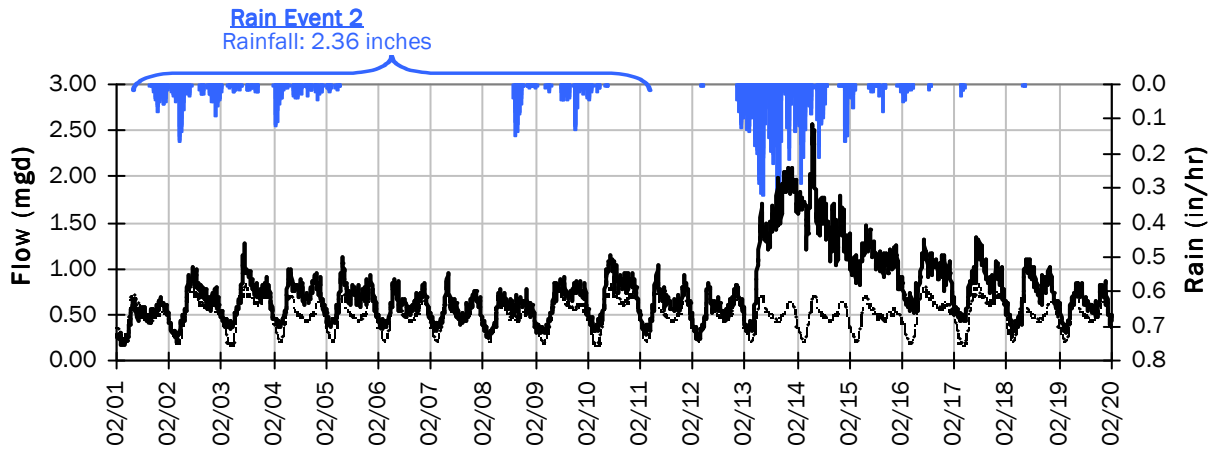


Storm Event I/I Analysis (Rain = 2.98 inches)

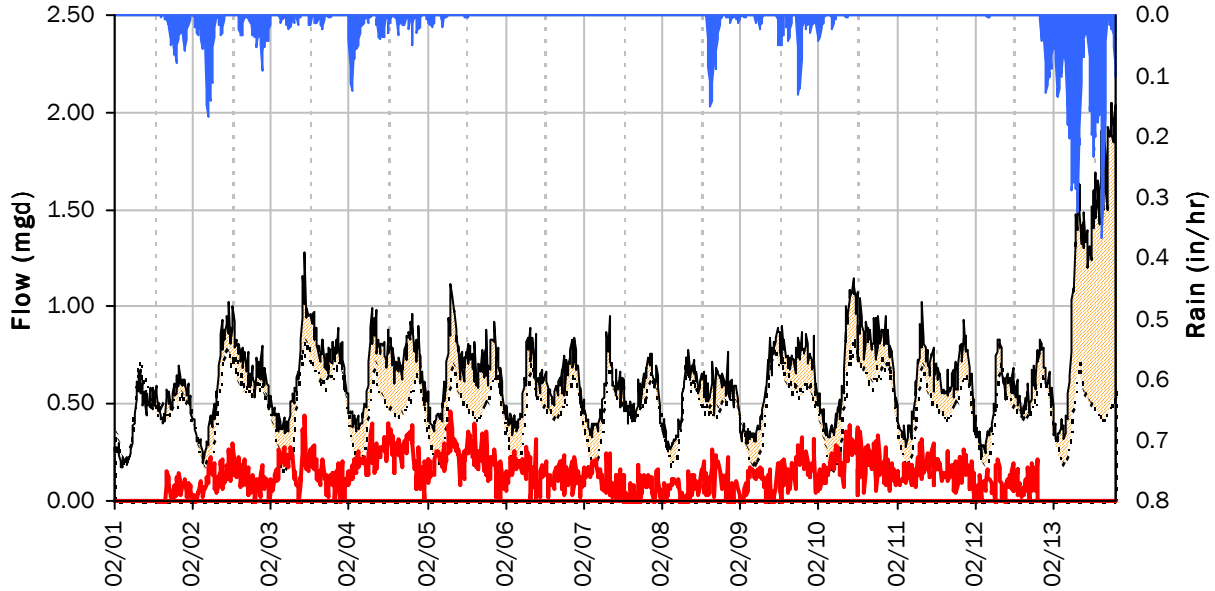
Capacity		Inflow / Infiltration	
Peak Flow:	1.547 *mgd*	**Peak I/I Rate:**	0.917 *mgd*
PF:	3.26	**Total I/I:**	1,615,000 *gallons*
Peak Level:	4.85 *in*		
d/D Ratio:	0.32		

SITE 3
I/I Summary: Rain Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 2 Detail Graph

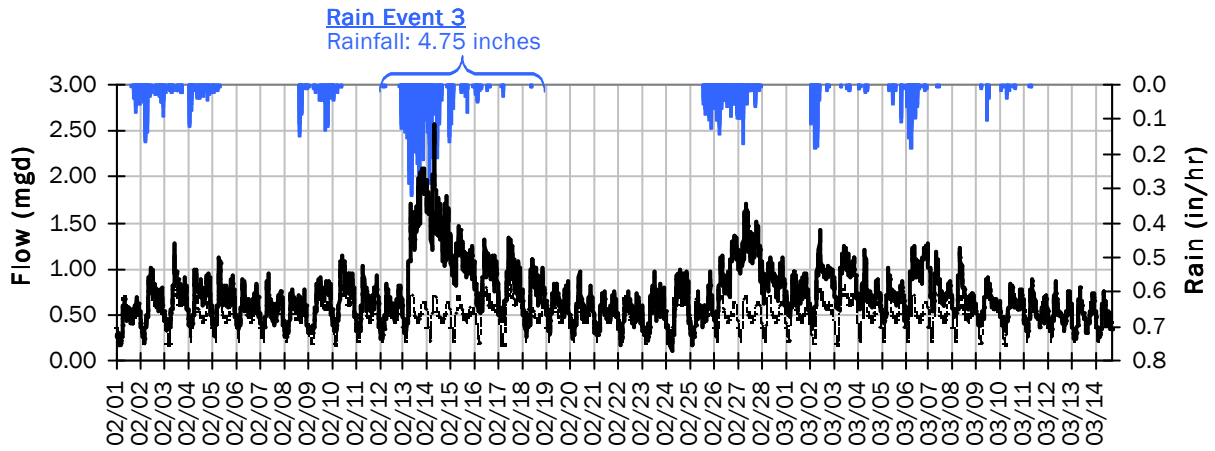


Storm Event I/I Analysis (Rain = 2.36 inches)

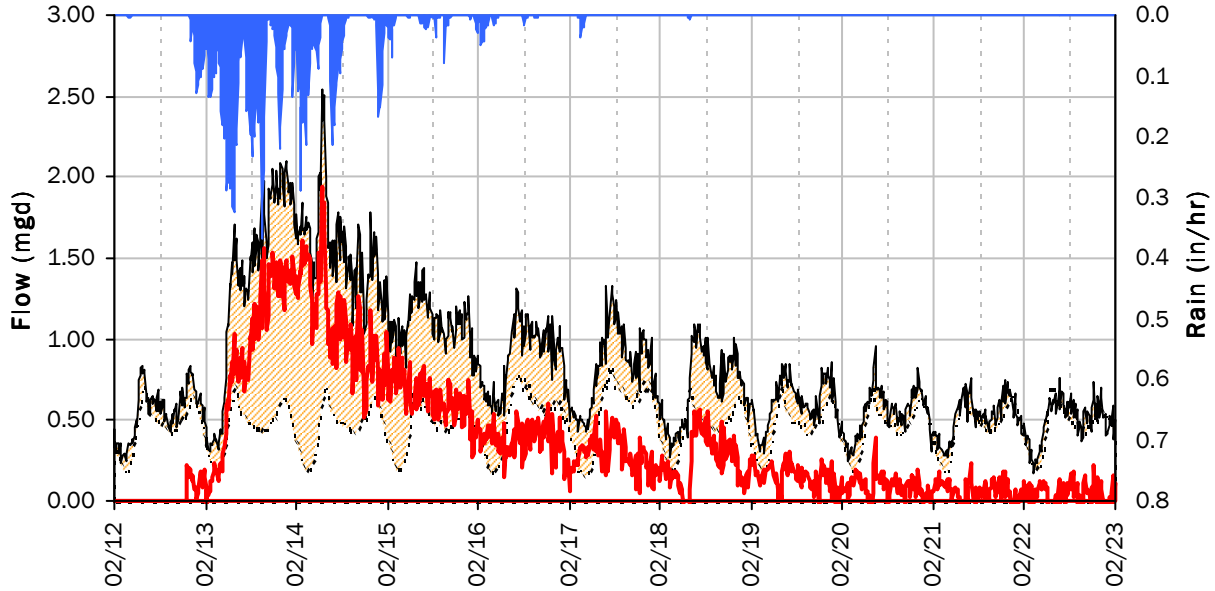
Capacity		Inflow / Infiltration	
Peak Flow:	1.281 *mgd*	**Peak I/I Rate:**	0.457 *mgd*
PF:	2.70	**Total I/I:**	1,589,000 *gallons*
Peak Level:	4.36 *in*		
d/D Ratio:	0.29		

SITE 3
I/I Summary: Rain Event 3

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3 Detail Graph

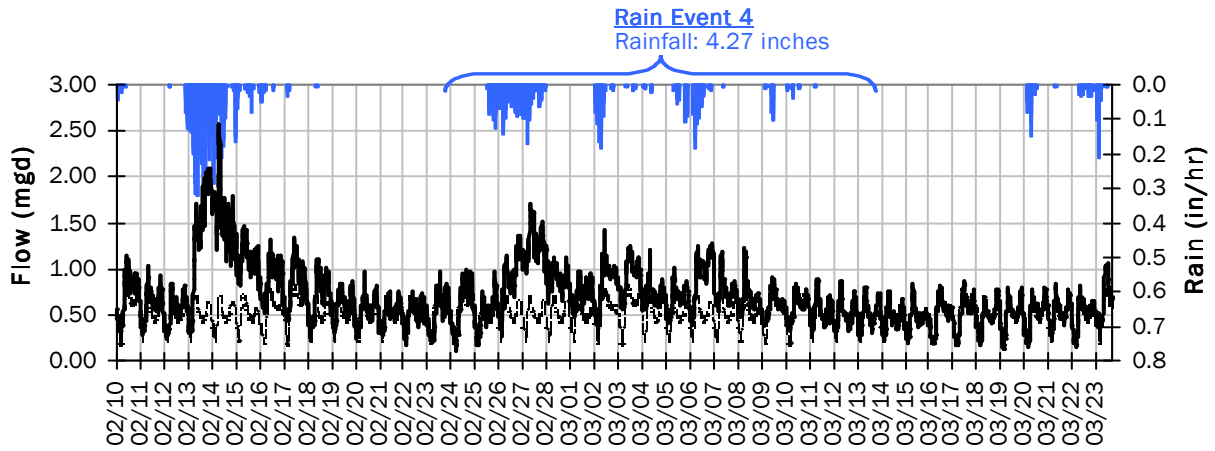


Storm Event I/I Analysis (Rain = 4.75 inches)

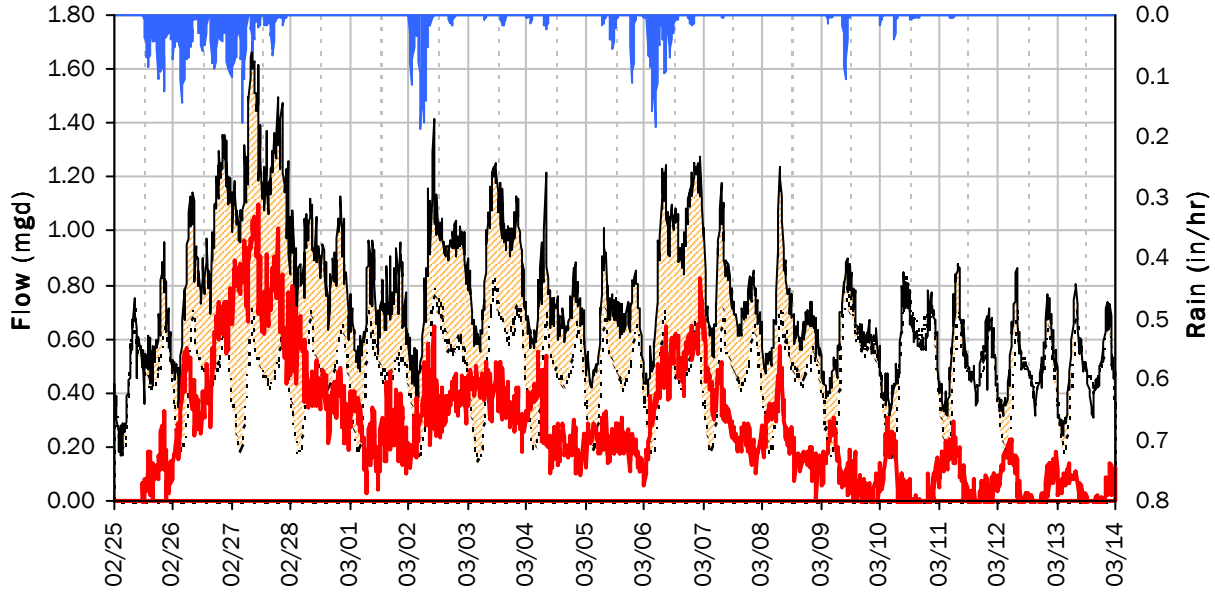
Capacity		Inflow / Infiltration	
Peak Flow:	2.54 *mgd*	**Peak I/I Rate:**	1.94 *mgd*
PF:	5.36	**Total I/I:**	3,930,000 *gallons*
Peak Level:	6.52 *in*		
d/D Ratio:	0.43		

SITE 3
I/I Summary: Rain Event 4

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 4 Detail Graph

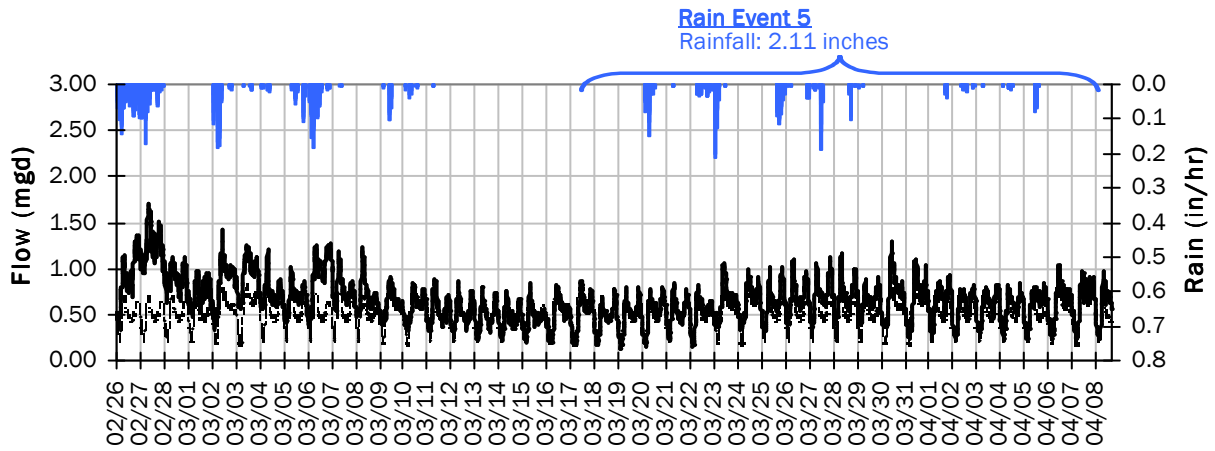


Storm Event I/I Analysis (Rain = 4.27 inches)

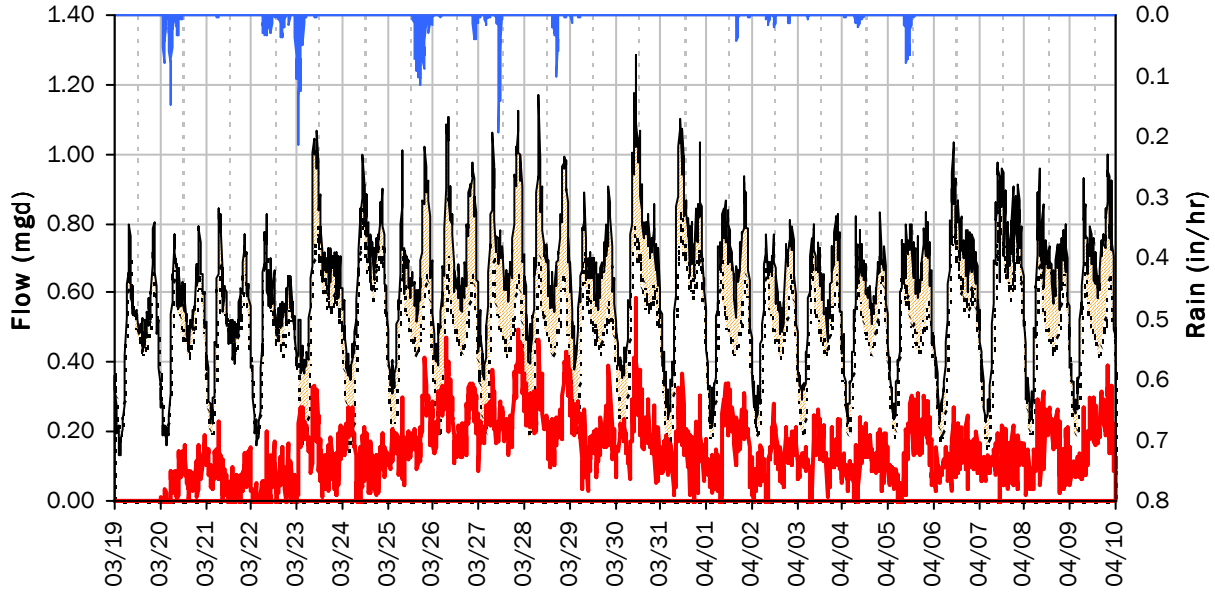
Capacity		Inflow / Infiltration	
Peak Flow:	1.70 *mgd*	**Peak I/I Rate:**	1.10 *mgd*
PF:	3.59	**Total I/I:**	4,596,000 *gallons*
Peak Level:	5.04 *in*		
d/D Ratio:	0.34		

SITE 3
I/I Summary: Rain Event 5

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 5 Detail Graph



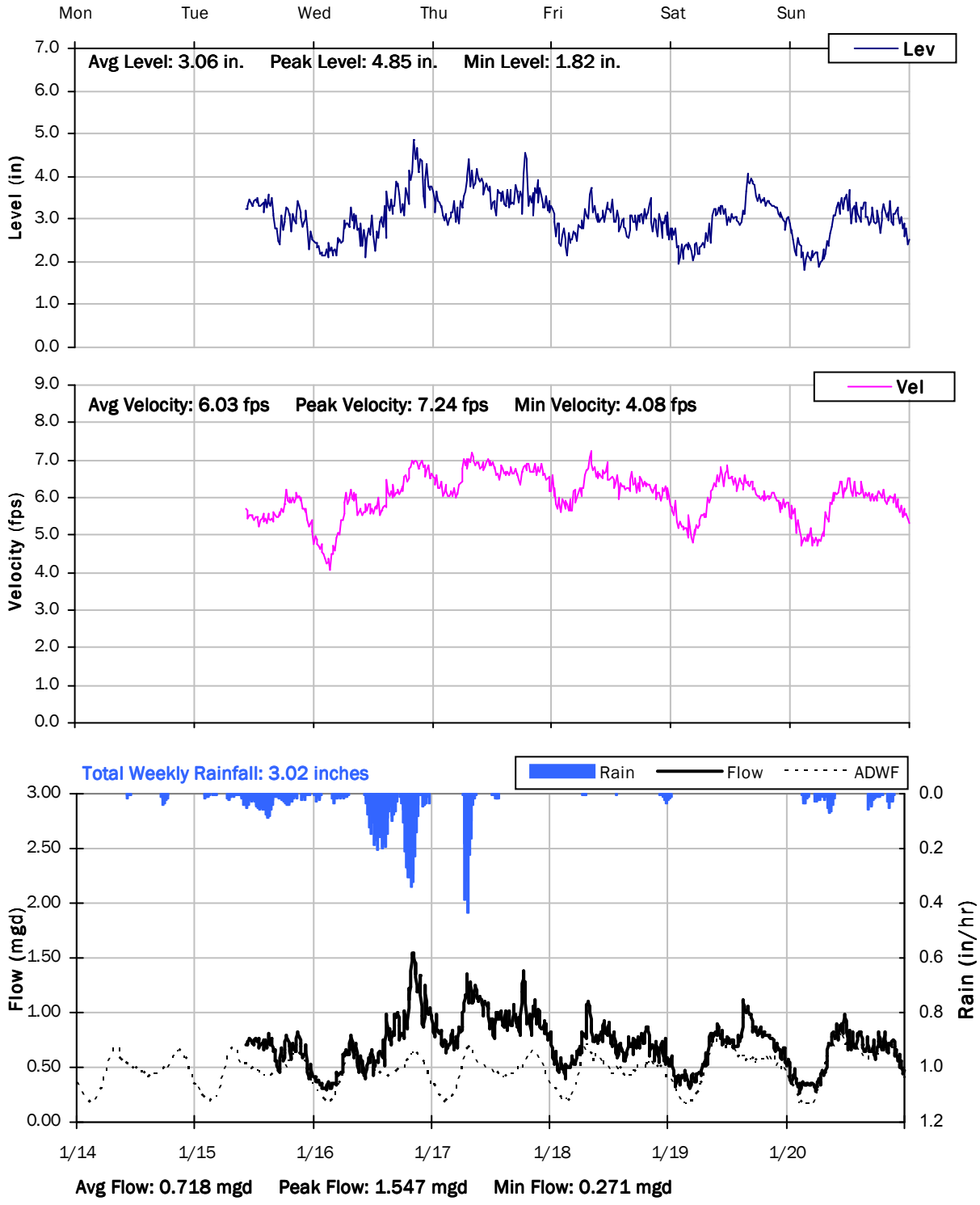
Storm Event I/I Analysis (Rain = 2.11 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	1.29 *mgd*	**Peak I/I Rate:**	0.58 *mgd*
PF:	2.71	**Total I/I:**	3,147,000 *gallons*
Peak Level:	4.17 *in*		
d/D Ratio:	0.28		

SITE 3

Weekly Level, Velocity and Flow Hydrographs

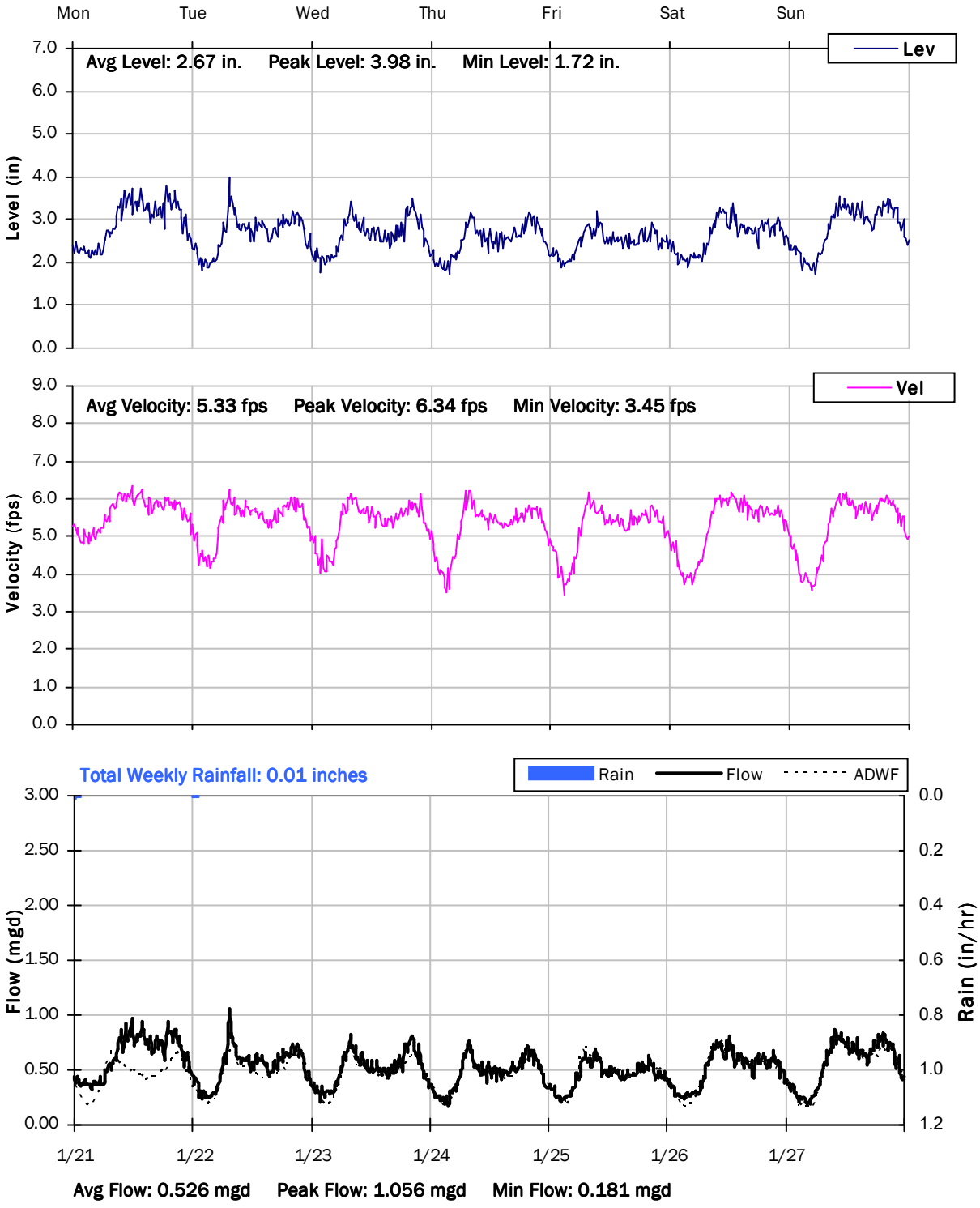
1/14/2019 to 1/21/2019



SITE 3

Weekly Level, Velocity and Flow Hydrographs

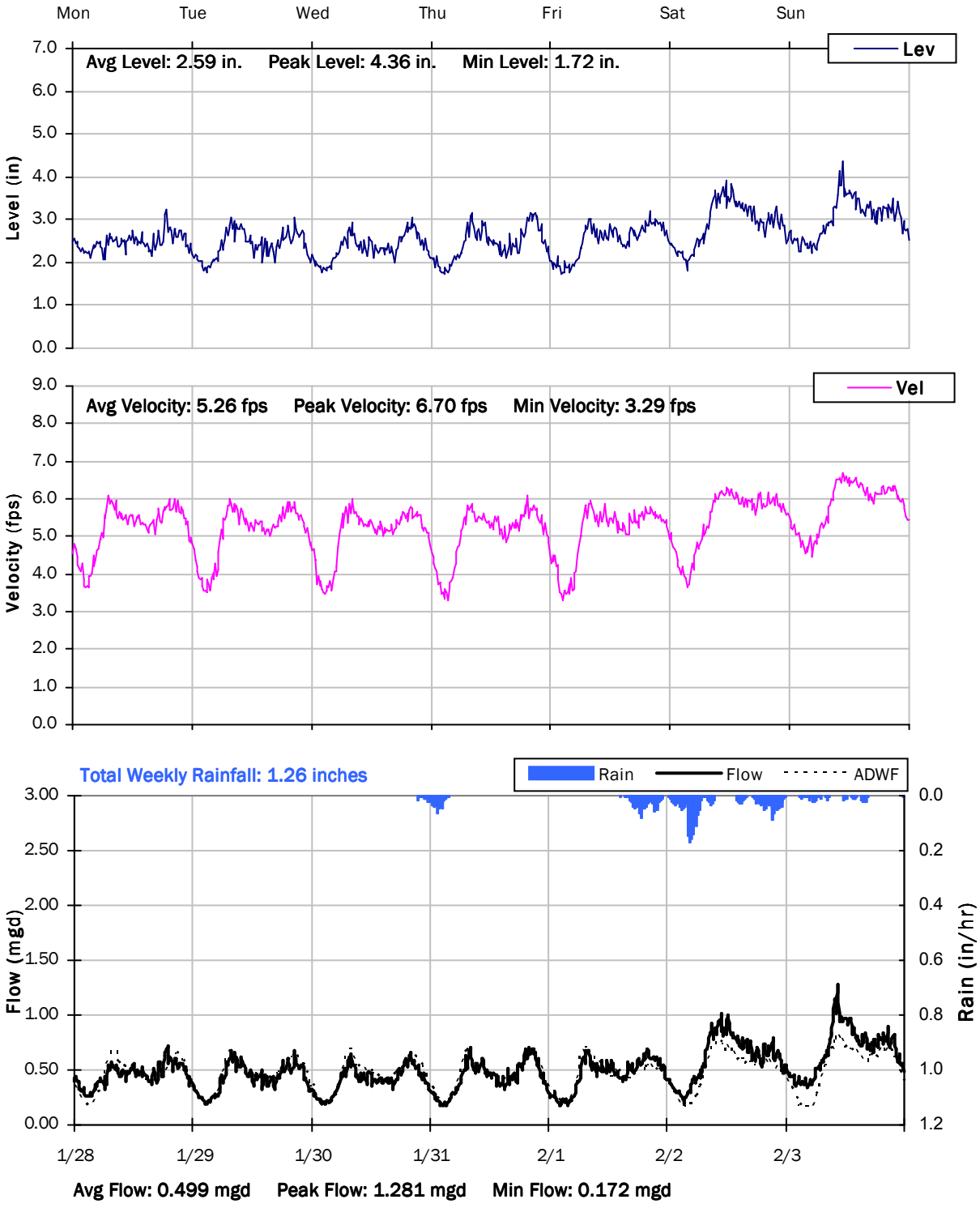
1/21/2019 to 1/28/2019



SITE 3

Weekly Level, Velocity and Flow Hydrographs

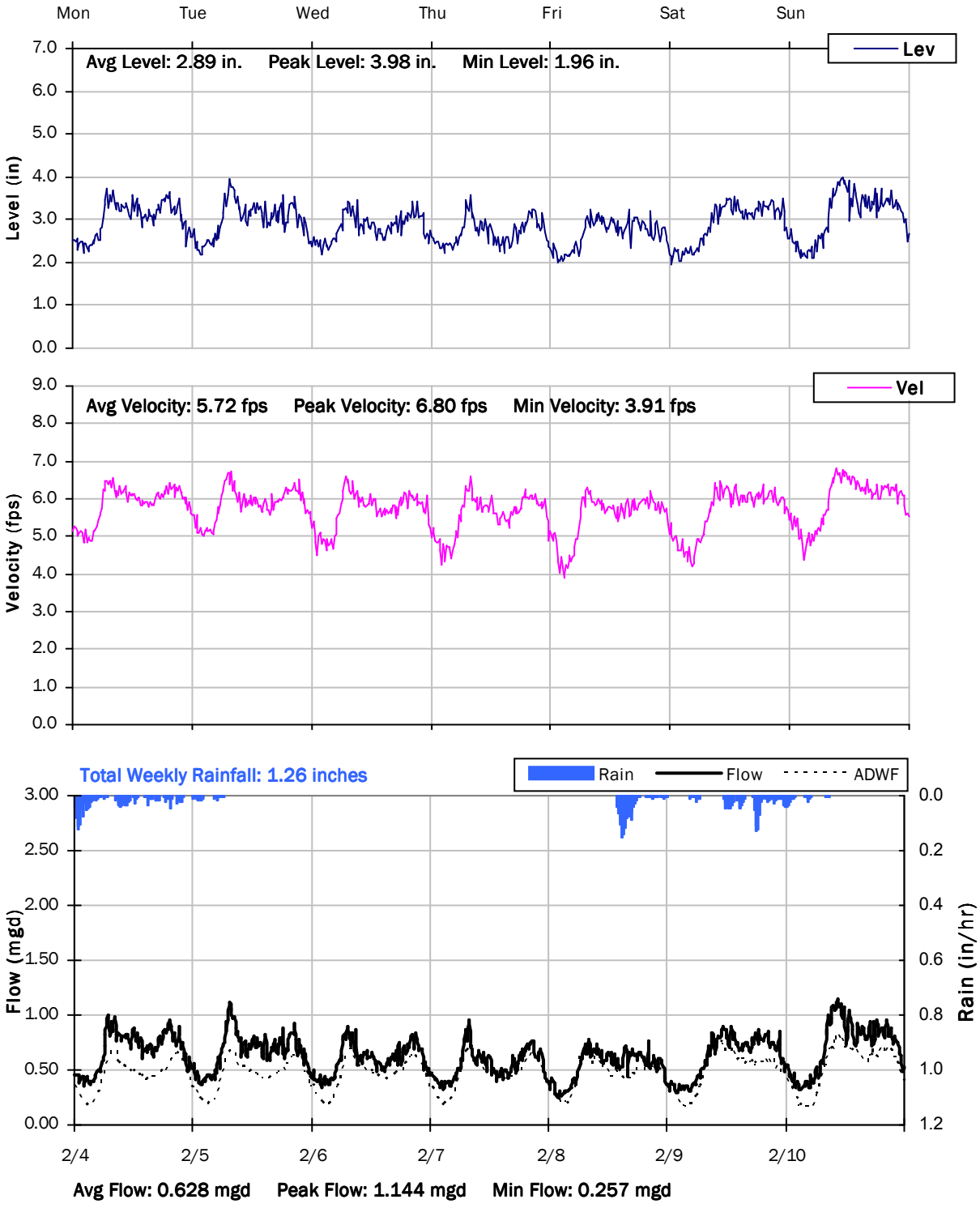
1/28/2019 to 2/4/2019



SITE 3

Weekly Level, Velocity and Flow Hydrographs

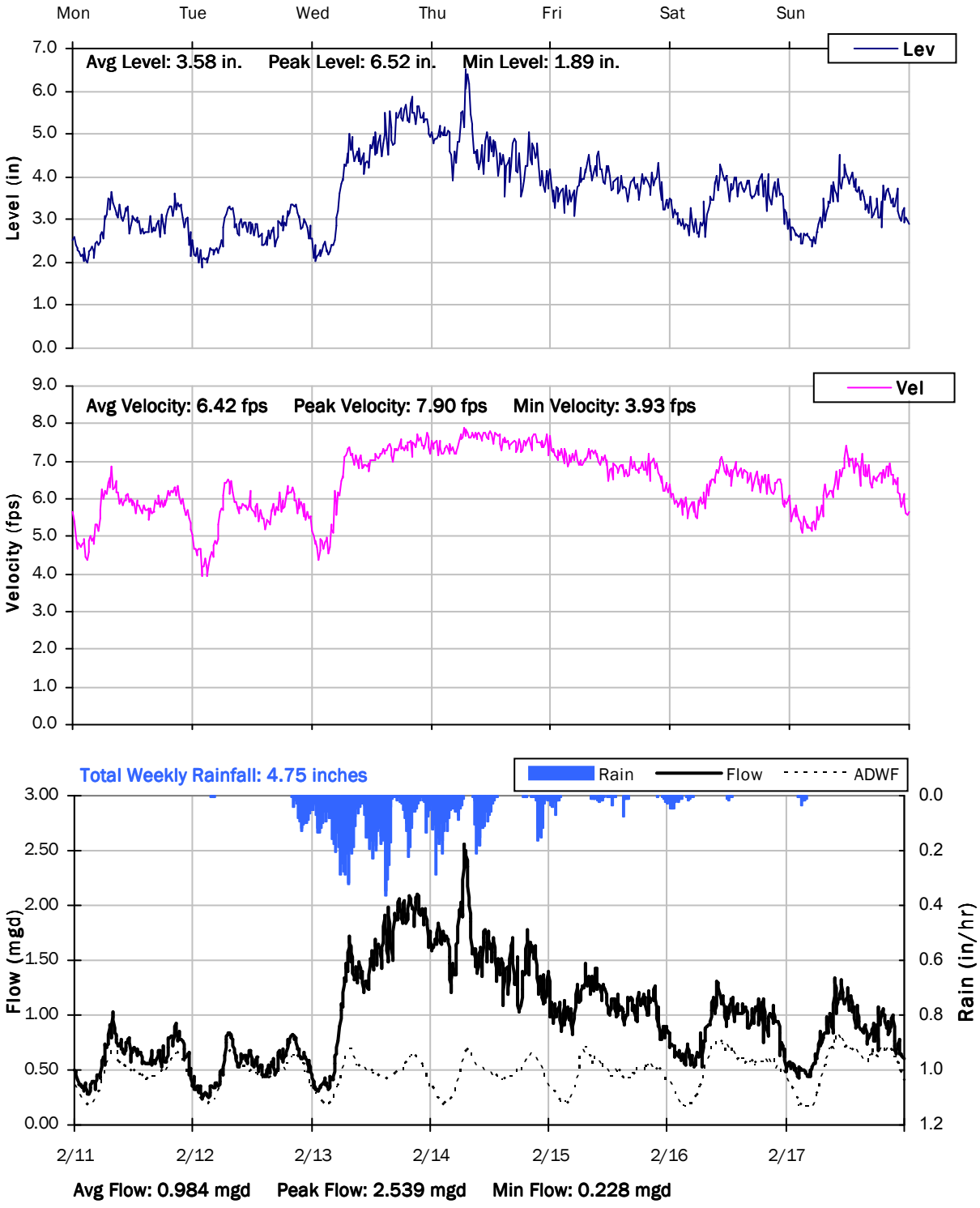
2/4/2019 to 2/11/2019



SITE 3

Weekly Level, Velocity and Flow Hydrographs

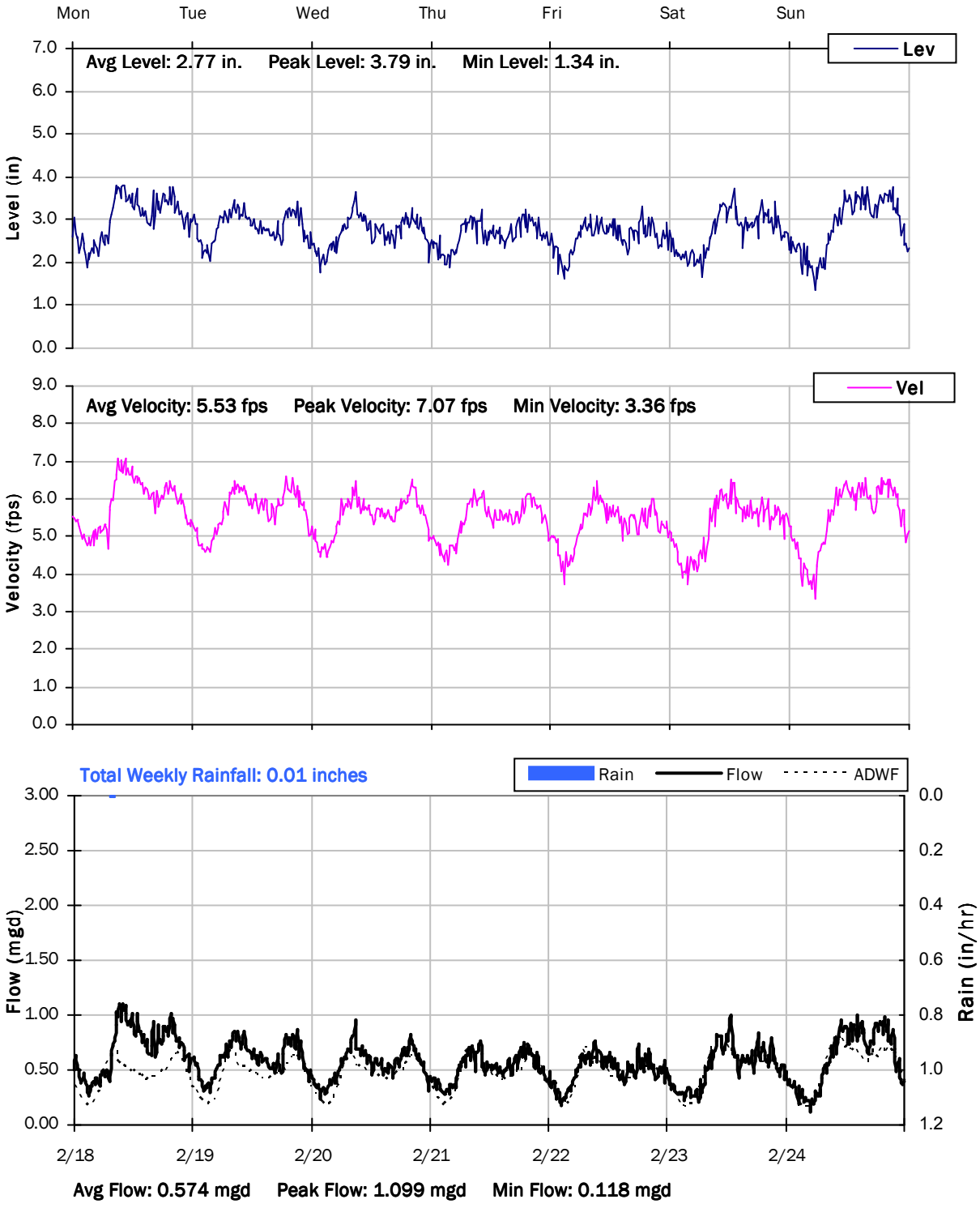
2/11/2019 to 2/18/2019



SITE 3

Weekly Level, Velocity and Flow Hydrographs

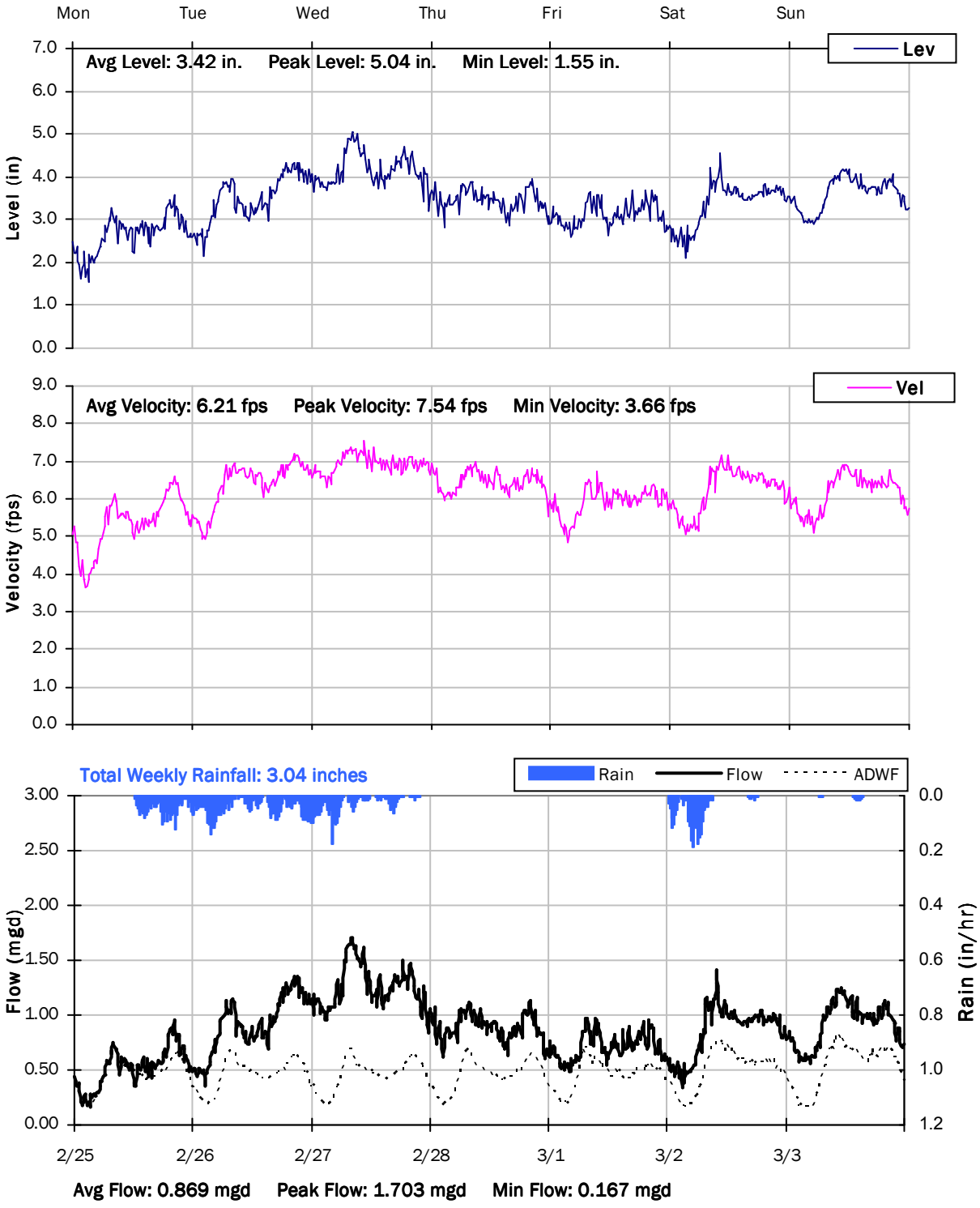
2/18/2019 to 2/25/2019



SITE 3

Weekly Level, Velocity and Flow Hydrographs

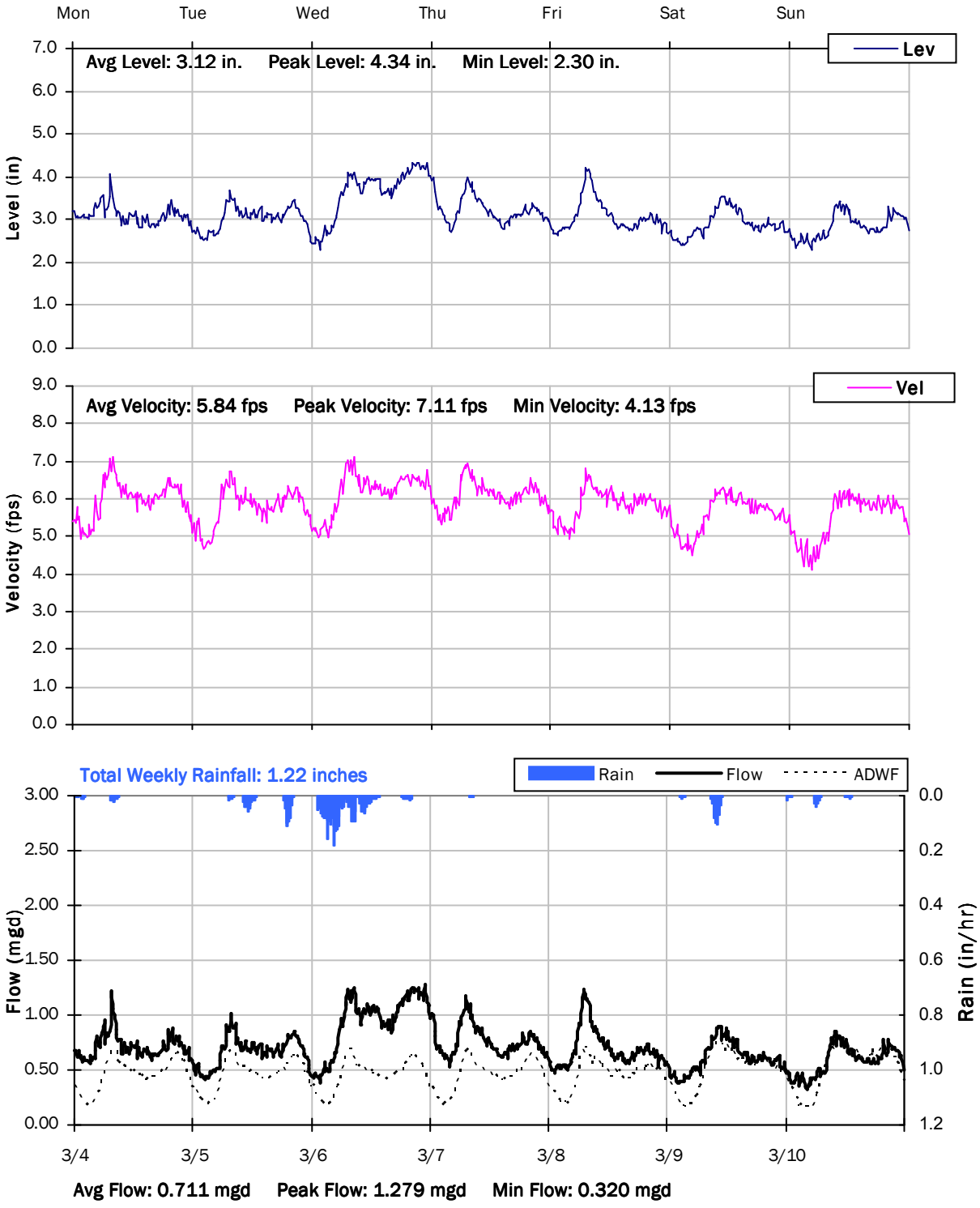
2/25/2019 to 3/4/2019



SITE 3

Weekly Level, Velocity and Flow Hydrographs

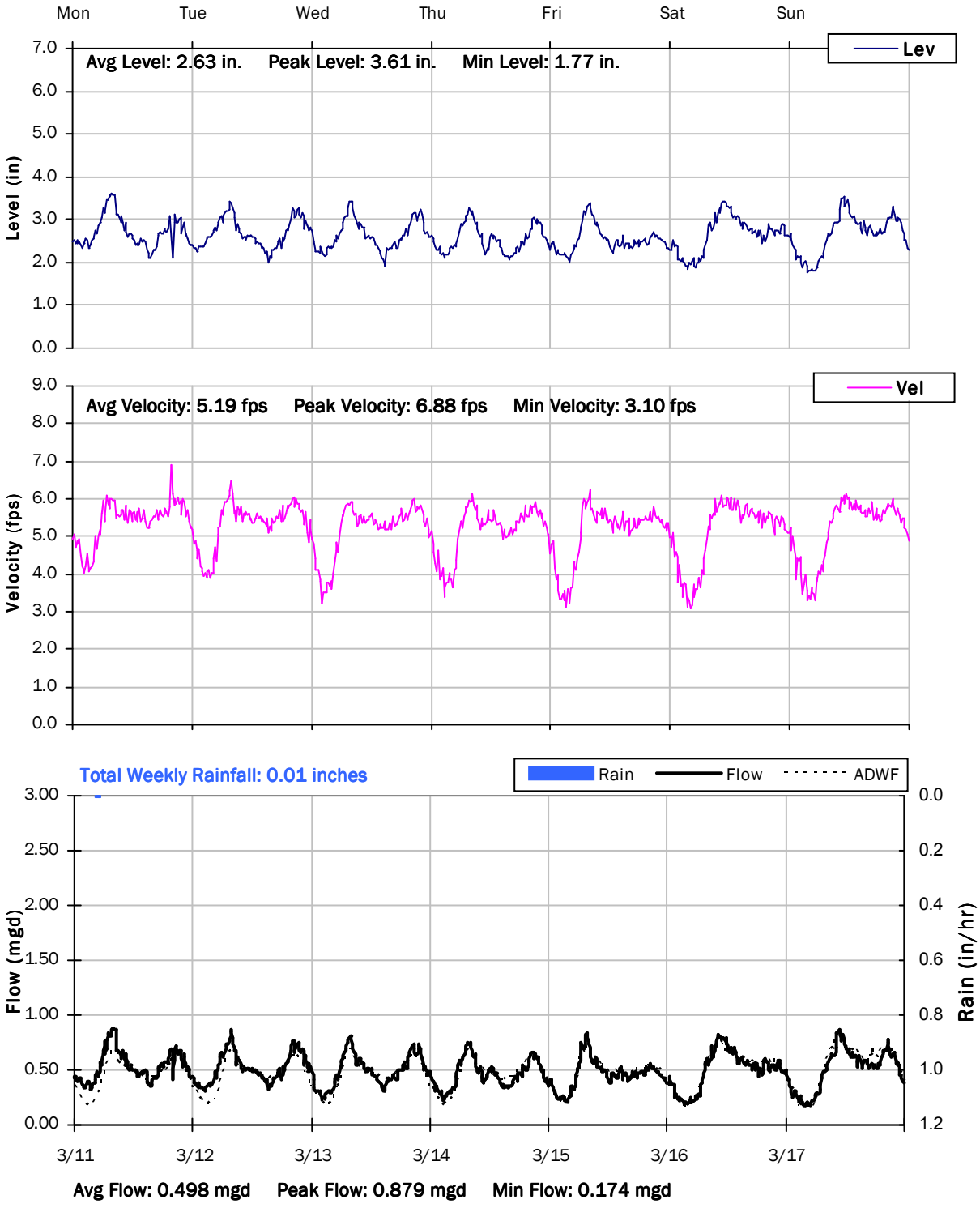
3/4/2019 to 3/11/2019



SITE 3

Weekly Level, Velocity and Flow Hydrographs

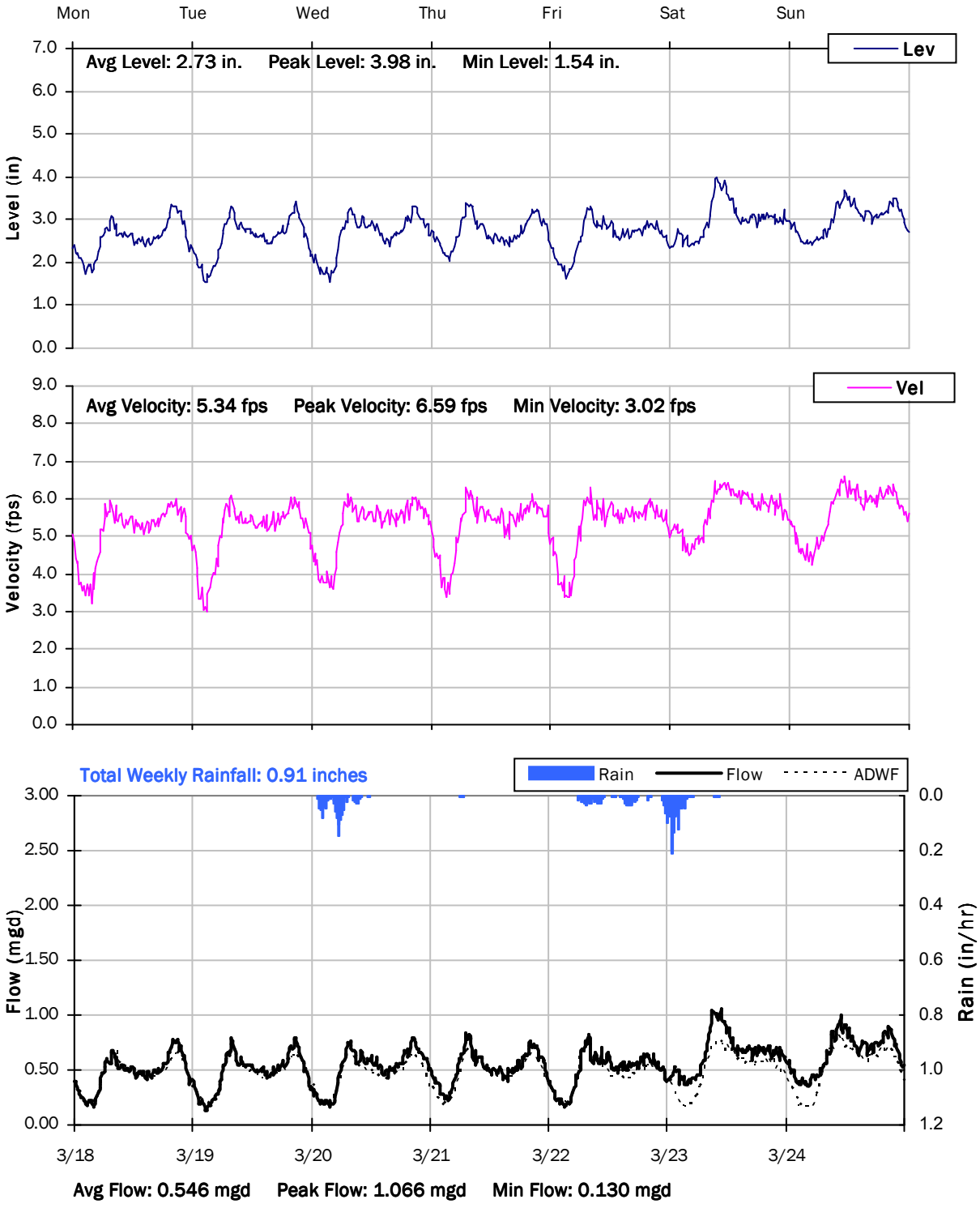
3/11/2019 to 3/18/2019



SITE 3

Weekly Level, Velocity and Flow Hydrographs

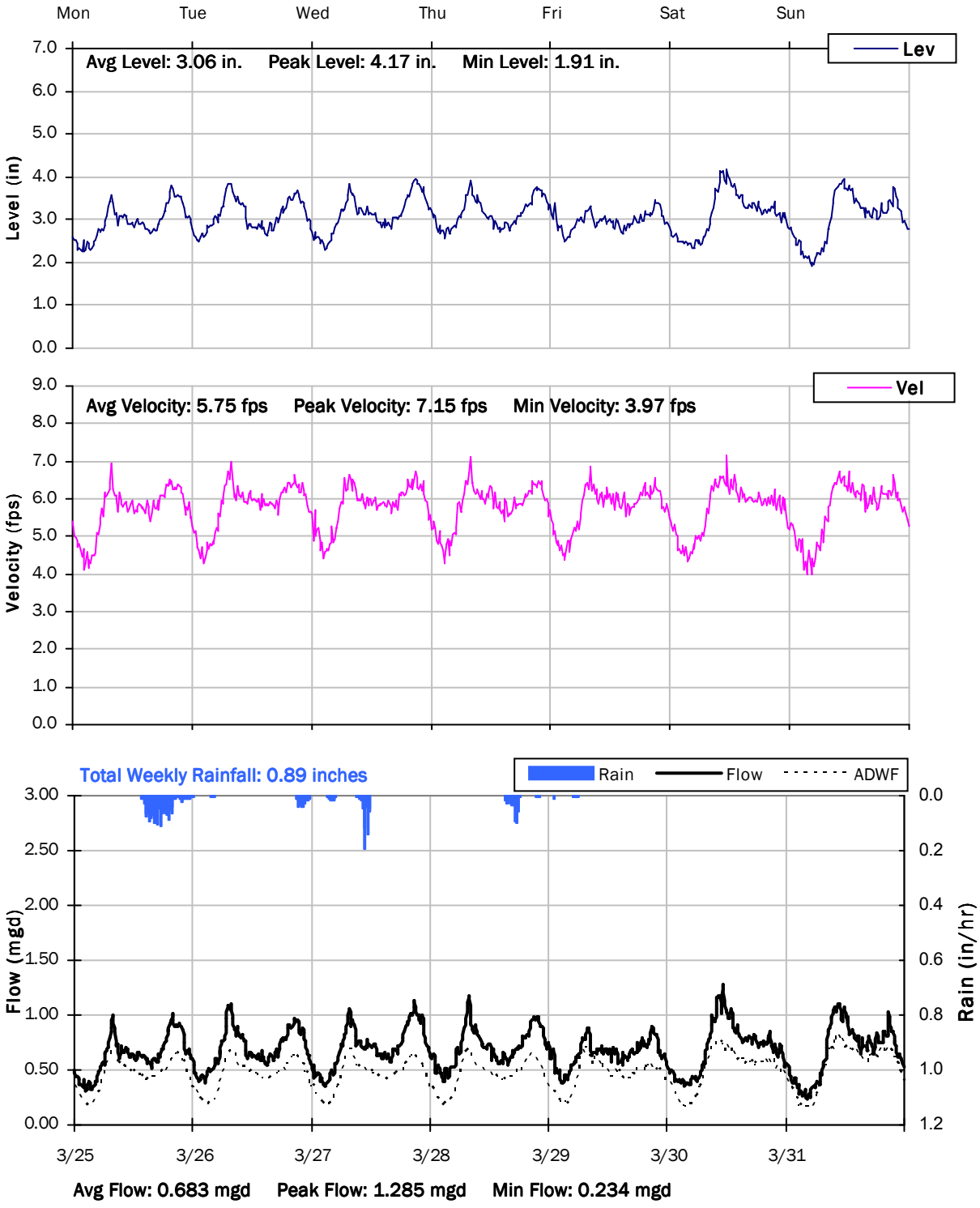
3/18/2019 to 3/25/2019



SITE 3

Weekly Level, Velocity and Flow Hydrographs

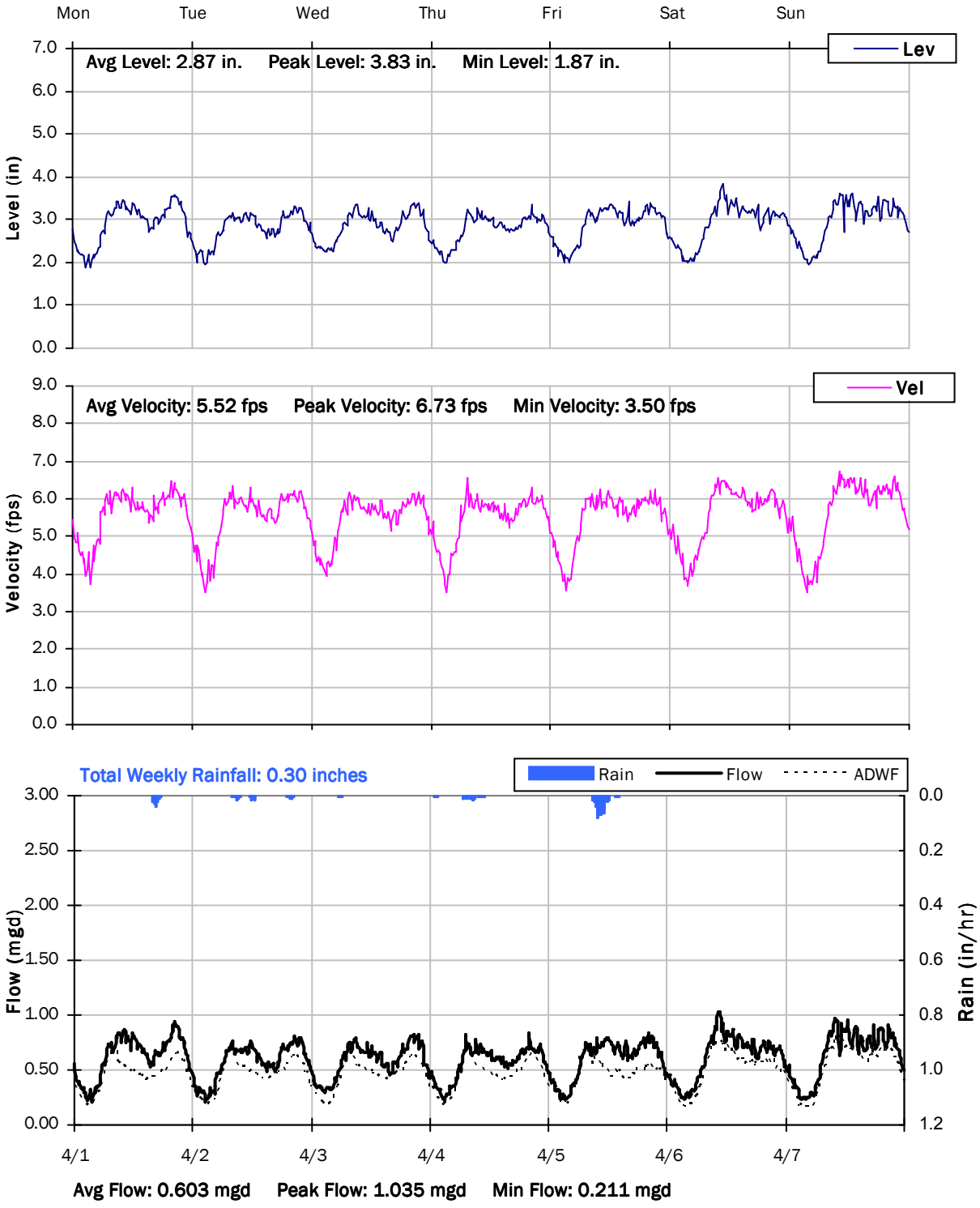
3/25/2019 to 4/1/2019



SITE 3

Weekly Level, Velocity and Flow Hydrographs

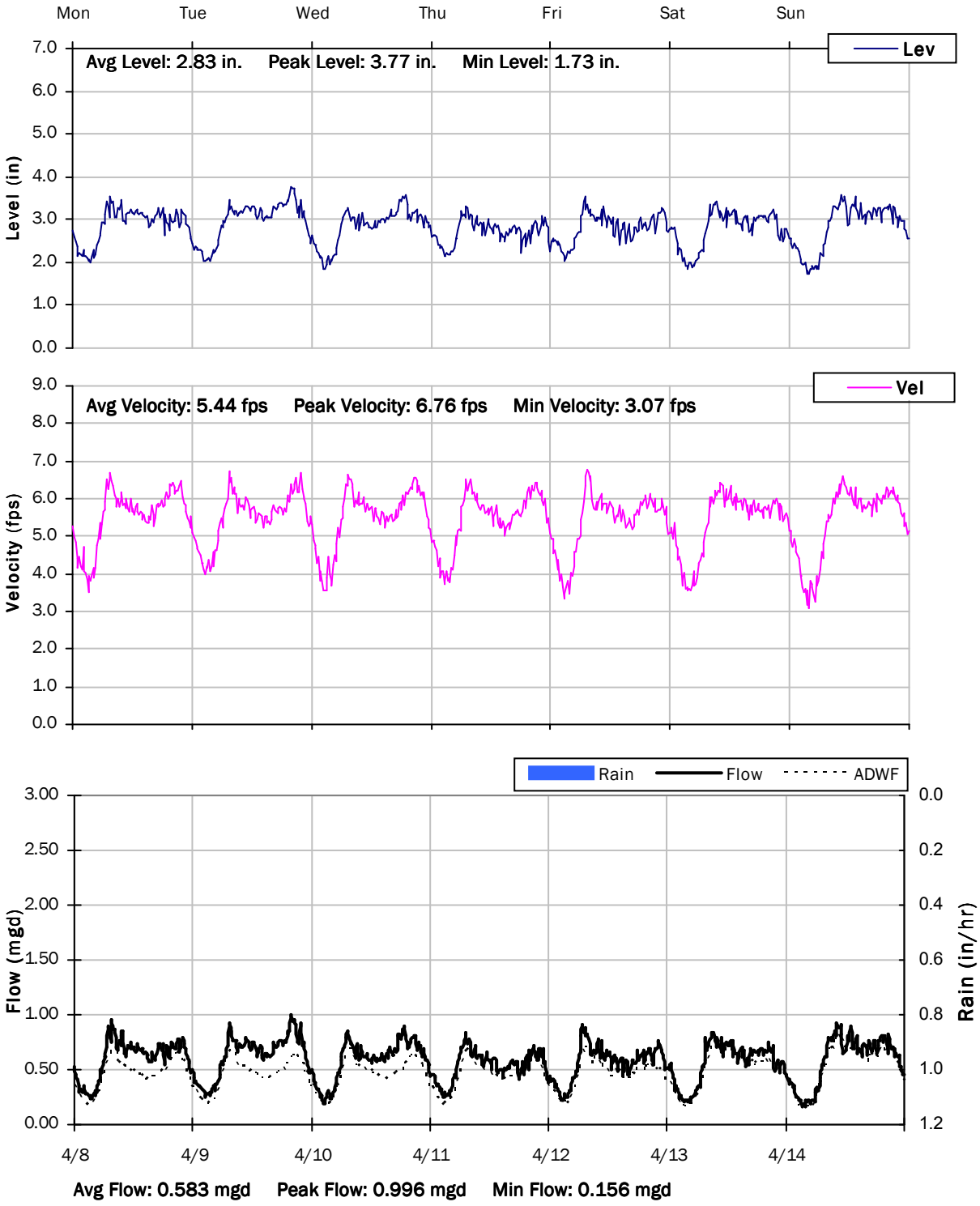
4/1/2019 to 4/8/2019



SITE 3

Weekly Level, Velocity and Flow Hydrographs

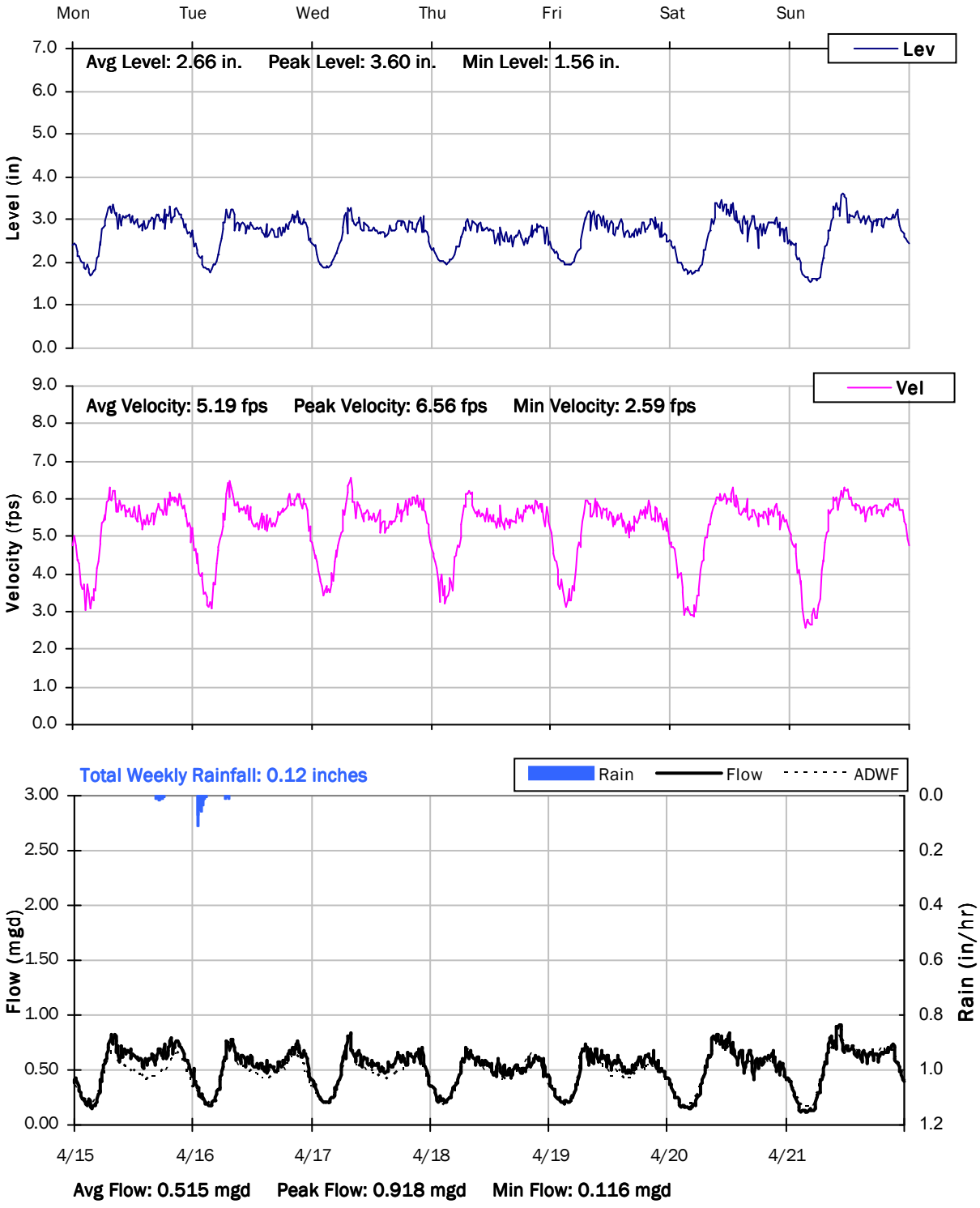
4/8/2019 to 4/15/2019



SITE 3

Weekly Level, Velocity and Flow Hydrographs

4/15/2019 to 4/22/2019



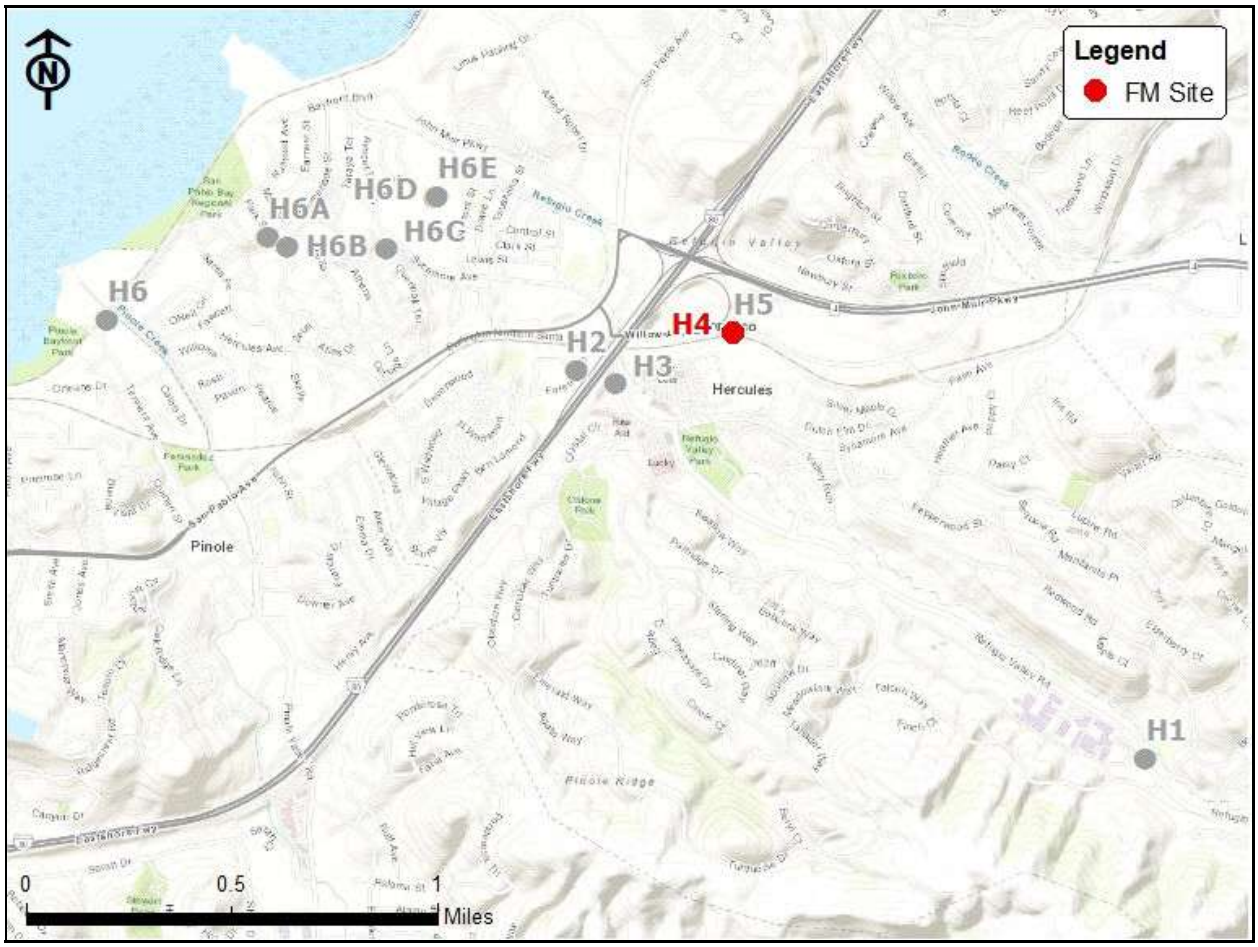
City of Hercules, California

Sanitary Sewer Flow Monitoring
January 14 - April 21, 2019

Monitoring Site: Site 4

Location: Willow Avenue at freeway entrance

Data Summary Report



Vicinity Map: Site 4

SITE 4

Site Information

Location: Willow Avenue at freeway entrance

Coordinates: 122.2673° W, 38.0125° N

Rim Elevation (Earth): 79 feet

Measured Pipe Diameter: 10 inches

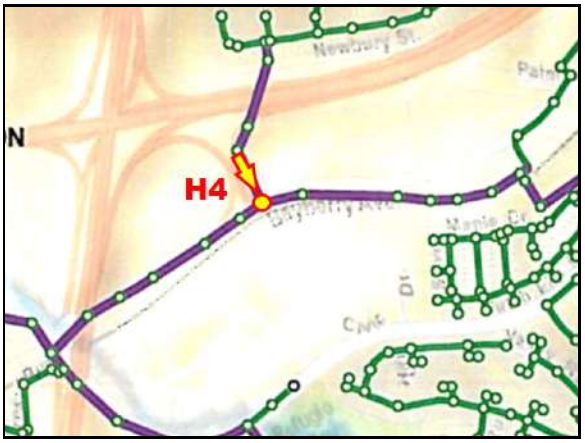
ADWF: 0.106 mgd

Peak Measured Flow: 0.566 mgd

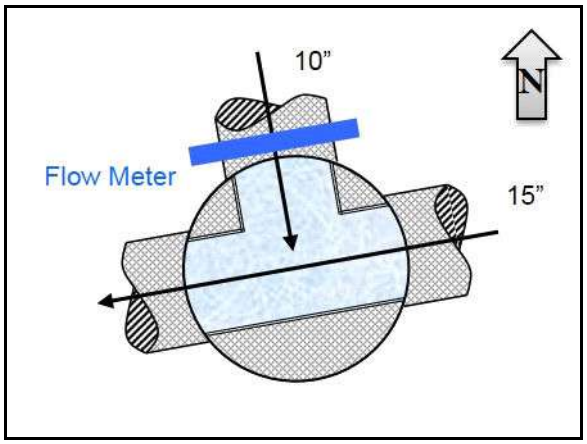
Sediment: None



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

SITE 4

Additional Site Photos

Effluent Pipe



Monitored North Influent Pipe



SITE 4

Additional Site Photos

East Influent Pipe

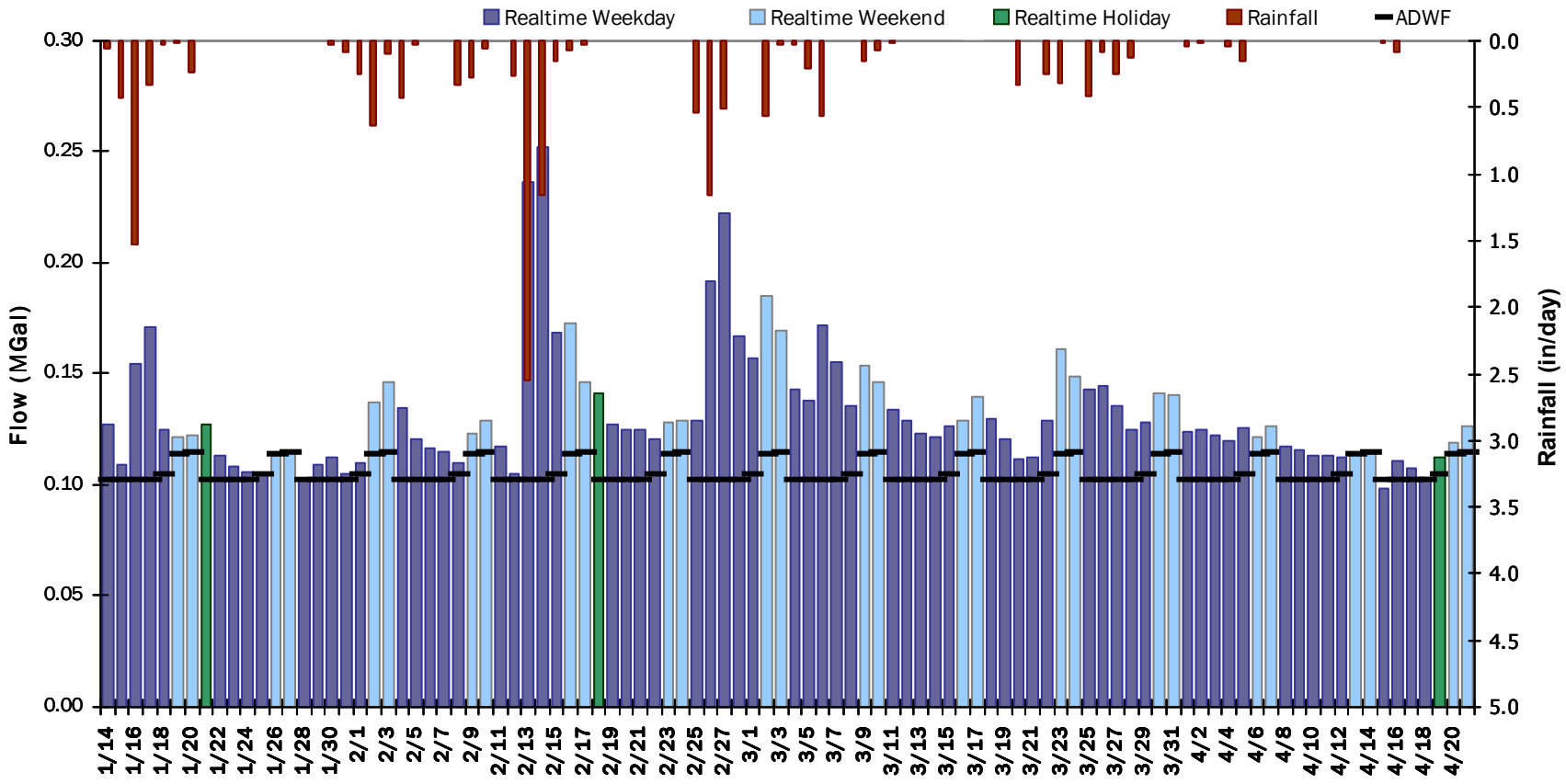


SITE 4

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.132 MGal Peak Daily Flow: 0.252 MGal Min Daily Flow: 0.099 MGal

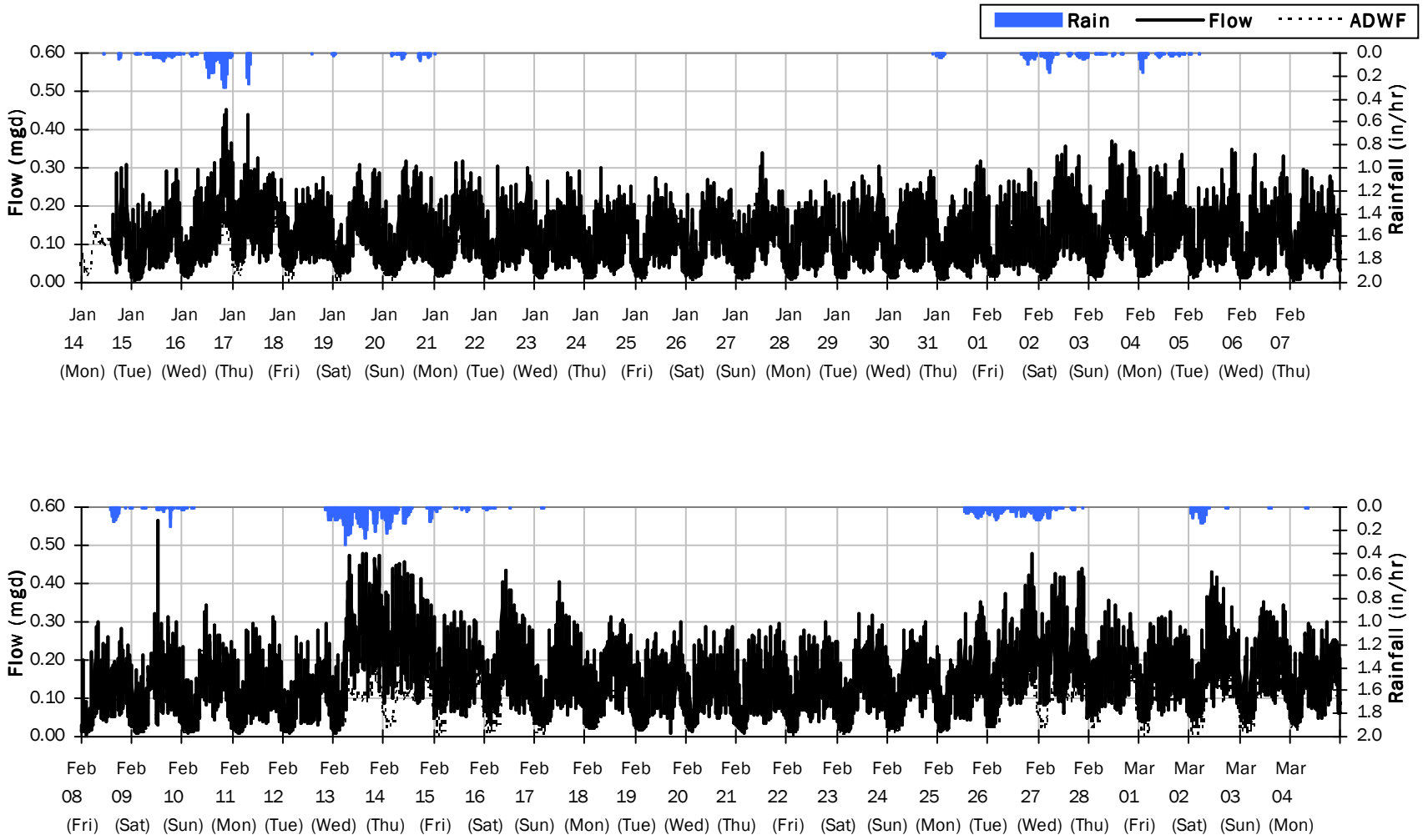
Total Rainfall: 14.96 inches



SITE 4

Flow Summary: 1/14/2019 to 3/4/2019

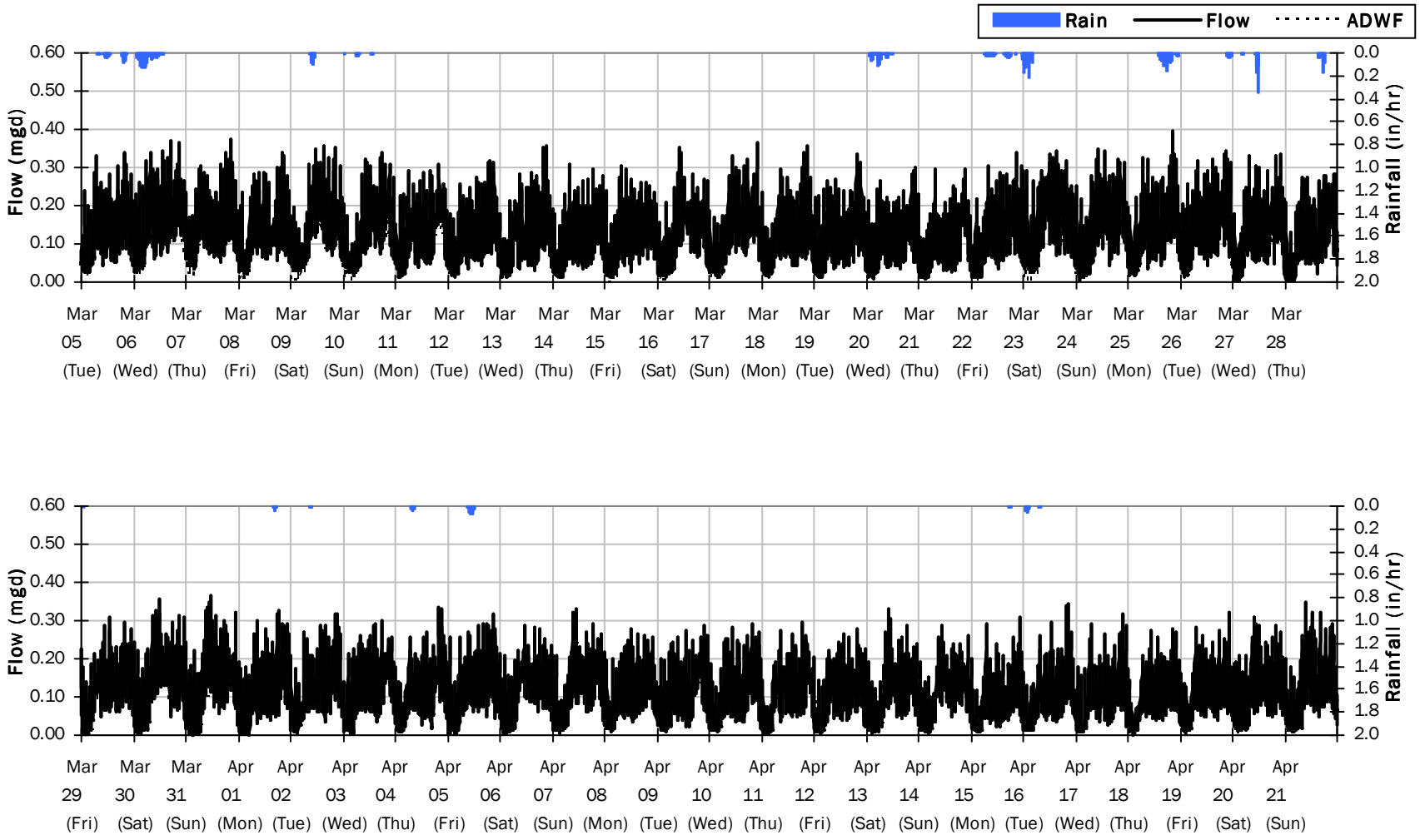
Period Rainfall: 11.86 inches Period Avg Flow: 0.137 mgd Period Peak Flow: 0.566 mgd Period Min Flow: 0.004 mgd



SITE 4

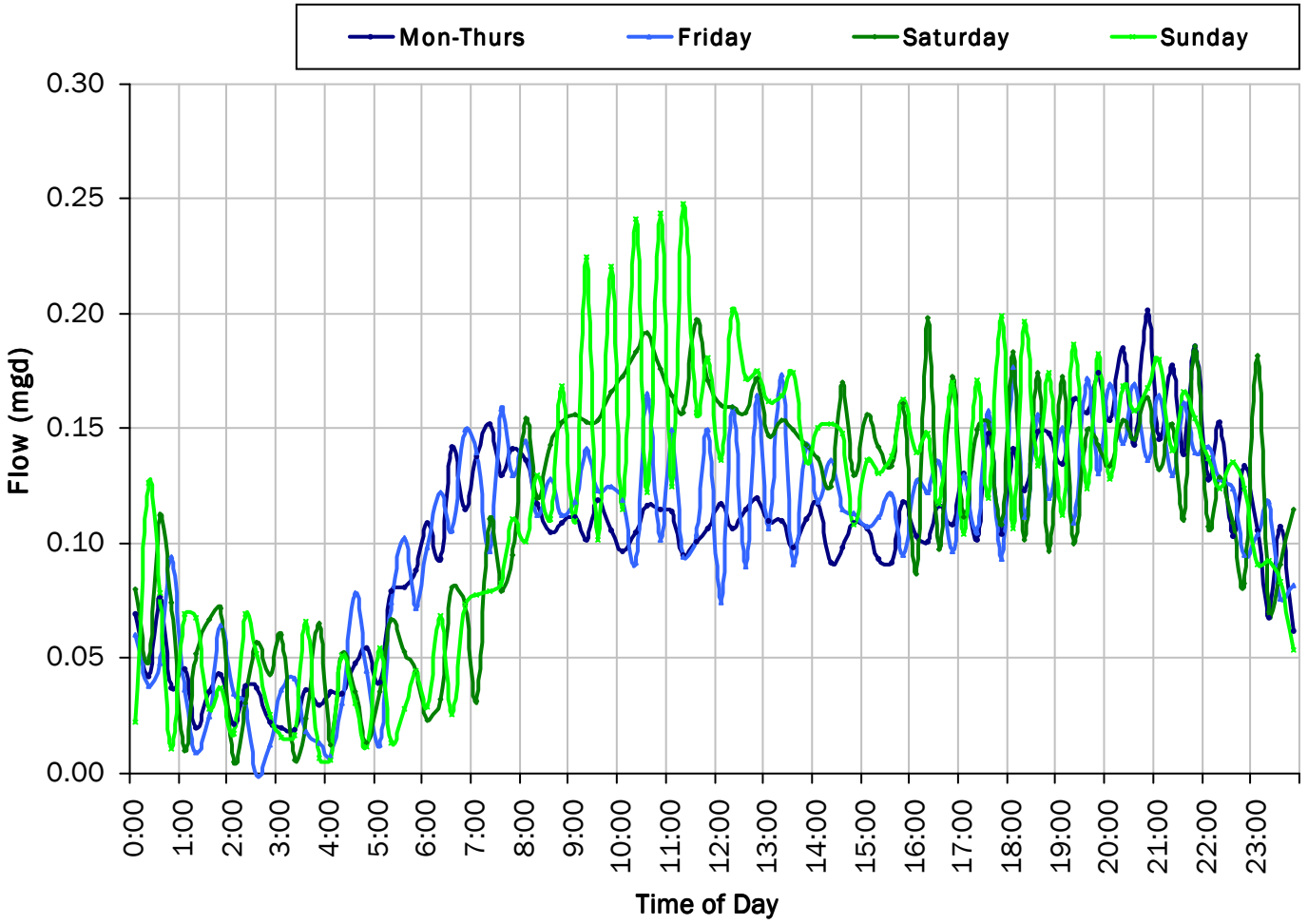
Flow Summary: 3/5/2019 to 4/21/2019

Period Rainfall: 3.12 inches Period Avg Flow: 0.127 mgd Period Peak Flow: 0.396 mgd Period Min Flow: 0.002 mgd



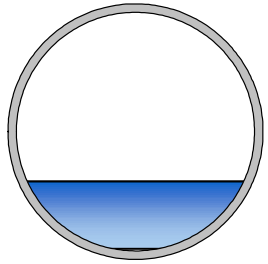
SITE 4

Average Dry Weather Flow Hydrographs



ADWF:

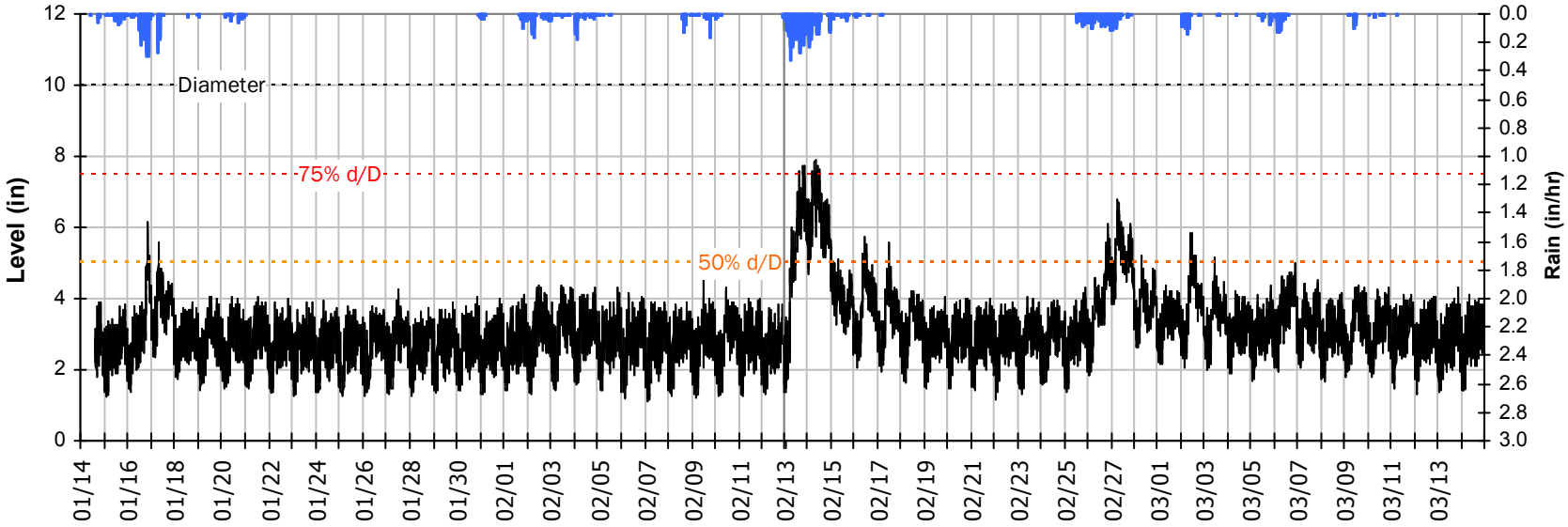
0.106 *mgd*

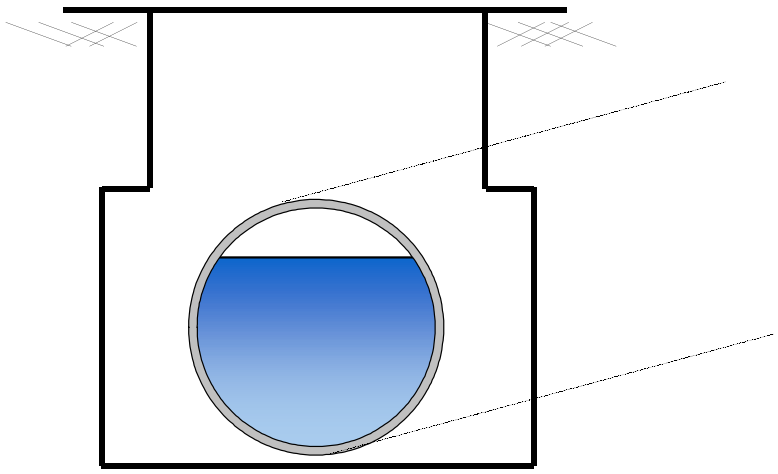


SITE 4

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



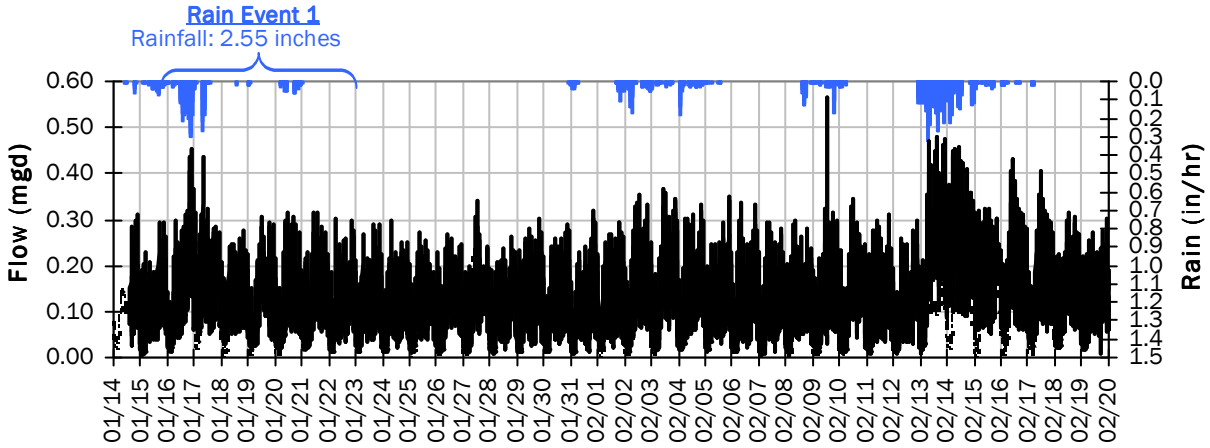


Pipe Diameter:	10	*inches*
Peak Measured Level:	7.89	*inches*
Peak d/D Ratio:	0.79	

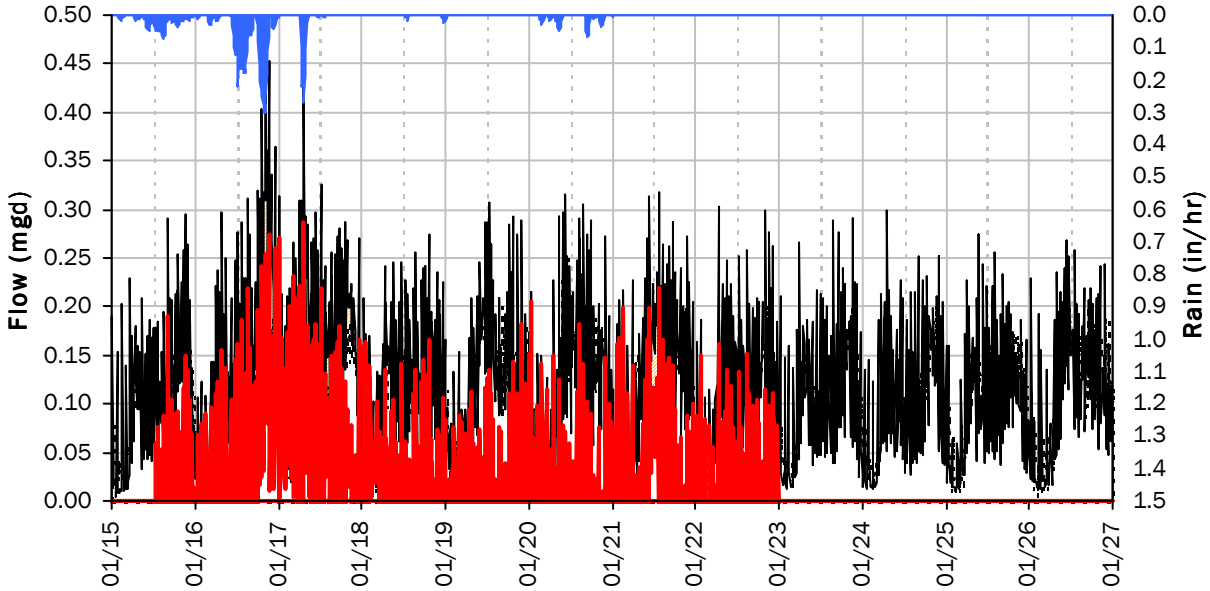
SITE 4

I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph

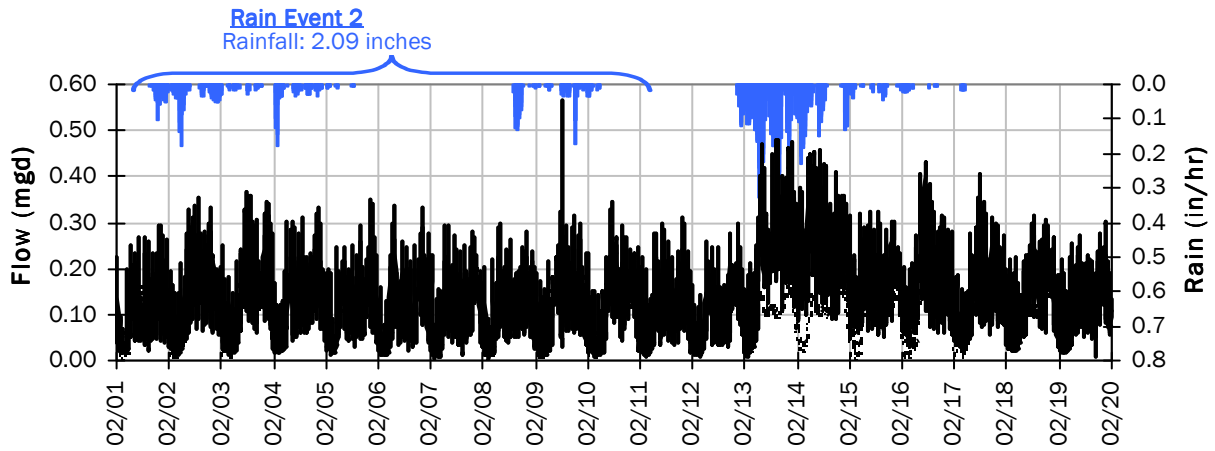


Storm Event I/I Analysis (Rain = 2.55 inches)

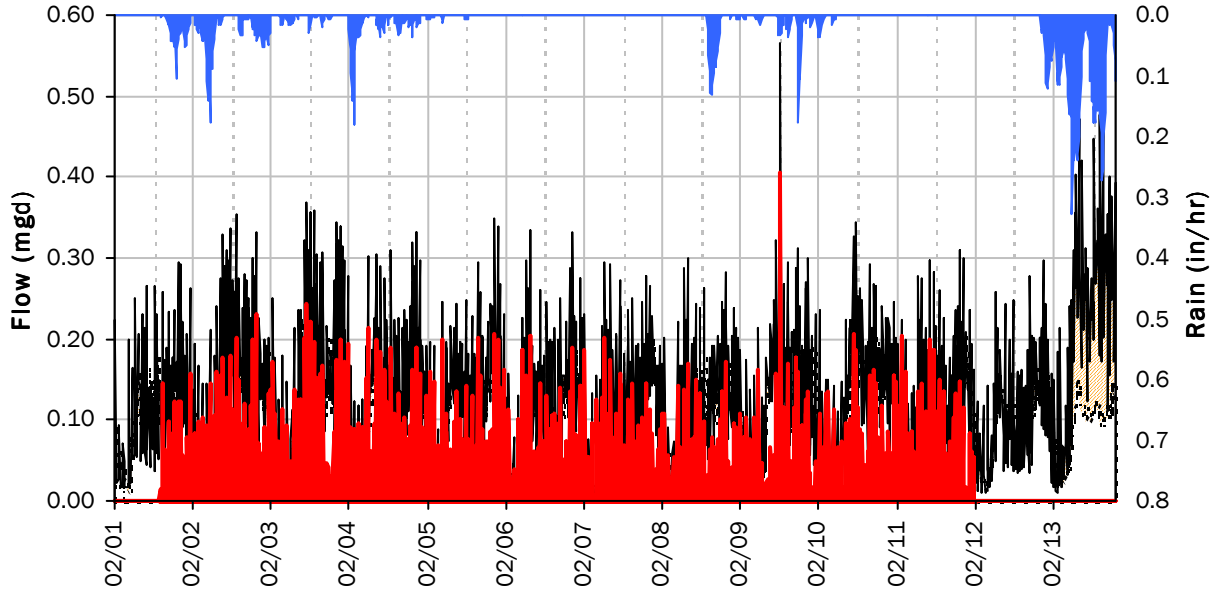
Capacity		Inflow / Infiltration	
Peak Flow:	0.452 *mgd*	**Peak I/I Rate:**	0.286 *mgd*
PF:	4.26	**Total I/I:**	196,000 *gallons*
Peak Level:	6.17 *in*		
d/D Ratio:	0.62		

SITE 4
I/I Summary: Rain Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 2 Detail Graph

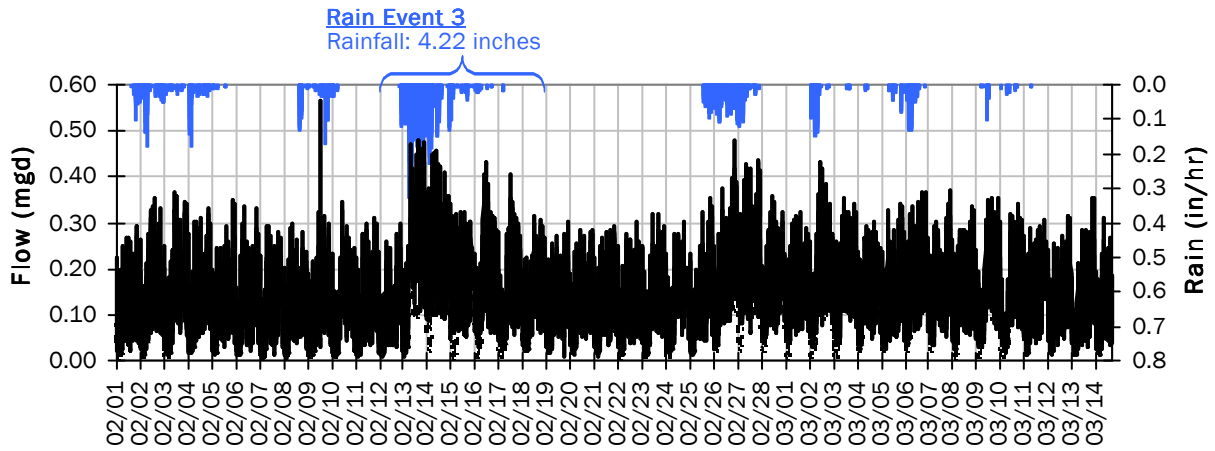


Storm Event I/I Analysis (Rain = 2.09 inches)

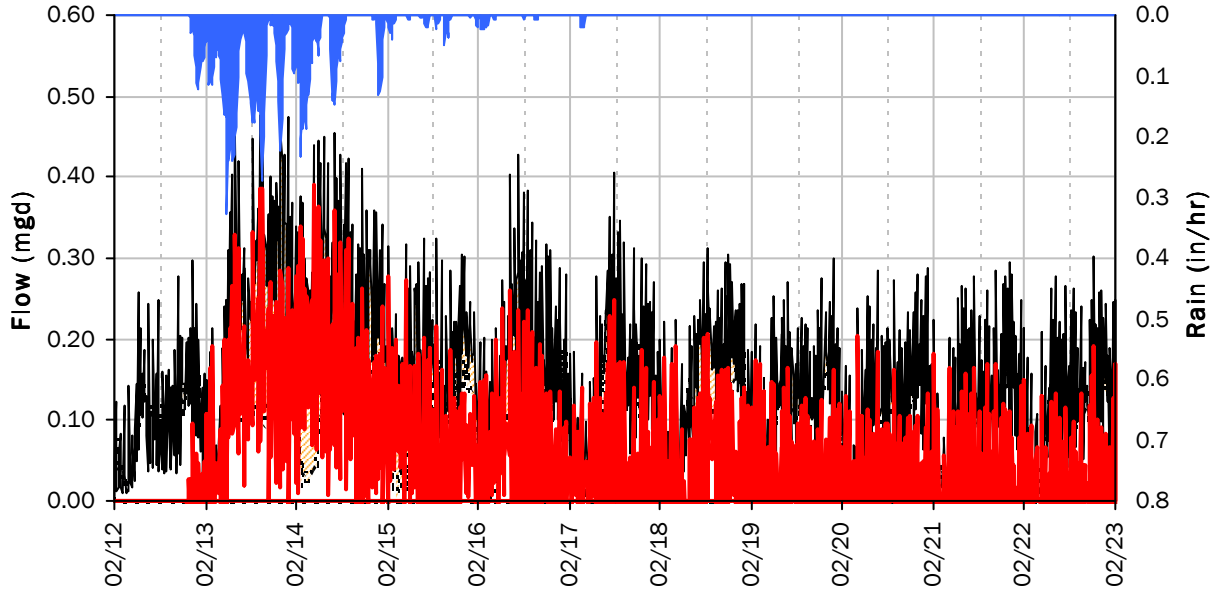
Capacity		Inflow / Infiltration	
Peak Flow:	0.566 *mgd*	**Peak I/I Rate:**	0.406 *mgd*
PF:	5.33	**Total I/I:**	177,000 *gallons*
Peak Level:	5.15 *in*		
d/D Ratio:	0.52		

SITE 4
I/I Summary: Rain Event 3

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3 Detail Graph

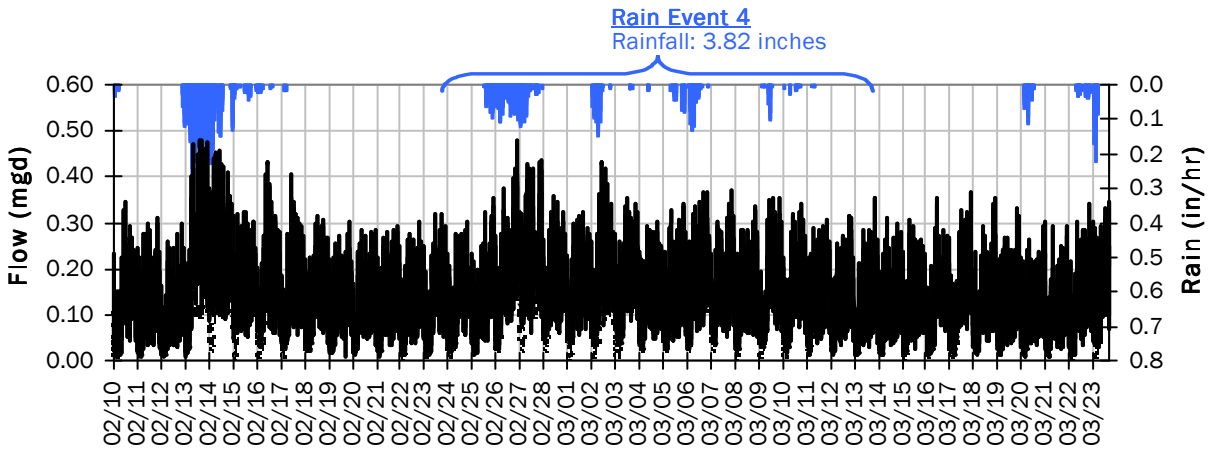


Storm Event I/I Analysis (Rain = 4.22 inches)

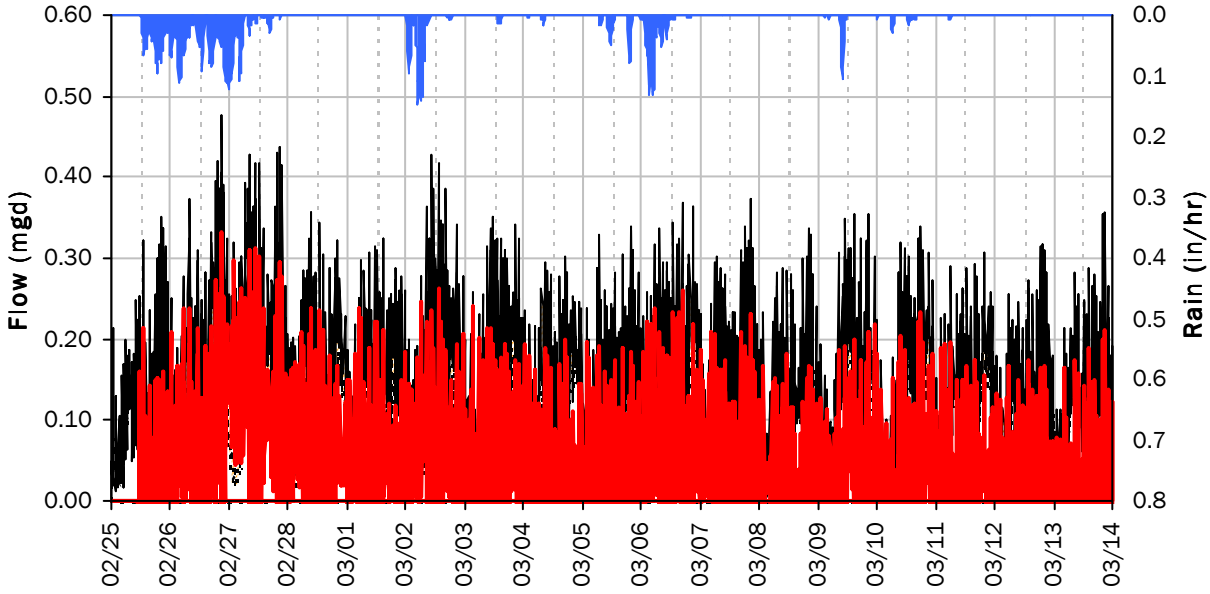
Capacity		Inflow / Infiltration	
Peak Flow:	0.48 *mgd*	**Peak I/I Rate:**	0.39 *mgd*
PF:	4.51	**Total I/I:**	562,000 *gallons*
Peak Level:	7.89 *in*		
d/D Ratio:	0.79		

SITE 4
I/I Summary: Rain Event 4

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 4 Detail Graph

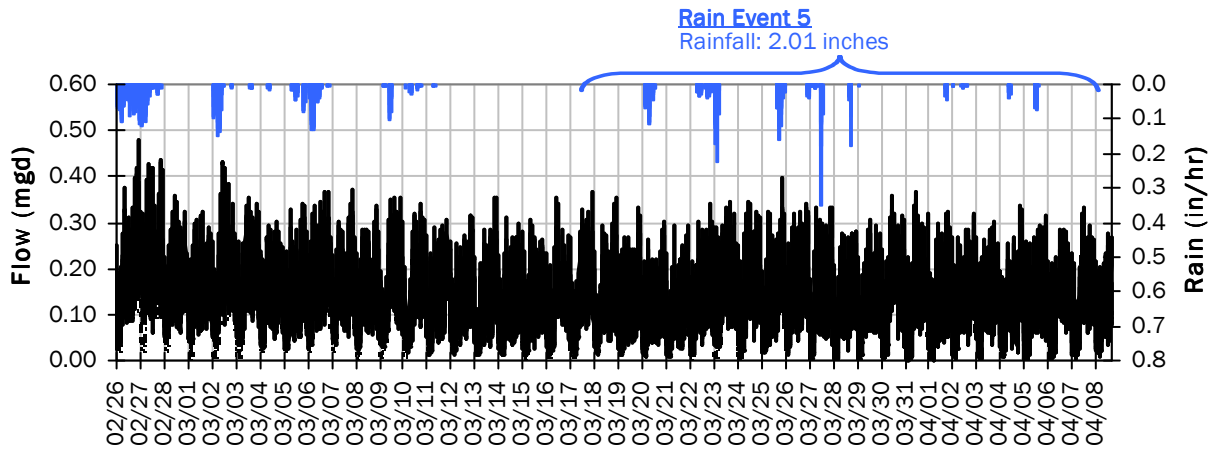


Storm Event I/I Analysis (Rain = 3.82 inches)

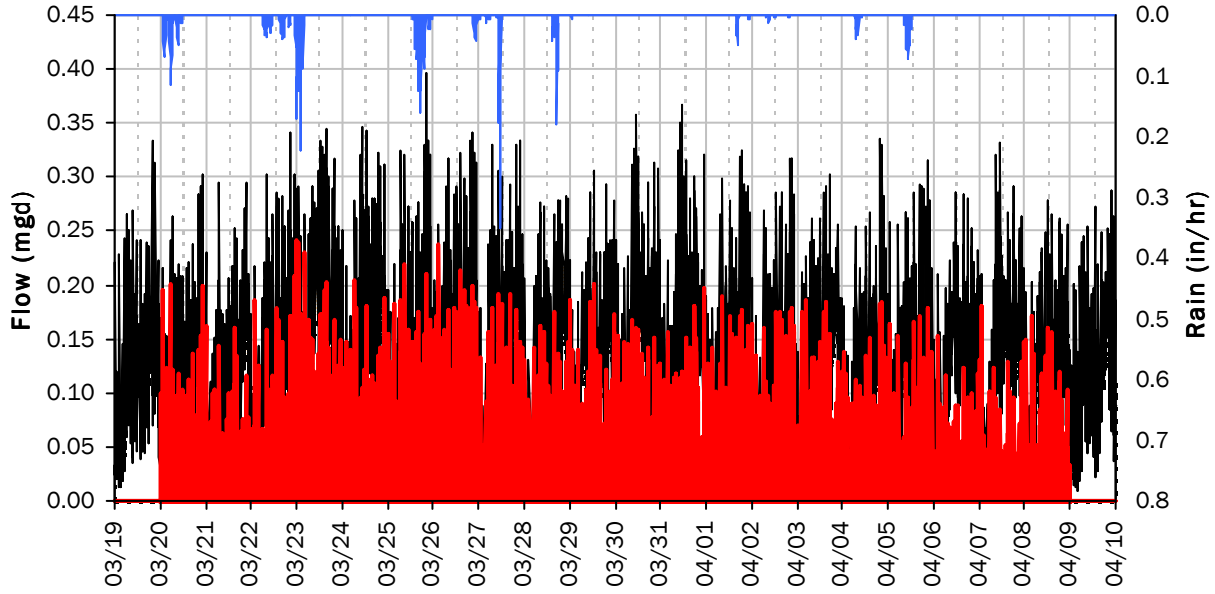
Capacity		Inflow / Infiltration	
Peak Flow:	0.48 *mgd*	**Peak I/I Rate:**	0.33 *mgd*
PF:	4.49	**Total I/I:**	851,000 *gallons*
Peak Level:	6.80 *in*		
d/D Ratio:	0.68		

SITE 4
I/I Summary: Rain Event 5

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 5 Detail Graph



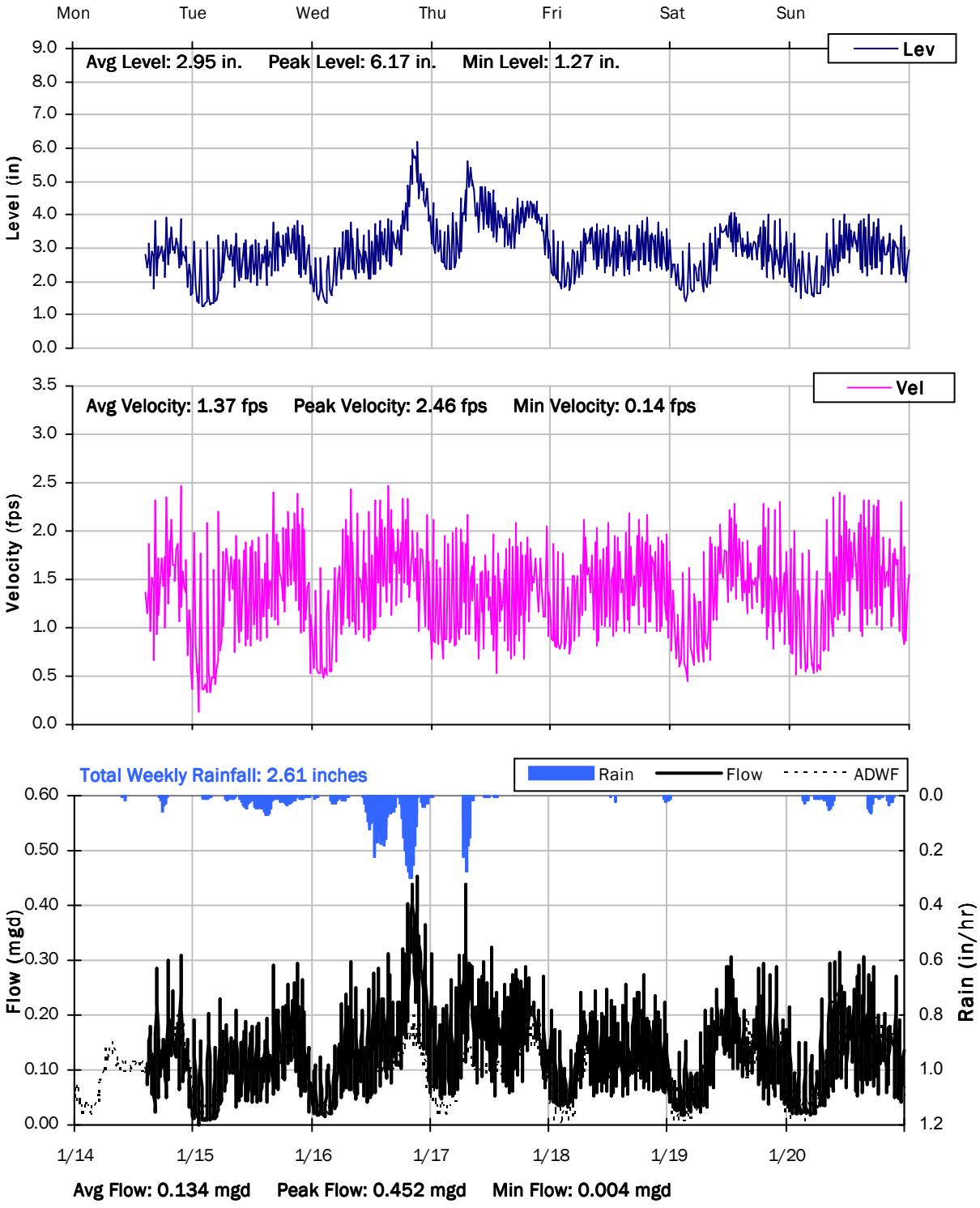
Storm Event I/I Analysis (Rain = 2.01 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.40 *mgd*	**Peak I/I Rate:**	0.24 *mgd*
PF:	3.73	**Total I/I:**	474,000 *gallons*
Peak Level:	4.53 *in*		
d/D Ratio:	0.45		

SITE 4

Weekly Level, Velocity and Flow Hydrographs

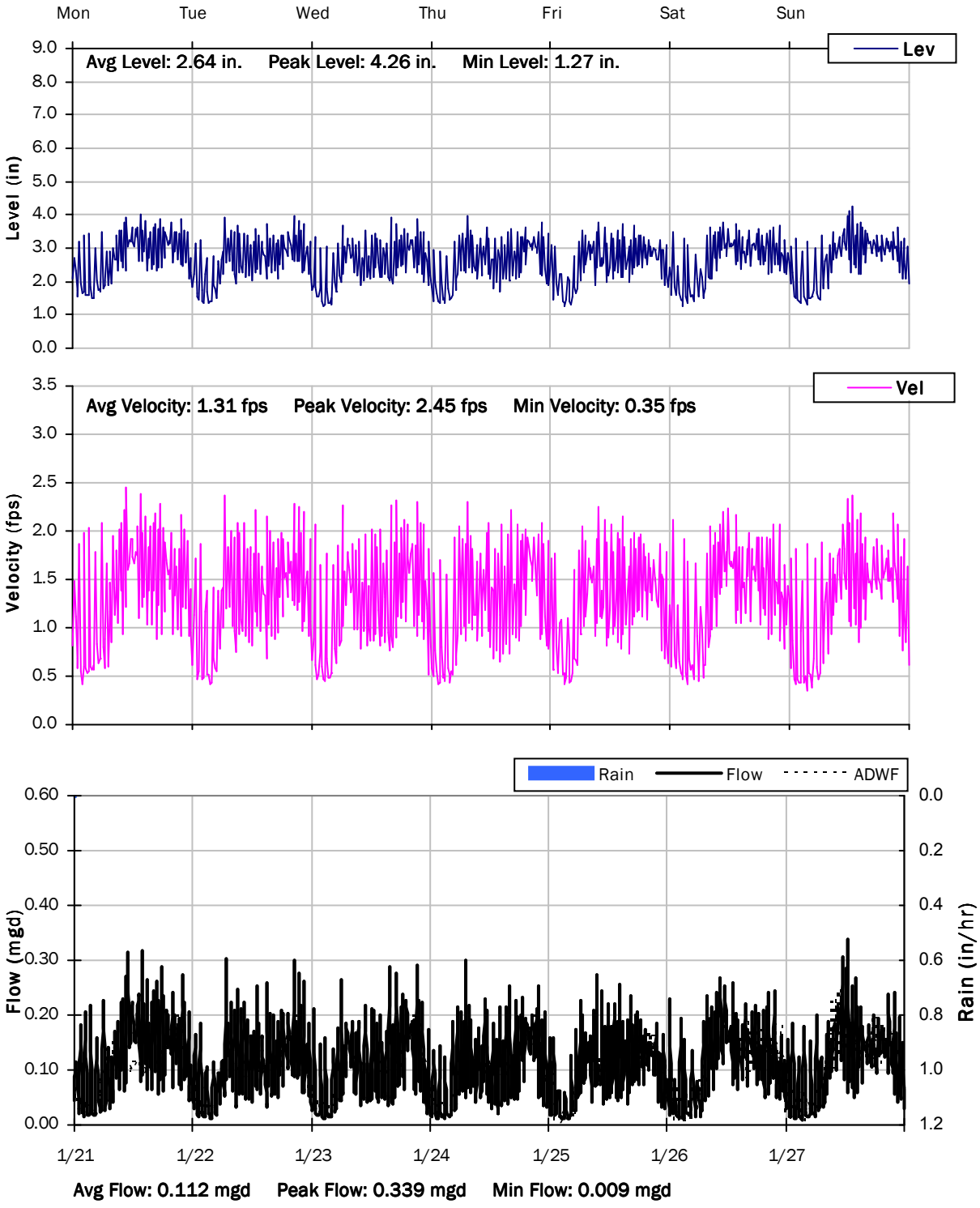
1/14/2019 to 1/21/2019



SITE 4

Weekly Level, Velocity and Flow Hydrographs

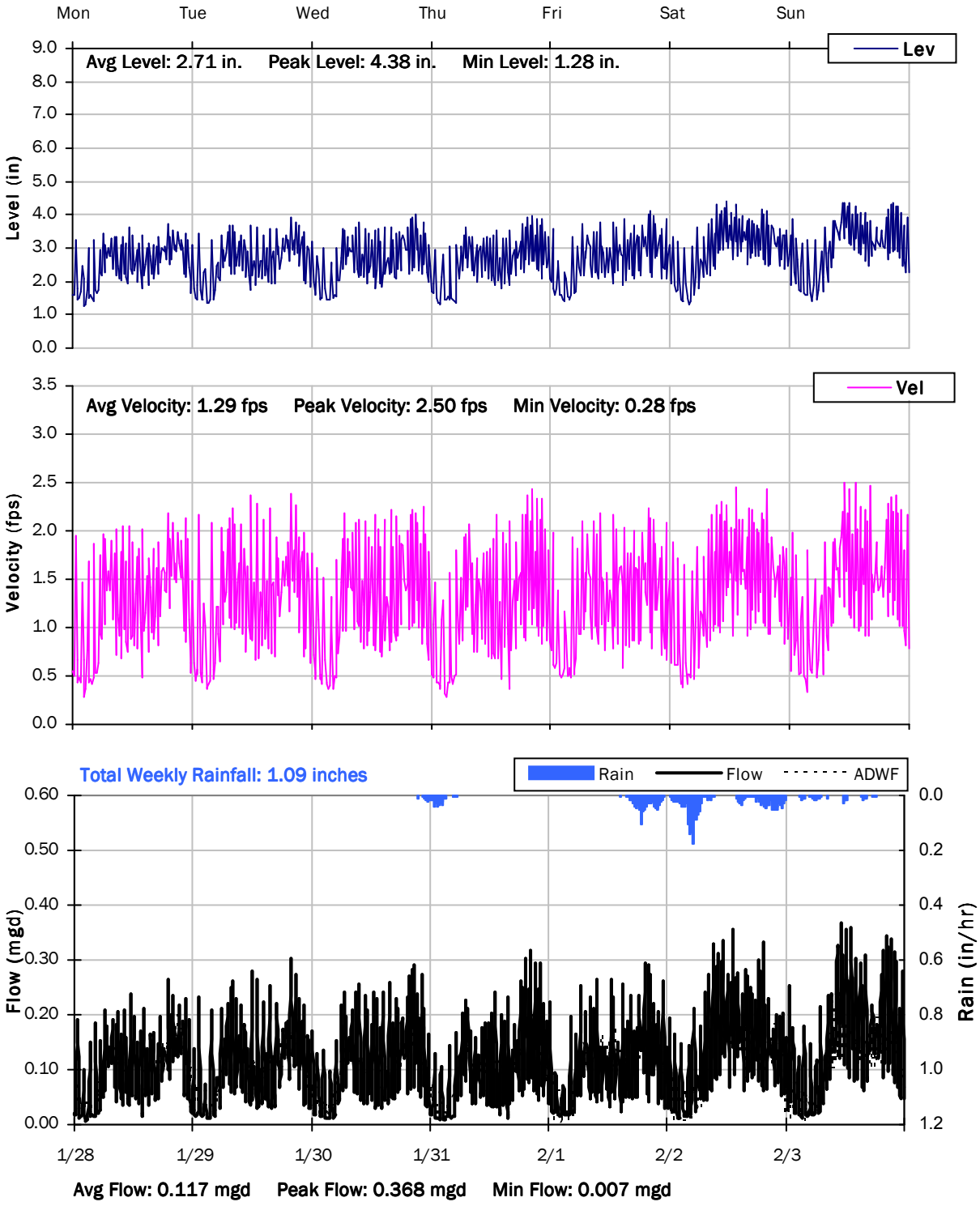
1/21/2019 to 1/28/2019



SITE 4

Weekly Level, Velocity and Flow Hydrographs

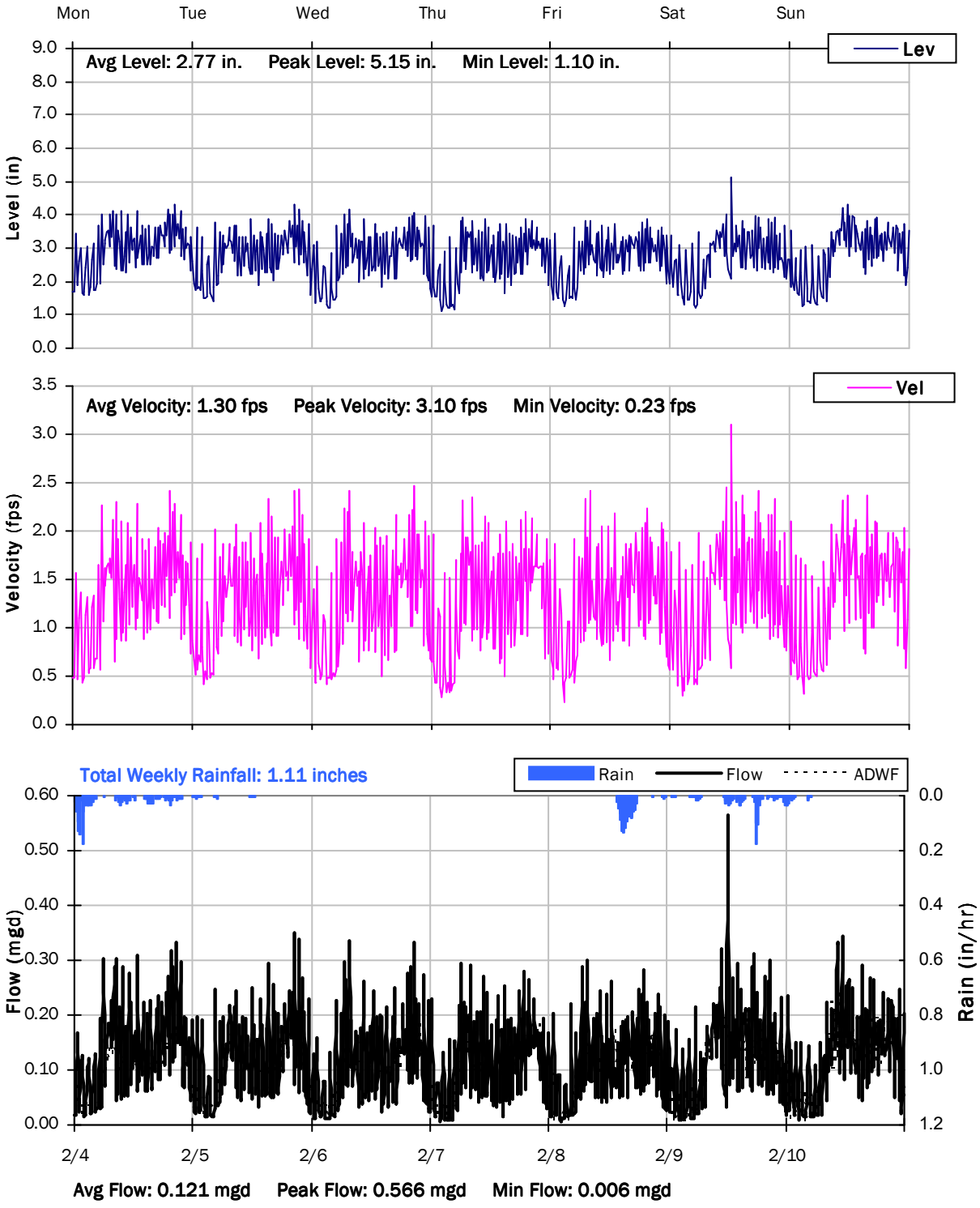
1/28/2019 to 2/4/2019



SITE 4

Weekly Level, Velocity and Flow Hydrographs

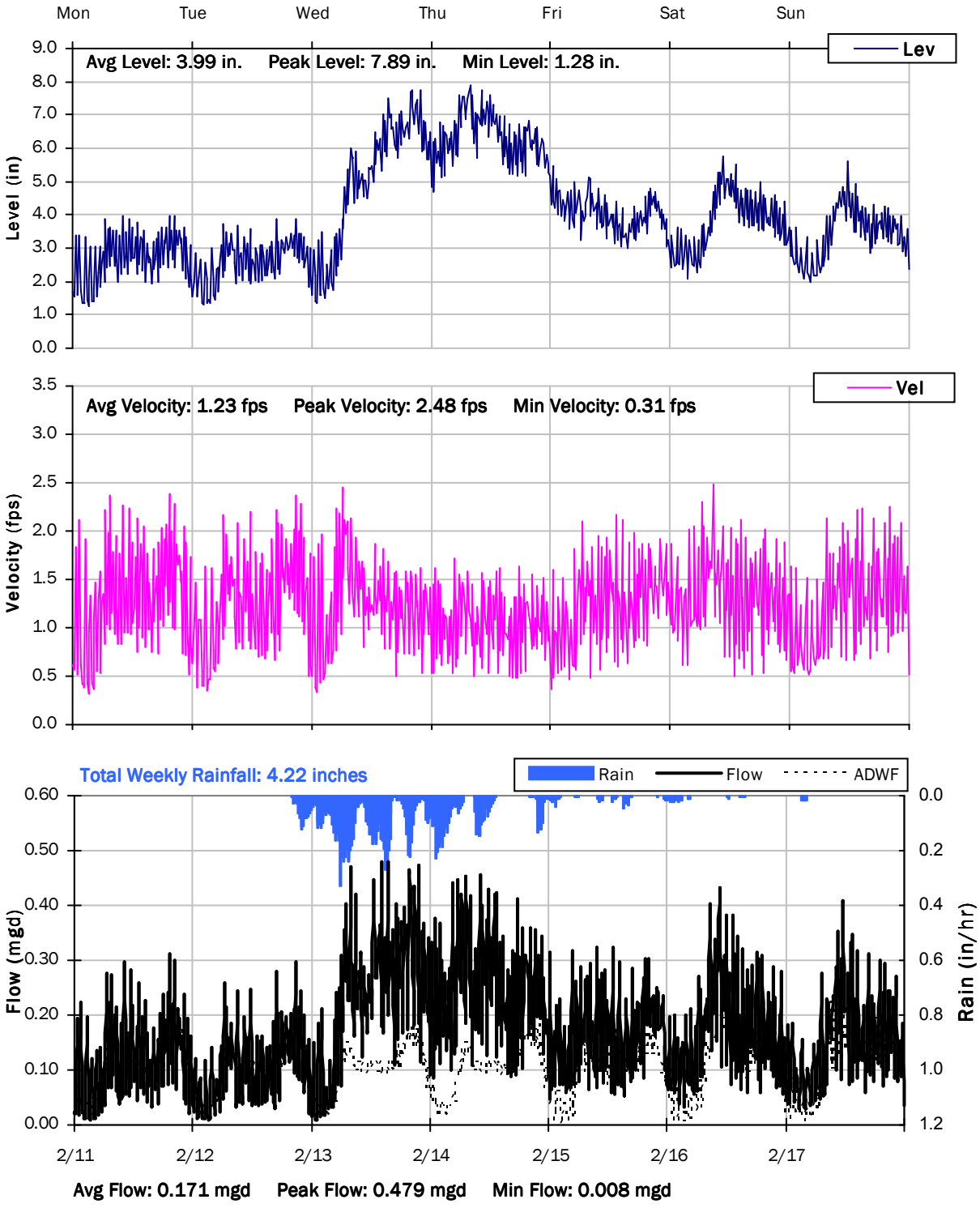
2/4/2019 to 2/11/2019



SITE 4

Weekly Level, Velocity and Flow Hydrographs

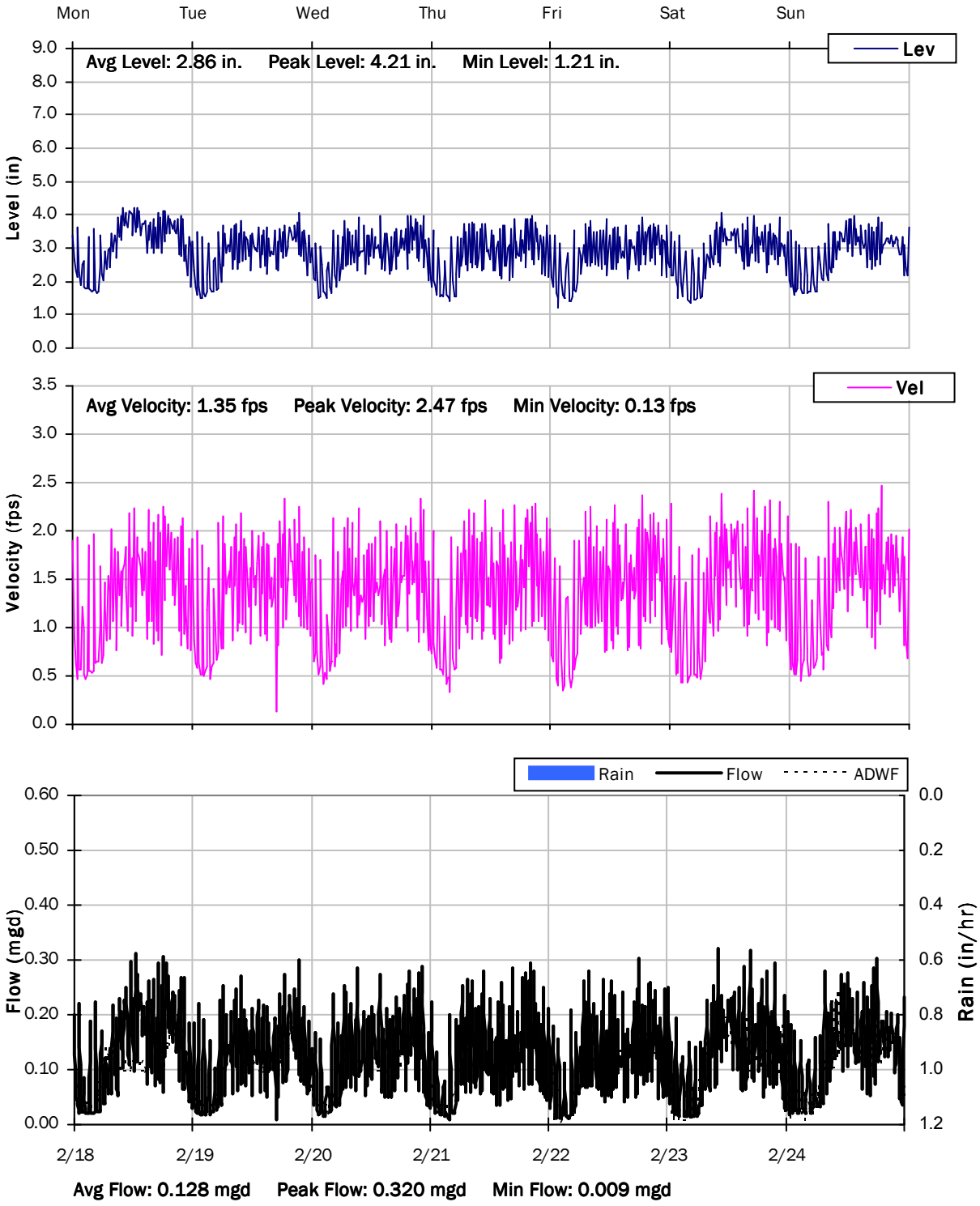
2/11/2019 to 2/18/2019



SITE 4

Weekly Level, Velocity and Flow Hydrographs

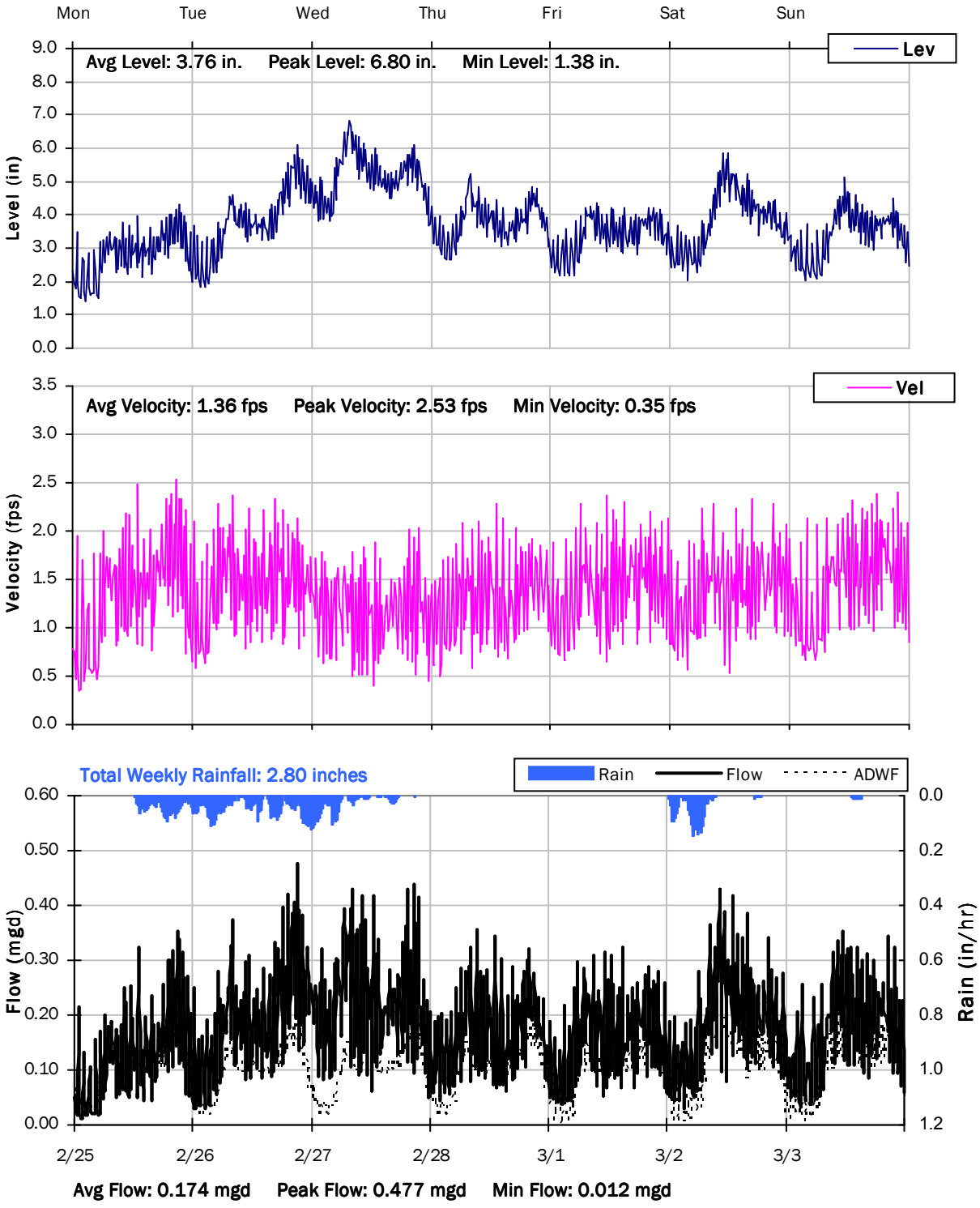
2/18/2019 to 2/25/2019



SITE 4

Weekly Level, Velocity and Flow Hydrographs

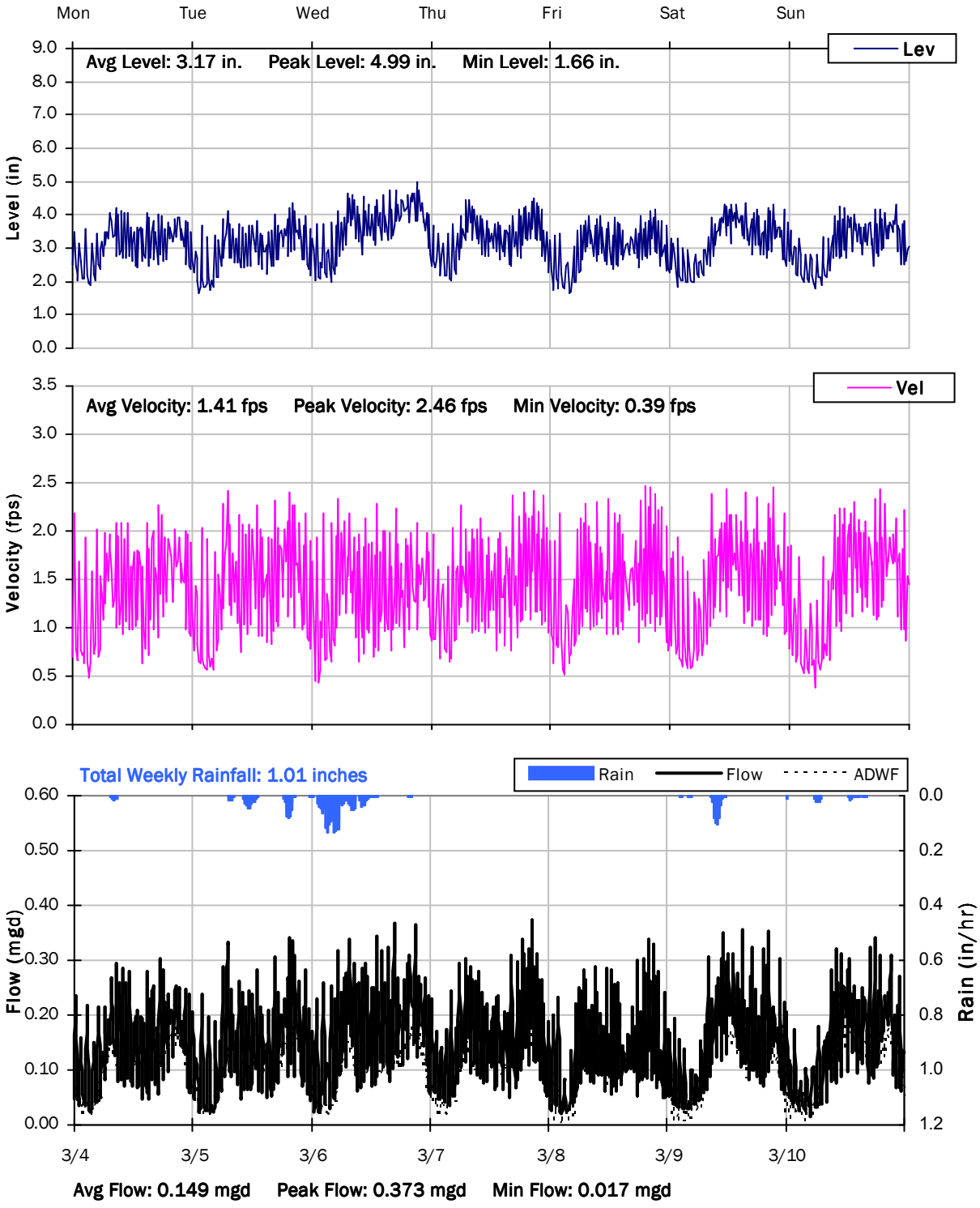
2/25/2019 to 3/4/2019



SITE 4

Weekly Level, Velocity and Flow Hydrographs

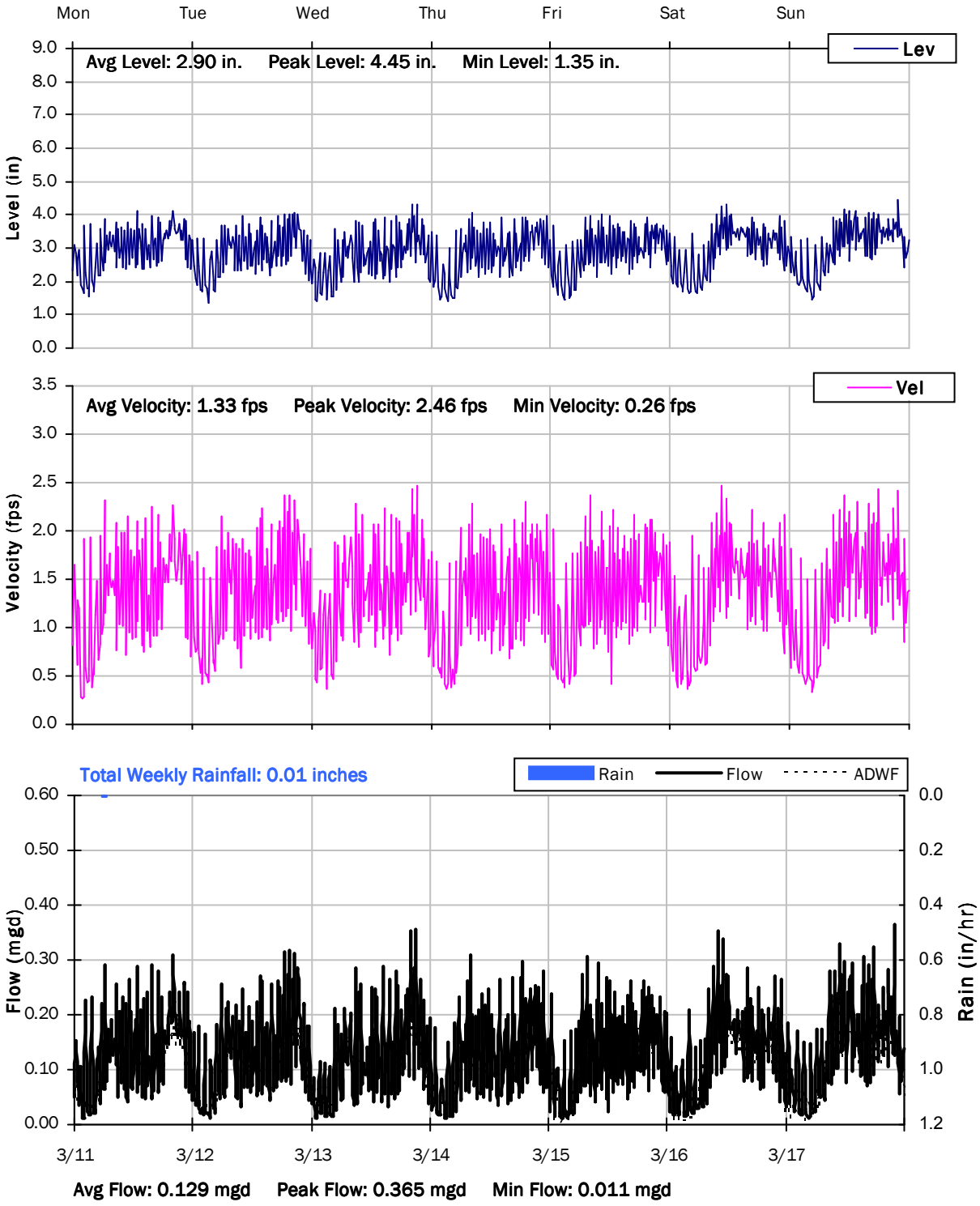
3/4/2019 to 3/11/2019



SITE 4

Weekly Level, Velocity and Flow Hydrographs

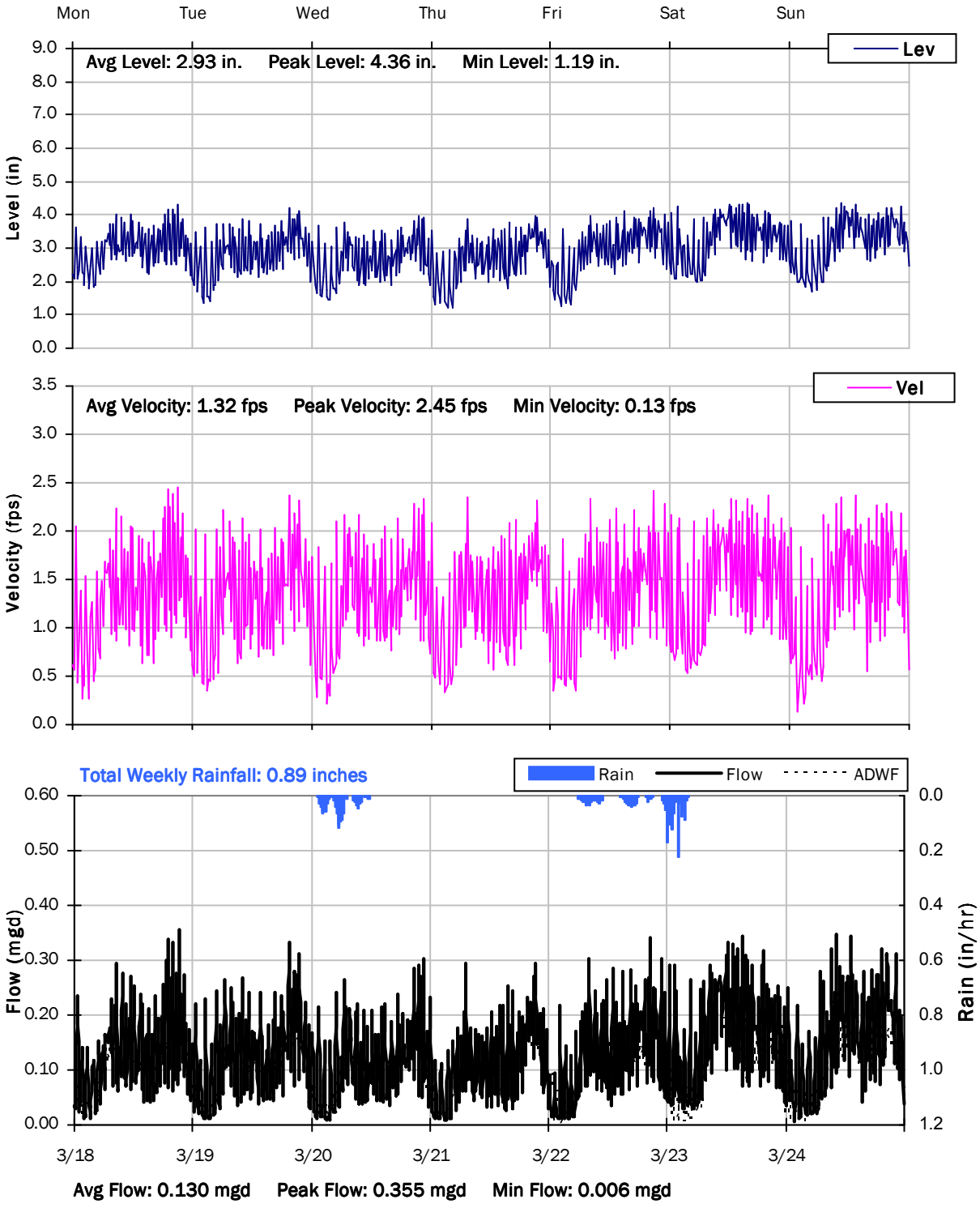
3/11/2019 to 3/18/2019



SITE 4

Weekly Level, Velocity and Flow Hydrographs

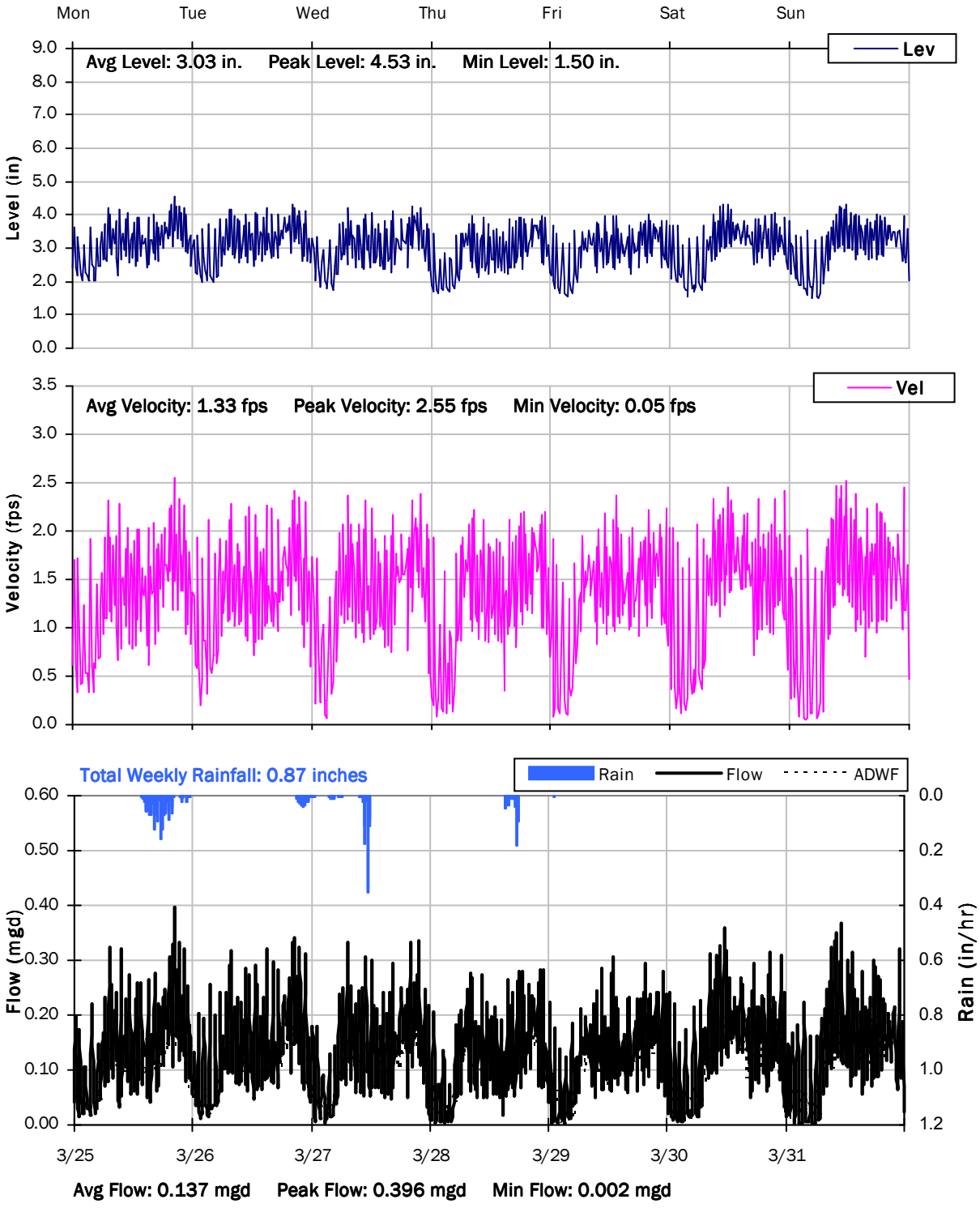
3/18/2019 to 3/25/2019



SITE 4

Weekly Level, Velocity and Flow Hydrographs

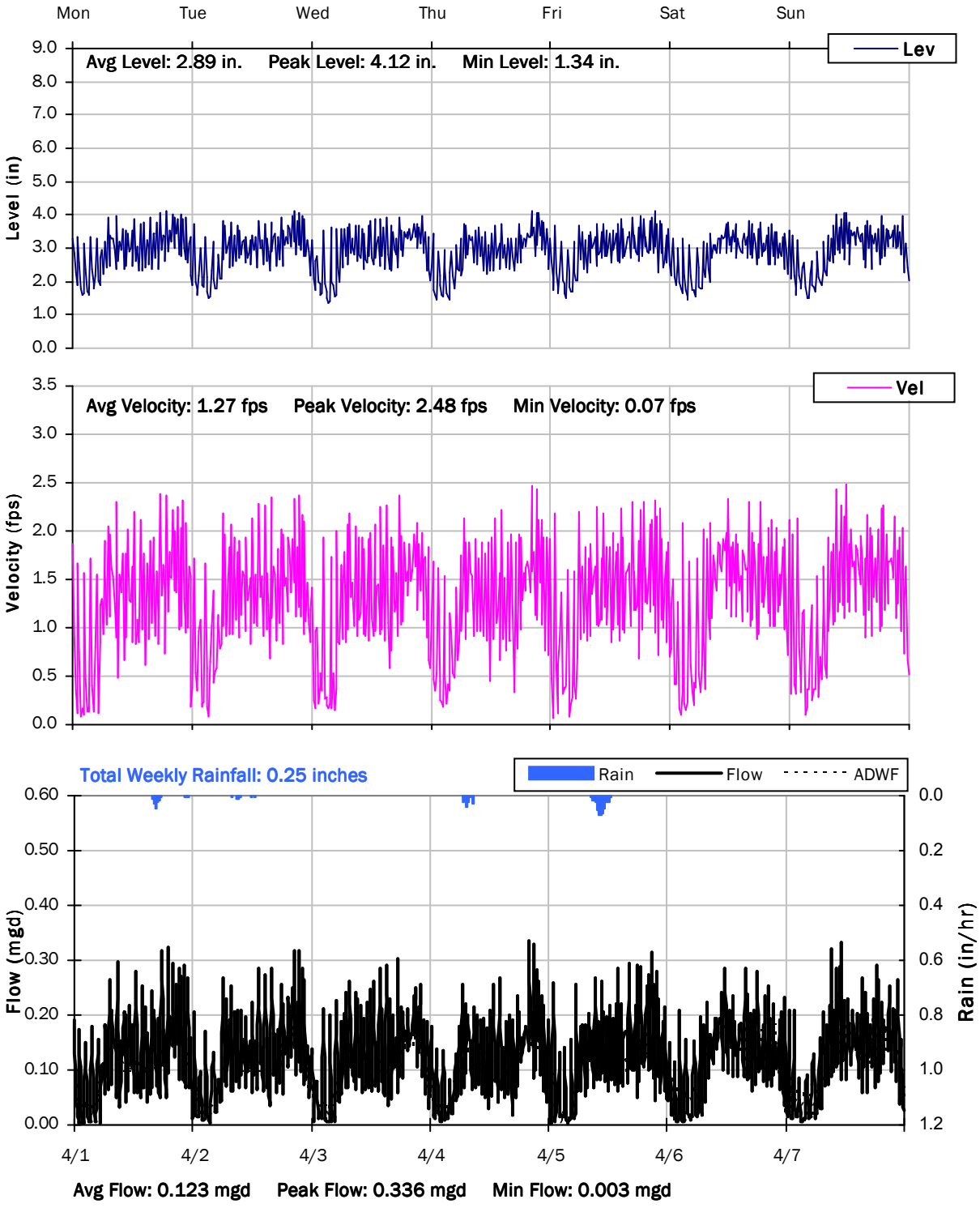
3/25/2019 to 4/1/2019



SITE 4

Weekly Level, Velocity and Flow Hydrographs

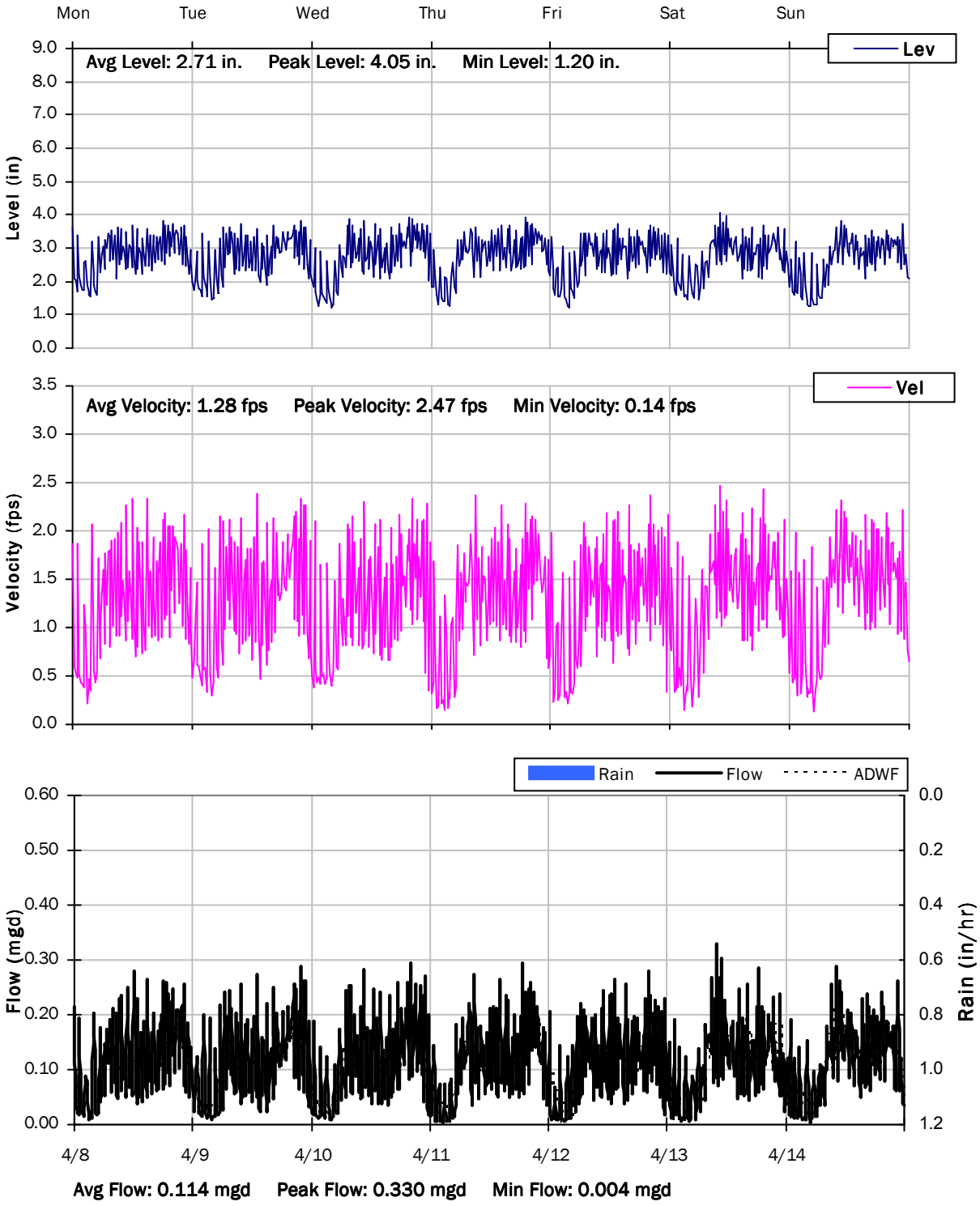
4/1/2019 to 4/8/2019



SITE 4

Weekly Level, Velocity and Flow Hydrographs

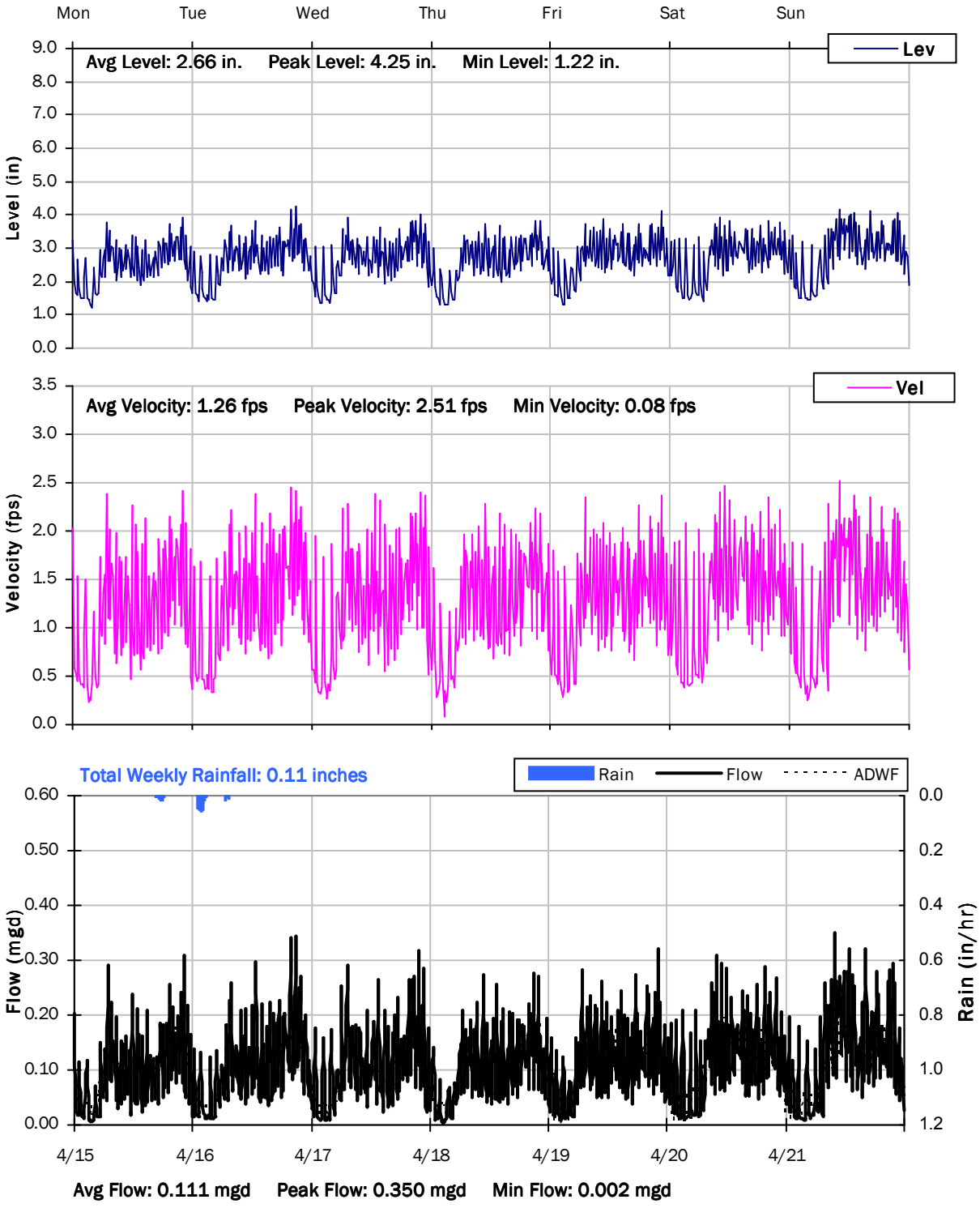
4/8/2019 to 4/15/2019



SITE 4

Weekly Level, Velocity and Flow Hydrographs

4/15/2019 to 4/22/2019



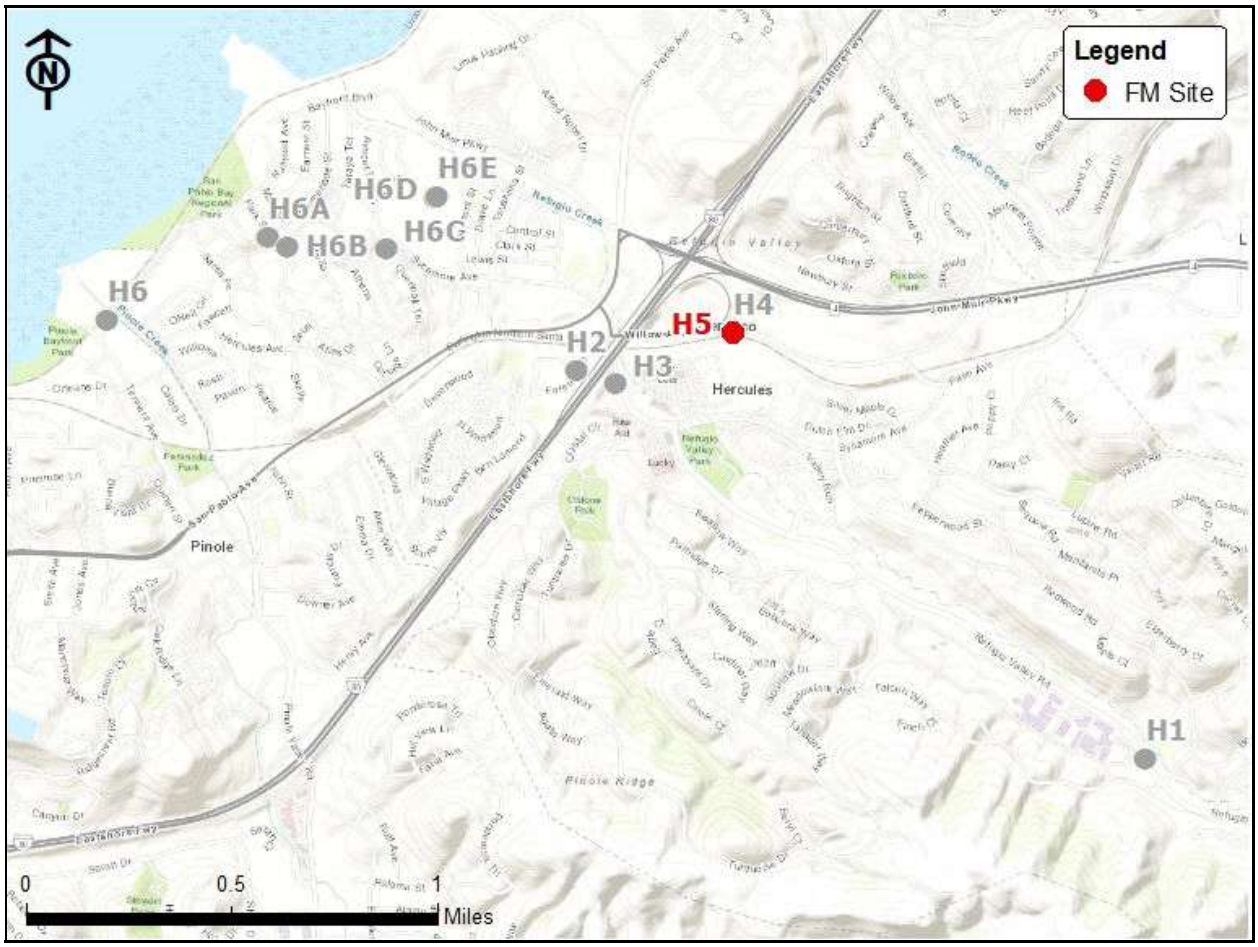
City of Hercules, California

Sanitary Sewer Flow Monitoring
January 14 - April 21, 2019

Monitoring Site: Site 5

Location: Willow Avenue at freeway entrance

Data Summary Report



Vicinity Map: Site 5

SITE 5

Site Information

Location: Willow Avenue at freeway entrance

Coordinates: 122.2673° W, 38.0125° N

Rim Elevation (Earth): 79 feet

Measured Pipe Diameter: 15 inches

ADWF: 0.260 mgd

Peak Measured Flow: 1.295 mgd

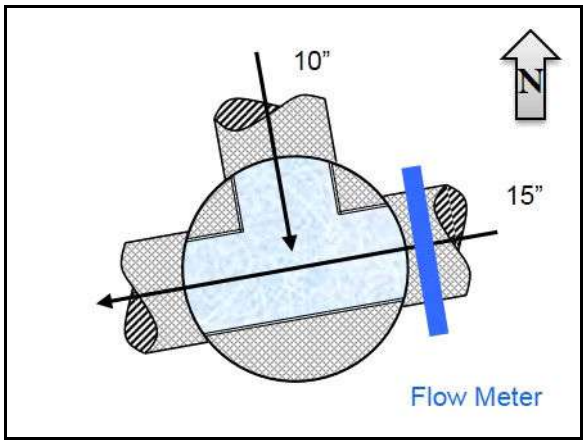
Sediment: None



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

SITE 5

Additional Site Photos

Effluent Pipe



Monitored East Influent Pipe



SITE 5

Additional Site Photos

North Influent Pipe

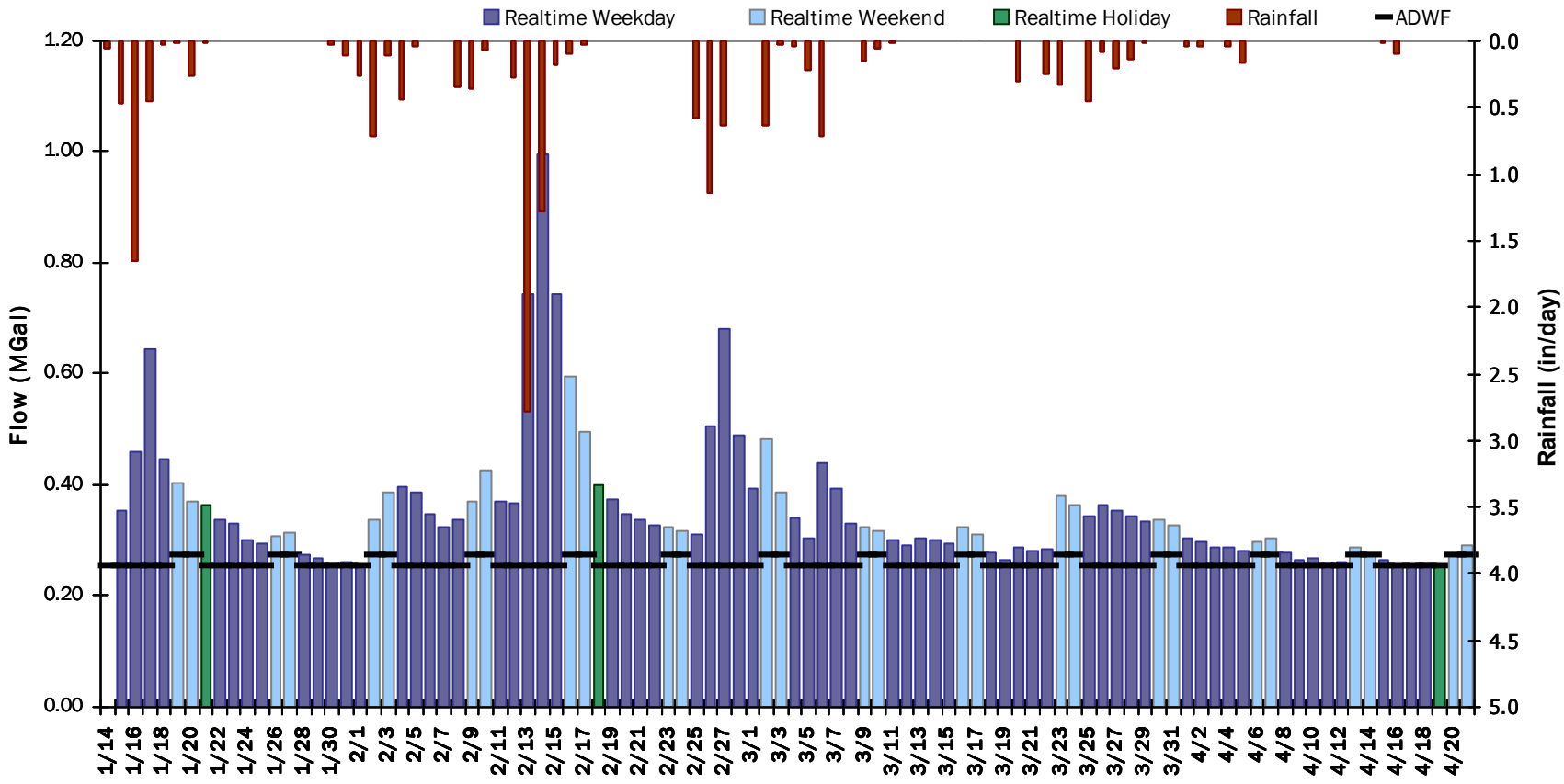


SITE 5

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.355 MGal Peak Daily Flow: 0.994 MGal Min Daily Flow: 0.253 MGal

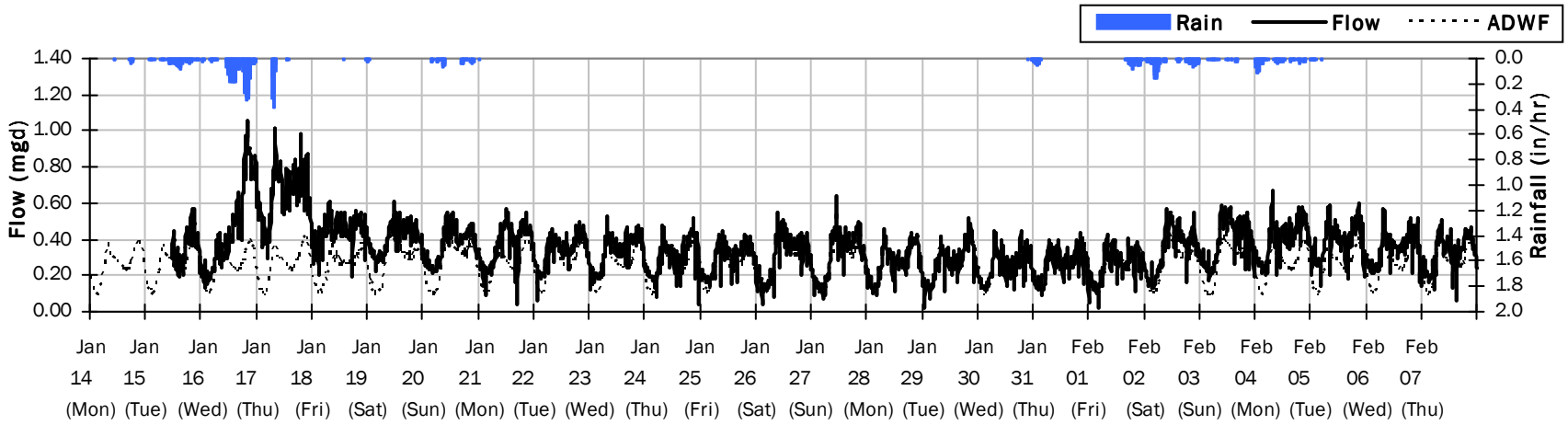
Total Rainfall: 16.27 inches

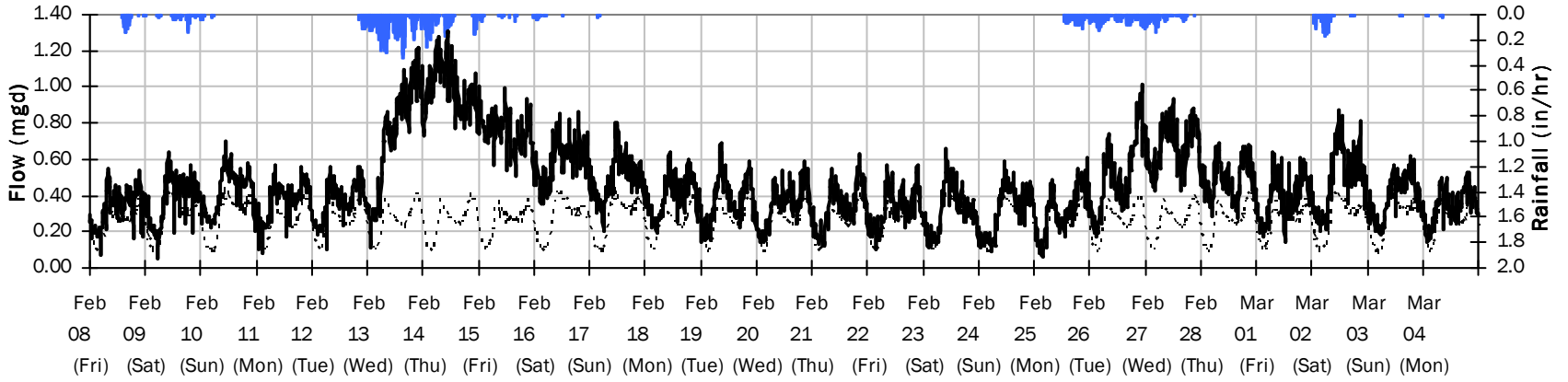


SITE 5

Flow Summary: 1/14/2019 to 3/4/2019

Period Rainfall: 13.09 inches Period Avg Flow: 0.406 mgd Period Peak Flow: 1.295 mgd Period Min Flow: 0.019 mgd

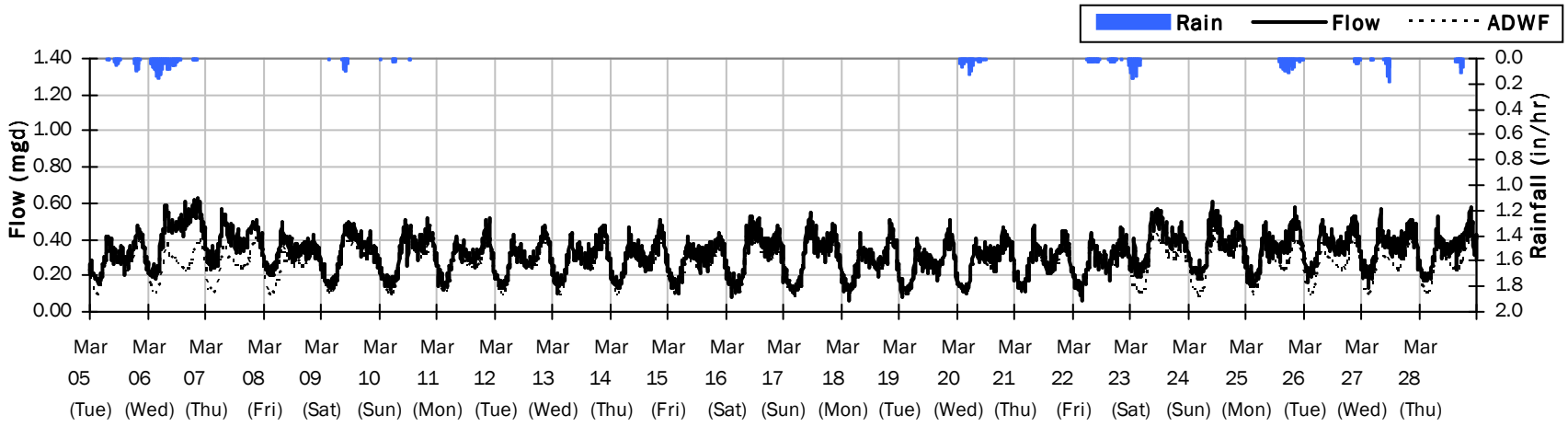


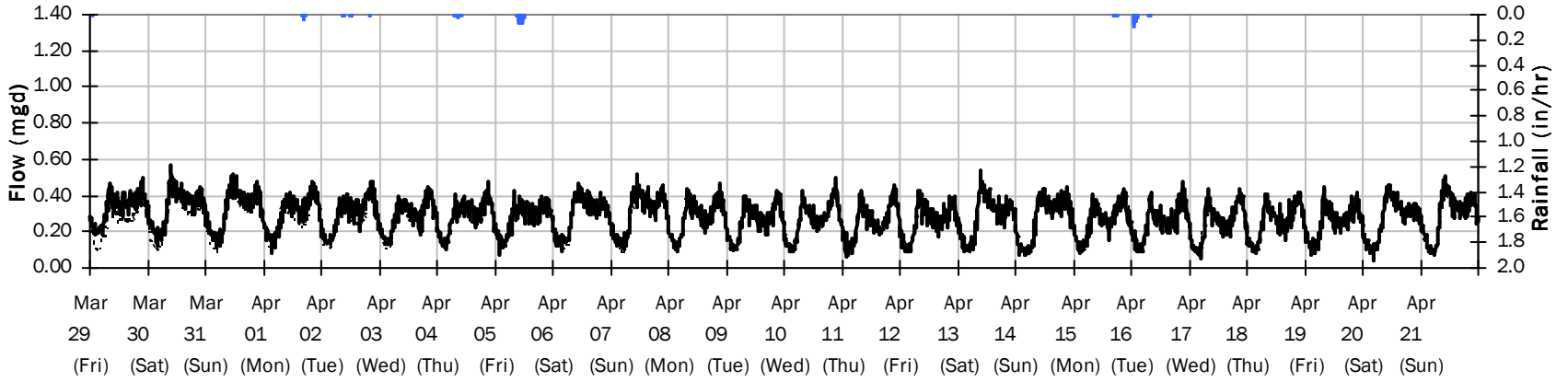


SITE 5

Flow Summary: 3/5/2019 to 4/21/2019

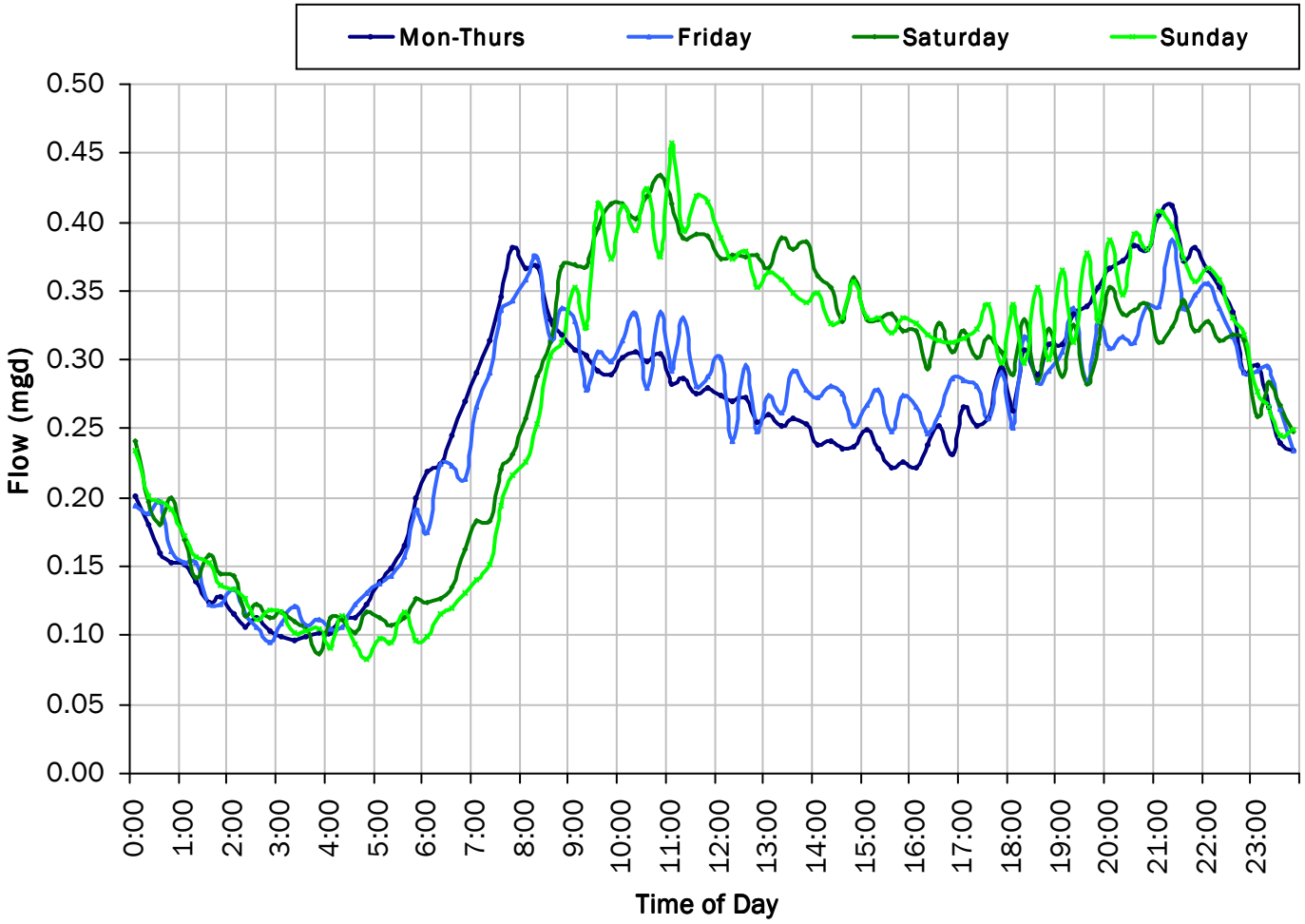
Period Rainfall: 3.34 inches Period Avg Flow: 0.304 mgd Period Peak Flow: 0.631 mgd Period Min Flow: 0.039 mgd





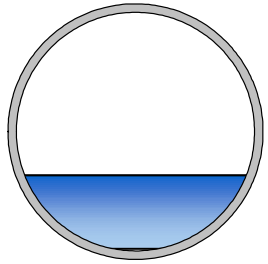
SITE 5

Average Dry Weather Flow Hydrographs



ADWF:

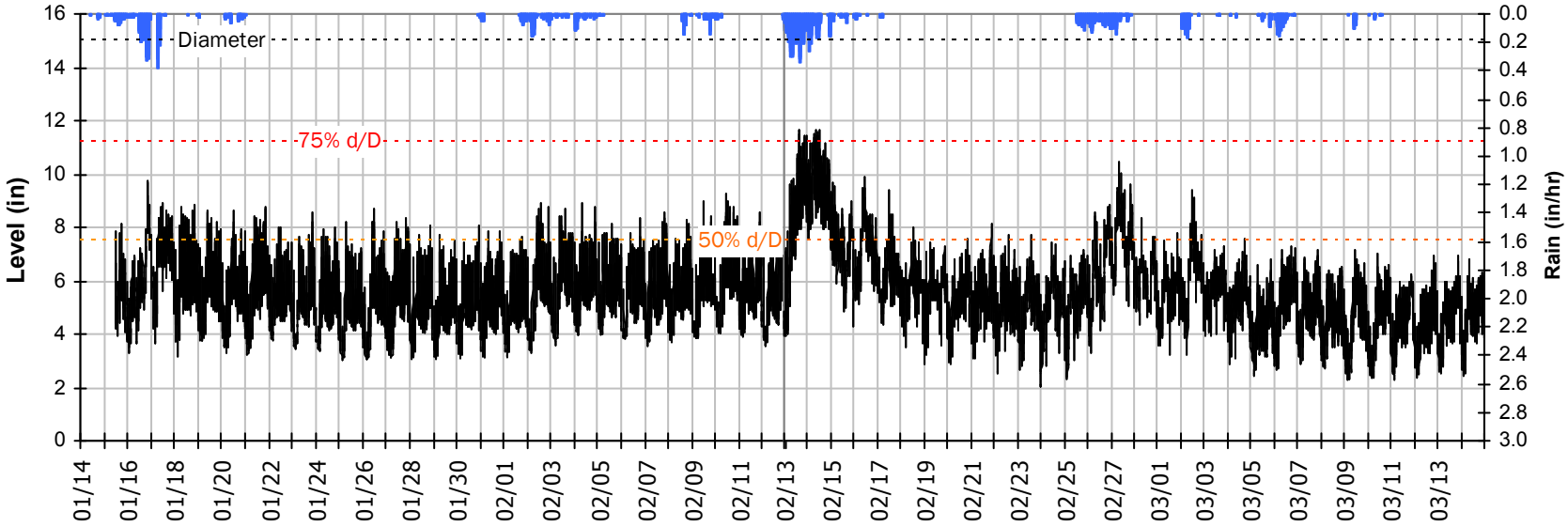
0.260 *mgd*

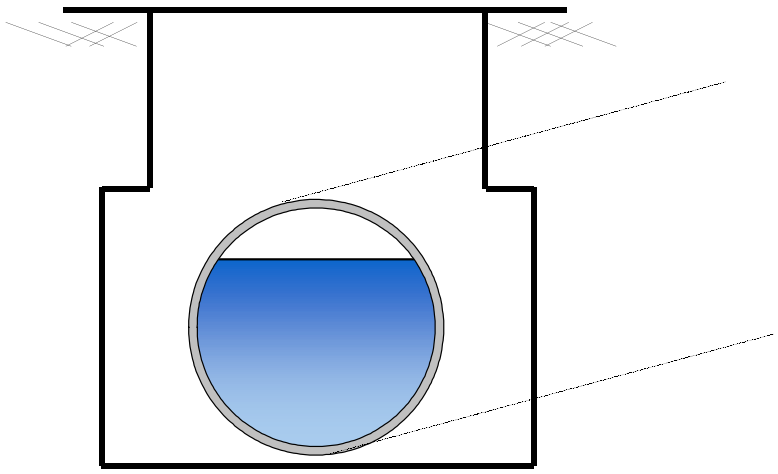


SITE 5

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

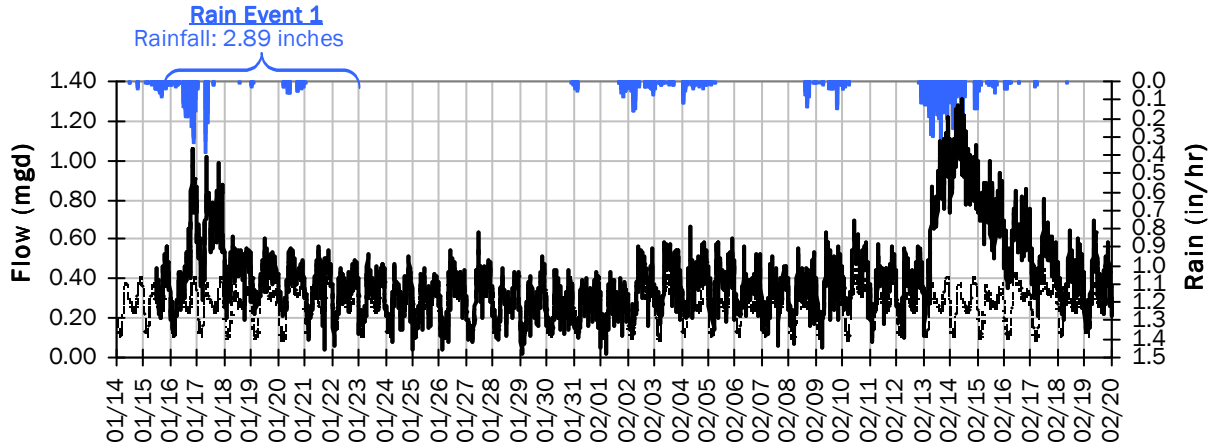




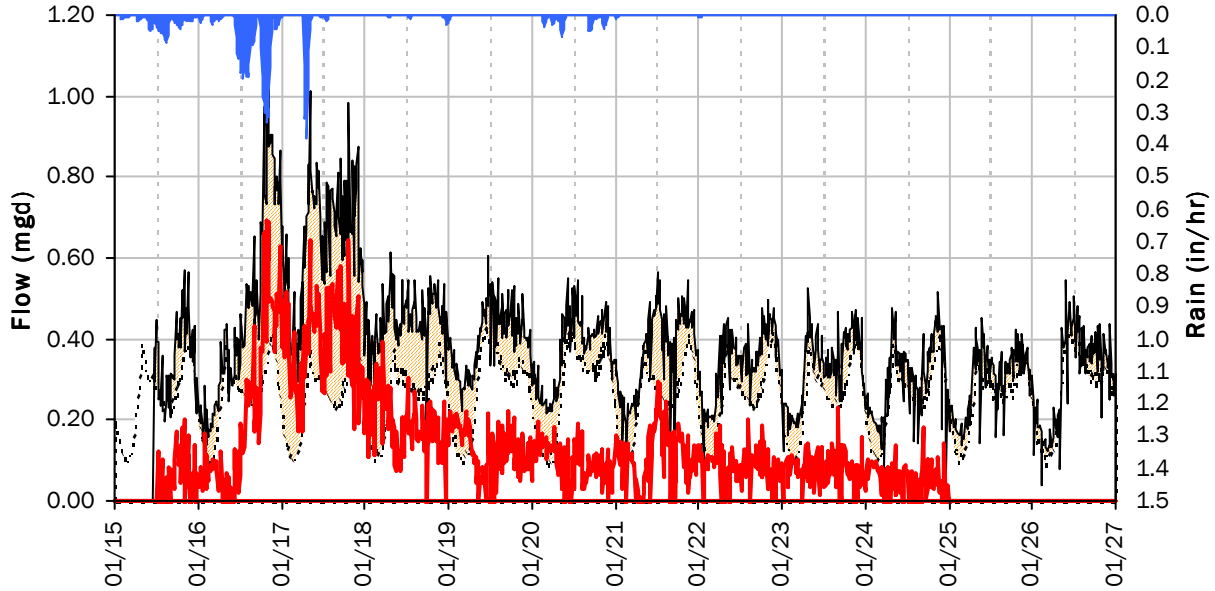
Pipe Diameter:	15	*inches*
Peak Measured Level:	11.7	*inches*
Peak d/D Ratio:	0.78	

SITE 5
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph

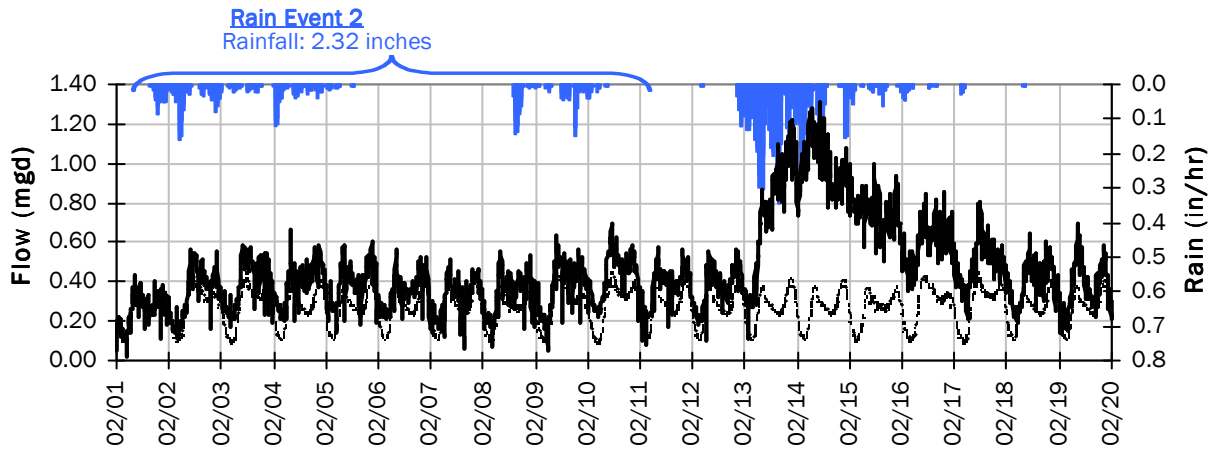


Storm Event I/I Analysis (Rain = 2.89 inches)

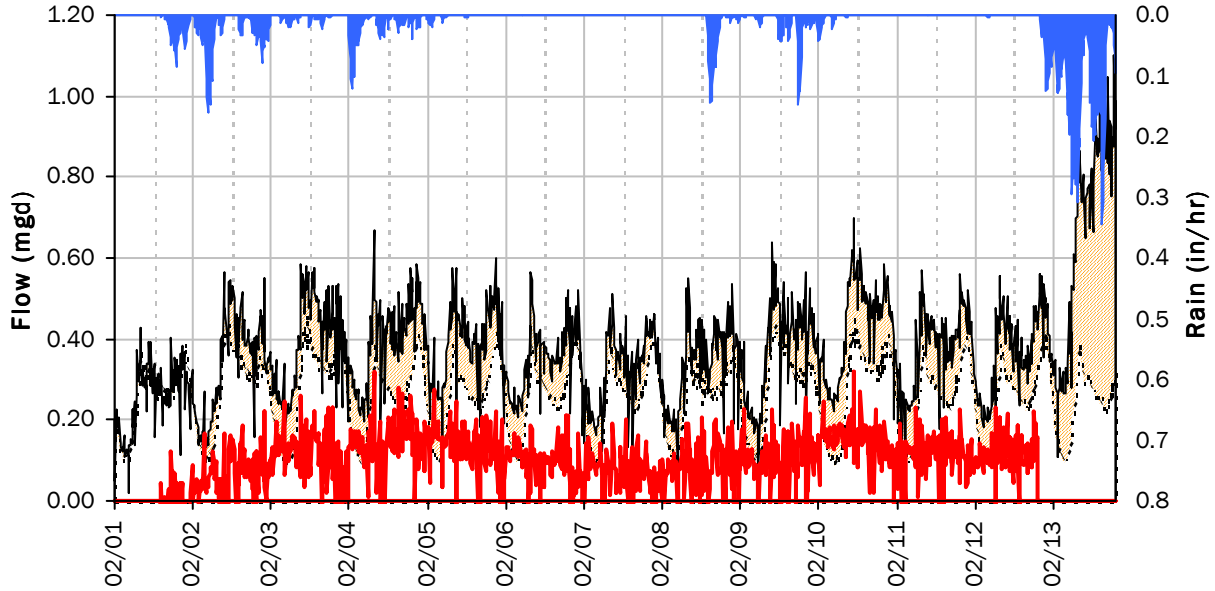
Capacity		Inflow / Infiltration	
Peak Flow:	1.059 *mgd*	**Peak I/I Rate:**	0.691 *mgd*
PF:	4.08	**Total I/I:**	1,359,000 *gallons*
Peak Level:	9.76 *in*		
d/D Ratio:	0.65		

SITE 5
I/I Summary: Rain Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 2 Detail Graph

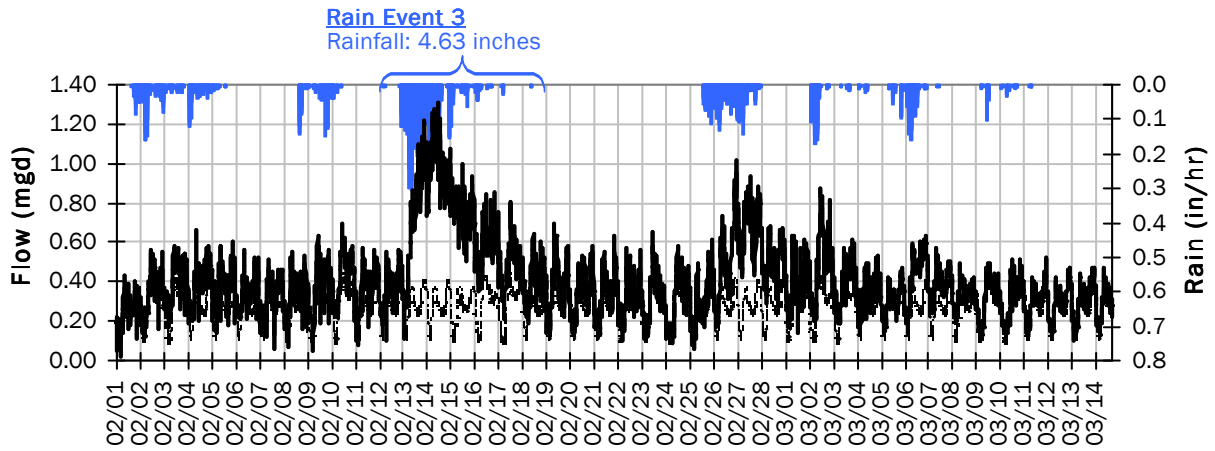


Storm Event I/I Analysis (Rain = 2.32 inches)

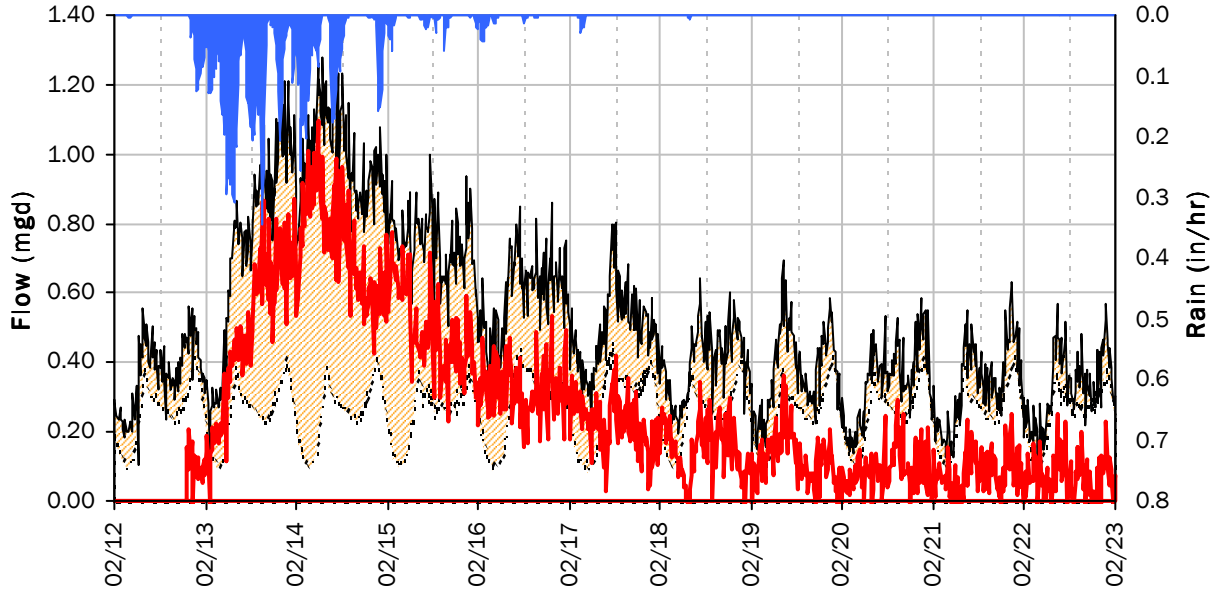
Capacity		Inflow / Infiltration	
Peak Flow:	0.697 *mgd*	**Peak I/I Rate:**	0.322 *mgd*
PF:	2.69	**Total I/I:**	1,158,000 *gallons*
Peak Level:	9.23 *in*		
d/D Ratio:	0.62		

SITE 5
I/I Summary: Rain Event 3

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3 Detail Graph

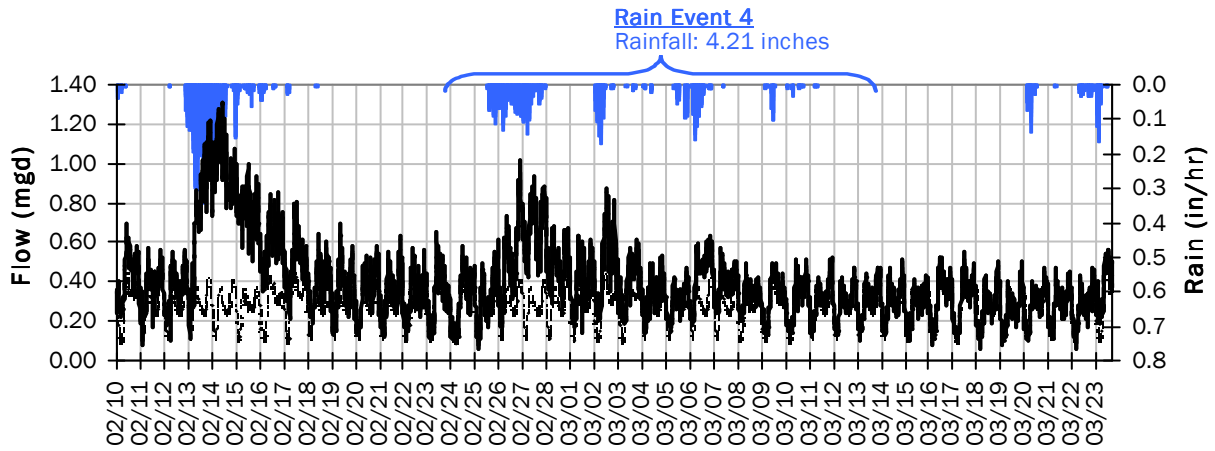


Storm Event I/I Analysis (Rain = 4.63 inches)

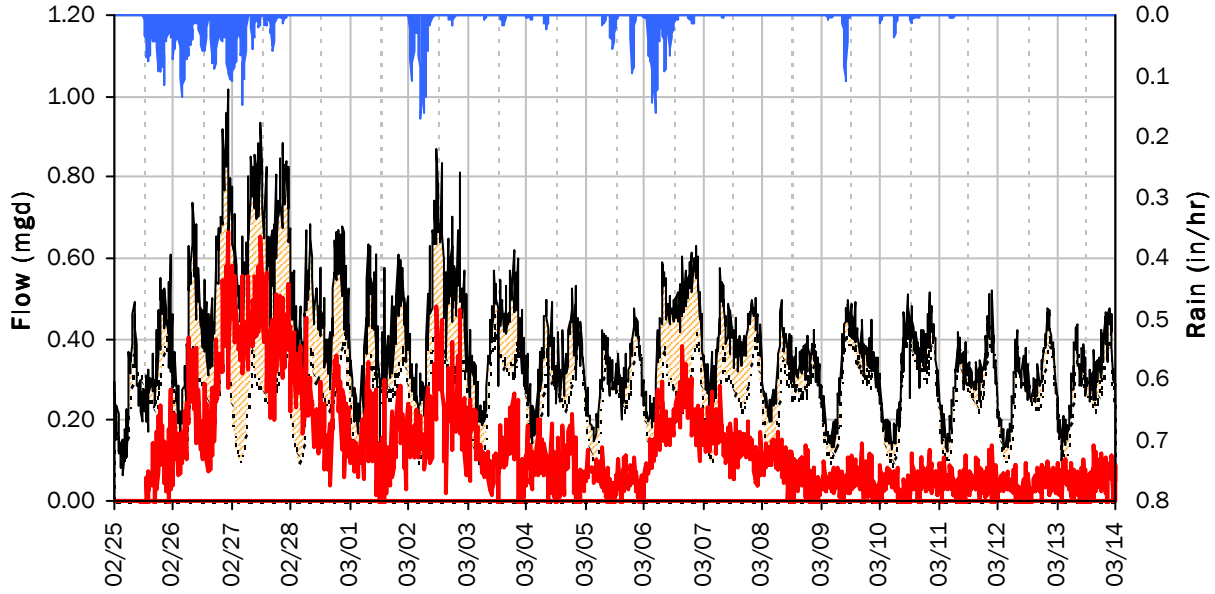
Capacity		Inflow / Infiltration	
Peak Flow:	1.30 *mgd*	**Peak I/I Rate:**	1.10 *mgd*
PF:	4.99	**Total I/I:**	2,803,000 *gallons*
Peak Level:	11.66 *in*		
d/D Ratio:	0.78		

SITE 5
I/I Summary: Rain Event 4

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 4 Detail Graph

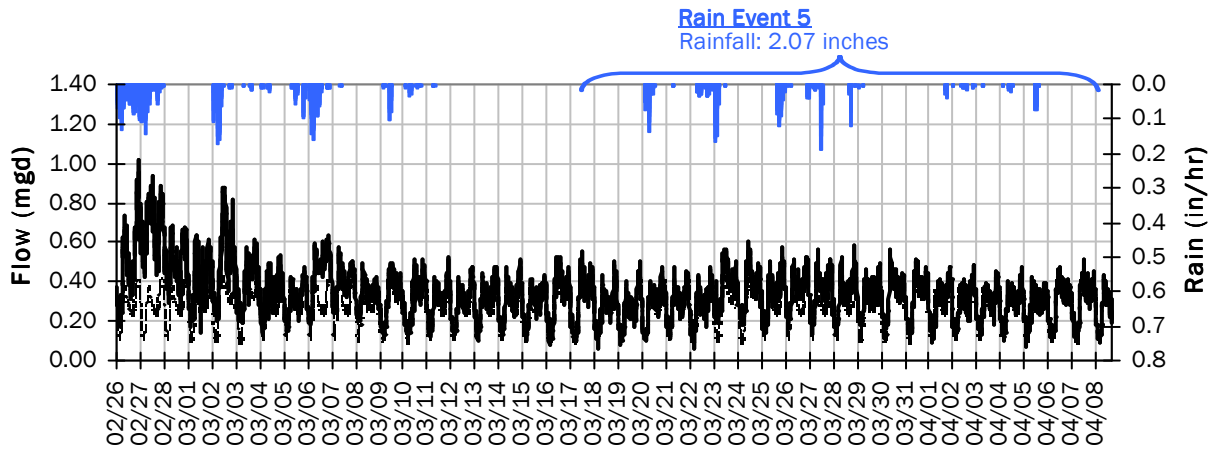


Storm Event I/I Analysis (Rain = 4.21 inches)

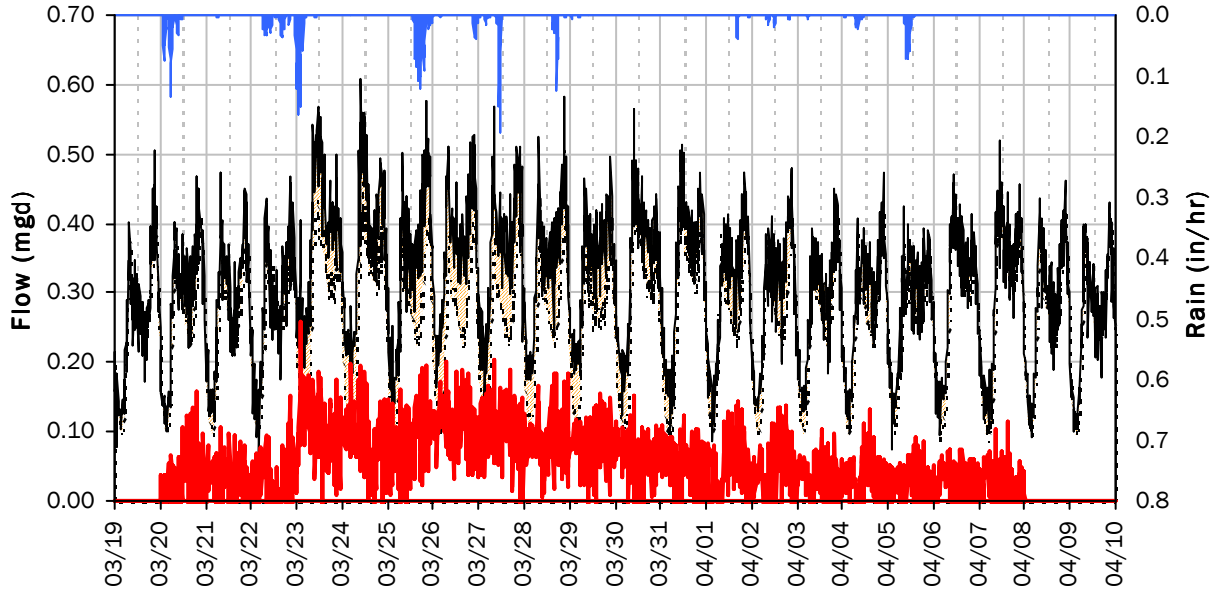
Capacity		Inflow / Infiltration	
Peak Flow:	1.02 *mgd*	**Peak I/I Rate:**	0.67 *mgd*
PF:	3.92	**Total I/I:**	2,180,000 *gallons*
Peak Level:	10.45 *in*		
d/D Ratio:	0.70		

SITE 5
I/I Summary: Rain Event 5

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 5 Detail Graph



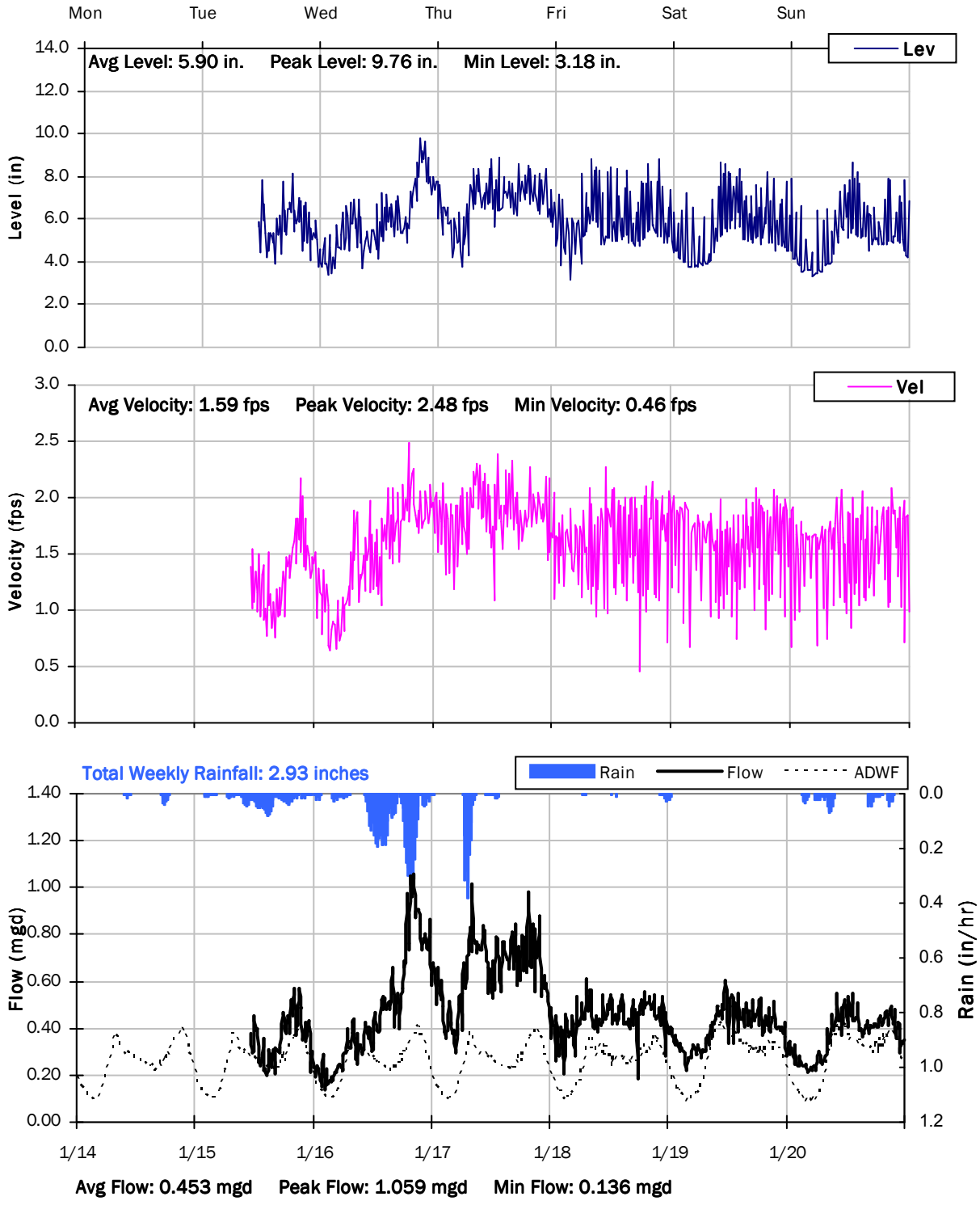
Storm Event I/I Analysis (Rain = 2.07 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.61 *mgd*	**Peak I/I Rate:**	0.26 *mgd*
PF:	2.34	**Total I/I:**	1,120,000 *gallons*
Peak Level:	7.35 *in*		
d/D Ratio:	0.49		

SITE 5

Weekly Level, Velocity and Flow Hydrographs

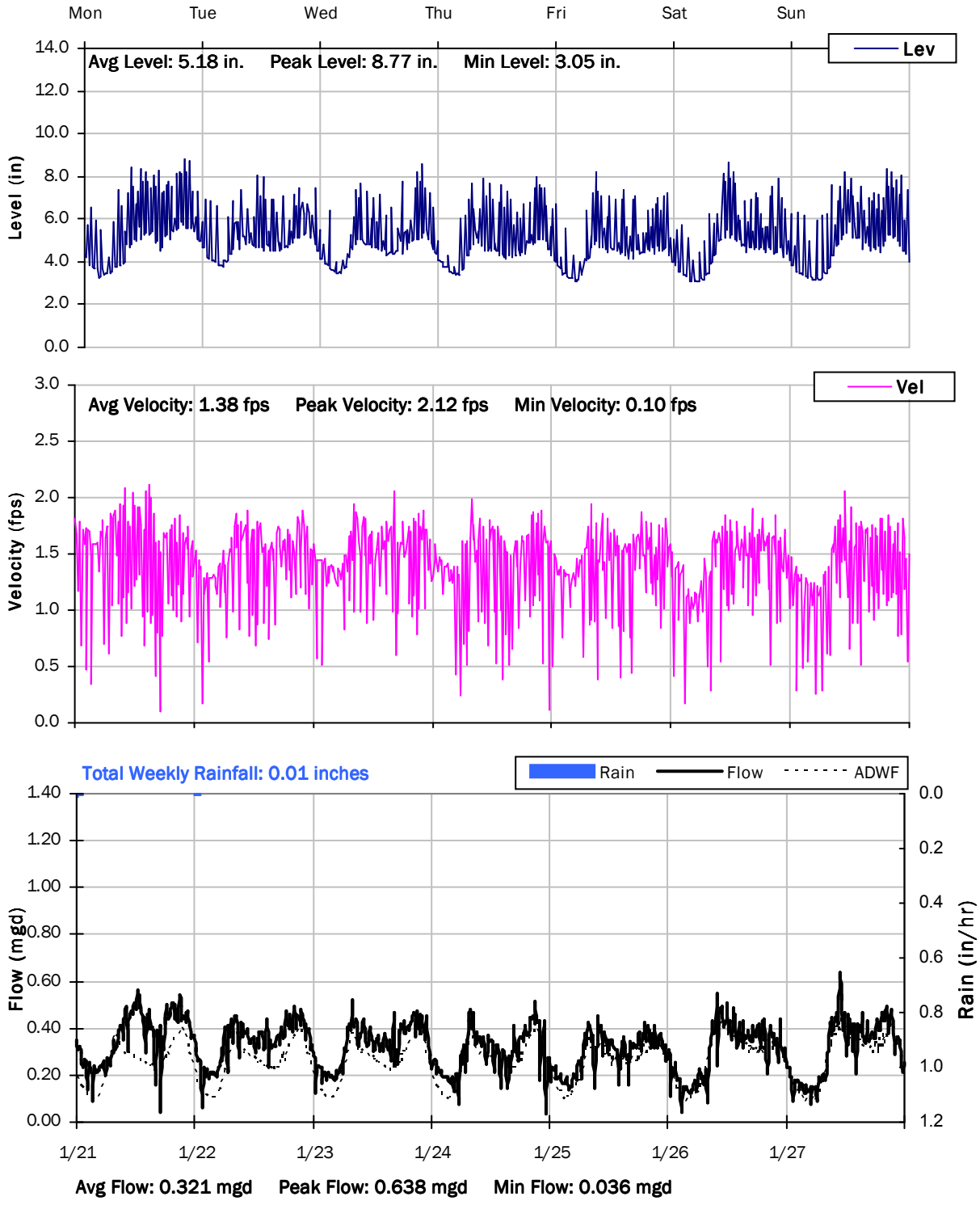
1/14/2019 to 1/21/2019



SITE 5

Weekly Level, Velocity and Flow Hydrographs

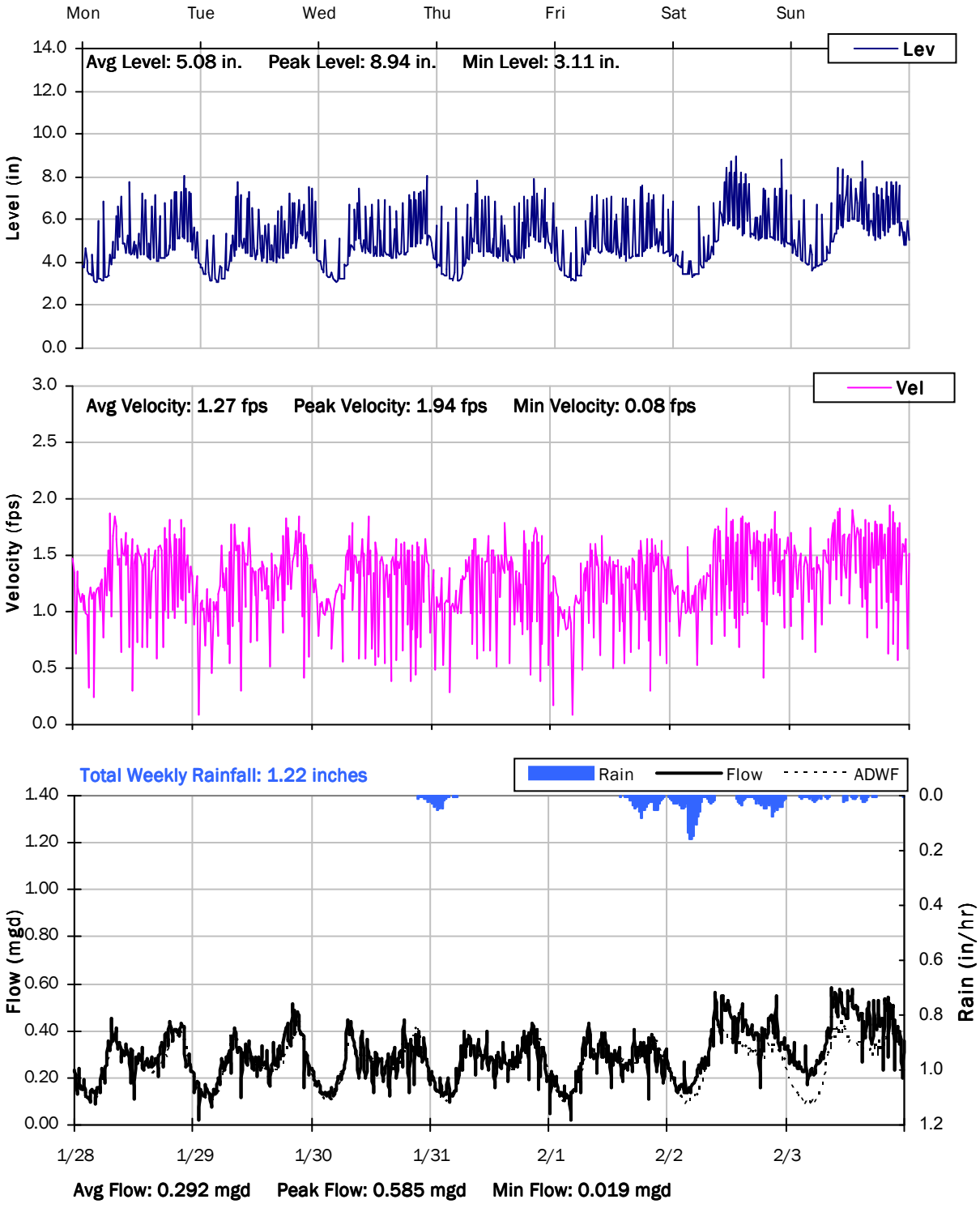
1/21/2019 to 1/28/2019



SITE 5

Weekly Level, Velocity and Flow Hydrographs

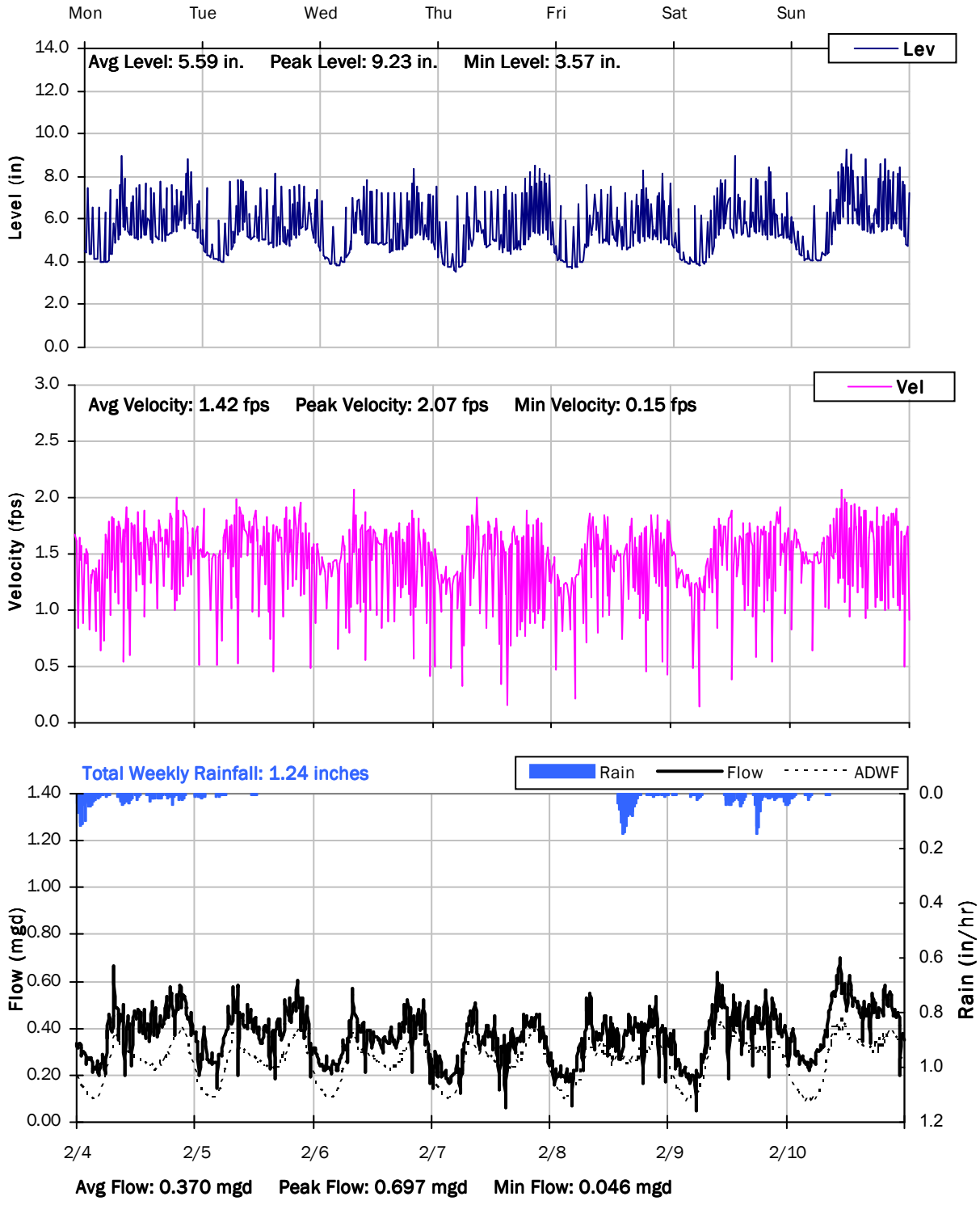
1/28/2019 to 2/4/2019



SITE 5

Weekly Level, Velocity and Flow Hydrographs

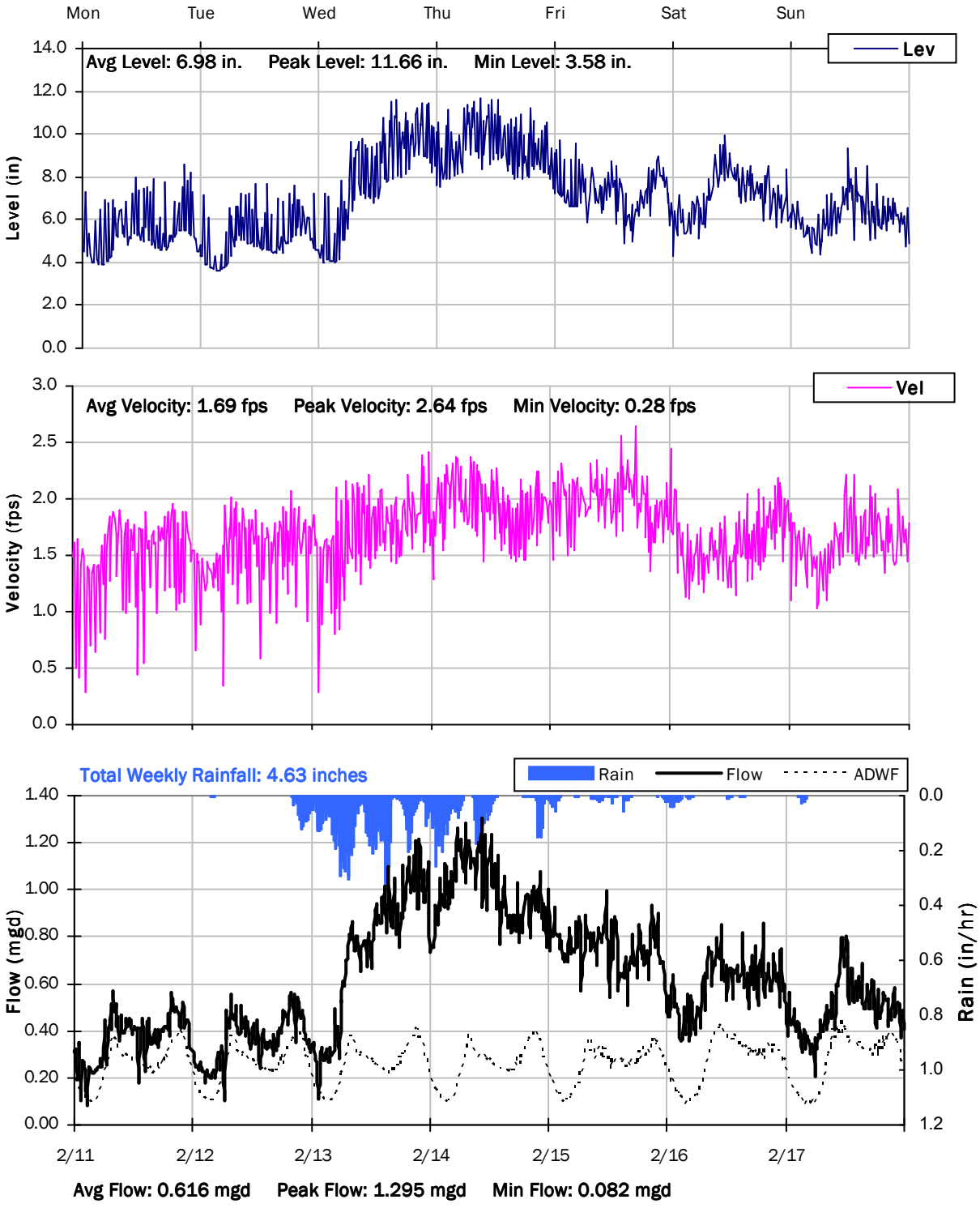
2/4/2019 to 2/11/2019



SITE 5

Weekly Level, Velocity and Flow Hydrographs

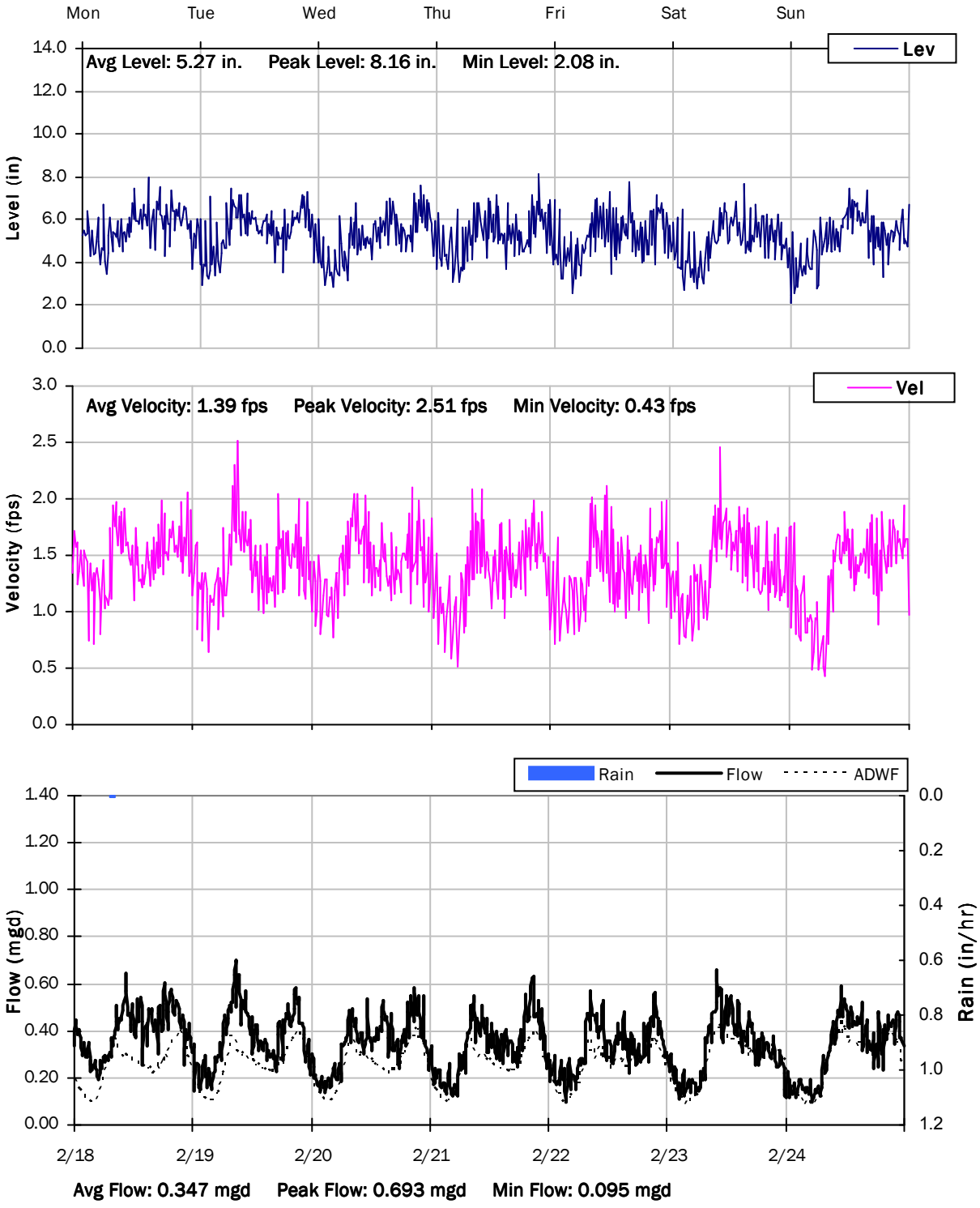
2/11/2019 to 2/18/2019



SITE 5

Weekly Level, Velocity and Flow Hydrographs

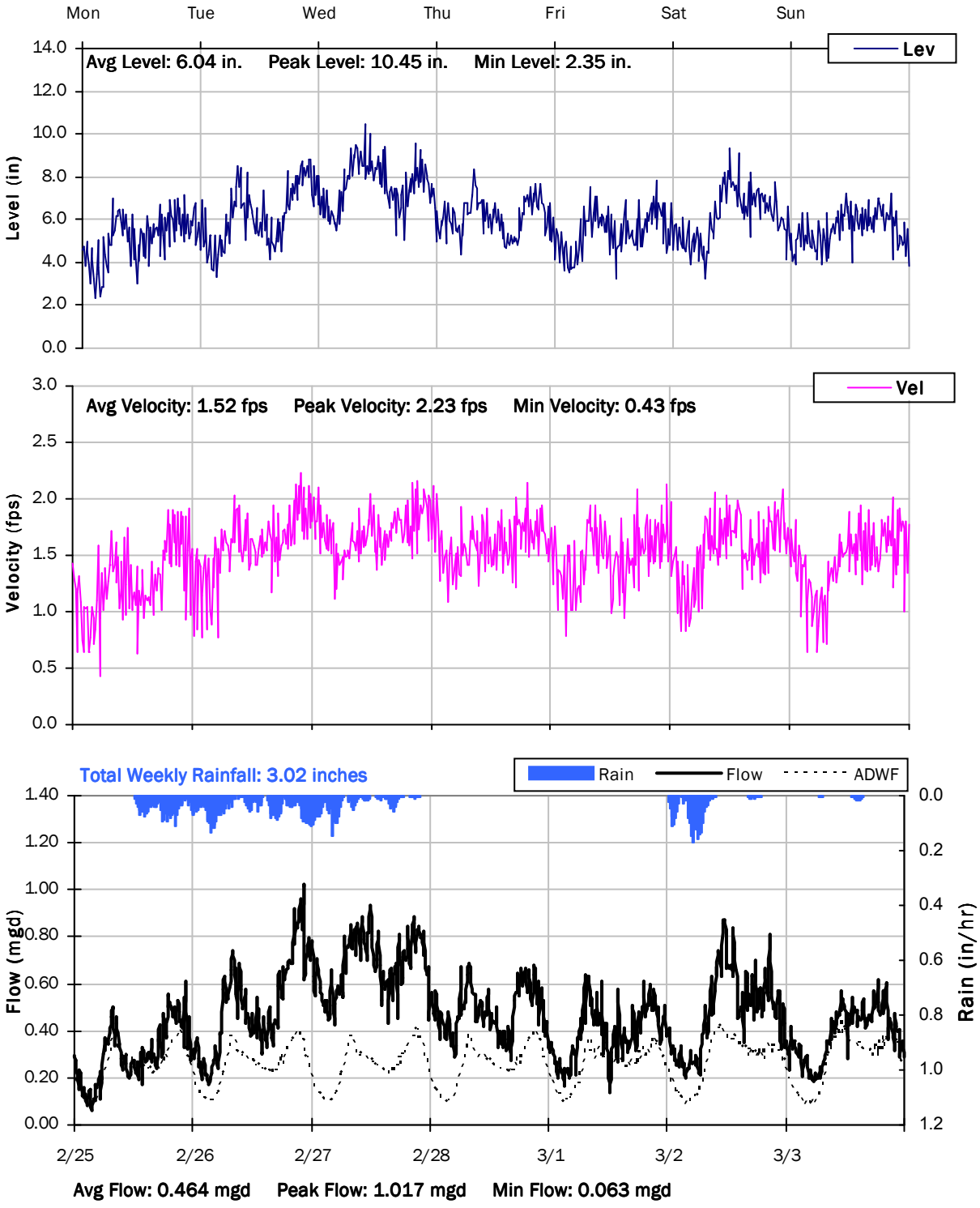
2/18/2019 to 2/25/2019



SITE 5

Weekly Level, Velocity and Flow Hydrographs

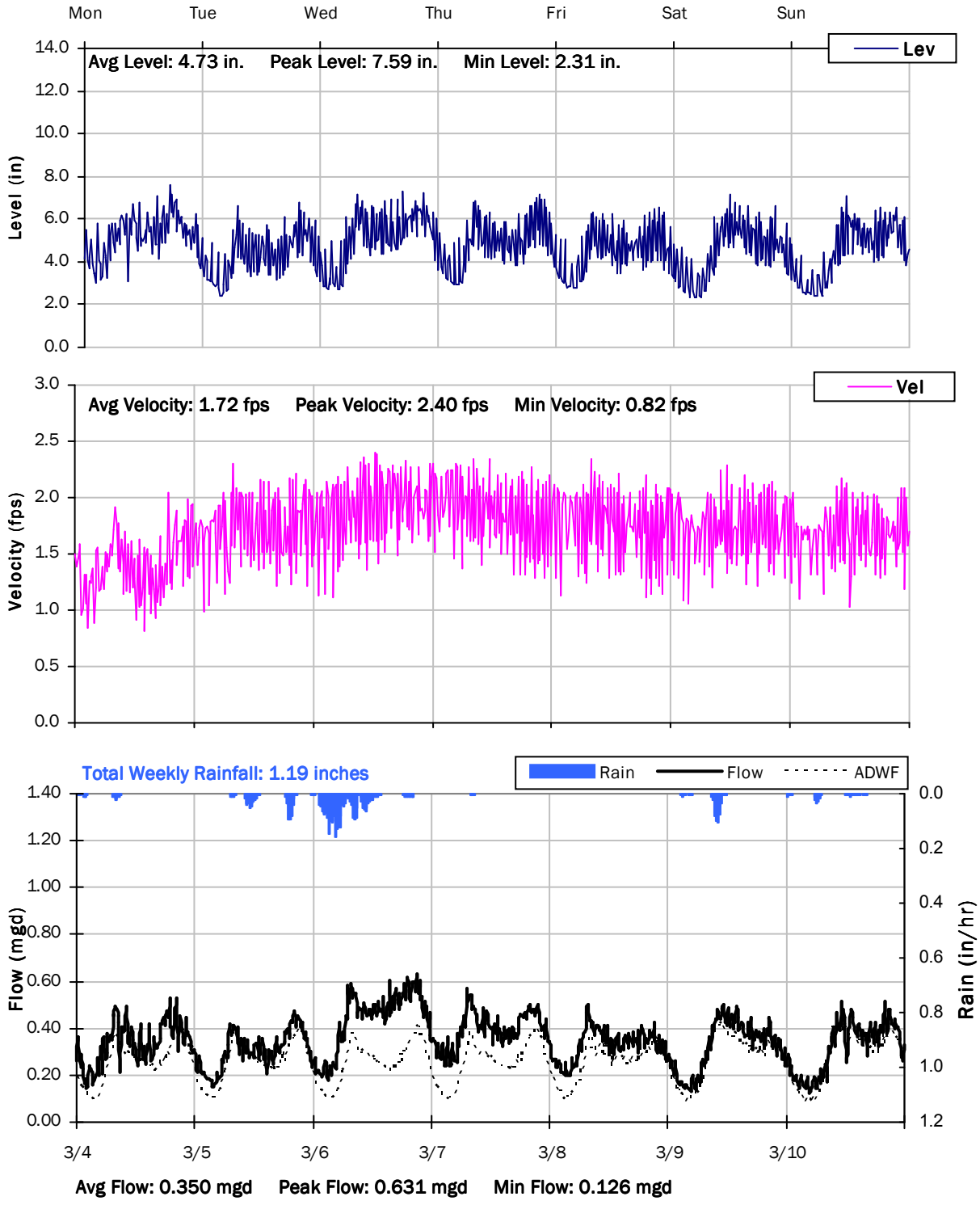
2/25/2019 to 3/4/2019



SITE 5

Weekly Level, Velocity and Flow Hydrographs

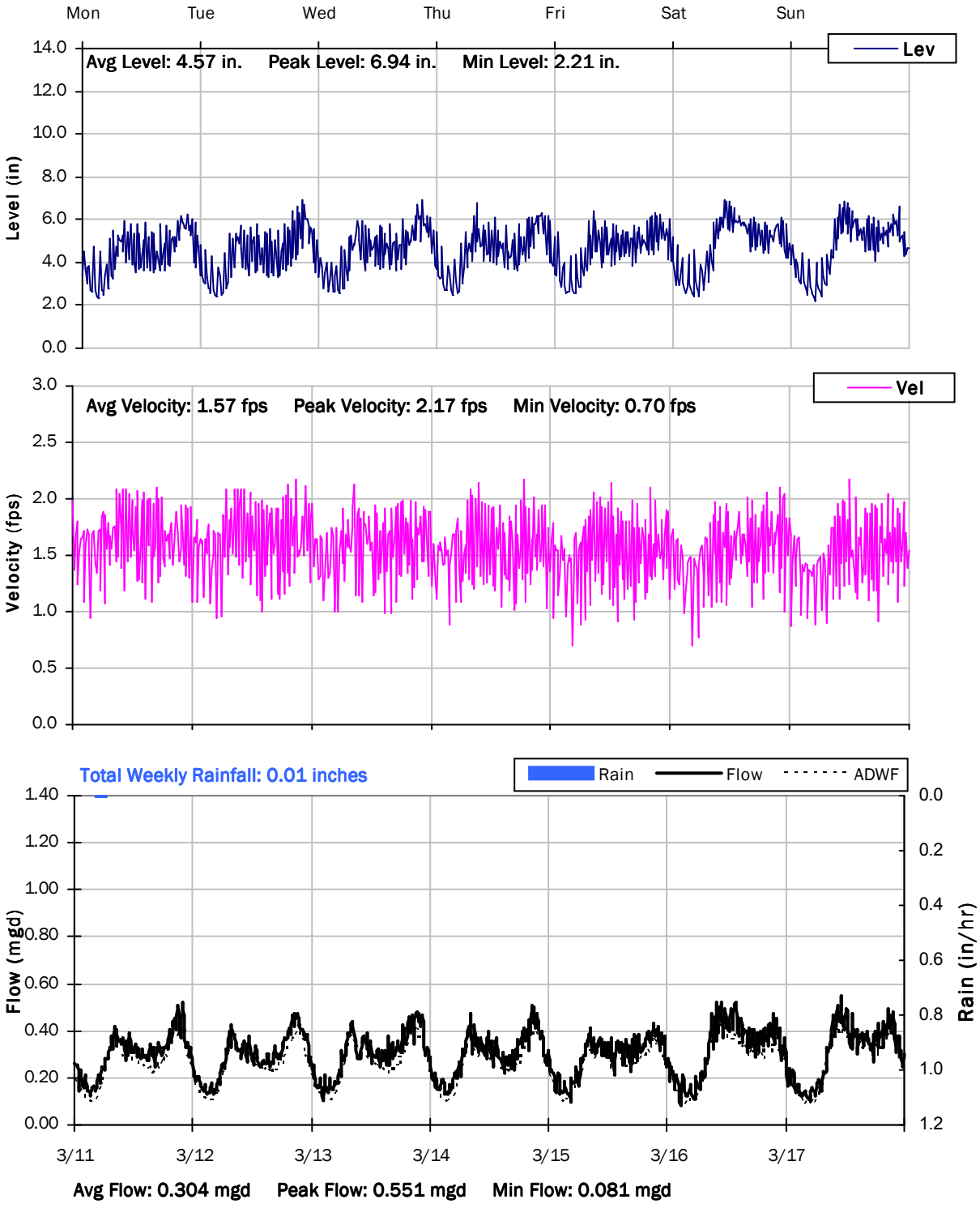
3/4/2019 to 3/11/2019



SITE 5

Weekly Level, Velocity and Flow Hydrographs

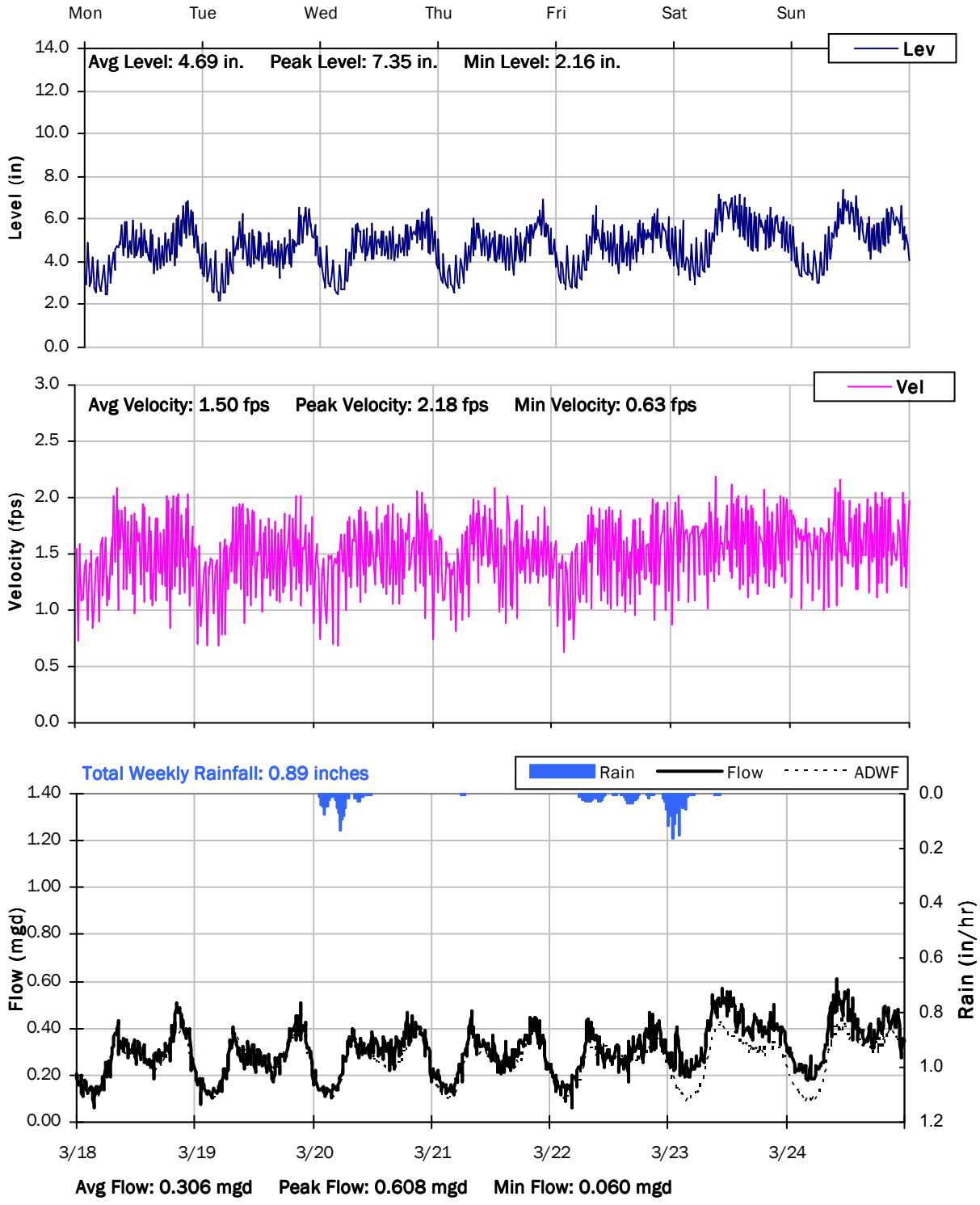
3/11/2019 to 3/18/2019



SITE 5

Weekly Level, Velocity and Flow Hydrographs

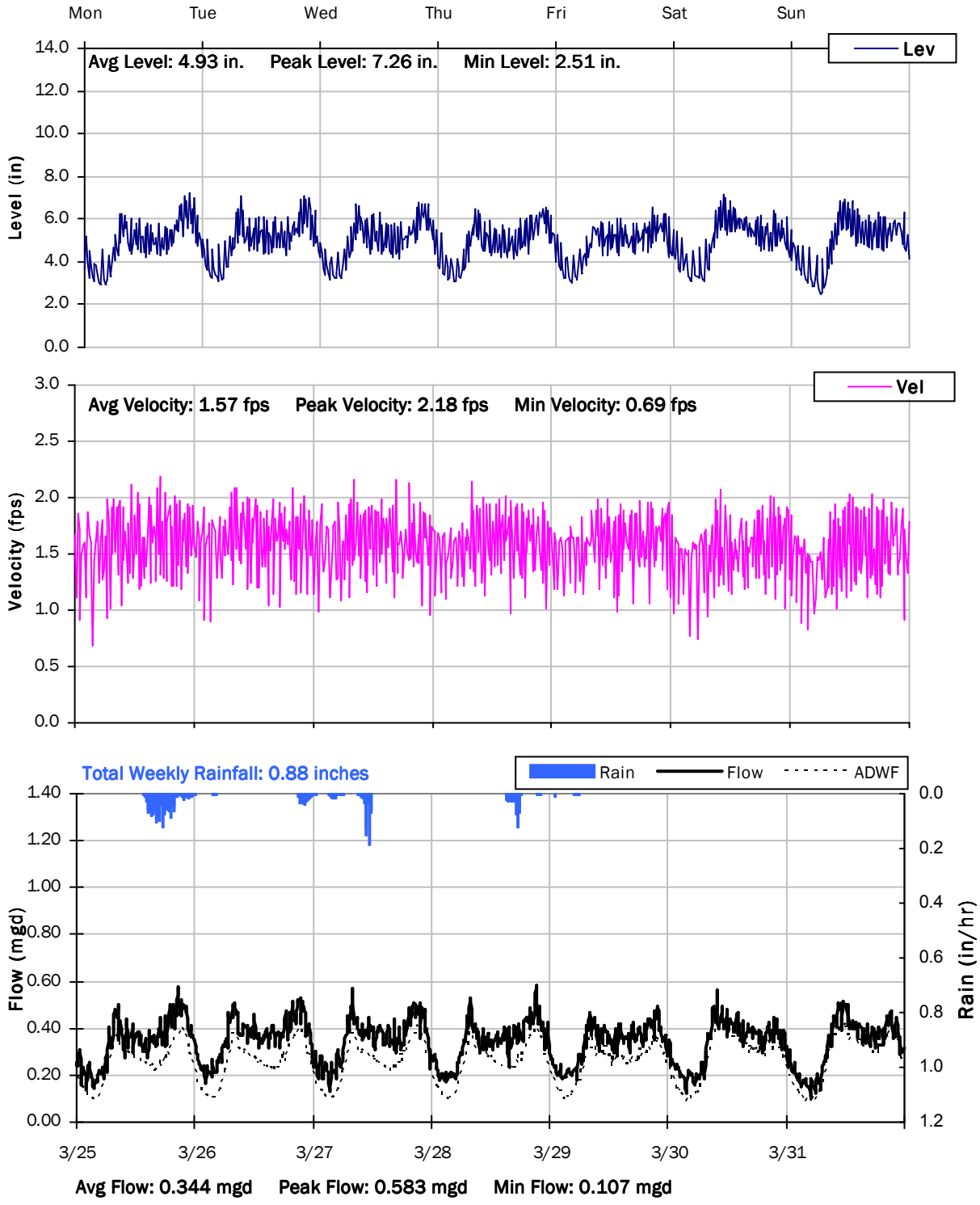
3/18/2019 to 3/25/2019



SITE 5

Weekly Level, Velocity and Flow Hydrographs

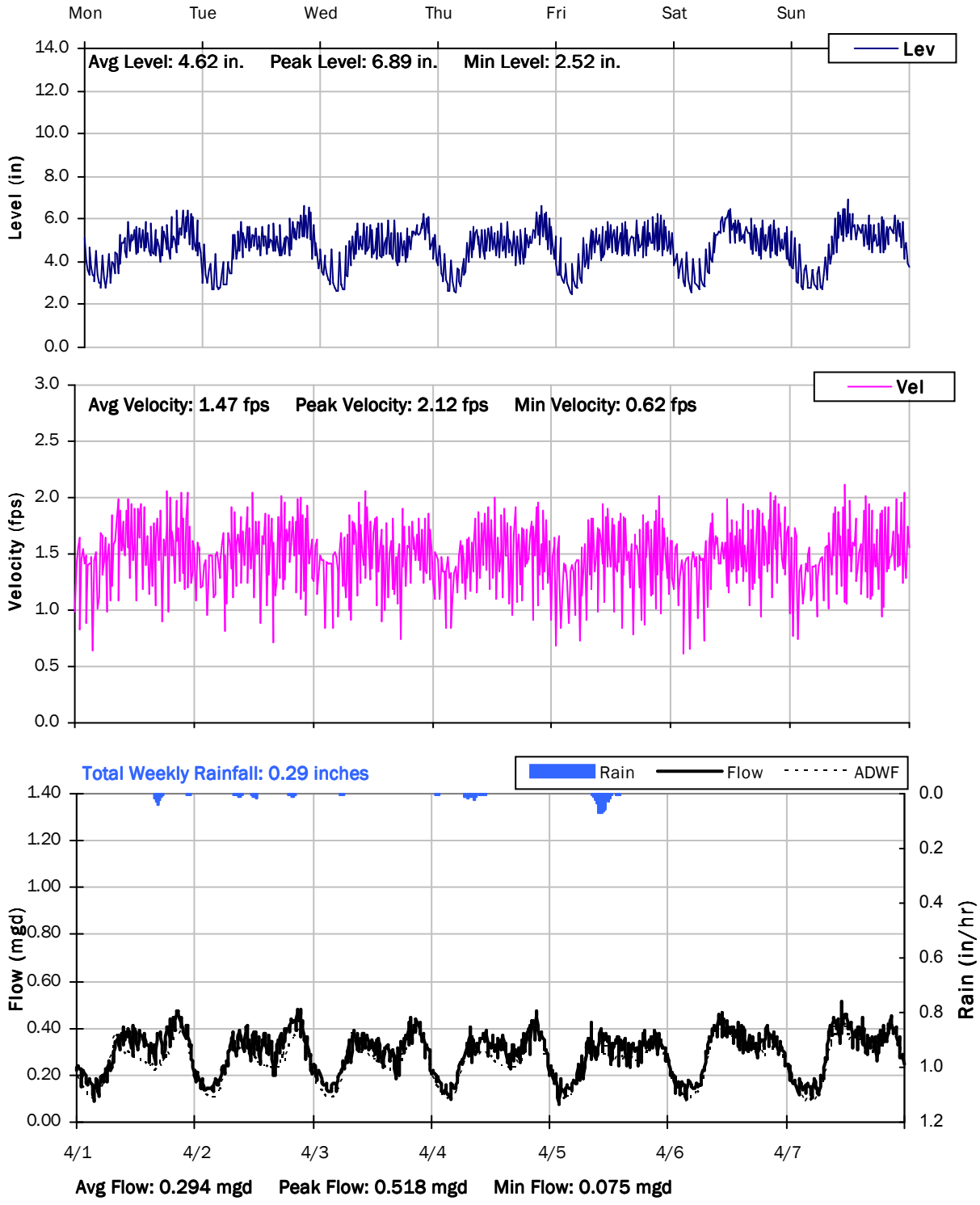
3/25/2019 to 4/1/2019



SITE 5

Weekly Level, Velocity and Flow Hydrographs

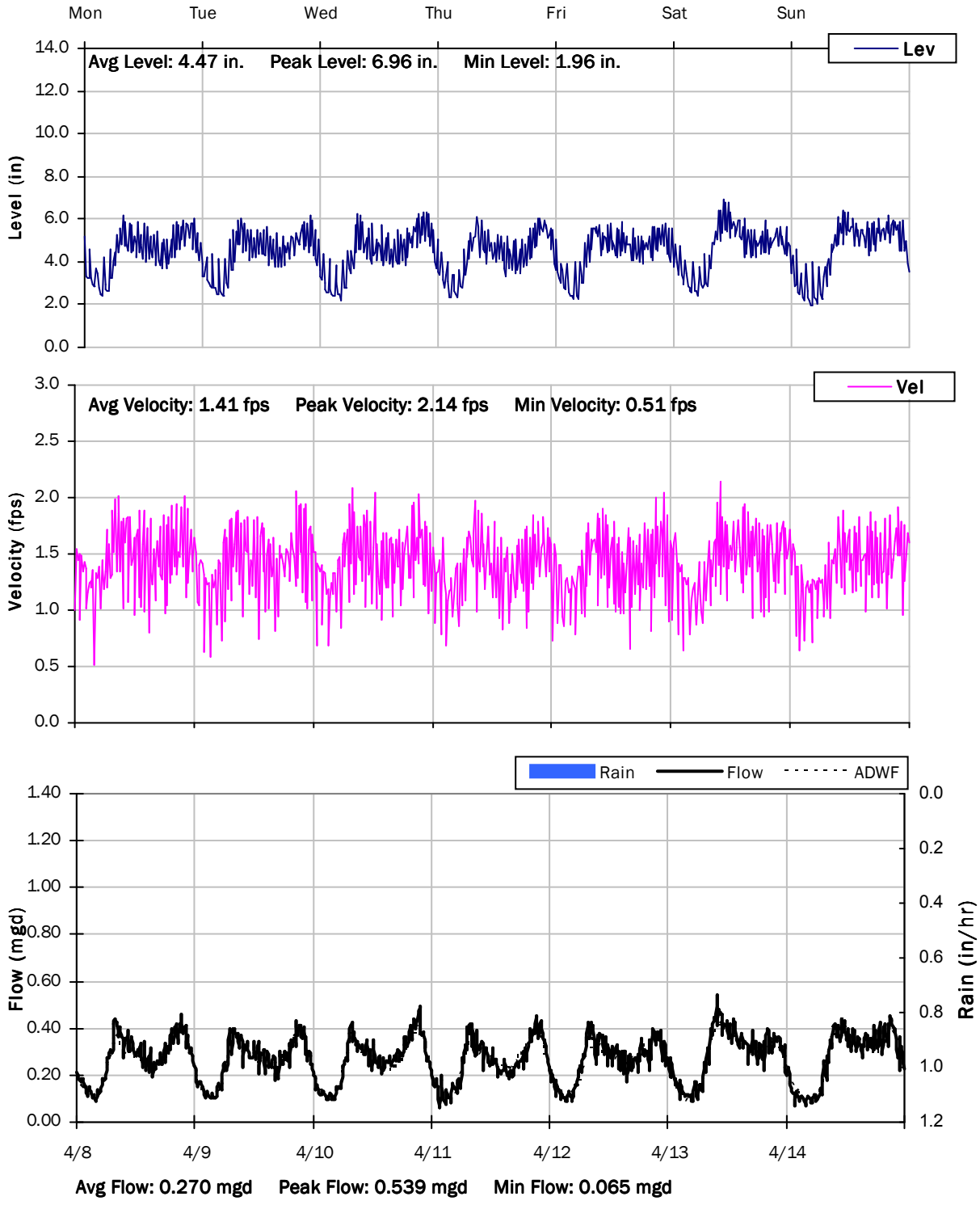
4/1/2019 to 4/8/2019



SITE 5

Weekly Level, Velocity and Flow Hydrographs

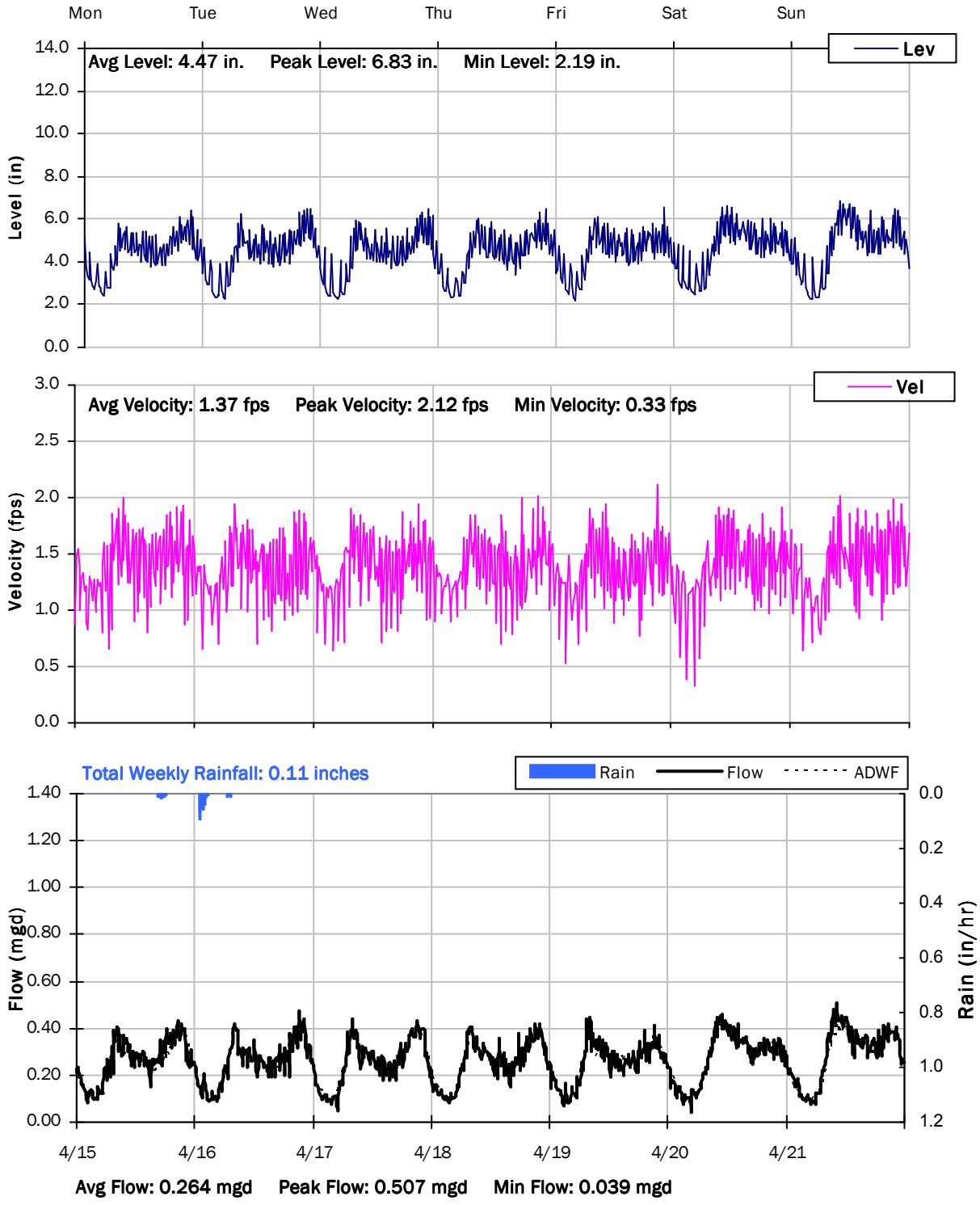
4/8/2019 to 4/15/2019



SITE 5

Weekly Level, Velocity and Flow Hydrographs

4/15/2019 to 4/22/2019



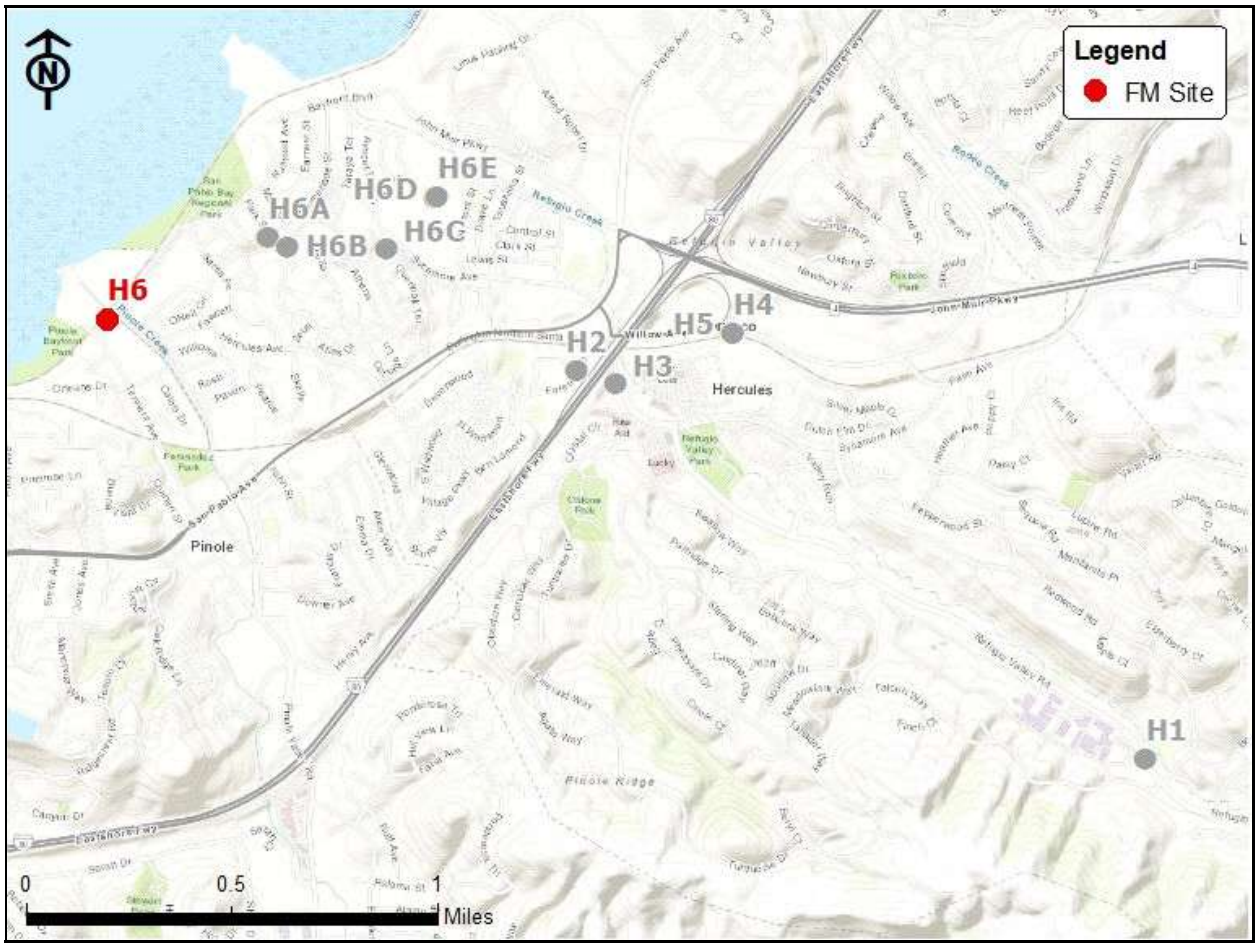
City of Hercules, California

Sanitary Sewer Flow Monitoring
January 14 - April 21, 2019

Monitoring Site: Site 6

Location: Railroad Avenue east of Tennent Avenue

Data Summary Report



Vicinity Map: Site 6

SITE 6

Site Information

Location: Railroad Avenue east of Tennent Avenue

Coordinates: 122.2952° W, 38.0125° N

Rim Elevation (Earth): 10 feet

Measured Pipe Diameter: 22.5 inches

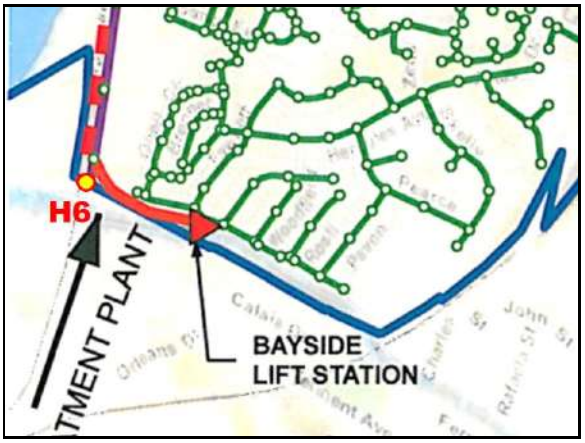
ADWF: 1.625 mgd

Peak Measured Flow: 5.750 mgd

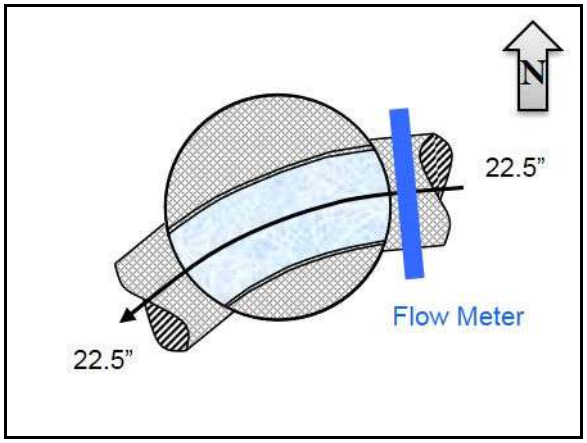
Sediment: None



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

SITE 6

Additional Site Photos

Effluent Pipe



Monitored Influent Pipe

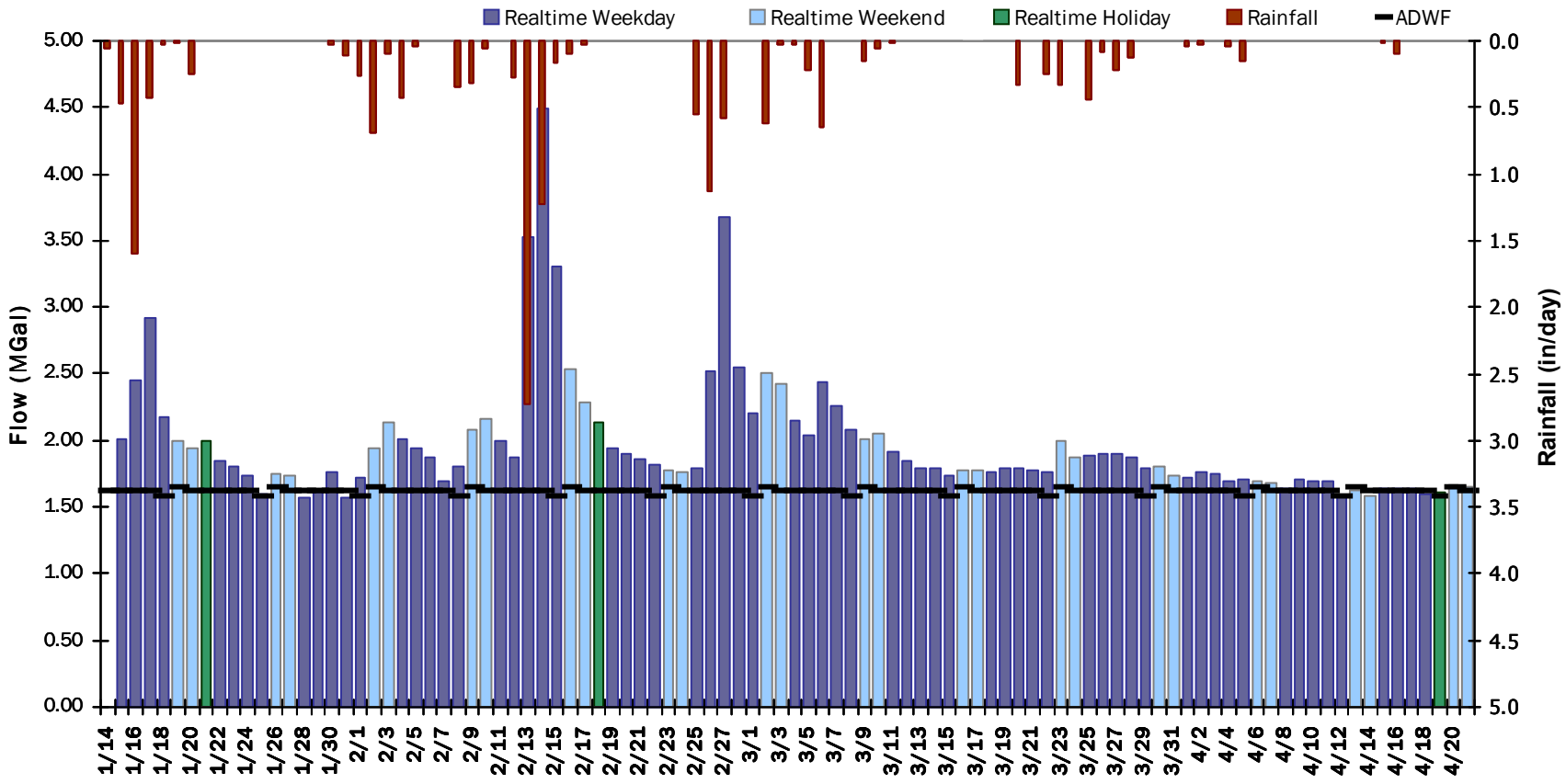


SITE 6

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 1.968 MGal Peak Daily Flow: 4.496 MGal Min Daily Flow: 1.567 MGal

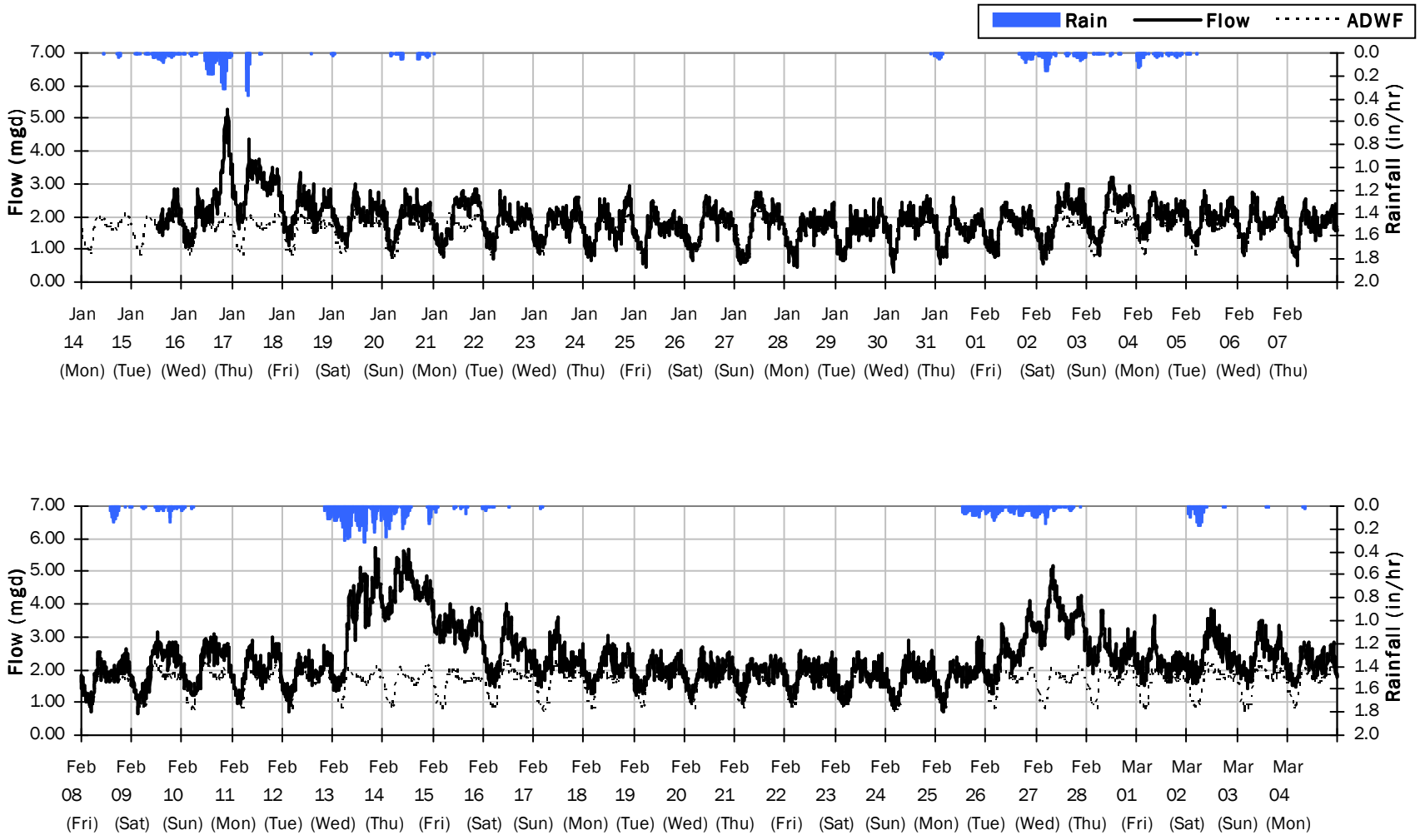
Total Rainfall: 15.75 inches



SITE 6

Flow Summary: 1/14/2019 to 3/4/2019

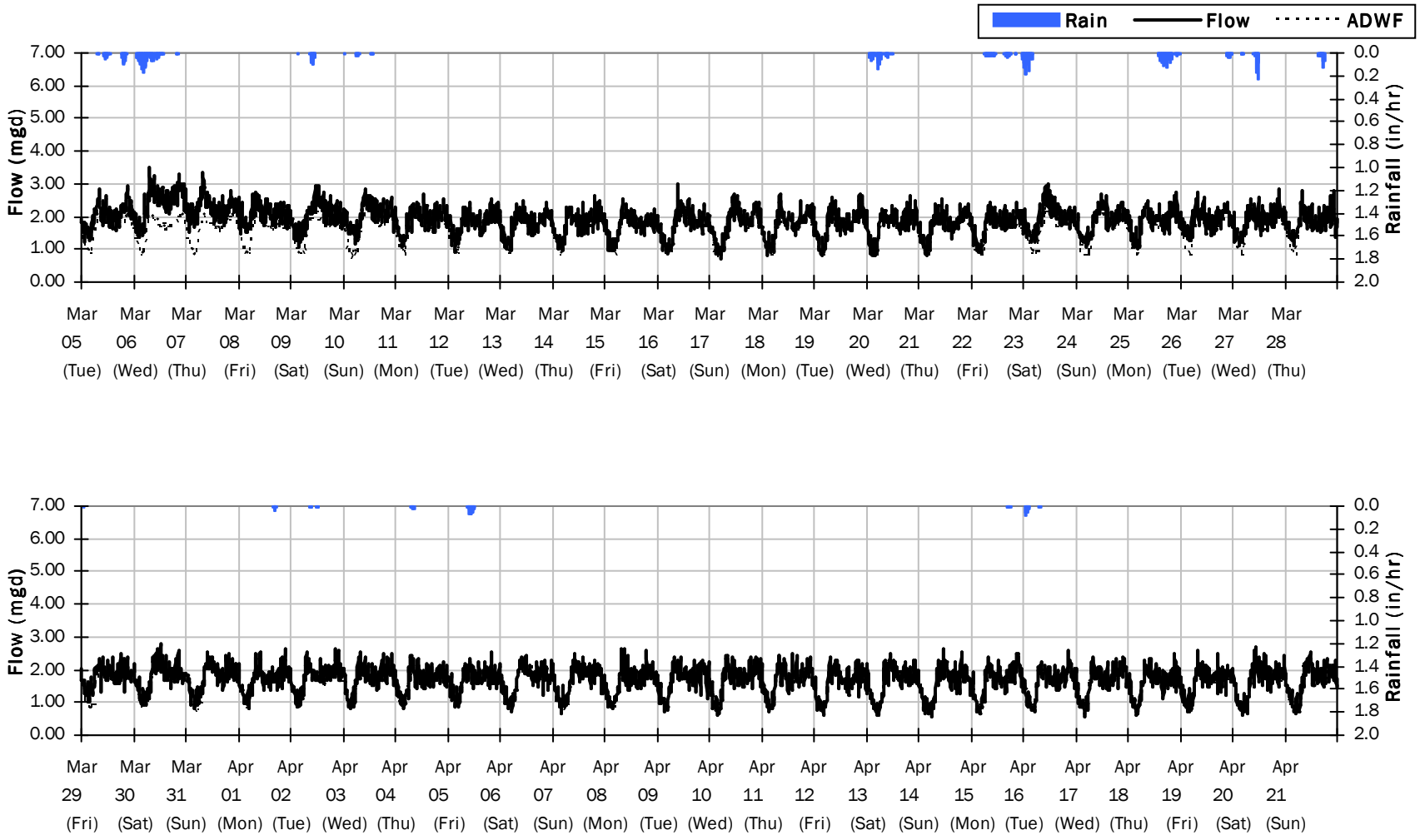
Period Rainfall: 12.67 inches Period Avg Flow: 2.140 mgd Period Peak Flow: 5.750 mgd Period Min Flow: 0.327 mgd



SITE 6

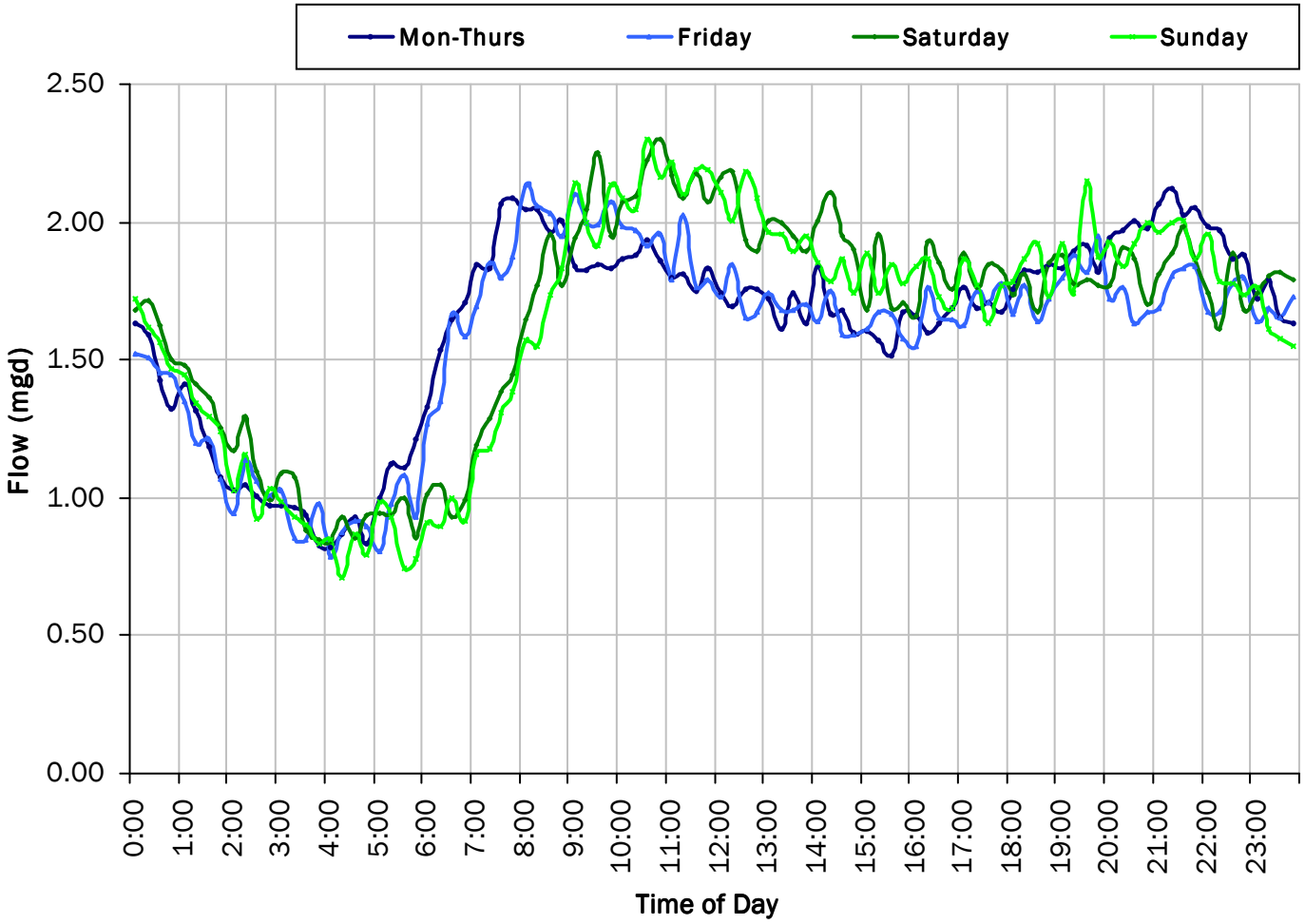
Flow Summary: 3/5/2019 to 4/21/2019

Period Rainfall: 3.28 inches Period Avg Flow: 1.794 mgd Period Peak Flow: 3.484 mgd Period Min Flow: 0.569 mgd



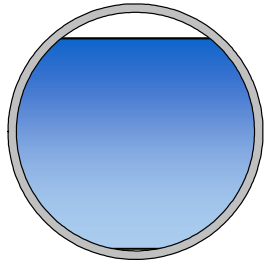
SITE 6

Average Dry Weather Flow Hydrographs



ADWF:

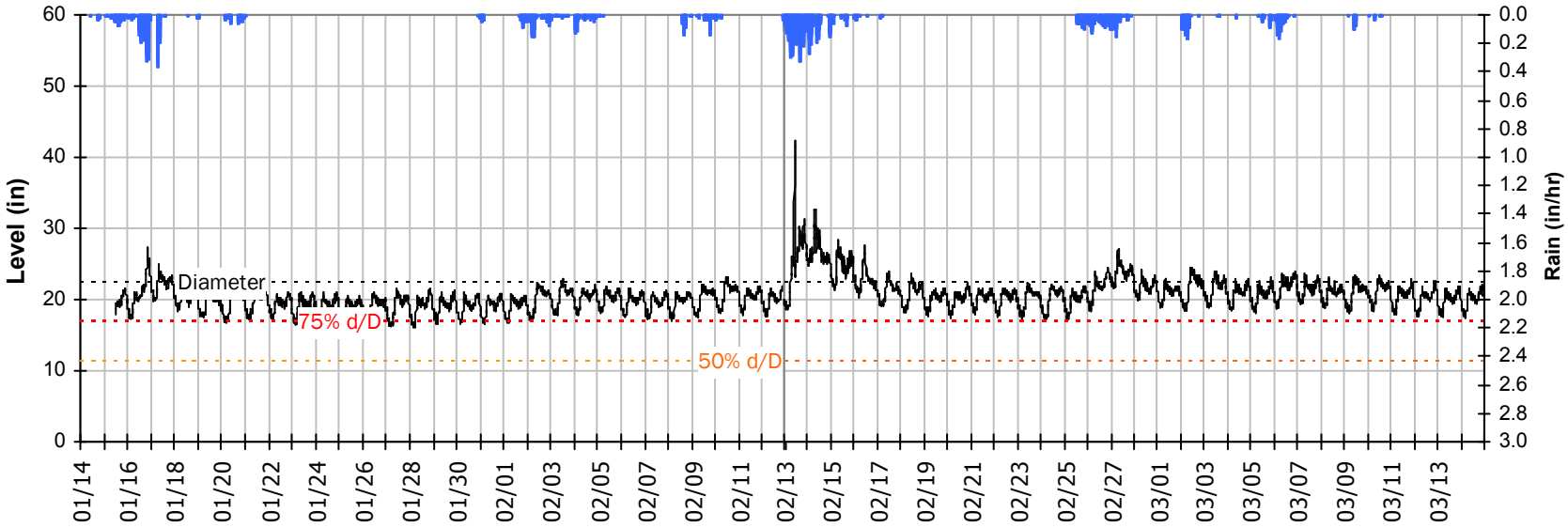
1.625 *mgd*

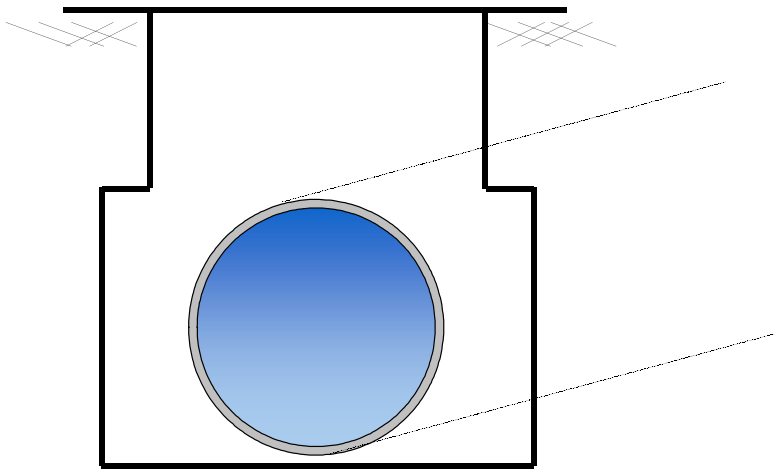


SITE 6

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



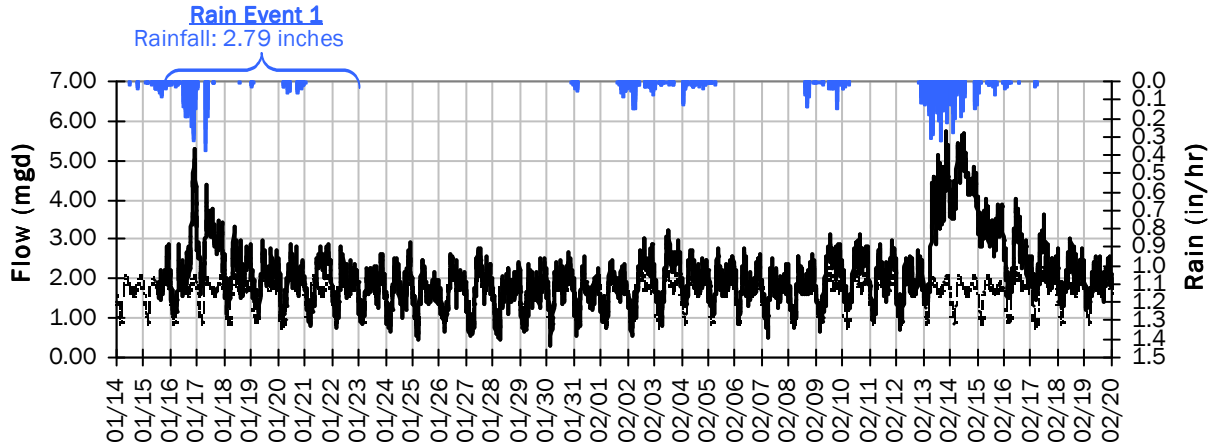


Pipe Diameter:	22.5	*inches*
Peak Measured Level:	42.3	*inches*
Peak d/D Ratio:	1.88	

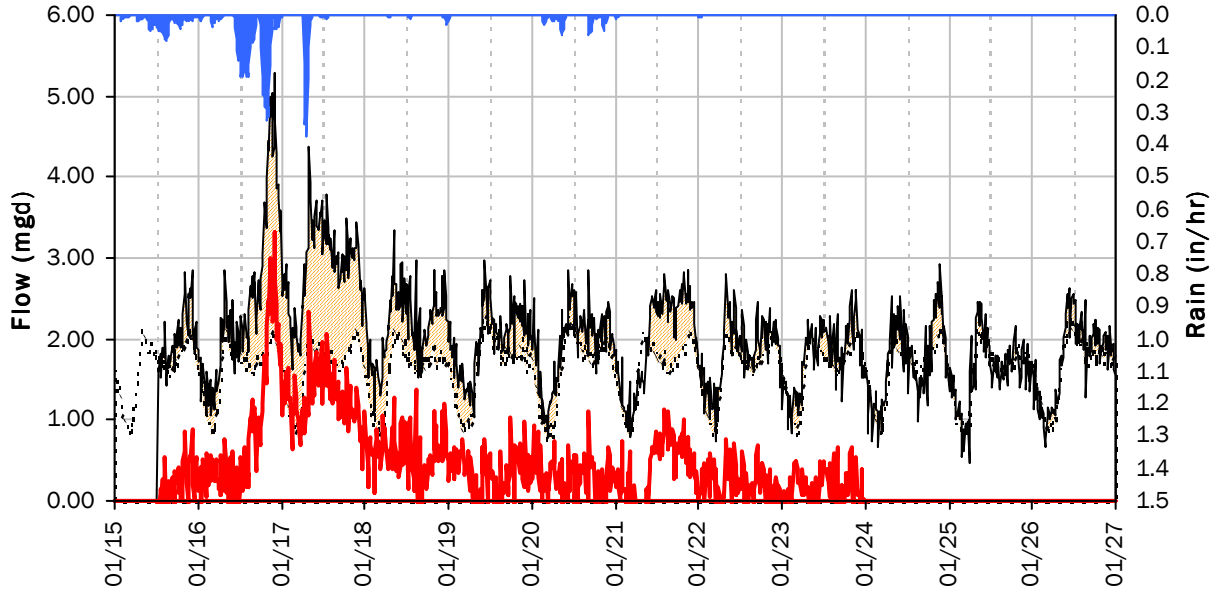
Surcharged 19.8 inches over crown

SITE 6
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph

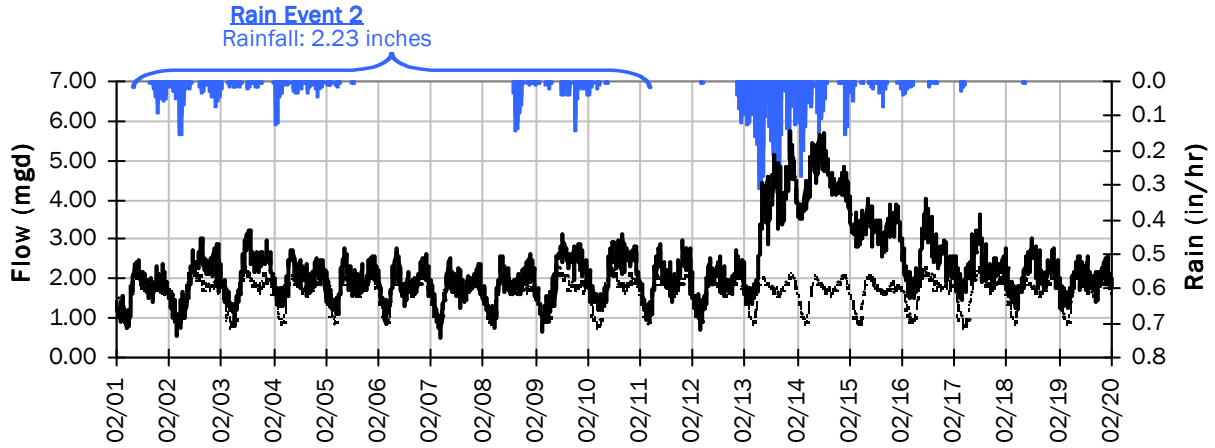


Storm Event I/I Analysis (Rain = 2.79 inches)

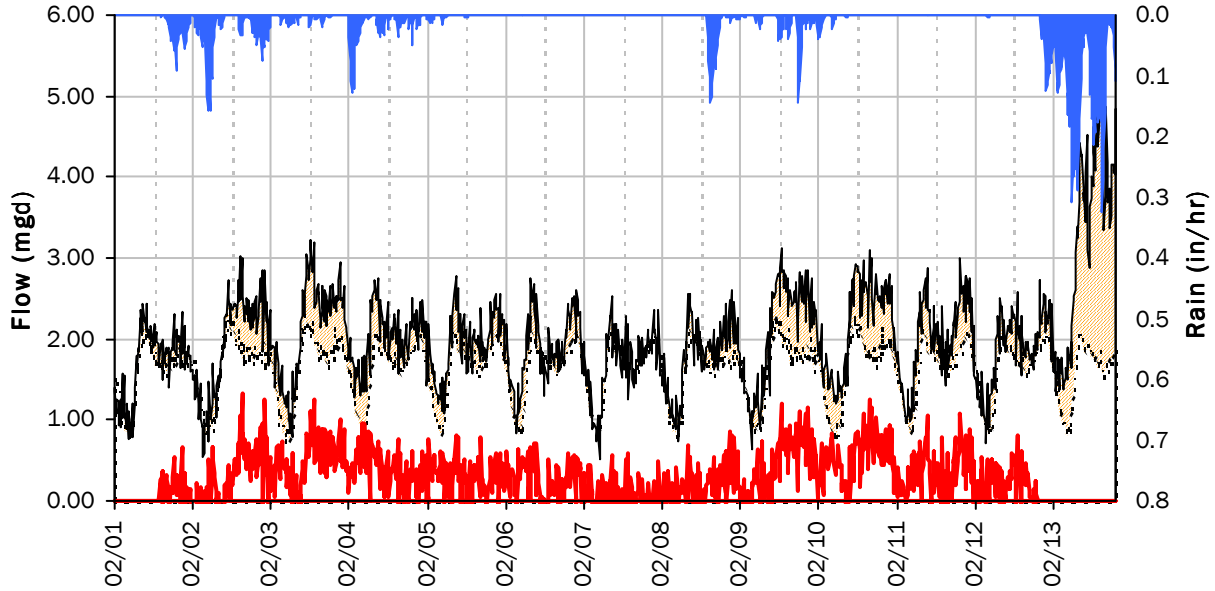
Capacity		Inflow / Infiltration	
Peak Flow:	5.290 *mgd*	**Peak I/I Rate:**	3.308 *mgd*
PF:	3.25	**Total I/I:**	4,210,000 *gallons*
Peak Level:	27.47 *in*		
d/D Ratio:	1.22		

SITE 6
I/I Summary: Rain Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 2 Detail Graph

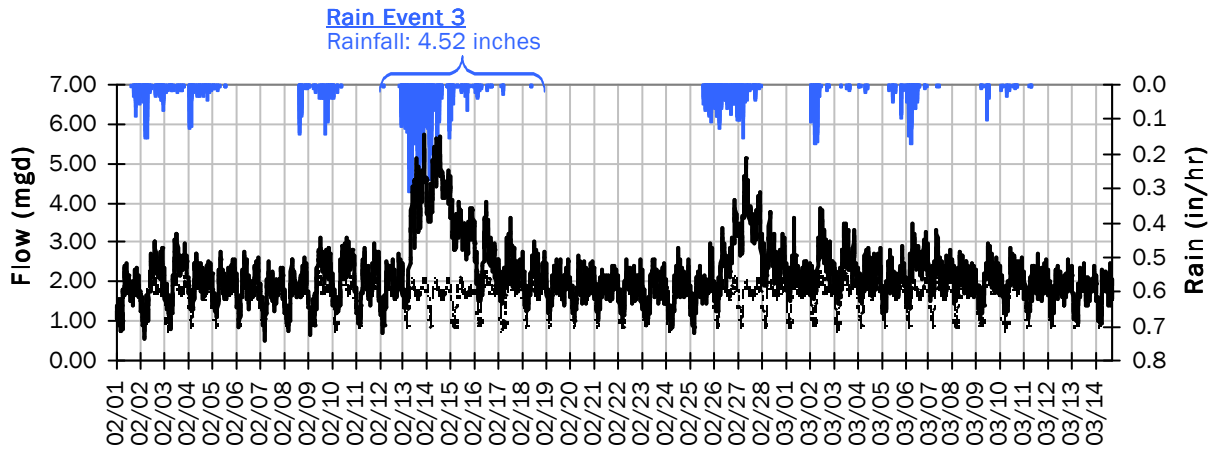


Storm Event I/I Analysis (Rain = 2.23 inches)

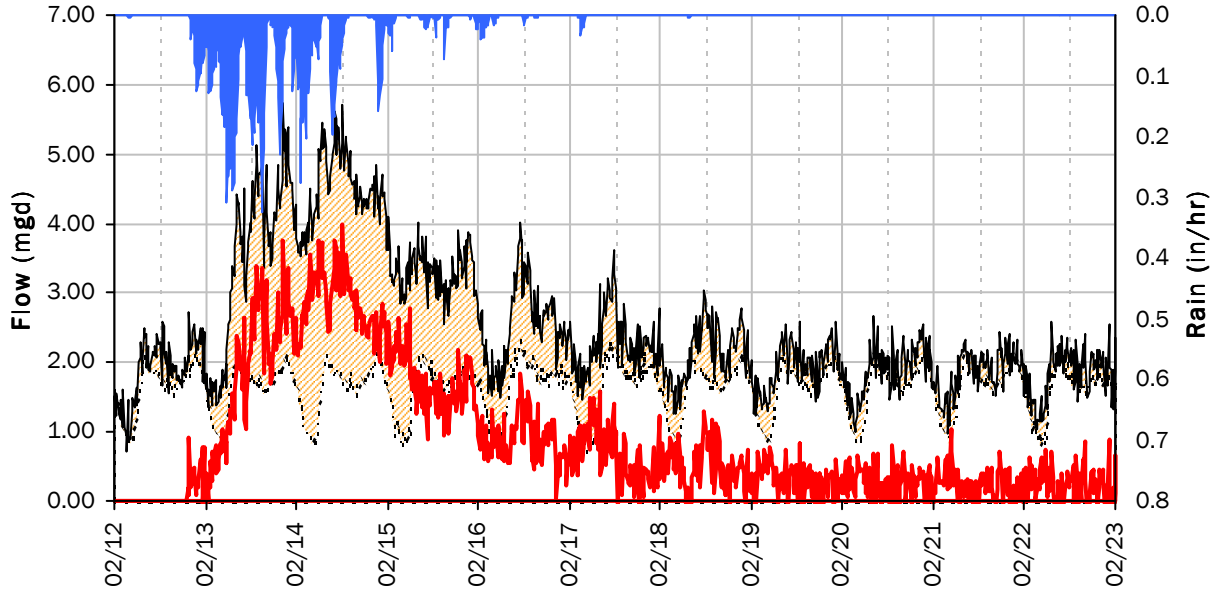
Capacity		Inflow / Infiltration	
Peak Flow:	3.216 *mgd*	**Peak I/I Rate:**	1.323 *mgd*
PF:	1.98	**Total I/I:**	3,580,000 *gallons*
Peak Level:	23.23 *in*		
d/D Ratio:	1.03		

SITE 6
I/I Summary: Rain Event 3

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3 Detail Graph

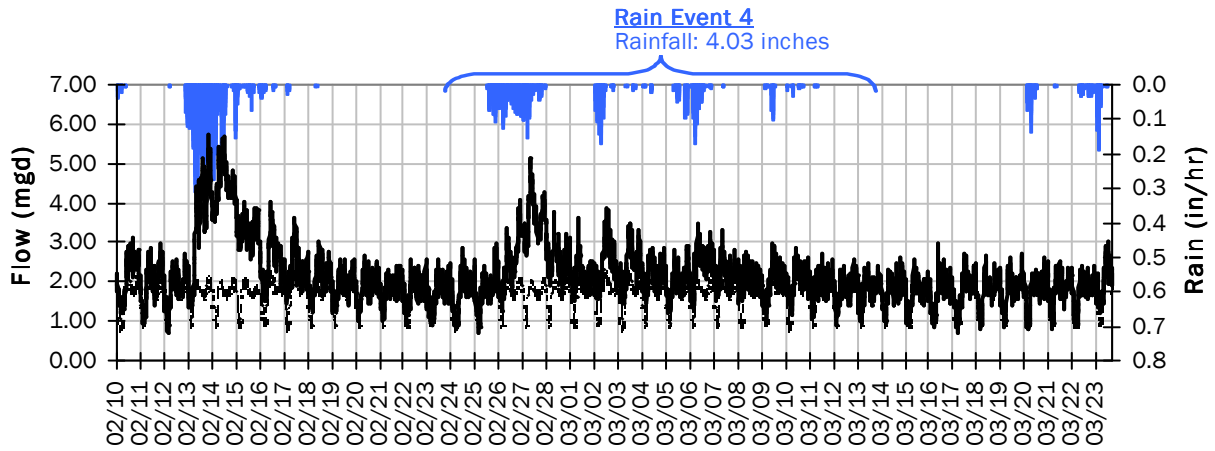


Storm Event I/I Analysis (Rain = 4.52 inches)

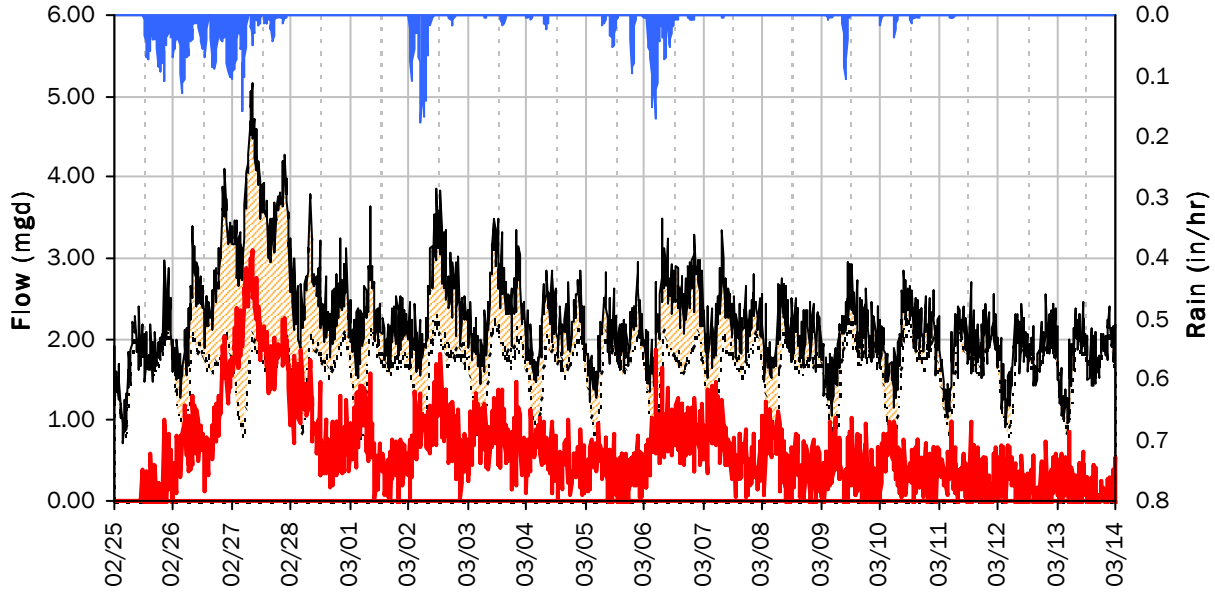
Capacity		Inflow / Infiltration	
Peak Flow:	5.75 *mgd*	**Peak I/I Rate:**	4.00 *mgd*
PF:	3.54	**Total I/I:**	9,647,000 *gallons*
Peak Level:	42.27 *in*		
d/D Ratio:	1.88		

SITE 6
I/I Summary: Rain Event 4

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 4 Detail Graph

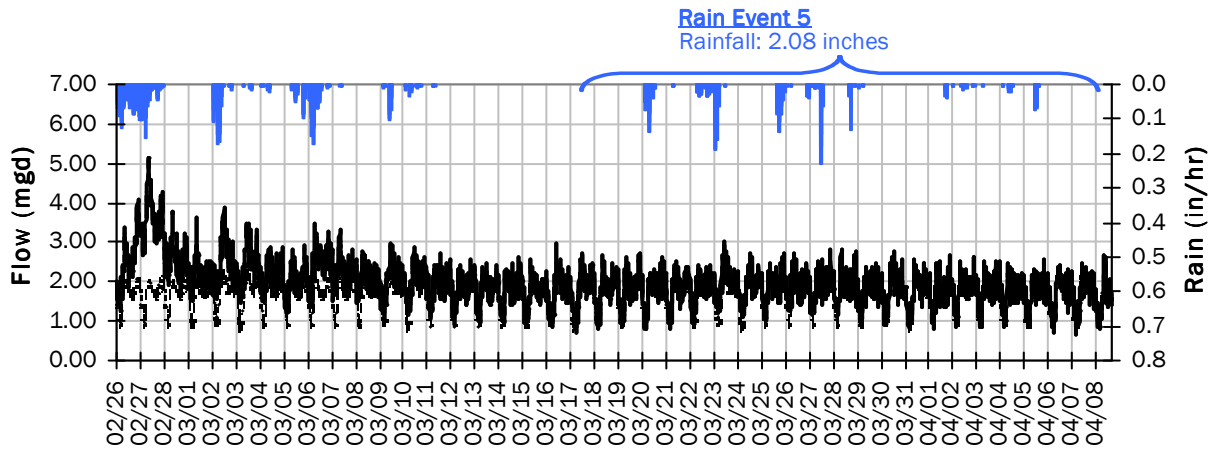


Storm Event I/I Analysis (Rain = 4.03 inches)

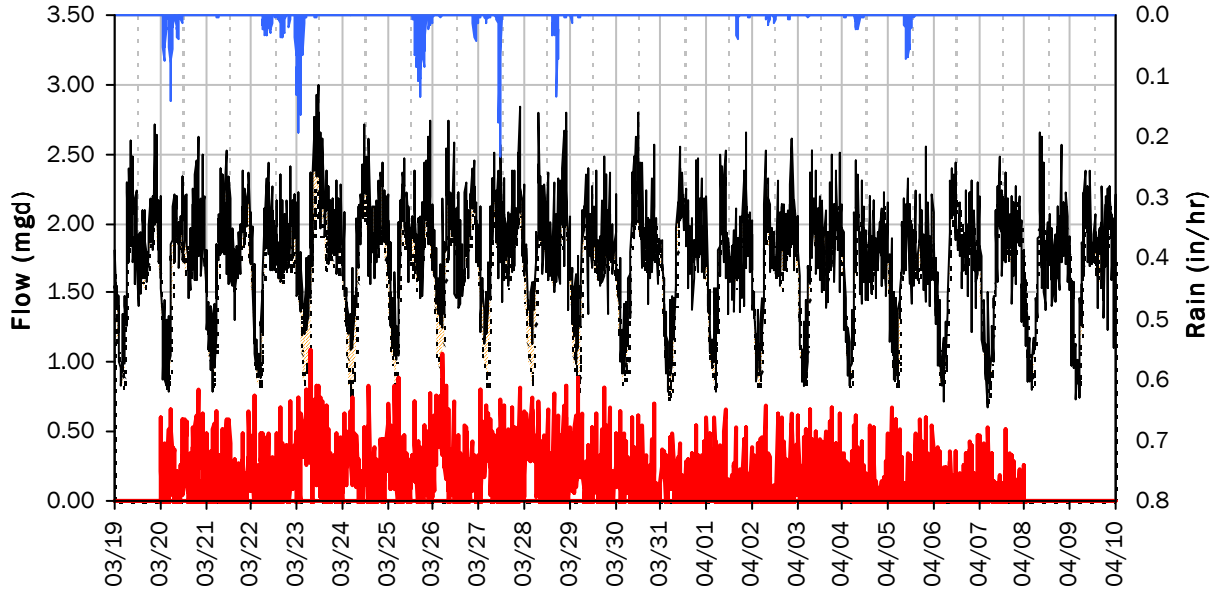
Capacity		Inflow / Infiltration	
Peak Flow:	5.15 *mgd*	**Peak I/I Rate:**	3.11 *mgd*
PF:	3.17	**Total I/I:**	10,570,000 *gallons*
Peak Level:	27.12 *in*		
d/D Ratio:	1.21		

SITE 6
I/I Summary: Rain Event 5

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 5 Detail Graph



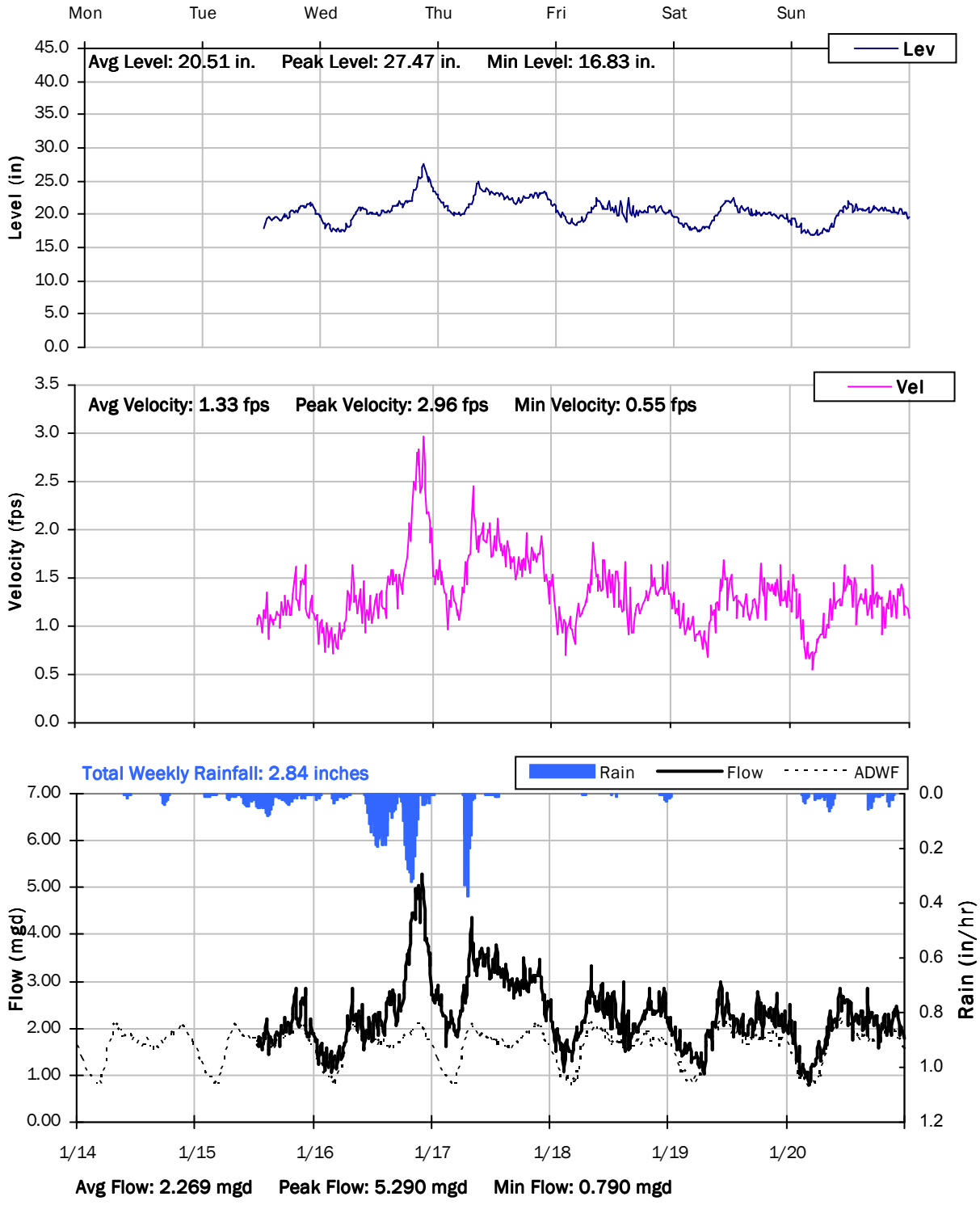
Storm Event I/I Analysis (Rain = 2.08 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	3.00 *mgd*	**Peak I/I Rate:**	1.09 *mgd*
PF:	1.84	**Total I/I:**	3,197,000 *gallons*
Peak Level:	23.07 *in*		
d/D Ratio:	1.03		

SITE 6

Weekly Level, Velocity and Flow Hydrographs

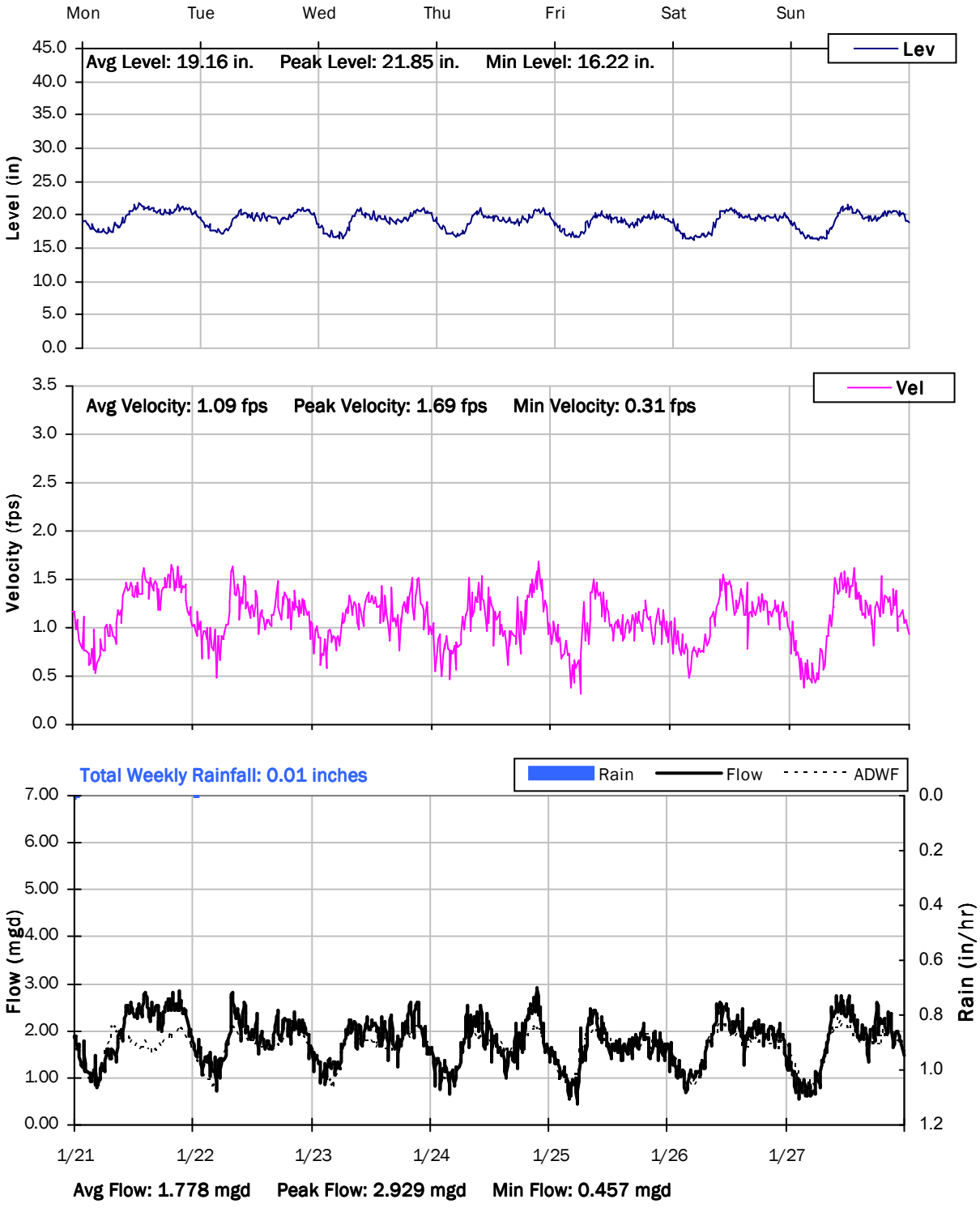
1/14/2019 to 1/21/2019



SITE 6

Weekly Level, Velocity and Flow Hydrographs

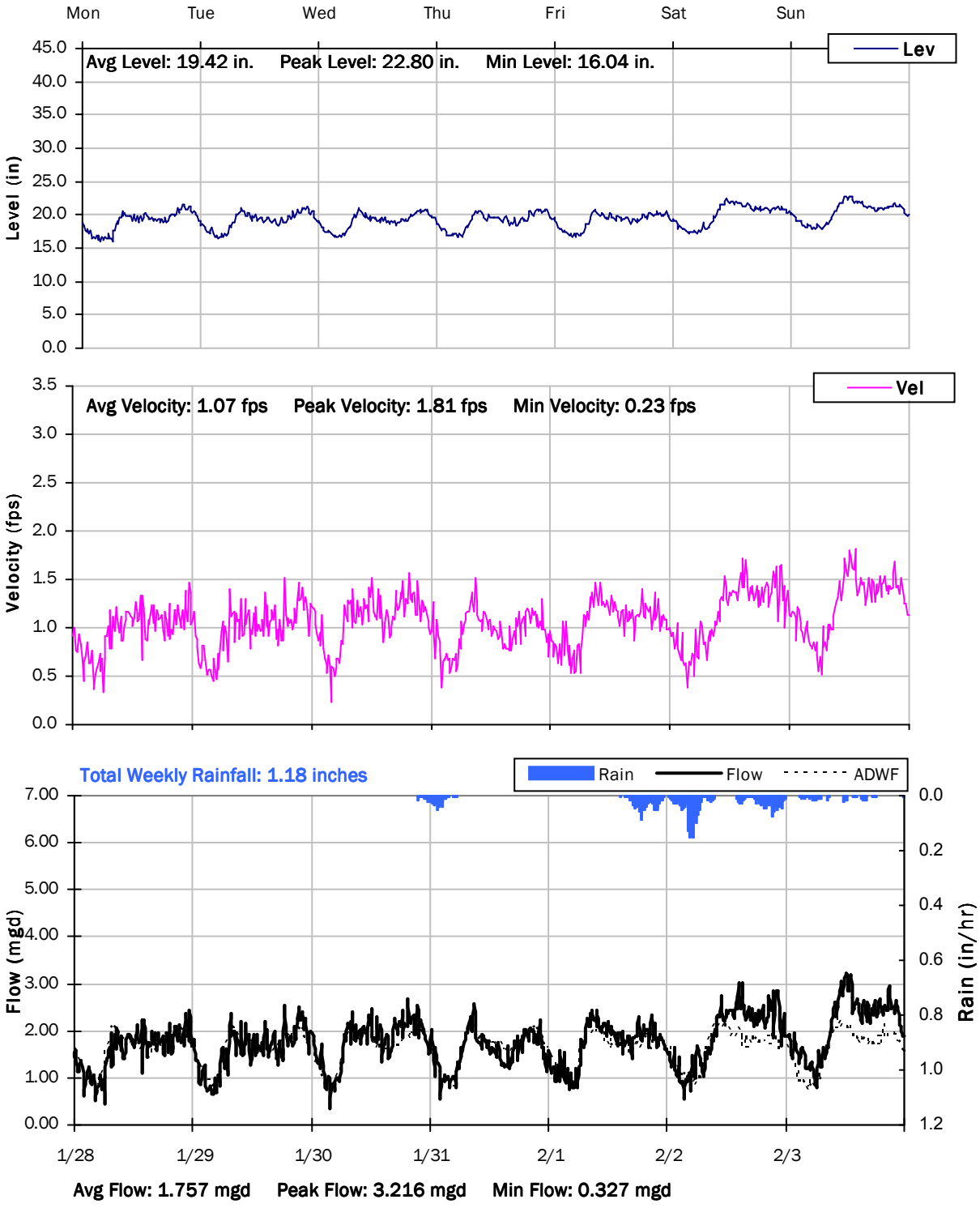
1/21/2019 to 1/28/2019



SITE 6

Weekly Level, Velocity and Flow Hydrographs

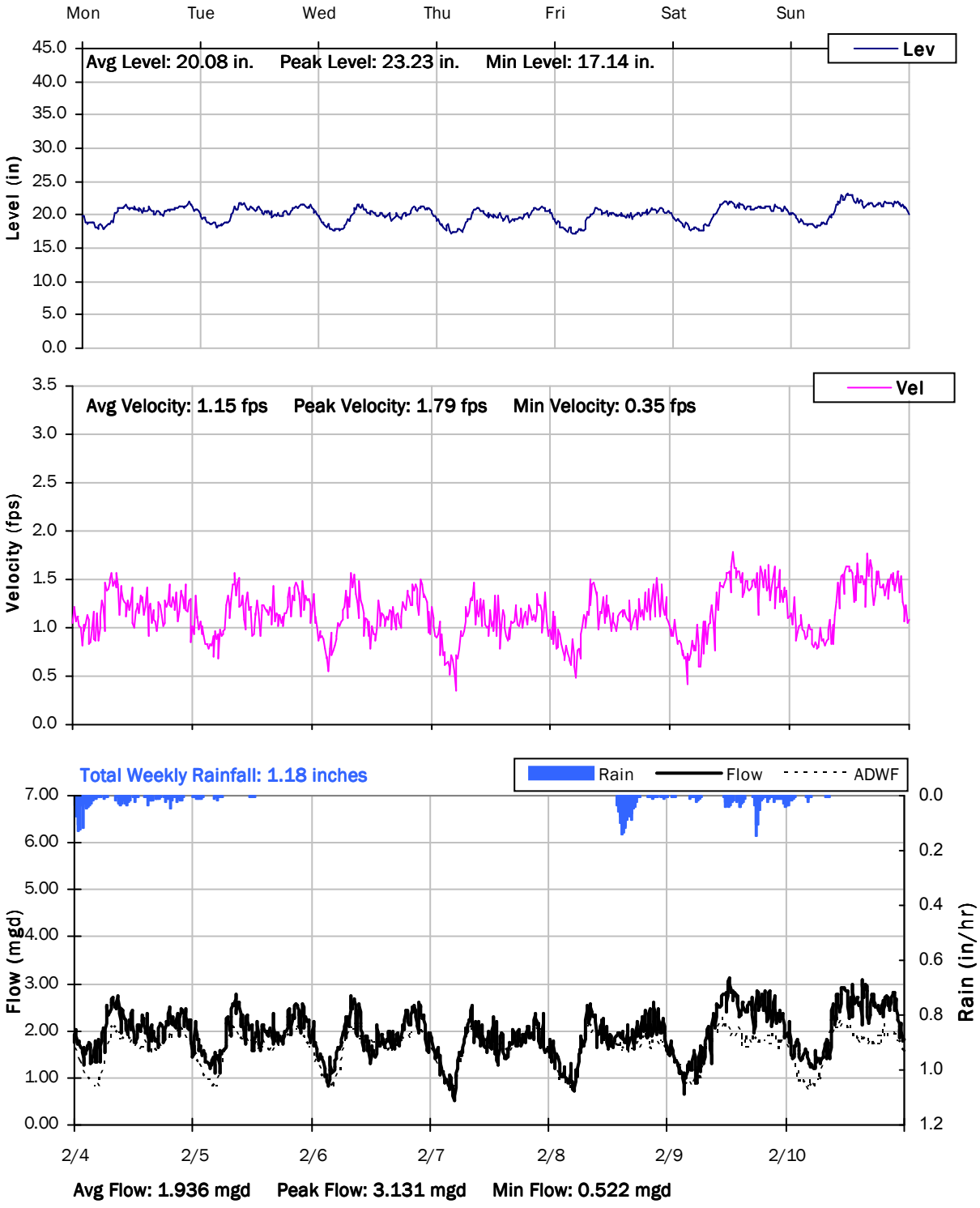
1/28/2019 to 2/4/2019



SITE 6

Weekly Level, Velocity and Flow Hydrographs

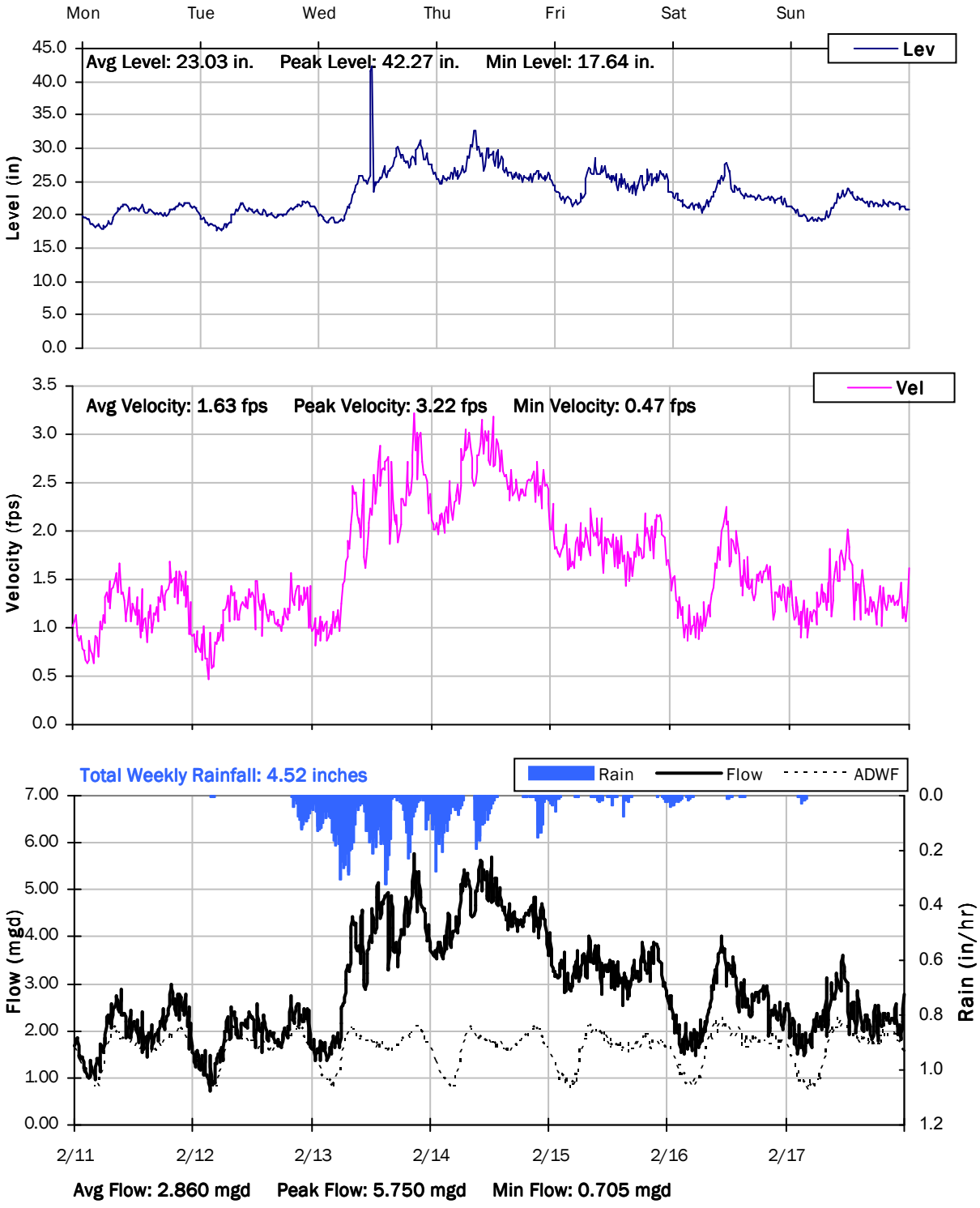
2/4/2019 to 2/11/2019



SITE 6

Weekly Level, Velocity and Flow Hydrographs

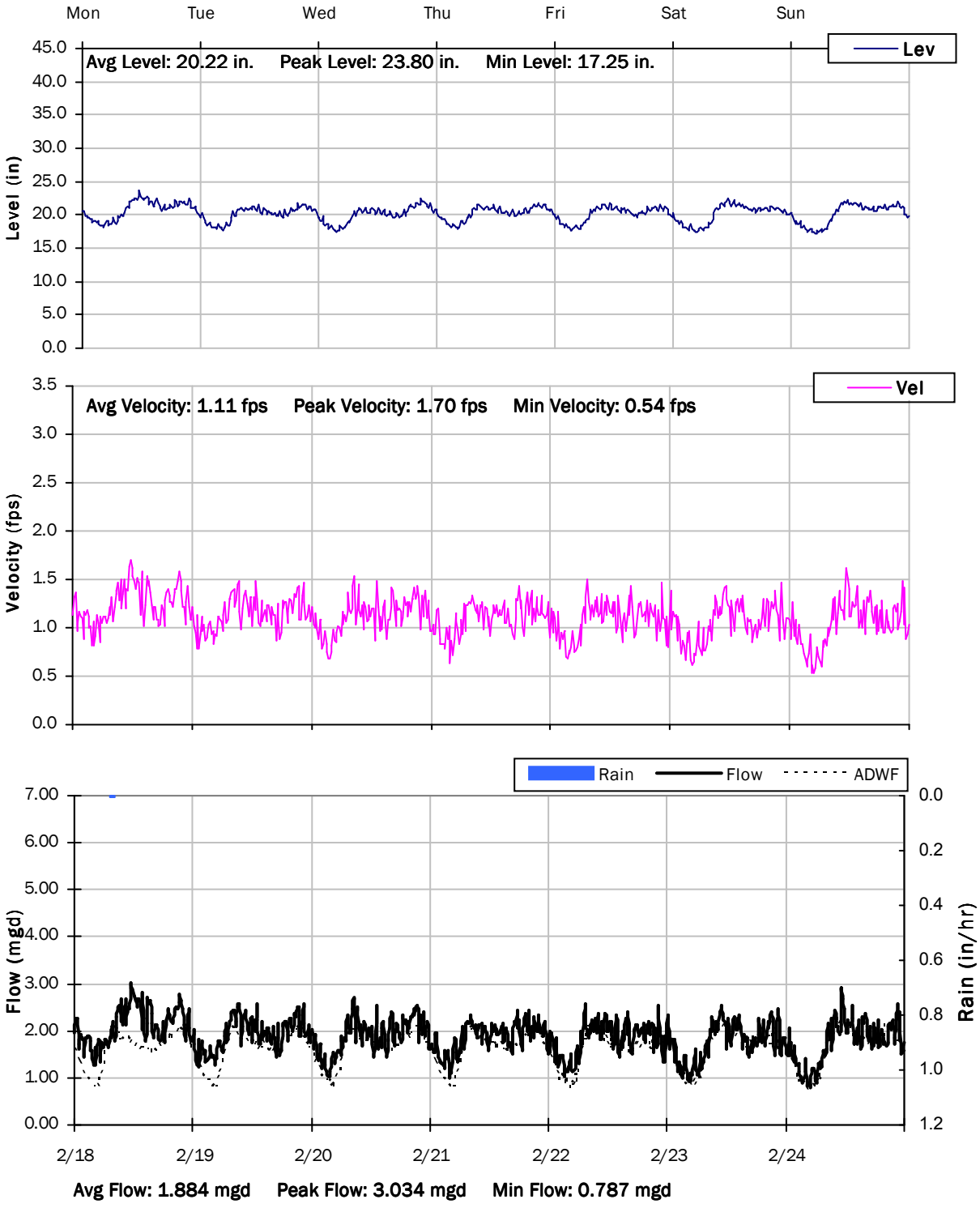
2/11/2019 to 2/18/2019



SITE 6

Weekly Level, Velocity and Flow Hydrographs

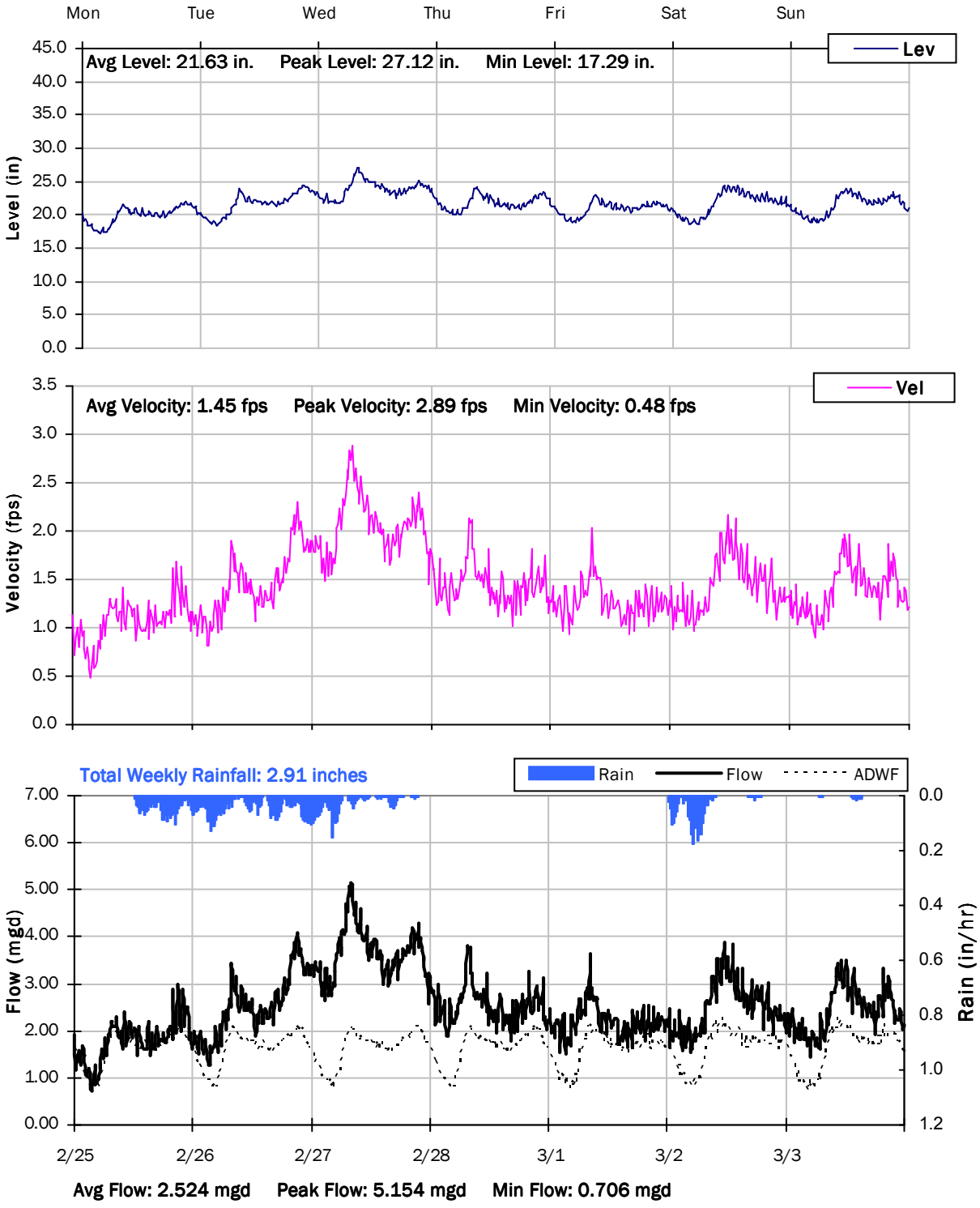
2/18/2019 to 2/25/2019



SITE 6

Weekly Level, Velocity and Flow Hydrographs

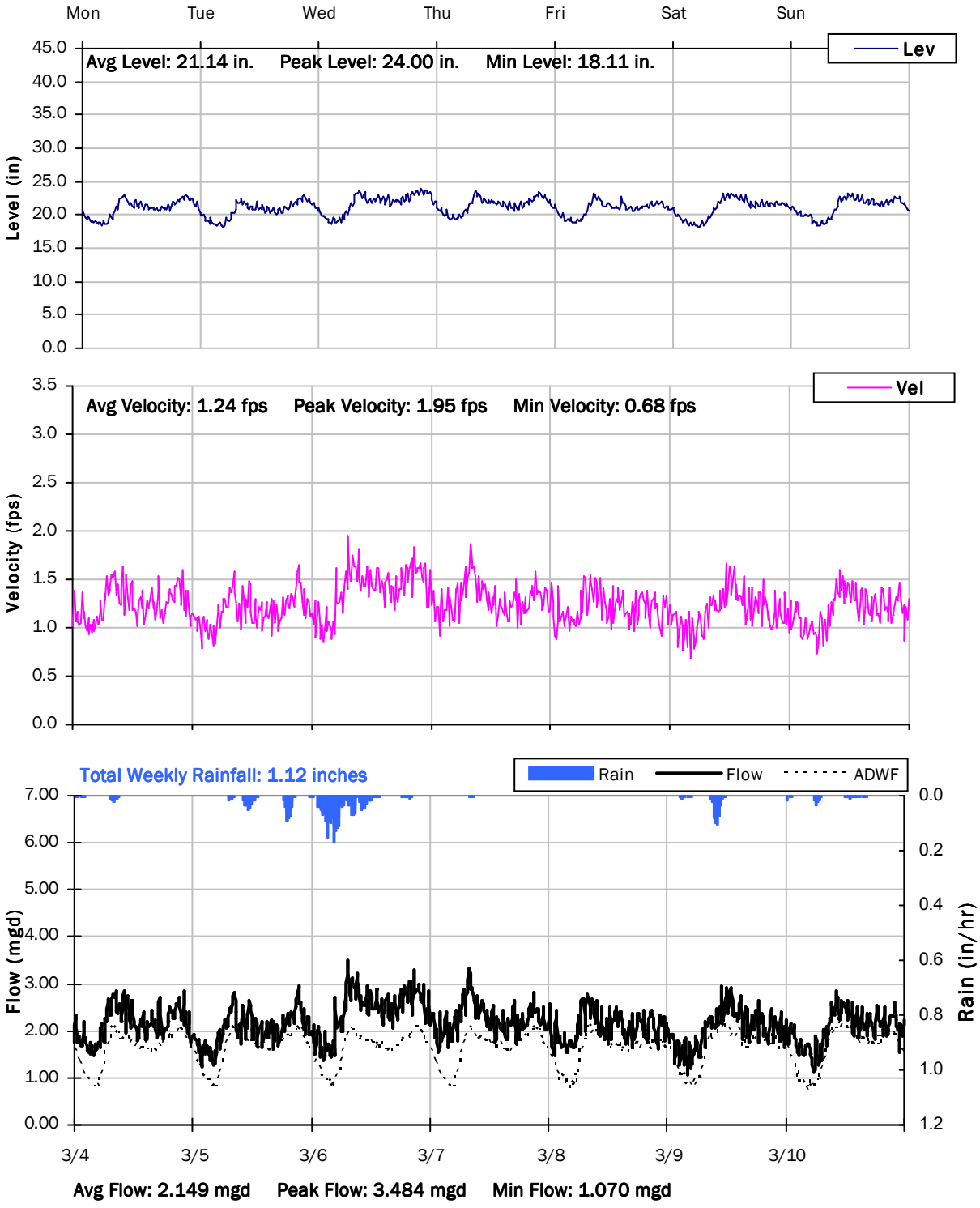
2/25/2019 to 3/4/2019



SITE 6

Weekly Level, Velocity and Flow Hydrographs

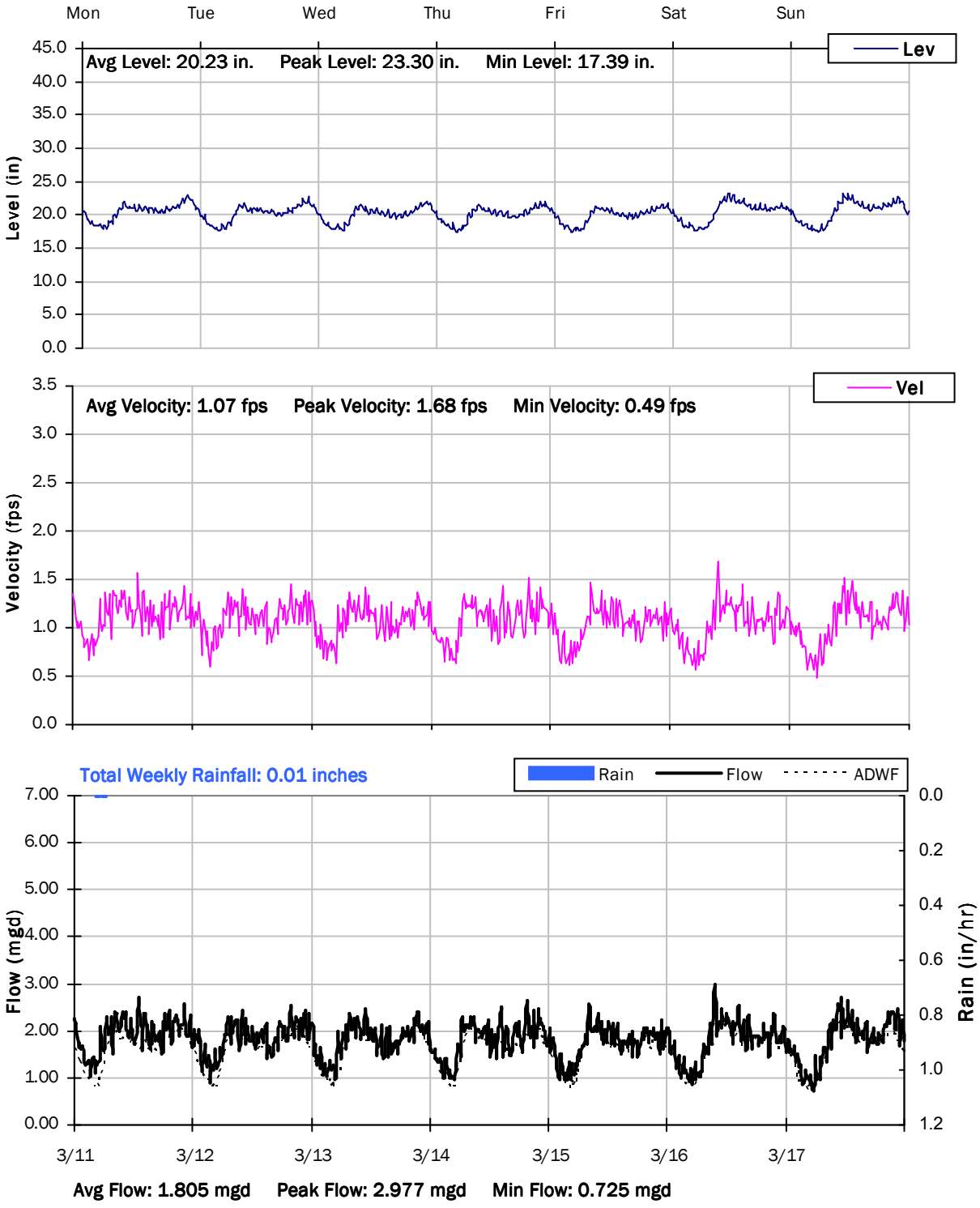
3/4/2019 to 3/11/2019



SITE 6

Weekly Level, Velocity and Flow Hydrographs

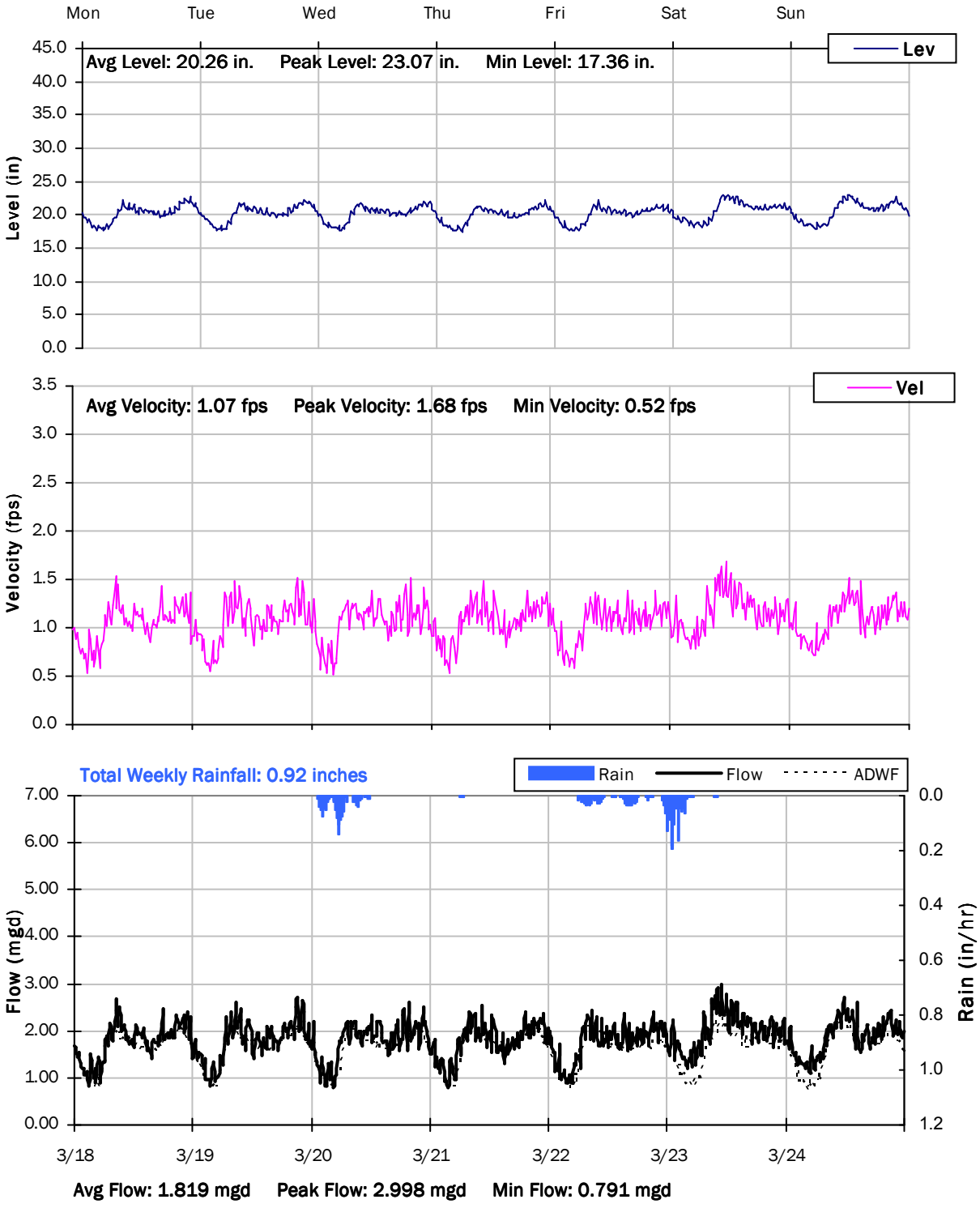
3/11/2019 to 3/18/2019



SITE 6

Weekly Level, Velocity and Flow Hydrographs

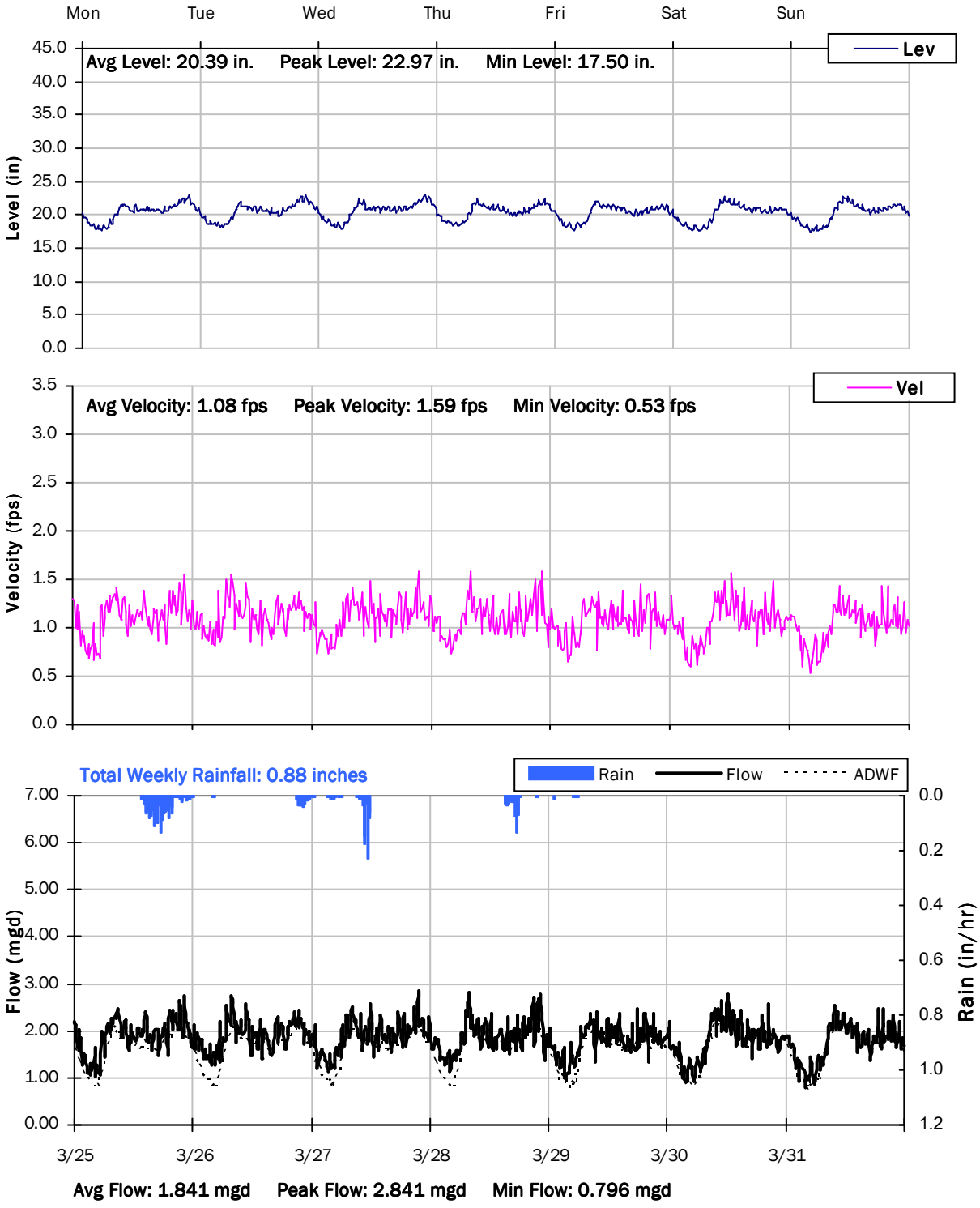
3/18/2019 to 3/25/2019



SITE 6

Weekly Level, Velocity and Flow Hydrographs

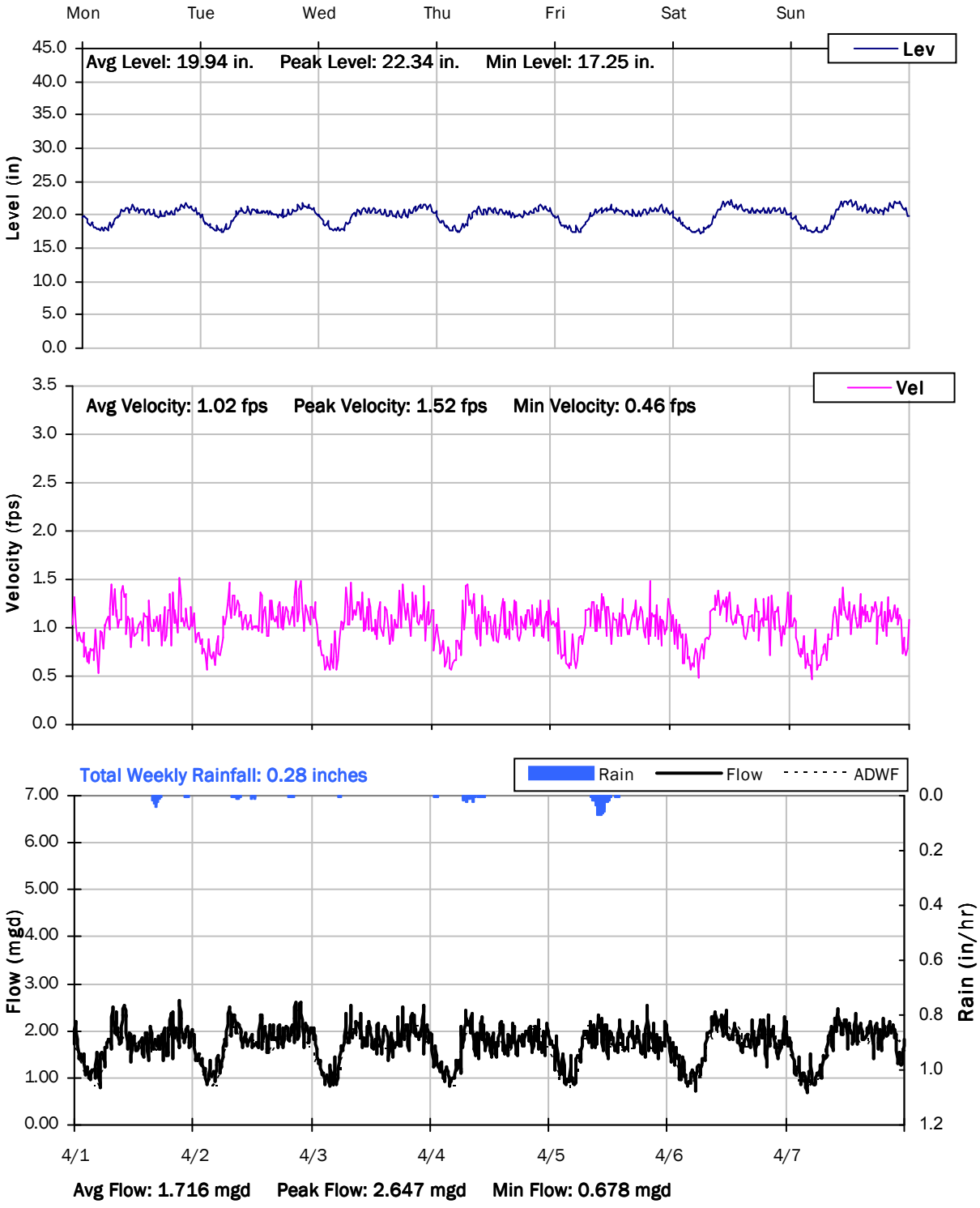
3/25/2019 to 4/1/2019



SITE 6

Weekly Level, Velocity and Flow Hydrographs

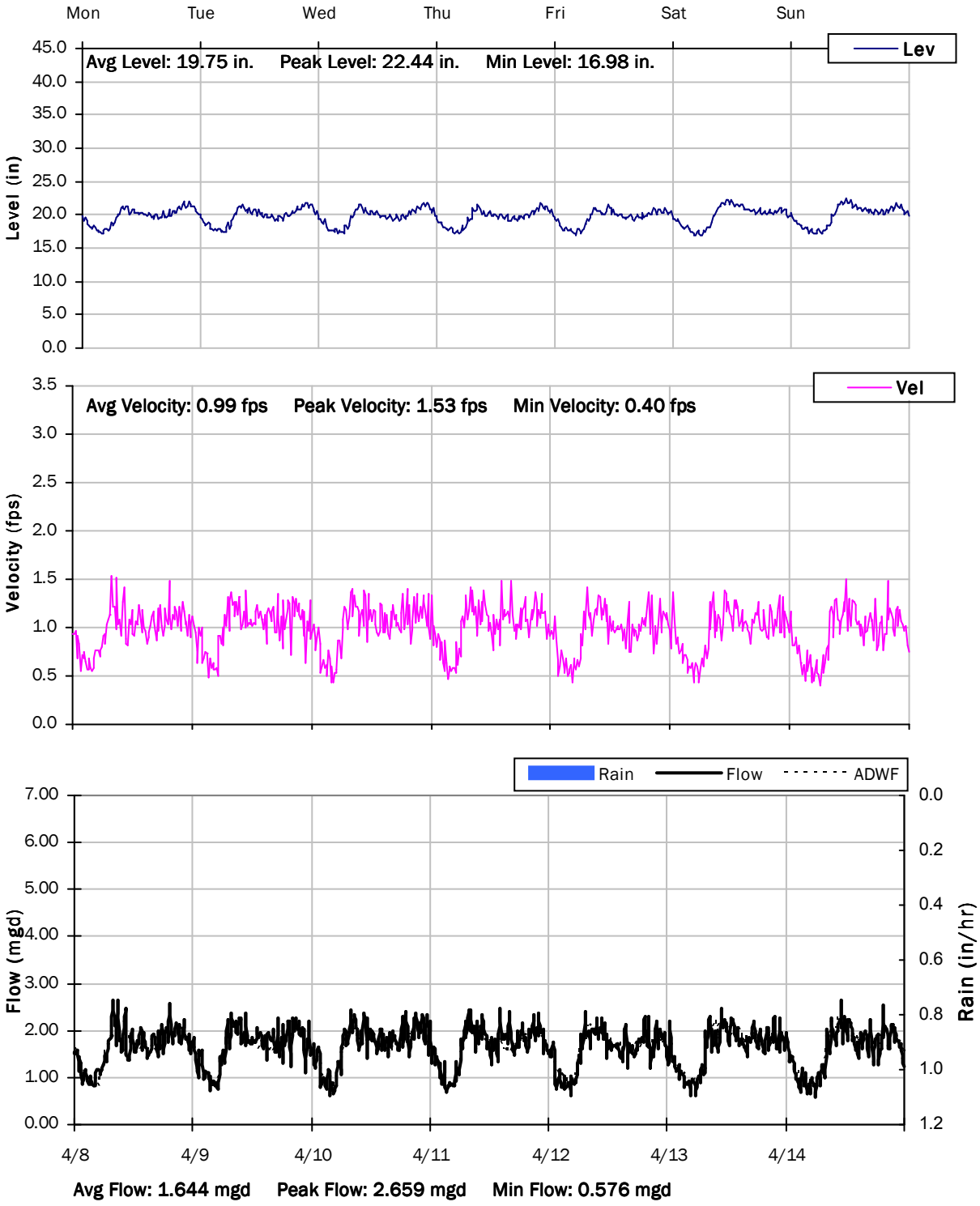
4/1/2019 to 4/8/2019



SITE 6

Weekly Level, Velocity and Flow Hydrographs

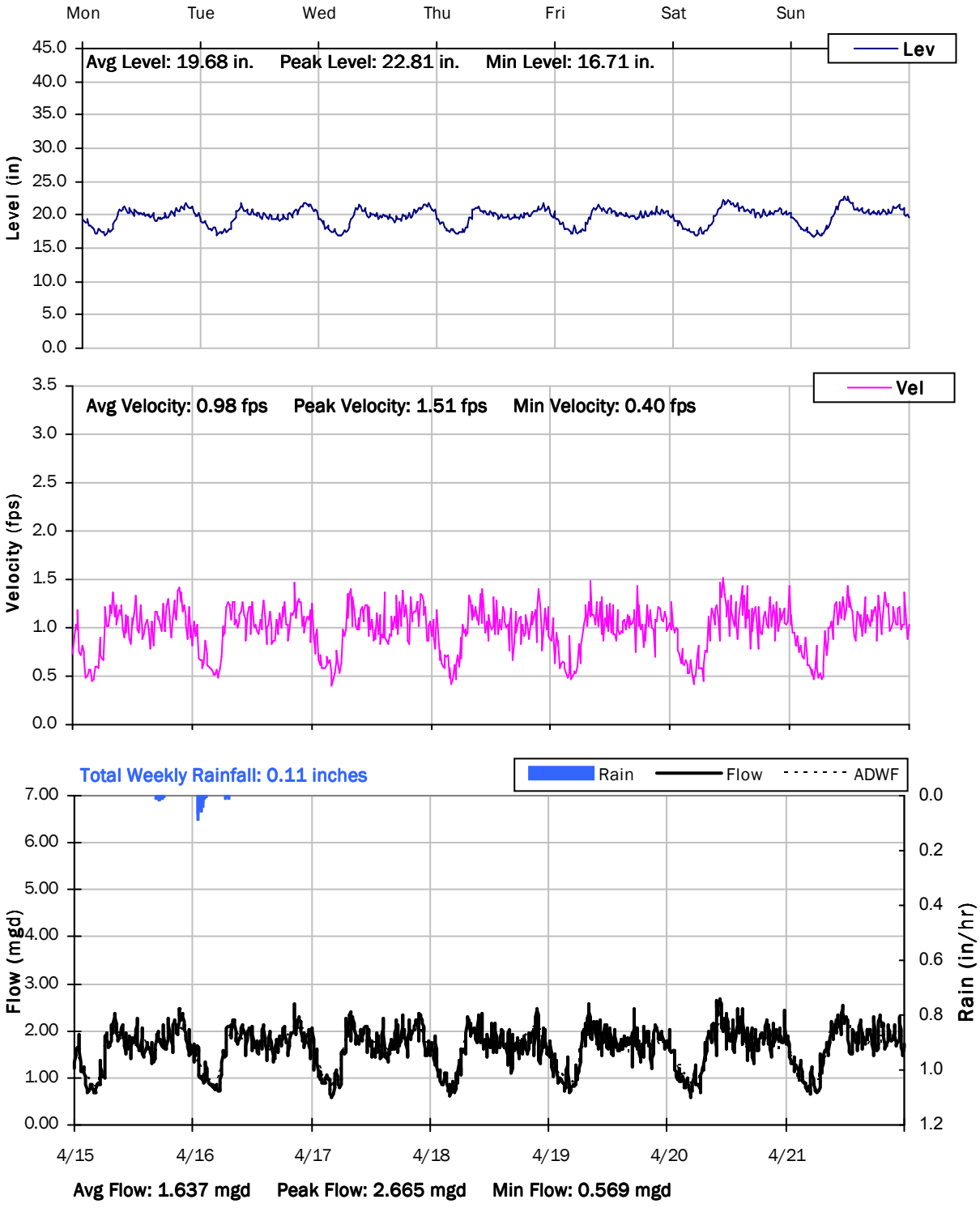
4/8/2019 to 4/15/2019



SITE 6

Weekly Level, Velocity and Flow Hydrographs

4/15/2019 to 4/22/2019



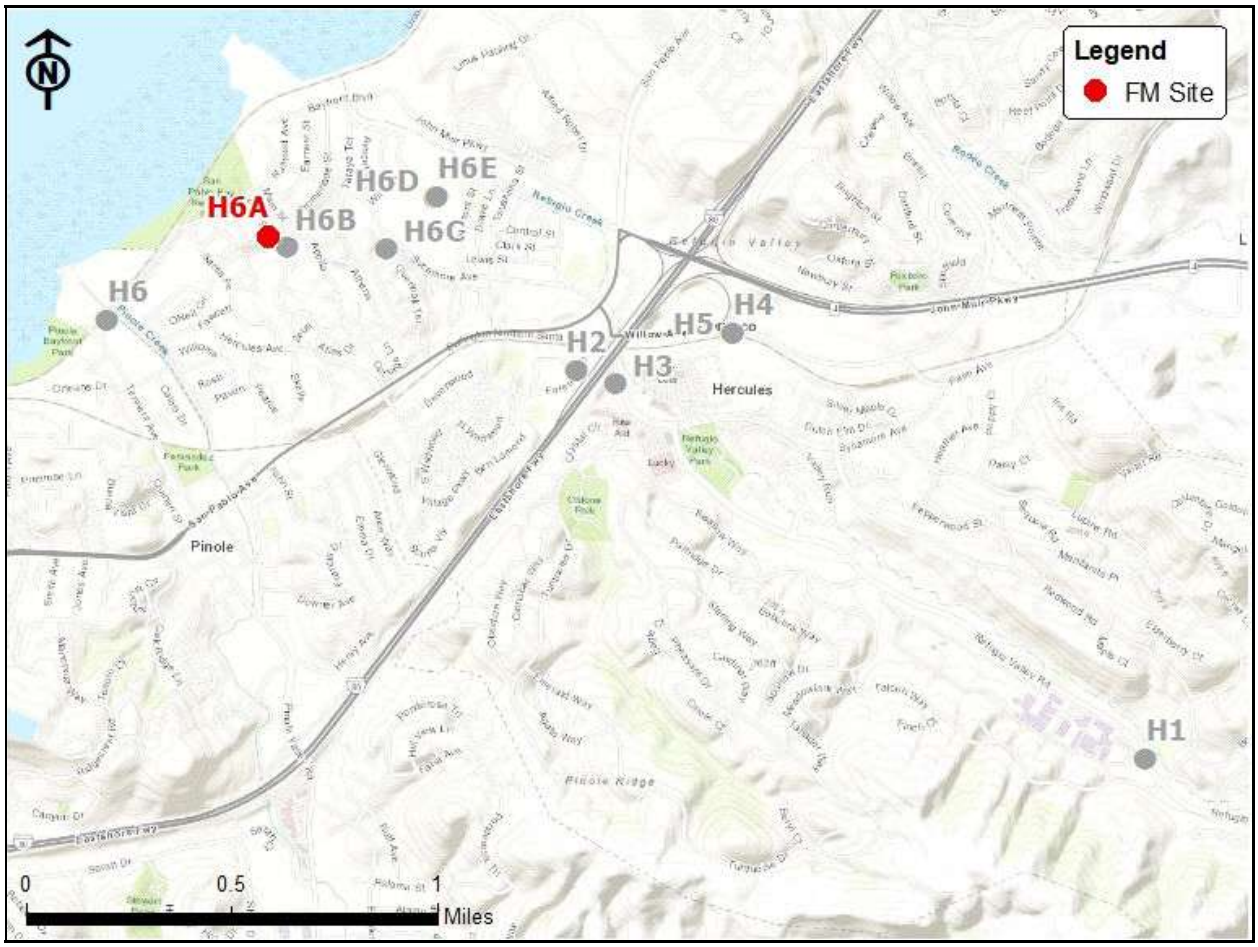
City of Hercules, California

Sanitary Sewer Flow Monitoring
January 14 - April 21, 2019

Monitoring Site: Site 6A

Location: Promenade Street at Park Street

Data Summary Report



Vicinity Map: Site 6A

SITE 6A

Site Information

Location: Promenade Street at Park Street

Coordinates: 122.2881° W, 38.0155° N

Rim Elevation (Earth): 44 feet

Measured Pipe Diameter: 8 inches

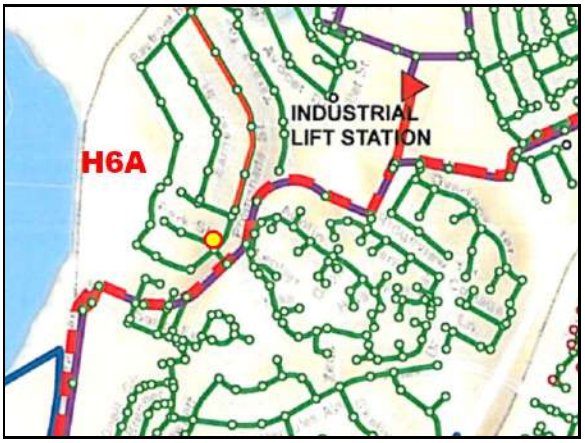
ADWF: 0.030 mgd

Peak Measured Flow: 0.171 mgd

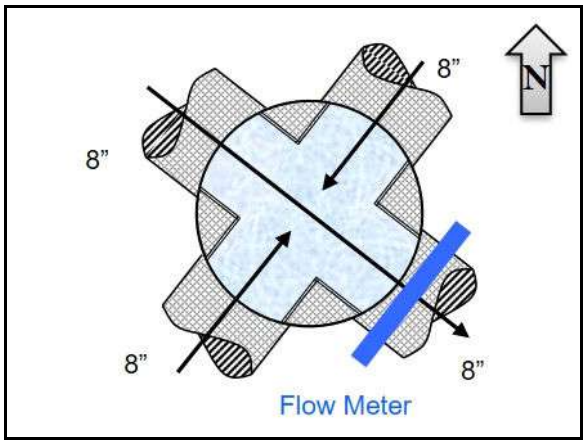
Sediment: None



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

SITE 6A

Additional Site Photos

Monitored Effluent Pipe



Southwest Influent Pipe



SITE 6A

Additional Site Photos

Northwest Influent Pipe



Northeast Influent Pipe

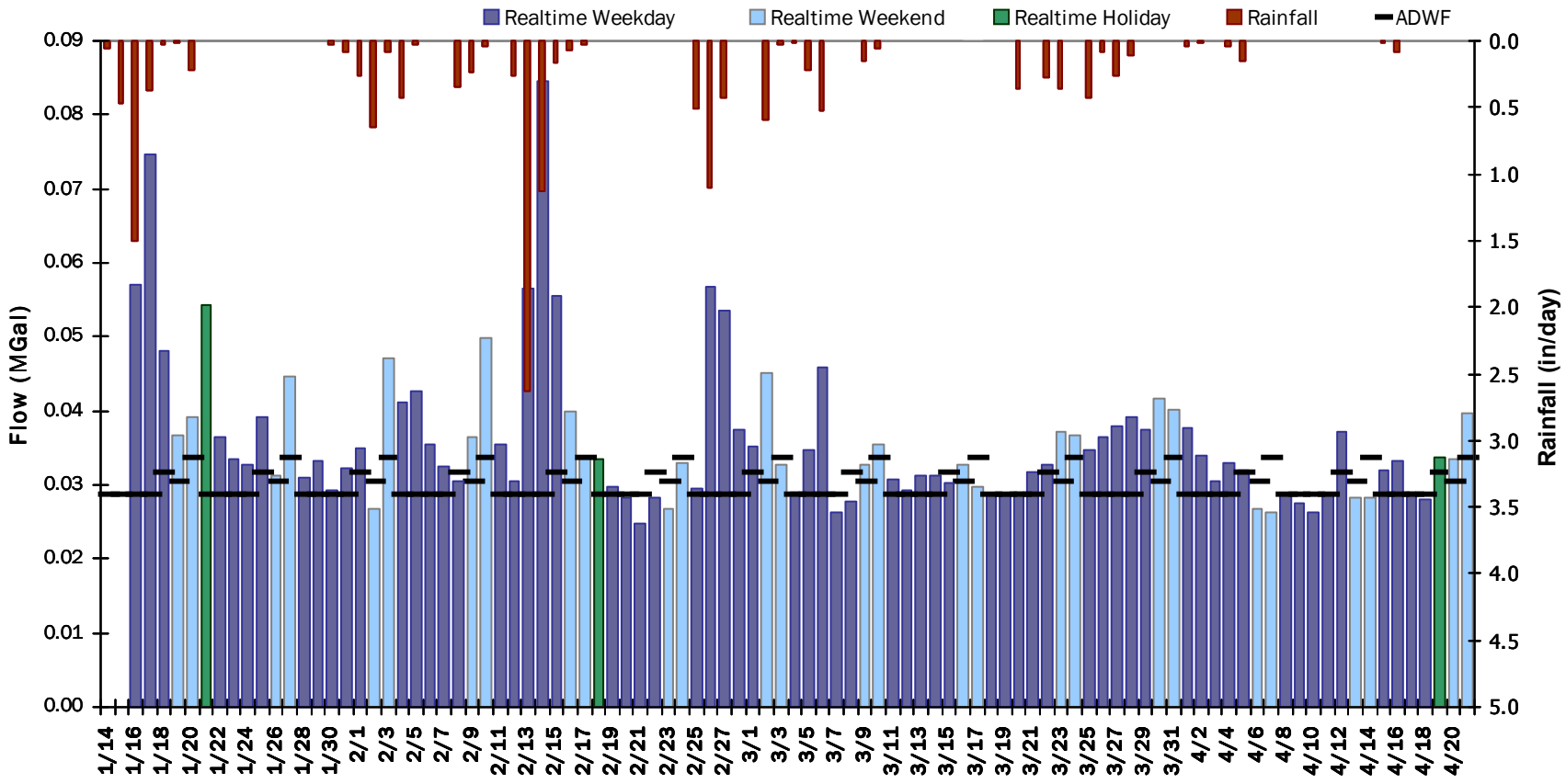


SITE 6A

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.036 MGal Peak Daily Flow: 0.085 MGal Min Daily Flow: 0.025 MGal

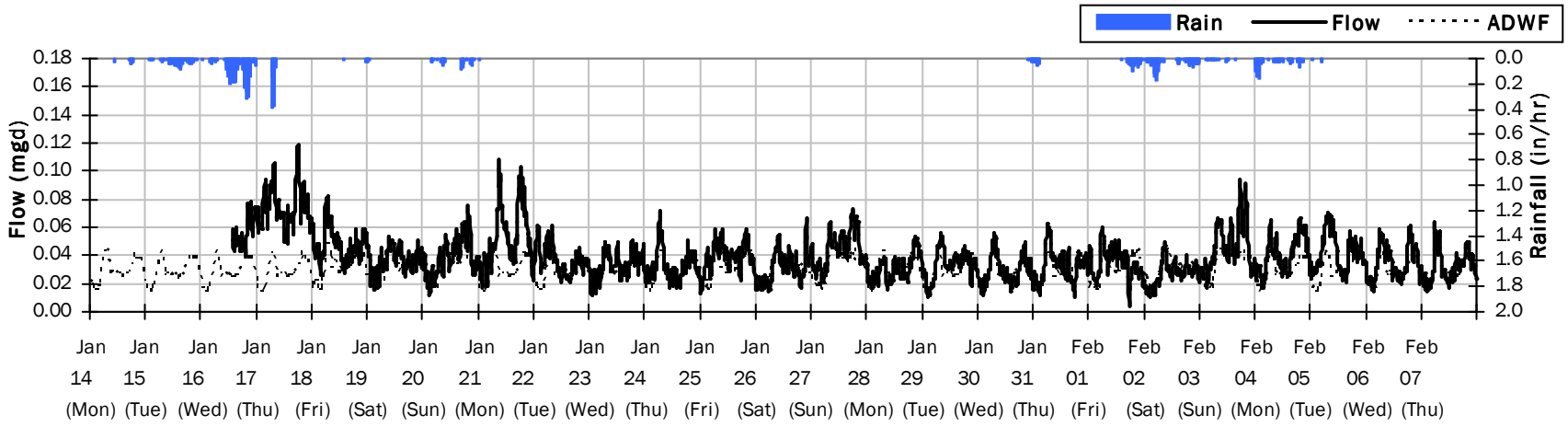
Total Rainfall: 13.98 inches

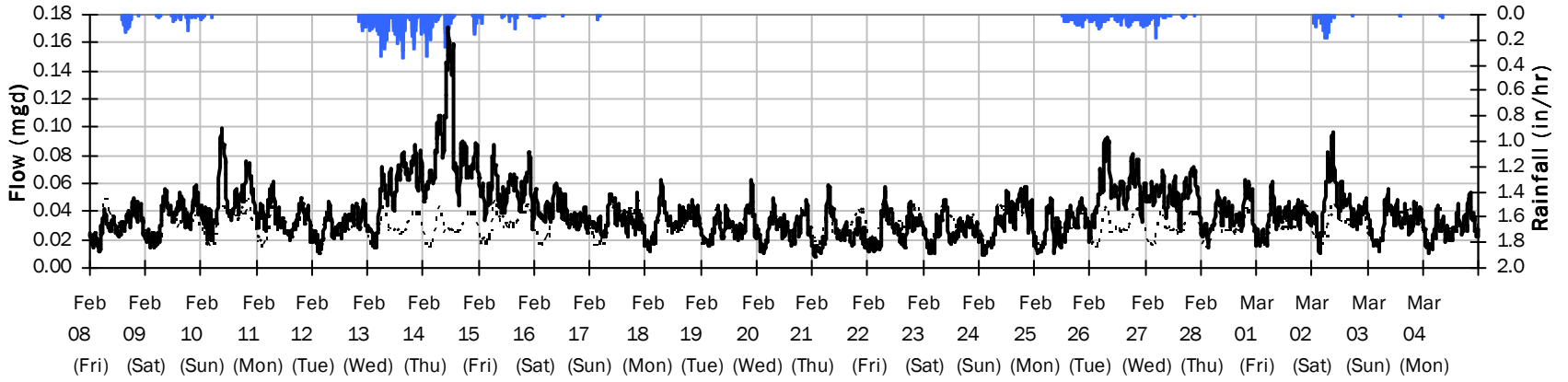


SITE 6A

Flow Summary: 1/14/2019 to 3/4/2019

Period Rainfall: 11.80 inches Period Avg Flow: 0.039 mgd Period Peak Flow: 0.171 mgd Period Min Flow: 0.004 mgd

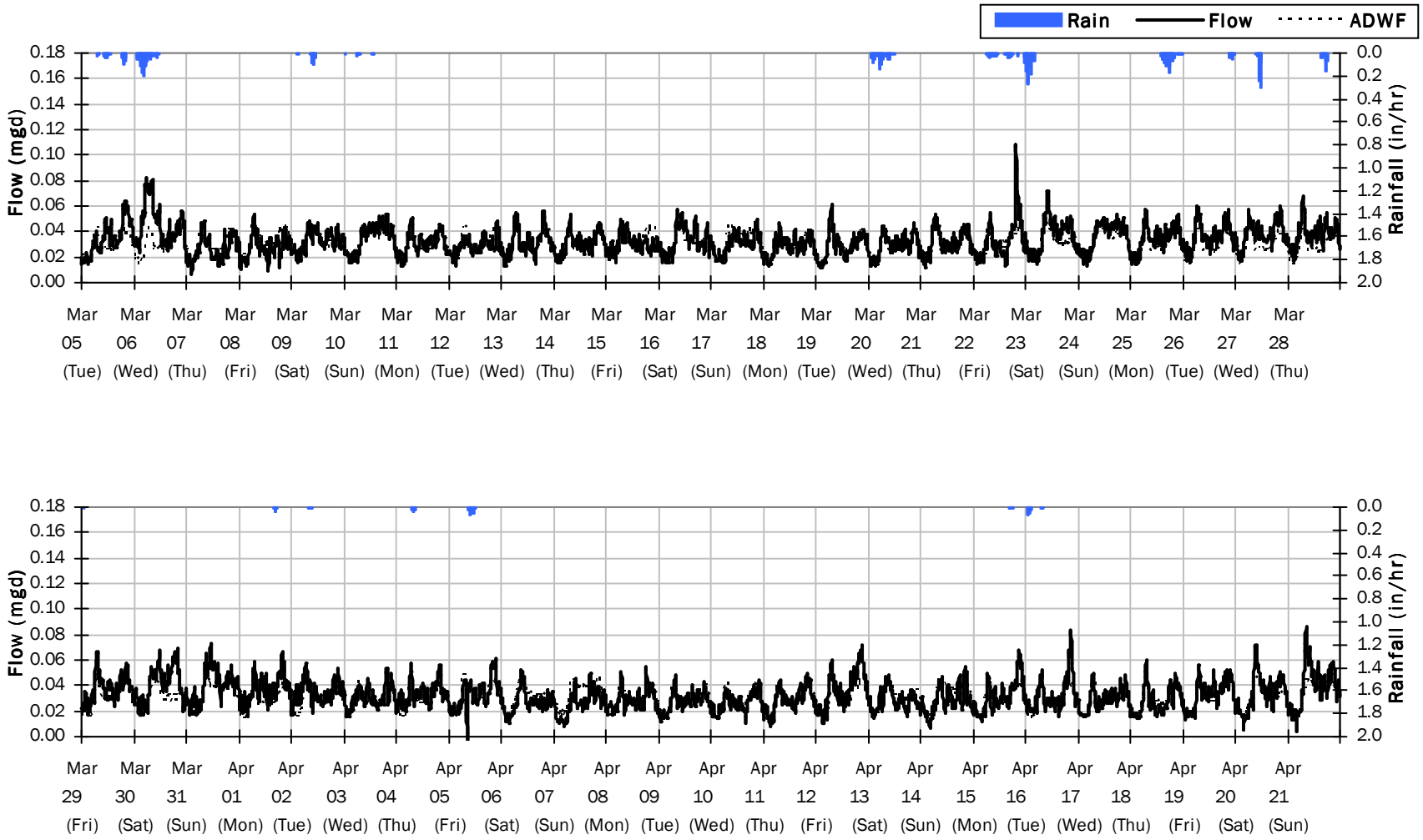




SITE 6A

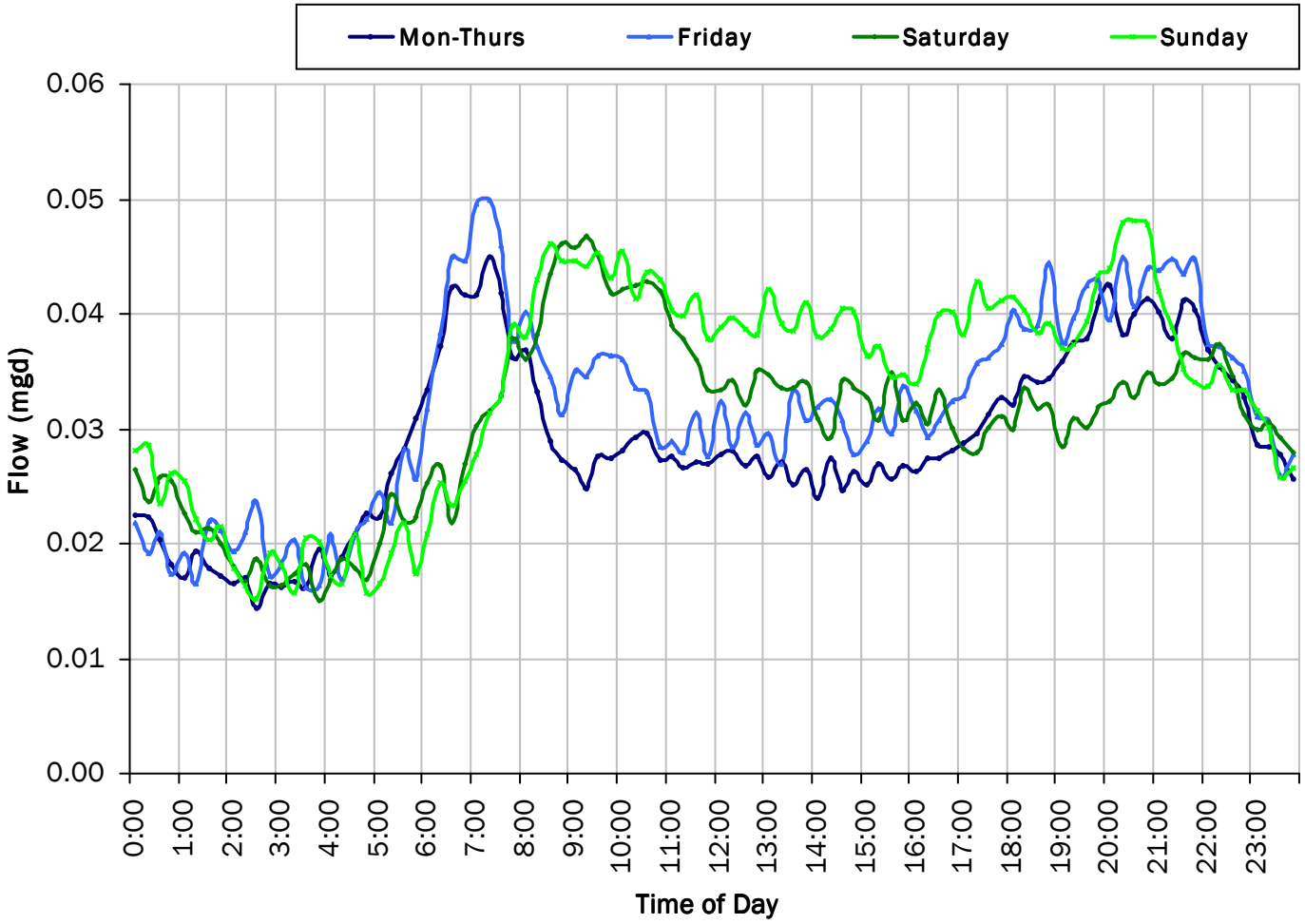
Flow Summary: 3/5/2019 to 4/21/2019

Period Rainfall: 3.18 inches Period Avg Flow: 0.033 mgd Period Peak Flow: 0.107 mgd Period Min Flow: -0.041 mgd



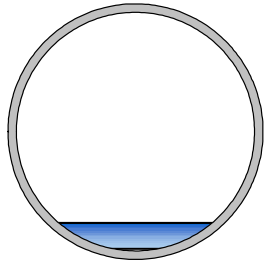
SITE 6A

Average Dry Weather Flow Hydrographs



ADWF:

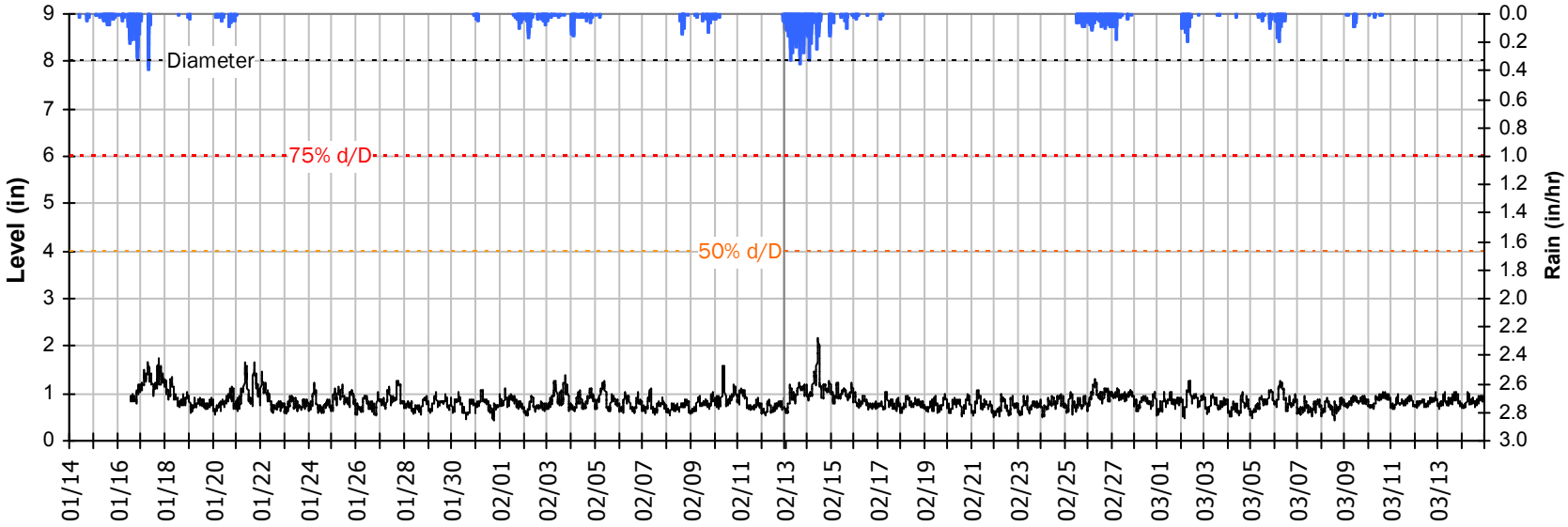
0.030 *mgd*

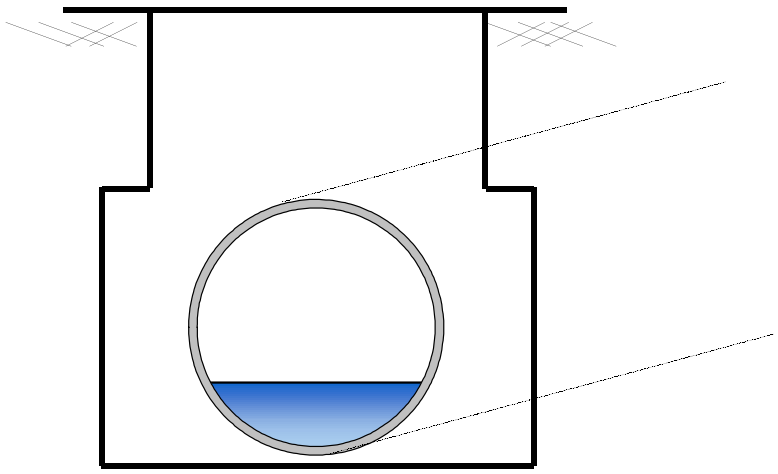


SITE 6A

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



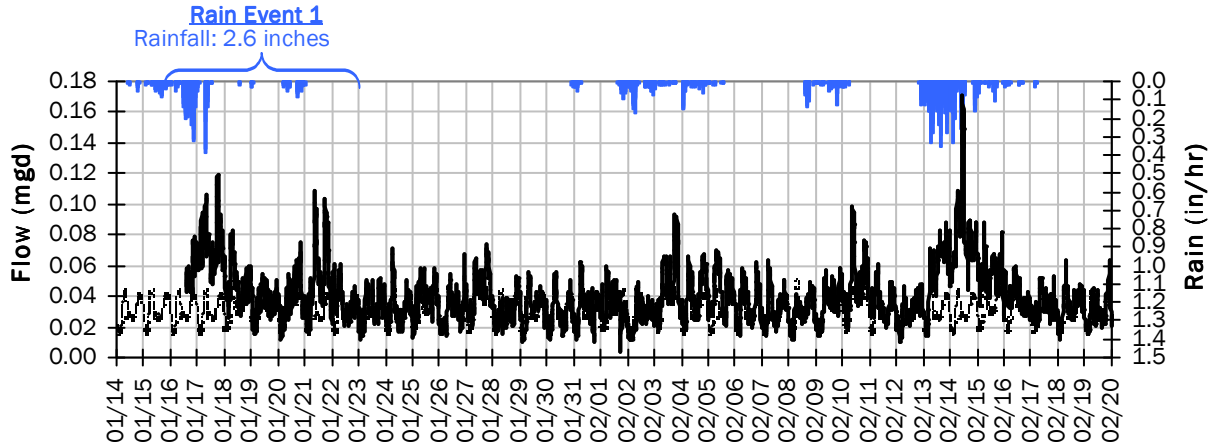


Pipe Diameter:	8	*inches*
Peak Measured Level:	2.16	*inches*
Peak d/D Ratio:	0.27	

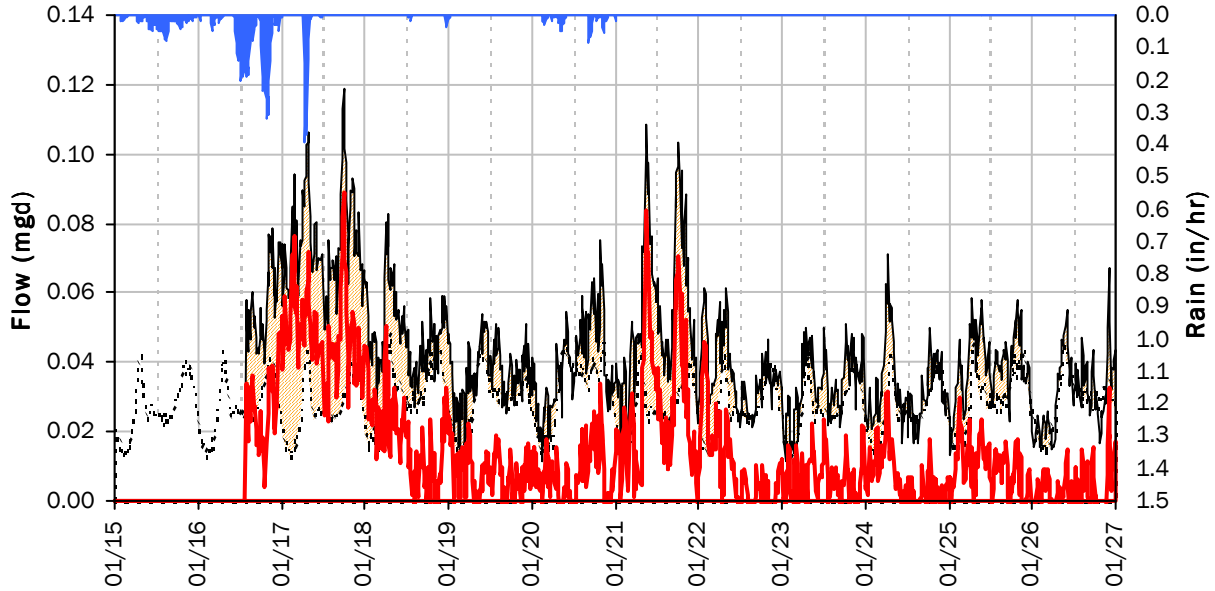
SITE 6A

I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph

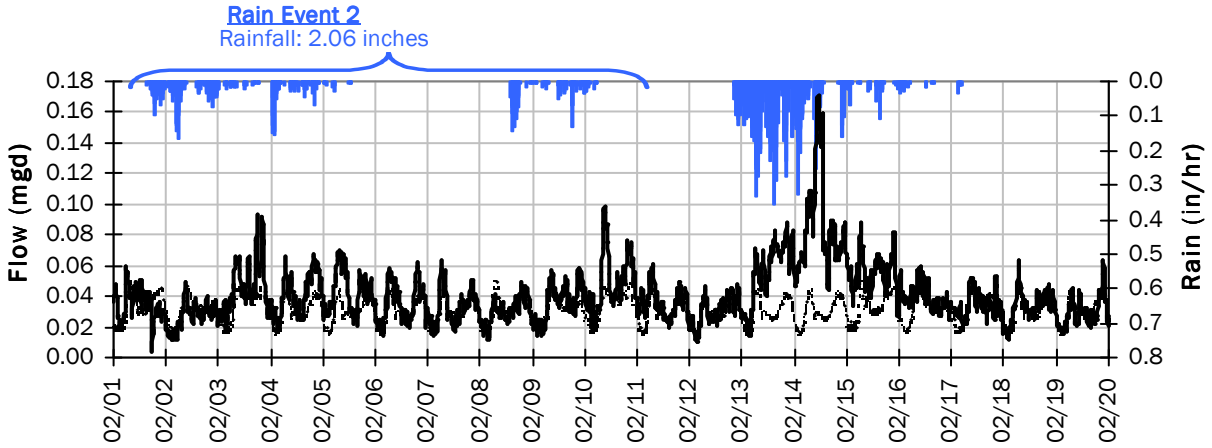


Storm Event I/I Analysis (Rain = 2.60 inches)

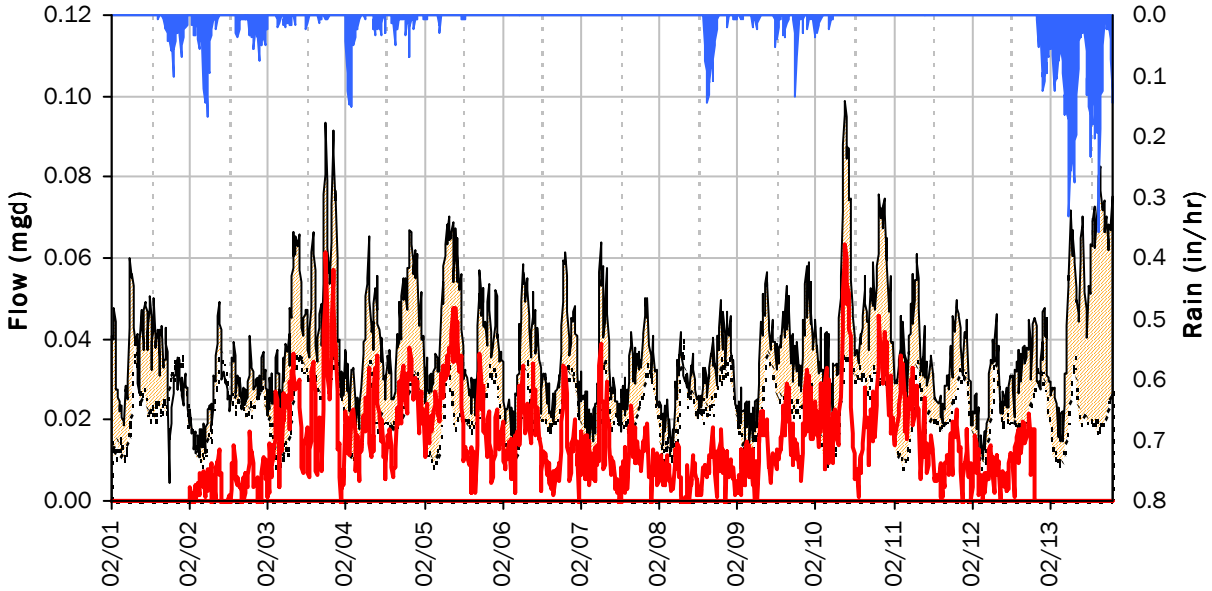
Capacity		Inflow / Infiltration	
Peak Flow:	0.119 *mgd*	**Peak I/I Rate:**	0.089 *mgd*
PF:	3.94	**Total I/I:**	156,000 *gallons*
Peak Level:	1.73 *in*		
d/D Ratio:	0.22		

SITE 6A
I/I Summary: Rain Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 2 Detail Graph

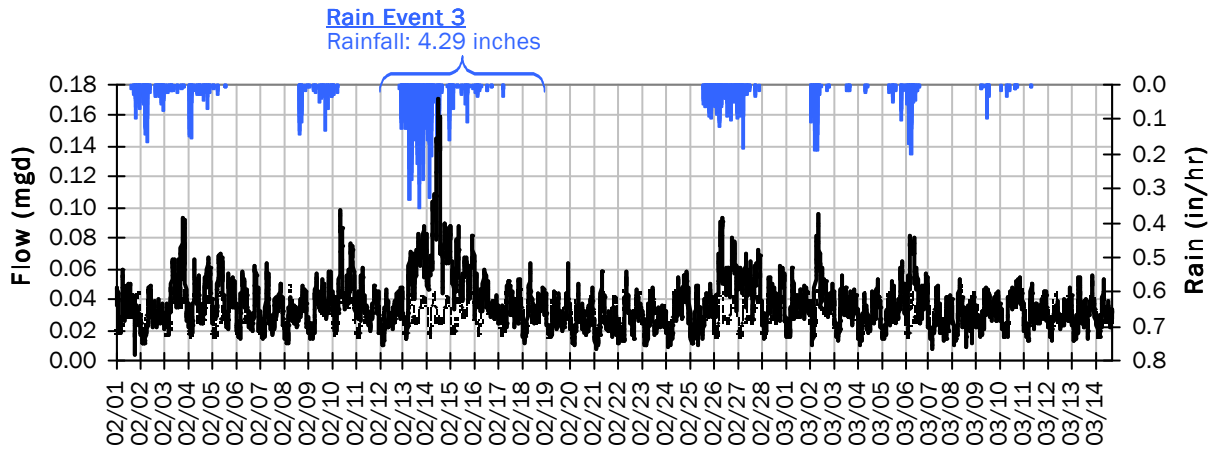


Storm Event I/I Analysis (Rain = 2.06 inches)

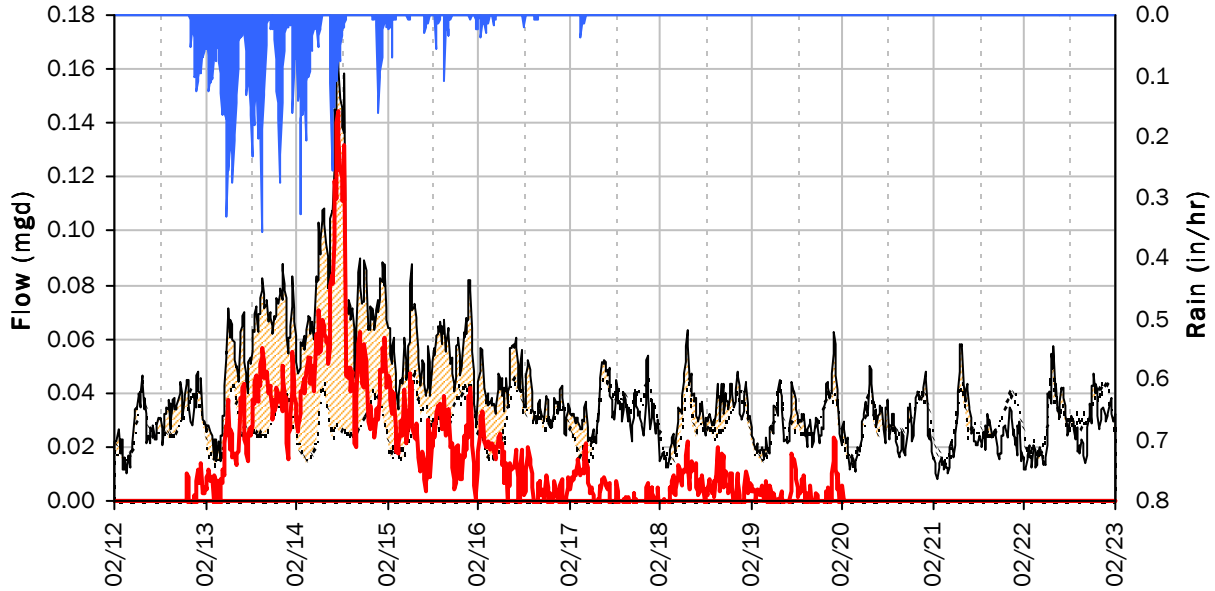
Capacity		Inflow / Infiltration	
Peak Flow:	0.099 *mgd*	**Peak I/I Rate:**	0.064 *mgd*
PF:	3.28	**Total I/I:**	163,000 *gallons*
Peak Level:	1.58 *in*		
d/D Ratio:	0.20		

SITE 6A
I/I Summary: Rain Event 3

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3 Detail Graph

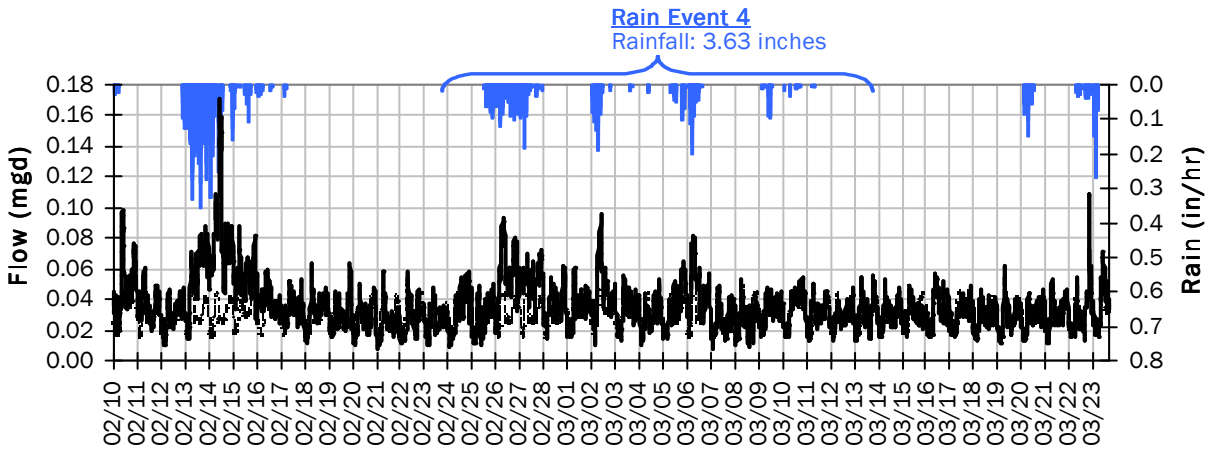


Storm Event I/I Analysis (Rain = 4.29 inches)

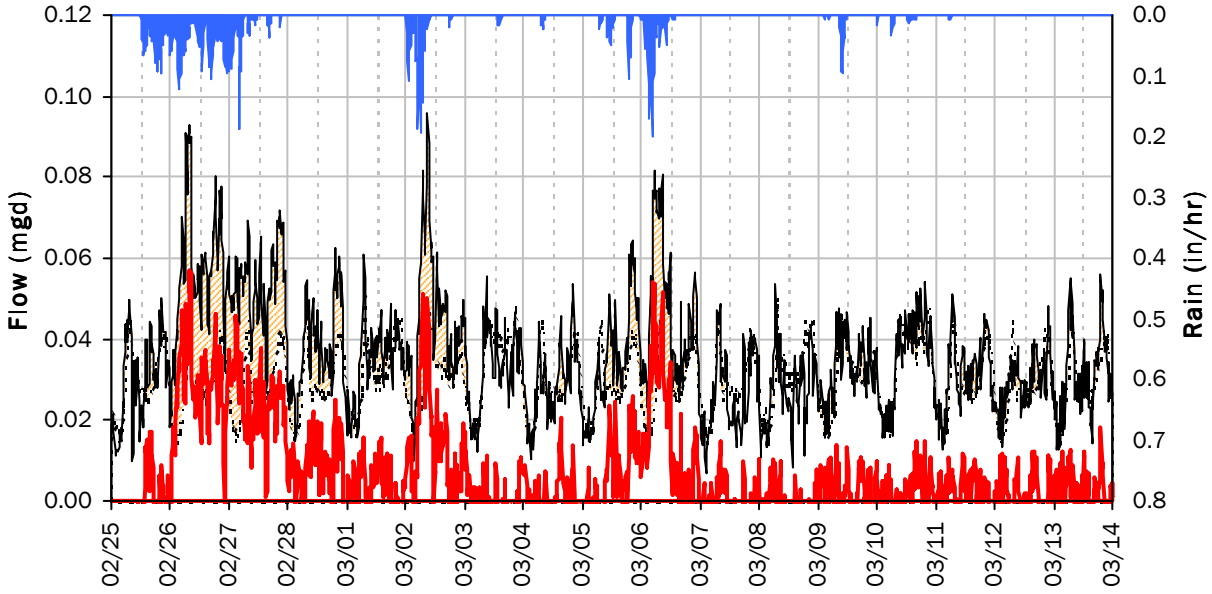
Capacity		Inflow / Infiltration	
Peak Flow:	0.17 *mgd*	**Peak I/I Rate:**	0.14 *mgd*
PF:	5.69	**Total I/I:**	130,000 *gallons*
Peak Level:	2.16 *in*		
d/D Ratio:	0.27		

SITE 6A
I/I Summary: Rain Event 4

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 4 Detail Graph

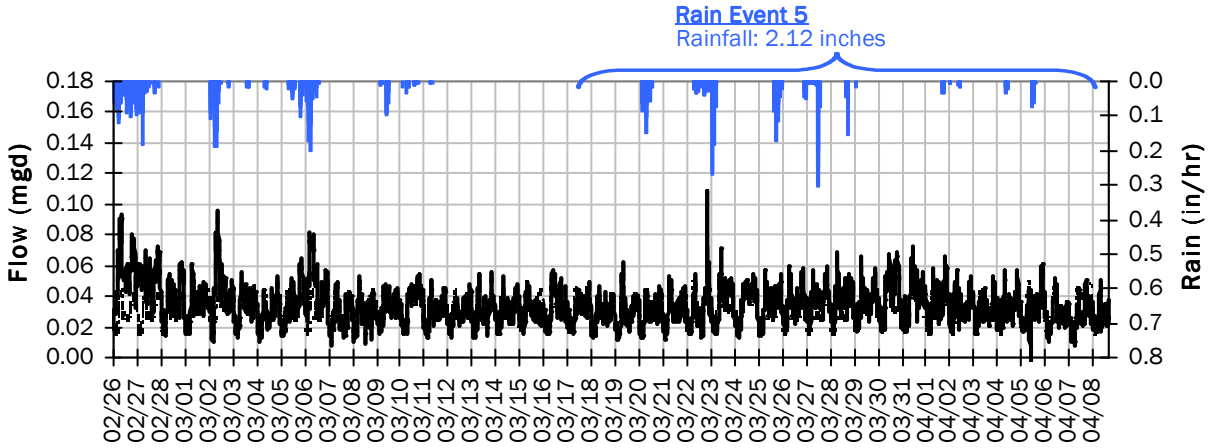


Storm Event I/I Analysis (Rain = 3.63 inches)

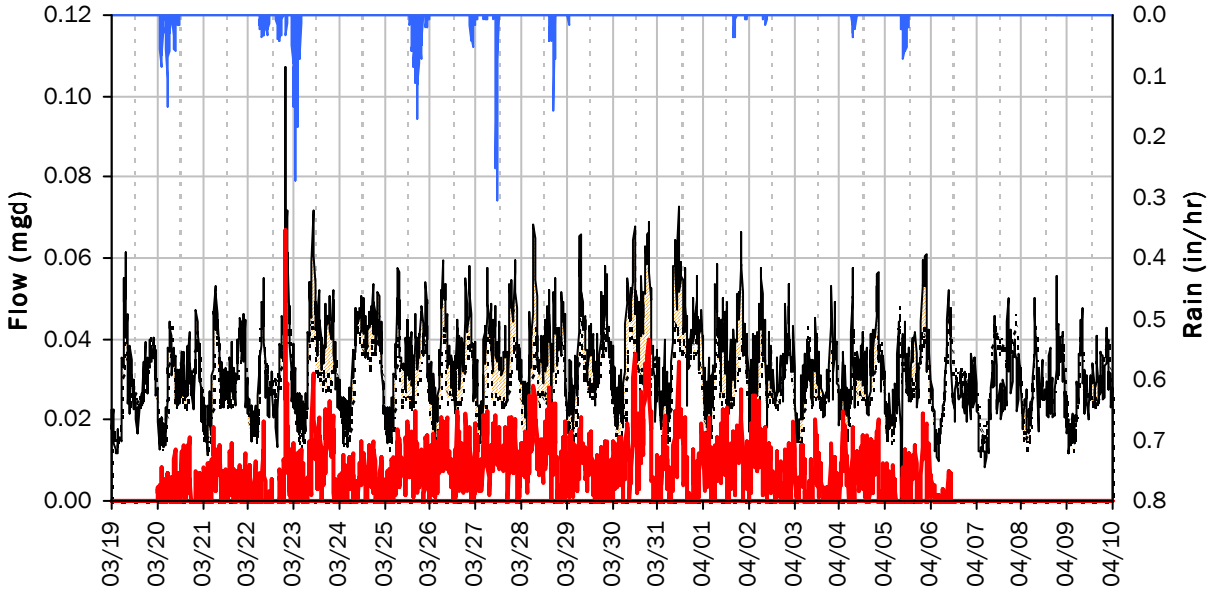
Capacity		Inflow / Infiltration	
Peak Flow:	0.10 *mgd*	**Peak I/I Rate:**	0.06 *mgd*
PF:	3.19	**Total I/I:**	105,000 *gallons*
Peak Level:	1.32 *in*		
d/D Ratio:	0.17		

SITE 6A
I/I Summary: Rain Event 5

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 5 Detail Graph



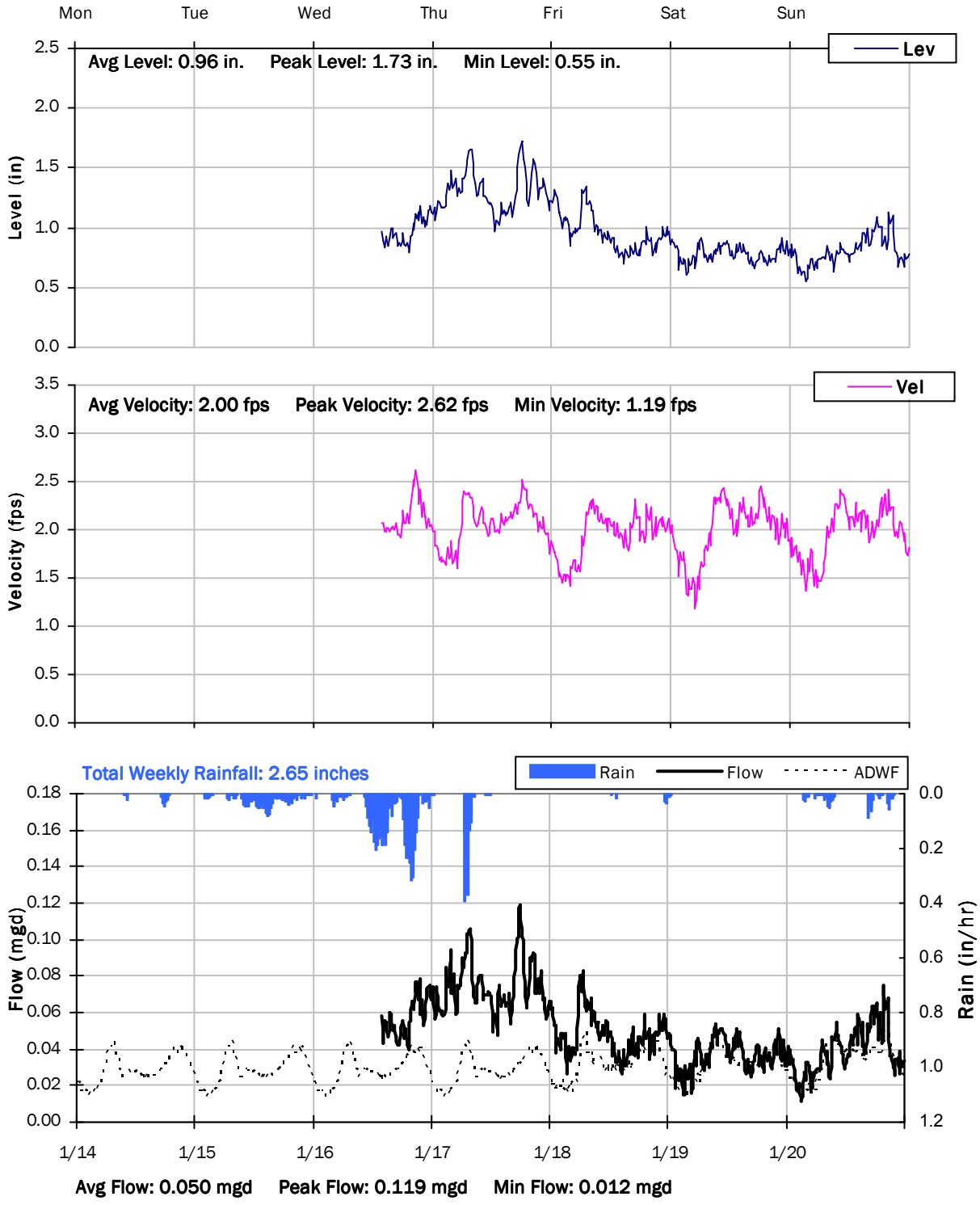
Storm Event I/I Analysis (Rain = 2.12 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.11 *mgd*	**Peak I/I Rate:**	0.07 *mgd*
PF:	3.56	**Total I/I:**	125,000 *gallons*
Peak Level:	1.35 *in*		
d/D Ratio:	0.17		

SITE 6A

Weekly Level, Velocity and Flow Hydrographs

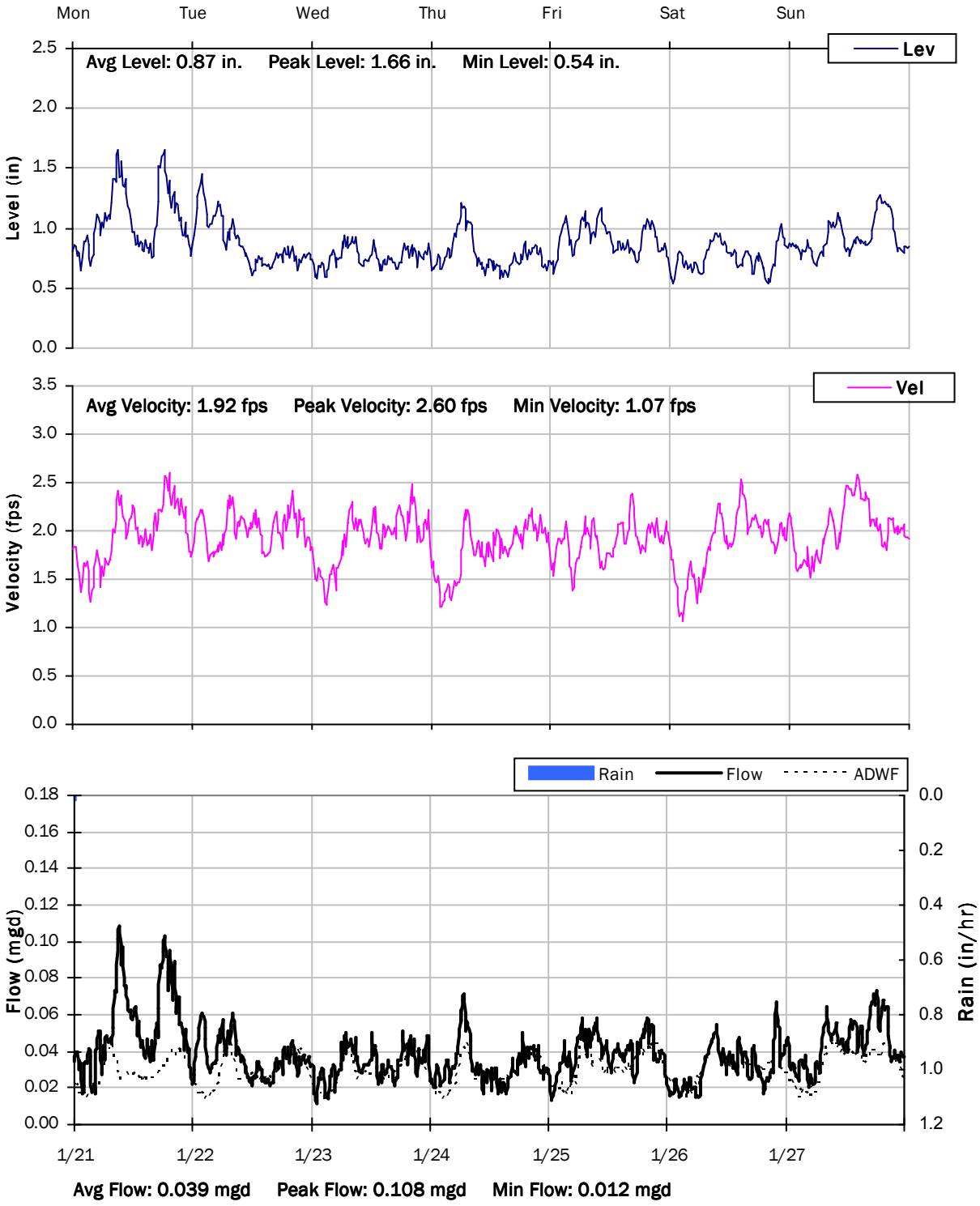
1/14/2019 to 1/21/2019



SITE 6A

Weekly Level, Velocity and Flow Hydrographs

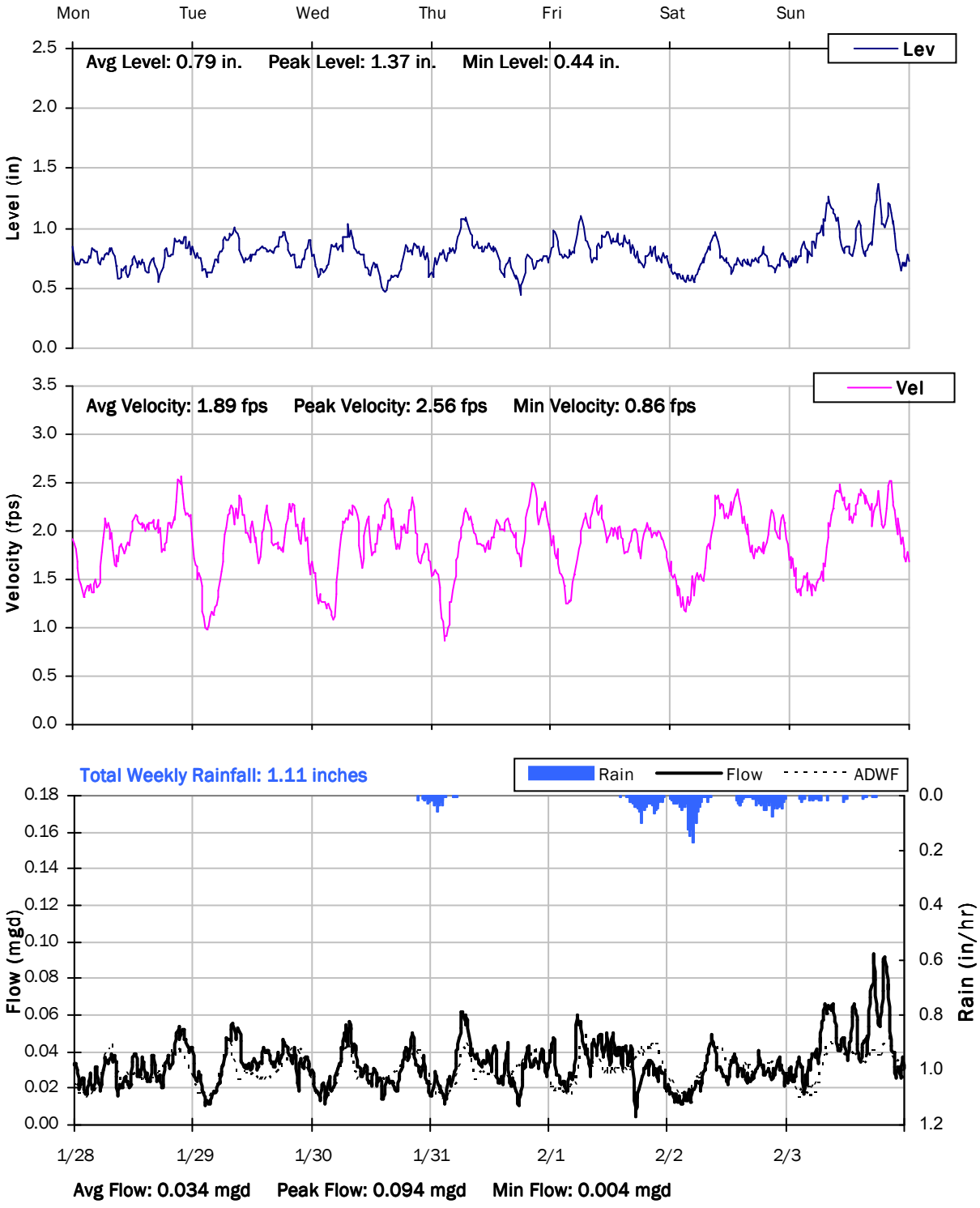
1/21/2019 to 1/28/2019



SITE 6A

Weekly Level, Velocity and Flow Hydrographs

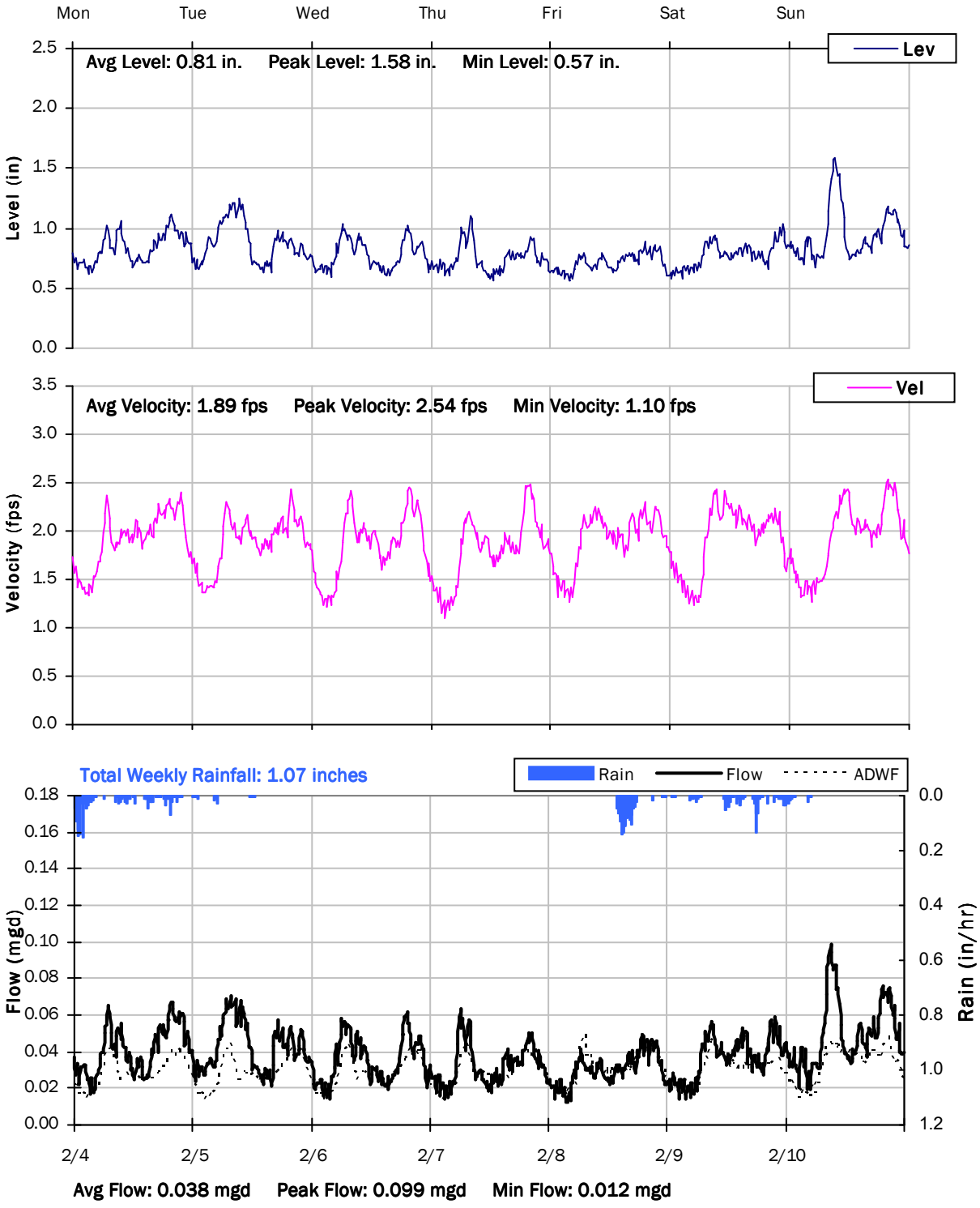
1/28/2019 to 2/4/2019



SITE 6A

Weekly Level, Velocity and Flow Hydrographs

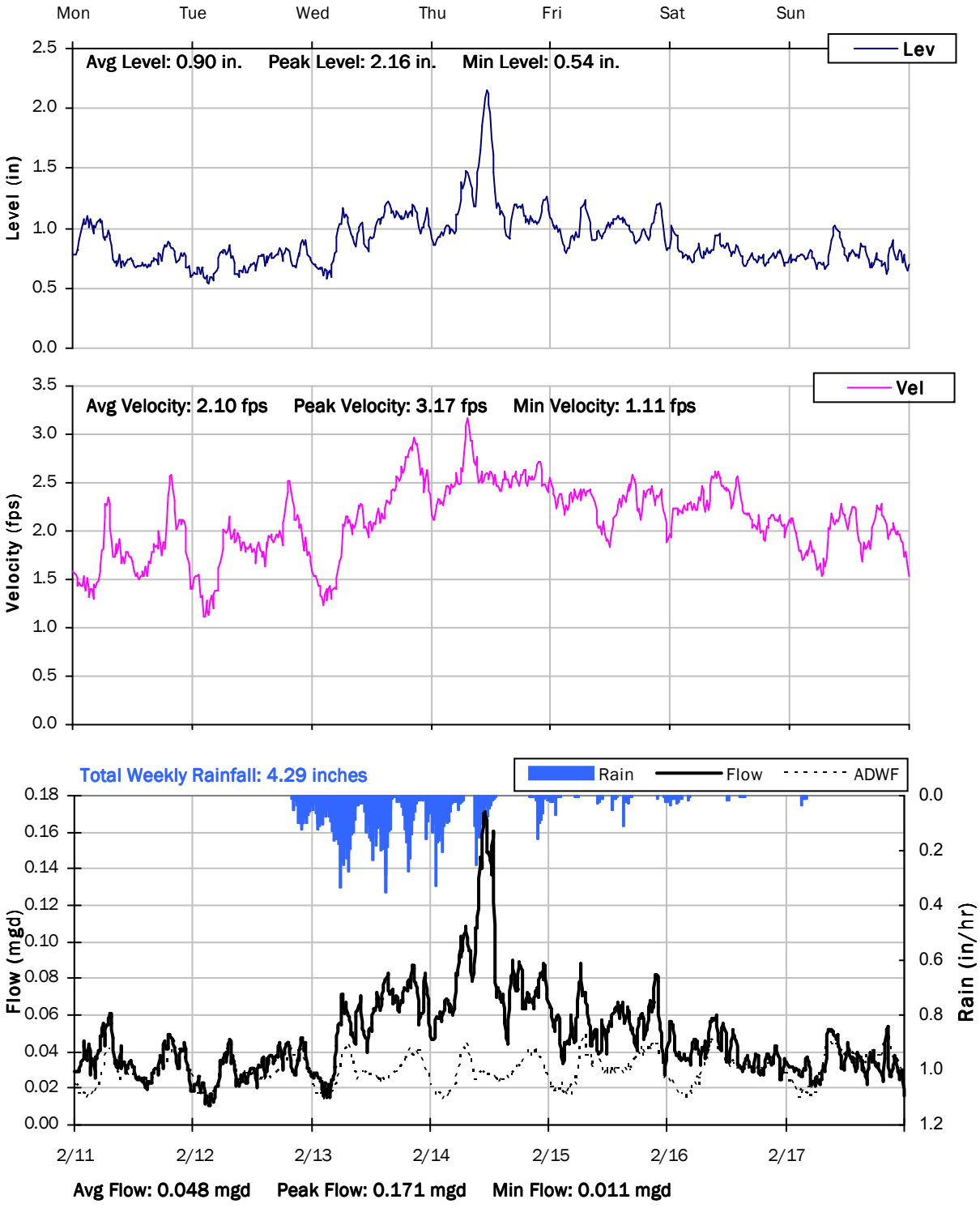
2/4/2019 to 2/11/2019



SITE 6A

Weekly Level, Velocity and Flow Hydrographs

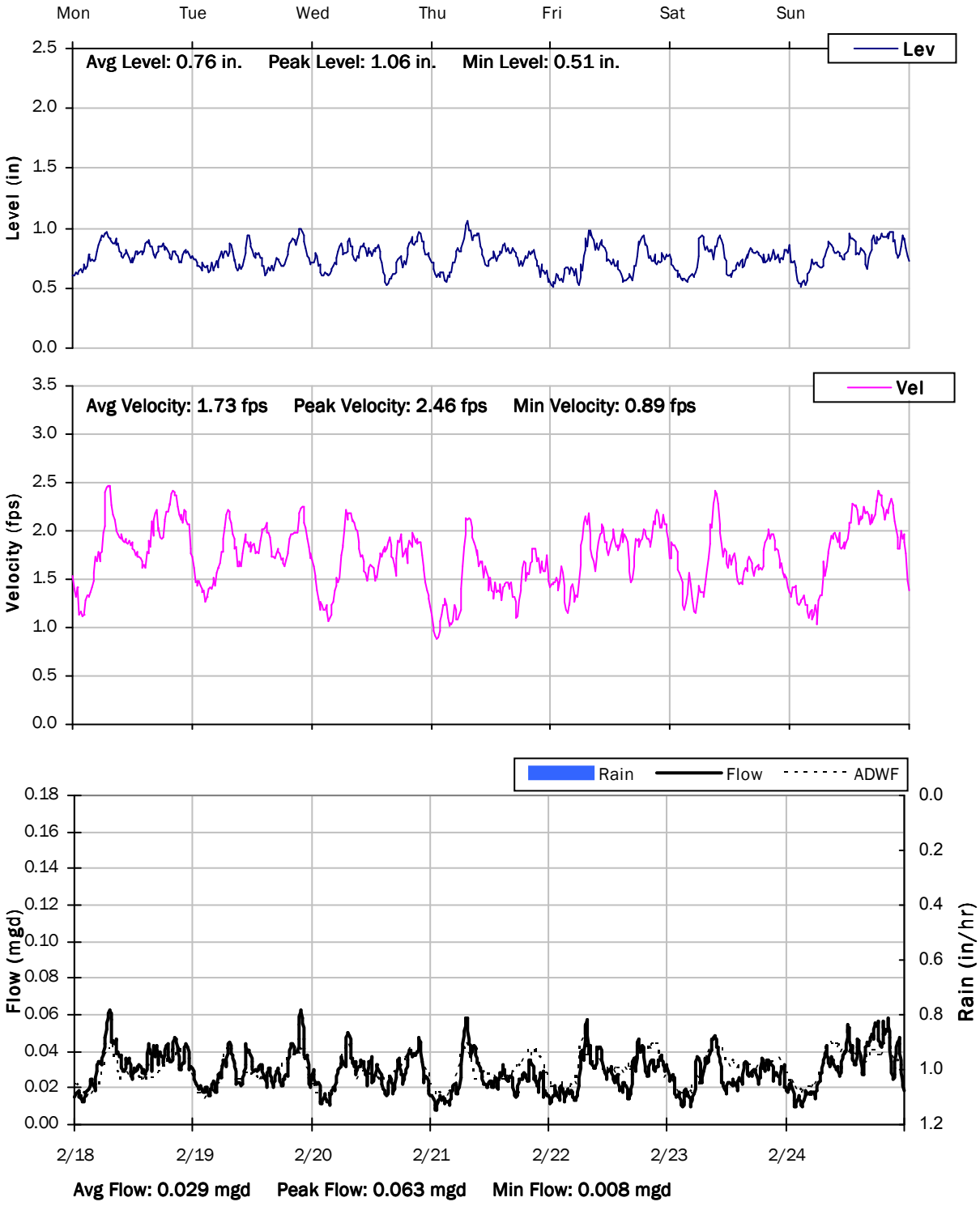
2/11/2019 to 2/18/2019



SITE 6A

Weekly Level, Velocity and Flow Hydrographs

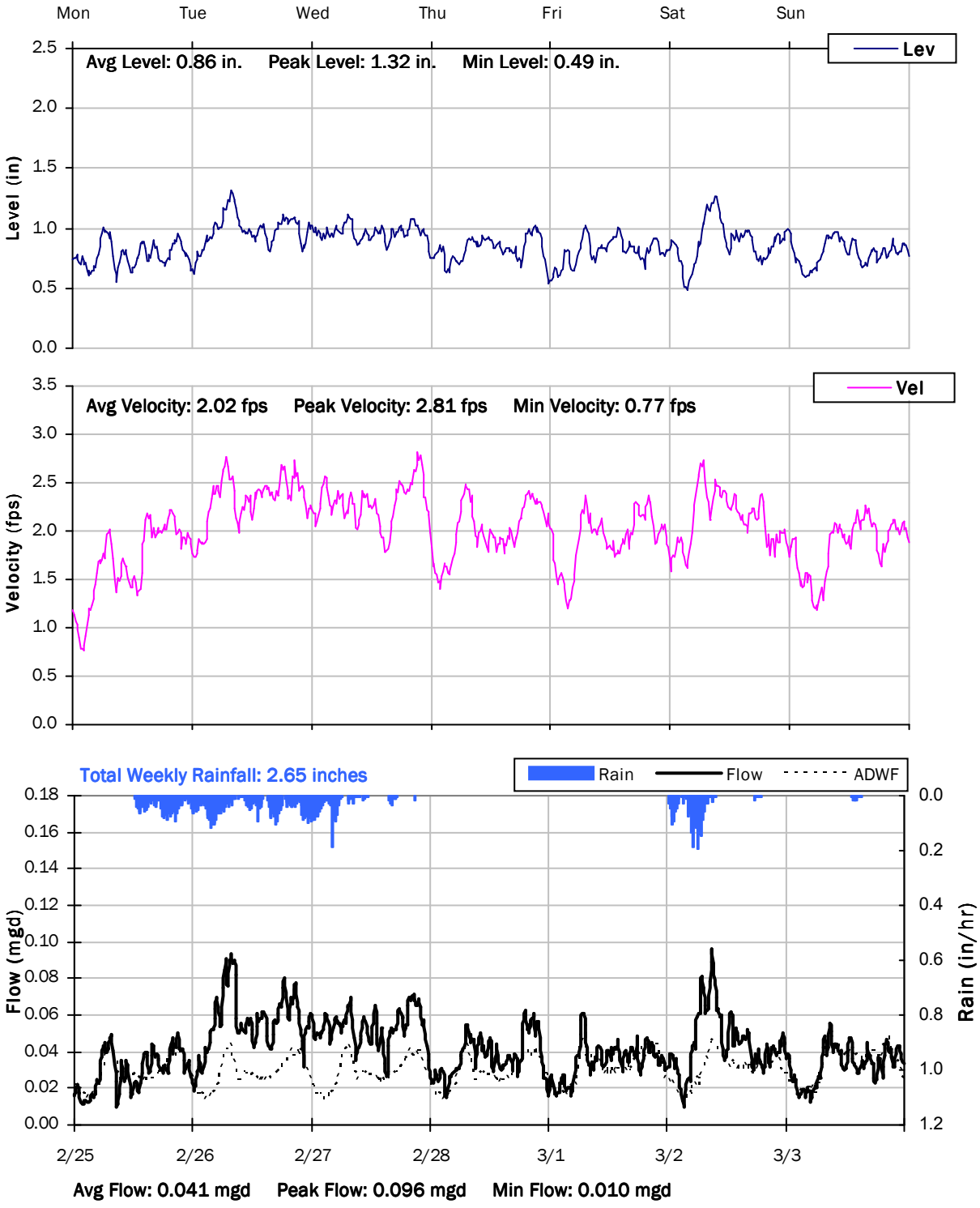
2/18/2019 to 2/25/2019



SITE 6A

Weekly Level, Velocity and Flow Hydrographs

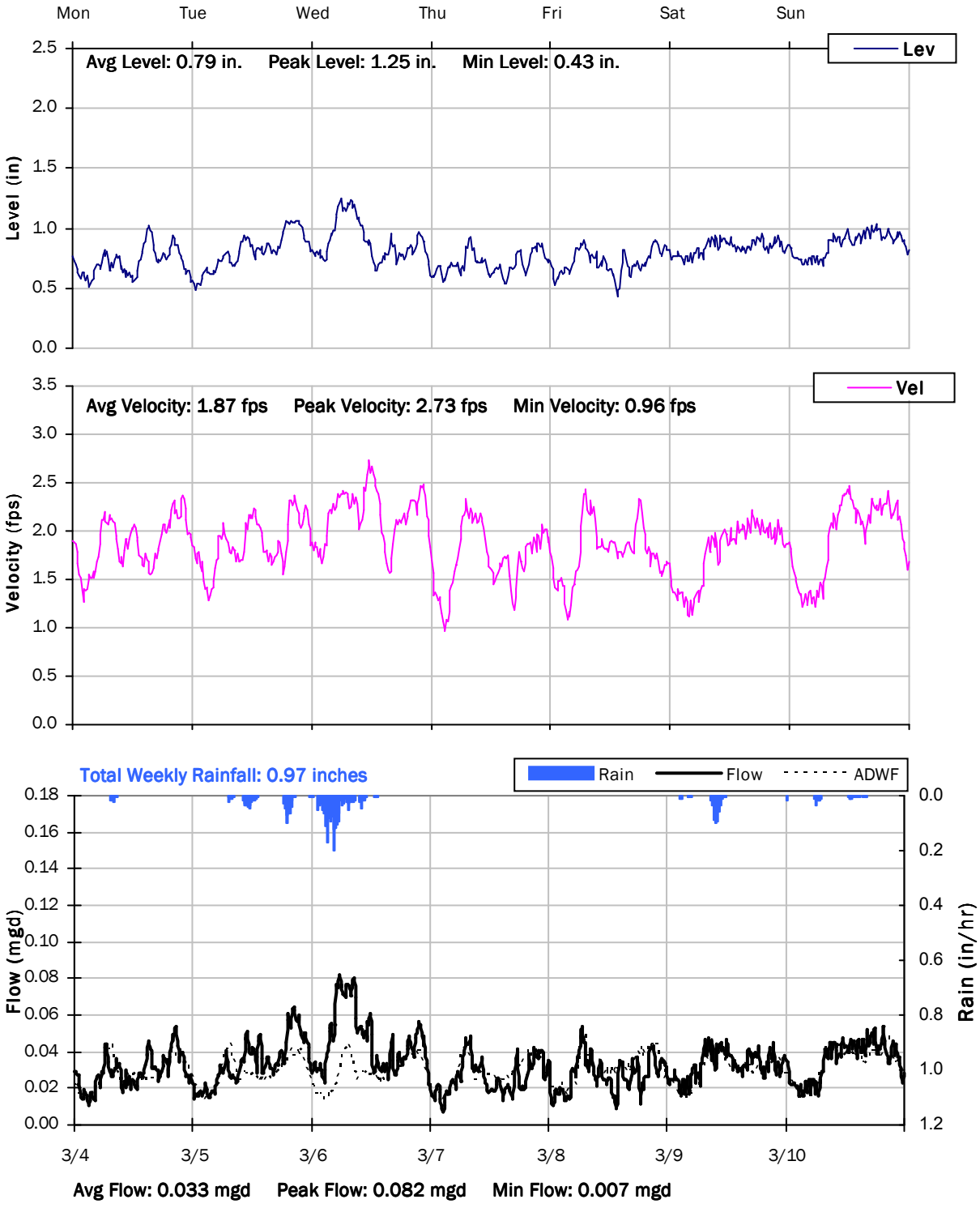
2/25/2019 to 3/4/2019



SITE 6A

Weekly Level, Velocity and Flow Hydrographs

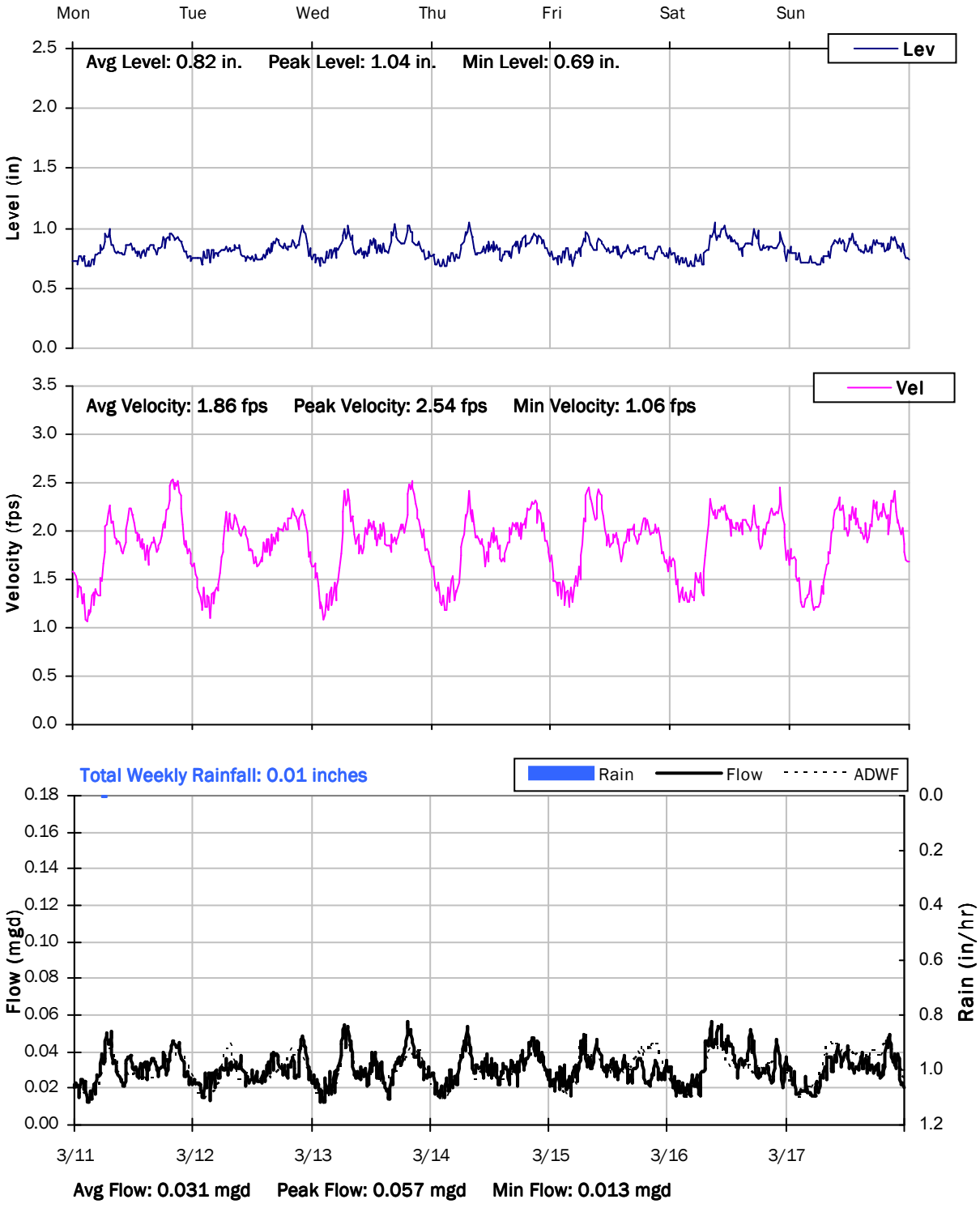
3/4/2019 to 3/11/2019



SITE 6A

Weekly Level, Velocity and Flow Hydrographs

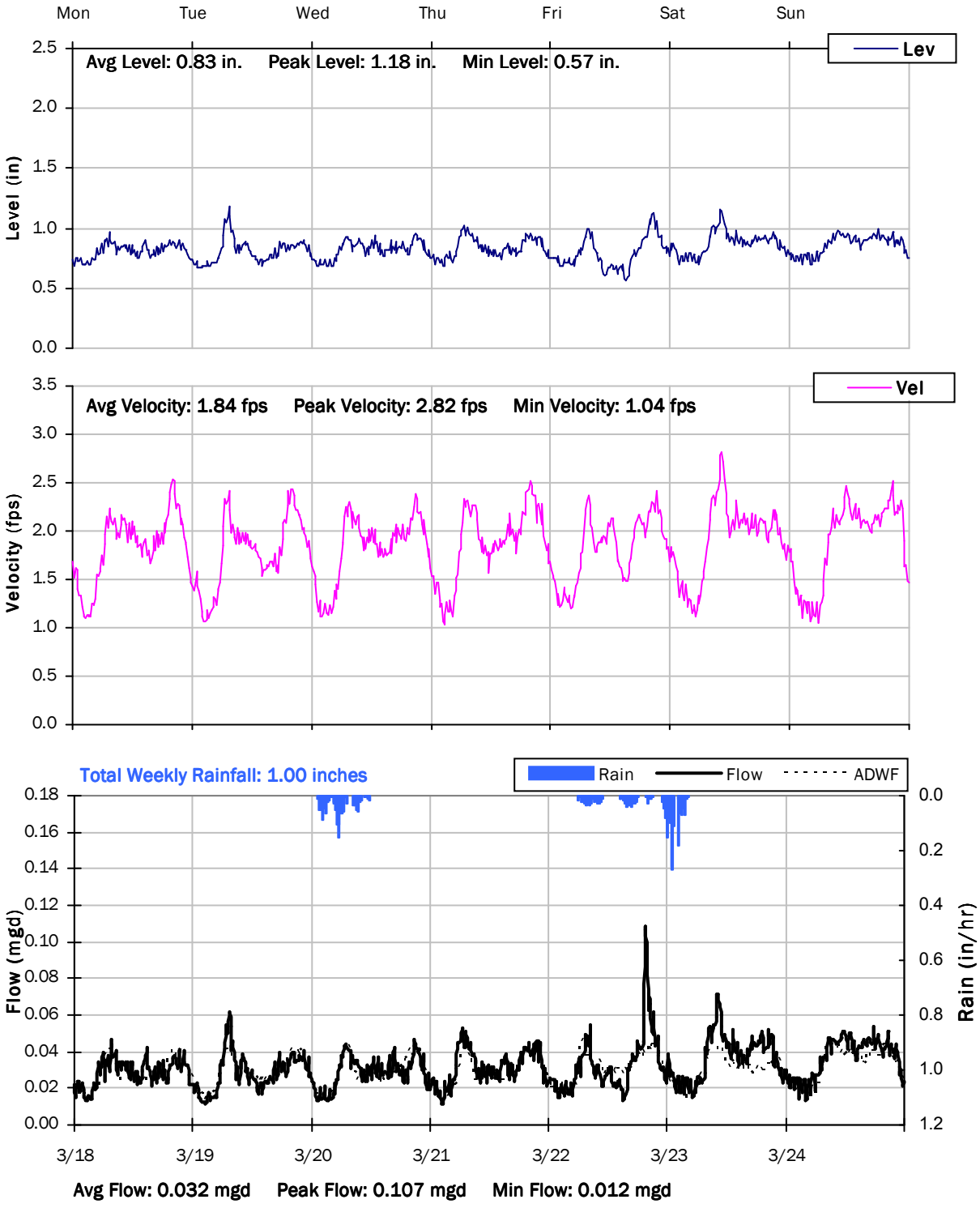
3/11/2019 to 3/18/2019



SITE 6A

Weekly Level, Velocity and Flow Hydrographs

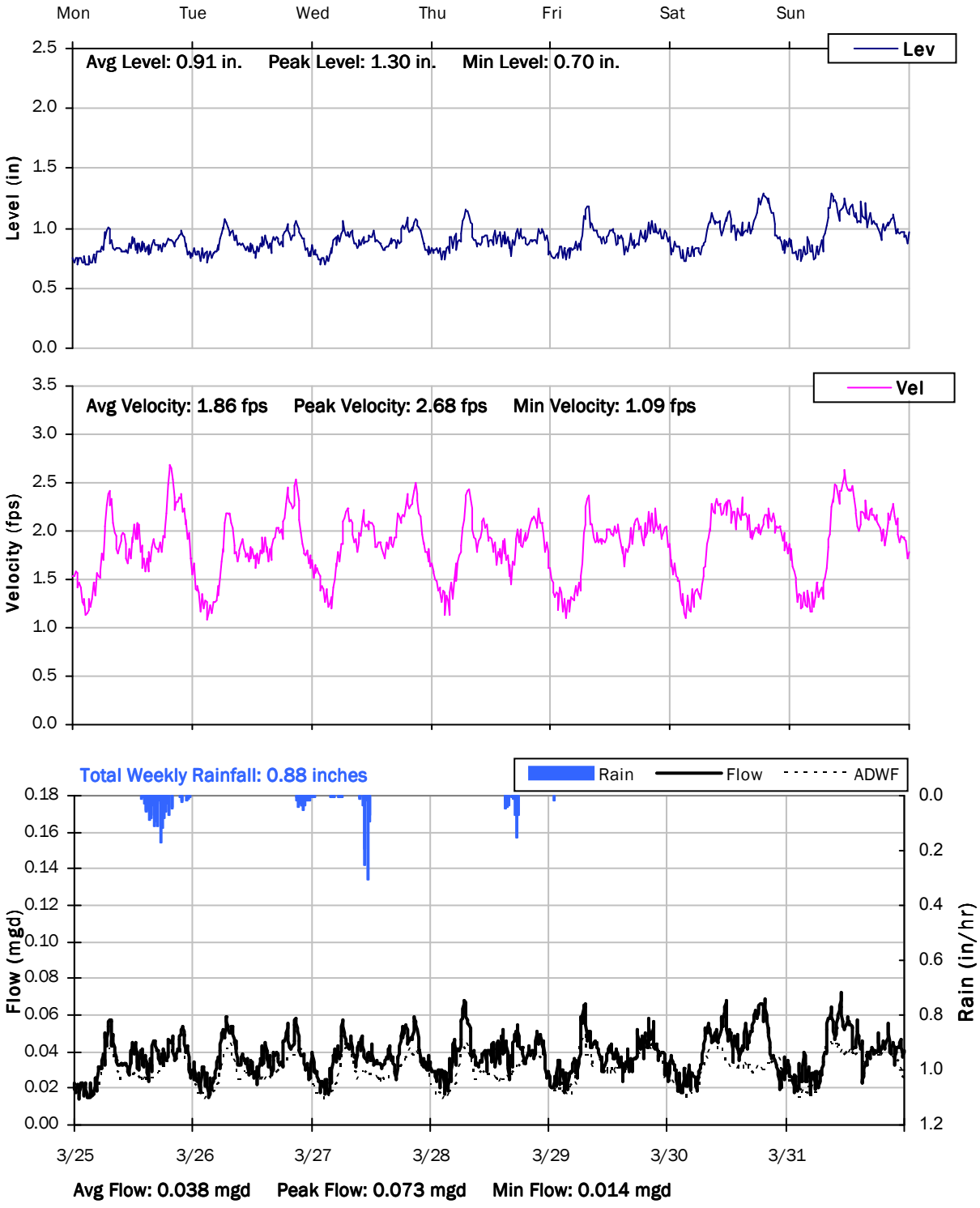
3/18/2019 to 3/25/2019



SITE 6A

Weekly Level, Velocity and Flow Hydrographs

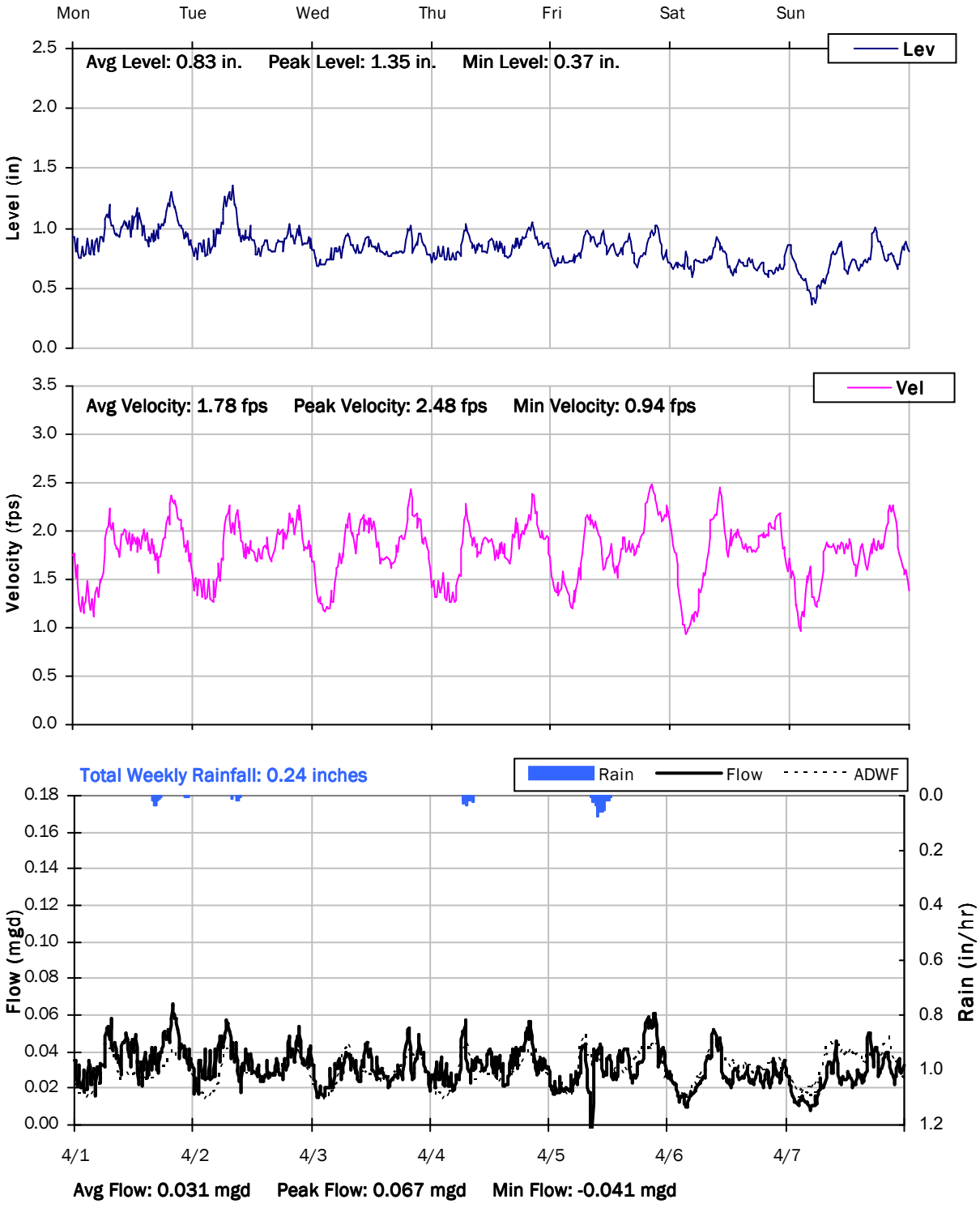
3/25/2019 to 4/1/2019



SITE 6A

Weekly Level, Velocity and Flow Hydrographs

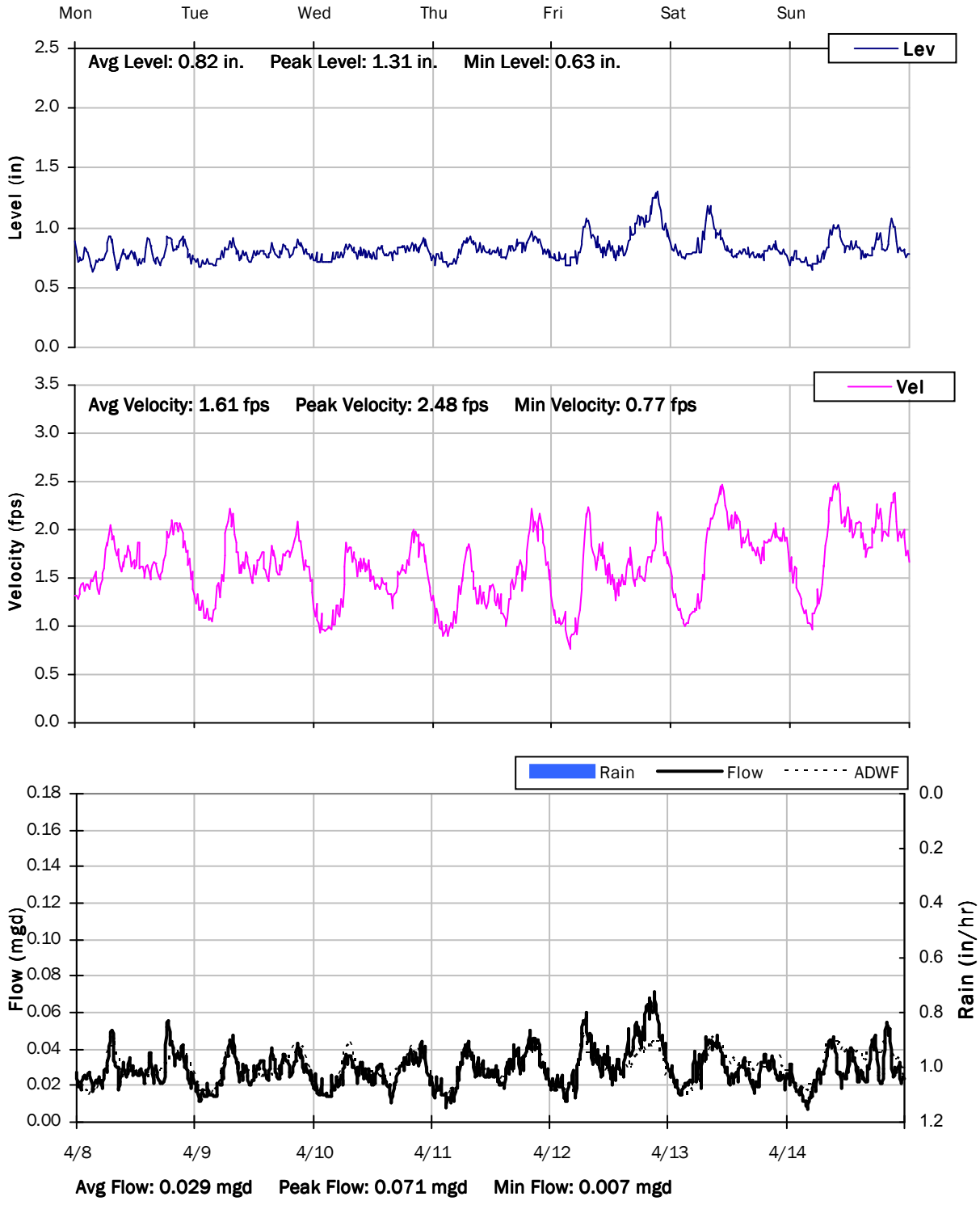
4/1/2019 to 4/8/2019



SITE 6A

Weekly Level, Velocity and Flow Hydrographs

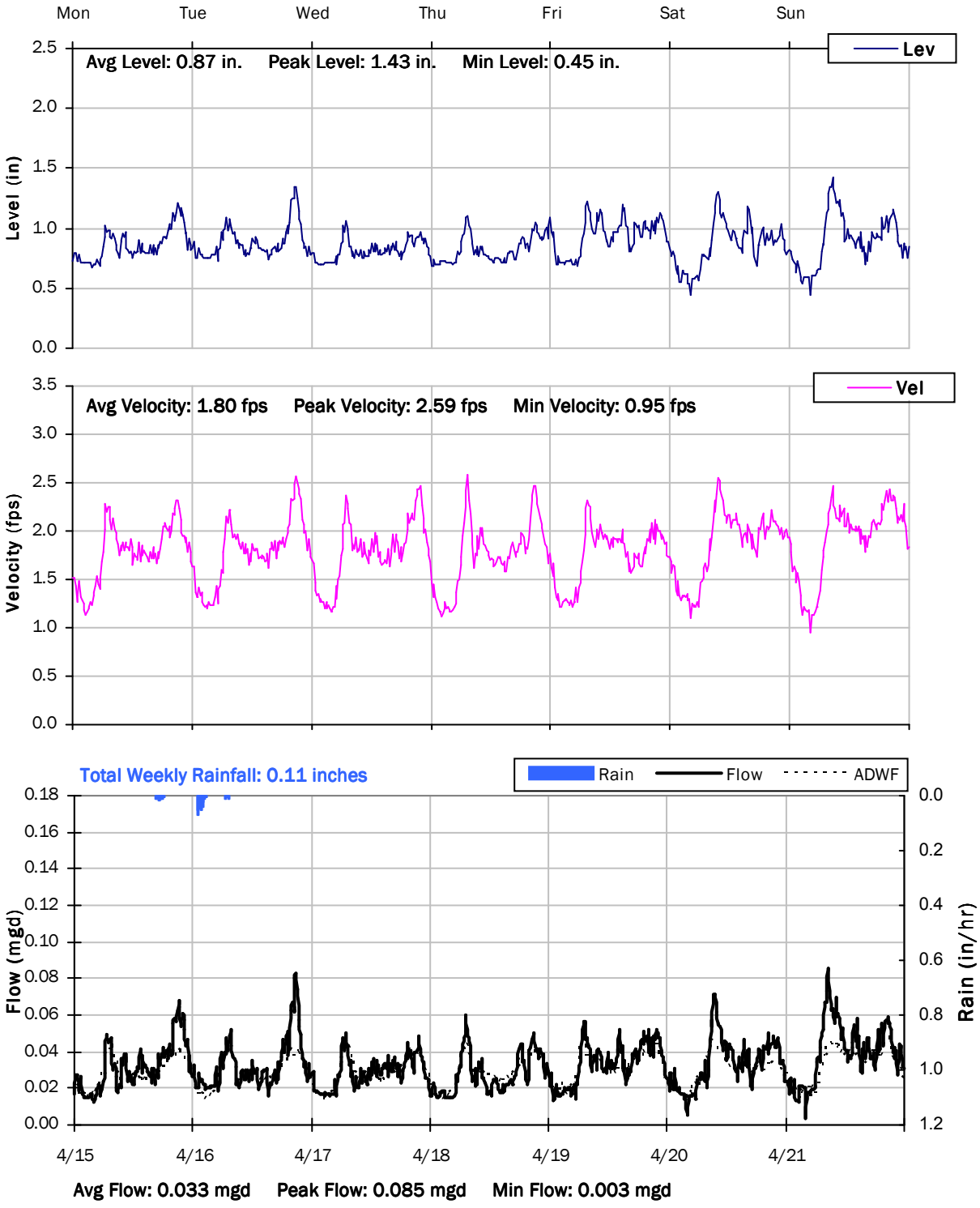
4/8/2019 to 4/15/2019



SITE 6A

Weekly Level, Velocity and Flow Hydrographs

4/15/2019 to 4/22/2019



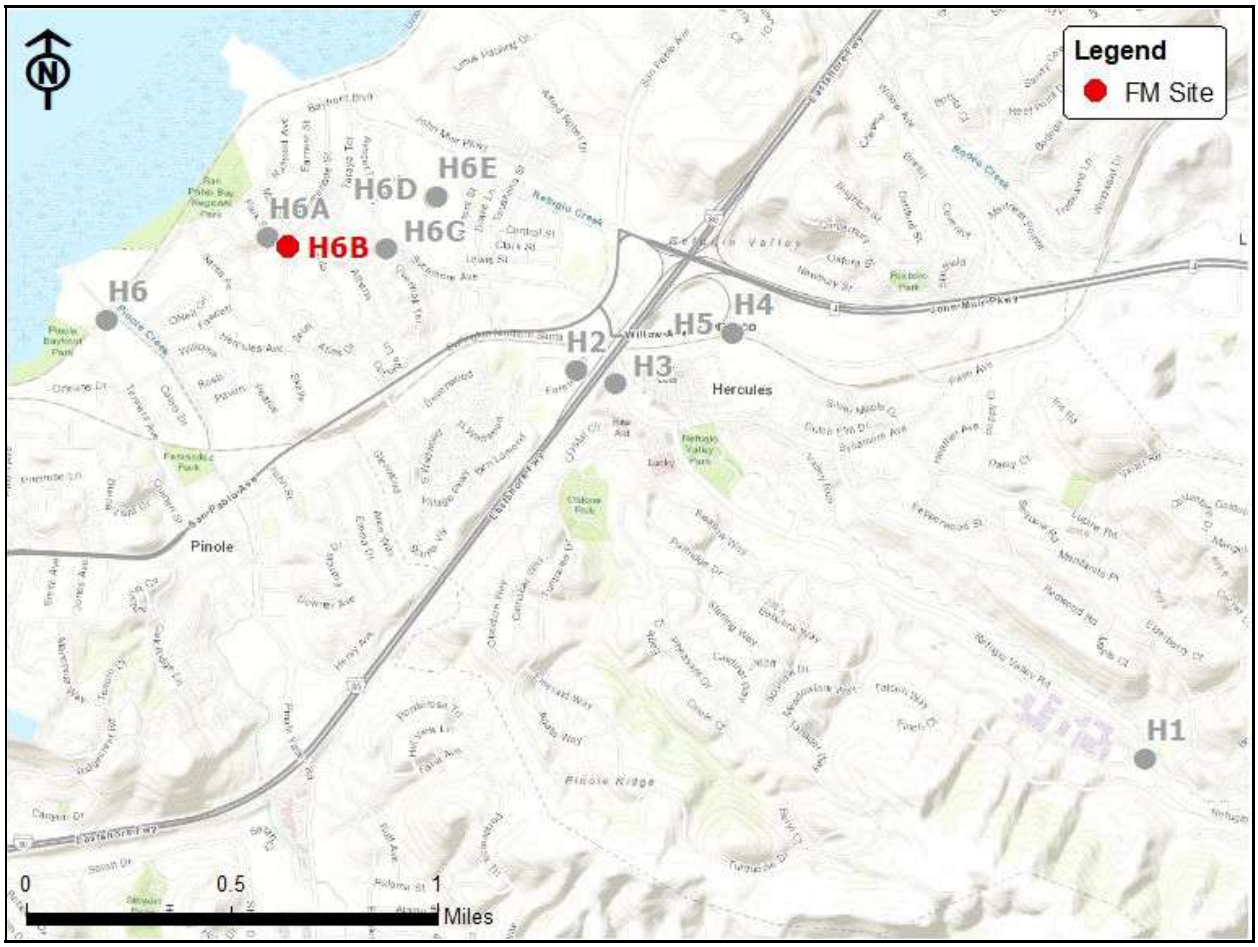
City of Hercules, California

Sanitary Sewer Flow Monitoring
January 14 - April 21, 2019

Monitoring Site: Site 6B

Location: Apollo north of Zephyr

Data Summary Report



Vicinity Map: Site 6B

SITE 6B

Site Information

Location: Apollo north of Zephyr

Coordinates: 122.2872° W, 38.0152° N

Rim Elevation (Earth): 43 feet

Measured Pipe Diameter: 8 inches

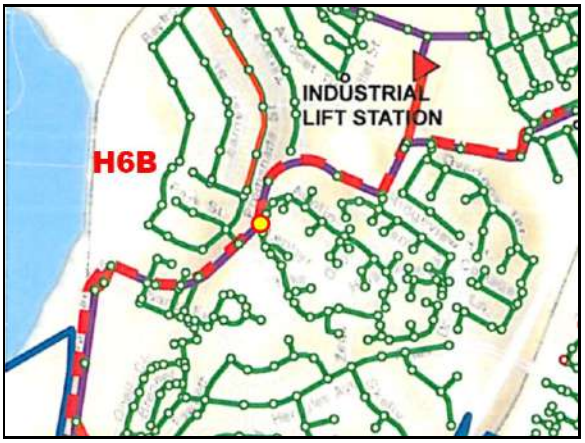
ADWF: 0.050 mgd

Peak Measured Flow: 0.342 mgd

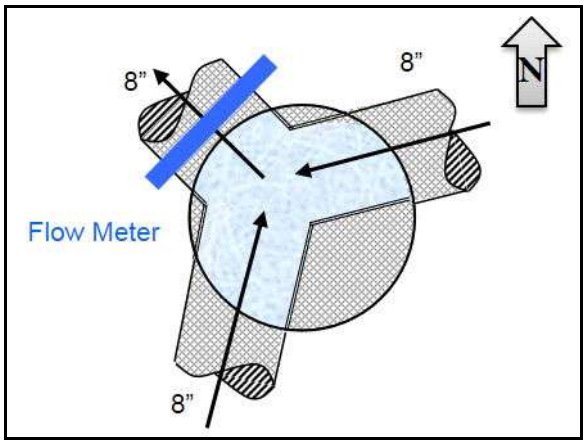
Sediment: None



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

SITE 6B

Additional Site Photos

Monitored Effluent Pipe



Northeast Influent Pipe



SITE 6B

Additional Site Photos

Southwest Influent Pipe

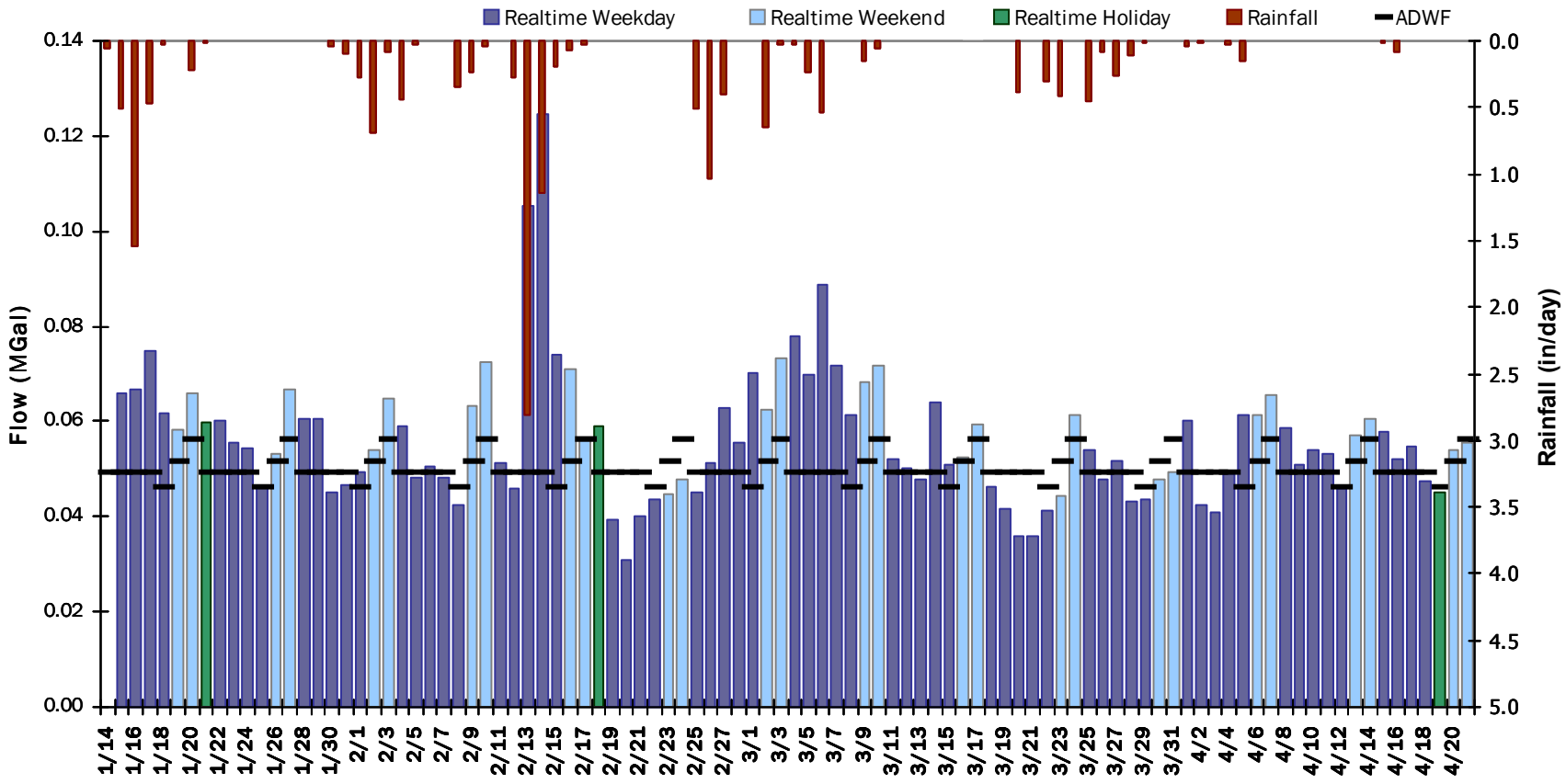


SITE 6B

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.056 MGal Peak Daily Flow: 0.125 MGal Min Daily Flow: 0.031 MGal

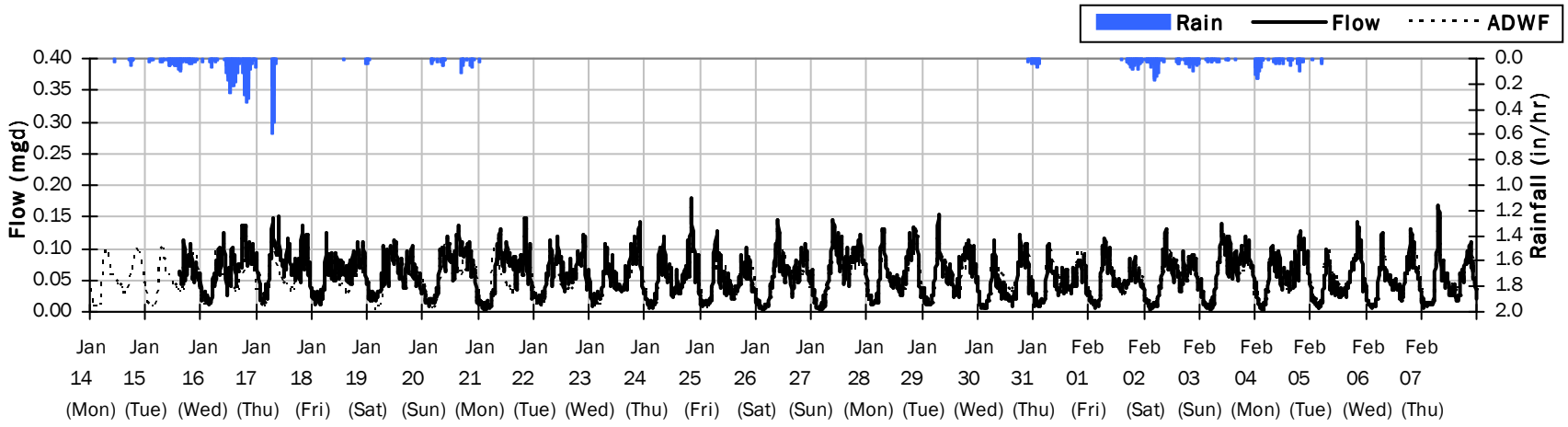
Total Rainfall: 15.23 inches

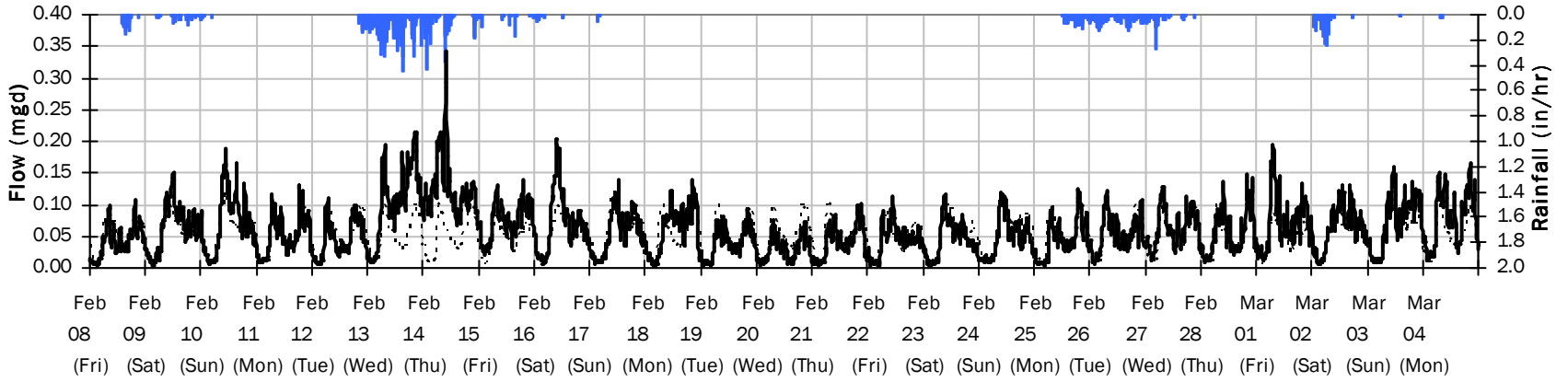


SITE 6B

Flow Summary: 1/14/2019 to 3/4/2019

Period Rainfall: 12.25 inches Period Avg Flow: 0.059 mgd Period Peak Flow: 0.342 mgd Period Min Flow: 0.002 mgd

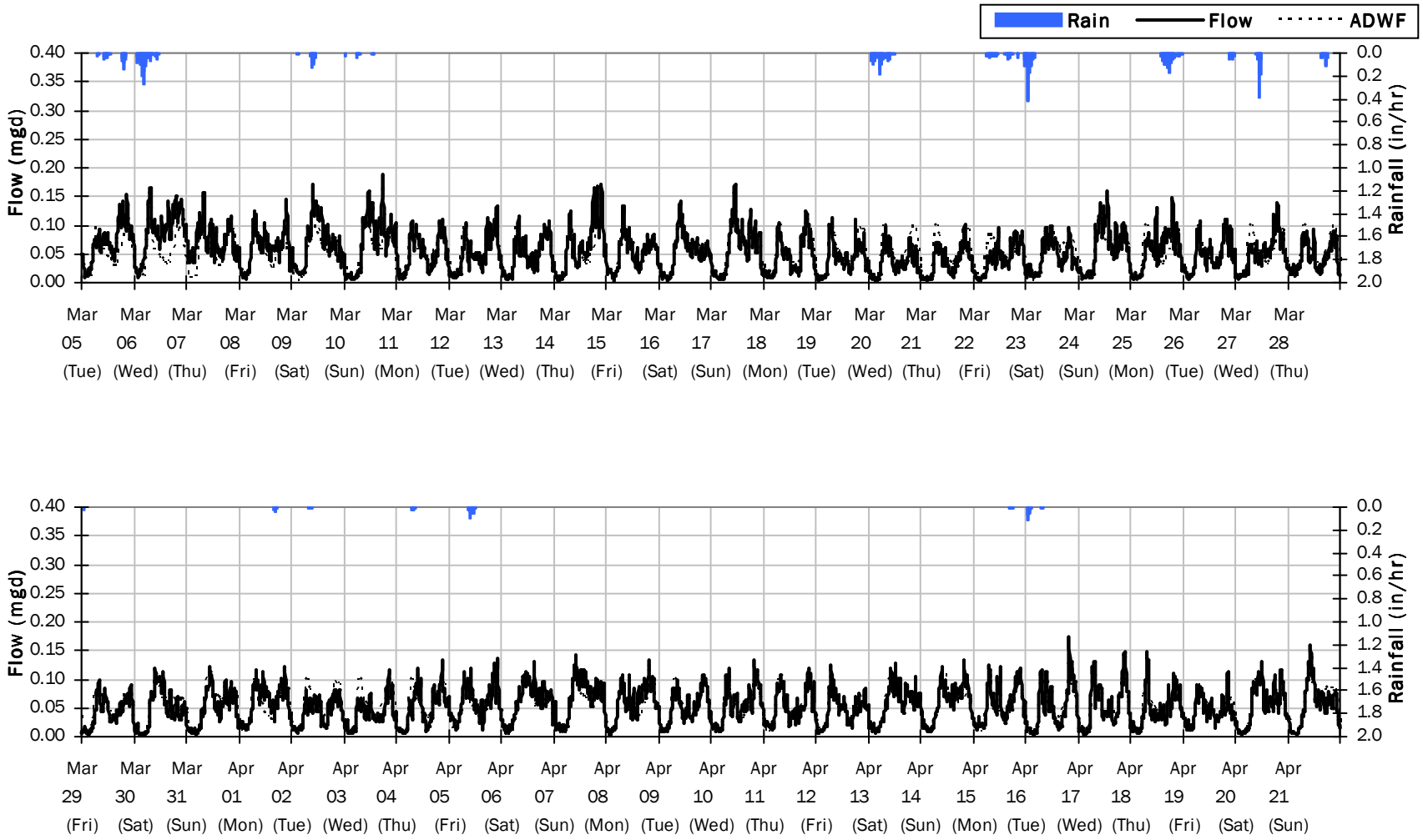




SITE 6B

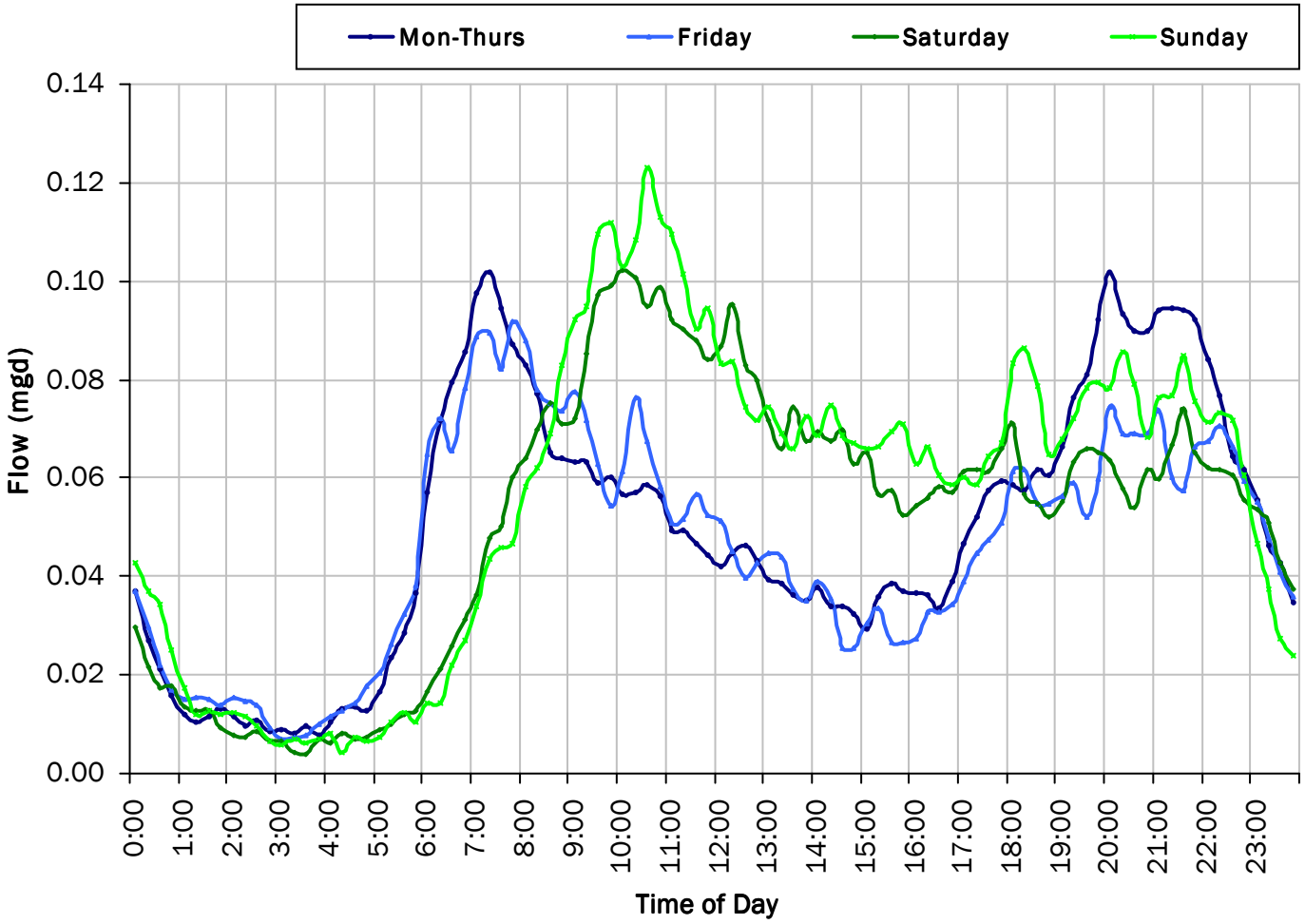
Flow Summary: 3/5/2019 to 4/21/2019

Period Rainfall: 3.32 inches Period Avg Flow: 0.054 mgd Period Peak Flow: 0.187 mgd Period Min Flow: 0.002 mgd



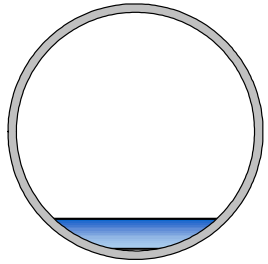
SITE 6B

Average Dry Weather Flow Hydrographs



ADWF:

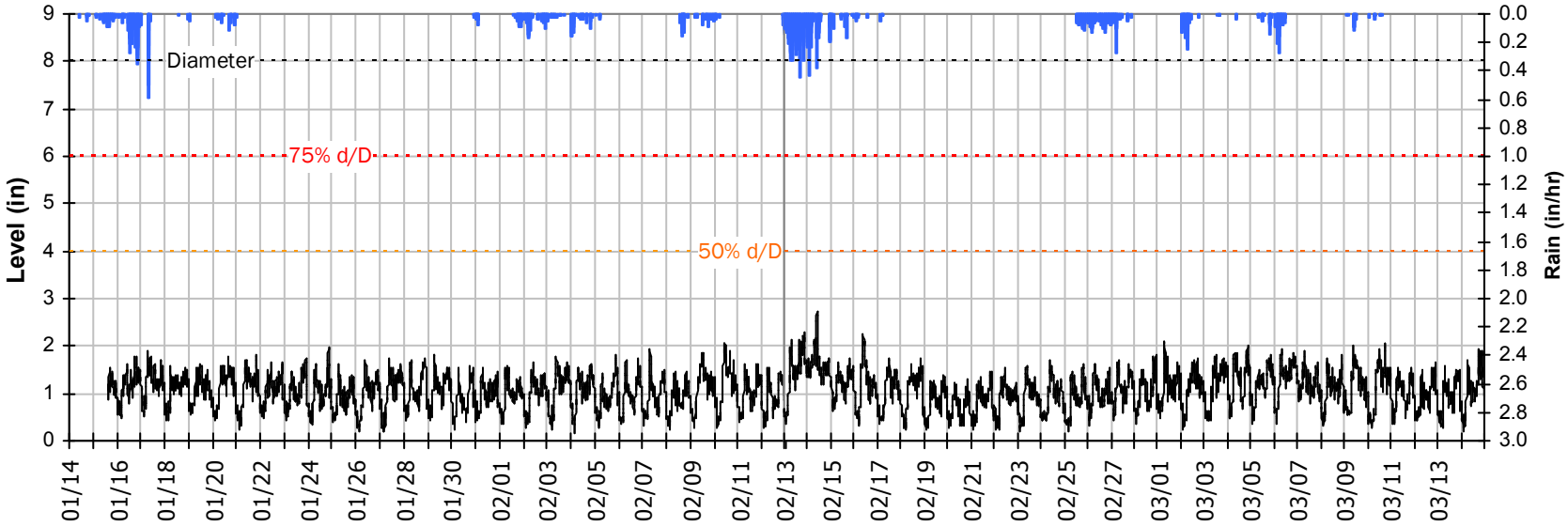
0.050 *mgd*

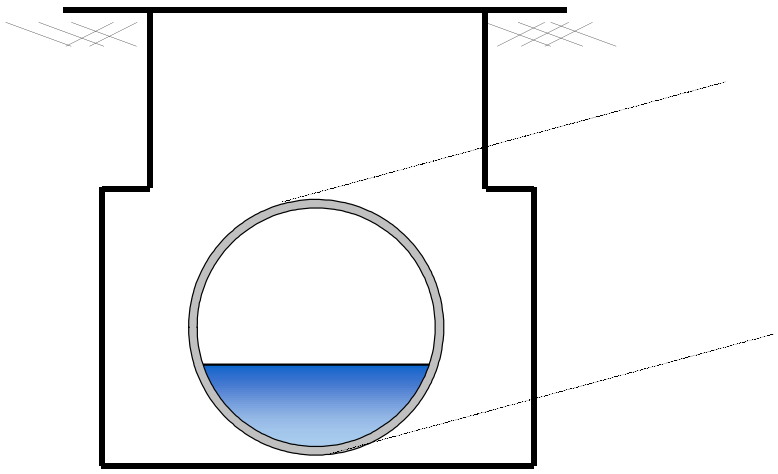


SITE 6B

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



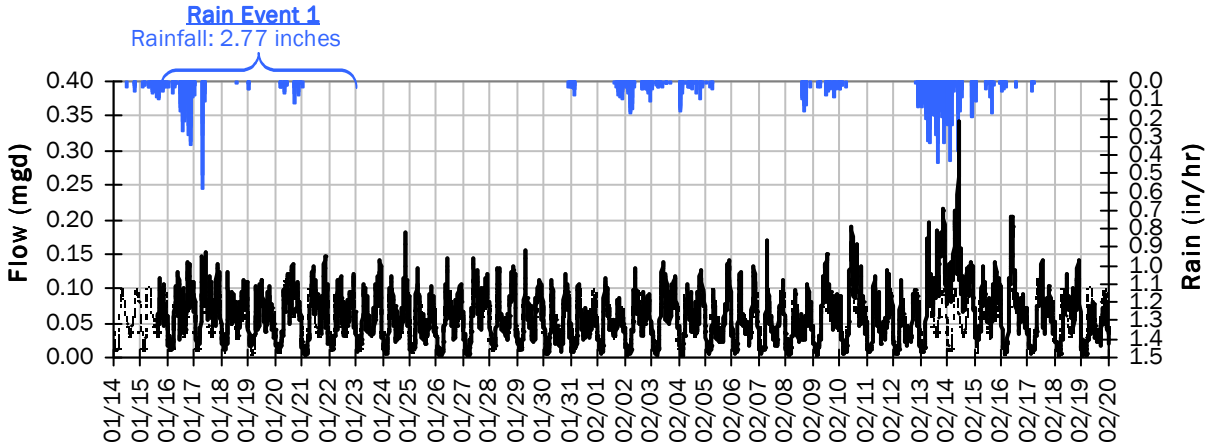


Pipe Diameter:	8	*inches*
Peak Measured Level:	2.73	*inches*
Peak d/D Ratio:	0.34	

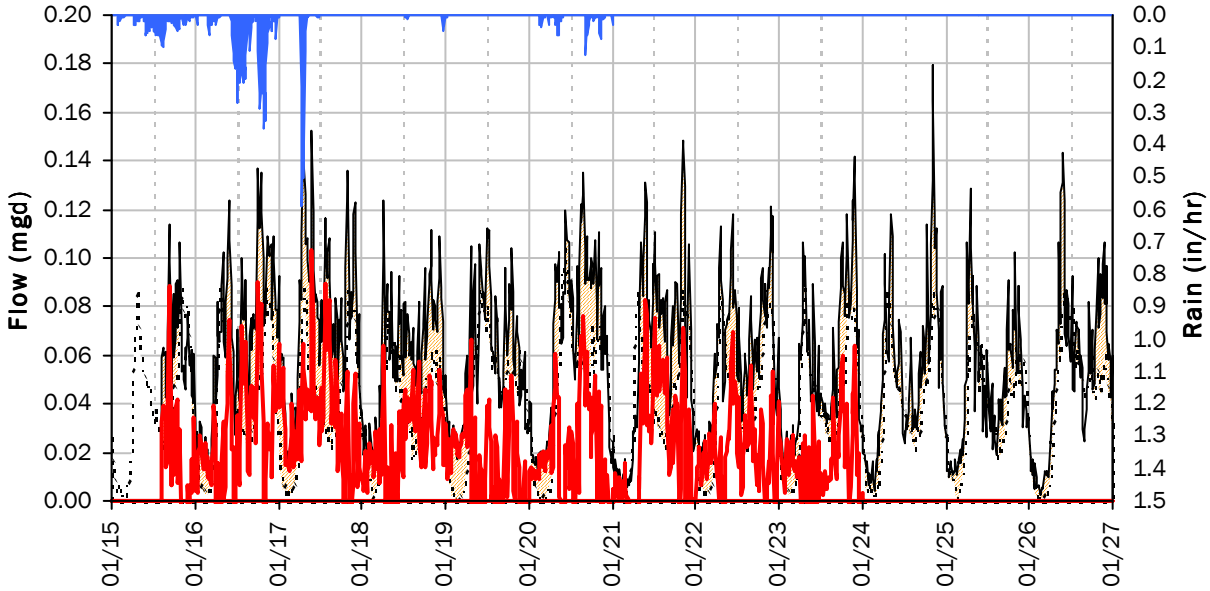
SITE 6B

I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph

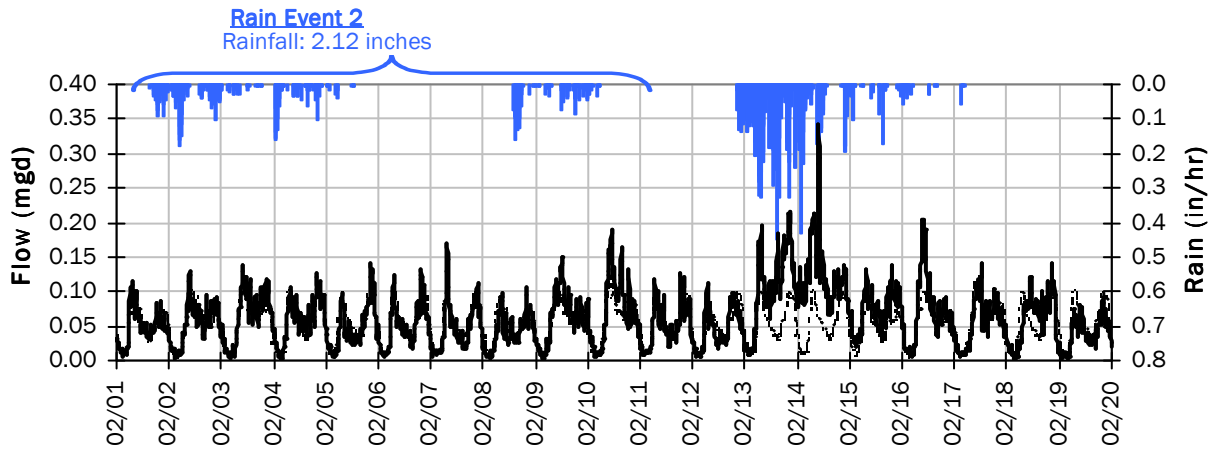


Storm Event I/I Analysis (Rain = 2.77 inches)

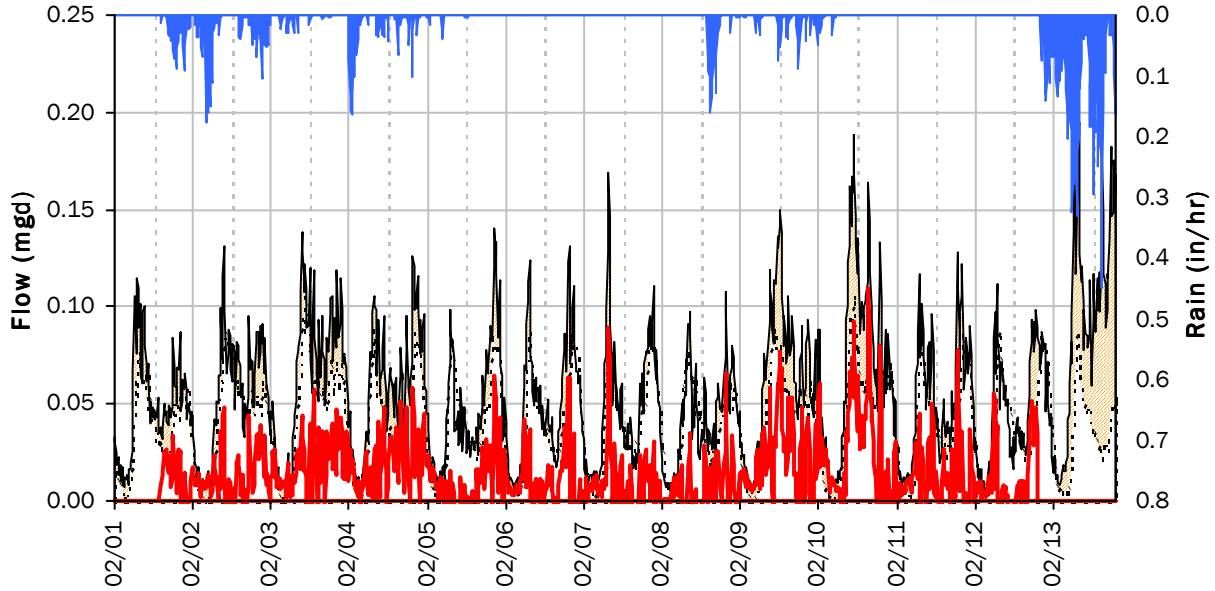
Capacity		Inflow / Infiltration	
Peak Flow:	0.152 *mgd*	**Peak I/I Rate:**	0.103 *mgd*
PF:	3.03	**Total I/I:**	189,000 *gallons*
Peak Level:	1.90 *in*		
d/D Ratio:	0.24		

SITE 6B
I/I Summary: Rain Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 2 Detail Graph

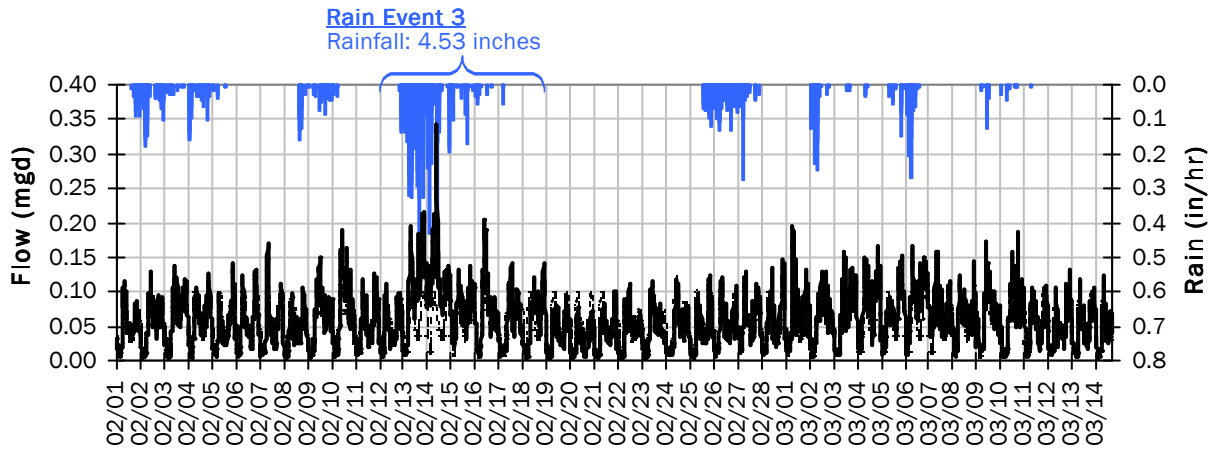


Storm Event I/I Analysis (Rain = 2.12 inches)

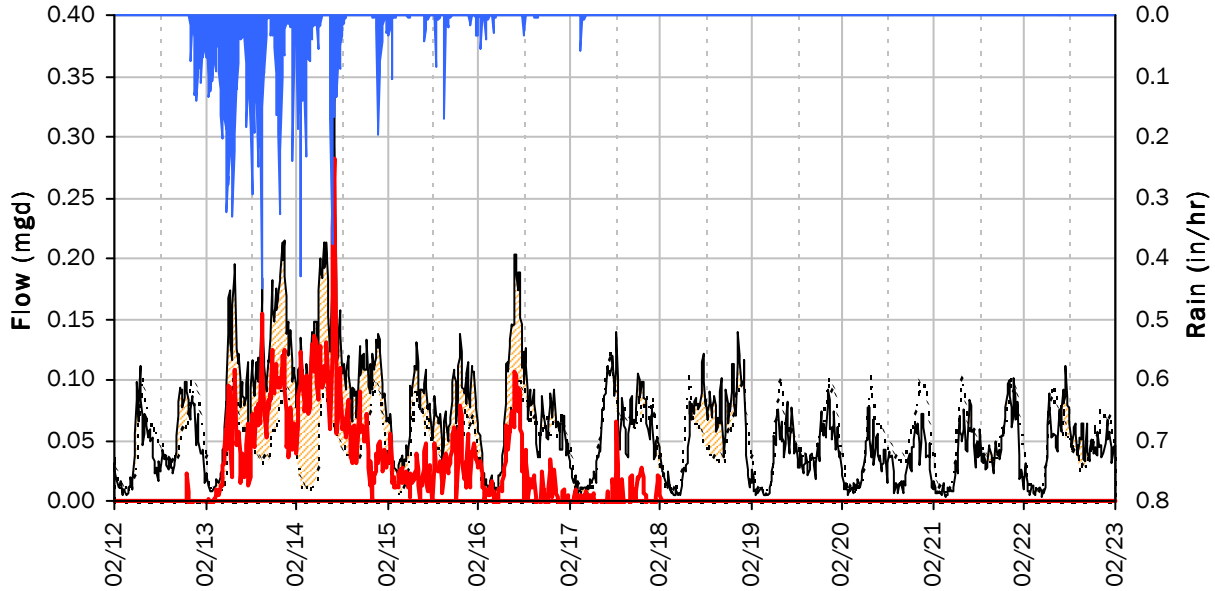
Capacity		Inflow / Infiltration	
Peak Flow:	0.189 *mgd*	**Peak I/I Rate:**	0.109 *mgd*
PF:	3.76	**Total I/I:**	159,000 *gallons*
Peak Level:	2.07 *in*		
d/D Ratio:	0.26		

SITE 6B
I/I Summary: Rain Event 3

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3 Detail Graph

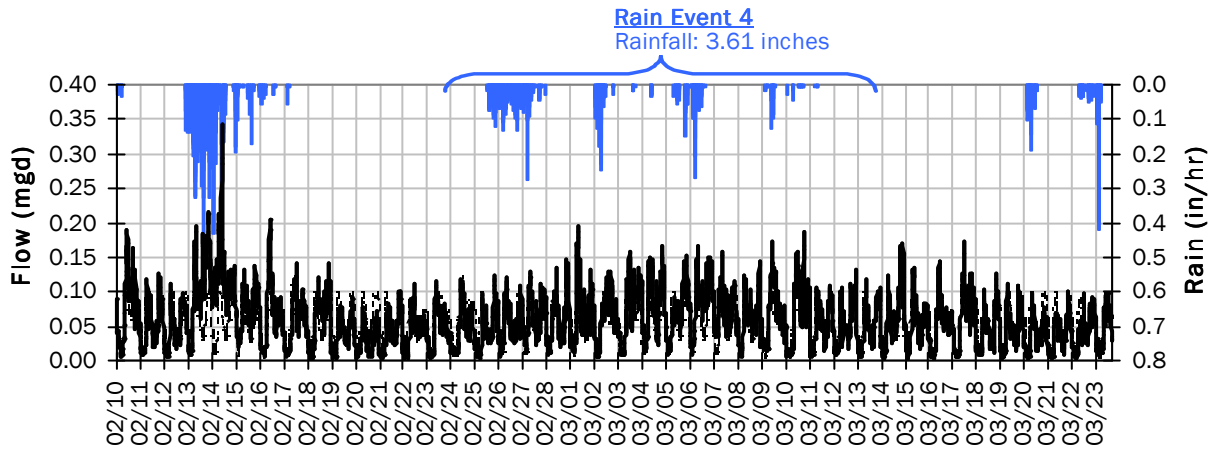


Storm Event I/I Analysis (Rain = 4.53 inches)

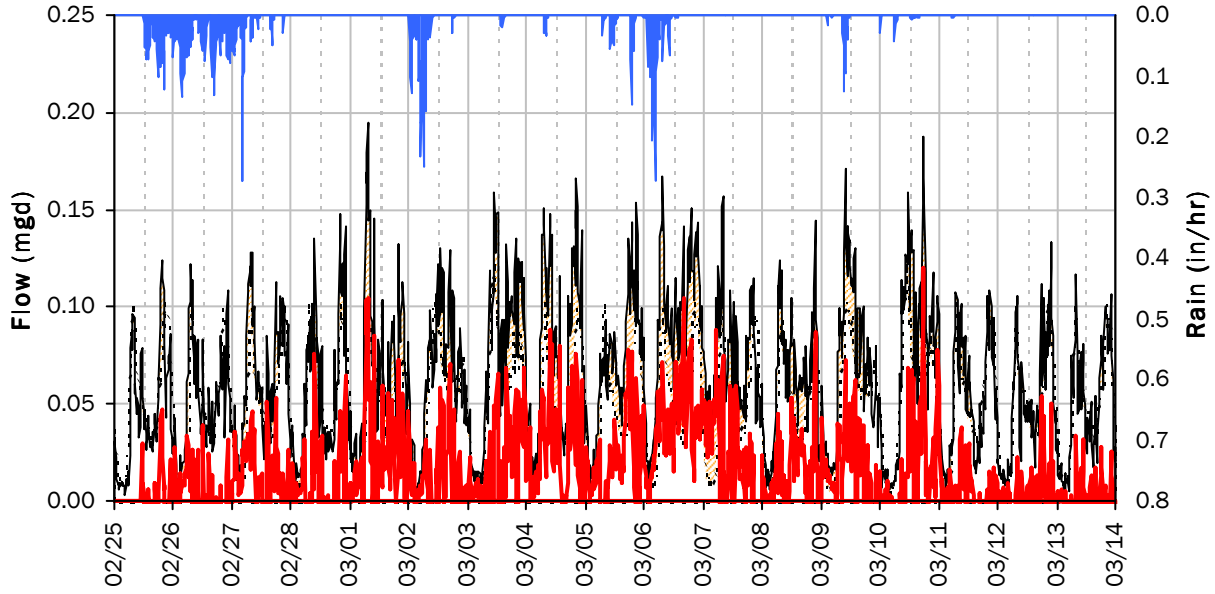
Capacity		Inflow / Infiltration	
Peak Flow:	0.34 *mgd*	**Peak I/I Rate:**	0.28 *mgd*
PF:	6.81	**Total I/I:**	175,000 *gallons*
Peak Level:	2.73 *in*		
d/D Ratio:	0.34		

SITE 6B
I/I Summary: Rain Event 4

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 4 Detail Graph

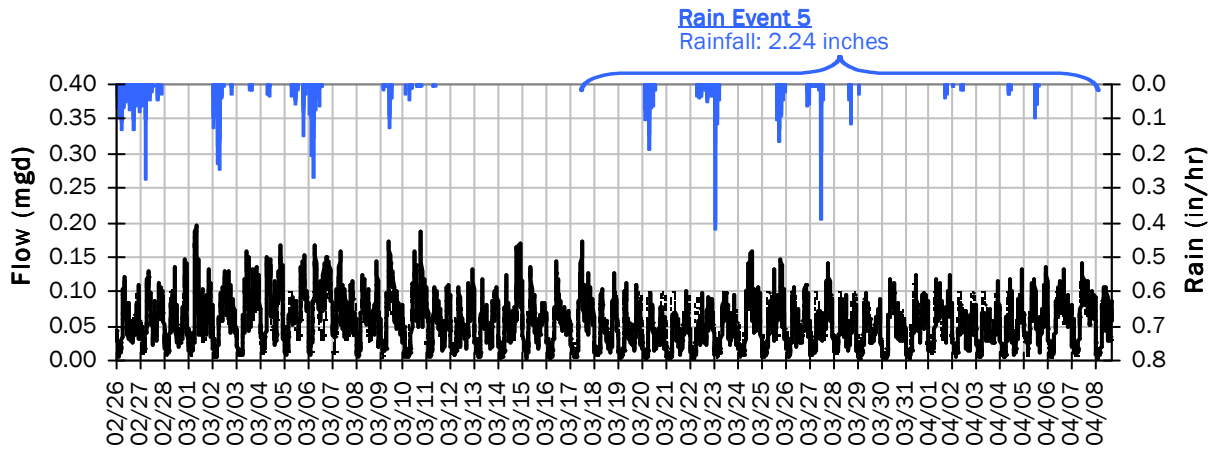


Storm Event I/I Analysis (Rain = 3.61 inches)

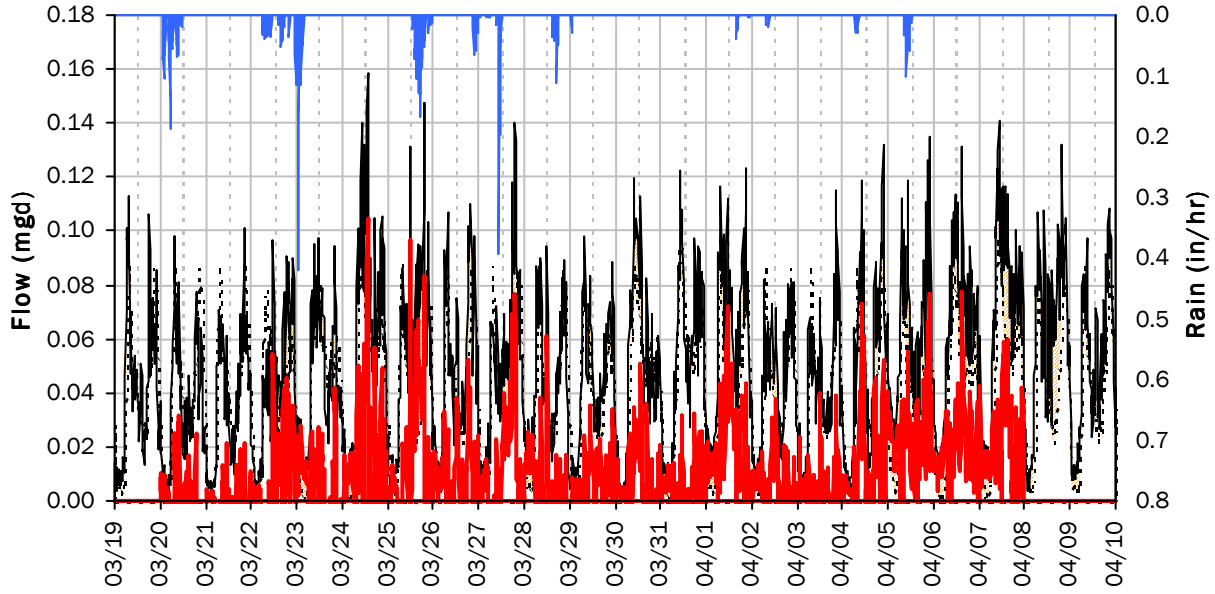
Capacity		Inflow / Infiltration	
Peak Flow:	0.19 *mgd*	**Peak I/I Rate:**	0.12 *mgd*
PF:	3.87	**Total I/I:**	233,000 *gallons*
Peak Level:	2.10 *in*		
d/D Ratio:	0.26		

SITE 6B
I/I Summary: Rain Event 5

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 5 Detail Graph



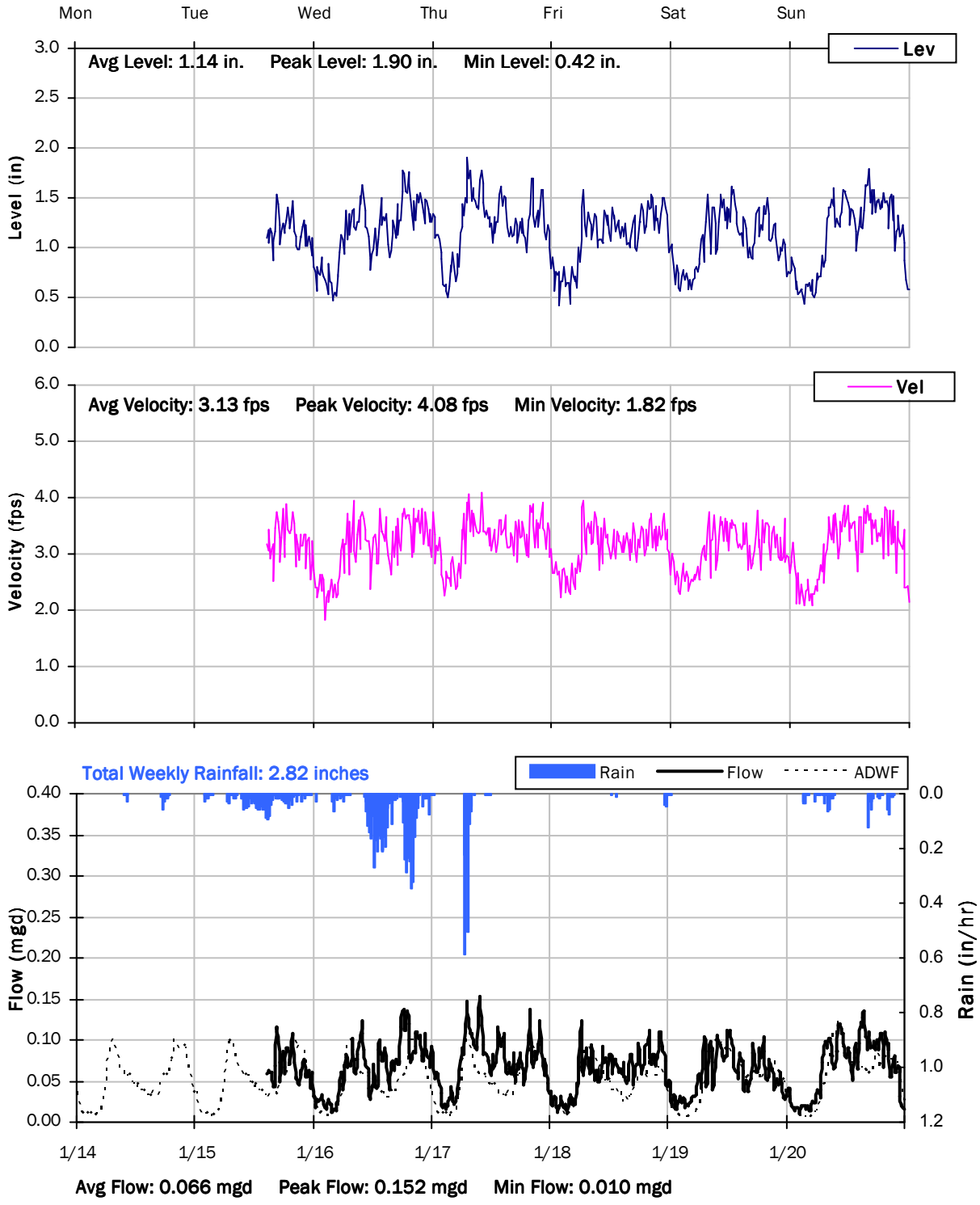
Storm Event I/I Analysis (Rain = 2.24 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.16 *mgd*	**Peak I/I Rate:**	0.10 *mgd*
PF:	3.16	**Total I/I:**	172,000 *gallons*
Peak Level:	1.84 *in*		
d/D Ratio:	0.23		

SITE 6B

Weekly Level, Velocity and Flow Hydrographs

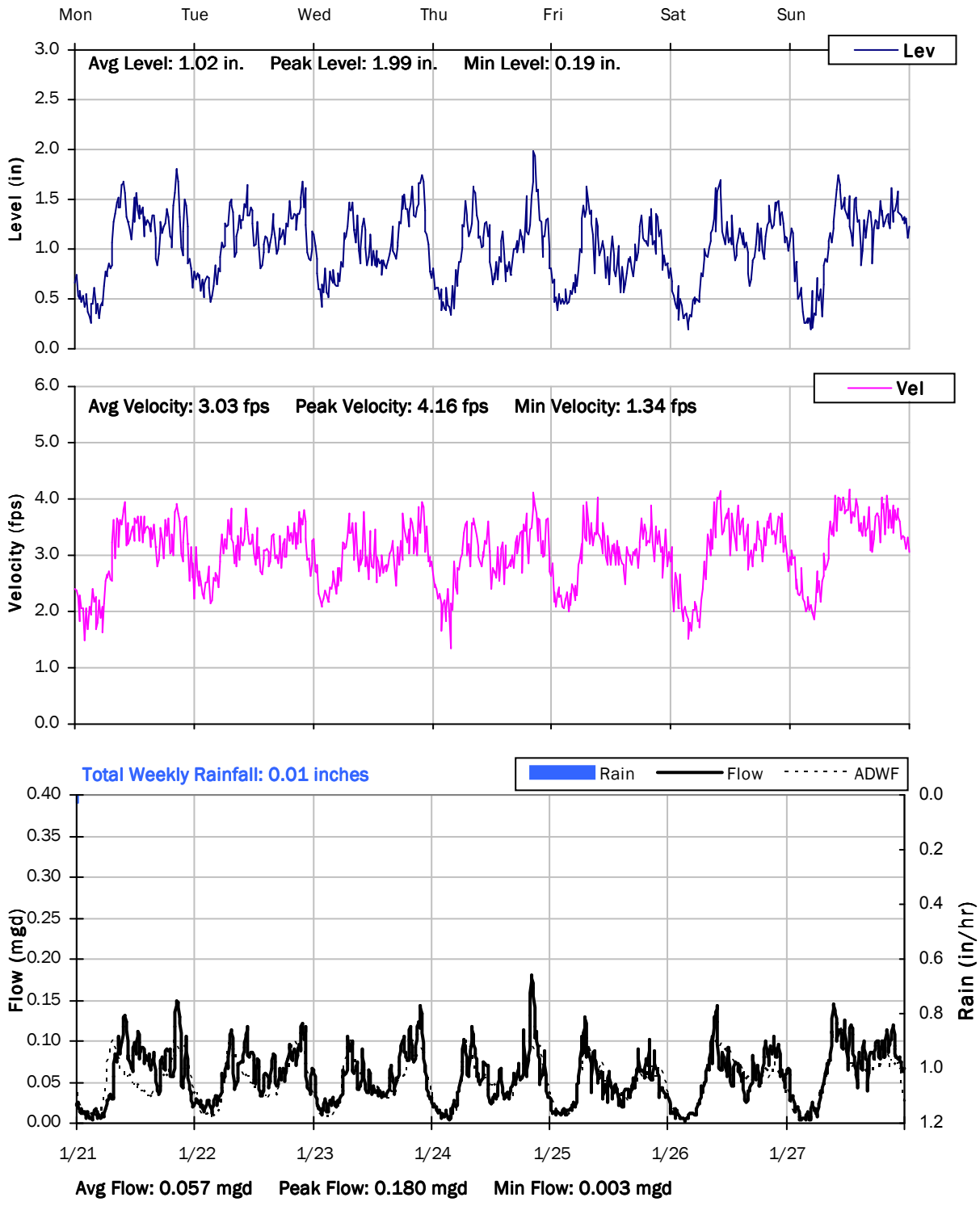
1/14/2019 to 1/21/2019



SITE 6B

Weekly Level, Velocity and Flow Hydrographs

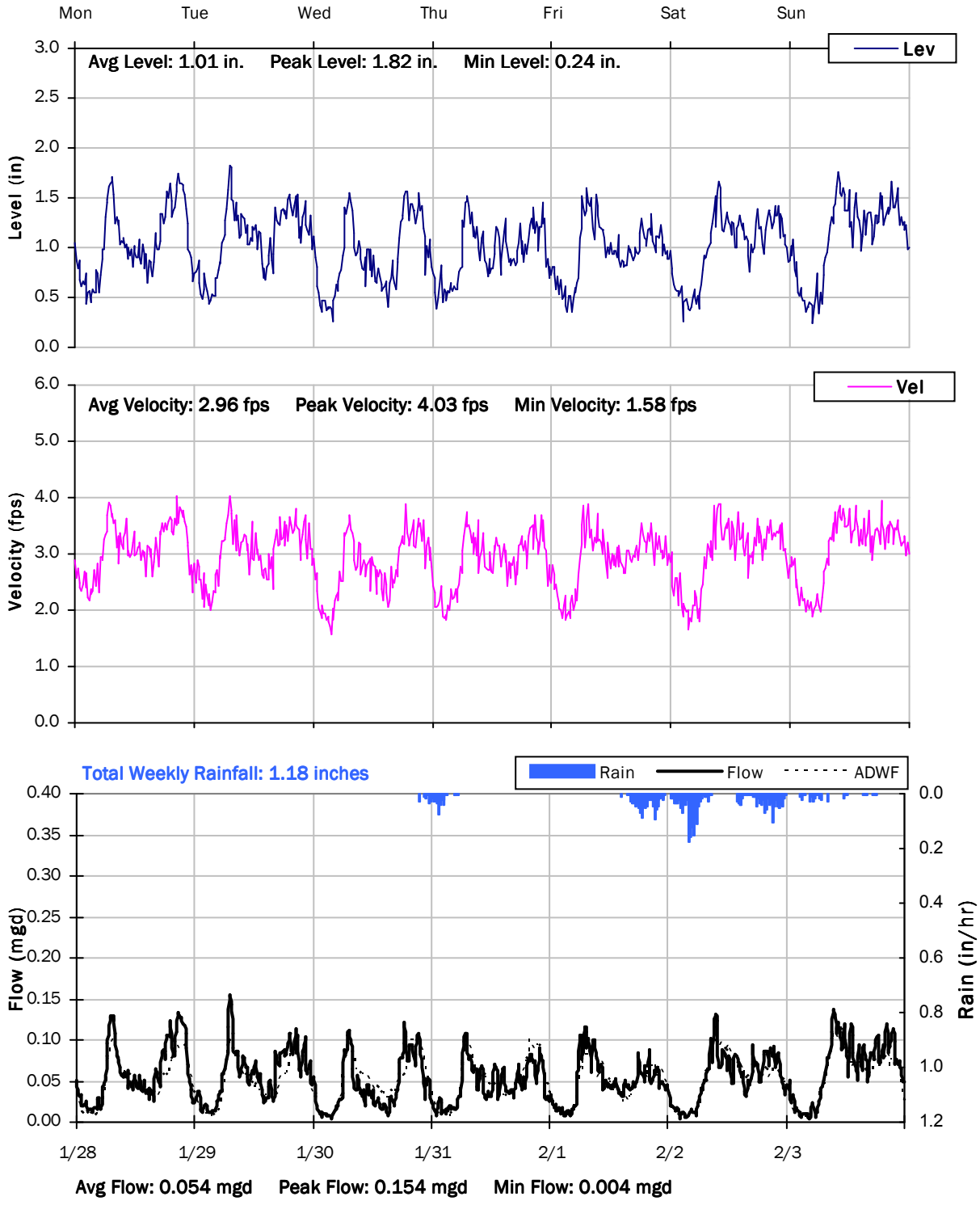
1/21/2019 to 1/28/2019



SITE 6B

Weekly Level, Velocity and Flow Hydrographs

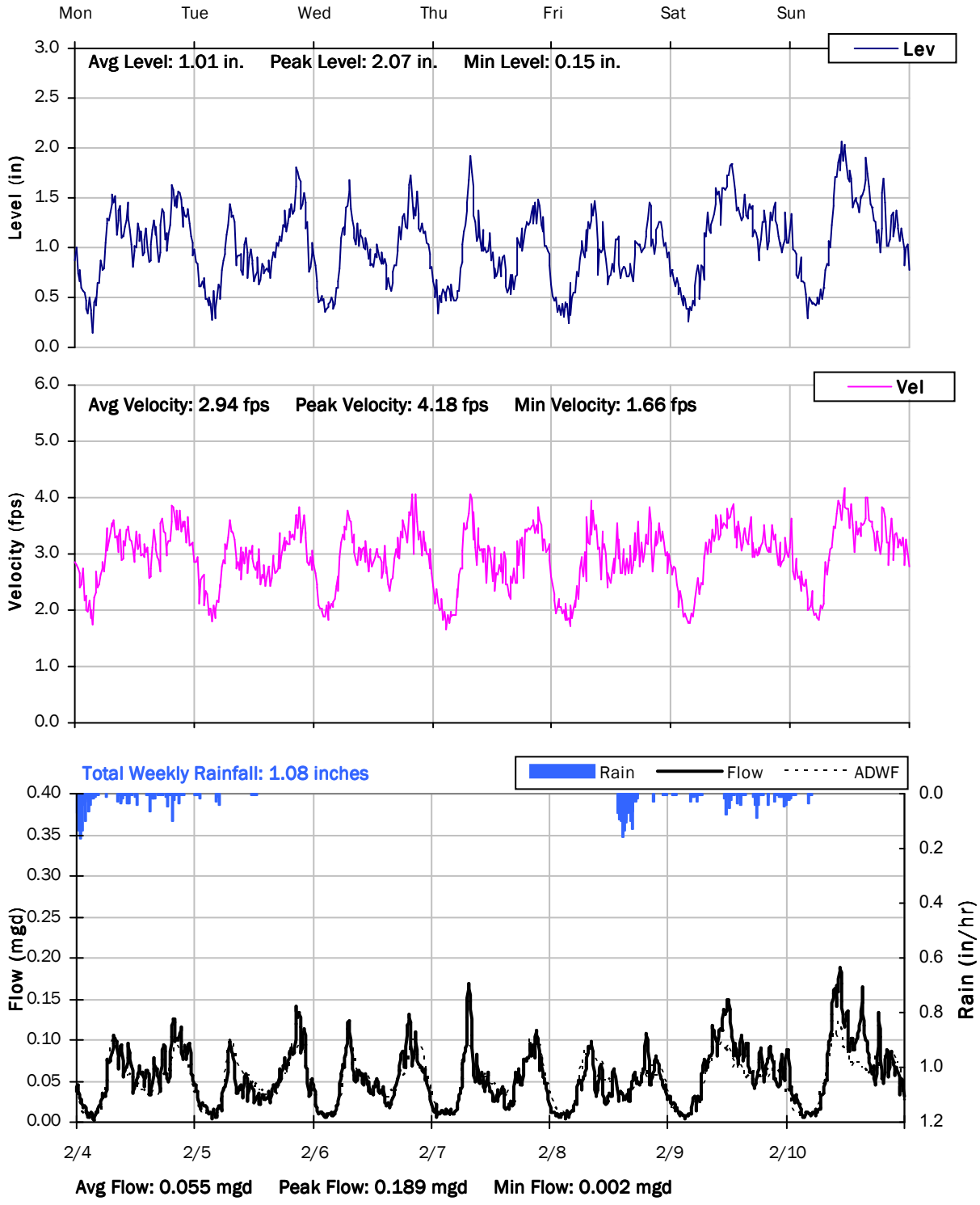
1/28/2019 to 2/4/2019



SITE 6B

Weekly Level, Velocity and Flow Hydrographs

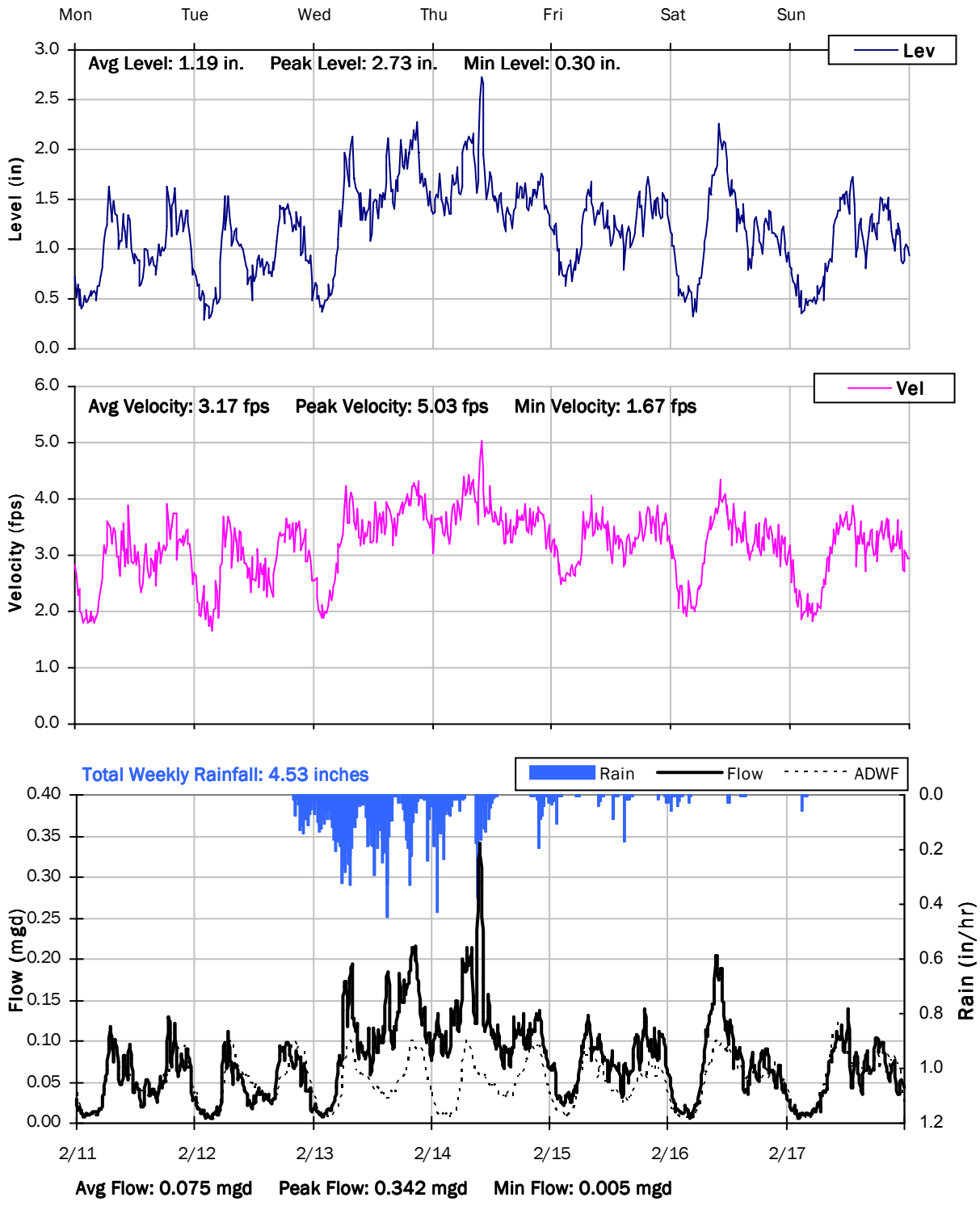
2/4/2019 to 2/11/2019



SITE 6B

Weekly Level, Velocity and Flow Hydrographs

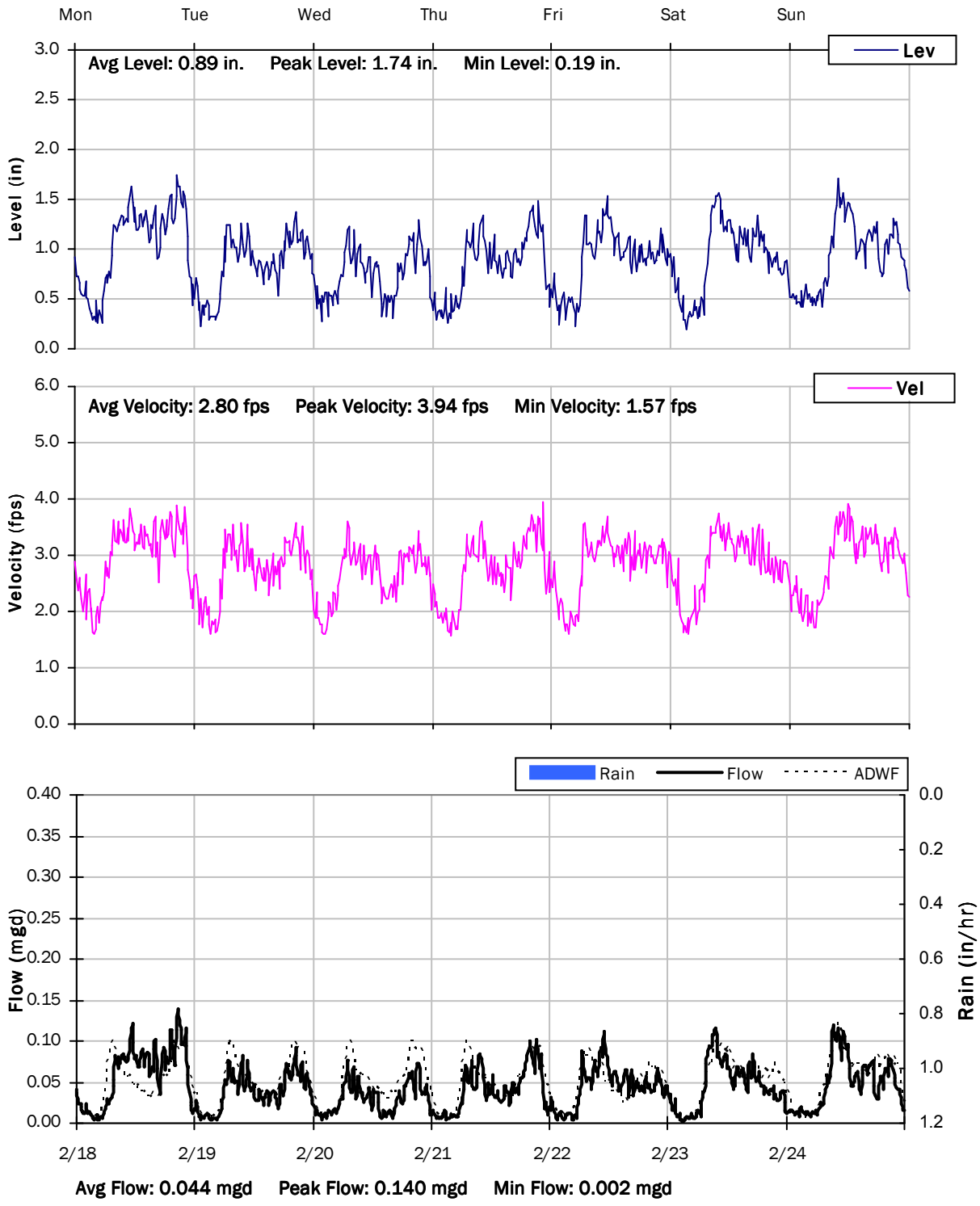
2/11/2019 to 2/18/2019



SITE 6B

Weekly Level, Velocity and Flow Hydrographs

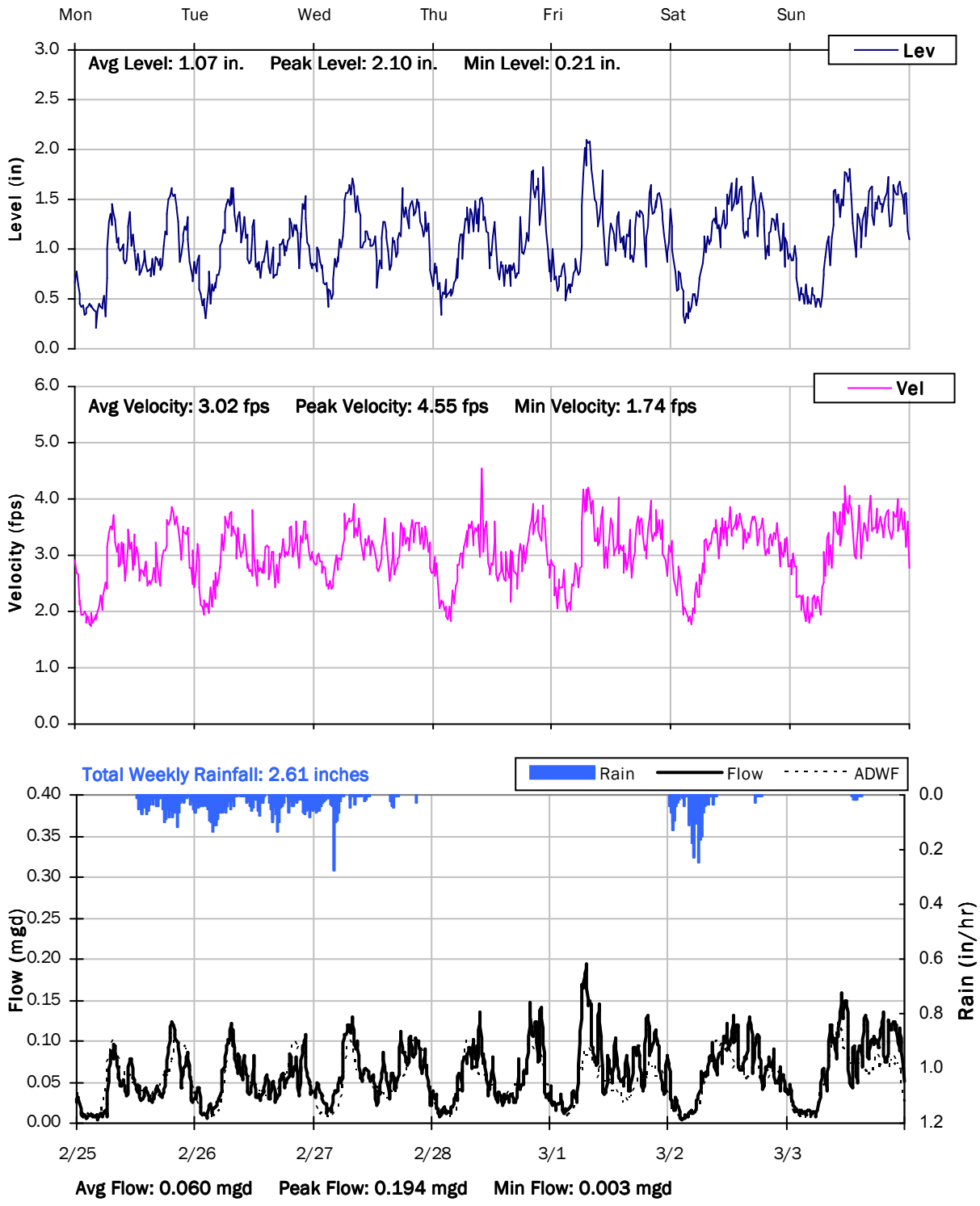
2/18/2019 to 2/25/2019



SITE 6B

Weekly Level, Velocity and Flow Hydrographs

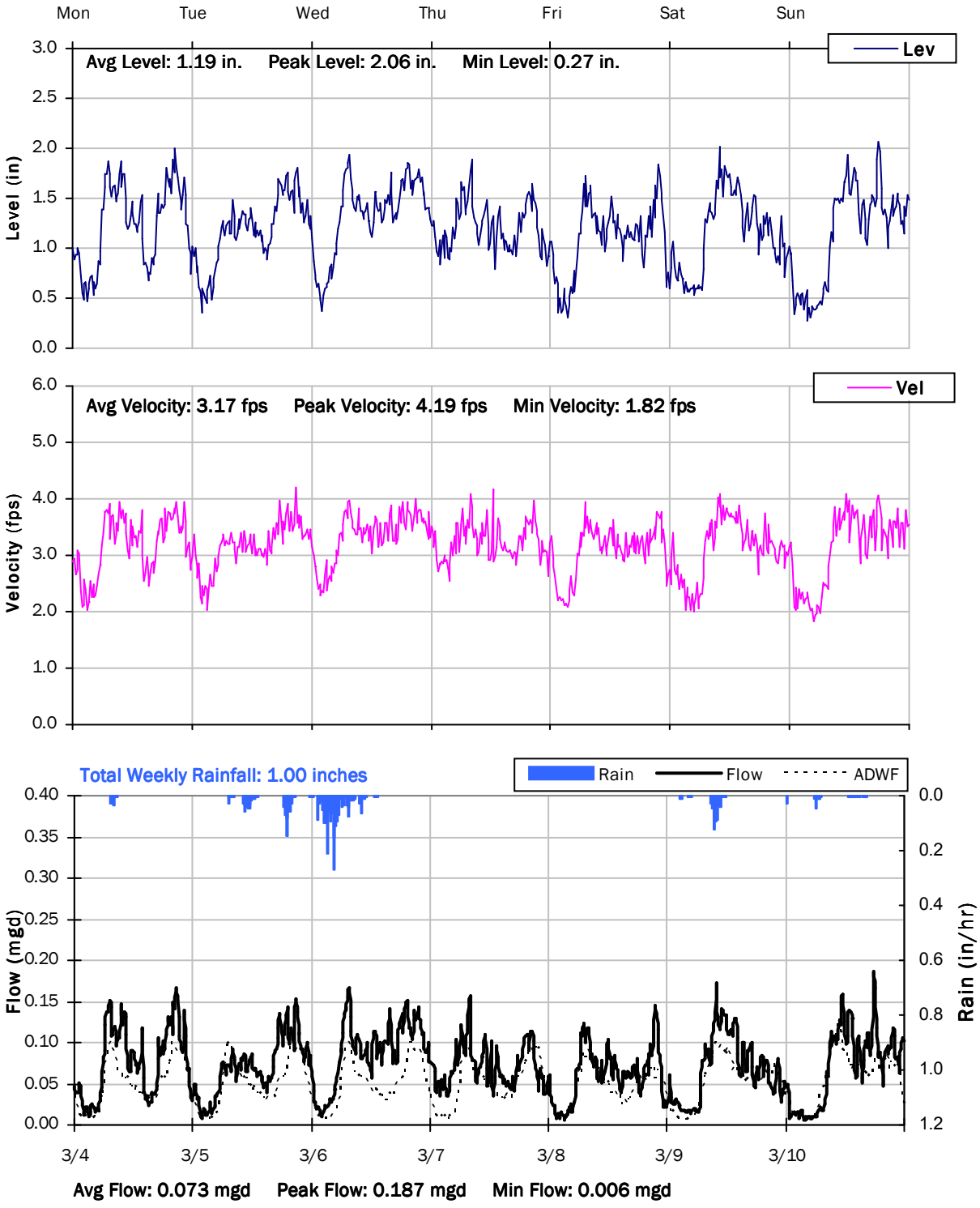
2/25/2019 to 3/4/2019



SITE 6B

Weekly Level, Velocity and Flow Hydrographs

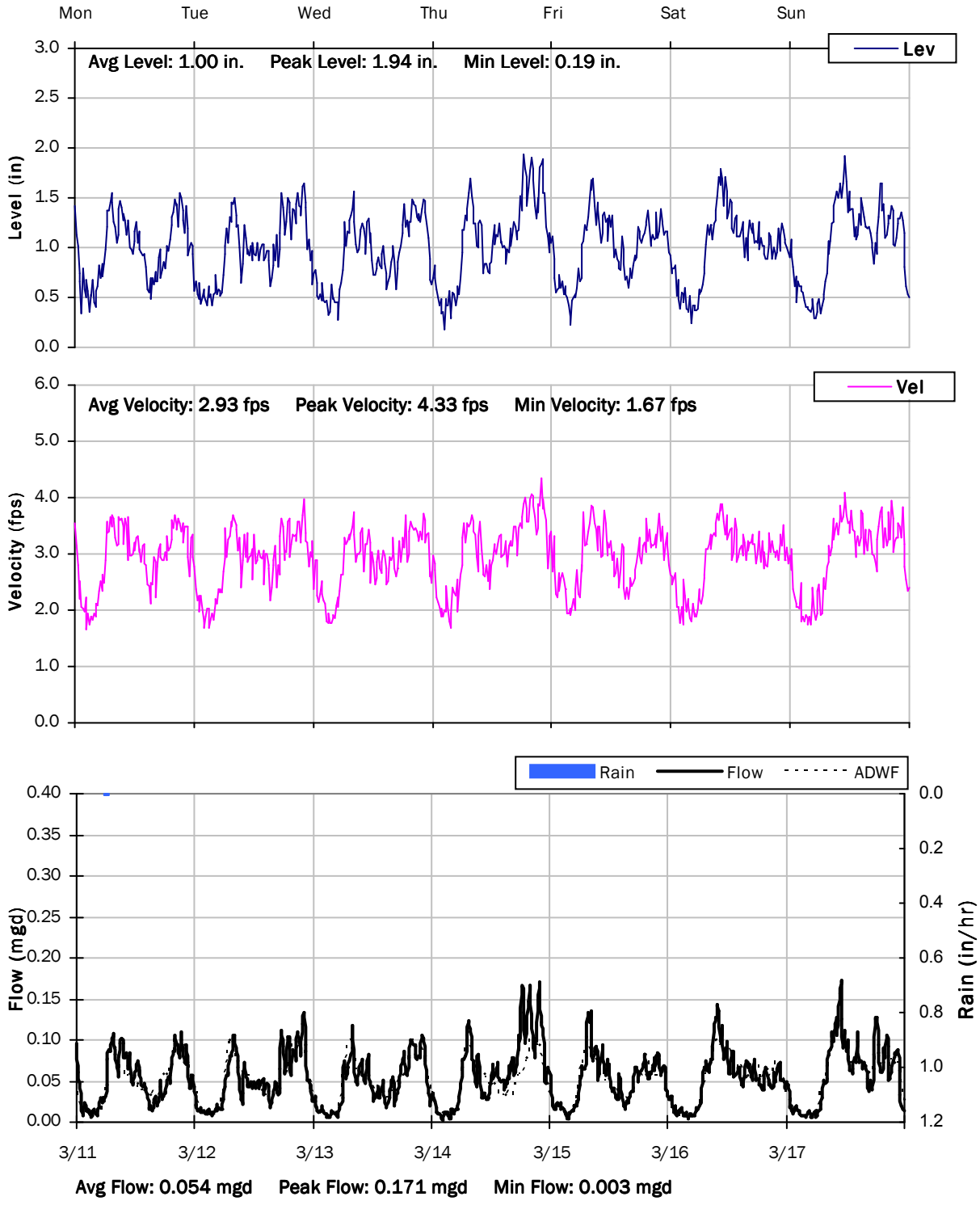
3/4/2019 to 3/11/2019



SITE 6B

Weekly Level, Velocity and Flow Hydrographs

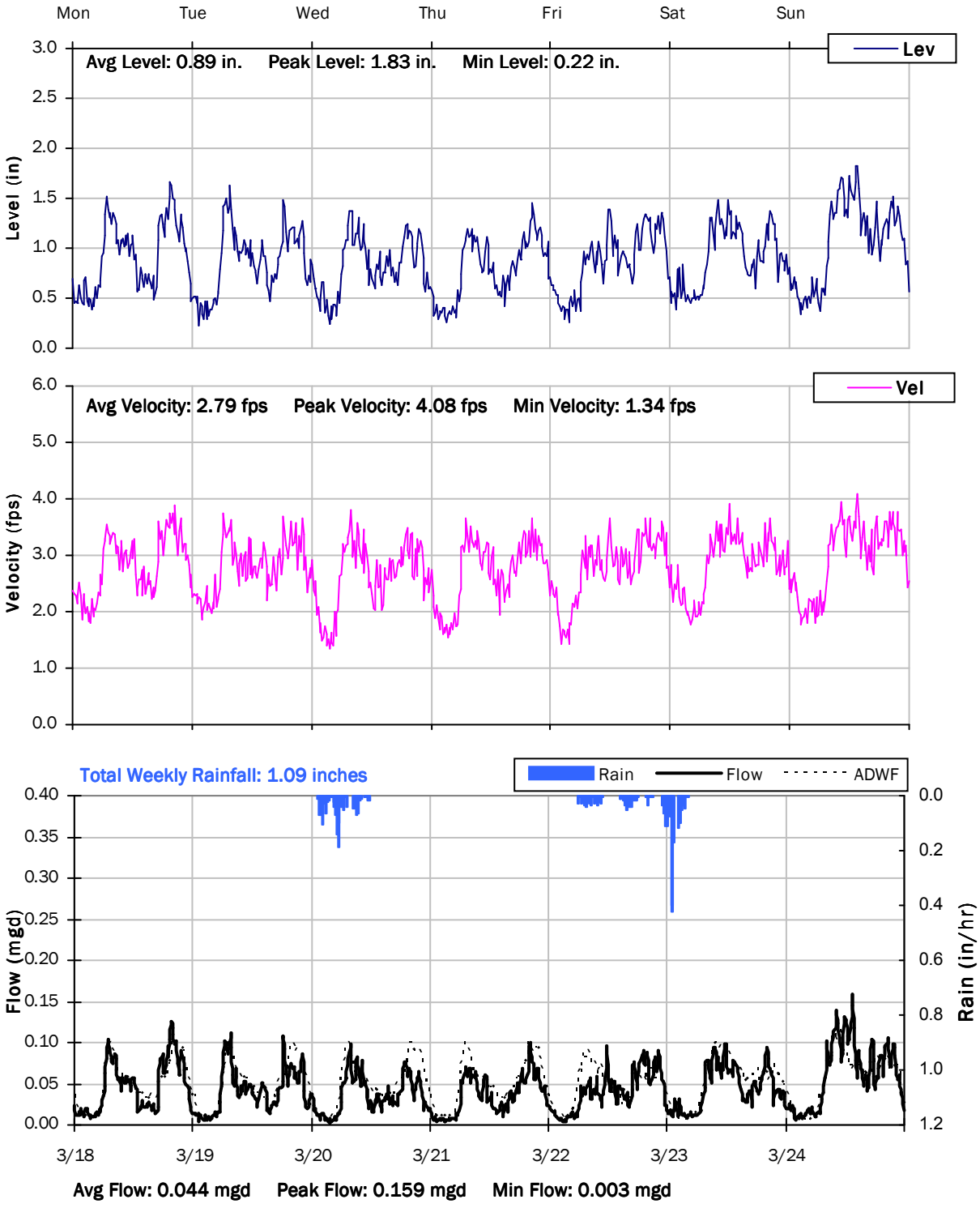
3/11/2019 to 3/18/2019



SITE 6B

Weekly Level, Velocity and Flow Hydrographs

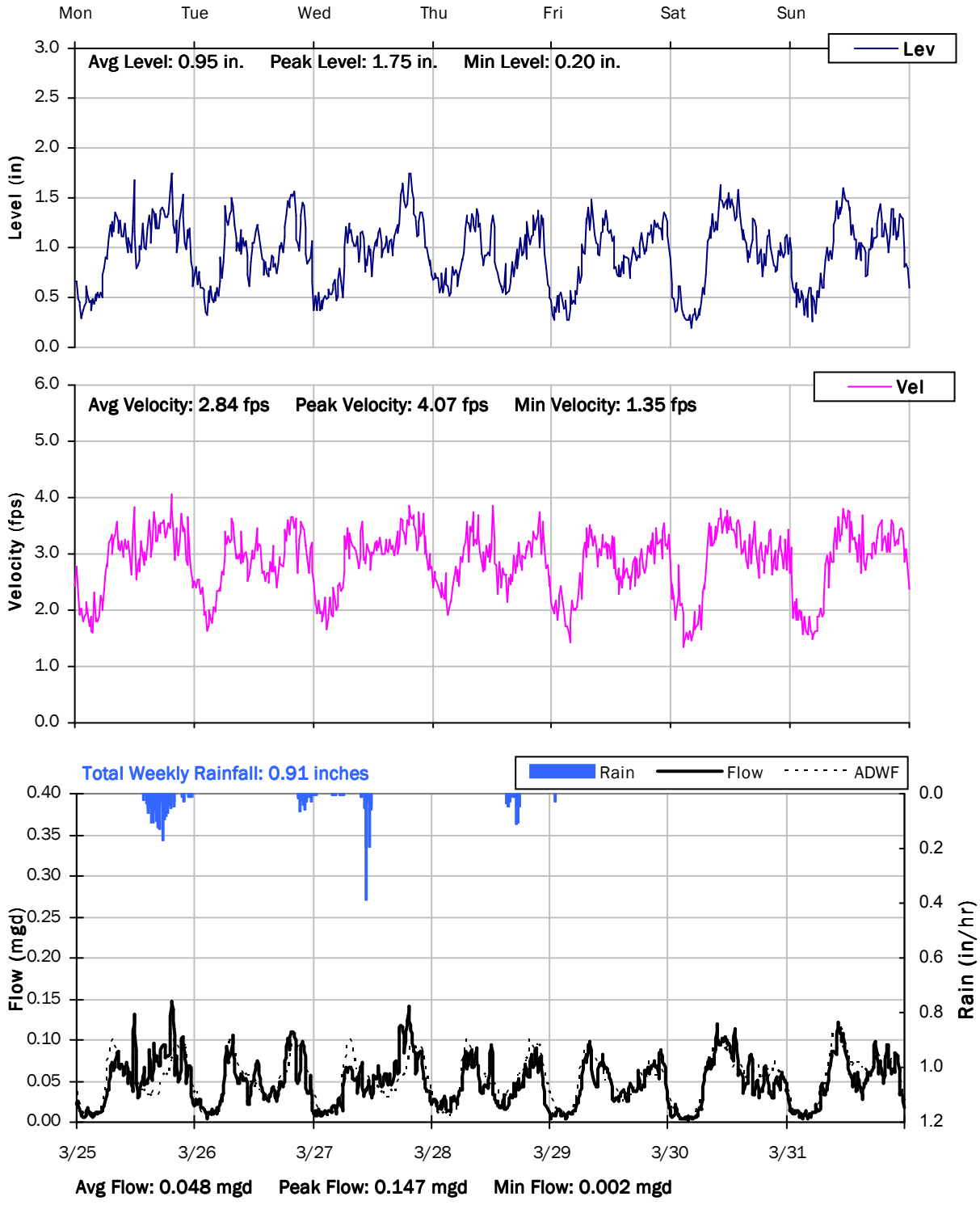
3/18/2019 to 3/25/2019



SITE 6B

Weekly Level, Velocity and Flow Hydrographs

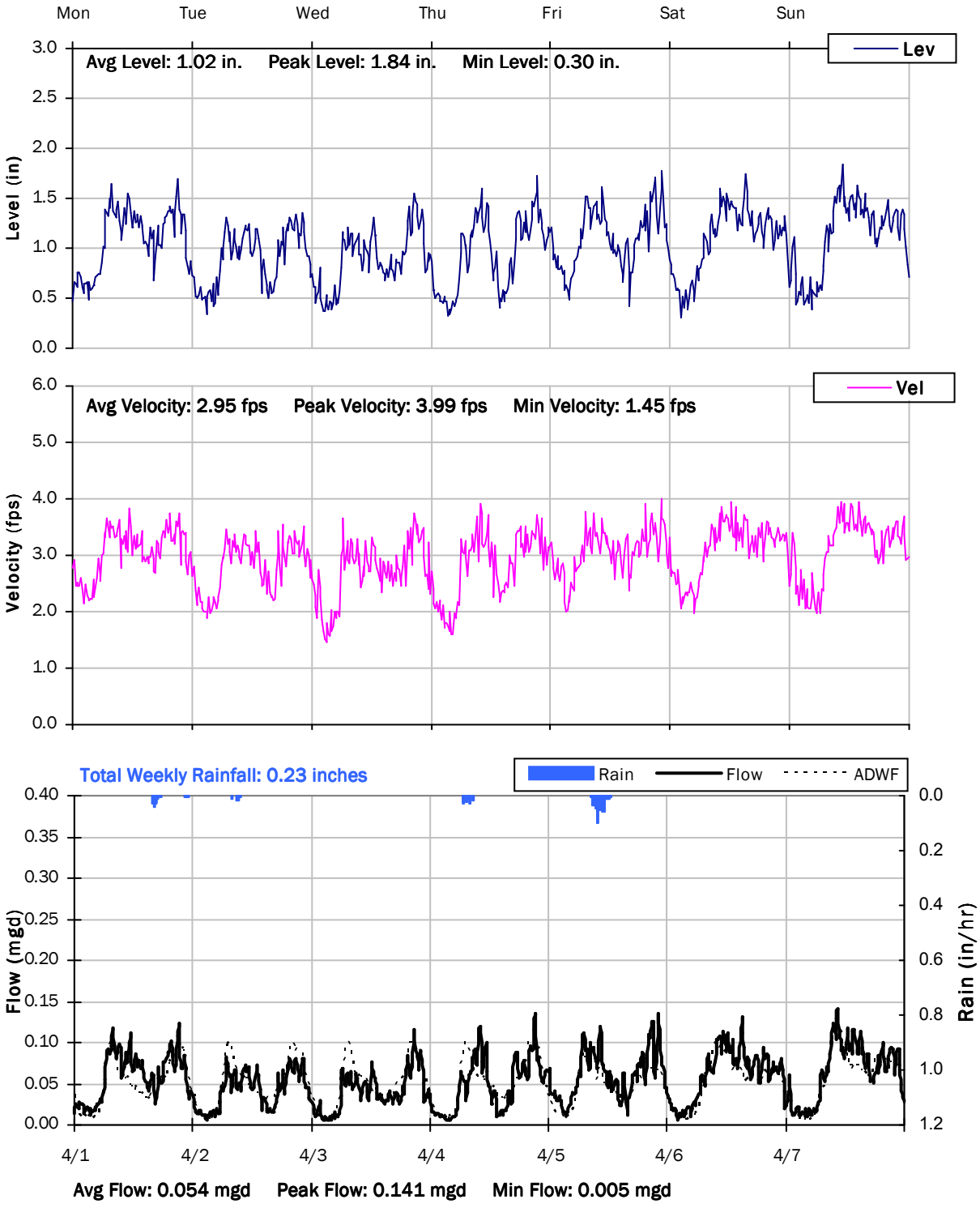
3/25/2019 to 4/1/2019



SITE 6B

Weekly Level, Velocity and Flow Hydrographs

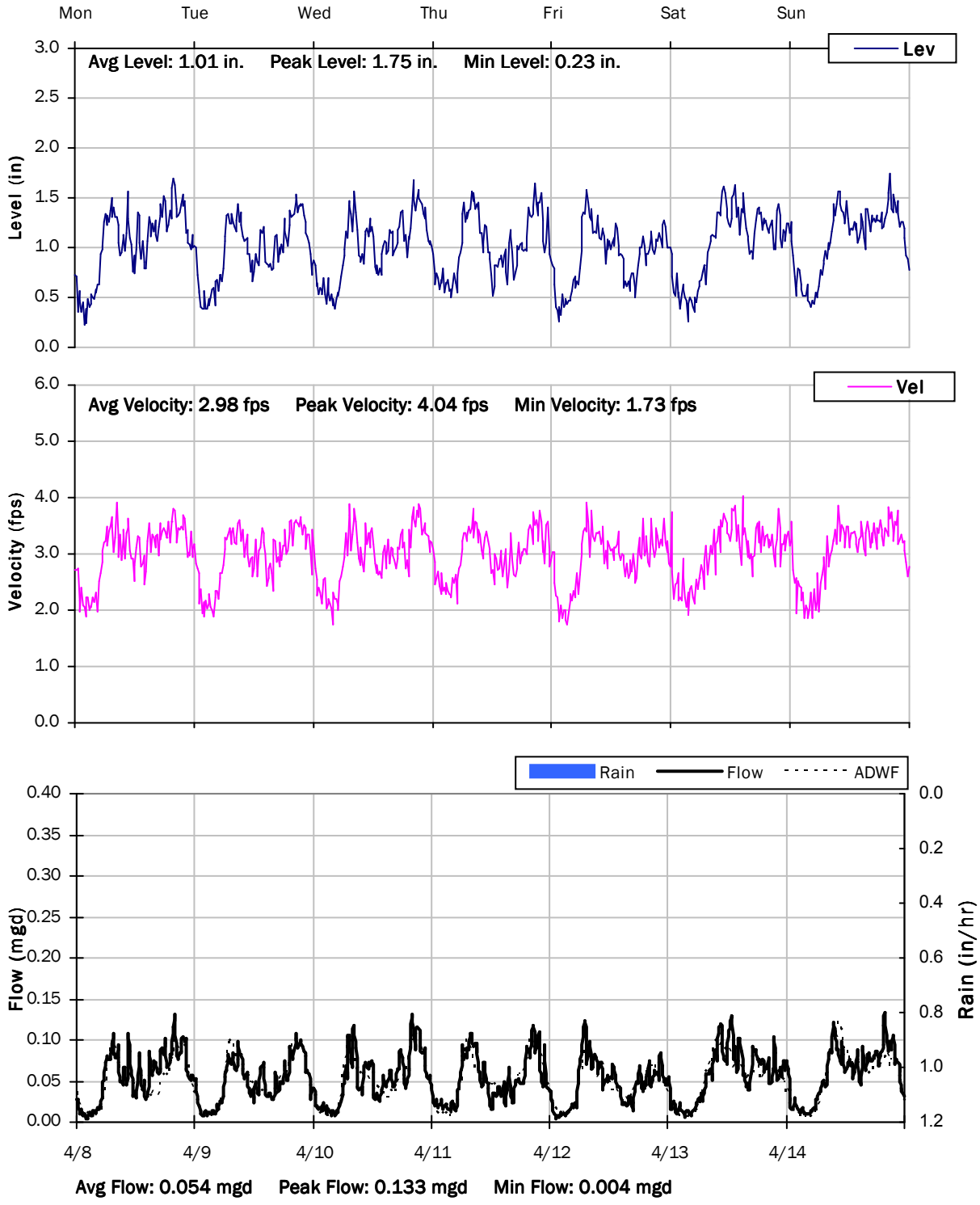
4/1/2019 to 4/8/2019



SITE 6B

Weekly Level, Velocity and Flow Hydrographs

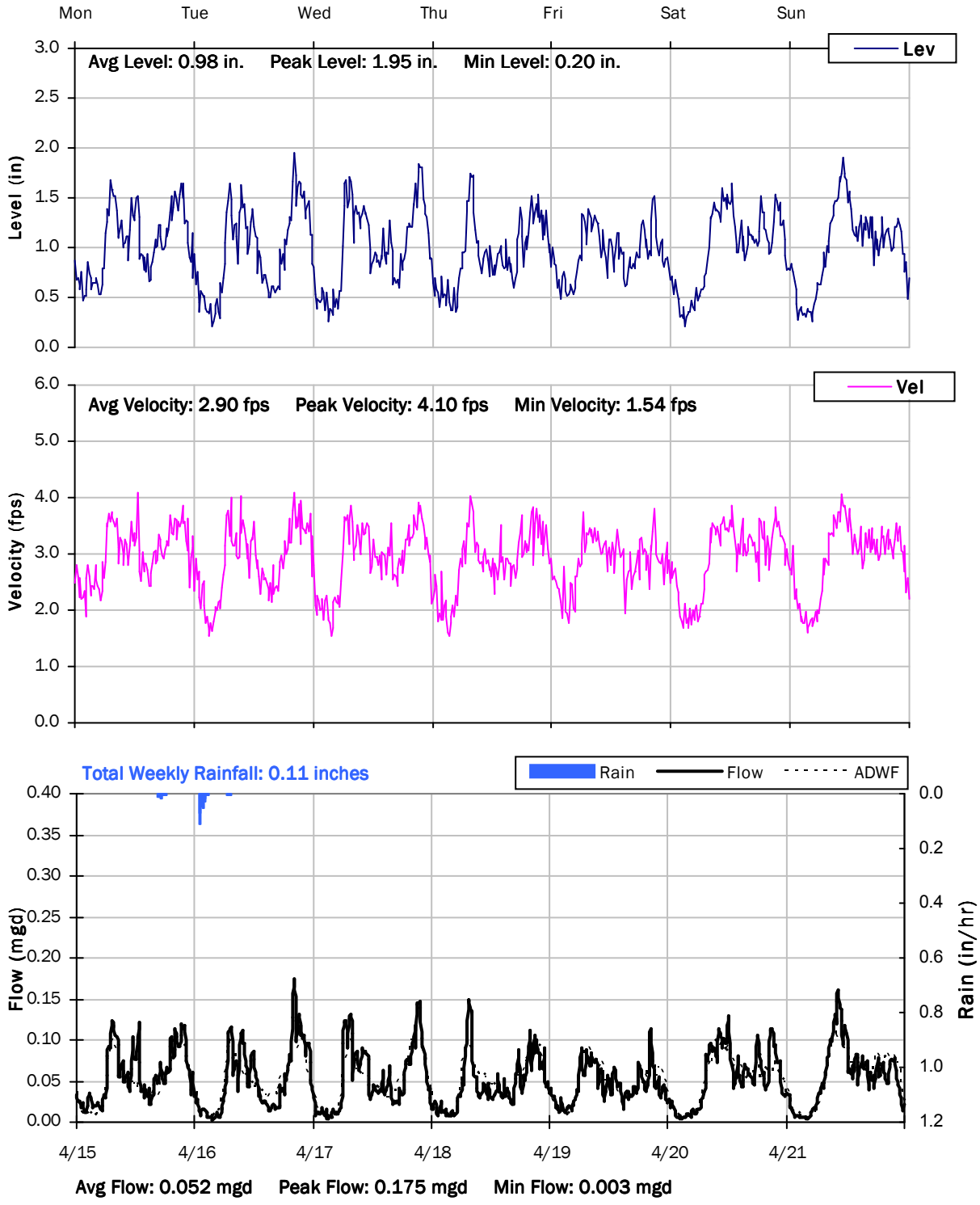
4/8/2019 to 4/15/2019



SITE 6B

Weekly Level, Velocity and Flow Hydrographs

4/15/2019 to 4/22/2019



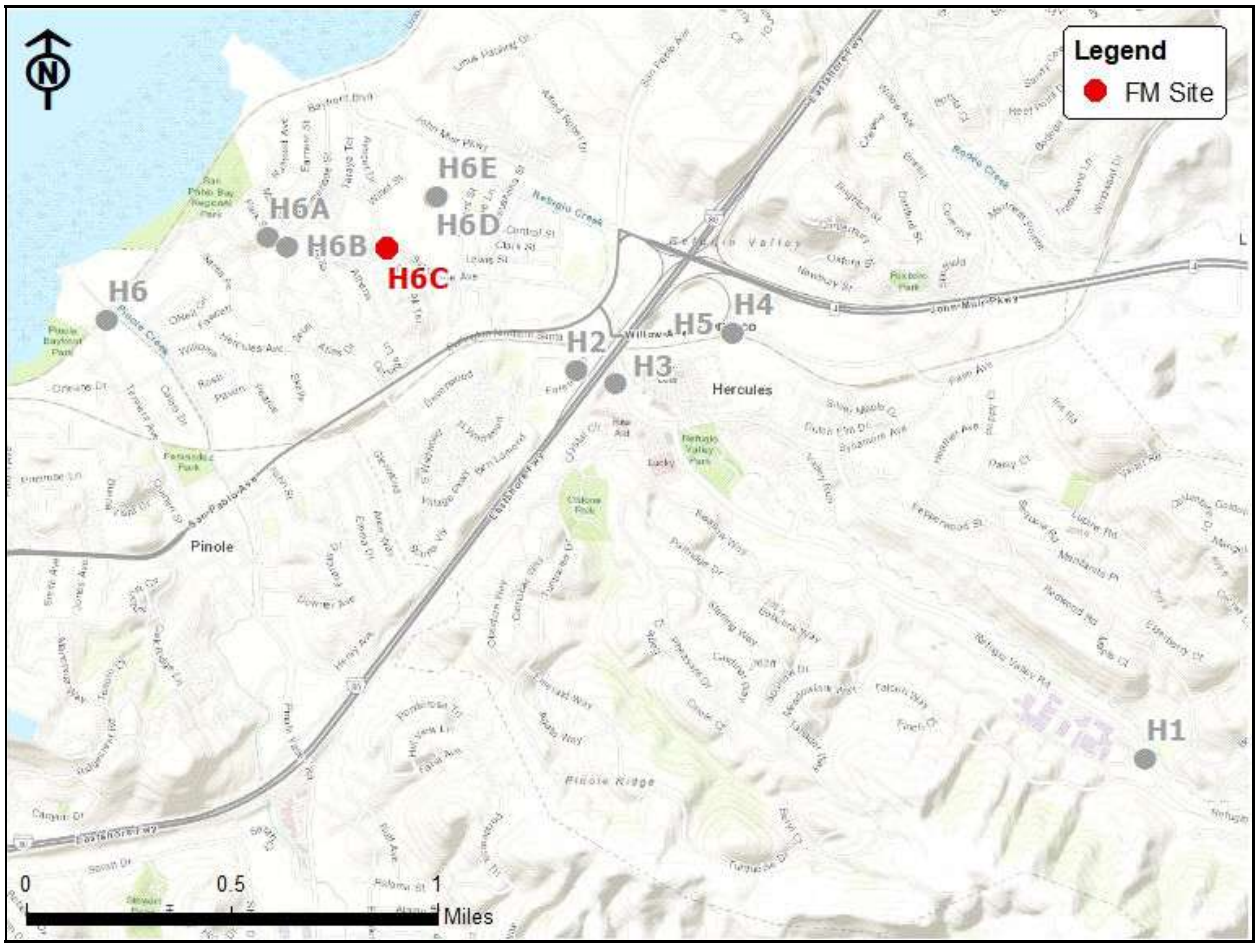
City of Hercules, California

Sanitary Sewer Flow Monitoring
January 14 - April 21, 2019

Monitoring Site: Site 6C

Location: Duck Pond Park, 997 Sycamore Ave

Data Summary Report



Vicinity Map: Site 6C

SITE 6C

Site Information

Location: Duck Pond Park, 997 Sycamore Ave

Coordinates: 122.2828° W, 38.0152° N

Rim Elevation (Earth): 31 feet

Measured Pipe Diameter: 24 inches

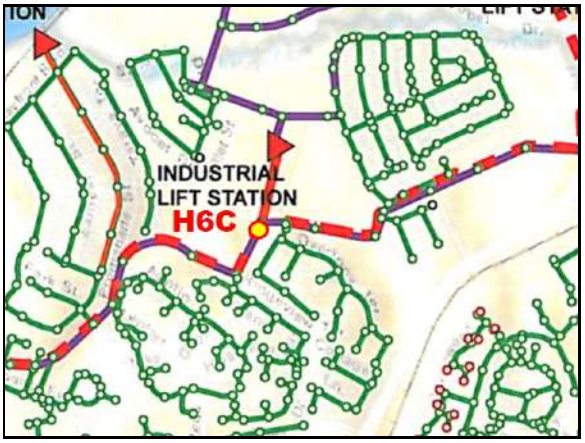
ADWF: 1.437 mgd

Peak Measured Flow: 4.519 mgd

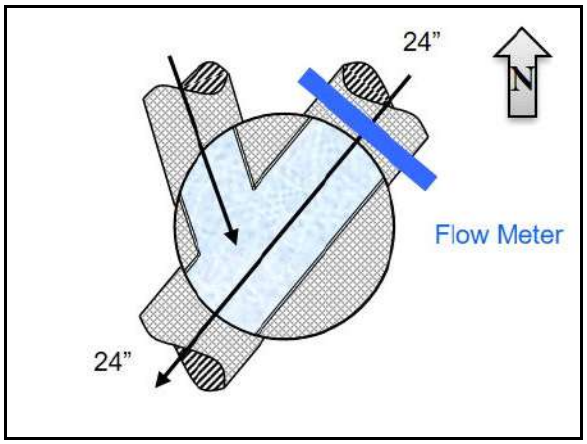
Sediment: 0.5 inches



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

SITE 6C

Additional Site Photos

Effluent Pipe



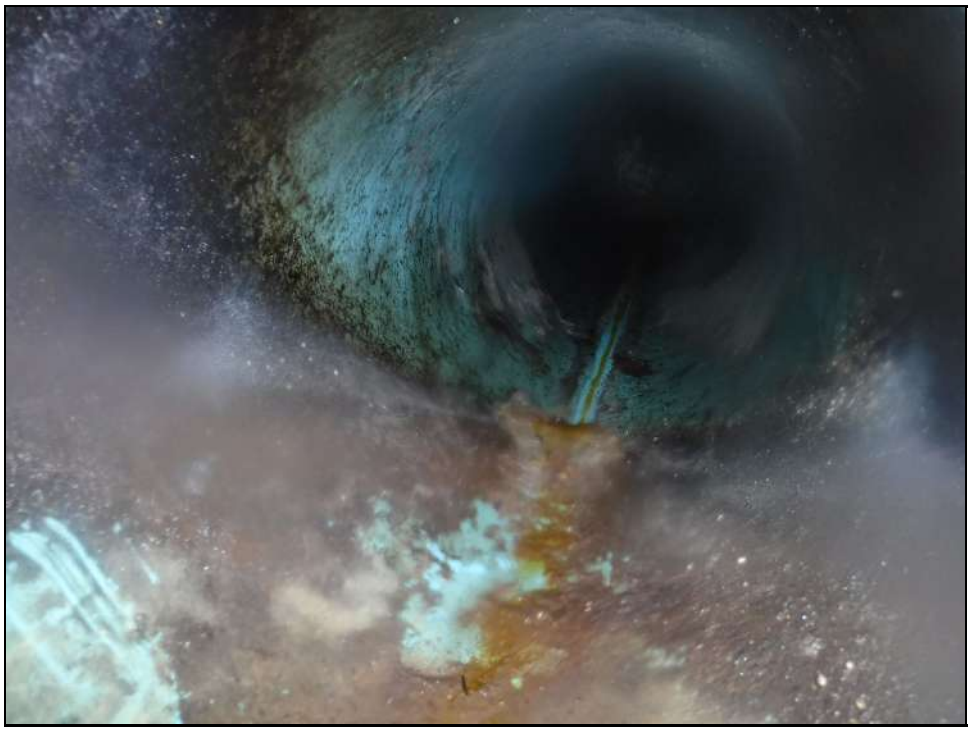
Monitored Northeast Influent Pipe



SITE 6C

Additional Site Photos

Northwest Influent Pipe

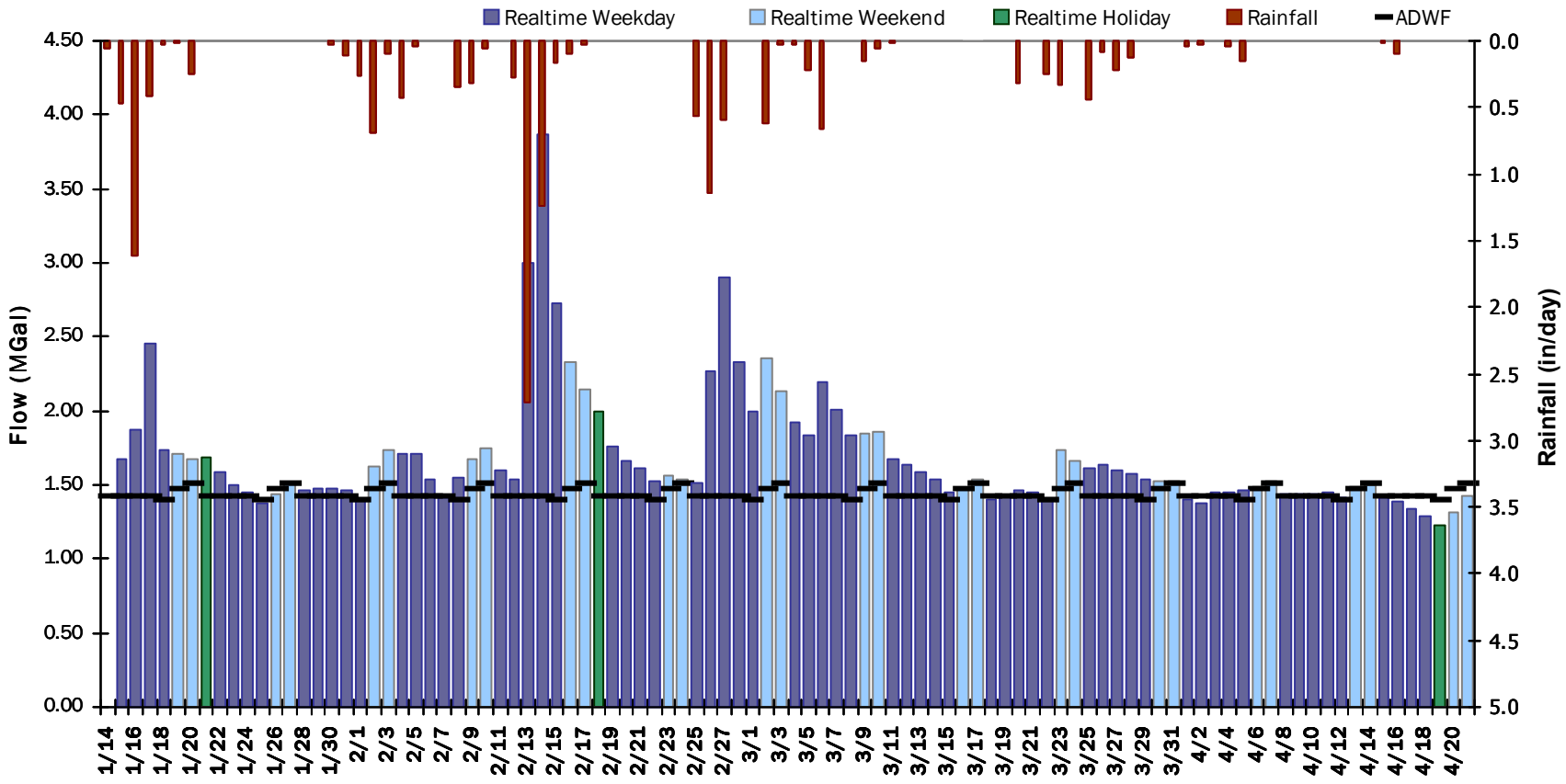


SITE 6C

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 1.687 MGal Peak Daily Flow: 3.867 MGal Min Daily Flow: 1.230 MGal

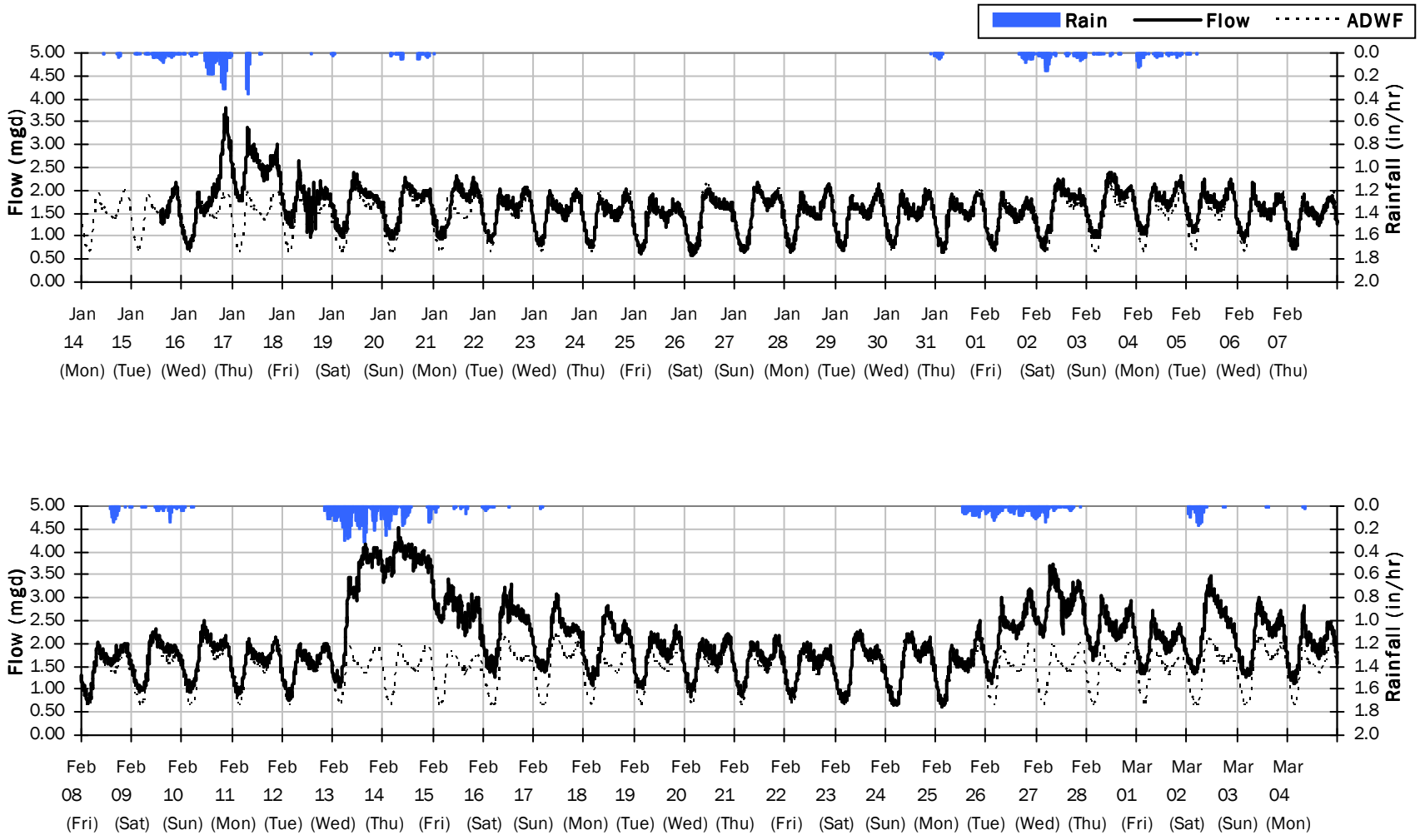
Total Rainfall: 15.72 inches



SITE 6C

Flow Summary: 1/14/2019 to 3/4/2019

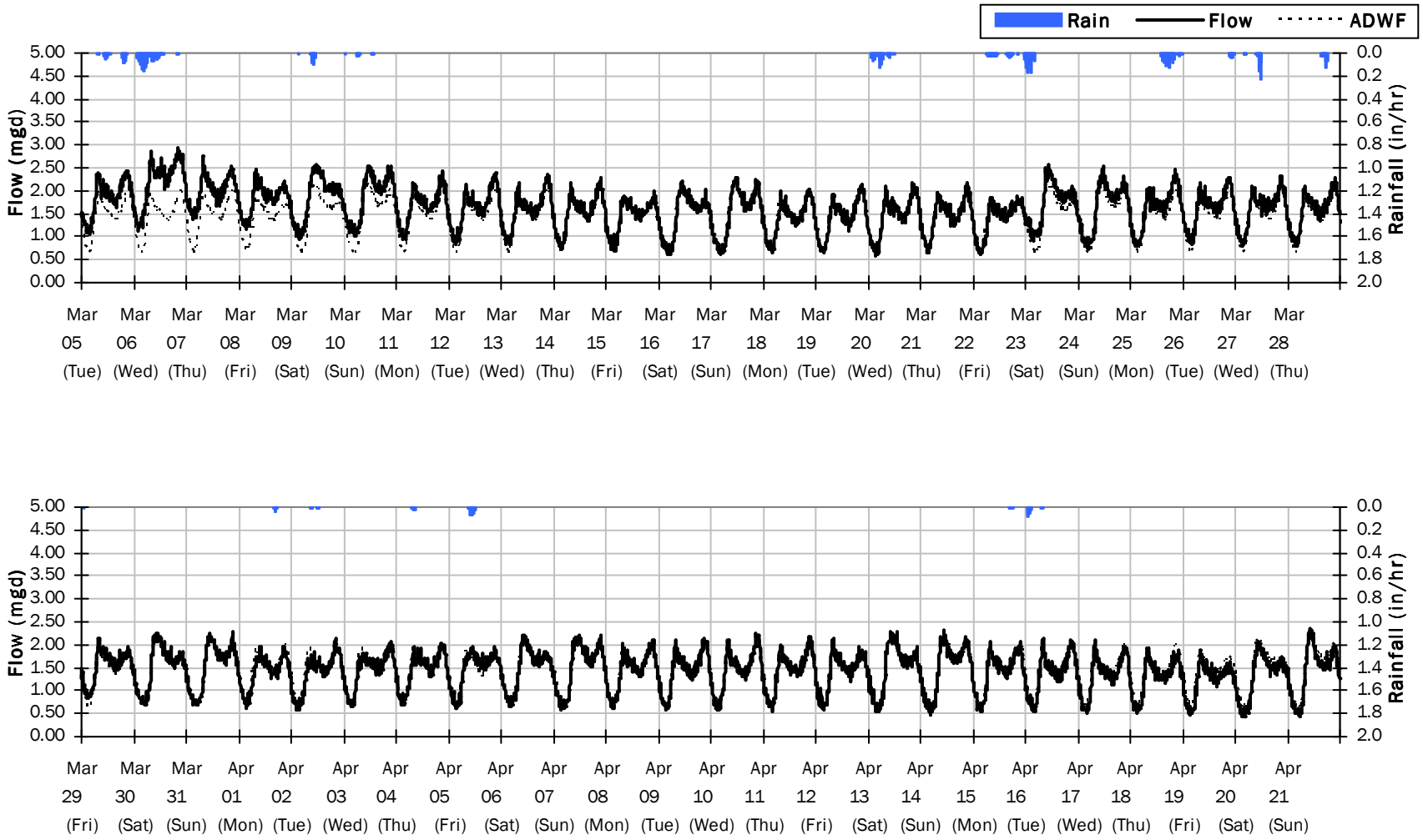
Period Rainfall: 12.70 inches Period Avg Flow: 1.837 mgd Period Peak Flow: 4.519 mgd Period Min Flow: 0.597 mgd



SITE 6C

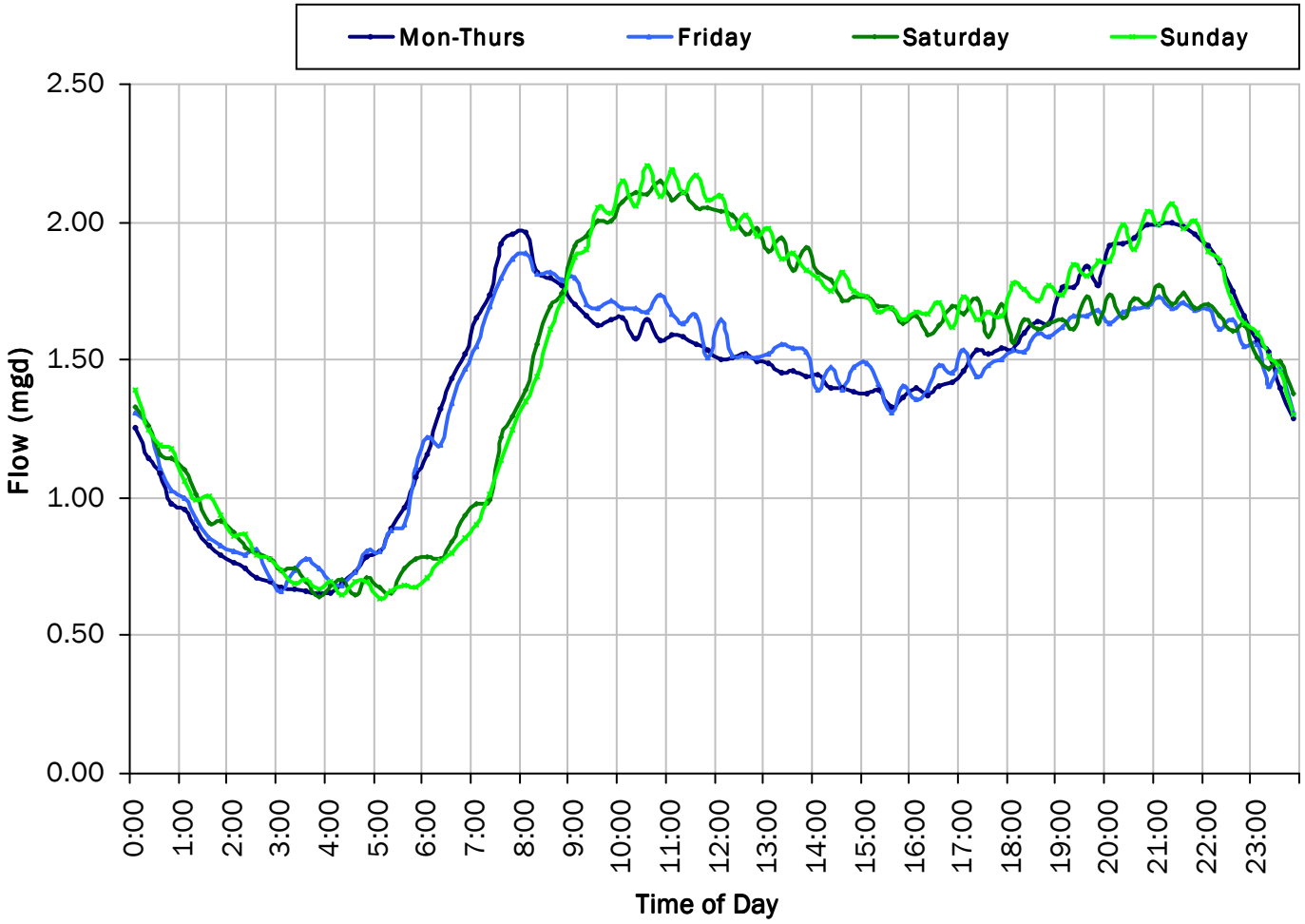
Flow Summary: 3/5/2019 to 4/21/2019

Period Rainfall: 3.28 inches Period Avg Flow: 1.537 mgd Period Peak Flow: 2.919 mgd Period Min Flow: 0.429 mgd



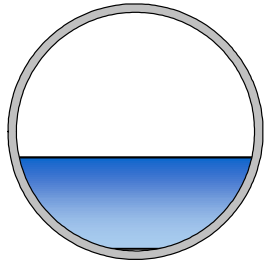
SITE 6C

Average Dry Weather Flow Hydrographs



ADWF:

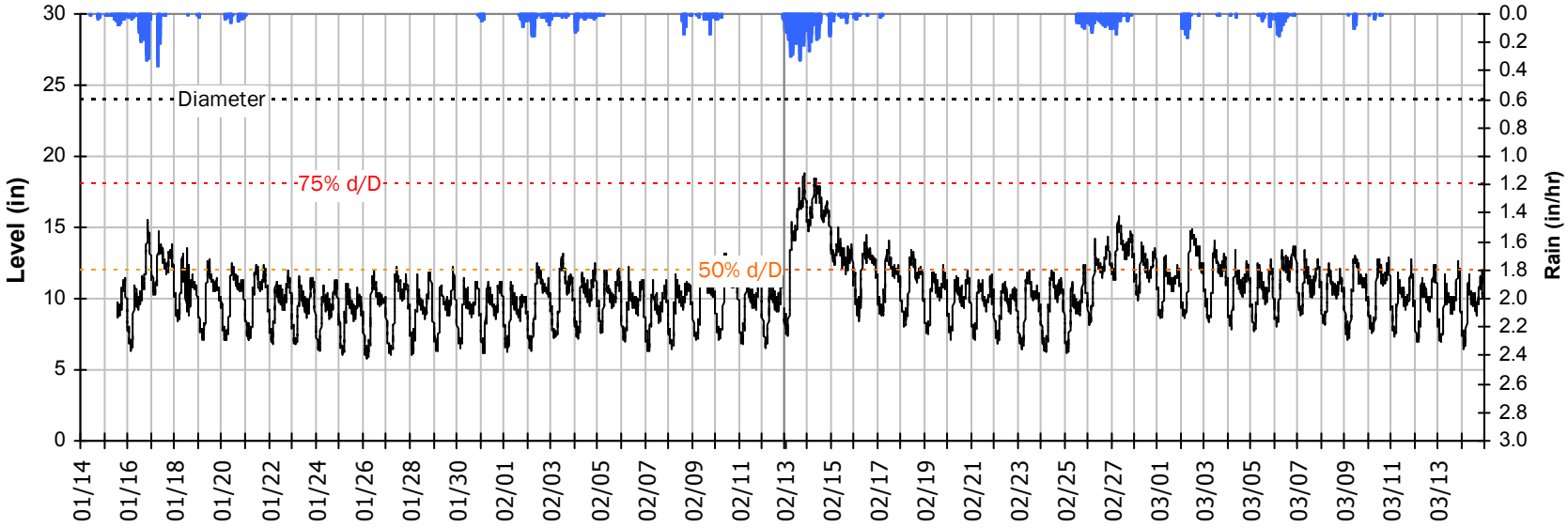
1.437 *mgd*

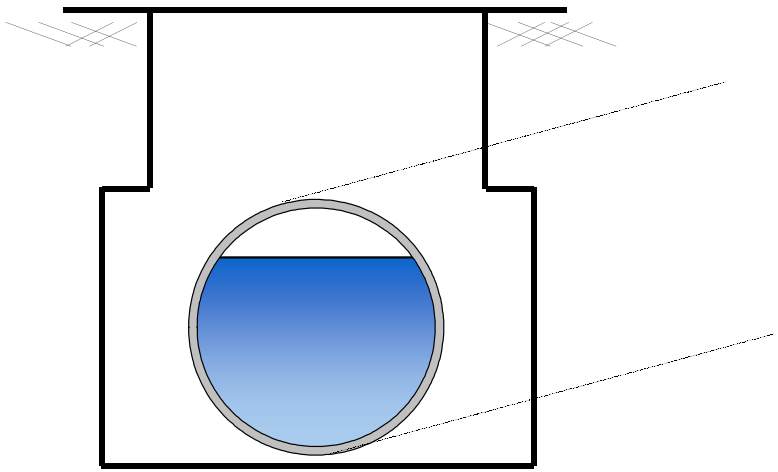


SITE 6C

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period

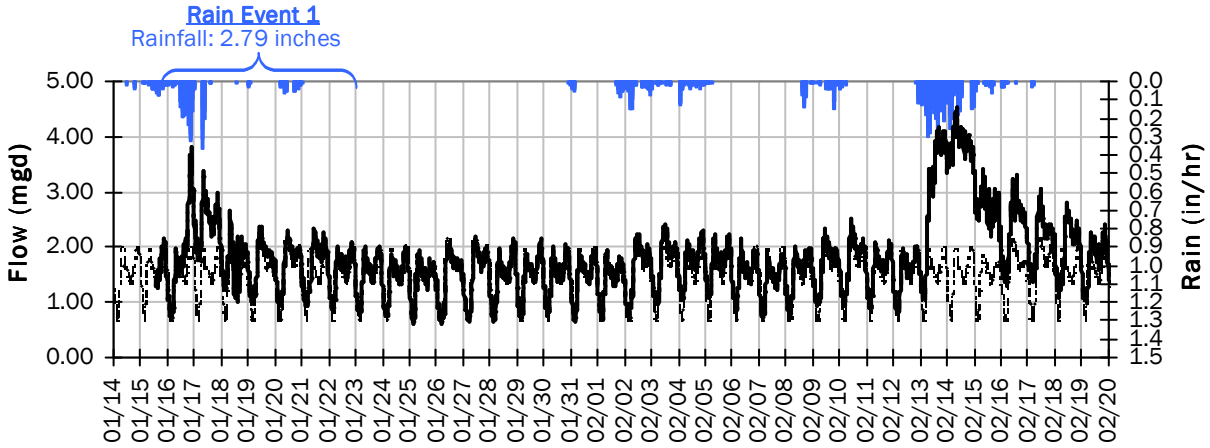




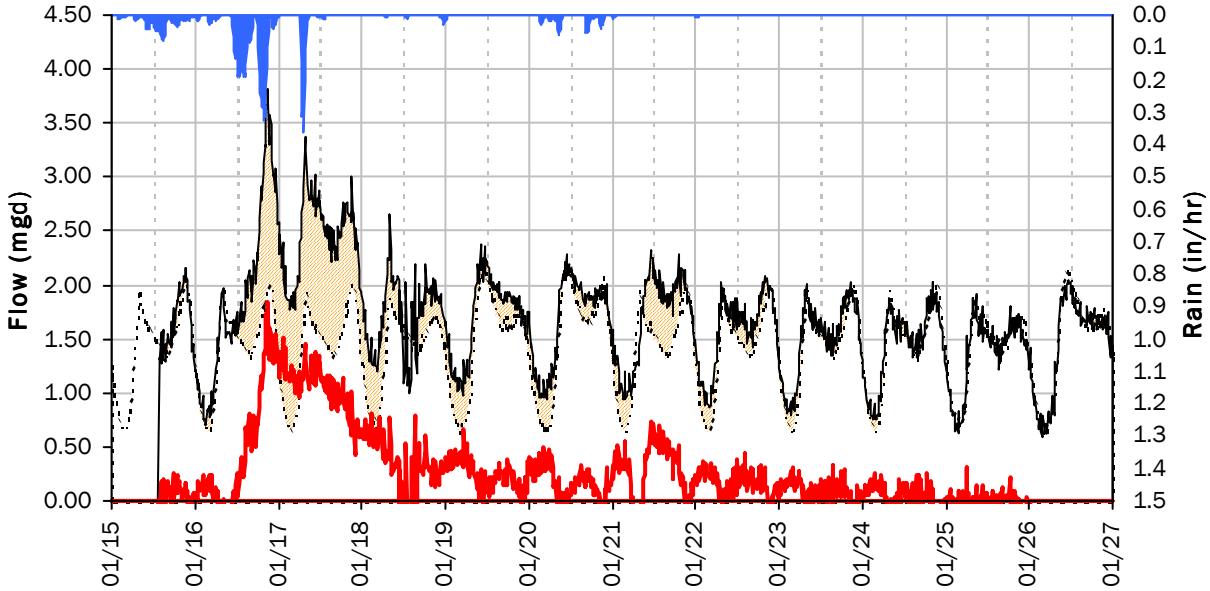
Pipe Diameter:	24	*inches*
Peak Measured Level:	18.8	*inches*
Peak d/D Ratio:	0.78	

SITE 6C
I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph

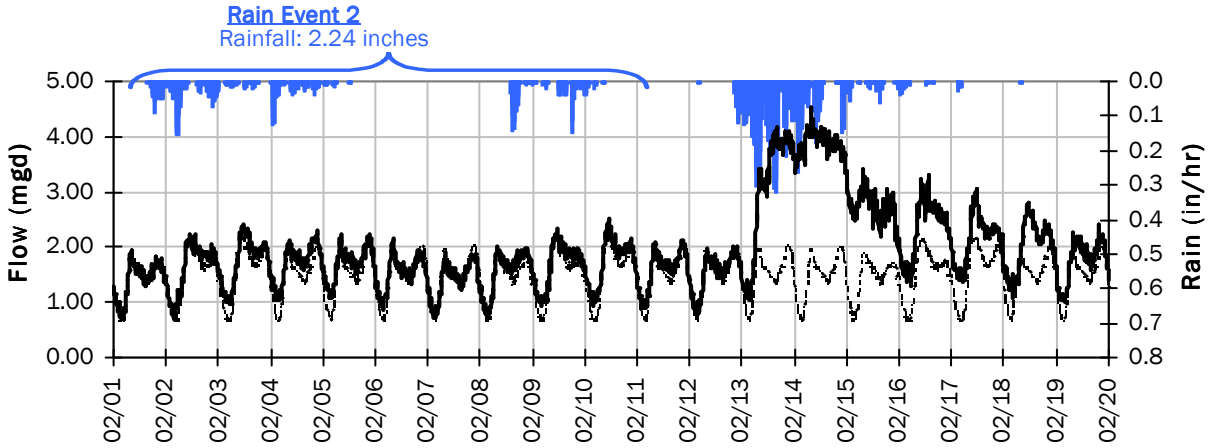


Storm Event I/I Analysis (Rain = 2.79 inches)

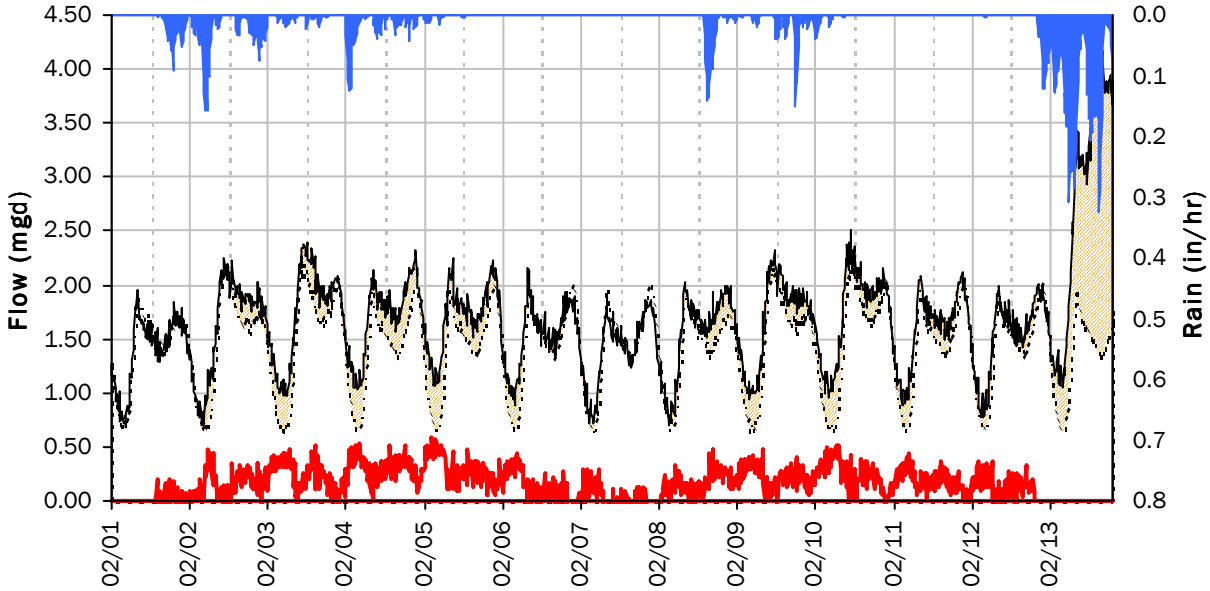
Capacity		Inflow / Infiltration	
Peak Flow:	3.820 *mgd*	**Peak I/I Rate:**	1.840 *mgd*
PF:	2.66	**Total I/I:**	2,875,000 *gallons*
Peak Level:	15.51 *in*		
d/D Ratio:	0.65		

SITE 6C
I/I Summary: Rain Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 2 Detail Graph

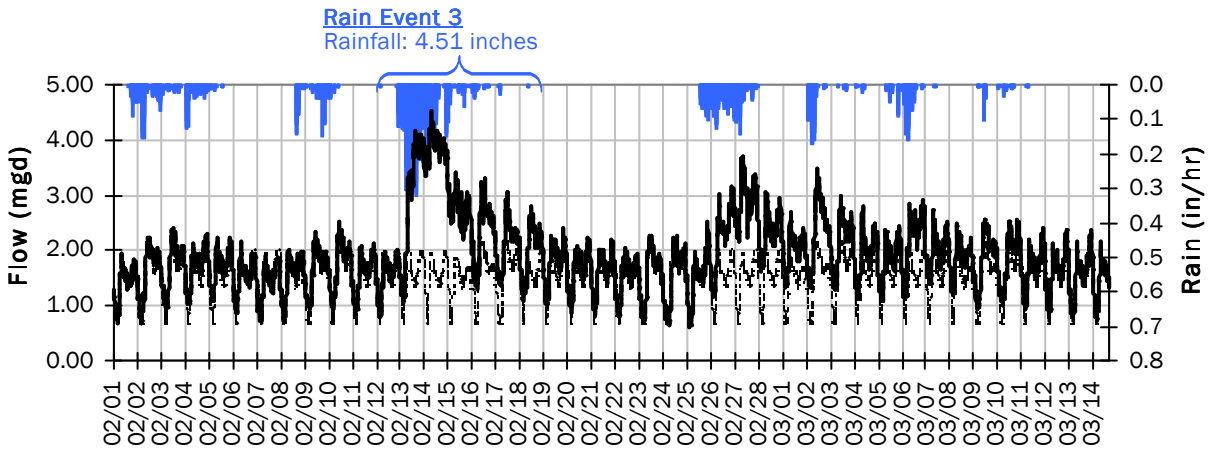


Storm Event I/I Analysis (Rain = 2.24 inches)

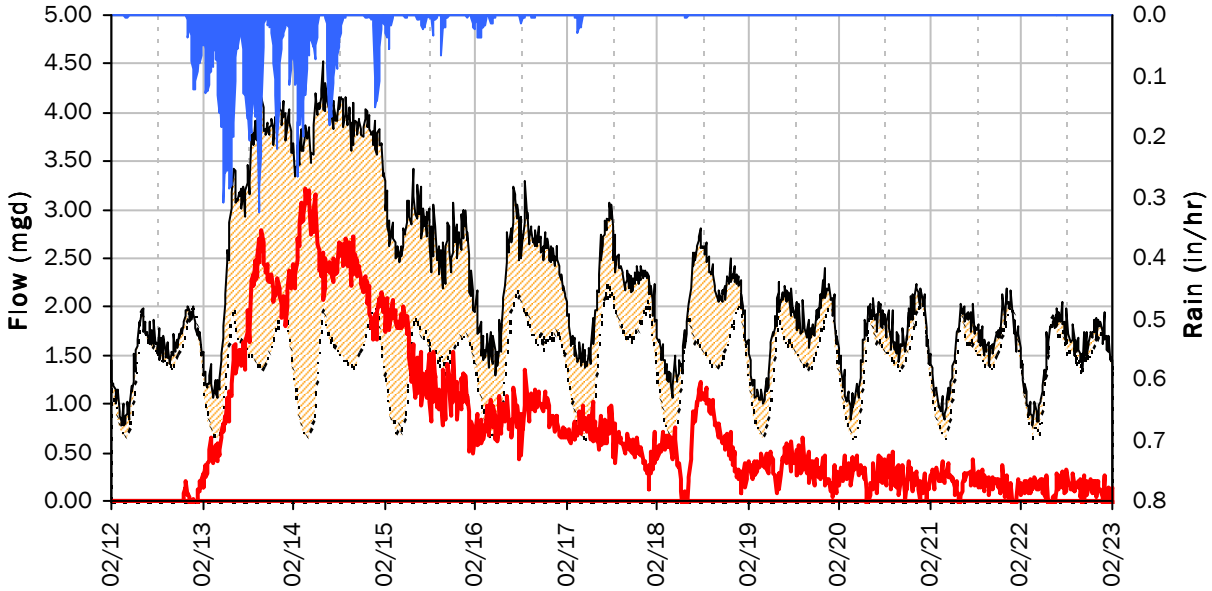
Capacity		Inflow / Infiltration	
Peak Flow:	2.515 *mgd*	**Peak I/I Rate:**	0.591 *mgd*
PF:	1.75	**Total I/I:**	2,038,000 *gallons*
Peak Level:	13.22 *in*		
d/D Ratio:	0.55		

SITE 6C
I/I Summary: Rain Event 3

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3 Detail Graph

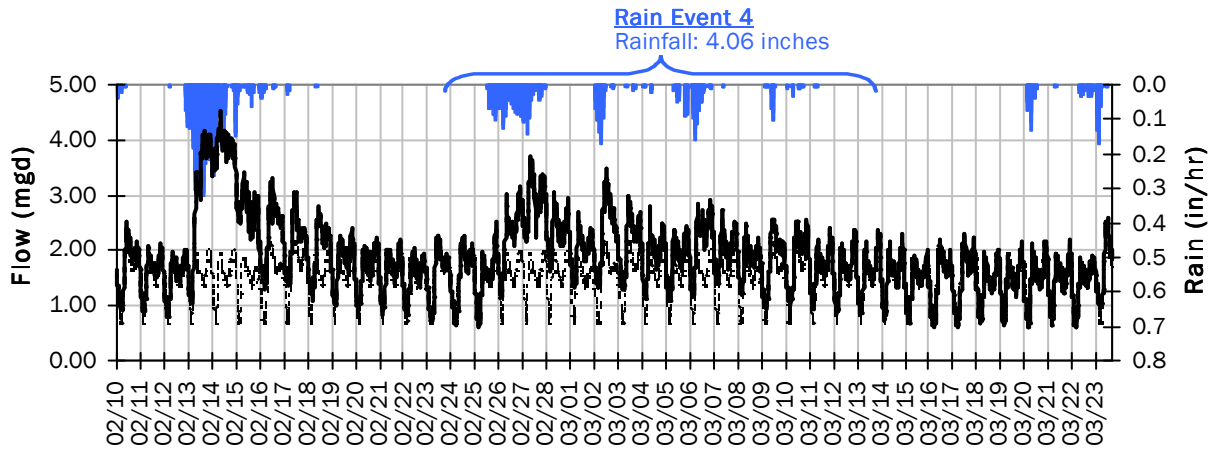


Storm Event I/I Analysis (Rain = 4.51 inches)

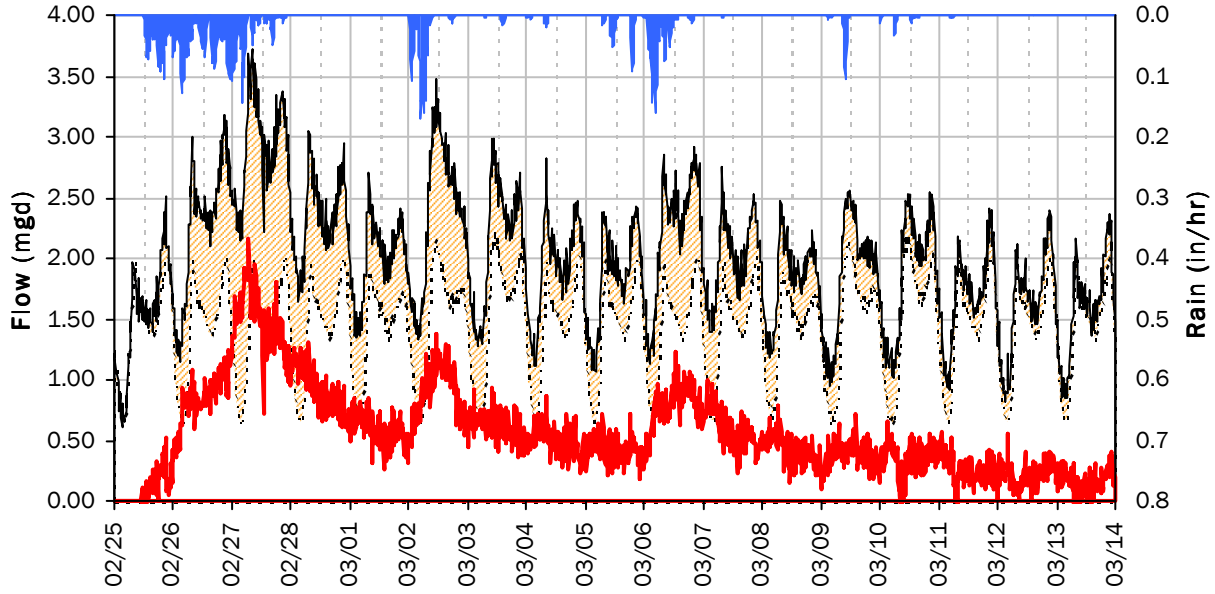
Capacity		Inflow / Infiltration	
Peak Flow:	4.52 *mgd*	**Peak I/I Rate:**	3.21 *mgd*
PF:	3.15	**Total I/I:**	8,333,000 *gallons*
Peak Level:	18.83 *in*		
d/D Ratio:	0.78		

SITE 6C
I/I Summary: Rain Event 4

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 4 Detail Graph

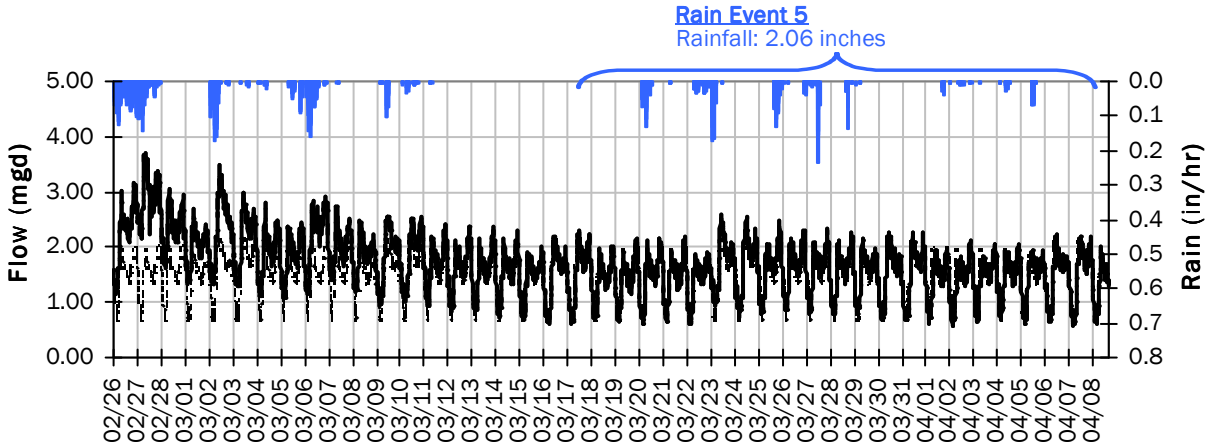


Storm Event I/I Analysis (Rain = 4.06 inches)

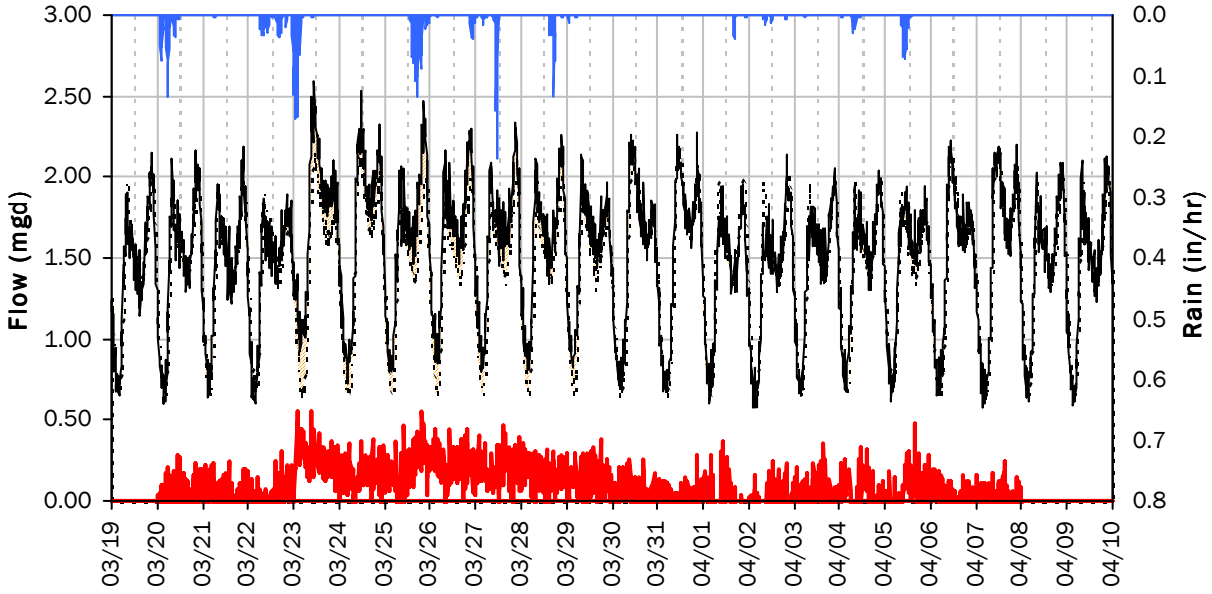
Capacity		Inflow / Infiltration	
Peak Flow:	3.72 *mgd*	**Peak I/I Rate:**	2.16 *mgd*
PF:	2.59	**Total I/I:**	9,528,000 *gallons*
Peak Level:	15.73 *in*		
d/D Ratio:	0.66		

SITE 6C
I/I Summary: Rain Event 5

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 5 Detail Graph



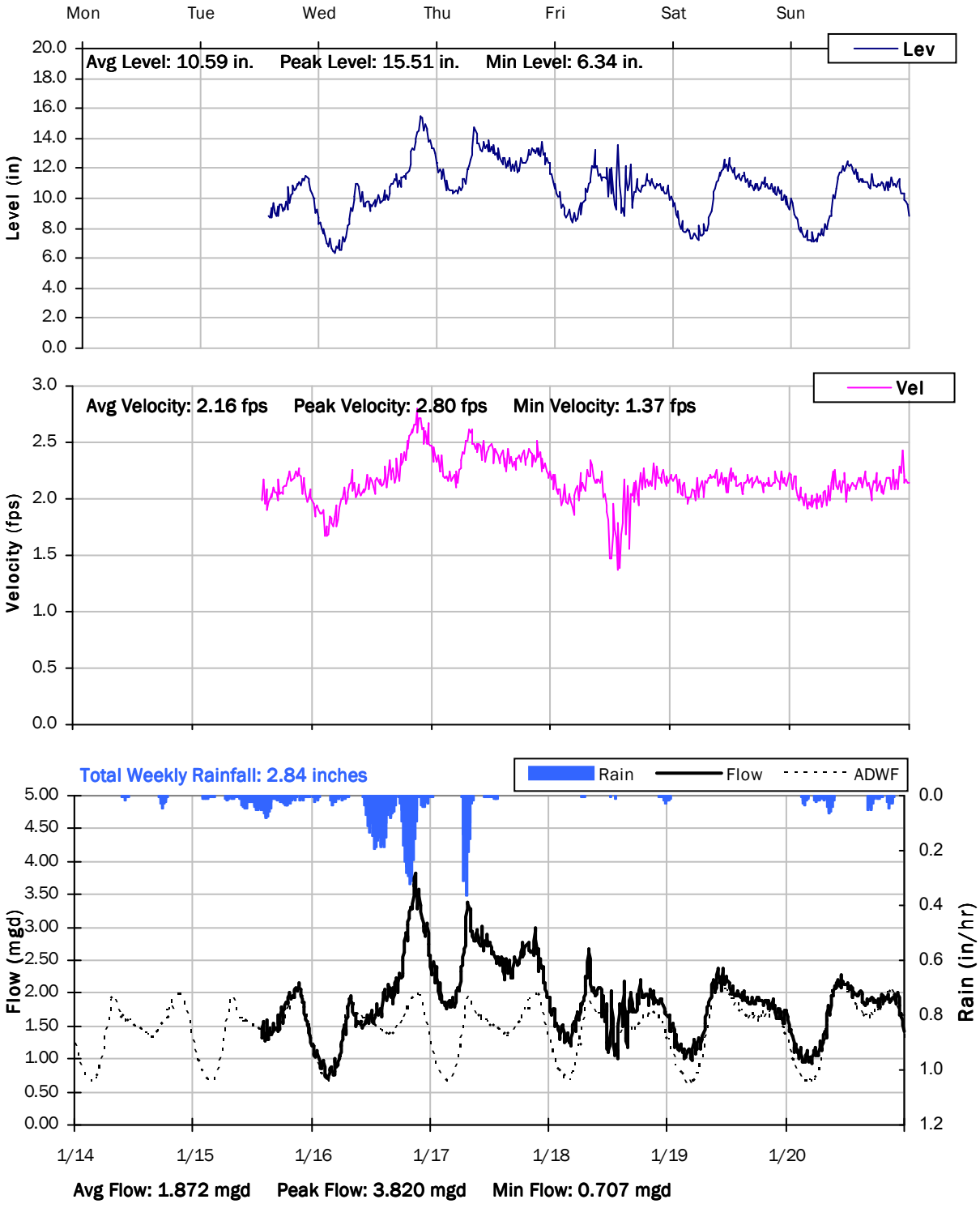
Storm Event I/I Analysis (Rain = 2.06 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	2.59 *mgd*	**Peak I/I Rate:**	0.56 *mgd*
PF:	1.80	**Total I/I:**	1,554,000 *gallons*
Peak Level:	12.90 *in*		
d/D Ratio:	0.54		

SITE 6C

Weekly Level, Velocity and Flow Hydrographs

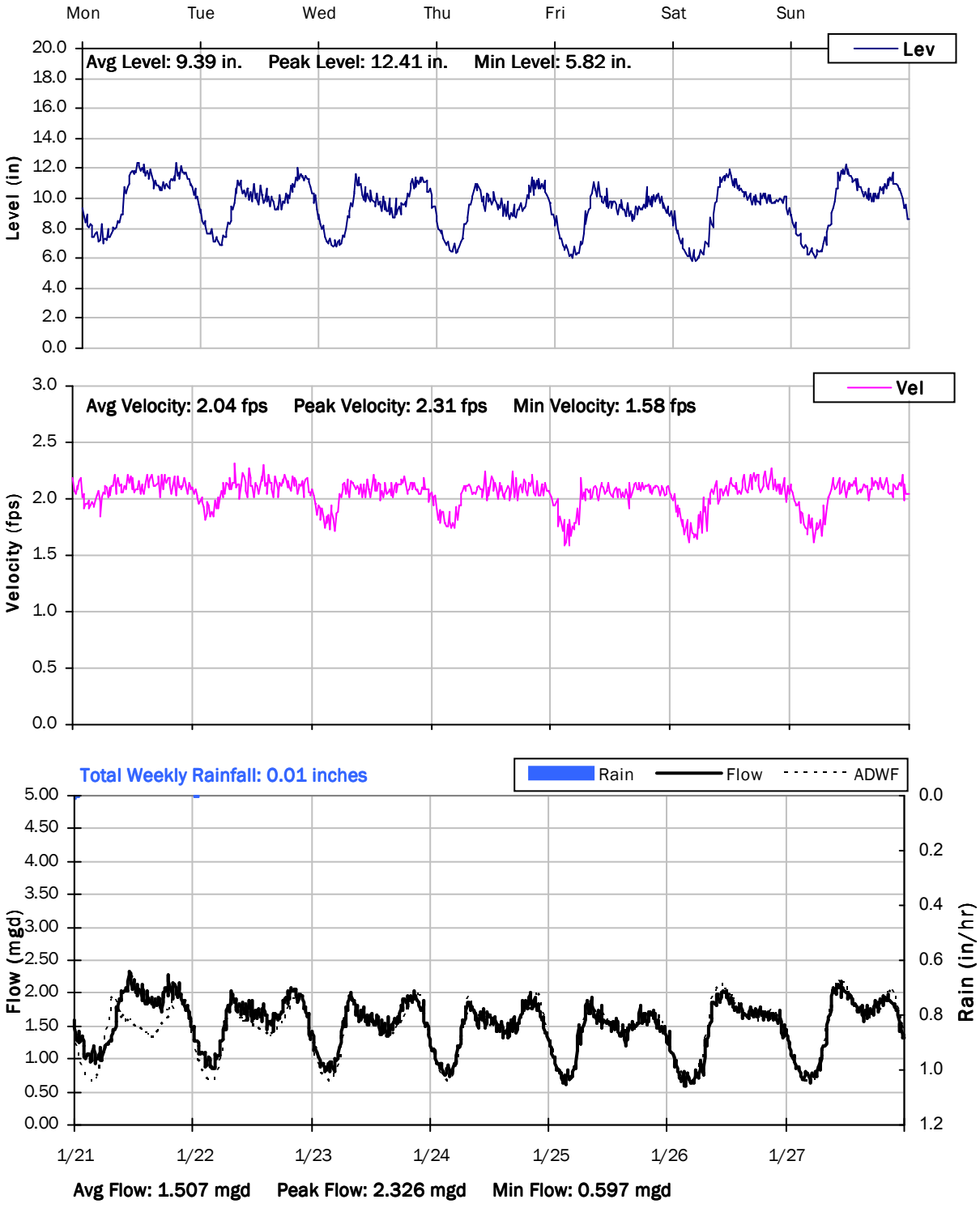
1/14/2019 to 1/21/2019



SITE 6C

Weekly Level, Velocity and Flow Hydrographs

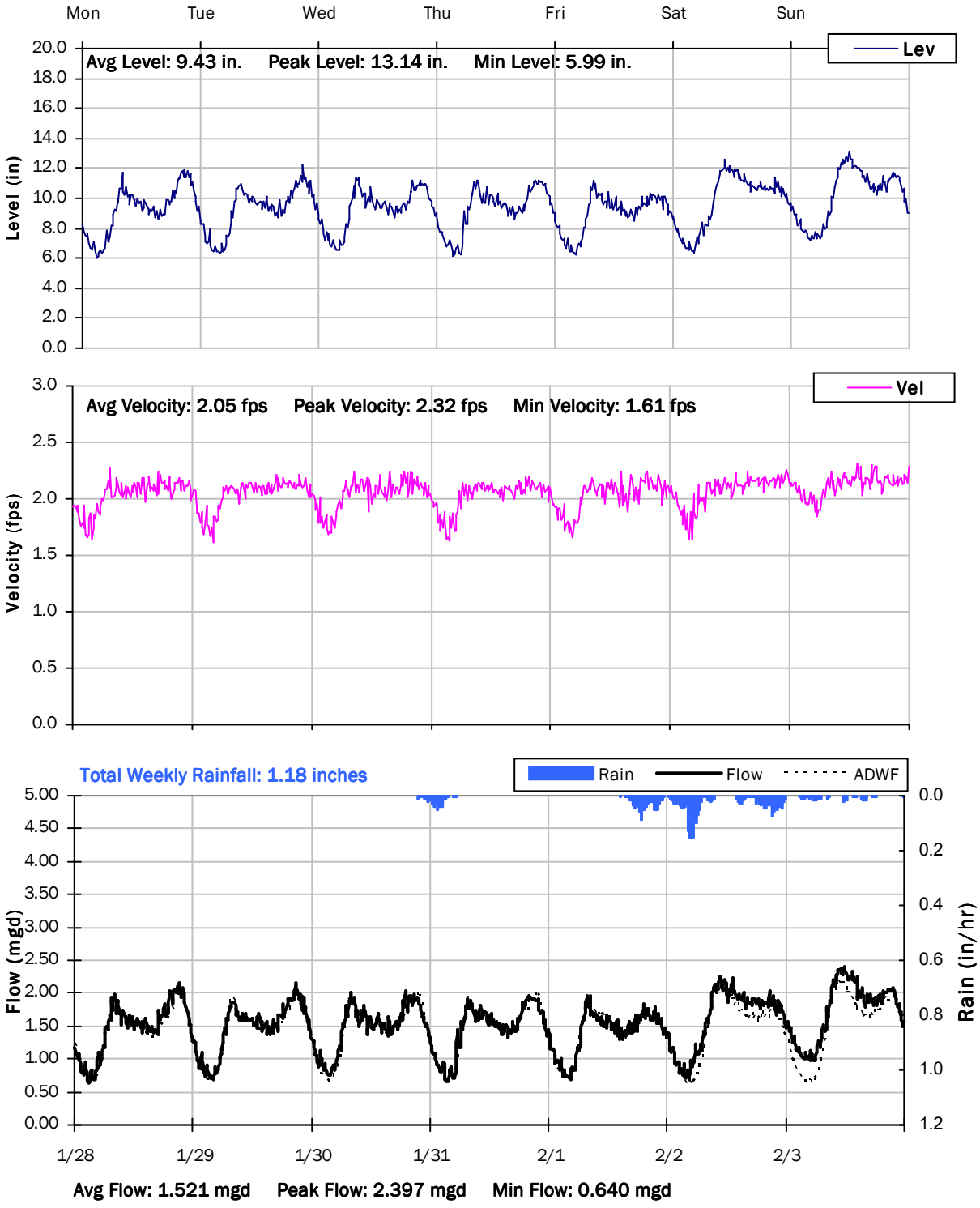
1/21/2019 to 1/28/2019



SITE 6C

Weekly Level, Velocity and Flow Hydrographs

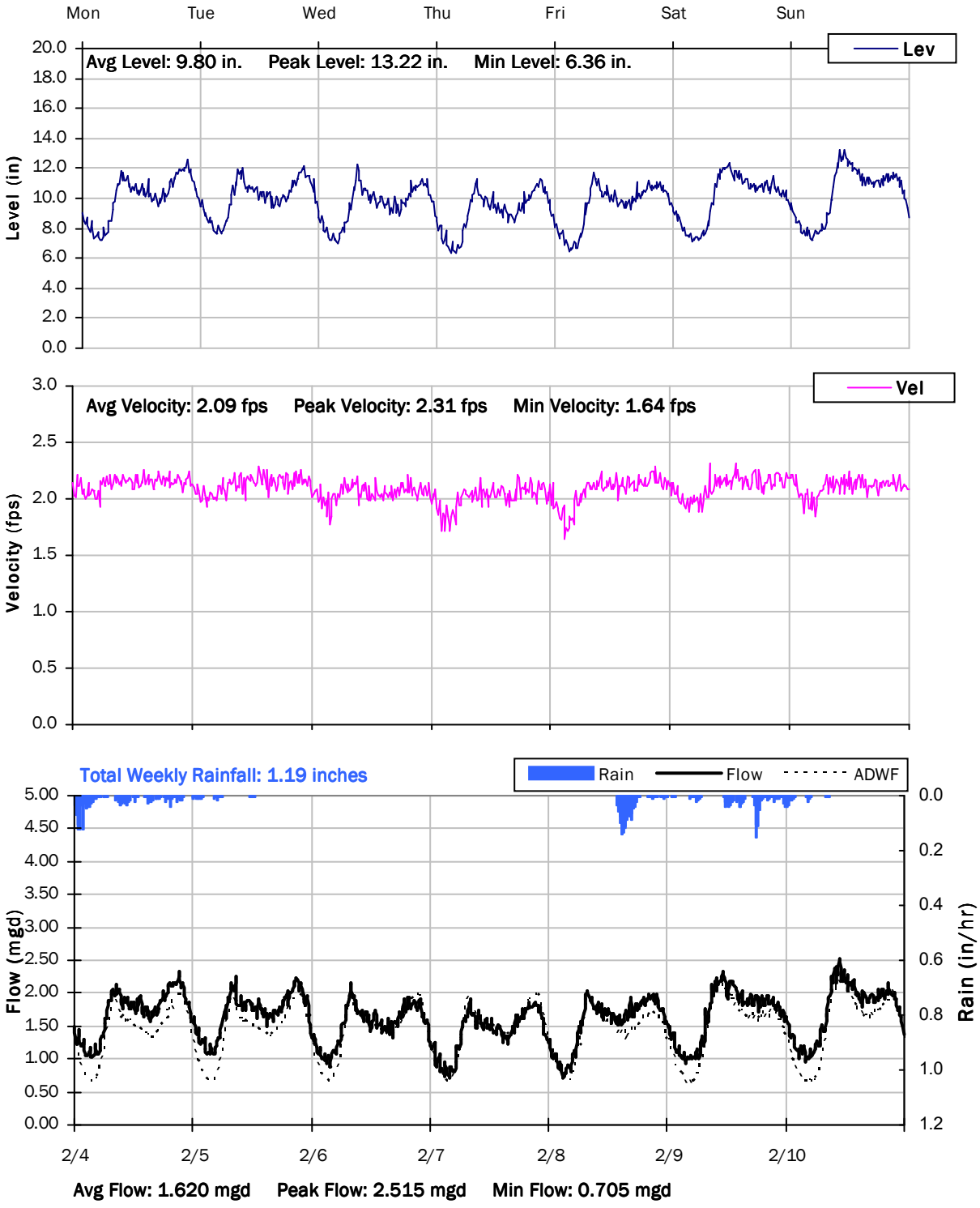
1/28/2019 to 2/4/2019



SITE 6C

Weekly Level, Velocity and Flow Hydrographs

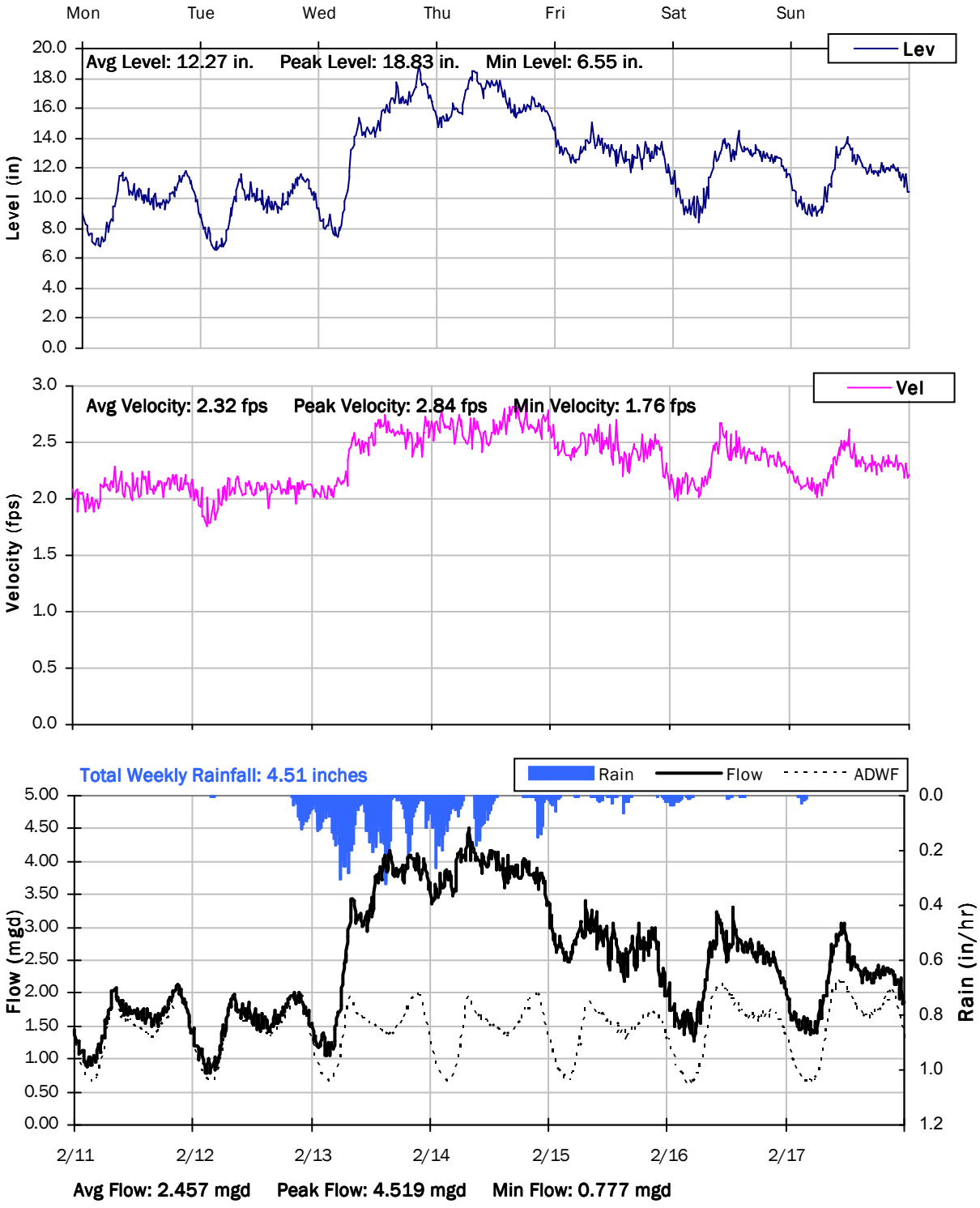
2/4/2019 to 2/11/2019



SITE 6C

Weekly Level, Velocity and Flow Hydrographs

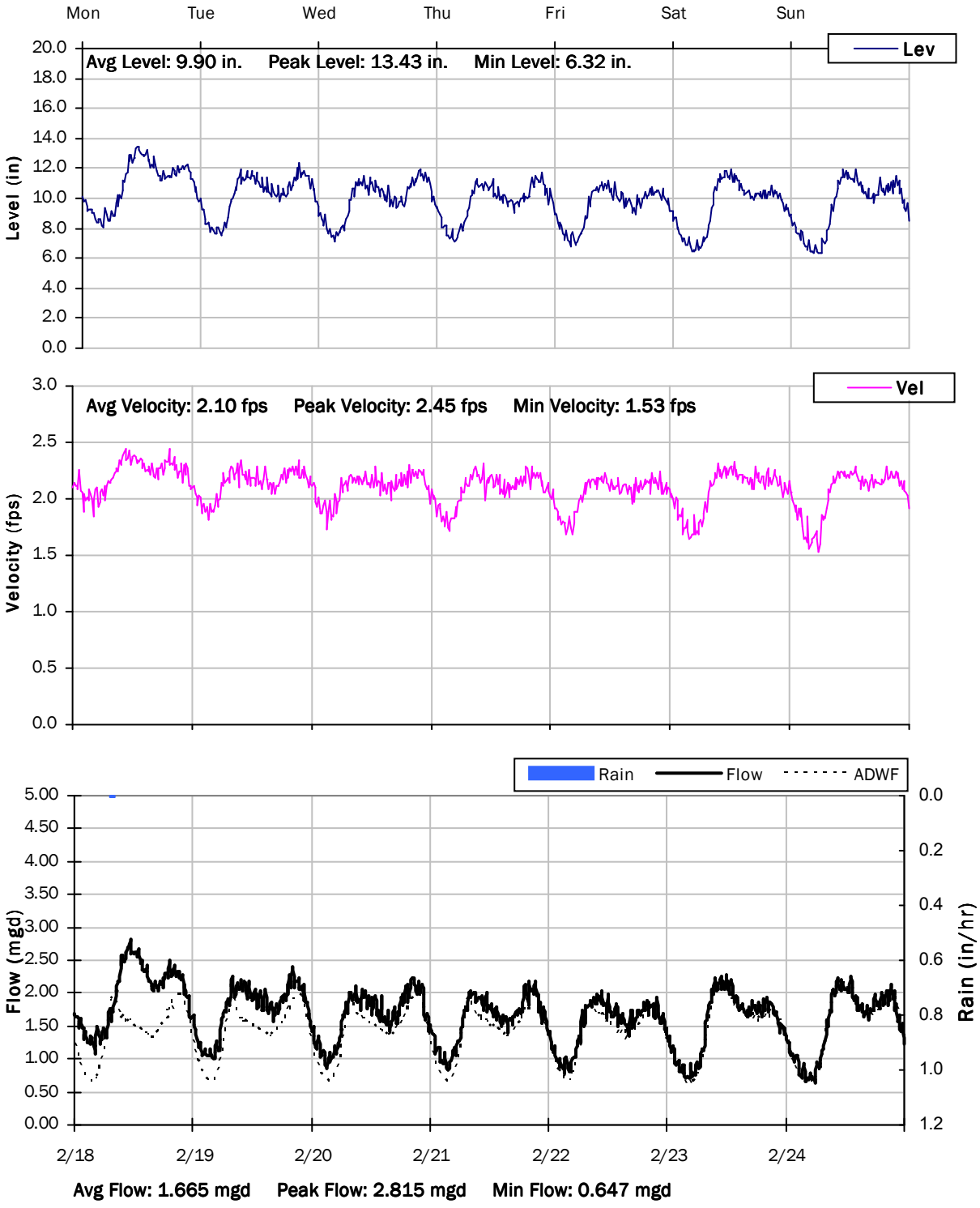
2/11/2019 to 2/18/2019



SITE 6C

Weekly Level, Velocity and Flow Hydrographs

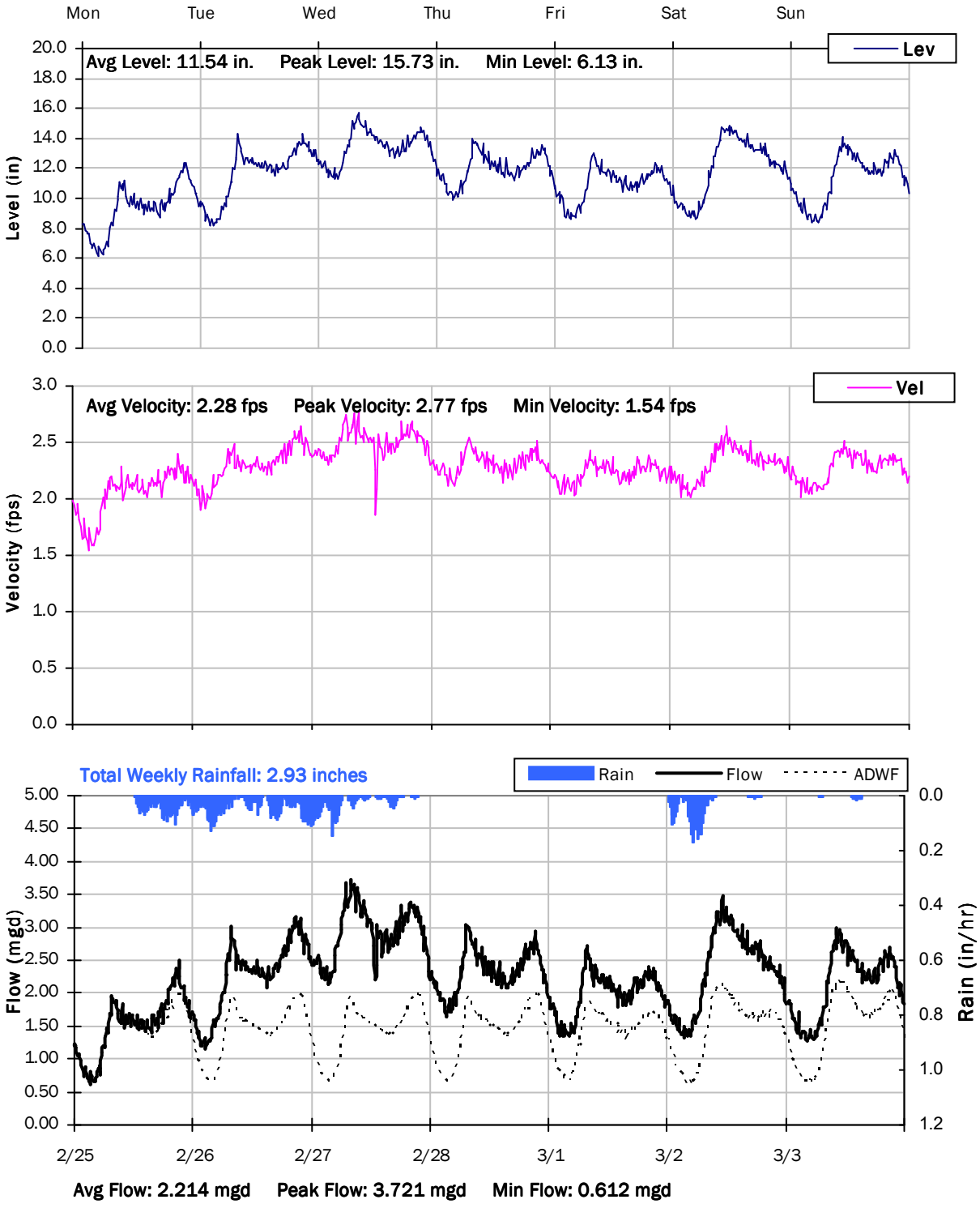
2/18/2019 to 2/25/2019



SITE 6C

Weekly Level, Velocity and Flow Hydrographs

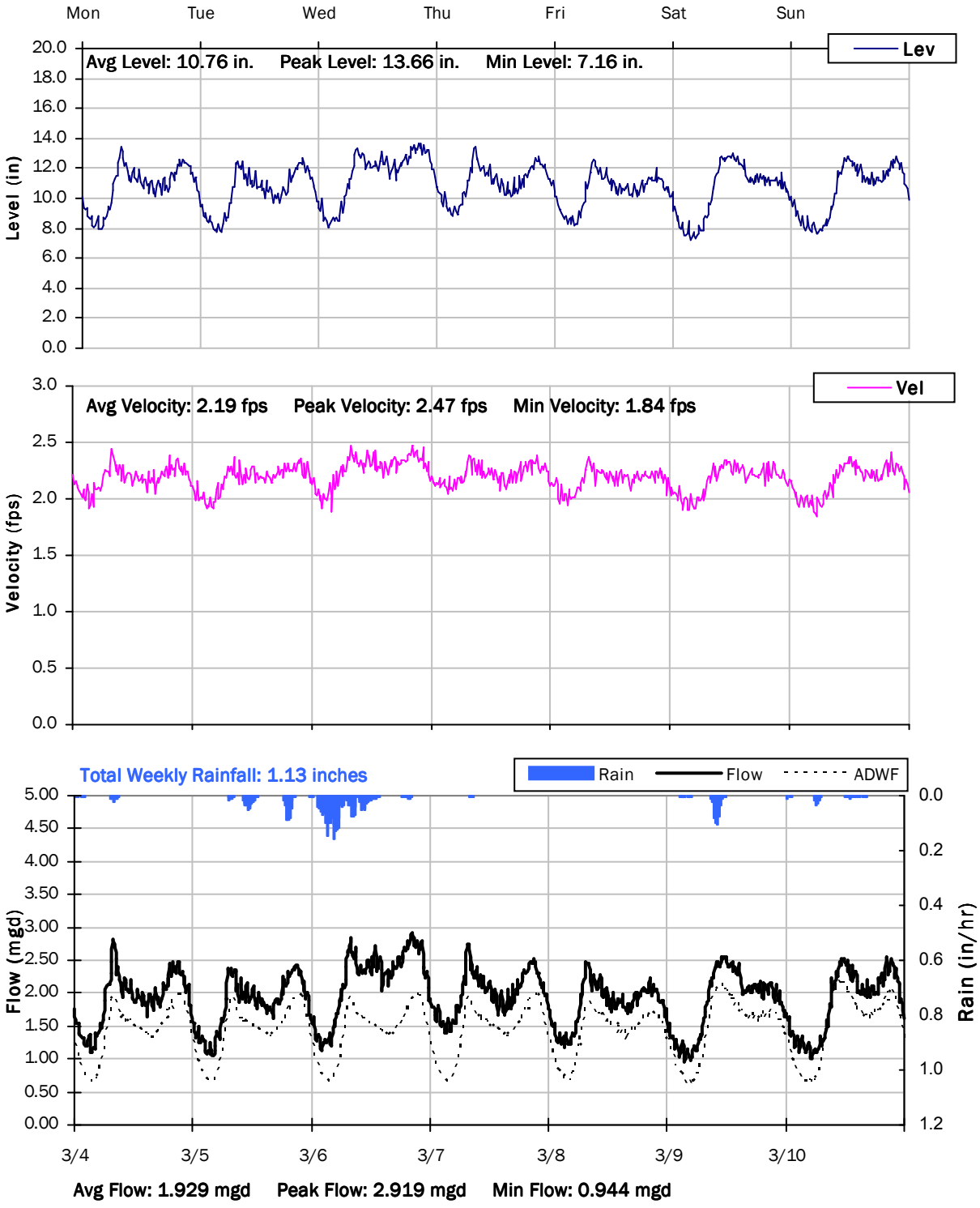
2/25/2019 to 3/4/2019



SITE 6C

Weekly Level, Velocity and Flow Hydrographs

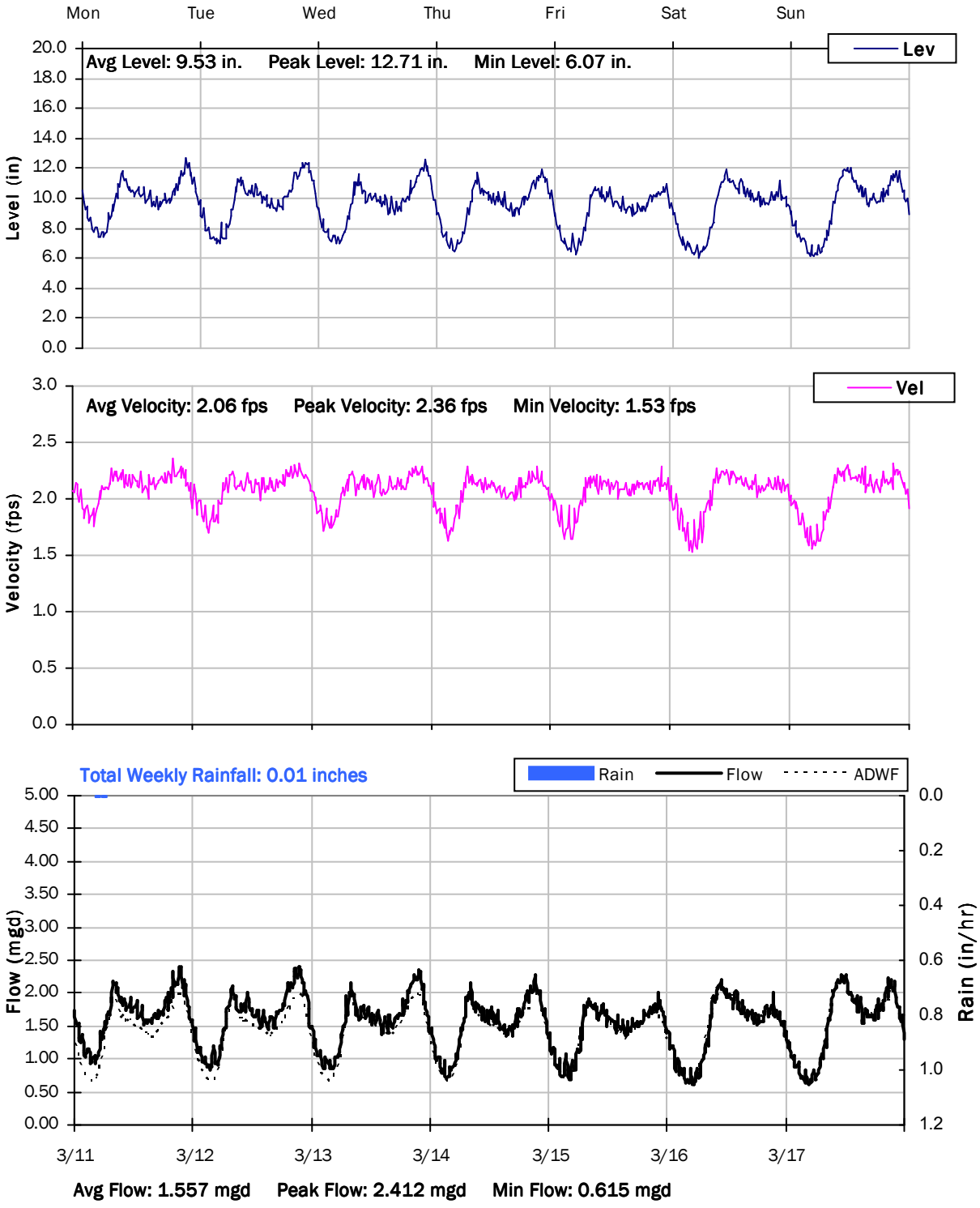
3/4/2019 to 3/11/2019



SITE 6C

Weekly Level, Velocity and Flow Hydrographs

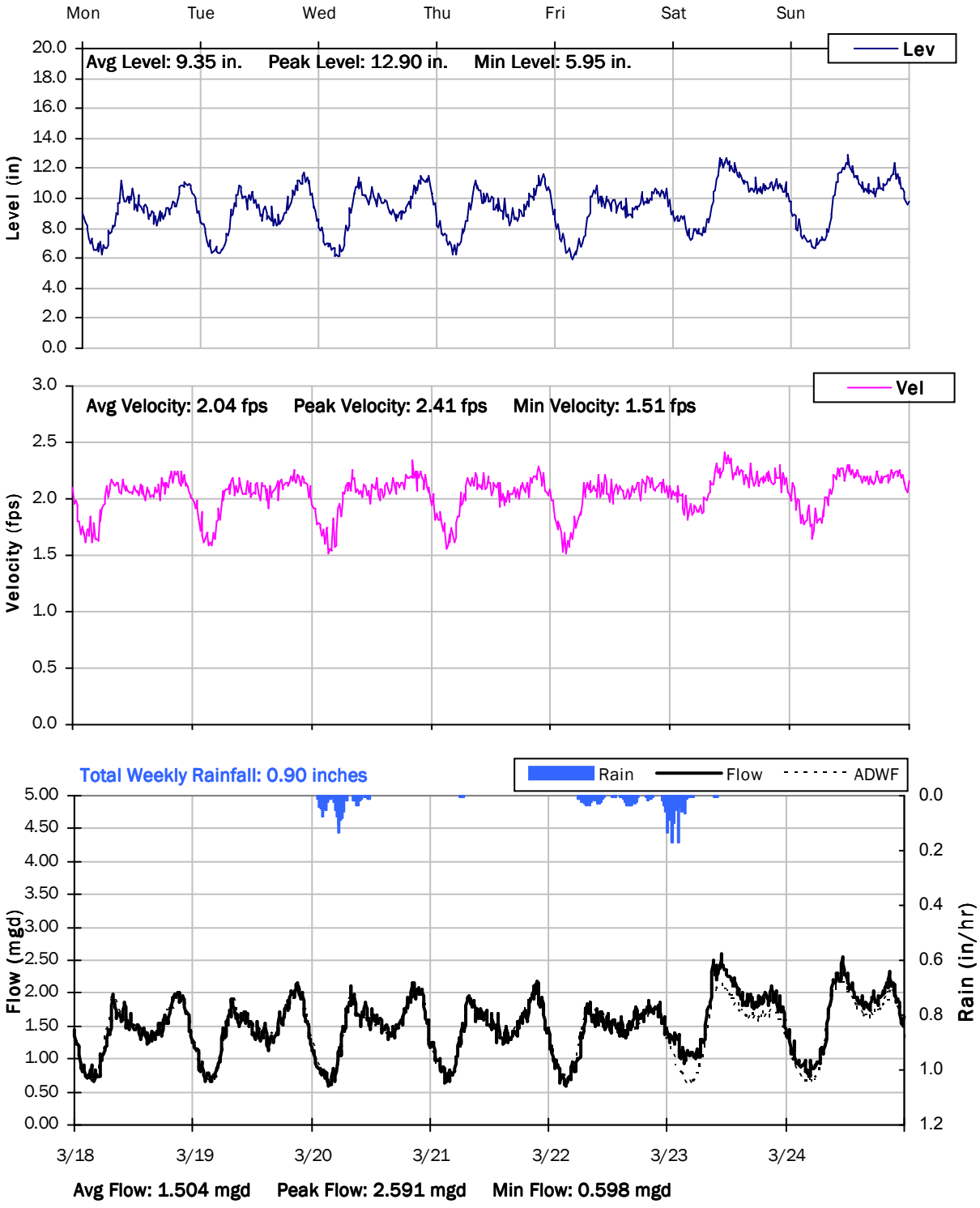
3/11/2019 to 3/18/2019



SITE 6C

Weekly Level, Velocity and Flow Hydrographs

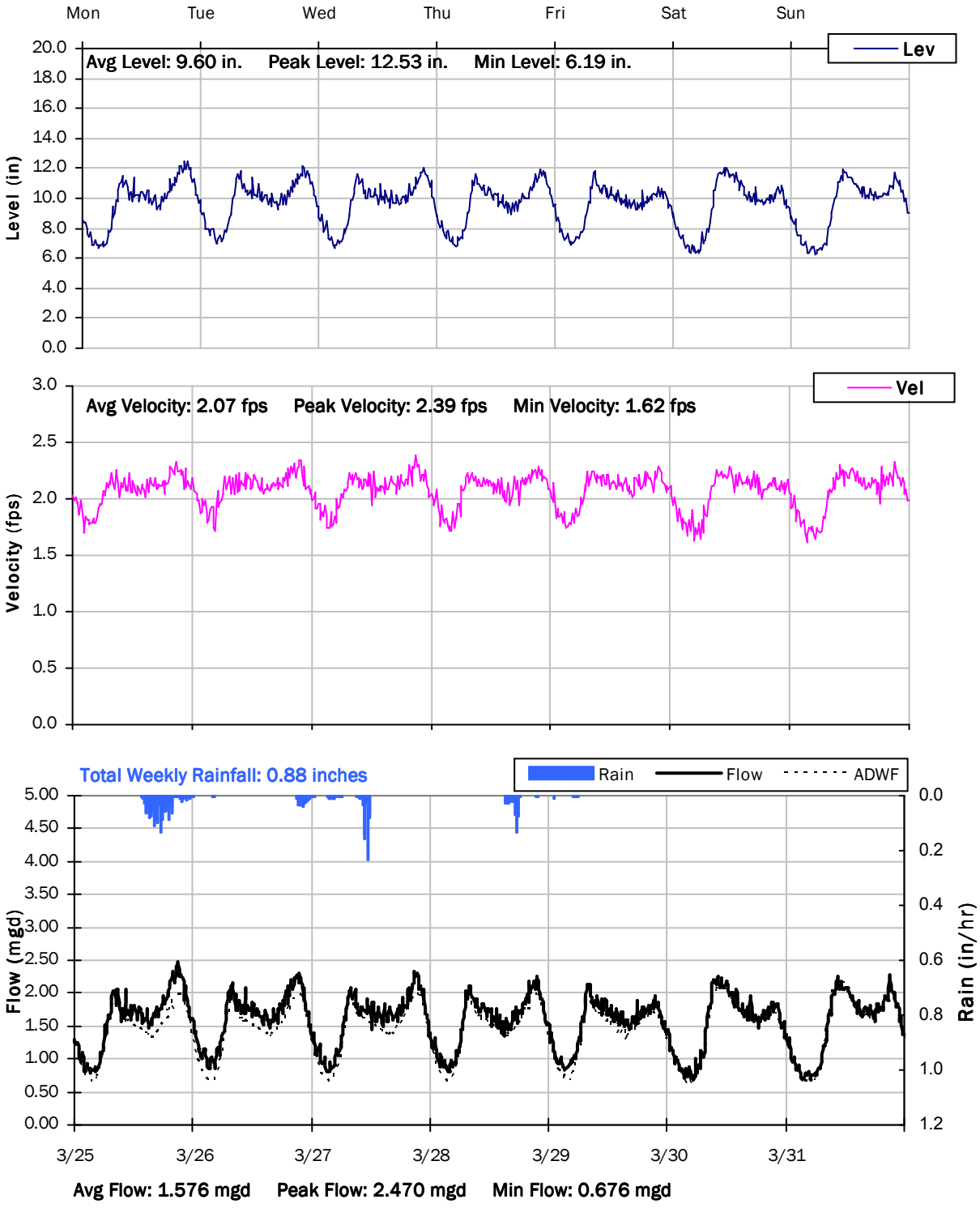
3/18/2019 to 3/25/2019



SITE 6C

Weekly Level, Velocity and Flow Hydrographs

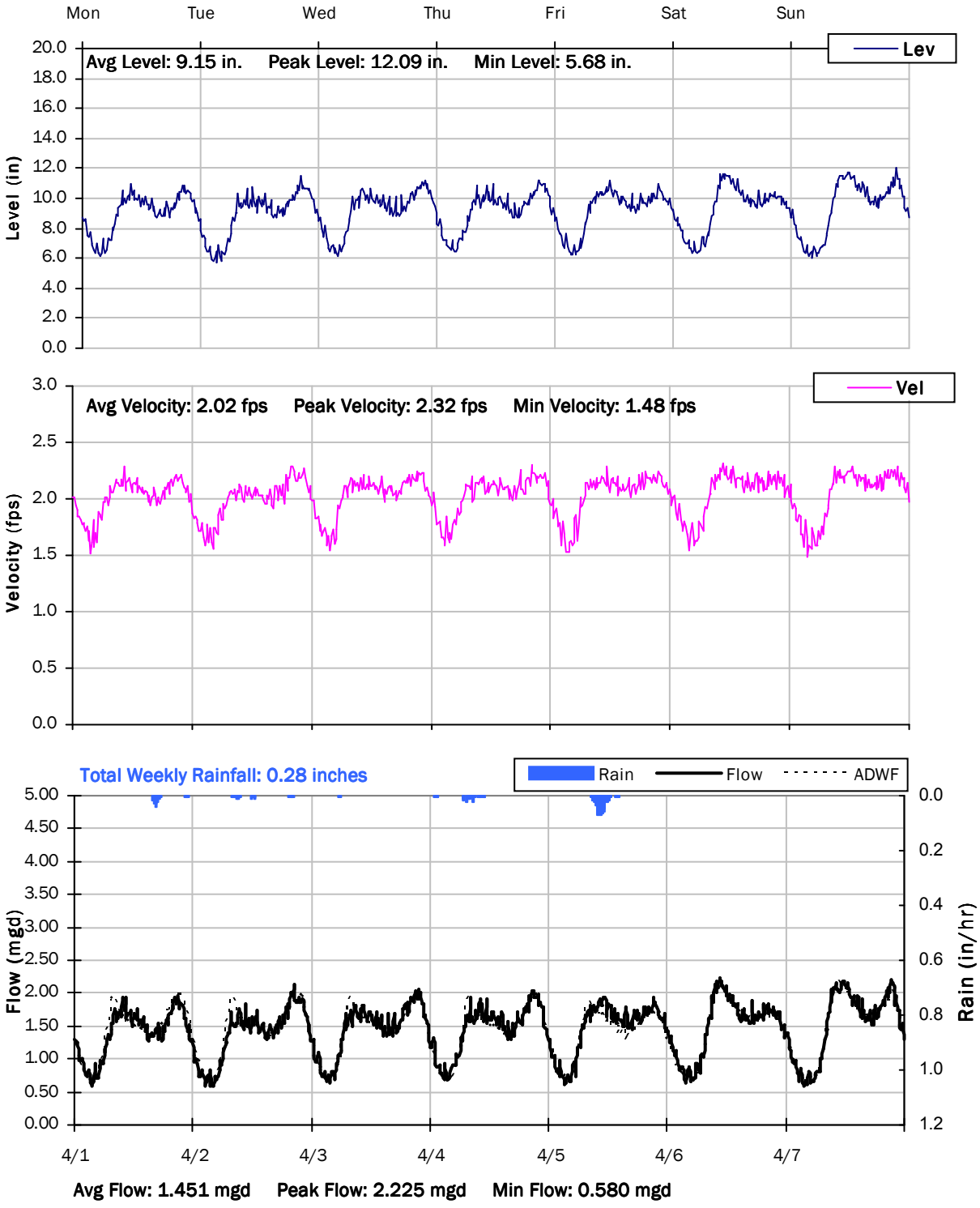
3/25/2019 to 4/1/2019



SITE 6C

Weekly Level, Velocity and Flow Hydrographs

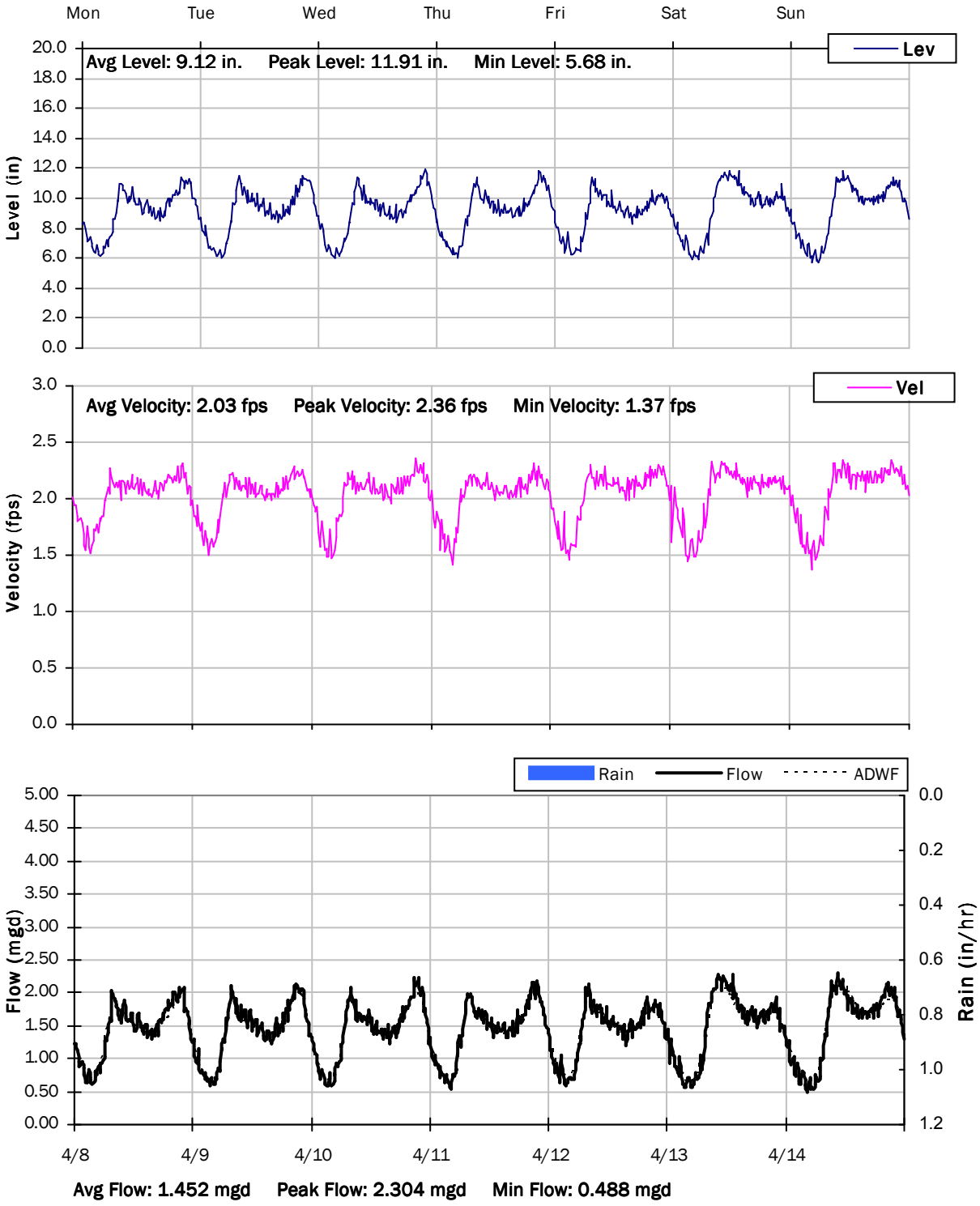
4/1/2019 to 4/8/2019



SITE 6C

Weekly Level, Velocity and Flow Hydrographs

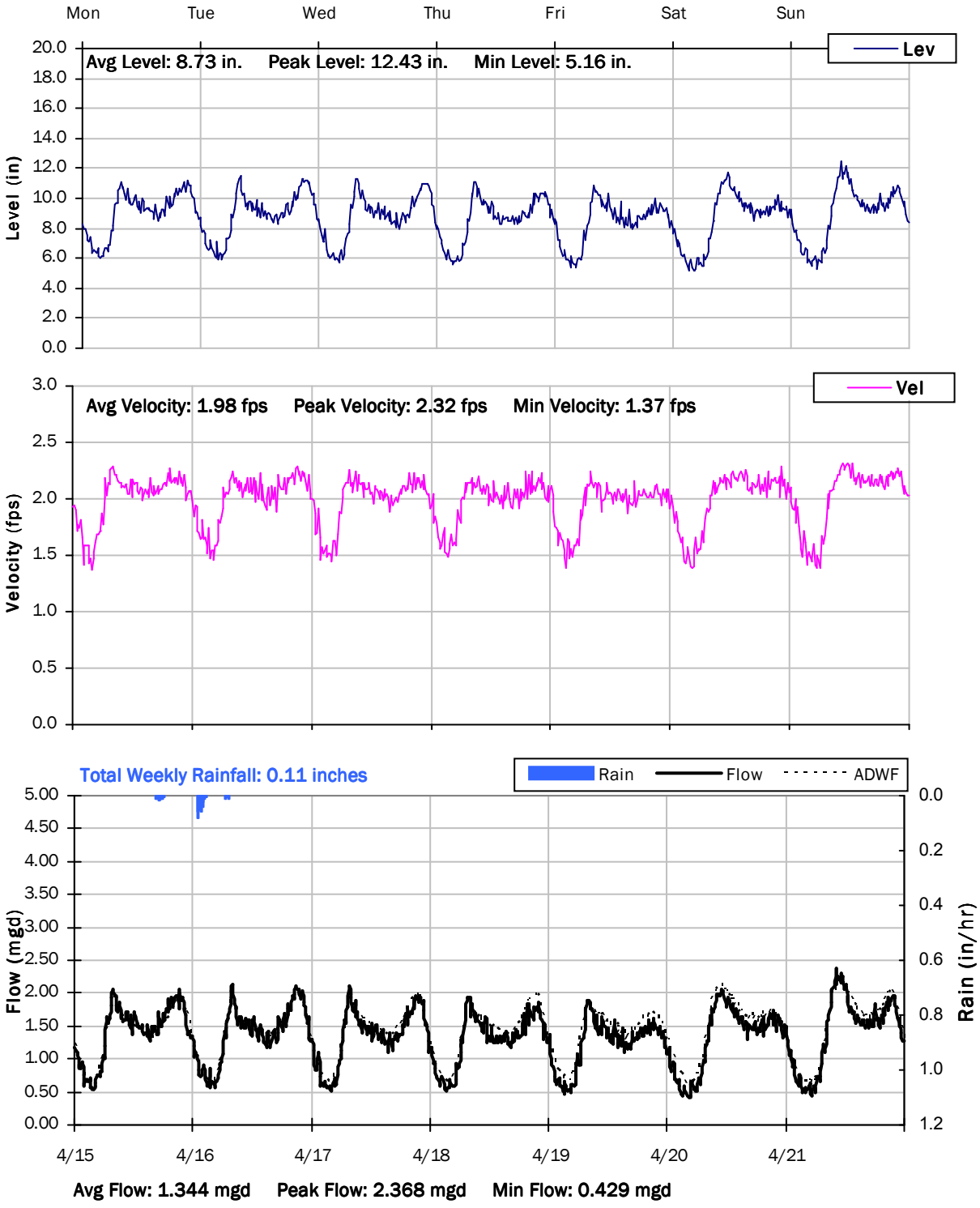
4/8/2019 to 4/15/2019



SITE 6C

Weekly Level, Velocity and Flow Hydrographs

4/15/2019 to 4/22/2019



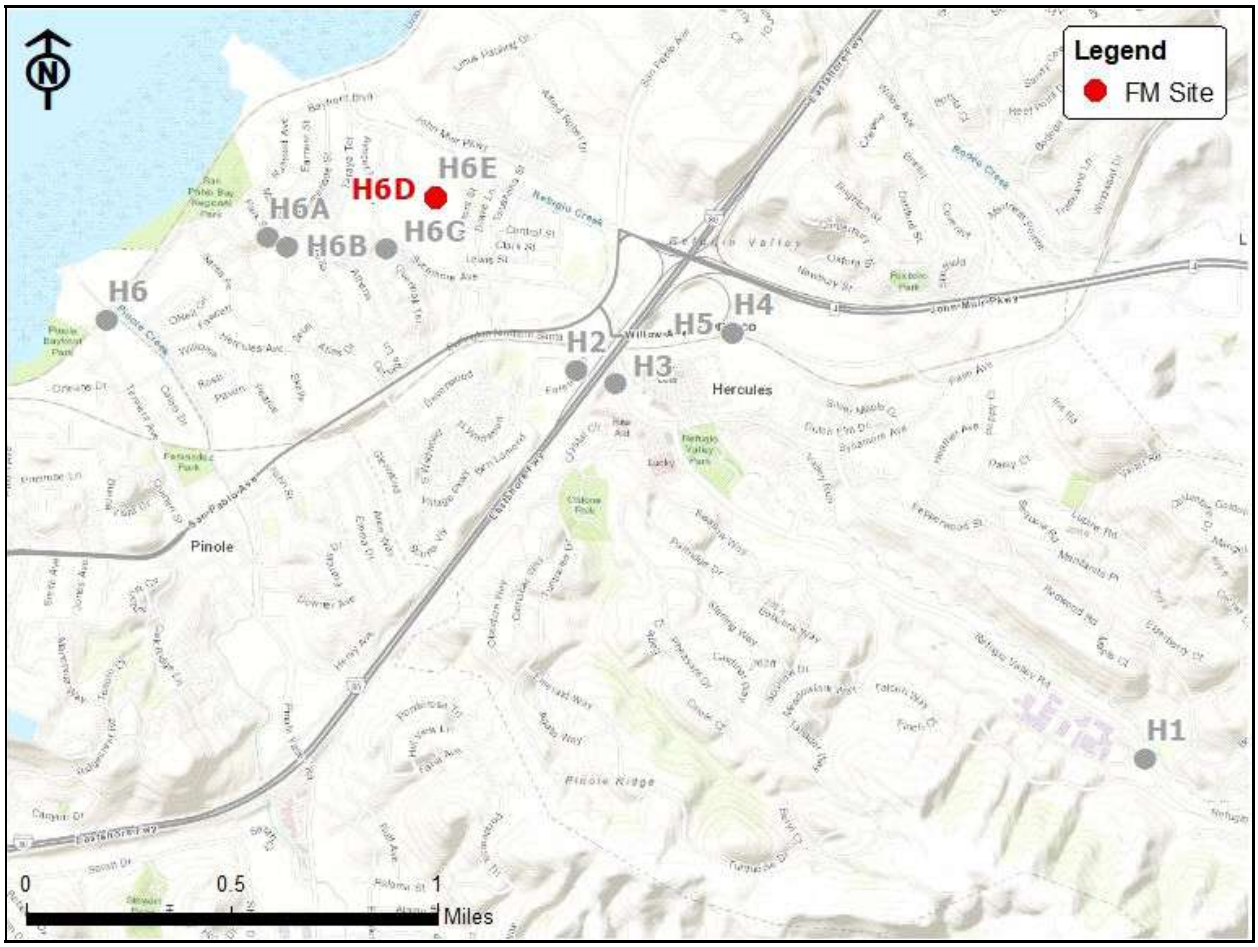
City of Hercules, California

Sanitary Sewer Flow Monitoring
January 14 - April 21, 2019

Monitoring Site: Site 6D

Location: Open space southeast of Willet Street ant Sanderling Drive

Data Summary Report



Vicinity Map: Site 6D

SITE 6D

Site Information

Location: Open space southeast of Willet Street ant Sanderling Drive

Coordinates: 122.2807° W, 38.0170° N

Rim Elevation (Earth): 18 feet

Measured Pipe Diameter: 14 inches

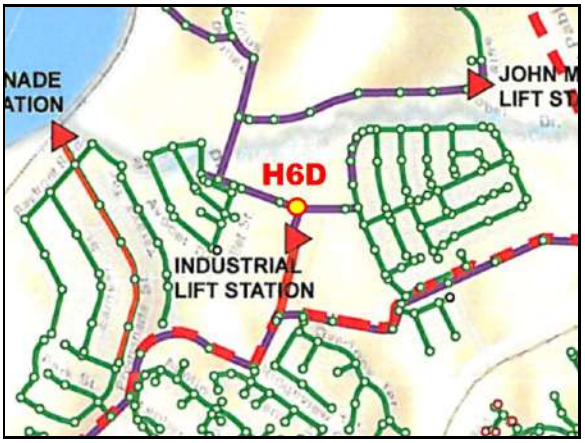
ADWF: 0.137 mgd

Peak Measured Flow: 0.681 mgd

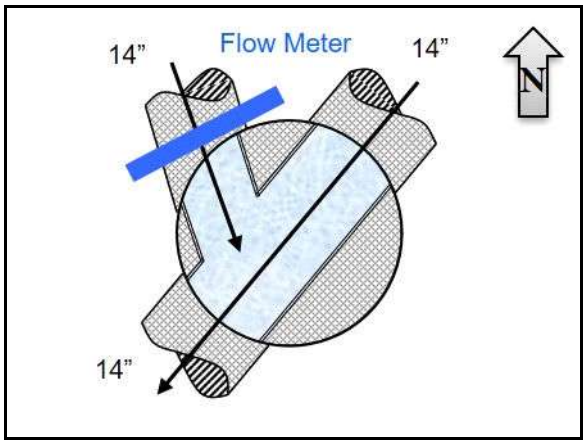
Sediment: None



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

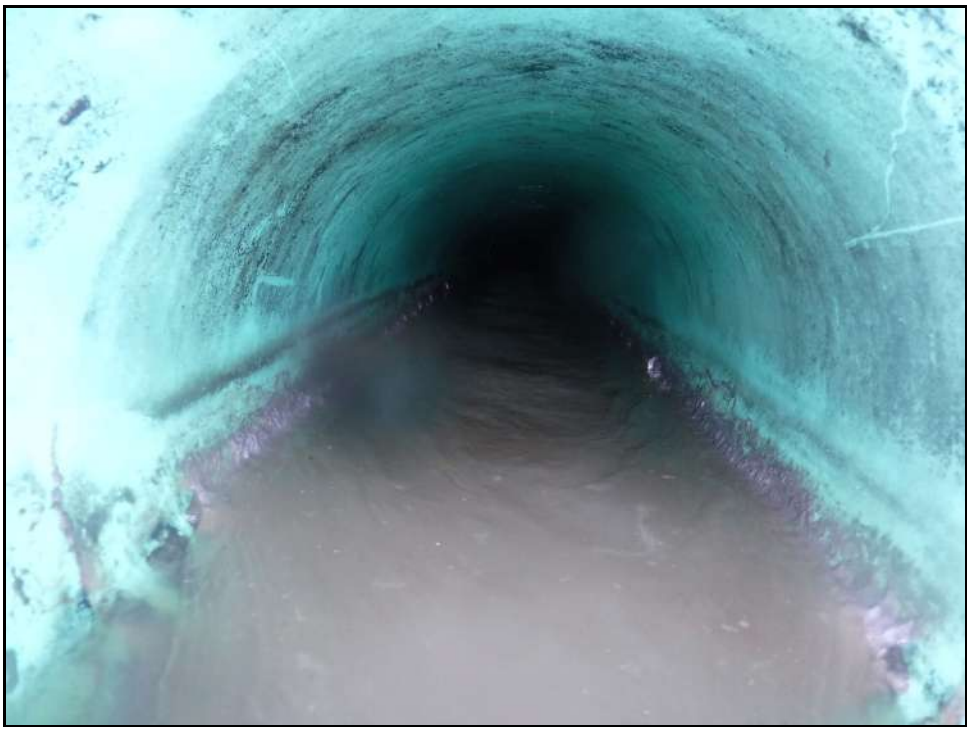
SITE 6D

Additional Site Photos

Effluent Pipe



Monitored Northwest Influent Pipe



SITE 6D

Additional Site Photos

Northeast Influent Pipe

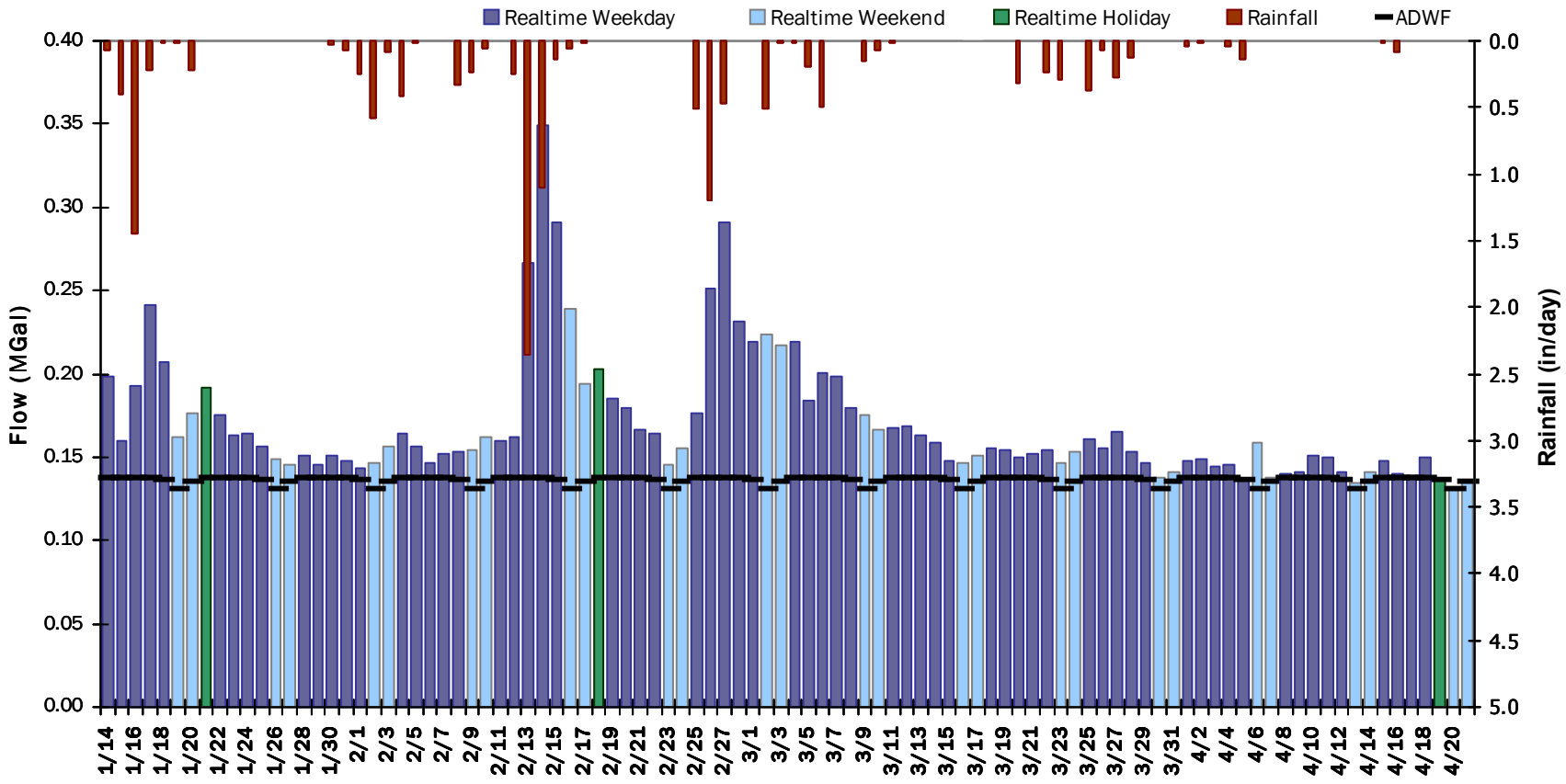


SITE 6D

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.170 MGal Peak Daily Flow: 0.349 MGal Min Daily Flow: 0.131 MGal

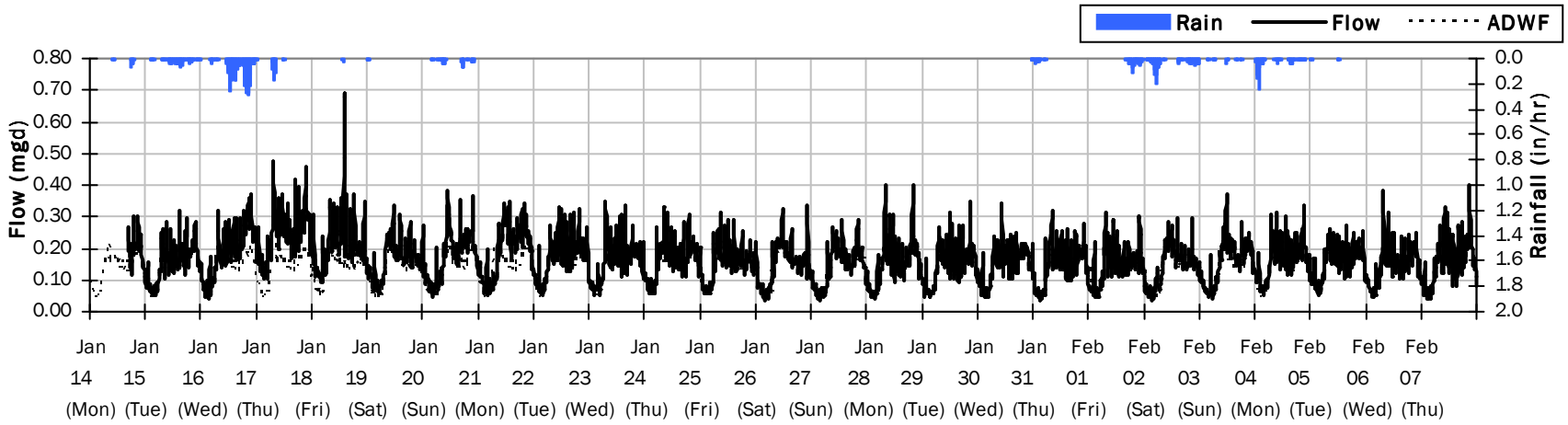
Total Rainfall: 14.02 inches

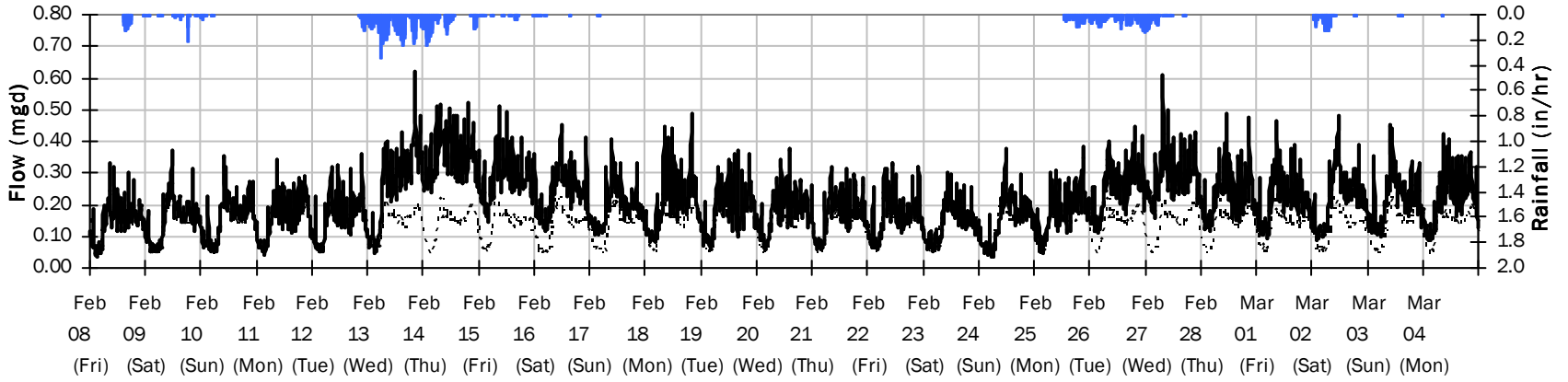


SITE 6D

Flow Summary: 1/14/2019 to 3/4/2019

Period Rainfall: 11.08 inches Period Avg Flow: 0.186 mgd Period Peak Flow: 0.681 mgd Period Min Flow: 0.034 mgd

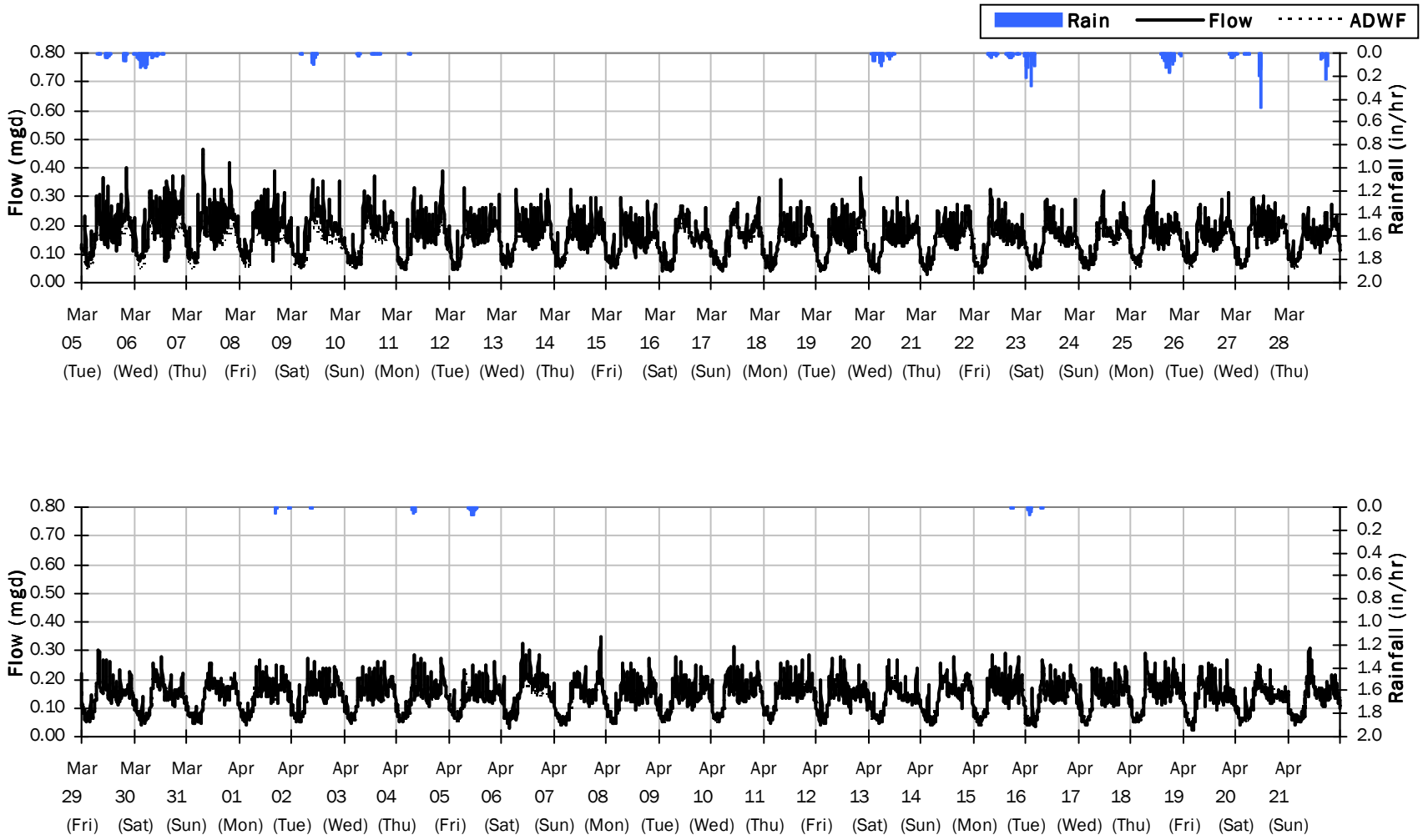




SITE 6D

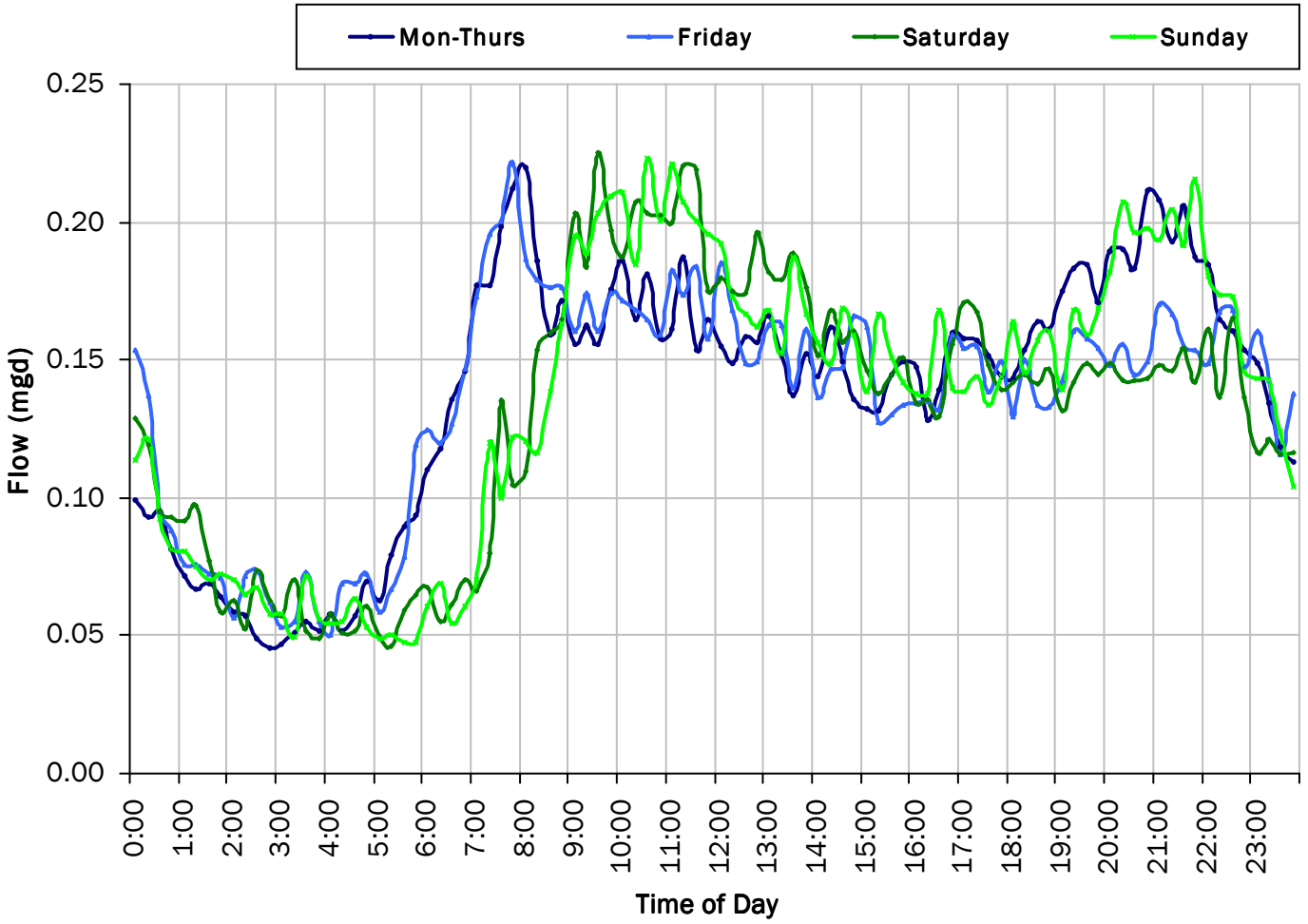
Flow Summary: 3/5/2019 to 4/21/2019

Period Rainfall: 2.94 inches Period Avg Flow: 0.153 mgd Period Peak Flow: 0.466 mgd Period Min Flow: 0.025 mgd



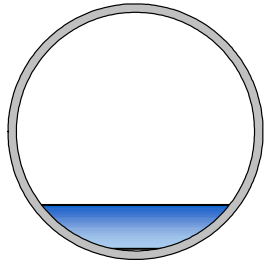
SITE 6D

Average Dry Weather Flow Hydrographs



ADWF:

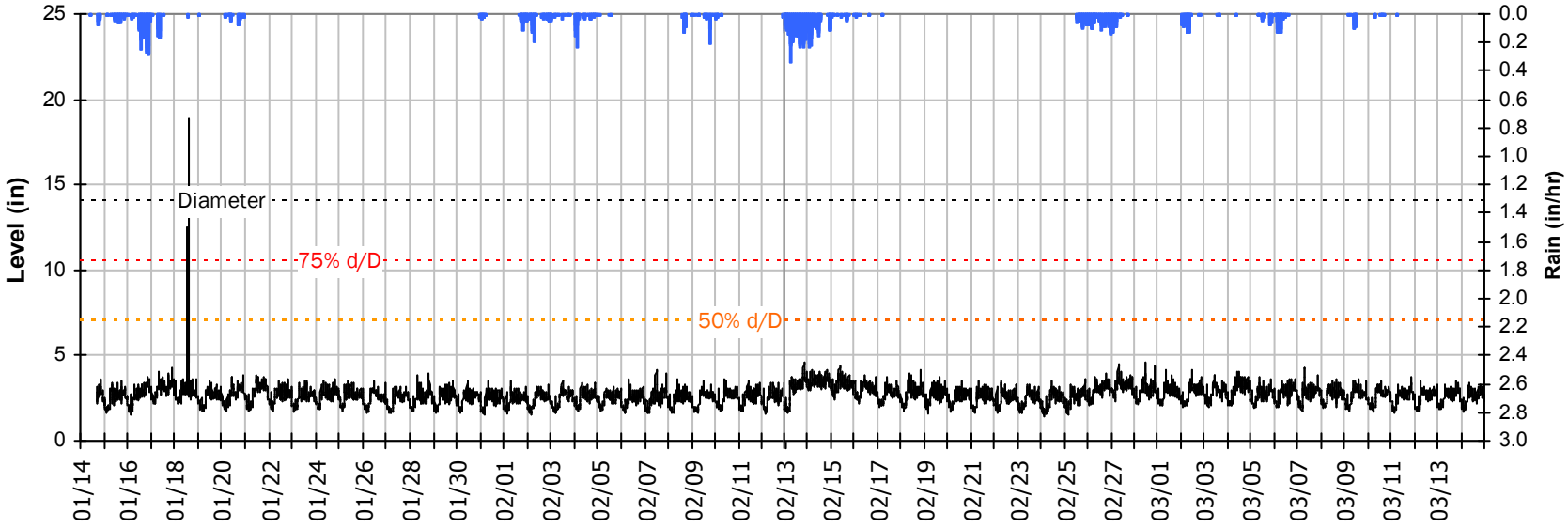
0.137 *mgd*

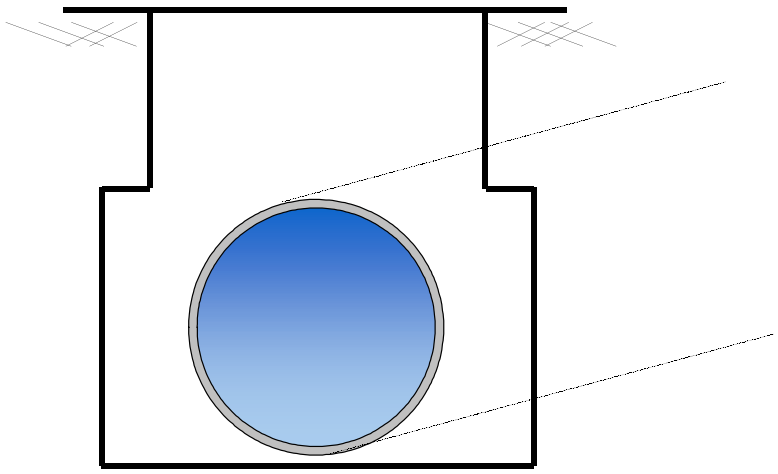


SITE 6D

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period





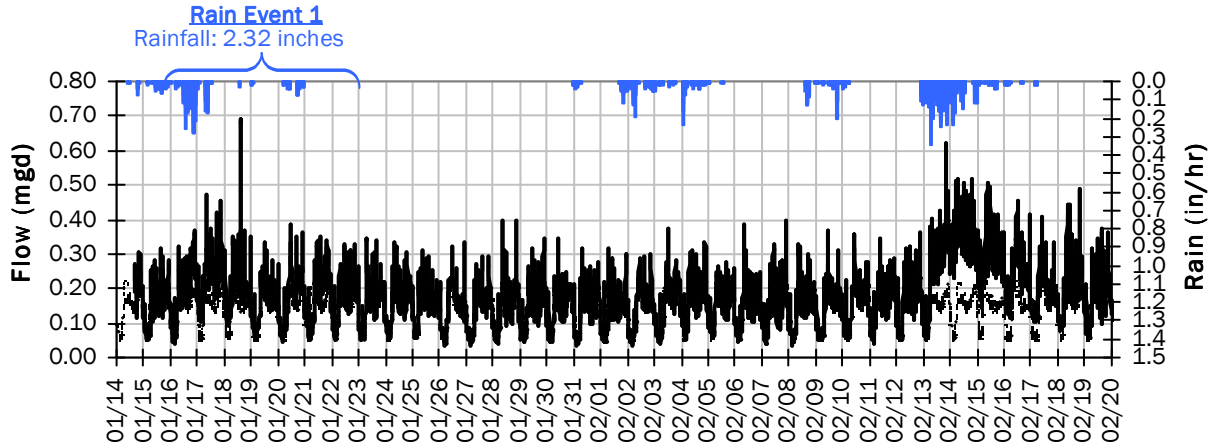
Pipe Diameter:	14	*inches*
Peak Measured Level:	18.7	*inches*
Peak d/D Ratio:	1.34	

Surcharged 4.7 inches over crown

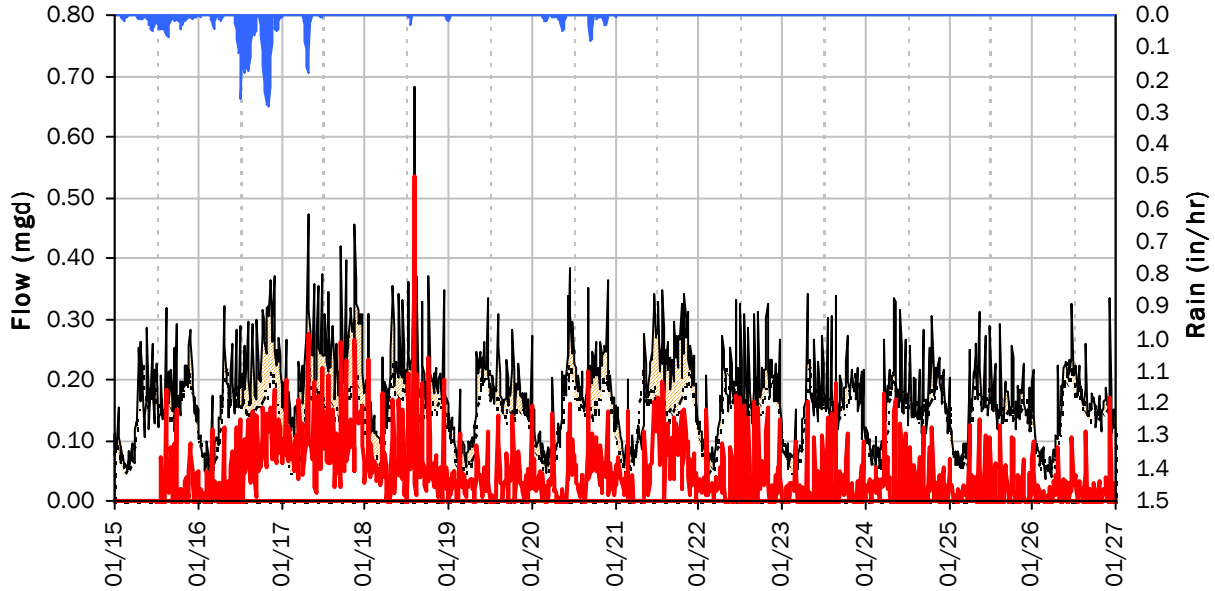
SITE 6D

I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph

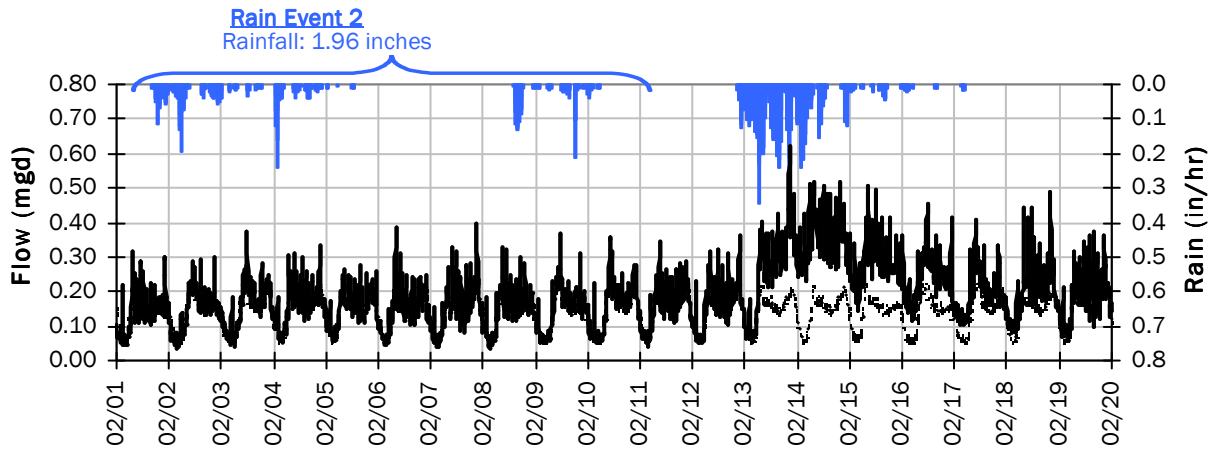


Storm Event I/I Analysis (Rain = 2.32 inches)

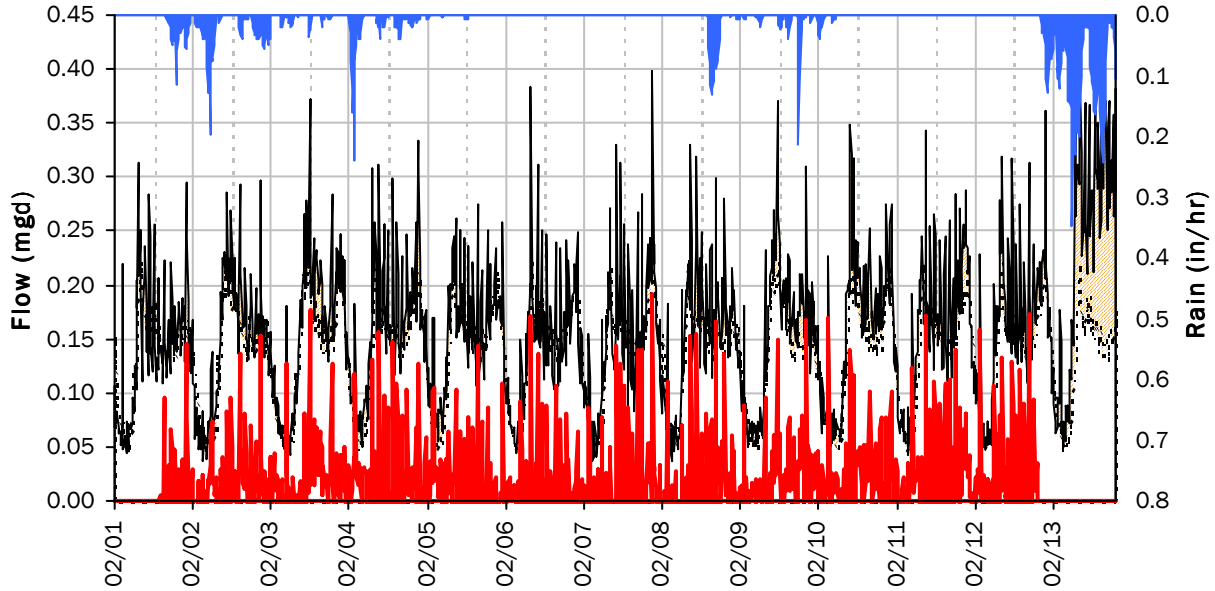
Capacity		Inflow / Infiltration	
Peak Flow:	0.681 *mgd*	**Peak I/I Rate:**	0.534 *mgd*
PF:	4.99	**Total I/I:**	493,000 *gallons*
Peak Level:	18.71 *in*		
d/D Ratio:	1.34		

SITE 6D
I/I Summary: Rain Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 2 Detail Graph

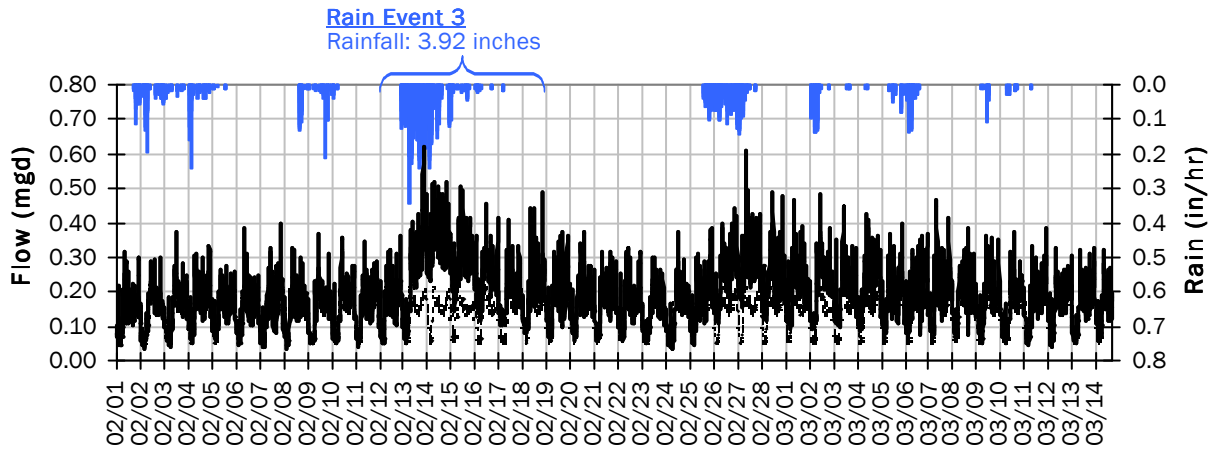


Storm Event I/I Analysis (Rain = 1.96 inches)

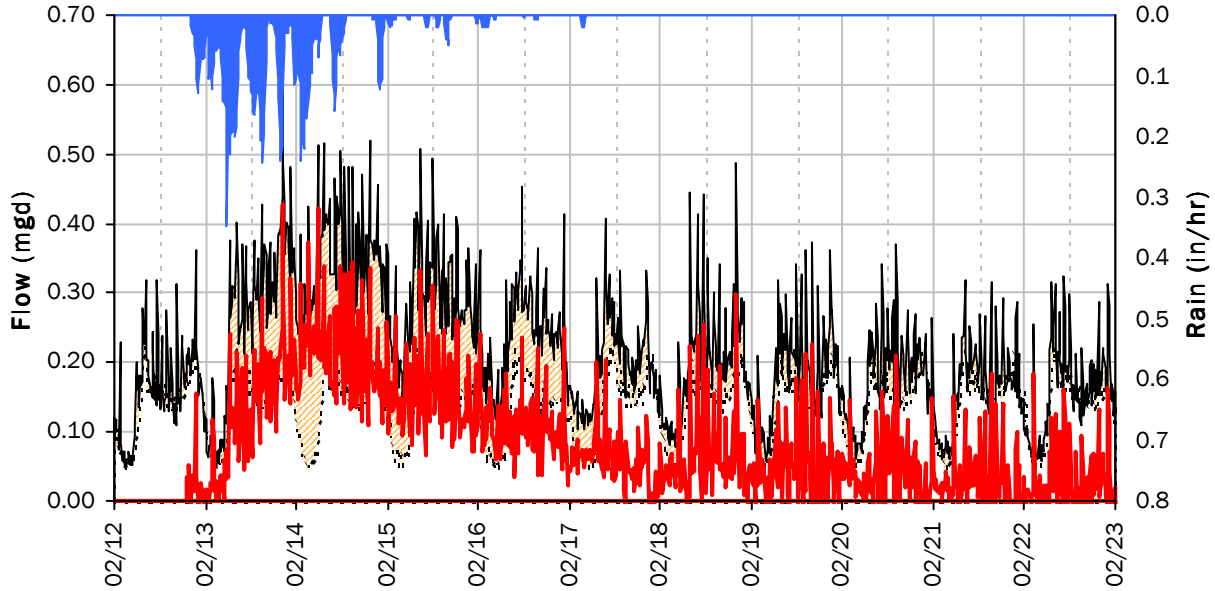
Capacity		Inflow / Infiltration	
Peak Flow:	0.399 *mgd*	**Peak I/I Rate:**	0.191 *mgd*
PF:	2.92	**Total I/I:**	214,000 *gallons*
Peak Level:	4.21 *in*		
d/D Ratio:	0.30		

SITE 6D
I/I Summary: Rain Event 3

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3 Detail Graph

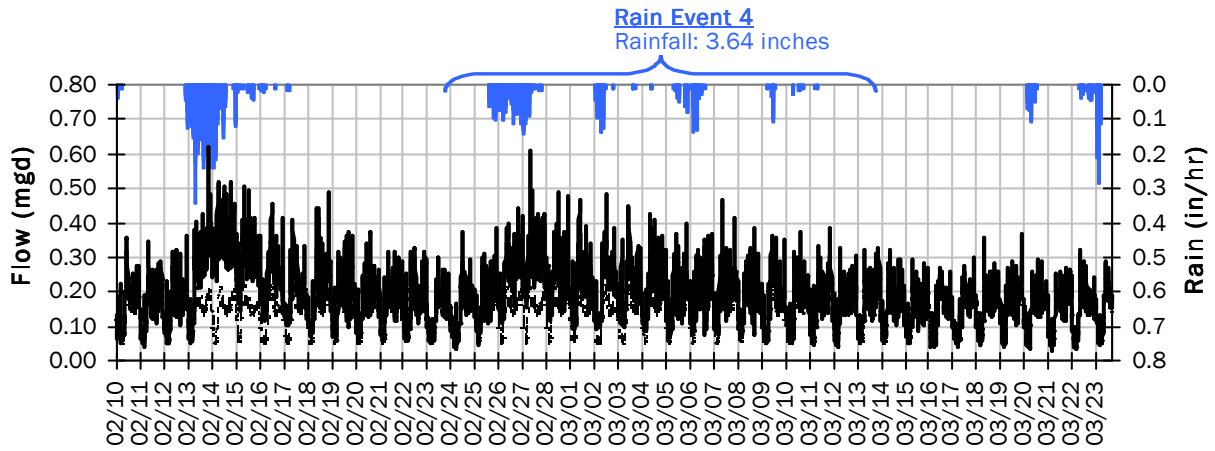


Storm Event I/I Analysis (Rain = 3.92 inches)

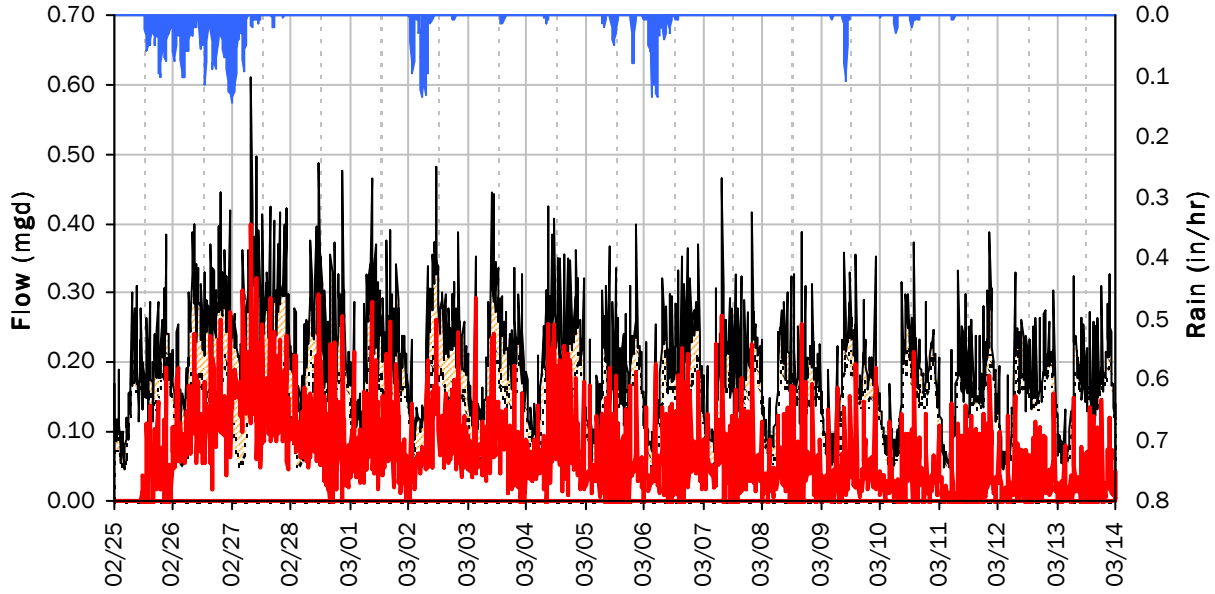
Capacity		Inflow / Infiltration	
Peak Flow:	0.62 *mgd*	**Peak I/I Rate:**	0.43 *mgd*
PF:	4.53	**Total I/I:**	873,000 *gallons*
Peak Level:	4.61 *in*		
d/D Ratio:	0.33		

SITE 6D
I/I Summary: Rain Event 4

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 4 Detail Graph

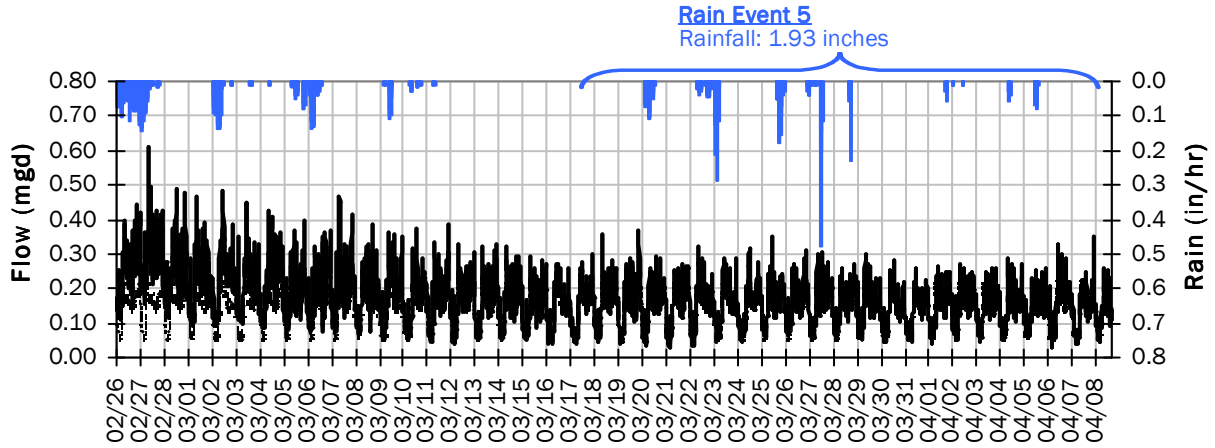


Storm Event I/I Analysis (Rain = 3.64 inches)

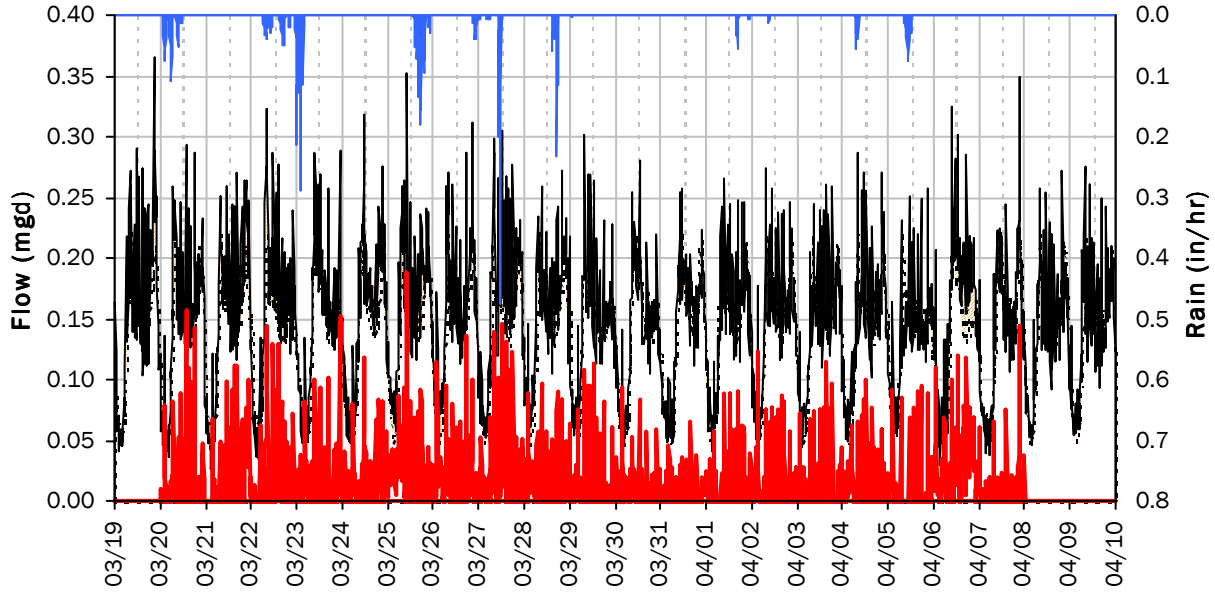
Capacity		Inflow / Infiltration	
Peak Flow:	0.61 *mgd*	**Peak I/I Rate:**	0.40 *mgd*
PF:	4.47	**Total I/I:**	1,095,000 *gallons*
Peak Level:	4.62 *in*		
d/D Ratio:	0.33		

SITE 6D
I/I Summary: Rain Event 5

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 5 Detail Graph



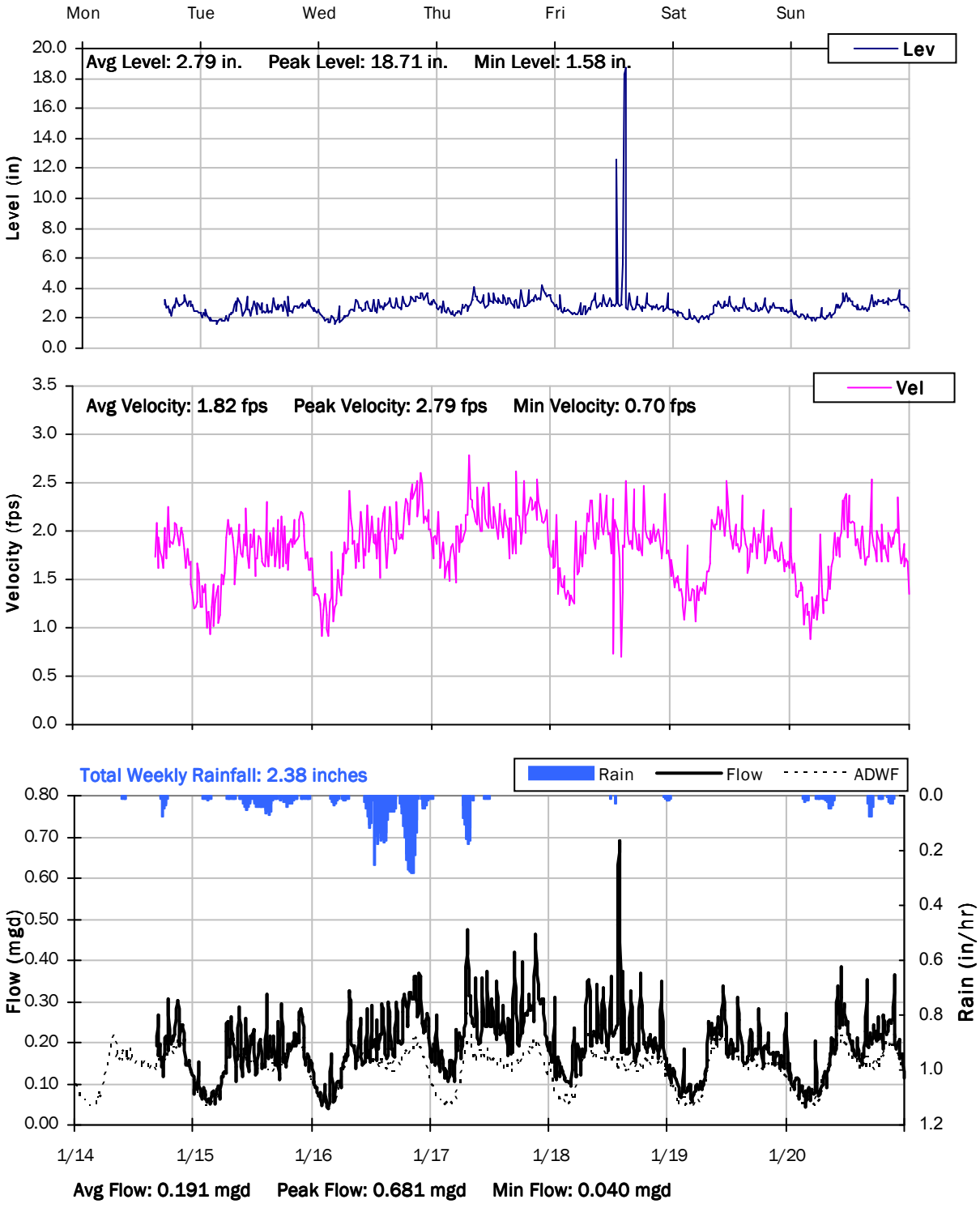
Storm Event I/I Analysis (Rain = 1.93 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.35 *mgd*	**Peak I/I Rate:**	0.19 *mgd*
PF:	2.58	**Total I/I:**	244,000 *gallons*
Peak Level:	3.57 *in*		
d/D Ratio:	0.25		

SITE 6D

Weekly Level, Velocity and Flow Hydrographs

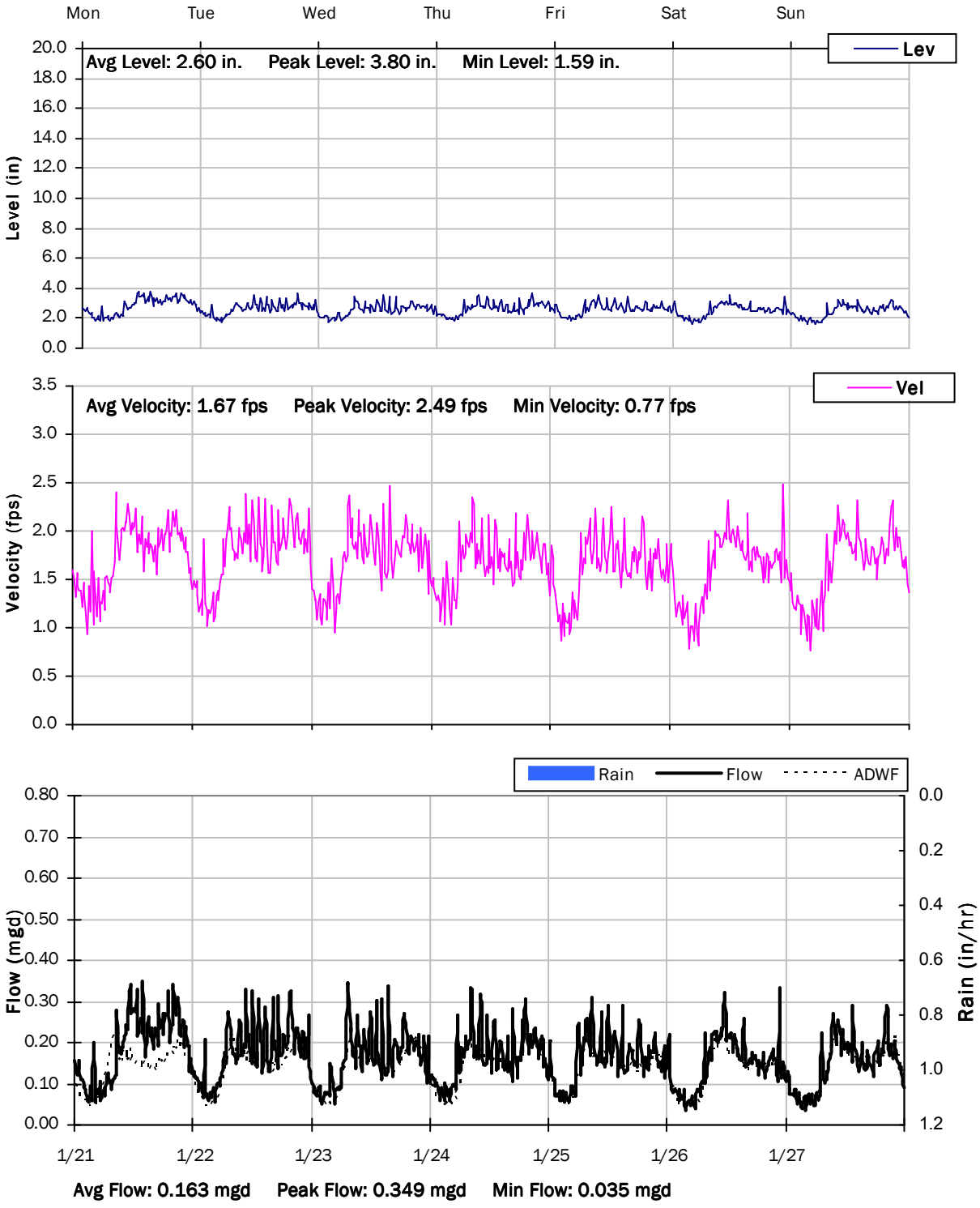
1/14/2019 to 1/21/2019



SITE 6D

Weekly Level, Velocity and Flow Hydrographs

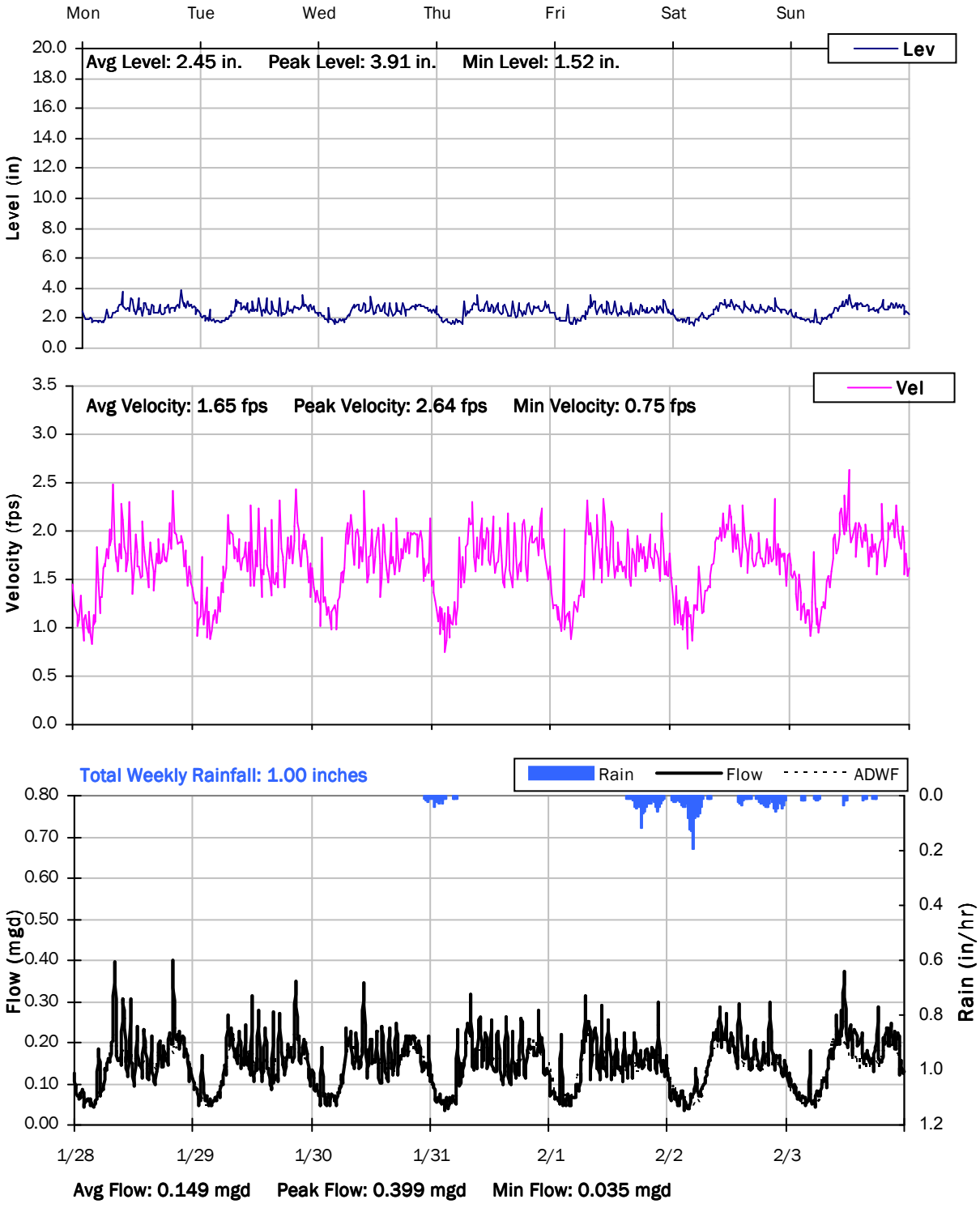
1/21/2019 to 1/28/2019



SITE 6D

Weekly Level, Velocity and Flow Hydrographs

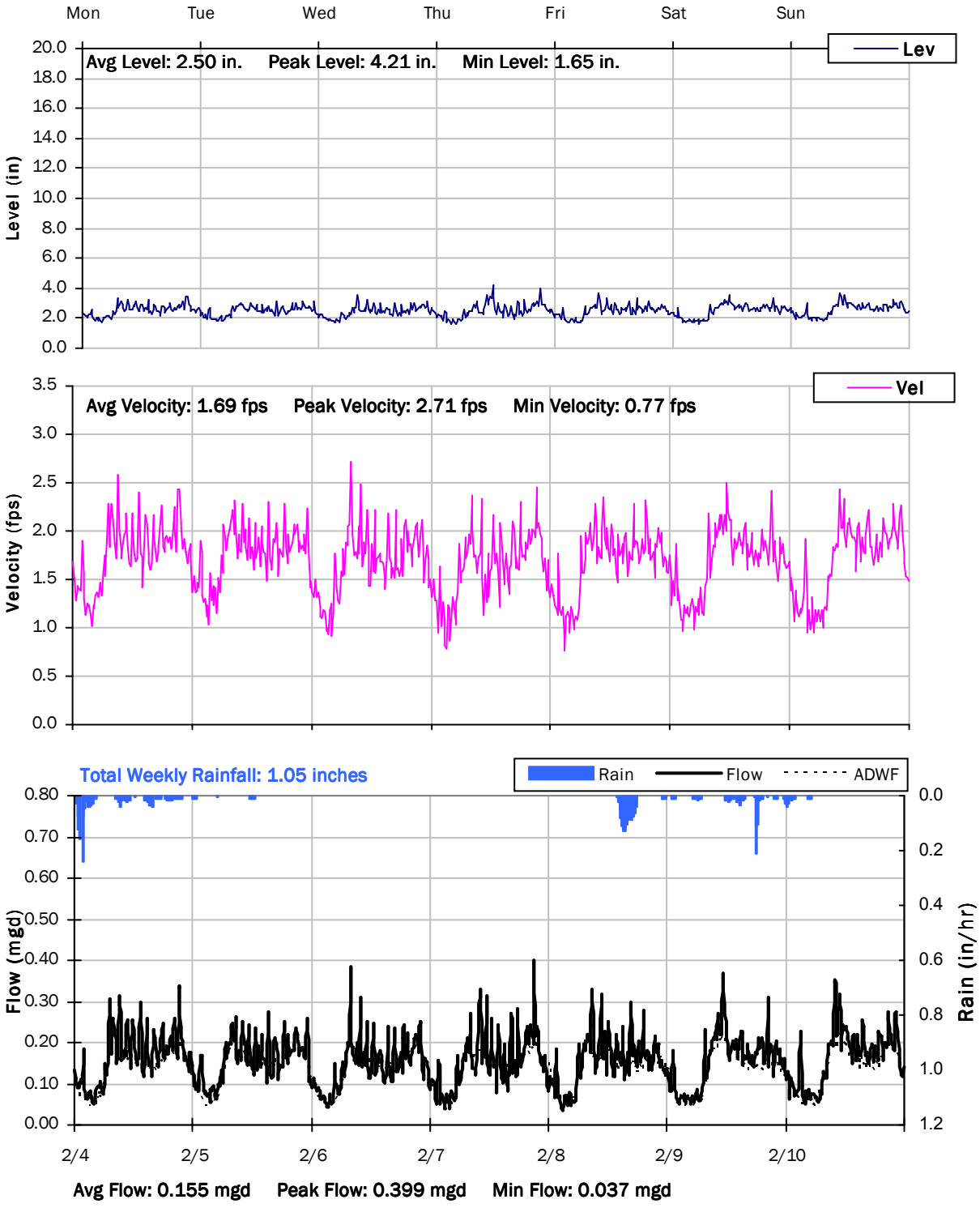
1/28/2019 to 2/4/2019



SITE 6D

Weekly Level, Velocity and Flow Hydrographs

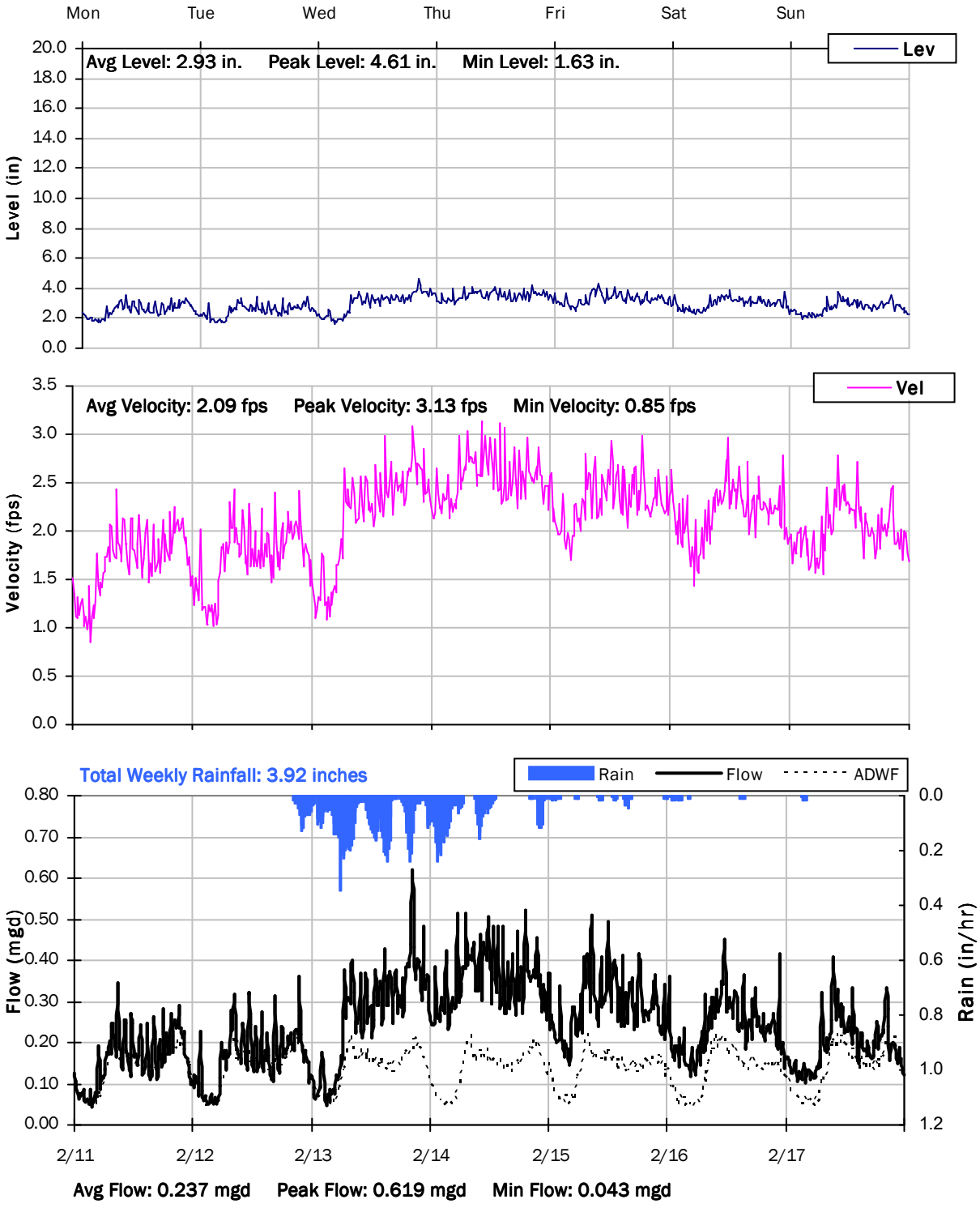
2/4/2019 to 2/11/2019



SITE 6D

Weekly Level, Velocity and Flow Hydrographs

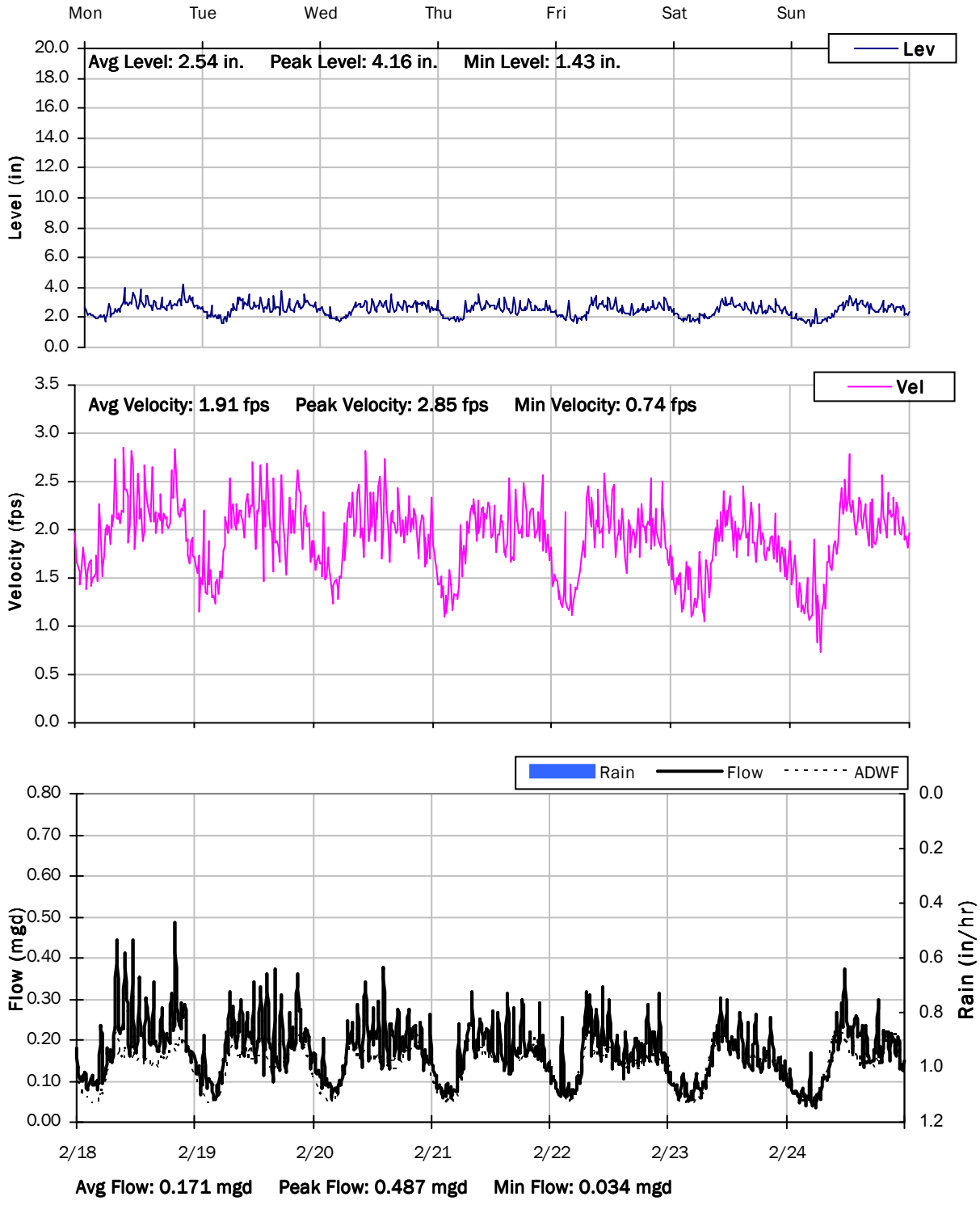
2/11/2019 to 2/18/2019



SITE 6D

Weekly Level, Velocity and Flow Hydrographs

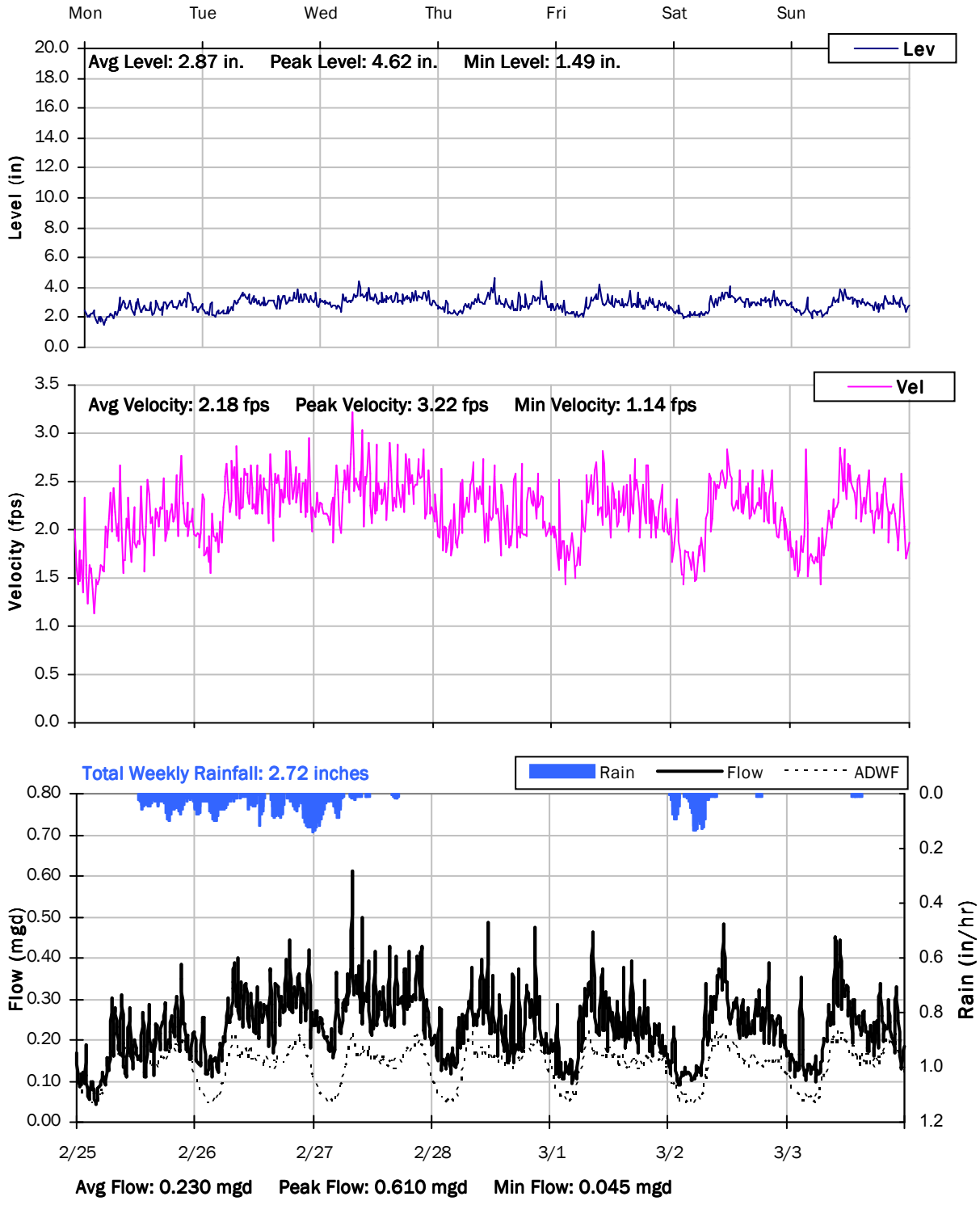
2/18/2019 to 2/25/2019



SITE 6D

Weekly Level, Velocity and Flow Hydrographs

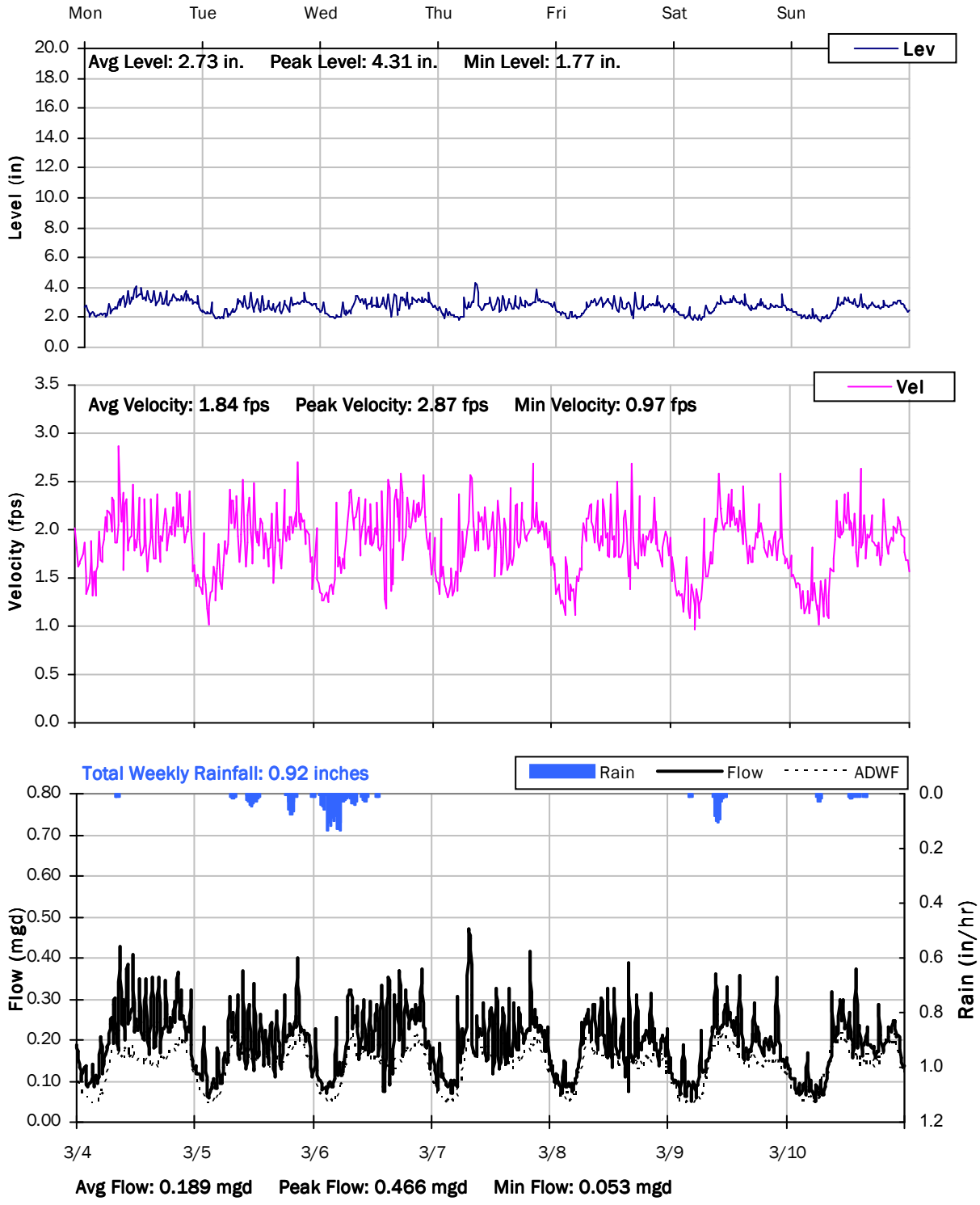
2/25/2019 to 3/4/2019



SITE 6D

Weekly Level, Velocity and Flow Hydrographs

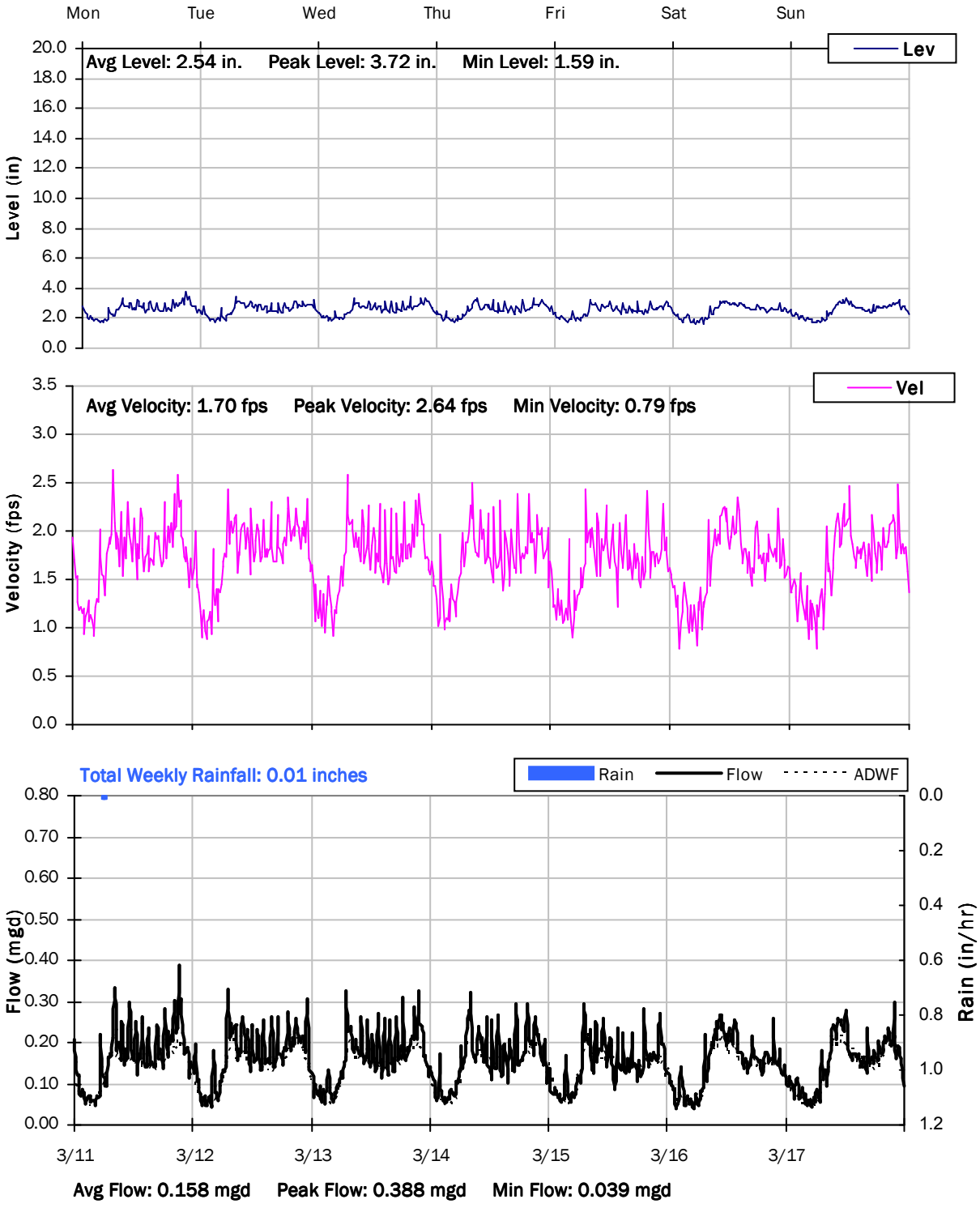
3/4/2019 to 3/11/2019



SITE 6D

Weekly Level, Velocity and Flow Hydrographs

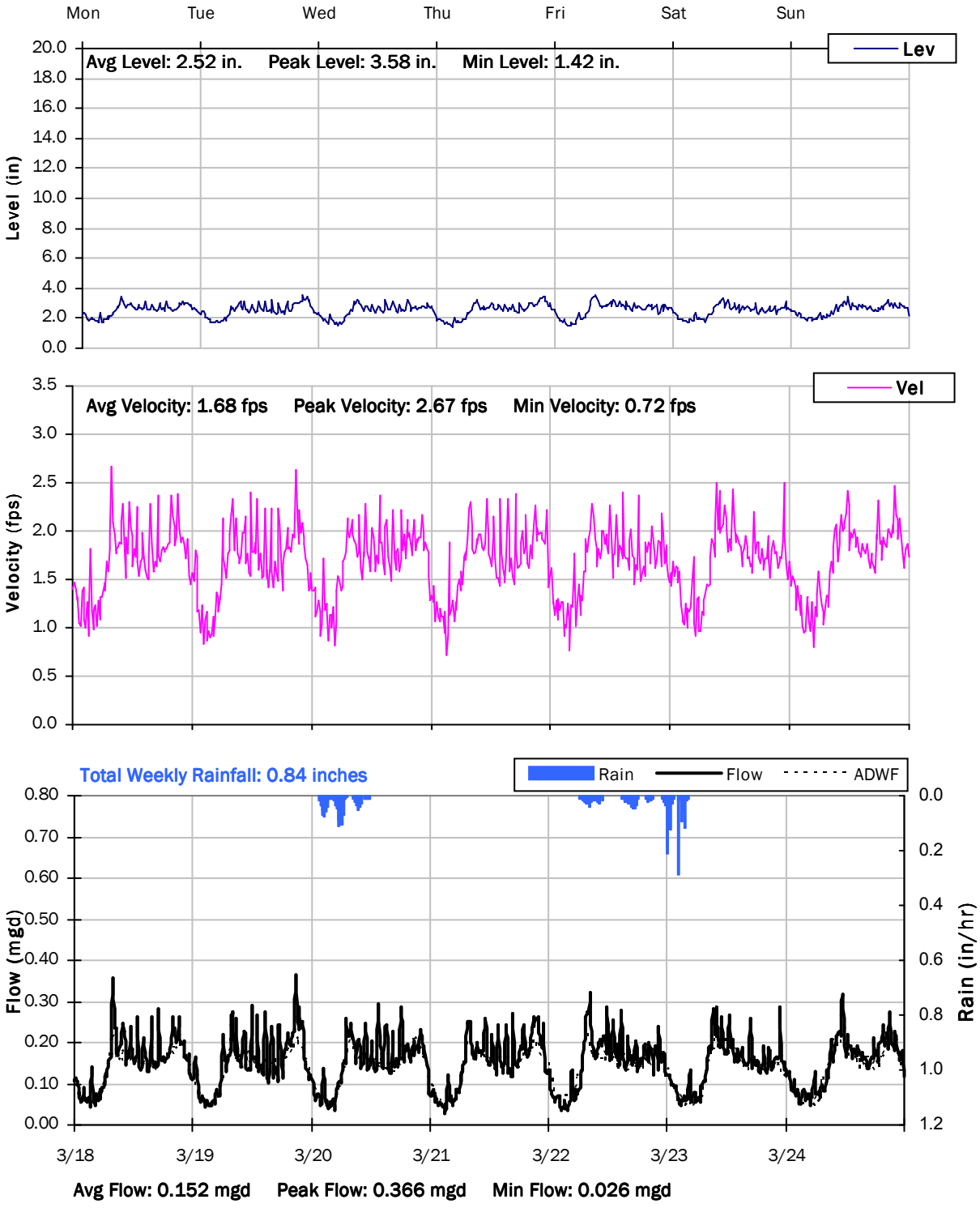
3/11/2019 to 3/18/2019



SITE 6D

Weekly Level, Velocity and Flow Hydrographs

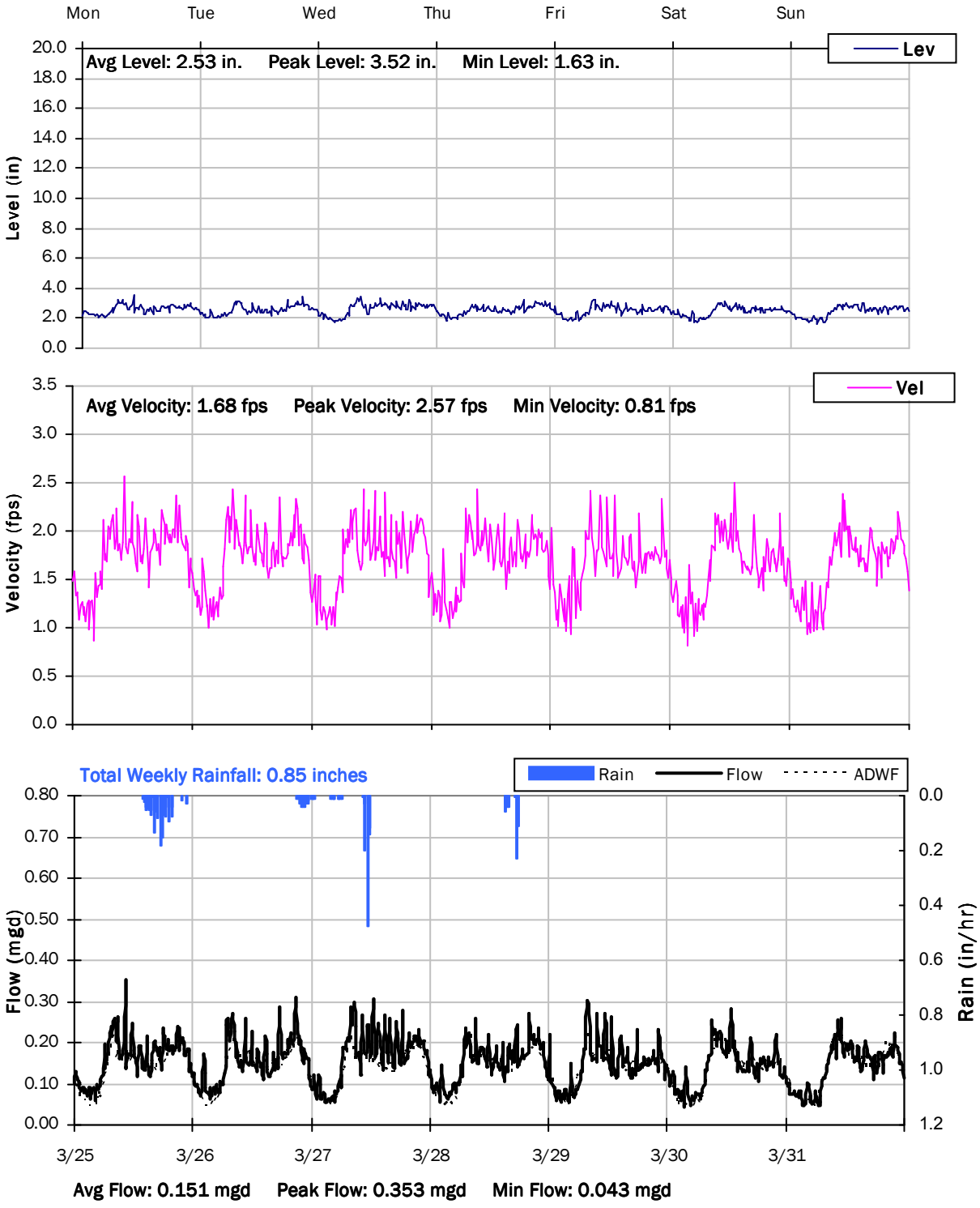
3/18/2019 to 3/25/2019



SITE 6D

Weekly Level, Velocity and Flow Hydrographs

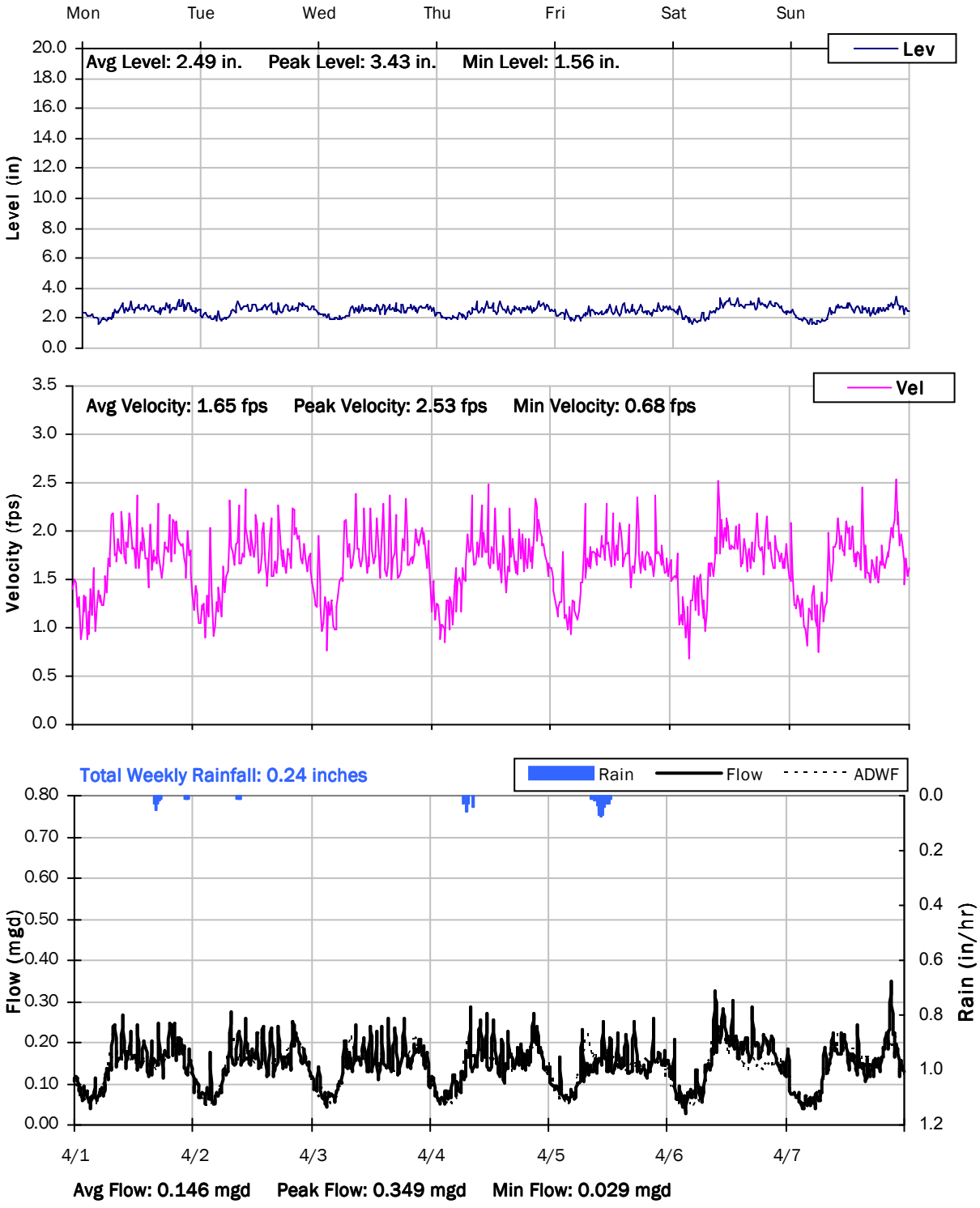
3/25/2019 to 4/1/2019



SITE 6D

Weekly Level, Velocity and Flow Hydrographs

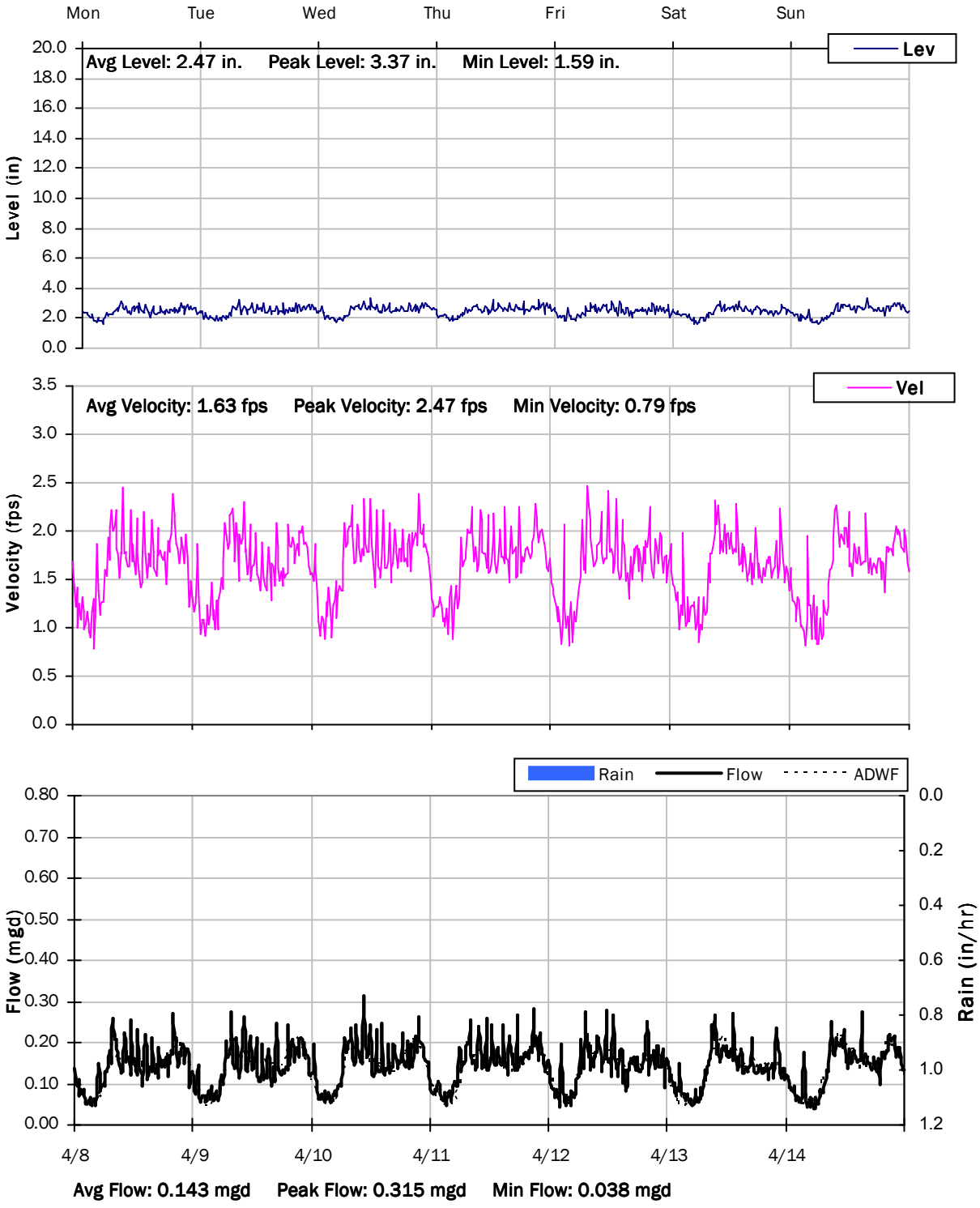
4/1/2019 to 4/8/2019



SITE 6D

Weekly Level, Velocity and Flow Hydrographs

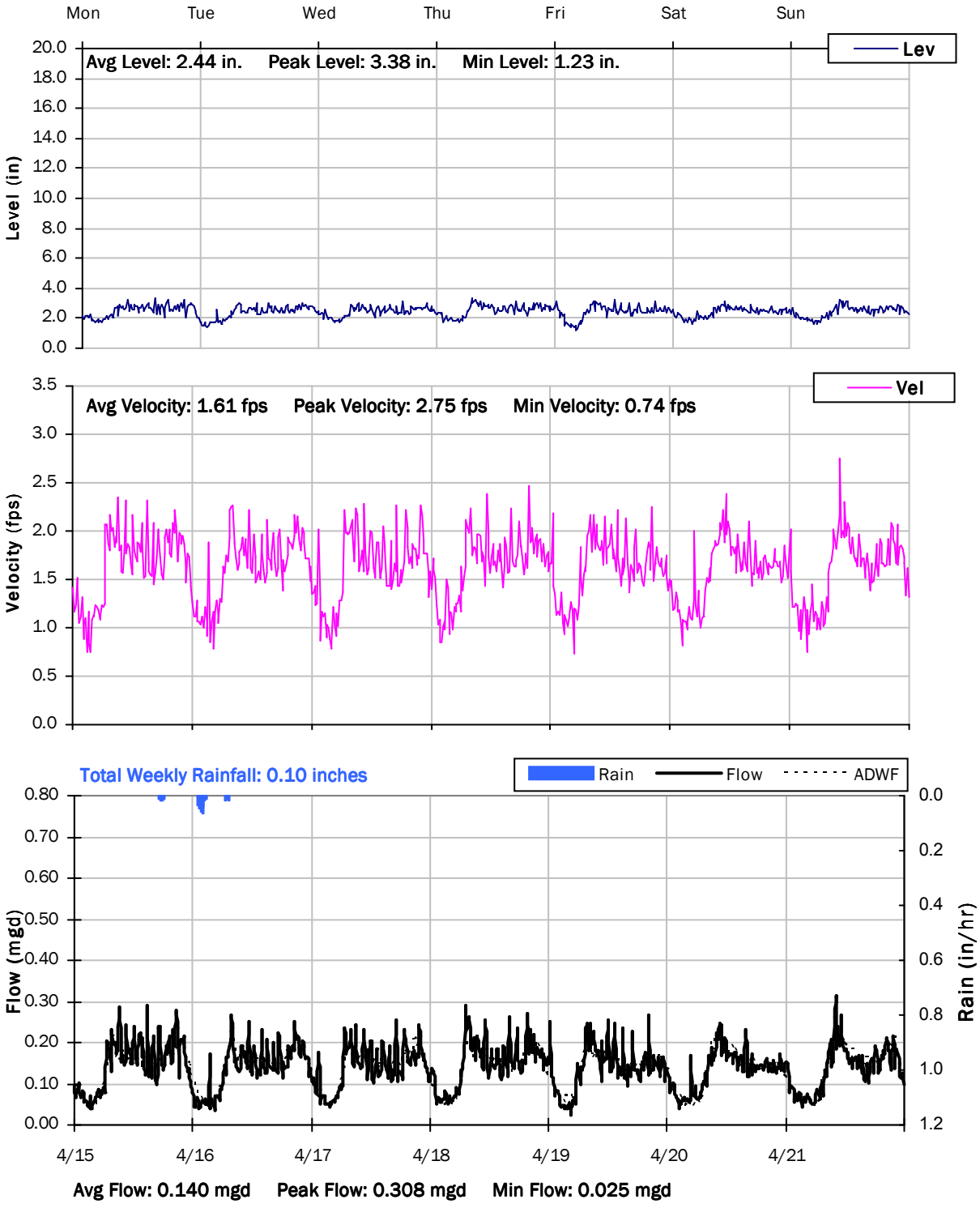
4/8/2019 to 4/15/2019



SITE 6D

Weekly Level, Velocity and Flow Hydrographs

4/15/2019 to 4/22/2019



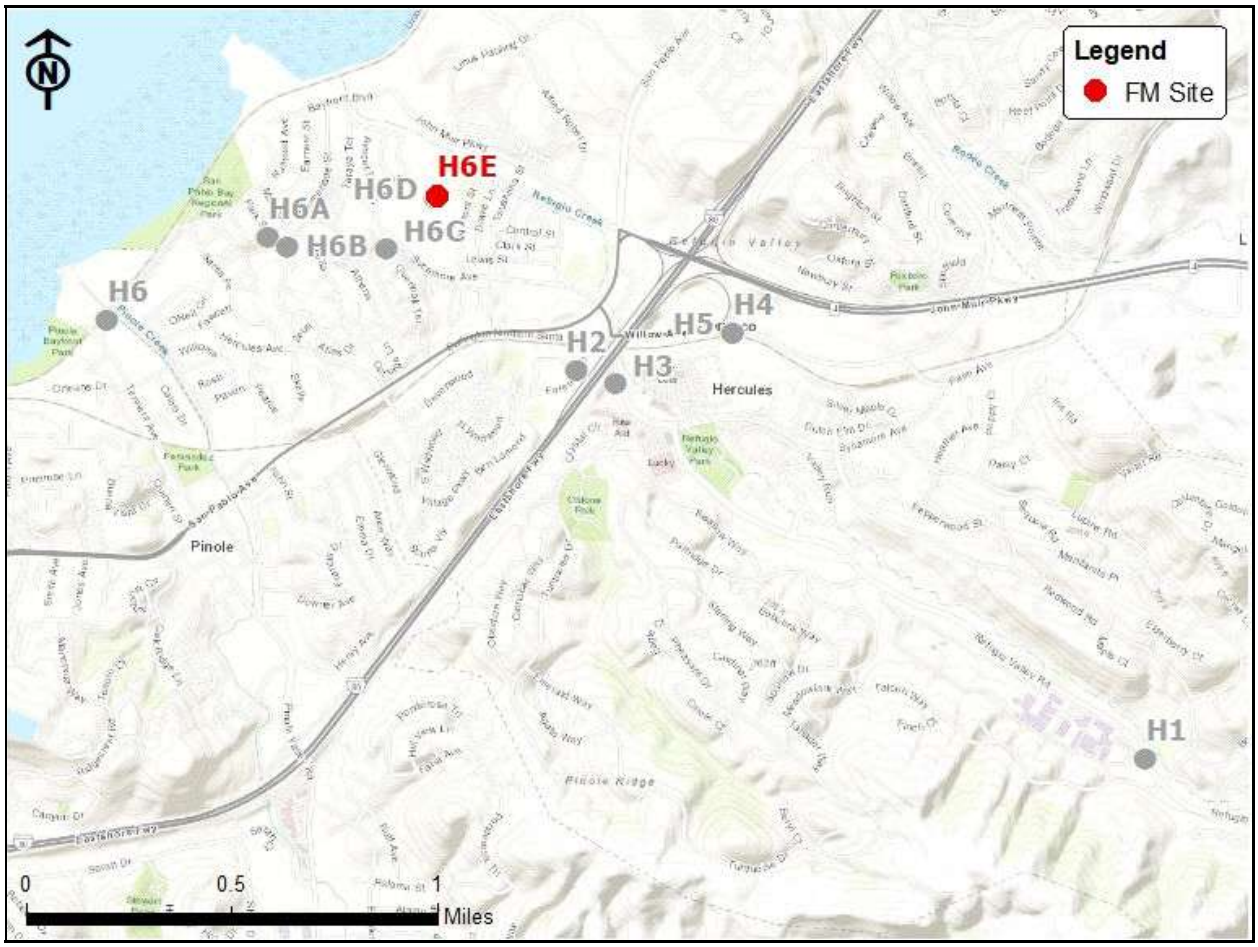
City of Hercules, California

Sanitary Sewer Flow Monitoring
January 14 - April 21, 2019

Monitoring Site: Site 6E

Location: Open space southeast of Willet Street ant Sanderling Drive

Data Summary Report



Vicinity Map: Site 6E

SITE 6E

Site Information

Location: Open space southeast of Willet Street ant Sanderling Drive

Coordinates: 122.2806° W, 38.0171° N

Rim Elevation (Earth): 18 feet

Measured Pipe Diameter: 12 inches

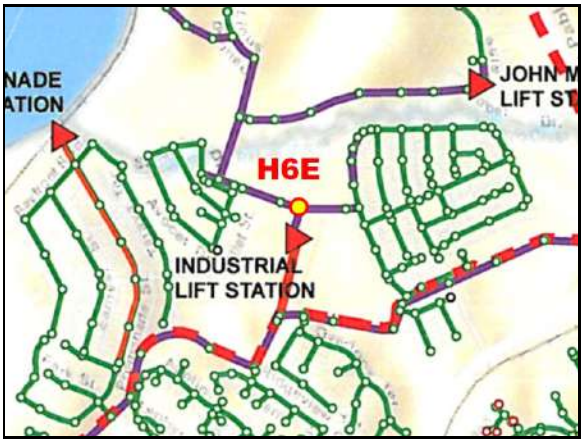
ADWF: 0.121 mgd

Peak Measured Flow: 0.454 mgd

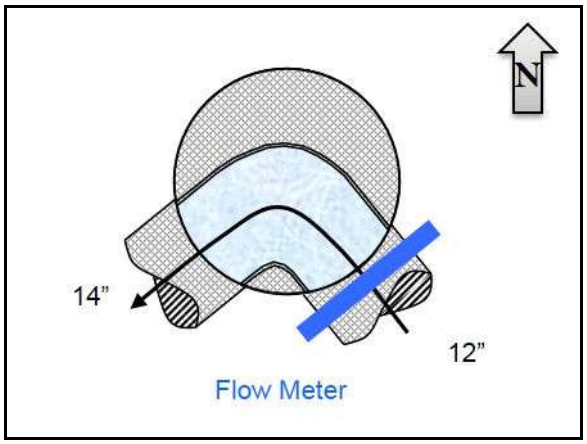
Sediment: None



Satellite Map



Sewer Map



Flow Sketch



Street View



Plan View

SITE 6E

Additional Site Photos

Effluent Pipe



Monitored Influent Pipe

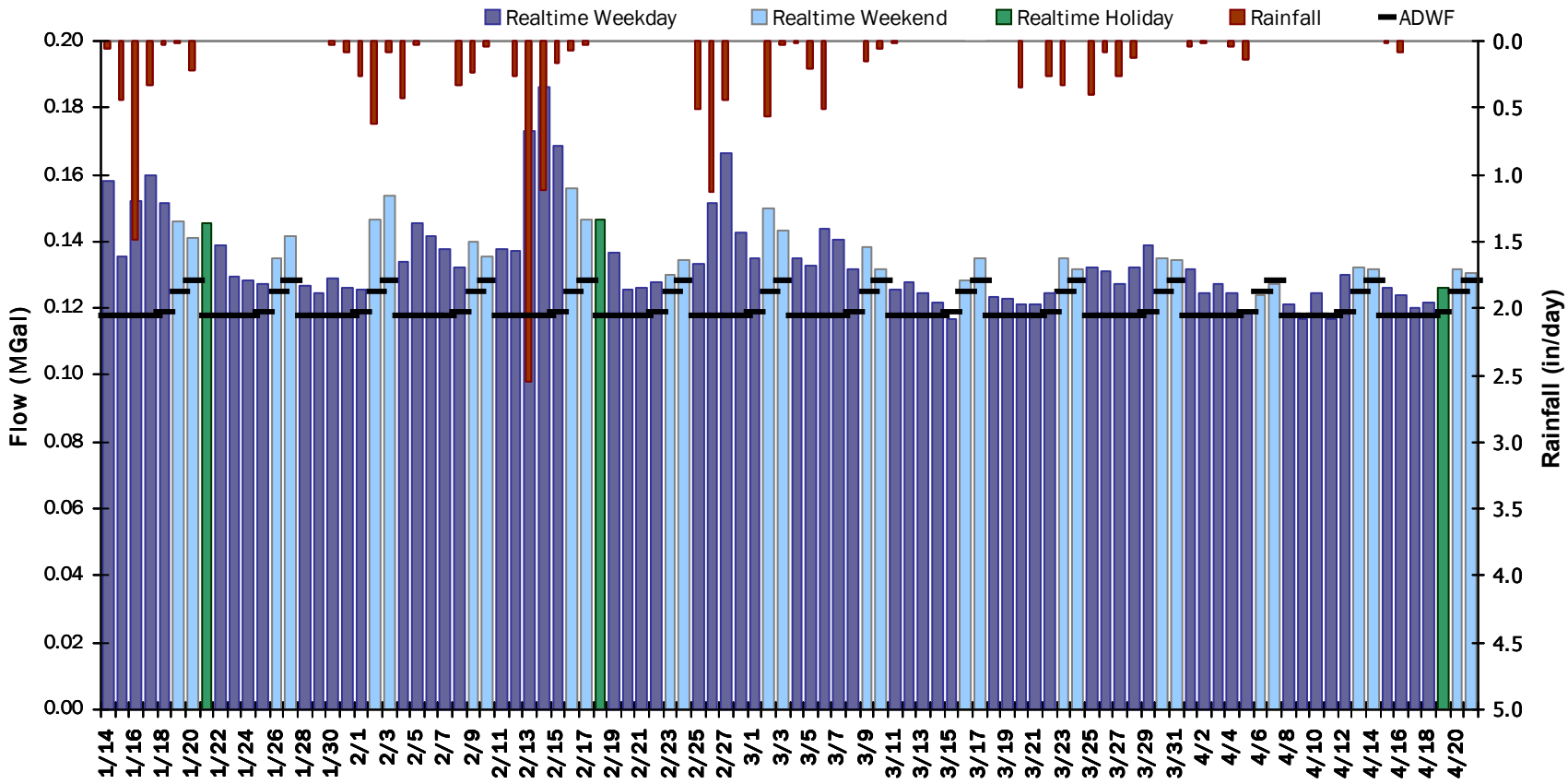


SITE 6E

Period Flow Summary: Daily Flow Totals

Avg Daily Flow: 0.135 MGal Peak Daily Flow: 0.186 MGal Min Daily Flow: 0.117 MGal

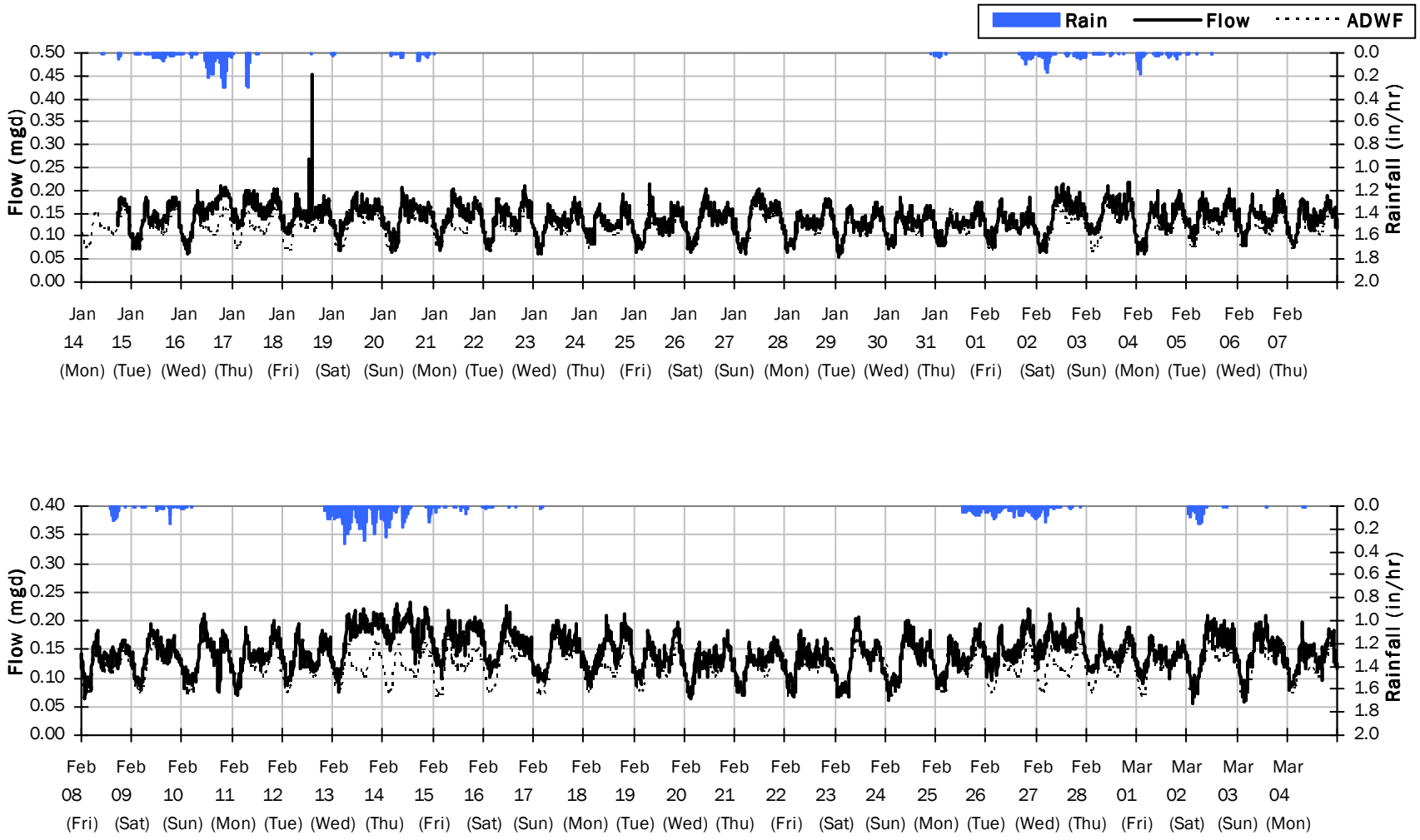
Total Rainfall: 14.65 inches



SITE 6E

Flow Summary: 1/14/2019 to 3/4/2019

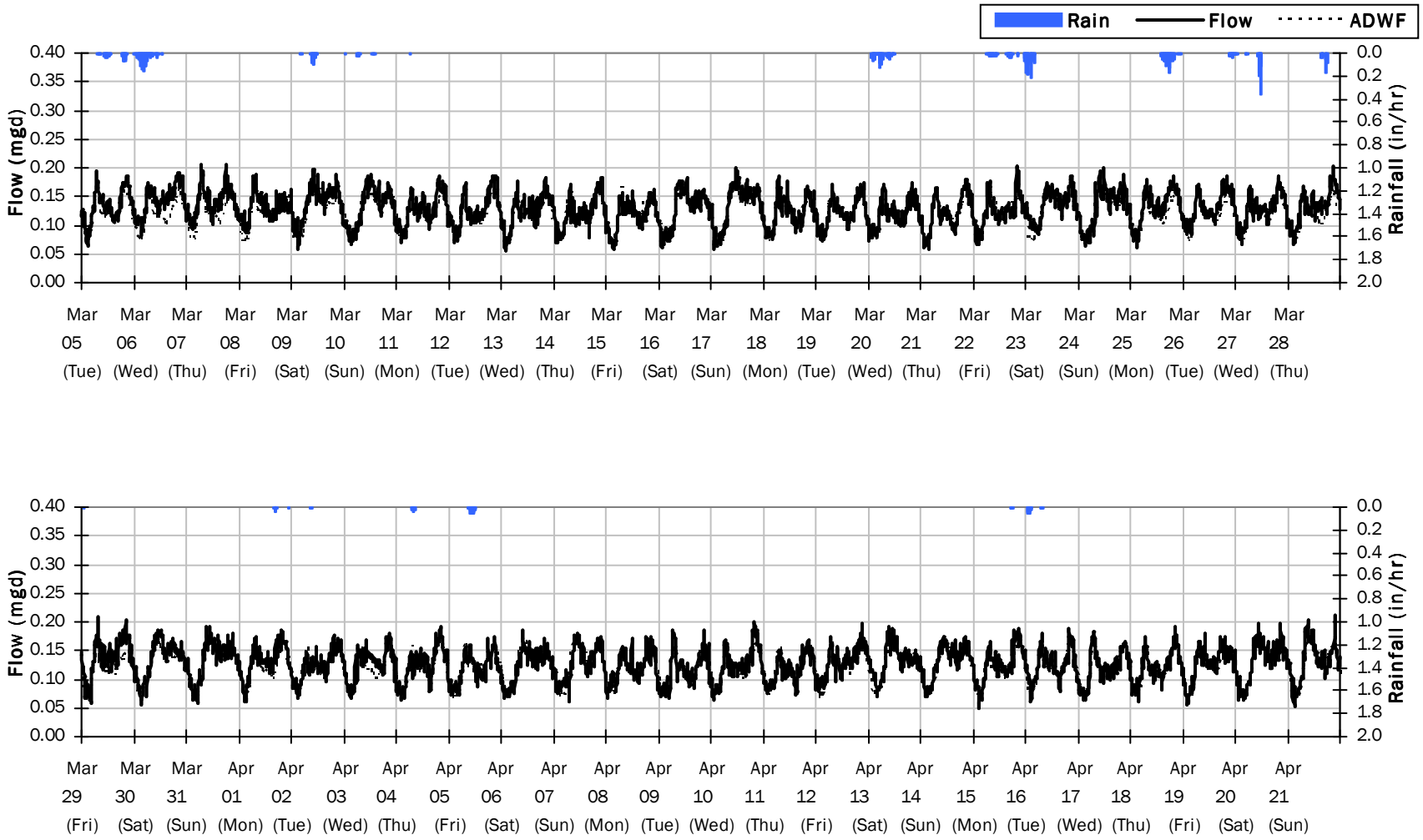
Period Rainfall: 11.56 inches Period Avg Flow: 0.141 mgd Period Peak Flow: 0.454 mgd Period Min Flow: 0.053 mgd



SITE 6E

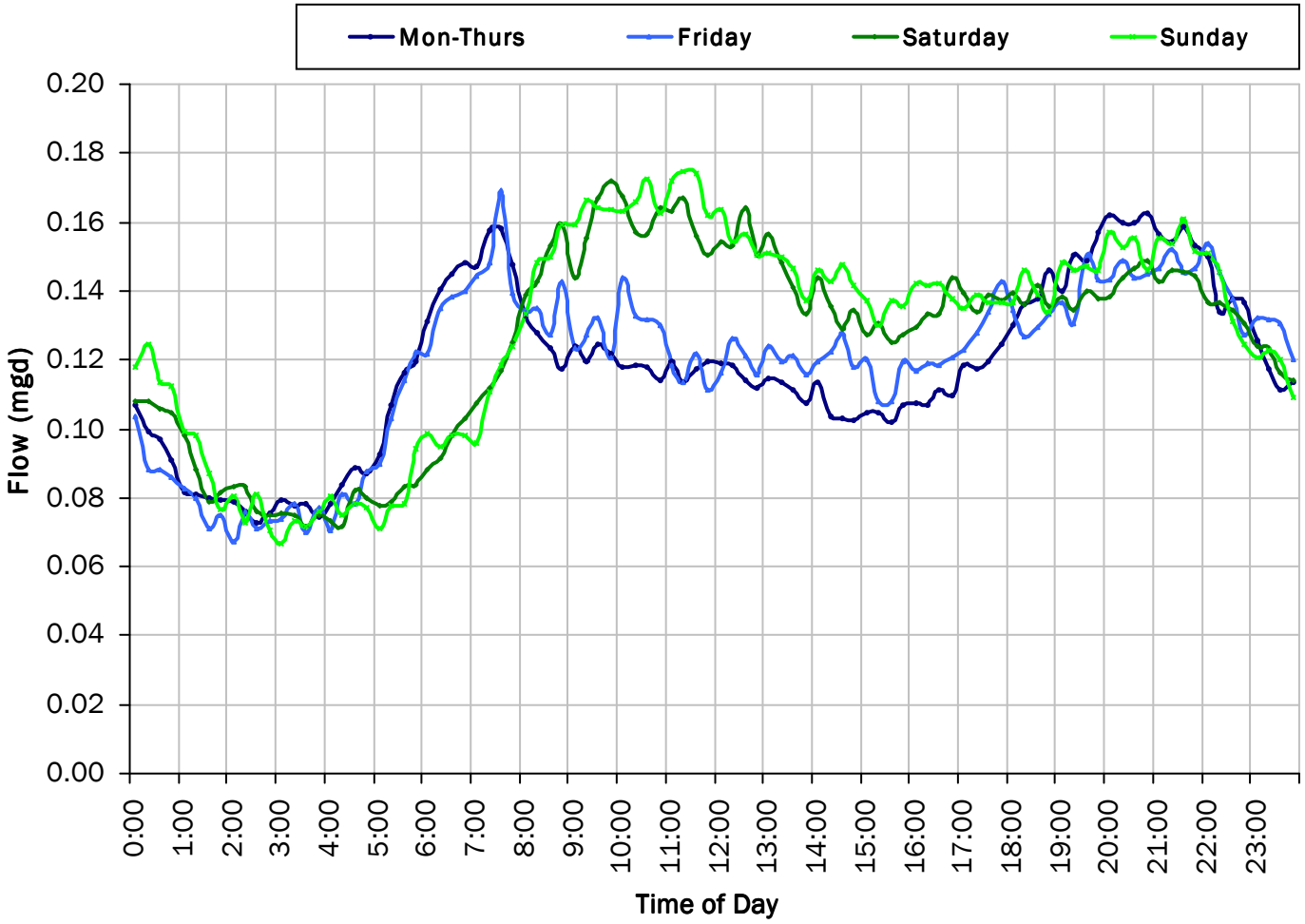
Flow Summary: 3/5/2019 to 4/21/2019

Period Rainfall: 3.10 inches Period Avg Flow: 0.128 mgd Period Peak Flow: 0.212 mgd Period Min Flow: 0.049 mgd



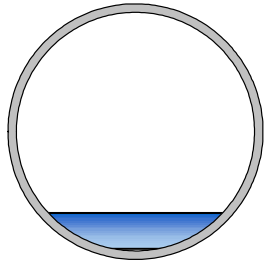
SITE 6E

Average Dry Weather Flow Hydrographs



ADWF:

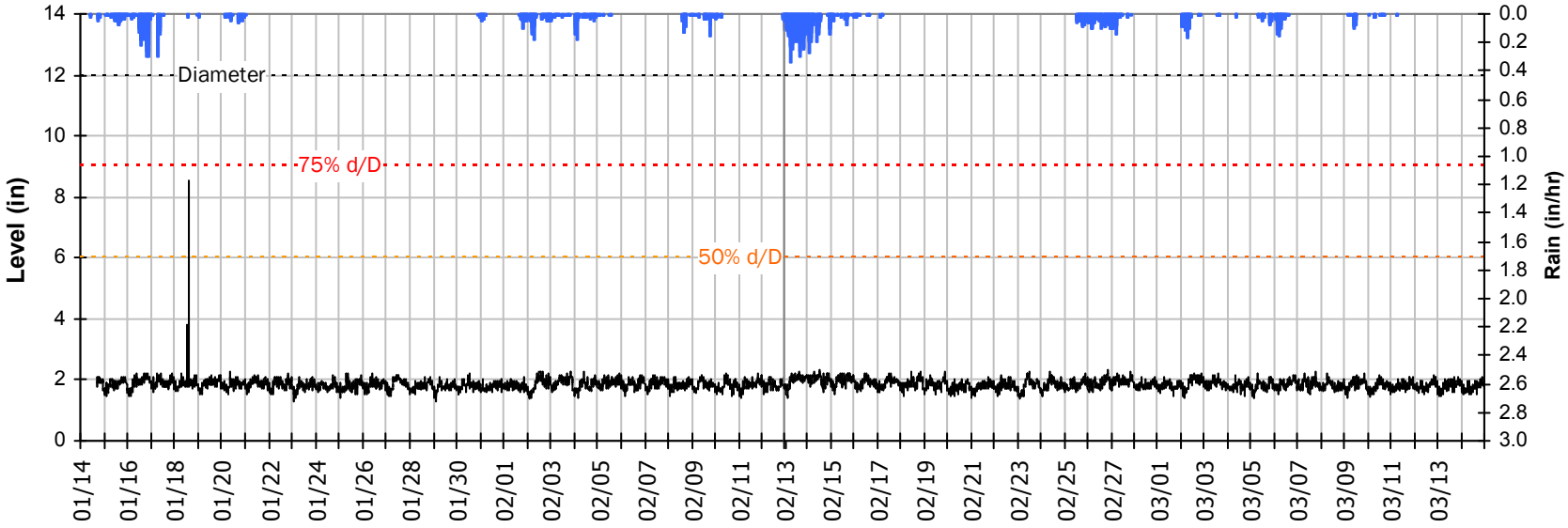
0.121 *mgd*

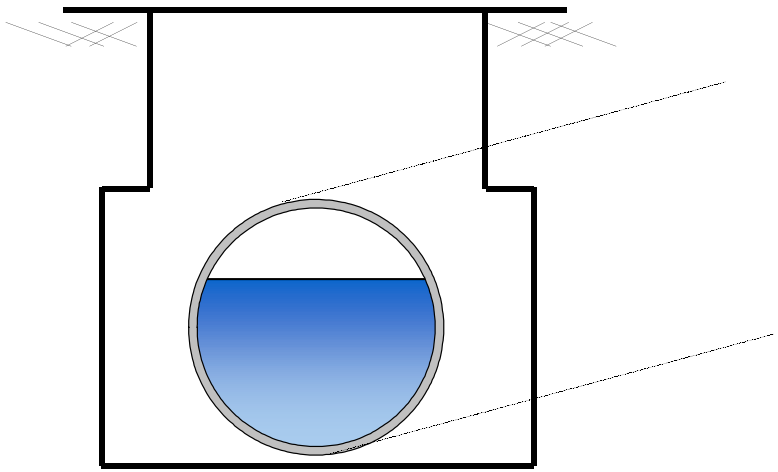


SITE 6E

Site Capacity and Surcharge Summary

Realtime Flow Levels with Rainfall Data over Peak Level Period



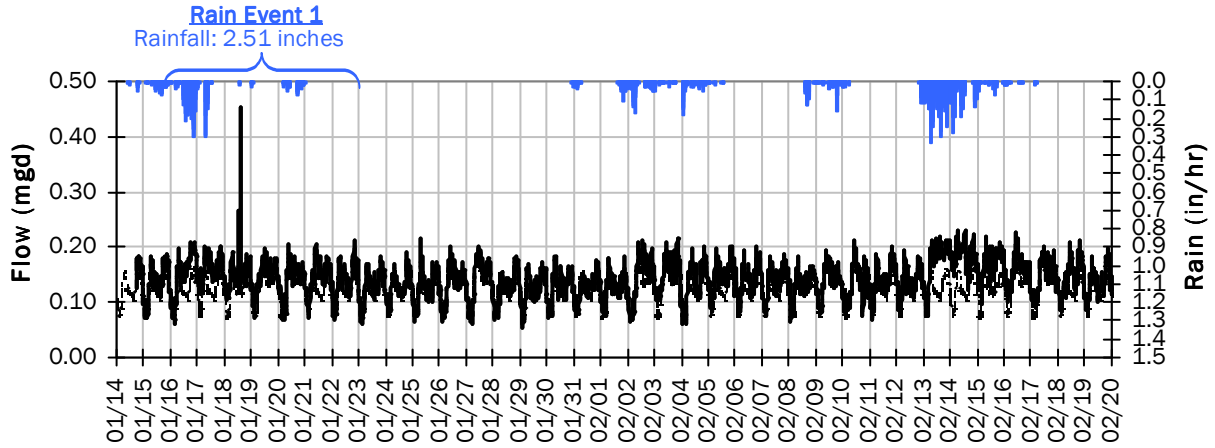


Pipe Diameter:	12	*inches*
Peak Measured Level:	8.4	*inches*
Peak d/D Ratio:	0.70	

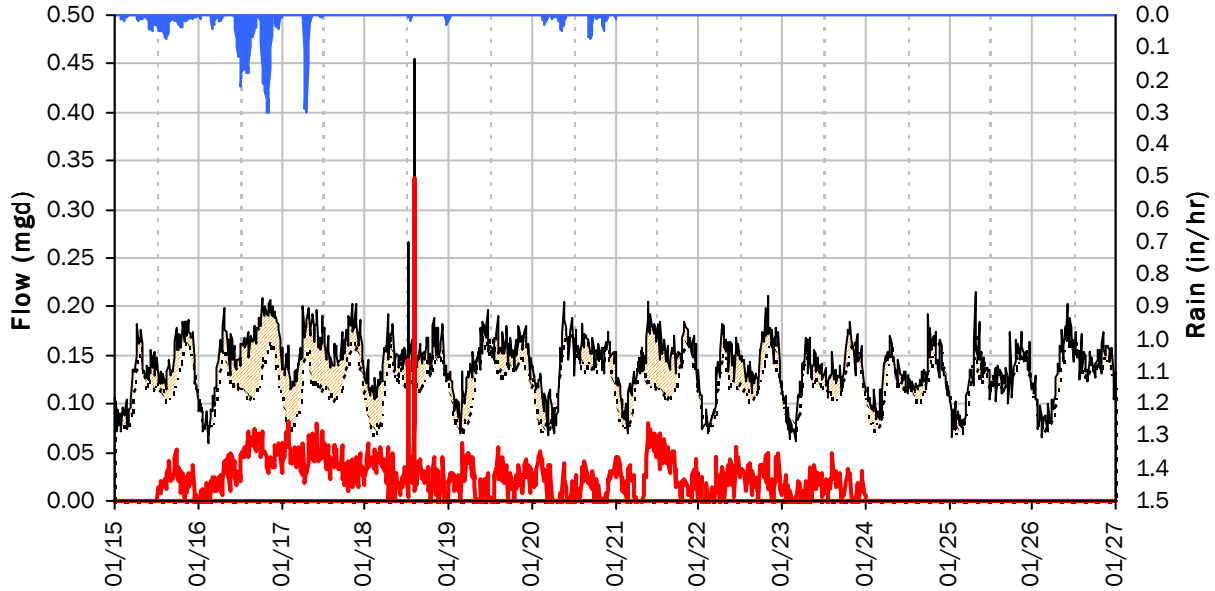
SITE 6E

I/I Summary: Rain Event 1

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 1 Detail Graph

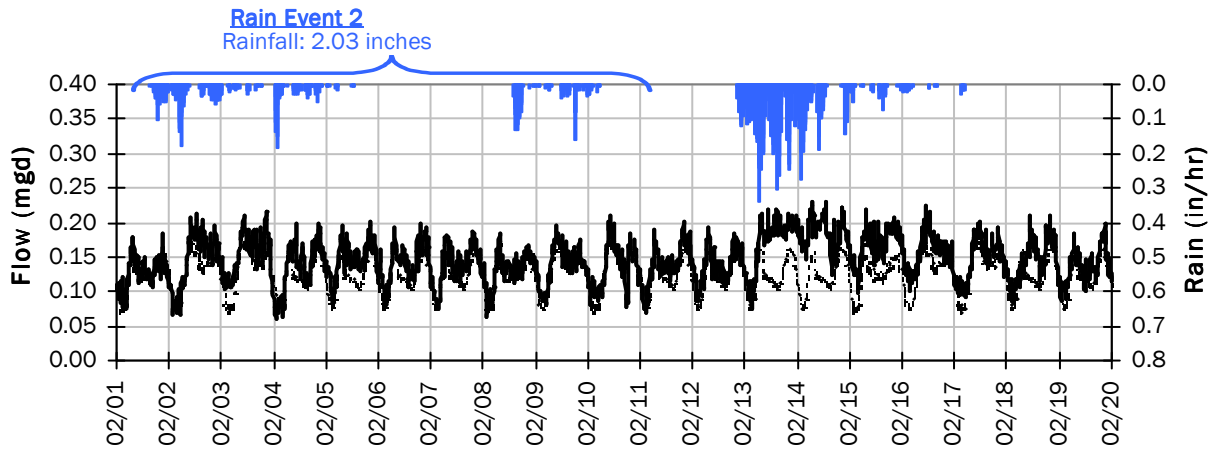


Storm Event I/I Analysis (Rain = 2.51 inches)

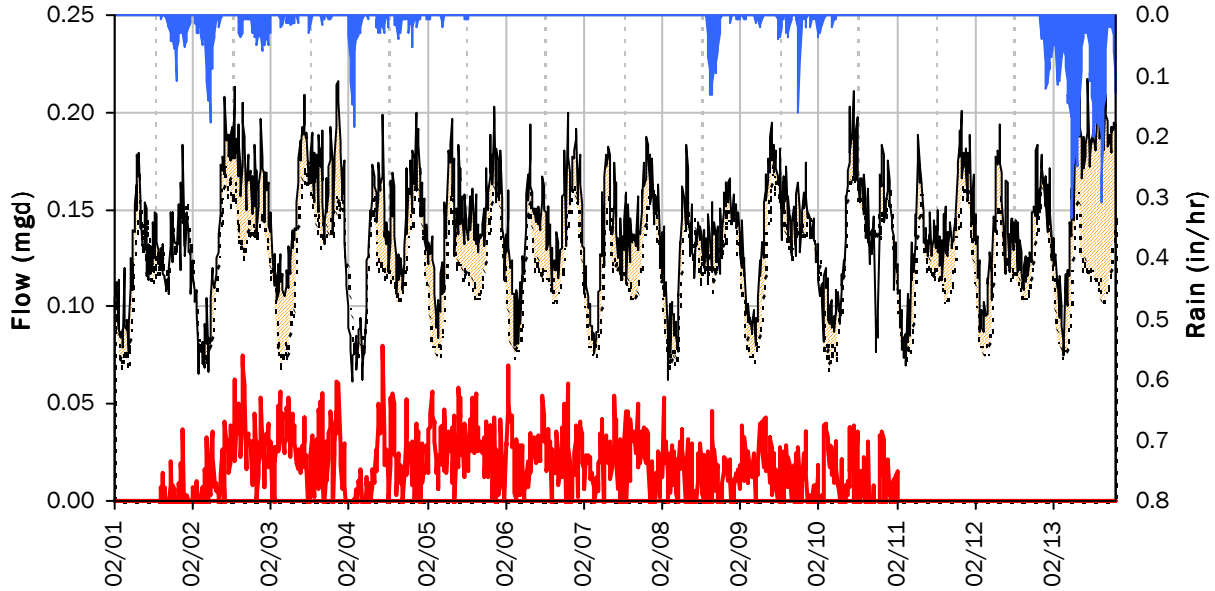
Capacity		Inflow / Infiltration	
Peak Flow:	0.378 *mgd*	**Peak I/I Rate:**	0.268 *mgd*
PF:	3.49	**Total I/I:**	197,000 *gallons*
Peak Level:	8.40 *in*		
d/D Ratio:	0.70		

SITE 6E
I/I Summary: Rain Event 2

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 2 Detail Graph

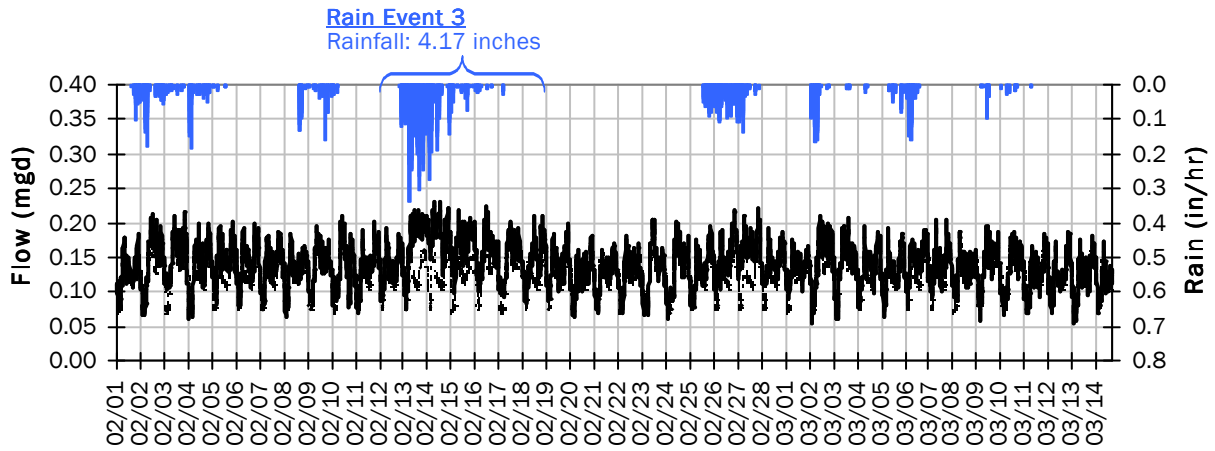


Storm Event I/I Analysis (Rain = 2.03 inches)

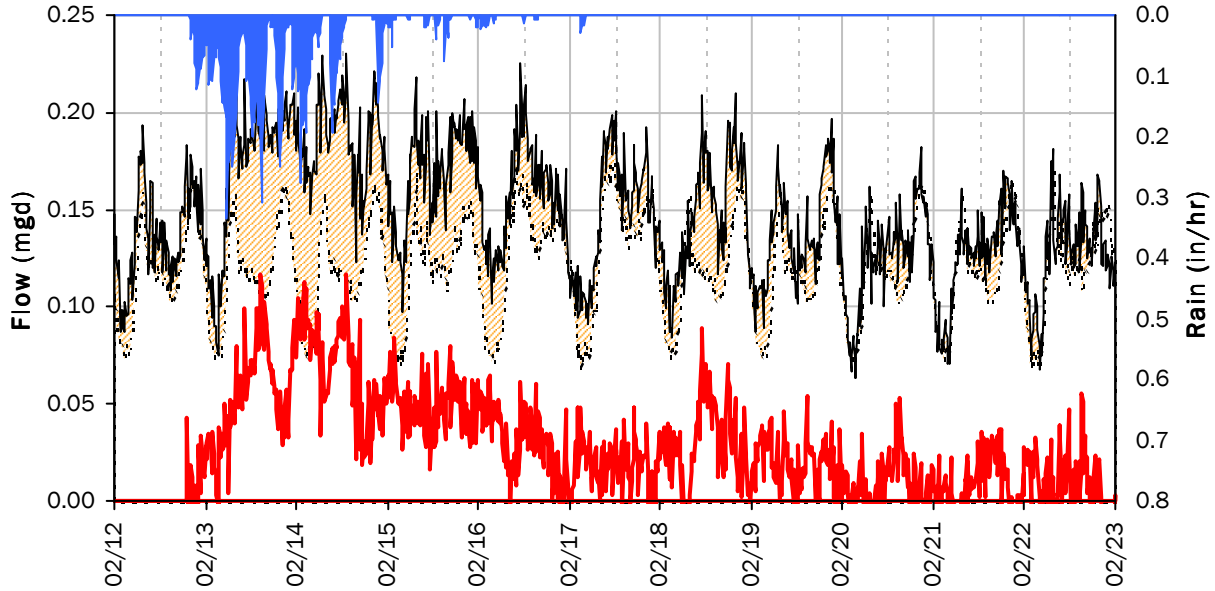
Capacity		Inflow / Infiltration	
Peak Flow:	0.195 *mgd*	**Peak I/I Rate:**	0.072 *mgd*
PF:	1.79	**Total I/I:**	157,000 *gallons*
Peak Level:	2.30 *in*		
d/D Ratio:	0.19		

SITE 6E
I/I Summary: Rain Event 3

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 3 Detail Graph

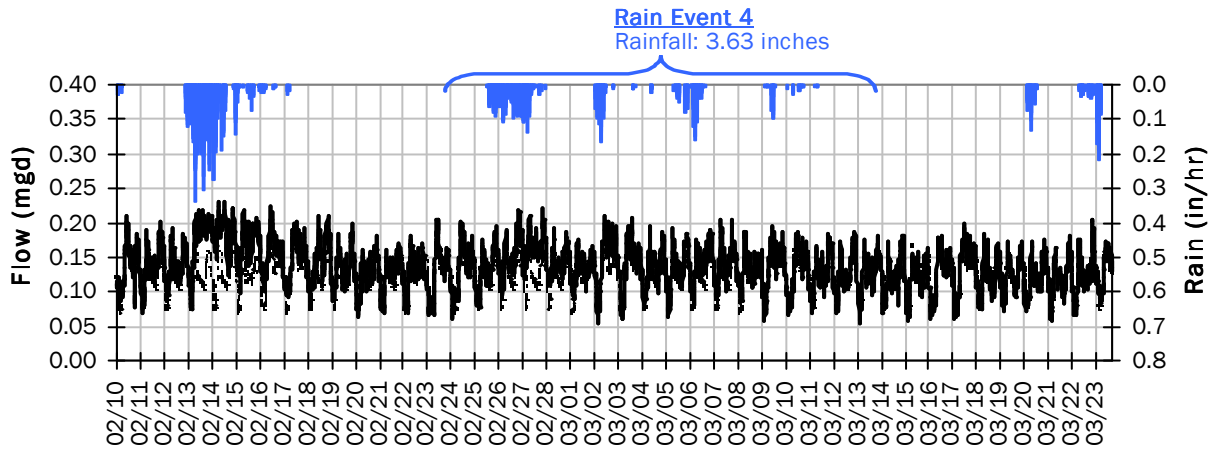


Storm Event I/I Analysis (Rain = 4.17 inches)

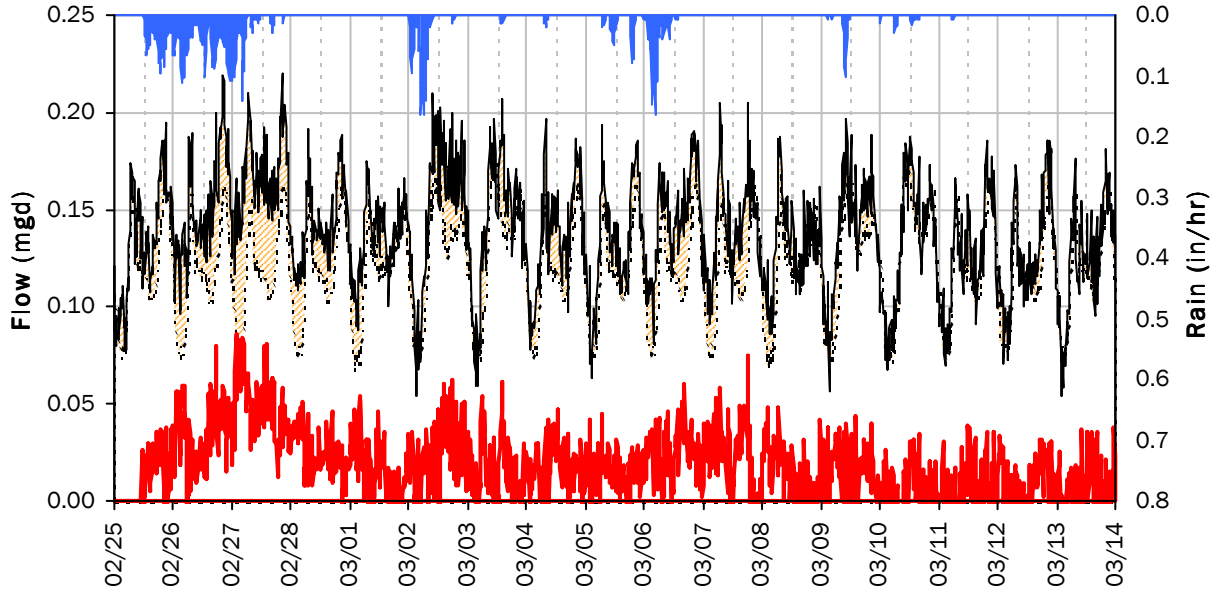
Capacity		Inflow / Infiltration	
Peak Flow:	0.23 *mgd*	**Peak I/I Rate:**	0.12 *mgd*
PF:	1.91	**Total I/I:**	297,000 *gallons*
Peak Level:	2.31 *in*		
d/D Ratio:	0.19		

SITE 6E
I/I Summary: Rain Event 4

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 4 Detail Graph

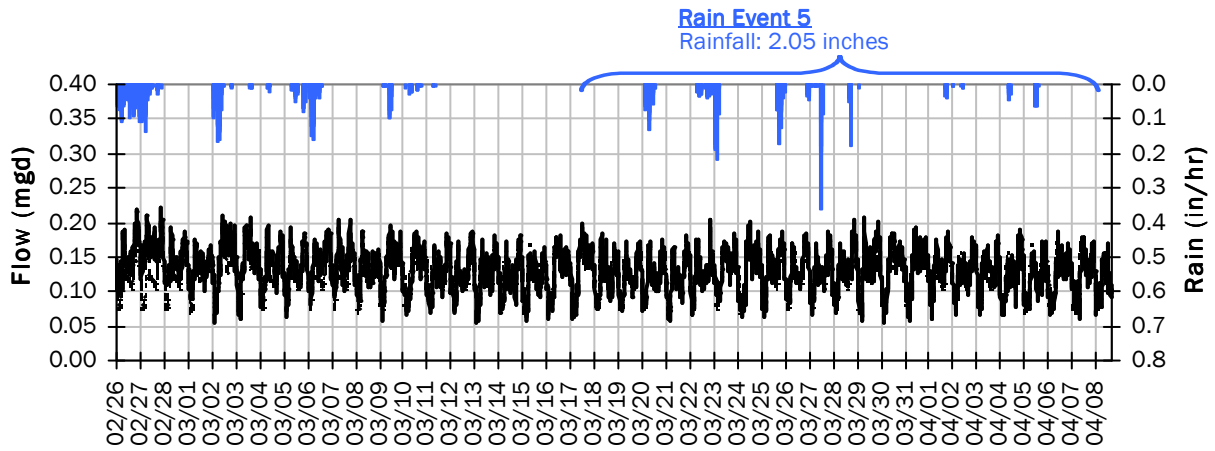


Storm Event I/I Analysis (Rain = 3.63 inches)

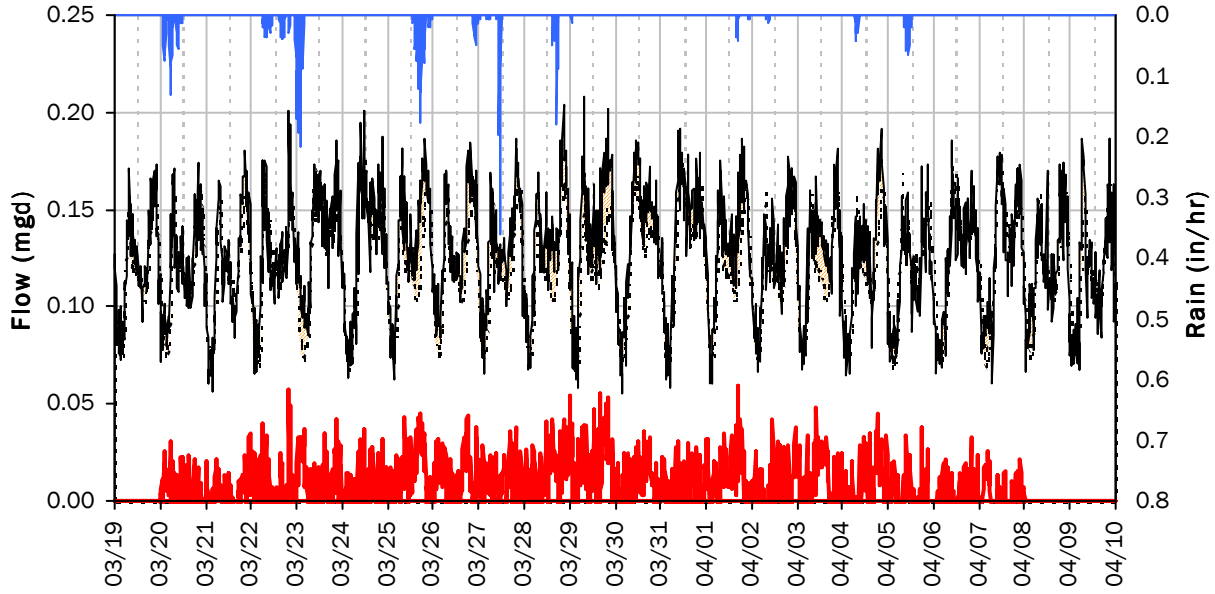
Capacity		Inflow / Infiltration	
Peak Flow:	0.22 *mgd*	**Peak I/I Rate:**	0.09 *mgd*
PF:	1.83	**Total I/I:**	308,000 *gallons*
Peak Level:	2.31 *in*		
d/D Ratio:	0.19		

SITE 6E
I/I Summary: Rain Event 5

Baseline and Realtime Flows with Rainfall Data over Monitoring Period



Rain Event 5 Detail Graph



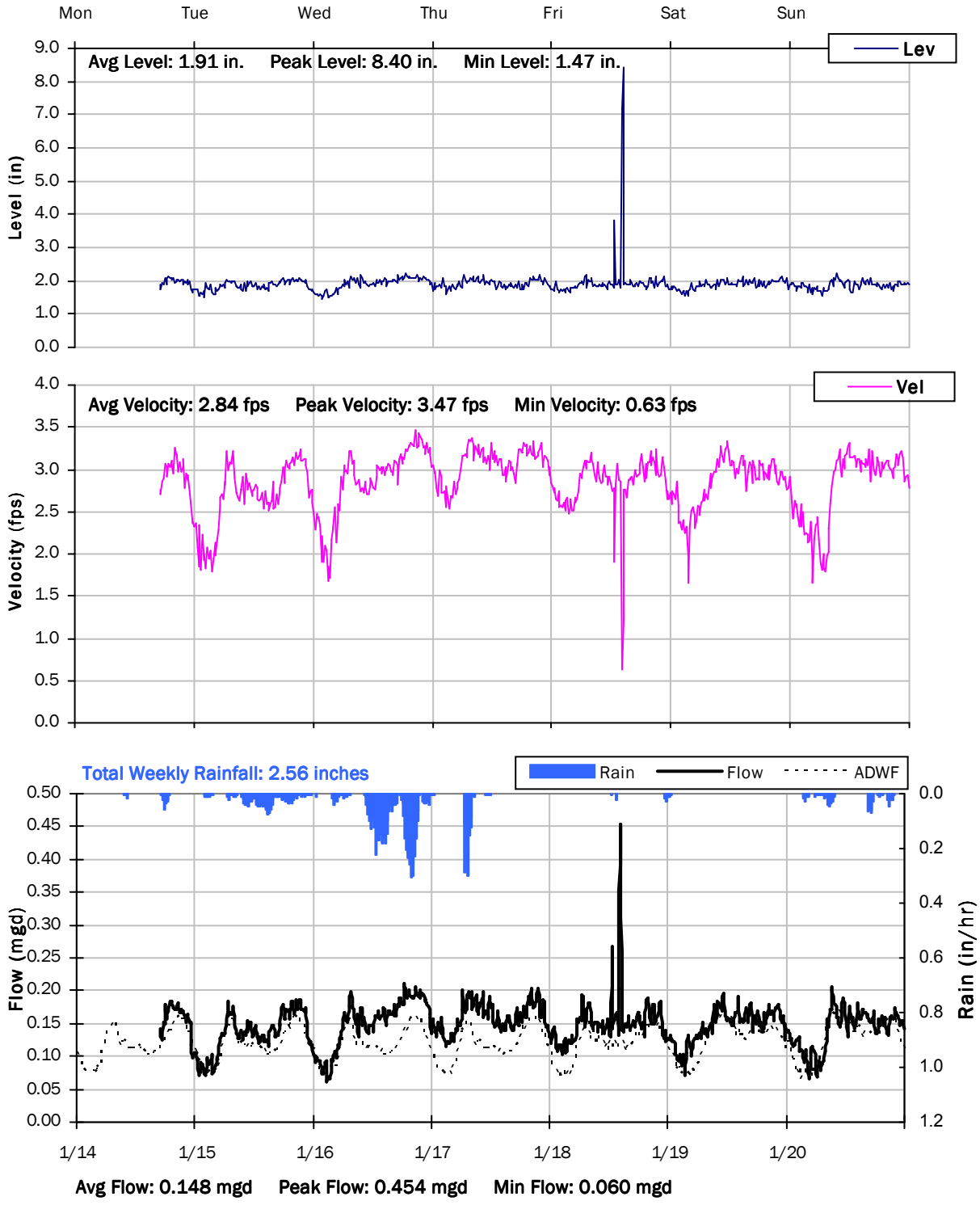
Storm Event I/I Analysis (Rain = 2.05 inches)

Capacity		Inflow / Infiltration	
Peak Flow:	0.21 *mgd*	**Peak I/I Rate:**	0.06 *mgd*
PF:	1.72	**Total I/I:**	147,000 *gallons*
Peak Level:	2.27 *in*		
d/D Ratio:	0.19		

SITE 6E

Weekly Level, Velocity and Flow Hydrographs

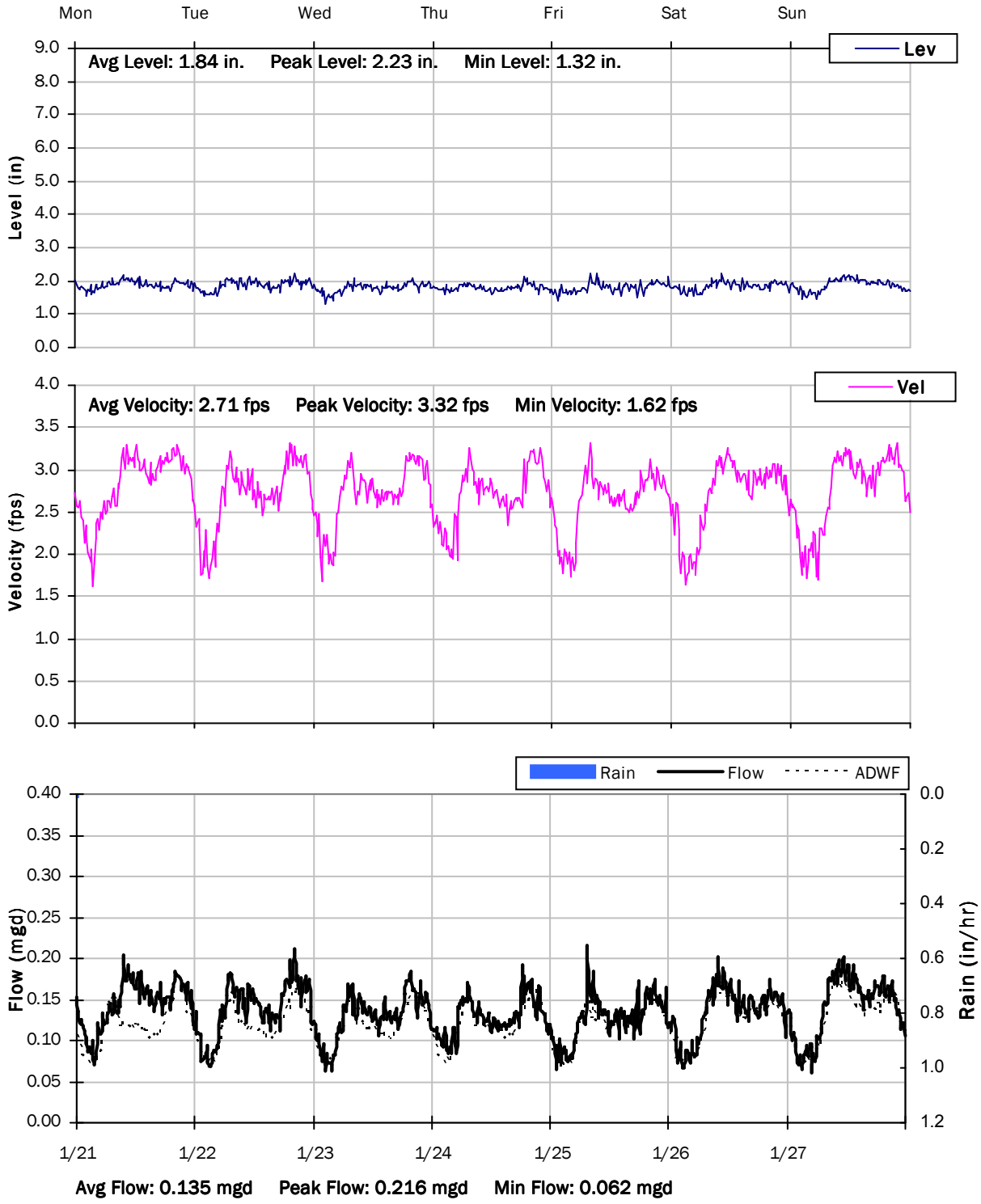
1/14/2019 to 1/21/2019



SITE 6E

Weekly Level, Velocity and Flow Hydrographs

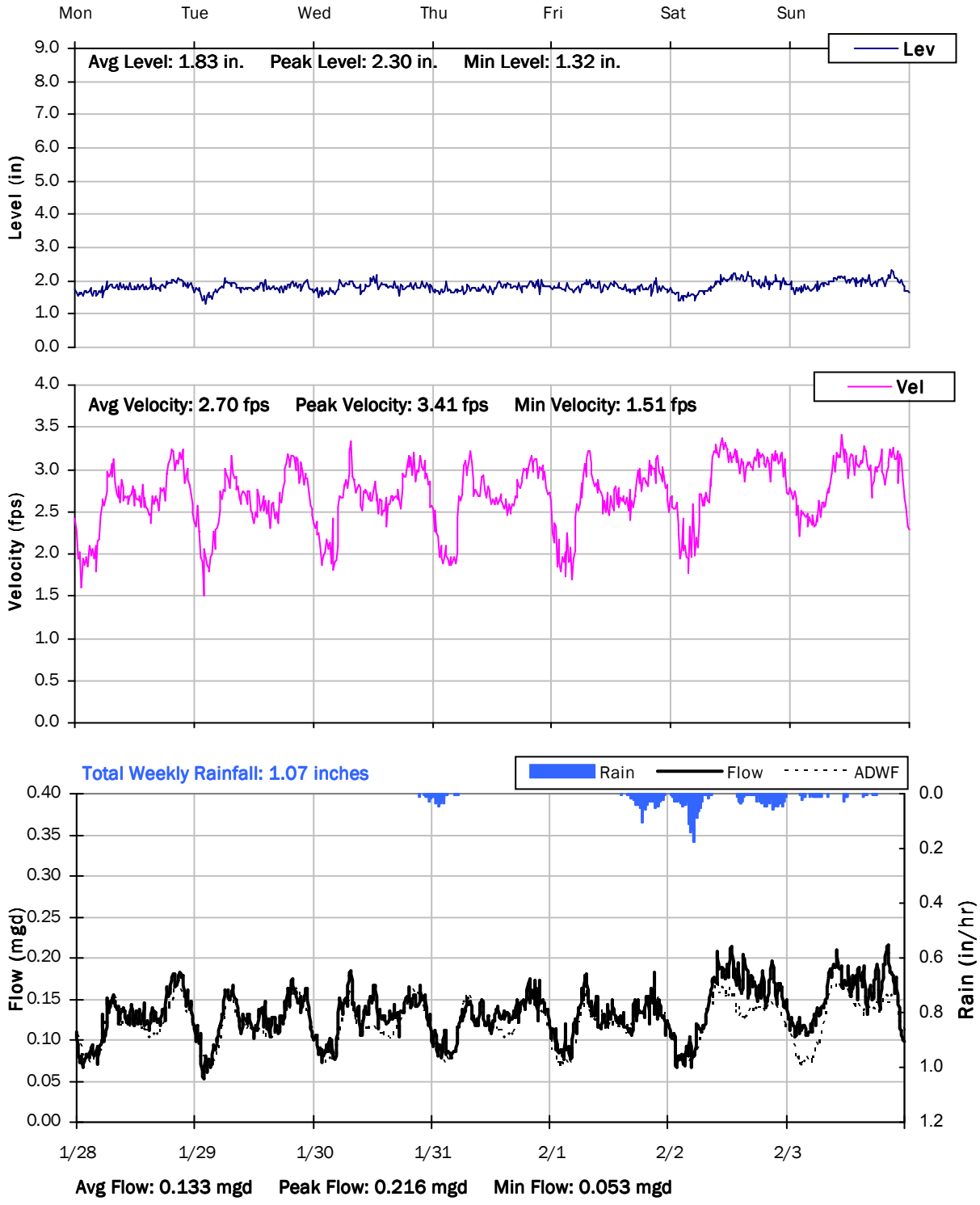
1/21/2019 to 1/28/2019



SITE 6E

Weekly Level, Velocity and Flow Hydrographs

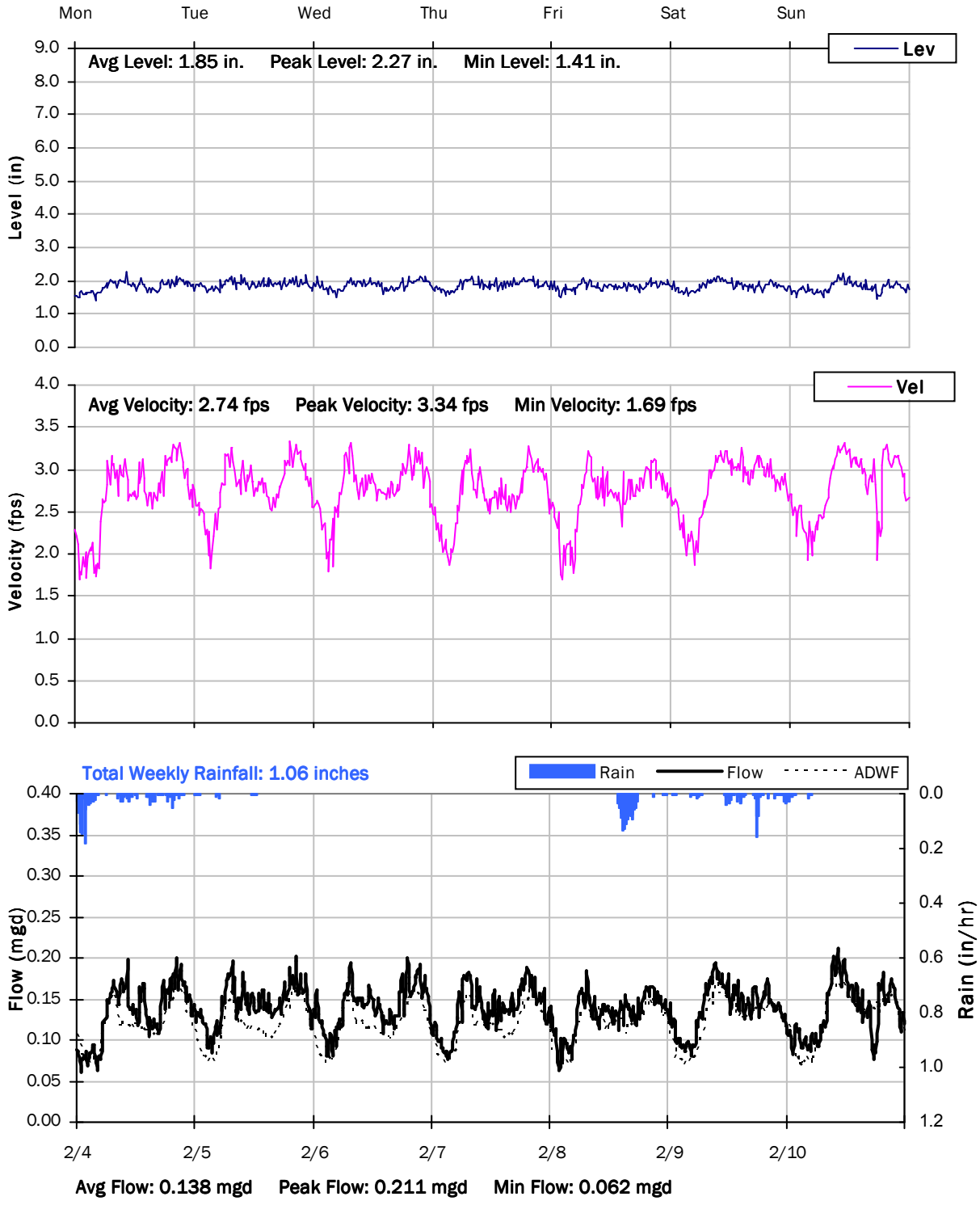
1/28/2019 to 2/4/2019



SITE 6E

Weekly Level, Velocity and Flow Hydrographs

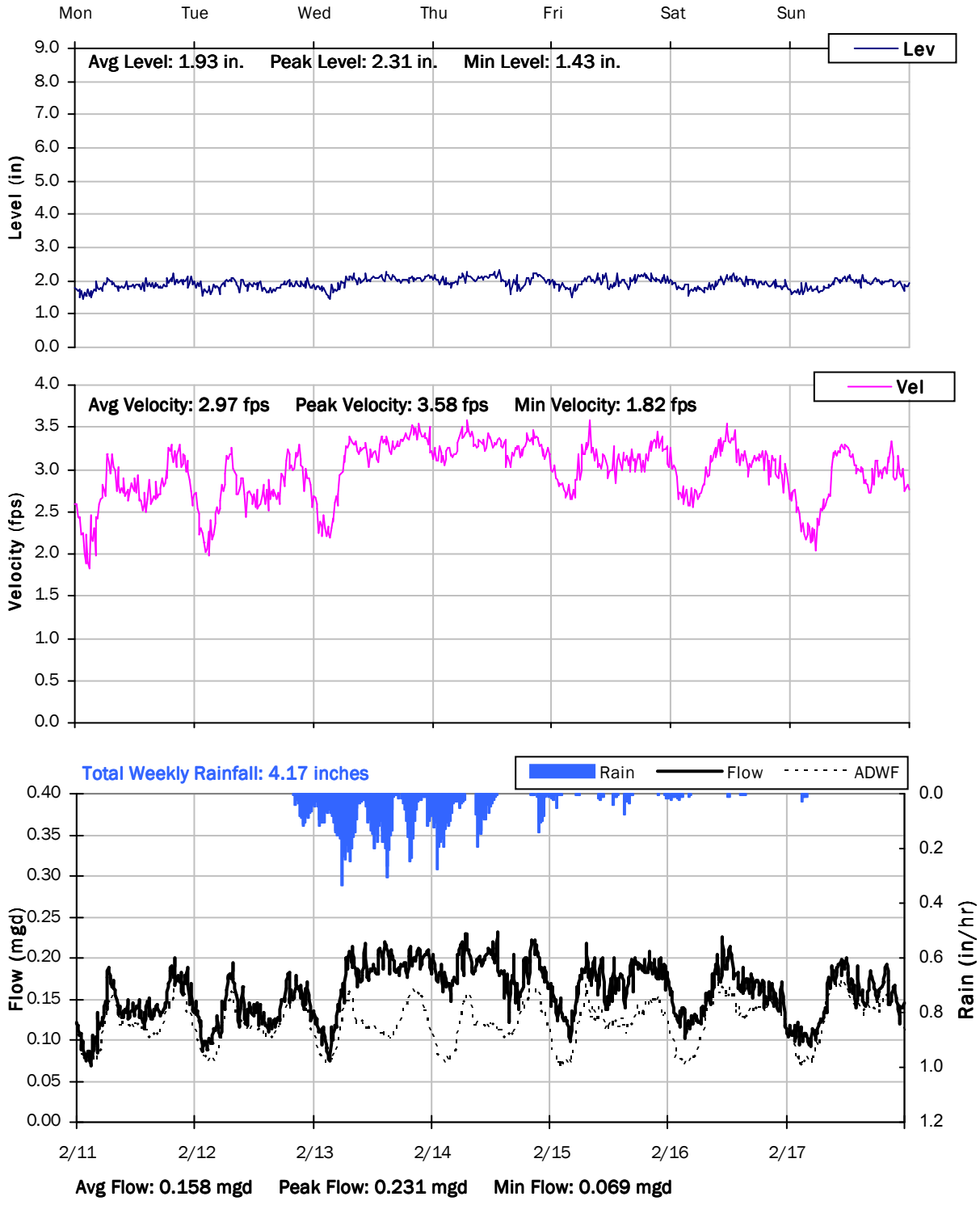
2/4/2019 to 2/11/2019



SITE 6E

Weekly Level, Velocity and Flow Hydrographs

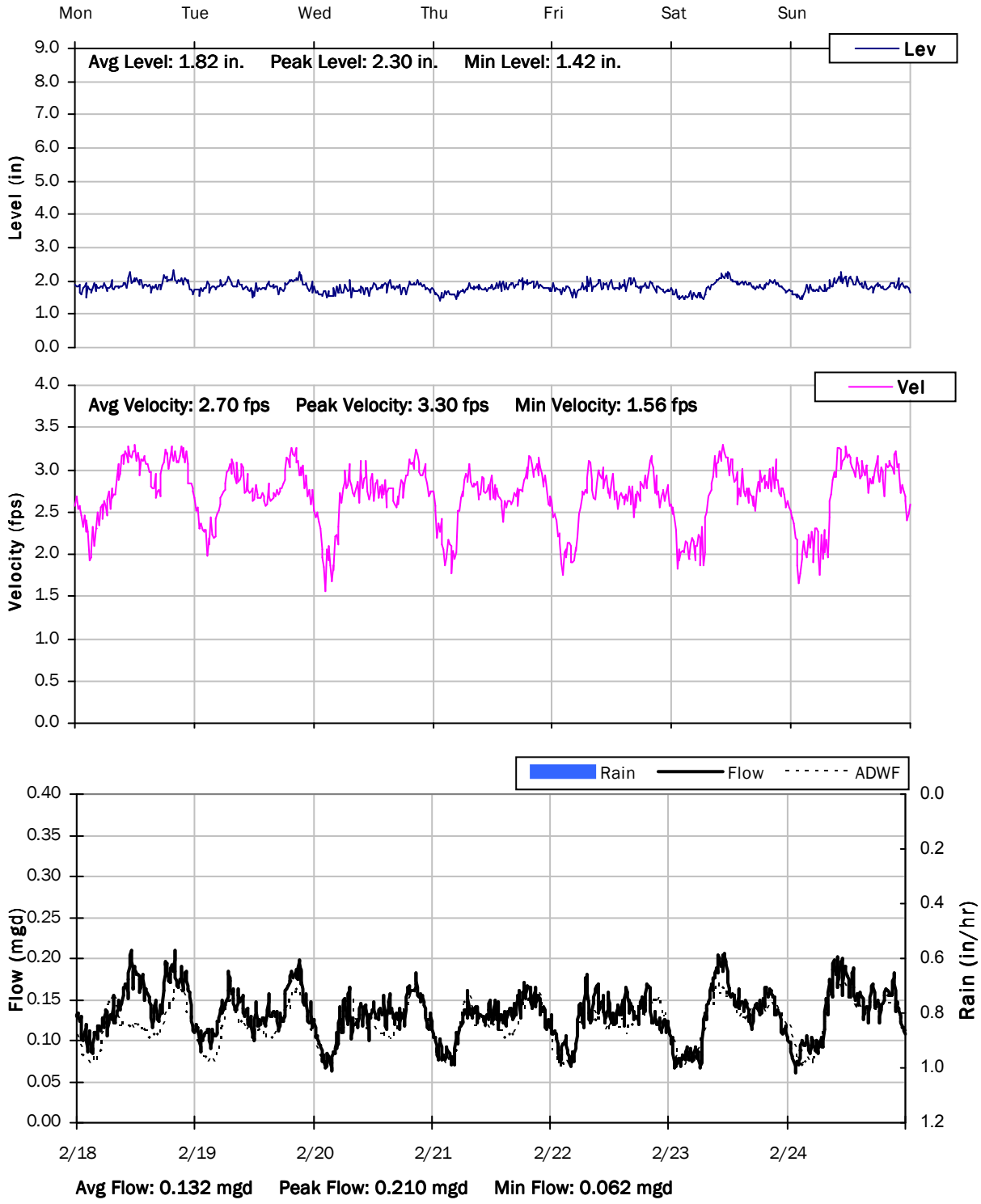
2/11/2019 to 2/18/2019



SITE 6E

Weekly Level, Velocity and Flow Hydrographs

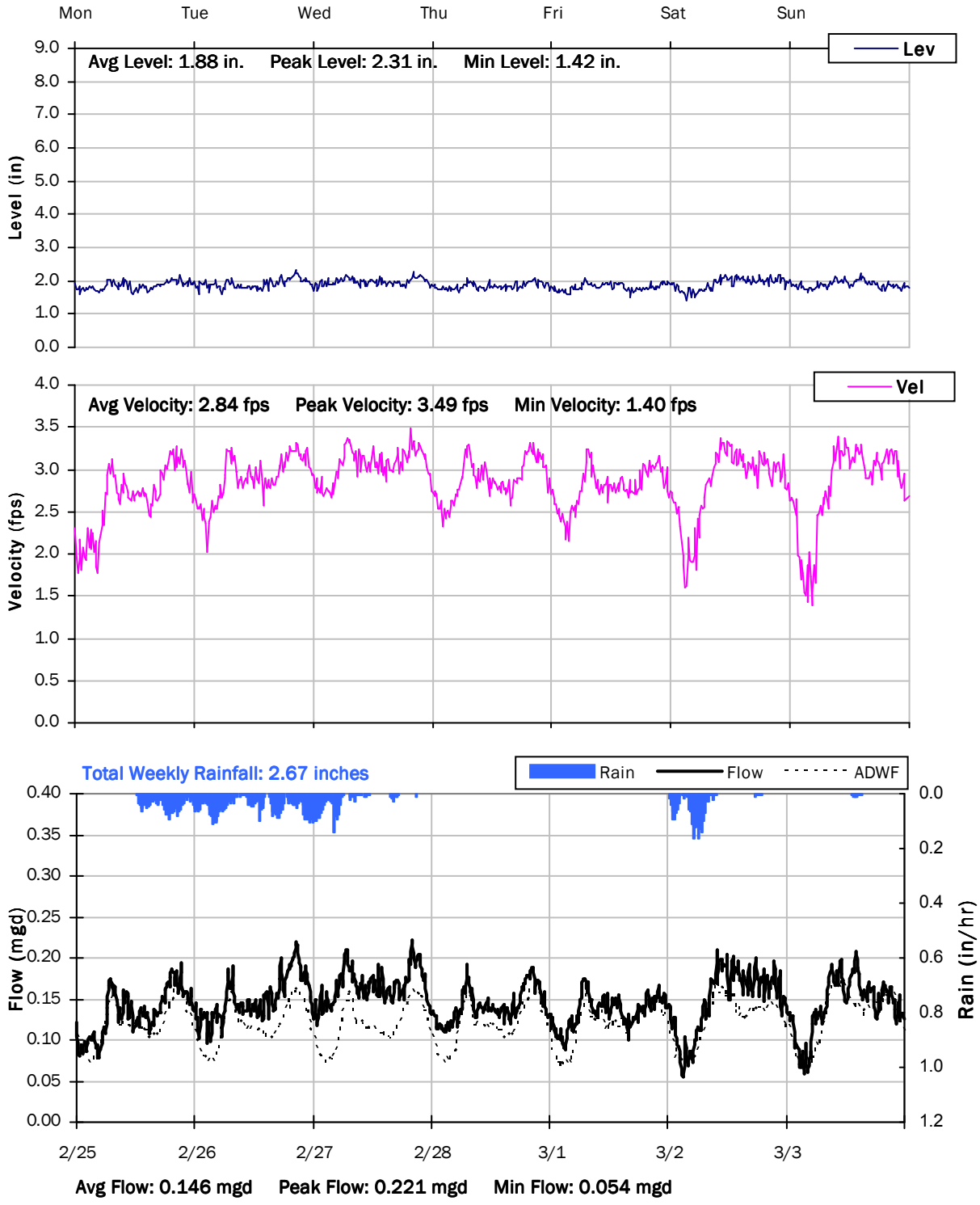
2/18/2019 to 2/25/2019



SITE 6E

Weekly Level, Velocity and Flow Hydrographs

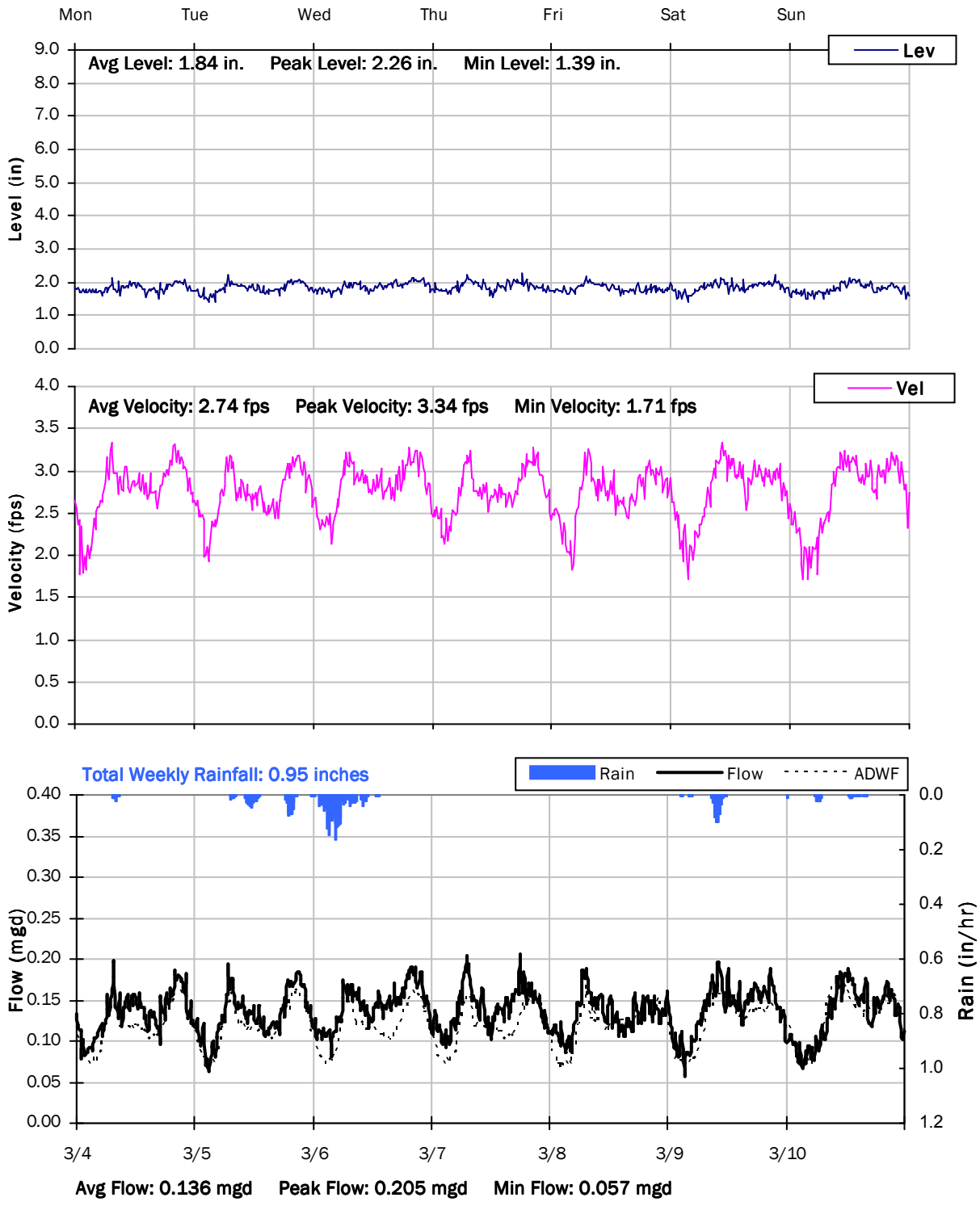
2/25/2019 to 3/4/2019



SITE 6E

Weekly Level, Velocity and Flow Hydrographs

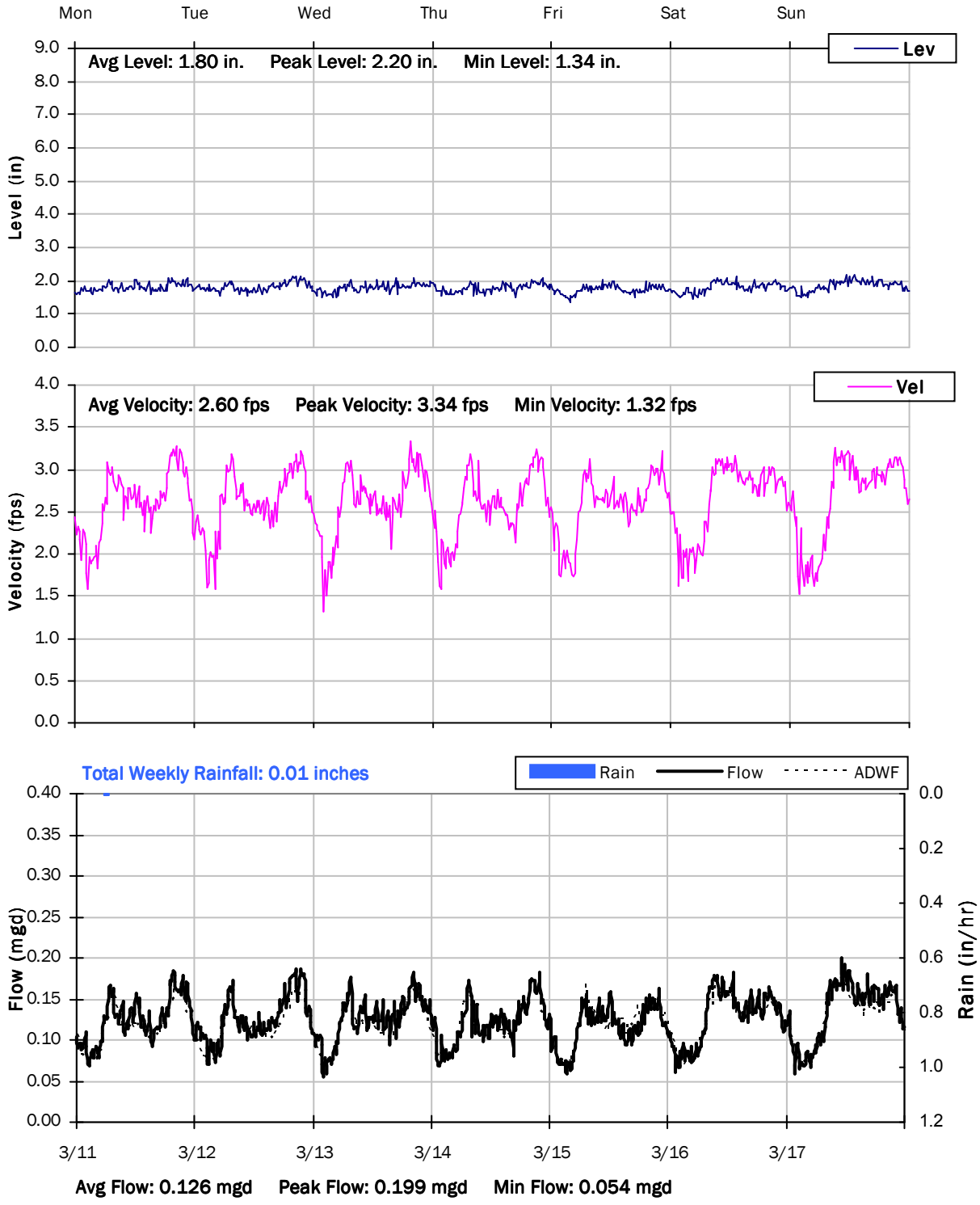
3/4/2019 to 3/11/2019



SITE 6E

Weekly Level, Velocity and Flow Hydrographs

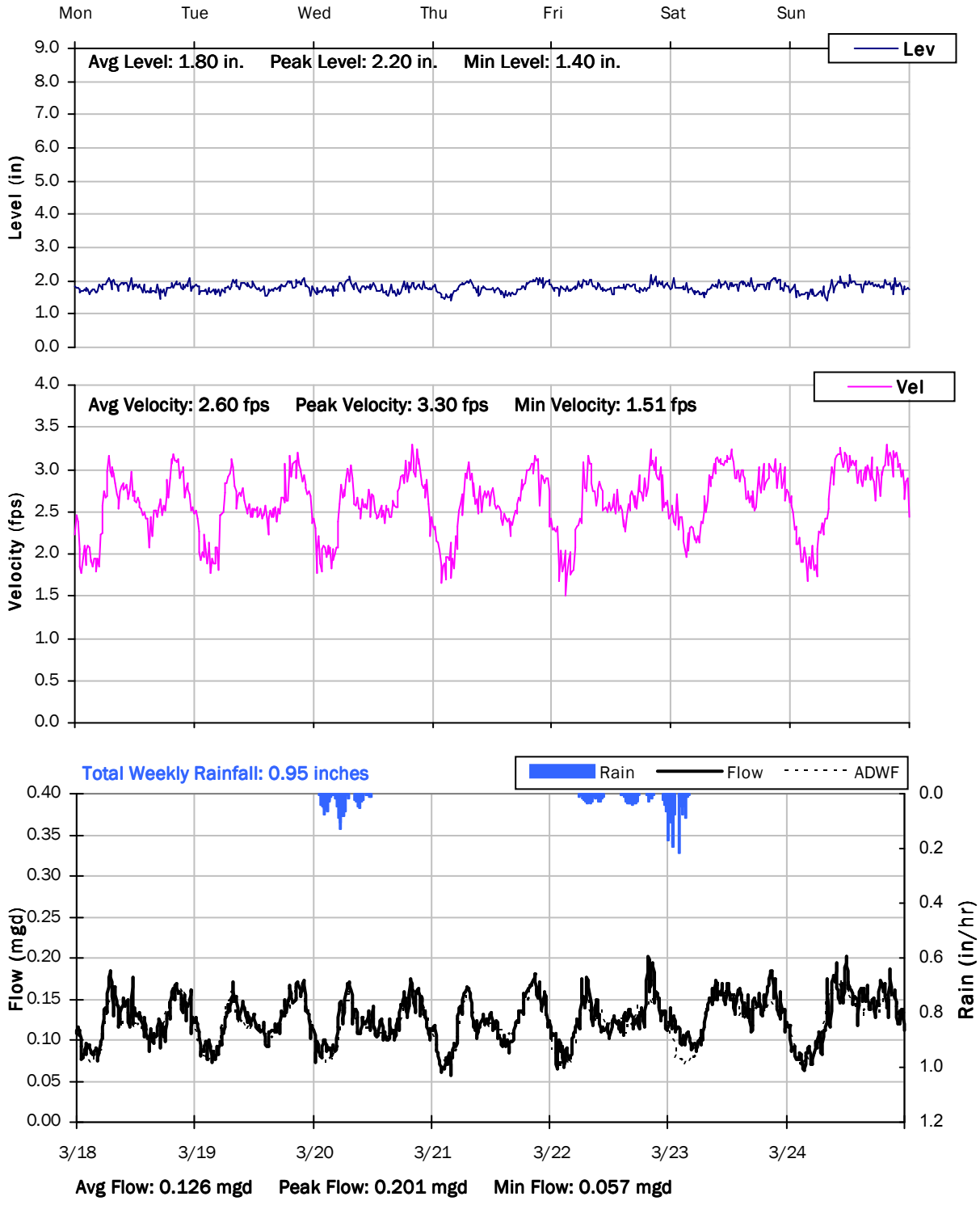
3/11/2019 to 3/18/2019



SITE 6E

Weekly Level, Velocity and Flow Hydrographs

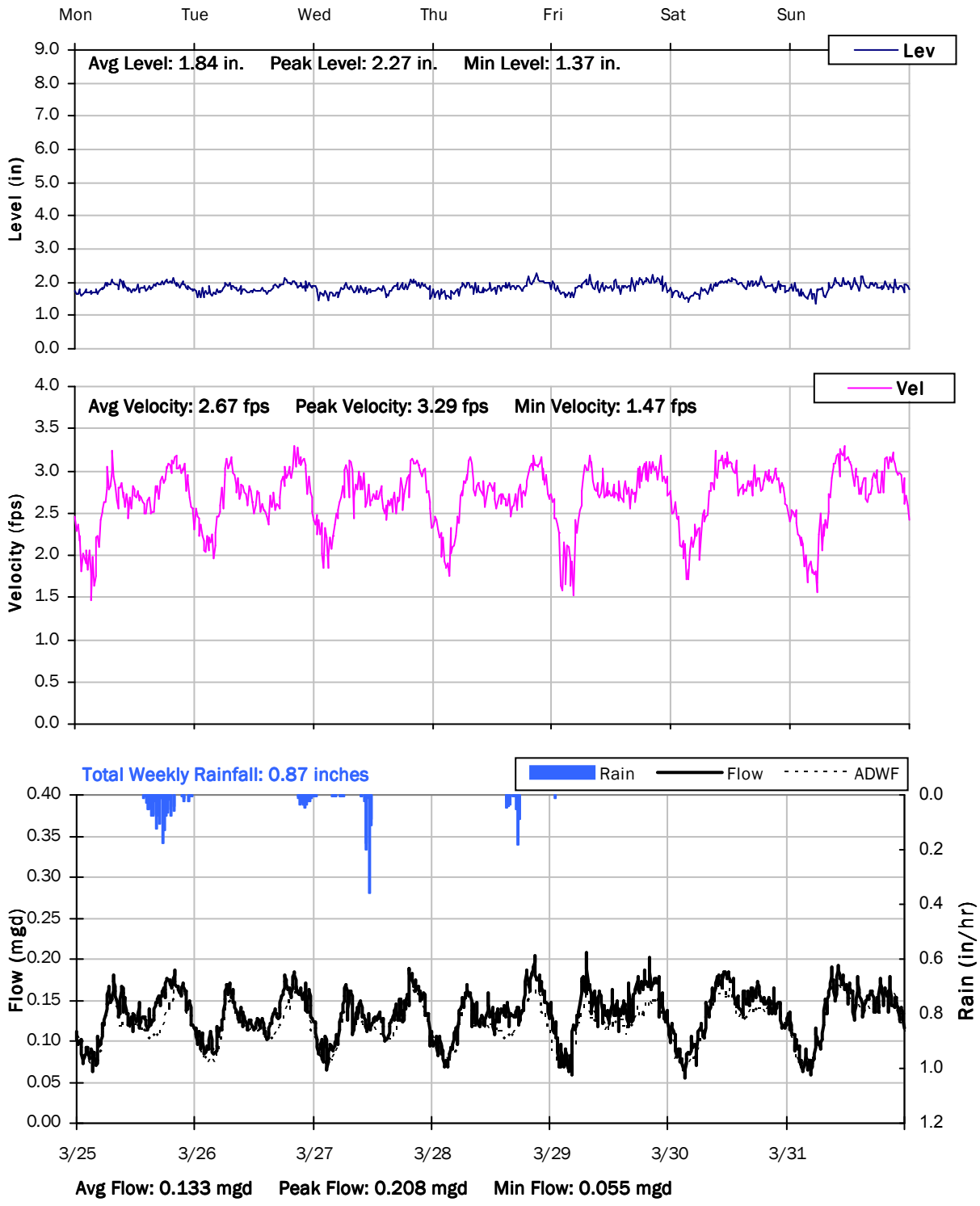
3/18/2019 to 3/25/2019



SITE 6E

Weekly Level, Velocity and Flow Hydrographs

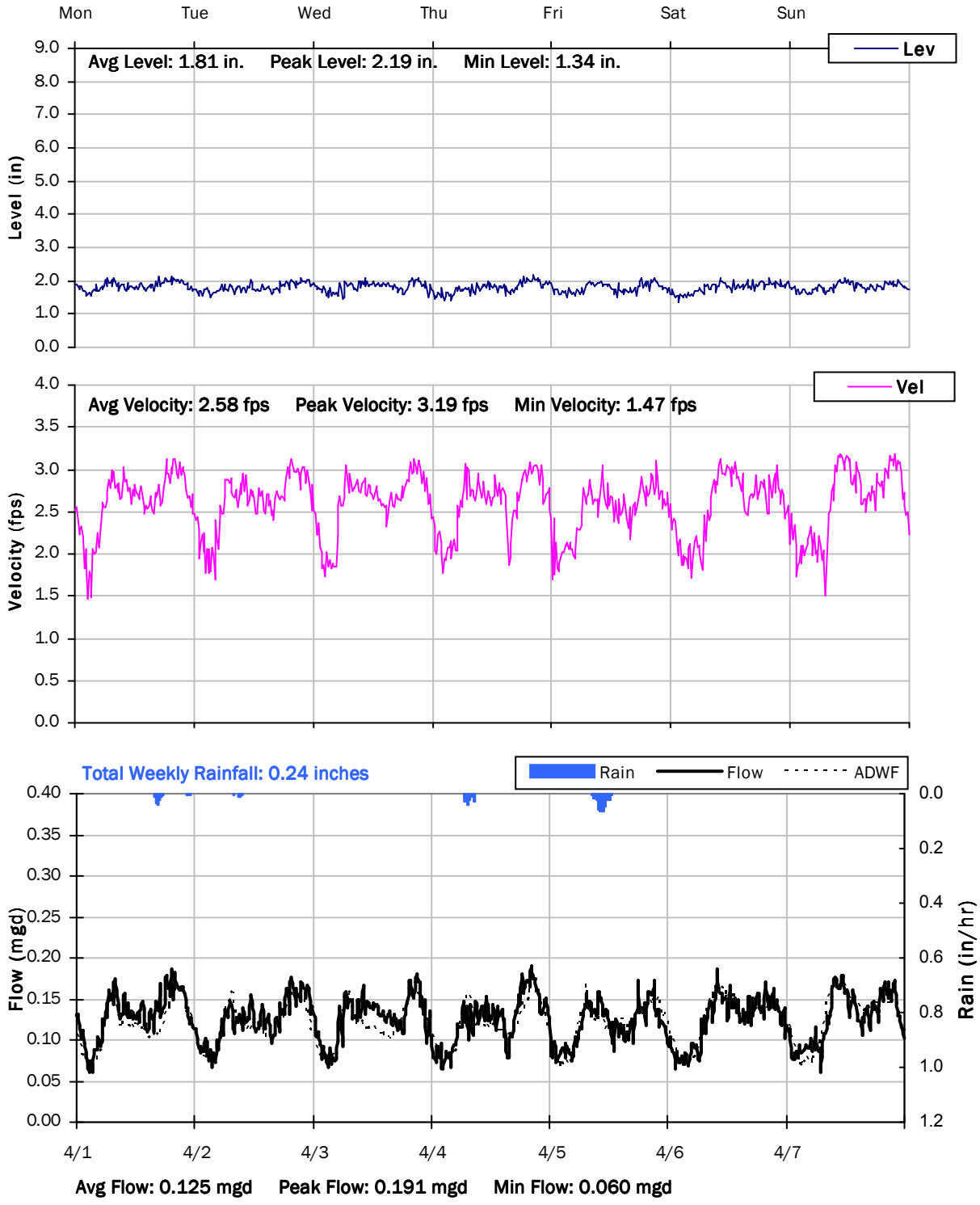
3/25/2019 to 4/1/2019



SITE 6E

Weekly Level, Velocity and Flow Hydrographs

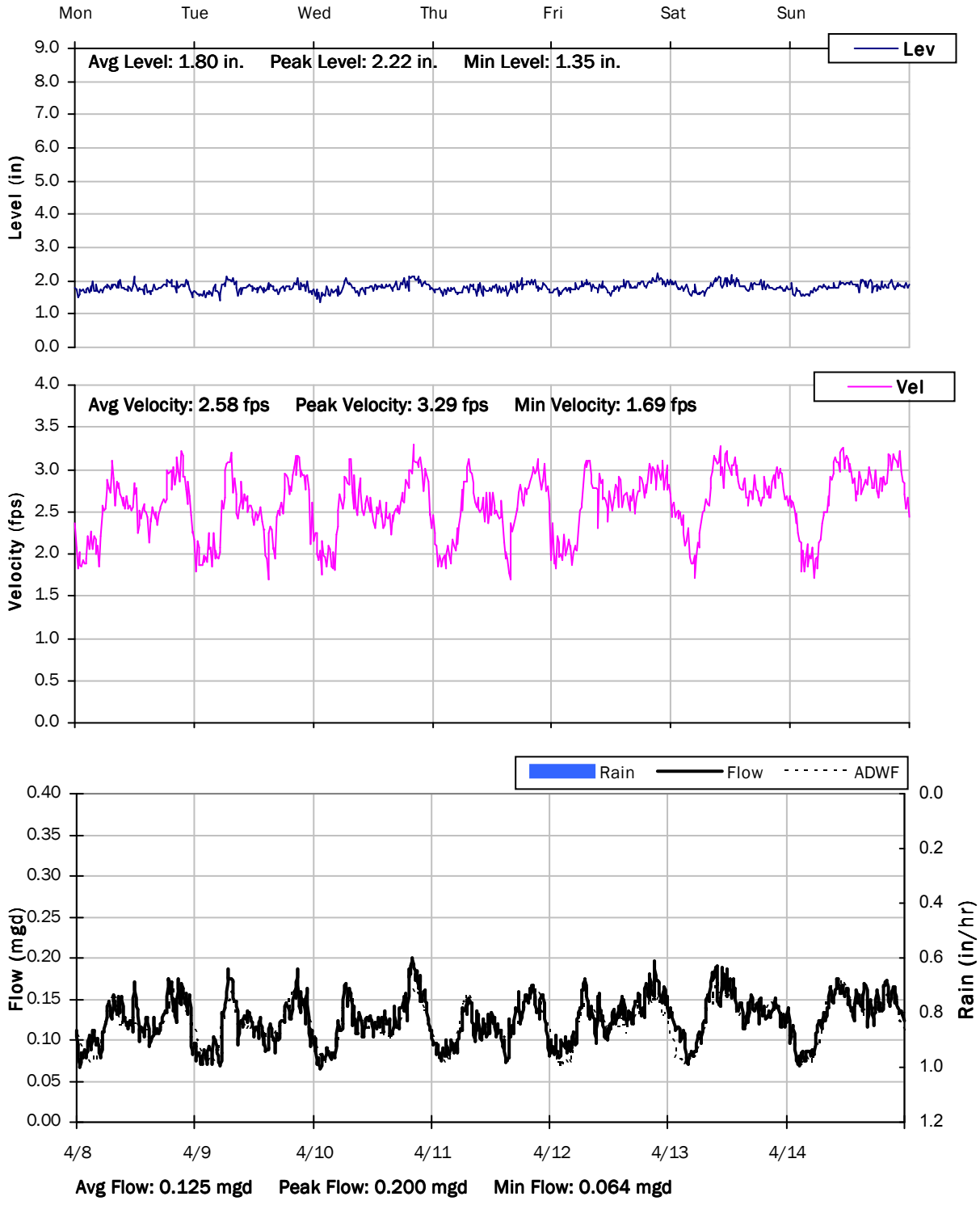
4/1/2019 to 4/8/2019



SITE 6E

Weekly Level, Velocity and Flow Hydrographs

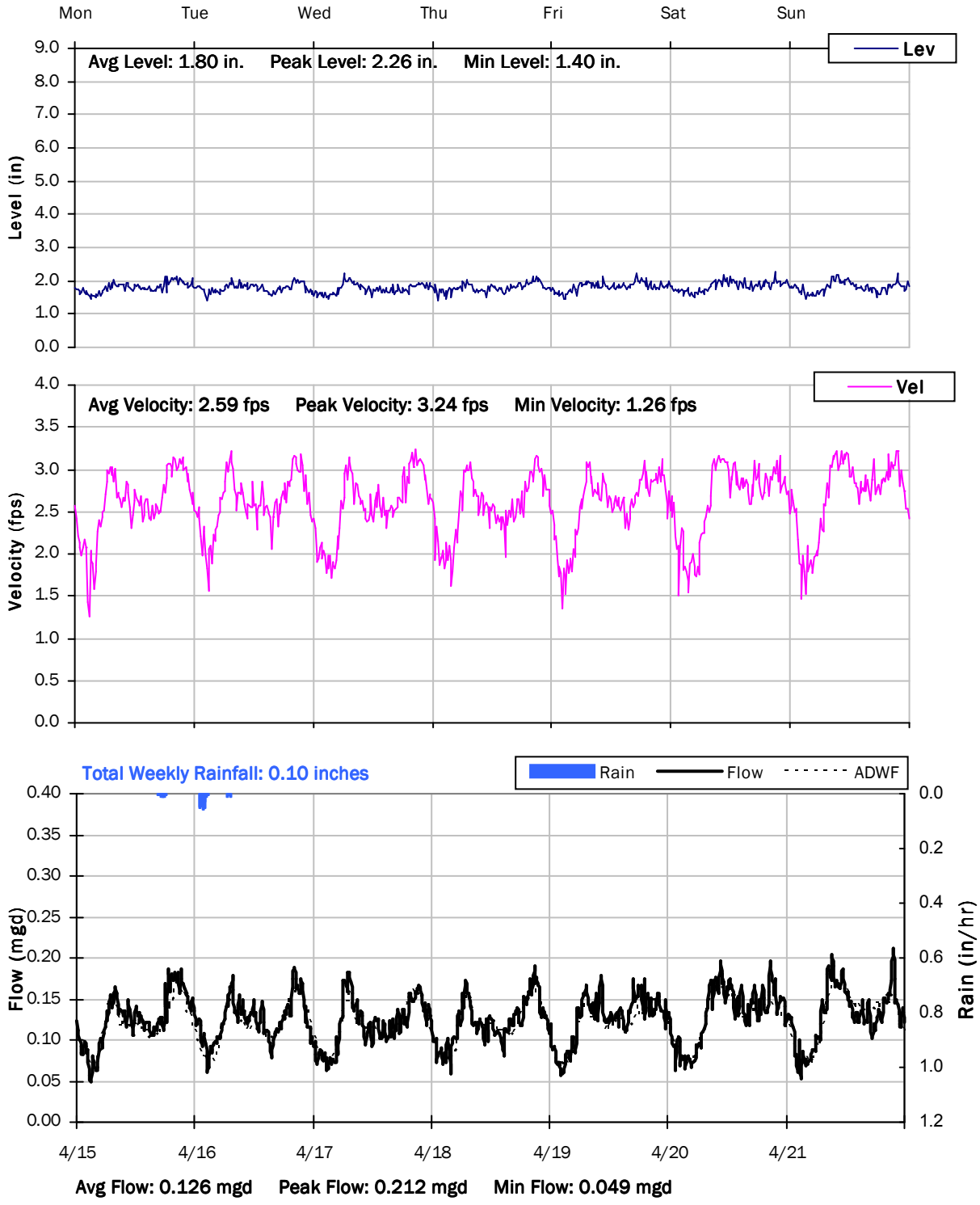
4/8/2019 to 4/15/2019



SITE 6E

Weekly Level, Velocity and Flow Hydrographs

4/15/2019 to 4/22/2019



Appendix B

TECHNICAL SPECIFICATIONS | TABLE OF CONTENTS

CITY OF HERCULES

SYCAMORE AVENUE TRUNK SEWER REPLACEMENT

TECHNICAL SPECIFICATIONS LIST

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

00100	Advertisement for Bids - California
00200	Instructions to Bidders - California
00410	Bid Form - California
00432	Bid Bond
00434	Proposed Subcontractors Form- California
00451B	Construction Contractor's Qualification Requirements
00451F	Cured-in-Place Pipe Rehabilitation Qualification Form
00451G	Manhole Rehabilitation Qualification Form
00453	Bid Preferences
00456	Non-Collusion Affidavit
00459	Prohibited Business Disclosure Form
00510	Notice of Award
00520	Agreement - California
00550	Notice to Proceed
00602A	Escrow Agreement for Security Deposits in Lieu of Retention - California, Public Contract Code §10263
00602B	Escrow Agreement for Security Deposits in Lieu of Retention - California, Public Contract Code §22300
00612	Performance Bond
00614	Payment Bond
00620	Contractor's Application for Payment
00632	Request for Information or Interpretation (RFI)
00633	Field Order
00634	Work Change Directive
00636	Change Order
00700	General Conditions
00800	Supplementary Conditions - California
00823	Escrow Bid Documents
00899	Certificate of Substantial Completion

DIVISION 01 - GENERAL REQUIREMENTS

01110	Summary of Work
01116	Contract Document Language
01140	Work Restrictions
01210	Allowances
01220	Measurement and Payment
01230	Alternates
01243	Value Engineering
01260	Contract Modification Procedures
01292	Schedule of Values
01294	Applications for Payment
01312	Project Meetings
01322	Web Based Construction Document Management
01329	Safety Plan
01330	Submittal Procedures
01340	Photographic and Videographic Documentation
01351	Environmental Procedures
01353	Special Procedures for Locating and Verifying Concealed Existing Utilities
01354	Hazardous Material Procedures
01355A	Stormwater Pollution Prevention Construction Activities: Best Management Practices
01410	Regulatory Requirements
01424	Abbreviations and Acronyms
01450	Quality Control
01455	Special Tests and Inspections
01460	Contractor Quality Control Plan
01500	Temporary Facilities and Controls
01550	Traffic Control
01562	Temporary Tree and Plant Protection
01573	Erosion and Sediment Control
01601	Product Requirements
01610	Project Design Criteria
01612	Seismic Design Criteria
01722	Field Engineering
01734	Work Within Public Right-of-Way
01738	Selective Alterations and Demolition
01742	Grease Management and Disposal
01770	Closeout Procedures

01782 Operation and Maintenance Data
01783 Warranties and Bonds

DIVISION 02 - SITE CONSTRUCTION

02001 Common Work Results for Linear Pipelines - Infrastructure
02003 Pipe Identification
02007 Pipe Couplings
02009 Piping Systems Testing
02050 Soils and Aggregates for Earthwork
02084 Precast Drainage Structures
02085 Precast Concrete Vaults
02200 Site Clearing
02241 Dewatering
02244 Soil Preparation for Microtunneling Using Compaction Grouting
02260 Excavation Support and Protection
02280 Subsurface Utility Engineering
02290 Inclinometers
02300 Earthwork
02312 Controlled Low Strength Material (CLSM)
02314 Low Density Cellular Concrete Fill
02318 Trenching
02441 Microtunneling
02448 Jacking Steel Pipe Casings
02613 Cured-In-Place Manhole Liners
02621 Stabilization Fabric
02700 Cured-in-Place Pipe Rehabilitation - Full Structural (Pressure)
02706 Polyvinyl Chloride (PVC) Pipe Pressure
02707 High Density Polyethylene (HDPE) Pipe: AWWA C906
02714 Sliplining with Segmented Liner Pipe
02720 CCTV Inspection of Sewer Pipelines
02742A Asphaltic Concrete Paving (CA)
02762 Pavement Markings
02763 Sewer Pipe and Structure Cleaning
02772 Concrete Curbs, Gutters, and Sidewalks
02939 Seeding
02952 Pavement Restoration and Rehabilitation

DIVISION 03 - CONCRETE

03150 Concrete Accessories

03154 Hydrophilic Rubber Waterstop

03155 Thermoplastic Elastomeric Rubber Waterstops

03200 Concrete Reinforcing

03600 Grouting

DIVISION 15 - MECHANICAL

15052 Common Work Results for General Piping - Plant

15956 Piping Systems Testing

Appendix C

CONSTRUCTION COST ESTIMATE

City of Hercules

Sycamore Ave. Trunk Sewer Replacement

Preliminary Cost Estimate

Description	Quantity	Unit	Unit Price	Extended Price
Mobilization / Demobilization	1	LS	5%	$320,000
Pipeline				
30" Fusible PVC (DR 21) In Open Trench in AC Road	3,936	LF	$530	$2,087,100
12" Fusible PVC (DR 18) In Open Trench in AC Road (Unnamed Path)	990	LF	$797	$789,000
8" SDR 26 PVC In Open Trench in AC Road (Pinole Street)	45	LF	$245	$11,000
Trenchless Installations				
Guided Auger Bore with 36" Stl Casing (UPRR)	168	LF	$2,184	$366,900
Guided Auger Bore Launching Shaft	1	LS	$132,615	$132,600
Guided Auger Bore Receiving Shaft	1	LS	$53,275	$53,300
Microtunnel with 60" Stl casing (Pinole Creek)	260	LF	$3,885	$1,010,200
Microtunnel Launching Shaft	1	LS	$884,098	$884,100
Microtunnel Receiving Shaft	1	LS	$355,170	$355,200
24" CIPP Lining	990	LF	$259	$256,400
8" Sliplining (Railroad Ave.)	105	LF	$167	$17,500
Access Locations				
48" Manholes	2	EA	$9,624	$19,200
60" Manholes	21	EA	$17,007	$357,100
Siphon Splitter Boxes	2	EA	$29,158	$58,300
Bypass Pumping				
Bypass Pumping	1	LS	$833,000	$833,000
TOTAL DIRECT COST				**$7,551,000**
General Conditions			12.0%	$906,000
Subtotal				**$8,457,000**
Estimating Contingency			20.0%	$1,691,400
Subtotal				**$10,148,400**
General Contractor Overhead, Profit & Risk			15.0%	$1,522,260
Subtotal				**$11,670,660**
Escalation to Mid-Point of Construction (Oct-2020)			3.5%	$408,000
Subtotal				**$12,078,660**
Sales Tax (Based on 50% of TDC)			8.75%	$528,000
Subtotal				**$12,606,660**
Bid Market Allowance			0.0%	$0
TOTAL ESTIMATED CONSTRUCTION COST				**$12,606,660**
updated: 11/18/19				

Appendix D

SUMMARY OF TITLE ISSUES AND UTILITY INFORMATION AT RAILROAD AVE IN PINOLE

Summary of Title Issues and Utility information at Railroad Avenue in Pinole

A. Title issues per preliminary title report # 07-39114585 by Chicago Title Co. effective date Nov. 16, 2007

1. The subject property is a 100 foot wide strip of land (former station site) lying adjacent to the 100 foot wide mainline track right of way and described in the deed from Bernardo Fernandez to the Northern Rail-Way Company, recorded June 4, 1877 in Book 32 of Deeds at Page 583.
2. Fee title is now vested in both the Union Pacific Railroad and the heirs/successors of Bernardo Fernandez as enumerated in the title report.
3. Title exception # 5, rights to divert and appropriate the waters of Pinole Creek granted to Hercules Water Company in the Final Order of Condemnation recorded 3/3/1904 in 103 Deeds 438 (Court judgment of 2/15/1904) and also in FOC recorded 6/22/1908 in 138 Deeds 44 (Court judgment of 5/26/1908) affect this property. See related item 12 below.
4. Title exception # 6, an easement for PGE transmission lines (407 Deeds 258) is not applicable to the subject property (lies further to the east).
5. Title exception # 7, an easement for sewer, water and a private road crossing to the City of Pinole (2765 OR 491) is also not applicable to the subject property. Lies within the Tennant Avenue crossing of the mainline tracks.
6. Title exception # 8, an easement to CCCFC&WCD (4895 OR 789) is for the flood control channel along the creek and a private road crossing of the mainline tracks at Tennant Ave. The bulk of the subject property (Railroad Ave. outside of the flood channel) is not part of this description. The 2nd document cited in this exception (4895 OR 800) is located at Rodeo creek and is not applicable.
7. Title exception # 9, is an agreement between the Railroad, the CCCFC&WCD and the City of Pinole (4951 OR 859) concerning the private crossing of the mainline tracks at Tennant Ave in item 6 above. It does not pertain to the subject property (Railroad Ave).
8. Title exception # 10, a sewer easement to City of Hercules (7115 OR 90) runs thru the subject property (Railroad Ave) but has no width specified. Exact location not defined as the referenced drawing is not attached to the recorded document as stated. Physical evidence includes a manhole at the North end, the pipe attached at the East side of the bridge and the record (stationing) call to existing road crossing (Tennant Ave.) of mainline tracks. See note 1 on map.
9. Title exception # 11, a public street easement to City of Pinole (84-137307 aka 11981 OR 900) refers to a 40 foot wide (at Tennant Ave.) crossing of tracks and is not applicable to subject property (Railroad Ave).
10. Title exception # 12, a PGE hot oil line lies within the 100 foot mainline track right of way and not the subject property (Railroad Ave) as shown on the drawing recorded with the preceding item. See note 8 on map.

B. Utilities attached to the Railroad Avenue Bridge structure.

11. Kinder-Morgan 12'' pipeline easement rights per 95-013908 (94-228442) (7131 OR 558). See note 2 on map. Line is located within the 100 foot wide mainline parcel and is attached to the West side of the bridge. The bridge itself is constructed partially within the 100 foot wide mainline track right of way.
12. EBMUD 8"waterline location based on their 1954 drawing. No recorded easement document found. Line was possibly constructed under the assumption of being within City street franchise rights, but the City has no road easement. EBMUD letter dated 2/22/2010 claims easement originally obtained by predecessor (Hercules Water Co) but no specific document provided. Item 3 above is possibly relevant. See note 4 on map.
13. City of Hercules 24" sewer line easement rights per 7115 OR 90. See item 8 above and note 1 on map.
14. PGE 2.5" gas line on east side of bridge. No other field location marks found, nor any recorded documentation. See note 5 on map

C. Other utilities visible in the vicinity.

15. Fiber optic line appears to lie entirely within 100 foot mainline track right of way and not within subject parcel (Railroad Ave). See note 3 on map. No documentation found.
16. Overhead power line (PGE) lies within the subject property. No documentation found. See map note 7.

DRAFT

RAILROAD AVENUE BRIDGE AT PINOLE CREEK

SCALE 1"=30'

CITY OF PINOLE
SEWAGE PLANT
11 OR 444

CCCFC&WCD
4958 OR 483

Town

• SEE NOTE 1

CITY OF PINOLE
SEWER & WATER EASEMENT
2765 OR 491

CITY OF PINOLE
40' ROAD EASEMENT
1984-137307 (11981 on 900)

CCCFC&WCD EASEMENT
4895 OR 789
• ALSO SEE NOTE 6

UNION PACIFIC RAILROAD MAINLINE
100'

• SEE NOTE 3 "BURIED FIBER OPTIC CABLE"
"MCI FIBER OPTIC CABLE"

• SEE NOTE 8

• SEE NOTE 2

12" PIPE
• SEE NOTE 2

"OIL PIPELINE"

"OIL PIPELINE"

• SEE NOTE 8

• SEE NOTE 2

CITY OF PINOLE
CITY OF HERCULES

BRIDGE

• SEE NOTE 4

• SEE NOTE 4

• SEE NOTE 1

RAILROAD AVE

APPROX EP

• SEE NOTE 1 MH

MH

APPROX EP

JP

OVERHEAD WIRE
• SEE NOTE 7

24" PIPE
• SEE NOTE 1

2.5" GAS PIPE
• SEE NOTE 5

8" PIPE
• SEE NOTE 4

POLE

PARCEL 'C'
292 M 40

20'

• SEE NOTE 1

MH

SEWER EASEMENT 7366 OR 438

100'

UNION PACIFIC RAILROAD ET. UX.
(32 DEEDS 5B3 6/4/1877)
• SEE NOTE 9

MARIOTT
2005-D1185B

TENNENT AVE

CUARDA CT

PINOLE TRAILER STORAGE
2003-D600048

CCCFC&WCD
6D13 OR 272

PG&E
6D07 OR 41D

CITY OF PINOLE
CITY OF HERCULES

SUBDIVISION 6773
(312 M 22)

NOTES:

1) CITY OF HERCULES SEWER EASEMENT PER 7115 OR 9D CROSSES THIS PARCEL. THE REFERENCED DRAWING IS NOT ATTACHED TO THE RECORDED DOCUMENT. EXACT LOCATION OF 24" PIPELINE IS INDETERMINANT.

2) APPROXIMATE LOCATION OF 12.75" OD KINDER MORGAN PIPELINE. TIES TO EASTBOUND MAINLINE TRACK PER KM DRAWING: LINE #485D37AWRM, SHEET #025, DATED 03/16/09.

3) NO INFORMATION PROVIDED FOR FIBER OPTIC LINE.

4) APPROXIMATE LOCATION OF 8" WATER MAIN PER EBMUD DRAWING NO. W-1129, DATED 10/22/54.

5) NO INFORMATION PROVIDED FOR 2.5" PG&E GAS LINE.

6) RIGHT TO CROSS RAILROAD PROPERTY GRANTED TO CITY OF PINOLE AND CCCFC&WCD PER 4951 OR 859.

7) NO INFORMATION PROVIDED FOR OVERHEAD ELECTRIC LINE.

8) OIL PIPELINE LOCATION BY FOUND MARKERS AND IS SHOWN ON SOUTHERN PACIFIC TRANSPORTATION CO. DRAWING NO. P-1283 REVISED AUG 26, 1982, A COPY OF SAID MAP IS RECORDED IN BOOK 11981 OR PAGE 905.

9) TITLE OF 100' WIDE (FORMER) RAILROAD STATION PARCEL IS VESTED IN UNION PACIFIC RAILROAD, AND OTHERS PER CHICAGO TITLE COMPANY PRELIMINARY REPORT NO. 07-391145B5-ML, EFFECTIVE NOV. 16, 2007. NO EXCEPTION IS NOTED FOR PUBLIC RIGHTS IN A ROADWAY (RAILROAD AVE).

10) THIS PLOT IS A COMPILATION OF RECORD DEED INFORMATION AND UTILITY AS-BUILT INFORMATION FROM VARIOUS SOURCES. PREPARED BY CONTRA COSTA COUNTY PUBLIC WORKS DEPARTMENT, MARCH 2011.

Appendix B

Air Quality Emissions Calculations

Road Construction Emissions Model, Version 7.1.5.1

Emission Estimates for ->	City of Hercules - Sycamore Avenue Trunk Sewer Replacement F			Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	**ROG (lbs/day)**	**CO (lbs/day)**	**NOx (lbs/day)**	**PM10 (lbs/day)**	**PM10 (lbs/day)**	**PM10 (lbs/day)**	**PM2.5 (lbs/day)**	**PM2.5 (lbs/day)**	**PM2.5 (lbs/day)**	**CO2 (lbs/day)**
Grubbing/Land Clearing	1.3	10.3	11.6	1.5	0.5	1.0	0.7	0.4	0.2	2,045.6
Grading/Excavation	5.6	44.5	54.9	3.5	2.5	1.0	2.5	2.3	0.2	9,469.1
Drainage/Utilities/Sub-Grade	4.7	36.0	43.1	3.1	2.1	1.0	2.1	1.9	0.2	7,394.6
Paving	1.9	16.9	16.3	0.9	0.9	-	0.8	0.8	-	3,173.7
Maximum (pounds/day)	5.6	44.5	54.9	3.5	2.5	1.0	2.5	2.3	0.2	9,469.1
Total (tons/construction project)	0.4	3.0	3.6	0.2	0.2	0.1	0.2	0.2	0.0	621.0

Notes: Project Start Year -> 2021
Project Length (months) -> 8
Total Project Area (acres) -> 4
Maximum Area Disturbed/Day (acres) -> 0
Total Soil Imported/Exported (yd^3/day)-> 2

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for ->	City of Hercules - Sycamore Avenue Trunk Sewer Replacement F			Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	**ROG (kgs/day)**	**CO (kgs/day)**	**NOx (kgs/day)**	**PM10 (kgs/day)**	**PM10 (kgs/day)**	**PM10 (kgs/day)**	**PM2.5 (kgs/day)**	**PM2.5 (kgs/day)**	**PM2.5 (kgs/day)**	**CO2 (kgs/day)**
Grubbing/Land Clearing	0.6	4.7	5.3	0.7	0.2	0.5	0.3	0.2	0.1	929.8
Grading/Excavation	2.6	20.2	25.0	1.6	1.1	0.5	1.1	1.0	0.1	4,304.1
Drainage/Utilities/Sub-Grade	2.1	16.4	19.6	1.4	0.9	0.5	0.9	0.9	0.1	3,361.2
Paving	0.9	7.7	7.4	0.4	0.4	-	0.4	0.4	-	1,442.6
Maximum (kilograms/day)	2.6	20.2	25.0	1.6	1.1	0.5	1.1	1.0	0.1	4,304.1
Total (megagrams/construction project)	0.3	2.7	3.2	0.2	0.2	0.1	0.2	0.1	0.0	563.2

Notes: Project Start Year -> 2021
Project Length (months) -> 8
Total Project Area (hectares) -> 2
Maximum Area Disturbed/Day (hectares) -> 0
Total Soil Imported/Exported (m^3/day)-> 2

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Appendix C

Special Status Species Lists

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Mare Island (3812213))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Antrozous pallidus pallid bat	AMACC10010	None	None	G5	S3	SSC
Ardea herodias great blue heron	ABNGA04010	None	None	G5	S4	
Bombus occidentalis western bumble bee	IIHYM24250	None	Candidate Endangered	G2G3	S1	
Chloropyron molle ssp. molle soft salty bird's-beak	PDSCR0J0D2	Endangered	Rare	G2T1	S1	1B.2
Danaus plexippus pop. 1 monarch - California overwintering population	IILEPP2012	None	None	G4T2T3	S2S3	
Elanus leucurus white-tailed kite	ABNKC06010	None	None	G5	S3S4	FP
Fritillaria liliacea fragrant fritillary	PMLIL0V0C0	None	None	G2	S2	1B.2
Geothlypis trichas sinuosa saltmarsh common yellowthroat	ABPBX1201A	None	None	G5T3	S3	SSC
Hypomesus transpacificus Delta smelt	AFCHB01040	Threatened	Endangered	G1	S1	
Isocoma arguta Carquinez goldenbush	PDAST57050	None	None	G1	S1	1B.1
Laterallus jamaicensis coturniculus California black rail	ABNME03041	None	Threatened	G3G4T1	S1	FP
Lathyrus jepsonii var. jepsonii Delta tule pea	PDFAB250D2	None	None	G5T2	S2	1B.2
Lilaeopsis masonii Mason's lilaeopsis	PDAPI19030	None	Rare	G2	S2	1B.1
Melospiza melodia samuelis San Pablo song sparrow	ABPBXA301W	None	None	G5T2	S2	SSC
Northern Coastal Salt Marsh Northern Coastal Salt Marsh	CTT52110CA	None	None	G3	S3.2	
Pandion haliaetus osprey	ABNKC01010	None	None	G5	S4	WL
Pogonichthys macrolepidotus Sacramento splittail	AFCJB34020	None	None	GNR	S3	SSC
Rallus obsoletus obsoletus California Ridgway's rail	ABNME05011	Endangered	Endangered	G5T1	S1	FP
Rana draytonii California red-legged frog	AAABH01022	Threatened	None	G2G3	S2S3	SSC
Reithrodontomys raviventris salt-marsh harvest mouse	AMAFF02040	Endangered	Endangered	G1G2	S1S2	FP

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Senecio aphanactis chaparral ragwort	PDAST8H060	None	None	G3	S2	2B.2
Sorex ornatus sinuosus Suisun shrew	AMABA01103	None	None	G5T1T2Q	S1S2	SSC
Spirinchus thaleichthys longfin smelt	AFCHB03010	Candidate	Threatened	G5	S1	
Xanthocephalus xanthocephalus yellow-headed blackbird	ABPBXB3010	None	None	G5	S3	SSC

Record Count: 24

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: March 26, 2020
Consultation Code: 08ESMF00-2020-SLI-1440
Event Code: 08ESMF00-2020-E-04547
Project Name: Sycamore Avenue Sewer trunk Replacement Project

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

This project's location is within the jurisdiction of multiple offices. Expect additional species list documents from the following office, and expect that the species and critical habitats in each document reflect only those that fall in the office's jurisdiction:

San Francisco Bay-Delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
(916) 930-5603

Project Summary

Consultation Code: 08ESMF00-2020-SLI-1440

Event Code: 08ESMF00-2020-E-04547

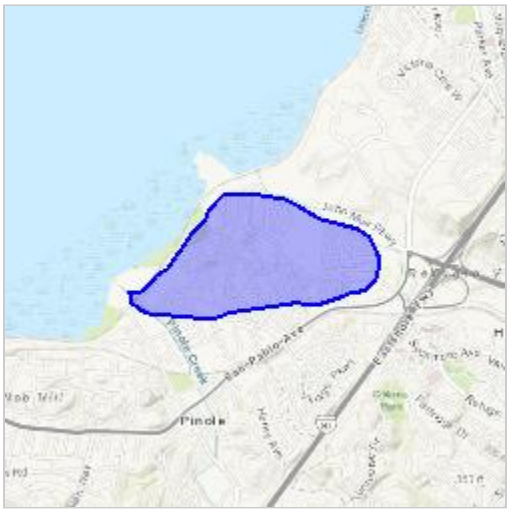
Project Name: Sycamore Avenue Sewer trunk Replacement Project

Project Type: WASTEWATER FACILITY

Project Description: Replace existing sewer trunk pipeline

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/38.01565692952667N122.28330159124721W



Counties: Contra Costa, CA

Endangered Species Act Species

There is a total of 14 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse *Reithrodontomys raviventris* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/613	Endangered

Birds

NAME	STATUS
California Clapper Rail *Rallus longirostris obsoletus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern *Sterna antillarum browni* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8104	Endangered
Northern Spotted Owl *Strix occidentalis caurina* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1123	Threatened
Western Snowy Plover *Charadrius nivosus nivosus* Population: Pacific Coast population DPS-U.S.A. (CA, OR, WA), Mexico (within 50 miles of Pacific coast) There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8035	Threatened

Reptiles

NAME	STATUS
Alameda Whipsnake (=striped Racer) *Masticophis lateralis euryxanthus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5524	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891 Species survey guidelines: https://ecos.fws.gov/ipac/guideline/survey/population/205/office/11420.pdf	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Callippe Silverspot Butterfly *Speyeria callippe callippe* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3779	Endangered
San Bruno Elfin Butterfly *Callophrys mossii bayensis* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3394	Endangered

Crustaceans

NAME	STATUS
California Freshwater Shrimp *Syncaris pacifica* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7903	Endangered
Conservancy Fairy Shrimp *Branchinecta conservatio* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8246	Endangered

Flowering Plants

NAME	STATUS
Contra Costa Goldfields *Lasthenia conjugens* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7058	Endangered
Soft Bird's-beak *Cordylanthus mollis ssp. mollis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8541	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Appendix D

AB 52 Outreach

March 3, 2020

Native American Heritage Commission
1550 Harbor Boulevard, Suite 100
West Sacramento, CA 95691

Subject: **Sacred Land Files and Native American Contact List Request for the City of Hercules' Sycamore Avenue Sewer Trunk Replacement Project**

To Whom It May Concern:

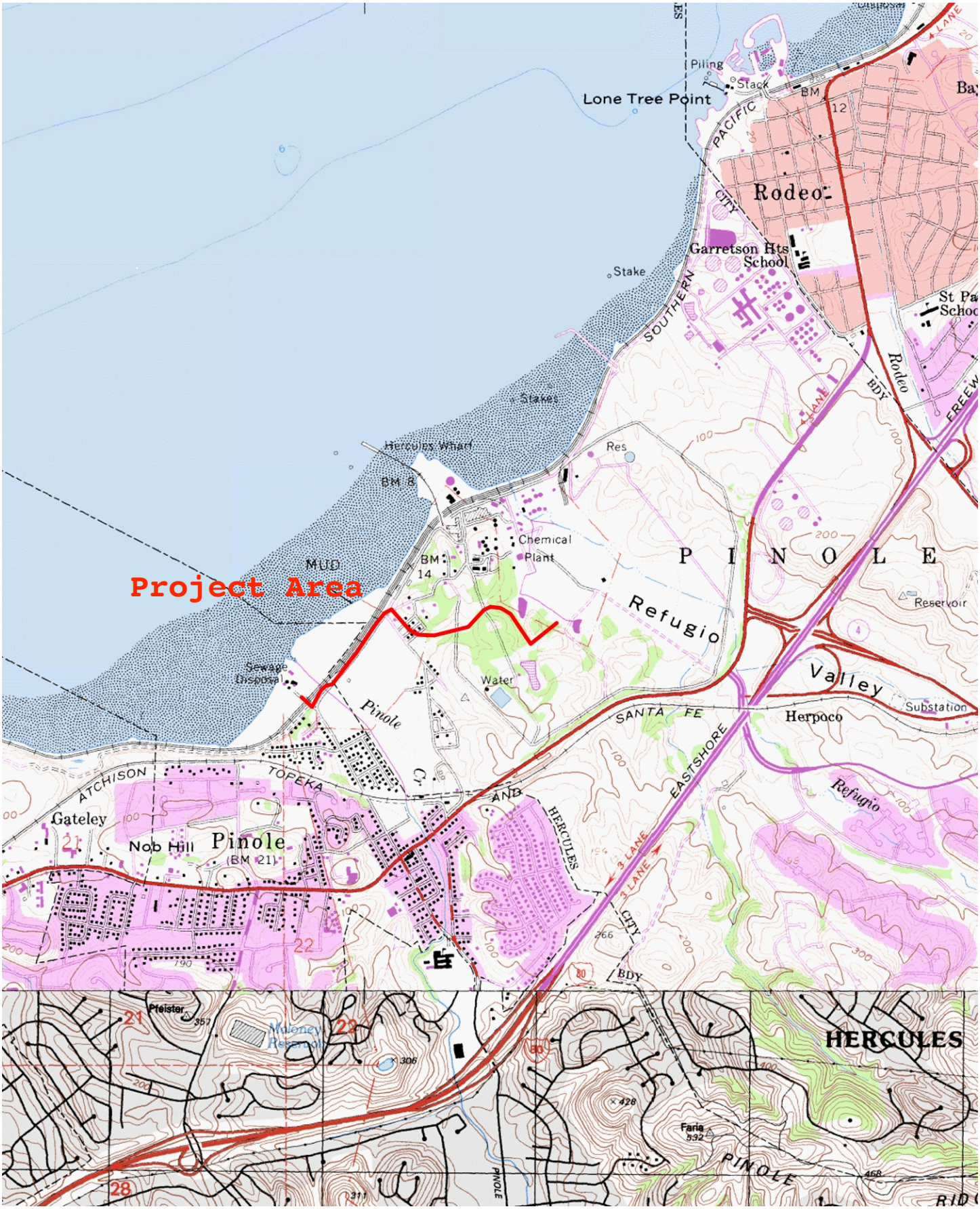
SMB Environmental, Inc. (SMB) is assisting the City of Hercules (City) with its proposed Sycamore Sewer Trunk Replacement Project (Proposed Project) which includes the replacement of approximately 5,500 linear feet of existing 20- to 24-inch diameter sewer trunk main with new 27- to 36-inch diameter pipelines. The project location is within the Mare Island Quad - Section 15 Township 2 North Range 4 West. Please see attached request form.

We would appreciate your checking the Sacred Lands Files to see if there are any culturally sensitive areas within the immediate project vicinity. We would also like to receive a list of Native American organizations that may have knowledge in the area and we will attempt to contact them to solicit their written input/concerns about the Proposed Project.

Thank you for your cooperation and assistance. I look forward to your earliest possible reply. If any questions, please feel free to contact me at 916-517-2189 or at steve@smbenvironmental.com.

Sincerely,

Steve Brown
Principal



Mercator Projection
WGS84
USNG Zone 10SEH

CalTopo

0.5 1.0 1.5 2.0 2.5 km

0.5 1.0 1.5 mi

Scale **1:24000** 1 inch = 2000 feet

N MN 13°

Figure 1

City of Hercules Sycamore Avenue Sewer Trunk Replacement Project

NATIVE AMERICAN HERITAGE COMMISSION

CHAIRPERSON
Laura Miranda
Luiseño

VICE CHAIRPERSON
Reginald Pagaling
Chumash

SECRETARY
Merri Lopez-Keifer
Luiseño

PARLIAMENTARIAN
Russell Attebery
Karuk

COMMISSIONER
Marshall McKay
Wintun

COMMISSIONER
William Mungary
Paiute/White Mountain Apache

COMMISSIONER
Joseph Myers
Pomo

COMMISSIONER
Julie Tumamait-Stenslie
Chumash

COMMISSIONER
[**Vacant**]

EXECUTIVE SECRETARY
Christina Snider
Pomo

NAHC HEADQUARTERS
1550 Harbor Boulevard
Suite 100
West Sacramento,
California 95691
(916) 373-3710
nahc@nahc.ca.gov
NAHC.ca.gov

March 6, 2020

Steve Brown, Principal
SMB Environmental, Inc.

Via Email to: steve@smbenvironmental.com

Re: Native American Tribal Consultation, Pursuant to the Assembly Bill 52 (AB 52), Amendments to the California Environmental Quality Act (CEQA) (Chapter 532, Statutes of 2014), Public Resources Code Sections 5097.94 (m), 21073, 21074, 21080.3.1, 21080.3.2, 21082.3, 21083.09, 21084.2 and 21084.3, City of Hercules Sycamore Avenue Sewer Trunk Replacement Project, Contra Costa County

Dear Mr. Brown:

Pursuant to Public Resources Code section 21080.3.1 (c), attached is a consultation list of tribes that are traditionally and culturally affiliated with the geographic area of the above-listed project. Please note that the intent of the AB 52 amendments to CEQA is to avoid and/or mitigate impacts to tribal cultural resources, (Pub. Resources Code §21084.3 (a)) ("Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource.")

Public Resources Code sections 21080.3.1 and 21084.3(c) require CEQA lead agencies to consult with California Native American tribes that have requested notice from such agencies of proposed projects in the geographic area that are traditionally and culturally affiliated with the tribes on projects for which a Notice of Preparation or Notice of Negative Declaration or Mitigated Negative Declaration has been filed on or after July 1, 2015. Specifically, Public Resources Code section 21080.3.1 (d) provides:

Within 14 days of determining that an application for a project is complete or a decision by a public agency to undertake a project, the lead agency shall provide formal notification to the designated contact of, or a tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, which shall be accomplished by means of at least one written notification that includes a brief description of the proposed project and its location, the lead agency contact information, and a notification that the California Native American tribe has 30 days to request consultation pursuant to this section.

The AB 52 amendments to CEQA law does not preclude initiating consultation with the tribes that are culturally and traditionally affiliated within your jurisdiction prior to receiving requests for notification of projects in the tribe's areas of traditional and cultural affiliation. The Native American Heritage Commission (NAHC) recommends, but does not require, early consultation as a best practice to ensure that lead agencies receive sufficient information about cultural resources in a project area to avoid damaging effects to tribal cultural resources.

The NAHC also recommends, but does not require that agencies should also include with their notification letters, information regarding any cultural resources assessment that has been completed on the area of potential effect (APE), such as:

1. The results of any record search that may have been conducted at an Information Center of the California Historical Resources Information System (CHRIS), including, but not limited to:

- A listing of any and all known cultural resources that have already been recorded on or adjacent to the APE, such as known archaeological sites;
- Copies of any and all cultural resource records and study reports that may have been provided by the Information Center as part of the records search response;
- Whether the records search indicates a low, moderate, or high probability that unrecorded cultural resources are located in the APE; and
- If a survey is recommended by the Information Center to determine whether previously unrecorded cultural resources are present.

2. The results of any archaeological inventory survey that was conducted, including:

   - Any report that may contain site forms, site significance, and suggested mitigation measures.

     All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for public disclosure in accordance with Government Code section 6254.10.

3. The result of any Sacred Lands File (SLF) check conducted through the Native American Heritage Commission was negative.

4. Any ethnographic studies conducted for any area including all or part of the APE; and

5. Any geotechnical reports regarding all or part of the APE.

Lead agencies should be aware that records maintained by the NAHC and CHRIS are not exhaustive and a negative response to these searches does not preclude the existence of a tribal cultural resource. A tribe may be the only source of information regarding the existence of a tribal cultural resource.

This information will aid tribes in determining whether to request formal consultation. In the event that they do, having the information beforehand will help to facilitate the consultation process.

If you receive notification of change of addresses and phone numbers from tribes, please notify the NAHC. With your assistance, we can assure that our consultation list remains current.

If you have any questions, please contact me at my email address: Sarah.Fonseca@nahc.ac.gov.

Sincerely,



Sarah Fonseca
Cultural Resources Analyst

Attachment

Native American Heritage Commission
Tribal Consultation List
Contra Costa County
3/6/2020

Amah MutsunTribal Band of Mission San Juan Bautista
Irenne Zwierlein, Chairperson
789 Canada Road
Woodside, CA, 94062
Phone: (650) 851 - 7489
Fax: (650) 332-1526
amahmutsuntribal@gmail.com
Costanoan

Guidiville Indian Rancheria
Merlene Sanchez, Chairperson
P.O. Box 339
Talmage, CA, 95481
Phone: (707) 462 - 3682
Fax: (707) 462-9183
admin@guidiville.net
Pomo

Indian Canyon Mutsun Band of Costanoan
Ann Marie Sayers, Chairperson
P.O. Box 28
Hollister, CA, 95024
Phone: (831) 637 - 4238
ams@indiancanyon.org
Costanoan

Muwekma Ohlone Indian Tribe of the SF Bay Area
Charlene Nijmeh, Chairperson
20885 Redwood Road, Suite 232
Castro Valley, CA, 94546
Phone: (408) 464 - 2892
cnijmeh@muwekma.org
Costanoan

Muwekma Ohlone Indian Tribe of the SF Bay Area
Monica Arellano,
20885 Redwood Road, Suite 232
Castro Valley, CA, 94546
Phone: (408) 205 - 9714
marellano@muwekma.org
Costanoan

North Valley Yokuts Tribe
Katherine Perez, Chairperson
P.O. Box 717
Linden, CA, 95236
Phone: (209) 887 - 3415
canutes@verizon.net
Costanoan
Northern Valley Yokut

The Ohlone Indian Tribe
Andrew Galvan,
P.O. Box 3388
Fremont, CA, 94539
Phone: (510) 882 - 0527
Fax: (510) 687-9393
chochenyo@AOL.com
Bay Miwok
Ohlone
Patwin
Plains Miwok

The Confederated Villages of Lisjan
Corrina Gould, Chairperson
10926 Edes Avenue
Oakland, CA, 94603
Phone: (510) 575 - 8408
cvltribe@gmail.com
Bay Miwok
Ohlone
Delta Yokut

This list is current only as of the date of this document. Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and section 5097.98 of the Public Resources Code.

This list is only applicable for consultation with Native American tribes under Public Resources Code Sections 21080.3.1 for the proposed City of Hercules Sycamore Avenue Sewer Trunk Replacement Project, Contra Costa County.

April 7, 2020 VIA EMAIL cnijmeh@muwekma.org

Muwekma Ohlone Indian Tribe of the SF Bay Area
Attn: Charlene Nijmeh, Chairperson
20885 Redwood Road, Suite 232
Castro Valley, CA, 94546

Subject: Request for Section 106 Native American (Section 106) and Government-to-Government Consultation Under Assembly Bill 52 (AB52) for the City of Hercules's Sycamore Avenue Project

Dear Charlene Nijmeh, Chairperson:

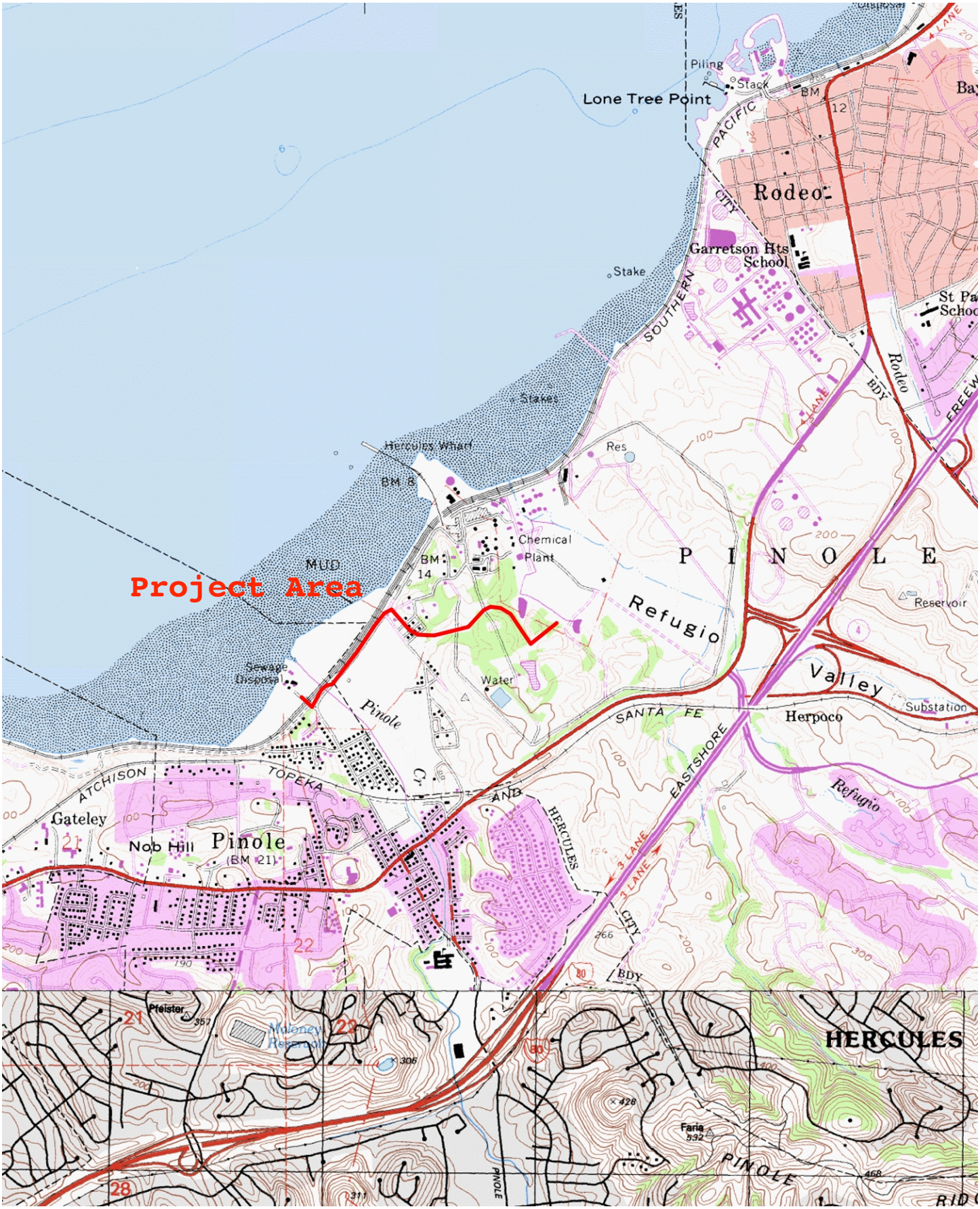
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The Native American Heritage Commission was contacted about the Proposed Project and provided us with a list of Native American individuals and organizations that may have knowledge of tribal and/or cultural resources in the Project Area as part of the Section 106 and AB52 requirements. As a result, we are requesting that you please provide us with any information you may have about cultural resources or sites in the Project Area so that we can determine ways to protect those sites, including archeological sites and other locations of special value to Native Americans.

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Sincerely,

Michael Roberts, PE
Public Works Director/City Engineer



Mercator Projection
WGS84
USNG Zone 10SEH

CalTopo

0.5 1.0 1.5 2.0 2.5 km

0.5 1.0 1.5 mi

Scale **1:24000** 1 inch = 2000 feet

N MN 13°

Figure 1

City of Hercules Sycamore Avenue Sewer Trunk Replacement Project

April 7, 2020 VIA EMAIL cnijmeh@muwekma.org

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Attn: Charlene Nijmeh, Chairperson
20885 Redwood Road, Suite 232
Castro Valley, CA, 94546

Subject: Request for Section 106 Native American (Section 106) and Government-to-Government Consultation Under Assembly Bill 52 (AB52) for the City of Hercules's Sycamore Avenue Project

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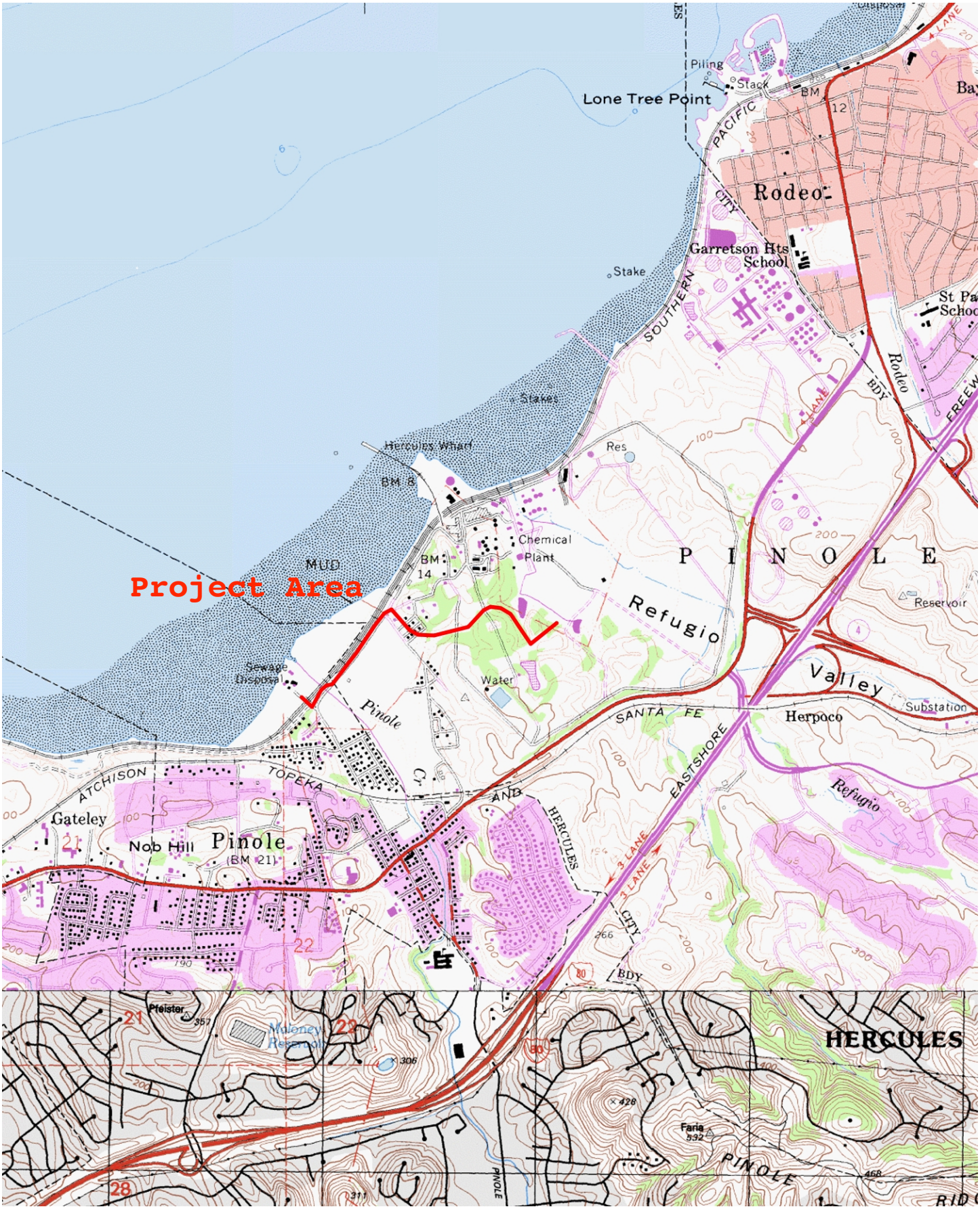
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WGS84
USNG Zone 10SEH

CalTopo

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0.5 1.0 1.5 mi

Scale **1:24000** 1 inch = 2000 feet

N MN 13°

Figure 1

City of Hercules Sycamore Avenue Sewer Trunk Replacement Project

April 7, 2020 VIA EMAIL marellano@muwekma.org

Muwekma Ohlone Indian Tribe of the SF Bay Area
Attn: Monica Arellano
20885 Redwood Road, Suite 232
Castro Valley, CA, 94546

Subject: Request for Section 106 Native American (Section 106) and Government-to-Government Consultation Under Assembly Bill 52 (AB52) for the City of Hercules's Sycamore Avenue Project

Dear Monica Arellano:

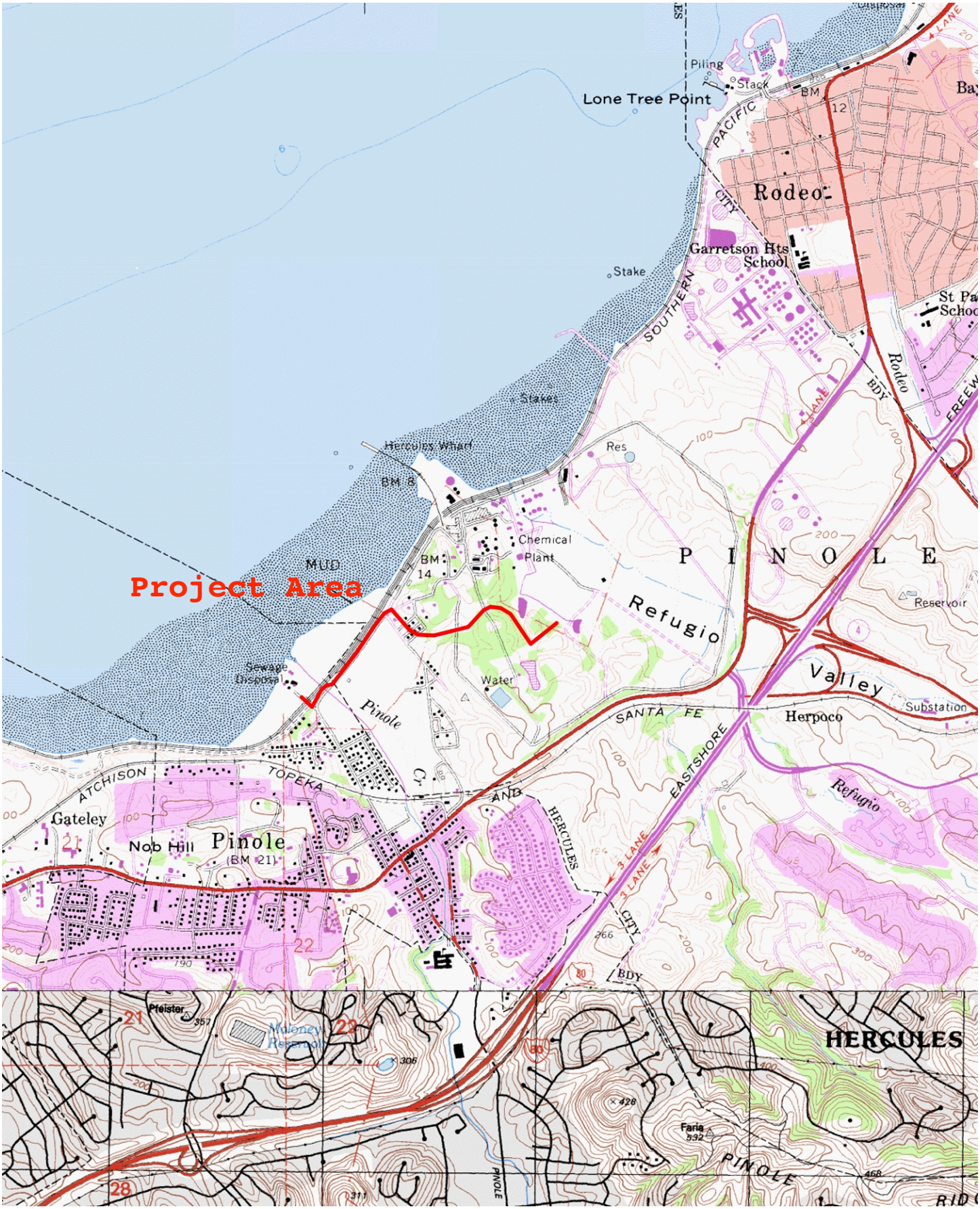
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Mercator Projection
WGS84
USNG Zone 10SEH

CalTopo

0.5 1.0 1.5 2.0 2.5 km

0.5 1.0 1.5 mi

Scale **1:24000** 1 inch = 2000 feet

N MN 13°

Figure 1

City of Hercules Sycamore Avenue Sewer Trunk Replacement Project

April 7, 2020 VIA EMAIL admin@guidiville.net

Guidiville Indian Rancheria
Attn: Merlene Sanchez, Chairperson
P.O. Box 339
Talmage, CA, 95481

Subject: Request for Section 106 Native American (Section 106) and Government-to-Government Consultation Under Assembly Bill 52 (AB52) for the City of Hercules's Sycamore Avenue Project

Dear Merlene Sanchez, Chairperson:

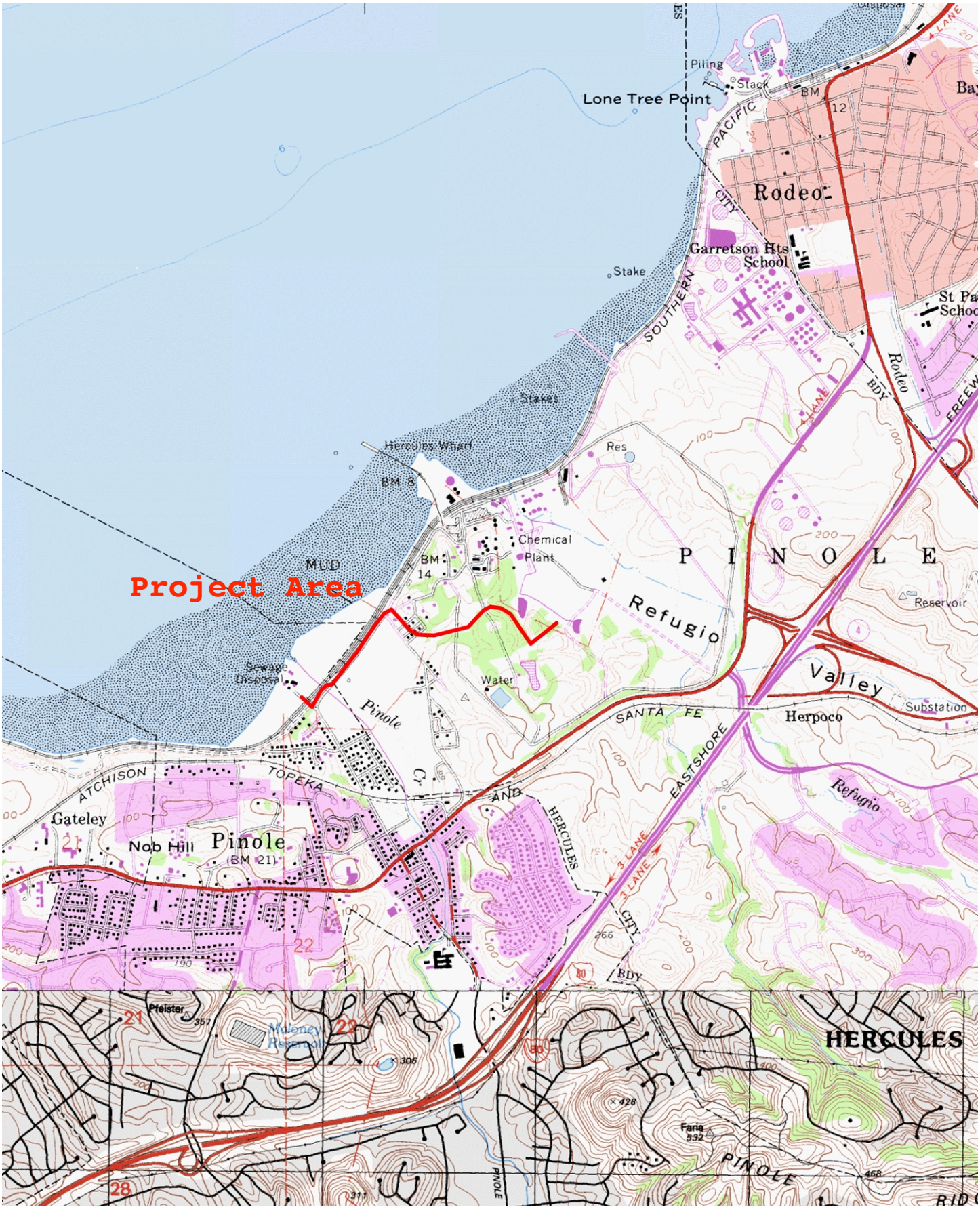
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Public Works Director/City Engineer



Mercator Projection
WGS84
USNG Zone 10SEH

CalTopo

0.5 1.0 1.5 2.0 2.5 km

0.5 1.0 1.5 mi

Scale **1:24000** 1 inch = 2000 feet

N MN 13°

Figure 1

City of Hercules Sycamore Avenue Sewer Trunk Replacement Project

April 7, 2020 VIA EMAIL amahmutsuntribal@gmail.com

Amah MutsunTribal Band of Mission San Juan Bautista
Attn: Irenne Zwierlein, Chairperson
789 Canada Road
Woodside, CA, 94062

Subject: Request for Section 106 Native American (Section 106) and Government-to-Government Consultation Under Assembly Bill 52 (AB52) for the City of Hercules's Sycamore Avenue Project

Dear Irenne Zwierlein, Chairperson:

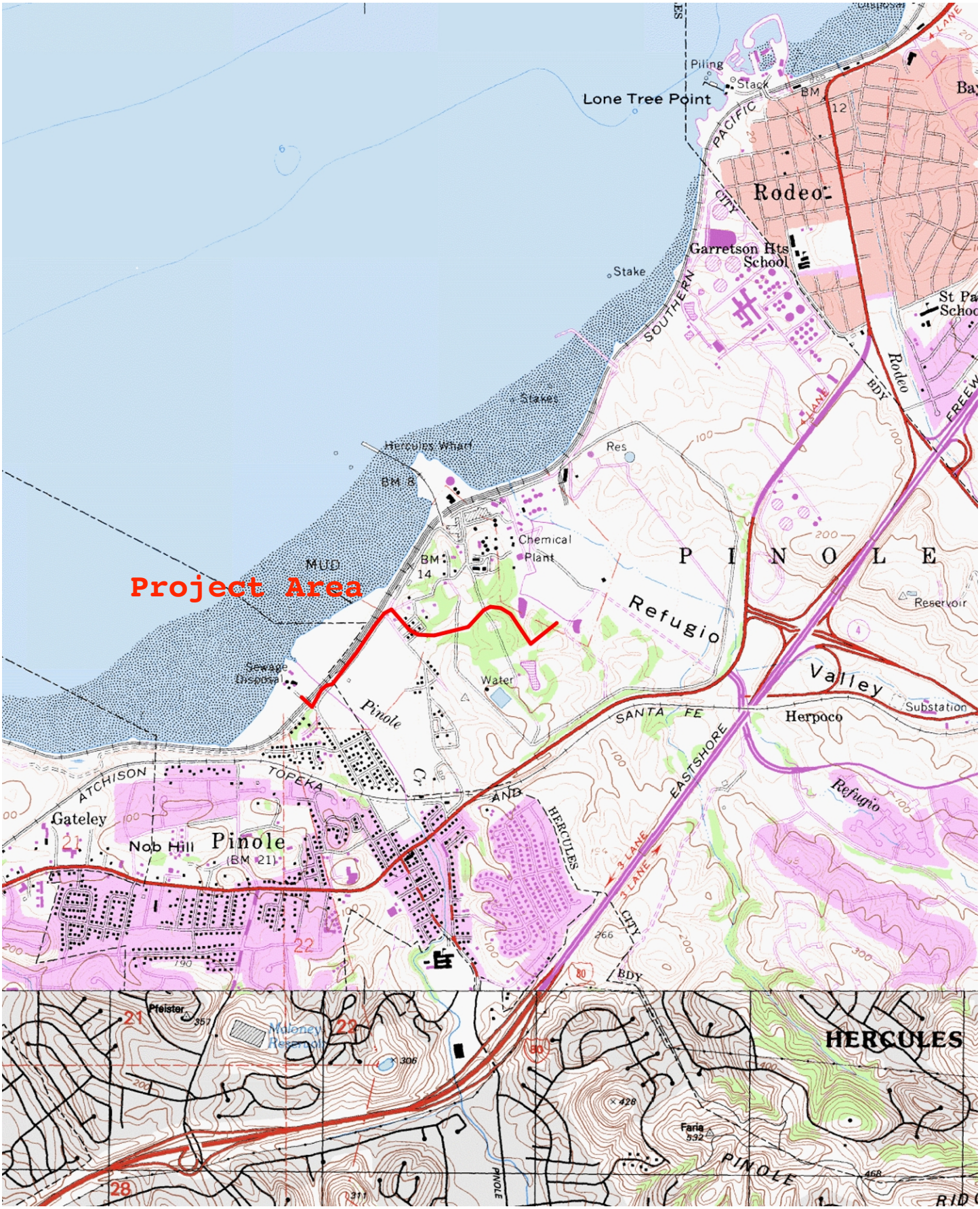
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Mercator Projection
WGS84
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CalTopo

0.5 1.0 1.5 2.0 2.5 km

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Scale **1:24000** 1 inch = 2000 feet

N MN 13°

Figure 1

City of Hercules Sycamore Avenue Sewer Trunk Replacement Project

April 7, 2020 VIA EMAIL chochenyo@AOL.com

The Ohlone Indian Tribe
Attn: Andrew Galvan
P.O. Box 3388
Fremont, CA, 94539

Subject: Request for Section 106 Native American (Section 106) and Government-to-Government Consultation Under Assembly Bill 52 (AB52) for the City of Hercules's Sycamore Avenue Project

Dear Andrew Galvan:

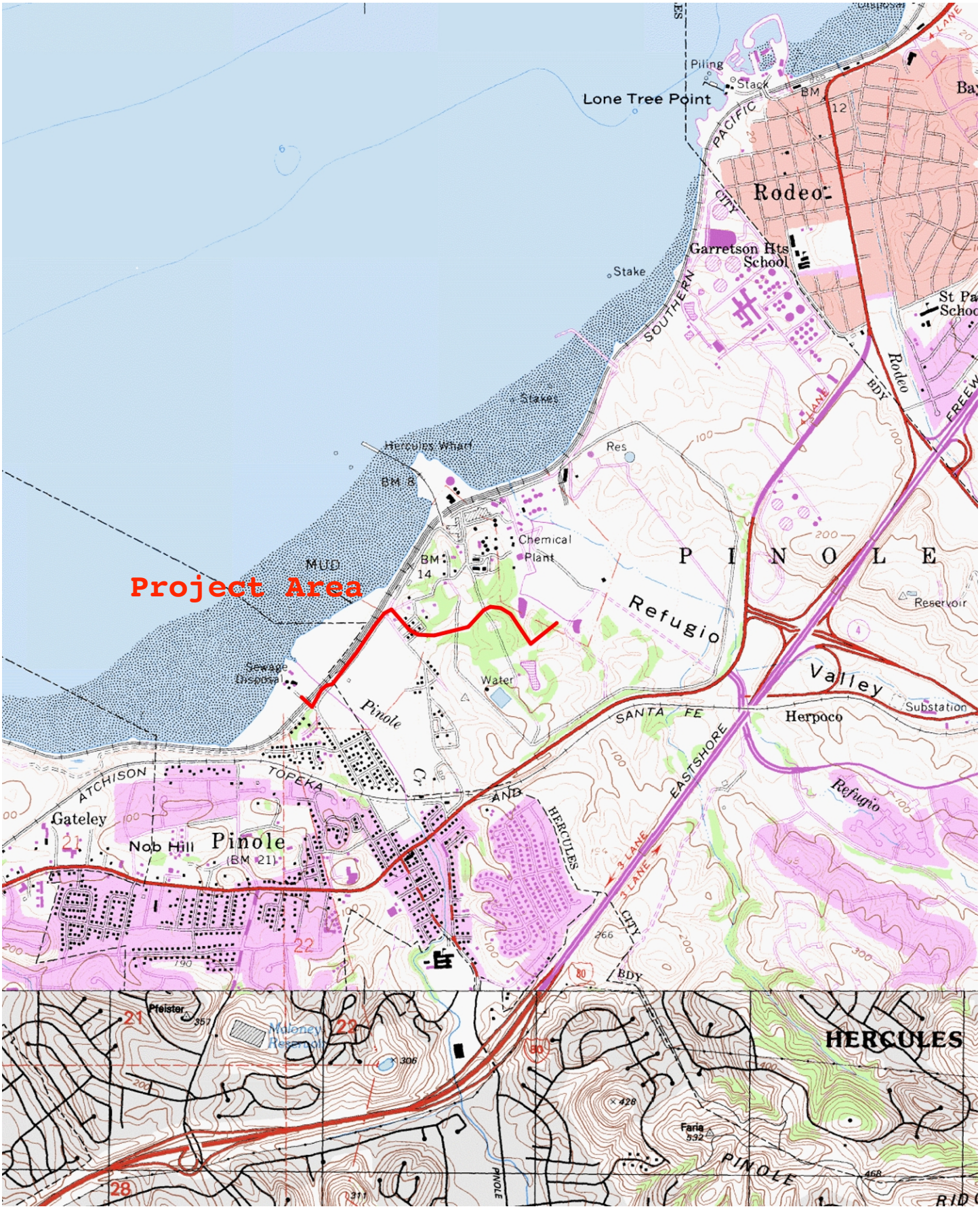
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N MN 13°

Figure 1

City of Hercules Sycamore Avenue Sewer Trunk Replacement Project

April 7, 2020 VIA EMAIL cvltribe@gmail.com

The Confederated Villages of Lisjan
Attn: Corrina Gould, Chairperson
10926 Edes Avenue
Oakland, CA, 94603

Subject: Request for Section 106 Native American (Section 106) and Government-to-Government Consultation Under Assembly Bill 52 (AB52) for the City of Hercules's Sycamore Avenue Project

Dear Corrina Gould, Chairperson:

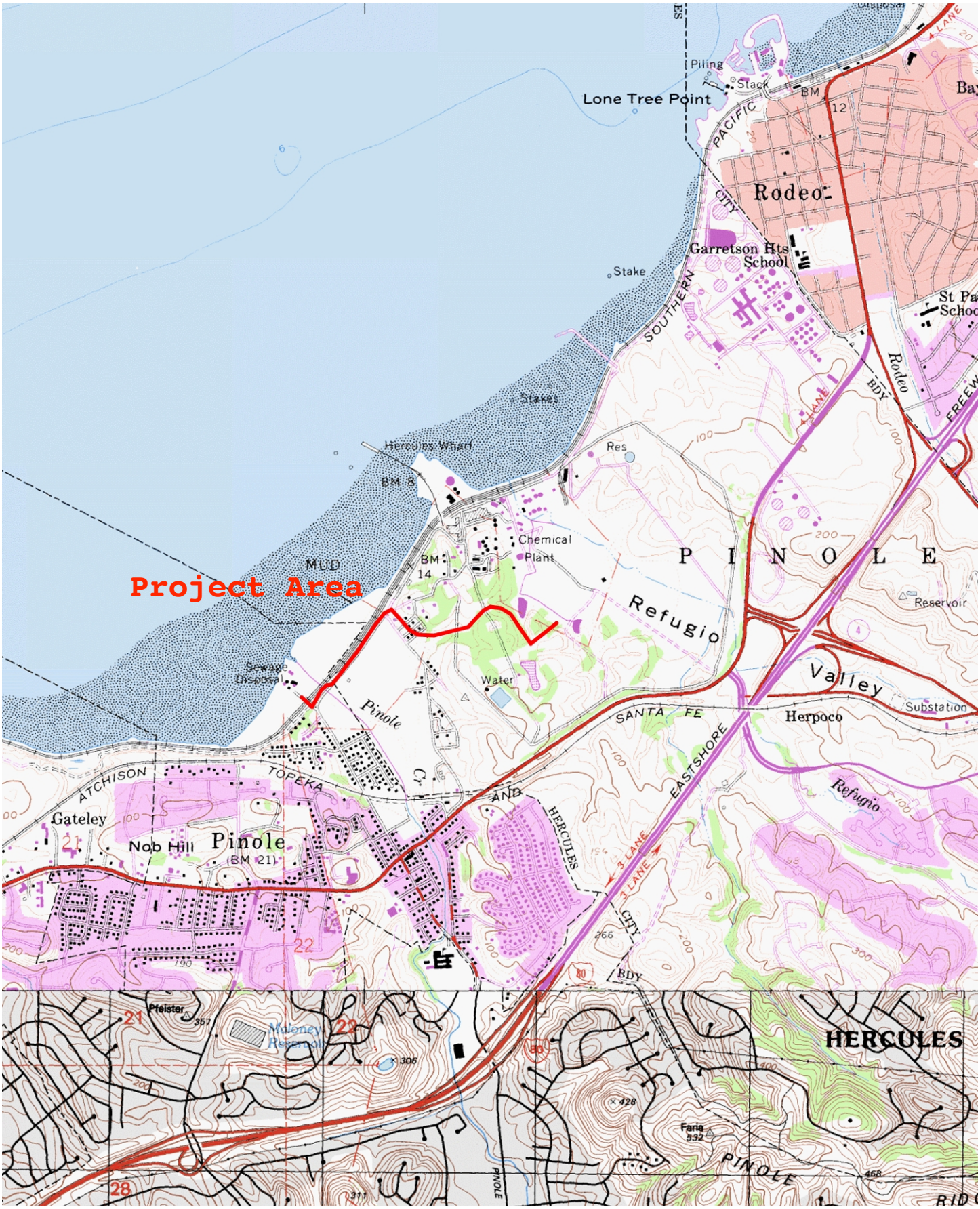
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Michael Roberts, PE
Public Works Director/City Engineer



Mercator Projection
WGS84
USNG Zone 10SEH

CalTopo

0.5 1.0 1.5 2.0 2.5 km

0.5 1.0 1.5 mi

Scale **1:24000** 1 inch = 2000 feet

N MN 13°

Figure 1

City of Hercules Sycamore Avenue Sewer Trunk Replacement Project

April 7, 2020 VIA EMAIL canutes@verizon.net

North Valley Yokuts Tribe
Attn: Katherine Perez, Chairperson
P.O. Box 717
Linden, CA, 95236

Subject: Request for Section 106 Native American (Section 106) and Government-to-Government Consultation Under Assembly Bill 52 (AB52) for the City of Hercules's Sycamore Avenue Project

Dear Katherine Perez, Chairperson:

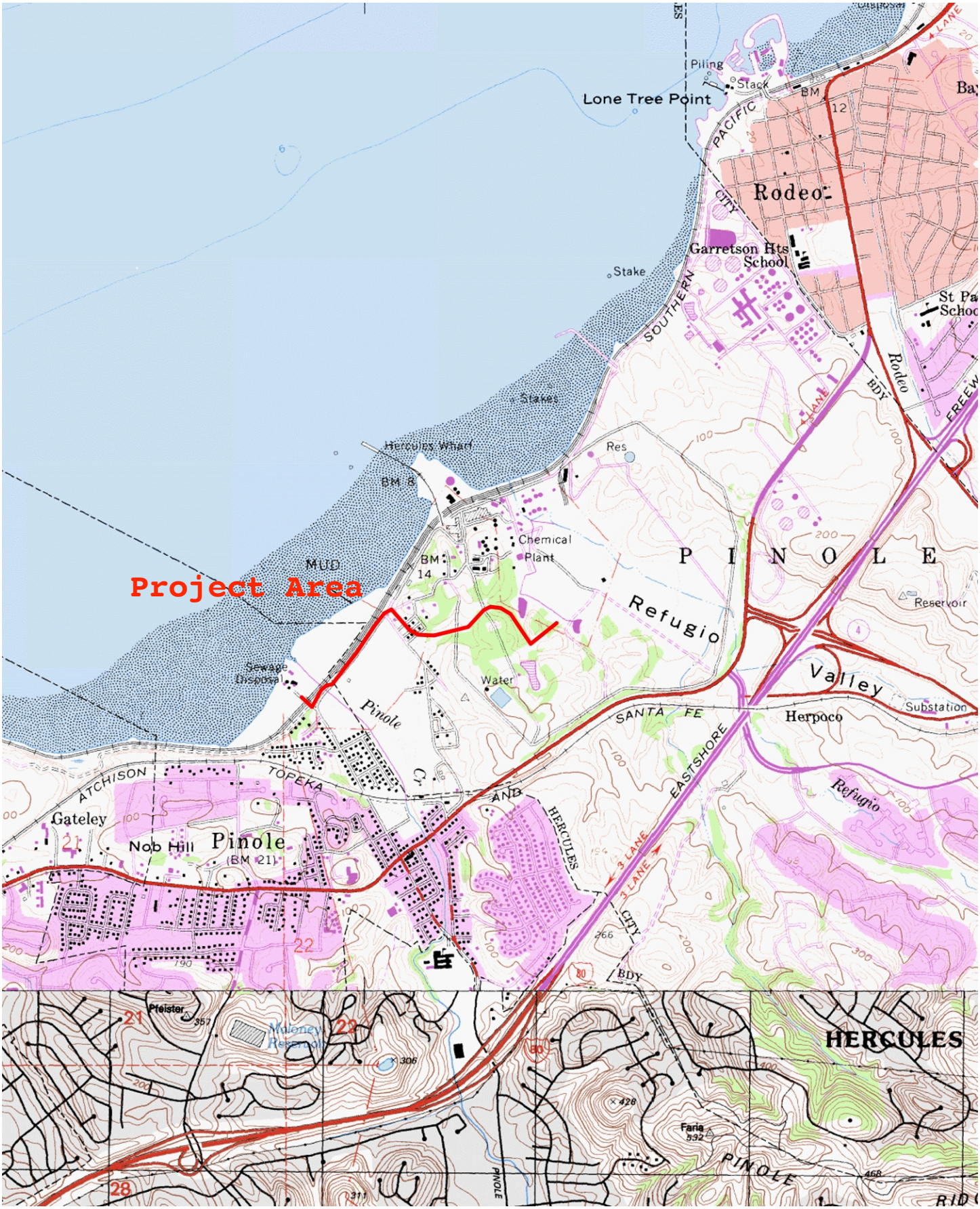
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Figure 1

City of Hercules Sycamore Avenue Sewer Trunk Replacement Project

April 7, 2020 VIA EMAIL ams@indiancanyon.org

Indian Canyon Mutsun Band of Costanoan
Attn: Ann Marie Sayers, Chairperson
P.O. Box 28
Hollister, CA, 95024

Subject: Request for Section 106 Native American (Section 106) and Government-to-Government Consultation Under Assembly Bill 52 (AB52) for the City of Hercules's Sycamore Avenue Project

Dear Ann Marie Sayers, Chairperson:

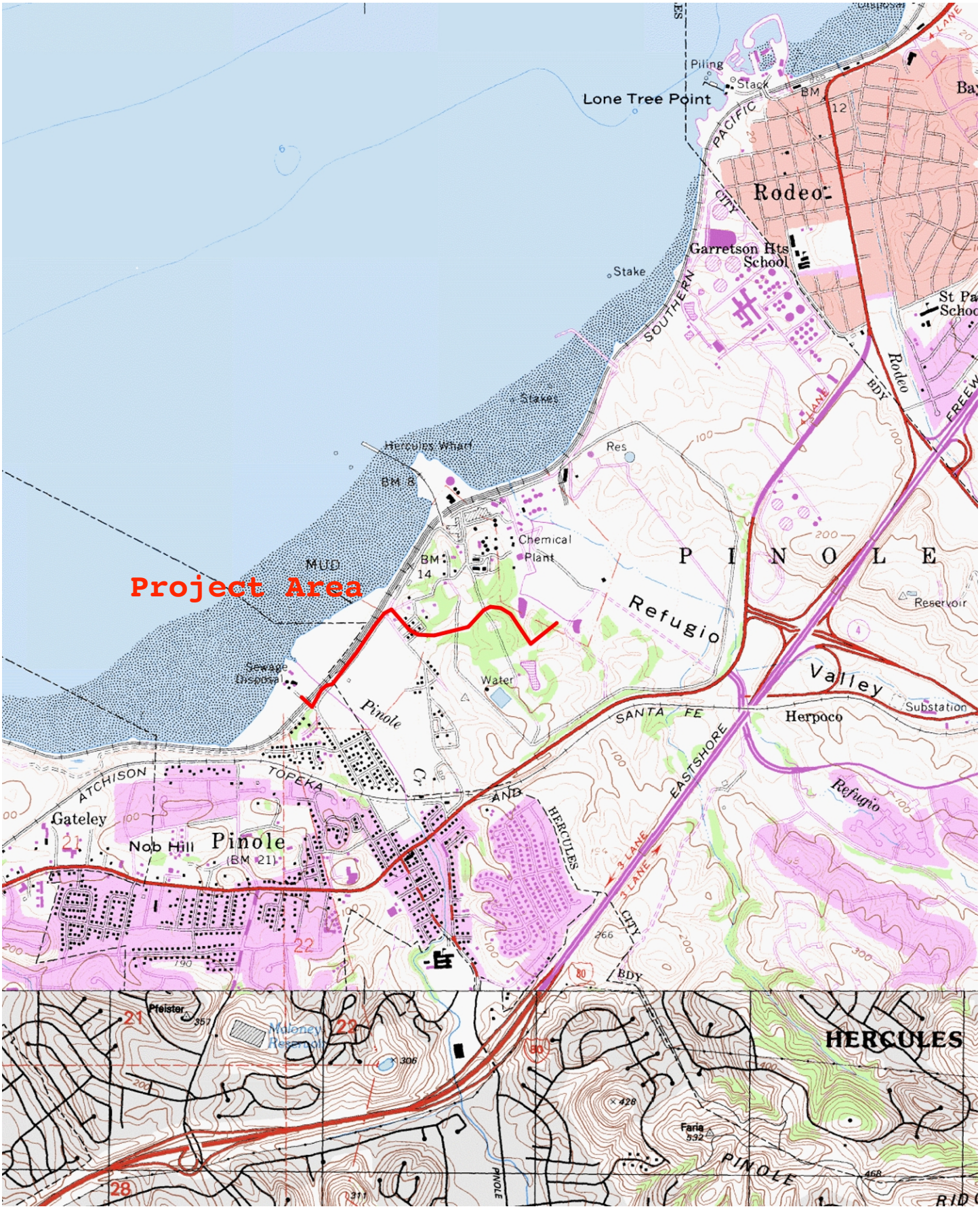
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