

FINAL REPORT

Evaluation Report for the  
South-Central Area  
Horizontal Biosparge Pilot Test  
SFPP Norwalk Pump Station  
Norwalk, California

*Prepared for*

Kinder Morgan Energy Partners, L.P.

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# Acronyms and Abbreviations

µg/L	microgram(s) per liter
1,2-DCA	1,2-dichloroethane
ASTM	ASTM International
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
BTS	Blaine Tech Services
CH2M	CH2M HILL Engineers, Inc.
COPC	chemical of potential concern
DFSP	Defense Fuel Support Point
DO	dissolved oxygen
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
FBBR	fluidized bed bioreactor
ft/day	feet per day
ft/ft	foot per foot
GWE	groundwater extraction
GWTS	groundwater treatment system
HHRA	Human Health Risk Assessment
JP-4	jet propellant number 4
JP-5	jet propellant number 5
JP-8	jet propellant number 8
Kinder Morgan	Kinder Morgan Energy Partners, L.P.
LGAC	liquid-phase granular activated carbon
LNAPL	light non-aqueous phase liquid
mg/L	milligram(s) per liter
MRP	Monitoring and Reporting Program
MTBE	methyl tertiary butyl ether
ORP	oxidation-reduction potential
OWS	oil-water separator
PID	photoionization detector
psi	pounds per square inch
PVC	polyvinyl chloride
RTO	regenerative thermal oxidizer



ACRONYMS AND ABBREVIATIONS

RWQCB	Regional Water Quality Control Board
scfm	standard cubic feet per minute
SF <sub>6</sub>	sulfur hexafluoride
SFPP	SFPP, L.P., an operating partnership of Kinder Morgan Energy Partners, L.P.
site	SFPP Norwalk Pump Station, 15306 Norwalk Boulevard, Norwalk, California
SVE	soil vapor extraction
TBA	tertiary butyl alcohol (also known as tert-butanol)
TFE	total fluids extraction
TPH	total petroleum hydrocarbons
TPH-d	total petroleum hydrocarbons, quantified as diesel
TPH-g	total petroleum hydrocarbons, quantified as gasoline
VOC	volatile organic compound
ZOI	zone of influence

# Introduction

## 1.1 Overview

This evaluation report was prepared by CH2M HILL Engineers, Inc. (CH2M) on behalf of SFPP, L.P. (SFPP), an operating partnership of Kinder Morgan Energy Partners, L.P. (Kinder Morgan), to summarize data collected during the first year of horizontal well biosparge pilot test operation at the SFPP Norwalk Pump Station, located at 15306 Norwalk Boulevard, Norwalk, California (the site) (Figure 1).

Pilot test data include groundwater chemistry, soil vapor, and groundwater sample analytical results from January 2016 (startup) through October 2016. The following sections summarize background information, objectives, methodology, and results of the pilot test, as well as recommendations for system expansion.

## 1.2 Site Description

The Defense Fuel Support Point (DFSP) facility located at 15306 Norwalk Boulevard in Norwalk, California is currently owned by the U.S. Air Force. DLA Energy (formerly Defense Energy Support Center) performs remediation activities at the site on behalf of the Air Force. The facility was formerly occupied by 12 inactive aboveground fuel storage tanks and associated piping and facilities. The tanks were used to store and distribute refined petroleum products, including jet propellant numbers 5 and 8 (JP-5 and JP-8), and had a maximum capacity of 35 million gallons. They reportedly also stored aviation gasoline and jet propellant number 4 (JP-4). In addition, DLA Energy previously operated truck fill stands and various fuel transfer systems. The facility was decommissioned in 2001 and is no longer used to store fuel. The aboveground tanks and the main infrastructure were demolished in 2011; demolition of the subsurface piping was completed in 2012.

SFPP maintains remediation equipment within 2 acres at the DFSP facility and easements for its pipelines along the southern and eastern boundaries of the facility. Previously, SFPP operated a pump station near the south-central area of the site. The pump station was used to transfer fuel to and from the DFSP facility, and as an in-line pumping station for portions of the SFPP pipeline network. The pump station was decommissioned in 2001, but three pipelines heading eastward along the southern boundary of the DFSP facility (one of which bends at the southeastern corner of the facility and continues northward within the eastern easement) remain in service and continue to convey refined petroleum fuels including gasoline, diesel, and jet fuel. The pipelines were fitted with block valves, two of which are located along a 24-inch diameter pipeline, within areas currently undergoing remediation. One block valve, located in the south-central portion of the site, is referred to as the intermediate 24-inch block valve. The other block valve, located offsite to the southeast, is referred to as the southeastern 24-inch block valve. SFPP removed these block valves in 2017 as part of their pipeline relocation project.

Subsurface assessments have been performed at the DFSP facility since 1986. The investigations characterized the nature and extent of fuel-related hydrocarbons in the shallow water-bearing zone related to historical releases from SFPP's pipelines at the DFSP facility. Based on these assessments, fuel was released from the block valves and migrated vertically to the water table. Separate-phase floating product, or light non-aqueous phase liquid (LNAPL), as well as sorbed-phase and dissolved-phase fuel hydrocarbons were delineated in areas beneath the DFSP facility and at offsite properties to the south, west, and east. Site assessments indicated that the chemicals of potential concern (COPCs) are total petroleum hydrocarbons (TPH), including TPH quantified as gasoline (TPH-g), diesel fuel (TPH-d), JP-4, JP-5, and JP-8; benzene, toluene, ethylbenzene, and total xylenes (BTEX); 1,2-dichloroethane (1,2-DCA);

methyl tertiary butyl ether (MTBE); and tertiary butyl alcohol (TBA [also known as tert-butanol]). A groundwater Monitoring and Reporting Program (MRP) has been in effect at the site since 1995. The current groundwater MRP is specified in the *Revised Groundwater Sampling and Analysis Plan, SFPP Norwalk Pump Station* (CH2M, 2013).

# Background

This section presents a summary of hydrogeologic conditions, and a description of SFPP's remediation systems at the site.

## 2.1 Hydrogeologic Conditions

The hydrogeologic units underlying the site consist of the following:

- Shallow water-bearing zone
- Bellflower aquitard
- Exposition aquifer

The shallow semiperched water-bearing zone extends from approximately 25 to 50 feet below ground surface (bgs). Lithology within this zone consists of sand, silty sand, clayey sand, and sandy silt. In general, the lower 20 feet (30 to 50 feet bgs) consists of poorly sorted fine to medium sand, while the upper 30 feet (ground surface to 30 feet bgs) consists of interbedded fine sand, silty sand, clayey sand, and sandy silt.

Groundwater flow within the shallow water-bearing zone, as interpreted during previous assessments and monitoring at DFSP, is generally toward the north, with a horizontal gradient of approximately 0.002 foot per foot (ft/ft). Hydraulic conductivity ranges from 12 to 73 feet per day (ft/day) in the south-central area to 20 to 60 ft/day in the southeastern area (AMEC, 2010).

The shallow water-bearing zone is underlain by the Bellflower aquitard of the Lakewood Formation. Based on lithologic logs from previous assessments at and near DFSP, the depth of the Bellflower aquitard ranges from approximately 50 to 80 feet bgs beneath the site and consists of predominantly clay, silty clay, and sandy clay with some interbedded sand with silt.

The regional water-bearing zone, the Exposition aquifer, underlies the Bellflower aquitard and ranges in depth from approximately 80 to 220 feet bgs. The horizontal hydraulic gradient in the Exposition aquifer is approximately 0.0004 ft/ft and the direction of groundwater flow is to the southeast, opposite the direction of the shallow water-bearing zone. Distinct hydraulic conditions above and below the Bellflower aquitard support the interpretation that the Bellflower aquitard is laterally continuous, with a relatively low vertical hydraulic conductivity.

Figure 2 provides a hydrograph with representative wells from the shallow water-bearing zone in the SFPP remediation areas and all wells within the Exposition aquifer. The hydrograph on Figure 2 shows the following:

- Groundwater elevations in the shallow water-bearing zone are approximately 20 feet higher than the Exposition aquifer, demonstrating that the Bellflower aquitard impedes vertical groundwater flow between the two units.
- Groundwater elevations in the shallow water-bearing zone fluctuate seasonally and over the long term in response to recharge by precipitation and extraction from the DLA and SFPP remediation systems. Annually, groundwater elevations increase during the winter rainy season and decrease during the summer dry season. Groundwater elevations in the shallow water-bearing zone are at historical lows since groundwater monitoring began in the mid-1990s.
- Groundwater elevations in the Exposition aquifer also fluctuate seasonally and over the long term in response to recharge by precipitation, and in response to regional water supply pumping in the Central Basin.

## 2.2 Remediation Systems

SFPP operates remediation systems consisting of soil vapor extraction (SVE), biosparging, total fluids extraction (TFE; extraction of free product and/or groundwater using a top-loading pump), and groundwater extraction (GWE; extraction of groundwater using a bottom-loading pump) within the following two areas:

- **South-Central Area.** LNAPL and dissolved-phase hydrocarbons occur in the south-central area beneath the DFSP facility and offsite beneath the residential area to the south. These impacts occurred from a historical release from the intermediate 24-inch block valve and potentially other unidentified sources at the former pump station.
- **Southeastern Area.** LNAPL and dissolved-phase hydrocarbons occur in the southeast area beneath the DFSP facility and offsite in the Holifield Park area. These impacts occurred from a historical release from the southeastern 24-inch block valve in this area.

Remediation in the south-central and southeastern areas consists of SVE and TFE (GWE is also performed at one location in the southeastern area). At several locations, SVE is coupled with TFE (or GWE) in a process referred to as dual-phase extraction. Biosparging is also employed in the south-central area to enhance mass removal of hydrocarbon constituents.

The objectives of the remediation systems are to contain and control the migration of hydrocarbon constituents in groundwater and soil vapor and to remove hydrocarbon mass from soil and groundwater. The remediation systems include the following:

- South-Central Area
  - 20 TFE wells
  - 24 onsite and 6 offsite SVE wells (most collocated with TFE wells)
  - 2 horizontal SVE wells
  - 1 horizontal biosparge well
- Southeast Area
  - 4 TFE wells (GMW-O-15, GMW-O-18, GMW-36, and GMW-SF-9)
  - 3 SVE wells (collocated with TFE wells)
  - 1 GWE well (GMW-SF-10)

The remediation system layout is shown on Figure 3. A brief description of each system is provided below.

### 2.2.1 Soil Vapor Extraction System

SVE is performed using a blower to remove soil vapors from the south-central and southeastern areas. The extracted vapors are conveyed to a knock-out tank that separates entrained moisture from the soil vapors. Accumulated moisture in the knock-out tank is treated by the main groundwater treatment system (GWTS) described below. The soil vapors are then treated in a regenerative thermal oxidizer (RTO) where volatile organic compounds (VOCs) are converted to carbon dioxide and water prior to being discharged to the atmosphere. Operation of the GWTS and SVE system is conducted in accordance with Permits to Construct (Application Nos. 569588 and 567723, respectively; ID 110835) issued by the South Coast Air Quality Management District.

### 2.2.2 Groundwater Treatment System

The main GWTS receives free product and groundwater recovered from the south-central and southeastern parts of the site. Free product and groundwater recovered by pneumatically operated top-loading total fluids pumps and bottom-loading groundwater pumps is routed to an oil-water

separator (OWS). Any free product retained in the OWS is collected in a storage tank and recycled at an offsite location. Groundwater from the OWS is subsequently routed through an onsite 3,000-gallon equalization tank, two fluidized bed bioreactors (FBBRs; used to treat fuel oxygenates such as TBA and MTBE), and finally through two liquid-phase granular activated carbon (LGAC) beds prior to discharge in accordance with a National Pollutant Discharge Elimination System permit (Permit No. CA0063509; Order No. R4-2016-0309).

### 2.2.3 Horizontal Biosparge System

The horizontal biosparge well was drilled and installed in August of 2014. The well is constructed of 4-inch-diameter Schedule 80 polyvinyl chloride (PVC), including 600 feet of slotted pipe (“screen”) at 45 feet bgs and 250 feet of riser. The screen section is centered below the central portion of the south-central area hydrocarbon plume, as shown on Figure 3. A completion diagram of the well is shown on Figure 4. The depth of the screen interval was selected to be as close as practicable to the bottom of the shallow water-bearing zone, to maximize the zone of influence (ZOI).

Additional details regarding construction of the horizontal biosparge well are documented in the report titled, *Horizontal Biosparge Well and Soil Vapor Monitoring Probe Completion Report* (CH2M, 2015).

The aboveground system includes the following components:

- 100-horsepower rotary screw air compressor, supplying approximately 500 standard cubic feet per minute (scfm) and 100 pounds per square inch (psi)
- 8-foot by 20-foot system enclosure with ventilation, noise suppression, ducting, and lighting
- 200-gallon air receiver
- Condensate treatment system including 300-gallon treated water storage tank
- Air sparge manifold with five legs, each with solenoid valves with timers to facilitate cycling of air flow

Compressed air is injected into the horizontal biosparge well, BS-01, at a maximum rate of approximately 500 scfm. SFPP’s SVE system has an interlock, which ensures the biosparge system cannot operate unless the SVE system is operating. Operation of the SVE system controls vapor migration during biosparge system operation.

# Horizontal Well Biosparge Pilot Testing

## 3.1 Pilot Test Objectives

The objectives of the biosparge pilot test were as follows:

1. Evaluate the effectiveness of biosparge technology to enhance petroleum mass removal in the south-central area of the site. This objective was accomplished based on measurements of LNAPL in monitoring wells screened in the shallow water-bearing zone, as well as dissolved-phase concentrations in monitoring wells without LNAPL. In addition, SFPP will compare LNAPL saturation and LNAPL chemistry in soil cores collected before, and 2 to 3 years after, commencement of biosparging to further evaluate mass removal, and specifically the change in LNAPL saturation and composition.
2. Evaluate the potential for vapor migration beneath the offsite residential areas located immediately south of the site. This objective was accomplished by conducting routine sampling of the new and previously installed soil vapor monitoring probes.
3. Evaluate the feasibility of system expansion to other portions of the south-central area and southeastern area. Data collected from the above activities were used to meet this objective.

## 3.2 Pilot Test Methodology

Pilot test activities in the south-central area included the following primary components:

1. ZOI Evaluation – collection of water level and field water quality data during the flow ramp-up period, in conjunction with injection of sulfur hexafluoride (SF<sub>6</sub>) tracer gas into the biosparge well at peak flow to estimate the ZOI.
2. Soil Vapor Monitoring – collection of routine soil vapor monitoring data during biosparge system operations.
3. Groundwater Monitoring – collection of routine groundwater monitoring data during biosparge system operations.

### 3.2.1 Zone of Influence Evaluation

The biosparge system was activated on January 7, 2016, at an initial flow rate of 60 scfm. System flow was gradually increased at a rate of 60 scfm per week over a period of approximately 7 weeks to achieve the maximum design flow rate of 480 scfm (0.8 scfm per foot of screen) as follows:

- January 7, 2016: 60 scfm
- January 9, 2016: 120 scfm
- January 15, 2016: 180 scfm
- January 20, 2016: 240 scfm
- January 25, 2016: 300 scfm
- January 27, 2016: 360 scfm
- January 29, 2016: 420 scfm
- February 4, 2016: 480 scfm

Down-well probes with pressure transducers and dissolved oxygen (DO), pH, temperature, conductivity, and oxidation-reduction potential (ORP) sensors were placed in the six monitoring/remediation wells in the south-central area (GMW-1, GMW-26, GMW-28, GMW-O-10, MW-SF-5, and MW-SF-6) on

December 29, 2015, to continuously measure water levels and field water quality throughout the flow ramp up period. Replacement probes were installed in MW-SF-6 on January 7, 2016, and GMW-1 on January 18, 2016, because of a faulty sensor with previously installed probes. Manual water level measurements were conducted using an interface probe, and visual observations of bubbling from select monitoring wells were also noted. Water level changes were measured to determine the time required for peak water table displacement to occur, which can be used to evaluate pulsed operation scenarios.

An SF<sub>6</sub> tracer gas injection event was conducted from February 16 to 18, 2016. It included injection of ambient air and SF<sub>6</sub> tracer, blended at approximately 0.1 percent by volume, into the biosparge well at the maximum design flow rate (480 scfm), with subsequent collection of groundwater samples from select wells for SF<sub>6</sub> analysis. The lateral extent of the ZOI was subsequently based on detection of SF<sub>6</sub> in groundwater samples and/or increases in DO concentrations.

Groundwater samples were collected on February 17 and 18, 2016, and submitted for laboratory analysis to confirm the presence of SF<sub>6</sub> tracer in surrounding observation wells. Wells sampled are as follows: GMW-1, GMW-9, GMW-23, GMW-26, GMW-28, GMW-29, GMW-30, GMW-O-3, GMW-O-9, GMW-O-10, GMW-O-14, HL-3, MW-18 (MID), PZ-2, MW-SF-13, MW-SF-14, MW-SF-16, and PZ-10. Groundwater samples were collected by Blaine Tech Services (BTS) using low-flow methods and shipped to CH2M's Applied Sciences Laboratory in Corvallis, Oregon, for SF<sub>6</sub> analysis. Well gauging and sampling records for the tracer study are provided in Appendix A.

## 3.2.2 Soil Vapor Monitoring and Analysis

### 3.2.2.1 SVE System Influent Sampling

Field total VOC (as hexane) measurements were collected from the SVE influent at approximately weekly intervals during pilot testing activities using a photoionization detector (PID). In addition, approximately once per month, a sample was submitted to an offsite laboratory (Air Technology Laboratory) for the following analyses: VOCs using U.S. Environmental Protection Agency (EPA) Method TO-3 and TO-15, and fixed gases (methane, carbon dioxide, and oxygen) using ASTM International (ASTM) D-1946. These activities were performed to monitor fluctuations in hydrocarbon constituents in extracted soil vapor.

### 3.2.2.2 Soil Vapor Monitoring Probe Sampling

Collection of soil vapor samples from the onsite and offsite nested soil vapor monitoring probes was conducted to monitor for potential off-gassing of volatile hydrocarbon constituents during pilot testing activities. CH2M field staff performed weekly PID monitoring of the south-central area soil vapor monitoring network (SVM-1 through SVM-3, SVM-5 through SVM-8, and SVM-10 through SVM-16) during the initial 2 months of biosparge operations, then monthly thereafter. Figure 5 shows the location of soil vapor monitoring probes. Figure 6 shows the construction details for a typical nested probe.

CH2M retained American Analytics of Chatsworth, California, to collect and analyze soil vapor samples from the same probes at approximately monthly intervals. A mobile laboratory was used by American Analytics for onsite laboratory analysis of soil vapor samples.

### **PID and Vacuum Measurements**

Approximately once per week in January and February 2016, a CH2M field technician collected field VOC measurements from the south-central area soil vapor probe network using a PID calibrated against hexane. Subsequent field VOC measurements were collected during mobile laboratory monitoring events as described below. Field readings were collected after each probe was purged approximately three system volumes using a hand-held portable vacuum pump. A vacuum measurement was also collected from each probe using a digital manometer.



### Vapor Sample Analysis Using Mobile Laboratory

Monthly soil vapor samples were collected from probes SVM-1 through SVM-3, SVM-5 through SVM-8, and SVM-10 through SVM-16 by American Analytics and analyzed onsite using its mobile laboratory under the direction of CH2M. Sampling was conducted on the following dates:

- January 27 to 29, 2016
- February 24 to 26, 2016
- April 27 to 29, 2016
- May 25 to 27, 2016
- June 22 to 24, 2016
- August 29 to 31, 2016

The soil vapor probes at each monitoring location were purged and sampled in accordance with the recommended guidelines in the Department of Toxic Substances Control (DTSC) *Advisory for Active Soil Gas Investigations* (the Advisory), dated July 2015 (DTSC, 2015). The analytical results were evaluated by comparing the results to soil gas screening levels based on the most current DTSC guidance (*Human Health Risk Assessment [HHRA] Note 3*; DTSC, 2016). The soil gas screening levels are calculated from indoor air screening levels published by DTSC (2016) using the default attenuation factors presented in DTSC's vapor intrusion guidance (DTSC, 2011).

Soil vapor samples were not collected at the deep probe of SVM-2 and shallow probe of SVM-10 due to flow restrictions (excessive vacuum) observed during purging activities with a hand-held sampling pump. Soil vapor samples also were not collected from the shallow or deep probes of SVM-4 due to property access restrictions. SVM-9 was not sampled during routine monitoring events because of its location in the southeastern area; however, it was sampled in August 2016 as part of the requirements to sample this probe on an annual basis.

Vapor samples were collected using 1.4-liter Summa canisters and glass syringes, and analyzed by the American Analytics onsite mobile laboratory for VOCs using EPA Method TO-15, TPH-g using EPA Method TO-3, and fixed gases (carbon dioxide, methane, and oxygen) using EPA Method 3C. Included in the TO-15 analyte list were BTEX, MTBE, naphthalene, TBA, 1,2-DCA, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, n-butylbenzene, sec-butylbenzene, isopropylbenzene, n-propylbenzene, and 2-propanol (the leak test compound). These constituents were identified as COPCs based on the results of the 2006 soil gas investigation and HHRA (Geomatrix, 2006).

In accordance with the Advisory (DTSC, 2015), field duplicate samples were collected at a minimum frequency of 1 per every 20 primary samples collected. The duplicate samples were collected and analyzed in the same manner as the primary samples.

Ambient air samples were also collected each day of sampling and analyzed by the mobile laboratory for VOCs and TPH-g. The purpose of the ambient air samples was to quantify background concentrations of COPCs near select sampling locations.

### 3.2.3 Groundwater Monitoring

Selected monitoring and remediation wells were gauged and sampled during March, June, and August 2016 as part of the pilot testing activities to evaluate the effect on free-phase and dissolved-phase hydrocarbons in the south-central area. Groundwater sampling and analysis was also performed for a broader number of wells in April and October 2016 as part of the monitoring that is conducted by DLA Energy and Kinder Morgan on a semiannual basis. Groundwater samples were collected by BTS using low-flow methods and shipped to Alpha Analytical in Sparks, Nevada, for the following analyses: VOCs including fuel oxygenates using EPA Method 8260B, and TPH-g and TPH-d using EPA Method 8015M.

Prior to starting gauging, purging, or sampling activities, SFPP remediation systems were deactivated for several days to allow water levels to recover to near-static conditions. Subsequently, BTS measured depth to water in each well using a water level meter, or depth to water and free product thickness using an interface probe. Field instruments used to gauge the wells were cleaned with a laboratory-grade, non-detergent cleaner, then rinsed successively in two containers with distilled water before each use.

Before sampling, each well was purged by using low-flow purge techniques at a rate of approximately 200 to 500 milliliters per minute. During purging, groundwater field parameters consisting of temperature, pH, electrical conductivity, turbidity, DO, and ORP were monitored. Water levels also were monitored during low-flow purging to verify minimal drawdown. Samples were collected using a 2-inch-diameter submersible Grundfos pump with new or dedicated tubing. Well gauging and sampling records for monitoring performed in March, June, and August 2016 are provided in Appendix B. Well gauging and sampling records for April and October 2016 are provided in the routine semiannual monitoring reports submitted to the Regional Water Quality Control Board (RWQCB) under separate cover.

Groundwater field parameters were allowed time to stabilize, before collecting the sample. Water samples analyzed for TPH-g, TPH-d, and VOCs were collected in 40-milliliter volatile organic analysis vials containing hydrochloric acid preservative, filled to zero headspace, and sealed with Teflon septa and airtight caps. The samples were labeled and placed on ice for transport to the laboratory following proper chain-of-custody procedures.

# Results

## 4.1 Down-well Probe and Manual Water Level Data

DO, pH, ORP and water level plots for data recorded by the down-well probes in wells GMW-1, GMW-26, GMW-28, GMW-O-10, MW-SF-5, and MW-SF-6 are presented on Figures 7 through 12. DO data were not available for well MW-SF-6 due to equipment (sensor) failure.

Manual water level measurements were also collected from the wells noted above and other wells, including MW-18 (MID), MW-SF-3, and PZ-10, during the flow ramp-up period to evaluate water table displacement in the general vicinity of the biosparge well. Table 1 and Figure 13 provide a summary of maximum water level increases (or rise) observed during ZOI evaluation. With exception of wells GMW-28 and PZ-10, maximum water table displacement corresponded to the period immediately following startup, after 2 days of operation. Figure 13 presents water table displacement in select monitoring wells versus lateral distance from the biosparge well at a flow rate of 120 scfm. Water table displacement generally decreased with increasing lateral distance from the biosparge well. A maximum water level rise of 13.1 feet was observed in remediation well MW-SF-3, located approximately 10 feet from the biosparge well.

Water table displacement is not used to determine the ZOI because it extends beyond the zone of air contact. However, it can be used to determine optimum cycle time for pulsed system operation. Based on review of the data, an optimum cycle time (if used for pulsed operation in the future) of 48 to 72 hours is recommended.

## 4.2 Biosparge Well Zone of Influence – DO and SF<sub>6</sub> Tracer Data

Table 2 provides a summary of DO, pH, and ORP field data and SF<sub>6</sub> analytical results from the tracer test conducted on February 16, 2016, corresponding to the maximum air sparge rate of 480 scfm. The laboratory analytical report for the SF<sub>6</sub> data is provided in Appendix C. An isoconcentration contour map of field DO data and laboratory SF<sub>6</sub> data is shown on Figure 14. Figure 15 presents field DO concentrations with respect to lateral distance from the biosparge well. As shown on the figures, maximum DO concentrations (greater than 6 milligrams per liter [mg/L]), were reported in wells located within approximately 50 lateral feet and on both sides of the biosparge well screen, including the following:

- GMW-9 (7.48 mg/L), MW-SF-13 (7.84 mg/L), and PZ-10 (7.34 mg/L) to the north
- and MW-SF-14 (6.36 mg/L) and MW-SF-16 (6.96 mg/L) to the south

DO concentrations in GMW-23 and GMW-29 approached 2 mg/L, which is above the average DO concentration (0.55 mg/L) reported in in 2015. The field DO concentration in PZ-2 (2.33 mg/L), located approximately 214 feet north of the biosparge well screen, was also above the average background DO concentration. Field DO concentrations in the remaining wells were generally less than 1 mg/L, near background concentrations.

Figure 16 presents a plot of SF<sub>6</sub> concentrations with respect to lateral distance from the biosparge well screen. The maximum SF<sub>6</sub> concentration was reported at PZ-2 (3.1096 micrograms per liter [µg/L]). Relatively high concentrations of SF<sub>6</sub> were also reported in wells GMW-1 and MW-18 (MID), located within a distance of approximately 100 feet from the biosparge well. However, the majority of

detectable concentrations of SF<sub>6</sub> were reported in wells located within a distance of approximately 50 feet of the biosparge well, on both sides of the well screen. Concentrations in these wells ranged from 0.0007 µg/L in MW-SF-16 to 2.6881 µg/L in GMW-23. SF<sub>6</sub> was not detected in wells GMW-O-3, GMW-O-9, GMW-O-14, and HL-3; these wells are located more than 180 lateral feet from the biosparge well screen. SF<sub>6</sub> was also not detected in wells GMW-26, GMW-29, and GMW-O-10; these wells are located within approximately 100 lateral feet of the biosparge well screen, near the termination of the well.

## 4.3 Soil Vapor Monitoring

### 4.3.1 SVE Influent Monitoring

Figure 17 presents field PID and total VOC concentrations at the SVE influent between July 2015 and October 2016. Table 3 presents a summary of analytical data for samples collected from the SVE influent (pre- or post-dilution). To maintain compliance with permit conditions and optimize extracted vapor treatment efficiency, throttle valves for the onsite SVE wellfield were closed by 50 percent on April 14, 2016, and for the remainder of 2016. All offsite wellfield valves remained fully open.

As shown on Figure 17, the maximum field PID measurement at the SVE inlet occurred immediately after startup, and then again in early March 2016. PID concentrations generally decrease after this time. Similarly, total VOC concentrations peak immediately after biosparge system startup and generally decrease with continued (steady-state) biosparge system operations. The biosparge system was deactivated on November 11, 2016, to facilitate installation of a new RTO system. Following installation of the RTO, biosparging will resume as normal, and onsite wellfield valves will be reopened to increase mass removal.

### 4.3.2 Field PID and Vacuum Monitoring

Figure 18 presents field PID measurements collected from all soil vapor probes between January and August 2016 while the SVE and biosparge systems were operating. Data collected from September 2015 are also presented to provide a comparison with background conditions while the SVE and biosparge systems were offline. Table 4 presents a summary of the field PID and vacuum measurements collected. As shown on Figure 18, PID concentrations are generally highest during January and February 2016, then decline during subsequent events. Figure 19 presents soil vapor PID concentrations with respect to lateral distance from the biosparge well. An overall downward trend in concentrations with increasing lateral distance from the well is evident.

### 4.3.3 Mobile Laboratory Monitoring

A summary of analytical results for samples analyzed by the mobile laboratory in January, February, April, May, June, and August 2016 is provided in Appendix D. The laboratory analytical reports are presented in Appendix E. Table 5 presents a summary of “positive” VOC detections and human health screening-level exceedances (residential and/or commercial) in samples collected from the offsite and onsite soil vapor monitoring probes. Offsite soil vapor monitoring probes sampled included SVM-1 through SVM-3, SVM-5 through SVM-8, SVM-10, SVM-15, and SVM-16; onsite probes sampled included SVM-11 through SVM-14. Samples were collected while the biosparge and SVE systems were online.

As shown in Table 5 and Appendix D, detections of VOCs were reported in either shallow or deep offsite probes for each sampling event. However, all concentrations were less than residential and commercial screening criteria, except for the sample collected from the deepest probe (22-foot depth) at SVM-15 during the February 2016 sampling event, which had a benzene concentration of 1.7 µg/L. Trace-level VOCs, including bromodichloromethane and chloroform, were detected in the shallow and/or deep probes of SVM-3 in May, June, and August 2016. However, these concentrations were less than

residential and commercial screening criteria. VOCs were also detected in the deepest probe (22-foot depth) at SVM-16 at concentrations less than screening criteria.

In the onsite area, VOCs were detected most frequently during the February 2016 sampling event, then declined over subsequent sampling events. In February 2016, detections exceeded screening levels in the deepest probe (22-foot depth) of SVM-12 and SVM-14. Screening levels were also exceeded in the shallow probe (7-foot depth) and middle probe (15-foot depth) of SVM-14. However, during subsequent sampling events, concentrations only exceeded screening criteria in the deepest probe of SVM-14. Elevated VOC concentrations in SVM-14 were not unexpected given its relatively close lateral proximity (11 feet) to the biosparge well and the hydrocarbon smear zone, which occurs at an average depth of approximately 27 to 31 feet bgs in the south-central area.

## 4.4 Groundwater Monitoring

Selected monitoring and remediation wells were gauged and sampled during March, June, and August 2016 as part of the pilot testing activities to evaluate the effect on free-phase and dissolved-phase hydrocarbons in the south-central area. Groundwater sampling and analysis was also performed for a broader number of wells in April and October 2016 as part of the monitoring that is conducted by DLA Energy and Kinder Morgan on a semiannual basis. Gauging data collected between March and October 2016 at select wells in the south-central area monitored as part of the pilot study are presented in Table 6. Analytical data for samples collected from the same wells during this timeframe are presented in Table 7. Laboratory analytical reports for samples collected in March, June, and August 2016 are presented in Appendix F. Analytical reports for samples collected during routine semiannual events (April and October 2016) have been previously submitted to the RWQCB in DLA Energy and Kinder Morgan's combined semiannual groundwater monitoring reports.

LNAPL thickness data and dissolved-phase analytical results collected during the pilot test are discussed in the following subsections.

### 4.4.1 LNAPL Thickness

Measured LNAPL in monitoring wells in the south-central area as of October 2016 is shown on Figure 20. Table 8 presents a summary of LNAPL thickness data collected from the fourth quarter 2015 (baseline) through October 2016. Time series charts showing groundwater elevation and product thickness data collected from 2011 to 2016 are presented in Appendix G.

LNAPL was measured in a total of 21 monitoring or remediation wells in the south-central area during the baseline gauging event. After 10 months of biosparging (October 2016), only six wells had measurable LNAPL. It should be noted that TFE or manual bailing of product occurred in some remediation wells during this timeframe. TFE was performed in wells GMW-9, GMW-10, GMW-22, GMW-25, GMW-O-20, GMW-O-23, MW-SF-2, MW-SF-11, and MW-SF-12. Manual bailing was performed in GMW-O-12, GMW-O-21, MW-SF-9, and MW-SF-13. Total volumes of LNAPL bailed from these wells were 17, 12.5, 0.05, and 12 gallons, respectively. Active remediation methods were not employed in wells GMW-23, GMW-29, GMW-30, GMW-O-11, GWR-3, MW-O-2, MW-SF-4, and MW-SF-15.

The average decrease in measured LNAPL thickness from October 2015 to October 2016 with TFE/manual bailing was 2.42 feet; the average decrease in wells without TFE/manual bailing was 1.19 feet; the average decrease in all wells was 1.95 feet. The maximum LNAPL thickness measured during the October 2016 gauging event was 1.45 feet in GMW-10 and 2.3 feet in GMW-O-12, both of which are located over 200 feet from the biosparge well, and on opposite sides. Based on the data collected, the magnitude and extent of measureable LNAPL thickness in monitoring wells in the south-central area was significantly reduced after 1 year of biosparging.

#### 4.4.2 Dissolved-Phase Hydrocarbons

Dissolved-phase TPH-g, TPH-d, benzene, MTBE, and TBA concentrations from baseline (baseline is considered to be pre-biosparge conditions between 2011 and 2015, depending on when the well was last sampled) through the pilot study period are summarized in Tables 9 through 13, and presented graphically in Appendix H. Groundwater samples were not collected from wells containing LNAPL. As shown in these tables and graphs, trends for TPH-g, TPH-d, benzene, and MTBE show decreasing concentrations from baseline through the study period for monitoring wells located within approximately 100 feet of the biosparge well (the outer extreme of the ZOI). TPH-d shows an overall decreasing trend from baseline, but a stable or slightly increasing trend in some wells (GMW-28, GMW-O-23, and GMW-1) during the study period. Diesel-range organics are relatively slow to degrade aerobically, especially in zones with historical and/or residual LNAPL. There were insufficient TBA detections during pre-biosparge conditions to show definitive trends with this constituent during the pilot test period. Average reductions from baseline through October 2016 for TPH-g, TPH-d, benzene, and MTBE (all wells sampled) were 82 percent, 70 percent, 87 percent, and 98 percent, respectively.

# Summary and Recommendations

This section presents a summary of the biosparging pilot test results and recommendations for future operations at the site:

- The horizontal biosparge well installed in the south-central area is constructed of 4-inch-diameter Schedule 80 PVC, with 600 feet of screen at 45 feet bgs and 250 feet of riser pipe. Sparging was initiated in January 2016, and continued through October 2016 (the pilot study period). The maximum flow rate was 480 scfm.
- Based on DO and SF<sub>6</sub> tracer data, the ZOI of the sparge well at the maximum flow rate of 480 scfm is approximately 50 feet on both sides of the horizontal biosparge well. Reductions in measured thickness of LNAPL in wells and dissolved hydrocarbon concentrations suggest a more expansive influence zone of up to 100 feet on both sides of the well in some areas; however, the 50 foot ZOI is supported by all data collected during the pilot study.
- During the baseline gauging event (October 2015), LNAPL was measured in 21 monitoring or remediation wells in the south-central area. After 10 months of biosparging, only six wells contained measurable LNAPL. The average reduction in LNAPL thickness in all wells was 1.95 feet. Dissolved-phase TPH-g, TPH-d, benzene, and MTBE concentrations also showed significant reductions during the test period.
- Testing data indicate minimal risk for vapor intrusion, with VOC concentrations detected in offsite soil vapor monitoring probes below the residential or commercial screening criteria in all cases, except for one sample collected from the deepest probe of SVM-15 (1.7 µg/L benzene) in February 2016. A new RTO system has been brought online, which will further enhance SVE performance.
- Based on the favorable results of the pilot study, CH2M recommends continued operation of the south-central system and expansion of biosparging to the southeastern area, which will include a second horizontal well scheduled to be installed in the third or fourth quarter of 2017. Dual-nested soil vapor monitoring probes were recently installed in the southeastern area to facilitate shallow soil closure in the eastern 15-acre parcel. These probes will be utilized for monitoring soil vapors during future pilot testing and long-term operation of the southeastern biosparge system. Prior to construction, a biosparge system expansion work plan will be prepared and submitted to the RWQCB.
- An additional laser-induced fluorescence study, with pore fluid saturation sampling and analysis, is recommended for the south-central area after 2 to 3 years of biosparging to further characterize changes in LNAPL saturation and composition.
- CH2M also recommends continuing soil vapor monitoring of onsite and offsite probes in the south-central area on a quarterly basis; groundwater monitoring should continue to be performed on a semiannual basis in accordance with the current groundwater MRP.

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Tables

**Table 1. Maximum Water Level Rise Observed in Select Monitoring Wells at 120 scfm**

*SFPP Norwalk Pump Station, Norwalk, California*

Well	Date	Static Depth to Water (feet btoc)	Date	Biosparge System Flow (scfm)	Minimum Depth to Water (feet btoc)	Maximum Rise in Water Level (feet)	Lateral Distance from Biosparge Well Screen (feet)	Comments
GMW-1	1/7/16 11:25	33.10	1/8/16 3:12 PM	120	26.25	6.9	93	
GMW-26	1/7/16 12:30	32.95	1/8/16 4:32 PM	120	29.30	3.7	103	
GMW-28	1/7/16 12:30	32.98	1/8/16 6:54 PM	120	27.48	5.5	33	Overall maximum water level rise of 5.76 feet observed at 480 scfm
GMW-O-10	1/7/16 12:30	32.53	1/8/16 4:16 PM	120	30.06	2.5	94	
MW-18 (MID)	1/7/16 11:10	38.18	1/8/16 3:14 PM	120	32.71	5.5	84	
MW-SF-3	1/7/16 12:30	37.45	1/9/16 7:56 AM	120	24.35	13.1	10	
MW-SF-5	1/7/16 12:30	37.62	1/8/16 4:06 PM	120	29.89	7.7	25	
MW-SF-6	1/7/16 12:30	35.08	1/8/16 1:41 PM	120	27.97	7.1	42	
PZ-10	1/7/16 11:13	32.70	1/8/16 3:10 PM	120	25.40	7.3	49	Overall maximum water level rise of 9.92 feet observed at 420 scfm

Notes:

btoc - below top of casing

scfm - standard cubic feet per minute

**Table 2. SF<sub>6</sub> Tracer Test Water Quality Results**  
*SFPP Norwalk Pump Station, Norwalk, California*

Well	Date	DO (mg/L)	pH (s.u.)	ORP (mV)	SF <sub>6</sub> (µg/L)
GMW-1	2/17/2016	0.91	7.41	127.5	0.4723
GMW-9	2/18/2016	7.48	8	23.4	0.0089
GMW-23	2/18/2016	1.99	7.66	3.7	2.6881
GMW-26	2/17/2016	0.54	6.54	-59.4	<0.0007
GMW-28	2/17/2016	0.62	6.36	-54	0.1058
GMW-29	2/17/2016	1.97	6.76	130.2	<0.0007
GMW-30	2/18/2016	0.18	7.16	-88.5	1.3116
GMW-O-3	2/17/2016	1.19	6.85	-81.7	<0.0007
GMW-O-9	2/17/2016	1.15	6.77	156.7	<0.0007
GMW-O-10	2/18/2016	0.59	7.22	-111.3	<0.0007
GMW-O-14	2/18/2016	0.36	7.17	-136.5	<0.0008
HL-3	2/17/2016	0.79	6.72	101.1	<0.0007
MW-18 (MID)	2/17/2016	0.86	7.54	122.2	0.0478
MW-SF-13	2/18/2016	7.84	8.22	49	0.0044
MW-SF-14	2/18/2016	6.36	8.05	81.6	0.0038
MW-SF-16	2/18/2016	6.96	7.83	74.4	0.0007
PZ-2	2/17/2016	2.33	7.19	-14	2.9962
PZ-2 (FD)	2/17/2016	2.33	7.19	-14	3.1096
PZ-10	2/18/2016	7.34	8.13	59.1	0.0109

Notes:

<0.0007 = less than laboratory minimum reporting limit

µg/L = micrograms per liter

DO = dissolved oxygen

mg/L = milligrams per liter

mV = millivolt(s)

ORP = oxidation-reduction potential

s.u. = standard units

SF<sub>6</sub> = sulfur hexafluoride

**Table 3. Extracted Vapor Analytical Results for Select VOCs**

SFPP Norwalk Pump Station, Norwalk, California

Date Sampled	Location	EPA TO-3	SCAQMD 25.1	EPA TO-15				
		TVOCs (ppmv)	TGNMOC (ppmv)	Benzene (ppbv)	Ethylbenzene (ppbv)	Toluene (ppbv)	Xylenes (ppbv)	MTBE (ppbv)
7/14/2015	Pre-dilution	---	650	7,000	950	7,900	6,100	<200
8/4/2015	Pre-dilution	---	560	6,200	710	7,700	4,800	<0.097
8/17/2015	Post-dilution	---	480	5,200	580	6,300	4,100	<0.099
9/1/2015	Post-dilution	---	930	12,000	1,500	14,000	11,400	<0.140
10/6/2015	Post-dilution	---	960	14,000	3,100	25,000	15,900	<200
11/10/2015	Post-dilution	860	---	9,100	1,800	15,000	9,400	<97
12/10/2015	Post-dilution	580	---	6,400	1,200	10,000	7,600	<120
1/4/2016	Post-dilution	750	---	9,600	2,400	20,000	13,500	<220
2/4/2016	Post-dilution	2,000	---	16,000	2,600	29,000	19,300	<610
3/3/2016	Post-dilution	1,200	---	11,000	3,000	27,000	27,500	<130
4/5/2016	Post-dilution	760	---	6,600	1,300	14,000	11,800	<95
5/13/2016	Post-dilution	500	---	4,100	850	9,400	6,900	<55
6/7/2016	Post-dilution	480	---	3,600	520	7,300	3,800	<79
7/7/2016	Post-dilution	210	---	1,100	73	1,500	460	<40
8/2/2016	Post-dilution	270	---	2,700	1,400	7,600	13,600	<40
9/7/2016	Post-dilution	360	---	2,400	970	6,000	9,800	<40
10/13/2016	Post-dilution	320	---	2,600	720	5,500	8,800	<38

## Notes:

--- = data not available

&lt;38 = not detected at or above the laboratory reporting limit shown

ASTM = ASTM International

EPA = U.S. Environmental Protection Agency

MTBE = methyl tertiary butyl ether

ppbv = parts per billion by volume

ppmv = parts per million by volume

SCAQMD = South Coast Air Quality Management District

TGNMOC = total gaseous non-methane organic carbon

TVOC = total volatile organic compound

Table 4. Soil Vapor Probe Field PID and Vacuum Readings

SFPF Norwalk Pump Station, Norwalk, California

			Date	9/23/2015	1/9/16	1/15/16	1/22/16	1/27/16 to 1/29/16	2/5/16	2/12/16	2/19/16	2/24/16 to 2/26/16	4/27/16 to 4/29/16	6/17/2016	6/22/16 to 6/24/16	7/29/2016	8/29/16 to 8/31/16															
			SVE System	Off	On	On	On	On	On	On	On	On	On	On	On	On	On															
			BS System	Off	On	On	On	On	On	On	On	On	On	On	On	On	On															
			BS Flow Rate (scfm)	0	120	180	240	360	500	500	500	500	240	420	420	460	110-360															
Probe	Location	Zone	Screen Interval (feet bgs)		PID (ppmv)	PID (ppmv)	Vacuum (in. H <sub>2</sub> O)	PID (ppmv)	Vacuum (in. H <sub>2</sub> O)	PID (ppmv)	Vacuum (in. H <sub>2</sub> O)	PID (ppmv)	Vacuum (in. H <sub>2</sub> O)	PID (ppmv)	Vacuum (in. H <sub>2</sub> O)	PID (ppmv)	Vacuum (in. H <sub>2</sub> O)	PID (ppmv)	Vacuum (in. H <sub>2</sub> O)	PID (ppmv)	Vacuum (in. H <sub>2</sub> O)	PID (ppmv)	Vacuum (in. H <sub>2</sub> O)	PID (ppmv)	Vacuum (in. H <sub>2</sub> O)	PID (ppmv)	Vacuum (in. H <sub>2</sub> O)	PID (ppmv)	Vacuum (in. H <sub>2</sub> O)			
			From	To																												
SVM-1	Offsite	Shallow	5	5.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.5	0.4	0	0	0	0	0	0	0	0	-0.5
SVM-1	Offsite	Deep	14.5	15	0	0	-2.7	0	-1.9	0	-2.2	0	-2	0	-2.3	0	-1.7	0	-1.9	0	-2.2	0	-1.8	0	-1.6	0	-1.7	0	-1.9	0	-1.8	
SVM-2	Offsite	Shallow	5	5.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.5
SVM-3	Offsite	Shallow	5	5.5	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0
SVM-3	Offsite	Deep	15	15.5	4.3	0	0	0	0	0	0	1.4	0	0	-0.5	0	-0.5	0	-0.7	0	0	0	0	0.2	-0.8	1.1	-0.7	0	-0.7	0	-0.7	
SVM-5	Offsite	Shallow	5	5.5	0.2	0.2	-0.5	0	0	0	-0.8	0	0	0	0	0	0	-0.6	0	-0.8	0	0	0	-0.6	0	0	0	0	0	0	-0.7	
SVM-5	Offsite	Deep	15.5	16	0.2	0.1	-5.8	0	-5.8	0	-6.4	0	-5.2	0	0	0	-4.4	0	-5	0	-7.3	0	-3.7	0	-4.9	0	-4.6	0	-4.2	0	-4.4	
SVM-6	Offsite	Shallow	6.5	7	0	0	0	0	0	0	0	1.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	-0.5	
SVM-6	Offsite	Deep	15.5	16	0	0	-3.2	0	-2.6	0	-3.1	0	-1.9	0	-0.8	520	0	153	-0.8	47	0	0	-2.5	0	0	1	-2.7	0	-1.8	0	-4	
SVM-7	Offsite	Shallow	7	7.5	0	0	0	0	0	0	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	-0.5	0	0	0	0	0	0	
SVM-7	Offsite	Deep	13.25	13.75	0	0	0.6	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	-0.5	0	-0.5	0	-0.5	0	0	0	-0.8	
SVM-8	Offsite	Shallow	5	5.5	0	0	0	0	0	0	-0.5	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.5	
SVM-8	Offsite	Deep	15	15.5	0.5	0.5	-1.9	0	-2	0	-2.2	4.4	-1.8	0	-1.7	0	-1.4	0	-1.7	0	-1.2	0	-1.1	0	-1.8	0	-1.6	0	-1.1	0	-1.7	
SVM-9	Offsite	Shallow	5	5.5	1.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0
SVM-9	Offsite	Deep	14.5	15	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0
SVM-10	Offsite	Deep	15.5	16	0.5	0	0.5	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SVM-11	Onsite	Shallow	7	7.5	0	0.5	0	0	0	0	0	5.1	0	0	0	97	0	348	0	3.6	0	0	0	--	--	--	--	2.2	0	0	0	0
SVM-11	Onsite	Middle	15	15.5	0	0.5	0	0	-0.5	0	0	6	0	0	0	305	0	378	0	13.2	0	0	0	--	--	--	--	57.4	0	0	0	-0.5
SVM-11	Onsite	Deep	21	21.5	0	0.2	0	0	0	0	0	--	--	--	--	128	0	>2000	0	0	0	0	0	--	--	--	--	>15000	0	27.4	0	-0.6
SVM-12	Onsite	Shallow	7	7.5	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SVM-12	Onsite	Middle	15	15.5	0	0.3	0	0.1	0	0	0	0	0	0	0	0	0	9.2	0	16.3	0	0	0	0	0	0	0	0	0	0	0	0
SVM-12	Onsite	Deep	22	22.5	0	0.8	0	0.1	0	0	0	0	0	0	0	0	0.5	1266	0	2770	0	0	0	0	0	0	0	0	0	0	0	0
SVM-13	Onsite	Shallow	7	7.5	2.3	1.4	-0.9	0	-1.2	0	0	0	0	0	0	0	-4.1	>2000	-5.8	0	-5.1	0	-2.1	0	-2.4	0	-2	0	-1.8	0	-1.5	
SVM-13	Onsite	Middle	15.5	16	0.8	1.2	-5	0	-6.2	0	-5.5	0	-3.4	0	-2.9	0	-18.1	>2000	-19.7	0	-17.2	0	-14.2	2.3	-14.7	2	-14.7	0	-13.9	0	-12.8	
SVM-13	Onsite	Deep	22.5	23	0	>15000	-6.1	1500	-8.8	100.3	-8.9	>2000	-3.5	353	-2.6	1111	-16	554	-17.4	145	-16.1	0	-18.6	0.6	-19.7	2	-19.2	0	-17.5	0	-16.1	
SVM-14	Onsite	Shallow	7	7.5	0	>15000	0	160	0	1491	0	>2000	34.4	710	0	>2000	0.7	>2000	0	13000	0	0	0	1.2	0	3.8	0	0	0	0	0	
SVM-14	Onsite	Middle	15	15.5	0	>15000	0.5	341.2	-0.6	3772	0	945	6	1471	0.9	>2000	1.4	>2000	0.8	>15000	1	2.6	1	0.8	0	3.1	0	0	0.5	0	1	
SVM-14	Onsite	Deep	22	22.5	>2999	4195	6.6	>15000	1	>15000	7.5	>2000	0	>2000	45.7	>2000	55.5	>2000	53.2	>15000	52.4	>15000	25.2	>2000	20.6	2427	26.2	>15000	45.9	>15000	41.6	
SVM-15	Offsite	Shallow	7	7.5	0	0	0	0	0	0	0	2.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.5	
SVM-15	Offsite	Middle	15	15.5	0	0	0	0	0	0	0	1.1	0	0	0	0	0	0	0	0	0	0	0	-0.5	0	0	0	0	0	0	-0.5	
SVM-15	Offsite	Deep	22	22.5	0	0	-8.2	0	-8.9	0	-9.1	8.5	-3.8	82.3	-2.6	0	-2.7	20.48	-2.9	524	-2.9	0	-8.5	0	-7.5	0	-7.3	0	-3.5	0	-5.4	
SVM-16	Offsite	Shallow	7	7.5	2.2	0	0	0	0	0	0	3.3	0	0	0	0	0	0	0	0	0	0	0	0	2.4	0	0	0	0	0	0	
SVM-16	Offsite	Middle	15.5	16	0.2	0.2	-1.1	0	-1.2	0	-1	0	-1.1	0	-1	0	-0.6	0	-1	0	0	0	-0.6	0	-1.3	1.5	-1.1	0	-0.9	0	-1.2	
SVM-16	Offsite	Deep	22	22.5	1300	1.1	-1.8	8	0	7.6	-1.6	0	-1.7	0	-1.7	0	-1.2	0	1.6	2.3	-0.7	5.8	-1.1	0.2	-1.8	2.2	-1.5	4.2	-1.5	0	-1.6	

Notes:  
 Field PID readings collected using MiniRae 3000 or MultiRae IR 4-gas meter, calibrated to 50 ppm hexane  
 -- data not available  
 bgs = below ground surface  
 BS = Biosparge  
 in. H<sub>2</sub>O = inches of water  
 PID = photoionization detector  
 ppmv = parts per million by volume  
 scfm = standard cubic feet per minute  
 SVE = soil vapor extraction  
 VOC = volatile organic compound

**Table 5. Soil Vapor Probe VOCs Detection and Screening Level Exceedance Summary**  
 SFPP Norwalk Pump Station, Norwalk, California

Offsite Probes	Screen Interval (feet bgs)		Lateral Distance to Biosparge Well Screen (feet)	January 27 to 29, 2016			February 24 to 26, 2016			April 27 to 29, 2016			May 25 to 27, 2016			June 22 to 24, 2016			August 29 to 31, 2016			
	From	To		VOCs <sup>a</sup>	Exceeds SL <sup>b</sup>	VOCs Exceeding SL	VOCs <sup>a</sup>	Exceeds SL <sup>b</sup>	VOCs Exceeding SL	VOCs <sup>a</sup>	Exceeds SL <sup>b</sup>	VOCs Exceeding SL	VOCs <sup>a</sup>	Exceeds SL <sup>b</sup>	VOCs Exceeding SL	VOCs <sup>a</sup>	Exceeds SL <sup>b</sup>	VOCs Exceeding SL	VOCs <sup>a</sup>	Exceeds SL <sup>b</sup>	VOCs Exceeding SL	
SVM-1	Shallow	5	5.5	157	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-1	Deep	14.5	15	157	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-2	Shallow	5	5.5	252	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-3	Shallow	5	5.5	190	0	---	0	---	0	---	0	---	✓	0	---	✓	0	---	✓	0	---	---
SVM-3	Deep	15	15.5	190	✓	0	---	0	---	0	---	✓	0	---	✓	0	---	✓	0	---	---	---
SVM-5	Shallow	5	5.5	98	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-5	Deep	15.5	16	98	✓	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	---
SVM-6	Shallow	6.5	7	139	0	---	✓	0	---	0	---	0	---	0	---	0	---	0	---	0	---	---
SVM-6	Deep	15.5	16	139	0	---	✓	0	---	0	---	0	---	0	---	0	---	0	---	0	---	---
SVM-7	Shallow	7	7.5	209	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	✓	0
SVM-7	Deep	13.25	13.75	209	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-8	Shallow	5	5.5	202	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-8	Deep	15	15.5	202	✓	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	---
SVM-10	Deep	15.5	16	343	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-15	Shallow	7	7.5	71	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-15	Middle	15	15.5	71	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-15	Deep	22	22.5	71	0	---	✓	✓	benzene	0	---	0	---	0	---	0	---	0	---	0	---	---
SVM-16	Shallow	7	7.5	279	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-16	Middle	15.5	16	279	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-16	Deep	22	22.5	279	✓	0	---	0	---	✓	0	---	✓	0	---	✓	0	---	✓	0	---	---
<b>Onsite Probes</b>																						
SVM-11	Shallow	7	7.5	129	0	---	✓	0	---	0	---	0	---	0	---	NS	---	NS	---	0	---	---
SVM-11	Middle	15	15.5	129	0	---	✓	0	---	0	---	0	---	0	---	NS	---	NS	---	0	---	---
SVM-11	Deep	21	21.5	129	0	---	0	---	0	---	0	---	0	---	NS	---	NS	---	✓	0	---	---
SVM-12	Shallow	7	7.5	31	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-12	Middle	15	15.5	31	0	---	✓	0	---	0	---	0	---	0	---	0	---	0	---	0	---	---
SVM-12	Deep	22	22.5	31	0	---	✓	✓	TPH-g, benzene	✓	0	---	0	---	0	---	0	---	0	---	0	---
SVM-13	Shallow	7	7.5	19	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-13	Middle	15.5	16	19	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-13	Deep	22.5	23	19	✓	✓	TPH-g, benzene, ethylbenzene	✓	0	---	0	---	0	---	0	---	0	---	0	---	0	---
SVM-14	Shallow	7	7.5	11	✓	✓	TPH-g	✓	✓	TPH-g	0	---	0	---	0	---	0	---	0	---	0	---
SVM-14	Middle	15	15.5	11	✓	0	---	✓	✓	TPH-g, toluene, xylenes	✓	0	---	✓	0	---	✓	0	---	✓	0	---
SVM-14	Deep	22	22.5	11	✓	✓	TPH-g, benzene, toluene, xylenes, n-hexane	✓	✓	TPH-g, 1,2,4-TMB, ethylbenzene, toluene, xylenes	✓	✓	TPH-g, 1,2,4-TMB, ethylbenzene, xylenes	✓	✓	TPH-g, 1,2,4-TMB	✓	✓	TPH-g, 1,2,4-TMB	✓	✓	1,2,4-TMB

Notes:

<sup>a</sup> VOCs

- ✓ = one or more VOCs were positively detected
- 0 = VOCs were not detected

<sup>b</sup> Exceeds SL

- ✓ = one or more VOCs were detected above the residential and/or commercial screening level
- 0 = one or more VOCs were positively detected

--- = not available or applicable

1,2,4-TMB = 1,2,4-trimethylbenzene

feet bgs = feet below ground surface

NS = not sampled

SL = residential or commercial screening level

TPH-g = total petroleum hydrocarbons, quantified as gasoline

VOC = volatile organic compound

**Table 6. Gauging Data for Select Wells in the South-Central Area - March 2016 to October 2016***SFPP Norwalk Pump Station, Norwalk, California*

<b>Well</b>	<b>Date</b>	<b>Top of Casing Elevation (feet amsl)</b>	<b>Depth to Product (feet btoc)</b>	<b>Depth to Water (feet btoc)</b>	<b>Apparent Product Thickness (feet)</b>	<b>Groundwater Elevation (feet amsl)</b>
GMW-1	03/14/16	74.77	---	36.16	---	38.61
GMW-1	04/11/16	74.77	---	34.00	---	40.77
GMW-1	06/29/16	74.77	---	35.12	---	39.65
GMW-1	08/22/16	74.77	---	35.06	---	39.71
GMW-1	10/03/16	74.77	---	35.80	---	38.97
GMW-9	03/14/16	77.16	---	36.10	---	41.06
GMW-9	04/11/16	77.16	---	36.20	---	40.96
GMW-9	06/30/16	77.16	---	31.02	---	46.14
GMW-9	08/22/16	77.16	---	37.27	---	39.89
GMW-9	10/03/16	77.16	---	38.02	---	39.14
GMW-10	03/16/16	73.35	33.42	34.47	1.05	39.74
GMW-10	04/11/16	73.35	32.10	33.70	1.60	40.95
GMW-10	06/29/16	73.35	---	33.02	---	40.33
GMW-10	08/22/16	73.35	32.93	33.82	0.89	40.26
GMW-10	10/03/16	73.35	33.65	35.10	1.45	39.43
GMW-22	03/16/16	77.24	37.61	39.73	2.12	39.24
GMW-22	04/11/16	77.24	35.50	38.59	3.09	41.17
GMW-22	06/30/16	77.24	---	36.55	---	40.69
GMW-22	08/22/16	77.24	---	NM	---	NC
GMW-22	10/03/16	77.24	---	37.70	---	39.54
GMW-23	03/14/16	74.85	---	36.35	---	38.50
GMW-23	04/11/16	74.85	34.10	34.12	0.02	40.75
GMW-23	06/29/16	74.85	---	35.25	---	39.60
GMW-23	08/22/16	74.85	---	35.58	---	39.27
GMW-23	10/03/16	74.85	---	36.15	---	38.70
GMW-24	03/16/16	77.48	---	38.83	---	38.65
GMW-24	04/11/16	77.48	---	37.10	---	40.38
GMW-24	06/29/16	77.48	---	38.20	---	39.28
GMW-24	08/22/16	77.48	---	38.40	---	39.08
GMW-24	10/03/16	77.48	---	39.31	---	38.17
GMW-25	03/16/16	78.14	---	38.99	---	39.15
GMW-25	04/12/16	78.14	---	37.15	---	40.99
GMW-25	06/29/16	78.14	---	38.40	---	39.74
GMW-25	08/22/16	78.14	---	38.44	---	39.70
GMW-25	10/03/16	78.14	---	38.70	---	39.44
GMW-26	03/14/16	74.52	---	34.56	---	39.96
GMW-26	04/11/16	74.52	---	35.55	---	38.97
GMW-26	06/29/16	74.52	---	34.45	---	40.07
GMW-26	08/22/16	74.52	---	34.58	---	39.94
GMW-26	10/03/16	74.52	---	35.12	---	39.40
GMW-28	03/14/16	74.68	---	35.66	---	39.02
GMW-28	04/11/16	74.68	---	34.10	---	40.58
GMW-28	06/29/16	74.68	---	34.95	---	39.73
GMW-28	08/22/16	74.68	---	35.33	---	39.35
GMW-28	10/03/16	74.68	---	35.81	---	38.87
GMW-29	03/14/16	77.57	---	36.15	---	41.42
GMW-29	04/11/16	77.57	33.55	34.95	1.40	43.74
GMW-29	06/29/16	77.57	34.50	37.82	3.32	42.41
GMW-29	08/22/16	77.57	35.16	35.67	0.51	42.31
GMW-29	10/03/16	77.57	35.75	36.00	0.25	41.77
GMW-30	03/14/16	74.91	---	36.22	---	38.69

**Table 6. Gauging Data for Select Wells in the South-Central Area - March 2016 to October 2016***SFPP Norwalk Pump Station, Norwalk, California*

Well	Date	Top of Casing Elevation (feet amsl)	Depth to Product (feet btoc)	Depth to Water (feet btoc)	Apparent Product Thickness (feet)	Groundwater Elevation (feet amsl)
GMW-30	04/11/16	74.91	---	34.01	---	40.90
GMW-30	06/29/16	74.91	---	35.28	---	39.63
GMW-30	08/22/16	74.91	---	35.40	---	39.51
GMW-30	10/03/16	74.91	---	36.30	---	38.61
GMW-O-2	03/14/16	72.54	---	30.44	---	42.10
GMW-O-2	04/11/16	72.54	---	30.20	---	42.34
GMW-O-2	06/29/16	72.54	---	30.77	---	41.77
GMW-O-2	08/22/16	72.54	---	30.79	---	41.75
GMW-O-2	10/03/16	72.54	---	31.30	---	41.24
GMW-O-3	03/14/16	72.19	---	30.60	---	41.59
GMW-O-3	04/11/16	72.19	---	30.51	---	41.68
GMW-O-3	06/29/16	72.19	---	31.10	---	41.09
GMW-O-3	08/22/16	72.19	---	31.02	---	41.17
GMW-O-3	10/03/16	72.19	---	31.45	---	40.74
GMW-O-4	03/14/16	71.95	---	30.55	---	41.40
GMW-O-4	04/11/16	71.95	---	29.80	---	42.15
GMW-O-4	06/29/16	71.95	---	30.30	---	41.65
GMW-O-4	08/22/16	71.95	---	30.34	---	41.61
GMW-O-4	10/03/16	71.95	---	30.90	---	41.05
GMW-O-4 (MID)	08/22/16	72.24	---	37.57	---	34.67
GMW-O-5	03/14/16	72.36	---	30.98	---	41.38
GMW-O-5	04/11/16	72.36	---	30.30	---	42.06
GMW-O-5	06/29/16	72.36	---	30.13	---	42.23
GMW-O-5	08/22/16	72.36	---	31.01	---	41.35
GMW-O-5	10/03/16	72.36	---	31.43	---	40.93
GMW-O-9	03/14/16	73.50	---	31.88	---	41.62
GMW-O-9	04/11/16	73.50	---	31.62	---	41.88
GMW-O-9	06/29/16	73.50	---	31.41	---	42.09
GMW-O-9	08/22/16	73.50	---	32.66	---	40.84
GMW-O-9	10/03/16	73.50	---	33.03	---	40.47
GMW-O-1	03/14/16	71.45	---	30.66	---	40.79
GMW-O-1	04/11/16	71.45	---	29.71	---	41.74
GMW-O-1	06/29/16	71.45	---	30.50	---	40.95
GMW-O-1	08/22/16	71.45	---	30.61	---	40.84
GMW-O-1	10/03/16	71.45	---	31.20	---	40.25
GMW-O-10	03/14/16	73.98	---	32.65	---	41.33
GMW-O-10	04/11/16	73.98	---	32.23	---	41.75
GMW-O-10	06/29/16	73.98	---	32.20	---	41.78
GMW-O-10	08/22/16	73.98	---	34.18	---	39.80
GMW-O-10	10/03/16	73.98	---	33.13	---	40.85
GMW-O-11	03/16/16	74.17	33.16	33.39	0.23	40.96
GMW-O-11	04/12/16	74.17	33.12	33.33	0.21	41.01
GMW-O-11	06/30/16	74.17	---	31.50	---	42.67
GMW-O-11	08/22/16	74.17	32.74	32.75	0.01	41.43
GMW-O-11	10/06/16	74.17	32.71	32.72	0.01	41.46
GMW-O-12	03/14/16	73.49	31.60	32.40	0.80	41.73
GMW-O-12	04/11/16	73.49	26.86	33.35	6.49	45.30
GMW-O-12	06/29/16	73.49	33.10	33.90	0.80	40.23
GMW-O-12	08/22/16	73.49	31.07	33.56	2.49	41.91
GMW-O-12	10/03/16	73.49	31.90	34.20	2.30	41.12
GMW-O-14	03/14/16	74.08	---	32.62	---	41.46



**Table 6. Gauging Data for Select Wells in the South-Central Area - March 2016 to October 2016***SFPP Norwalk Pump Station, Norwalk, California*

Well	Date	Top of Casing Elevation (feet amsl)	Depth to Product (feet btoc)	Depth to Water (feet btoc)	Apparent Product Thickness (feet)	Groundwater Elevation (feet amsl)
GMW-O-14	04/11/16	74.08	---	32.34	---	41.74
GMW-O-14	06/29/16	74.08	---	32.08	---	42.00
GMW-O-14	08/22/16	74.08	---	33.44	---	40.64
GMW-O-14	10/03/16	74.08	---	34.08	---	40.00
GMW-O-20	03/16/16	73.32	---	32.54	---	40.78
GMW-O-20	04/12/16	73.32	---	32.48	---	40.84
GMW-O-20	06/29/16	73.32	---	32.50	---	40.82
GMW-O-20	08/22/16	73.32	---	32.18	---	41.14
GMW-O-20	10/03/16	73.32	---	33.12	---	40.20
GMW-O-21	03/14/16	71.43	33.17	33.20	0.03	38.25
GMW-O-21	04/11/16	71.43	31.84	32.17	0.33	39.52
GMW-O-21	06/29/16	71.43	32.83	33.03	0.20	38.56
GMW-O-21	08/22/16	71.43	---	33.72	---	37.71
GMW-O-21	10/03/16	71.43	---	33.45	---	37.98
GMW-O-23	03/16/16	73.63	---	34.43	---	39.20
GMW-O-23	04/12/16	73.63	---	32.59	---	41.04
GMW-O-23	06/29/16	73.63	---	33.90	---	39.73
GMW-O-23	08/22/16	73.63	---	33.89	---	39.74
GMW-O-23	10/03/16	73.63	---	34.90	---	38.73
GWR-3	03/16/16	77.60	---	38.60	---	39.00
GWR-3	04/11/16	77.60	---	36.90	---	40.70
GWR-3	06/29/16	77.60	---	37.77	---	39.83
GWR-3	08/22/16	77.60	---	38.24	---	39.36
GWR-3	10/03/16	77.60	39.15	39.20	0.05	38.44
HL-3	03/14/16	76.86	---	36.84	---	40.02
HL-3	04/11/16	76.86	---	36.03	---	40.83
HL-3	06/29/16	76.86	---	36.60	---	40.26
HL-3	08/22/16	76.86	---	36.53	---	40.33
HL-3	10/03/16	76.86	---	37.22	---	39.64
MW-18 (MID)	03/14/16	75.67	---	40.70	---	34.97
MW-18 (MID)	04/11/16	75.67	---	38.89	---	36.78
MW-18 (MID)	06/29/16	75.67	---	39.94	---	35.73
MW-18 (MID)	08/22/16	75.67	---	40.14	---	35.53
MW-18 (MID)	10/03/16	75.67	---	40.93	---	34.74
MW-19 (MID)	04/11/16	78.14	---	32.97	---	45.17
MW-19 (MID)	10/03/16	78.14	---	40.60	---	37.54
MW-O-1	03/14/16	75.48	---	DRY	---	NC
MW-O-1	04/11/16	75.48	---	DRY	---	NC
MW-O-1	06/29/16	75.48	---	DRY	---	NC
MW-O-1	08/22/16	75.48	---	DRY	---	NC
MW-O-1	10/03/16	75.48	---	DRY	---	NC
MW-O-2	03/14/16	71.90	34.86	35.49	0.63	36.91
MW-O-2	04/11/16	71.90	32.54	33.03	0.49	39.26
MW-O-2	06/30/16	71.90	33.80	34.20	0.40	38.02
MW-O-2	08/22/16	71.90	---	33.93	---	37.97
MW-O-2	10/03/16	71.90	34.22	34.30	0.08	37.66
MW-SF-1	03/14/16	78.93	---	40.40	---	38.53
MW-SF-1	04/11/16	78.93	---	37.96	---	40.97
MW-SF-1	06/29/16	78.93	---	39.05	---	39.88
MW-SF-1	08/22/16	78.93	---	39.04	---	39.89
MW-SF-1	10/03/16	78.93	---	39.20	---	39.73

**Table 6. Gauging Data for Select Wells in the South-Central Area - March 2016 to October 2016**  
*SFPP Norwalk Pump Station, Norwalk, California*

Well	Date	Top of Casing Elevation (feet amsl)	Depth to Product (feet btoc)	Depth to Water (feet btoc)	Apparent Product Thickness (feet)	Groundwater Elevation (feet amsl)
MW-SF-2	03/16/16	78.53	---	39.27	---	39.26
MW-SF-2	04/11/16	78.53	---	37.47	---	41.06
MW-SF-2	06/29/16	78.53	---	38.08	---	40.45
MW-SF-2	08/22/16	78.53	---	38.83	---	39.70
MW-SF-2	10/03/16	78.53	---	39.60	---	38.93
MW-SF-3	03/14/16	78.12	39.40	39.43	0.03	38.71
MW-SF-3	04/11/16	78.12	---	37.17	---	40.95
MW-SF-3	06/30/16	78.12	---	38.28	---	39.84
MW-SF-3	08/23/16	78.12	---	38.33	---	39.79
MW-SF-3	10/03/16	78.12	---	39.40	---	38.72
MW-SF-4	03/14/16	79.38	---	40.80	---	38.58
MW-SF-4	04/11/16	79.38	---	37.76	---	41.62
MW-SF-4	06/29/16	79.38	---	39.54	---	39.84
MW-SF-4	08/22/16	79.38	---	39.76	---	39.62
MW-SF-4	10/03/16	79.38	---	41.05	---	38.33
MW-SF-5	03/14/16	79.74	---	DRY	---	NC
MW-SF-5	04/11/16	79.74	---	DRY	---	NC
MW-SF-5	06/29/16	79.74	---	DRY	---	NC
MW-SF-5	08/22/16	79.74	---	DRY	---	NC
MW-SF-5	10/03/16	79.74	---	DRY	---	NC
MW-SF-6	03/14/16	76.80	38.08	38.10	0.02	38.72
MW-SF-6	04/11/16	76.80	---	35.83	---	40.97
MW-SF-6	06/29/16	76.80	---	36.89	---	39.91
MW-SF-6	08/22/16	76.80	---	37.11	---	39.69
MW-SF-6	10/03/16	76.80	---	38.45	---	38.35
MW-SF-9	03/14/16	74.10	---	34.14	---	39.96
MW-SF-9	04/11/16	74.10	---	32.89	---	41.21
MW-SF-9	06/29/16	74.10	---	34.00	---	40.10
MW-SF-9	08/22/16	74.10	---	NM	---	NC
MW-SF-10	03/14/16	76.53	---	DRY	---	NC
MW-SF-10	04/11/16	76.53	---	DRY	---	NC
MW-SF-10	06/29/16	76.53	---	DRY	---	NC
MW-SF-10	08/22/16	76.53	---	DRY	---	NC
MW-SF-10	10/03/16	76.53	---	DRY	---	NC
MW-SF-11	03/16/16	78.56	---	39.56	---	39.00
MW-SF-11	04/11/16	78.56	---	37.62	---	40.94
MW-SF-11	06/29/16	78.56	---	37.06	---	41.50
MW-SF-11	08/22/16	78.56	---	39.25	---	39.31
MW-SF-11	10/03/16	78.56	---	40.05	---	38.51
MW-SF-12	03/16/16	78.07	---	39.03	---	39.04
MW-SF-12	04/11/16	78.07	---	37.13	---	40.94
MW-SF-12	06/29/16	78.07	38.28	38.34	0.06	39.78
MW-SF-12	08/22/16	78.07	---	38.60	---	39.47
MW-SF-12	10/03/16	78.07	---	39.45	---	38.62
MW-SF-13	03/14/16	73.40	---	34.72	---	38.68
MW-SF-13	04/11/16	73.40	---	32.28	---	41.12
MW-SF-13	06/29/16	73.40	---	33.62	---	39.78
MW-SF-13	08/22/16	73.40	---	33.66	---	39.74
MW-SF-13	10/03/16	73.40	---	34.20	---	39.20
MW-SF-14	03/14/16	78.16	---	36.21	---	41.95
MW-SF-14	04/11/16	78.16	---	37.14	---	41.02

**Table 6. Gauging Data for Select Wells in the South-Central Area - March 2016 to October 2016***SFPP Norwalk Pump Station, Norwalk, California*

<b>Well</b>	<b>Date</b>	<b>Top of Casing Elevation (feet amsl)</b>	<b>Depth to Product (feet btoc)</b>	<b>Depth to Water (feet btoc)</b>	<b>Apparent Product Thickness (feet)</b>	<b>Groundwater Elevation (feet amsl)</b>
MW-SF-14	06/29/16	78.16	---	37.36	---	40.80
MW-SF-14	08/22/16	78.16	---	DRY	---	NC
MW-SF-14	10/03/16	78.16	---	DRY	---	NC
MW-SF-15	03/14/16	78.27	---	39.70	---	38.57
MW-SF-15	04/11/16	78.27	---	37.24	---	41.03
MW-SF-15	06/29/16	78.27	---	38.70	---	39.57
MW-SF-15	08/22/16	78.27	---	38.78	---	39.49
MW-SF-15	10/03/16	78.27	---	39.56	---	38.71
MW-SF-16	03/14/16	78.21	---	39.60	---	38.61
MW-SF-16	04/11/16	78.21	---	37.15	---	41.06
MW-SF-16	06/29/16	78.21	---	38.35	---	39.86
MW-SF-16	08/22/16	78.21	---	38.51	---	39.70
MW-SF-16	10/03/16	78.21	---	39.35	---	38.86
PZ-2	03/14/16	73.96	---	34.72	---	39.24
PZ-2	04/11/16	73.96	---	32.97	---	40.99
PZ-2	06/29/16	73.96	---	34.04	---	39.92
PZ-2	08/22/16	73.96	---	33.95	---	40.01
PZ-2	10/03/16	73.96	---	34.67	---	39.29
PZ-3	04/11/16	76.17	---	34.07	---	42.10
PZ-10	03/14/16	74.34	---	DRY	---	NC
PZ-10	04/11/16	74.34	---	33.37	---	40.97
PZ-10	06/29/16	74.34	---	DRY	---	NC
PZ-10	08/22/16	74.34	---	DRY	---	NC
PZ-10	10/03/16	74.34	---	DRY	---	NC

**Notes:**

--- = not detected or applicable

feet amsl = feet above mean sea level, based on Los Angeles County Datum, 1980

feet btoc = feet below top of casing

NC = not calculated

NM = not measured

**Table 7. TPH and Select VOCs Analytical Summary - March 2016 to October 2016**

*SFPP Norwalk Pump Station, Norwalk, California*

Well	Date	TPH-g	TPH-d	Benzene	Toluene	Ethylbenzene	Xylenes	1,2-DCA	MTBE	TBA	DIPE	ETBE	TAME
GMW-1	03/15/16	<50	180	<0.50	<0.50	<0.50	<0.50	<0.50	0.85	<10	<1	<1	<1
GMW-1	04/14/16	55	70	<0.50	<0.50	<0.50	7.7	<0.50	2.9	22	<1	<1	<1
GMW-1	06/29/16	<50	69	<0.50	<0.50	<0.50	2.3	<0.50	2.9	16	<1	<1	<1
GMW-1	08/23/16	<50	68	0.09	0.11	0.19	1.4	<0.50	1.8	12	0.12	<1	0.19
GMW-1	10/06/16	57	150	0.56	<0.50	<0.50	2.9	<0.50	2.0	13	<1	<1	<1
GMW-9	08/23/16	94	1700	0.71	<0.50	<0.50	3.4	<0.50	2.3	80	4.7	<1	<1
GMW-9	10/06/16	67	140	4.6	<0.50	<0.50	<0.50	0.64	0.84	110	13	<1	<1
GMW-23	03/15/16	540	13,000	4.6	<0.50	<0.50	2.4	<1	2.1	42	12	<1	<1
GMW-23	06/30/16	120	23,000	2.7	<0.50	<0.50	2.1	<0.50	0.52	<10	<1	<1	<1
GMW-23	08/23/16	59	730	0.08	0.03	0.09	<0.50	0.18	0.76	42	13	0.20	<1
GMW-23	10/06/16	130	6,100	2.9	<0.50	<0.50	<0.50	<0.50	<0.50	14	4.8	<1	<1
GMW-25	06/30/16	90	480	<0.50	<0.50	<0.50	3.2	<0.50	1.7	22	2.3	<1	<1
GMW-25	08/23/16	<50	1,300	0.09	0.08	0.11	<0.50	0.73	0.82	160	6.4	0.20	<1
GMW-25	10/06/16	70	780	<0.50	<0.50	<0.50	1.1	0.88	0.50	18	1.2	<1	<1
GMW-26	03/15/16	<50	<100	<0.50	<0.50	<0.50	<0.50	1.5	1.2	<10	2.3	<1	<1
GMW-26	04/14/16	<50	76	<0.50	<0.50	<0.50	<0.50	1.1	0.72	<10	1.4	<1	<1
GMW-26	06/29/16	<50	<50	<0.50	<0.50	<0.50	<0.50	1.4	0.59	<10	1.5	<1	<1
GMW-26	08/23/16	<50	77	0.01	0.01	0.09	<0.50	2.4	0.65	1.3	1.9	<1	<1
GMW-26	10/06/16	<50	<50	<0.50	<0.50	<0.50	<0.50	2.3	0.64	<10	2.0	<1	<1
GMW-28	03/15/16	520	390	230	1.9	2.2	6.5	<3	25	<30	11	<3	<3
GMW-28	04/15/16	600	89	370	<2	4.5	<2	<4	25	<40	8.6	<4	<4
GMW-28	06/30/16	230	540	3.5	<0.50	1.6	7.2	<0.50	16	<10	<1	<1	<1
GMW-28	08/23/16	88	490	0.43	0.02	0.20	4.7	0.04	5.1	5.8	3.4	<1	0.21
GMW-28	10/06/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	1.6	46	19	<1	<1
GMW-29	03/15/16	74,000	65,000	260	320	540	6,000	<40	<20	<400	<40	<40	<40
GMW-30	03/15/16	9,100	3,500	1,100	20	33	920	<10	<5	<100	<10	<10	<10
GMW-30	04/15/16	14,000	2,400	3,600	16	85	860	<30	<15	<300	<30	<30	<30
GMW-30	06/30/16	1,600	6,400	34	0.88	1.5	6.7	1.4	3.4	33	8.6	<1	<1
GMW-30	08/23/16	400	1,400	41	0.20	0.22	3.1	0.24	2.1	60	4.0	0.39	0.39
GMW-30	10/07/16	360	3,600	24	0.60	2.6	3.0	1.2	2.3	27	6.0	<1	<1
GMW-O-2	03/14/16	<50	<100	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-2	04/12/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-2	06/29/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-2	10/04/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-3	03/14/16	<50	<100	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-3	04/12/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-3	06/29/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-3	08/22/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-3	10/05/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1

**Table 7. TPH and Select VOCs Analytical Summary - March 2016 to October 2016**

*SFPP Norwalk Pump Station, Norwalk, California*

Well	Date	TPH-g	TPH-d	Benzene	Toluene	Ethylbenzene	Xylenes	1,2-DCA	MTBE	TBA	DIPE	ETBE	TAME
GMW-O-4	03/14/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-4	04/13/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-4	06/29/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-4	08/23/16	<50	<50	<b>0.01</b>	<0.50	<b>0.08</b>	<0.50	<0.50	<b>0.12</b>	<b>1.9</b>	<1	<1	<1
GMW-O-4	10/05/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-5	03/14/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-5	04/13/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-5	06/29/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-5	10/04/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-9	03/15/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-9	04/13/16	<50	<b>59</b>	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-9	06/29/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-9	08/22/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-9	10/05/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-1	03/14/16	<50	<100	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-1	04/12/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-1	06/29/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-1	08/22/16	<50	<b>100</b>	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-1	10/04/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-10	03/15/16	<b>91</b>	<b>75</b>	<b>16</b>	<0.50	<b>3.4</b>	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-10	04/14/16	<b>910</b>	<b>89</b>	<b>430</b>	<b>12</b>	<b>16</b>	<2.5	<5	<2.5	<50	<5	<5	<5
GMW-O-10	06/29/16	<b>87</b>	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-10	08/23/16	<50	<b>52</b>	<b>0.05</b>	<b>0.05</b>	<b>0.12</b>	<0.50	<b>2.6</b>	<b>0.19</b>	<b>1.3</b>	<b>0.18</b>	<1	<1
GMW-O-10	10/04/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
GMW-O-14	03/15/16	<b>21,000</b>	<b>440</b>	<b>11,000</b>	<50	<b>240</b>	<b>250</b>	<100	<50	<1000	<b>240</b>	<100	<100
GMW-O-14	04/15/16	<b>3,200</b>	<b>930</b>	<b>1,300</b>	<10	<10	<10	<20	<b>13</b>	<200	<b>100</b>	<20	<20
GMW-O-14	06/29/16	<b>13,000</b>	<b>430</b>	<b>6,300</b>	<b>80</b>	<b>270</b>	<b>200</b>	<40	<b>30</b>	<400	<b>230</b>	<40	<40
GMW-O-14	08/23/16	<b>6,000</b>	<b>380</b>	<b>3,100</b>	<b>18</b>	<b>36</b>	<b>46</b>	<b>13</b>	<b>19</b>	<b>150</b>	<b>130</b>	<60	<b>12</b>
GMW-O-14	10/07/16	<b>30,000</b>	<b>640</b>	<b>12,000</b>	<b>72</b>	<b>390</b>	<b>290</b>	<100	<50	<1000	<b>220</b>	<100	<100
GMW-O-20	06/29/16	<b>23,000</b>	<b>7,500</b>	<b>6,800</b>	<b>560</b>	<b>370</b>	<b>1,300</b>	<40	<b>51</b>	<400	<40	<40	<40
GMW-O-20	08/23/16	<b>13,000</b>	<b>31,000</b>	<b>2,600</b>	<b>260</b>	<b>150</b>	<b>1,300</b>	<b>1.6</b>	<b>27</b>	<b>79</b>	<b>5.8</b>	<60	<60
GMW-O-20	10/07/16	<b>35,000</b>	<b>95,000</b>	<b>2,700</b>	<b>930</b>	<b>230</b>	<b>4,200</b>	<40	<b>38</b>	<400	<40	<40	<40
GMW-O-21	10/07/16	<b>18,000</b>	<b>2,000</b>	<b>2,900</b>	<b>21</b>	<b>280</b>	<b>1,600</b>	<40	<20	<400	<40	<40	<40
GMW-O-23	06/29/16	<b>17,000</b>	<b>120,000</b>	<b>250</b>	<b>89</b>	<b>88</b>	<b>1,700</b>	<10	<b>20</b>	<100	<10	<10	<10
GMW-O-23	08/23/16	<b>8,700</b>	<b>160,000</b>	<b>81</b>	<b>13</b>	<b>16</b>	<b>620</b>	<b>0.26</b>	<b>8.2</b>	<b>81</b>	<b>0.47</b>	<20	<20
GMW-O-23	10/07/16	<b>2,800</b>	<b>170,000</b>	<b>15</b>	<4	<b>9.3</b>	<b>110</b>	<8	<b>5.0</b>	<80	<8	<8	<8
HL-3	03/14/16	<b>130</b>	<b>130</b>	<b>1.1</b>	<b>2.8</b>	<b>7.1</b>	<b>27</b>	<0.50	<0.50	<10	<1	<1	<1
HL-3	04/13/16	<50	<b>100</b>	<0.50	<0.50	<b>0.80</b>	<b>3.0</b>	<0.50	<0.50	<10	<1	<1	<1
HL-3	06/29/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<b>0.58</b>	<10	<1	<1	<1

**Table 7. TPH and Select VOCs Analytical Summary - March 2016 to October 2016**

*SFPP Norwalk Pump Station, Norwalk, California*

Well	Date	TPH-g	TPH-d	Benzene	Toluene	Ethylbenzene	Xylenes	1,2-DCA	MTBE	TBA	DIPE	ETBE	TAME
HL-3	10/06/16	<50	<50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<10	<1	<1	<1
MW-18 (MID)	03/15/16	<b>390</b>	<b>390</b>	<b>120</b>	<b>1.3</b>	<0.50	<b>0.91</b>	<0.50	<b>5.0</b>	<b>28</b>	<b>5.9</b>	<1	<1
MW-18 (MID)	04/13/16	<b>390</b>	<b>440</b>	<b>65</b>	<b>1.4</b>	<0.50	<b>2.0</b>	<1	<b>4.7</b>	<b>74</b>	<b>1.5</b>	<1	<1
MW-18 (MID)	08/23/16	<b>150</b>	<b>330</b>	<b>12</b>	<b>0.28</b>	<b>0.17</b>	<b>1.7</b>	<b>0.23</b>	<b>7.7</b>	<b>46</b>	<b>4.4</b>	<1	<b>0.20</b>
MW-18 (MID)	10/06/16	<b>200</b>	<b>490</b>	<b>6.1</b>	<0.50	<0.50	<b>1.5</b>	<1	<b>2.7</b>	<b>55</b>	<b>1.3</b>	<1	<1
MW-O-2	08/23/16	<b>73,000</b>	<b>81,000</b>	<b>3,400</b>	<b>510</b>	<b>410</b>	<b>9,700</b>	<b>0.46</b>	<b>410</b>	<b>680</b>	<b>30</b>	<80	<b>16</b>
MW-SF-1	06/30/16	<b>260</b>	<b>760</b>	<b>0.69</b>	<0.50	<b>0.50</b>	<b>0.98</b>	<1	<b>1.6</b>	<b>19</b>	<1	<1	<1
MW-SF-1	08/23/16	<100	<b>920</b>	<b>0.89</b>	<b>0.31</b>	<b>0.32</b>	<b>1.6</b>	<b>0.02</b>	<b>0.76</b>	<b>9.9</b>	<b>0.21</b>	<2	<b>0.39</b>
MW-SF-1	10/07/16	<b>55</b>	<b>1,200</b>	<0.50	<0.50	<0.50	<0.50	<0.50	<b>0.57</b>	<10	<1	<1	<1
MW-SF-4	06/30/16	<b>540</b>	<b>20,000</b>	<b>2.3</b>	<0.50	<b>0.75</b>	<b>20</b>	<0.50	<0.50	<10	<1	<1	<1
MW-SF-4	08/23/16	<100	<b>5,000</b>	<b>0.57</b>	<b>0.13</b>	<b>0.27</b>	<b>2.2</b>	<1	<b>0.28</b>	<b>6.5</b>	<b>0.08</b>	<b>0.41</b>	<2
MW-SF-4	10/07/16	<500	<b>4,700</b>	<2.5	<2.5	<2.5	<2.5	<5	<2.5	<50	<5	<5	<5
MW-SF-6	08/23/16	<b>13,000</b>	<b>2,700</b>	<b>2,400</b>	<10	<b>66</b>	<b>1,300</b>	<20	<b>58</b>	<b>510</b>	<20	<20	<20
MW-SF-6	10/07/16	<b>8,400</b>	<b>10,000</b>	<b>430</b>	<5	<b>35</b>	<b>640</b>	<10	<b>53</b>	<b>390</b>	<10	<10	<10
MW-SF-9	04/14/16	<b>2,300</b>	<b>5,100</b>	<b>96</b>	<b>1.8</b>	<b>64</b>	<b>170</b>	<3	<b>1.7</b>	<b>130</b>	<b>3.4</b>	<3	<3
MW-SF-13	08/23/16	<b>790</b>	<b>2,600</b>	<b>2.6</b>	<b>1.2</b>	<b>8.2</b>	<b>24</b>	<2	<1	<20	<2	<2	<2
MW-SF-13	10/07/16	<b>5,300</b>	<b>4,400</b>	<5	<5	<b>200</b>	<b>350</b>	<10	<5	<100	<10	<10	<10
MW-SF-14	04/15/16	<b>370</b>	<b>17,000</b>	<b>4.7</b>	<0.50	<0.50	<b>39</b>	<0.50	<b>63</b>	<b>500</b>	<1	<1	<1
MW-SF-15	08/23/16	<b>300</b>	<b>1,400</b>	<b>5.2</b>	<b>0.57</b>	<b>3.0</b>	<b>23</b>	<b>0.04</b>	<b>38</b>	<b>440</b>	<b>5.2</b>	<b>0.78</b>	<b>1.4</b>
MW-SF-15	10/07/16	<500	<b>16,000</b>	<b>7.1</b>	<2.5	<2.5	<b>3.5</b>	<5	<b>26</b>	<b>720</b>	<b>12</b>	<5	<5
PZ-2	03/15/16	<b>1,200</b>	<b>1,800</b>	<b>150</b>	<b>16</b>	<b>32</b>	<b>72</b>	<2	<b>4.0</b>	<20	<2	<2	<2
PZ-2	04/13/16	<b>2,300</b>	<b>1,300</b>	<b>110</b>	<b>20</b>	<b>120</b>	<b>390</b>	<2	<b>1.3</b>	<20	<2	<2	<2
PZ-2	06/30/16	<b>790</b>	<b>550</b>	<b>77</b>	<b>3.0</b>	<b>21</b>	<b>43</b>	<0.50	<b>1.2</b>	<10	<b>1.0</b>	<1	<1
PZ-2	08/23/16	<b>590</b>	<b>570</b>	<b>62</b>	<b>7.9</b>	<b>12</b>	<b>37</b>	<b>0.55</b>	<b>1.3</b>	<b>11</b>	<b>1.4</b>	<2	<b>0.38</b>
PZ-2	10/06/16	<b>410</b>	<b>550</b>	<b>3.5</b>	<b>0.84</b>	<b>8.2</b>	<b>22</b>	<0.50	<b>1.7</b>	<b>23</b>	<1	<1	<1
PZ-10	04/14/16	<200	<b>240</b>	<1	<1	<1	<1	<2	<1	<20	<2	<2	<2

Notes:

Results are expressed in units of micrograms per liter (µg/L)

--- = not analyzed

< = not detected at or above the laboratory reporting limit shown

1,2-DCA = 1,2-dichloroethane

DIPE = di-isopropyl ether

ETBE = ethyl tertiary butyl ether

MTBE = methyl tertiary butyl ether

TAME = tertiary amyl methyl ether

TBA = tertiary butyl alcohol

TPH-d = total extractable petroleum hydrocarbons, quantified using a diesel standard

TPH-g = total purgeable petroleum hydrocarbons, quantified using a gasoline standard

Xylenes = total of m,p-xylene and o-xylene when detected

**Table 8. Reduction in Product Thickness for Select South-Central Area Wells**

SFPP Norwalk Pump Station, Norwalk, California

Well	Distance from BS Well Screen (feet)	Type	Pre-Biosparging			March 2016			April 2016			June 2016			August 2016			October 2016		
			Date	Product Thickness (feet)	Change in Product Thickness (feet)	Change in Product Thickness (%)	Product Thickness (feet)	Change in Product Thickness (feet)	Change in Product Thickness (%)	Product Thickness (feet)	Change in Product Thickness (feet)	Change in Product Thickness (%)	Product Thickness (feet)	Change in Product Thickness (feet)	Change in Product Thickness (%)	Product Thickness (feet)	Change in Product Thickness (feet)	Change in Product Thickness (%)		
<b>Wells with Active Remediation</b>																				
GMW-9	11	SVE/TFE	10/20/15	0.24	0.00	-0.24	-100%	0.00	-0.24	-100%	0.00	-0.24	-100%	0.00	-0.24	-100%	0.00	-0.24	-100%	
MW-SF-11	26	SVE/TFE	10/20/15	2.04	0.00	-2.04	-100%	0.00	-2.04	-100%	0.00	-2.04	-100%	0.00	-2.04	-100%	0.00	-2.04	-100%	
MW-SF-12	26	SVE/TFE	10/20/15	1.94	0.00	-1.94	-100%	0.00	-1.94	-100%	0.06	-1.88	-97%	0.00	-1.94	-100%	0.00	-1.94	-100%	
MW-SF-13	29	SVE/TFE	12/11/15	8.11	0.00	-8.11	-100%	0.00	-8.11	-100%	0.00	-8.11	-100%	0.00	-8.11	-100%	0.00	-8.11	-100%	
MW-SF-2	45	SVE/TFE	10/21/15	0.19	0.00	-0.19	-100%	0.00	-0.19	-100%	0.00	-0.19	-100%	0.00	-0.19	-100%	0.00	-0.19	-100%	
MW-SF-9	45	SVE	12/11/15	0.45	0.00	-0.45	-100%	0.00	-0.45	-100%	0.00	-0.45	-100%	---	---	---	---	---	---	
GMW-22	48	SVE/TFE	10/20/15	1.18	2.12	0.94	80%	3.09	1.91	162%	0.00	-1.18	-100%	---	---	---	0.00	-1.18	-100%	
GMW-25	72	SVE/TFE	10/20/15	0.02	0.00	-0.02	-100%	0.00	-0.02	-100%	0.00	-0.02	-100%	0.00	-0.02	-100%	0.00	-0.02	-100%	
GMW-O-23	76	SVE/TFE	10/22/15	2.36	0.00	-2.36	-100%	0.00	-2.36	-100%	0.00	-2.36	-100%	0.00	-2.36	-100%	0.00	-2.36	-100%	
GMW-O-20	185	SVE/TFE	10/22/15	1.98	0.00	-1.98	-100%	0.00	-1.98	-100%	0.00	-1.98	-100%	0.00	-1.98	-100%	0.00	-1.98	-100%	
GMW-O-21	213	TFE	11/17/15	9.9	0.03	-9.87	-100%	0.33	-9.57	-97%	0.20	-9.70	-98%	0.00	-9.90	-100%	0.00	-9.90	-100%	
GMW-10	255	SVE/TFE	10/20/15	1.94	1.05	-0.89	-46%	1.60	-0.34	-18%	0.00	-1.94	-100%	0.89	-1.05	-54%	1.45	-0.49	-25%	
GMW-O-12	269	SVE	12/11/15	4.92	0.80	-4.12	-84%	6.49	1.57	32%	0.80	-4.12	-84%	2.49	-2.43	-49%	2.30	-2.62	-53%	
<b>Wells without Active Remediation</b>																				
MW-SF-4	8	SVE	12/11/15	0.69	0.00	-0.69	-100%	0.00	-0.69	-100%	0.00	-0.69	-100%	0.00	-0.69	-100%	0.00	-0.69	-100%	
GWR-3	13	SVE/TFE	10/20/15	1.33	0.00	-1.33	-100%	0.00	-1.33	-100%	0.00	-1.33	-100%	0.00	-1.33	-100%	0.05	-1.28	-96%	
GMW-23	18	MW	12/11/15	0.52	0.00	-0.52	-100%	0.02	-0.50	-96%	0.00	-0.52	-100%	0.00	-0.52	-100%	0.00	-0.52	-100%	
MW-SF-15	25	SVE/TFE	12/11/15	0.42	0.00	-0.42	-100%	0.00	-0.42	-100%	0.00	-0.42	-100%	0.00	-0.42	-100%	0.00	-0.42	-100%	
GMW-30	40	MW	12/11/15	0.53	0.00	-0.53	-100%	0.00	-0.53	-100%	0.00	-0.53	-100%	0.00	-0.53	-100%	0.00	-0.53	-100%	
GMW-29	43	MW	12/11/15	0.68	0.00	-0.68	-100%	1.40	0.72	106%	3.32	2.64	388%	0.51	-0.17	-25%	0.25	-0.43	-63%	
MW-O-2	77	SVE/TFE	10/19/15	1.86	0.63	-1.23	-66%	0.49	-1.37	-74%	0.40	-1.46	-78%	0.00	-1.86	-100%	0.08	-1.78	-96%	
GMW-O-11	114	SVE/TFE	10/22/15	3.85	0.23	-3.62	-94%	0.21	-3.64	-95%	0.00	-3.85	-100%	0.01	-3.84	-100%	0.01	-3.84	-100%	
<b>Average for Wells with Active Remediation</b>			---	2.71	0.31	-2.41	-0.81	0.89	-1.83	-0.63	0.08	-2.63	-0.98	0.31	-2.75	-0.91	0.31	-2.59	-0.90	
<b>Average for Wells without Active Remediation</b>			---	1.24	0.11	-1.13	-0.95	0.27	-0.97	-0.70	0.47	-0.77	-0.36	0.07	-1.17	-0.91	0.05	-1.19	-0.94	
<b>Average for All Wells</b>			---	2.15	0.23	-1.92	-0.86	0.65	-1.50	-0.66	0.23	-1.92	-0.75	0.21	-2.09	-0.91	0.21	-2.03	-0.92	

Notes:

Biosparging commenced on January 7, 2016.

TFE, SVE, and biosparge systems were shut down 5 to 7 days prior to gauging wells.

--- not applicable or not available

BS = biosparge

MW = monitoring well

SVE = soil vapor extraction

TFE = total fluids extraction

**Table 9. TPH-g Reduction in Select South-Central Area Wells**

*SFPP Norwalk Pump Station, Norwalk, California*

Well	Type	Distance from BS Well Screen (feet)	Baseline		March 2016			April 2016		June 2016		August 2016		October 2016	
			Date	TPH-g (µg/L)	TPH-g (µg/L)	Reduction (%)	TPH-g (µg/L)	Reduction (%)	TPH-g (µg/L)	Reduction (%)	TPH-g (µg/L)	Reduction (%)	TPH-g (µg/L)	Reduction (%)	
MW-SF-4	SVE	8	01/15/13	13000	ns	---	ns	---	540	-96%	<b>50</b>	-100%	<b>250</b>	-98%	
GMW-9	SVE/TFE	11	10/13/11	61000	ns	---	ns	---	ns	---	94	-100%	67	-100%	
GMW-23	MW	18	04/23/15	37000	540	-99%	ns	---	120	-100%	59	-100%	130	-100%	
MW-SF-15	SVE/TFE	25	10/14/11	35000	ns	---	ns	---	ns	---	300	-99%	<b>250</b>	-99%	
MW-SF-1	SVE	26	01/15/13	8500	ns	---	ns	---	260	-97%	<b>50</b>	-99%	55	-99%	
MW-SF-13	SVE/TFE	29	10/14/11	42000	ns	---	ns	---	ns	---	790	-98%	5300	-87%	
GMW-28	MW	33	10/26/15	280	520	<b>Increase</b>	600	<b>Increase</b>	230	-18%	88	-69%	<b>25</b>	-91%	
MW-SF-6	SVE/TFE	42	10/13/11	40000	ns	---	ns	---	ns	---	13000	-68%	8400	-79%	
PZ-10	MW	49	10/26/15	340	ns	---	<b>100</b>	-71%	ns	---	ns	---	ns	---	
GMW-O-23	SVE/TFE	76	10/19/12	29000	ns	---	ns	---	17000	-41%	8700	-70%	2800	-90%	
GMW-1	MW	93	10/23/15	110	<b>25</b>	-77%	55	-50%	<b>25</b>	-77%	<b>25</b>	-77%	57	-48%	
GMW-O-10	MW	94	10/26/15	160	91	-43%	910	<b>Increase</b>	87	-46%	<b>25</b>	-84%	<b>25</b>	-84%	
GMW-O-20	SVE/TFE	185	10/19/12	36000	ns	---	ns	---	23000	-36%	13000	-64%	35000	-3%	
GMW-O-14	MW	189	10/26/15	24000	21000	-13%	3200	-87%	13000	-46%	6000	-75%	30000	<b>Increase</b>	
PZ-2	MW	214	10/27/15	210	1200	<b>Increase</b>	2300	<b>Increase</b>	790	<b>Increase</b>	590	<b>Increase</b>	410	<b>Increase</b>	
<b>Average TPH-g Reduction</b>					---	-58%	---	-69%	---	-62%	---	-85%	---	-82%	

Notes:

Biosparging commenced on January 7, 2016

TFE, SVE, and biosparge systems were shut down 5 to 7 days prior to sampling wells.

Baseline samples for some wells could not be collected in October 2015 due to the presence of free product. The latest analytical results for these wells are provided above for comparison to post-biosparge conditions.

Wells sampled as part of the pilot test evaluation that had nondetect concentrations during the background (October 2015) sampling event are not provided above

Wells with increases in concentrations during pilot testing (March through October 2016) are not included in the average TPH-g reduction calculator

Bold and italic values indicate that the result was nondetect. One half of the reporting limit is listed for reduction calculation purpose:

--- not applicable

µg/L = micrograms per liter

BS = biosparge

MW = monitoring well

ns = not sampled

SVE = soil vapor extraction

TFE = total fluids extraction

TPH-g = total petroleum hydrocarbons, quantified as gasoline (C4-C13)



**Table 10. TPH-d Reduction in Select South-Central Area Wells**

SFPP Norwalk Pump Station, Norwalk, California

Well	Type	Distance from BS Well Screen (feet)	Baseline		March 2016		April 2016		June 2016		August 2016		October 2016	
			Date	TPH-d or TPH-fp (µg/L)	TPH-d (µg/L)	Change (%)	TPH-d (µg/L)	Change (%)	TPH-d (µg/L)	Change (%)	TPH-d (µg/L)	Change (%)	TPH-d (µg/L)	Change (%)
MW-SF-4	SVE	8	01/15/13	3700	ns	---	ns	---	20000	Increase	5000	Increase	4700	Increase
GMW-9	SVE/TFE	11	10/13/11	7600	ns	---	ns	---	ns	---	1700	-78%	140	-98%
GMW-23	MW	18	04/23/15	240000	13000	-95%	ns	---	23000	-90%	730	-100%	6100	-97%
MW-SF-15	SVE/TFE	25	10/14/11	39000	ns	---	ns	---	ns	---	1400	-96%	16000	-59%
MW-SF-1	SVE	26	01/15/13	4100	ns	---	ns	---	760	-81%	920	-78%	1200	-71%
MW-SF-13	SVE/TFE	29	10/14/11	13000	ns	---	ns	---	ns	---	2600	-80%	4400	-66%
GMW-28	MW	33	10/26/15	360	390	Increase	89	-75%	540	Increase	490	Increase	<b>25</b>	-93%
MW-SF-6	SVE/TFE	42	10/13/11	11000	ns	---	ns	---	ns	---	2700	-75%	10000	-9%
PZ-10	MW	49	10/26/15	1200	ns	---	240	-80%	ns	---	ns	---	ns	---
GMW-25	SVE/TFE	72	10/13/11	31000	ns	---	ns	---	480	-98%	1300	-96%	780	-97%
GMW-O-23	SVE/TFE	76	10/19/12	31000	ns	---	ns	---	120000	Increase	160000	Increase	170000	Increase
GMW-1	MW	93	10/23/15	140	180	Increase	70	-50%	69	-51%	68	-51%	150	Increase
GMW-O-10	MW	94	10/26/15	180	75	-58%	89	-51%	<b>25</b>	-86%	52	-71%	<b>25</b>	-86%
GMW-O-20	SVE/TFE	185	10/19/12	340000	ns	---	ns	---	7500	-98%	31000	-91%	95000	-72%
GMW-O-14	MW	189	10/26/15	890	440	-51%	930	Increase	430	-52%	380	-57%	640	-28%
PZ-2	MW	214	10/27/15	460	1800	Increase	1300	Increase	550	Increase	570	Increase	550	Increase
HL-3	MW	284	10/23/15	60	130	Increase	100	Increase	<b>25</b>	-58%	ns	---	<b>25</b>	-58%
<b>Average TPH-d Reduction</b>					---	-68%	---	-64%	---	-77%	---	-79%	---	-70%

Notes:

Biosparging commenced on January 7, 2016.

TFE, SVE, and biosparge systems were shut down 5 to 7 days prior to sampling wells.

Baseline samples for some wells could not be collected in October 2015 due to the presence of free product. The latest analytical results for these wells are provided above for comparison to post-biosparge conditions.

Wells sampled as part of the pilot test evaluation that had nondetect concentrations during the background (October 2015) sampling event are not provided above.

Wells with increases in concentrations during pilot testing (March through October 2016) are not included in the average TPH-d reduction calculation.

Bold and italic values indicate that the result was nondetect. One half of the reporting limit is listed for reduction calculation purpose.

For wells GMW-9, GMW-25, MW-SF-6, MW-SF-13, and MW-SF-15, baseline TPH-fp results are provided in lieu of TPH-d results since TPH-d results were unavailable.

--- not applicable

µg/L = micrograms per liter

BS = biosparge

MW = monitoring well

ns = not sampled

SVE = soil vapor extraction

TFE = total fluids extraction

TPH-d = total petroleum hydrocarbons, quantified as diesel (C14-C22)

TPH-fp = total petroleum hydrocarbons, quantified as fuel product (C8-C22)

**Table 11. Benzene Reduction in Select South-Central Area Wells**

*SFPP Norwalk Pump Station, Norwalk, California*

Well	Type	Distance from BS Well Screen (feet)	Baseline		March 2016		April 2016		June 2016		August 2016		October 2016	
			Date	Benzene (µg/L)	Benzene (µg/L)	Change (%)	Benzene (µg/L)	Change (%)	Benzene (µg/L)	Change (%)	Benzene (µg/L)	Change (%)	Benzene (µg/L)	Change (%)
MW-SF-4	SVE	8	01/15/13	5000	ns	---	ns	---	2.3	-100%	0.57	-100%	<b>1.25</b>	-100%
GMW-9	SVE/TFE	11	10/13/11	18000	ns	---	ns	---	ns	---	0.71	-100%	4.6	-100%
GMW-23	MW	18	04/23/15	2100	4.6	-100%	ns	---	2.7	-100%	0.08	-100%	2.9	-100%
MW-SF-15	SVE/TFE	25	10/14/11	11000	ns	---	ns	---	ns	---	5.2	-100%	7.1	-100%
MW-SF-1	SVE	26	01/15/13	4500	ns	---	ns	---	0.69	-100%	0.89	-100%	<b>0.25</b>	-100%
MW-SF-13	SVE/TFE	29	10/14/11	12000	ns	---	ns	---	ns	---	2.6	-100%	<b>2.5</b>	-100%
GMW-28	MW	33	10/26/15	3.3	230	<b>Increase</b>	370	<b>Increase</b>	3.5	<b>Increase</b>	0.43	-87%	<b>0.25</b>	-92%
MW-SF-6	SVE/TFE	42	10/13/11	14000	ns	---	ns	---	ns	---	2400	-83%	430	-97%
GMW-25	SVE/TFE	72	10/13/11	9700	ns	---	ns	---	<b>0.25</b>	-100%	0.09	-100%	<b>0.25</b>	-100%
GMW-O-23	SVE/TFE	76	10/19/12	7000	ns	---	ns	---	250	-96%	81	-99%	15	-100%
GMW-O-20	SVE/TFE	185	10/19/12	6100	ns	---	ns	---	6800	<b>Increase</b>	2600	-57%	2700	-56%
GMW-O-14	MW	189	10/26/15	12000	11000	<b>Increase</b>	1300	-89%	6300	-48%	3100	-74%	12000	0%
PZ-2	MW	214	10/27/15	1.2	150	<b>Increase</b>	110	<b>Increase</b>	77	<b>Increase</b>	62	<b>Increase</b>	3.5	<b>Increase</b>
<b>Average Benzene Reduction</b>					---	-100%	---	-89%	---	-91%	---	-92%	---	-87%

Notes:

Biosparging commenced on January 7, 2016.

TFE, SVE, and biosparge systems were shut down 5 to 7 days prior to sampling wells.

Baseline samples for some wells could not be collected in October 2015 due to the presence of free product. The latest analytical results for these wells are provided above for comparison to post-biosparge conditions.

Wells sampled as part of the pilot test evaluation that had nondetect concentrations during the background (October 2015) sampling event are not provided above.

Wells with increases in concentrations during pilot testing (March through October 2016) are not included in the average benzene reduction calculator.

Bold and italic values indicate that the result was nondetect. One half of the reporting limit is listed for reduction calculation purpose:

--- not applicable

µg/L = micrograms per liter

BS = biosparge

MW = monitoring well

ns = not sampled

SVE = soil vapor extraction

TFE = total fluids extraction

**Table 12. MTBE Reduction in Select South-Central Area Wells**

*SFPP Norwalk Pump Station, Norwalk, California*

Well	Type	Distance from BS Well Screen (feet)	Baseline		March 2016		April 2016		June 2016		August 2016		October 2016	
			Date	MTBE (µg/L)	MTBE (µg/L)	Change (%)	MTBE (µg/L)	Change (%)	MTBE (µg/L)	Change (%)	MTBE (µg/L)	Change (%)	MTBE (µg/L)	Change (%)
MW-SF-4	SVE	8	01/15/13	380	ns	---	ns	---	<b>0.25</b>	-100%	0.28	-100%	1.25	-100%
GMW-9	SVE/TFE	11	10/13/11	2100	ns	---	ns	---	ns	---	2.3	-100%	0.84	-100%
MW-SF-15	SVE/TFE	25	10/14/11	780	ns	---	ns	---	ns	---	38	-95%	26	-97%
MW-SF-1	SVE	26	01/15/13	110	ns	---	ns	---	1.6	-99%	0.76	-99%	0.57	-99%
MW-SF-13	SVE/TFE	29	10/14/11	580	ns	---	ns	---	ns	---	<b>0.5</b>	-100%	<b>2.5</b>	-100%
GMW-28	MW	33	10/26/15	73	25	-66%	25	-66%	16	-78%	5.1	-93%	1.6	-98%
MW-SF-6	SVE/TFE	42	10/13/11	570	ns	---	ns	---	ns	---	58	-90%	53	-91%
GMW-O-23	SVE/TFE	76	10/19/12	400	ns	---	ns	---	20	-95%	8.2	-98%	5	-99%
GMW-1	MW	93	10/23/15	1.9	0.85	-55%	2.9	<b>Increase</b>	2.9	<b>Increase</b>	1.8	-5%	2	<b>Increase</b>
PZ-2	MW	214	10/27/15	0.56	4	<b>Increase</b>	1.3	<b>Increase</b>	1.2	<b>Increase</b>	1.3	<b>Increase</b>	1.7	<b>Increase</b>
<b>Average MTBE Reduction</b>					---	-61%	---	-66%	---	-93%	---	-87%	---	-98%

Notes:

Biosparging commenced on January 7, 2016.

TFE, SVE, and biosparge systems were shut down 5 to 7 days prior to sampling wells.

Baseline samples for some wells could not be collected in October 2015 due to the presence of free product. The latest analytical results for these wells are provided above for comparison to post-biosparge conditions.

Wells sampled as part of the pilot test evaluation that had nondetect concentrations during the background (October 2015) sampling event are not provided above.

Wells with increases in concentrations during pilot testing (March through October 2016) are not included in the average MTBE reduction calculator.

Bold and italic values indicate that the result was nondetect. One half of the reporting limit is listed for reduction calculation purpose:

--- not applicable

µg/L = micrograms per liter

BS = biosparge

MTBE = methyl tertiary butyl ether

MW = monitoring well

ns = not sampled

SVE = soil vapor extraction

TFE = total fluids extraction

**Table 13. TBA Reduction in Select South-Central Area Wells**

SFPP Norwalk Pump Station, Norwalk, California

Well	Type	Distance from BS Well Screen (feet)	Baseline		March 2016		April 2016		June 2016		August 2016		October 2016	
			Date	TBA (µg/L)	TBA (µg/L)	Change (%)	TBA (µg/L)	Change (%)	TBA (µg/L)	Change (%)	TBA (µg/L)	Change (%)	TBA (µg/L)	Change (%)
GMW-23	MW	18	04/23/15	360	42	-88%	ns	---	<b>5</b>	-99%	42	-88%	14	-96%
MW-SF-15	SVE/TFE	25	10/14/11	2300	ns	---	ns	---	ns	---	440	-81%	720	-69%
GMW-28	MW	33	10/26/15	20	<b>15</b>	-25%	<b>20</b>	0%	<b>5</b>	-75%	5.8	-71%	46	<b>Increase</b>
PZ-10	MW	49	10/26/15	140	ns	---	<b>10</b>	-93%	ns	---	ns	---	ns	---
GMW-1	MW	93	10/23/15	13	<b>5</b>	-62%	22	<b>Increase</b>	16	<b>Increase</b>	12	-8%	13	0%
PZ-2	MW	214	10/27/15	42	<b>10</b>	-76%	<b>10</b>	-76%	<b>5</b>	-88%	11	-74%	23	-45%
<b>Average TBA Reduction</b>					---	-63%	---	-56%	---	-87%	---	-64%	---	-53%

Notes:

Biosparging commenced on January 7, 2016.

TFE, SVE, and biosparge systems were shut down 5 to 7 days prior to sampling wells.

Baseline samples for some wells could not be collected in October 2015 due to the presence of free product. The latest analytical results for these wells are provided above for comparison to post-biosparge conditions.

Wells sampled as part of the pilot test evaluation that had nondetect concentrations during the background (October 2015) sampling event are not provided above

Wells with increases in concentrations during pilot testing (March through October 2016) are not included in the average TBA reduction calculator

Bold and italic values indicate that the result was nondetect. One half of the reporting limit is listed for reduction calculation purpose:

--- not applicable

µg/L = micrograms per liter

BS = biosparge

MW = monitoring well

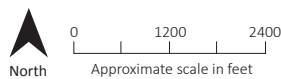
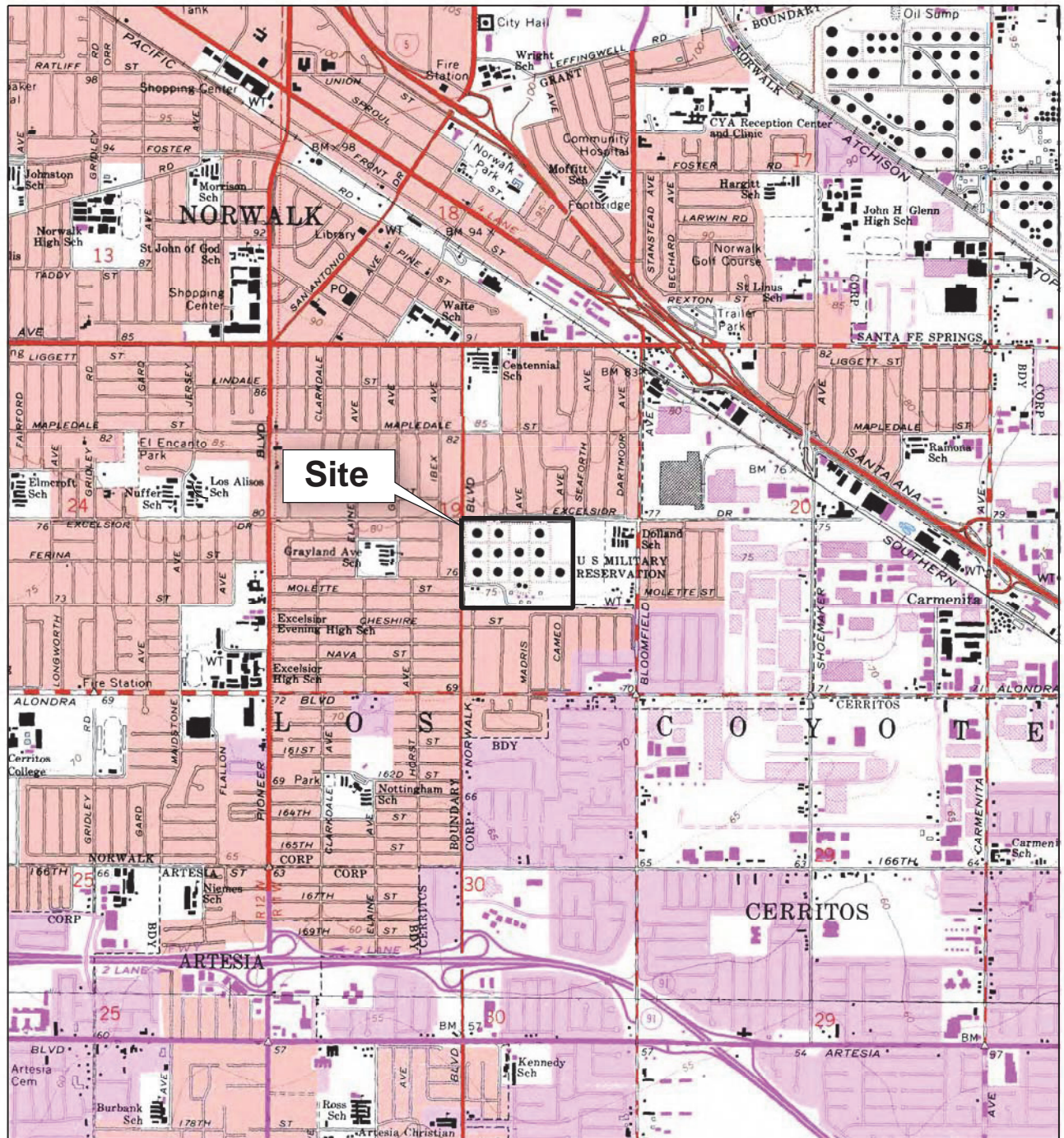
ns = not sampled

SVE = soil vapor extraction

TBA = tertiary butyl alcohol

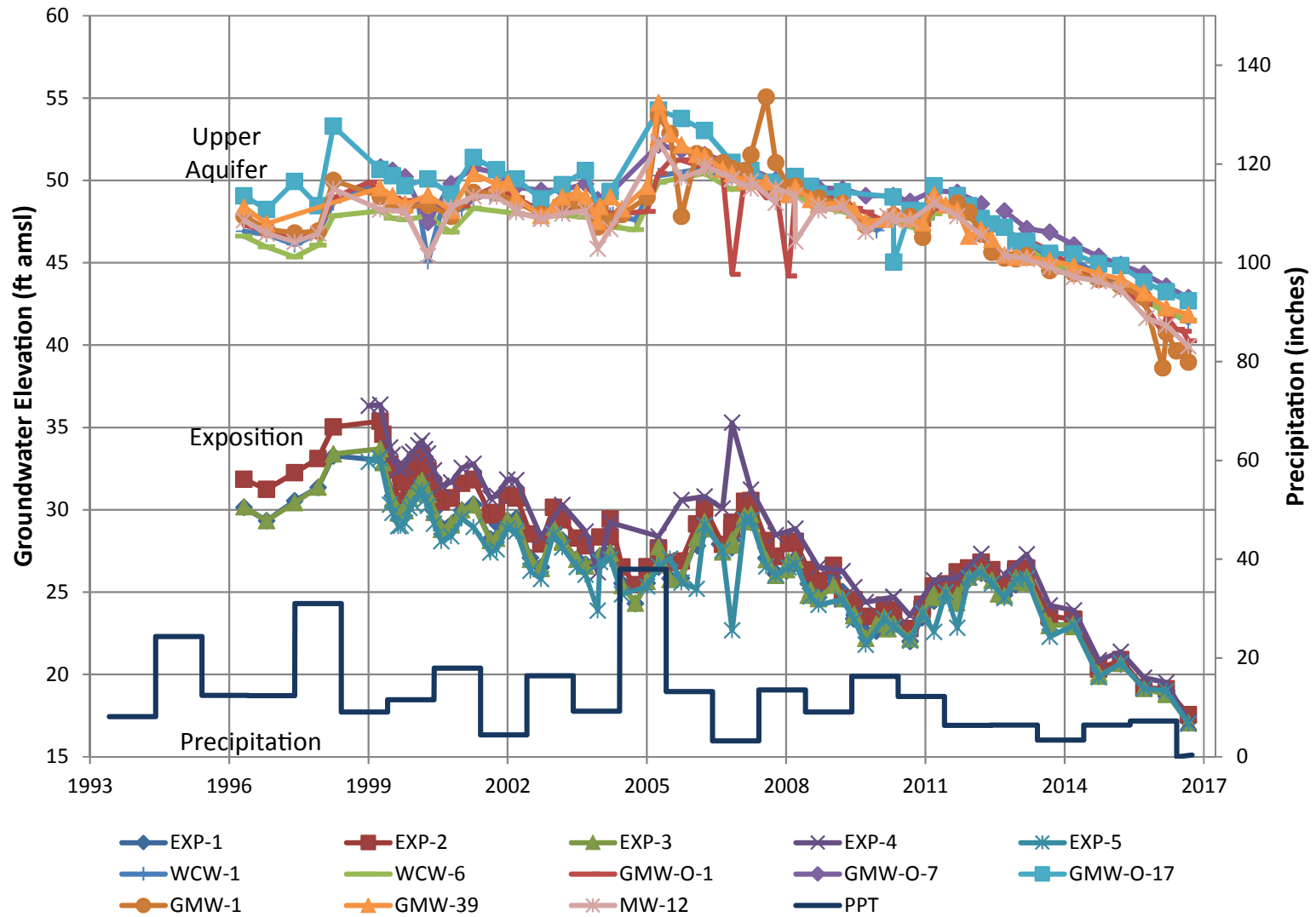
TFE = total fluids extraction

Figures



**Figure 1**  
**Site Location Map**  
 SFP Norwalk Pump Station  
 Norwalk, California

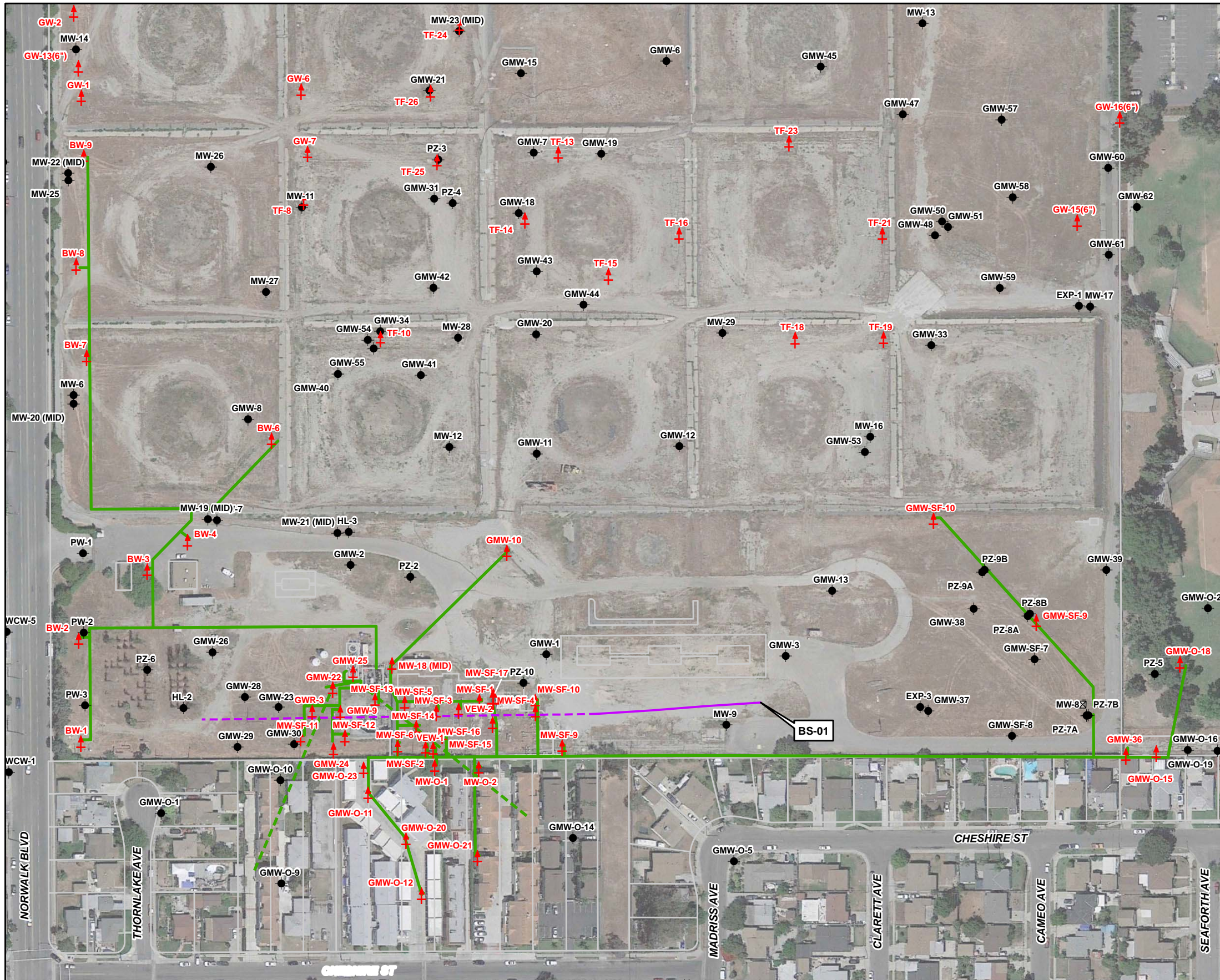
BASEMAP MODIFIED FROM U.S.G.S. 7.5 MINUTE QUADRANGLE MAP  
 LOS ALAMITOS 1964, CALIFORNIA. PHOTO-REVISED 1981.  
 WHITTIER 1965, CALIFORNIA. PHOTO-REVISED 1981.



**Figure 2**  
**Hydrographs for Select Groundwater Monitoring Wells**  
*SFPP Norwalk Pump Station*  
*Norwalk, California*



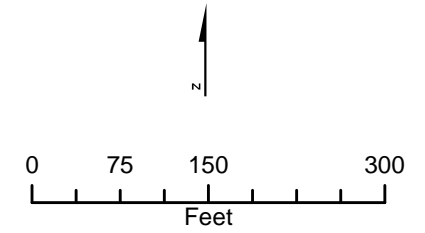




**Legend**

- Existing Groundwater Monitoring Well
- ⊕ Existing Remediation Well
- Horizontal Biosparge Well  
(dashed line depicts approximate lateral extent of well screen)
- KMEP Remediation Piping Layout  
(above ground and below ground)
- - - Horizontal Vapor Extraction Well Piping

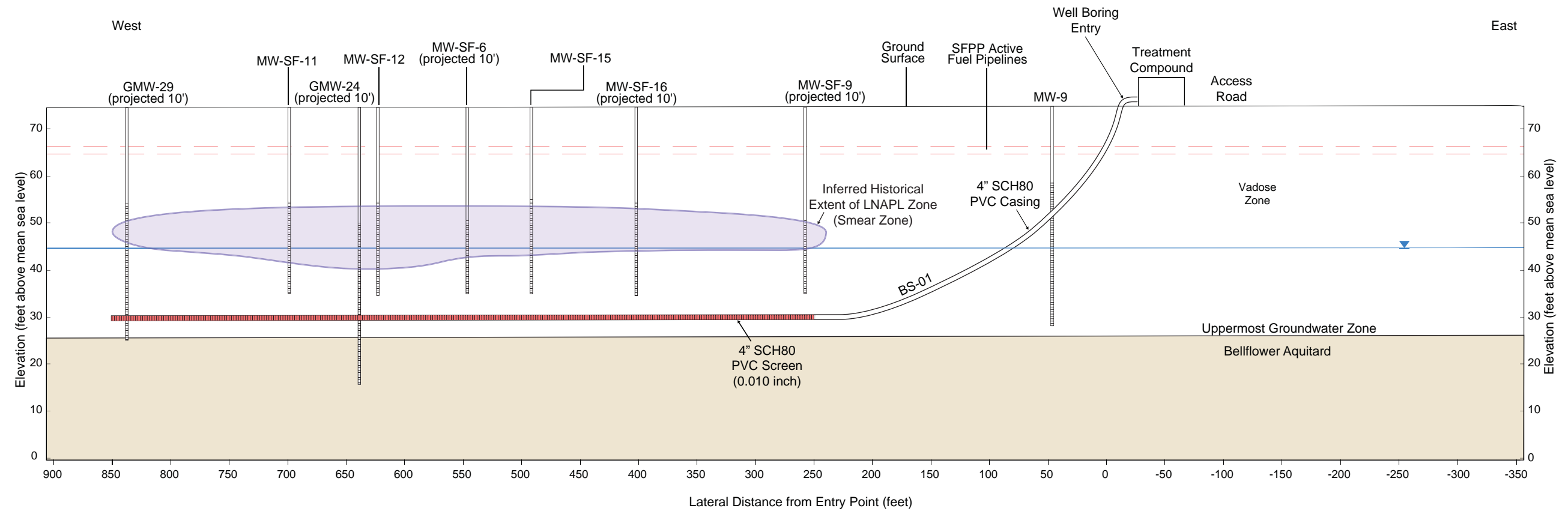
Imagery Source:  
Google Earth April 17, 2013.






**Figure 3**  
**Remediation System Layout**  
SFPP Norwalk Pump Station  
Norwalk, California







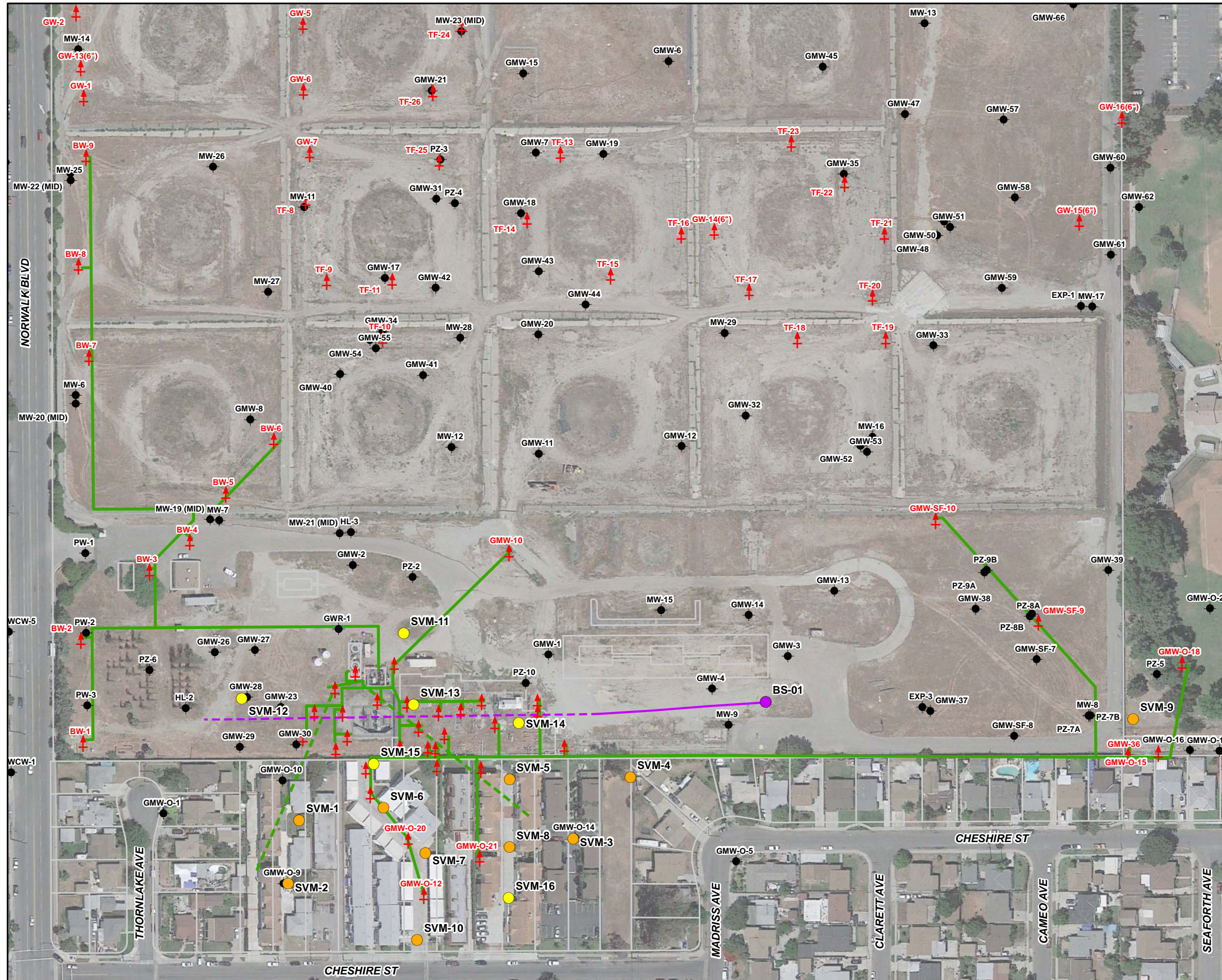
**LEGEND**

-  Monitoring or TFE/SVE Well Screen
-  Horizontal Biosparge Well Screen
-  Approximate Groundwater Elevation in Uppermost Groundwater Zone (April 2013)

**Note:**  
 Top of the Bellflower Aquitard was interpreted based on (1) review of the lithological descriptions provided on the select well and boring logs (Preliminary Conceptual Site Model, AMEC Geomatrix, Inc., February 13, 2009) and (2) Conceptual Site Model and Proposed Alternate Interim Remedy for Soil, Groundwater, and LNAPL (CH2M HILL, September 3, 2013)

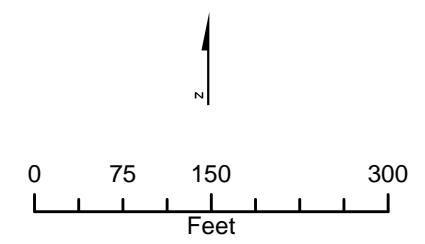
**Figure 4**  
**Horizontal Biosparge Well Completion Diagram**  
 SFPP Norwalk Pump Station  
 Norwalk, California





- Legend**
- New Soil Vapor Monitoring Probes
  - Previously Installed Soil Vapor Monitoring Probes
  - Horizontal Biosparge Well Entry Point
  - Existing Groundwater Monitoring Well
  - ⊕ Existing Remediation Well
  - Horizontal Biosparge Well (dashed line depicts approximate lateral extent of well screen)
  - KMEP Remediation Piping Layout (above ground and below ground)
  - Horizontal Vapor Extraction Well Piping

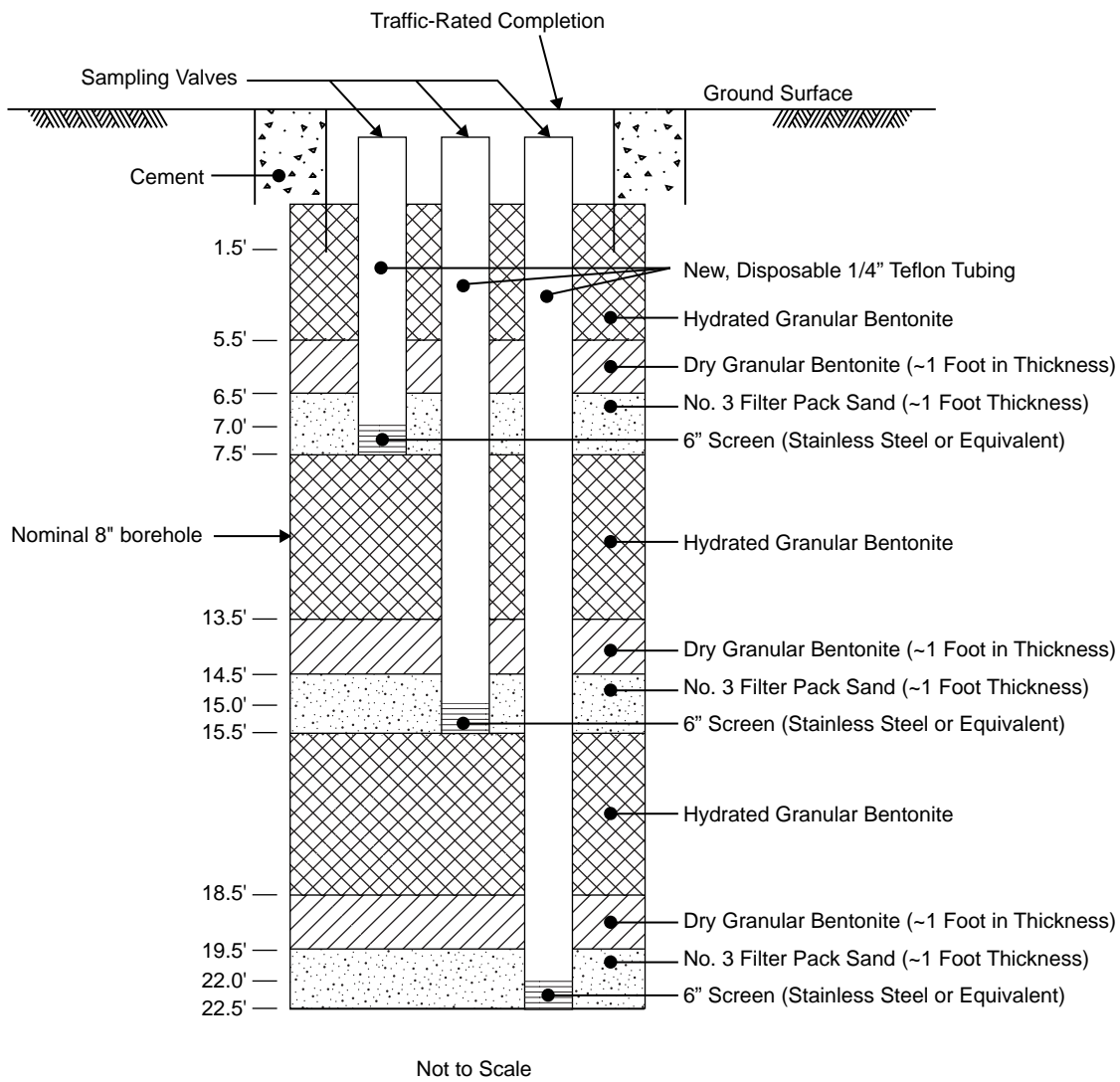
Imagery Source:  
Google Earth April 17, 2013.



**Figure 5**  
**Biosparge Well and**  
**Soil Vapor Monitoring Probe Locations**  
SFPP Norwalk Pump Station  
Norwalk, California



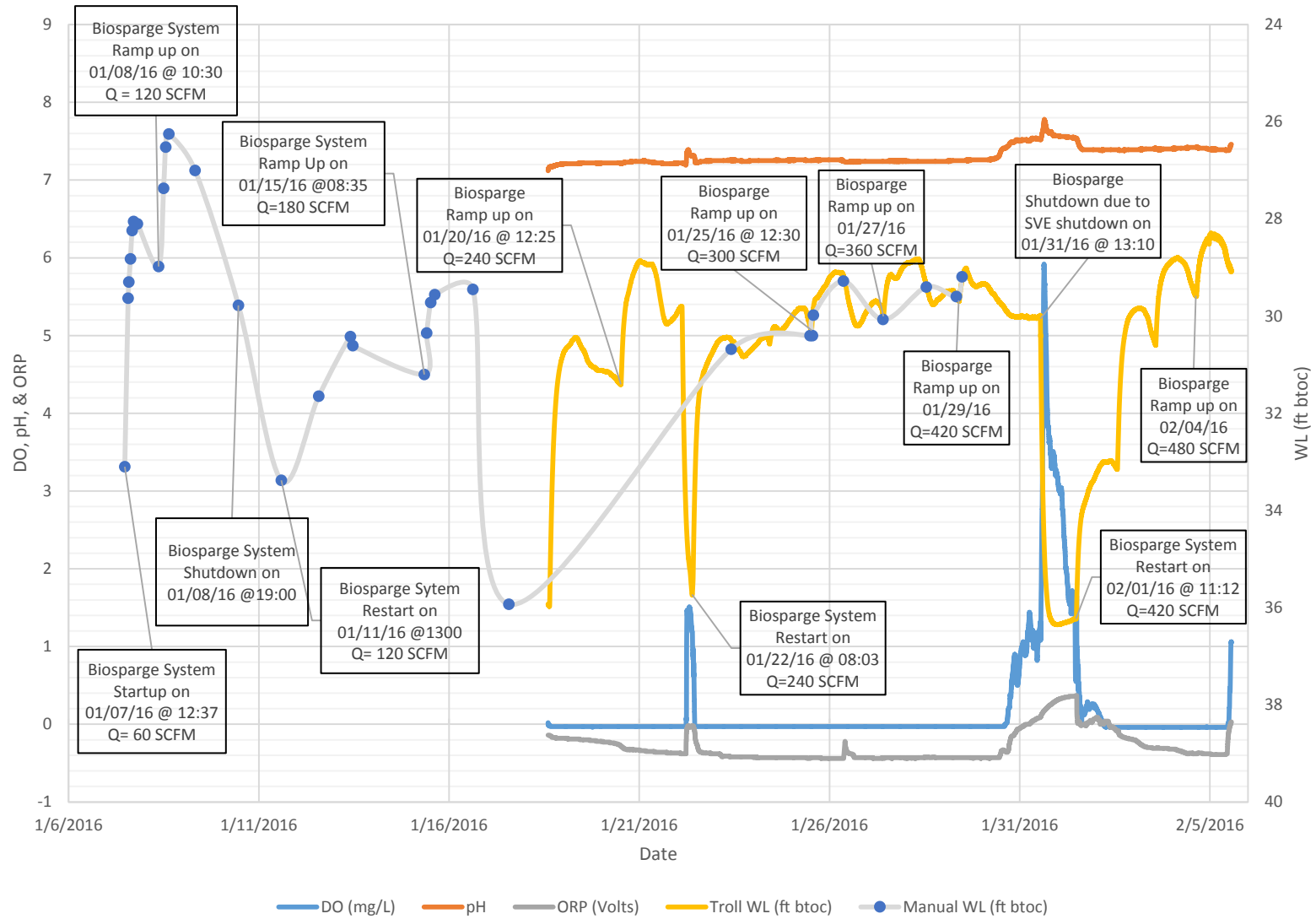




**Figure 6**  
**Typical Nested Soil Vapor**  
**Monitoring Probe Completion Diagram**  
*SFPP Norwalk Pump Station*  
*Norwalk, California*



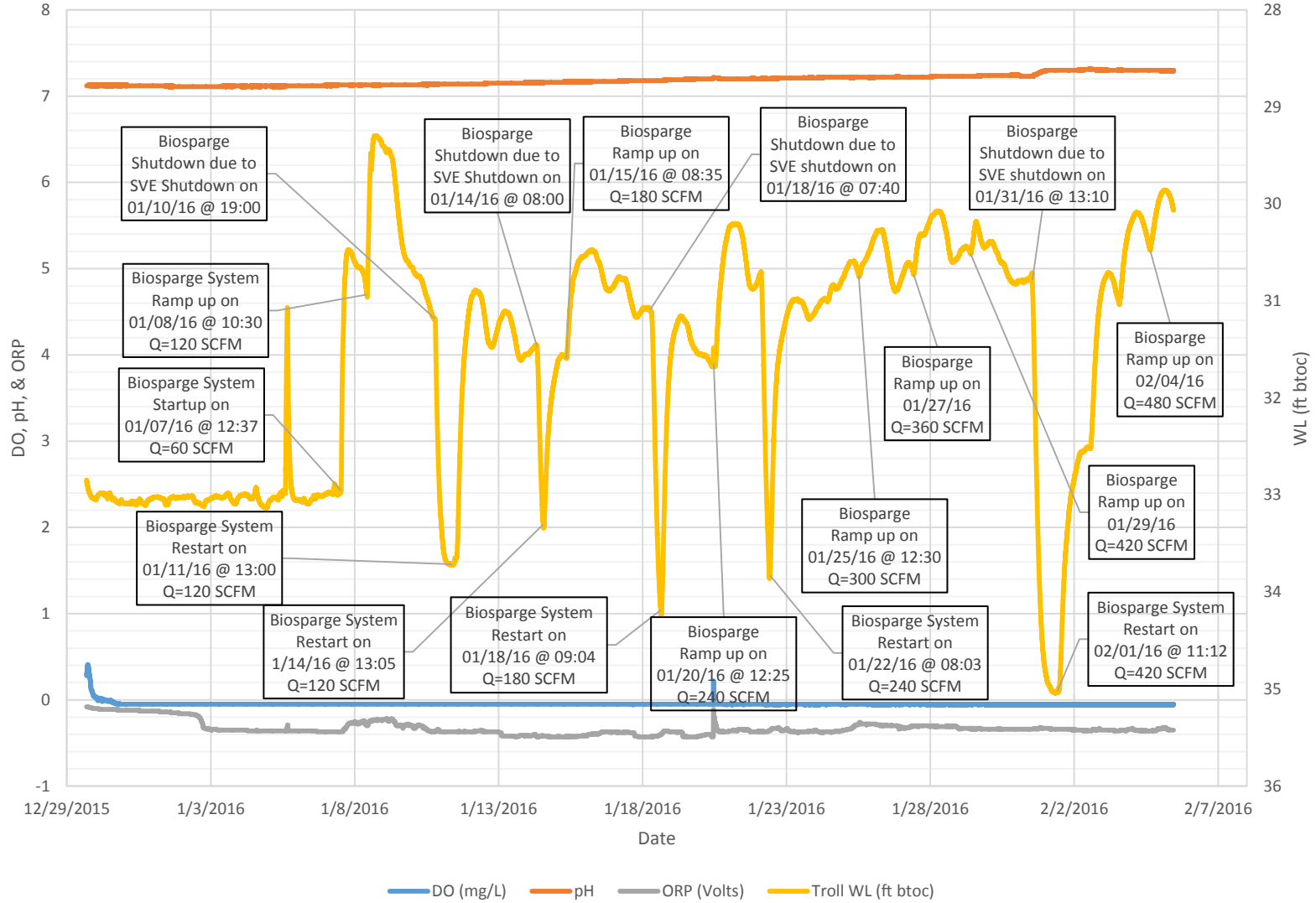
# GMW-1



**Figure 7**  
**DO, pH, ORP and Water Level Plot for GMW-1**  
*SFPP Norwalk Pump Station*  
*Norwalk, California*



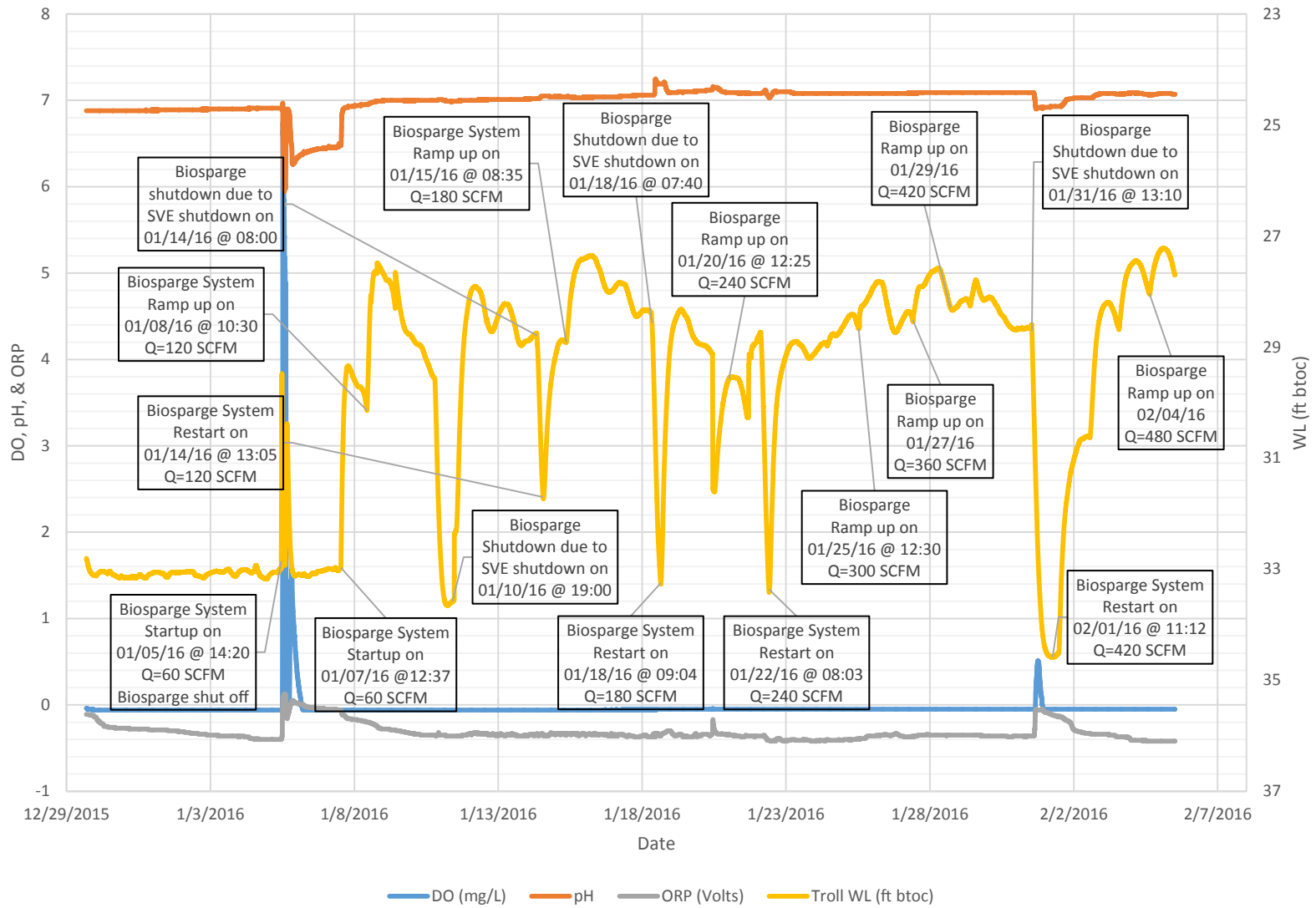
# GMW-26



**Figure 8**  
**DO, pH, ORP and Water Level Plot for GMW-26**  
*SFPP Norwalk Pump Station*  
*Norwalk, California*



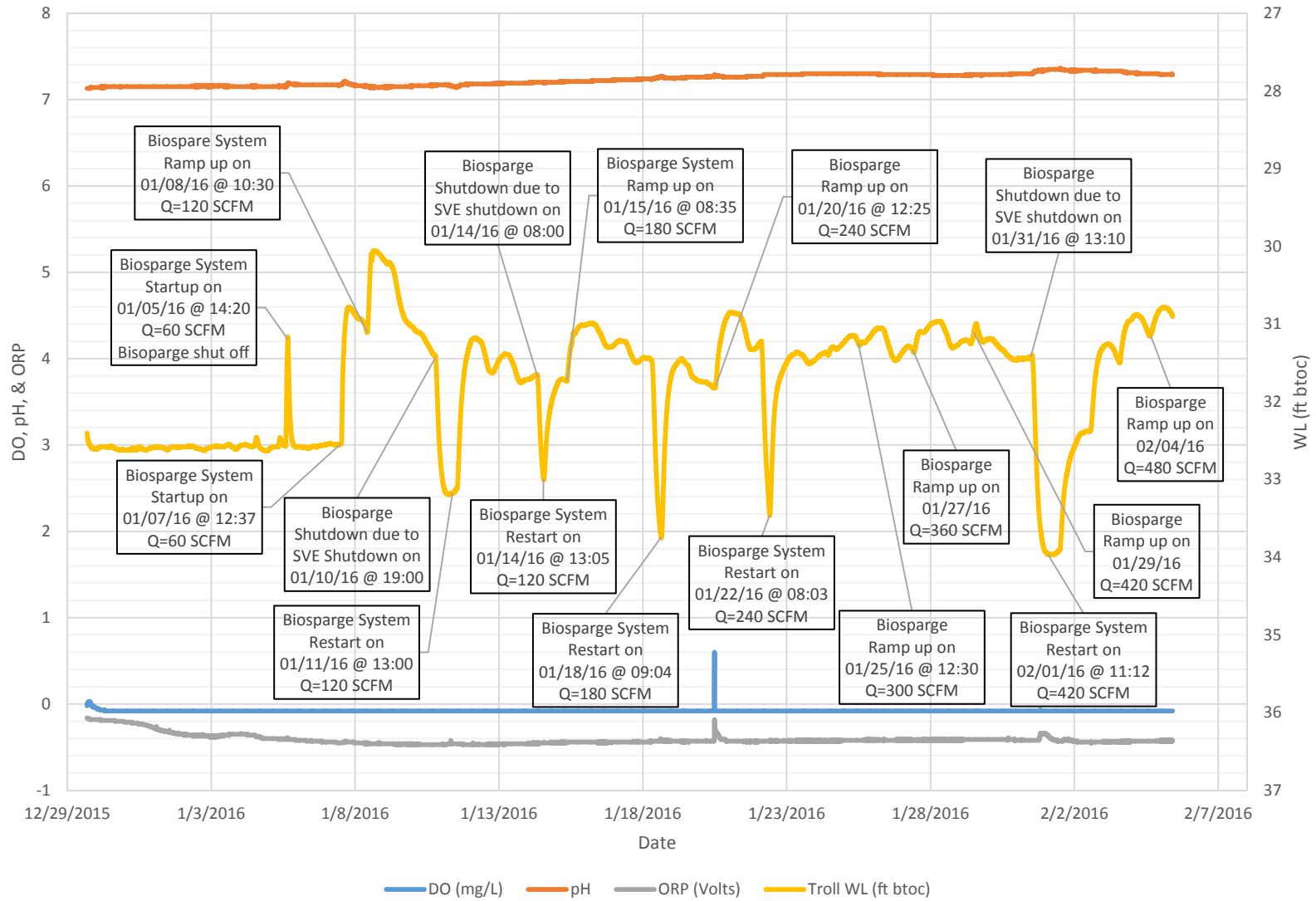
GMW-28



**Figure 9**  
**DO, pH, ORP and Water Level Plot for GMW-28**  
 SFPP Norwalk Pump Station  
 Norwalk, California



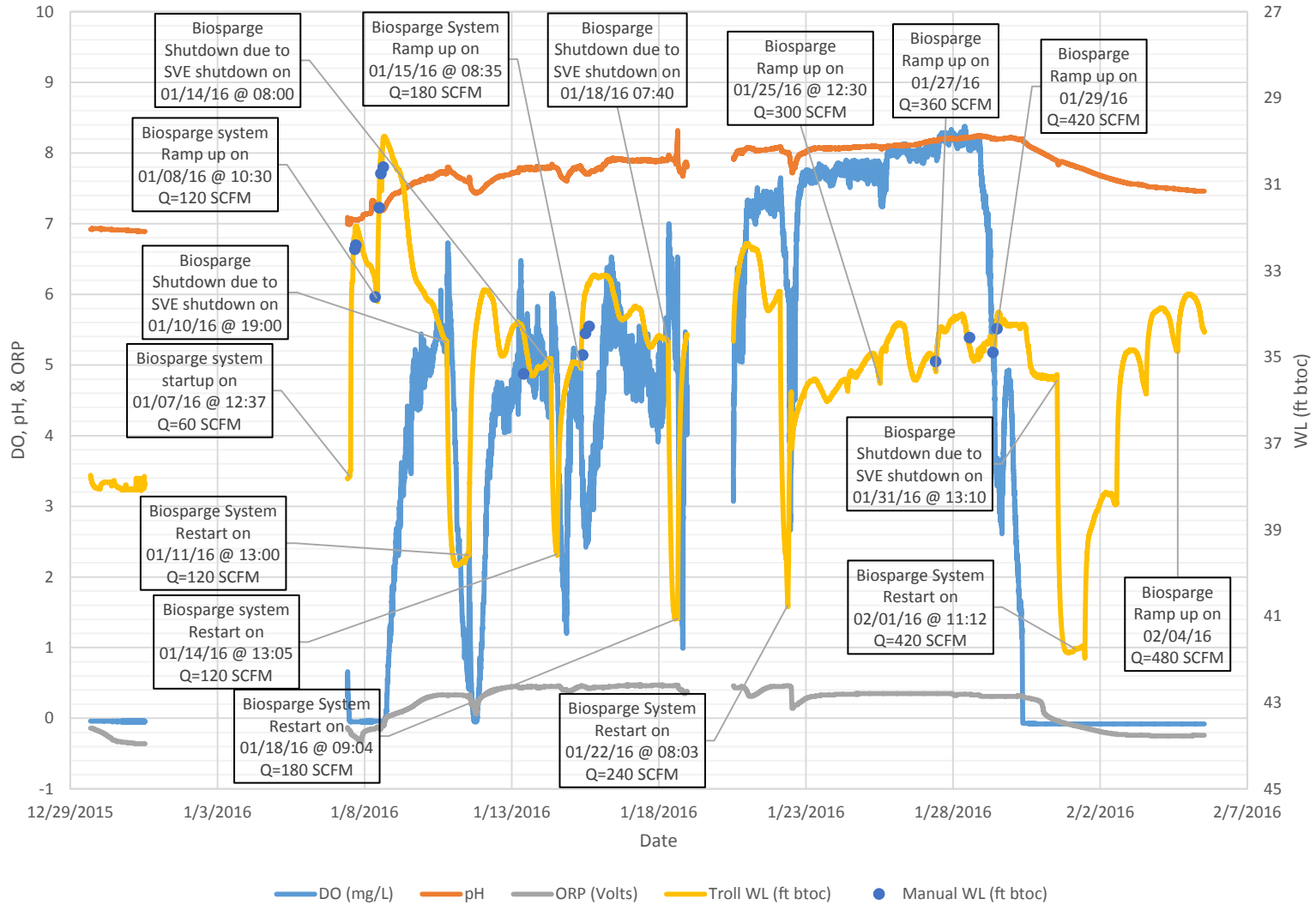
# GMW-O-10



**Figure 10**  
**DO, pH, ORP and Water Level Plot for GMW-O-10**  
 SFPP Norwalk Pump Station  
 Norwalk, California



### MW-SF-5

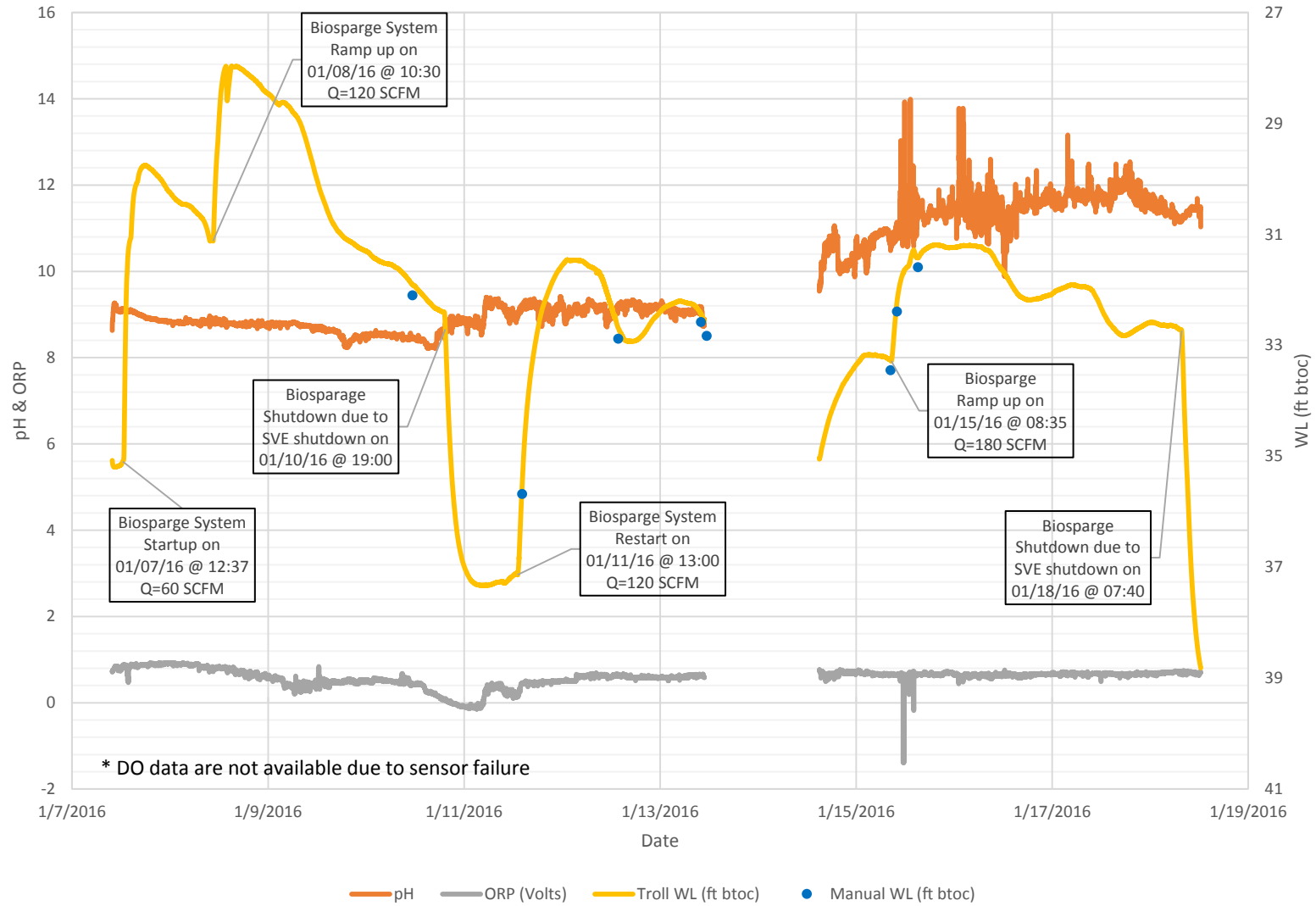


**Figure 11**  
**DO, pH, ORP and Water Level Plot for MW-SF-5**  
*SFPP Norwalk Pump Station*  
*Norwalk, California*





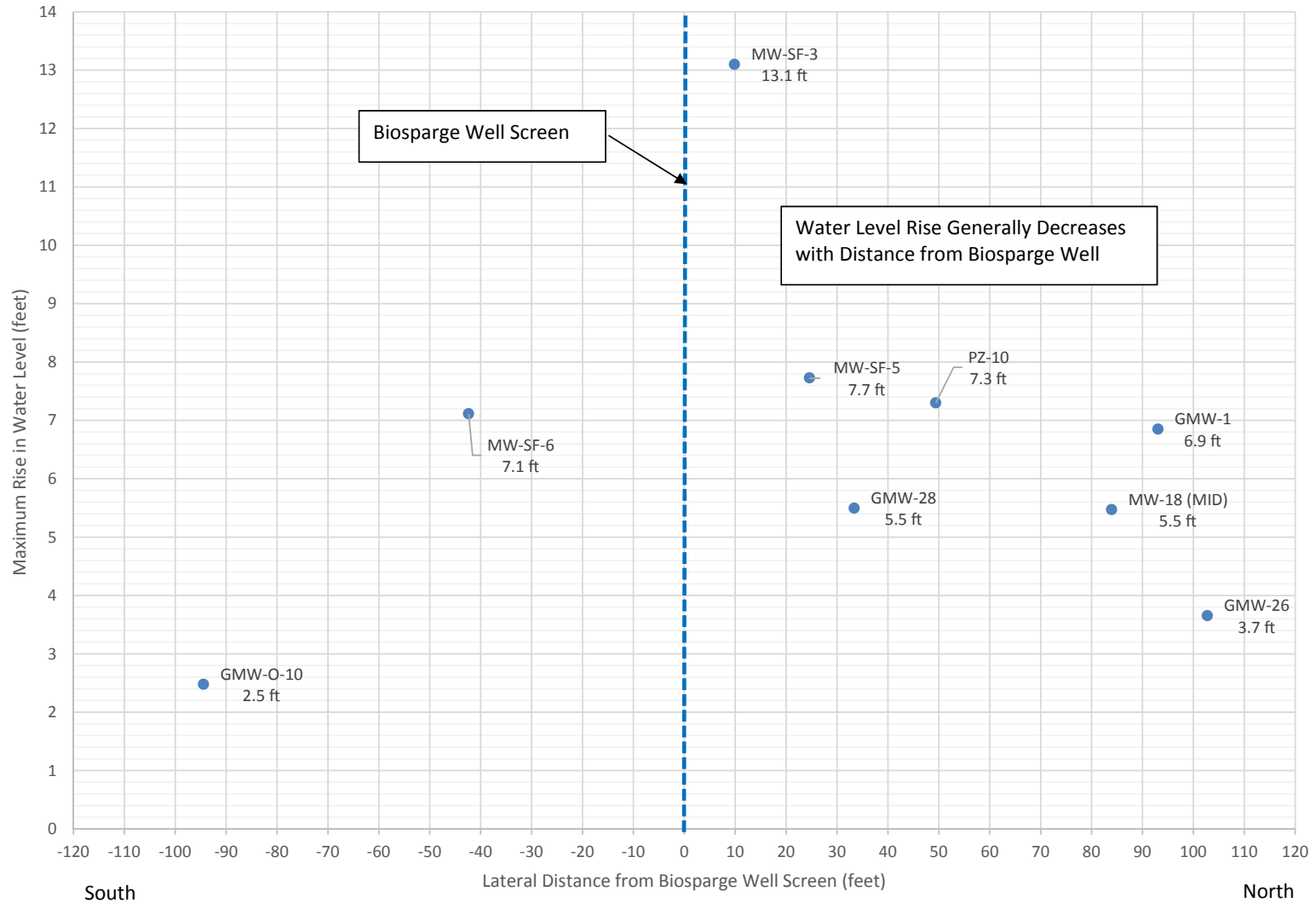
MW-SF-6



**Figure 12**  
**DO, pH, ORP and Water Level Plot for MW-SF-6**  
 SFPP Norwalk Pump Station  
 Norwalk, California



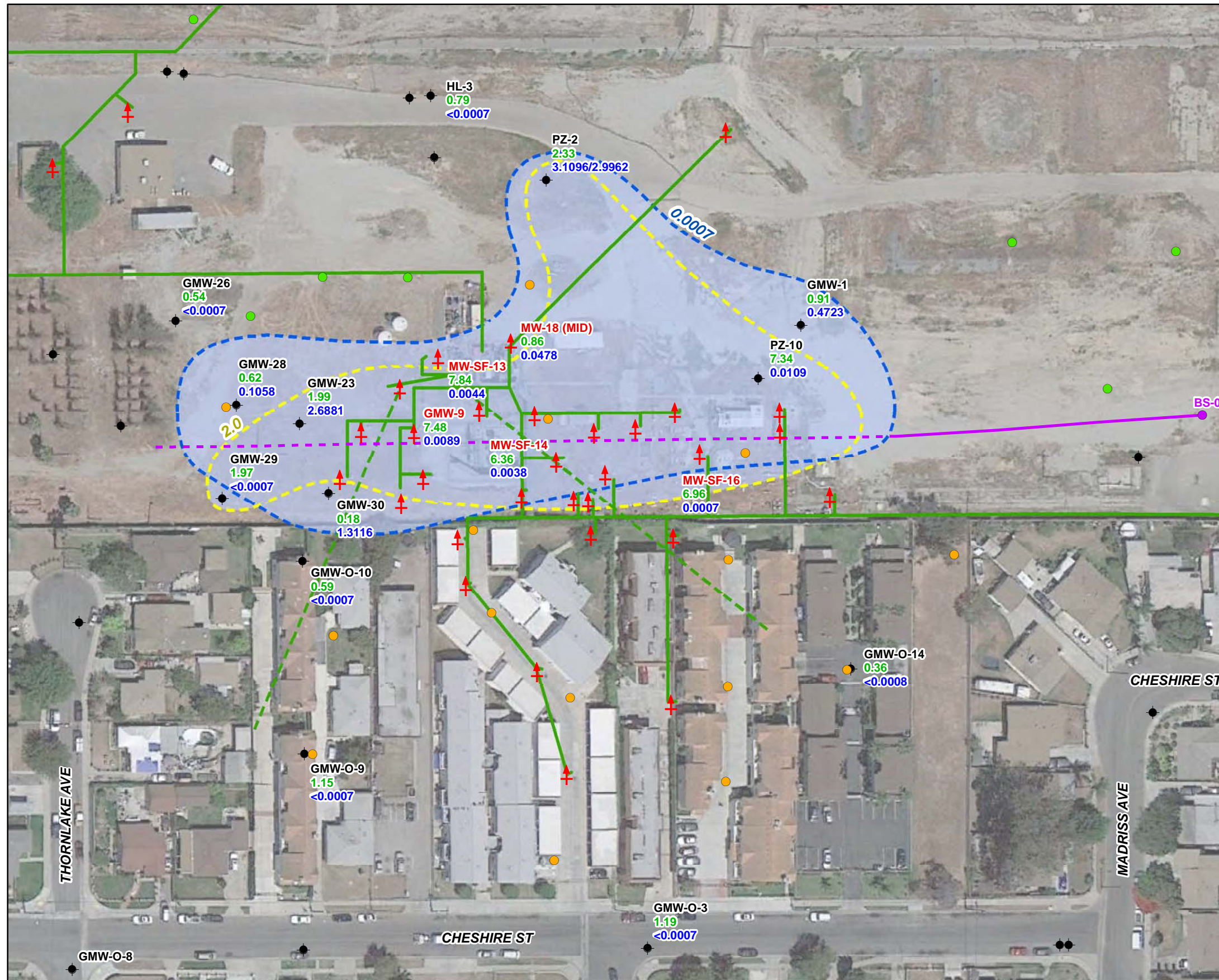
### Rise in Water Levels with Distance from Biosparge Well Screen - 120 scfm



**Figure 13**  
**Rise in Water Levels with Distance from Biosparge Well Screen – 120 scfm**  
SFPP Norwalk Pump Station  
Norwalk, California







**Legend**

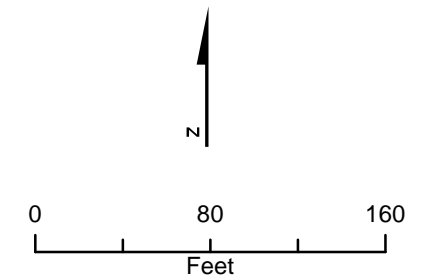
- Horizontal Biosparge Well Entry Point
- Destroyed Well
- Soil Vapor Monitoring Probes
- Monitoring Well
- † Remediation Well
- Horizontal Biosparge Well (dashed line depicts approximate lateral extent of well screen)
- KMEP Remediation Piping Layout (above ground and below ground)
- Horizontal Vapor Extraction Well Piping
- Dissolved Oxygen Isoconcentration (mg/L)
- SF-6 Isoconcentration (µg/L)
- Combined Extent of SF-6 and DO Concentrations

**Well Data**

**GMW-1** - Well ID  
**0.91** - DO Result (mg/L)  
**0.4723** - SF-6 Result (µg/L)

**Notes:**

- SF-6 samples and DO data collected on February 17 and 18, 2016.
- SF-6 samples analyzed by CH2M Applied Sciences Laboratory.

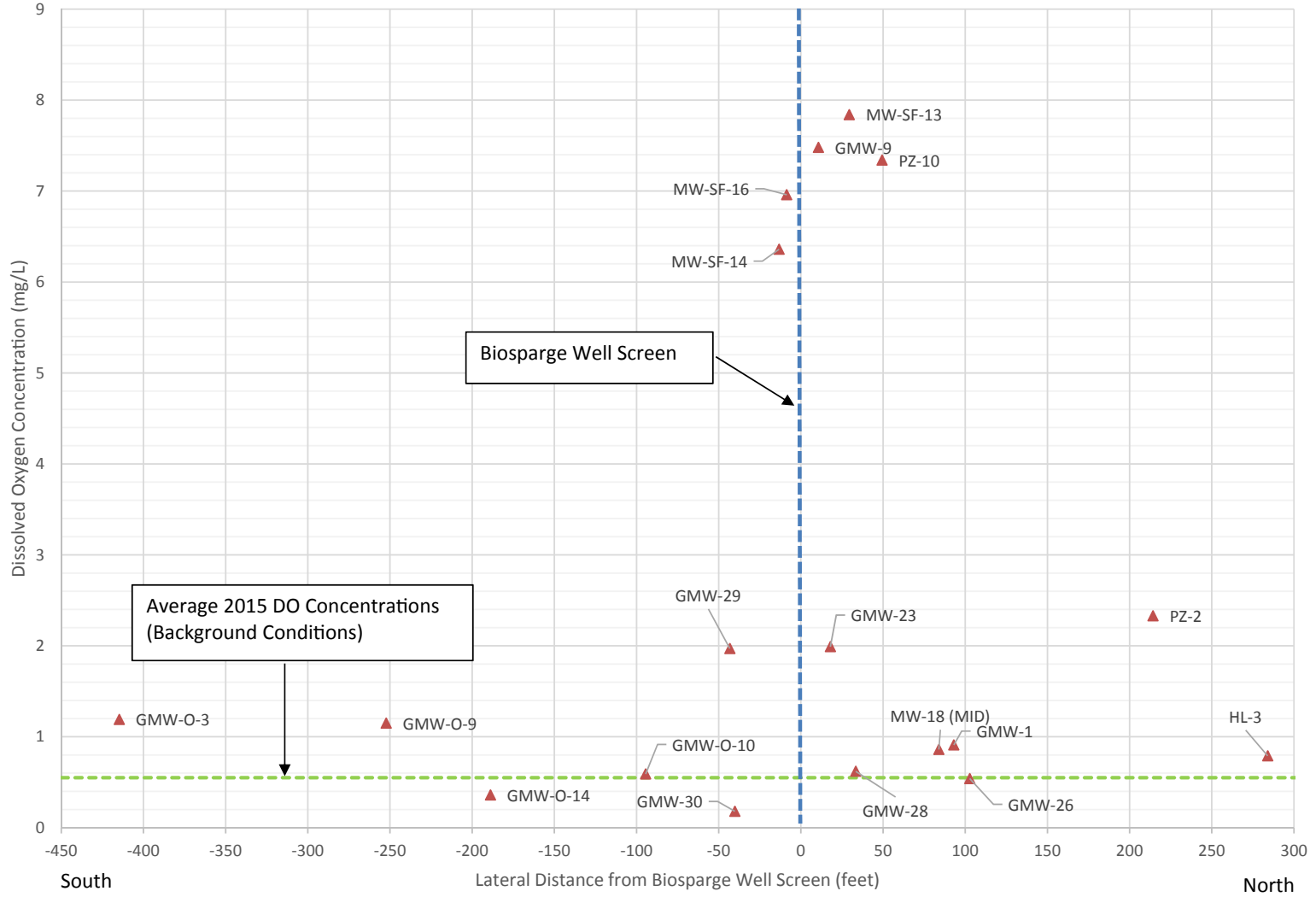


**Figure 14**  
**Dissolved Oxygen and SF6 Isoconcentrations**  
**in Groundwater**  
 SFPP Norwalk Pump Station  
 Norwalk, California



Imagery Source: Google Earth April 17, 2013.

Dissolved Oxygen Concentration with Distance from Biosparge Well Screen - 480 scfm

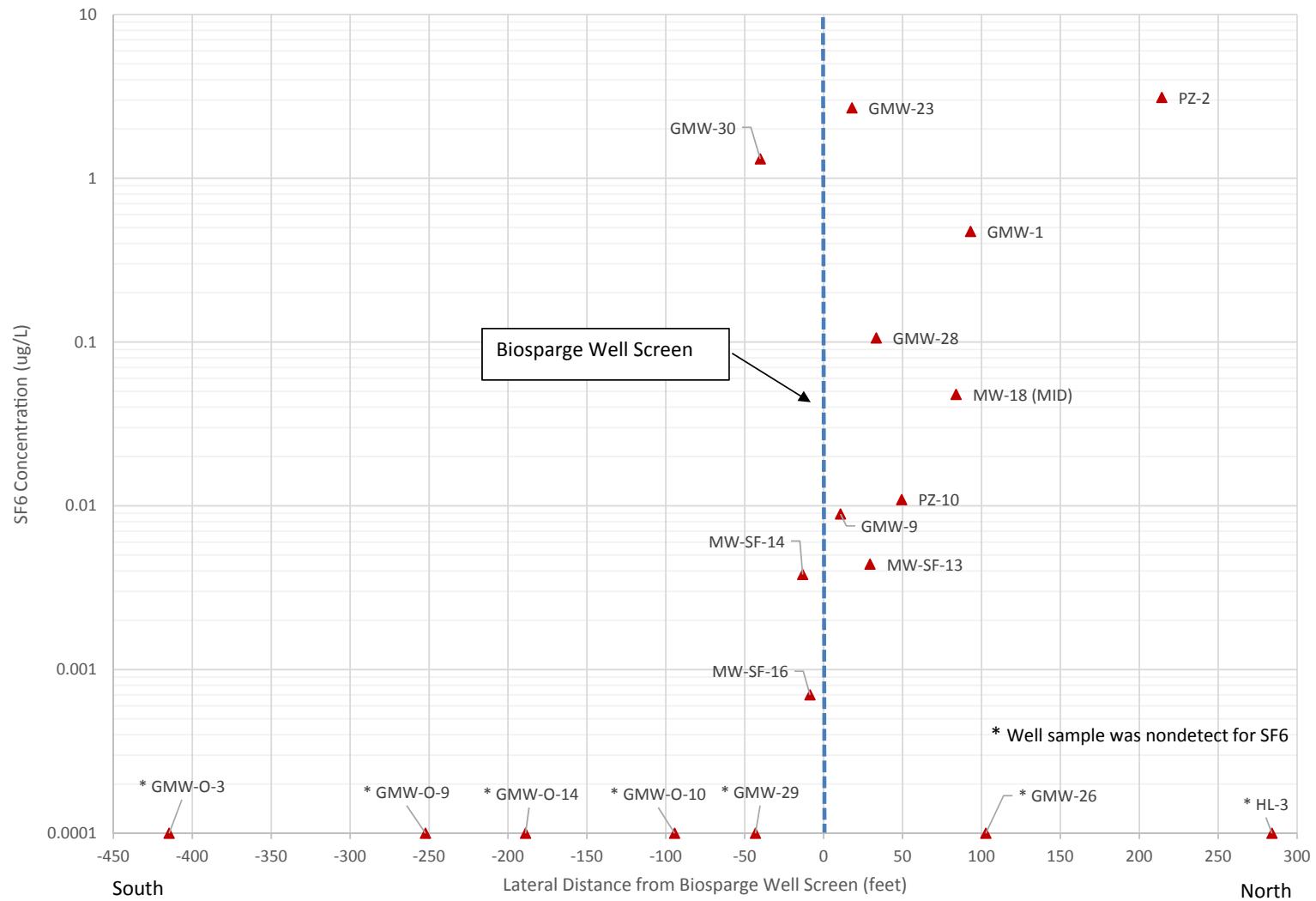


**Figure 15**  
**Dissolved Oxygen Concentration with Distance**  
**from Biosparge Well Screen – 480 scfm**  
 SFPP Norwalk Pump Station  
 Norwalk, California





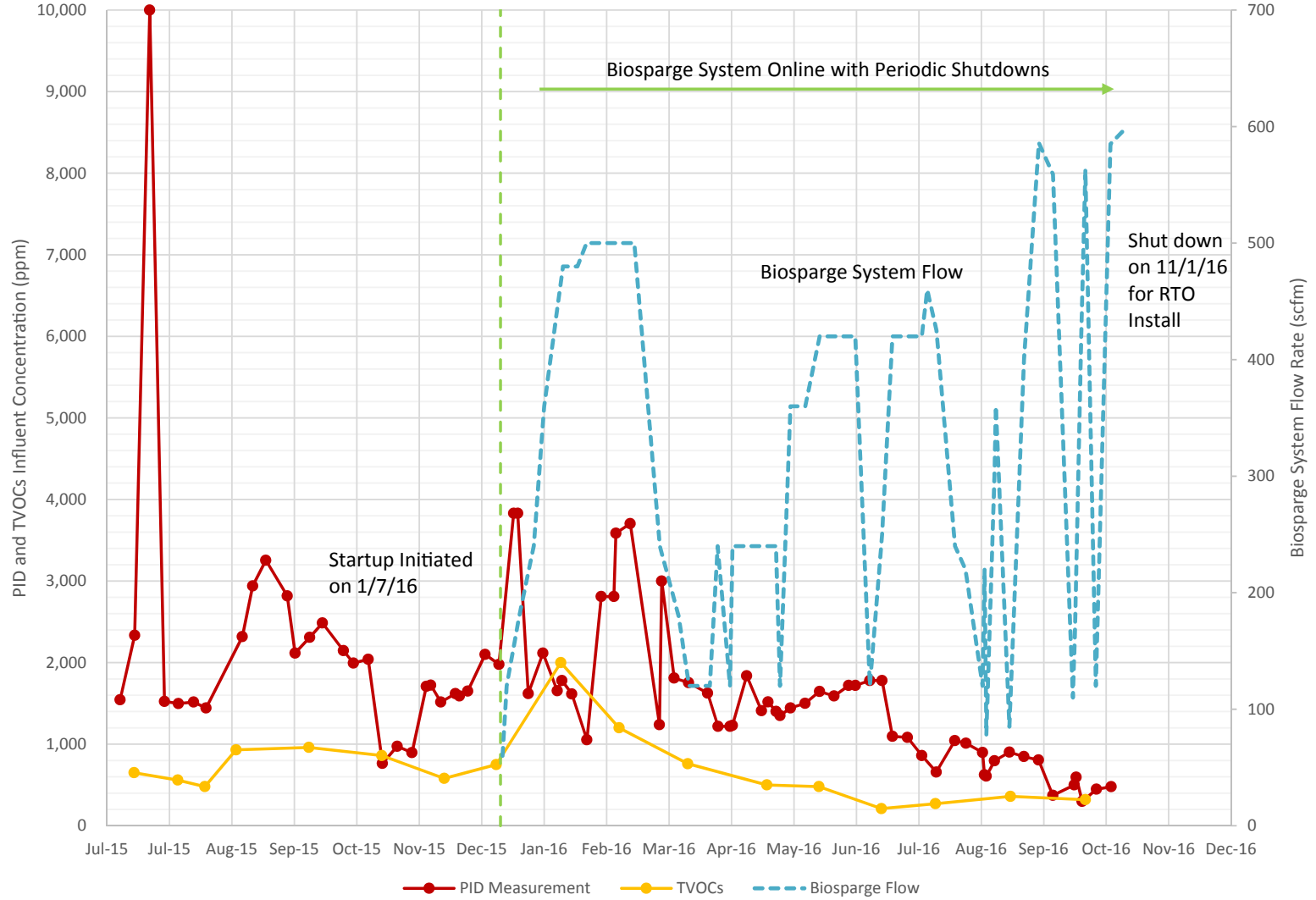
SF6 Concentration with Distance from Biosparge Well Screen - 480 scfm



**Figure 16**  
**SF<sub>6</sub> Concentration with Distance from Biosparge Well Screen – 480 scfm**  
 SFPP Norwalk Pump Station  
 Norwalk, California



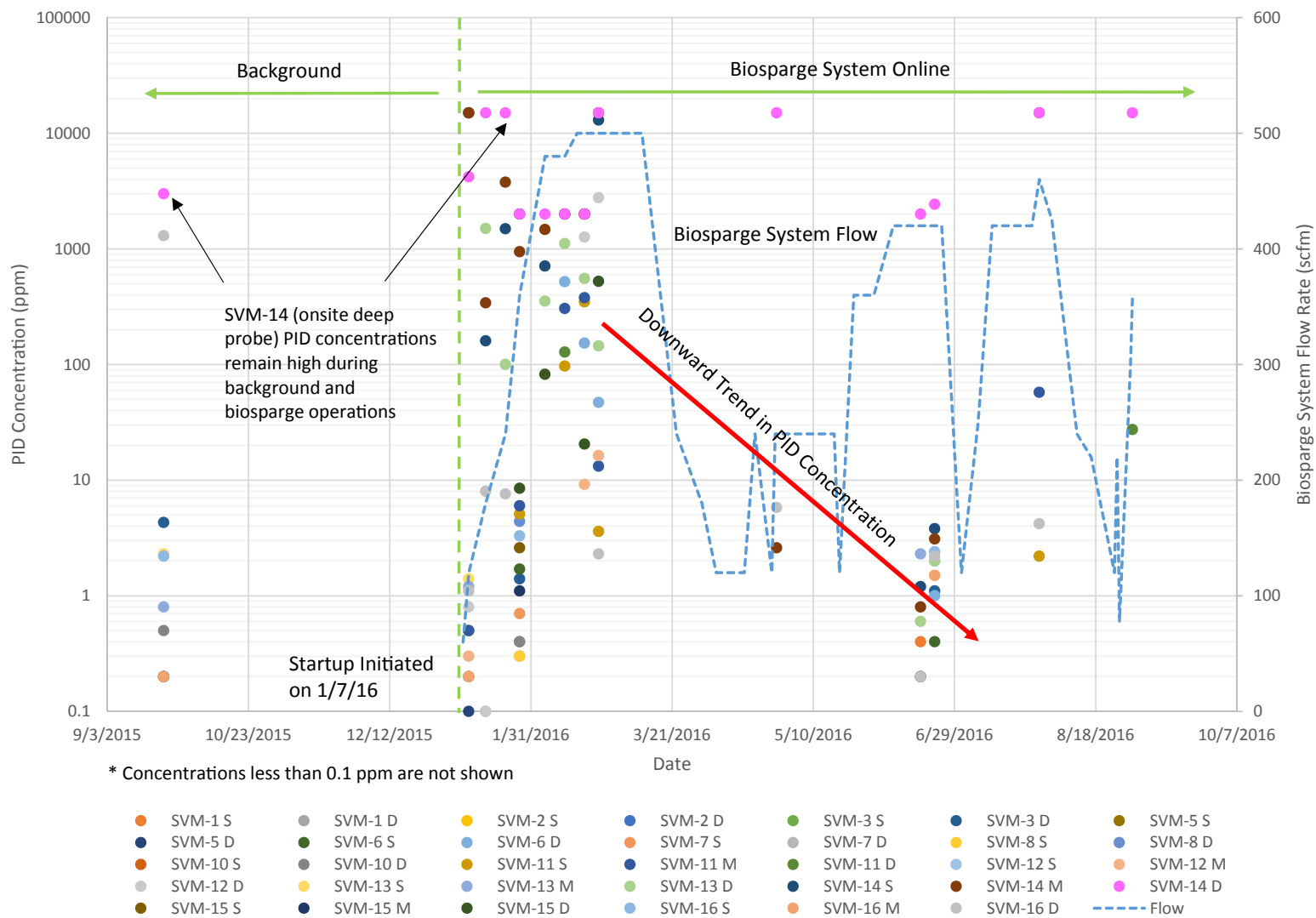
### PID and Total VOCs Influent Concentrations for SVE System



**Figure 17**  
**PID and Total VOCs Influent Concentrations for SVE System**  
*SFPP Norwalk Pump Station*  
*Norwalk, California*



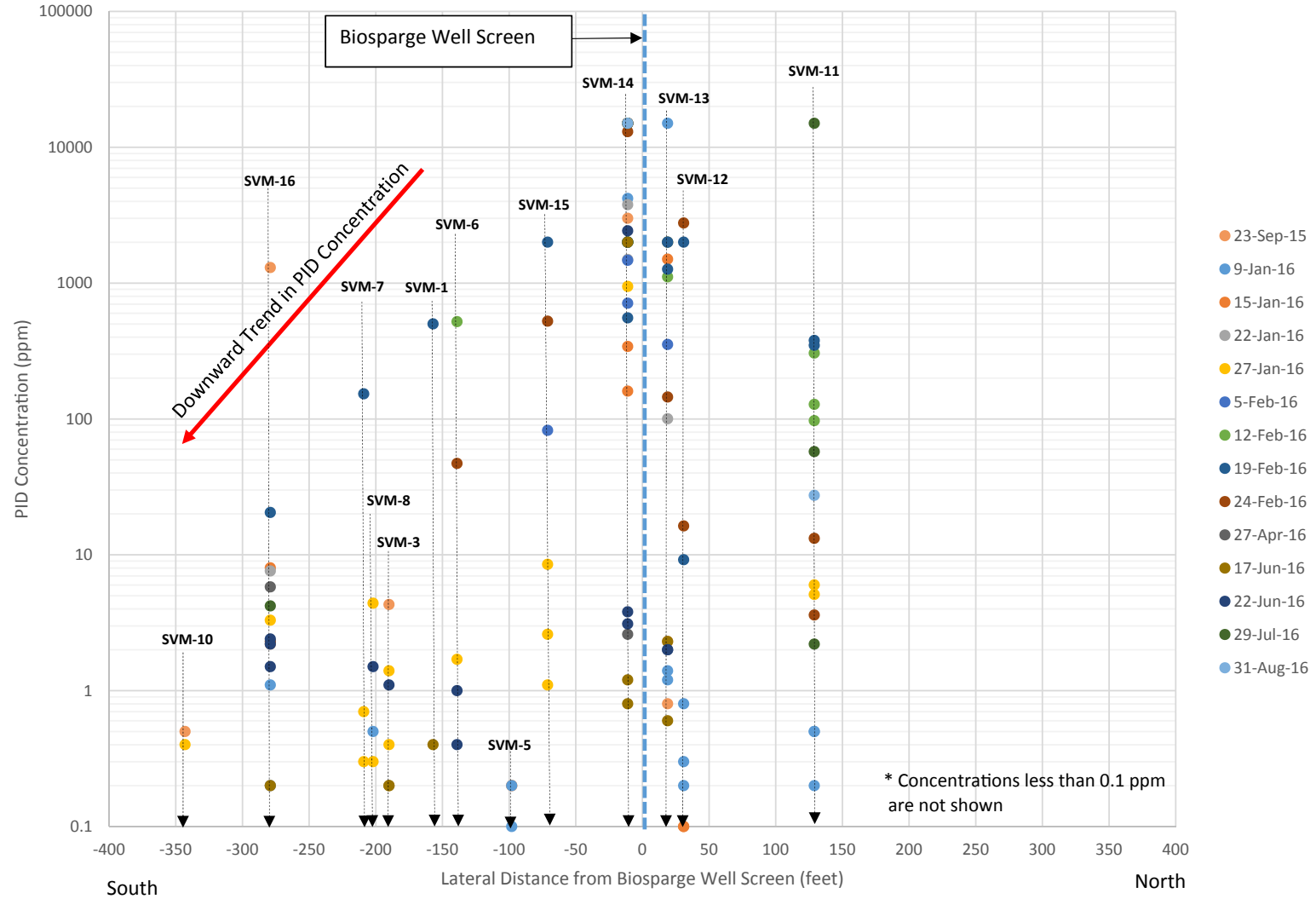
### Soil Vapor Concentrations - All Probes



**Figure 18**  
**Soil Vapor Concentrations – All Probes**  
*SFPP Norwalk Pump Station*  
*Norwalk, California*



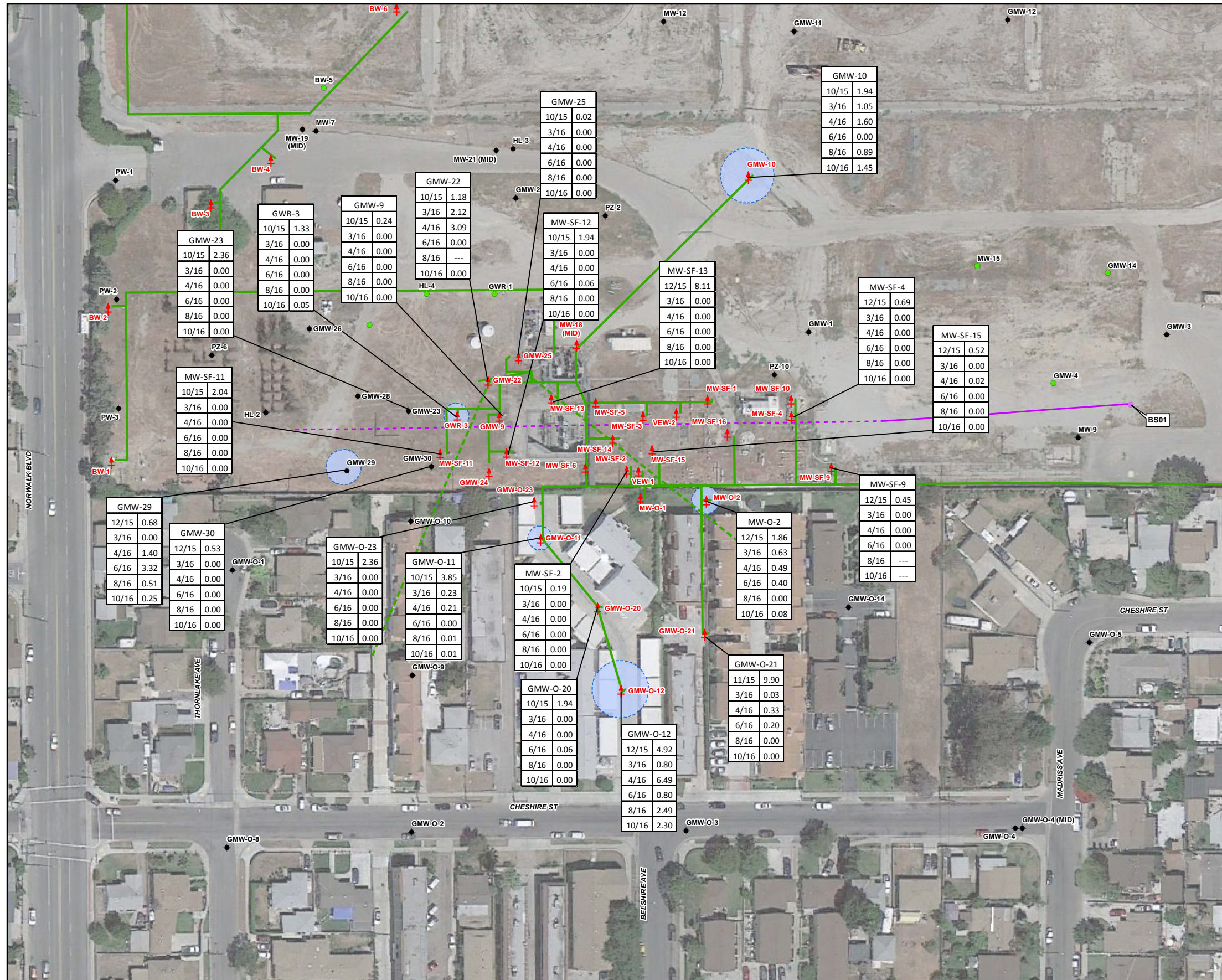
### Soil Vapor PID Concentration with Distance from Biosparge Well Screen - All Probes



**Figure 19**  
**Soil Vapor PID Concentration with Distance**  
**from Biosparge Well Screen – All Probes**  
*SFPP Norwalk Pump Station*  
*Norwalk, California*







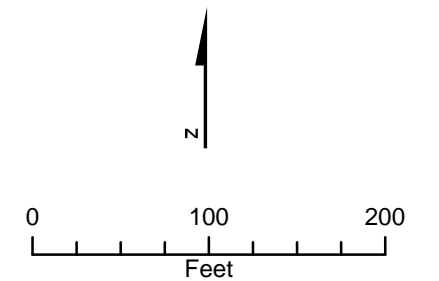
**Legend**

- Monitoring well used for sample collection and/or water level measurement
- ↑ Vapor extraction, groundwater extraction, total fluids, or free product extraction well used for site remediation
- Decommissioned Well
- Estimated extent of measurable light nonaqueous phase liquid (LNAPL, free product) on groundwater, October 2016; dashed where inferred
- Horizontal Biosparge Well (dashed line depicts approximate lateral extent of well screen)
- KMEP Remediation Piping Layout (above ground and below ground)
- Horizontal Vapor Extraction Well Piping

MW-SF-15	
12/15	0.52
3/16	0.00
4/16	0.02
6/16	0.00
8/16	0.00
10/16	0.00

Measured LNAPL thickness in feet for six most recent gauging events.

Imagery Source:  
Google Earth April 17, 2013.



**Figure 20**  
Distribution of Measurable LNAPL in  
Uppermost Groundwater Zone  
SFPP Norwalk Pump Station  
Norwalk, California

