DRAFT
2015 ANNUAL PERFORMANCE MONITORING REPORT

ENHANCED IN SITU BIOREMEDIATION
INSTALLATION RESTORATION PROGRAM SITE 70
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

Naval Facilities Engineering Command Southwest
Contracts Department
1220 Pacific Highway, Building 127, Room 112
San Diego, California 92132-5190

CONTRACT NO. N62473-12-D-2004
DELIVERY ORDER NO. 0007

DCN: ECIN-2004-0007-0007

June 2016

Prepared by:

ECC-INSIGHT LLC
1746 Cole Boulevard, Suite 350
Lakewood, CO 80401

This page intentionally left blank

Naval Facilities Engineering Command Southwest
Contracts Department
1220 Pacific Highway, Building 127, Room 112
San Diego, California 92132-5190

CONTRACT NO. N62473-12-D-2004
DELIVERY ORDER NO. 0007

DRAFT
2015 ANNUAL PERFORMANCE MONITORING REPORT
June 2016

ENHANCED IN SITU BIOREMEDIATION
INSTALLATION RESTORATION PROGRAM SITE 70
NAVAL WEAPONS STATION SEAL BEACH
SEAL BEACH, CALIFORNIA

DCN: ECIN-2004-0007-0007

Prepared by:

ECC-INSIGHT LLC

1746 Cole Boulevard, Suite 350
Lakewood, CO 80401

Marco Mendoza, PG
Geologist

Anthony Ford
Project Manager

PROFESSIONAL GEOLOGIST
MARCO A. MENDOZA
No. 8363
STATE OF CALIFORNIA
Expires Jan. 31, 20 17

This page intentionally left blank

EXECUTIVE SUMMARY

This 2015 Annual Performance Monitoring Report (PMR) presents the results of groundwater sampling completed to evaluate the effectiveness of the enhanced in situ bioremediation (EISB) at Installation Restoration Program (IRP) Site 70, Naval Weapons Station (NAVWPNSTA) Seal Beach, Seal Beach, California (Figure 1-1). The EISB is being implemented to treat elevated levels of trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC) in groundwater. The 2015 annual groundwater sampling event was completed in December 2015. A letter report presenting the results of the July 2015 semiannual monitoring event was previously provided to the regulatory agencies for review and is included as Attachment 1 of this report. The semiannual results were evaluated with the more recent annual data in the context of assessing the overall performance of the EISB remedy. Both the annual and semiannual data was used in the assessment of long-term trending of site data for this annual report.

The remediation at IRP Site 70 is being conducted under the IRP. NAVWPNSTA Seal Beach is an active federal facility and is not on the National Priorities List. The lead federal agency for this Comprehensive Environmental Response, Compensation, and Liability Act cleanup action is the Department of the Navy. The California Department of Toxic Substances Control (DTSC) and the California Regional Water Quality Control Board Santa Ana Region are the state regulatory agencies providing support and oversight.

To remediate the elevated levels of TCE, cis-1,2-DCE, and VC in groundwater, emulsified vegetable oil (EVO) and *Dehalococcoides* (Dhc) bacteria (in the form of the dechlorinating microbial culture [KB-1®] culture) were initially injected into all injection wells in the contaminant source area (Source Area Treatment Grid [SATG]) and six downgradient biobarriers, including the Source Area Biobarrier (SAB), the First Sand Biobarriers (FSB)-1 and FSB-2, the Shell Horizon Biobarriers (SHB)-1 and SHB-3, and the Second Sand Biobarrier (SSB)-1 between 2008 and 2010. Since that initial round of injection, one additional round of injection (EVO only) was completed in select wells at six of the seven biobarriers. Additional EVO was not injected at SHB-1 because it was determined that conditions for reductive dechlorination at that biobarrier were satisfactory. The SATG and the six downgradient biobarriers treat contaminants in four hydrostratigraphic units, including the Upper Fines, First Sand, Shell Horizon, and Second Sand.

The following field activities were completed during the 2015 annual performance monitoring event in December 2015:

- Depth to groundwater was measured in each hydrostratigraphic unit.
- Groundwater samples were collected from 79 wells. Samples were analyzed for volatile organic compounds (VOCs), dissolved hydrocarbon gases, volatile fatty acids (VFAs), anions, total dissolved solids, alkalinity, total organic carbon (TOC), dissolved metals, sulfide, and Gene-Trac Dhc with vinyl chloride reductase A gene (*vcr*A). In addition, field parameters, including pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), and specific conductance of groundwater, were measured.
- 11 of 12 soil vapor probes located in the contaminant source area were sampled for methane, hydrogen sulfide, and VOCs. The ambient air both inside and outside of

buildings, and utility corridors near the contaminant source area was monitored for methane and VOCs for health and safety purposes.

In addition, the following field activities were completed during the 2015 semiannual performance monitoring event in July 2015:

- Depth to groundwater was measured in each hydrostratigraphic unit.
- Groundwater samples were collected from 35 wells. Samples were analyzed for VOCs, dissolved hydrocarbon gases, VFAs, anions, total dissolved solids, alkalinity, and TOC. In addition, field parameters, including pH, DO, ORP, and specific conductance of groundwater, were measured.

Review of the data collected during 2015 indicate that, overall, reductive dechlorination is occurring at the site. The following summarize the results of the events:

- Groundwater flow directions and gradients in each hydrostratigraphic unit are consistent with historical data, with the overall groundwater flow to the southeast, with the exception of the Upper Fines Unit which flows locally at the site to the northwest, with relatively low gradients.
- Data obtained from the annual performance monitoring event in 2013 indicated that while conditions along portions of each biobarrier were still effectively enhancing the reductive dechlorination of TCE, other portions of the biobarriers contained the electron donor TOC at concentrations below those considered necessary to support reductive dechlorination. Based on these results, additional EVO was injected into select wells at six of the seven biobarriers between September and December 2013. The results of the 2015 annual monitoring events indicate that reductive dechlorination is occurring. While the 2013 EVO injections had some noticeable positive impacts on oxidation-reduction (redox) conditions, the most recent (2015) TOC data indicate that only two of the 13 injection wells sampled this event have TOC above 50 milligrams per liter (mg/L).
- Compared to the last annual event in 2014, TCE concentrations across the site generally decreased or were relatively stable. The highest TCE concentrations remain in the Upper Fines Unit (2,200 micrograms per liter [µg/L] versus 2,800 µg/L in 2014) and the First Sand Unit (3,400 µg/L versus 3,400 µg/L in 2014).
- Compared to the last annual event in 2014, the cis-1,2-DCE concentrations in the Upper Fines Unit have remained stable. Relatively elevated concentrations of cis-1,2-DCE are still present in all of the hydrostratigraphic units, including the Upper Fines Unit (5,400 µg/L versus 790 µg/L in 2014), the First Sand Unit (1,000 µg/L versus 1,300 µg/L in 2014), the Shell Horizon Unit (1,200 µg/L versus 1,600 µg/L in 2014), and the Second Sand Unit (1,100 µg/L versus 1,500 µg/L in 2014).
- Compared to the last annual event in 2014, the VC concentrations in the Upper Fines Unit remained stable. Relatively elevated concentrations of VC are still present in all of the hydrostratigraphic units including the Upper Fines Unit (2,400 µg/L versus 3,700 µg/L in 2014), the First Sand Unit (790 µg/L versus 920 µg/L in 2014), the Shell Horizon Unit (290 µg/L versus 180 µg/L in 2014), and the Second Sand Unit (410 µg/L versus 310 µg/L in 2014).

- Data indicate that some of the highest concentrations of TCE are in the SATG near well MW-70-MNA01 (2,200 µg/L). Only TCE in well MW-70-PMW06B, located in the First Sand Unit immediately upgradient of the FSB-1, is higher (3,400 µg/L).
- Increasing cis-1,2-DCE trends in Shell Horizon Unit well MW-70-MNA14 and in Second Sand Unit well MW-70-MNA16, located approximately 100 feet downgradient of the furthest downgradient biobarrier (SHB-3), suggest that complete dechlorination did not occur in either biobarrier and cis-1,2-DCE contamination is continuing to migrate in this area.
- The elevated concentration of TCE reported in 2012 in well MW-70-43B (550 µg/L), located to the north of SSB-1, suggested that the plume was potentially migrating past this biobarrier. TCE concentrations at this well have significantly declined since their peak in 2012, and are now below the target cleanup goal (TCG).
- Low-to-trace levels of contamination were reported in a few of the point of compliance (POC) wells at four hydrostratigraphic units (Upper Fines, First Sand, Second Sand, and Deep Sand Units), suggesting that overall groundwater contamination at the site remains contained within the POC well boundary.
- Tetrachloroethylene (PCE) had previously been reported above the TCG in Second Sand Unit POC well MW-70-36 (12 µg/L in 2014, 24 µg/L in 2013). In 2015, it was reported below the TCG of 5 µg/L.
- Reductive dechlorination requires anaerobic conditions (DO levels below 0.5 mg/L, or at least not greater than 1 mg/L [generally considered anaerobic based on limitations of field instrumentation]). Within the injection wells in both the SATG and all of the downgradient biobarriers, the DO concentrations were equal to or below 1 mg/L in 6 of 13 wells, suggesting conditions within the areas of injection are becoming less anaerobic (Table 2-2). DO levels were greater than 1 mg/L in two monitoring wells, five MNA wells, and two PMW well (Table 2-2). While the aquifer remains generally anoxic, increasing DO levels have been observed since 2014.
- ORP is a measure of the reducing capacity of the aquifer. In order for Dhc to survive and grow, and for reductive dechlorination to proceed optimally, ORP levels should be -100 millivolts (mV) or lower. ORP levels in the injection wells in the SATG and in all of the downgradient biobarriers that were sampled were all below -100 mV (Table 2-2). ORP levels were also lower than -100 mV in all but one of the remaining wells sampled (Table 2-2) except POC wells. Overall, ORP levels indicate that reducing conditions are present in the aquifer.
- While the redox conditions are clearly supportive of reductive dechlorination, the indicators of adequate electron donor presence to support microbial activity (through assessment of TOC and VFAs, as described below) are less suggestive of widespread optimal conditions. Data indicate that optimal concentrations of the electron donor EVO (TOC above 50 mg/L [Section 2.5.2]) were present in only two of the 13 injection wells sampled. 11 of the 13 injection wells sampled have TOC below 50 mg/L. As expected, the TOC levels have generally decreased since the 2013 annual sampling which was completed just after the 2013 additional EVO injections. In addition, 26 performance monitoring wells were sampled for TOC, with approximately half of them located upgradient of the biobarriers and half located downgradient. Overall, the TOC

concentrations in these wells remained generally low and unchanged from the 2014 annual sampling event.

- VFAs (which are produced during the metabolic degradation of EVO) were detected in two of the seven treatment areas in 2012, and detected in six of the seven treatment areas (all except the SHB-1) in 2013. In 2015, VFAs were detected in three of the seven treatment areas. VFAs were detected in two of the 13 injection wells sampled and in two of the monitoring wells sampled.
- The depletion of sulfate, an alternate electron acceptor, and the presence or increase in methane, a metabolic by-product of anaerobic microbial biodegradation, can indicate that anaerobic microbial respiration is occurring. During the 2015 annual event, sulfate was relatively stable in a majority of the wells sampled compared to the 2014 annual event, with sulfate in some wells slightly reduced, and sulfate in even fewer wells somewhat higher. Methane concentrations at the site generally increased after the initial treatment. Although methane concentrations have generally remained elevated, a general decrease in methane concentrations has been observed over the past year with about 70 percent of wells sampled in 2015 reporting a decrease in methane concentrations since 2014. Overall, the elevated levels of methane in the aquifer suggest that anaerobic microbial respiration is occurring.
- Dhc concentrations in two of the 13 injection wells sampled were above the desired concentration of 10^7 gene copies/liter (L), and *vcr*A concentrations in nine of the 13 injection wells sampled were above the desired concentration of 10^5 gene copies/L. In addition to the 13 injection wells, 51 monitoring wells were sampled for Dhc, with 38 of those 51 samples receiving the additional vcrA analysis. Approximately half of these monitoring wells are located upgradient of the biobarriers and half located downgradient. One of the 51 samples had Dhc at levels above the desired concentration of 10^7 gene copies/L and 14 of the 38 samples had *vcr*A at levels above the desired concentration of 10^5 gene copies/L.
- Methane in soil gas was detected in all samples between 220 parts per million by volume (ppm_V) and 520,000 ppm_V (Figure 2-34). The lower explosive limit (LEL) for methane in air is 50,000 ppm_V and the upper explosive limit (UEL) in air is 150,000 ppm_V. Methane was reported above its LEL at five locations, including SV-70-02, SV-70-05, SV-70-06, SV-70-07, and SV-70-10 (Figure 2-34). At three of these locations the UEL was also exceeded. Compared to the 2014 soil vapor sampling event, 2015 results were mixed with approximately half of the probe locations showing an increase in methane concentrations. The highest concentration, 520,000 ppm_V, was detected at probe SV-70-05, located near the south western edge of the SATG (Figure 2-34). The presence of elevated levels of methane gas in subsurface soils suggests that microbial respiration is occurring. It is noted that methane gas was not detected inside the buildings surveyed or in the outdoor areas/utility corridors.
- Six VOC, benzene, chloroform, cis-1,2-DCE, PCE, TCE and VC, were detected in soil gas samples at concentrations well above their respective environmental screening levels and California Human Health Screening Level (California EPA, 2005). It is noted that VOCs were not detected inside the buildings surveyed or in the outdoor areas/utility corridors. Benzene is not a contaminant of concern (COC) VOC and its detection in soil vapor samples may be indicative of off-site petroleum contamination. In review of the

State Water Resources Control Board GeoTracker web site, there are three Leaking Underground Storage Tank (LUST) Cleanup sites nearby. One of these LUST cleanup status is still open (with petroleum contamination, including benzene), located directly upgradient and off-site of IRP Site 70 which may be potential source of the benzene.

Data collected during 2015 also indicate that some areas of the contaminant plumes are in locations that cannot be readily treated with the existing SATG and biobarriers. It is suggested that additional investigation be considered in these areas. Based on the results of the 2015 monitoring events, the following recommendations are made:

- As noted in the 2014 annual PMR, some of the highest concentrations of TCE at the site are located in monitoring wells situated east of the SATG injection well network at wells MW-70-MNA01 (2,200 µg/L) and MW-70-27 (85 µg/L). No information is available on the contaminant plume between these wells. The 2014 annual PMR recommended that additional site investigation be considered in this area to better identify the nature and extent of contamination and to determine whether additional injection wells should be considered. It was recommended that the investigation be completed with Site Characterization and Analysis Penetrometer System or a similar technology in which a probe is hydraulically driven into the subsurface to identify subsurface stratigraphy and the presence of contamination. Samples of soil and groundwater can also be collected through the probe for additional analyses. The data gaps include: a) the eastern side of the SATG source area (between wells MW-70-MNA-01 and MW-70-27, and east of well MW-70-MNA-01); b) the northern extent of the SATG source area (north of well MW-70-MNA-01). Based on the 2015 data, it is recommended that additional characterization be implemented in this area as outlined in the Letter Work Plan submitted in October 2015 (ECC-Insight 2015c).
- Elevated concentrations of TCE approaching or exceeding the 200 µg/L criterion for active treatment were reported to the north of SSB-1 between 2011 and 2014 at MW-70-43B, suggesting that a portion of the contaminant plume was migrating past this biobarrier. In 2012 for example, TCE was detected in well MW-70-43B at 550 µg/L. TCE concentrations have declined at this well since their peak in 2012, and, during the 2015 annual event, the TCE concentration in well MW-70-43B had decreased to below the TCG. However, this area continues to show high concentrations of cis-1,2-DCE. For example, a cis-1,2-DCE concentration of 830 µg/L was reported at well MW-70-14 for 2015. While it appears that aquifer biogeochemistry favors the reduction of TCE to DCE, significant reductions in DCE concentrations and concomitant VC generation has not yet been observed. Because active injection is not being conducted in this portion of the aquifer, it remains unclear if DCE in the area will reduce to VC and then to ethane/ethane. In this area, the lack of ethane detections, very low ethene concentrations (near the detection limit), and low concentrations of methane along with low TOC and VFAs suggest that while dechlorination is ongoing, it is not likely robust enough to degrade DCE sufficiently to halt continued downgradient migration. Based on the elevated cis-1,2-DCE concentrations and historically elevated TCE concentrations, it is recommended that additional site investigation be considered in this area to better identify the nature and extent of contamination and to determine whether additional injection wells should be considered. It is recommended that the investigation be completed with the Site Characterization and Analysis Penetrometer System (or similar technology) in which a

cone penetrometer containing various sensors is hydraulically driven into the subsurface to identify subsurface stratigraphy and the presence of contamination. Samples of soil and groundwater can also be collected through the probe for additional analyses.

- During baseline sampling in 2008, well MW-70-MNA14, located in the Shell Horizon approximately 400 feet downgradient of the last Shell Horizon biobarrier (SHB-3) (Figure 2-35), had less than 1 µg/L TCE (currently 5.3 µg/L), suggesting that the increasing levels of cis-1,2-DCE and VC reported in the well (currently 1,200µg/L and 78 µg/L, respectively) is the result of contaminant migration in the Shell Horizon Unit and not from dechlorination of TCE in the vicinity of the well. In addition, the cis-1,2-DCE concentration in Second Sand Unit well MW-70-MNA16, located approximately 100 feet downgradient of the furthest downgradient biobarrier (SSB-1), has shown an increasing trend (from 880 µg/L in 2012 to 1,100 µg/L in 2015), suggesting that complete dechlorination also did not occur in this biobarrier and cis-1,2-DCE contamination is continuing to migrate in this area. Even though the TCE concentrations in these wells are below the criterion for active treatment (200 µg/L), the cis-1,2-DCE and VC concentrations are significantly above the TCGs (6 and 0.5 µg/L, respectively). Since there are no biobarriers installed downgradient of these wells, it would be desirable to have additional downgradient monitoring wells to more closely monitor plume migration. The Orange County Water District (OCWD) has been monitoring an OCWD well installed within the Shell Horizon Unit and located close to sentinel wells MW-70-POC04/MW-70-21. Data provided from the OCWD to the Navy (Li Li, personal communication, 27 May 2016 [included in Appendix G]) indicates that TCE and DCE may have migrated as far as this downgradient area within the Shell Horizon Unit. It is recommended that a Shell Horizon Unit well be installed coincident with the location of Second Sand Unit well MW-70-21 or use the OCWD well for monitoring under future sampling events. Further, it is recommended that the far downgradient wells existing in this area (e.g., First Sand Unit well MW-70-16 and Second Sand Unit wells MW-70-15 and MW-70-21) continue to be closely monitored.
- The presence of electron donor, in concert with the indication of anaerobic respiration and dechlorination, should be critically assessed in select injection wells during the next semi-annual event as a means of determining electron donor presence/significance. This evaluation should focus on sampling select injection wells not sampled as part of the routine semi-annual sampling event. It is recommended that the following injection wells be sampled for TOC and VFAs: IW-70-SAT-21 and IW-70-SAT-15 in the SATG; IW-70-FSB116 and IW-70-FSB112 in the FSB-1; IW-70-FSB219 and IW-70-FSB207 in the FSB-2; IW-70-SHB306 and IW-70-SHB317 in SHB-3; and IW-70-SSB121 and IW-70-SSB116 in the SSB-1. In addition, one well of the two wells noted in the SATG, IW-70-SAT-21, and one injection well in each of the aforementioned biobarriers (IW-70-FSB112 in the FSB-1; IW-70-FSB219 in the FSB-2; IW-70-SHB306 in the SHB-3; and IW-70-SSB121 in the SSB-1) should also be sampled for dissolved gases and Dhc analysis in the next annual sampling event.
- The robustness of the microbial community, changes in dissolved hydrogen gases, and ethene generation should continue to be critically monitored and assessed in the next annual event. The results of the suggested expanded semi-annual and annual sampling and analysis (noted above) should be used in the next (2016) annual assessment to evaluate overall EISB performance and the need to conduct any further optimization of

the injection scheme. Continue implementation of the existing methane monitoring program that is in place. Continue monitoring ambient air and suspected soil gas entry locations (i.e., foundation cracks, utility corridors, etc.) with both a photo-ionization detector (PID) and a 4-gas meter for lower explosive limit (LEL), percent carbon dioxide and percent oxygen in addition to methane. Consider supplementing the PID with a flame-ionization detector (FID) which is intrinsically safe to the environment and also responds to methane and has excellent response to chlorinated volatile organic compounds (CVOCs).

This page intentionally left blank

TABLE OF CONTENTS

PAGE

EXECUTIVE SUMMARY ES-1

1.0 INTRODUCTION 1-1
1.1 Scope of Work 1-2
1.2 Background 1-2
1.2.1 Summary of Monitoring and Injection Well Network 1-3
1.2.2 Physical Setting and Site Conditions 1-4
1.2.3 Site-Specific Hydrogeology 1-5
1.2.4 Nature and Extent of Contamination 1-6
1.3 Report Organization 1-7

2.0 FIELD ACTIVITIES AND RESULTS 2-1
2.1 Groundwater Monitoring Program 2-1
2.2 2015 Semiannual Groundwater Monitoring 2-1
2.3 Groundwater Flow and Direction 2-2
2.3.1 Upper Fines Unit Groundwater Elevations 2-2
2.3.2 First Sand Unit Groundwater Elevations 2-3
2.3.3 Shell Horizon Unit Groundwater Elevations 2-3
2.3.4 Second Sand Unit Groundwater Elevations 2-4
2.3.5 Deep Sand Unit Groundwater Elevations 2-4
2.3.6 Summary of Groundwater Elevation Data 2-4
2.4 Remedy Performance Evaluation 2-5
2.4.1 Chlorinated Ethenes 2-5
2.4.2 Electron Donor (EVO) 2-7
2.4.3 Aquifer Redox Conditions 2-8
2.4.4 Bioaugmentation (*Dehalococcoides*) 2-9
2.4.5 Water Quality Parameters 2-10
2.4.6 Summary of Remedy Performance Evaluation 2-10
2.5 Soil Vapor Results 2-11
2.5.1 Methane Soil Vapor Results 2-11
2.5.2 VOC Soil Vapor Results 2-11
2.5.3 Hydrogen Sulfide Soil Vapor Results 2-12
2.5.4 Ambient Air Monitoring for Methane Gas and VOCs 2-12
2.5.5 Summary of Soil Vapor Results 2-12

3.0 CONCEPTUAL SITE MODEL UPDATE 3-1
3.1 Lithology 3-1
3.2 Contaminants of Concern 3-2
3.2.1 Upper Fines Unit 3-2
3.2.2 First Sand Unit 3-3
3.2.3 Shell Horizon Unit 3-4
3.2.4 Second Sand Unit 3-5
3.2.5 Deep Sand Unit 3-6
3.3 Visualization of Dissolved Plume Extent 3-7
3.3.1 Trichloroethene 3-7

TABLE OF CONTENTS
(Continued)

PAGE

3.3.2 Cis-1,2-Dichloroethene 3-8
3.3.3 Vinyl Chloride 3-8
3.3.4 Ethene 3-8

4.0 VARIANCES TO THE WORK PLAN AND DATA QUALITY ASSESSMENT 4-1
4.1 Variances to the Work Plan 4-1
4.2 Data Quality Assessment 4-1

5.0 LAND-USE CONTROLS 5-1

6.0 SUMMARY AND RECOMMENDATIONS 6-1
6.1 Summary of Results 6-1
6.2 Recommendations 6-4

7.0 REFERENCES 7-1

TABLE OF CONTENTS
(Continued)

TABLES

Table 1-1 Contaminants of Concern and Target Cleanup Goals
Table 1-2 2015 Groundwater and Performance Monitoring Schedule
Table 1-3 Well Construction Summary
Table 2-1 Groundwater Level Data
Table 2-2 Field Parameter Data
Table 2-3 Source Area Treatment Grid Analytical Results
Table 2-4 Upper Fines Point of Compliance Analytical Results
Table 2-5 Source Area Biobarrier/First Sand Analytical Results
Table 2-6 First Sand Biobarrier 1 Analytical Results
Table 2-7 First Sand Biobarrier 2 Analytical Results
Table 2-8 First Sand Point of Compliance Analytical Results
Table 2-9 Shell Horizon Biobarrier 1 Analytical Results
Table 2-10 Shell Horizon Biobarrier 3 Analytical Results
Table 2-11 Shell Horizon Point of Compliance Analytical Results
Table 2-12 Second Sand Biobarrier 1 Analytical Results
Table 2-13 Second Sand Point of Compliance Analytical Results
Table 2-14 Deep Sand Point of Compliance Analytical Results
Table 2-15 Soil Vapor Analytical Results
Table 3-1 Comparison of Baseline (2008), 2012, and 2015 Annual Maximum and Average Concentrations of TCE, Cis-1,2-DCE, and VC for Each Hydrostratigraphic Unit

FIGURES

Figure 1-1 Site Location Map
Figure 1-2 Well Location Map
Figure 1-3 Soil Vapor Probe Location Map
Figure 2-1 Upper Fines Groundwater Elevations – December 2015
Figure 2-2 First Sand Groundwater Elevations – December 2015
Figure 2-3 Shell Horizon Groundwater Elevations – December 2015
Figure 2-4 Second Sand Groundwater Elevations – December 2015
Figure 2-5 Deep Sand Groundwater Elevations – December 2015
Figure 2-6 Water Level Trend Graphs: Upper Fines and First Sand (2008–2015)
Figure 2-7 Water Level Trend Graphs: Shell Horizon, Second Sand, and Deep Sand (2008–2015)
Figure 2-8 CVOC Molar Concentrations – Source Area Treatment Grid
Figure 2-9 CVOC Molar Concentrations – Source Area Biobarrier 1
Figure 2-10 CVOC Molar Concentrations – First Sand Biobarrier 1
Figure 2-11 CVOC Molar Concentrations – First Sand Biobarrier 2
Figure 2-12 CVOC Molar Concentrations – Shell Horizon Biobarrier 1
Figure 2-13 CVOC Molar Concentrations – Shell Horizon Biobarrier 3

TABLE OF CONTENTS
(Continued)

Figure 2-14 CVOC Molar Concentrations – Second Sand Biobarrier 1
Figure 2-15 Total Organic Carbon Trends: SATG, SAB, and FSB-1
Figure 2-16 Total Organic Carbon Trends: FSB-2, SHB-1, SHB-3, and SSB-1
Figure 2-17 Volatile Fatty Acid (VFA) Trends Since Baseline
Figure 2-18 DO-ORP Trends Since Baseline
Figure 2-19 Sulfate-Methane Trends Since Baseline
Figure 2-20 Dehalococcoides Trends Since Baseline: SATG, SAB, FSB-1, FSB-2
Figure 2-21 Dehalococcoides Trends Since Baseline: SHB-1, SHB-3, SSB
Figure 2-22 IR Site 70, Upper Fines – Source Area Treatment Grid, Trichloroethene in Groundwater – 2015
Figure 2-23 IR Site 70, Upper Fines – Source Area Treatment Grid, cis-1,2-Dichloroethene in Groundwater – 2015
Figure 2-24 IR Site 70, Upper Fines – Source Area Treatment Grid, Vinyl Chloride in Groundwater – 2015
Figure 2-25 IR Site 70, First Sand – Source Area Biobarrier, First Sand Biobarriers 1 & 2, Trichloroethene in Groundwater – 2015
Figure 2-26 IR Site 70, First Sand – Source Area Biobarrier, First Sand Biobarriers 1 & 2, cis-1,2-DCE in Groundwater – 2015
Figure 2-27 IR Site 70, First Sand – Source Area Biobarrier, First Sand Biobarriers 1 & 2, Vinyl Chloride in Groundwater – 2015
Figure 2-28 IR Site 70 – Shell Horizon Biobarriers 1 & 3, Trichloroethene in Groundwater – 2015
Figure 2-29 IR Site 70 – Shell Horizon Biobarriers 1 & 3, cis-1,2-Dichloroethene in Groundwater – 2015
Figure 2-30 IR Site 70 – Shell Horizon Biobarriers 1 & 3, Vinyl Chloride in Groundwater – 2015
Figure 2-31 IR Site 70, Second Sand – Second Sand Biobarrier 1, Trichloroethene in Groundwater – 2015
Figure 2-32 IR Site 70, Second Sand – Second Sand Biobarrier 1, cis-1,2-Dichloroethene in Groundwater – 2015
Figure 2-33 IR Site 70, Second Sand – Second Sand Biobarrier 1, Vinyl Chloride in Groundwater – 2015
Figure 2-34 IR Site 70 – Soil Vapor Analytical Results
Figure 2-35 2008 Baseline TCE Extent (Projected to Ground Surface)
Figure 2-36 2015 Baseline TCE Extent (Projected to Ground Surface)
Figure 3-1 Trichloroethene Extent Above 1,000 µg/L in the Source Area, 2015 Annual Sampling Event
Figure 3-2 Trichloroethene Extent Above 250 µg/L Along Cross Section A-A', 2015 Annual Sampling Event
Figure 3-3 Trichloroethene Extent Above 250 µg/L Along Cross Section B-B', 2015 Annual Sampling Event
Figure 3-4 Trichloroethene Extent Above 250 µg/L, 2015 Annual Sampling Event
Figure 3-5 Cis-1,2-Dichloroethene Extent Above 60 µg/L, 2015 Annual Sampling Event

TABLE OF CONTENTS
(Continued)

Figure 3-6 Vinyl Chloride Extent Above 20 µg/L, 2015 Annual Sampling Event
Figure 3-7 Ethene Extent Above 10 µg/L, 2015 Annual Sampling Event
Figure 3-8 Cis-1,2-Dichloroethene Extent Above 60 µg/L Along Cross Section J-J', 2015 Annual Sampling Event
Figure 3-9 Vinyl Chloride Extent Above 20 µg/L Along Cross Section J-J', 2015 Annual Sampling Event
Figure 3-10 Ethene Extent Above 10 µg/L Along Cross Section J-J', 2015 Annual Sampling Event
Figure 3-11 Three Dimensional Views of the Trichloroethene Plume (>250 µg/L) 2008 – 2015
Figure 3-12 Three Dimensional Views of the Cis-1,2-Dichloroethene Plume (>60 µg/L) and Vinyl Chloride Plume (>20 µg/L) 2010 – 2015

APPENDICES

Appendix A Field Sample Collection and Ambient Air Monitoring Logs (on CD only)
Appendix B-1 Laboratory Analytical Reports and Chain-of-Custody Documentation (on CD only)
Appendix B-2 Laboratory Data Validation Reports (on CD only)
Appendix C Performance Monitoring Detailed Trend Graphs (on CD only)
Appendix D 2008 Baseline Sampling Maps (on CD only)
Appendix E Long Beach Airport Precipitation Data (on CD only)
Appendix F Seal Beach Constant-Discharge Pumping Test Results for Orange County Sanitation District Seal Beach Pump Station (on CD only)

ATTACHMENTS

Attachment 1 Final Data Submittal for the 2015 Semiannual Performance Monitoring Event – Enhanced In Situ Bioremediation (EISB) at IR Site 70, Naval Weapons Station Seal Beach, Seal Beach, CA (on CD only)

ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
µg/L	micrograms per liter
bgs	below ground surface
BEI	Bechtel Environmental, Inc.
CHHSL	California Human Health Screening Level
COC	contaminant of concern
CSM	conceptual site model
CVOC	chlorinated VOC
DCE	dichloroethene
Dhc	*Dehalococcoides*
DNA	deoxyribonucleic acid
DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
ECC/Geosyntec	Environmental Chemical Corporation/Geosyntec Consultants
EISB	enhanced in situ bioremediation
EPA	U.S. Environmental Protection Agency
EWI	Environmental Work Instruction
EVO	emulsified vegetable oil
FID	flame-ionization detector
FSB	First Sand Biobarrier
GMS	Groundwater Modeling Software
IC	institutional control
IRP	Installation Restoration Program
J	estimated
JEG	Jacobs Engineering Group Inc.
KB-1®	dechlorinating microbial culture
L	liter
LEL	lower explosive limit
LUC	land-use control
LUST	Leaking Underground Storage Tank
MCL	maximum contaminant level
mg/L	milligrams per liter
MNA	monitored natural attenuation
MSL	mean sea level
mV	millivolt
NASA	National Aeronautics and Space Administration
NAVFAC SW	Naval Facilities Engineering Command Southwest
NAVWPNSTA	Naval Weapons Station
OCWD	Orange County Water District
ORP	oxidation-reduction potential
PCE	tetrachloroethylene
PID	photo-ionization detector
pH	potential of hydrogen

ABBREVIATIONS AND ACRONYMS
(Continued)

PMR	Performance Monitoring Report
PMW	performance monitoring well
POC	point of compliance
ppbV	parts per billion by volume
ppmv	parts per million by volume
QA	quality assurance
QC	quality control
RAWP	Remedial Action Work Plan
redox	oxidation-reduction
SAB	Source Area Biobarrier
SAP	Sampling and Analysis Plan
SATG	Source Area Treatment Grid
SHB	Shell Horizon Biobarrier
SSB	Second Sand Biobarrier
TCE	trichloroethene
TCG	target cleanup goal
TOC	total organic carbon
TtEC	Tetra Tech, EC, Inc.
UEL	upper explosive limit
UJ	non-detected estimated
VC	vinyl chloride
*vcr*A	vinyl chloride reductase A gene
VFA	volatile fatty acid
VOC	volatile organic compound

This page intentionally left blank

1.0 INTRODUCTION

This 2015 Annual Performance Monitoring Report (PMR) presents the field activities and results of annual groundwater sampling that was completed at Installation Restoration Program (IRP) Site 70 (Research, Testing, and Evaluation Area), at Naval Weapons Station (NAVWPNSTA) Seal Beach, Seal Beach, California (Figure 1-1). The primary purpose of the sampling was to evaluate the effectiveness of seven enhanced in situ bioremediation (EISB) treatment areas at the site. The 2015 annual groundwater sampling event was completed in December 2015. A letter report presenting the results of the 2015 semiannual monitoring event was previously provided to the regulatory agencies for review and is included as Attachment 1 of this report. These semiannual results were evaluated with the more recent annual data in the context of assessing the overall performance of the EISB remedy. All semiannual data was used in the assessment of long-term trending of site data for this annual report. This PMR was prepared by ECC-Insight, LLC on behalf of Naval Facilities Engineering Command Southwest (NAVFAC SW) under Contract No. N62473-12-D-2004, Contract Task Order No. 0007.

The remediation at IRP Site 70 is being conducted under the IRP. NAVWPNSTA Seal Beach is an active federal facility and is not on the National Priorities List. The lead federal agency is the Department of the Navy, with the California Department of Toxic Substances Control (DTSC) and the California Regional Water Quality Control Board Santa Ana Region providing support and oversight.

NAVFAC SW directs the remedial action in accordance with requirements of the Comprehensive Environmental Response, Compensation, and Liability Act and the National Oil and Hazardous Substances Pollution Contingency Plan. A Final Remedial Action Work Plan (RAWP) defined the implementation of the EISB (Environmental Chemical Corporation/Geosyntec Consultants [ECC/Geosyntec] 2008a), and the current sampling activities were completed pursuant to the *Addendum No. 5 to the Final Sampling and Analysis Plan* (SAP) (ECC-Insight 2014a) and *Addendum No.4 to the Final Accident Prevention Plan/Site Safety and Health Plan* (ECC-Insight 2014b).

The EISB treatment areas were installed at IRP Site 70 for remediation of dissolved phase chlorinated solvents and potential dense non-aqueous phase liquids (DNAPLs) in groundwater. The EISB program is a semi-passive approach, comprising biostimulation and bioaugmentation, which incorporates a grid of injection wells in the contaminant source area and six rows of injection wells (biobarriers) that transect the downgradient dissolved phase plume (Figure 1-2). The injection wells were used to inject both an electron donor emulsified vegetable oil (EVO) and the dechlorinating microbial culture (KB-1®) Dehalococcoides (Dhc) bacteria culture initially between 2008 and 2010, and one additional EVO injection into select wells in 2013.

The initial areas of injection were selected based on the vertical and lateral extent of 250 micrograms per liter (µg/L) trichloroethene (TCE) (ECC/Geosyntec 2008b, Bechtel Environmental, Inc. [BEI] 2006). It was proposed that treatment be terminated once the TCE concentrations in groundwater were reduced to 200 µg/L, and that monitored natural attenuation (MNA) would then be employed until target cleanup goals (TCGs) for contaminants of concern (COCs) were achieved (Table 1-1).

1.1 Scope of Work

The annual groundwater sampling event was completed in December 2015. The following field activities were completed during the annual performance monitoring event:

- Depth to groundwater measurements were collected on December 14, 2015, before groundwater sampling activities began. The water level measurements and associated groundwater flow maps are discussed in Section 2.3.
- Groundwater samples were collected between December 15 and December 22, 2015 from 79 wells. The wells sampled and the associated laboratory analyses completed are listed in Table 1-2.
- Eleven of the 12 soil vapor probes located in the contaminant source area (Figure 1-3) were sampled for methane, hydrogen sulfide and volatile organic compounds (VOCs). SV-70-03 was not sampled due to water in port. Additionally, the ambient air both inside and outside of buildings near the contaminant source area was monitored for methane for health and safety purposes.

In addition to activities completed for the annual sampling event, the following field activities were completed during the 2015 semi-annual performance monitoring event in July 2015:

- Depth to groundwater was measured in each hydrostratigraphic unit.
- Groundwater samples were collected from 35 wells. Samples were analyzed for VOCs, dissolved hydrocarbon gases, volatile fatty acids (VFAs), anions, total dissolved solids, alkalinity, and total organic carbon (TOC). In addition, field parameters, including pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), and specific conductance of groundwater, were measured.

1.2 Background

IRP Site 70 encompasses approximately 40 acres located south of Westminster Boulevard and east of Seal Beach Boulevard in the city of Seal Beach, California (Figure 1-1). Groundwater at the site is impacted by chlorinated solvents, primarily TCE and associated degradation products, up to a depth of approximately 160 feet below ground surface (bgs) (ECC/Geosyntec 2008b, BEI 2006). The remedial approach for the site was first presented in the *Revised Feasibility Study* (Geosyntec 2005). Previous investigations are summarized in the RAWP (ECC/Geosyntec 2008a) and the Fifth Annual Groundwater Monitoring Report (BEI 2006). The EISB baseline groundwater sampling results from 2008, and subsequent groundwater sampling results (2009 through 2014) have previously been documented (ECC-Insight 2009a, 2010, 2011, 2012, 2015a; Tetra Tech, EC, Inc. [TtEC] 2013, 2014).

IRP Site 70 consists of multi-story office and production buildings, asphalt-paved parking areas, an assortment of aboveground tanks, associated above- and belowground piping systems, and concrete-lined sumps. From 1962 to 1973, the National Aeronautics and Space Administration (NASA) and its contractors utilized the area for the design and manufacture of the second stage of the Saturn V launch vehicle for the Apollo Program. Subsequent to NASA leaving the area, the United States Department of Energy and Garrett Engineering (Allied Signal) conducted pilot test assembly operations for a classified uranium enrichment process in portions of Building 112.

The tests were conducted from 1980 to 1985 but did not include either the manufacture or enrichment of uranium. Currently, the building is used for storage, equipment testing, and office space.

The Final Removal Site Evaluation Report for IRP Site 70 (Bechtel National, Inc. 1996) evaluated the following structures in the contaminant source area:

- Bulkhead Fabrication Building 128
- Vertical Assembly and Hydrotest Building 112
- Pneumatic Test, Paint, and Packaging Building 122
- Tool and Maintenance Building 130
- Structural Test Tower
- Water Conditioning Plant

Operations at these facilities included the use of diluted acids, VOCs (including TCE), phenolic compounds, petroleum oils, sodium dichromate containing hexavalent chromium, detergents, metals containing paint wastes, and machine lubricating oil.

1.2.1 Summary of Monitoring and Injection Well Network

The groundwater monitoring well network at IRP Site 70 (Figure 1-2 and Table 1-3) consists of wells screened within five hydrostratigraphic units designated as the Upper Fines, First Sand, Shell Horizon, Second Sand, and Deep Sand. The monitoring wells have three general purposes based on their location (Geosyntec 2006b):

1. MNA wells. These wells are located on the fringe of the plume and provide early indications of plume migration and information on the natural attenuation of lower contaminant concentrations.
2. Performance monitoring wells (PMWs). These wells are located along the core of the plume between the biobarriers and provide information on biobarrier performance.
3. Point of compliance (POC) or "sentinel" wells. These wells are located downgradient of the contaminant plume to provide early indication of contamination migration off the site.

The majority of these wells were installed in 2007 (ECC/Geosyntec 2008b, 2009) and were sampled for the first time during the baseline monitoring event completed in 2008. The 2015 annual monitoring event included resampling these wells to evaluate the performance of the biobarriers.

The initial EISB injection at IRP Site 70 began in November 2008 after the baseline groundwater monitoring event was completed. Both EVO and Dhc were injected into seven treatment areas, including a general grid pattern at the contaminant source area, and six downgradient biobarriers. The injection wells were installed in four separate hydrostratigraphic units. To date, one additional round of EVO injection (without additional Dhc) has been completed in select wells at six of the seven treatment areas. Rationale for the locations of the additional EVO injections, completed between September and December 2013, are included in the *Final Annual Performance*

Monitoring Report, Enhanced In Situ Bioremediation, Installation Restoration Program Site 70, Naval Weapons Station Seal Beach, Seal Beach, California (TtEC 2013). Additional EVO was not injected at the Shell Horizon Biobarrier (SHB)-1 because it was determined that conditions for reductive dechlorination at that biobarrier were satisfactory (TtEC 2013).

The initial large scale EVO and Dhc injection activities were performed over the course of one and a half years at the following treatment areas in the following sequence (ECC-Insight 2010, 2011):

1. Source Area Biobarrier (SAB). Injection was completed on January 30, 2009.
2. Second Sand Biobarrier (SSB)-1. Injection was completed on March 18, 2009.
3. SHB-3. Injection was completed on September 25, 2009.
4. First Sand Biobarrier (FSB)-2. Injection was completed on November 24, 2009.
5. FSB-1. Injection was completed on February 12, 2010.
6. SHB-1. Injection was completed on April 7, 2010.
7. Source Area Treatment Grid (SATG). Injection was completed on August 3, 2010.

1.2.2 Physical Setting and Site Conditions

NAVWPNSTA Seal Beach is located within the Los Angeles-Orange County coastal plain situated at latitude 33° 45′ 27″ N and longitude 118° 4′ 22″ W, San Bernardino Baseline and Meridian. Most of NAVWPNSTA Seal Beach lies in the flat alluvial deposits in the southeastern portion of the Los Angeles Basin. The Los Angeles Basin is bounded on the north by the Santa Monica Mountains, to the northeast by the Repetto and Puente Hills, to the east and southeast by the Santa Ana Mountains and the San Joaquin Hills, and to the south, southwest, and west by the Palos Verdes Hills and the Pacific Ocean. NAVWPNSTA Seal Beach slopes evenly from approximately 20 feet mean sea level (msl) in the northwestern part, near the IRP Site 70, to sea level in the tidal flats of the Seal Beach National Wildlife Refuge in the southeast (Figure 1-1).

The climate in the area is classified as a marine-influenced southern California coastal region with temperature ranges from winter lows of approximately 30 degrees Fahrenheit (°F) to summer highs around 90°F. Annual precipitation is variable with an average of 12.5 inches. Prevailing winds average 4 miles per hour from the west with occasional strong dry winds ("Santa Ana") that can occur in the fall and winter. Groundwater levels are influenced by periods of high precipitation or drought, as well as tidal cycles near the tidal flats (ECC/Geosyntec 2008a). The sequence of regional stratigraphic units underlying the site, from youngest (shallowest) to oldest (deepest), is:

- Recent Alluvium with a maximum depth of approximately 80 to 100 feet bgs. The upper 50 feet consists of fine sands, silty clays, and clays, overlying sands and gravels, silty sands, silty clays, and clays.
- Upper Pleistocene Lakewood Formation extends between approximately 80 to 100 feet bgs to approximately 350 feet bgs. Lithologic units are discontinuous and contain zones of high and low permeability (California Department of Water Resources [DWR] 1961).
- Lower Pleistocene San Pedro Formation.

- Pliocene Pico Formation.

NAVWPNSTA Seal Beach is located on the Newport-Inglewood fault zone. Two faults, the Seal Beach fault and the Los Alamitos fault, are part of the Newport-Inglewood fault zone. The Seal Beach fault is located in the southern portion of the Newport-Inglewood fault zone. On the station, the Seal Beach fault has uplifted Upper Pleistocene deposits at Landing Hill and Hog Island (Jacobs Engineering Group Inc. [JEG] 1995). Movement along the fault appears to not have displaced recent sediments.

1.2.3 Site-Specific Hydrogeology

NAVWPNSTA Seal Beach is located at the southwestern corner of the Orange County Basin, which includes six major aquifers: the Artesia, Gage, Hollydale, Jefferson, Lynwood, and Silverado aquifers.

There are four general aquifer zones identified at NAVWPSTA Seal Beach (JEG 1995):

- A semiperched, unconfined zone within the upper portion of the Recent Alluvial deposits;
- A confined fresh groundwater zone contained in the lower portion of the Recent Alluvial deposits;
- Late and Early Pleistocene deposits of the Lakewood and San Pedro Formations, respectively, and in some parts, deposits of the Late Pliocene Pico Formation; and
- A confined zone of saline water underlying the freshwater zone.

More specifically, groundwater underlying NAVWPNSTA Seal Beach (upper Recent Alluvium deposits) is within the Lower Santa Ana River Basin (Orange County Management Zone) (Water Board 1995, with Amendment R8-2004-001 2004). Beneficial uses of groundwater within this zone include municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply. However, shallow groundwater underlying IRP Site 70 does not serve as a water source for any of the beneficial uses designated in the Water Quality Control Plan, Santa Ana River Basin (Basin Plan) (Water Board 1995).

The principal freshwater aquifer body (lower Recent Alluvium deposits and Upper Pleistocene Lakewood Formation) is part of a large confined aquifer that occupies two zones. The first zone is approximately 75 to 200 feet deep and is saline. The second zone is approximately 250 to 1,000 feet deep and is fresh water. This second zone is the primary water supply source for neighboring cities. Groundwater levels in this principal freshwater zone fluctuate from year to year due to variations in pumping, infiltration, and recharge. Recharge to this aquifer is primarily from unconfined areas located upgradient and from unlined rivers that are hydraulically connected to the aquifer. Seasonal variations occur with highs in the wet winter months and lows in the dry summer months when large quantities of water are used for irrigation (JEG 1995).

Six specific stratigraphic units have been delineated beneath IRP Site 70, as presented in the Final Technical Memorandum (ECC/Geosyntec 2008b):

1. **Upper Fines Unit (ground surface to approximately 60 feet bgs)**. The Upper Fines Unit comprises three zones: a) a shallow zone of surficial soils and recent clayey sediments; b) an intermediate zone of interbedded silts, clays, and sandy silts and clays that include a semiperched zone; and c) a lower zone of interbedded silts, clays, and fine- to coarse-grained, silty to clayey sands. A zone of organic material, mainly wood chips, was encountered in a number of boreholes at a depth of approximately 45 to 50 feet bgs.
2. **First Sand Unit (approximately 60 to 105 feet bgs).** The First Sand Unit consists of poorly graded, fine-grained sands and silty sands. A coarse sand/fine gravel layer was encountered in several borings between 80 and 95 feet bgs. This coarse layer lies just above or slightly within the underlying Shell Horizon Unit. The First Sand Unit varies in thickness from approximately 30 to 50 feet.
3. **Shell Horizon Unit (approximately 105 to 135 feet bgs).** The Shell Horizon Unit is characterized by a sequence of interbedded clays, silts, sands, and gravels with laterally discontinuous interbeds of dense shells and shell fragments. This unit is characterized by a sequence of interbedded clays, silts, sands, and gravels below the source area grading downgradient to predominantly fine grained sand in the dissolved-phase plume area. This unit has been subdivided into an area with primarily interbedded clays and an area with primarily fine-grained sands to reflect differences in the hydrogeologic characteristics and potential plume migration behavior. Shell and gravel layers were encountered in some but not all borings, which compose interbeds within the unit that do not appear to be spatially extensive. Wood chips were encountered in several borings at a depth of about 110 feet bgs.
4. **Second Sand Unit (approximately 135 to 170 feet bgs).** Although similar in character to the First Sand Unit, this deeper unit appears to be slightly coarser in its upper section.
5. **Deep Clay Unit (approximately 170 to 190 feet bgs).** The Deep Clay Unit consists of an upper clay to silty clay horizon and an underlying clayey silt, silt, sandy silt, or sandy clay layer. The upper clay to silty clay horizon appears to be a continuous low-permeability unit that is encountered at depths between 164 to 176 feet bgs. The upper clay to silty clay unit grades downward to clayey silt, silt, sandy silt, or sandy clay. This underlying layer is 3 to 20 feet thick, extending to depths of 175 to 188 feet bgs. Below the clayey silt, silt, sandy silt, or sandy clay layer is a silty sand and sand layer, up to 6 feet thick, which has been found to a depth of 191 feet bgs.
6. **Deep Sand Unit (approximately 190 feet bgs and below).** The Deep Sand Unit, where encountered, consists of fine-grained sands and silty sands, and appears to be similar in character to the First and Second Sand Units.

1.2.4 Nature and Extent of Contamination

The initial nature and extent of contamination at IRP Site 70, based on historical site investigations and the baseline groundwater monitoring event completed in 2008, formed the basis of the EISB remedial design (BEI 2002, 2006; Geosyntec 2006b; ECC-Insight 2009a).

Groundwater contamination at IRP Site 70 has been divided into two areas:

1. Source Area: potential residual DNAPL and dissolved phase TCE and its breakdown by-products contamination (cis-1,2-dichloroethene [DCE] and vinyl chloride [VC]) is located in the Upper Fines Unit between approximately 0 and 60 feet bgs. TCE concentrations in some areas exceed 1,000 µg/L.
2. Downgradient dissolved-phase plume: extends in a southeasterly direction from the Source Area. The primary VOCs in the dissolved-phase plume are TCE and its breakdown by-products (cis-1,2-DCE and VC), which extended approximately 4,000 feet downgradient and down to approximately 160 feet bgs. The downgradient dissolved-phase plume has been identified in the First Sand Unit (60 to 105 feet bgs), the Shell Horizon Unit (105 to 135 feet bgs), and the Second Sand Unit (135 to 170 feet bgs).

The extent of contamination depicted in the current conceptual site model (CSM) (Section 3.0) is consistent with previous CSMs where the local spatial termination of fine-grained stratigraphic horizons allows for a downward "stair stepping" geometry to the VOC plume (ECC-Insight 2009a; ECC/Geosyntec 2008b).

1.3 Report Organization

This report is organized as follows:

- Section 2.0 summarizes the 2015 groundwater sampling field activities and results.
- Section 3.0 includes a site CSM update.
- Section 4.0 describes variances from the work plan and a data quality assessment.
- Section 5.0 discusses land-use controls (LUCs).
- Section 6.0 presents a report summary and recommendations.
- Section 7.0 lists references cited in this report.
- Appendix A provides field sampling logs and ambient air monitoring documentation.
- Appendix B-1 provides laboratory analytical reports and chain-of-custody documentation.
- Appendix B-2 provides laboratory data validation reports
- Appendix C provides graphs of performance monitoring trends.
- Appendix D provides the 2008 baseline sampling plume maps.
- Appendix E provides precipitation data from Long Beach Airport.
- Attachment 1 consists of the *Final Data Submittal for the 2015 Semiannual Performance Monitoring Event – Enhanced In Situ Bioremediation (EISB) at IR Site 70, Naval Weapons Station Seal Beach.*

2.0 FIELD ACTIVITIES AND RESULTS

This section documents the activities associated with the groundwater and soil vapor monitoring completed at the site in December 2015.

2.1 Groundwater Monitoring Program

Per the Remedial Design and RAWP (Geosyntec 2006b; ECC/Geosyntec 2008a), the groundwater monitoring program was established to track the progress of achieving the following performance criteria for the EISB remedy:

- Complete dechlorination of TCE to ethene within the biobarriers.
- Microbial growth (Dhc) to concentrations exceeding 10^7 gene copies/L and migration of microbes throughout the active treatment areas.
- Localized and/or minimal secondary groundwater quality impacts.

For complete reductive dechlorination of TCE to occur, three primary factors are required. First, the oxidation-reduction (redox) state of the aquifer must be sufficiently reducing to support the required microbial community. Second, an adequate supply of electron donor must be present to maintain the reducing redox condition of the aquifer as well as provide the microbial community with its preferred electron donor (i.e., molecular hydrogen). Third, an active microbial community (Dhc) must be present.

The groundwater sampling program measures various parameters necessary to evaluate progress towards achieving the complete reductive dechlorination of TCE. The concentrations of chlorinated ethenes, including cis-1,2-DCE and VC, serve as direct evidence of the degradation of TCE. Other performance indicators include changes in dissolved hydrogen gases and polymerase chain reaction assays specific to Dhc. In addition, surrogate monitoring of EVO through evaluating TOC and volatile fatty acids (acetic, butyric, lactic, and propionic acids) were completed to assess the presence of the electron donor.

Determining the redox state of the aquifer at each biobarrier is important since reductive dechlorination of TCE by Dhc occurs best when the environment is reducing. The redox state of the aquifer is best evaluated using several parameters including ORP, DO, nitrate, ferrous iron, sulfate, and methane. Reducing environments are anaerobic as heterotrophic bacteria utilize the oxygen in the aquifer. Evaluating these parameters helps determine the aquifer's redox potential.

In the following subsections, the groundwater flow and direction, quality and redox potential in the aquifer, and soil vapor and ambient air sampling results obtained in 2015 are discussed. Table 1-2 summarizes the wells sampled and the parameters measured during the 2015 annual performance monitoring event.

2.2 2015 Semiannual Groundwater Monitoring

In July 2015, the 2015 semiannual groundwater sampling event was completed. Groundwater samples were collected from 35 wells. A letter report presenting the results of the 2015 semiannual monitoring event was previously provided to the regulatory agencies for review and is included as

Attachment 1 of this report. These semiannual results were evaluated with the more recent annual data in the context of assessing the overall performance of the EISB remedy. All semiannual data was used in the assessment of long-term trending of site data for this annual report.

2.3 Groundwater Flow and Direction

On December 14, 2015, groundwater levels were measured prior to beginning the annual groundwater sampling activities (Table 2-1). The hydraulic gradient and flow direction were determined for the Upper Fines, First Sand, Shell Horizon, Second Sand, and Deep Sand hydrostratigraphic units. Water level elevation contour maps for each hydrostratigraphic unit are included on Figures 2-1 through 2-5, and water level trend graphs for each unit are included on Figures 2-6 and 2-7.

Due to the very low hydraulic gradients across the site, external factors may influence local flow directions, including nearby aquifer recharge activities and pumping from nearby water supply wells. Aquifer recharge occurs at the Alamitos Injection Barrier, which is located approximately 2,000 feet northwest of the site. The barrier is operated by the Los Angeles County Department of Public Works, the Water Replenishment District of Southern California, and the Orange County Water District (OCWD) to prevent seawater intrusion. This barrier injects fresh water at depths as shallow as 27 feet bgs (Geosyntec 2006b).

As described for each hydrostratigraphic unit below, groundwater flow directions and gradients across the site for this event were consistent with historical data, suggesting that significant influence from external pumping wells or injection wells did not occur. Overall, groundwater elevations across the site were similar to last year. Groundwater elevations remain significantly below the high observed in 2011, most likely a reflection of the prolonged drought conditions affecting the region. Rainfall amounts continue to fall below the average annual precipitation of 12.25 inches. A total annual precipitation of 9.35 inches was recorded for Long Beach Airport for water year 2015 (Appendix E). This is an increase from the annual total of 4.62 inches recorded for water year 2014. A total of 6.70 inches was reported in 2013. Annual precipitation for the past three years has been significantly lower than the average annual precipitation.

2.3.1 Upper Fines Unit Groundwater Elevations

Groundwater levels in the Upper Fines Unit were measured in 13 wells (Figure 2-1 and Table 2-1). Note that water level data collected from MW-70-28 and MW-70-PMW01B was not used to generate groundwater elevation contours due to the presence of vertical gradients and the difference in screen elevations between these and nearby and/or co-located Upper Fines wells. For example, MW-70-28 is horizontally co-located with MW-70-27. However, MW-70-28 is screened 25-ft deeper than MW-70-27. The difference in water levels between these two wells is 0.77-ft. Due to the observed vertical gradient between horizons, the water level at MW-70-28 could be considered to be more representative of the potentiometric heads in the transition between hydrostratigraphic units. The Upper Fines Unit, the shallowest hydrostratigraphic unit at the site, is located between the ground surface and approximately 60 feet bgs. Wells installed in the source area treatment grid are targeting the Upper Fines.

Groundwater elevations in the Upper Fines Unit measured in December 2015 are generally consistent with historical data. In December 2015, depth to groundwater ranged between

approximately 9 and 15 feet bgs, and the groundwater elevations generally ranged between 0.01 and -6.3 feet msl. Comparison of the December 2015 water levels to the water levels recorded during the last annual event in December 2014 indicates that water levels have remained stable (Table 2-1).

The direction of groundwater flow in the Upper Fines in December 2015 was to the northwest (gradient 0.0019), creating a groundwater low near the center of the source area (Figure 2-1).

The different groundwater flow directions observed in the Upper Fines Unit as compared to the other deeper units at the site is consistent with historical data. An old stream drainage system has been traced from north of Westminster Boulevard, trending southwest, through the source area, parallel to the current drainage channel that ultimately flows into Anaheim Bay (BEI 2006). This old stream drainage system is believed to influence groundwater flow directions in the Upper Fines Unit in the source area (BEI 2006).

2.3.2 First Sand Unit Groundwater Elevations

Groundwater levels in the First Sand Unit were measured in 33 wells (Figure 2-2 and Table 2-1). Note that water level data collected from IW-70-FSB118, IW-70-FSB216, MW-70-PMW08B and MW-MNA-10 was not used to generate groundwater elevation contours due to the presence of vertical gradients and the difference in screen elevations between these and nearby and/or co-located First Sand wells. The First Sand Unit is located between approximately 60 to 105 feet bgs. Wells installed in and near biobarriers SAB-1, FSB-1, and FSB-2 are screened in the First Sand Unit.

Groundwater elevations measured in the First Sand Unit are generally consistent with historical data. In December 2015, depth to groundwater ranged between approximately 10 and 20 feet bgs, and groundwater elevations generally ranged between approximately -6.0 and -10.6 feet msl. Comparison of the December 2015 water levels to the water levels recorded during the last annual event in December 2014 indicates that water levels have remained stable (Table 2-1).

The direction of groundwater flow in the First Sand Unit in December 2015 was to the southeast with an overall gradient of approximately 0.003 (Figure 2-2).

2.3.3 Shell Horizon Unit Groundwater Elevations

Groundwater levels in the Shell Horizon Unit were measured in 12 wells (Figure 2-3 and Table 2-1). Note that water level data collected from IW-70-SHB113, MW-70-PMW11A, MW-70-PMW12A was not used to generate groundwater elevation contours due to the presence of vertical gradients and the difference in screen elevations between these and nearby and/or co-located Shell Horizon wells. The Shell Horizon Unit is located between approximately 105 to 135 feet bgs, and wells installed in and near biobarriers SHB-1 and SHB-3 are screened in the Shell Horizon.

Groundwater elevations measured in the Shell Horizon are generally consistent with historical data. In December 2015, depth to groundwater ranged between approximately 16 and 23 feet bgs, and the groundwater elevations generally ranged between approximately -8.3 and -11.4 feet msl. Comparison of the December 2015 water levels to the water levels recorded during the last annual event in December 2014 indicates that water levels have remained stable (Table 2-1).

The direction of groundwater flow in the Shell Horizon in December 2015 was to the southeast with a very low gradient of approximately 0.001 (Figure 2-3).

2.3.4 Second Sand Unit Groundwater Elevations

Groundwater levels in the Second Sand Unit were measured in 14 wells (Figure 2-4 and Table 2-1). Note that water level data collected from MW-70-MNA16, MW-70-PMW13A/B, MW-70-PMW14A/B was not used to generate groundwater elevation contours due to the presence of vertical gradients and the difference in screen elevations between these and nearby Second Sand wells. The Second Sand Unit is located between approximately 135 to 170 feet bgs, and wells installed in and near biobarrier SSB-1 are screened in the Second Sand Unit.

Groundwater elevations measured in the Second Sand Unit are generally consistent with historical data. In December 2015, depth to groundwater ranged between approximately 16 and 21 feet bgs, and the groundwater elevations generally ranged between approximately -8.9 and -12.7 feet msl. The groundwater elevations for the two sets of performance monitoring wells at the biobarrier were somewhat higher than nearby wells, possibly due to well screen locations and lithologic variances within the Second Sand Unit. Comparison of the December 2015 water levels to the water levels recorded during the last annual event in December 2014 indicates that water levels have remained stable (Table 2-1).

The direction of groundwater flow in the Second Sand Unit in December 2015 was to the southeast with a gradient of approximately 0.0011 (Figure 2-4).

2.3.5 Deep Sand Unit Groundwater Elevations

Groundwater levels in the Deep Sand Unit were measured in three POC wells (Figure 2-5 and Table 2-1). The Deep Sand Unit is located below approximately 190 feet bgs.

Groundwater elevations measured in the Deep Sand Unit are generally consistent with historical data. In December 2015, depth to groundwater ranged between approximately 19 and 22 feet bgs, and the groundwater elevations generally ranged between approximately -9.3 and -13.5 feet msl. Comparison of the December 2015 water levels to the water levels recorded during the last annual event in December 2014 indicates that water levels have remained stable (Table 2-1).

The direction of groundwater flow in the Deep Sand Unit in December 2015 was to the southeast with a gradient of approximately 0.0019 (Figure 2-5).

2.3.6 Summary of Groundwater Elevation Data

Groundwater flow directions and gradients in each hydrostratigraphic unit are generally consistent with historical data (TtEC 2013), indicating that influence from external pumping wells or injection wells did not occur in 2015. Overall, groundwater flows to the southeast in each unit, with the exception of the Upper Fines Unit which flows locally at the site to the northwest, and each unit has a generally similar horizontal gradient (approximately 0.0010 to 0.0030).

Overall, the groundwater elevations measured for this event are similar to elevations measured during the last annual sampling event in December 2014 (Figures 2-6 and 2-7). The continued depressed groundwater elevations are likely attributable to the lower than average annual rainfalls

for the past three years. The annual precipitation total for water year 2015 was 9.35 inches for the Long Beach Airport area, compared to the annual average rainfall of 12.25 inches.

The groundwater elevations were also slightly lower in each successively deeper hydrostratigraphic unit from the Upper Fines Unit through the Shell Horizon Unit, indicating a downward vertical gradient across the site through these units. The limited co-located groundwater head data from the Second Sand Unit and the Deep Sand Unit prevent definitive determination of vertical gradients, and the mapped interpolation of the December 2015 head data for these units is inconclusive regarding apparent vertical gradients between these units.

2.4 Remedy Performance Evaluation

The 2015 annual groundwater sampling event consisted of collecting groundwater samples from all 79 groundwater monitoring wells scheduled to be sampled (Table 1-2). The sampling event was completed to monitor the performance of the EISB activities within, upgradient, and downgradient of the biobarriers.

The performance of the EISB treatment in the contaminant source area (SATG) and the six downgradient biobarriers (SAB, FSB-1, FSB-2, SHB-1, SHB-3, and SSB-1) is discussed below based primarily on changes in molar concentrations of chlorinated ethenes and biogeochemistry. Contaminant concentrations are discussed in terms of molar concentrations because reductive dechlorination is a 1 to 1 stoichiometric conversion (i.e., for each mole of TCE degraded, one mole of DCE is produced). Graphs displaying the molar concentrations of TCE, DCE, VC, and ethene are presented as Figures 2-8 through 2-14. In addition, trend graphs of various performance monitoring parameters (including TOC, volatile fatty acids [VFAs], DO, ORP, etc.) are included as Figures 2-15 through 2-21; two-dimensional contaminant concentration maps for TCE, cis-1,2-DCE, and VC for each of the biobarriers are included as Figures 2-22 through 2-33; and three-dimensional computer visualizations showing VOC contamination are presented in Section 3.0.

2.4.1 Chlorinated Ethenes

Overall, the data indicate that the TCE initially reported at each of the EISB treatment areas is being dechlorinated. In general, the emulsified oil injections have enhanced conditions in groundwater around the treatment areas for reductive dechlorination though many locations did not respond as favorably as expected based on the initial injection events conducted between 2008 and 2010. The following summarize the chlorinated ethene data (TCE, cis-1,2-DCE, and VC) and observations associated with each treatment area:

- SATG: Data collected during the 2015 annual event indicate that most of the remaining chlorinated ethenes continue to be located in two general areas: 1) immediately to the east of the SATG, and 2) to the southwest, outside the SATG (Figures 2-8, 2-22, 2-23, and 2-24). Data collected since baseline sampling in 2008 indicate that TCE, cis-1,2-DCE, and VC concentrations in wells located outside the SATG have remained relatively stable (MW-70-MNA01, MW-70-MNA02, MW-70-MNA03, and MW-70-MNA04) (Figure 2-8). TCE and cis-1,2-DCE concentrations in wells within the SATG have generally been variable to overall decreasing, and the VC concentrations have generally been stable. The highest concentration of VC in the SATG is 2,400 µg/L in well MW-70-28 (Figure 2-24). It is noted that there is incomplete characterization of the source

area contaminant distribution. The data gaps include: a) the eastern side of the SATG source area (between wells MW-70-MNA-01 and MW-70-27, and east of well MW-70-MNA-01); b) the northern extent of the SATG source area (north of well MW-70-MNA-01).

- SAB: Data collected during the 2015 annual event indicate that relatively low concentrations of TCE are currently present in the SAB (Figures 2-9 and 2-25). The highest TCE concentration is 2.7 µg/L at MW-70-PMW02B. The highest cis-1,2-DCE and VC concentrations are 120 µg/L (Figure 2-26) and 130 µg/L (Figure 2-27), respectively, in well MW-70-PMW03B, which has a relatively deep screen interval suggesting that most of the contamination remaining near the SAB-1 is near the bottom of the First Sand Unit.
- FSB-1: Data collected during the 2015 annual event indicate that, overall, while TCE concentrations have remained relatively low and stable since 2013, cis-1,2-DCE, VC, and ethene concentrations are somewhat variable (Figure 2-10). The highest TCE concentration is in upgradient well MW-70-PMW06B (3,400 µg/L) (Figure 2-25), which has had relatively stable TCE concentrations since 2008. Well MW-70-PMW06B has a relatively deep screen interval, suggesting that most of the contamination remaining in this area is near the bottom of the First Sand Unit. The relatively lower concentration of TCE, and the relatively elevated concentrations of cis-1,2-DCE and VC in downgradient wells MW-70-MNA07 and MW-70-PMW05B, suggest that dechlorination is occurring. However, complete dechlorination to ethene is not yet supported by the data from this horizon.
- FSB-2: Data collected during the 2015 annual event indicate that, overall, TCE concentrations have remained relatively low and stable the last few years (Figure 2-11). The cis-1,2-DCE, VC, and ethene concentrations have generally remained stable overall, with variability in some wells. In well MW-70-MNA12, located approximately 500 feet downgradient of the SSB (Figure 2-26), the cis-1,2-DCE concentration remains relatively elevated (1,000 µg/L).
- SHB-1: Data collected during the 2015 annual event indicate that the TCE and cis-1,2-DCE concentrations have remained low and, overall, have decreased since 2013 (Figure 2-12). VC and ethene concentrations have remained relatively stable since 2013.
- SHB-3: Data collected during the 2015 annual event indicate that the TCE concentrations have remained low and relatively stable since 2014 (Figure 2-13). Cis-1,2-DCE and VC concentrations have shown a generally stable trend since 2014. Ethene concentrations remain relatively low. The concentrations of cis-1,2-DCE (1,200 µg/L), and VC (78 µg/L) in downgradient well MW-70-MNA14 (Figures 2-29 and 2-30, respectively), located approximately 400 feet downgradient of the biobarrier, have decreased since their peak in 2014. In 2008, well MW-70-MNA14 had less than 1 µg/L TCE, suggesting that the elevated cis-1,2-DCE and VC concentrations currently reported in the well are the result of contaminant migration and not from dechlorination of the low level of TCE originally in the well.
- SSB-1: Data collected during the 2015 annual event indicate that overall the TCE concentrations have remained relatively stable since 2013 (Figure 2-14). Compared to 2014, the cis-1,2-DCE and VC concentrations trends are variable, increasing in some

wells and decreasing in other wells. The ethene concentrations remain relatively low (Figure 2-14). While TCE in well MW-70-43B has decreased from 170 µg/L in 2013 to 4.5 µg/L in 2015, the elevated concentration of cis-1,2-DCE in adjacent well MW-70-14 (830 µg/L) suggests that a portion of the plume has likely migrated to the northern extent of the biobarrier (Figures 2-31 and 2-32, respectively). The cis-1,2-DCE concentration in downgradient well MW-70-MNA16, located approximately 100 feet downgradient of the south-central portion of the SSB-1, remains relatively elevated (1,100 µg/L).

In general, the TCE concentrations across the site decreased or were relatively stable compared to the last annual sampling event in 2014. The highest TCE concentrations are in the Upper Fines Unit (2,200 µg/L) and the First Sand Unit (3,400 µg/L). Relatively high concentrations of cis-1,2-DCE are present in all of the hydrostratigraphic units, including the Upper Fines Unit (5,400 µg/L), the First Sand Unit (1,000 µg/L), the Shell Horizon Unit (1,200 µg/L), and the Second Sand Unit (1,100 µg/L). Relatively high concentrations of VC are also present in all of the hydrostratigraphic units including the Upper Fines Unit (2,400 µg/L), the First Sand Unit (790 µg/L), the Shell Horizon Unit (290 µg/L), and the Second Sand Unit (410 µg/L).

Overall, the data indicate that while the TCE concentrations have decreased, the cis-1,2-DCE and VC concentrations remain relatively high, and the ethene concentrations remain relatively low. Data indicate that while reductive dechlorination is occurring, relatively elevated concentrations of TCE appear to be present in the eastern portion of the SATG between wells MW-70-27 (85 µg/L) and MW-70-MNA01 (2,200 µg/L). The highest remaining concentration of TCE at the site is located near the bottom of the First Sand Unit (3,400 µg/L in MW-70-PMW06B). Increasing cis-1,2-DCE concentrations in Shell Horizon Unit well MW-70-MNA14 (from 590 µg/L in 2012 to 1,200 µg/L in 2015), and in Second Sand Unit well MW-70-MNA16 (from 880 µg/L in 2012 to 1,100 µg/L in 2015), located approximately 100 feet downgradient of the furthest downgradient biobarrier (SHB-3), suggest that complete dechlorination did not occur in either biobarrier and cis-1,2-DCE contamination is continuing to migrate in this area. In 2014, the somewhat elevated concentration of TCE in well MW-70-43B (79 µg/L) and elevated cis-1,2-DCE in well MW-70-14 (1,100 µg/L), located to the north of the SSB-1, suggested that a portion (the northern edge) of the TCE plume may migrate north of the northern extent of the SSB. Data from 2015 show a decrease in concentrations at these two wells. TCE is now below the TCG at MW-70-43B (although cis-1,2-DCE has increased at this well), and cis-1,2-DCE has decreased from 1,100 to 830µg/L at MW-70-14.

2.4.2 Electron Donor (EVO)

As part of the annual performance monitoring, TOC and VFAs were measured to evaluate the presence of the electron donor EVO. The presence of TOC can be used as a direct indicator of substrate availability, and the metabolic degradation of EVO produces VFAs. TOC concentrations above 20 milligrams per liter (mg/L) are generally considered necessary to support anaerobic dechlorination. For the purposes of this project, to be conservative, TOC levels above 50 mg/L are considered optimal for supporting reductive dechlorination, and TOC levels above 20 mg/L are considered acceptable. Figures 2-15 to 2-17 show TOC and VFA trends for select performance monitoring wells associated with each biobarrier, and additional trend graphs for additional wells are included in Appendix C.

During baseline sampling in 2008, all of the TOC concentrations were below 3 mg/L. In general, after injection of the EVO, the TOC concentrations in the injection wells increased to greater than 100 mg/L. As expected, the TOC levels within the biobarriers decrease with time as EVO is consumed during reductive dechlorination. As indicated on the graphs on Figures 2-15 and 2-16, the TOC levels in most of the groundwater monitoring wells located outside the biobarriers have consistently been low (below 50 mg/L), likely a result of their distance from the injection wells.

TOC data from injection wells sampled for the 2015 annual event indicate that only two of the 13 wells sampled have TOC above 50 mg/L (Tables 2-3 to 2-12). As expected, the TOC levels have generally decreased since the 2013 annual sampling which was completed just after the 2013 additional EVO injections. In addition, 30 monitoring wells were sampled, with approximately half of them located upgradient of the biobarriers and half located downgradient. Overall, the TOC concentrations in these wells remained generally low and unchanged from the 2014 annual sampling event.

TOC concentrations are just one line of evidence used to evaluate whether conditions are suitable for reductive dechlorination. However, TOC is considered of primary importance, as it reflects the presence of an electron donor required to drive the process. Additionally, the presence of COCs, ethene, redox conditions, Dhc, and vinyl chloride reductase A gene (*vcr*A) levels are also being evaluated to assess biobarrier performance.

VFAs (acetic, butyric, lactic, and propionic acids) were also monitored to evaluate the presence of EVO (Figure 2-17; Tables 2-3 through 2-14). VFAs are produced during the metabolic degradation of EVO, and monitoring for VFAs helps to indirectly evaluate the distribution of and metabolism EVO. In 2012, VFAs were detected in two of the seven treatment areas (SATG and the SHB-3), and in 2013 VFAs were detected in six of the seven treatment areas (all except the SHB-1). In 2014, VFAs were detected in two of the seven treatment areas (SATG and SHB-3). In 2015, VFAs were detected in three of the seven treatment areas (SATG, FSB-1 and SHB-3). VFAs were detected in two of the injection wells sampled and in two of the monitoring wells sampled. As noted above, concentrations of VFAs are one line of evidence to assess the suitability of the aquifer to support active reductive dechlorination.

2.4.3 Aquifer Redox Conditions

This section discusses DO-ORP and sulfate-methane concentrations measured during the annual event.

2.4.3.1 DO-ORP

Reductive dechlorination occurs under anaerobic conditions. This requires DO levels below 0.5 mg/L, or at least no higher than 1 mg/L. Within the injection wells in both the SATG and all of the downgradient biobarriers, the DO concentrations were equal to or below 1 mg/L in six of 13 wells, suggesting conditions within the areas of injection are becoming less anaerobic (Table 2-2). DO levels were greater than 1 mg/L in two monitoring wells, five MNA wells, and two PMW well (Table 2-2). While the aquifer remains generally anoxic, increasing DO levels have been observed since 2014.

ORP is a measure of the reducing capacity of the aquifer. In order for Dhc to survive and grow, and for reductive dechlorination to proceed optimally, ORP levels should be between -100 and -300 millivolts (mV) or lower. ORP levels in the injection wells in the SATG and in all of the downgradient biobarriers that were sampled were all below -100 mV (Table 2-2). ORP levels were also lower than -100 mV in all but one of the remaining wells sampled (Table 2-2) except POC wells. Overall, ORP levels indicate that reducing conditions are present in the aquifer.

Figure 2-18 show DO-ORP trends for a select performance monitoring well associated with each biobarrier.

2.4.3.2 Sulfate-Methane

The depletion of sulfate, an alternate electron acceptor, and the presence or increase in methane, a metabolic by-product of anaerobic microbial biodegradation, can indicate that anaerobic microbial respiration is occurring. Although there are variations within each biobarrier, historical data generally indicate that sulfate concentrations were initially reduced in the injection wells and other nearby monitoring wells shortly after the original EVO injections, but eventually the concentrations increased with time. During the 2015 annual event, sulfate was relatively stable in a majority of the wells sampled compared to the 2014 annual event, with sulfate in some wells slightly reduced, and sulfate in even fewer wells somewhat higher. Methane concentrations at the site also generally increased after the initial treatment, and have generally remained elevated. About 70 percent of wells sampled in 2015 reported a decrease in methane concentrations since 2014, although methane concentrations remain elevated. Overall, the elevated levels of methane in the aquifer suggest that anaerobic microbial respiration is occurring.

Figure 2-19 shows sulfate-methane trends for select performance monitoring wells associated with each biobarrier, and additional trend graphs for additional wells are included in Appendix C.

2.4.4 Bioaugmentation (*Dehalococcoides*)

As part of the EISB remedy, a commercially available dechlorinating culture containing Dhc organisms (KB-1®) was injected into the aquifer following the injection of the EVO during the initial 2008 to 2010 injection program. Additional Dhc organisms were not injected into the aquifer during the 2013 EVO injection program. One of the important lines of evidence indicating that the EISB remedy is functioning is to confirm the presence of Dhc and the *vcr*A gene. The presence of the *vcr*A gene in the dechlorinating population has been shown to be important in facilitating complete reduction of TCE to ethene.

The concentrations of Dhc and *vcr*A were measured in select wells located both within and around the biobarriers. A total of 64 samples were submitted for Dhc analysis. 51 of those 64 samples were also submitted for *vcr*A analysis. A total of 13 injection wells were sampled for both Dhc and *vcr*A from six of the biobarriers plus the source treatment area. Two injection wells had Dhc at levels above the desired concentration of 10^7 gene copies/liter (L), and nine had *vcr*A at levels above the desired concentration of 10^5 gene copies/L (Tables 2-3 to 2-14, Figures 2-20 and 2-21). In addition to the 13 injection wells, 51 monitoring wells were sampled for Dhc, with 38 of those 51 samples receiving the additional vcrA analysis. Approximately half of these monitoring wells are located upgradient of the biobarriers and half located downgradient. One of the 51 samples

had Dhc at levels above the desired concentration of 10^7 gene copies/L and 14 of the 38 samples had *vcr*A at levels above the desired concentration of 10^5 gene copies/L.

2.4.5 Water Quality Parameters

During the 2015 annual event, aquifer hydrogen ion concentration (pH) values primarily ranged between 6 and 8, the range ideal for microbial growth. Relatively high pH outside this range was reported in MW-70-43A (8.2).

Alkalinity is an indicator of the buffering capacity of the aquifer, and the alkalinity values reported during the annual event are consistent with historical results.

Results are provided under Table 2-2.

2.4.6 Summary of Remedy Performance Evaluation

Overall, the data indicate that while the TCE concentrations have decreased, the cis-1,2-DCE and VC concentrations remain relatively high, and the ethene concentrations remain relatively low. Overall, the remedy has been effective in reducing TCE concentrations. However, the results for cis-1,2-DCE and VC suggest that while dechlorination continues throughout the plume, complete dechlorination to ethene has been less uniform. Relatively high concentrations of cis-1,2-DCE and VC are present in all of the hydrostratigraphic units at the site. The stable to increasing concentrations of cis-1,2-DCE and VC in the Shell Horizon and Second Sand Units suggests continued migration from upgradient sources and incomplete dechlorination within these zones. The results suggest that continued monitoring north of the northern extent of the SSB1 barrier is necessary to assess continued plume migration along the northern extent of the plume in the Second Sand Unit that may be outside the influence of the injection wells.

The redox conditions (specifically DO and ORP) generally remained during 2015 in the optimal range to support reductive dechlorination. The low DO clearly indicates that all hydrostratigraphic units are anaerobic and the ORP similarly indicates all units are reducing. While the redox conditions are clearly supportive of reductive dechlorination, the indicators of adequate electron donor presence to support microbial activity (through assessment of TOC and VFAs) are less suggestive of widespread optimal conditions. While the 2013 EVO injections had some noticeable positive impacts on redox conditions, the most recent (2015) TOC data indicate that only two of the 13 injection wells have TOC above 50 mg/L. Furthermore, VFAs were detected in only two of the 13 injection wells and in two of the monitoring wells sampled. The presence of electron donors, in concert with the indication of anaerobic respiration and dechlorination, should be critically assessed in select injection wells during the next semi-annual event as a means of determining electron donor presence and significance.

Two of the 13 injection wells sampled had Dhc at levels above the desired concentration of 10^7 gene copies/L, and nine had vcrA at levels above the desired concentration of 10^5 gene copies/L. The presence of elevated methane in many locations suggests that anaerobic microbial respiration is still occurring at the site. The robustness of the microbial community and associated changes in hydrogen gases should continue to be critically monitored in the next annual event. The results of the suggested semi-annual assessment of electron donor and standard annual sampling and analysis

should be used in the next annual assessment to evaluate overall EISB performance and the need to conduct any further optimization of the injection scheme.

2.5 Soil Vapor Results

Twelve soil vapor probes were installed in the contaminant source area (Figure 2-34) to monitor methane and hydrogen sulfide gases within the vadose zone for health and safety purposes (ECC-Insight 2009a). The soil vapor probes were constructed with screens at depths between 5 and 6 feet bgs (the vadose zone extends from ground surface to between 9 and 17 feet bgs) at locations near active buildings or underground utility corridors that could potentially contain elevated concentrations. The probes were installed to monitor for migration of methane and hydrogen sulfide gases, as required by the RAWP (ECC/Geosyntec 2008a), for the protection of on-site workers and tenants/occupants of the surrounding facilities. In addition, a *Methane Monitoring Plan* with emergency procedures was prepared in 2009 (ECC-Insight 2009b) for implementation after elevated concentrations of methane were initially detected in the soil vapor probes during the 2008 base line sampling event. As part of this plan, the methane levels are measured within utility corridors and nearby buildings in the contaminant source area where methane concentrations could potentially accumulate.

In addition to methane and hydrogen sulfide gas measurements, soil gas samples were analyzed for VOCs to monitor for TCE and TCE-related biological breakdown products in the vicinity of the in-situ bioremediation area.

During the 2015 annual performance monitoring event, soil gas samples were collected from 11 of the 12 probes and analyzed for methane and hydrogen sulfide gases, and VOCs. SV-70-03 was not sampled due to the presence of water in the probe port. The analytical results are shown in Table 2-15 and on Figure 2-34 and discussed in further detail below.

2.5.1 Methane Soil Vapor Results

Methane was reported in all samples between 220 parts per million by volume (ppm_V) and 520,000 ppm_V (Figure 2-34). The lower explosive limit (LEL) for methane in air is 50,000 ppm_V and the upper explosive limit (UEL) in air is 150,000 ppm_V. Methane was reported above its LEL at five locations, including SV-70-02, SV-70-05, SV-70-06, SV-70-07, and SV-70-10 (Figure 2-34). At three of these locations the UEL was also exceeded. Compared to the 2014 soil vapor sampling event, 2015 results were mixed with approximately half of the probe locations showing an increase in methane concentrations. The highest concentration, 520,000 ppmV, was detected at probe SV-70-05, located near the south western edge of the SATG (Figure 2-34).

2.5.2 VOC Soil Vapor Results

All 11 samples were analyzed for VOCs. Benzene was detected in three samples. The maximum concentration was 210 parts per billion by volume (ppbV). Cis-1,2-DCE was detected in all 11 samples. The maximum concentration was 18,000 ppbV. Chloroform was detected in four samples. The maximum concentration was 610 ppbV. Tetrachloroethylene (PCE) was detected in three samples. The maximum concentration was 220 ppbV. TCE was detected in nine samples. The maximum concentration was 10,000 ppbV. VC was detected in all 11 samples. The maximum concentration was 45,000 ppbV.

2.5.3 Hydrogen Sulfide Soil Vapor Results

Hydrogen sulfide was detected in two samples. The maximum concentration was 3.5 ppmV.

2.5.4 Ambient Air Monitoring for Methane Gas and VOCs

Ambient air monitoring, for both methane gas and VOCs, was conducted on January 15, 2016 in the contaminant source area, including areas extending from utility corridors and around buildings within the treatment grid to the southeast towards SAB-1. The areas surveyed were consistent with the areas identified in the *Methane Monitoring Plan* (ECC-Insight 2009b) and previous surveys. Specifically, ambient air monitoring was conducted inside Buildings 118, 119, 121, 122, 123, and 124, and utility corridors west of the tank farm and east of soil gas probes SV-70-02 and SV-70-05 Methane gas monitoring was conducted using a hand-held multi-gas monitor with methane and oxygen sensors (RKI Eagle). A photo-ionization detector (PID) was used to monitor for the presence of VOCs. Field monitoring logs documenting the locations monitored and results are included in Appendix A.

Gas measurements were obtained from surface features such as cracks, joints, penetrations, corners, subsurface utility accesses at exterior asphalt paved areas and inside the buildings at floor slabs that could serve as potential pathways for the migration of methane gas and/or VOCs from underlying soils. No VOCs or methane were detected at any of the locations surveyed.

2.5.5 Summary of Soil Vapor Results

The presence of elevated methane gas concentrations and both secondary and tertiary TCE daughter products in soil gas samples provides further evidence that substantial biodegradation has been occurring in the remedial target area at IRP Site 70. Although these findings are quite positive with respect to remedial performance, several of the soil gas findings warrant further evaluation because of potential hazards and/or human health risks.

Potential risks associated with the soil gas conditions reported at IRP Site 70 include the following:

- Acute Risk - Fire/Explosion hazard resulting from methane gas concentrations greater than both its LEL and UEL: the presence of methane at concentrations exceeding 50,000 ppm_v in soil gas creates the potential for methane and oxygen to accumulate at explosive concentrations within confined spaces, utility vaults/corridors and similar locations where soil gas may mix with ambient air under confined or semi-confined conditions.

- Acute Risk – Asphyxiation hazard due to depressed oxygen conditions resulting from elevated methane gas and other soil gas components (principally carbon dioxide): the presence of methane at percent levels within the vadose zone creates the potential for confined or semi-confined spaces to become asphyxiation hazards. Such conditions can be Immediately Dangerous to Life and Health.

- Several chlorinated VOCs (CVOCs), including PCE, TCE, cis-1,2-DCE, and VC were reported in soil gas samples. As noted under Section 2.5.4 where ambient air showed no detections for VOCs, these soil gas data do not have any impact on indoor air.

Soil Gas Recommendations:

- Continue implementation of the existing confined space monitoring program at IRP Site 70.
- Continue monitoring ambient air and suspected soil gas entry locations (i.e., foundation cracks, utility corridors, etc.) with both PID and a 4-gas meter, for LEL, percent carbon dioxide and percent oxygen in addition to methane. Consider supplementing the PID with a flame-ionization detector (FID) which is intrinsically safe to the environment and also responds to methane and has excellent response to CVOCs.

3.0 CONCEPTUAL SITE MODEL UPDATE

The primary purpose of the CSM is to provide a visualization of both the subsurface hydrogeology and dissolved-phase TCE, cis-DCE, and VC plume morphologies. This is achieved by using both two-dimensional water-level and plume contour maps, and three-dimensional plume visualization figures using Groundwater Modeling Software (GMS). Over several CSM iterations, both the hydrogeology and contaminant distribution have been improved and refined. This updated CSM provides an understanding of the current conditions at IRP Site 70 based on the 2015 annual performance monitoring results (Figures 3-1 through 3-12). Specific data include:

- Water level elevation data from the 2015 annual performance monitoring event
- Groundwater sample results for TCE and daughter products of reductive dechlorination (specifically, cis-1,2-DCE, VC, and ethene data) from the 2015 sampling event

3.1 Lithology

No new lithologic information for IRP Site 70 was obtained during 2015; therefore, the hydrogeology of the site used in the 2012 CSM was used in the 2015 revision. A summary of the subsurface hydrogeology used in the model is illustrated in cross-sections both through the source area (Figures 3-2 and 3-3) and the downgradient plume (Figures 3-8 through 3-10) and is described below:

- **Upper Fines Unit (from surface fill material to approximately 60 feet bgs).** The Upper Fines Unit comprises the following five subunits:
  - **Clay 1:** Clayey soils are present from below the fill to approximately 20 feet bgs (i.e., "surficial fines").
  - **Sand 1:** Beginning at approximately 20 feet bgs, a predominantly fine-grained sand is present that ranges in thickness from 2 to 17 feet (i.e., "20 foot sand").
  - **Clay 2:** Beginning at approximately 30 to 38 feet bgs, a predominantly clayey unit is present that ranges in thickness from approximately 3 to 10 feet (i.e., "30 foot fines").
  - **Sand 2:** Beginning at approximately 38 to 57 feet bgs, a fine- to medium-grained sand unit is present that ranges in thickness from 13 to 20 feet (i.e., "40 foot sand").
  - **Clay 3:** Beginning at approximately 57 to 60 feet bgs, a silty clay to clay layer is present that ranges in thickness from 2 to 3 feet (i.e., "60 foot clay").
- **First Sand Unit (approximately 60 to 105 feet bgs).** The First Sand Unit consists of interbedded fine-grained and medium-grained sands and silty sands. A coarse sand/fine gravel layer was encountered in several borings between 80 and 95 feet bgs, and localized clays layers were observed between 80 to 90 feet bgs in several SAB injection wells. The First Sand Unit varies in thickness from approximately 30 to 50 feet.
- **Shell Horizon Unit (approximately 105 to 135 feet bgs).** The Shell Horizon Unit consists of a sequence of interbedded clays, silts, sands, and gravels with laterally discontinuous interbeds of dense shells and shell fragments. In the source area, this unit comprises a sequence of interbedded clays, silts, sands, and gravels. The unit transitions to predominantly fine-grained sand near well RDO-6A/B between First and Second

Street in the downgradient plume area. Within the CSM, the Shell Horizon Unit is subdivided into the Shell Horizon Clays Unit (interbedded) and Shell Horizon Sand Unit (fine-grained) to reflect differences in hydrogeologic characteristics.

- **Second Sand Unit (approximately 135 to 170 feet bgs).** Although similar in overall lithology to the First Sand Unit, the Second Sand Unit appears to be slightly coarser grained in its upper section.
- **Deep Clay Unit (approximately 170 to 190 feet bgs).** The Deep Clay Unit consists of an upper clay to silty clay horizon and a lower clayey silt, silt, sandy silt, or sandy clay layer. The upper clay to silty clay layer appears to be a continuous low-permeability unit that is encountered between 164 to 176 feet bgs. The upper clay to silty clay unit grades downward to clayey silt, silt, sandy silt, or sandy clay. This lower layer is 3 to 20 feet thick, and extends to depths of 175 to 188 feet bgs. Below the clayey silt, silt, sandy silt, or sandy clay layer is a silty sand and sand layer, up to 6 feet thick, which has been observed at a depth of 191 feet bgs.
- **Deep Sand Unit (approximately 190 feet bgs and deeper).** The Deep Sand Unit consists of fine-grained sands and silty sands and appears to be similar in character to the First and Second Sand Units. It should be noted that the Deep Sand Unit has been logged in only a few boreholes on NAVWPNSTA Seal Beach (BEI 2002).

3.2 Contaminants of Concern

This section discusses the COCs detected in each of the hydrostratigraphic units based on the 2014 groundwater monitoring results (Tables 2-3 through 2-14, and Figures 2-22 through 2-33). The COCs identified for IRP Site 70 include TCE, cis-1,2-DCE, VC, trans-1,2-DCE, PCE, 1,1-DCE, and chloroform. In addition, concentrations of TCE are compared to results from the baseline sampling event completed in 2008, and concentrations of cis-1,2-DCE and VC are compared to results from the last annual sampling event completed in 2014 (Table 3-1).

3.2.1 Upper Fines Unit

Contamination in the Upper Fines Unit is monitored by wells located in and near the SATG. During the 2015 performance monitoring event, 10 monitoring wells and four POC wells were sampled in the Upper Fines Unit.

The analytical results are presented in Tables 2-4, and the results for TCE, cis-1,2-DCE, and VC are summarized on Figures 2-22, 2-23, and 2-24, respectively. The following summarizes the results for COCs:

- TCE was detected above the TCG (5 µg/L) in seven of the 10 monitoring wells. The two highest TCE concentrations were 2,200 µg/L and 85 µg/L (wells MW-70-MNA01 and MW-70-27, respectively), with the remaining concentrations above the TCG ranging between 7.5 and 64 µg/L. The maximum concentration of TCE in the Upper Fines Unit during baseline sampling in 2008 was 11,000 µg/L, compared to the current (2015) maximum concentration of 2,200 µg/L (Table 3-1).

- Cis-1,2-DCE was detected above the TCG (6 µg/L) in nine of the 10 monitoring wells. The two highest cis-1,2-DCE concentrations were 5,400 µg/L and 2,200 µg/L (wells MW-70-28 and MW-70-27, respectively), with the remaining concentrations above the TCG ranging between 16 and 730 µg/L. The maximum concentration of cis-1,2-DCE in the Upper Fines Unit during the 2012 annual sampling event was 5,700 µg/L, compared to the current (2015) maximum concentration of 5,400 µg/L (Table 3-1).
- VC was detected above the TCG (0.5 µg/L) in eight of the 10 monitoring wells. Two monitoring wells had VC above 1,000 µg/L, including MW-70-28 (2,400 µg/L), and MW-70-PMW01B (1,500 µg/L). The maximum concentration of VC in the Upper Fines Unit during the 2012 annual sampling event was 9,000 µg/L, compared to the current (2015) maximum concentration of 2,400 µg/L (Table 3-1).
- Trans-1,2-DCE was detected above the TCG (10 µg/L) in seven of the 10 monitoring wells. The highest trans-1,2-DCE concentration was 86 µg/L in well MW-70-MNA01, compared to the maximum concentration of 44 µg/L reported in the Upper Fines Unit during baseline sampling in 2008.
- PCE was not detected in any of the POC wells, and was not detected in any of the 10 monitoring wells above the TCG of 5 µg/L. PCE was reported up to 9.5 µg/L in the Upper Fines Unit during baseline sampling in 2008.
- 1,1-DCE was detected above the TCG (6 µg/L) in one of the 10 monitoring wells (MW-70-28), and was not detected in any of the POC wells. 1,1-DCE was reported up to 16 µg/L in the Upper Fines during baseline sampling in 2008.
- Chloroform was not detected above the TCG (100 µg/L) in any of the sampled wells.

Mostly low concentrations of some non-COC VOCs were reported (Tables 2-4). However, 1,1-dichloroethane was reported slightly above its maximum contaminant level (MCL) of 5.0 µg/L in one well (MW-70-28 at 5.5 µg/L); 1,2-dichloroethane was reported slightly above its MCL of 0.5 µg/L in two wells (MW-70-28 at 0.58 µg/L and MW-70-MNA03 at 0.66 µg/L); and methyl tert-butyl ether was detected in upgradient POC well MW-70-02 at 22 µg/L, which is above its MCL of 13 µg/L.

3.2.2 First Sand Unit

Contamination in the First Sand Unit is monitored by wells located in and near the SAB, FSB-1, and FSB-2. During the 2015 performance monitoring event, 25 monitoring wells, six injection wells, and four POC wells were sampled in the First Sand Unit.

The analytical results are presented in Tables 2-5 to 2-8, and the results for TCE, cis-1,2-DCE, and VC are summarized on Figures 2-25, 2-26, and 2-27, respectively. The following summarizes the results for COCs:

- TCE was detected above the TCG (5 µg/L) in four of the 25 monitoring wells, detected at trace levels at two of the six injection wells, and was not detected in the four POC wells. The highest TCE concentration was 3,400 µg/L (MW-70-PMW06B), with the remaining concentrations above the TCG ranging between 7 and 15 µg/L. The maximum

concentration of TCE in the First Sand Unit during baseline sampling in 2008 was 4,100 µg/L, compared to the current (2015) maximum concentration of 3,400 µg/L (Table 3-1).

- Cis-1,2-DCE was detected above the TCG (6 µg/L) in 19 of the 25 monitoring wells. Three monitoring wells had cis-1,2-DCE concentrations over 500 µg/L, including MW-70-PMW07B (640 µg/L), MW-70-PMW06B (760 µg/L), and MW-70-MNA12 (1,000 µg/L). Cis-1,2-DCE was detected at trace concentrations at two of the four POC wells (MW-70-11 and -35) which are located lateral to the main flow direction. The maximum concentration of cis-1,2-DCE in the First Sand Unit during the 2012 annual sampling event was 1,600 µg/L, compared to the current (2015) maximum concentration of 1,000 µg/L (Table 3-1).
- VC was detected above the TCG (0.5 µg/L) in 23 of the 25 monitoring wells and in five of the six injection wells. VC was not detected in any of the POC wells. The highest VC concentration was 790 µg/L in well MW-70-PMW06A. The maximum concentration of VC in the First Sand Unit during the 2012 annual sampling event was 850 µg/L, compared to the current (2015) maximum concentration of 790 µg/L (Table 3-1).
- Trans-1,2-DCE was detected above the TCG (10 µg/L) in four of the 24 monitoring wells and not detected in the six injection wells. Trans-1,2-DCE was not detected in any of the POC wells. The highest trans-1,2-DCE concentration was 140 µg/L in well MW-70-PMW06B, compared to the maximum concentration of 47 µg/L reported in the First Sand Unit during baseline sampling in 2008.
- PCE was not detected in any of the monitoring, injection, or POC wells during the 2015 sampling event. PCE was reported at a maximum of 2 µg/L in the First Sand Unit during baseline sampling in 2008.
- 1,1-DCE was detected above the TCG (6 µg/L) in one of the 25 monitoring wells (MW-70-PMW06A) at 8.6 µg/L. 1,1-DCE was not detected in any of the injection wells nor in any of the POC wells. 1,1-DCE was reported up to 14 µg/L during baseline sampling in 2008.
- Chloroform was not detected above the TCG (100 µg/L) in any of the sampled wells.

Low concentrations of some non-COC VOCs were reported (Tables 2-5 to 2-8); however, none of the compounds were present above their respective MCLs.

3.2.3 Shell Horizon Unit

Contamination in the Shell Horizon Unit is monitored by wells located in and near the SHB-1 and the SHB-3. During the 2015 performance monitoring event, eight monitoring wells, four injection wells, and one POC well were sampled.

The analytical results are presented in Tables 2-9 to 2-11, and the results for TCE, cis-1,2-DCE, and VC are summarized on Figures 2-28, 2-29, and 2-30, respectively. The following summarizes the results for COCs:

- TCE was detected slightly above the TCG (5 µg/L) in two of the eight monitoring wells and in two of the four injection wells. TCE was not detected in the POC well. The highest TCE concentration was 7.4 µg/L (MW-70-SHB217). The maximum

concentration of TCE in the Shell Horizon Unit during baseline sampling in 2008 was 4,300 µg/L, compared to the current (2015) maximum concentration of 7.4 µg/L (Table 3-1).

- Cis-1,2-DCE was detected above the TCG (6 µg/L) in six of eight of the monitoring wells and in three of four of the injection wells. Cis-1,2-DCE was not detected in the POC well. One monitoring well and one injection well had cis-1,2-DCE over 500 µg/L. The maximum concentration of cis-1,2-DCE in the Shell Horizon Unit during the 2012 annual sampling event was 1,800 µg/L, compared to the current (2015) maximum concentration of 1,200 µg/L (Table 3-1).
- VC was detected above the TCG (0.5 µg/L) in seven of the eight monitoring wells and in all four of the injection wells. VC was not detected in the POC well. Two monitoring wells and one injection well had VC over 100 µg/L, with the highest concentration at 290 µg/L (IW-70-SHB113). The maximum concentration of VC in the Shell Horizon Unit during the 2012 annual sampling event was 440 µg/L, compared to the current (2015) maximum concentration of 290 µg/L (Table 3-1).
- Trans-1,2-DCE was detected above the TCG (10 µg/L) in four of the eight monitoring wells and in one of the four injection wells. Trans-1,2-DCE was not detected in the POC well. The highest trans-1,2-DCE concentration was 56 µg/L in well IW-70-SHB217, compared to the maximum concentration of 60 µg/L reported in the Shell Horizon Unit during baseline sampling in 2008.
- PCE was not detected in any of the monitoring, injection, or POC wells during the 2015 sampling event. PCE was also not detected in the Shell Horizon Unit during the baseline sampling event in 2008.
- 1,1-DCE was not detected above the TCG (6 µg/L) in any of the eight monitoring wells or in any of the four injection wells. 1,1-DCE was not detected in the POC well. During the baseline sampling event in 2008, 1,1-DCE was detected in the Shell Horizon Unit at a maximum of 6 µg/L.
- Chloroform was not detected in any of the sampled wells.

Mostly low concentrations (below their respective MCLs) of some non-COC VOCs were reported (Tables 2-9 to 2-11); Acetone and 2-butanone were reported at elevated concentrations, but no MCL has been established for either compound. Acetone and 2-butanone are common laboratory contaminants.

3.2.4 Second Sand Unit

Contamination in the Second Sand Unit is monitored by wells located in and near SSB-1. During the 2015 performance monitoring event, 10 monitoring wells, two injection wells, and two POC wells were sampled.

The analytical results are presented in Tables 2-12 and 2-13, and the results for TCE, cis-1,2-DCE, and VC are summarized on Figures 2-31, 2-32, and 2-33, respectively. The following summarizes the results for COCs:

- TCE was detected above the TCG (5 µg/L) in five of the 10 monitoring wells, but was not detected above the TCG in the two injection wells. TCE was not detected in any of the POC wells. The highest TCE concentration was 6.8 µg/L (MW-70-MNA16). The maximum concentration of TCE in the Second Sand Unit during baseline sampling in 2008 was 1,100 µg/L, compared to the current (2015) maximum concentration of 6.8 µg/L (Table 3-1).
- Cis-1,2-DCE was detected above the TCG (6 µg/L) in nine of the 10 monitoring wells, but was not detected above the TCG in the two injection wells. Cis-1,2-DCE was not detected in the two POC wells. The highest cis-1,2-DCE concentration was 1,100 µg/L (the concentration reported for both MW-70-MNA16 and MW-70-PMW14A). The maximum concentration of cis-1,2-DCE in the Second Sand Unit during the 2012 annual sampling event was 1,100 µg/L, compared to the current (2015) maximum concentration of 1,100 µg/L (Table 3-1).
- VC was detected above the TCG (0.5 µg/L) in six of the 10 monitoring wells and in both of the injection wells. VC was not detected in the two POC wells. The highest VC concentration was 410 µg/L (MW-70-PMW14B), located downgradient of the biobarrier. The maximum concentration of VC in the Second Sand Unit during the 2012 annual sampling event was 370 µg/L, compared to the current (2014) maximum concentration of 410 µg/L (Table 3-1).
- Trans-1,2-DCE was detected above the TCG (10 µg/L) in six of the 10 monitoring wells and in both of the two injection wells. Trans-1,2-DCE was not detected in the two POC wells. The highest trans-1,2-DCE concentration was 79 µg/L in well MW-70-PMW14A, compared to the maximum concentration of 39 µg/L reported during baseline sampling in 2008.
- PCE was not detected in any of the monitoring or injection wells during the 2015 sampling event. However, PCE was reported in one of the two POC wells at 1.5 µg/L (MW-70-36), below the TCG of 5 µg/L. During the baseline sampling event in 2008, PCE was reported in the Second Sand Unit at a maximum of 2.4 µg/L.
- 1,1-DCE was not detected in any of the injection or POC wells, and was not reported above the TCG (6 µg/L) in any of the monitoring wells. During the baseline sampling event in 2008, 1,1-DCE was also not reported in the Second Sand Unit above the TCG (6 µg/L).
- Chloroform was not detected in any of the monitoring wells, injection wells, or the POC wells during the 2015 sampling event.

Low concentrations of some non-COC VOCs were reported (Tables 2-12 and 2-13); however, none of the compounds were present above their respective MCLs.

3.2.5 Deep Sand Unit

Contamination in the Deep Sand Unit is monitored by three POC wells (Figure 2-5). The analytical results are presented in Table 2-14. COCs were not detected in any of the Deep Sand wells during the 2015 monitoring event.

The only two compounds reported in the Deep Sand Unit were toluene and carbon disulfide. Toluene was reported at 1.2 µg/L in well MW-70-POC04, which is significantly below the 150 µg/L MCL. Carbon disulfide was reported at a low concentration of 0.37 µg/L in well MW-70-POC02.

3.3 Visualization of Dissolved Plume Extent

Groundwater data from the 2015 performance monitoring event were imported into GMS, a 3-dimensional visualization software package. The Environmental Visualization Software presentation of the nature and extent of site contamination identified during the baseline sampling event in 2008 is included in Appendix D for reference to help illustrate the remediation progress achieved to date. A discussion on the spatial extent of contamination is provided in the subsequent subsections based on the results of the GMS visualization (Figures 3-1 through 3-12) and the two-dimensional plume contour maps (Figures 2-22 through 2-33). Assessment of the spatial extent of the plumes is made based on mapping the plumes at their respective TCGs and at concentrations reflective of the core of the plumes, including 250 µg/L for TCE, 60 µg/L for DCE, 20 µg/L for VC and 10 µg/L for ethene. In addition, the extent of the TCE plume at concentrations greater than 1000 µg/L is also evaluated.

3.3.1 Trichloroethene

The extent of TCE at concentrations greater than 1000 µg/L is illustrated in Figure 3-1. The extent of plume at this concentration threshold is very similar to the conceptualization presented in the 2014 annual assessment (TtEC 2014). A comparison of the extent of TCE above 250 µg/L between 2008 and 2015 is shown on Figures 2-35 and 2-36, respectively. The 2015 TCE plume footprint is approximately one percent of the area of the 2008 plume footprint. In the 2014 and 2015 annual monitoring events, there were about an equal number of wells with TCE greater than 250 µg/L, with three wells with TCE concentrations greater than 250 µg/L in 2014 and two wells with TCE concentrations greater than 250 µg/L in 2015. The core of the TCE plume has not changed appreciably since the 2014 sampling event.

TCE at concentrations greater than 250 µg/L was detected in the Upper Fines Unit (contaminant source area) and the First Sand Unit (Figures 2-22, 2-25, 3-2, 3-3, 3-4, and 3-11). As shown on Cross Section B-B' (Figure 3-3), the elevated concentration of TCE in the First Sand Unit is located near the bottom of the unit.

After comparing the plume maps showing the extent of TCE above the MCL for drinking water (5 µg/L) between the 2015 event (Figures 2-22, 2-25, 2-28 and 2-31) and the 2014 event (ECC 2015a), the overall extent of TCE was generally similar to slightly smaller with the exception of a slightly larger footprint in the Upper Fines Unit centered around MW-70-MNA04. TCE concentrations overall remained stable in each unit and the areal extent of the 5 µg/L plume boundaries did not change significantly. The most notable change in plume extents is in the Second Sand Unit, in the vicinity of MW-70-43B where the plume has attenuated to below the TCG. TCE was not reported in any POC wells, suggesting that overall the plume remains adequately contained within the POC well boundary.

3.3.2 Cis-1,2-Dichloroethene

During the 2015 annual monitoring event, a total of 32 of 79 wells sampled contained cis-1,2-DCE concentrations greater than 60 µg/L, compared to 34 of 79 wells during the 2014 annual event. Comparing the plume maps showing the extent of cis-1,2-DCE above the maximum concentration limit for drinking water (60 µg/L) between the 2015 event (Figures 2-23, 2-26, 2-29 and 2-32, 3-5, 3-8 and 3-12) and the 2014 event (ECC-Insight 2015a), the overall extent of cis-1,2-DCE was generally similar to slightly smaller except at the leading edge of the plume where the plume is projected to have migrated slightly in the First and Second Sand Units.

Cis-1,2-DCE was reported at trace concentrations in the two cross-gradient POC wells within the First sand Unit, suggesting that overall the plume remains adequately contained within the POC well boundary.

3.3.3 Vinyl Chloride

During the 2015 annual monitoring event, a total of 28 of 79 wells sampled had VC concentrations greater than 20 µg/L, compared to 28 of 79 wells during the 2014 annual event. Comparing the plume maps showing the extent of VC above the maximum concentration limit for drinking water (0.5 µg/L) between the 2015 event (Figures 2-24, 2-27, 2-30 and 2-33) and the 2014 event (ECC 2015a), the overall extent of VC was generally similar to slightly smaller.

VC was not reported in any POC wells, suggesting that overall the plume remains adequately contained within the POC well boundary.

3.3.4 Ethene

The extent of ethene at concentrations greater than 10 µg/L from the 2015 CSM is shown on Figure 3-7, which shows the plume generally similar to the 2014 CSM (ECC 2015a).

4.0 VARIANCES TO THE WORK PLAN AND DATA QUALITY ASSESSMENT

This section summarizes variances to the RAWP and a Data Quality Assessment of the data collected during the 2015 annual performance monitoring event.

4.1 Variances to the Work Plan

An addendum (#5) to the SAP (ECC-Insight, 2014a) was completed which included the addition of the new scope for sampling and analysis of the soil vapor samples for VOCs. No other changes were made to the previous addendum (#4).

In addition, one of the 12 soil vapor probes, SV-70-03, was not sampled due to the presence of water in the probe port.

4.2 Data Quality Assessment

Samples were collected and analyzed in accordance with the Final Addendum 5 to the Final SAP (ECC-Insight 2014a). Groundwater samples were analyzed by EMAX located in Torrance, California, for some or all of the following parameters:

- VOCs by U.S. Environmental Protection Agency (EPA) Method 8260B
- Dissolved hydrocarbon gases (ethane, ethene, and methane) by RSK175
- Total alkalinity by Standard Method 2320B
- Total dissolved solids by Standard Method 2540C
- Anions (bromide, chloride, nitrate, nitrite, sulfate) by EPA Method 300.0
- VFAs (acetate, butyrate, lactate, propionate) by EPA Method 300.0M
- Dissolved hydrogen sulfide by Standard Method 4500S2H
- TOC by Standard Method 5310B
- Dissolved metals (arsenic, iron, manganese) by EPA Method 6010B

In addition, some of the groundwater samples required deoxyribonucleic acid (DNA) assay analysis, which was conducted by SiREM Labs located in Ontario, Canada.

Soil gas vapor samples were also collected during this performance period for methane and hydrogen sulfide analysis at 11 locations using EPA Methods 25C and 16, respectively. In addition, VOCs by EPA Method TO-15 (Full List). These vapor samples were analyzed by Eurofins/Calscience, Inc. located in Garden Grove, California.

A third-party validation company (Laboratory Data Consultants, Inc.) performed data validation only on groundwater sample analyses performed by EMAX. DNA assay analysis and soil vapor analysis were not required to be third-party validated. The data validation was conducted in accordance with Environmental Work Instruction (EWI) #1, 3EN2.1, Chemical Data Validation (NAVFAC SW 2001), the Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA 540/R-99/008 (EPA 1999), the Contract Laboratory Program National

Functional Guidelines for Inorganic Data Review, EPA 540-R-0-/004 (EPA 2004), the Quality Systems Manual for Environmental Laboratories (Department of Defense 2010), and the criteria specified in the Final Addendum 5 to the Final SAP (ECC-Insight 2014a). Twenty percent of the samples were validated in accordance with an EPA Level IV-equivalent protocol, and the remaining samples were validated with an EPA Level III-equivalent protocol.

Tables 2-3 through 2-14 summarize the groundwater results, and Table 2-15 summarizes the soil gas results. Appendix B-1 contains the laboratory analytical reports and chain-of-custody forms.

The laboratory's quality assurance oversight involved the performance of a first-level screening of the data and an indication of any deviations from their precision, accuracy, detection limit, or laboratory quality assurance/quality control (QA/QC) criteria. A copy of the laboratory QA/QC analytical results including the chain-of-custody documentation can be found in Appendix B-1. A representative from the laboratory signed the data sheets, ensuring that the screening described above had been completed. Subsequently, ECC-Insight completed data review by comparing chain-of-custody forms, sample receipts, sample log-ins, and laboratory data packages. Review of these summaries confirmed that data quality objectives were met. Additionally, the analytical data, along with the associated laboratory quality control information, were forwarded to Laboratory Data Consultants, Inc., for data validation. An EPA Level III data validation was performed on all of the groundwater samples; with 20 percent of the samples undergoing a Level IV data validation. Data validation reports are provided in Appendix B-2.

Data validation includes evaluation of holding times, sample preservation, instrument performance checks, initial and continuing calibration verifications, method blanks, surrogates, laboratory control samples, internal standards, inductively coupled plasma interference check, target compound identification, matrix spikes, serial dilution, field blanks, field duplicates and system performance. Generally, the results were within analytical criteria with a few minor exceptions, such as calibration outliers of some VOCs, detections in the laboratory method blanks and equipment blanks, VOC surrogate spikes, trip blank hits for methane and matrix spike outliers for acetate and arsenic. All affected compounds were qualified "J" (estimated) or "UJ" (non-detect estimated) and blanks were qualified as "U" (non-detect).

QA/QC measurements were taken in the field to ensure that meaningful and representative data sets were generated. Field duplicate samples were collected at a rate of 10 percent of the total number of groundwater monitoring wells sampled and trip blank samples were included in the coolers that contained volatile organic analysis vials. These samples were collected to ensure the consistency and integrity of sample collection methods. Field duplicate samples were collected for wells: MW-70-10, MW-70-MNA01, MW-70-MNA11, MW-70-PMW-02A, MW-70-PMW04A, MW-70-PMW07A, MW-70-PMW09 and MW-70-SSB109. Field duplicate results are generally similar to the original results and no significant problems were noted. Seven trip blank samples were shipped. No VOC contaminant was reported with exception of hits for methane in the trip blanks. Four equipment rinse samples were collected. Minor exceptions are noted in the data validation reports under Appendix B-2. One source blank was collected. Minor exceptions are noted in the data validation reports under Appendix B-2.

Data were generally found to be acceptable with respect to accuracy, precision, completeness, and comparability criteria. All analytical data presented in Tables 2-3 through 2-14 are valid and usable. Validation findings were advisory and findings are detailed in Appendix B-2.

5.0 LAND-USE CONTROLS

This section summarizes the LUCs implemented at IRP Site 70, per the Record of Decision and RAWP (Geosyntec 2006a, ECC/Geosyntec 2008a). The LUC objectives include:

- Preventing the use of VOC-contaminated groundwater until cleanup objectives have been achieved
- Protecting the integrity groundwater monitoring and injection wells
- Managing intrusive activities at the site to minimize potential human exposure to contaminated groundwater
- Managing groundwater injection and extraction activities to ensure that hydraulic control of the contaminant plume is not unacceptably compromised

The LUCs are applied to approximately 50 acres overlying the existing areas of contamination, but extend to a half-mile radius buffer zone established for groundwater from the surface to a depth of 495 feet bgs. The institutional controls (ICs) addressing the on-station portion of the groundwater plume are implemented through the Station Project Review Process.

The purpose of this IC with Orange County Health Care Agency is to prevent off-base activities to influence groundwater flow direction drastically. Also the purpose of the IC inside the Base, where the plume is completely encompassed, is to protect the human receptors and to protect the integrity of the remediation system. This is all controlled by the Navy. ICs are implemented to prevent use of or exposure to contaminated groundwater; protect the integrity of the remedial action; and allow access for sampling, installing, operating, and maintaining monitoring wells or remediation equipment, and implementing future remedial measures. Per the Navy's "10.7 Land Use Controls," Orange County Environmental Health has not issued any well construction permits for any off-site water supply wells or injections wells in 2015 within the Seal Beach Naval Weapons Station buffer zone.

The field activities that were completed as part of the on-station ICs during the reporting period, or since the last annual groundwater sampling event was completed (December 2014) were related to the 2015 semiannual groundwater sampling event and the 2015 annual performance monitoring event. None of the completed water level measuring, groundwater sampling, soil vapor sampling, or injection activities completed violated the LUC objectives established for IRP Site 70 as outlined in the Record of Decision and RAWP.

6.0 SUMMARY AND RECOMMENDATIONS

The remedial activities at IRP Site 70 are being conducted in accordance with the technical and functional requirements specified in the RAWP (ECC/Geosyntec 2008a). The following summarizes the field activities described in this report:

- For the annual groundwater sampling event, the depth to groundwater was measured in each well prior to sampling. Groundwater samples were collected in December 2015 from 79 wells, including injection, monitoring, performance monitoring, MNA, and POC wells.
- 11 of 12 soil vapor probes located in the contaminant source area were sampled for methane, hydrogen sulfide and VOCs. In addition, the ambient air both inside and outside of buildings near the contaminant source area was monitored for methane gas and VOCs for health and safety purposes.

6.1 Summary of Results

The following summarizes the results of data collected during 2015:

- Groundwater flow directions and gradients in each hydrostratigraphic unit are consistent with historical data, including the overall groundwater flow to the southeast, with the exception of the Upper Fines Unit which flows locally at the site to the northwest, and relatively low gradients.
- Data obtained from the annual performance monitoring event in 2012 indicated that while conditions along portions of each biobarrier were still effectively enhancing the reductive dechlorination of TCE, other portions of the biobarriers contained the electron donor TOC at concentrations below those considered necessary to support reductive dechlorination. Based on these results, additional EVO was injected into select wells between September and December 2013. The results of the 2015 annual monitoring event indicate that reductive dechlorination is still occurring.
- Compared to the last annual event in 2014, TCE concentrations across the site generally decreased or were relatively stable. The highest TCE concentrations remain in the Upper Fines Unit (2,200 µg/L versus 2,800 µg/L in 2014) and the First Sand Unit (3,400 µg/L versus 3,400 µg/L in 2014).
- Compared to the last annual event in 2014, the cis-1,2-DCE concentrations in the Upper Fines Unit have remained stable. Relatively elevated concentrations of cis-1,2-DCE are still present in all of the hydrostratigraphic units, including the Upper Fines Unit (5,400 µg/L versus 790 µg/L in 2014), the First Sand Unit (1,000 µg/L versus 1,300 µg/L in 2014), the Shell Horizon Unit (1,200 µg/L versus 1,600 µg/L in 2014), and the Second Sand Unit (1,100 µg/L versus 1,500 µg/L in 2014).
- Compared to the last annual event in 2014, the VC concentrations in the Upper Fines Unit remained stable. Relatively elevated concentrations of VC are still present in all of the hydrostratigraphic units including the Upper Fines Unit (2,400 µg/L versus 3,700 µg/L in 2014), the First Sand Unit (790 µg/L versus 920 µg/L in 2014), the Shell Horizon

Unit (290 µg/L versus 180 µg/L in 2014), and the Second Sand Unit (410 µg/L versus 310 µg/L in 2014).

- Data indicate that some of the highest concentrations of TCE are in the SATG near well MW-70-MNA01 (2,200 µg/L). Only the TCE in well MW-70-PMW06B, located in the First Sand Unit immediately upgradient of the FSB-1, is higher (3,400 µg/L).
- Increasing cis-1,2-DCE trends in Shell Horizon Unit well MW-70-MNA14 and in Second Sand Unit well MW-70-MNA16, located approximately 100 feet downgradient of the furthest downgradient biobarrier (SHB-3), suggest that complete dechlorination did not occur in either biobarrier and cis-1,2-DCE contamination is continuing to migrate in this area.
- The elevated concentration of TCE reported in 2012 in well MW-70-43B (550 µg/L), located to the north of SSB-1, suggested that the plume was potentially migrating past this biobarrier. TCE concentrations at this well have significantly declined since their peak in 2012, and are now below the TCG.
- Low-to-trace levels of contamination were reported in a few of the POC wells at four hydrostratigraphic units (Upper Fines, First Sand, Second Sand, and Deep Sand Units), suggesting that overall groundwater contamination at the site remains contained within the POC well boundary.
- PCE had previously been reported above the TCG in Second Sand Unit POC well MW-70-36 (12 µg/L in 2014, 24 µg/L in 2013). In 2015, it was reported below the TCG of 5 µg/L.
- Reductive dechlorination requires anaerobic conditions (DO levels below 0.5 mg/L, or at least not greater than 1 mg/L [generally considered anaerobic based on limitations of field instrumentation]). Within the injection wells in both the SATG and all of the downgradient biobarriers, the DO concentrations were equal to or below 1 mg/L in 6 of 13 wells, suggesting conditions within the areas of injection are becoming less anaerobic (Table 2-2). DO levels were greater than 1 mg/L in two monitoring wells, five MNA wells, and two PMW well (Table 2-2). While the aquifer remains generally anoxic, increasing DO levels have been observed since 2014.
- ORP is a measure of the reducing capacity of the aquifer. In order for Dhc to survive and grow, and for reductive dechlorination to proceed optimally, ORP levels should be between -100 and 300 mV or lower. ORP levels in the injection wells in the SATG and in all of the downgradient biobarriers that were sampled were all below -100 mV (Table 2-2). ORP levels were also lower than -100 mV in all but one of the remaining wells sampled (Table 2-2) except POC wells, where reducing conditions are not expected. Overall, ORP levels indicate that reducing conditions are present in the aquifer.
- While the redox conditions are clearly supportive of reductive dechlorination, the indicators of adequate electron donor presence to support microbial activity (through assessment of TOC and VFAs, as described below) are less suggestive of widespread optimal conditions. Data indicate that optimal concentrations of the electron donor EVO (TOC above 50 mg/L [Section 2.5.2]) were present in only two of the 13 injection wells sampled. 11 of the 13 injection wells sampled have TOC below 50 mg/L. As expected, the TOC levels have generally decreased since the 2013 annual sampling which was

completed just after the 2013 additional EVO injections. In addition, 26 performance monitoring wells were sampled, with approximately half of them located upgradient of the biobarriers and half located downgradient. Overall, the TOC concentrations in these wells remained generally low and unchanged from the 2014 annual sampling event.

- VFAs (which are produced during the metabolic degradation of EVO) were detected in two of the seven treatment areas in 2012, and detected in six of the seven treatment areas (all except the SHB-1) in 2013. In 2015, VFAs were detected in three of the seven treatment areas. VFAs were detected in two of the 13 injection wells sampled and in two of the monitoring wells sampled.
- The depletion of sulfate, an alternate electron acceptor, and the presence or increase in methane, a metabolic by-product of anaerobic microbial biodegradation, can indicate that anaerobic microbial respiration is occurring. During the 2015 annual event, sulfate was relatively stable in a majority of the wells sampled compared to the 2014 annual event, with sulfate in some wells slightly reduced, and sulfate in even fewer wells somewhat higher. Methane concentrations at the site generally increased after the initial treatment. Although methane concentrations have generally remained elevated, a general decrease in methane concentrations has been observed over the past year with about 70 percent of wells sampled in 2015 reporting a decrease in methane concentrations since 2014. Overall, the elevated levels of methane in the aquifer suggest that anaerobic microbial respiration is occurring.
- Dhc concentrations in two of the 13 injection wells sampled were above the desired concentration of 10^7 gene copies/L, and *vcr*A concentrations in nine of the 13 injection wells sampled were above the desired concentration of 10^5 gene copies/L. In addition to the 13 injection wells, 51 monitoring wells were sampled for Dhc, with 38 of those 51 samples receiving the additional vcrA analysis. Approximately half of these monitoring wells are located upgradient of the biobarriers and half located downgradient. One of the 51 samples had Dhc at levels above the desired concentration of 10^7 gene copies/L and 14 of the 38 samples had *vcr*A at levels above the desired concentration of 10^5 gene copies/L.
- Methane in soil gas was detected in all samples between 220 parts per million by volume (ppm_V) and 520,000 ppm_V (Figure 2-34). The lower explosive limit (LEL) for methane in air is 50,000 ppm_V and the upper explosive limit (UEL) in air is 150,000 ppm_V. Methane was reported above its LEL at five locations, including SV-70-02, SV-70-05, SV-70-06, SV-70-07, and SV-70-10 (Figure 2-34). At three of these locations the UEL was also exceeded. Compared to the 2014 soil vapor sampling event, 2015 results were mixed with approximately half of the probe locations showing an increase in methane concentrations. The highest concentration, 520,000 ppm_V, was detected at probe SV-70-05, located near the south western edge of the SATG (Figure 2-34). The presence of elevated levels of methane gas in subsurface soils suggests that microbial respiration is occurring. It is noted that methane gas was not detected inside the buildings surveyed or in the outdoor areas/utility corridors.
- Six VOC, benzene, chloroform, cis-1,2-DCE, PCE, TCE and VC, were detected in soil gas samples at concentrations well above their respective environmental screening levels and California Human Health Screening Level. It is noted that VOCs were not detected inside the buildings surveyed or in the outdoor areas/utility corridors. Benzene is not a

COC VOC and its detection in soil vapor samples may be indicative of off-site petroleum contamination. In review of the State Water Resources Control Board GeoTracker web site, there are three Leaking Underground Storage Tank (LUST) Cleanup sites nearby. One of these LUST cleanup status is still open (with petroleum contamination, including benzene), located directly upgradient and off-site of IRP Site 70 which may be potential source of the benzene.

6.2 Recommendations

Based on the results of the data collected during 2015, the following recommendations are made:

- Data from 2015 indicate that some areas of the contaminant plumes remain in locations that cannot be readily treated with the SATG. It is suggested that additional investigation be conducted in this area to refine the CSM and to determine the need, and design parameters, for optimization of this treatment area. The results should be used to optimize the injection well footprint within the SATG treatment area:
  - As noted in the 2014 annual PMR, some of the highest concentrations of TCE at the site are located in monitoring wells situated east of the SATG injection well network at wells MW-70-MNA01 (2,200 µg/L) and MW-70-27 (85 µg/L). No information is available on the contaminant plume between these wells. The 2014 annual PMR recommended that additional site investigation be considered in this area to better identify the nature and extent of contamination and to determine whether additional injection wells should be considered. It was recommended that the investigation be completed with Site Characterization and Analysis Penetrometer System or a similar technology in which a probe is hydraulically driven into the subsurface to identify subsurface stratigraphy and the presence of contamination. Samples of soil and groundwater can also be collected through the probe for additional analyses. The data gaps include: a) the eastern side of the SATG source area (between wells MW-70-MNA-01 and MW-70-27, and east of well MW-70-MNA-01); b) the northern extent of the SATG source area (north of well MW-70-MNA-01). Based on the 2015 data, it is recommended that this source area additional characterization be implemented as outlined in the Letter Work Plan submitted in October 2015 (ECC-Insight 2015c).
- Elevated concentrations of TCE approaching or exceeding the 200 µg/L criterion for active treatment were reported to the north of SSB-1 between 2011 and 2014 at MW-70-43B, suggesting that a portion of the contaminant plume was migrating past this biobarrier. In 2012 for example, TCE was detected in well MW-70-43Bat 550 µg/L. TCE concentrations have declined at this well since their peak in 2012, and, during the 2015 annual event, the TCE concentration in well MW-70-43B decreased to below the TCG. However, this area continues to show high concentrations of cis-1,2-DCE. For example, a cis-1,2-DCE concentration of 830 µg/L was reported at well MW-70-14 in 2015. While it appears that aquifer biogeochemistry favors the reduction of TCE to DCE, significant reductions in DCE concentrations and concomitant VC generation has not yet been observed. Because active injection is not being conducted in this portion of the aquifer – it is remains unclear if DCE in the area will reduce to VC and then ethane/ethane. The lack of ethane detections, very low ethene concentrations (near the detection limit), and low concentrations of

methane along with low TOC and VFAs suggest that while dechlorination is ongoing, it is not likely robust enough to degrade the DCE sufficiently to halt continued downgradient migration. Based on the elevated cis-1,2-DCE concentrations and historically elevated TCE concentrations, it is recommended that additional site investigation be considered in this area to better identify the nature and extent of contamination and to determine whether additional injection wells should be considered. It is recommended that the investigation be completed with the Site Characterization and Analysis Penetrometer System (or similar technology) in which a cone penetrometer containing various sensors is hydraulically driven into the subsurface to identify subsurface stratigraphy and the presence of contamination. Samples of soil and groundwater can also be collected through the probe for additional analyses.

- During baseline sampling in 2008, well MW-70-MNA14, located in the Shell Horizon Unit approximately 400 feet downgradient of the last Shell Horizon biobarrier (SHB-3) (Figure 2-35), had less than 1 µg/L TCE (currently 5.3 µg/L), suggesting that the increasing levels of cis-1,2-DCE and VC reported in the well (currently 1,200µg/L and 78 µg/L, respectively) is the result of contaminant migration in the Shell Horizon Unit and not from dechlorination of TCE in the well. In addition, the cis-1,2-DCE concentration in Second Sand Unit well MW-70-MNA16, located approximately 100 feet downgradient of the furthest downgradient biobarrier (SSB-1), increased (from 880 µg/L in 2012 to 1,100 µg/L in 2015), suggesting that complete dechlorination also did not occur in this biobarrier and cis-1,2-DCE contamination is continuing to migrate in this area. Even though the TCE concentrations in these wells are below the criterion for active treatment (200 µg/L), the cis-1,2-DCE and VC concentrations are significantly above the TCGs (6 and 0.5 µg/L, respectively). Since there are no biobarriers installed downgradient of these wells, it would be desirable to have additional downgradient monitoring wells to more closely monitor plume migration. The Orange County Water District (OCWD) has been monitoring an OCWD well installed within the Shell Horizon Unit and located close to sentinel wells MW-70-POC04/MW-70-21. Data provided from the OCWD to the Navy (Li Li, personal communication, 27 May 2016 [included in Appendix G]) indicates that TCE and DCE may have migrated as far as this downgradient area within the Shell Horizon Unit. It is recommended that a Shell Horizon Unit well be installed coincident with the location of Second Sand Unit well MW-70-21 or use the OCWD well for monitoring under future sampling events. Further, it is recommended that the far downgradient wells existing in this area (e.g., First Sand well MW-70-16 and Second Sand Unit wells MW-70-15 and MW-70-21) continue to be closely monitored.
- There was not a significant response in aquifer biogeochemical conditions following the most recent (2013) EVO injection; there was little to no change in TOC concentration, VFA presence, Dhc cell count, and ethene generation. Therefore, the presence of electron donor in concert with the indication of anaerobic respiration and dechlorination should be critically assessed in select injection wells during the next semi-annual event as a means of determining electron donor presence/significance. This evaluation should focus on sampling select additional injection wells not sampled as part of the routine semi-annual sampling event. It is recommended that

the following injection wells be sampled for TOC and VFAs: IW-70-SAT-21 and IW-70-SAT-15 in the SATG; IW-70-FSB116 and IW-70-FSB112 in the FSB-1; IW-70-FSB219 and IW-70-FSB207 in the FSB-2; IW-70-SHB306 and IW-70-SHB317 in SHB-3; and IW-70-SSB121 and IW-70-SSB116 in the SSB-1. These wells were selected based on their relative position to those injection wells routinely sampled and the location of high contaminant concentration zones within the biobarriers and SATG. In addition, one well of the two wells noted in the SATG, IW-70-SAT-21, and one injection well in each of the aforementioned biobarriers (IW-70-FSB112 in the FSB-1; IW-70-FSB219 in the FSB-2; IW-70-SHB306 in the SHB-3; and IW-70-SSB121 in the SSB-1) should also be sampled for dissolved gases and Dhc analysis in the next annual sampling event.

- The robustness of the microbial community, changes in hydrogen gases, and ethene generation should continue to be critically monitored and evaluated in the next annual assessment. The results of the suggested expanded semi-annual and annual sampling (noted above) should be used in the next (2016) annual assessment to evaluate overall EISB performance and the need to conduct any further optimization of the injection scheme.
- Continue implementation of the existing confined space monitoring program including an updated survey of known or suspected confined spaces.
- Continue monitoring ambient air and suspected soil gas entry locations (i.e., foundation cracks, utility corridors, etc.) with both PID and 4-gas monitors, reporting percent carbon dioxide and percent oxygen in addition to methane. Consider supplementing the PID with a flame-ionization detector which is intrinsically safe to the environment and also responds to methane and has excellent response to CVOCs.

7.0 REFERENCES

BEI (Bechtel Environmental, Inc.). 2002. Final Groundwater Feasibility Study Report, Installation Restoration Program Sites 40 and 70, Naval Weapons Station, Seal Beach, Seal Beach, California. June.

————. 2006. Final Fifth Annual Groundwater Monitoring Report IRP Sites 40 and 70, Naval Weapons Station Seal Beach, California. April.

Bechtel National, Inc. 1996. Final Removal Site Evaluation Report, for the Research, Testing, and Evaluation Area, Naval Weapons Station, Seal Beach, Seal Beach, California. November.

California Environmental Protection Agency (California EPA). 2005. Use of California Human Health Screening Levels (CHHSLs) in Evaluation of Contaminated Properties. January.

Department of Defense. 2010. Quality Systems Manual for Environmental Laboratories. Version 4.2. October.

DWR (California Department of Water Resources). 1961. Planned Utilization of Ground Water Basins of the Coastal Plain of Los Angeles County. Bulletin 104. Appendix B. June.

ECC/Geosyntec (Environmental Chemical Corporation/Geosyntec Consultants). 2008a. Final Remedial Action Work Plan, Implementation of Enhanced *In-Situ* Bioremediation, Installation Restoration Program Site 70, Naval Weapons Station Seal Beach, Seal Beach, California. March.

————. 2008b. Final Technical Memorandum, Installation Restoration Program Site 70, Installation of Enhanced *In-Situ* Bioremediation System, Well Installation Phase, Naval Weapons Station Seal Beach, Seal Beach, California. January.

————. 2009. Errata to Final Technical Memorandum, Installation Restoration Program Site 70, Installation of Enhanced *In-Situ* Bioremediation System, Well Installation Phase, Naval Weapons Station Seal Beach, Seal Beach, California. January.

EPA (U.S. Environmental Protection Agency). 1999. National Functional Guidelines for Organic Data Review, EPA 540/R-99/008. Contract Laboratory Program. October.

————. 2004. National Functional Guidelines for Inorganic Data Review, EPA 540/R-04/004. Contract Laboratory Program. October.

Geosyntec (Geosyntec Consultants). 2005. Final Revised Groundwater Feasibility Study Report, Installation Restoration Program Site 70, Naval Weapons Station, Seal Beach, Seal Beach, California. August.

————. 2006a. Record of Decision for IR Site 70 , Naval Weapons Station, Seal Beach, Seal Beach, California. August.

————. 2006b. Final Remedial Design for IR Site 70 Enhanced *In-Situ* Bioremediation, Naval Weapons Station, Seal Beach, Seal Beach, California. December.

ECC-Insight, Inc. 2009a. Baseline Groundwater Monitoring Report. Installation Restoration Program Site 70, Naval Weapons Station, Seal Beach, Seal Beach, California. April.

——————. 2009b. Methane Monitoring Plan and Emergency Procedures. Installation Restoration Program Site 70, Naval Weapons Station, Seal Beach, Seal Beach, California. January.

——————. 2010. 2009 Performance Monitoring Report Enhanced In Situ Bioremediation Installation Restoration Program Site 70, Naval Weapons Station, Seal Beach, California.

——————. 2011. 2010 Performance Monitoring Report Enhanced In Situ Bioremediation Installation Restoration Program Site 70, Naval Weapons Station, Seal Beach, California. August.

——————. 2012. 2011 Performance Monitoring Report Enhanced In Situ Bioremediation Installation Restoration Program Site 70, Naval Weapons Station, Seal Beach, California.

——————. 2014a. Addendum Number 5 to the Final Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan), Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach, California.

——————. 2014b. Addendum Number 4 to the Accident Prevention Plan/ Site Safety and Health Plan, Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach, California. December.

——————. 2015a. 2014 Performance Monitoring Report Enhanced In Situ Bioremediation Installation Restoration Program Site 70, Naval Weapons Station, Seal Beach, California.

——————. 2015b. 2015 Semi-Annual Performance Monitoring Report Enhanced In Situ Bioremediation Installation Restoration Program Site 70, Naval Weapons Station, Seal Beach, California.

——————. 2015c. Letter Work Plan: Additional Source Area Site Characterization, Groundwater Sampling, and Injection Well Replacement in Support of Installation Restoration Program (IRP) Site 70 at Naval Weapons Station Seal Beach, California. October.

JEG (Jacobs Engineering Group Inc.). 1995. Final Preliminary Assessment Report for the Research, Testing and Evaluation Area, Naval Weapons Station, Seal Beach, Seal Beach, California. February.

NAVFAC SW (Naval Facilities Engineering Command Southwest). 2001. Environmental Work Instruction (EWI) #1, 3EN2.1, Chemical Data Validation. November.

State Water Resources Control Board. 2012. GeoTracker map for sites in the vicinity of 13980 Seal Beach Boulevard, Seal Beach, CA: http://geotracker.waterboards.ca.gov /map/?CMD=runreport&myaddress=13980+SeaI+Beach+Blvd.%2C+Seal+Beach%2C+ CA

TtEC (Tetra Tech, EC, Inc.). 2012. Addendum Number 4 to the Final Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan), Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach, California. November.

——————. 2013. Final Annual Performance Monitoring Report, Enhanced In Situ Bioremediation, Installation Restoration Program Site 70, Naval Weapons Station Seal Beach, Seal Beach, California. October.

——————. 2014. Final Annual Performance Monitoring Report, Enhanced In Situ Bioremediation, Installation Restoration Program Site 70, Naval Weapons Station Seal Beach, Seal Beach, California. October.

Water Board (California Regional Water Quality Control Board, Santa Ana Region). 1995. Water Quality Control Plan, Santa Ana River Basin; with amendment R8-2004-0001, January 2004.

Water Resources Control Board California. 2015. GeoTracker map for sites in the vicinity of 13980 Seal Beach Boulevard, Seal Beach, CA. http://geotracker.waterboards.ca.gov/

——————. 2013. User's Guide: Derivation and Application of Environmental Screening Levels, Interim Final. December.

TABLES

This page intentionally left blank.

TABLE 1-1
CONTAMINANTS OF CONCERN AND TARGET CLEANUP GOALS

Contaminant of Concern	Exposure Pathway	Receptors	Target Cleanup Goal (µg/L)
Chloroform	Ingestion	Future residential groundwater users	100
1,1-Dichloroethene	Ingestion	Future residential groundwater users	6
cis-1,2-Dichloroethene	Ingestion	Future residential groundwater users	6
trans-1,2-Dichloroethene	Ingestion	Future residential groundwater users	10
Tetrachloroethene	Ingestion	Future residential groundwater users	5
Trichloroethene	Ingestion	Future residential groundwater users	5
Vinyl Chloride	Ingestion	Future residential groundwater users	0.5

Source: ECC/Geosyntec (2008a) – Remedial Action Work Plan. Target Cleanup Goals are based on Applicable or Relevant and Appropriate Requirements. Reevaluation of the Target Cleanup Goals may be required at a future date, per trends in remedial performance.

Abbreviations and Acronyms:
µg/L – micrograms per liter

This page intentionally left blank

TABLE 1-2
2015 GROUNDWATER AND PERFORMANCE MONITORING SCHEDULE
Seal Beach IRP Site 70

	Field Parameters [a]	VOCs (8260B)	Dissolved Hydrogen Gases (DHGs) (RSK 175)	Anions/TDS/Alkalinity [b]	Volatile Fatty Acids (VFAs) (300.0M)	TOC (5013B)	Sulfide (Method 4500 S2F)	Dissolved Metals [c] (6010B)	DHC/vcrA [d]	Soil Vapor [e]
Source Area Treatment Grid										
IW-70-SAT35 (25-55)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW01A (25-35)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW01B (45-55)	X	X	X	X	X	X	X	X	X	—
MW-70-27 (25.5-35.5)	X	X	X	X	X	X	X	X	X	—
MW-70-28 (50.3-60.3)	X	X	X	X	X	X	X	X	X	—
MW-70-MNA01 (40-50)	X	X	X	—	X	—	—	—	X	—
MW-70-MNA02 (35-45)	X	X	X	—	X	—	—	—	X	—
MW-70-MNA03 (35-45)	X	X	X	—	X	—	—	—	X	—
MW-70-MNA04 (35-45)	X	X	X	—	X	—	—	—	X	—
Point of Compliance/Upper Fines										
MW-70-02 (20-30)	X	X	—	—	—	—	—	—	—	—
MW-70-03 (20-30)	X	X	—	—	—	—	—	—	—	—
MW-70-10 (30-40)	X	X	—	—	—	—	—	—	—	—
MW-70-17 (30-40)	X	X	—	—	—	—	—	—	—	—
MW-70-22 (20-30)	X	X	—	—	—	—	—	—	—	—
Source Area Biobarrier/First Sand										
IW-70-SAB06 (65-80/85-105)	X	X	X	X	X	X	X	X	X	—
IW-70-SAB11 (65-105)	X	X	X	X	X	X	X	X	X	—
MW-70-MNA05 (70-80)	X	X	X	—	X	—	—	—	X	—
MW-70-PMW02A (70.5-80.5)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW02B (90-100)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW03A (70.5-80.5)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW03B (90-100)	X	X	X	X	X	X	X	X	X	—

TABLE 1-2
2015 GROUNDWATER AND PERFORMANCE MONITORING SCHEDULE
Seal Beach IRP Site 70

	Field Parameters [a]	VOCs (8260B)	Dissolved Hydrogen Gases (DHGs) (RSK 175)	Anions/TDS/Alkalinity [b]	Volatile Fatty Acids (VFAs) (300.0M)	TOC (5013B)	Sulfide (Method 4500 S2F)	Dissolved Metals [c] (6010B)	DHC/vcrA [d]	Soil Vapor [e]
First Sand Biobarrier 1										
MW-70-38 (80-100)	X	X	X	X	X	X	X	X	X	—
IW-70-FSB108 (60-105)	X	X	X	X	X	X	X	X	X	—
IW-70-FSB118 (60-105)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW04A (70-80)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW04B (90-100)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW05A (70-80)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW05B (90-100)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW06A (69.5-79.5)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW06B (91-101)	X	X	X	X	X	X	X	X	X	—
RDO-5 (65-105)	X	X	X	X	X	X	X	X	X	—
MW-70-MNA08 (80-90)	X	X	X	—	X	—	—	—	X	—
MW-70-MNA06 (80-90)	X	X	X	—	X	—	—	—	X	—
MW-70-MNA11 (80-90)	X	X	X	—	X	—	—	—	X	—
MW-70-MNA07 (90-100)	X	X	X	—	X	—	—	—	X	—
MW-70-43A (86-106)	X	X	X	—	X	—	—	—	X	—
First Sand Biobarrier 2										
IW-70-FSB216 (65-100)	X	X	X	X	X	X	X	X	X	—
IW-70-FSB229 (65-100)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW07A (65-75)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW07B (85-95)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW08A (65-75)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW08B (85-95)	X	X	X	X	X	X	X	X	X	—
MW-70-MNA09 (64-74)	X	X	X	—	X	—	—	—	X	—
MW-70-MNA10 (75-85)	X	X	X	—	X	—	—	—	X	—
MW-70-MNA12 (75-85)	X	X	X	—	X	—	—	—	X	—

TABLE 1-2
2015 GROUNDWATER AND PERFORMANCE MONITORING SCHEDULE
Seal Beach IRP Site 70

	Field Parameters [a]	VOCs (8260B)	Dissolved Hydrogen Gases (DHGs) (RSK 175)	Anions/TDS/Alkalinity [b]	Volatile Fatty Acids (VFAs) (300.0M)	TOC (5013B)	Sulfide (Method 4500 S2F)	Dissolved Metals [c] (6010B)	DHC/vcrA [d]	Soil Vapor [e]
Point of Compliance/First Sand										
MW-70-11 (80-100)	X	X	—	—	—	—	—	—	—	—
MW-70-16 (95-105)	X	X	—	—	—	—	—	—	—	—
MW-70-35 (90-100)	X	X	—	—	—	—	—	—	—	—
MW-70-POC01 (80-90)	X	X	—	—	—	—	—	—	—	—
Shell Horizon Biobarrier 1										
IW-70-SHB113 (105-130)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW09 (120-130)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW10 (120-130)	X	X	X	X	X	X	X	X	X	—
IW-70-SHB217 (105-130)	X	X	X	X	X	X	X	X	X	—
MW-70-MNA13 (115-125)	X	X	X	—	X	—	—	—	X	—
Shell Horizon Biobarrier 3										
IW-70-SHB310 (105-130)	X	X	X	X	X	X	X	X	X	—
IW-70-SHB311 (80-95)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW11A (85-95)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW11B (115-125)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW12A (85-95)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW12B (115-125)	X	X	X	X	X	X	X	X	X	—
MW-70-MNA14 (115-125)	X	X	X	—	X	—	—	—	X	—
Point of Compliance/Shell Horizon										
MW-70-23 (110-130)	X	X	—	—	—	—	—	—	—	—

TABLE 1-2
2015 GROUNDWATER AND PERFORMANCE MONITORING SCHEDULE
Seal Beach IRP Site 70

	Field Parameters [a]	VOCs (8260B)	Dissolved Hydrogen Gases (DHGs) (RSK 175)	Anions/TDS/Alkalinity [b]	Volatile Fatty Acids (VFAs) (300.0M)	TOC (5013B)	Sulfide (Method 4500 S2F)	Dissolved Metals [c] (6010B)	DHC/vcrA [d]	Soil Vapor [e]
Second Sand Biobarrier 1										
IW-70-SSB109 (125.75-165.75)	X	X	X	X	X	X	X	X	X	—
IW-70-SSB119 (125-165)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW13A (125-135)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW13B (145-155)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW14A (128-138)	X	X	X	X	X	X	X	X	X	—
MW-70-PMW14B (149-159)	X	X	X	X	X	X	X	X	X	—
MW-70-MNA16 (140.5-150.5)	X	X	X	—	X	—	—	—	X	—
MW-70-MNA17 (140-150)	X	X	X	—	X	—	—	—	X	—
MW-70-15 (161-171)	X	X	X	—	X	—	—	—	X	—
MW-70-14 (160-170)	X	X	X	—	X	—	—	—	X	—
MW-70-43B (136-146)	X	X	X	—	X	—	—	—	X	—
MW-70-49 (125-165)	X	X	X	—	X	—	—	—	X	—
Point of Compliance/Second Sand										
MW-70-21 (150-170)	X	X	—	—	—	—	—	—	—	—
MW-70-36 (150-160)	X	X	—	—	—	—	—	—	—	—
Point of Compliance/Deep Sand										
MW-70-POC02 (190-200)	X	X	—	—	—	—	—	—	—	—
MW-70-POC03 (190-200)	X	X	—	—	—	—	—	—	—	—
MW-70-POC04 (195-205)	X	X	—	—	—	—	—	—	—	—
Soil Vapor Samples										
SV-70-01	—	—	—	—	—	—	—	—	—	X
SV-70-02	—	—	—	—	—	—	—	—	—	X
SV-70-03*	—	—	—	—	—	—	—	—	—	X
SV-70-04	—	—	—	—	—	—	—	—	—	X
SV-70-05	—	—	—	—	—	—	—	—	—	X
SV-70-06	—	—	—	—	—	—	—	—	—	X

TABLE 1-2
2015 GROUNDWATER AND PERFORMANCE MONITORING SCHEDULE
Seal Beach IRP Site 70

	Field Parameters [a]	VOCs (8260B)	Dissolved Hydrogen Gases (DHGs) (RSK 175)	Anions/TDS/Alkalinity [b]	Volatile Fatty Acids (VFAs) (300.0M)	TOC (5013B)	Sulfide (Method 4500 S2F)	Dissolved Metals [c] (6010B)	DHC/vcrA [d]	Soil Vapor [e]
SV-70-07	—	—	—	—	—	—	—	—	—	X
SV-70-08	—	—	—	—	—	—	—	—	—	X
SV-70-09	—	—	—	—	—	—	—	—	—	X
SV-70-10	—	—	—	—	—	—	—	—	—	X
SV-70-11	—	—	—	—	—	—	—	—	—	X
SV-70-12	—	—	—	—	—	—	—	—	—	X

Notes:

— not analyzed

[a] pH, DO, ORP, conductivity, temperature, and turbidity

[b] Anions (EPA Method 300.0)/TDS (EPA Method 2540C)/Alkalinity (EPA Method 2320B)

[c] dissolved metals – iron, manganese, and arsenic

[d] DHC/vcrA – Polymerase Chain Reaction Assay (Dehalococcoides/vinyl chloride reductase gene)

* - SV-70-03 was not sampled due to water in port

Abbreviations and Acronyms:

DHC – dehalococcoides

DHG – dissolved hydrocarbon gas

TDS – total dissolved solids

TOC – total organic carbon

vcrA – vinyl chloride reductase A gene

VFA – volatile fatty acid

VOC – volatile organic compound

This page intentionally left blank

TABLE 1-3
WELL CONSTRUCTION SUMMARY

Well Number	Well Installation			Construction Depths (feet bgs)					Construction Elevations (feet MSL, NGVD29)						Screen Dimensions			Well Maintenance		
	Date Installed	Coordinates (feet NAD83)		Borehole Depth	Filter Pack		Screen Interval		TOC	Ground Surface	Filter Pack		Screen Interval		Length (feet)	Diameter (inches)	Slot Size (inches)	Date Last Developed	Well Depth	
		Northing	Easting		Top	Bottom	Top	Bottom			Top	Bottom	Top	Bottom					Date Measured	Measurement (feet below TOC)
Source Area Treatment/Upper Fines																				
MW-70-27	07/03/01	2224170.00	6005991.20	36.00	23.00	36.00	25.50	35.50	8.25	8.80	-14.20	-27.20	-16.70	-26.70	10.00	4	0.01	08/21/01	07/09/01	35.90
MW-70-28	07/03/01	2224165.50	6005991.20	62.00	45.00	62.00	50.30	60.30	8.30	8.65	-36.35	-53.35	-41.65	-51.65	10.00	4	0.01	08/21/01	07/09/01	60.70
MW-70-MNA01	02/21/07	2224281.89	6006003.22	57.00	38.00	57.00	40.00	50.00	8.36	8.76	-29.24	-48.24	-31.24	-41.24	10.00	4	0.02	03/15/07	03/15/07	50.42
MW-70-MNA02	02/13/07	2224020.66	6006052.91	47.00	33.00	46.00	35.00	45.00	8.51	8.78	-24.22	-37.22	-26.22	-36.22	10.00	4	0.02	03/06/07	03/06/07	45.58
MW-70-MNA03	02/26/07	2224096.48	6006104.81	47.00	31.00	47.00	35.00	45.00	9.18	9.47	-21.53	-37.53	-25.53	-35.53	10.00	4	0.02	03/06/07	03/06/07	45.42
MW-70-MNA04	02/14/07	2224052.55	6005800.63	47.00	32.00	46.00	35.00	45.00	8.39	8.65	-23.35	-37.35	-26.35	-36.35	10.00	4	0.02	03/05/07	03/05/07	45.66
MW-70-PMW01A	02/26/07	2224162.70	6005948.30	37.00	20.00	37.00	25.00	35.00	8.23	8.51	-11.49	-28.49	-16.49	-26.49	10.00	4	0.02	03/19/07	03/19/07	35.67
MW-70-PMW01B	02/27/07	2224163.30	6005952.70	57.00	41.90	57.00	45.00	55.00	8.21	8.49	-33.41	-48.51	-36.51	-46.51	10.00	4	0.02	03/19/07	03/19/07	55.08
IW-70-SAT01	02/22/07	2224308.07	6005882.81	57.00	20.00	57.00	25.00	55.00	9.21	9.44	-10.56	-47.56	-15.56	-45.56	30.00	4	0.02	03/26/07	03/26/07	55.40
IW-70-SAT02	02/13/07	2224286.80	6005883.15	57.00	20.00	57.00	25.00	55.00	9.19	9.45	-10.55	-47.55	-15.55	-45.55	30.00	4	0.02	04/02/07	04/02/07	55.80
IW-70-SAT03	06/05/07	2224286.83	6005948.18	57.00	22.00	57.00	25.00	55.00	9.16	9.30	-12.70	-47.70	-15.70	-45.70	30.00	4	0.02	06/14/07	06/14/07	54.80
IW-70-SAT04	06/07/07	2224281.63	6005958.82	57.00	20.00	57.00	25.00	55.00	9.01	9.16	-10.84	-47.84	-15.84	-45.84	30.00	4	0.02	06/13/07	06/13/07	52.40
IW-70-SAT05	04/24/07	2224283.87	6005900.79	57.00	21.50	57.00	25.00	55.00	9.39	9.60	-11.90	-47.40	-45.40	-45.40	30.00	4	0.02	05/09/07	05/08/07	54.00
IW-70-SAT06	05/01/07	2224279.17	6005925.75	57.00	21.50	57.00	25.00	55.00	9.14	9.36	-12.14	-47.64	-45.64	-45.64	30.00	4	0.02	05/08/07	05/08/07	55.40
IW-70-SAT07	06/06/07	2224271.70	6005956.20	57.00	21.00	57.00	25.00	55.00	8.89	9.15	-11.85	-47.85	-15.85	-45.85	30.00	4	0.02	06/20/07	06/20/07	54.90
IW-70-SAT08	02/08/07	2224266.79	6005871.29	62.00	20.00	60.00	25.00	55.00	9.00	9.31	-10.69	-50.69	-15.69	-45.69	30.00	4	0.02	04/03/07	04/03/07	53.70
IW-70-SAT09	04/23/07	2224268.38	6005896.88	57.00	22.00	57.00	25.00	55.00	9.18	9.44	-12.56	-47.56	-15.56	-45.56	30.00	4	0.02	05/09/07	05/08/07	55.00
IW-70-SAT10	05/03/07	2224267.02	6005934.82	57.00	22.00	57.00	25.00	55.00	9.26	9.42	-12.58	-47.58	-15.58	-45.58	30.00	4	0.02	05/08/07	05/08/07	55.67
IW-70-SAT11	04/19/07	2224260.42	6005960.01	57.00	22.00	57.00	25.00	55.00	8.95	9.23	-12.77	-47.77	-15.77	-45.77	30.00	4	0.02	06/20/07	06/14/07	52.90
IW-70-SAT12	06/04/07	2224266.96	6005945.79	57.00	20.00	57.00	25.00	55.00	9.24	9.41	-10.59	-47.59	-15.59	-45.59	30.00	4	0.02	06/14/07	06/14/07	55.00
IW-70-SAT13	06/01/07	2224220.16	6005941.83	57.00	20.00	57.00	25.00	55.00	9.10	9.29	-10.71	-47.71	-15.71	-15.71	30.00	4	0.02	06/11/07	06/11/07	55.50
IW-70-SAT14	05/30/07	2224216.81	6005949.90	57.00	20.00	57.00	25.00	55.00	9.20	9.32	-10.68	-47.68	-15.68	-45.68	30.00	4	0.02	06/11/07	06/11/07	55.20
IW-70-SAT15	05/31/07	2224218.67	6005973.62	57.00	20.00	57.00	25.00	55.00	9.12	9.30	-10.70	-47.70	-15.70	-45.70	30.00	4	0.02	06/12/07	06/12/07	55.50
IW-70-SAT16	05/29/07	2224206.66	6005943.24	57.00	20.00	57.00	25.00	55.00	8.93	9.18	-10.82	-47.82	-15.82	-45.82	30.00	4	0.02	06/12/07	06/12/07	53.40
IW-70-SAT17	02/28/07	2224206.64	6005963.27	57.00	21.00	57.00	25.00	55.00	9.06	9.23	-11.77	-47.77	-15.77	-45.77	30.00	4	0.02	03/15/07	03/15/07	55.50
IW-70-SAT18	02/22/07	2224206.59	6005983.32	57.00	20.00	57.00	25.00	55.00	8.61	8.81	-11.19	-48.19	-16.19	-46.19	30.00	4	0.02	03/14/07	03/14/07	55.50
IW-70-SAT19	02/21/07	2224199.76	6005923.20	57.00	20.00	57.00	25.00	55.00	8.66	8.87	-11.13	-48.13	-16.13	-26.13	30.00	4	0.02	03/28/07	03/28/07	55.20
IW-70-SAT20	02/07/07	2224186.41	6005878.23	57.00	21.00	56.00	25.00	55.00	8.63	8.86	-12.14	-47.14	-16.14	-46.14	30.00	4	0.02	03/28/07	03/28/07	53.00
IW-70-SAT21	02/13/07	2224189.36	6005933.56	57.00	20.00	57.00	25.00	55.00	8.65	8.83	-11.17	-48.17	-16.17	-46.17	30.00	4	0.02	03/26/07	03/22/07	55.67
IW-70-SAT22	02/27/07	2224189.38	6005953.39	57.00	20.00	57.00	25.00	55.00	8.69	8.90	-11.10	-48.10	-16.10	-46.10	30.00	4	0.02	03/22/07	03/21/07	55.00
IW-70-SAT23	02/12/07	2224166.93	6005881.47	57.00	20.00	57.00	25.00	55.00	8.50	8.64	-11.36	-48.36	-16.36	-46.36	30.00	4	0.02	03/27/07	03/27/07	53.60
IW-70-SAT24	02/14/07	2224166.75	6005949.70	57.00	20.00	57.00	25.00	55.00	8.30	8.56	-11.44	-48.44	-16.44	-46.44	30.00	4	0.02	03/21/07	03/20/07	55.10
IW-70-SAT25	02/06/07	2224166.69	6005963.20	62.00	21.00	59.00	25.00	55.00	8.34	8.57	-12.43	-50.43	-16.43	-46.43	30.00	4	0.02	03/20/07	03/20/07	55.58
IW-70-SAT26	02/26/07	2224147.43	6005877.11	57.00	20.00	57.00	25.00	55.00	8.10	8.34	-11.66	-48.66	-16.66	-46.66	30.00	4	0.02	03/27/07	03/27/07	55.50
IW-70-SAT27	02/27/07	2224128.90	6005902.08	57.00	20.60	57.00	25.00	55.00	7.98	8.22	-12.38	-48.78	-16.78	-46.78	30.00	4	0.02	03/12/07	03/12/07	55.58
IW-70-SAT28	03/01/07	2224146.56	6005933.34	57.00	19.00	57.00	25.00	55.00	8.13	8.30	-10.70	-48.70	-16.70	-46.70	30.00	4	0.02	04/05/07	04/04/07	55.40
IW-70-SAT29	02/15/07	2224146.68	6005953.13	57.00	20.00	57.00	25.00	55.00	8.24	8.32	-11.68	-48.68	-16.68	-46.68	30.00	4	0.02	03/14/07	03/13/07	55.33
IW-70-SAT30	02/28/07	2224131.36	6005923.41	57.00	21.40	56.00	25.00	55.00	8.22	8.18	-13.22	-47.82	-16.82	-46.82	30.00	4	0.02	03/12/07	03/12/07	55.33
IW-70-SAT31	02/28/07	2224130.42	6005942.91	57.00	21.60	57.00	25.00	55.00	8.18	8.07	-13.53	-48.93	-16.93	-46.93	30.00	4	0.02	03/13/07	03/13/07	56.08
IW-70-SAT32	02/23/07	2224097.57	6005993.18	57.00	21.00	57.00	25.00	55.00	8.53	8.77	-12.23	-48.23	-16.23	-46.23	30.00	4	0.02	03/08/07	03/08/07	55.90
IW-70-SAT33	02/22/07	2224100.53	6006013.44	57.00	21.00	57.00	25.00	55.00	8.56	8.76	-12.24	-48.24	-16.24	-46.24	30.00	4	0.02	03/08/07	03/07/07	55.50
IW-70-SAT34	02/22/07	2224100.68	6006034.35	57.00	21.75	57.00	25.00	55.00	8.65	8.92	-12.83	-48.08	-16.08	-46.08	30.00	4	0.02	03/07/07	03/07/07	56.16
IW-70-SAT35	04/13/10	2224242.29	6005863.16	57.00	21.00	57.00	25.00	55.00	9.02	9.34	-11.66	-47.66	-15.66	-45.66	30.00	4	0.02	04/21/10	04/21/10	56.00
IW-70-SAT36	05/10/10	2224240.96	6005881.59	57.00	21.00	57.00	25.00	55.00	8.86	9.19	-11.81	-47.81	-15.81	-45.81	30.00	4	0.02	05/13/10	05/13/10	55.00

TABLE 1-3
WELL CONSTRUCTION SUMMARY

Well Number	Well Installation			Construction Depths (feet bgs)					Construction Elevations (feet MSL, NGVD29)						Screen Dimensions			Well Maintenance		
	Date Installed	Coordinates (feet NAD83)		Borehole Depth	Filter Pack		Screen Interval		TOC	Ground Surface	Filter Pack		Screen Interval		Length (feet)	Diameter (inches)	Slot Size (inches)	Date Last Developed	Well Depth	
		Northing	Easting		Top	Bottom	Top	Bottom			Top	Bottom	Top	Bottom					Date Measured	Measurement (feet below TOC)
IW-70-SAT37	04/13/10	2224229.21	6005880.64	57.00	22.00	57.00	26.50	56.50	8.96	9.06	-12.94	-47.94	-17.44	-47.44	30.00	4	0.02	05/13/10	05/13/10	55.00
IW-70-SAT38	05/12/10	2224215.28	6005887.15	57.00	21.00	57.00	25.00	55.00	8.77	9.16	-11.84	-47.84	-15.84	-45.84	30.00	4	0.02	05/17/10	05/17/10	55.00
IW-70-SAT39	04/14/10	2224199.16	6005880.05	57.00	21.00	57.00	25.00	55.00	8.63	9.04	-11.96	-47.96	-15.96	-45.96	30.00	4	0.02	04/21/10	04/21/10	55.60
IW-70-SAT40	04/14/10	2224201.29	6005893.29	57.00	21.00	57.00	25.00	55.00	8.75	9.16	-11.84	-47.84	-15.84	-45.84	30.00	4	0.02	04/22/10	04/22/10	55.00
IW-70-SAT41	04/15/10	2224196.03	6005916.09	57.00	20.50	57.00	25.00	55.00	8.55	8.92	-11.58	-48.08	-16.08	-46.08	30.00	4	0.02	04/22/10	04/22/10	55.50
IW-70-SAT42	04/16/10	2224183.70	6005896.09	57.00	21.00	57.00	25.00	55.00	8.77	8.98	-12.02	-48.02	-16.02	-46.02	30.00	4	0.02	04/23/10	04/23/10	55.00
IW-70-SAT43	04/28/10	2224183.59	6005916.47	57.00	21.00	57.00	25.00	55.00	8.42	8.84	-12.16	-48.16	-16.16	-46.16	30.00	4	0.02	05/04/10	05/04/10	55.00
IW-70-SAT44	04/16/10	2224181.51	6005974.36	57.00	21.00	57.00	25.00	55.00	8.43	8.81	-12.19	-48.19	-16.19	-46.19	30.00	4	0.02	04/23/10	04/23/10	54.90
IW-70-SAT45	04/26/10	2224193.23	6005995.85	57.00	21.00	57.00	25.00	55.00	8.30	8.67	-12.33	-48.33	-16.33	-46.33	30.00	4	0.02	05/04/10	05/04/10	55.00
IW-70-SAT46	05/13/10	2224155.27	6005884.75	57.00	21.00	57.00	25.00	55.00	8.19	8.48	-12.52	-48.52	-16.52	-46.52	30.00	4	0.02	05/17/10	05/17/10	55.00
IW-70-SAT47	05/14/10	2224180.44	6005940.92	57.00	21.00	57.00	25.00	55.00	8.44	8.86	-12.14	-48.14	-16.14	-46.14	30.00	4	0.02	05/18/10	05/18/10	55.00
IW-70-SAT48	04/27/10	2224168.70	6005984.54	57.00	21.00	57.00	25.00	55.00	8.42	8.83	-12.17	-48.17	-16.17	-46.17	30.00	4	0.02	05/03/10	05/03/10	55.00
IW-70-SAT49	04/13/10	2224166.15	6006005.15	57.00	21.00	57.00	25.00	55.00	7.96	8.37	-12.63	-48.63	-16.63	-46.63	30.00	4	0.02	04/28/10	04/28/10	55.60
IW-70-SAT50	05/13/10	2224145.73	6005926.70	57.00	21.00	57.00	25.00	55.00	7.97	8.33	-12.67	-48.67	-16.67	-46.67	30.00	4	0.02	05/18/10	05/18/10	55.00
IW-70-SAT51	04/19/10	2224144.99	6005975.30	57.00	21.00	57.00	25.00	55.00	8.00	8.38	-12.62	-48.62	-16.62	-46.62	30.00	4	0.02	04/28/10	04/28/10	55.20
IW-70-SAT52	04/28/10	2224144.89	6005996.09	57.00	21.00	57.00	25.00	55.00	7.94	8.31	-12.69	-48.69	-16.69	-46.69	30.00	4	0.02	05/04/10	05/04/10	55.00
IW-70-SAT53	04/23/10	2224143.90	6006027.57	57.00	21.00	57.00	25.00	55.00	7.77	8.20	-12.80	-48.80	-16.80	-46.80	30.00	4	0.02	04/27/10	04/27/10	56.10
IW-70-SAT54	04/21/10	2224128.75	6005967.94	57.00	21.00	57.00	25.00	55.00	7.73	8.06	-12.94	-48.94	-16.94	-46.94	30.00	4	0.02	04/26/10	04/26/10	55.00
IW-70-SAT55	04/20/10	2224128.29	6005986.14	57.00	21.00	57.00	25.00	55.00	7.80	8.23	-12.77	-48.77	-16.77	-46.77	30.00	4	0.02	04/26/10	04/26/10	55.00
IW-70-SAT56	04/20/10	2224127.58	6006005.90	57.00	20.00	57.00	25.00	55.00	7.65	8.12	-11.88	-48.88	-16.88	-46.88	30.00	4	0.02	04/26/10	04/26/10	56.00
IW-70-SAT57	04/22/10	2224128.64	6005886.17	57.00	21.00	57.00	25.00	55.00	8.13	8.35	-12.65	-48.65	-16.65	-46.65	30.00	4	0.02	04/27/10	04/27/10	56.00
Source Area Biobarrier/First Sand																				
MW-70-MNA05	01/24/07	2224052.67	6005796.72	87.00	67.00	82.00	70.00	80.00	8.46	8.67	-58.33	-73.33	-61.33	-71.33	10.00	4	0.02	02/07/07	02/07/07	81.45
MW-70-PMW02A	02/15/07	2223909.82	6005902.30	82.00	67.84	82.00	70.50	80.50	8.35	8.56	-59.28	-73.44	-61.94	-71.94	10.00	4	0.02	03/01/07	03/01/07	81.33
MW-70-PMW02B	02/21/07	2223912.08	6005905.73	102.00	86.75	102.00	90.00	100.00	8.38	8.57	-78.18	-93.43	-81.43	-91.43	10.00	4	0.02	03/05/07	03/05/07	100.25
MW-70-PMW03A	02/15/07	2223867.82	6005930.07	82.00	66.00	82.00	70.00	80.00	7.94	8.21	-57.79	-73.79	-61.79	-71.79	10.00	4	0.02	03/01/07	03/01/07	80.75
MW-70-PMW03B	02/20/07	2223870.34	6005933.39	102.00	87.00	102.00	90.00	100.00	7.88	8.21	-78.79	-93.79	-81.79	-91.79	10.00	4	0.02	02/28/07	02/28/07	100.91
IW-70-SAB01	01/23/07	2223802.98	6005831.22	120.00	57.00	82.00	60.00	80.00	7.55	7.71	-49.29	-74.29	-52.29	-72.29	20.00	4	0.02	02/06/07	02/06/07	81.30
IW-70-SAB02	01/29/07	2223817.58	6005849.48	117.00	60.00	107.00	65.00	105.00	7.58	7.78	-52.22	-99.22	-57.22	-97.22	40.00	4	0.02	02/06/07	02/06/07	105.60
IW-70-SAB03	01/31/07	2223836.63	6005867.03	107.00	60.00	107.00	65.00	105.00	8.11	8.36	-51.64	-98.64	-56.64	-96.64	40.00	4	0.02	02/23/07	02/23/07	106.50
IW-70-SAB04 (Screen 1)	01/23/07	2223846.50	6005889.02	107.00	57.00	81.00	60.00	80.00	8.14	8.33	-48.67	-72.67	-51.67	-71.67	20.00	4	0.02	02/07/07	02/07/07	105.00
IW-70-SAB04 (Screen 2)	01/23/07	2223846.50	6005889.02	107.00	84.00	106.00	85.00	105.00	8.14	8.33	-75.67	-97.67	-76.67	-96.67	20.00	4	0.02	02/07/07	02/07/07	105.00
IW-70-SAB05	02/07/07	2223861.03	6005908.25	107.00	61.50	107.00	65.00	105.00	7.83	8.07	-53.43	-98.93	-56.93	-96.93	40.00	4	0.02	02/23/07	02/23/07	105.00
IW-70-SAB06 (Screen 1)	02/05/07	2223875.37	6005927.28	117.00	60.00	80.00	65.00	80.00	8.07	8.25	-51.75	-71.75	-56.75	-71.75	15.00	4	0.02	02/27/07	02/27/07	106.08
IW-70-SAB06 (Screen 2)	02/05/07	2223875.37	6005927.28	117.00	85.00	106.00	85.00	105.00	8.07	8.25	-76.75	-97.75	-76.75	-96.75	20.00	4	0.02	02/27/07	02/27/07	106.08
IW-70-SAB07	02/08/07	2223889.57	6005946.53	107.00	60.00	107.00	65.00	105.00	8.18	8.47	-51.53	-98.53	-56.53	-96.53	40.00	4	0.02	02/28/07	02/28/07	105.00
IW-70-SAB08	01/31/07	2223904.42	6005965.58	117.00	60.00	107.00	65.00	105.00	8.36	8.60	-51.40	-98.40	-56.40	-96.40	40.00	4	0.02	02/21/07	02/21/07	105.00
IW-70-SAB09	02/01/07	2223918.58	6005984.74	107.00	59.50	107.00	65.00	105.00	8.46	8.75	-50.75	-98.25	-56.25	-96.25	40.00	4	0.02	02/19/07	02/19/07	105.00
IW-70-SAB10 (Screen 1)	02/05/07	2223927.98	6006003.88	117.00	62.00	87.00	67.00	87.00	8.05	8.09	-53.91	-78.91	-58.91	-78.91	20.00	4	0.02	02/15/07	02/15/07	108.00
IW-70-SAB10 (Screen 2)	02/05/07	2223927.98	6006003.88	117.00	91.00	108.00	92.00	107.00	8.05	8.09	-82.91	-99.91	-83.91	-98.91	15.00	4	0.02	02/15/07	02/15/07	108.00
IW-70-SAB11	02/06/07	2223947.40	6006023.16	107.00	61.00	107.00	65.00	105.00	8.02	8.19	-52.81	-98.81	-56.81	-96.81	40.00	4	0.02	02/15/07	02/15/07	105.40
IW-70-SAB12	01/29/07	2223961.76	6006042.52	117.00	60.00	106.00	65.00	105.00	8.19	8.34	-51.66	-97.66	-56.66	-96.66	40.00	4	0.02	04/04/07	04/04/07	104.70
IW-70-SAB13	04/16/07	2223976.19	6006061.42	106.00	61.00	106.00	65.00	105.00	8.54	8.85	-52.15	-97.15	-56.15	-96.15	40.00	4	0.02	05/07/07	05/07/07	105.50
IW-70-SAB14	01/25/07	2223999.69	6006072.38	107.00	58.50	106.00	60.00	105.00	8.81	9.02	-49.48	-96.98	-50.98	-95.98	45.00	4	0.02	02/08/07	02/08/07	105.00

TABLE 1-3
WELL CONSTRUCTION SUMMARY

Well Number	Well Installation			Construction Depths (feet bgs)					Construction Elevations (feet MSL, NGVD29)						Screen Dimensions			Well Maintenance		
	Date Installed	Coordinates (feet NAD83)		Borehole Depth	Filter Pack		Screen Interval		TOC	Ground Surface	Filter Pack		Screen Interval		Length (feet)	Diameter (inches)	Slot Size (inches)	Date Last Developed	Well Depth	
		Northing	Easting		Top	Bottom	Top	Bottom			Top	Bottom	Top	Bottom					Date Measured	Measurement (feet below TOC)
First Sand Biobarrier 1																				
MW-70-38	09/17/03	2223522.20	6006119.80	101.50	75.00	101.50	80.00	100.00	6.85	4.37	-70.63	-97.13	-75.63	-95.63	20.00	4	0.01	09/24/03	09/16/03	102.98
MW-70-43A	07/19/05	2222847.90	6007211.10	150.00	82.30	108.60	85.50	105.50	10.76	7.93	-71.54	-100.67	-77.57	-97.57	10.00	2	0.01	07/22/05	NM	NM
MW-70-MNA06	05/03/07	2223223.94	6005822.01	92.00	74.50	91.00	80.00	90.00	3.95	4.30	-70.20	-86.70	-75.70	-85.70	10.00	4	0.02	05/08/07	05/08/07	90.30
MW-70-MNA07	05/10/07	2223353.52	6006032.68	102.00	86.00	102.00	90.00	100.00	4.63	5.00	-81.00	-97.00	-85.00	-95.00	10.00	4	0.02	05/17/07	05/17/07	99.70
MW-70-MNA08	03/29/07	2223428.52	6006211.91	92.00	75.00	92.00	80.00	90.00	7.66	8.00	-67.00	-84.00	-72.00	-82.00	10.00	4	0.02	04/19/07	04/19/07	90.10
MW-70-MNA11	03/28/07	2223538.78	6006673.87	94.00	75.00	94.00	80.00	90.00	8.30	8.80	-66.20	-85.20	-71.20	-81.20	10.00	4	0.02	04/18/07	04/18/07	89.90
MW-70-PMW04A	05/07/07	2223422.47	6005948.01	92.00	65.00	82.00	70.00	80.00	4.52	5.00	-60.00	-77.00	-65.00	-75.00	10.00	4	0.02	05/21/07	05/21/07	80.10
MW-70-PMW04B	05/08/07	2223422.44	6005942.78	102.00	85.00	99.00	90.00	100.00	4.53	5.00	-80.00	-94.00	-85.00	-95.00	10.00	4	0.02	05/22/07	05/22/07	100.57
MW-70-PMW05A	05/14/07	2223356.43	6005957.41	82.00	64.00	82.00	70.00	80.00	4.21	4.60	-59.40	-77.40	-65.40	-75.40	10.00	4	0.02	08/07/07	08/07/07	80.25
MW-70-PMW05B	05/14/07	2223355.68	6005965.64	102.00	87.00	102.00	90.00	100.00	4.34	4.90	-82.10	-97.10	-85.10	-95.10	10.00	4	0.02	05/23/07	05/23/07	100.35
MW-70-PMW06A	05/08/07	2223555.96	6006088.30	82.00	65.25	80.00	69.50	79.50	4.14	4.60	-60.65	-75.40	-64.90	-74.90	10.00	4	0.02	05/21/07	05/21/07	79.70
MW-70-PMW06B	05/09/07	2223550.60	6006086.34	102.00	85.00	102.00	91.00	101.00	4.16	4.60	-80.40	-97.40	-86.40	-96.40	10.00	4	0.02	05/14/07	05/14/07	101.30
IW-70-FSB101	05/01/07	2223378.30	6005796.47	107.00	56.50	106.00	60.50	105.50	4.49	4.55	-51.95	-101.45	-55.95	-100.95	45.00	4	0.02	05/08/07	05/08/07	105.50
IW-70-FSB102	04/26/07	2223377.60	6005819.46	107.00	56.50	105.00	61.00	106.00	4.38	4.45	-52.05	-100.55	-56.55	-101.55	45.00	4	0.02	05/08/07	05/08/07	103.45
IW-70-FSB103	04/25/07	2223377.79	6005842.17	107.00	56.00	107.00	60.00	105.00	4.31	4.35	-51.65	-102.65	-55.65	-100.65	45.00	4	0.02	05/07/07	05/07/07	105.00
IW-70-FSB104	04/24/07	2223378.19	6005864.40	107.00	55.95	107.00	60.00	105.00	4.35	4.45	-51.50	-102.55	-55.55	-100.55	45.00	4	0.02	NM	NM	105.00
IW-70-FSB105	04/19/07	2223377.45	6005886.78	107.00	57.00	107.00	60.00	105.00	4.51	4.75	-52.25	-102.25	-55.25	-100.25	45.00	4	0.02	05/02/07	05/02/07	105.50
IW-70-FSB106	04/18/07	2223377.49	6005910.28	107.00	57.00	107.00	60.00	105.00	4.48	4.55	-52.45	-102.45	-55.45	-100.45	45.00	4	0.02	05/02/07	05/02/07	106.50
IW-70-FSB107	04/18/07	2223376.75	6005933.24	107.00	54.00	107.00	60.00	105.00	4.39	4.65	-49.35	-102.35	-55.35	-100.35	45.00	4	0.02	05/02/07	05/02/07	103.70
IW-70-FSB108	04/17/07	2223375.30	6005955.71	107.00	56.00	107.00	60.00	105.00	4.64	4.90	-51.10	-102.10	-55.10	-100.10	45.00	4	0.02	05/01/07	05/01/07	105.30
IW-70-FSB109	04/16/07	2223375.40	6005978.82	107.00	56.00	107.00	60.00	105.00	4.72	4.85	-51.15	-102.15	-55.15	-100.15	45.00	4	0.02	04/30/07	04/30/07	105.65
IW-70-FSB110	04/11/07	2223374.32	6006001.81	107.00	54.50	107.00	59.00	104.00	4.46	4.65	-49.85	-102.35	-54.35	-99.35	45.00	4	0.02	04/26/07	04/26/07	104.50
IW-70-FSB111	04/11/07	2223374.26	6006024.77	107.00	55.00	107.00	60.70	105.70	4.08	4.25	-50.75	-102.75	-56.45	-101.45	45.00	4	0.02	04/25/07	04/25/07	105.70
IW-70-FSB112	04/10/07	2223393.48	6006037.31	107.00	55.00	107.00	60.00	105.00	4.04	4.15	-50.85	-102.85	-55.85	-100.85	45.00	4	0.02	04/24/07	04/24/07	104.70
IW-70-FSB113	04/09/07	2222413.19	6006049.43	107.00	55.00	107.00	60.00	105.00	4.26	4.45	-50.55	-102.55	-55.55	-100.55	45.00	4	0.02	04/24/07	04/23/07	104.60
IW-70-FSB114	04/03/07	2223432.63	6006061.39	107.00	57.00	107.00	60.00	105.00	4.32	4.45	-52.55	-102.55	-57.55	-102.55	45.00	4	0.02	04/23/07	04/23/07	103.90
IW-70-FSB115	05/09/07	2223476.05	6006085.17	107.00	58.00	107.00	65.00	105.00	4.21	4.35	-53.65	-102.65	-60.65	-100.65	45.00	4	0.02	05/16/07	05/16/07	106.40
IW-70-FSB116	05/08/07	2223492.98	6006094.23	107.00	55.00	107.00	60.00	105.00	4.13	4.35	-50.65	-102.65	-55.65	-100.65	45.00	4	0.02	05/17/07	05/17/07	105.60
IW-70-FSB117	05/07/07	2223514.06	6006104.40	107.00	61.00	107.00	60.00	105.00	4.09	4.35	-56.65	-102.65	-55.65	-100.65	45.00	4	0.02	05/16/07	05/16/07	105.20
IW-70-FSB118	05/02/07	2223552.40	6006128.68	107.00	55.00	107.00	60.00	105.00	4.42	4.60	-50.40	-102.40	-55.40	-100.40	45.00	4	0.02	05/15/07	05/15/07	105.45
IW-70-FSB119	05/01/07	2223569.99	6006142.21	107.00	55.00	107.00	60.00	105.00	4.44	4.65	-50.35	-102.35	-55.35	-100.35	45.00	4	0.02	05/15/07	05/15/07	105.65
IW-70-FSB120	04/30/07	2223588.30	6006155.56	107.00	55.00	107.00	60.00	105.00	4.66	4.75	-50.25	-102.25	-55.25	-100.25	45.00	4	0.02	05/15/07	05/15/07	105.50
IW-70-FSB121	04/25/07	2223606.06	6006169.28	107.00	55.00	107.00	60.00	105.00	4.68	4.75	-50.25	-102.25	-55.25	-100.25	45.00	4	0.02	05/14/07	05/14/07	105.00
IW-70-FSB122	04/24/07	2223648.83	6006186.92	107.00	55.00	107.00	60.00	105.00	4.86	4.95	-50.05	-102.05	-55.05	-100.05	45.00	4	0.02	05/14/07	05/14/07	105.40
IW-70-FSB123	04/23/07	2223664.05	6006207.36	107.00	55.00	106.00	60.00	105.00	4.96	5.15	-49.85	-100.85	-54.85	-99.85	45.00	4	0.02	05/10/07	05/10/07	105.50
IW-70-FSB124	04/19/07	2223683.35	6006219.55	107.00	53.00	107.00	60.00	105.00	5.25	5.25	-47.75	-101.75	-54.75	-99.75	45.00	4	0.02	05/09/07	05/09/07	105.00
IW-70-FSB125	04/17/07	2223703.25	6006232.21	107.00	56.00	107.00	60.00	105.00	5.21	5.35	-50.65	-101.65	-54.65	-99.65	45.00	4	0.02	05/10/07	05/10/07	105.35
IW-70-FSB126	04/16/07	2223722.50	6006244.80	107.00	54.00	107.00	60.00	105.00	4.96	4.95	-49.05	-102.05	-55.05	-100.05	45.00	4	0.02	05/08/07	05/08/07	105.95
IW-70-FSB127	04/12/07	2223742.00	6006357.78	107.00	57.00	107.00	60.00	105.00	5.14	5.35	-51.65	-101.65	-54.65	-99.65	45.00	4	0.02	04/26/07	04/26/07	105.00
IW-70-FSB128	04/11/07	2223762.66	6006265.42	107.00	55.00	107.00	60.00	105.00	5.98	6.25	-48.75	-100.75	-53.76	-98.75	45.00	4	0.02	05/17/07	05/17/07	105.20
IW-70-FSB129	04/10/07	2223780.39	6006283.15	107.00	57.00	107.00	60.00	105.00	5.95	5.95	-51.05	-101.05	-54.05	-99.05	45.00	4	0.02	04/25/07	04/25/07	105.50
IW-70-FSB130	04/05/07	2223818.20	6006309.06	107.00	56.00	107.00	60.00	105.00	5.45	5.51	-50.49	-101.49	-54.49	-99.49	45.00	4	0.02	04/24/07	04/24/07	104.00
IW-70-FSB131	04/03/07	2223835.73	6006324.05	107.00	53.00	107.00	60.00	105.00	5.39	5.45	-47.55	-101.55	-54.55	-99.55	45.00	4	0.02	04/23/07	04/23/07	105.20
IW-70-FSB132	04/02/07	2223854.61	6006338.08	112.00	55.00	105.00	60.00	105.00	5.47	5.55	-49.45	-99.45	-54.45	-99.45	45.00	4	0.02	04/19/07	04/19/07	105.30

TABLE 1-3
WELL CONSTRUCTION SUMMARY

Well Number	Well Installation			Construction Depths (feet bgs)					Construction Elevations (feet MSL, NGVD29)						Screen Dimensions			Well Maintenance		
	Date Installed	Coordinates (feet NAD83)		Borehole Depth	Filter Pack		Screen Interval		TOC	Ground Surface	Filter Pack		Screen Interval		Length (feet)	Diameter (inches)	Slot Size (inches)	Date Last Developed	Well Depth	
		Northing	Easting		Top	Bottom	Top	Bottom			Top	Bottom	Top	Bottom					Date Measured	Measurement (feet below TOC)
RDO-1	08/19/05	2223799.53	6006296.04	110.00	60.50	107.00	65.10	105.10	5.21	5.35	-55.15	-101.65	-59.75	-99.75	40.00	4	0.02	08/28/07	08/28/07	105.10
RDO-2	08/18/05	2223624.53	6006182.61	110.00	60.50	107.00	65.10	105.10	4.62	4.65	-55.85	-102.35	-60.45	-100.45	40.00	4	0.02	08/29/07	08/29/07	105.10
RDO-3A	08/23/05	2223534.56	6006114.83	31.00	16.50	31.00	20.00	30.00	9.28	7.09	-9.41	-23.91	-12.91	-22.91	10.00	4	0.02	NM	NM	NM
RDO-3B	08/23/05	2223534.56	6006114.83	107.00	61.30	107.00	65.00	105.00	6.96	4.35	-56.95	-102.65	-60.65	-100.65	40.00	4	0.02	09/06/07	09/06/07	106.08
RDO-4	08/16/05	2223452.05	6006074.35	111.50	60.00	107.00	65.00	105.00	4.13	4.15	-55.85	-102.85	-60.85	-100.85	40.00	4	0.02	09/07/07	09/07/07	105.60
RDO-5	08/15/05	2223283.80	6005966.40	107.00	61.00	107.00	65.00	105.00	6.01	4.00	-57.00	-103.00	-61.00	-101.00	40.00	4	0.02	08/19/05	08/19/05	103.39
RDO-6A	08/30/05	2223072.00	6006285.00	109.00	90.30	107.50	95.00	105.00	11.30	9.28	-81.02	-98.22	-85.72	-95.72	10.00	4	0.02	NM	NM	NM
RDO-6B	08/25/05	2223059.00	6006258.00	145.00	125.00	142.00	130.00	140.00	10.60	8.44	-116.56	-133.56	-121.56	-131.56	10.00	4	0.02	08/19/05	08/19/05	103.39
First Sand Biobarrier 2																				
MW-70-MNA09	03/05/07	2222951.70	6006103.60	87.00	60.00	76.00	64.25	74.25	6.82	7.10	-52.90	-68.90	-57.15	-67.15	10.00	4	0.02	04/18/07	04/18/07	73.80
MW-70-MNA10	03/27/07	2223077.90	6006534.00	87.00	71.50	87.00	74.50	84.50	7.01	7.40	-64.10	-79.60	-67.10	-77.10	10.00	4	0.02	05/18/07	04/18/07	84.10
MW-70-MNA12	03/29/07	2222706.20	6006650.50	87.00	70.00	87.00	75.00	85.00	5.85	6.10	-63.90	-80.90	-68.90	-78.90	10.00	4	0.02	04/18/07	04/18/07	85.30
MW-70-PMW07A	03/22/07	2223191.90	6006440.40	77.00	61.00	77.00	65.00	75.00	7.89	8.10	-52.90	-68.90	-56.90	-66.90	10.00	4	0.02	04/04/07	04/04/07	75.40
MW-70-PMW07B	03/27/07	2223194.30	6006445.20	97.00	80.00	97.00	85.00	95.00	7.52	8.00	-72.00	-89.00	-77.00	-87.00	10.00	4	0.02	04/04/07	04/04/07	95.60
MW-70-PMW08A	03/28/07	2223146.80	6006447.80	77.00	60.00	77.00	65.00	75.00	9.04	9.20	-50.80	-67.80	-55.80	-65.80	10.00	4	0.02	04/05/07	04/05/07	75.50
MW-70-PMW08B	03/28/07	2223144.40	6006442.70	97.00	80.00	97.00	85.00	95.00	9.08	9.20	-70.80	-87.80	-75.80	-85.80	10.00	4	0.02	04/09/07	04/05/07	95.50
IW-70-FSB201	03/06/07	2222968.01	6006154.54	107.00	61.00	107.00	65.00	100.00	8.24	8.45	-52.55	-98.55	-56.55	-91.55	35.00	4	0.02	04/17/07	04/17/07	100.30
IW-70-FSB202	03/06/07	2222994.69	6006169.02	107.00	62.50	101.00	65.00	100.00	8.75	8.95	-53.55	-92.05	-56.05	-91.05	35.00	4	0.02	04/16/07	04/16/07	100.10
IW-70-FSB203	03/07/07	2223008.01	6006188.90	107.00	61.00	107.00	65.00	100.00	7.78	7.85	-53.15	-99.15	-57.15	-92.15	35.00	4	0.02	04/17/07	04/17/07	100.40
IW-70-FSB204	03/08/07	2223020.91	6006210.05	107.00	61.00	107.00	65.00	100.00	6.50	6.65	-54.35	-100.35	-58.35	-93.35	35.00	4	0.02	04/12/07	04/12/07	100.90
IW-70-FSB205	03/12/07	2223033.98	6006229.89	107.00	61.00	102.00	65.00	100.00	5.75	5.95	-55.05	-96.05	-59.05	-94.05	35.00	4	0.02	04/16/07	04/16/07	100.60
IW-70-FSB206	03/13/07	2223045.69	6006249.09	107.00	63.00	107.00	65.00	100.00	5.94	6.15	-56.85	-100.85	-58.85	-93.85	35.00	4	0.02	04/12/07	04/12/07	100.10
IW-70-FSB207	03/14/07	2223059.19	6006269.71	107.00	62.00	105.00	65.00	100.00	6.27	6.15	-55.85	-98.85	-58.85	-93.85	35.00	4	0.02	04/12/07	04/12/07	100.00
IW-70-FSB208	03/13/07	2223071.31	6006292.10	107.00	59.00	107.00	65.00	100.00	7.30	7.05	-51.95	-99.95	-57.95	-92.95	35.00	4	0.02	04/11/07	04/11/07	100.00
IW-70-FSB209	03/15/07	2223084.89	6006310.87	107.00	60.00	107.00	65.00	100.00	7.81	8.15	-51.85	-98.85	-56.85	-91.85	35.00	4	0.02	04/11/07	04/11/07	100.00
IW-70-FSB210	03/21/07	2223107.56	6006328.12	102.00	60.00	102.00	65.00	100.00	8.01	8.35	-51.65	-93.65	-56.65	-91.65	35.00	4	0.02	04/10/07	04/10/07	100.40
IW-70-FSB211	03/20/07	2223111.01	6006352.02	102.00	62.00	102.00	65.00	100.00	8.84	9.13	-52.87	-92.87	-55.87	-90.87	35.00	4	0.02	04/11/07	04/11/07	99.90
IW-70-FSB212	03/19/07	2223124.06	6006371.93	102.00	61.00	102.00	65.00	100.00	8.72	9.03	-51.97	-92.97	-55.97	-90.97	35.00	4	0.02	04/09/07	04/09/07	99.50
IW-70-FSB213	03/20/07	2223135.90	6006391.89	102.00	60.33	102.00	65.00	100.00	8.69	8.88	-51.45	-93.12	-56.12	-91.12	35.00	4	0.02	04/10/07	04/10/07	100.30
IW-70-FSB214	03/20/07	2223148.98	6006411.70	102.00	59.83	102.00	65.00	100.00	8.75	8.96	-50.87	-93.04	-56.04	-91.05	35.00	4	0.02	04/09/07	04/09/07	100.00
IW-70-FSB215	03/05/07	2223162.09	6006433.16	102.00	61.00	102.00	66.00	101.00	8.53	8.55	-52.45	-93.45	-57.45	-92.45	35.00	4	0.02	04/05/07	04/05/07	99.50
IW-70-FSB216	03/06/07	2223174.70	6006453.10	102.00	61.00	102.00	65.00	100.00	8.34	8.60	-52.40	-93.40	-56.40	-91.40	35.00	4	0.02	04/09/07	04/05/07	99.70
IW-70-FSB217	03/06/07	2223187.76	6006472.94	102.00	61.00	102.00	65.00	100.00	8.33	8.45	-52.55	-93.55	-56.55	-91.55	35.00	4	0.02	04/04/07	04/04/07	100.00
IW-70-FSB218	03/07/07	2223202.19	6006493.55	102.00	60.00	102.00	65.00	100.00	8.39	8.45	-51.55	-93.55	-56.55	-91.55	35.00	4	0.02	04/04/07	04/04/07	99.95
IW-70-FSB219	03/07/07	2223213.05	6006514.05	102.00	61.00	102.00	65.50	100.50	8.14	8.25	-52.75	-93.75	-57.25	-92.25	35.00	4	0.02	04/03/07	04/03/07	100.20
IW-70-FSB220	03/26/07	2223236.28	6006523.70	102.00	62.00	102.00	65.00	100.00	7.70	7.75	-54.25	-94.25	-57.25	-92.25	35.00	4	0.02	04/02/07	04/02/07	100.60
IW-70-FSB221	03/08/07	2223239.02	6006554.31	102.00	54.00	102.00	65.00	100.00	7.43	7.55	-46.45	-94.45	-57.45	-92.45	35.00	4	0.02	04/03/07	04/03/07	100.20
IW-70-FSB222	03/12/07	2223251.90	6006575.07	102.00	60.00	102.00	65.00	100.00	7.47	7.55	-52.45	-94.45	-57.45	-92.45	35.00	4	0.02	03/29/07	03/29/07	100.30
IW-70-FSB223	03/13/07	2223263.90	6006595.39	102.00	60.00	102.00	65.00	100.00	7.48	7.65	-52.35	-94.35	-57.35	-92.35	35.00	4	0.02	03/28/07	03/28/07	100.00
IW-70-FSB224	03/13/07	2223274.28	6006617.78	102.00	60.00	102.00	65.00	100.00	7.37	7.35	-52.65	-94.65	-57.65	-92.65	35.00	4	0.02	03/29/07	03/29/07	100.30
IW-70-FSB225	03/15/07	2223283.98	6006640.13	102.00	58.66	102.00	65.00	100.00	7.09	6.95	-51.71	-95.05	-58.05	-93.05	35.00	4	0.02	03/28/07	03/28/07	100.50
IW-70-FSB226	03/15/07	2223292.06	6006663.09	102.00	59.33	102.00	65.00	100.00	7.22	7.25	-52.08	-94.75	-57.75	-92.75	35.00	4	0.02	03/28/07	03/28/07	100.00
IW-70-FSB227	03/19/07	2223293.29	6006693.53	102.00	60.00	102.00	65.00	100.00	6.91	6.95	-53.05	-95.05	-58.05	-93.05	35.00	4	0.02	03/27/07	03/27/07	100.70
IW-70-FSB228	03/21/07	2223321.92	6006698.54	102.00	60.00	102.00	65.00	100.00	6.94	6.85	-53.15	-95.15	-58.05	-93.05	35.00	4	0.02	03/28/07	03/28/07	98.45
IW-70-FSB229	03/22/07	2223341.19	6006714.70	102.00	60.00	102.00	65.00	100.00	6.83	7.05	-52.95	-94.95	-57.95	-92.95	35.00	4	0.02	03/27/07	03/27/07	99.70

TABLE 1-3
WELL CONSTRUCTION SUMMARY

Well Number	Well Installation			Construction Depths (feet bgs)					Construction Elevations (feet MSL, NGVD29)						Screen Dimensions			Well Maintenance		
	Date Installed	Coordinates (feet NAD83)		Borehole Depth	Filter Pack		Screen Interval		TOC	Ground Surface	Filter Pack		Screen Interval		Length (feet)	Diameter (inches)	Slot Size (inches)	Date Last Developed	Well Depth	
		Northing	Easting		Top	Bottom	Top	Bottom			Top	Bottom	Top	Bottom					Date Measured	Measurement (feet below TOC)
Shell Horizon Biobarrier 1																				
MW-70-MNA13	07/17/07	2222951.31	6006096.89	128.00	113.00	128.00	115.00	125.00	6.64	6.90	-106.10	-121.10	-108.10	-118.10	10.00	4	0.02	07/30/07	07/30/07	121.50
MW-70-PMW09	06/28/07	2223253.90	6006226.30	132.00	117.00	132.00	120.00	130.00	6.82	7.00	-110.00	-125.00	-113.00	-123.00	10.00	4	0.02	07/10/07	07/10/07	130.59
MW-70-PMW10	08/02/07	2223215.80	6006247.20	132.00	116.00	132.00	120.00	130.00	6.60	7.00	-109.00	-125.00	-113.00	-123.00	10.00	4	0.02	07/09/07	07/09/07	130.70
IW-70-SHB101	05/22/07	2223111.23	6006007.76	137.00	101.00	137.00	105.00	130.00	7.77	7.95	-93.05	-129.05	-97.05	-122.05	25.00	4	0.2	06/28/07	06/28/07	128.10
IW-70-SHB102	07/17/07	2223127.25	6006021.88	132.00	102.00	132.00	105.00	130.00	8.10	8.45	-93.55	-123.55	-96.55	-121.55	25.00	4	0.2	07/31/07	07/31/07	129.52
IW-70-SHB103	07/26/07	2223136.27	6006040.01	132.00	100.00	132.00	105.00	130.00	8.65	8.86	-91.14	-123.14	-96.14	-121.14	25.00	4	0.2	08/08/07	08/08/07	121.40
IW-70-SHB104	07/30/07	2223144.96	6006057.96	132.00	100.00	132.00	105.00	130.00	8.83	9.03	-90.97	-122.97	-95.97	-120.97	25.00	4	0.2	08/02/07	08/02/07	129.90
IW-70-SHB105	07/31/07	2223154.22	6006076.12	132.00	101.00	132.00	105.00	130.00	8.67	8.82	-92.18	-123.18	-96.18	-121.18	25.00	4	0.2	08/08/07	08/08/07	129.15
IW-70-SHB106	07/10/07	2223163.10	6006093.86	132.00	99.00	132.00	105.00	130.00	8.36	8.89	-90.11	-123.11	-96.11	-121.11	25.00	4	0.2	08/02/07	08/02/07	129.40
IW-70-SHB107	06/18/07	2223172.96	6006113.11	132.00	100.00	132.00	105.00	130.00	8.40	8.45	-91.55	-123.55	-96.55	-121.55	25.00	4	0.2	07/03/07	07/03/07	129.80
IW-70-SHB108 (Screen 1)	06/20/07	2223181.38	6006129.32	132.00	100.00	111.50	105.00	110.00	8.58	8.65	-91.35	-102.85	-96.35	-101.35	5.00	4	0.2	07/10/07	07/10/07	130.00
IW-70-SHB108 (Screen 2)	06/20/07	2223181.38	6006129.32	132.00	113.50	132.00	115.00	130.00	8.58	8.65	-104.85	-123.35	-106.35	-121.35	15.00	4	0.2	07/10/07	07/10/07	130.00
IW-70-SHB109 (Screen 1)	06/21/07	2223190.18	6006146.80	135.00	94.50	110.50	100.00	110.00	8.20	8.45	-86.05	-102.05	-91.55	-101.55	10.00	4	0.2	07/11/07	07/11/07	130.55
IW-70-SHB109 (Screen 2)	06/21/07	2223190.18	6006146.80	135.00	114.00	135.00	115.00	130.00	8.20	8.45	-105.55	-126.55	-106.55	-121.55	15.00	4	0.2	07/11/07	07/11/07	130.55
IW-70-SHB110	06/26/07	2223200.36	6006164.79	132.00	101.00	132.00	105.00	130.00	8.50	8.45	-92.55	-123.55	-96.55	-121.55	25.00	4	0.2	07/31/07	07/31/07	129.25
IW-70-SHB111 (Screen 1)	07/09/07	2223228.40	6006171.38	132.00	95.00	112.50	100.00	110.00	8.31	8.55	-86.45	-103.95	-91.45	-101.45	10.00	4	0.2	07/30/07	07/30/07	127.54
IW-70-SHB111 (Screen 2)	07/09/07	2223228.40	6006171.38	132.00	115.00	132.00	120.00	130.00	8.31	8.55	-106.45	-123.45	-111.45	-121.45	10.00	4	0.2	07/30/07	07/30/07	127.54
IW-70-SHB112 (Screen 1)	06/28/07	2223218.79	6006200.98	132.00	94.50	110.50	100.00	110.00	8.21	8.25	-86.25	-102.25	-91.75	-101.75	10.00	4	0.2	07/11/07	07/11/07	130.50
IW-70-SHB112 (Screen 2)	06/28/07	2223218.79	6006200.98	132.00	113.00	132.00	115.00	130.00	8.21	8.25	-104.75	-123.75	-106.75	-121.75	15.00	4	0.2	07/11/07	07/11/07	130.50
IW-70-SHB113	05/16/07	2223226.40	6006218.07	132.00	100.00	132.00	105.00	130.00	7.49	7.60	-92.40	-124.40	-97.40	-122.40	25.00	4	0.02	05/24/07	06/27/07	131.20
IW-70-SHB114	05/21/07	2223236.09	6006235.54	137.00	100.00	137.00	105.00	130.00	6.72	6.85	-93.15	-130.15	-98.15	-123.15	25.00	4	0.02	05/23/07	05/23/07	130.35
IW-70-SHB115 (Screen 1)	05/30/07	2223244.79	6006254.10	132.00	100.00	110.50	105.00	110.00	6.33	6.55	-93.45	-103.95	-98.45	-103.45	5.00	4	0.02	06/26/07	06/26/07	130.00
IW-70-SHB115 (Screen 2)	05/30/07	2223244.79	6006254.10	132.00	111.00	132.00	115.00	130.00	6.33	6.55	-104.45	-125.45	-108.45	-123.45	15.00	4	0.02	06/26/07	06/26/07	130.00
IW-70-SHB116 (Screen 1)	5/31/1/07	2223254.20	6006271.93	132.00	99.00	111.50	105.00	110.00	6.41	6.55	-92.45	-104.95	-98.45	-103.45	5.00	4	0.02	06/27/07	06/27/07	130.80
IW-70-SHB116 (Screen 2)	5/31-6/1/07	2223254.20	6006271.93	132.00	112.50	132.00	115.00	130.00	6.41	6.55	-105.95	-125.45	-108.45	-123.45	15.00	4	0.02	06/27/07	06/27/07	130.80
IW-70-SHB117 (Screen 1)	06/06/07	2223262.61	6006290.12	132.00	100.50	111.00	105.50	110.50	6.48	6.65	-93.85	-104.35	-98.85	-103.85	5.00	4	0.02	07/09/07	07/09/07	130.00
IW-70-SHB117 (Screen 2)	06/06/07	2223262.61	6006290.12	132.00	113.00	131.00	115.50	130.50	6.48	6.65	-106.35	-124.35	-108.85	-123.85	15.00	4	0.02	07/09/07	07/09/07	130.00
IW-70-SHB118 (Screen 1)	06/13/07	2223279.23	6006304.06	132.00	93.00	110.50	100.00	110.00	6.31	6.55	-86.45	-103.95	-93.45	-103.45	10.00	4	0.02	07/02/07	07/02/07	128.70
IW-70-SHB118 (Screen 2)	06/13/07	2223279.23	6006304.06	132.00	114.00	132.00	115.00	130.00	6.31	6.55	-107.45	-125.45	-108.45	-123.45	15.00	4	0.02	07/02/07	07/02/07	128.70
IW-70-SHB119 (Screen 1)	06/19/07	2223288.27	6006320.24	132.00	98.00	110.50	100.00	110.00	7.00	7.25	-90.75	-103.25	-92.75	-102.75	10.00	4	0.02	06/28/07	06/28/07	130.30
IW-70-SHB119 (Screen 2)	06/19/07	2223288.27	6006320.24	132.00	114.00	132.00	115.00	130.00	7.00	7.25	-106.75	-124.75	-107.75	-122.75	15.00	4	0.02	06/28/07	06/28/07	130.30
IW-70-SHB120 (Screen 1)	06/21/07	2223289.71	6006342.88	137.00	96.00	112.00	100.00	110.00	7.83	8.05	-87.95	-103.95	-91.95	-101.95	10.00	4	0.02	06/27/07	06/28/07	130.60
IW-70-SHB120 (Screen 2)	06/21/07	2223289.71	6006342.88	137.00	117.00	132.00	120.00	130.00	7.83	8.05	-108.95	-123.95	-111.95	-121.95	10.00	4	0.02	06/28/07	06/28/07	130.60
IW-70-SHB121 (Screen 1)	06/14/07	2223298.01	6006360.94	132.00	98.00	112.00	100.00	110.00	8.57	8.75	-89.25	-103.25	-91.25	-101.25	10.00	4	0.02	06/27/07	06/27/07	130.00
IW-70-SHB121 (Screen 2)	06/14/07	2223298.01	6006360.94	132.00	117.00	132.00	120.00	130.00	8.57	8.75	-108.25	-123.25	-111.25	-121.25	10.00	4	0.02	06/27/07	06/27/07	130.00
IW-70-SHB122 (Screen 1)	06/13/07	2223303.82	6006380.97	132.00	96.00	112.00	100.00	110.00	8.15	8.35	-87.65	-103.65	-91.65	-101.65	10.00	4	0.02	06/26/07	06/26/07	130.00
IW-70-SHB122 (Screen 2)	06/13/07	2223303.82	6006380.97	132.00	117.50	132.00	120.00	130.00	8.15	8.35	-109.15	-123.65	-111.65	-121.65	10.00	4	0.02	06/26/07	06/26/07	130.00
IW-70-SHB123 (Screen 1)	06/11/07	2223302.16	6006405.55	132.00	97.00	112.00	100.00	110.00	6.46	6.55	-90.45	-105.45	-93.45	-103.45	10.00	4	0.02	06/26/07	06/26/07	130.00
IW-70-SHB123 (Screen 2)	06/11/07	2223302.16	6006405.55	132.00	119.00	132.00	120.00	130.00	6.46	6.55	-112.45	-125.45	-113.45	-123.45	10.00	4	0.02	06/26/07	06/26/07	130.00
IW-70-SHB124 (Screen 1)	06/01/07	2223337.35	6006409.84	132.00	100.00	112.00	105.00	110.00	7.58	7.65	-92.35	-104.35	-97.35	-102.35	5.00	4	0.02	06/19/07	06/19/07	130.00
IW-70-SHB124 (Screen 2)	06/01/07	2223337.35	6006409.84	132.00	113.00	132.00	115.00	130.00	7.58	7.65	-105.35	-124.35	-107.35	-122.35	15.00	4	0.02	06/19/07	06/19/07	130.00
IW-70-SHB125	05/31/07	2223336.14	6006431.77	135.00	100.00	135.00	105.00	130.00	6.53	6.65	-93.35	-128.35	-98.35	-123.35	15.00	4	0.02	06/20/07	06/20/07	130.30
IW-70-SHB126 (Screen 1)	05/30/07	2223345.25	6006449.68	132.00	101.00	112.00	105.00	110.00	6.57	6.65	-94.35	-105.35	-98.35	-103.35	5.00	4	0.02	06/21/07	06/21/07	130.60
IW-70-SHB126 (Screen 2)	05/30/07	2223345.25	6006449.68	132.00	113.08	132.00	115.00	130.00	6.57	6.65	-106.43	-125.35	-108.35	-123.35	15.00	4	0.02	06/21/07	06/21/07	130.60

TABLE 1-3
WELL CONSTRUCTION SUMMARY

Well Number	Well Installation			Construction Depths (feet bgs)					Construction Elevations (feet MSL, NGVD29)						Screen Dimensions			Well Maintenance		
	Date Installed	Coordinates (feet NAD83)		Borehole Depth	Filter Pack		Screen Interval		TOC	Ground Surface	Filter Pack		Screen Interval		Length (feet)	Diameter (inches)	Slot Size (inches)	Date Last Developed	Well Depth	
		Northing	Easting		Top	Bottom	Top	Bottom			Top	Bottom	Top	Bottom					Date Measured	Measurement (feet below TOC)
IW-70-SHB127	05/17/07	2223353.91	6006467.89	132.00	99.00	132.00	103.50	128.50	6.79	6.85	-92.15	-125.15	-96.65	-121.65	25.00	4	0.02	05/24/07	05/24/07	127.60
IW-70-SHB128	05/16/07	2223362.83	6006485.63	132.00	102.00	132.00	105.00	130.00	7.61	7.75	-94.25	-124.25	-97.25	-122.25	25.00	4	0.02	05/22/07	05/22/07	130.85
IW-70-SHB129 (Screen 1)	07/11/07	2223371.33	6006504.09	132.00	96.00	112.00	100.00	110.00	8.58	8.75	-87.25	-103.25	-91.25	-101.25	10.00	4	0.02	08/01/07	08/01/07	130.00
IW-70-SHB129 (Screen 2)	07/11/07	2223371.33	6006504.09	132.00	116.00	132.00	120.00	130.00	8.58	8.75	-107.25	-123.25	-111.25	-121.25	10.00	4	0.02	08/01/07	08/01/07	130.00
IW-70-SHB130 (Screen 1)	07/13/07	2223380.74	6006521.04	132.00	97.00	110.00	100.00	110.00	9.01	9.16	-87.84	-100.84	-100.84	-110.84	10.00	4	0.02	08/01/07	08/01/07	130.00
IW-70-SHB130 (Screen 2)	07/13/07	2223380.74	6006521.04	132.00	116.00	132.00	120.00	130.00	9.01	9.16	-106.84	-122.84	-110.84	-120.84	10.00	4	0.02	08/01/07	08/01/07	130.00
IW-70-SHB131 (Screen 1)	07/12/07	2223389.92	6006538.90	132.00	97.00	112.00	100.00	110.00	9.06	9.19	-87.81	-102.81	-90.81	-100.81	10.00	4	0.02	08/01/07	08/01/07	129.90
IW-70-SHB131 (Screen 2)	07/12/07	2223389.92	6006538.90	132.00	116.00	132.00	120.00	130.00	9.06	9.19	-106.81	-122.81	-110.81	-120.81	10.00	4	0.02	08/01/07	08/01/07	129.90
IW-70-SHB132 (Screen 1)	06/07/07	2223398.76	6006557.30	135.00	101.00	111.20	105.00	110.00	8.57	8.65	-92.35	-102.55	-96.35	-101.35	5.00	4	0.02	06/25/07	06/25/07	132.90
IW-70-SHB132 (Screen 2)	06/07/07	2223398.76	6006557.30	135.00	113.50	135.00	115.00	130.00	8.57	8.65	-104.85	-126.35	-110.35	-120.35	15.00	4	0.02	06/25/07	06/25/07	132.90
IW-70-SHB133 (Screen 1)	06/05/07	2223407.64	6006574.95	132.00	98.00	113.00	100.00	110.00	8.34	8.55	-89.45	-104.45	-91.45	-101.45	10.00	4	0.02	06/21/07	06/21/07	130.35
IW-70-SHB133 (Screen 2)	06/05/07	2223407.64	6006574.95	132.00	118.00	132.00	120.00	130.00	8.34	8.55	-109.45	-123.45	-111.45	-121.45	10.00	4	0.02	06/21/07	06/21/07	130.35
IW-70-SHB134 (Screen 1)	06/04/07	2223416.72	6006593.08	132.00	100.00	117.00	105.00	115.00	9.01	9.15	-90.85	-107.85	-95.85	-105.85	10.00	4	0.02	06/20/07	06/20/07	130.60
IW-70-SHB134 (Screen 2)	06/04/07	2223416.72	6006593.08	132.00	118.00	132.00	120.00	130.00	9.01	9.15	-108.85	-122.85	-110.85	-120.85	10.00	4	0.02	06/20/07	06/20/07	130.60
IW-70-SHB135 (Screen 1)	07/02/07	2223426.03	6006610.97	134.00	99.00	112.50	105.00	110.00	9.17	9.28	-89.72	-103.22	-95.72	-100.72	5.00	4	0.02	07/11/07	07/11/07	130.50
IW-70-SHB135 (Screen 2)	07/02/07	2223426.03	6006610.97	134.00	117.00	134.00	120.00	130.00	9.17	9.28	-107.72	-124.72	-110.72	-120.72	10.00	4	0.02	07/11/07	07/11/07	130.50
IW-70-SHB136 (Screen 1)	07/09/07	2223436.16	6006627.91	132.00	103.00	112.00	105.00	110.00	9.12	9.24	-93.76	-102.76	-95.76	-100.76	5.00	4	0.02	07/11/07	07/11/07	130.33
IW-70-SHB136 (Screen 2)	07/09/07	2223436.16	6006627.91	132.00	116.00	132.00	120.00	130.00	9.12	9.24	-106.76	-122.76	-110.76	-120.76	10.00	4	0.02	07/11/07	07/11/07	130.33
IW-70-SHB137 (Screen 1)	05/29/07	2223444.88	6006646.03	137.00	100.00	117.00	105.00	115.00	9.02	9.14	-90.86	-107.86	-95.86	-100.86	10.00	4	0.02	06/19/07	06/19/07	130.90
IW-70-SHB137 (Screen 2)	05/29/07	2223444.88	6006646.03	137.00	118.00	137.00	120.00	130.00	9.02	9.14	-108.86	-127.86	-110.86	-120.86	10.00	4	0.02	06/19/07	06/19/07	130.90
IW-70-SHB201	05/23/07	2222510.01	6006405.50	137.00	100.00	132.00	105.00	130.00	7.63	7.45	-92.55	-124.55	-97.55	-122.55	25.00	4	0.02	08/02/07	08/02/07	130.50
IW-70-SHB217	05/24/07	2222624.89	6006709.51	137.00	100.00	137.00	105.00	130.00	8.67	8.70	-91.30	-128.30	-96.30	-121.30	25.00	4	0.02	07/12/07	07/12/07	130.50
IW-70-SHB232	05/23/07	2222844.20	6006893.69	137.00	101.00	131.00	105.00	130.00	7.93	7.85	-93.15	-123.15	-97.15	-122.15	25.00	4	0.02	07/12/07	07/12/07	130.50
Shell Horizon Biobarrier 3																				
MW-70-MNA14	07/13/07	2222157.30	6007254.70	130.00	110.00	130.00	115.00	125.00	8.86	9.20	-100.80	-120.80	-105.80	-115.80	10.00	4	0.02	07/30/07	07/30/07	125.80
MW-70-PMW11A	08/14/07	2222552.20	6007015.00	97.00	81.00	95.00	85.00	95.00	8.13	8.40	-72.60	-86.60	-76.60	-86.60	10.00	4	0.02	09/07/07	09/07/07	95.95
MW-70-PMW11B	08/23/07	2222545.80	6007013.60	127.00	110.00	127.00	115.00	125.00	7.95	8.30	-101.70	-118.70	-106.70	-116.70	10.00	4	0.02	09/06/07	09/06/07	125.30
MW-70-PMW12A	08/14/07	2222526.80	6007058.10	97.00	79.00	97.00	85.00	95.00	7.86	8.20	-70.80	-88.80	-76.80	-86.80	10.00	4	0.02	09/05/07	09/05/07	94.90
MW-70-PMW12B	08/10/07	2222518.10	6007051.40	127.00	110.00	127.00	115.00	125.00	8.09	8.30	-101.70	-118.70	-106.70	-116.70	10.00	4	0.02	08/22/07	08/22/07	125.50
IW-70-SHB301 (Screen 1)	07/26/07	2222266.64	6006863.01	132.00	76.00	97.00	80.00	95.00	7.96	8.23	-67.77	-88.77	-71.77	-86.77	15.00	4	0.02	08/08/07	08/08/07	129.20
IW-70-SHB301 (Screen 2)	07/26/07	2222266.64	6006863.01	132.00	103.00	132.00	105.00	130.00	7.96	8.23	-94.77	-123.77	-96.77	-121.77	25.00	4	0.02	08/08/07	08/08/07	129.20
IW-70-SHB302 (Screen 1)	07/31/07	2222286.47	6006875.79	132.00	76.00	97.00	80.00	95.00	8.07	8.38	-67.62	-88.62	-71.62	-86.62	15.00	4	0.02	08/08/07	08/08/07	129.75
IW-70-SHB302 (Screen 2)	07/31/07	2222286.47	6006875.79	132.00	102.50	132.00	105.00	130.00	8.07	8.38	-94.12	-123.62	-96.62	-121.62	25.00	4	0.02	08/08/07	08/08/07	129.75
IW-70-SHB303 (Screen 1)	08/01/07	2222306.99	6006888.87	132.00	75.50	96.50	80.00	95.00	8.46	8.78	-66.72	-87.72	-71.22	-86.22	15.00	4	0.02	08/09/07	08/09/07	130.00
IW-70-SHB303 (Screen 2)	08/01/07	2222306.99	6006888.87	132.00	101.50	132.00	105.00	130.00	8.46	8.78	-92.72	-123.22	-96.22	-121.22	25.00	4	0.02	08/09/07	08/09/07	130.00
IW-70-SHB304 (Screen 1)	07/23/07	2222330.86	6006904.23	132.00	77.00	100.00	82.00	97.00	8.67	9.07	-67.93	-90.93	-72.93	-87.93	10.00	4	0.02	08/10/07	08/10/07	127.00
IW-70-SHB304 (Screen 2)	07/23/07	2222330.86	6006904.23	132.00	104.00	132.00	107.00	127.00	8.67	9.07	-94.93	-122.93	-97.93	-117.93	20.00	4	0.02	08/10/07	08/10/07	127.00
IW-70-SHB305 (Screen 1)	07/24/07	2222347.45	6006915.08	132.00	76.00	97.00	80.50	95.50	8.88	9.15	-66.85	-87.85	-71.35	-86.35	15.00	4	0.02	08/13/07	08/13/07	130.50
IW-70-SHB305 (Screen 2)	07/24/07	2222347.45	6006915.08	132.00	103.00	132.00	105.50	130.50	8.88	9.15	-93.85	-122.85	-96.35	-121.35	25.00	4	0.02	08/13/07	08/13/07	130.50
IW-70-SHB306 (Screen 1)	08/07/07	2222367.42	6006928.33	132.00	76.50	97.00	80.00	95.00	8.91	9.11	-67.39	-87.89	-70.89	-85.89	15.00	4	0.02	08/15/07	08/15/07	130.00
IW-70-SHB306 (Screen 2)	08/07/07	2222367.42	6006928.33	132.00	103.00	131.50	105.00	130.00	8.91	9.11	-93.89	-122.39	-95.89	-120.89	25.00	4	0.02	08/15/07	08/15/07	130.00
IW-70-SHB307 (Screen 1)	08/08/07	2222387.55	6006941.19	133.00	77.00	97.00	80.00	95.00	8.70	9.13	-67.87	-87.87	-70.87	-85.87	15.00	4	0.02	08/22/07	08/22/07	130.00
IW-70-SHB307 (Screen 2)	08/08/07	2222387.55	6006941.19	133.00	102.50	133.00	105.00	130.00	8.70	9.13	-93.37	-123.87	-95.87	-120.87	25.00	4	0.02	08/22/07	08/22/07	130.00
IW-70-SHB308 (Screen 1)	08/10/07	2222407.92	6006954.21	132.00	76.40	97.00	80.00	95.00	8.89	9.07	-67.33	-87.93	-70.93	-85.93	15.00	4	0.02	08/16/07	08/16/07	129.60
IW-70-SHB308 (Screen 2)	08/10/07	2222407.92	6006954.21	132.00	103.00	132.00	105.00	130.00	8.89	9.07	-93.93	-122.93	-95.93	-120.93	25.00	4	0.02	08/16/07	08/16/07	129.60

TABLE 1-3
WELL CONSTRUCTION SUMMARY

Well Number	Well Installation			Construction Depths (feet bgs)					Construction Elevations (feet MSL, NGVD29)						Screen Dimensions			Well Maintenance		
	Date Installed	Coordinates (feet NAD83)		Borehole Depth	Filter Pack		Screen Interval		TOC	Ground Surface	Filter Pack		Screen Interval		Length (feet)	Diameter (inches)	Slot Size (inches)	Date Last Developed	Well Depth	
		Northing	Easting		Top	Bottom	Top	Bottom			Top	Bottom	Top	Bottom					Date Measured	Measurement (feet below TOC)
IW-70-SHB309 (Screen 1)	07/26/07	2222427.88	6006967.25	132.00	75.00	97.00	80.00	95.00	8.89	9.09	-65.91	-87.91	-70.91	-85.91	15.00	4	0.02	08/23/07	08/23/07	130.50
IW-70-SHB309 (Screen 2)	07/26/07	2222427.88	6006967.25	132.00	103.00	130.50	105.00	130.00	8.89	9.09	-93.91	-121.41	-95.91	-120.91	25.00	4	0.02	08/23/07	08/23/07	130.50
IW-70-SHB310 (Screen 1)	07/30/07	2222447.97	6006980.50	137.00	77.00	95.00	80.00	95.00	8.73	9.11	-67.89	-85.89	-70.89	-85.89	15.00	4	0.02	08/27/07	08/27/07	130.70
IW-70-SHB310 (Screen 2)	07/30/07	2222447.97	6006980.50	137.00	103.00	132.00	105.00	130.00	8.73	9.11	-93.89	-122.89	-95.89	-120.89	25.00	4	0.02	08/27/07	08/27/07	130.70
IW-70-SHB311 (Screen 1)	08/01/07	2222466.38	6006996.03	132.00	76.00	98.00	80.00	95.00	8.78	9.06	-66.94	-88.94	-70.94	-85.94	15.00	4	0.02	08/14/07	08/14/07	130.00
IW-70-SHB311 (Screen 2)	08/01/07	2222466.38	6006996.03	132.00	103.00	132.00	105.00	130.00	8.78	9.06	-93.94	-122.94	-95.94	-120.94	25.00	4	0.02	08/14/07	08/14/07	130.00
IW-70-SHB312 (Screen 1)	07/25/07	2222488.35	6007006.82	132.00	76.70	102.00	80.00	100.00	8.67	8.78	-67.92	-93.22	-71.22	-91.22	20.00	4	0.02	08/13/07	08/13/07	131.00
IW-70-SHB312 (Screen 2)	07/25/07	2222488.35	6007006.82	132.00	108.00	132.00	110.00	130.00	8.67	8.78	-99.22	-123.22	-101.22	-121.22	20.00	4	0.02	08/13/07	08/13/07	131.00
IW-70-SHB313 (Screen 1)	07/23/07	2222508.44	6007019.69	132.00	76.00	103.00	80.50	100.50	8.26	8.46	-67.54	-94.54	-72.04	-92.04	20.00	4	0.02	08/10/07	08/10/07	129.55
IW-70-SHB313 (Screen 2)	07/23/07	2222508.44	6007019.69	132.00	108.00	132.00	110.50	130.50	8.26	8.46	-99.54	-123.54	-102.04	-122.04	20.00	4	0.02	08/10/07	08/10/07	129.55
IW-70-SHB314 (Screen 1)	08/09/07	2222527.76	6007033.48	132.00	75.00	102.00	80.00	100.00	7.88	8.05	-66.95	-93.95	-71.95	-91.95	20.00	4	0.02	08/20/07	08/20/07	129.80
IW-70-SHB314 (Screen 2)	08/09/07	2222527.76	6007033.48	132.00	107.00	132.00	110.00	130.00	7.88	8.05	-98.95	-123.95	-101.95	-121.95	20.00	4	0.02	08/20/07	08/20/07	129.80
IW-70-SHB315 (Screen 1)	08/08/07	2222544.33	6007043.63	132.00	75.50	102.00	80.00	100.00	8.06	8.25	-67.25	-93.75	-71.75	-91.75	20.00	4	0.02	08/21/07	08/21/07	129.80
IW-70-SHB315 (Screen 2)	08/08/07	2222544.33	6007043.63	132.00	107.50	132.00	110.00	130.00	8.06	8.25	-99.25	-123.75	-101.75	-121.75	20.00	4	0.02	08/21/07	08/21/07	129.80
IW-70-SHB316 (Screen 1)	07/18/07	2222561.57	6007056.54	132.00	75.50	102.50	80.00	100.00	8.77	8.95	-66.55	-93.55	-71.05	-91.05	20.00	4	0.02	08/07/07	08/07/07	129.70
IW-70-SHB316 (Screen 2)	07/18/07	2222561.57	6007056.54	132.00	107.00	132.00	110.00	130.00	8.77	8.95	-98.05	-123.05	-101.05	-121.05	20.00	4	0.02	08/07/07	08/07/07	129.70
IW-70-SHB317 (Screen 1)	08/13/07	2222587.72	6007073.02	132.00	75.00	102.00	80.00	100.00	8.75	8.95	-66.05	-93.05	-71.05	-91.05	20.00	4	0.02	08/16/07	08/16/07	130.35
IW-70-SHB317 (Screen 2)	08/13/07	2222587.72	6007073.02	132.00	107.00	132.00	110.00	130.00	8.75	8.95	-98.05	-123.05	-101.05	-121.05	20.00	4	0.02	08/16/07	08/16/07	130.35
IW-70-SHB318 (Screen 1)	08/07/07	2222611.82	6007089.34	132.00	75.00	101.50	80.00	100.00	7.76	7.85	-67.15	-93.65	-72.15	-92.15	20.00	4	0.02	08/21/07	08/21/07	130.30
IW-70-SHB318 (Screen 2)	08/07/07	2222611.82	6007089.34	132.00	105.50	132.00	110.00	130.00	7.76	7.85	-97.65	-124.15	-102.15	-121.15	20.00	4	0.02	08/21/07	08/21/07	130.30
IW-70-SHB319 (Screen 1)	08/01/07	2222631.06	6007100.61	132.00	75.00	101.00	80.00	100.00	7.54	7.85	-67.15	-93.15	-72.15	-92.15	20.00	4	0.02	08/22/07	08/22/07	128.80
IW-70-SHB319 (Screen 2)	08/01/07	2222631.06	6007100.61	132.00	107.00	132.00	110.00	130.00	7.54	7.85	-99.15	-124.15	-102.15	-121.15	20.00	4	0.02	08/22/07	08/22/07	128.80
IW-70-SHB320 (Screen 1)	07/23/07	2222648.10	60076112.67	137.00	75.00	102.66	80.00	100.00	7.78	8.15	-66.85	-94.51	-71.85	-91.85	20.00	4	0.02	08/20/07	08/20/07	130.50
IW-70-SHB320 (Screen 2)	07/23/07	2222648.10	60076112.67	137.00	105.50	137.00	110.00	130.00	7.78	8.15	-97.35	-128.85	-101.85	-121.85	20.00	4	0.02	08/20/07	08/20/07	130.50
Second Sand Biobarrier 1																				
MW-70-14	03/19/98	2223055.91	6007290.58	172.50	154.00	187.00	160.00	170.00	11.01	8.51	-145.49	-178.49	-151.49	-161.49	10.00	5	0.01	03/26/98	04/09/98	172.50
MW-70-15	03/23/98	2221994.30	6008038.90	175.00	155.00	175.00	160.80	170.30	9.41	7.14	-147.86	-167.86	-153.66	-163.16	9.50	5	0.01	03/30/98	04/08/98	172.82
MW-70-43B	07/19/05	2222847.90	6007211.10	150.00	131.30	150.00	135.50	145.50	10.58	7.93	-123.37	-142.07	-127.57	-137.57	20.00	2	0.01	07/22/05	NM	NM
MW-70-49	09/14/11	2222561.84	6007405.30	167.00	120.00	167.00	125.00	165.00	7.89	8.27	-111.73	-158.73	-116.73	-156.73	40.00	4	0.02	09/16/11	10/26/11	164.62
MW-70-MNA15	06/04/07	2222706.18	6006650.49	160.00	136.00	151.00	140.00	150.00	5.96	6.10	-129.90	-144.90	-133.90	-143.90	10.00	4	0.02	06/18/07	06/18/07	151.10
MW-70-MNA16	06/04/07	2222145.26	6007245.65	155.00	135.50	155.00	140.50	150.50	8.65	9.22	-126.28	-145.78	-131.28	-141.28	10.00	4	0.02	07/26/07	07/26/07	150.60
MW-70-MNA17	06/06/07	2222026.24	6007015.43	167.00	135.00	152.00	140.00	150.00	6.80	7.00	-128.00	-145.00	-133.00	-143.00	10.00	4	0.02	06/19/07	06/19/07	140.35
MW-70-PMW13A	08/20/07	2222293.78	6007163.19	137.00	119.00	137.00	125.00	135.00	7.47	4.60	-114.40	-132.40	-120.40	-130.40	10.00	4	0.02	09/06/07	09/06/07	135.60
MW-70-PMW13B	08/15/07	2222303.10	6007169.25	157.00	139.00	157.00	145.00	155.00	7.48	4.70	-134.30	-152.30	-140.30	-150.30	10.00	4	0.02	09/05/07	09/05/07	155.15
MW-70-PMW14A	08/22/07	2222253.67	6007203.49	140.00	123.00	140.00	128.00	138.00	7.64	8.00	-115.00	-132.00	-120.00	-130.00	10.00	4	0.02	09/05/07	09/05/07	139.35
MW-70-PMW14B	08/22/07	2222270.94	6007216.27	160.00	138.00	160.00	149.00	159.00	7.92	8.20	-129.80	-151.80	-140.80	-150.80	10.00	4	0.02	09/04/07	09/04/07	159.15
IW-70-SSB101	06/19/07	2222076.99	6007048.06	170.00	120.00	170.00	125.00	165.00	7.77	7.85	-112.15	-162.15	-117.15	-157.15	40.00	4	0.02	07/24/07	07/24/07	163.40
IW-70-SSB102	07/13/07	2222093.15	6007066.72	167.00	120.00	167.00	125.00	165.00	7.82	7.85	-112.15	-159.15	-117.15	-157.15	40.00	4	0.02	07/25/07	07/25/07	165.30
IW-70-SSB103	07/16/07	2222111.08	6007083.61	167.00	121.00	167.00	125.00	165.00	7.69	7.65	-113.35	-159.35	-117.35	-157.35	40.00	4	0.02	07/26/07	07/26/07	165.50
IW-70-SSB104	07/18/07	2222131.43	6007097.29	167.00	119.60	167.00	125.00	165.00	7.54	7.65	-111.95	-159.35	-117.35	-157.35	40.00	4	0.02	07/24/07	07/24/07	165.75
IW-70-SSB105	07/19/07	2222151.11	6007109.73	167.00	121.00	167.00	125.00	165.00	7.51	7.75	-113.25	-159.25	-117.25	-157.25	40.00	4	0.02	07/25/07	07/25/07	165.75
IW-70-SSB106	08/16/07	2222171.01	6007123.05	167.00	121.00	167.00	125.00	165.00	8.04	8.05	-112.95	-158.95	-116.95	-156.95	40.00	4	0.02	08/28/07	08/28/07	165.20
IW-70-SSB107	08/20/07	2222191.24	6007136.11	167.00	120.00	167.00	125.00	165.00	7.93	7.95	-112.05	-159.05	-117.05	-157.05	40.00	4	0.02	08/29/07	08/29/07	165.20
IW-70-SSB108	08/21/07	2222207.47	6007147.74	167.00	120.10	167.00	125.00	165.00	8.02	8.05	-112.05	-158.95	-116.95	-156.95	40.00	4	0.02	08/30/07	08/30/07	165.20
IW-70-SSB109	08/23/07	2222230.86	6007162.75	167.00	120.00	167.00	125.75	165.75	7.96	8.10	-111.90	-158.90	-117.65	-157.65	40.00	4	0.02	08/20/07	08/20/07	165.81

TABLE 1-3
WELL CONSTRUCTION SUMMARY

Well Number	Well Installation			Construction Depths (feet bgs)					Construction Elevations (feet MSL, NGVD29)						Screen Dimensions			Well Maintenance		
	Date Installed	Coordinates (feet NAD83)		Borehole Depth	Filter Pack		Screen Interval		TOC	Ground Surface	Filter Pack		Screen Interval		Length (feet)	Diameter (inches)	Slot Size (inches)	Date Last Developed	Well Depth	
		Northing	Easting		Top	Bottom	Top	Bottom			Top	Bottom	Top	Bottom					Date Measured	Measurement (feet below TOC)
IW-70-SSB110	08/10/07	2222256.03	6007179.36	167.00	122.00	167.00	125.00	165.00	8.90	9.05	-112.95	-157.95	-115.95	-155.95	40.00	4	0.02	08/29/07	08/29/07	165.30
IW-70-SSB111	08/09/07	2222270.57	6007189.28	167.00	120.50	167.00	125.00	165.00	8.90	9.05	-111.45	-157.95	-115.95	-155.95	40.00	4	0.02	08/14/07	08/14/07	165.00
IW-70-SSB112	06/20/07	2222290.37	6007203.00	167.00	120.00	170.00	125.00	165.00	7.87	8.05	-111.95	-161.95	-116.95	-156.95	40.00	4	0.02	07/16/07	07/16/07	165.50
IW-70-SSB113	08/08/07	2222310.44	6007215.97	167.00	121.50	167.00	125.00	165.00	7.84	7.85	-113.65	-159.15	-117.15	-157.15	40.00	4	0.02	08/15/07	08/14/07	165.00
IW-70-SSB114	07/11/07	2222330.31	6007229.33	167.00	121.00	167.00	125.00	165.00	7.68	7.85	-113.15	-159.15	-117.15	-157.15	40.00	4	0.02	07/19/07	07/19/07	166.00
IW-70-SSB115	07/10/07	2222350.66	6007242.08	167.00	120.00	167.00	125.00	165.00	7.98	8.05	-111.95	-158.95	-116.95	-156.95	40.00	4	0.02	07/18/07	07/18/07	165.50
IW-70-SSB116	06/27/07	2222370.00	6007255.79	167.00	120.00	167.00	125.00	165.00	8.42	8.45	-111.55	-158.55	-116.55	-156.55	40.00	4	0.02	07/17/07	07/17/07	165.50
IW-70-SSB117	07/02/07	2222389.76	6007268.13	167.00	120.50	167.00	125.00	165.00	8.45	8.55	-111.95	-158.45	-116.45	-156.45	40.00	4	0.02	07/18/07	07/18/07	165.50
IW-70-SSB118	08/13/07	2222409.23	6007281.32	167.00	122.00	165.00	125.00	165.00	8.54	8.75	-113.25	-156.25	-116.25	-156.25	40.00	4	0.02	08/28/07	08/28/07	164.15
IW-70-SSB119	08/14/07	2222429.64	6007294.68	167.00	121.00	167.00	125.00	165.00	9.06	9.34	-111.66	-157.66	-115.66	-155.66	40.00	4	0.02	08/27/07	08/27/07	166.30
IW-70-SSB120	08/13/07	2222452.33	6007308.58	167.00	122.00	167.00	125.00	165.00	8.24	8.75	-113.25	-158.25	-116.25	-156.25	40.00	4	0.02	08/23/07	08/23/07	163.30
IW-70-SSB121	06/26/07	2222469.91	6007320.42	167.00	120.00	167.00	125.00	165.00	8.34	8.55	-111.45	-158.45	-116.45	-156.45	40.00	4	0.02	07/19/07	07/19/07	165.50
IW-70-SSB122	06/21/07	2222487.22	6007331.79	170.00	120.00	170.00	125.00	165.00	8.20	8.45	-111.55	-161.55	-116.55	-156.55	40.00	4	0.02	07/18/07	07/18/07	165.50
Point of Compliance/Upper Fines																				
MW-70-02	07/21/97	2224602.60	6005708.20	32.00	17.00	32.00	20.00	30.00	7.85	5.90	-11.10	-26.10	-14.10	-24.10	10.00	4	0.01	08/04/97	07/21/97	33.95
MW-70-10	04/13/00	2223724.30	6007203.10	41.50	27.00	41.50	30.10	40.10	10.10	8.37	-18.63	-33.13	-21.73	-31.73	10.00	4	0.01	04/24/00	04/24/00	42.28
MW-70-17	04/14/00	2222804.90	6005569.00	41.50	27.00	41.50	30.00	40.00	4.58	2.85	-24.15	-38.65	-27.15	-37.15	10.00	4	0.01	05/01/00	05/01/00	42.10
MW-70-22	04/17/00	2221971.60	6007067.40	32.00	17.00	32.00	20.00	30.00	10.21	8.67	-8.33	-23.33	-11.33	-21.33	10.00	4	0.01	05/03/00	05/03/00	32.09
Point of Compliance/First Sand																				
MW-70-11	04/21/00	2223726.20	6007217.50	102.00	67.80	102.00	80.00	100.00	11.07	8.56	-59.24	-93.44	-71.44	-91.44	20.00	5	0.01	04/24/00	04/24/00	101.70
MW-70-16	03/26/98	2222003.60	6008020.10	110.00	89.50	110.00	94.70	104.70	9.76	7.19	-82.31	-102.81	-87.51	-97.51	10.00	5	0.01	04/01/98	04/09/98	107.22
MW-70-35	03/01/02	2222536.90	6005190.60	103.00	84.00	103.00	90.00	100.00	6.31	3.67	-80.33	-99.33	-86.33	-96.33	10.00	4	0.01	03/04/02	05/02/02	103.50
MW-70-POC01	09/21/07	2224584.60	6005713.40	96.00	77.00	96.00	80.00	90.00	8.88	6.41	-70.59	-89.59	-73.59	-83.59	10.00	4	0.02	10/02/07	10/02/07	93.50
Point of Compliance/Shell Horizon																				
MW-70-23	04/18/00	2223145.60	6008894.60	132.00	103.90	132.00	110.00	130.00	11.17	8.46	-95.44	-123.54	-101.54	-121.54	20.00	5	0.01	04/21/00	04/21/00	132.00
Point of Compliance/Second Sand																				
MW-70-21	04/25/00	2221200.70	6008513.60	172.00	143.00	172.00	150.00	170.00	7.70	5.33	-137.67	-166.67	-144.67	-164.67	20.00	5	0.01	04/27/00	04/27/00	170.20
MW-70-36	03/04/02	2221672.00	6006269.80	170.00	143.00	170.00	150.00	160.00	9.04	6.71	-136.29	-163.29	-143.29	-153.29	10.00	4	0.01	03/08/02	05/23/02	163.23
Point of Compliance/Deep Sand																				
MW-70-POC02	09/19/07	2223170.00	6008885.30	240.00	186.00	202.00	190.00	200.00	8.25	8.68	-177.32	-193.32	-181.32	-191.32	10.00	4	0.02	10/03/07	10/03/07	200.50
MW-70-POC03	09/11/07	2221664.30	6006260.90	205.00	187.00	205.00	190.00	200.00	9.64	7.19	-179.81	-197.81	-182.81	-192.81	10.00	4	0.02	10/03/07	10/03/07	203.30
MW-70-POC04	10/18/07	2221192.20	6008511.20	210.00	191.00	210.00	195.00	205.00	8.50	5.87	-185.13	-204.13	-189.13	-199.13	10.00	4	0.02	10/07/08	10/07/08	208.48

Table 2-1
Groundwater Level Data

Well No.	Screen Interval (feet above MSL)	TOC Elevation (feet above MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)
Upper Fines																	
MW-70-03	20-30	8.03	8/18/2008	NA	NA	8/24/2009	19.19	-11.16	8/25/2010	13.7	-5.67	7/25/2011	9.50	-1.47	10/26/2011	9.61	-1.58
Source Area Treatment/Upper Fines																	
MW-70-PMW01A	25-35	8.23	8/18/2008	20.31	-12.08	8/24/2009	21.60	-13.37	8/25/2010	15.21	-6.98	7/25/2011	8.95	-0.72	10/26/2011	9.06	-0.83
MW-70-PMW01B	45-55	8.21	8/18/2008	22.02	-13.81	8/24/2009	22.04	-13.83	8/25/2010	16.25	-8.04	7/25/2011	9.21	--1.00	10/26/2011	9.30	-1.09
MW-70-27[a]	26-36	8.25	8/21/2008	21.70	-13.45	8/24/2009	21.78	-13.53	8/25/2010	15.20	-6.95	7/25/2011	9.10	-0.85	10/26/2011	9.20	-0.95
MW-70-28[a]	50-60	8.30	8/21/2008	22.13	-13.83	8/24/2009	21.81	-13.51	8/25/2010	17.02	-8.72	7/25/2011	9.43	-1.13	10/26/2011	9.54	-1.24
MW-70-MNA01	40-50	8.36	8/18/2008	22.48	-14.12	8/24/2009	22.32	-13.96	8/25/2010	17.07	-8.71	7/25/2011	9.57	-1.21	10/26/2011	9.68	-1.32
MW-70-MNA02	35-45	8.51	8/18/2008	22.23	-13.72	8/24/2009	20.45**	-11.94	8/25/2010	15.13	-6.62	7/25/2011	9.23	-0.72	10/26/2011	9.33	-0.82
MW-70-MNA03	35-45	9.18	8/18/2008	20.90	-11.72	8/24/2009	21.46	-12.28	8/25/2010	15.73	-6.55	7/25/2011	9.85	-0.67	10/26/2011	9.96	-0.78
MW-70-MNA04	35-45	8.39	8/18/2008	20.52	-12.13	8/24/2009	21.06	-12.67	8/25/2010	15.37	-6.98	7/25/2011	9.20	-0.81	10/26/2011	9.32	-0.93
Source Area Biobarrier/First Sand																	
MW-70-PMW02A	71-81	8.35	8/18/2008	23.06	-14.71	8/24/2009	22.82	-14.47	8/25/2010	17.45	--9.10	7/25/2011	9.52	-1.17	10/26/2011	9.63	-1.28
MW-70-PMW02B	90-100	8.38	8/18/2008	23.11	-14.73	8/24/2009	22.88	--14.50	8/25/2010	17.50	-9.12	7/25/2011	9.57	-1.19	10/26/2011	9.67	-1.29
IW-70-SAB06	65-80/85-105	8.07	8/18/2008	22.81	-14.74	8/24/2009	22.60	-14.53	8/25/2010	17.22	-9.15	7/25/2011	9.27	--1.20	10/26/2011	9.38	-1.31
MW-70-MNA05	70-80	8.46	8/18/2008	22.90	-14.44	8/24/2009	22.79	-14.33	8/25/2010	17.45	-8.99	7/25/2011	9.55	-1.09	10/26/2011	9.65	-1.19
MW-70-PMW03A	70-80	7.94	8/18/2008	22.72	-14.78	8/24/2009	22.49	-14.55	8/25/2010	17.05	-9.11	7/25/2011	9.56	-1.62	10/26/2011	9.67	-1.73
MW-70-P MW03B	90-100	7.88	8/18/2008	22.69	-14.81	8/24/2009	22.44	-14.56	8/25/2010	17.05	-9.17	7/25/2011	9.07	-1.19	10/26/2011	9.18	--1.30
First Sand Biobarrier 1																	
MW-70-38	80-100	6.85	8/18/2008	22.20	-15.35	8/24/2009	21.80	-14.95	8/25/2010	16.32	-9.47	7/25/2011	8.10	-1.25	10/26/2011	8.60	-1.75
IW-70-FSB118	60-105	4.42	8/18/2008	19.71	-15.29	8/24/2009	19.30	-14.88	8/25/2010	13.97	-9.55	7/25/2011	5.79	-1.37	10/26/2011	6.20	-1.78
MW-70-PMW06A	70-80	4.14	8/18/2008	19.42	-15.28	8/24/2009	19.04	--14.90	8/25/2010	13.68	-9.54	7/25/2011	5.50	-1.36	10/26/2011	6.00	-1.86
MW-70-PMW06B	91-101	4.16	8/18/2008	19.50	-15.34	8/24/2009	19.05	-14.89	8/25/2010	13.68	-9.52	7/25/2011	5.47	-1.31	10/26/2011	6.02	-1.86
MW-70-PMW04A	70-80	4.52	8/18/2008	19.90	-15.38	8/24/2009	19.47	-14.95	8/25/2010	14.03	-9.51	7/25/2011	5.78	-1.26	10/26/2011	6.24	-1.72
MW-70-PMW04B	90-100	4.53	8/18/2008	19.05	-14.52	8/24/2009	19.51	-14.98	8/25/2010	14.05	-9.52	7/25/2011	5.82	-1.29	10/26/2011	6.36	-1.83
IW-70-FSB108	60-105	4.64	8/18/2008	20.02	-15.38	8/24/2009	19.63	-14.99	8/25/2010	14.21	-9.57	7/25/2011	6.11	-1.47	10/26/2011	6.55	-1.91
MW-70-PMW05A	70-80	4.21	8/18/2008	19.65	-15.44	8/24/2009	19.21	--15.00	8/25/2010	13.82	-9.61	7/25/2011	5.51	--1.30	10/26/2011	6.06	-1.85
MW-70-PMW05B	90-100	4.34	8/18/2008	19.80	-15.46	8/24/2009	19.34	--15.00	8/25/2010	14.00	-9.66	7/25/2011	5.68	-1.34	10/26/2011	6.11	-1.77
RDO-5	65-105	6.01	8/18/2008	21.55	-15.54	8/24/2009	21.05	-15.04	8/25/2010	15.58	-9.57	7/25/2011	7.33	-1.32	10/26/2011	7.73	-1.72
MW-70-MNA08	80-90	7.66	8/18/2008	23.27	-15.61	8/24/2009	22.74		8/25/2010	17.21	-9.55	7/25/2011	8.99	-1.33	10/26/2011	9.41	-1.75
MW-70-MNA06	80-90	3.95	8/18/2008	19.48	-15.53	8/24/2009	19.03	-15.08	8/25/2010	13.58	-9.63	7/25/2011	5.30	-1.35	10/26/2011	5.70	-1.75
MW-70-MNA11	80-90	8.30	8/18/2008	24.55	-16.25	8/24/2009	23.90	--15.60	8/25/2010	18.35	-10.05	7/25/2011	9.73	-1.43	10/26/2011	10.25	-1.95
MW-70-MNA07	90-100	4.63	8/18/2008	20.18	-15.55	8/24/2009	19.74	-15.11	8/25/2010	14.29	-9.66	7/25/2011	5.97	-1.34	10/26/2011	6.43	--1.80
First Sand Biobarrier 2																	
MW-70-PMW07A	65-75	7.89	8/18/2008	24.43	-16.54	8/24/2009	23.61	-15.72	8/25/2010	17.97	-10.08	7/25/2011	9.10	-1.21	10/26/2011	9.97	-2.08
MW-70-PMW07B	85-95	7.52	8/18/2008	26.44	-18.92	8/24/2009	25.43	-17.91	8/25/2010	19.60	-12.08	7/25/2011	9.44	-1.92	10/26/2011	9.95	-2.43
IW-70-FSB216	65-100	8.34	8/18/2008	26.89	-18.55	8/24/2009	26.50	-18.16	8/25/2010	19.13	-10.79	7/25/2011	10.75	-2.41	10/26/2011	11.34	--3.00
MW-70-PMW08A	65-75	9.04	8/18/2008	26.77	-17.73	8/24/2009	25.98	-16.94	8/25/2010	20.30	-11.26	7/25/2011	10.96	-1.92	10/26/2011	11.50	-2.46
MW-70-PMW08B	85-95	9.08	8/18/2008	28.26	-19.18	8/24/2009	27.32	-18.24	8/25/2010	21.58	--12.50	7/25/2011	11.24	-2.16	10/26/2011	11.84	-2.76
MW-70-MNA09	64-74	6.82	8/18/2008	23.30	-16.48	8/24/2009	22.68	-15.86	8/25/2010	17.08	-10.26	7/25/2011	8.53	-1.71	10/26/2011	9.00	-2.18
MW-70-MNA10	75-85	7.01	8/18/2008	26.67	-19.66	8/24/2009	25.63	-18.62	8/25/2010	19.69	-12.68	7/25/2011	9.24	-2.23	10/26/2011	9.85	-2.84
MW-70-MNA12	75-85	5.85	8/18/2008	26.22	-20.37	8/24/2009	25.07	-19.22	8/25/2010	19.23	-13.38	7/25/2011	8.33	-2.48	10/26/2011	8.91	-3.06
MW-70-43A	86-106	10.76	8/18/2008	NA	NA	8/24/2009	30.44	-19.68	8/25/2010	24.20	-13.44	7/26/2011	13.37	-2.61	10/26/2011	14.04	-3.28
Shell Horizon Biobarrier 1																	
MW-70-PMW09	120-130	6.82	8/18/2008	26.61	-19.79	8/24/2009	25.39	-18.57	8/25/2010	19.47	-12.65	7/25/2011	8.75	-1.93	10/26/2011	9.35	-2.53
IW-70-SHB113	105-130	7.49	8/18/2008	24.20	-16.71	8/24/2009	23.44	-15.95	8/25/2010	20.00	-12.51	7/25/2011	9.64	-2.15	10/26/2011	10.25	-2.76
MW-70-PMW10	120-130	6.60	8/18/2008	26.46	-19.86	8/24/2009	25.20	--18.60	8/25/2010	19.29	-12.69	7/25/2011	8.61	-2.01	10/26/2011	9.26	-2.66
IW-70-SHB217	105-130	8.67	8/18/2008	29.97	--21.30	8/24/2009	27.80	-19.13	8/25/2010	21.82	-13.15	7/25/2011	11.10	-2.43	10/26/2011	11.80	-3.13
MW-70-MNA13	115-125	6.64	8/18/2008	26.42	-19.78	8/24/2009	25.24	--18.60	8/25/2010	19.38	-12.74	7/25/2011	8.75	-2.11	10/26/2011	9.37	-2.73
Shell Horizon Biobarrier 3																	
MW-70-PMW11A	85-95	8.13	8/18/2008	28.81	-20.68	8/24/2009	27.51	-19.38	8/25/2010	22.19	-14.06	7/26/2011	10.10	-1.97	10/26/2011	11.68	-3.55
MW-70-PMW11B	115-125	7.95	8/18/2008	28.51	-20.56	8/24/2009	27.12	-19.17	8/25/2010	21.20	-13.25	7/26/2011	10.22	-2.27	10/26/2011	10.90	-2.95
IW-70-SHB310	80-95/105-120	8.73	8/18/2008	29.37	-20.64	8/24/2009	25.54	-16.81	8/25/2010	22.34	-13.61	7/26/2011	10.12	-1.39	10/26/2011	12.95	-4.22

Table 2-1
Groundwater Level Data

Well No.	Screen Interval (feet above MSL)	TOC Elevation (feet above MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)
MW-70-PMW12A	85-95	7.86	8/18/2008	28.54	-20.68	8/24/2009	27.20	-19.34	8/25/2010	22.28	-14.42	7/26/2011	10.21	-2.35	10/26/2011	10.97	-3.11
MW-70-PMW12B	115-125	8.09	8/18/2008	28.65	-20.56	8/24/2009	27.30	-19.21	8/25/2010	21.35	-13.26	7/26/2011	10.43	-2.34	10/26/2011	10.83	-2.74
MW-70-MNA14	115-125	8.86	8/18/2008	30.02	-21.16	8/24/2009	28.47	-19.61	8/25/2010	23.67	-14.81	7/26/2011	11.35	-2.49	10/26/2011	12.20	-3.34
Second Sand Biobarrier 1																	
MW-70-PMW13A	125-135	7.47	8/18/2008	27.37	--19.90	8/24/2009	26.16	-18.69	8/25/2010	20.25	-12.78	7/26/2011	9.11	-1.64	10/26/2011	9.93	-2.46
MW-70-PMW13B	145-155	7.48	8/18/2008	27.44	-19.96	8/24/2009	26.09	-18.61	8/25/2010	20.16	-12.68	7/26/2011	9.10	-1.62	10/26/2011	9.90	-2.42
IW-70-SSB109	126-166	7.96	8/18/2008	28.82	-20.86	8/24/2009	28.10	-20.14	8/25/2010	21.83	-13.87	7/26/2011	10.95	-2.99	10/26/2011	11.52	-3.56
MW-70-PMW14A	128-138	7.64	8/18/2008	27.62	-19.98	8/24/2009	26.05	-18.41	8/25/2010	20.10	-12.46	7/26/2011	8.97	-1.33	10/26/2011	9.80	-2.16
MW-70-PMW14B	149-159	7.92	8/18/2008	28.13	-20.21	8/24/2009	26.37	-18.45	8/25/2010	20.45	-12.53	7/26/2011	9.35	-1.43	10/26/2011	10.05	-2.13
MW-70-MNA16	141-151	8.65	8/18/2008	29.79	-21.14	8/24/2009	27.27	-18.62	8/25/2010	22.43	-13.78	7/26/2011	11.09	-2.44	10/26/2011	11.93	-3.28
MW-70-MNA17	140-150	6.80	8/18/2008	28.24	-21.44	8/24/2009	27.04	-20.24	8/25/2010	21.33	-14.53	7/26/2011	9.50	--2.70	10/26/2011	10.76	-3.96
MW-70-MNA15	140-150	5.96	8/18/2008	26.23	-20.27	8/24/2009	24.60	-18.64	8/25/2010	18.97	-13.01	7/25/2011	7.92	-1.96	10/26/2011	8.65	-2.69
MW-70-15	161-171	9.41	8/18/2008	31.48	-22.07	8/24/2009	29.97	-20.56	8/25/2010	23.97	-14.56	7/26/2011	12.44	-3.03	10/26/2011	13.35	-3.94
MW-70-14*	160-170	11.01	8/18/2008	NA	NA	8/24/2009	30.19	-19.18	8/25/2010	24.24	-13.23	7/26/2011	13.21	--2.20	10/26/2011	13.85	-2.84
MW-70-43B*	136-146	10.58	8/18/2008	NA	NA	8/24/2009	30.41	-19.83	8/25/2010	24.25	-13.67	7/26/2011	13.17	-2.59	10/26/2011	13.85	-3.27
MW-70-49	125-165	7.89	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10/26/2011	11.00	-3.11
Point of Compliance/Upper Fines																	
MW-70-02	20-30	7.85	8/18/2008	18.88	-11.03	8/24/2009	19.77	-11.92	8/25/2010	14.28	-6.43	7/25/2011	8.33	-0.48	10/26/2011	8.32	-0.47
MW-70-10	30-40	10.10	8/18/2008	19.33	-9.23	8/24/2009	20.29	-10.19	8/25/2010	15.44	-5.34	7/25/2011	10.41	-0.31	10/26/2011	10.73	-0.63
MW-70-17	30-40	4.58	8/18/2008	15.00	-10.42	8/24/2009	15.39	-10.81	8/25/2010	11.39	-6.81	7/25/2011	5.85	-1.27	10/26/2011	6.03	-1.45
MW-70-22	20-30	10.21	8/18/2008	12.51	--2.30	8/24/2009	12.65	-2.44	8/25/2010	11.85	-1.64	7/26/2011	10.37	-0.16	10/26/2011	10.16	0.05
Point of Compliance/First Sand																	
MW-70-POC01	80-90	8.88	8/18/2008	22.92	-14.04	8/24/2009	22.80	-13.92	8/25/2010	17.55	-8.67	7/25/2011	9.81	-0.93	10/26/2011	10.15	-1.27
MW-70-11	80-100	11.07	8/18/2008	28.67	--17.60	8/24/2009	27.76	-16.69	8/25/2010	22.10	-11.03	7/25/2011	12.73	-1.66	10/26/2011	13.35	-2.28
MW-70-35	90-100	6.31	8/18/2008	25.53	-19.22	8/24/2009	24.34	-18.03	8/25/2010	18.66	-12.35	7/25/2011	8.45	-2.14	10/26/2011	9.11	--2.80
MW-70-16	95-105	9.76	8/18/2008	31.49	-21.73	8/24/2009	30.01	-20.25	8/25/2010	23.99	-14.23	7/26/2011	12.45	-2.69	10/26/2011	13.36	--3.60
Point of Compliance/Shell Horizon																	
MW-70-23	110-130	11.17	8/18/2008	33.63	-22.46	8/24/2009	32.39	-21.22	8/25/2010	26.05	-14.88	7/26/2011	14.12	-2.95	10/26/2011	14.85	-3.68
Point of Compliance/Second Sand																	
MW-70-36	150-160	9.04	8/18/2008	29.85	-20.81	8/24/2009	28.41	-19.37	8/25/2010	22.57	-13.53	7/25/2011	11.62	-2.58	10/26/2011	12.64	--3.60
MW-70-21	150-170	7.70	8/18/2008	32.52	-24.82	8/24/2009	30.46	-22.76	8/25/2010	24.10	--16.40	7/26/2011	11.60	--3.90	10/26/2011	12.35	-4.65
Point of Compliance/Deep Sand																	
MW-70-POC02	190-200	8.25	8/18/2008	35.21	-26.96	8/24/2009	32.90	-24.65	8/25/2010	25.80	-17.55	7/26/2011	11.76	-3.51	10/26/2011	12.69	-4.44
MW-70-POC03	190-200	9.64	8/18/2008	30.00	-20.36	8/24/2009	28.39	-18.75	8/25/2010	22.34	--12.70	7/25/2011	10.25	-0.61	10/26/2011	12.30	-2.66
MW-70-POC04	195-205	8.50	8/18/2008	32.35	-23.85	8/24/2009	32.71	-24.21	8/25/2010	26.08	-17.58	7/26/2011	12.94	-4.44	10/26/2011	14.13	-5.63

Notes
NA = not applicable
MSL = mean sea level
TOC = top of casing

Table 2-1
Groundwater Level Data

Well No.	Screen Interval (feet above MSL)	TOC Elevation (feet above MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)
Upper Fines																	
MW-70-03	20-30	8.03	12/10/2013	NA	NA	8/22/2013	10.81	-2.78	1/27/2014	11.11	-3.08	7/21/2014	13	-4.97	12/15/2014	12.33	-4.3
Source Area Treatment/Upper Fines																	
MW-70-PMW01A	25-35	8.23	12/10/2013	10.28	-2.05	8/22/2013	12.03	-3.80	1/27/2014	11.31	-3.08	7/21/2014	13.99	-5.76	12/15/2014	13.24	-5.01
MW-70-PMW01B	45-55	8.21	12/10/2013	10.6	-2.39	8/22/2013	13.16	-4.95	1/27/2014	12.05	-3.84	7/21/2014	15.75	-7.54	12/15/2014	14.19	-5.98
MW-70-27[a]	26-36	8.25	12/10/2013	10.31	-2.06	8/22/2013	11.84	-3.59	1/27/2014	11.31	-3.06	7/21/2014	14.16	-5.91	12/15/2014	13.54	-5.29
MW-70-28[a]	50-60	8.30	12/10/2013	10.9	-2.60	8/22/2013	13.39	-5.09	1/27/2014	12.21	-3.91	7/21/2014	16.17	-7.87	12/15/2014	14.41	-6.11
MW-70-MNA01	40-50	8.36	12/10/2013	10.95	-2.59	8/22/2013	13.42	-5.06	1/27/2014	12.35	-3.99	7/21/2014	16.18	-7.82	12/15/2014	14.34	-5.98
MW-70-MNA02	35-45	8.51	12/10/2013	10.1	-1.59	8/22/2013	11.72	-3.21	1/27/2014	11.45	-2.94	7/21/2014	14.28	-5.77	12/15/2014	13.30	-4.79
MW-70-MNA03	35-45	9.18	12/10/2013	10.8	-1.62	8/22/2013	12.39	-3.21	1/27/2014	12.16	-2.98	7/21/2014	14.99	-5.81	12/15/2014	14.13	-4.95
MW-70-MNA04	35-45	8.39	12/10/2013	10.26	-1.87	8/22/2013	11.75	-3.36	1/27/2014	11.45	-3.06	7/21/2014	14.14	-5.75	12/15/2014	13.46	-5.07
Source Area Biobarrier/First Sand																	
MW-70-PMW02A	71-81	8.35	12/10/2013	10.03	-1.68	8/22/2013	13.78	-5.43	1/27/2014	12.54	-4.19	7/21/2014	16.65	-8.30	12/15/2014	14.62	-6.27
MW-70-PMW02B	90-100	8.38	12/10/2013	11.05	-2.67	8/22/2013	13.82	-5.44	1/27/2014	12.6	-4.22	7/21/2014	16.7	-8.32	12/15/2014	14.70	-6.32
IW-70-SAB06	65-80/85-105	8.07	12/10/2013	10.8	-2.73	8/22/2013	13.68	-5.61	1/27/2014	12.4	-4.33	7/21/2014	16.46	-8.39	12/15/2014	14.38	-6.31
MW-70-MNA05	70-80	8.46	12/10/2013	11.02	-2.56	8/22/2013	13.81	-5.35	1/27/2014	12.53	-4.07	7/21/2014	16.57	-8.11	12/15/2014	14.91	-6.45
MW-70-PMW03A	70-80	7.94	12/10/2013	10.56	-2.62	8/22/2013	13.51	-5.57	1/27/2014	12.17	-4.23	7/21/2014	16.27	-8.33	12/15/2014	14.23	-6.29
MW-70-P MW03B	90-100	7.88	12/10/2013	10.57	-2.69	8/22/2013	13.46	-5.58	1/27/2014	12.13	-4.25	7/21/2014	16.28	-8.40	12/15/2014	14.28	-6.4
First Sand Biobarrier 1																	
MW-70-38	80-100	6.85	12/10/2013	9.77	-2.92	8/22/2013	12.72	-5.87	1/27/2014	11.36	-4.51	7/21/2014	15.73	-8.88	12/15/2014	13.47	-6.62
IW-70-FSB118	60-105	4.42	12/10/2013	7.27	-2.85	8/22/2013	10.27	-5.85	1/27/2014	8.3	-3.88	7/21/2014	14.28	-9.86	12/15/2014	11.16	-6.74
MW-70-PMW06A	70-80	4.14	12/10/2013	7.09	-2.95	8/22/2013	10.05	-5.91	1/27/2014	8.7	-4.56	7/21/2014	13.06	-8.92	12/15/2014	10.79	-6.65
MW-70-PMW06B	91-101	4.16	12/10/2013	7.08	-2.92	8/22/2013	10.04	-5.88	1/27/2014	8.69	-4.53	7/21/2014	12.98	-8.82	12/15/2014	10.75	-6.59
MW-70-PMW04A	70-80	4.52	12/10/2013	7.39	-2.87	8/22/2013	10.39	-5.87	1/27/2014	9	-4.48	7/21/2014	13.32	-8.80	12/15/2014	11.12	-6.6
MW-70-PMW04B	90-100	4.53	12/10/2013	7.4	-2.87	8/22/2013	10.41	-5.88	1/27/2014	9.04	-4.51	7/21/2014	13.33	-8.80	12/15/2014	11.13	-6.6
IW-70-FSB108	60-105	4.64	12/10/2013	7.68	-3.04	8/22/2013	10.63	-5.99	1/27/2014	9.32	-4.68	7/21/2014	13.55	-8.91	12/15/2014	11.35	-6.71
MW-70-PMW05A	70-80	4.21	12/10/2013	7.13	-2.92	8/22/2013	10.11	-5.90	1/27/2014	8.79	-4.58	7/21/2014	13.05	-8.84	12/15/2014	10.88	-6.67
MW-70-PMW05B	90-100	4.34	12/10/2013	7.25	-2.91	8/22/2013	10.25	-5.91	1/27/2014	8.84	-4.5	7/21/2014	13.18	-8.84	12/15/2014	11.01	-6.67
RDO-5	65-105	6.01	12/10/2013	7.58	-1.57	8/22/2013			1/27/2014	10.53	-4.52		14.77	-8.76	12/15/2014		
MW-70-MNA08	80-90	7.66	12/10/2013	10.78	-3.12	8/22/2013	13.6	-5.94	1/27/2014	12.22	-4.56	7/21/2014	16.54	-8.88	12/15/2014	14.34	-6.68
MW-70-MNA06	80-90	3.95	12/10/2013	6.87	-2.92	8/22/2013	9.94	-5.99	1/27/2014	8.49	-4.54	7/21/2014	12.86	-8.91	12/15/2014	10.61	-6.66
MW-70-MNA11	80-90	8.30	12/10/2013	11.42	-3.12	8/22/2013	14.69	-6.39	1/27/2014	13.23	-4.93	7/21/2014	17.86	-9.56	12/15/2014	15.40	-7.1
MW-70-MNA07	90-100	4.63	12/10/2013	7.58	-2.95	8/22/2013	10.66	-6.03	1/27/2014	9.21	-4.58	7/21/2014	13.59	-8.96	12/15/2014	11.37	-6.74
First Sand Biobarrier 2																	
MW-70-PMW07A	65-75	7.89	12/10/2013	11	-3.11	8/22/2013	14.39	-6.50	1/27/2014	12.93	-5.04	7/21/2014	17.52	-9.63	12/15/2014	15.23	-7.34
MW-70-PMW07B	85-95	7.52	12/10/2013	11.34	-3.82	8/22/2013	15.64	-8.12	1/27/2014	13.79	-6.27	7/21/2014	18.35	-10.83	12/15/2014	16.26	-8.74
IW-70-FSB216	65-100	8.34	12/10/2013	12.54	-4.20	8/22/2013	15.75	-7.41	1/27/2014	12.09	-3.75	7/21/2014	13.48	-5.14	12/15/2014	15.80	-7.46
MW-70-PMW08A	65-75	9.04	12/10/2013	12.6	-3.56	8/22/2013	16.46	-7.42	1/27/2014	14.92	-5.88	7/21/2014	19.85	-10.81	12/15/2014	17.00	-7.96
MW-70-PMW08B	85-95	9.08	12/10/2013	13.09	-4.01	8/22/2013	17.71	-8.63	1/27/2014	15.81	-6.73	7/21/2014	21.43	-12.35	12/15/2014	17.91	-8.83
MW-70-MNA09	64-74	6.82	12/10/2013	10.19	-3.37	8/22/2013	13.49	-6.67	1/27/2014	12.01	-5.19	7/21/2014	16.49	-9.67	12/15/2014	14.02	-7.2
MW-70-MNA10	75-85	7.01	12/10/2013	11.4	-4.39	8/22/2013	15.79	-8.78	1/27/2014	13.94	-6.93	7/21/2014	19.58	-12.57	12/15/2014	16.00	-8.99
MW-70-MNA12	75-85	5.85	12/10/2013	9.84	-3.99	8/22/2013	14.88	-9.03	1/27/2014	13	-7.15	7/21/2014	18.88	-13.03	12/15/2014	15.07	-9.22
MW-70-43A	86-106	10.76	12/10/2013	10.78	-0.02	8/22/2013	20.36	-9.60	1/27/2014	18.49	-7.73	7/21/2014	24.48	-13.72	12/15/2014	20.48	-9.72
Shell Horizon Biobarrier 1																	
MW-70-PMW09	120-130	6.82	12/10/2013	10.71	-3.89	8/22/2013	15.6	-8.78	1/27/2014	13.41	-6.59	7/21/2014	19.42	-12.60	12/15/2014	15.59	-8.77
IW-70-SHB113	105-130	7.49	12/10/2013	11.44	-3.95	8/22/2013	16.09	-8.60	1/27/2014	13.64	-6.15	7/21/2014	19.07	-11.58	12/15/2014	15.62	-8.13
MW-70-PMW10	120-130	6.60	12/10/2013	10.53	-3.93	8/22/2013	15.47	-8.87	1/27/2014	13.29	-6.69	7/21/2014	19.27	-12.67	12/15/2014	15.43	-8.83
IW-70-SHB217	105-130	8.67	12/10/2013	12.97	-4.30	8/22/2013	16.04	-7.37	1/27/2014	16.12	-7.45	7/21/2014	22.24	-13.57	12/15/2014	18.36	-9.69
MW-70-MNA13	115-125	6.64	12/10/2013	11.08	-4.44	8/22/2013	15.48	-8.84	1/27/2014	13.42	-6.78	7/21/2014	19.14	-12.50	12/15/2014	15.53	-8.89
Shell Horizon Biobarrier 3																	
MW-70-PMW11A	85-95	8.13	12/10/2013	12.95	-4.82	8/22/2013	18.21	-10.08	1/27/2014	16.08	-7.95	7/21/2014	21.6	-13.47	12/15/2014	18.19	-10.06
MW-70-PMW11B	115-125	7.95	12/10/2013	12.02	-4.07	8/22/2013	17.28	-9.33	1/27/2014	15.39	-7.44	7/21/2014	22.25	-14.30	12/15/2014	17.63	-9.68
IW-70-SHB310	80-95/105-120	8.73	12/10/2013	15.6	-6.87	8/22/2013	NS	NS	1/27/2014	16.64	-7.91	NS	NS	NS	12/15/2014		

Table 2-1
Groundwater Level Data

Well No.	Screen Interval (feet above MSL)	TOC Elevation (feet above MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)
MW-70-PMW12A	85-95	7.86	12/10/2013	12.16	-4.30	8/22/2013	17.36	-9.64	1/27/2014	15.31	-7.45	7/21/2014	21.49	-13.63	12/15/2014	17.47	-9.61
MW-70-PMW12B	115-125	8.09	12/10/2013	12.36	-4.27	8/22/2013	17.5	-10.59	1/27/2014	15.34	-7.25	7/21/2014	22.52	-14.43	12/15/2014	17.64	-9.55
MW-70-MNA14	115-125	8.86	12/10/2013	13.34	-4.48	8/22/2013	18.68	-9.82	1/27/2014	16.51	-7.65	7/21/2014	22.93	-14.07	12/15/2014	21.87	-13.01
Second Sand Biobarrier 1																	
MW-70-PMW13A	125-135	7.47	12/10/2013	11.04	-3.57	8/22/2013	16.29	-8.82	1/27/2014	14.16	-6.69	7/21/2014	20.52	-13.05	12/15/2014	16.46	-8.99
MW-70-PMW13B	145-155	7.48	12/10/2013	11.02	-3.54	8/22/2013	16.26	-8.78	1/27/2014	14.11	-6.63	7/21/2014	20.4	-12.92	12/15/2014	16.40	-8.92
IW-70-SSB109	126-166	7.96	12/10/2013	12.98	-5.02	8/22/2013	18.1	-10.14	1/27/2014	15.74	-7.78	7/21/2014	22.21	-14.25	12/15/2014	18.18	-10.22
MW-70-PMW14A	128-138	7.64	12/10/2013	11.12	-3.48	8/22/2013	16.17	-9.07	1/27/2014	14.06	-6.42	7/21/2014	20.41	-12.77	12/15/2014	16.38	-8.74
MW-70-PMW14B	149-159	7.92	12/10/2013	11.59	-3.67	8/22/2013	16.71	-10.40	1/27/2014	14.57	-6.65	7/21/2014	21	-13.08	12/15/2014	17.20	-9.28
MW-70-MNA16	141-151	8.65	12/10/2013	12.97	-4.32	8/22/2013	18.32	-8.94	1/27/2014	16.25	-7.6	7/21/2014	22.62	-13.97	12/15/2014	18.53	-9.88
MW-70-MNA17	140-150	6.80	12/10/2013	12.31	-5.51	8/22/2013	17.59	-11.04	1/27/2014	15.44	-8.64	7/21/2014	21.87	-15.07	12/15/2014	17.92	-11.12
MW-70-MNA15	140-150	5.96	12/10/2013	14.2	-8.24	8/22/2013	17.84	-14.28	1/27/2014	13.2	-7.24	7/21/2014	19.17	-13.21	12/15/2014	15.41	-9.45
MW-70-15	161-171	9.41	12/10/2013	14.2	-4.79	8/22/2013	20.24	-10.83	1/27/2014	17.84	-8.43	7/21/2014	24.52	-15.11	12/15/2014	20.18	-10.77
MW-70-14*	160-170	11.01	12/10/2013	14.98	-3.97	8/22/2013	20.3	-9.27	1/27/2014	18.27	-7.26	7/21/2014	24.42	-13.41	12/15/2014	20.35	-9.34
MW-70-43B*	136-146	10.58	12/10/2013	14.86	-4.28	8/22/2013	20.28	-9.70	1/27/2014	18.25	-7.67	7/21/2014	24.41	-13.83	12/15/2014	20.42	-9.84
MW-70-49	125-165	7.89	12/10/2013	12.23	-4.34	8/22/2013	17.47	-9.58	1/27/2014	15.25	-7.36	7/21/2014	22.67	-14.78	12/15/2014		
Point of Compliance/Upper Fines																	
MW-70-02	20-30	7.85	12/10/2013	9.11	-1.26	8/22/2013	10.66	-2.81	1/27/2014	10.53	-2.68	7/21/2014	12.85	-5.00	12/15/2014	12.38	-4.53
MW-70-10	30-40	10.10	12/10/2013	11.64	-1.54	8/22/2013	12.7	-2.60	1/27/2014	12.76	-2.66	7/21/2014	14.92	-4.82	12/15/2014	15.25	-5.15
MW-70-17	30-40	4.58	12/10/2013	6.49	-1.91	8/22/2013	8.21	-3.63	1/27/2014	7.91	-3.33	7/21/2014	10.42	-5.84	12/15/2014	9.46	-4.88
MW-70-22	20-30	10.21	12/10/2013	10.61	-0.40	8/22/2013	10.75	-0.54	1/27/2014	10.4	-0.19	7/21/2014	9.66	0.55	12/15/2014	10.76	-0.55
Point of Compliance/First Sand																	
MW-70-POC01	80-90	8.88	12/10/2013	NA	NA	8/22/2013	13.87	-4.99	1/27/2014	12.62	-3.74	7/21/2014	16.6	-7.72	12/15/2014	14.67	-5.79
MW-70-11	80-100	11.07	12/10/2013	NA	NA	8/22/2013	18.38	-7.31	1/27/2014	16.64	-5.57	7/21/2014	21.88	-10.81	12/15/2014	18.89	-7.82
MW-70-35	90-100	6.31	12/10/2013	NA	NA	8/22/2013	14.85	-8.54	1/27/2014	12.75	-6.44	7/21/2014	18.27	-11.96	12/15/2014	14.93	-8.62
MW-70-16	95-105	9.76	12/10/2013	NA	NA	8/22/2013	20.02	-10.26	1/27/2014	17.85	-8.09	7/21/2014	24.51	-14.75	12/15/2014	20.12	-10.36
Point of Compliance/Shell Horizon																	
MW-70-23	110-130	11.17	12/10/2013	15.77	-4.60	8/22/2013	22.11	-10.94	1/27/2014	19.7	-8.53	7/21/2014	26.85	-15.68	12/15/2014	21.95	-10.78
Point of Compliance/Second Sand																	
MW-70-36	150-160	9.04	12/10/2013	13.58	-4.54	8/22/2013	18.71	-9.67	1/27/2014	16.86	-7.82	7/21/2014	22.52	-13.48	12/15/2014	18.96	-9.92
MW-70-21	150-170	7.70	12/10/2013	13.52	-5.82	8/22/2013	20.41	-12.71	1/27/2014	17.88	-10.18	7/21/2014	25.15	-17.45	12/15/2014	20.09	-12.39
Point of Compliance/Deep Sand																	
MW-70-POC02	190-200	8.25	12/10/2013	13.52	-5.27	8/22/2013	21.4	-13.15	1/27/2014	18.51	-10.26	7/21/2014	26.93	-18.68	12/15/2014	20.75	-12.5
MW-70-POC03	190-200	9.64	12/10/2013	13.56	-3.92	8/22/2013	18.65	-9.01	1/27/2014	16.63	-6.99	7/21/2014	22.56	-12.92	12/15/2014	18.87	-9.23
MW-70-POC04	195-205	8.50	12/10/2013	14.8	-6.30	8/22/2013	21.52	-13.02	1/27/2014	19.21	-10.71	7/21/2014	26.63	-18.13	12/15/2014	21.47	-12.97

Notes
NA = not applicable
MSL = mean sea level
TOC = top of casing

Table 2-1
Groundwater Level Data

Well No.	Screen Interval (feet above MSL)	TOC Elevation (feet above MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)
Upper Fines								
MW-70-03	20-30	8.03	7/6/2015	12.7	-4.67	12/14/2015	12.53	-4.50
Source Area Treatment/Upper Fines								
MW-70-PMW01A	25-35	8.23	7/6/2015	13.66	-5.43	12/14/2015	13.53	-5.30
MW-70-PMW01B	45-55	8.21	7/6/2015	14.84	-6.63	12/14/2015	14.4	-6.19
MW-70-27[a]	26-36	8.25	7/6/2015	13.88	-5.63	12/14/2015	13.77	-5.52
MW-70-28[a]	50-60	8.30	7/6/2015	15.06	-6.76	12/14/2015	14.59	-6.29
MW-70-MNA01	40-50	8.36	7/6/2015	15.04	-6.68	12/14/2015	14.55	-6.19
MW-70-MNA02	35-45	8.51	7/6/2015	13.82	-5.31	12/14/2015	13.54	-5.03
MW-70-MNA03	35-45	9.18	7/6/2015	14.48	-5.30	12/14/2015	14.22	-5.04
MW-70-MNA04	35-45	8.39	7/6/2015	13.61	-5.22	12/14/2015	13.49	-5.10
Source Area Biobarrier/First Sand								
MW-70-PMW02A	71-81	8.35	7/6/2015	15.39	-7.04	12/14/2015	14.8	-6.45
MW-70-PMW02B	90-100	8.38	7/6/2015	15.45	-7.07	12/14/2015	14.82	-6.44
IW-70-SAB06	65-80/85-105	8.07	7/6/2015	15.13	-7.06	12/14/2015	14.5	-6.43
MW-70-MNA05	70-80	8.46	7/6/2015	14.83	-6.37	12/14/2015	14.83	-6.37
MW-70-PMW03A	70-80	7.94	7/6/2015	15.05	-7.11	12/14/2015	14.4	-6.46
MW-70-P MW03B	90-100	7.88	7/6/2015	15.05	-7.17	12/14/2015	14.43	-6.55
First Sand Biobarrier 1								
MW-70-38	80-100	6.85	7/6/2015	14.28	-7.43	12/14/2015	13.56	-6.71
IW-70-FSB118	60-105	4.42	7/6/2015	8.67	-4.25	12/14/2015	11.05	-6.63
MW-70-PMW06A	70-80	4.14	7/6/2015	11.49	-7.35	12/14/2015	10.91	-6.77
MW-70-PMW06B	91-101	4.16	7/6/2015	11.54	-7.38	12/14/2015	10.95	-6.79
MW-70-PMW04A	70-80	4.52	7/6/2015	11.89	-7.37	12/14/2015	11.16	-6.64
MW-70-PMW04B	90-100	4.53	7/6/2015	11.88	-7.35	12/14/2015	11.23	-6.70
IW-70-FSB108	60-105	4.64	7/6/2015	12	-7.36	12/14/2015	11.33	-6.69
MW-70-PMW05A	70-80	4.21	7/6/2015	11.62	-7.41	12/14/2015	10.91	-6.70
MW-70-PMW05B	90-100	4.34	7/6/2015	11.72	-7.38	12/14/2015	11.16	-6.82
RDO-5	65-105	6.01	7/6/2015	13.43	-7.42	12/14/2015	12.74	-6.73
MW-70-MNA08	80-90	7.66	7/6/2015	15.09	-7.43	12/14/2015	14.48	-6.82
MW-70-MNA06	80-90	3.95	7/6/2015	11.43	-7.48	12/14/2015	10.65	-6.70
MW-70-MNA11	80-90	8.30	7/6/2015	16.31	-8.01	12/14/2015	15.55	-7.25
MW-70-MNA07	90-100	4.63	7/6/2015	12.14	-7.51	12/14/2015	11.43	-6.80
First Sand Biobarrier 2								
MW-70-PMW07A	65-75	7.89	7/6/2015	16.15	-8.26	12/14/2015	15.33	-7.44
MW-70-PMW07B	85-95	7.52	7/6/2015	16.84	-9.32	12/14/2015	15.85	-8.33
IW-70-FSB216	65-100	8.34	7/6/2015	16.08	-7.74	12/14/2015	14.44	-6.10
MW-70-PMW08A	65-75	9.04	7/6/2015	18.11	-9.07	12/14/2015	17.15	-8.11
MW-70-PMW08B	85-95	9.08	7/6/2015	19.39	-10.31	12/14/2015	18.05	-8.97
MW-70-MNA09	64-74	6.82	7/6/2015	14.9	-8.08	12/14/2015	14.03	-7.21
MW-70-MNA10	75-85	7.01	7/6/2015	17.48	-10.47	12/14/2015	16.13	-9.12
MW-70-MNA12	75-85	5.85	7/6/2015	16.63	-10.78	12/14/2015	15.19	-9.34
MW-70-43A	86-106	10.76	7/6/2015	22.14	-11.38	12/14/2015	20.73	-9.97
Shell Horizon Biobarrier 1								
MW-70-PMW09	120-130	6.82	7/6/2015	17.13	-10.31	12/14/2015	15.78	-8.96
IW-70-SHB113	105-130	7.49	7/6/2015	16.74	-9.25	12/14/2015	15.78	-8.29
MW-70-PMW10	120-130	6.60	7/6/2015	16.95	-10.35	12/14/2015	15.78	-9.18
IW-70-SHB217	105-130	8.67	7/6/2015	19.81	-11.14	12/14/2015	18.43	-9.76
MW-70-MNA13	115-125	6.64	7/6/2015	16.94	-10.30	12/14/2015	15.65	-9.01
Shell Horizon Biobarrier 3								
MW-70-PMW11A	85-95	8.13	7/6/2015	19.78	-11.65	12/14/2015	18.53	-10.40
MW-70-PMW11B	115-125	7.95	7/6/2015	19.2	-11.25	12/14/2015	17.75	-9.80
IW-70-SHB310	80-95/105-120	8.73	NS	NS	NS	12/14/2015	NS	NS

Table 2-1
Groundwater Level Data

Well No.	Screen Interval (feet above MSL)	TOC Elevation (feet above MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)
MW-70-PMW12A	85-95	7.86	7/6/2015	19.24	-11.38	12/14/2015	17.77	-9.91
MW-70-PMW12B	115-125	8.09	7/6/2015	19.16	-11.07	12/14/2015	17.71	-9.62
MW-70-MNA14	115-125	8.86	7/6/2015	20.37	-11.51	12/14/2015	18.91	-10.05
Second Sand Biobarrier 1								
MW-70-PMW13A	125-135	7.47	7/6/2015	18	-10.53	12/14/2015	16.58	-9.11
MW-70-PMW13B	145-155	7.48	7/6/2015	17.95	-10.47	12/14/2015	16.51	-9.03
IW-70-SSB109	126-166	7.96	7/6/2015	19.89	-11.93	12/14/2015	18.22	-10.26
MW-70-PMW14A	128-138	7.64	7/6/2015	17.92	-10.28	12/14/2015	16.5	-8.86
MW-70-PMW14B	149-159	7.92	7/6/2015	18.54	-10.62	12/14/2015	17.15	-9.23
MW-70-MNA16	141-151	8.65	7/6/2015	20.04	-11.39	12/14/2015	18.52	-9.87
MW-70-MNA17	140-150	6.80	7/6/2015	19.43	-12.63	12/14/2015	17.94	-11.14
MW-70-MNA15	140-150	5.96	7/6/2015	16.39	-10.43	12/14/2015	15.55	-9.59
MW-70-15	161-171	9.41	7/6/2015	21.86	-12.45	12/14/2015	20.44	-11.03
MW-70-14*	160-170	11.01	7/6/2015	21.98	-10.97	12/14/2015	20.57	-9.56
MW-70-43B*	136-146	10.58	7/6/2015	22.02	-11.44	12/14/2015	20.63	-10.05
MW-70-49	125-165	7.89	7/6/2015	19.36	-11.47	12/14/2015	17.99	-10.10
Point of Compliance/Upper Fines								
MW-70-02	20-30	7.85	7/6/2015	12.66	-4.81	12/14/2015	12.84	-4.99
MW-70-10	30-40	10.10	7/6/2015	14.61	-4.51	12/14/2015	14.79	-4.69
MW-70-17	30-40	4.58	7/6/2015	9.37	-4.79	12/14/2015	8.96	-4.38
MW-70-22	20-30	10.21	7/6/2015	11.25	-1.04	12/14/2015	10.2	0.01
Point of Compliance/First Sand								
MW-70-POC01	80-90	8.88	7/6/2015	15.44	-6.56	12/15/2015	14.85	-5.97
MW-70-11	80-100	11.07	7/6/2015	20.04	-8.97	12/15/2015	19.05	-7.98
MW-70-35	90-100	6.31	7/6/2015	16.08	-9.77	12/15/2015	14.95	-8.64
MW-70-16	95-105	9.76	7/6/2015	21.73	-11.97	12/15/2015	20.32	-10.56
Point of Compliance/Shell Horizon								
MW-70-23	110-130	11.17	7/6/2015	23.94	-12.77	12/15/2015	22.58	-11.41
Point of Compliance/Second Sand								
MW-70-36	150-160	9.04	7/6/2015	20.08	-11.04	12/15/2015	18.77	-9.73
MW-70-21	150-170	7.70	7/6/2015	21.86	-14.16	12/15/2015	20.41	-12.71
Point of Compliance/Deep Sand								
MW-70-POC02	190-200	8.25	7/6/2015	23.51	-15.26	12/15/2015	21.62	-13.37
MW-70-POC03	190-200	9.64	7/6/2015	20.08	-10.44	12/15/2015	18.91	-9.27
MW-70-POC04	195-205	8.50	7/6/2015	23.56	-15.06	12/15/2015	22.03	-13.53

Notes
NA = not applicable
MSL = mean sea level
TOC = top of casing

TABLE 2-2
FIELD PARAMETER DATA

Well ID	Date	pH	Conductivity (µs/cm)	Turbidity (NTU)	DO (mg/L)	Temperature (°C)	ORP (mV)
SOURCE AREA TREATMENT GRID							
IW-70-SAT35	12/14/2015	6.68	8,334	4	20.6	21.2	-346
MW-70-03	12/14/2015	7.3	497	5	0.74	23.3	-252
MW-70-27	12/14/2015	6.5	18,867	3	0.55	23.2	-215
MW-70-28	12/14/2015	6.35	6,169	4	0.29	22.9	-185
MW-70-MNA01	12/14/2015	6.67	8,099	3.5	0.29	21.4	-141
MW-70-MNA02	12/14/2015	6.49	4,509	3	1.31	21.3	-193
MW-70-MNA03	12/14/2015	6.32	6,351	3	1.52	20.8	-160
MW-70-MNA04	12/14/2015	7.17	5,664	5	1.05	22.6	-170
MW-70-PMW01A	12/15/2015	6.7	9,931	14.3	0.68	20.3	-351.2
MW-70-PMW01B	12/14/2015	6.31	5,409	2.9	0.18	21.5	-232.2
POINT OF COMPLIANCE/UPPER FINES							
MW-70-02	12/14/2015	6.45	5,425	0.7	0.96	15.9	-24.9
MW-70-10	12/14/2015	6.83	5,929	1.5	0.59	21	-175.3
MW-70-17	12/14/2015	6.46	12,185	2.7	0.8	21.2	-59.1
MW-70-22	12/14/2015	6.93	50,144	1	0.82	19	-147
SOURCE AREA BIOBARRIER/FIRST SAND							
IW-70-SAB06	12/14/2015	6.11	1,422	5	1.68	22.7	-263
IW-70-SAB11	12/14/2015	6.67	2,320	4	0.5	21.5	-278
MW-70-MNA05	12/14/2015	7.48	1,119	4	0.65	23.5	-248
MW-70-PMW02A	12/14/2015	7.47	1,199	2	1.78	21.3	-182
MW-70-PMW02B	12/14/2015	7.48	1,358	3.1	0.18	23.1	-261.4
MW-70-PMW03A	12/14/2015	7.14	1,308	3	0.79	22.3	-277
MW-70-PMW03B	12/14/2015	7.29	1,720	5	0.98	22.8	-252
FIRST SAND BIOBARRIER 1							
IW-70-FSB108	12/14/2015	6.77	1,662	3.6	0.37	21.3	-180.7
IW-70-FSB118	12/22/2015	6.29	2,899	9	1.33	19.6	-266.1
MW-70-38	12/14/2015	6.75	3,202	5	1.06	18.1	-118
MW-70-43A	12/14/2015	8.2	7,191	17	0.79	21.1	-224
MW-70-MNA06	12/14/2015	7.22	923	11.6	0.51	21.6	-179.9
MW-70-MNA07	12/14/2015	6.31	1,736	13.6	0.47	22	-215.8
MW-70-MNA08	12/14/2015	6.72	3,269	10.8	0.65	21.6	-250.3
MW-70-MNA11	12/14/2015	7.1	2,952	2	1.16	19.6	-228
MW-70-PMW04A	12/14/2015	7.23	1,071	1.7	0.39	21.9	-221.1
MW-70-PMW04B	12/14/2015	7.24	1,210	2.5	0.49	21.9	-235.2
MW-70-PMW05A	12/14/2015	7.74	988	5	0.82	21.1	-249
MW-70-PMW05B	12/14/2015	6.77	1,360	5.6	0.39	21.2	-213
MW-70-PMW06A	12/14/2015	7.28	2,710	4	0.89	21.2	-187
MW-70-PMW06B	12/14/2015	7.57	1,833	2	0.51	20.6	-162
RDO-5	12/14/2015	7.1	1,026	5.1	0.49	21.3	-253.6

TABLE 2-2
FIELD PARAMETER DATA

Well ID	Date	pH	Conductivity (µs/cm)	Turbidity (NTU)	DO (mg/L)	Temperature (°C)	ORP (mV)
FIRST SAND BIOBARRIER 2							
IW-70-FSB216	12/14/2015	6.21	38,751	4	1.27	20.9	-360
IW-70-FSB229	12/14/2015	7.1	3,382	4	1.22	21.2	-340
MW-70-MNA09	12/14/2015	6.74	18,887	2	0.87	21.5	-253
MW-70-MNA10	12/14/2015	6.88	9,293	2	0.69	19.9	-213
MW-70-MNA12	12/14/2015	6.9	10,972	3.9	0.16	20.4	-267.1
MW-70-PMW07A	12/14/2015	6.37	44,411	4	0.51	21	-230
MW-70-PMW07B	12/14/2015	7.04	6,944	4	0.68	20.6	-276
MW-70-PMW08A	12/14/2015	6.64	21,778	1.9	0.22	20.3	-229.3
MW-70-PMW08B	12/14/2015	6.55	5,112	6	0.29	20.3	-262.4
POINT OF COMPLIANCE/FIRST SAND							
MW-70-11	12/14/2015	7.07	2,568	3.7	0.49	20.6	-1920
MW-70-16	12/14/2015	6.86	12,101	1.7	0.62	19.9	-197.1
MW-70-35	12/14/2015	6.83	14,873	1	0.63	20.6	-161
MW-70-POC01	12/14/2015	7.46	1,164	0.75	0.6	16.8	-173.7
SHELL HORIZON BIOBARRIER 1							
IW-70-SHB113	12/14/2015	6.94	2,404	2	1.16	18.6	-272
IW-70-SHB217	12/14/2015	7.06	11,292	4	0.64	20	-250
MW-70-MNA13	12/14/2015	7.34	5,221	5	0.68	21.2	-270
MW-70-PMW09	12/14/2015	7.3	708	5	1.1	20.2	-95
MW-70-PMW10	12/14/2015	7.3	1,220	2	0.79	19.3	-232
SHELL HORIZON BIOBARRIER 3							
IW-70-SHB310	12/14/2015	4.84	8,298	8	0.76	21.5	-139
IW-70-SHB311	12/14/2015	6.3	3,697	5	1.87	21.1	-165
MW-70-MNA14	12/14/2015	7.02	4,919	2	1.69	19	-272
MW-70-PMW11A	12/14/2015	6.7	38,449	3	0.14	20.5	-240.1
MW-70-PMW11B	12/14/2015	6.94	5,801	7.6	0.79	20.1	-207.3
MW-70-PMW12A	12/14/2015	6.31	18,501	3.5	0.49	20.8	-136.2
MW-70-PMW12B	12/14/2015	6.59	7,795	5.7	0.38	20.5	-225.8
POINT OF COMPLIANCE/SHELL HORIZON							
MW-70-23	12/14/2015	7.18	3,718	2.7	0.6	20	-194.2
SECOND SAND BIOBARRIER 1							
IW-70-SSB109	12/14/2015	6.68	18,542	22.9	0.6	20.3	-304.3
IW-70-SSB119	12/14/2015	6.58	11,533	16.4	0.33	18.6	-336
MW-70-14	12/14/2015	6.85	13,740	4	1.29	19.6	-139.7
MW-70-15	12/14/2015	6.77	27,692	3.5	0.55	19.9	-104.6
MW-70-43B	12/14/2015	7	5,340	4	0.88	20.4	-206
MW-70-49	12/14/2015	6.93	7,808	9.9	0.74	20.4	-151.6
MW-70-MNA16	12/14/2015	7.06	11,475	4	0.81	20.2	-285
MW-70-MNA17	12/14/2015	7.03	24,375	5.5	0.45	21	-233.5
MW-70-PMW13A	12/14/2015	6.9	8,616	4.3	0.44	20.2	-215.9
MW-70-PMW13B	12/14/2015	7.1	13,411	2	0.38	20	-224.7
MW-70-PMW14A	12/14/2015	7.06	7,669	3.8	0.41	20.8	-203.2
MW-70-PMW14B	12/17/2015	6.9	13,695	5.5	0.36	21.4	-264.2

TABLE 2-2
FIELD PARAMETER DATA

Well ID	Date	pH	Conductivity (µs/cm)	Turbidity (NTU)	DO (mg/L)	Temperature (°C)	ORP (mV)
POINT OF COMPLIANCE/SECOND SAND							
MW-70-21	12/14/2015	6.73	28,330	2.3	0.71	19.8	-199.9
MW-70-36	12/14/2015	6.98	19,744	3.9	0.44	21.4	-219.1
POINT OF COMPLIANCE/DEEP SAND							
MW-70-POC02	12/14/2015	7.43	1,448	1.1	0.59	19	-237.2
MW-70-POC03	12/14/2015	6.86	19,405	1.2	0.38	21.6	-207
MW-70-POC04	12/14/2015	7.48	32,811	3.5	0.36	19.2	-195.8

Abbreviations and Acronyms:
°C – degrees Celsius
DO – dissolved oxygen
mS/cm – milli siemens per centimeter
mg/L – milligrams per liter
mV – millivolt
NTU – nephelometric turbidity unit
ORP – oxidation-reduction potential
pH – potential of hydrogen
* DO from Chemets field instrument

This page intentionally left blank

TABLE 2-3
SOURCE AREA TREATMENT GRID ANALYTICAL RESULTS

		Location	MW-70-03	MW-70-27	MW-70-28	MW-70-MNA01		MW-70-MNA02	MW-70-MNA03	MW-70-MNA04	MW-70-PMW01A
		Sample ID	IR70-A15-065	IR70-A15-003	IR70-A15-004	IR70-A15-005	IR70-A15-091	IR70-A15-006	IR70-A15-007	IR70-A15-008	IR70-A15-001
		QA/QC		MS/MSD			Duplicate				MS/MSD
		Sample Date	12/22/2015	12/21/2015	12/21/2015	12/15/2015	12/15/2015	12/16/2015	12/16/2015	12/15/2015	12/15/2015
Parameter	**Method**	**Unit**									
Wet Chemistry											
Total Alkalinity	2320B	mg/L	---	1130	634	---	---	---	---	---	2270
TDS	2540C	mg/L	---	16000	4410	---	---	---	---	---	6230
Bromide	300.0	mg/L	---	5.15	4.05	---	---	---	---	---	3.95
Chloride-Cl	300.0	mg/L	---	2760	1260	---	---	---	---	---	1750
Nitrate-N	300.0	mg/L	---	1.00 U	0.0516 J	---	---	---	---	---	1.00 U
NITRITE-N	300.0	mg/L	---	2.00 U	0.8 U	---	---	---	---	---	1.00 U
Sulfate	300.0	mg/L	---	7250	1090	---	---	---	---	---	992
Acetate	300.0_MOD	mg/L	---	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	6.96
Butyrate	300.0_MOD	mg/L	---	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Lactate	300.0_MOD	mg/L	---	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Propionate	300.0_MOD	mg/L	---	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Sulfide	4500_S2_F	mg/L	---	1 U	1 U	---	---	---	---	---	23.2
TOC	5310B	mg/L	---	7.78	3.07	---	---	---	---	---	13.7
Dissolved Metals											
Arsenic	6010B	mg/L	---	0.117 J	0.0259 J	---	---	---	---	---	0.0226 J
Iron	6010B	mg/L	---	27.4	36.6	---	---	---	---	---	0.653
Manganese	6010B	mg/L	---	7.64	2.35	---	---	---	---	---	0.0891 J
Volatile Organic Compounds											
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U	0.35 J	0.31 J	0.31 J	0.39 J	1.0 U	1.0 U	1.0 U	0.45 J
1,1-Dichloroethane	8260B	µg/L	1.0 U	1.6	5.5	0.73 J	0.73 J	0.47 J	4.7	2.2	1.8
1,1-Dichloroethene	8260B	µg/L	0.50 U	4.3	41	3.9	4.0	0.45 J	0.50 U	3.5	0.40 J
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	1.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.23 J	0.58	0.50 U	110	0.50 U	0.66	0.49 J	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	0.46 J	1.0 U	1.0 U	1.0 U	1.3	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

TABLE 2-3
SOURCE AREA TREATMENT GRID ANALYTICAL RESULTS

		Location	MW-70-03	MW-70-27	MW-70-28	MW-70-MNA01		MW-70-MNA02	MW-70-MNA03	MW-70-MNA04	MW-70-PMW01A
		Sample ID	IR70-A15-065	IR70-A15-003	IR70-A15-004	IR70-A15-005	IR70-A15-091	IR70-A15-006	IR70-A15-007	IR70-A15-008	IR70-A15-001
		QA/QC		MS/MSD			Duplicate				MS/MSD
		Sample Date	12/22/2015	12/21/2015	12/21/2015	12/15/2015	12/15/2015	12/16/2015	12/16/2015	12/15/2015	12/15/2015
Parameter	**Method**	**Unit**									
2-Butanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	1.0 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Hexanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	1.0 U
Acetone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	8 J	14
Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	1.0 U	1.0 U	0.56 J	0.38 J	0.27 J	1.0 U	1.0 U	0.54 J	0.54 J
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	8260B	µg/L	2.0 U	2.0 U	0.61 J	2.0 U	2.0 U	0.50 J	2.0 U	2.0 U	2.0 U
Chloroform	8260B	µg/L	1.0 U	2.9	5.8	0.88 J	0.89 J	1.0 U	1.0 U	0.31 J	0.40 J
Chloromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	2.3	2200	5400	650	600	58	16	440	45
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Freon113	8260B	µg/L	1.0 U	5.6	6.9	0.82 J	0.86 J	1.0 U	1.0 U	3.6	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	µg/L	22	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	0.50 J	1.0 U	0.75 J	0.95 J	1.0 U	1.0 U	1.2	1.0 U
Toluene	8260B	µg/L	1.0 U	1.0 U	0.34 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.31 J
Trans-1,2-Dichloroethene	8260B	µg/L	1.0 U	18	83	86	86	2	1.4	32	19

TABLE 2-3
SOURCE AREA TREATMENT GRID ANALYTICAL RESULTS

		Location	MW-70-03	MW-70-27	MW-70-28	MW-70-MNA01		MW-70-MNA02	MW-70-MNA03	MW-70-MNA04	MW-70-PMW01A
		Sample ID	IR70-A15-065	IR70-A15-003	IR70-A15-004	IR70-A15-005	IR70-A15-091	IR70-A15-006	IR70-A15-007	IR70-A15-008	IR70-A15-001
		QA/QC		MS/MSD			Duplicate				MS/MSD
		Sample Date	12/22/2015	12/21/2015	12/21/2015	12/15/2015	12/15/2015	12/16/2015	12/16/2015	12/15/2015	12/15/2015
Parameter	**Method**	**Unit**									
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	3.6 J	85	50	2200	1900	9.3	1.7 J	64	35
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	0.50 U	360	2400	340	310	3.5	0.45 J	6.8	190
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloride Reductase (vcrA)											
Dehalococcoides16 S rRNA gene	Gene-Trac Dhc	gene copies/liter	---	10000000	2000000	10000	---	1000 U	1000 U	300000	5000000
vinyl chloride reductase A gene	Gene-Trac VC	gene copies/liter	---	5000000	100000	2000	---	*	*	1000 U	30000000
Dissolved Hydrocarbon Gases											
Ethane	RSK-175	µg/L	---	5.2	15	2.0 U	2.0 U	0.66 J	0.93 J	9.3	21
Ethene	RSK-175	µg/L	---	10	61	28	28	0.99 J	2.0 U	2.0 U	370
Methane	RSK-175	µg/L	---	12000	17000	2000	1800	1100	45	110	12000

Notes:
U = Not Detected
J = Estimated value
µg/L = micrograms per liter
mg/L = milligrams per liter
--- = not analyzed
* = not analyzed since dehalococcoides was not detected

TABLE 2-3
SOURCE AREA TREATMENT GRID ANALYTICAL RESULTS

		Location	MW-70-PMW01B	IW-70-SAT35
		Sample ID	IR70-A15-002	IR70-A15-115
		QA/QC		
		Sample Date	12/15/2015	12/22/2015
Parameter	**Method**	**Unit**		
Wet Chemistry				
Total Alkalinity	2320B	mg/L	616	1770
TDS	2540C	mg/L	2240	5990
Bromide	300.0	mg/L	4.68	2.85
Chloride-Cl	300.0	mg/L	1210	1470
Nitrate-N	300.0	mg/L	0.0715 J	1.00 U
NITRITE-N	300.0	mg/L	0.8 U	1.00 U
Sulfate	300.0	mg/L	451	1130
Acetate	300.0_MOD	mg/L	1.00 U	1.00 U
Butyrate	300.0_MOD	mg/L	1.00 U	1.00 U
Lactate	300.0_MOD	mg/L	1.00 U	1.00 U
Propionate	300.0_MOD	mg/L	1.00 U	1.00 U
Sulfide	4500_S2_F	mg/L	1 U	91.2
TOC	5310B	mg/L	2.88	19.5
Dissolved Metals				
Arsenic	6010B	mg/L	0.0204J	0.200 U
Iron	6010B	mg/L	32.3	1.11
Manganese	6010B	mg/L	2.23	0.457
Volatile Organic Compounds				
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	0.40 J	0.69 J
1,1-Dichloroethane	8260B	µg/L	0.94 J	0.28 J
1,1-Dichloroethene	8260B	µg/L	5.4	0.50 U
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U

TABLE 2-3
SOURCE AREA TREATMENT GRID ANALYTICAL RESULTS

		Location	MW-70-PMW01B	IW-70-SAT35
		Sample ID	IR70-A15-002	IR70-A15-115
		QA/QC		
		Sample Date	12/15/2015	12/22/2015
Parameter	**Method**	**Unit**		
2-Butanone	8260B	µg/L	10 U	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U
2-Hexanone	8260B	µg/L	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U	10 U
Acetone	8260B	µg/L	10 U	10 U
Benzene	8260B	µg/L	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	0.51 J	0.50 J
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U
Chloroethane	8260B	µg/L	1.3 J	0.82 J
Chloroform	8260B	µg/L	1.8	3.1
Chloromethane	8260B	µg/L	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	730	240
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U
Freon113	8260B	µg/L	1	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	0.90 J
MTBE	8260B	µg/L	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	1.0 U
Toluene	8260B	µg/L	0.23 J	1.0 U
Trans-1,2-Dichloroethene	8260B	µg/L	25	34

TABLE 2-3
SOURCE AREA TREATMENT GRID ANALYTICAL RESULTS

		Location	MW-70-PMW01B	IW-70-SAT35
		Sample ID	IR70-A15-002	IR70-A15-115
		QA/QC		
		Sample Date	12/15/2015	12/22/2015
Parameter	**Method**	**Unit**		
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	7.5	2.9 J
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	1500	350
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U
Chloride Reductase (vcrA)				
Dehalococcoides16 S rRNA gene	Gene-Trac Dhc	gene copies/liter	3000000	400000000
vinyl chloride reductase A gene	Gene-Trac VC	gene copies/liter	1000000	1000000000
Dissolved Hydrocarbon Gases				
Ethane	RSK-175	µg/L	21	48
Ethene	RSK-175	µg/L	60	600
Methane	RSK-175	µg/L	16000	17000

Notes:
U = Not Detected
J = Estimated value
µg/L = micrograms per liter
mg/L = milligrams per liter
--- = not analyzed
* = not analyzed since dehalococcoides was not detected

TABLE 2-4
UPPER FINES POINT OF COMPLIANCE ANALYTICAL RESULTS

		Location	MW-70-02	MW-70-10		MW-70-17	MW-70-22
		Sample ID	IR70-A15-064	IR70-A15-066	IR70-A15-098	IR70-A15-067	IR70-A15-068
		QA/QC			Duplicate		
		Sample Date	12/22/2015	12/21/2015	12/21/2015	12/18/2015	12/22/2015
Parameter	**Method**	**Unit**					
Volatile Organic Compounds							
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Butanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Hexanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U
Acetone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U
Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

TABLE 2-4
UPPER FINES POINT OF COMPLIANCE ANALYTICAL RESULTS

		Location	MW-70-02	MW-70-10		MW-70-17	MW-70-22
		Sample ID	IR70-A15-064	IR70-A15-066	IR70-A15-098	IR70-A15-067	IR70-A15-068
		QA/QC			Duplicate		
		Sample Date	12/22/2015	12/21/2015	12/21/2015	12/18/2015	12/22/2015
Parameter	**Method**	**Unit**					
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Freon113	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	µg/L	22	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,2-Dichloroethene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Notes:
U = Not Detected
µg/L = micrograms per liter

TABLE 2-5
SOURCE AREA BIOBARRIER/FIRST SAND ANALYTICAL RESULTS

		Location	IW-70-SAB06	IW-70-SAB11	MW-70-MNA05	MW-70-PMW02A		MW-70-PMW02B	MW-70-PMW03A	MW-70-PMW03B
		Sample ID	IR70-A15-011	IR70-A15-012	IR70-A15-013	IR70-A15-009	IR70-A15-092	IR70-A15-010	IR70-A15-014	IR70-A15-015
		QA/QC					Duplicate			
		Sample Date	12/21/2015	12/21/2015	12/21/2015	12/21/2015	12/21/2015	12/15/2015	12/21/2015	12/15/2015
Parameter	**Method**	**Unit**								
Wet Chemistry										
Total Alkalinity	2320B	mg/L	483	907	---	189	187	183	335	208
TDS	2540C	mg/L	920	1470	---	855	870	734	800	1020
Bromide	300.0	mg/L	0.569	0.909	---	0.623	0.623	0.663	0.619	0.878
Chloride-Cl	300.0	mg/L	188	223	---	140	150	165	144	227
Nitrate-N	300.0	mg/L	0.0708 J	0.0906 J	---	0.2 U	0.2 U	0.0736 J	0.0508 J	0.0986 J
NITRITE-N	300.0	mg/L	0.2 U	0.200 U	---	0.2 U	0.2 U	0.200 U	0.2 U	0.200 U
Sulfate	300.0	mg/L	28.1	94.9	---	228	255	260	77.1	355
Acetate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Butyrate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Lactate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Propionate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Sulfide	4500_S2_F	mg/L	3.36	1.68	---	1 U	1 U	1 U	5.56	1 U
TOC	5310B	mg/L	23.3	28.9	---	0.698 J	0.718 J	0.79 J	5	0.89 J
Dissolved Metals										
Arsenic	6010B	mg/L	0.200 U	0.200 U	---	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
Iron	6010B	mg/L	0.277	0.428	---	0.365	0.368	0.239	0.0600 J	2.89
Manganese	6010B	mg/L	0.240	0.203	---	0.170 J	0.171 J	0.169 J	0.0743 J	0.509
Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.22 J	1.0 U	0.49 J
1,1-Dichloroethene	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.41 J	0.50 U	0.34 J
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

TABLE 2-5
SOURCE AREA BIOBARRIER/FIRST SAND ANALYTICAL RESULTS

		Location	IW-70-SAB06	IW-70-SAB11	MW-70-MNA05	MW-70-PMW02A		MW-70-PMW02B	MW-70-PMW03A	MW-70-PMW03B
		Sample ID	IR70-A15-011	IR70-A15-012	IR70-A15-013	IR70-A15-009	IR70-A15-092	IR70-A15-010	IR70-A15-014	IR70-A15-015
		QA/QC					Duplicate			
		Sample Date	12/21/2015	12/21/2015	12/21/2015	12/21/2015	12/21/2015	12/15/2015	12/21/2015	12/15/2015
Parameter	**Method**	**Unit**								
2-Butanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Hexanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5.2 J
Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.32 J	0.33 J
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	1.0 U	1.2	1.3	32	30	64	1.0 U	120
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Freon113	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,2-Dichloroethene	8260B	µg/L	0.57 J	0.55 J	0.24 J	0.38 J	0.26 J	0.68 J	0.22 J	3.7

TABLE 2-5
SOURCE AREA BIOBARRIER/FIRST SAND ANALYTICAL RESULTS

		Location	IW-70-SAB06	IW-70-SAB11	MW-70-MNA05	MW-70-PMW02A		MW-70-PMW02B	MW-70-PMW03A	MW-70-PMW03B
		Sample ID	IR70-A15-011	IR70-A15-012	IR70-A15-013	IR70-A15-009	IR70-A15-092	IR70-A15-010	IR70-A15-014	IR70-A15-015
		QA/QC					Duplicate			
		Sample Date	12/21/2015	12/21/2015	12/21/2015	12/21/2015	12/21/2015	12/15/2015	12/21/2015	12/15/2015
Parameter	**Method**	**Unit**								
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	5.0 U	5.0 U	5.0 U	1.9 J	2.1 J	2.7 J	5.0 U	1 J
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	1.9	1.9	13	1.5	1.2	3.4	2.4	130
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)										
Dehalococcoides16 S rRNA gene	Gene-Trac Dhc	gene copies/liter	200000	100000	50000	20000	---	20000	30000	400000
vinyl chloride reductase A gene	Gene-Trac VC	gene copies/liter	500000	600000	1000 U	1000 U	---	8000	2000000	2000000
Dissolved Hydrocarbon Gases										
Ethane	RSK-175	µg/L	0.82 J	1.5 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethene	RSK-175	µg/L	2.0 U	2.1	1.5 J	2.0 U	2.0 U	2.0 U	0.94 J	20
Methane	RSK-175	µg/L	19000	27000	11	31	27	36	9700	5100

Notes:
U = Not Detected
J = Estimated value
µg/L = micrograms per liter
mg/L = milligrams per liter
--- = not analyzed
* = not analyzed since dehalococcoides was not detected

This Page Intentionally Left Blank

TABLE 2-6
FIRST SAND BIOBARRIER 1 ANALYTICAL RESULTS

		Location	IW-70-FSB108	IW-70-FSB118	MW-70-38	MW-70-43A	MW-70-MNA06	MW-70-MNA07	MW-70-MNA08	MW-70-MNA11	
		Sample ID	IR70-A15-022	IR70-A15-017	IR70-A15-016	IR70-A15-030	IR70-A15-027	IR70-A15-029	IR70-A15-026	IR70-A15-028	IR70-A15-094
		QA/QC		MS/MSD							Duplicate
		Sample Date	12/21/2015	12/21/2015	12/15/2015	12/18/2015	12/18/2015	12/18/2015	12/18/2015	12/17/2015	12/15/2014
Parameter	**Method**	**Unit**									
Wet Chemistry											
Total Alkalinity	2320B	mg/L	704	666	677	---	---	---	---	---	---
TDS	2540C	mg/L	931	1680	1990	---	---	---	---	---	---
Bromide	300.0	mg/L	0.403 J	1.65 J	1.65	---	---	---	---	---	---
Chloride-Cl	300.0	mg/L	116	598	577	---	---	---	---	---	---
Nitrate-N	300.0	mg/L	0.0610 J	1.00 U	0.0582 J	---	---	---	---	---	---
NITRITE-N	300.0	mg/L	0.200 U	1.00 U	0.400 U	---	---	---	---	---	---
Sulfate	300.0	mg/L	1.42	1.00 U	251	---	---	---	---	---	---
Acetate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Butyrate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Lactate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Propionate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Sulfide	4500_S2_F	mg/L	1 U	5.24	1 U	---	---	---	---	---	---
TOC	5310B	mg/L	24.9	27	1.86	---	---	---	---	---	---
Dissolved Metals											
Arsenic	6010B	mg/L	0.00514 J	0.200 U	0.200 U	---	---	---	---	---	---
Iron	6010B	mg/L	7.59	3.51	7.67	---	---	---	---	---	---
Manganese	6010B	mg/L	0.719	0.769	0.681	---	---	---	---	---	---
Volatile Organic Compounds											
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	8260B	µg/L	1.0 U	1.0 U	0.92 J	1.0 U	1.0 U	0.78 J	1.1	1.0 U	1.0 U
1,1-Dichloroethene	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	1.3	0.50 U	0.50 U
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

TABLE 2-6
FIRST SAND BIOBARRIER 1 ANALYTICAL RESULTS

		Location	IW-70-FSB108	IW-70-FSB118	MW-70-38	MW-70-43A	MW-70-MNA06	MW-70-MNA07	MW-70-MNA08	MW-70-MNA11	
		Sample ID	IR70-A15-022	IR70-A15-017	IR70-A15-016	IR70-A15-030	IR70-A15-027	IR70-A15-029	IR70-A15-026	IR70-A15-028	IR70-A15-094
		QA/QC		MS/MSD							Duplicate
		Sample Date	12/21/2015	12/21/2015	12/15/2015	12/18/2015	12/18/2015	12/18/2015	12/18/2015	12/17/2015	12/15/2014
Parameter	**Method**	**Unit**									
2-Butanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Hexanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	1.0 U	0.49 J	1.0 U	1.0 U	1.0 U	0.35 J	0.64 J	1.0 U	1.0 U
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	8260B	µg/L	2.0 U	0.51 J	0.33 J	2.0 U	2.0 U	2.0 U	0.32 J	2.0 U	2.0 U
Chloroform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	2.0	1.1	14	2.8	17	110	300	2.9	2.7
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Freon113	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	8260B	µg/L	1.0 U	4.2	0.36 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,2-Dichloroethene	8260B	µg/L	1.5	1.7	5.6	0.29 J	0.63 J	12	8.0	0.33 J	0.31 J

TABLE 2-6
FIRST SAND BIOBARRIER 1 ANALYTICAL RESULTS

		Location	IW-70-FSB108	IW-70-FSB118	MW-70-38	MW-70-43A	MW-70-MNA06	MW-70-MNA07	MW-70-MNA08	MW-70-MNA11	
		Sample ID	IR70-A15-022	IR70-A15-017	IR70-A15-016	IR70-A15-030	IR70-A15-027	IR70-A15-029	IR70-A15-026	IR70-A15-028	IR70-A15-094
		QA/QC		MS/MSD							Duplicate
		Sample Date	12/21/2015	12/21/2015	12/15/2015	12/18/2015	12/18/2015	12/18/2015	12/18/2015	12/17/2015	12/15/2014
Parameter	**Method**	**Unit**									
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	5.0 U	0.59 J	3.1 J	1.6 J	0.42 J	2.3 J	2.1 J	0.56 J	0.52 J
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	3.4	4.2	73	0.27 J	10	180	220	0.50 U	0.50 U
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)											
Dehalococcoides16 S rRNA gene	Gene-Trac Dhc	gene copies/liter	100000	2000 J	100000	1000 U	90000	6000000	200000	4000	---
vinyl chloride reductase A gene	Gene-Trac VC	gene copies/liter	300000	20000 J	200000	*	1000 U	10000000	100000	4000	---
Dissolved Hydrocarbon Gases											
Ethane	RSK-175	µg/L	2.0 U	2.8	9.4	2.0 U	2.0 U	0.86 J	3.4	2.0 U	2.0 U
Ethene	RSK-175	µg/L	5.1	2.5	15	2.0 U	2.8	84	33	2.0 U	2.0 U
Methane	RSK-175	µg/L	21000	24000	18000	620	5800	18000	15000	82	92

Notes:
U = Not Detected
J = Estimated value
µg/L = micrograms per liter
mg/L = milligrams per liter
--- = not analyzed
* = not analyzed since dehalococcoides was not detected

TABLE 2-6
FIRST SAND BIOBARRIER 1 ANALYTICAL RESULTS

		Location	MW-70-PMW04A		MW-70-PMW04B	MW-70-PMW05A	MW-70-PMW05B	MW-70-PMW06A	MW-70-PMW06B	RDO-5
		Sample ID	IR70-A15-020	IR70-A15-093	IR70-A15-021	IR70-A15-023	IR70-A15-024	IR70-A15-018	IR70-A15-019	IR70-A15-025
		QA/QC		Duplicate			MS/MSD			
		Sample Date	12/21/2015	12/15/2014	12/21/2015	12/15/2015	12/18/2015	12/15/2015	12/21/2015	12/18/2015
Parameter	**Method**	**Unit**								
Wet Chemistry										
Total Alkalinity	2320B	mg/L	194	196	187	179	364	361	161	242
TDS	2540C	mg/L	611	620	685	521	850	1810	1140	660
Bromide	300.0	mg/L	0.508	0.508	0.526	0.460 J	0.585	1.31	0.850	0.495 J
Chloride-Cl	300.0	mg/L	126	128	159	105	135	455	351	91.6
Nitrate-N	300.0	mg/L	0.0909 J	0.0611 J	0.200 U	0.2 U	0.200 U	0.2 U	0.200 U	0.200 U
NITRITE-N	300.0	mg/L	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.400 U	0.200 U	0.200 U
Sulfate	300.0	mg/L	171	173	185	151	113	435	358	145
Acetate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.350 J
Butyrate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Lactate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.12
Propionate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Sulfide	4500_S2_F	mg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
TOC	5310B	mg/L	0.609 J	0.618 J	0.906	0.565 J	1.12	1.25	0.842 J	0.956 J
Dissolved Metals										
Arsenic	6010B	mg/L	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
Iron	6010B	mg/L	0.247	0.242	0.585	0.326	6.67	0.876	0.200 U	0.455
Manganese	6010B	mg/L	0.264	0.263	0.220	0.191 J	0.985	0.319	0.355	0.301
Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	8260B	µg/L	0.25 J	0.27 J	0.62 J	1.0 U	0.40 J	0.75 J	1.5	1.0 U
1,1-Dichloroethene	8260B	µg/L	1.7	1.8	1.8	1	1.6	3.1	8.6	0.50 U
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

TABLE 2-6
FIRST SAND BIOBARRIER 1 ANALYTICAL RESULTS

		Location	MW-70-PMW04A		MW-70-PMW04B	MW-70-PMW05A	MW-70-PMW05B	MW-70-PMW06A	MW-70-PMW06B	RDO-5
		Sample ID	IR70-A15-020	IR70-A15-093	IR70-A15-021	IR70-A15-023	IR70-A15-024	IR70-A15-018	IR70-A15-019	IR70-A15-025
		QA/QC		Duplicate			MS/MSD			
		Sample Date	12/21/2015	12/15/2014	12/21/2015	12/15/2015	12/18/2015	12/15/2015	12/21/2015	12/18/2015
Parameter	**Method**	**Unit**								
2-Butanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Hexanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	0.56 J	1.0 U	1.0 U	1.0 U	1.0 U	0.51 J	1.0 U	0.23 J
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	180	180	230	68	130	180	760	0.93 J
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	0.32 J	0.37 J	0.37 J	2.0 U	1.0 U	2.0 U	1.1 J	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Freon113	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,2-Dichloroethene	8260B	µg/L	1.9	2.0	11	1.3	5.3	7.4	140	0.35 J

TABLE 2-6
FIRST SAND BIOBARRIER 1 ANALYTICAL RESULTS

		Location	MW-70-PMW04A		MW-70-PMW04B	MW-70-PMW05A	MW-70-PMW05B	MW-70-PMW06A	MW-70-PMW06B	RDO-5
		Sample ID	IR70-A15-020	IR70-A15-093	IR70-A15-021	IR70-A15-023	IR70-A15-024	IR70-A15-018	IR70-A15-019	IR70-A15-025
		QA/QC		Duplicate			MS/MSD			
		Sample Date	12/21/2015	12/15/2014	12/21/2015	12/15/2015	12/18/2015	12/15/2015	12/21/2015	12/18/2015
Parameter	**Method**	**Unit**								
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	3.0 J	3.3 J	15	0.4 J	12	0.56 J	3400	5.0 U
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	73	72	770	42	160	790	7.6	4.7
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)										
Dehalococcoides16 S rRNA gene	Gene-Trac Dhc	gene copies/liter	20000	---	200000000	90000	700000	1000000	1000 U	10000
vinyl chloride reductase A gene	Gene-Trac VC	gene copies/liter	100000	---	200000	10000 J	2000000	70000	*	30000
Dissolved Hydrocarbon Gases										
Ethane	RSK-175	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.3	0.72 J	2.0 U
Ethene	RSK-175	µg/L	2.0 U	2.9	8.2	1.5 J	31	100	0.82 J	0.90 J
Methane	RSK-175	µg/L	2300	2300	9000	2800	11000	8400	270	11000

Notes:
U = Not Detected
J = Estimated value
µg/L = micrograms per liter
mg/L = milligrams per liter
--- = not analyzed
* = not analyzed since dehalococcoides was not detected

TABLE 2-7
FIRST SAND BIOBARRIER 2 ANALYTICAL RESULTS

		Location	IW-70-FSB216	IW-70-FSB229	MW-70-MNA09	MW-70-MNA10	MW-70-MNA12	MW-70-PMW07A		MW-70-PMW07B	MW-70-PMW08A	MW-70-PMW08B
		Sample ID	IR70-A15-033	IR70-A15-034	IR70-A15-037	IR70-A15-038	IR70-A15-039	IR70-A15-031	IR70-A15-095	IR70-A15-032	IR70-A15-035	IR70-A15-036
		QA/QC							Duplicate			MS/MSD
		Sample Date	12/17/2015	12/17/2015	12/16/2015	12/22/2015	12/16/2015	12/17/2015	12/17/2015	12/17/2015	12/16/2015	12/16/2015
Parameter	**Method**	**Unit**										
Wet Chemistry												
Total Alkalinity	2320B	mg/L	870	299	---	---	---	277	279	297	310	345
TDS	2540C	mg/L	24500	2060	---	---	---	27600	27900	4260	16000	3830
Bromide	300.0	mg/L	40.7	1.6	---	---	---	46	44.8	5.45	28.6	5.3
Chloride-Cl	300.0	mg/L	12700	462	---	---	---	14500	14100	1720	9190	1610
Nitrate-N	300.0	mg/L	1 U	0.2 U	---	---	---	1.00 U	1 U	0.2 U	0.4 U	0.2 U
NITRITE-N	300.0	mg/L	10 U	0.2 U	---	---	---	10 U	10 U	1.2 U	6 U	1.00 U
Sulfate	300.0	mg/L	1230	589	---	---	---	2960	2620	608	1610	551
Acetate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Butyrate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Lactate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Propionate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Sulfide	4500_S2_F	mg/L	148	5.4	---	---	---	1 U	1 U	1 U	1.00 U	1.00 U
TOC	5310B	mg/L	10.8	4.88	---	---	---	1.72	1.68	1.36	1.85	1.48
Dissolved Metals												
Arsenic	6010B	mg/L	0.200 U	0.200 U	---	---	---	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
Iron	6010B	mg/L	0.0435 J	0.0883 J	---	---	---	7.06	7.05	0.170 J	0.802	0.121 J
Manganese	6010B	mg/L	4.5	0.133 J	---	---	---	6.31	6.31	0.625	3.12	0.652
Volatile Organic Compounds												
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	0.52 J	0.72 J	1.0 U	1.0 U	0.68 J	0.32 J	0.85 J
1,1-Dichloroethene	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	4.5	0.50 U	0.50 U	2.6	0.50 U	0.50 U
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Butanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

TABLE 2-7
FIRST SAND BIOBARRIER 2 ANALYTICAL RESULTS

		Location	IW-70-FSB216	IW-70-FSB229	MW-70-MNA09	MW-70-MNA10	MW-70-MNA12	MW-70-PMW07A		MW-70-PMW07B	MW-70-PMW08A	MW-70-PMW08B
		Sample ID	IR70-A15-033	IR70-A15-034	IR70-A15-037	IR70-A15-038	IR70-A15-039	IR70-A15-031	IR70-A15-095	IR70-A15-032	IR70-A15-035	IR70-A15-036
		QA/QC							Duplicate			MS/MSD
		Sample Date	12/17/2015	12/17/2015	12/16/2015	12/22/2015	12/16/2015	12/17/2015	12/17/2015	12/17/2015	12/16/2015	12/16/2015
Parameter	**Method**	**Unit**										
2-Hexanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	8260B	µg/L	18	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	0.55 J	0.21 J	1.0 U	1.0 U	1.5	0.21 J	0.24 J	0.36 J	0.63 J	1.0 U
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	0.73 J	1.6	12	14	1000	16	15	640	2.5	18
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Freon113	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	µg/L	1.0 U	1.0 U	0.25 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	8260B	µg/L	0.21 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,2-Dichloroethene	8260B	µg/L	1.0 U	1.0 U	0.38 J	5.0	50	0.26 J	0.23 J	6.6	2	6.3
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	0.95 J	5.0 U	1.1 J	3.4 J	7	5 U	0.37 J	4.1 J	0.24 J	1.5 J
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	0.5 U	3.2	0.64	130	8.3	3	2.7	210	42	430

TABLE 2-7
FIRST SAND BIOBARRIER 2 ANALYTICAL RESULTS

		Location	IW-70-FSB216	IW-70-FSB229	MW-70-MNA09	MW-70-MNA10	MW-70-MNA12	MW-70-PMW07A		MW-70-PMW07B	MW-70-PMW08A	MW-70-PMW08B
		Sample ID	IR70-A15-033	IR70-A15-034	IR70-A15-037	IR70-A15-038	IR70-A15-039	IR70-A15-031	IR70-A15-095	IR70-A15-032	IR70-A15-035	IR70-A15-036
		QA/QC							Duplicate			MS/MSD
		Sample Date	12/17/2015	12/17/2015	12/16/2015	12/22/2015	12/16/2015	12/17/2015	12/17/2015	12/17/2015	12/16/2015	12/16/2015
Parameter	**Method**	**Unit**										
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)												
Dehalococcoides16 S rRNA gene	Gene-Trac Dhc	gene copies/liter	6000 J	3000 J	1000 U	2000000	1000 U	1000 U	---	10000	600000	2000000
vinyl chloride reductase A gene	Gene-Trac VC	gene copies/liter	3000 J	1000 U	---*	20000000	---*	---*	---	1000	200000	400000
Dissolved Hydrocarbon Gases												
Ethane	RSK-175	µg/L	2.0 U	2.0 U	2.0 U	4.0 U	2.0 U	2.0 U	2.0 U	0.87 J	0.72 J	1 J
Ethene	RSK-175	µg/L	0.83 J	2.0 U	2.0 U	62	2.1	1.3 J	1.2 J	55	12	71
Methane	RSK-175	µg/L	12000	6900	4100	15000	1100	910	790	7900	7800	13000

Notes:
U = Not Detected
J = Estimated value
µg/L = micrograms per liter
mg/L = milligrams per liter
--- = not analyzed
* = not analyzed since dehalococcoides was not detected

This Page Intentionally Left Blank

TABLE 2-8
FIRST SAND POINT OF COMPLIANCE ANALYTICAL RESULTS

		Location	MW-70-11	MW-70-16	MW-70-35	MW-70-POC01
		Sample ID	IR70-A15-070	IR70-A15-072	IR70-A15-071	IR70-A15-069
		QA/QC				
		Sample Date	12/21/2015	12/21/2015	12/21/2015	12/22/2015
Parameter	**Method**	**Unit**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
2-Butanone	8260B	µg/L	10 U	10 U	10 U	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
2-Hexanone	8260B	µg/L	10 U	10 U	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U	10 U	10 U	10 U
Acetone	8260B	µg/L	10 U	10 U	5.4 J	10 U
Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	1.0 U	0.20 J	1.0 U	1.0 U
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	0.81 J	1.0 U	0.56 J	1.0 U

TABLE 2-8
FIRST SAND POINT OF COMPLIANCE ANALYTICAL RESULTS

		Location	MW-70-11	MW-70-16	MW-70-35	MW-70-POC01
		Sample ID	IR70-A15-070	IR70-A15-072	IR70-A15-071	IR70-A15-069
		QA/QC				
		Sample Date	12/21/2015	12/21/2015	12/21/2015	12/22/2015
Parameter	**Method**	**Unit**				
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Freon113	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,2-Dichloroethene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	5.0 U	5.0 U	5.0 U	5.0 U
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U

Notes:
U = Not Detected
J = Estimated value
µg/L = micrograms per liter

TABLE 2-9
SHELL HORIZON BIOBARRIER 1 ANALYTICAL RESULTS

		Location	IW-70-SHB113	IW-70-SHB217	MW-70-MNA13	MW-70-PMW09		MW-70-PMW10
		Sample ID	IR70-A15-041	IR70-A15-043	IR70-A15-044	IR70-A15-040	IR70-A15-096	IR70-A15-042
		QA/QC					Duplicate	
		Sample Date	12/16/2015	12/22/2015	12/16/2015	12/16/2015	12/16/2015	12/16/2015
Parameter	**Method**	**Unit**						
Wet Chemistry								
Total Alkalinity	2320B	mg/L	425	189	---	152	152	306
TDS	2540C	mg/L	1370	7100	---	355	350	635
Bromide	300.0	mg/L	1.05	11.9	---	0.287 J	0.288 J	0.384 J
Chloride-Cl	300.0	mg/L	365	3790	---	83.4	77.5	133
Nitrate-N	300.0	mg/L	0.2 U	0.4 U	---	0.101 J	0.103 J	0.2 U
NITRITE-N	300.0	mg/L	0.2 U	2.4 U	---	0.200 U	0.200 U	0.2 U
Sulfate	300.0	mg/L	282	956	---	62.5	52.2	117
Acetate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Butyrate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Lactate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Propionate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Sulfide	4500_S2_F	mg/L	1.56	1 U	---	1 U	1 U	1 U
TOC	5310B	mg/L	2.1	1.31	---	1.78	1.00 U	0.777 J
Dissolved Metals								
Arsenic	6010B	mg/L	0.200 U	0.200 U	---	0.200 U	0.200 U	0.200 U
Iron	6010B	mg/L	0.0935 J	2.28	---	0.0520 J	0.0475 J	1.01
Manganese	6010B	mg/L	0.548	0.958	---	0.0268 J	0.0272 J	0.224
Volatile Organic Compounds								
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	8260B	µg/L	0.8 J	0.51 J	1.0 U	1.0 U	1.0 U	0.29 J
1,1-Dichloroethene	8260B	µg/L	0.50 U	5.2	0.75	0.24 J	0.26 J	0.6
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

TABLE 2-9
SHELL HORIZON BIOBARRIER 1 ANALYTICAL RESULTS

		Location	IW-70-SHB113	IW-70-SHB217	MW-70-MNA13	MW-70-PMW09		MW-70-PMW10
		Sample ID	IR70-A15-041	IR70-A15-043	IR70-A15-044	IR70-A15-040	IR70-A15-096	IR70-A15-042
		QA/QC					Duplicate	
		Sample Date	12/16/2015	12/22/2015	12/16/2015	12/16/2015	12/16/2015	12/16/2015
Parameter	**Method**	**Unit**						
2-Butanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Hexanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	1.0 U	1.0 U	1.0 U	0.24 J	1.0 U	0.23 J
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	54	1200	73	40	41	110
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U	0.31 J	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Freon113	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,2-Dichloroethene	8260B	µg/L	9.9	56	2.1	0.82 J	0.88 J	12

TABLE 2-9
SHELL HORIZON BIOBARRIER 1 ANALYTICAL RESULTS

		Location	IW-70-SHB113	IW-70-SHB217	MW-70-MNA13	MW-70-PMW09		MW-70-PMW10
		Sample ID	IR70-A15-041	IR70-A15-043	IR70-A15-044	IR70-A15-040	IR70-A15-096	IR70-A15-042
		QA/QC					Duplicate	
		Sample Date	12/16/2015	12/22/2015	12/16/2015	12/16/2015	12/16/2015	12/16/2015
Parameter	**Method**	**Unit**						
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	0.34 J	7.4	3 J	2.6 J	2.7	0.31 J
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	290	3.5	9.4	0.26 J	0.3 J	190
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)								
Dehalococcoides16 S rRNA gene	Gene-Trac Dhc	gene copies/liter	40000000	1000 J	700000	1000 U	---	10000000
vinyl chloride reductase A gene	Gene-Trac VC	gene copies/liter	100000000	1000 U	1000 J	---*	---	90000
Dissolved Hydrocarbon Gases								
Ethane	RSK-175	µg/L	2.5	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethene	RSK-175	µg/L	110	0.82 J	2.0 U	2.0 U	2.0 U	7.2
Methane	RSK-175	µg/L	16000	430	1200	11	0.42 J	9600

Notes:
U = Not Detected
J = Estimated value
µg/L = micrograms per liter
mg/L = milligrams per liter
--- = not analyzed
* = not analyzed since dehalococcoides was not detected

This Page Intentionally Left Blank

TABLE 2-10
SHELL HORIZON BIOBARRIER 3 ANALYTICAL RESULTS

		Location	IW-70-SHB310	IW-70-SHB311	MW-70-MNA14	MW-70-PMW11A	MW-70-PMW11B	MW-70-PMW12A	MW-70-PMW12B
		Sample ID	IR70-A15-047	IR70-A15-048	IR70-A15-051	IR70-A15-045	IR70-A15-046	IR70-A15-049	IR70-A15-050
		QA/QC							
		Sample Date	12/18/2015	12/18/2015	12/18/2015	12/16/2015	12/17/2015	12/16/2015	12/16/2015
Parameter	**Method**	**Unit**							
Wet Chemistry									
Total Alkalinity	2320B	mg/L	218	870	---	238	207	357	207
TDS	2540C	mg/L	6180	2200	---	30000	4350	11800	5150
Bromide	300.0	mg/L	8.67	2.72	---	55.4	5.63	21.6	8.25
Chloride-Cl	300.0	mg/L	3090	753	---	18400	1720	7010	2580
Nitrate-N	300.0	mg/L	1.00 U	0.200 J	---	1 U	0.2 U	0.4 U	0.2 U
NITRITE-N	300.0	mg/L	1.60 U	0.4 U	---	12 U	1.2 U	4 U	1.6 U
Sulfate	300.0	mg/L	2.23 J	1.28	---	2740	508	854	677
Acetate	300.0_MOD	mg/L	19.3	0.320 J	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Butyrate	300.0_MOD	mg/L	176	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Lactate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Propionate	300.0_MOD	mg/L	407	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Sulfide	4500_S2_F	mg/L	5.04	1 U	---	1.00 U	1 U	1 U	1 U
TOC	5310B	mg/L	1170	43.6	---	1.68	1.67	2.18	2.16
Dissolved Metals									
Arsenic	6010B	mg/L	0.200 U	0.200 U	---	0.200 U	0.200 U	0.200 U	0.200 U
Iron	6010B	mg/L	154	31.7	---	0.124 J	0.303	6.79	5.77
Manganese	6010B	mg/L	2.66	0.988	---	5.15	0.463	2.55	0.431
Volatile Organic Compounds									
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	8260B	µg/L	1.0 U	1.0 U	0.22 J	1.0 U	0.51 J	1.0 U	0.5 J
1,1-Dichloroethene	8260B	µg/L	0.50 U	0.50 U	3.1	0.50 U	0.5 U	0.50 U	1.9
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

TABLE 2-10
SHELL HORIZON BIOBARRIER 3 ANALYTICAL RESULTS

		Location	IW-70-SHB310	IW-70-SHB311	MW-70-MNA14	MW-70-PMW11A	MW-70-PMW11B	MW-70-PMW12A	MW-70-PMW12B
		Sample ID	IR70-A15-047	IR70-A15-048	IR70-A15-051	IR70-A15-045	IR70-A15-046	IR70-A15-049	IR70-A15-050
		QA/QC							
		Sample Date	12/18/2015	12/18/2015	12/18/2015	12/16/2015	12/17/2015	12/16/2015	12/16/2015
Parameter	**Method**	**Unit**							
Wet Chemistry									
Total Alkalinity	2320B	mg/L	218	870	---	238	207	357	207
2-Butanone	8260B	µg/L	360	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Hexanone	8260B	µg/L	73	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	52	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	8260B	µg/L	1100	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	8260B	µg/L	0.26 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	0.72 J	0.41 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	8260B	µg/L	0.44 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	8260B	µg/L	0.34 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	99	1.0 U	1200	1.4	6.8	0.42 J	460
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Freon113	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

TABLE 2-10
SHELL HORIZON BIOBARRIER 3 ANALYTICAL RESULTS

		Location	IW-70-SHB310	IW-70-SHB311	MW-70-MNA14	MW-70-PMW11A	MW-70-PMW11B	MW-70-PMW12A	MW-70-PMW12B
		Sample ID	IR70-A15-047	IR70-A15-048	IR70-A15-051	IR70-A15-045	IR70-A15-046	IR70-A15-049	IR70-A15-050
		QA/QC							
		Sample Date	12/18/2015	12/18/2015	12/18/2015	12/16/2015	12/17/2015	12/16/2015	12/16/2015
Parameter	**Method**	**Unit**							
Wet Chemistry									
Total Alkalinity	2320B	mg/L	218	870	---	238	207	357	207
Toluene	8260B	µg/L	0.43 J	0.51 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,2-Dichloroethene	8260B	µg/L	7.0	0.38 J	12	2.3	52	7.2	38
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	6.3	5.0 U	5.3	0.73 J	5 U	5.0 U	5.4
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	7.5	1.0	78	16	24	14	270
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)									
Dehalococcoides16 S rRNA gene	Gene-Trac Dhc	gene copies/liter	70000	300000	40000	5000	5000000	8000	50000
vinyl chloride reductase A gene	Gene-Trac VC	gene copies/liter	800000	300000	1000 U	1000 U	5000000	20000	7000
Dissolved Hydrocarbon Gases									
Ethane	RSK-175	µg/L	2.2	3.3	1.5 J	2.0 U	2.0 U	13	0.83 J
Ethene	RSK-175	µg/L	1.8 J	2.0 U	12	1.2 J	70	3.4	11
Methane	RSK-175	µg/L	17000	20000	9900	580	470	13000	8800

Notes:
U = Not Detected
J = Estimated value
µg/L = micrograms per liter
mg/L = milligrams per liter
--- = not analyzed

This Page Intentionally Left Blank

TABLE 2-11
SHELL HORIZON POINT OF COMPLIANCE ANALYTICAL RESULTS

		Location	MW-70-23
		Sample ID	IR70-A15-073
		QA/QC	
		Sample Date	12/21/2015
Parameter	**Method**	**Unit**	
Volatile Organic Compounds			
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U
1,1-Dichloroethane	8260B	µg/L	1.0 U
1,1-Dichloroethene	8260B	µg/L	0.50 U
1,1-Dichloropropene	8260B	µg/L	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U
2-Butanone	8260B	µg/L	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U
2-Hexanone	8260B	µg/L	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U
Acetone	8260B	µg/L	10 U
Benzene	8260B	µg/L	1.0 U
Bromobenzene	8260B	µg/L	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U
Bromoform	8260B	µg/L	1.0 U
Bromomethane	8260B	µg/L	2.0 U
Carbon Disulfide	8260B	µg/L	1.0 U
Carbon Tetrachloride	8260B	µg/L	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U
Chloroethane	8260B	µg/L	2.0 U
Chloroform	8260B	µg/L	1.0 U
Chloromethane	8260B	µg/L	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	1.0 U
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U
Dibromomethane	8260B	µg/L	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U
Freon113	8260B	µg/L	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U
MTBE	8260B	µg/L	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U
o-Xylene	8260B	µg/L	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U
Styrene	8260B	µg/L	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U
Toluene	8260B	µg/L	1.0 U
Trans-1,2-Dichloroethene	8260B	µg/L	1.0 U
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U
Trichloroethene	8260B	µg/L	5.0 U
Trichlorofluoromethane	8260B	µg/L	2.0 U
Vinyl Chloride	8260B	µg/L	0.50 U
Xylenes (Total)	8260B	µg/L	2.0 U

Notes:
U = Not Detected
µg/L = micrograms per liter

This Page Intentionally Left Blank

TABLE 2-12
SECOND SAND BIOBARRIER 1 ANALYTICAL RESULTS

		Location	IW-70-SSB109		IW-70-SSB119	MW-70-14	MW-70-15	MW-70-43B	MW-70-49	MW-70-MNA16	MW-70-MNA17	MW-70-PMW13A
		Sample ID	IR70-A15-054	IR70-A15-097	IR70-A15-055	IR70-A15-061	IR70-A15-063	IR70-A15-062	IR70-A15-060	IR70-A15-058	IR70-A15-059	IR70-A15-052
		QA/QC		Duplicate							MS/MSD	
		Sample Date	12/18/2015	12/18/2015	12/18/2015	12/17/2015	12/18/2015	12/17/2015	12/17/2015	12/18/2015	12/17/2015	12/17/2015
Parameter	**Method**	**Unit**										
Wet Chemistry												
Total Alkalinity	2320B	mg/L	380	387	1020	---	---	---	---	---	---	281
TDS	2540C	mg/L	13400	13100	6750	---	---	---	---	---	---	5870
Bromide	300.0	mg/L	24.6	25.4	14.0	---	---	---	---	---	---	9.24
Chloride-Cl	300.0	mg/L	6630	6980	3800	---	---	---	---	---	---	2560
Nitrate-N	300.0	mg/L	1.00 U	1.00 U	1.00 U	---	---	---	---	---	---	0.4 U
NITRITE-N	300.0	mg/L	4.0 U	4.0 U	2.40 U	---	---	---	---	---	---	1 U
Sulfate	300.0	mg/L	750	733	28.4	---	---	---	---	---	---	548
Acetate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Butyrate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Lactate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Propionate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Sulfide	4500_S2_F	mg/L	63.2	58.4	126	---	---	---	---	---	---	1 U
TOC	5310B	mg/L	25.6	28.4	50.7	---	---	---	---	---	---	1.59
Dissolved Metals												
Arsenic	6010B	mg/L	0.200 U	0.200 U	0.200 U	---	---	---	---	---	---	0.200 U
Iron	6010B	mg/L	0.242	0.183 J	0.103 J	---	---	---	---	---	---	4.25
Manganese	6010B	mg/L	0.483	0.467	0.472	---	---	---	---	---	---	0.563
Volatile Organic Compounds												
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	0.43 J	1.0 U	1.0 U	1.0 U	0.45 J	1.0 U	0.33 J
1,1-Dichloroethene	8260B	µg/L	0.50 U	0.50 U	0.50 U	3.5	0.32 J	0.68	0.49 J	4.8	0.50 U	3.7
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

TABLE 2-12
SECOND SAND BIOBARRIER 1 ANALYTICAL RESULTS

		Location	IW-70-SSB109		IW-70-SSB119	MW-70-14	MW-70-15	MW-70-43B	MW-70-49	MW-70-MNA16	MW-70-MNA17	MW-70-PMW13A
		Sample ID	IR70-A15-054	IR70-A15-097	IR70-A15-055	IR70-A15-061	IR70-A15-063	IR70-A15-062	IR70-A15-060	IR70-A15-058	IR70-A15-059	IR70-A15-052
		QA/QC		Duplicate							MS/MSD	
		Sample Date	12/18/2015	12/18/2015	12/18/2015	12/17/2015	12/18/2015	12/17/2015	12/17/2015	12/18/2015	12/17/2015	12/17/2015
Parameter	**Method**	**Unit**										
2-Butanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Hexanone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U	10 U	4.9 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	8260B	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	1.0 U	1.0 U	0.48 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.32 J
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	8260B	µg/L	2.0 U	2.0 U	0.42 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	5.1	5.2	0.39 J	830	57	120	97	1100	0.84 J	820
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Freon113	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MTBE	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	8260B	µg/L	1.0 U	1.0 U	0.32 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,2-Dichloroethene	8260B	µg/L	12	12	17	43	0.52 J	8.2	6.9	50	0.54 J	68

TABLE 2-12
SECOND SAND BIOBARRIER 1 ANALYTICAL RESULTS

		Location	IW-70-SSB109		IW-70-SSB119	MW-70-14	MW-70-15	MW-70-43B	MW-70-49	MW-70-MNA16	MW-70-MNA17	MW-70-PMW13A
		Sample ID	IR70-A15-054	IR70-A15-097	IR70-A15-055	IR70-A15-061	IR70-A15-063	IR70-A15-062	IR70-A15-060	IR70-A15-058	IR70-A15-059	IR70-A15-052
		QA/QC		Duplicate							MS/MSD	
		Sample Date	12/18/2015	12/18/2015	12/18/2015	12/17/2015	12/18/2015	12/17/2015	12/17/2015	12/18/2015	12/17/2015	12/17/2015
Parameter	**Method**	**Unit**										
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	0.42 J	0.41 J	0.39 J	4.6 J	4.5 J	4.5 J	1.1 J	6.8	6.7	6.6
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	21	20	5.9	4.1	0.50 U	0.34 J	0.3 J	12	0.50 U	190
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)												
Dehalococcoides16 S rRNA gene	Gene-Trac Dhc	gene copies/liter	700000	---	80000	300000	1000 U	1000 U	1000 U	400000	1000 U	10000
vinyl chloride reductase A gene	Gene-Trac VC	gene copies/liter	7000000	---	300000	70000	*	*	*	700000	*	1000 U
Dissolved Hydrocarbon Gases												
Ethane	RSK-175	µg/L	0.88 J	0.87 J	2.3	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethene	RSK-175	µg/L	24	24	31	2.0 U	2.0 U	2.0 U	0.67 J	4.1	2.0 U	5.8
Methane	RSK-175	µg/L	19000	22000	33000	910	30	170	580	15000	6	1700

Notes:
U = Not Detected
J = Estimated value
µg/L = micrograms per liter
mg/L = milligrams per liter
--- = not analyzed
* = not analyzed since dehalococcoides was not detected

TABLE 2-12
SECOND SAND BIOBARRIER 1 ANALYTICAL RESULTS

		Location	MW-70-PMW13B	MW-70-PMW14A	MW-70-PMW14B
		Sample ID	IR70-A15-053	IR70-A15-056	IR70-A15-057
		QA/QC			
		Sample Date	12/17/2015	12/17/2015	12/17/2015
Parameter	**Method**	**Unit**			
Wet Chemistry					
Total Alkalinity	2320B	mg/L	186	188	211
TDS	2540C	mg/L	10200	5230	8800
Bromide	300.0	mg/L	18.6	8.28	14.5
Chloride-Cl	300.0	mg/L	5110	2290	4130
Nitrate-N	300.0	mg/L	0.8 U	0.4 U	0.8 U
NITRITE-N	300.0	mg/L	0.8 U	0.4 U	0.8 U
Sulfate	300.0	mg/L	895	575	833
Acetate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U
Butyrate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U
Lactate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U
Propionate	300.0_MOD	mg/L	1.00 U	1.00 U	1.00 U
Sulfide	4500_S2_F	mg/L	1 U	1 U	1 U
TOC	5310B	mg/L	2.22	1.8	1.52
Dissolved Metals					
Arsenic	6010B	mg/L	0.200 U	0.200 U	0.00563 J
Iron	6010B	mg/L	2.03	3.79	16.4
Manganese	6010B	mg/L	0.813	0.357	0.704
Volatile Organic Compounds					
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	8260B	µg/L	0.45 J	0.47 J	0.49 J
1,1-Dichloroethene	8260B	µg/L	4.9	4.6	2.0
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.50 U	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U

TABLE 2-12
SECOND SAND BIOBARRIER 1 ANALYTICAL RESULTS

		Location	MW-70-PMW13B	MW-70-PMW14A	MW-70-PMW14B
		Sample ID	IR70-A15-053	IR70-A15-056	IR70-A15-057
		QA/QC			
		Sample Date	12/17/2015	12/17/2015	12/17/2015
Parameter	**Method**	**Unit**			
2-Butanone	8260B	µg/L	10 U	10 U	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U
2-Hexanone	8260B	µg/L	10 U	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U	10 U	10 U
Acetone	8260B	µg/L	10 U	10 U	10 U
Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	0.43 J	0.3 J	1.0 U
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Chloroethane	8260B	µg/L	2.0 U	2.0 U	2.0 U
Chloroform	8260B	µg/L	1.0 U	1.0 U	1.0 U
Chloromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	980	1100	400
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Freon113	8260B	µg/L	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	1.0 U	1.0 U
MTBE	8260B	µg/L	1.0 U	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Toluene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Trans-1,2-Dichloroethene	8260B	µg/L	48	79	35

TABLE 2-12
SECOND SAND BIOBARRIER 1 ANALYTICAL RESULTS

		Location	MW-70-PMW13B	MW-70-PMW14A	MW-70-PMW14B
		Sample ID	IR70-A15-053	IR70-A15-056	IR70-A15-057
		QA/QC			
		Sample Date	12/17/2015	12/17/2015	12/17/2015
Parameter	**Method**	**Unit**			
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	6.6	5.9	4 J
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	7.9	97	410
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U	2.0 U
Dehalococcoides (Dhc)/Vinyl Chloride Reductase (vcrA)					
Dehalococcoides16 S rRNA gene	Gene-Trac Dhc	gene copies/liter	1000 U	4000 J	60000
vinyl chloride reductase A gene	Gene-Trac VC	gene copies/liter	*	1000 U	1000 U
Dissolved Hydrocarbon Gases					
Ethane	RSK-175	µg/L	2.0 U	2.0 U	4.6
Ethene	RSK-175	µg/L	0.63 J	3.4	8.7
Methane	RSK-175	µg/L	200	890	16000

Notes:
U = Not Detected
J = Estimated value
µg/L = micrograms per liter
mg/L = milligrams per liter
--- = not analyzed
* = not analyzed since dehalococcoides was not detected

TABLE 2-13
SECOND SAND POINT OF COMPLIANCE ANALYTICAL RESULTS

		Location	MW-70-21	MW-70-36
		Sample ID	IR70-A15-075	IR70-A15-074
		QA/QC		
		Sample Date	12/21/2015	12/21/2015
Parameter	**Method**	**Unit**		
Volatile Organic Compounds				
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U	1.0 U
1,1-Dichloroethane	8260B	µg/L	1.0 U	1.0 U
1,1-Dichloroethene	8260B	µg/L	0.50 U	0.50 U
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U
2-Butanone	8260B	µg/L	10 U	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U
2-Hexanone	8260B	µg/L	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U	10 U
Acetone	8260B	µg/L	10 U	10 U
Benzene	8260B	µg/L	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	1.0 U	0.22 J
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U
Chloroethane	8260B	µg/L	2.0 U	2.0 U
Chloroform	8260B	µg/L	1.0 U	1.0 U
Chloromethane	8260B	µg/L	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	1.0 U	0.23 J
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U
Freon113	8260B	µg/L	1.0 U	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	1.0 U
MTBE	8260B	µg/L	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	1.5
Toluene	8260B	µg/L	1.0 U	1.0 U
Trans-1,2-Dichloroethene	8260B	µg/L	1.0 U	1.0 U
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	5.0 U	5.0 U
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	0.50 U	0.50 U
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U

Notes:

U = Not Detected

µg/L = micrograms per liter

This Page Intentionally Left Blank

TABLE 2-14
DEEP SAND POINT OF COMPLIANCE ANALYTICAL RESULTS

		Location	MW-70-POC02	MW-70-POC03	MW-70-POC04
		Sample ID	IR70-A15-076	IR70-A15-077	IR70-A15-078
		QA/QC			
		Sample Date	12/21/2015	12/21/2015	12/21/2015
Parameter	**Method**	**Unit**			
Volatile Organic Compounds					
1,1,1,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	8260B	µg/L	0.50 U	0.50 U	0.50 U
1,1-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	8260B	µg/L	0.50 U	0.50 U	0.50 U
1,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	8260B	µg/L	1.0 U	1.0 U	1.0 U
2-Butanone	8260B	µg/L	10 U	10 U	10 U
2-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U
2-Hexanone	8260B	µg/L	10 U	10 U	10 U
4-Chlorotoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U
4-Methyl-2-Pentanone	8260B	µg/L	10 U	10 U	10 U
Acetone	8260B	µg/L	10 U	10 U	10 U
Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Bromobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Bromodichloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
Bromoform	8260B	µg/L	1.0 U	1.0 U	1.0 U
Bromomethane	8260B	µg/L	2.0 U	2.0 U	2.0 U
Carbon Disulfide	8260B	µg/L	0.37 J	1.0 U	1.0 U
Carbon Tetrachloride	8260B	µg/L	0.50 U	0.50 U	0.50 U
Chlorobenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Chloroethane	8260B	µg/L	2.0 U	2.0 U	2.0 U
Chloroform	8260B	µg/L	1.0 U	1.0 U	1.0 U
Chloromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	8260B	µg/L	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Dibromochloromethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
Dibromomethane	8260B	µg/L	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U
Ethylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Freon113	8260B	µg/L	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Isopropyl Benzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
m/p-Xylenes	8260B	µg/L	1.0 U	1.0 U	1.0 U
Methylene Chloride	8260B	µg/L	1.0 U	1.0 U	1.0 U
MTBE	8260B	µg/L	1.0 U	1.0 U	1.0 U
n-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
n-Propylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
o-Xylene	8260B	µg/L	1.0 U	1.0 U	1.0 U
p-Isopropyltoluene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Sec-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Styrene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Tert-Butylbenzene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Toluene	8260B	µg/L	1.0 U	1.0 U	1.2
Trans-1,2-Dichloroethene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Trans-1,3-Dichloropropene	8260B	µg/L	1.0 U	1.0 U	1.0 U
Trichloroethene	8260B	µg/L	5.0 U	5.0 U	5.0 U
Trichlorofluoromethane	8260B	µg/L	2.0 U	2.0 U	2.0 U
Vinyl Chloride	8260B	µg/L	0.50 U	0.50 U	0.50 U
Xylenes (Total)	8260B	µg/L	2.0 U	2.0 U	2.0 U

Notes:
U = Not Detected
µg/L = micrograms per liter

This Page Intentionally Left Blank

TABLE 2-15
SOIL VAPOR ANALYTICAL RESULTS

		Sample Location	SV-70-01	SV-70-02	SV-70-04	SV-70-05	SV-70-06	SV-70-07	SV-70-08	SV-70-09	SV-70-10	SV-70-11	SV-70-12
		Sample Date	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016
Parameter	**Method**	**Unit**											
Hydrogen Sulfide													
Hydrogen Sulfide	EPA 16	ppmV	ND	ND	ND	3.5	ND	0.83 J	ND	ND	ND	ND	ND
Methane													
Methane	SCAQMD 25.1M	ppmV	14000	360000	21000	520000	53000	450000	26000	39000	60000	15000	220
Volatile Organic Compounds		**SampleDate**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**
1,1,1-Trichloroethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	53	ND	750	ND
1,1,2-Trichloroethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	270	ND	ND	13
1,1-Dichloroethene	EPA TO-15M	ppb (v/v)	39	200	42	ND	330	ND	710	1400	590	580	120
1,2,4-Trichlorobenzene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	17	ND	ND	ND
1,3,5-Trimethylbenzene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	EPA TO-15M	ppb (v/v)	ND	ND	108	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Ethyltoluene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	EPA TO-15M	ppb (v/v)	ND	ND	ND	210	ND	ND	ND	27	ND	ND	66
Benzyl Chloride	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
c-1,2-Dichloroethene	EPA TO-15M	ppb (v/v)	570	760	2000	2500	11000	420	17000	18000	11000	15000	4800
c-1,3-Dichloropropene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	EPA TO-15M	ppb (v/v)	ND	ND	20	ND	ND	ND	610	75	ND	ND	52
Chloromethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloro-1,3-Butadiene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE 2-15
SOIL VAPOR ANALYTICAL RESULTS

		Sample Location	SV-70-01	SV-70-02	SV-70-04	SV-70-05	SV-70-06	SV-70-07	SV-70-08	SV-70-09	SV-70-10	SV-70-11	SV-70-12
		Sample Date	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016	01/12/2016
Parameter	**Method**	**Unit**											
		Sample Location	SV-70-01	SV-70-02	SV-70-04	SV-70-05	SV-70-06	SV-70-07	SV-70-08	SV-70-09	SV-70-10	SV-70-11	SV-70-12
Volatile Organic Compounds		**SampleDate**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**	**12/28/15**
Parameter	**Method**	**Unit**											
Methyl-t-Butyl Ether (MTBE)	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p/m-Xylene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
t-1,2-Dichloroethene	EPA TO-15M	ppb (v/v)	54	76	240	400	930	1700	1100	3400	1800	650	450
t-1,3-Dichloropropene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	EPA TO-15M	ppb (v/v)	44	220	ND	ND	ND	ND	ND	ND	ND	ND	5.8
Toluene	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	EPA TO-15M	ppb (v/v)	670	930	1400	280	2600	ND	2200	10000	ND	5600	1300
Trichlorofluoromethane	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Acetate	EPA TO-15M	ppb (v/v)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	EPA TO-15M	ppb (v/v)	1400	520	380	30000	12000	45000	3000	20000	37000	5200	2800

Notes:
Cells highlighted in red indicate an exceedance of applicable criteria
J - estimated
ppb (v/v) - parts per billion (volume/volume)
ppmV – parts per million by volume
ND – not detected

TABLE 3-1

COMPARISON OF BASELINE (2008), 2012 AND 2015 ANNUAL MAXIMUM AND AVERAGE CONCENTRATIONS OF TCE, CIS-1,2-DCE, AND VC FOR EACH HYDROSTRATIGRAPHIC UNIT

Hydrostratigraphic Unit	Biobarrier	TCE					Cis-1,2-DCE				Vinyl Chloride			
		Baseline 2008		2015			2012		2015		2012		2015	
		Max (µg/L)	Ave (µg/L)	Max (µg/L)	Ave (µg/L)	Ave % Remaining	Max (µg/L)	Ave (µg/L)	Max (µg/L)	Ave (µg/L)	Max (µg/L)	Ave (µg/L)	Max (µg/L)	Ave (µg/L)
Upper Fines	SATG	11,000	4,800	2,200	246	5%	5,700	1,561	5,400	978	9,000	1,498	2,400	515
First Sand	SAB	350	184	2.7	0.8	0%	1,600	556	120	31	170	41	130	22
	FSB-1	4,100	1,144	3,400	229	20%	1,500	338	760	133	850	181	790	156
	FSB-2	970	299	7	2	1%	910	219	1,000	189	470	71	430	92
	Total	4,100	542	3,400	112	21%	1,600	371	1,000	127	850	97	790	107
Shell Horizon	SHB-1	4,300	1,553	7.4	2.7	0%	1,800	620	1,200	295	70	22	290	99
	SHB-3	870	380	6.3	2.5	1%	590	152	1,200	252	440	123	270	59
	Total	4,300	966	7.4	2.6	0%	1,800	386	1,200	270	440	73	290	75
Second Sand	SSB-1	1,100	413	6.8	4.3	1%	1,100	393	1,100	459	370	111	410	62

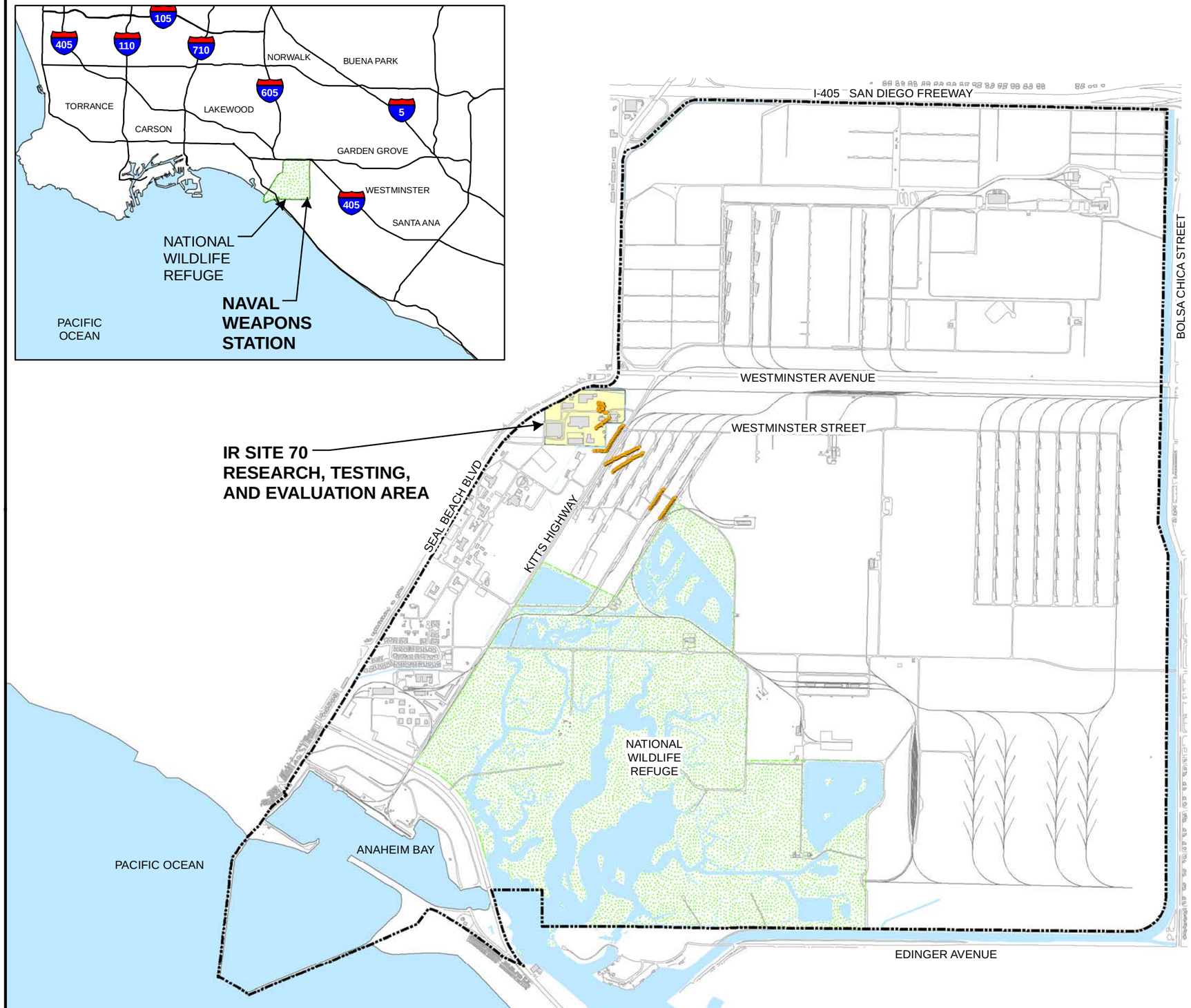
Notes:
Data used to determine the average are from tables on Figures 2-22 to 2-33. Only data from wells sampled in 2008, and the 2012 and 2015 annual events were used.
Detection limit was used for calculations when a result was non-detect.

Abbreviations and Acronyms:
µg/L – micrograms per liter
Ave – average
DCE – dichloroethene
FSB – First Sand Biobarrier
Max – maximum
SAB – Source Area Biobarrier
SATG – Source Area Treatment Grid
SHB – Shell Horizon Biobarrier
SSB – Second Sand Biobarrier
TCE – trichloroethene
VC – vinyl chloride

This page intentionally left blank

FIGURES

This page intentionally left blank.



LEGEND

- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- BUILDING

1,000 0 1,000 2,000 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 1-1
IR SITE 70
SITE LOCATION MAP

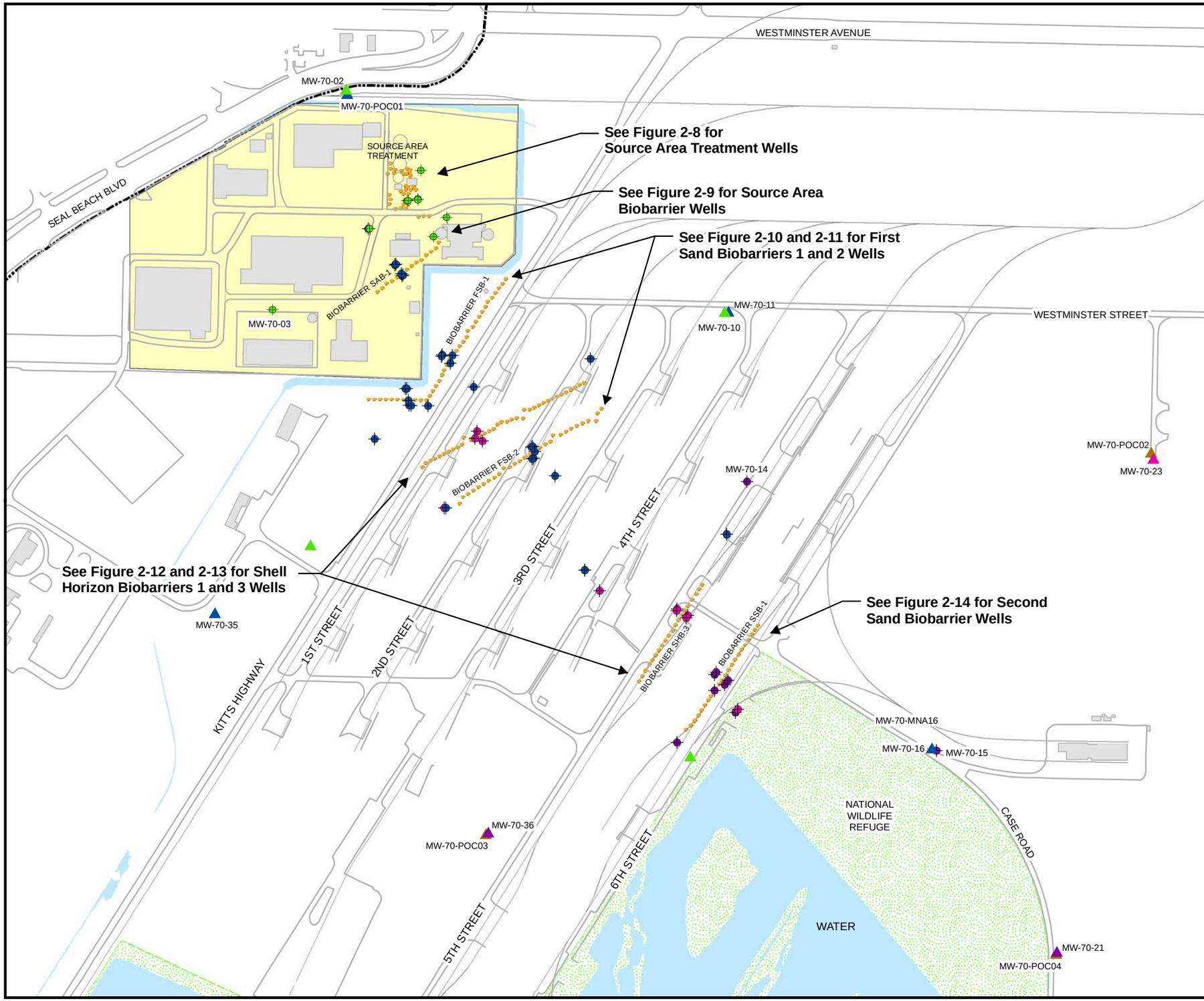
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 1-1.mxd

NAVFAC

ECC-INSIGHT LLC

This Page Intentionally Left Blank



LEGEND

- MW-70-MNA02 — UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL
- MW-70-22 — UPPER FINES/SOURCE AREA TREATMENT POC MONITORING WELL
- MW-70-MNA08 — FIRST SAND MONITORING WELL
- MW-70-11 — FIRST SAND POC MONITORING WELL
- MW-70-MNA14 — SHELL HORIZON MONITORING WELL
- MW-70-23 — SHELL HORIZON POC MONITORING WELL
- MW-70-15 — SECOND SAND MONITORING WELL
- MW-70-36 — SECOND SAND POC MONITORING WELL
- MW-70-POC02 — DEEP SAND POC MONITORING WELL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- BUILDING

NOTE:

POC - POINT OF COMPLIANCE

200 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 1-2
IR SITE 70
WELL LOCATION MAP

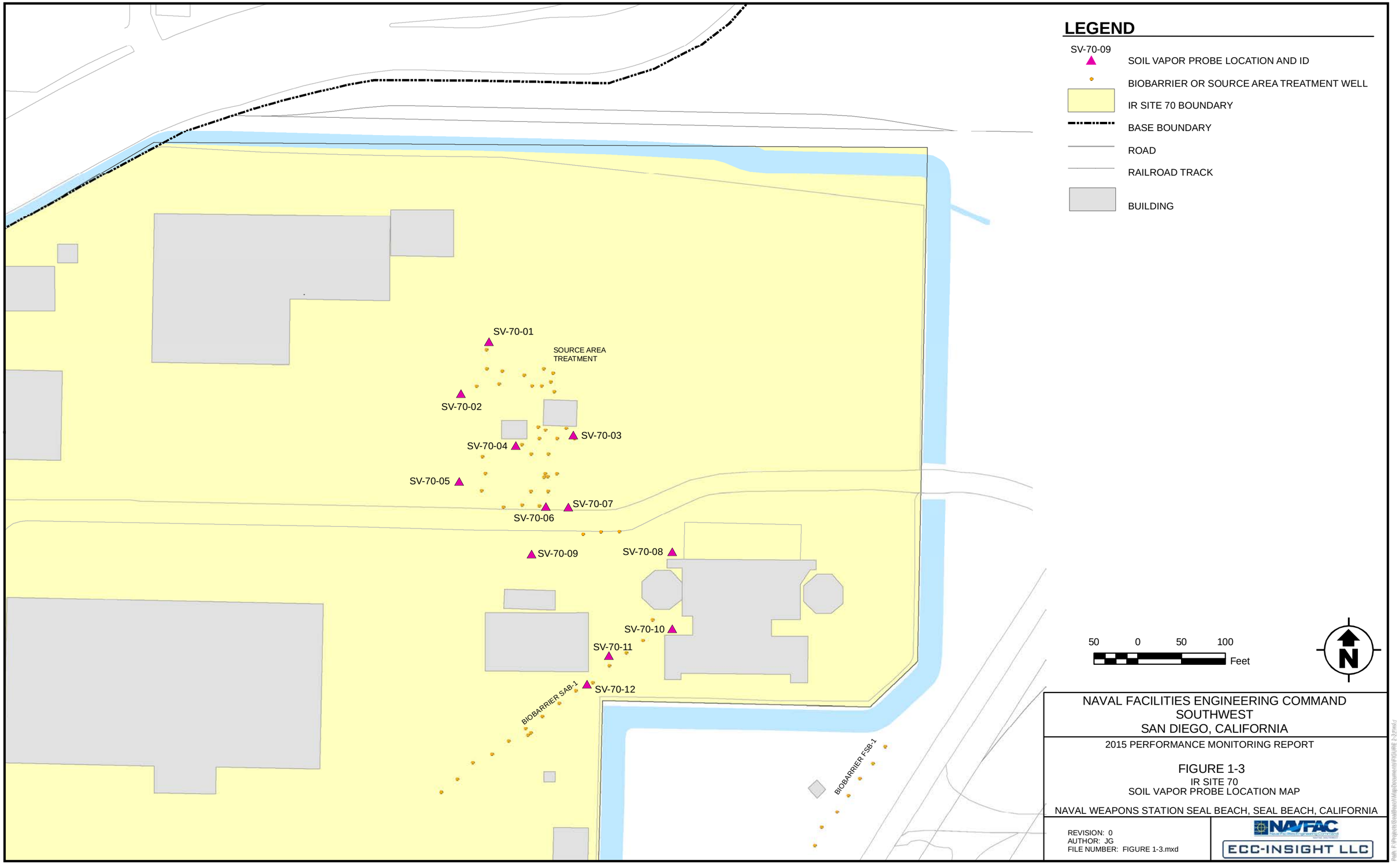
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 1-1.mxd

NAVFAC

ECC-INSIGHT LLC

This Page Intentionally Left Blank



NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

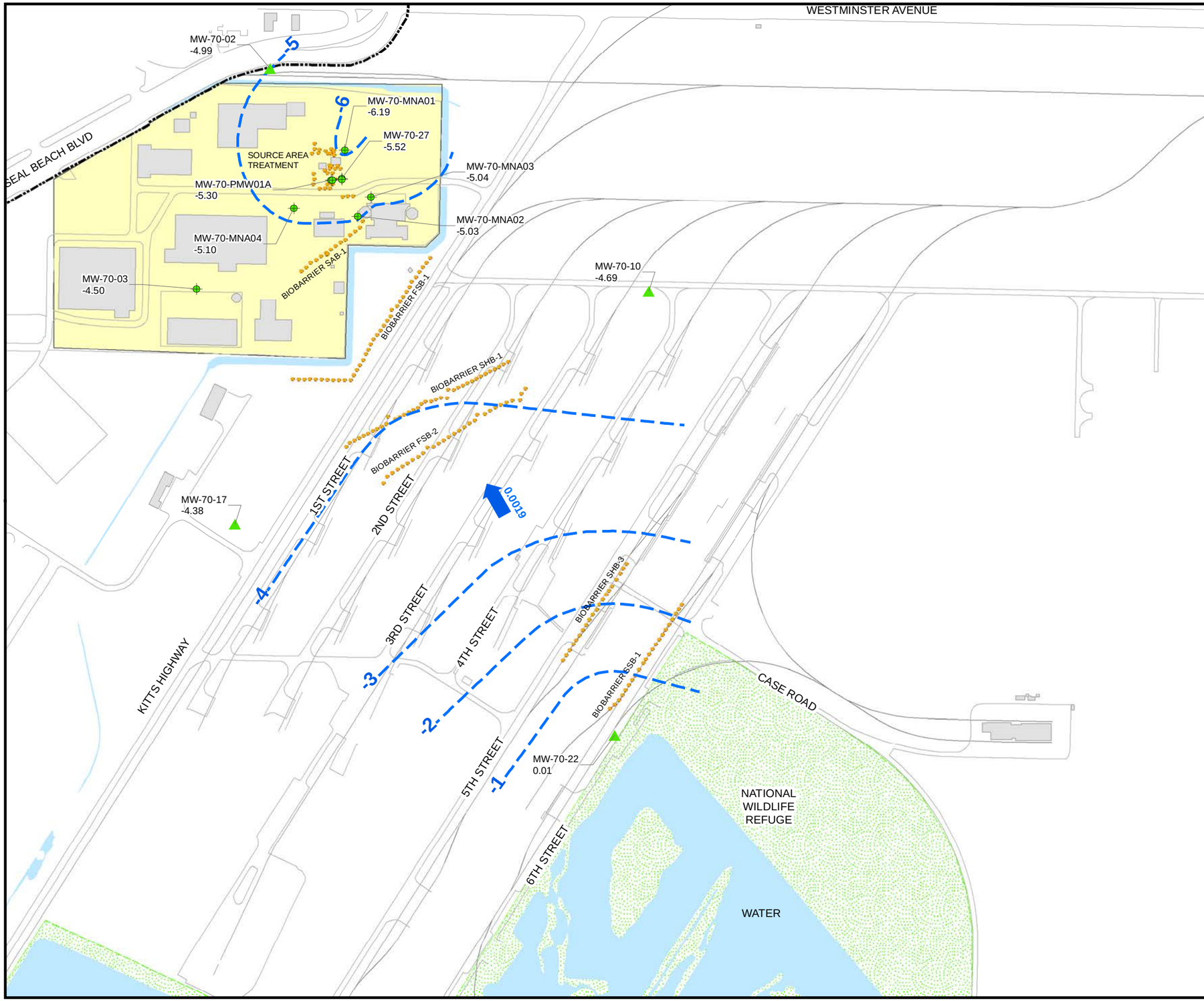
FIGURE 1-3
IR SITE 70
SOIL VAPOR PROBE LOCATION MAP

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 1-3.mxd

NAVFAC
ECC-INSIGHT LLC

This Page Intentionally Left Blank



LEGEND

MW-70-MNA02 -0.82	UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
MW-70-10 -0.63	UPPER FINES POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
0.0019	INFERRED DIRECTION OF GROUNDWATER FLOW WITH GRADIENT
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	APPROXIMATE GROUNDWATER ELEVATION IN FEET MEAN SEA LEVEL
	BUILDING

NOTES:

WATER LEVELS MEASURED ON DECEMBER 14 & 15, 2015

( ) - PARENTHESES INDICATE GROUNDWATER ELEVATION AT THIS WELL WAS NOT USED FOR CONTOURING DUE TO THE DIFFERENCE IN THE ELEVATION OF ITS SCREEN INTERVAL RELATIVE TO THOSE OF NEARBY WELLS.

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2014 PERFORMANCE MONITORING REPORT

FIGURE 2-1
UPPER FINES GROUNDWATER ELEVATIONS
DECEMBER 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

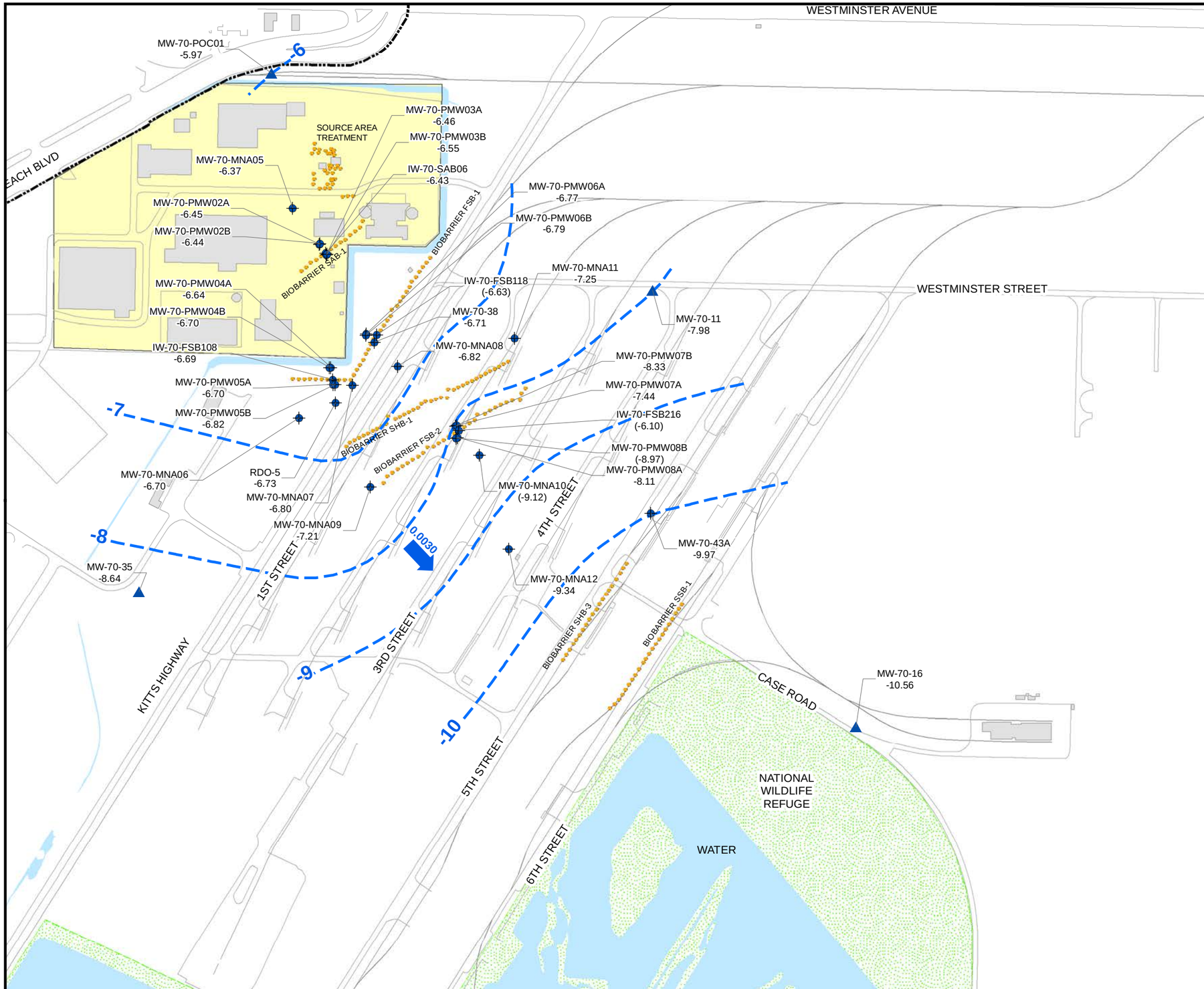
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-1.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-1.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-MNA08 -1.75	FIRST SAND MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET BGS MEAN SEA LEVEL
MW-70-16 -3.60	FIRST SAND POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET BGS MEAN SEA LEVEL
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
0.0030	INFERRED DIRECTION OF GROUNDWATER FLOW WITH GRADIENT
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL
	BUILDING

NOTES:

WATER LEVELS MEASURED ON DECEMBER 14 & 15, 2015

( ) - PARENTHESES INDICATE GROUNDWATER ELEVATION AT THIS WELL WAS NOT USED FOR CONTOURING DUE TO THE DIFFERENCE IN THE ELEVATION OF ITS SCREEN INTERVAL RELATIVE TO THOSE OF NEARBY WELLS.

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2014 PERFORMANCE MONITORING REPORT

FIGURE 2-2
FIRST SAND GROUNDWATER ELEVATIONS
DECEMBER 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

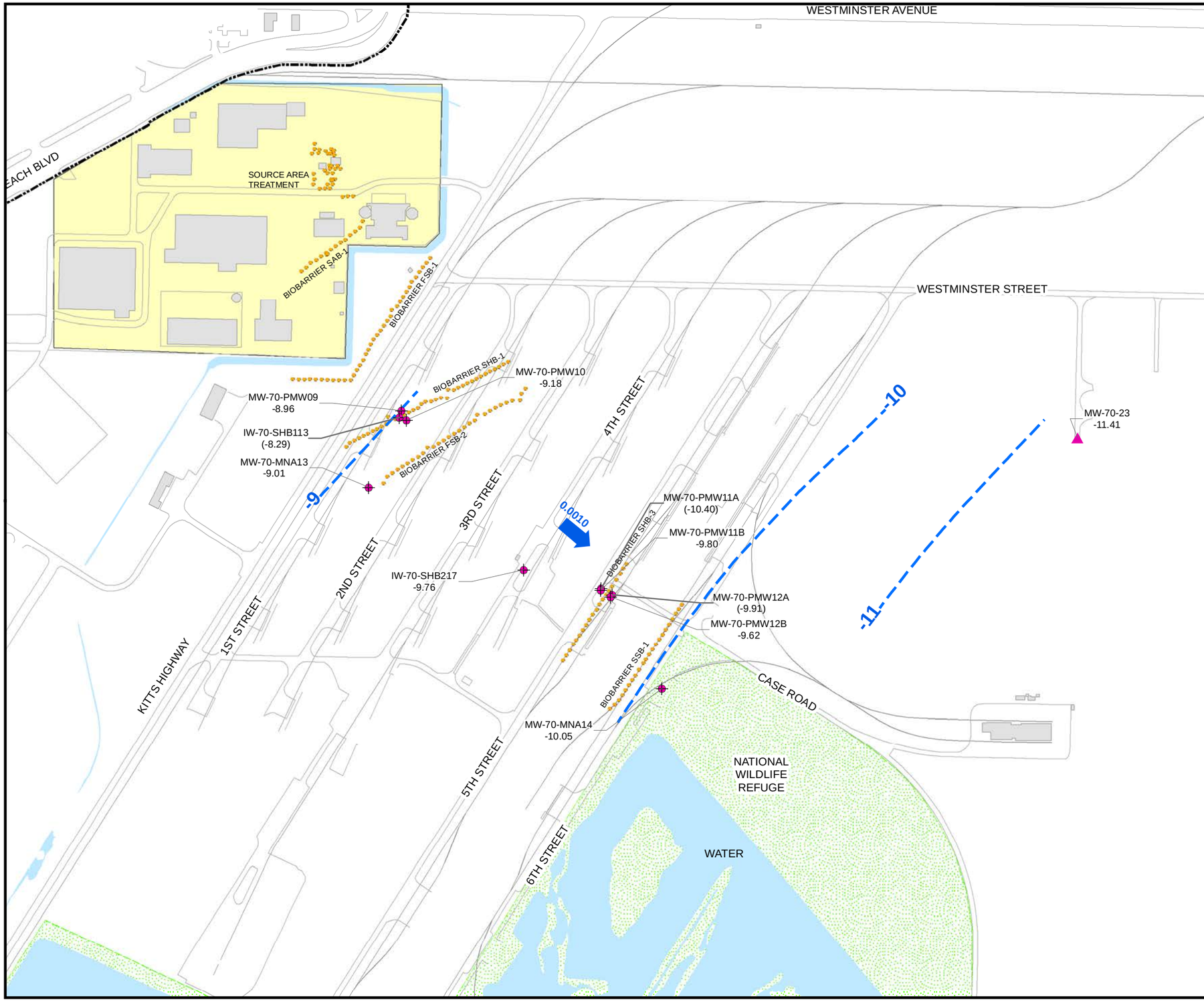
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-2.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-2.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-MNA14 -3.34	SHELL HORIZON MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
MW-70-23 -3.68	SHELL HORIZON POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
0.0010	INFERRED DIRECTION OF GROUNDWATER FLOW WITH GRADIENT
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL
	BUILDING

NOTES:

WATER LEVELS MEASURED ON DECEMBER 14 & 15, 2015

( ) - PARENTHESES INDICATE GROUNDWATER ELEVATION AT THIS WELL WAS NOT USED FOR CONTOURING DUE TO THE DIFFERENCE IN THE ELEVATION OF ITS SCREEN INTERVAL RELATIVE TO THOSE OF NEARBY WELLS.

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2014 PERFORMANCE MONITORING REPORT

FIGURE 2-3
SHELL HORIZON GROUNDWATER ELEVATIONS
DECEMBER 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

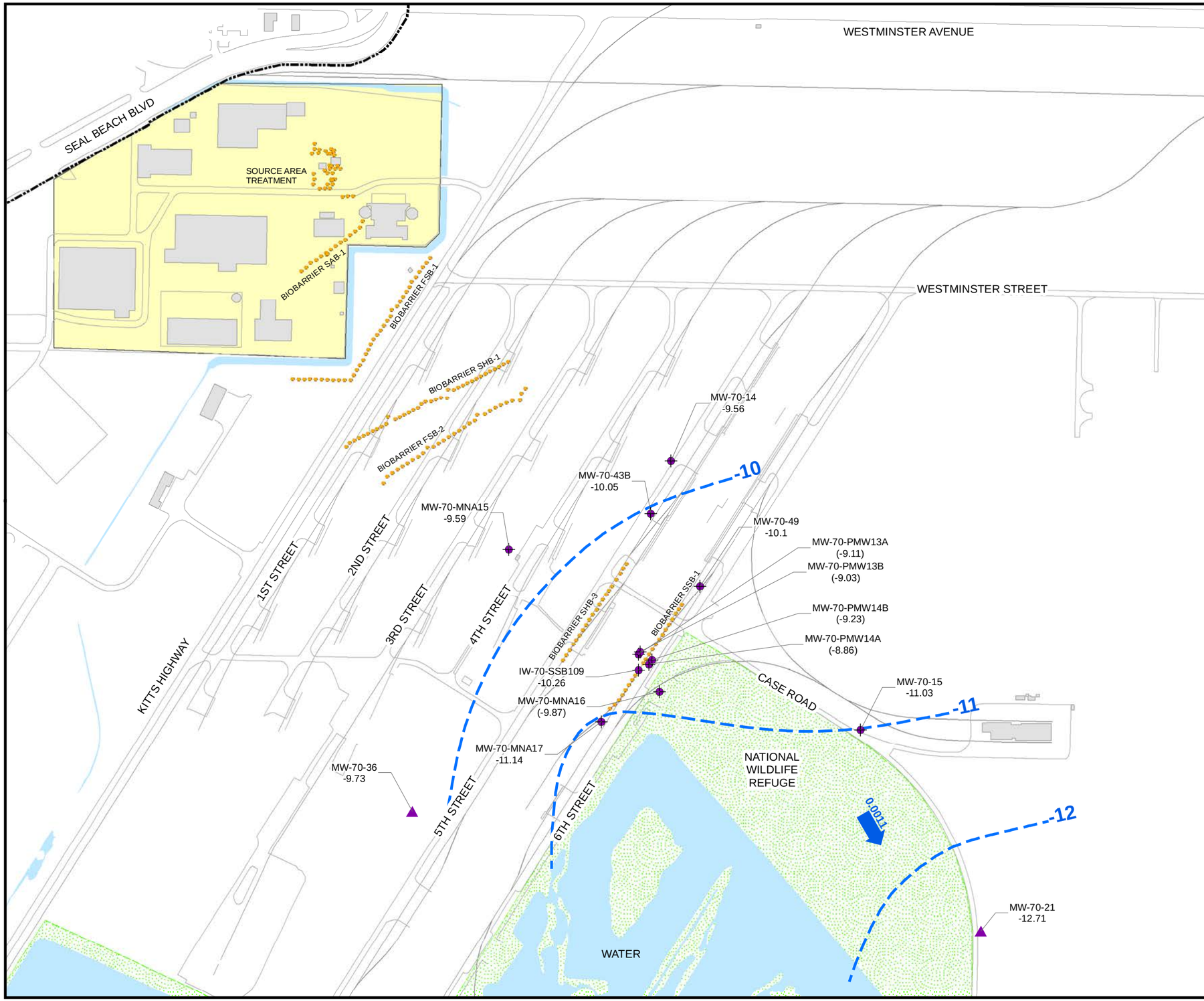
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-3.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-3.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-15 -3.94	SECOND SAND MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
MW-70-36 -3.60	SECOND SAND POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
0.0011	INFERRED DIRECTION OF GROUNDWATER FLOW, WITH GRADIENT
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL
	BUILDING

NOTES:

WATER LEVELS MEASURED ON DECEMBER 14 & 15, 2015

( ) - PARENTHESES INDICATE GROUNDWATER ELEVATION AT THIS WELL WAS NOT USED FOR CONTOURING DUE TO THE DIFFERENCE IN THE ELEVATION OF ITS SCREEN INTERVAL RELATIVE TO THOSE OF NEARBY WELLS.

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2014 PERFORMANCE MONITORING REPORT

FIGURE 2-4
SECOND SAND GROUNDWATER ELEVATIONS
DECEMBER 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

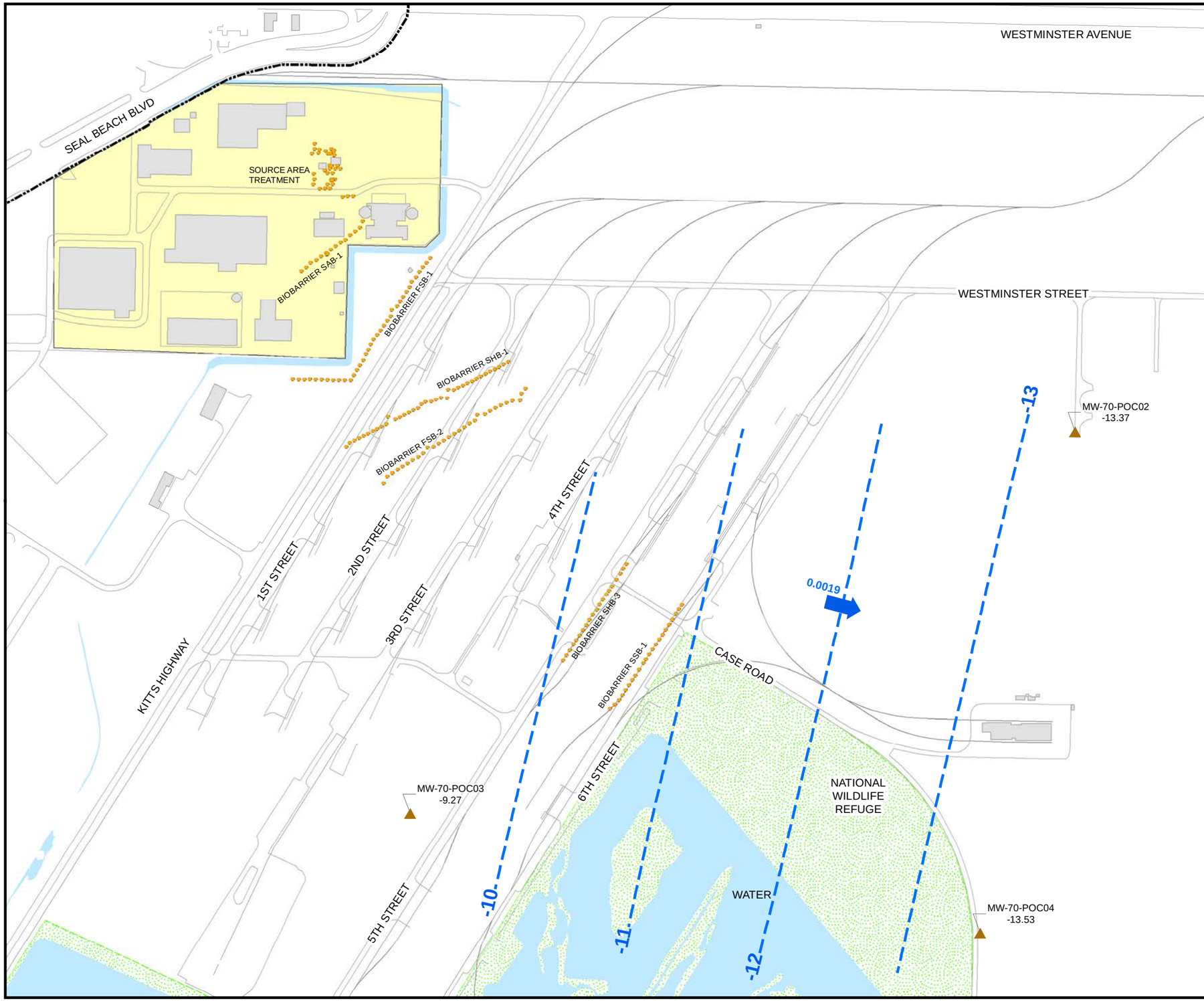
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-4.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-4.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-POC02 -4.44 — DEEP SAND POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL

BIOBARRIER OR SOURCE AREA TREATMENT WELL

0.0019 — INFERRED DIRECTION OF GROUNDWATER FLOW, WITH GRADIENT

IR SITE 70 BOUNDARY

BASE BOUNDARY

ROAD

RAILROAD TRACK

APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL

BUILDING

NOTES:

WATER LEVELS MEASURED ON DECEMBER 14 & 15, 2015

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2014 PERFORMANCE MONITORING REPORT

FIGURE 2-5
DEEP SAND GROUNDWATER ELEVATIONS
DECEMBER 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-5.mxd

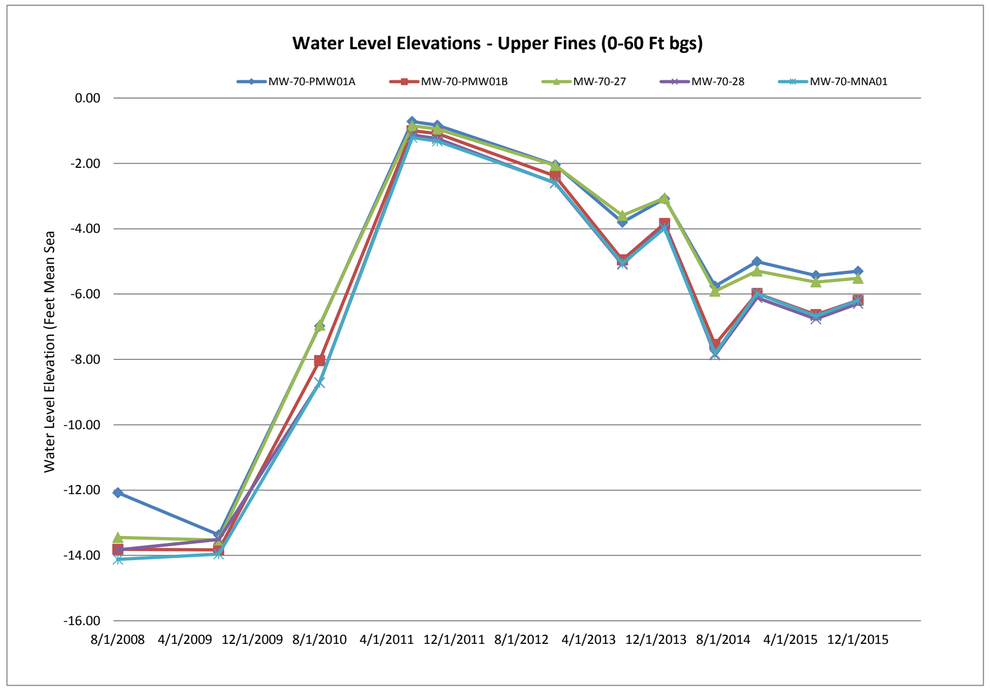
NAVFAC

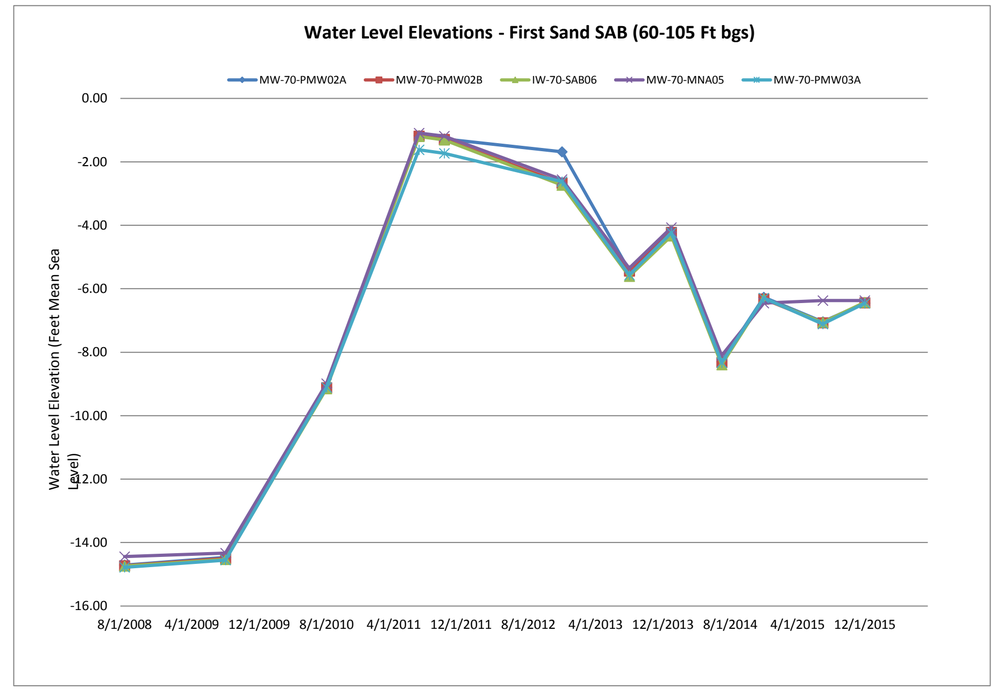
ECC-INSIGHT LLC

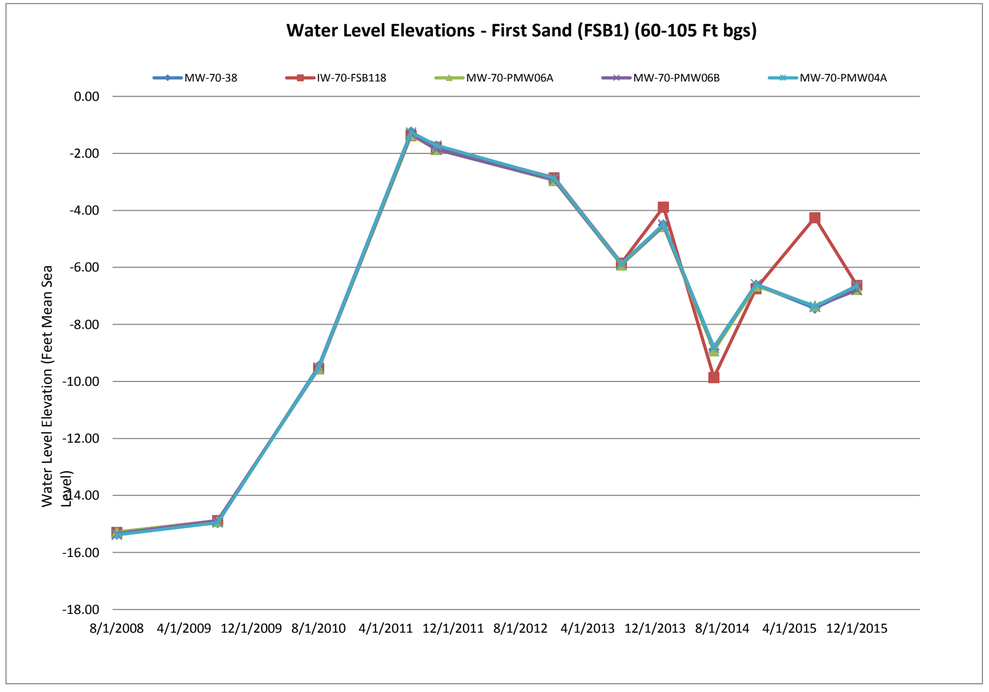
Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-5.mxd

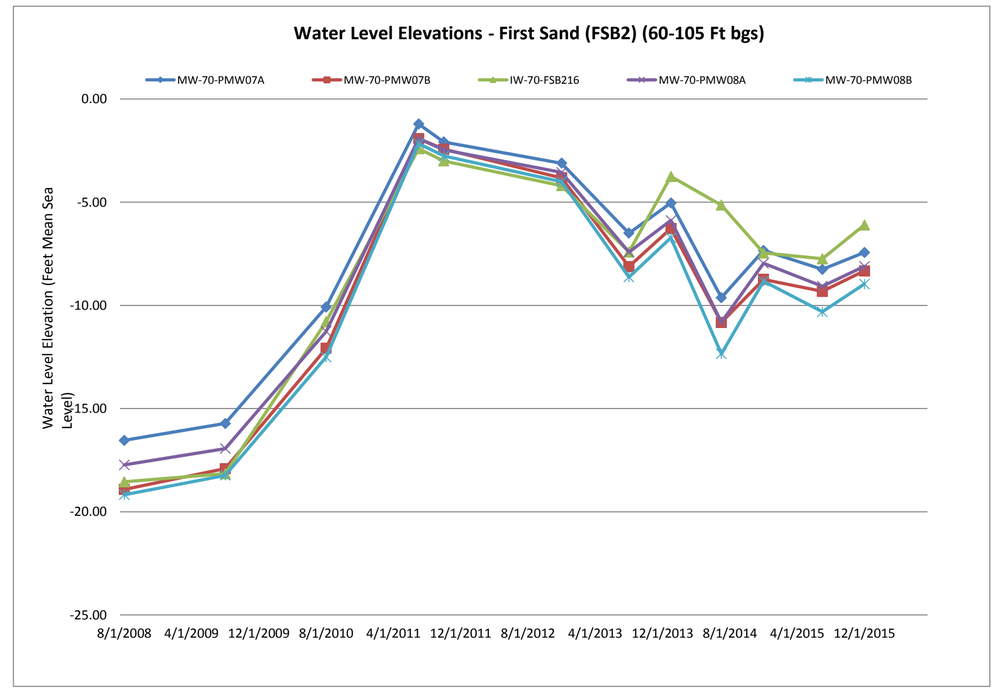
This Page Intentionally Left Blank

FIGURE 2-6
WATER LEVEL TREND GRAPHS: UPPER FINES AND FIRST SAND (2008-2015)



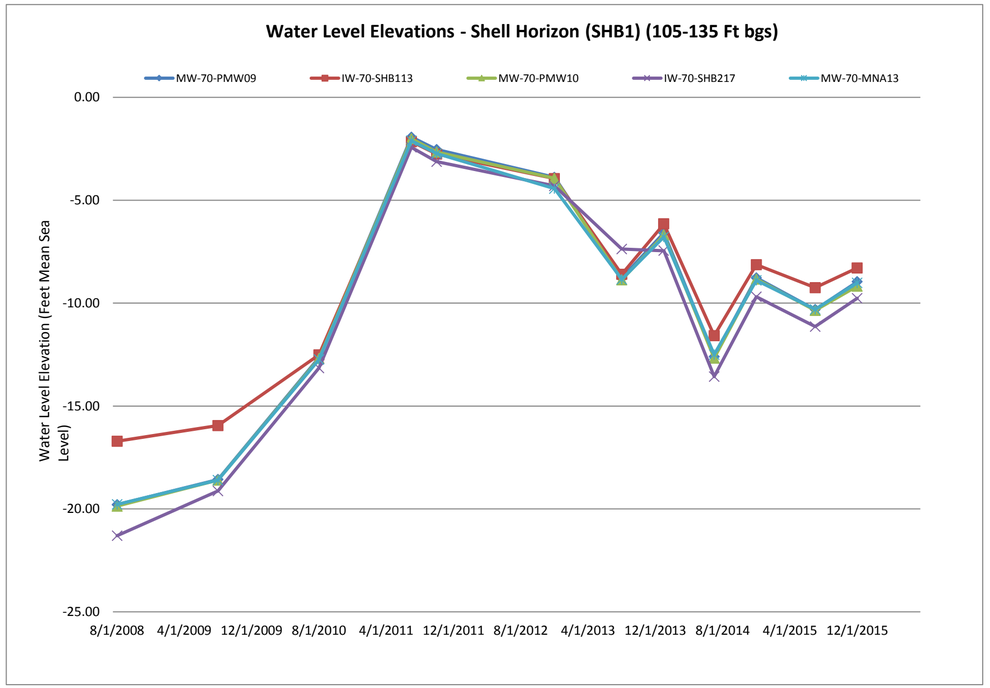


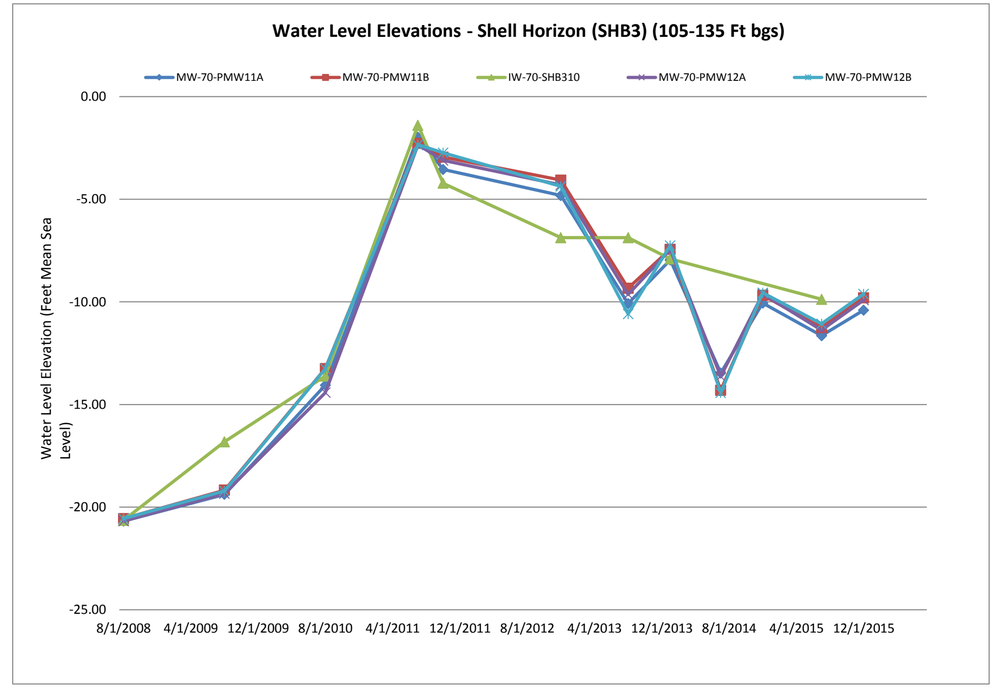


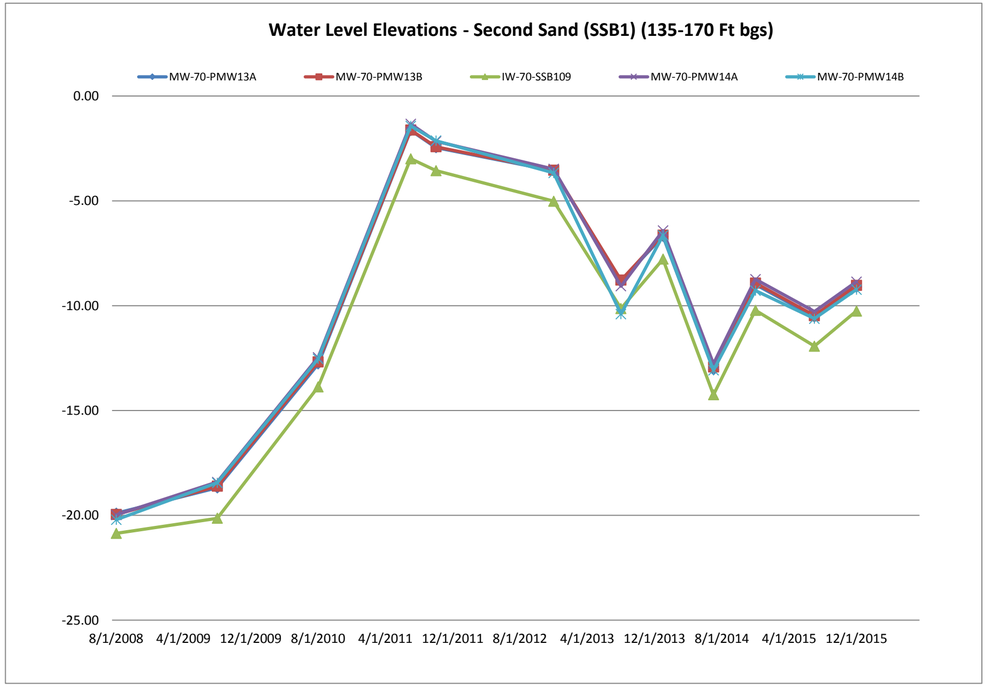


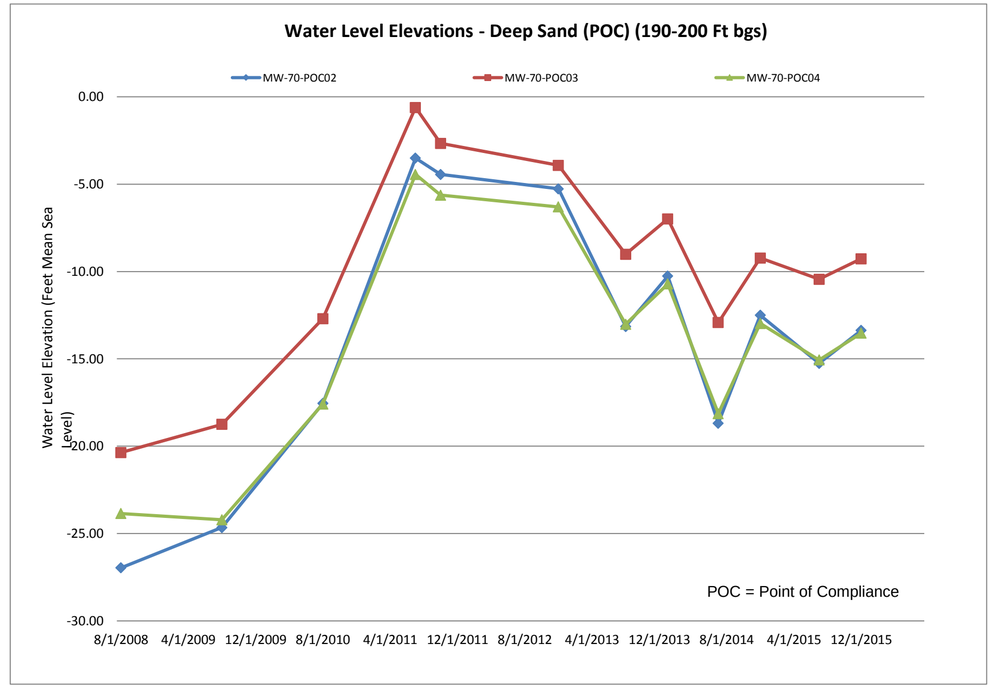
This Page Intentionally Left Blank

FIGURE 2-7
WATER LEVEL TREND GRAPHS: SHELL HORIZON, SECOND SAND, AND DEEP SAND (2008-2015)

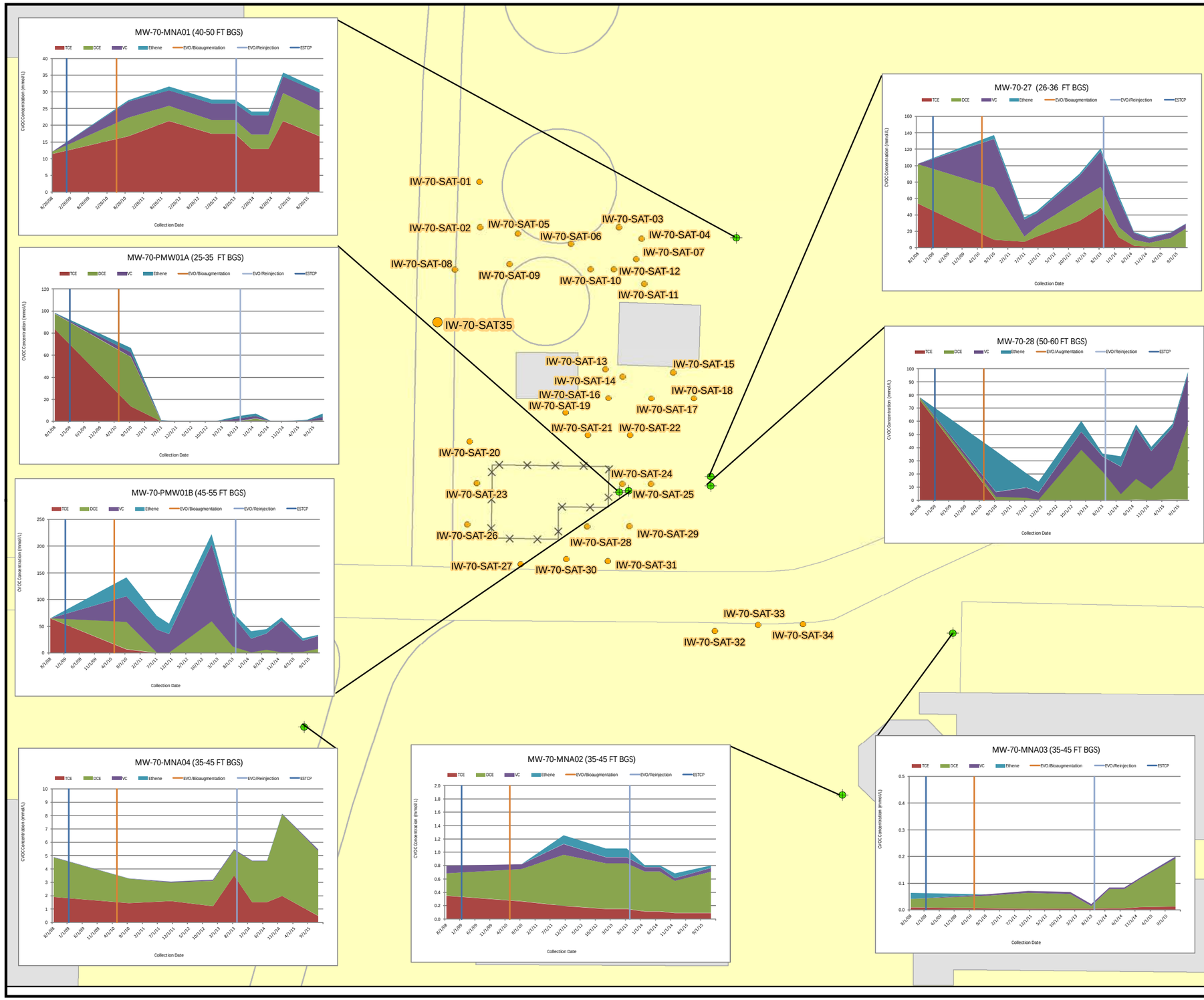








This Page Intentionally Left Blank



LEGEND

- UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL
- SAMPLED BIOBARRIER OR SOURCE AREA TREATMENT WELL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- BUILDING

20 10 0 20 40 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-8
CVOC MOLAR CONCENTRATION - SOURCE AREA TREATMENT GRID

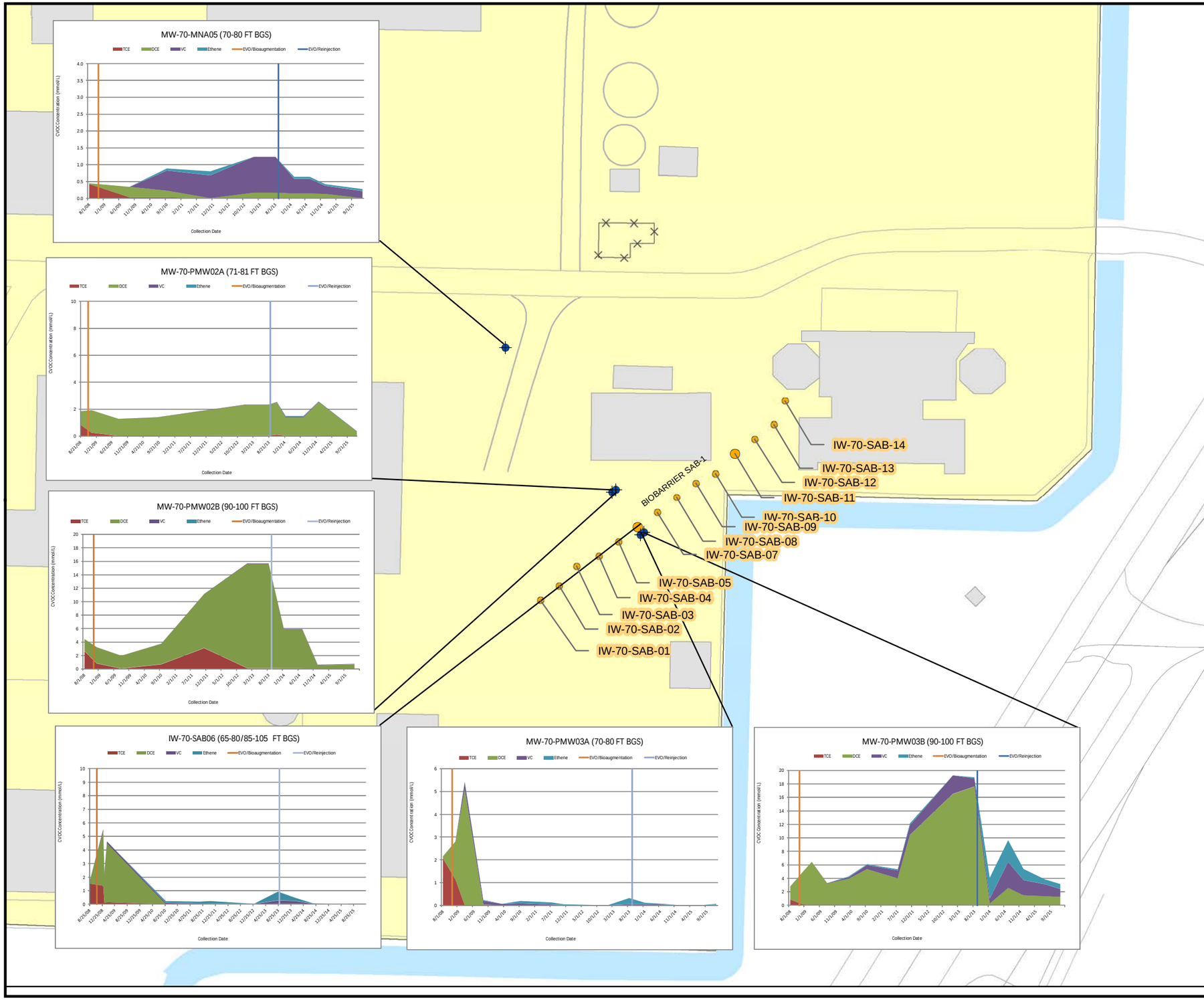
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-8.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-8.mxd

This Page Intentionally Left Blank



LEGEND

- FIRST SAND SOURCE AREA BIOBARRIER MONITORING WELL
- SAMPLED BIOBARRIER OR SOURCE AREA TREATMENT WELL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- BUILDING

50 25 0 50 100 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-9
CVOC MOLAR CONCENTRATION - SOURCE AREA BIOBARRIER 1

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

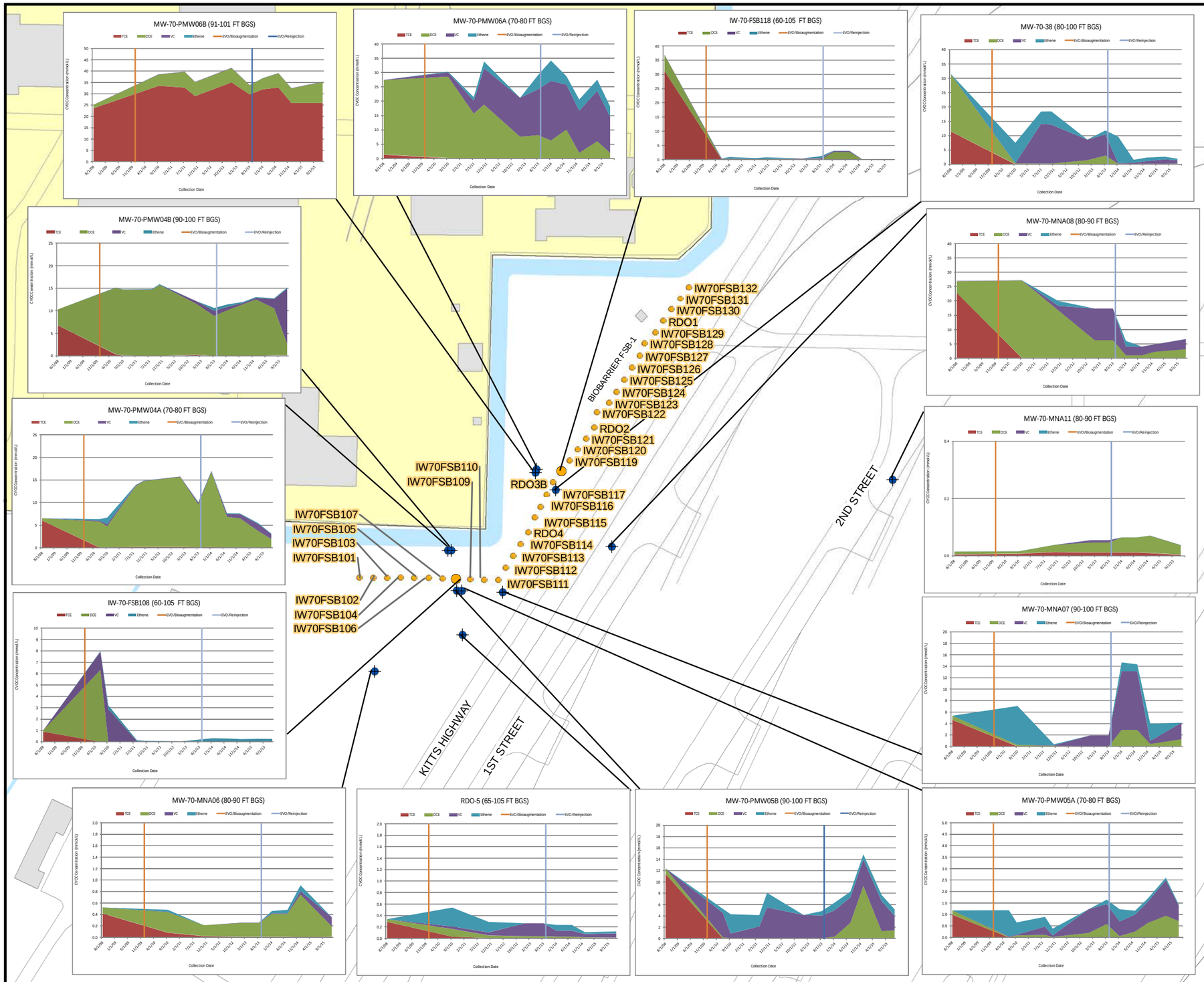
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-9.mxd

NAVFAC

ECC-INSIGHT LLC

Path: P:\Projects\SealBeach\Map Documents\FIGURE 2-9.mxd

This Page Intentionally Left Blank



LEGEND

- FIRST SAND BIOBARRIER 1 MONITORING WELL
- SAMPLED BIOBARRIER OR SOURCE AREA TREATMENT WELL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- BUILDING

100 50 0 100 200 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-10
CVOC MOLAR CONCENTRATION - FIRST SAND BIOBARRIER 1

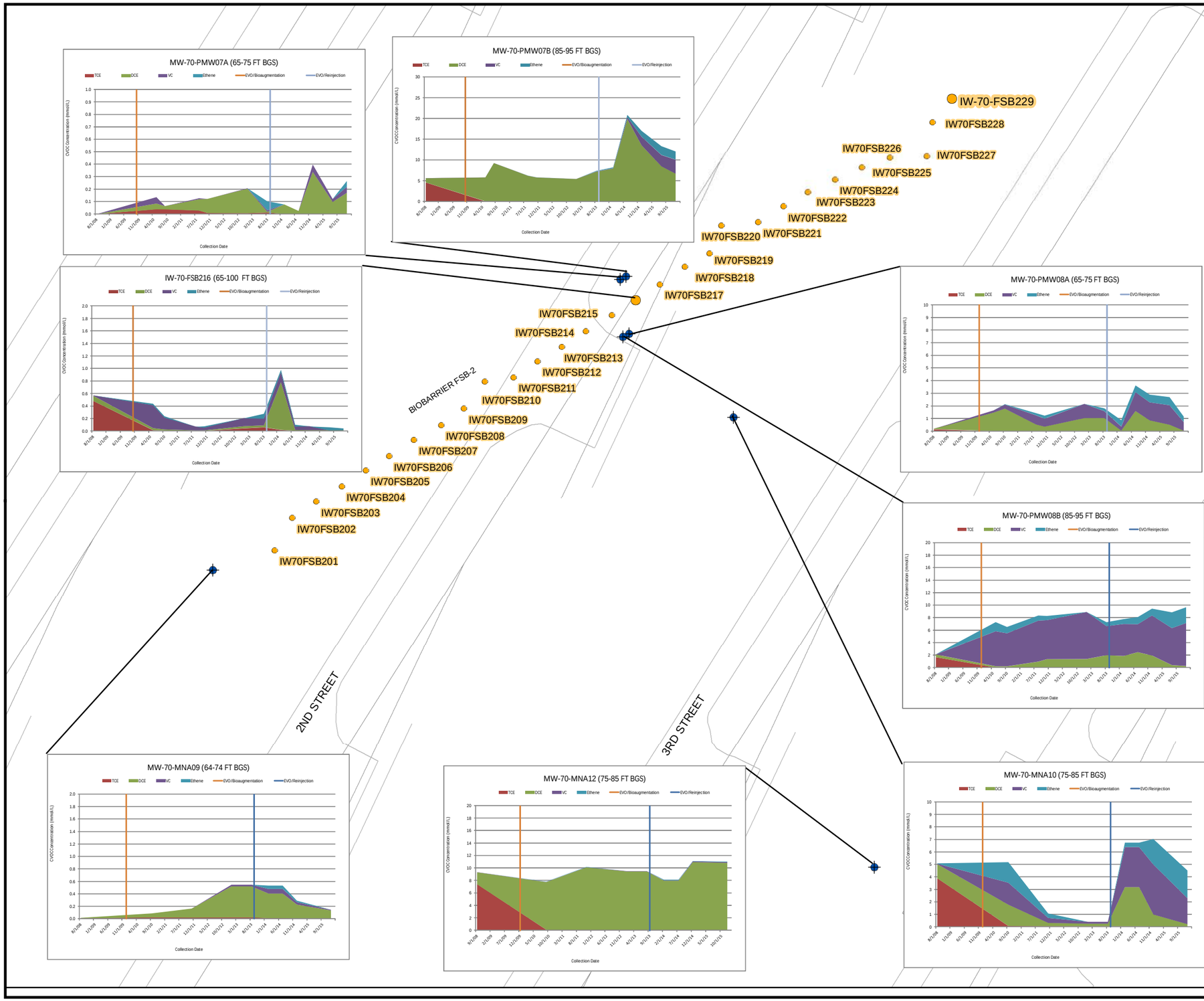
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-10.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-10.mxd

This Page Intentionally Left Blank



LEGEND

- FIRST SAND BIOBARRIER 2 MONITORING WELL
- SAMPLED BIOBARRIER OR SOURCE AREA TREATMENT WELL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- BUILDING

50 25 0 50 100 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-11
CVOC MOLAR CONCENTRATION - FIRST SAND BIOBARRIER 2

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

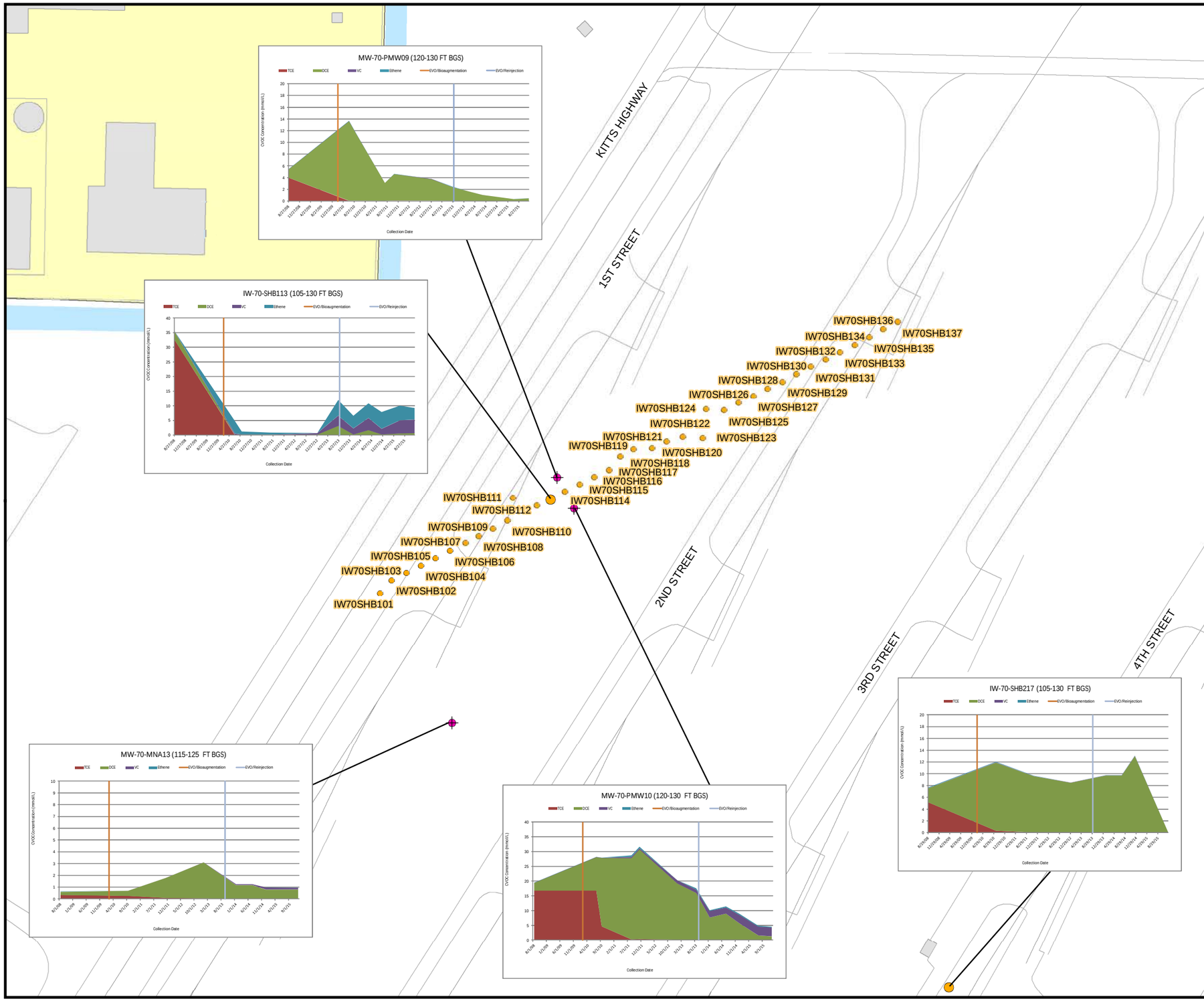
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-11.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-12.mxd

This Page Intentionally Left Blank



LEGEND

- SHELL HORIZON BIOBARRIER 1 MONITORING WELL
- SAMPLED BIOBARRIER OR SOURCE AREA TREATMENT WELL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- BUILDING

100 50 0 100 200 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-12
CVOC MOLAR CONCENTRATION - SHELL HORIZON BIOBARRIER 1

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

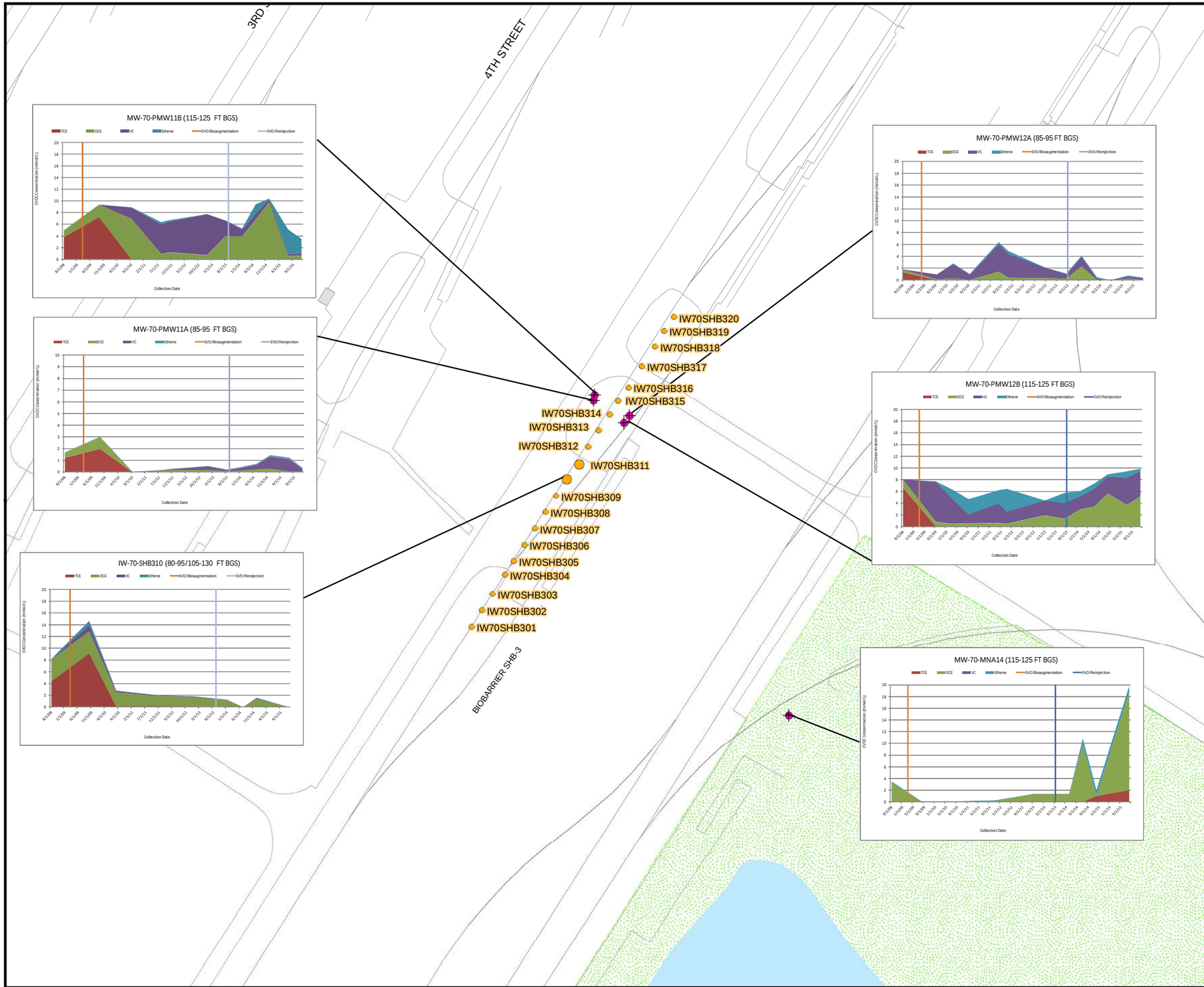
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-12.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map Documents\FIGURE 2-12.mxd

This Page Intentionally Left Blank



LEGEND

- SHELL HORIZON BIOBARRIER 3 MONITORING WELL
- SAMPLED BIOBARRIER OR SOURCE AREA TREATMENT WELL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- BUILDING

100 50 0 100 200 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-13
CVOC MOLAR CONCENTRATION - SHELL HORIZON BIOBARRIER 3

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

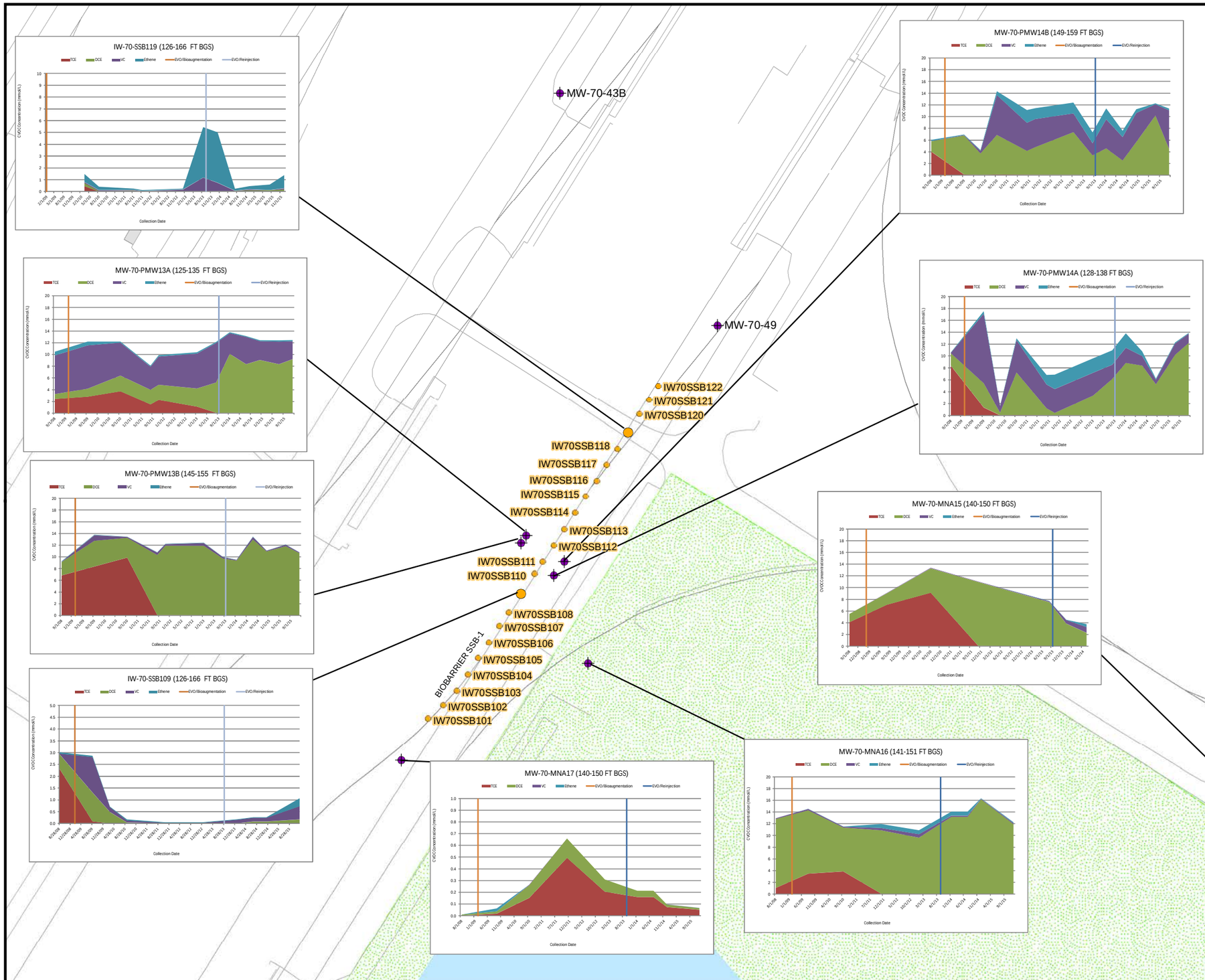
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-13.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-12.mxd

This Page Intentionally Left Blank



LEGEND

- SECOND SAND BIOBARRIER 1 MONITORING WELL
- SAMPLED BIOBARRIER OR SOURCE AREA TREATMENT WELL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- BUILDING

50 25 0 50 100 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-14
CVOC MOLAR CONCENTRATION - SECOND SAND BIOBARRIER 1

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

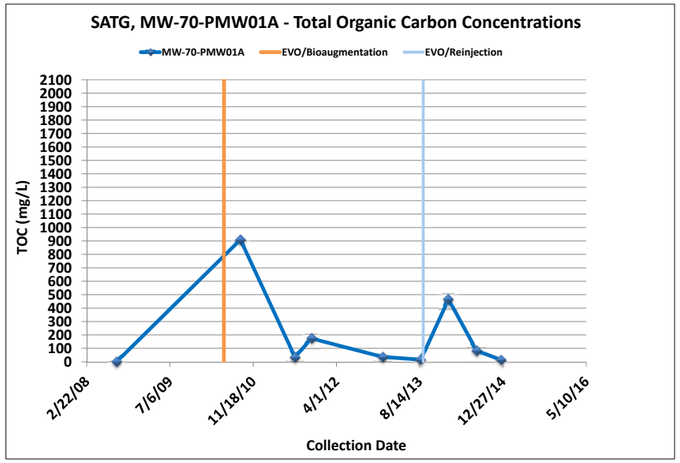
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-14.mxd

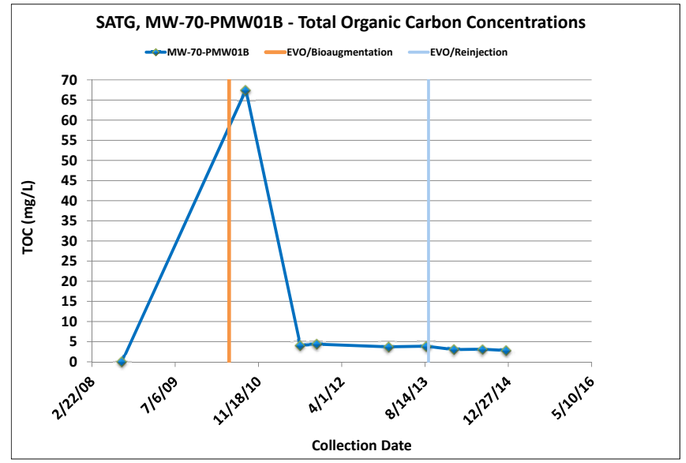
NAVFAC
ECC-INSIGHT LLC

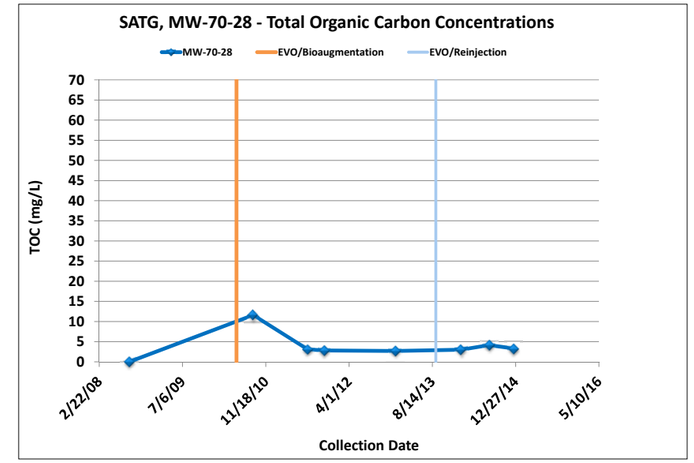
Path: F:\Projects\SealBeach\Map Documents\FIGURE 2-12.mxd

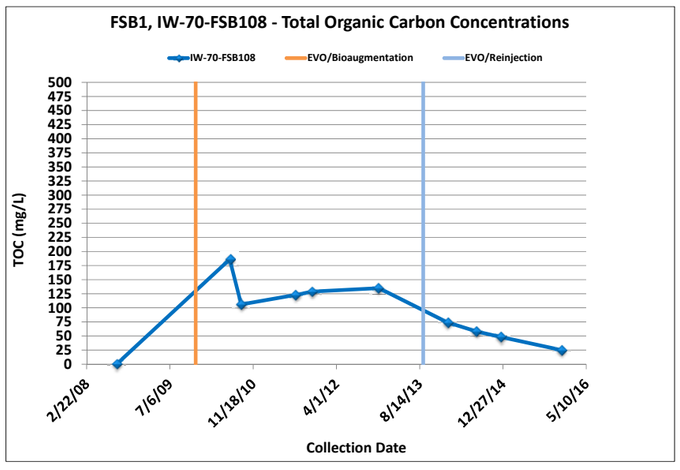
This Page Intentionally Left Blank

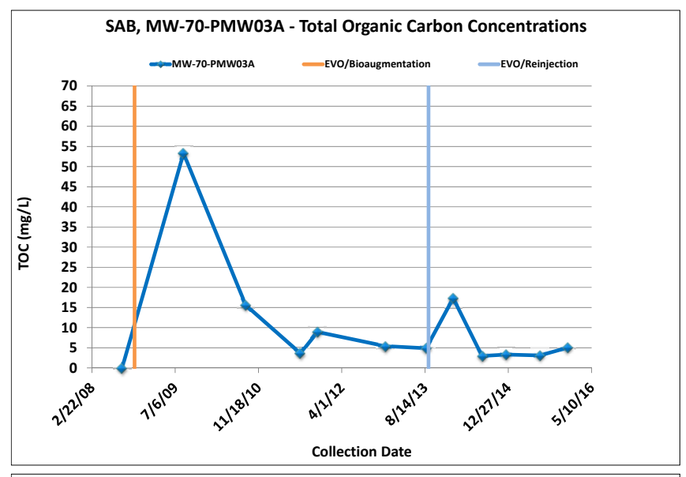
FIGURE 2-15
TOTAL ORGANIC CARBON TRENDS: SATG, SAB, AND FSB-1

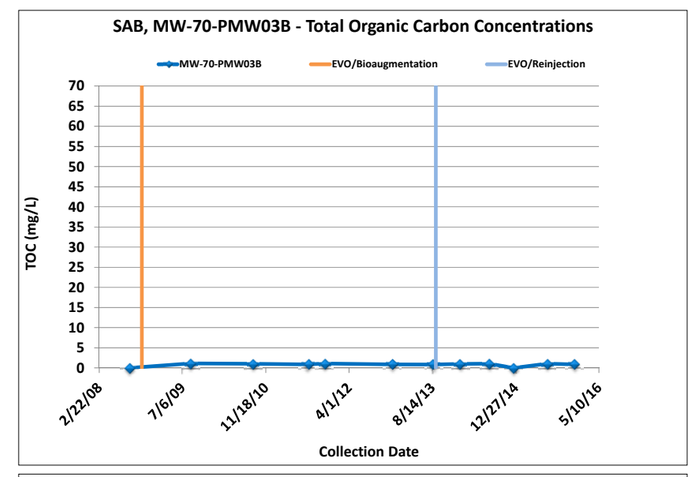


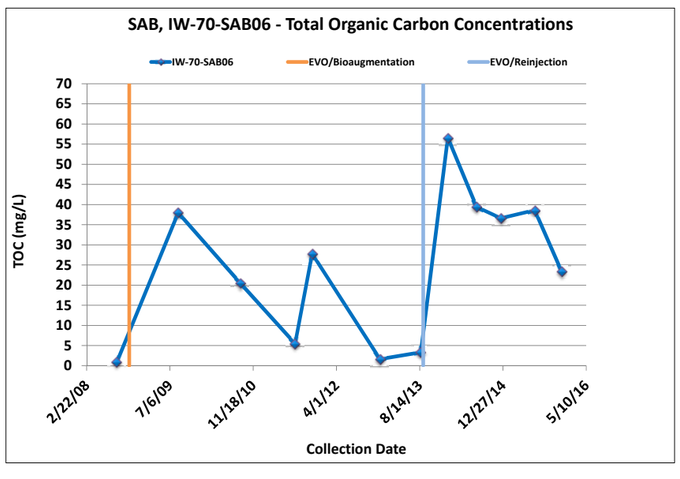


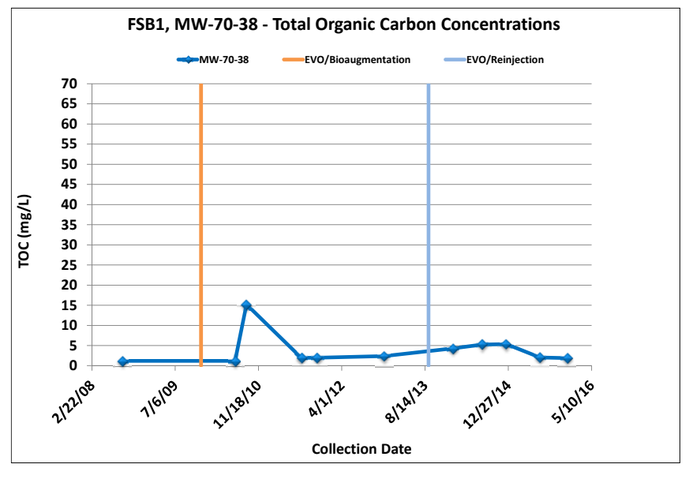


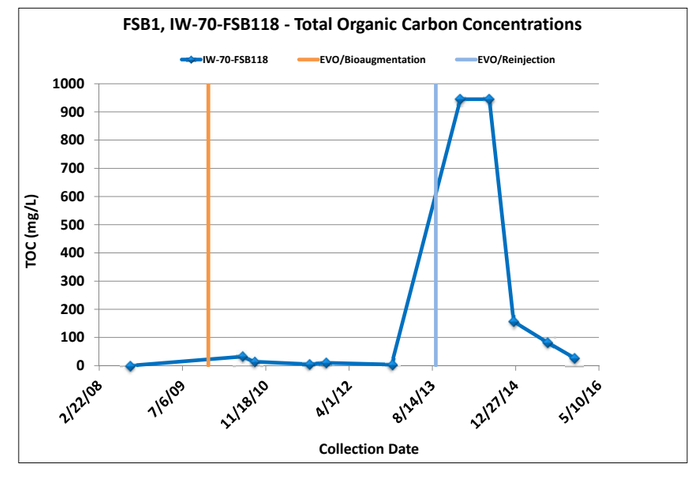






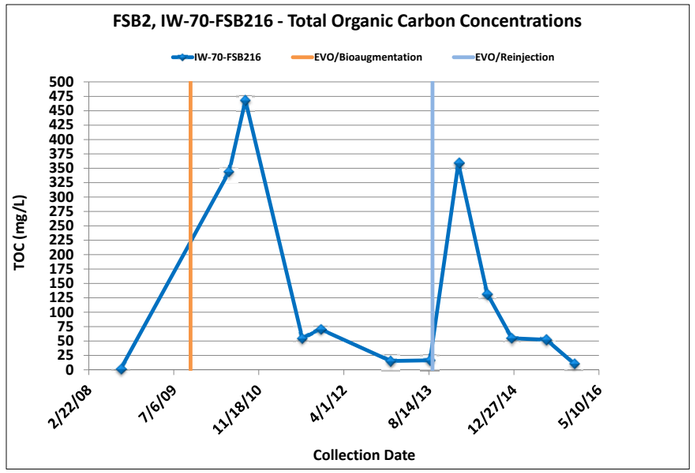


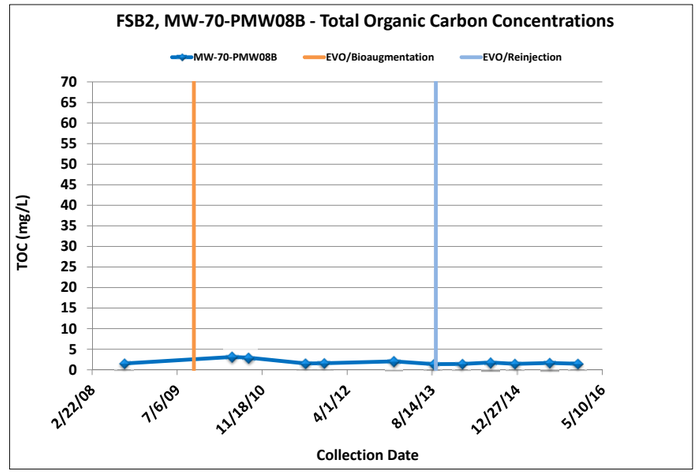


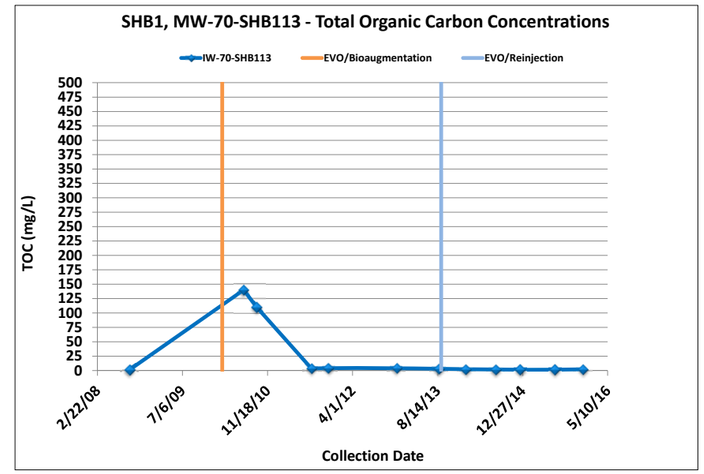


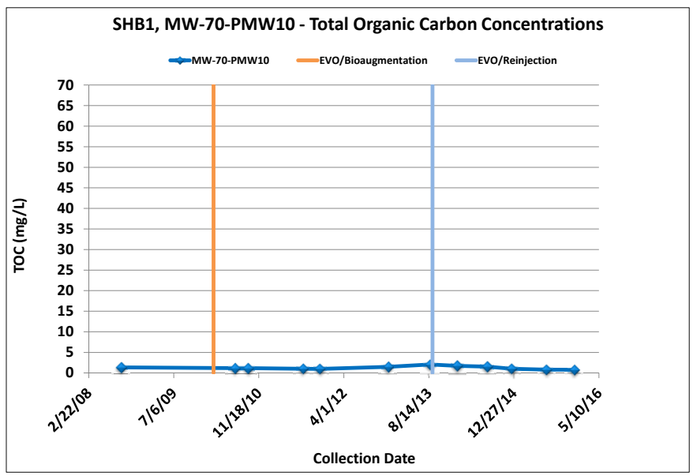
This Page Intentionally Left Blank

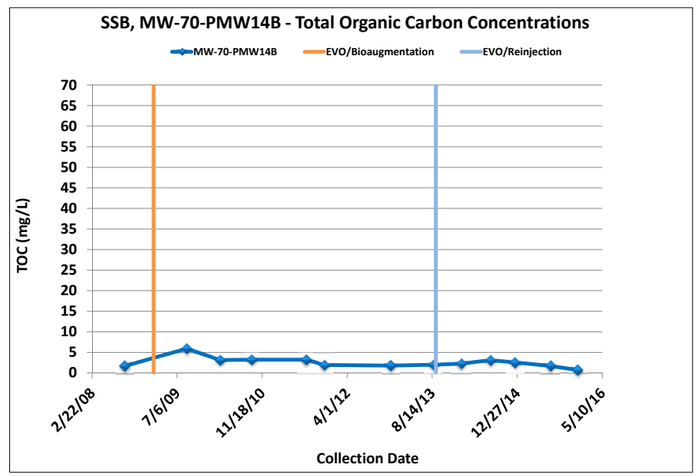
FIGURE 2-16
TOTAL ORGANIC CARBON TRENDS: FSB-2, SHB-1, SHB-3, AND SSB-1

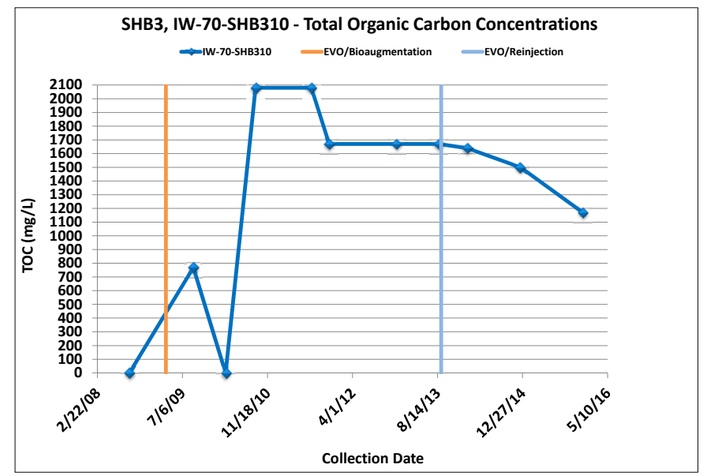


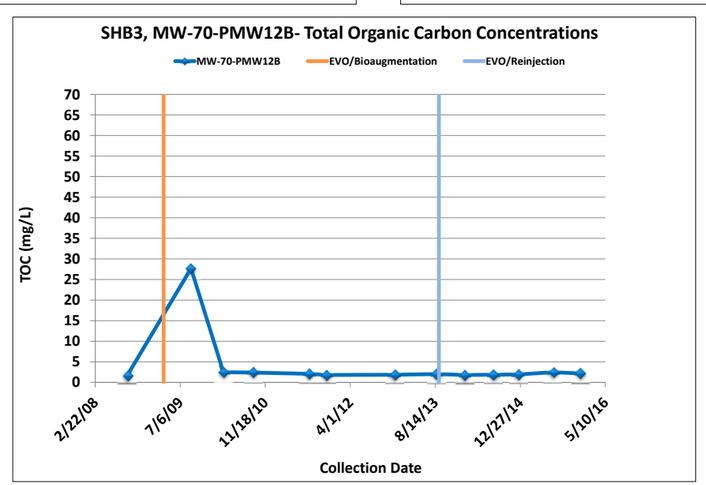


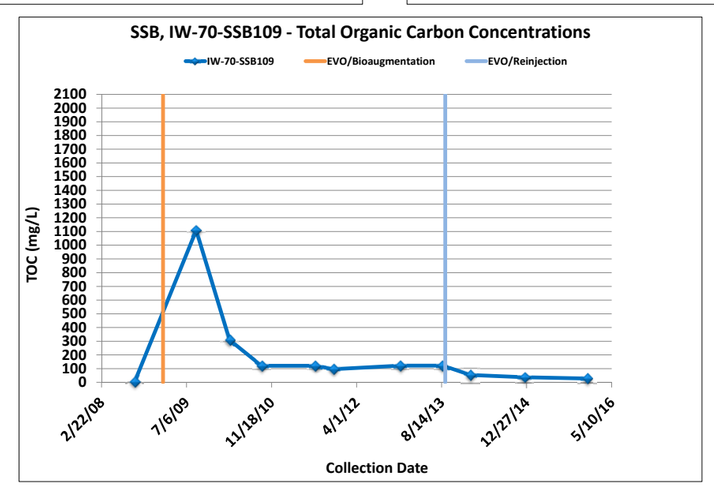






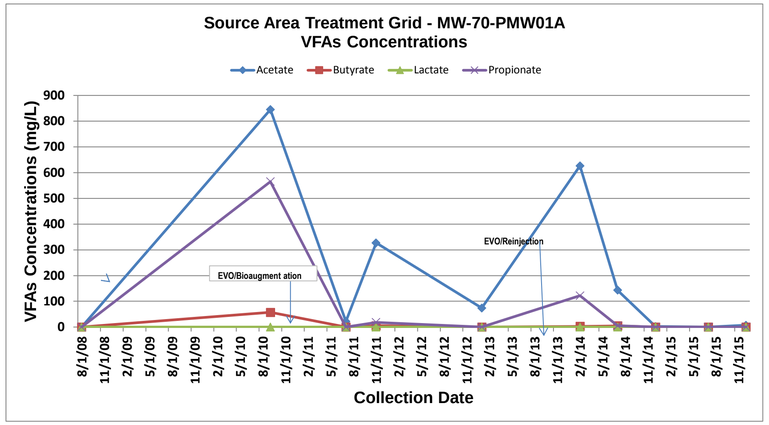


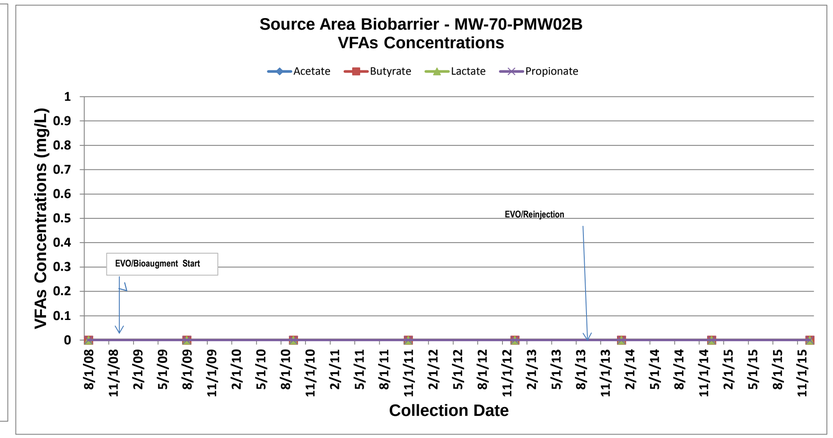


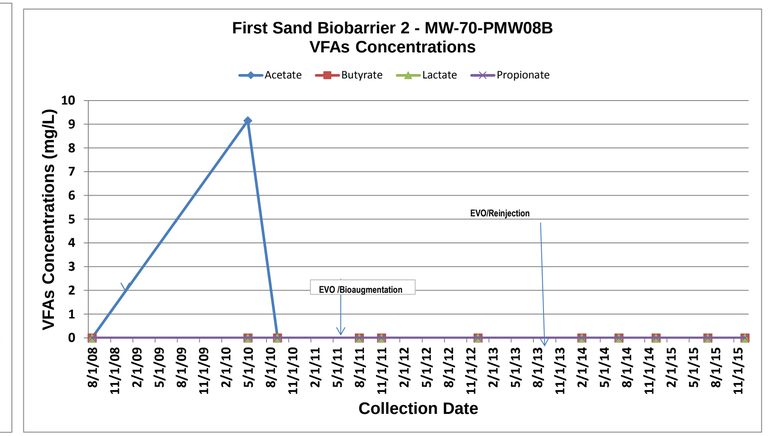


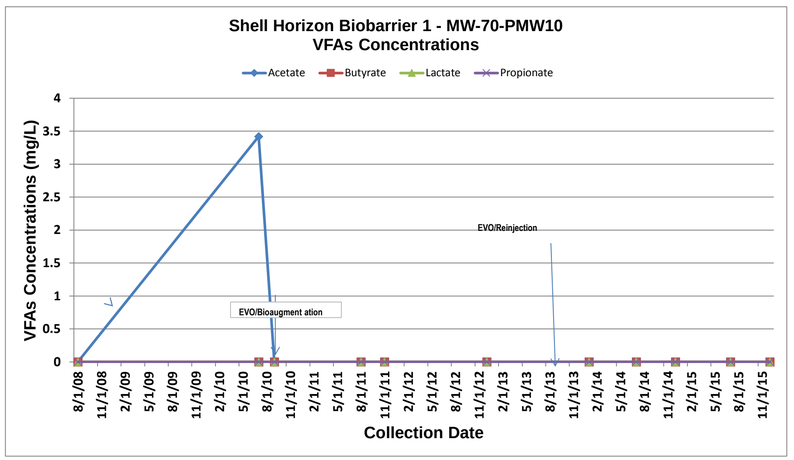
This Page Intentionally Left Blank

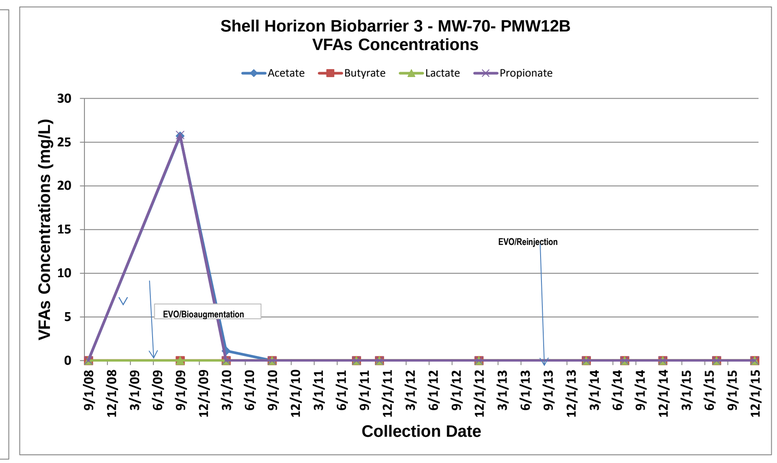
FIGURE 2-17
VOLATILE FATTY ACID (VFA) TRENDS SINCE BASELINE

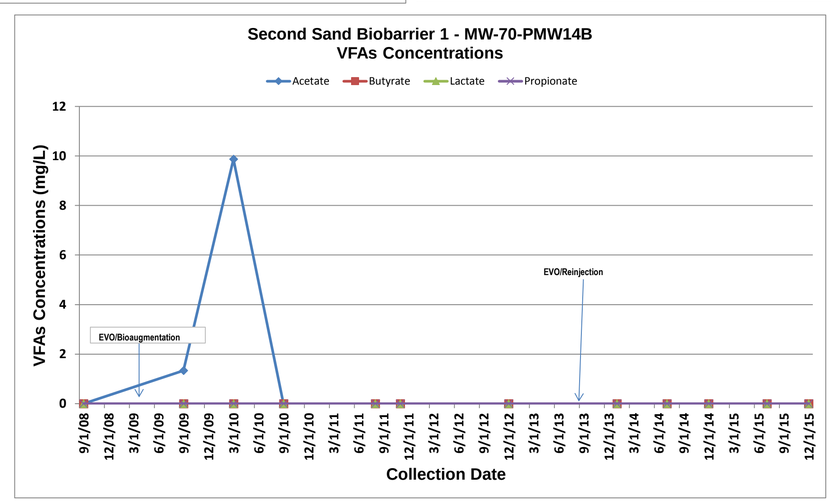






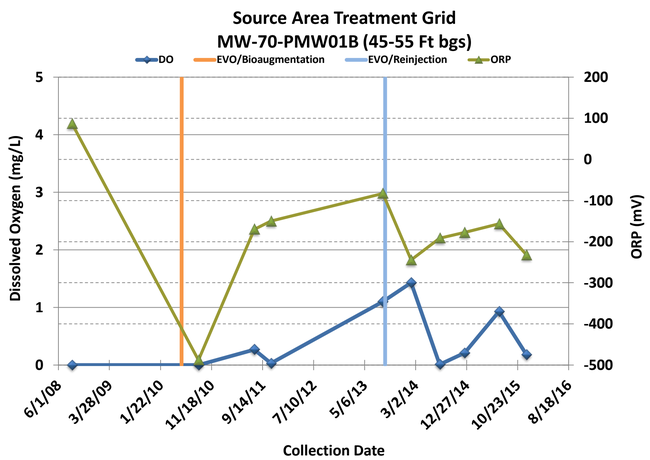


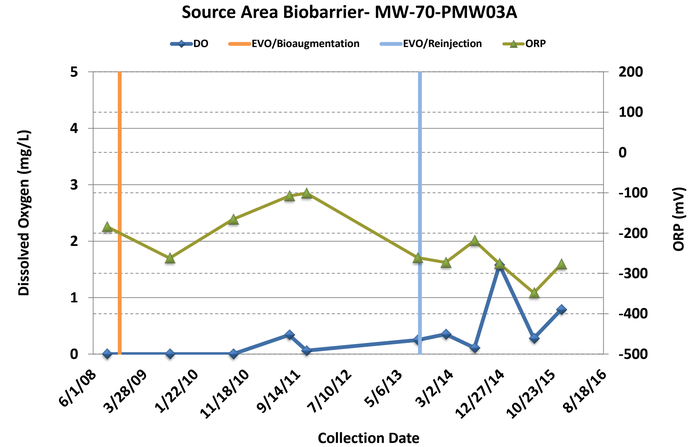


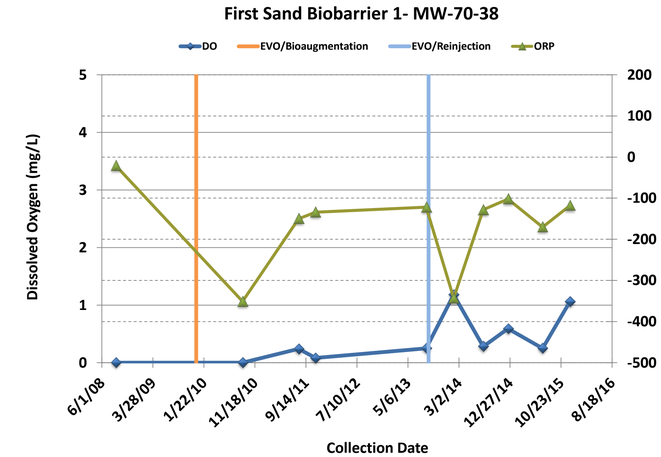


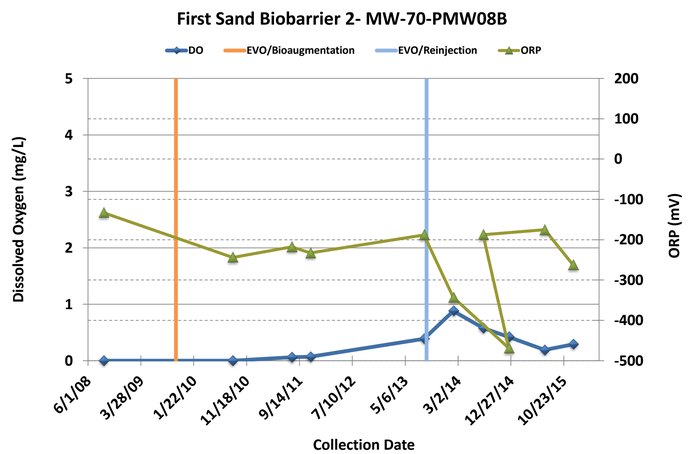
This Page Intentionally Left Blank

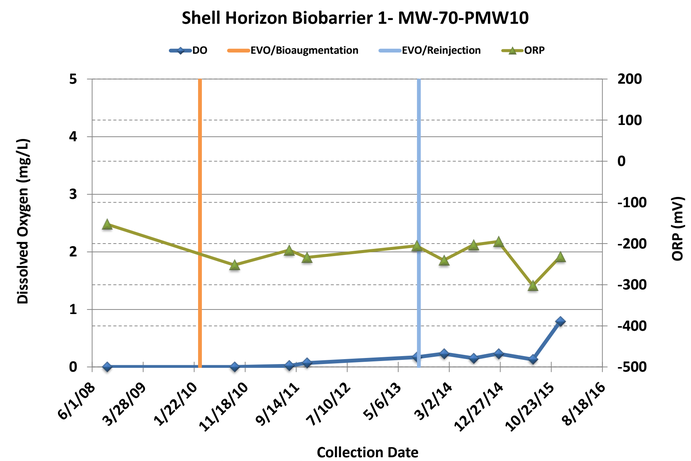
FIGURE 2-18
DO-ORP TRENDS SINCE BASELINE

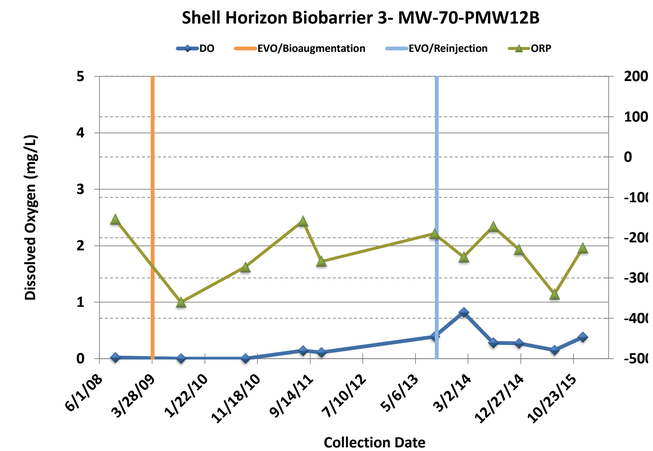


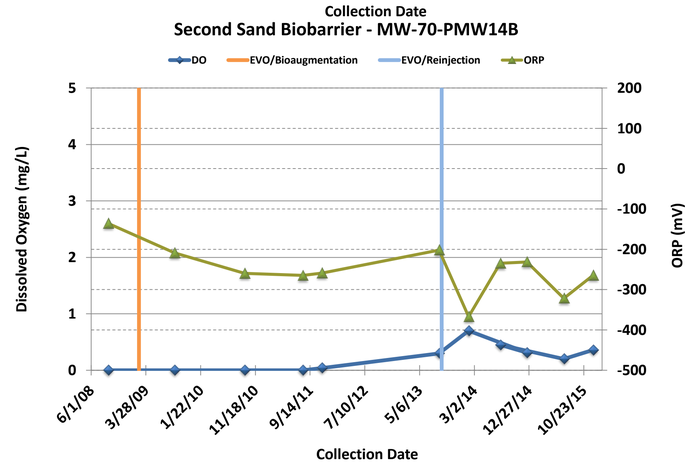






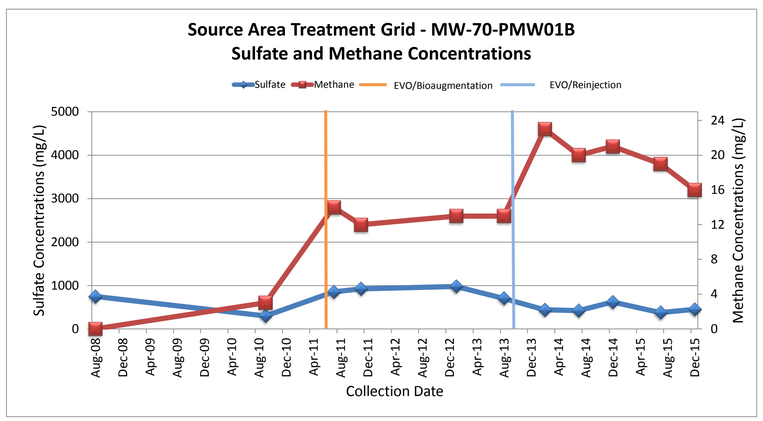


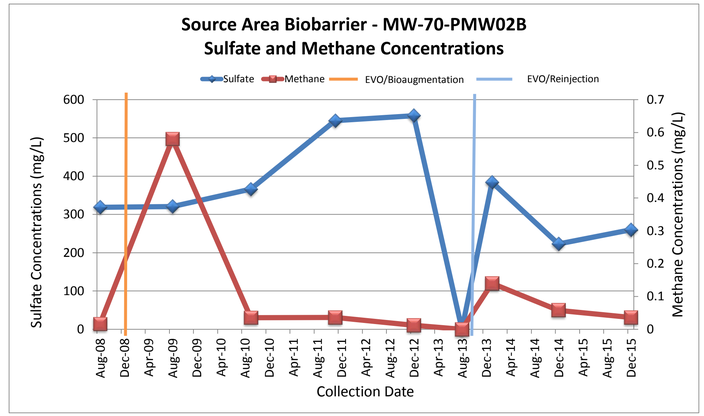


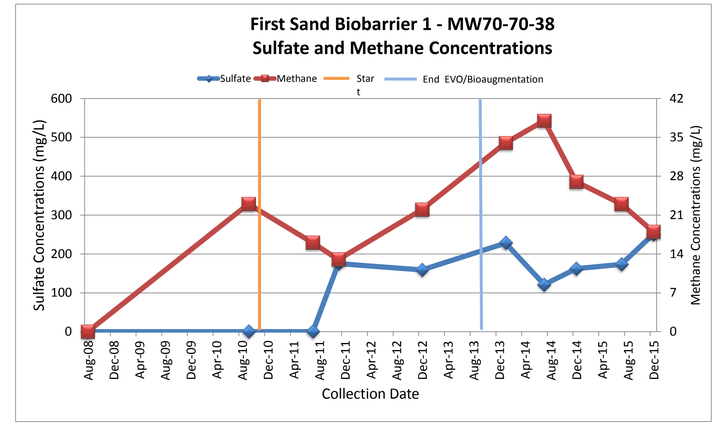


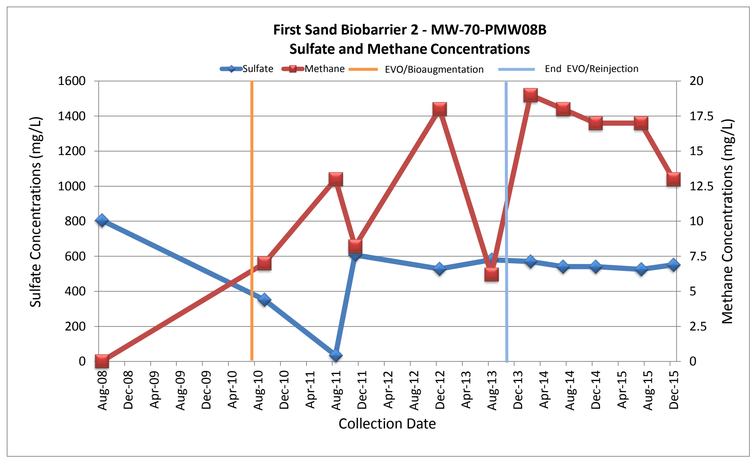
This Page Intentionally Left Blank

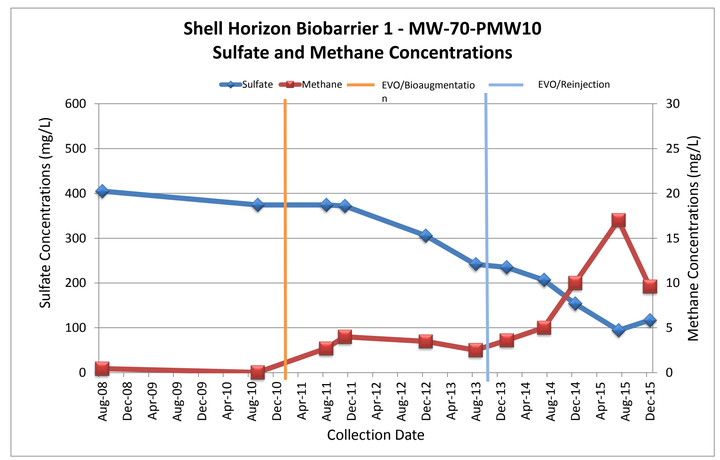
FIGURE 2-19
SULFATE-METHANE TRENDS SINCE BASELINE

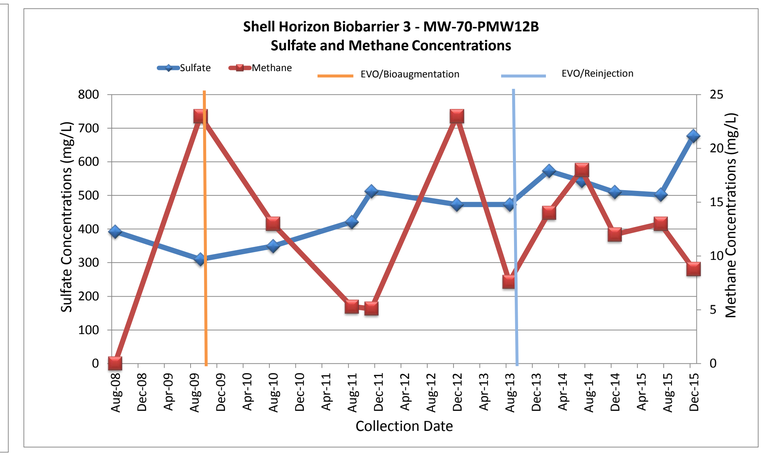


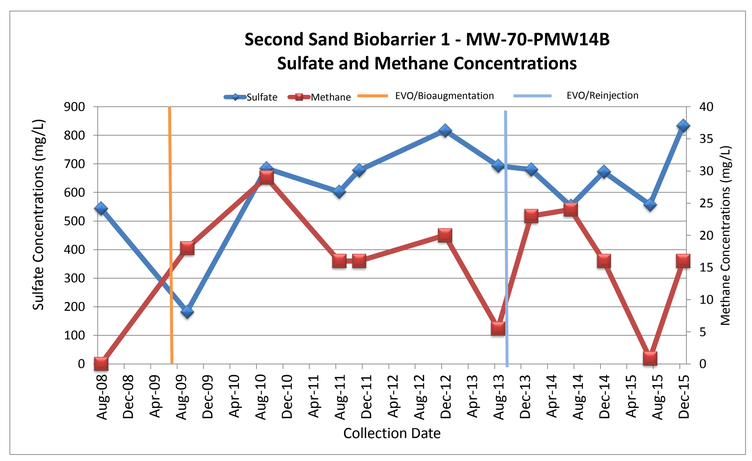






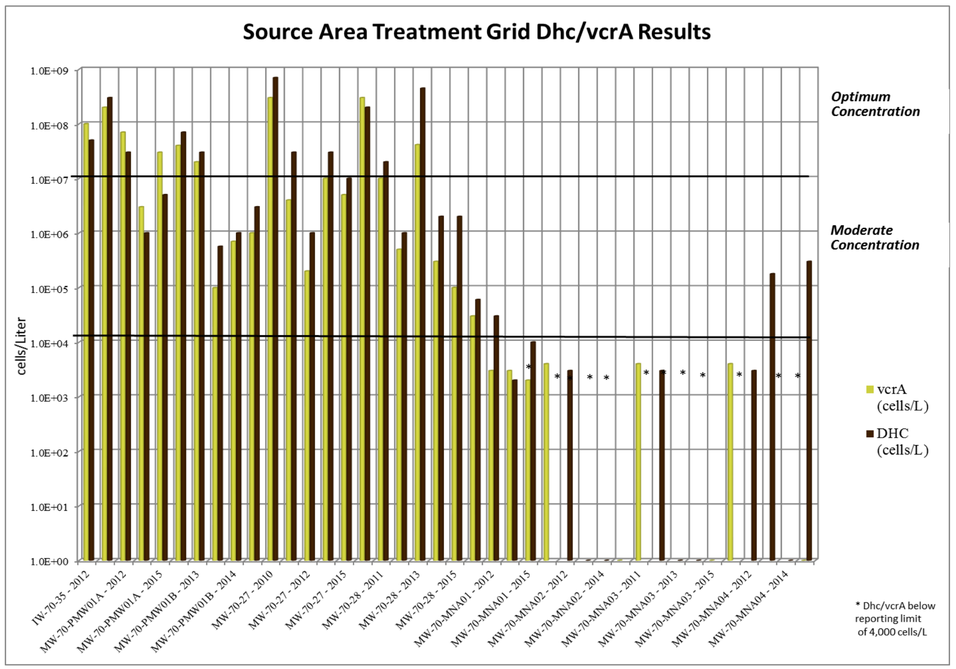


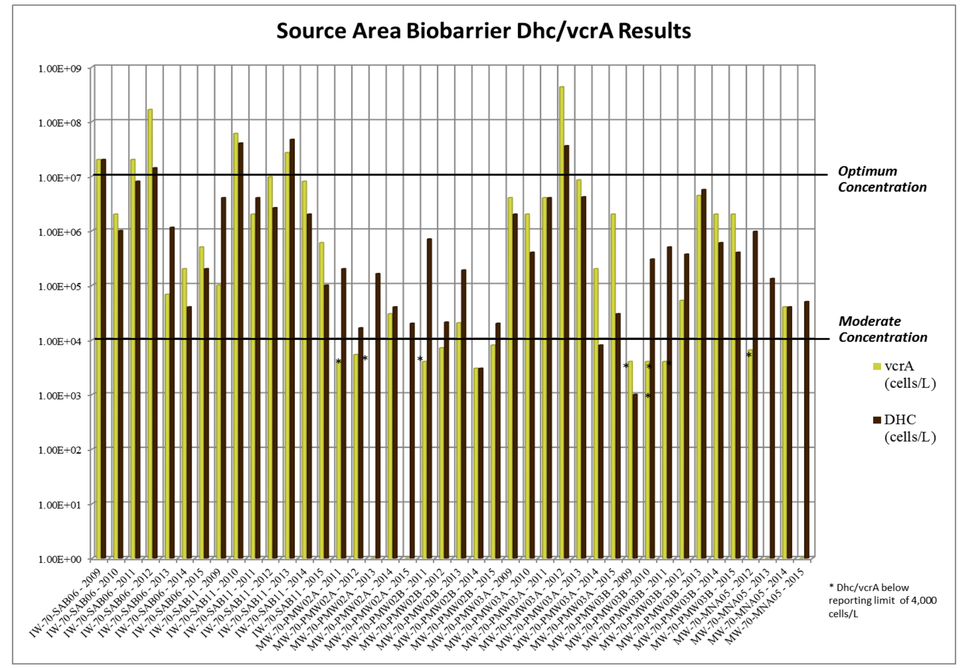


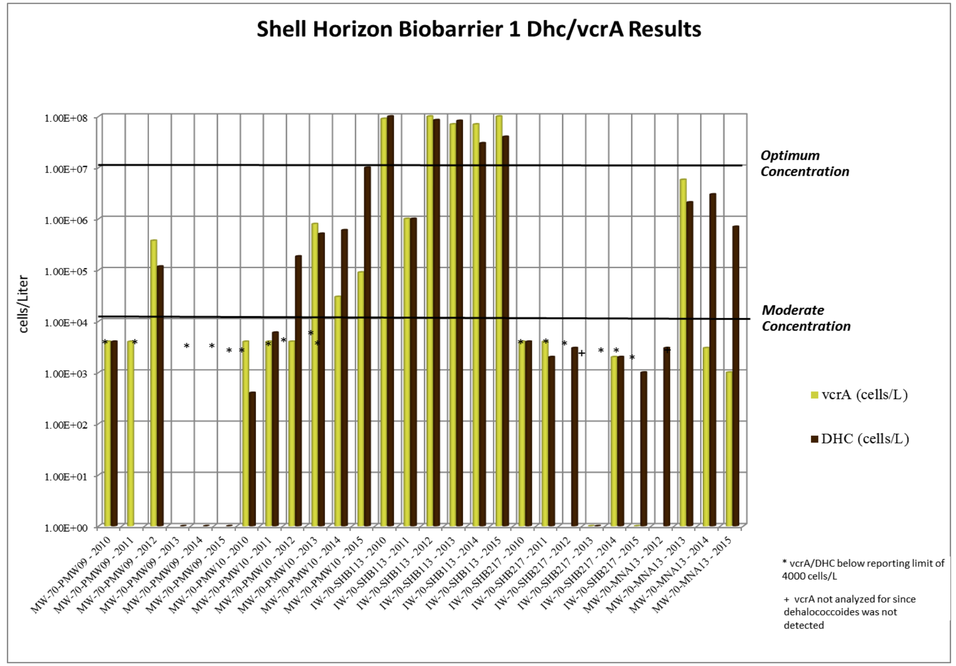


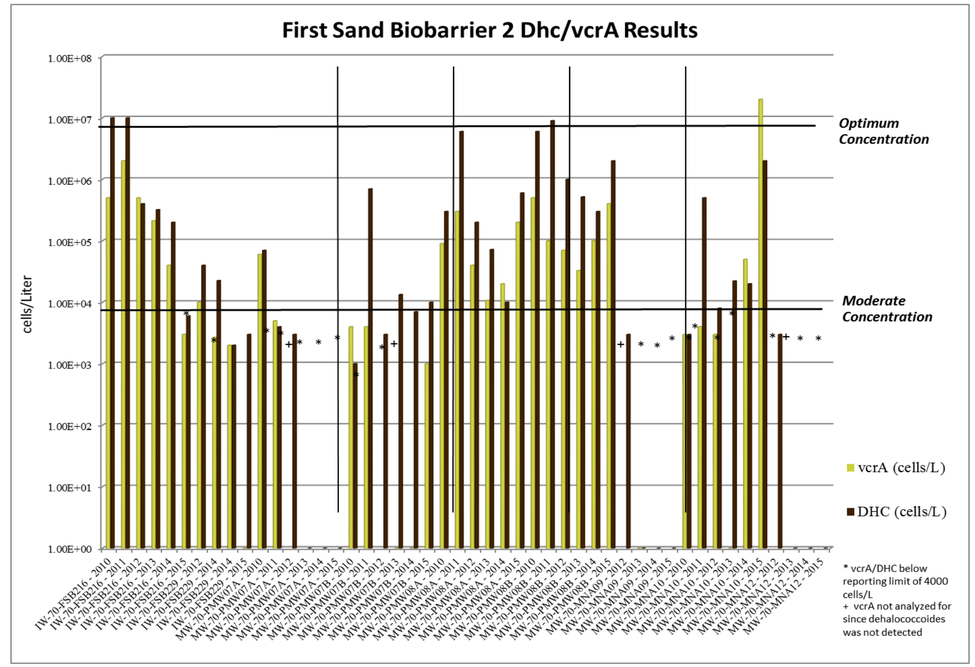
This Page Intentionally Left Blank

FIGURE 2-20
DEHALOCOCCOIDES TRENDS SINCE BASELINE: SATG, SAB, FSB-1, FSB-2



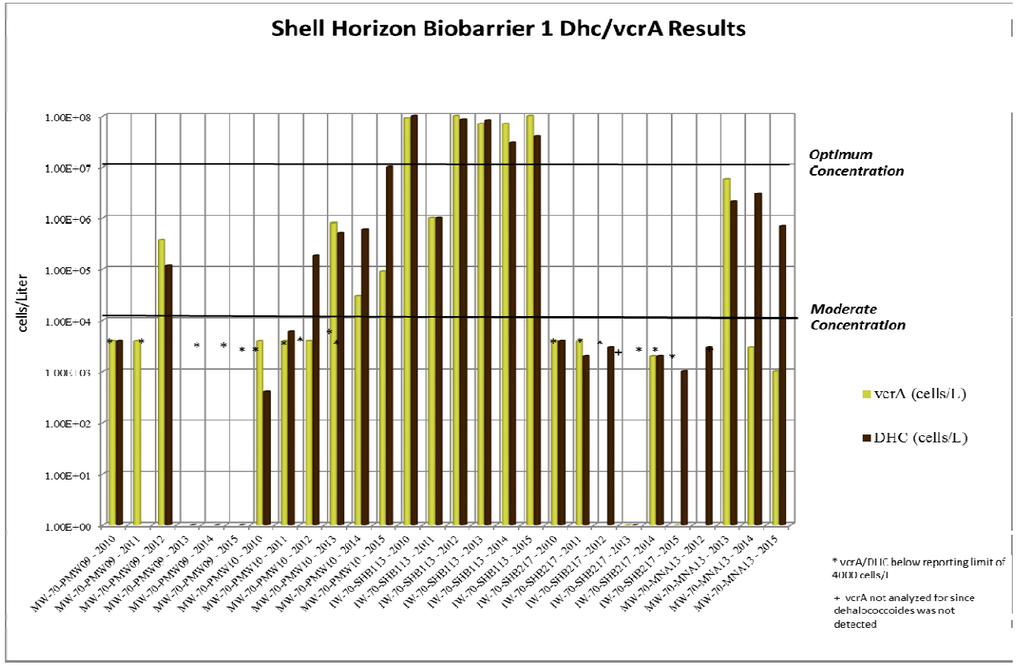


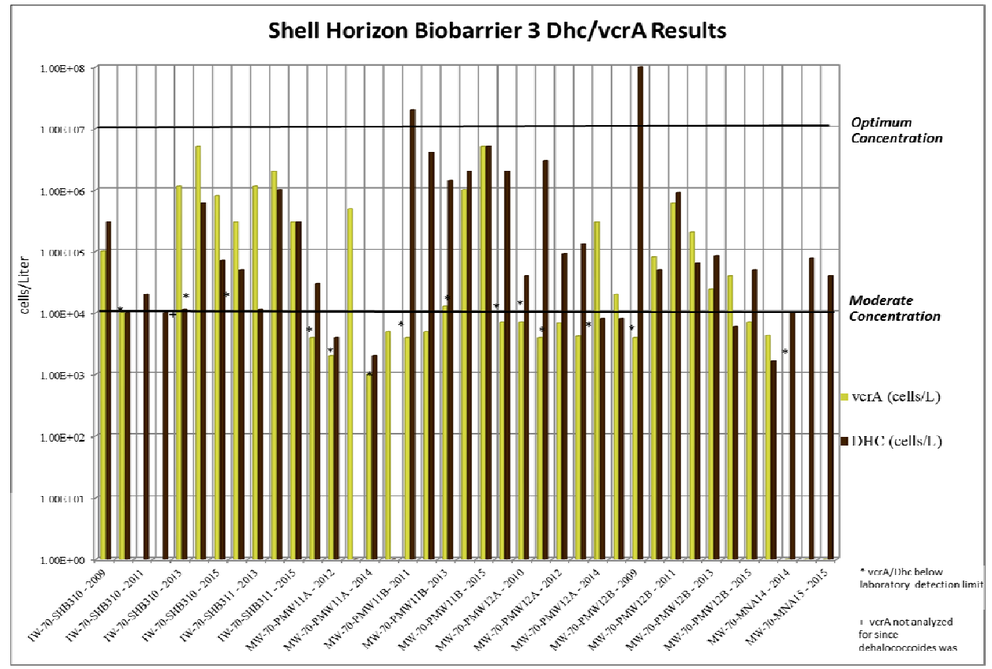


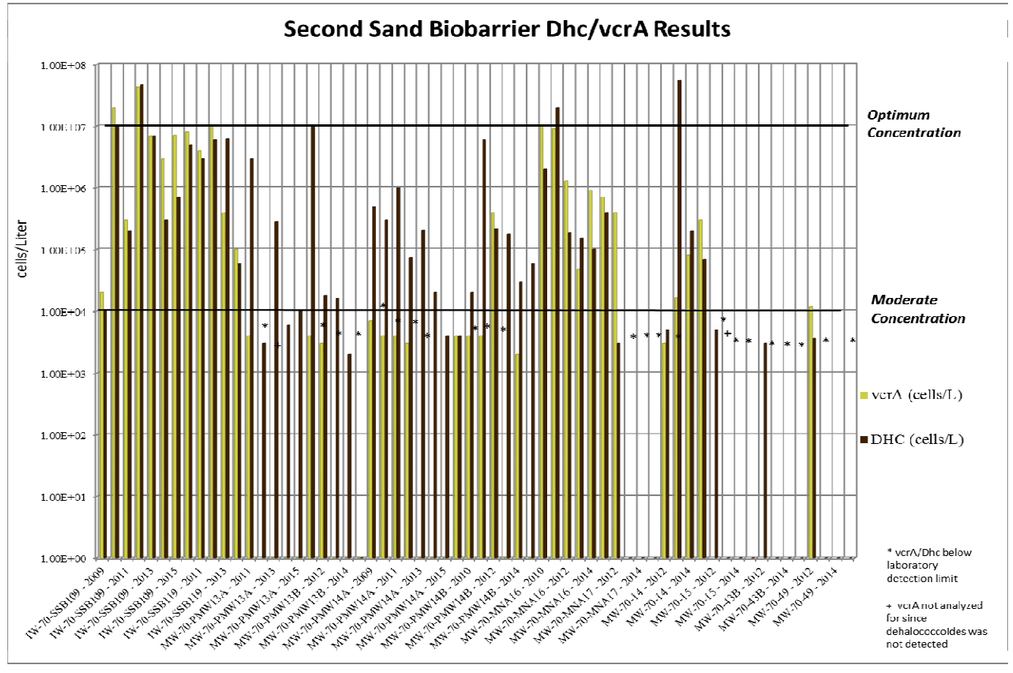


This Page Intentionally Left Blank

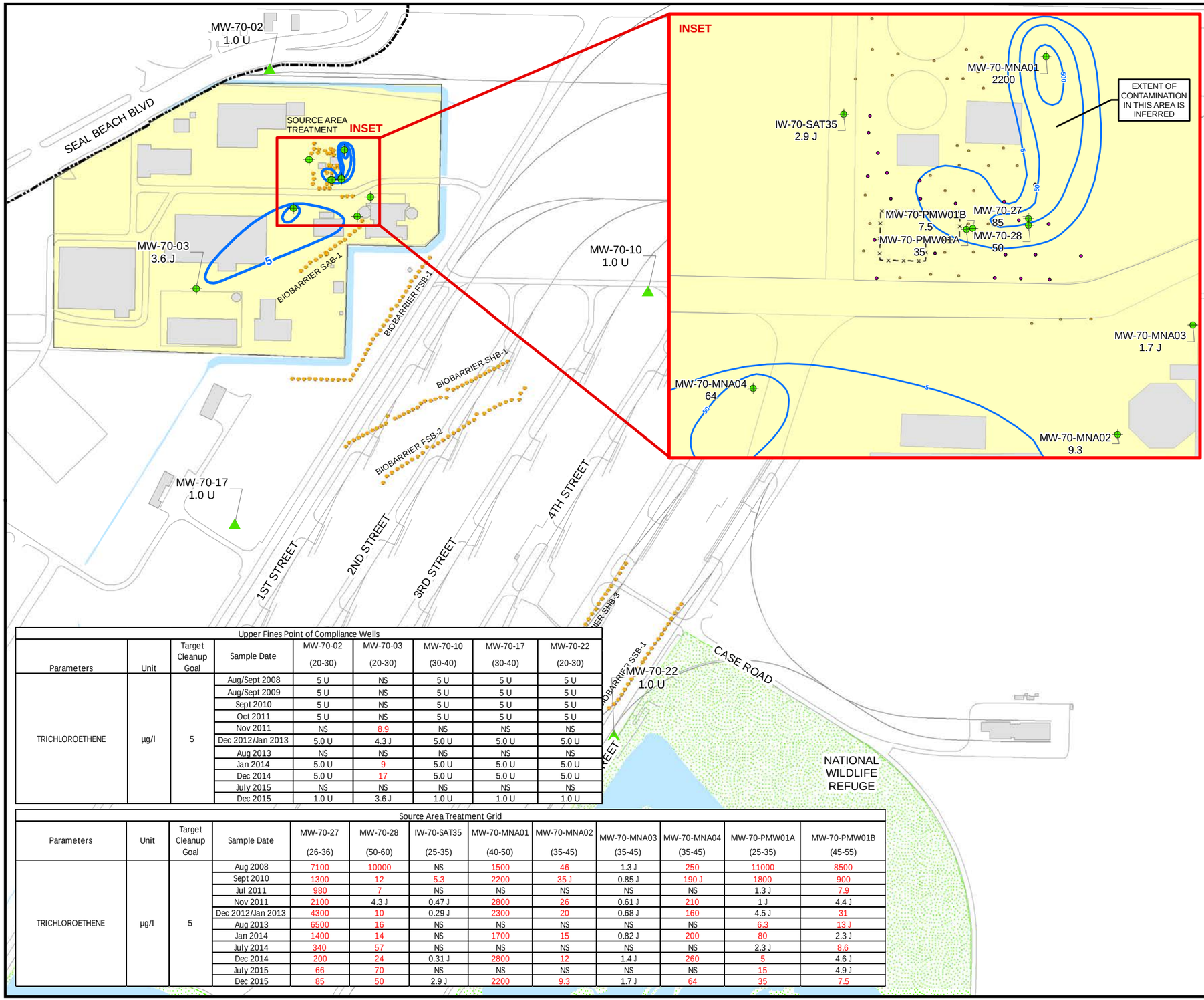
FIGURE 2-21
DEHALOCOCCOIDES TRENDS SINCE BASELINE: SHB-1, SHB-3, SSB







This Page Intentionally Left Blank



LEGEND

MW-70-MNA02 71	UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L
MW-70-02 1.0 U	UPPER FINES POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L
IW-70-SAT01 0.89J	SAMPLED BIOBARRIER OR SOURCE AREA TREATMENT WELL
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	BUILDING
5	APPROXIMATE ISOCONCENTRATION CONTOUR (ug/L)

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED
VALUE IS THE DETECTION LIMIT

POC - POINT OF COMPLIANCE

TCE - TRICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT
EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

200 100 0 200 400
Feet

N

Upper Fines Point of Compliance Wells

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-02 (20-30)	MW-70-03 (20-30)	MW-70-10 (30-40)	MW-70-17 (30-40)	MW-70-22 (20-30)
TRICHLOROETHENE	µg/l	5	Aug/Sept 2008	5 U	NS	5 U	5 U	5 U
			Aug/Sept 2009	5 U	NS	5 U	5 U	5 U
			Sept 2010	5 U	NS	5 U	5 U	5 U
			Oct 2011	5 U	NS	5 U	5 U	5 U
			Nov 2011	NS	8.9	NS	NS	NS
			Dec 2012/Jan 2013	5.0 U	4.3 J	5.0 U	5.0 U	5.0 U
			Aug 2013	NS	NS	NS	NS	NS
			Jan 2014	5.0 U	9	5.0 U	5.0 U	5.0 U
			Dec 2014	5.0 U	17	5.0 U	5.0 U	5.0 U
			July 2015	NS	NS	NS	NS	NS
			Dec 2015	1.0 U	3.6 J	1.0 U	1.0 U	1.0 U

Source Area Treatment Grid

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-27 (26-36)	MW-70-28 (50-60)	IW-70-SAT35 (25-35)	MW-70-MNA01 (40-50)	MW-70-MNA02 (35-45)	MW-70-MNA03 (35-45)	MW-70-MNA04 (35-45)	MW-70-PMW01A (25-35)	MW-70-PMW01B (45-55)
TRICHLOROETHENE	µg/l	5	Aug 2008	7100	10000	NS	1500	46	1.3 J	250	11000	8500
			Sept 2010	1300	12	5.3	2200	35 J	0.85 J	190 J	1800	900
			Jul 2011	980	7	NS	NS	NS	NS	NS	1.3 J	7.9
			Nov 2011	2100	4.3 J	0.47 J	2800	26	0.61 J	210	1 J	4.4 J
			Dec 2012/Jan 2013	4300	10	0.29 J	2300	20	0.68 J	160	4.5 J	31
			Aug 2013	6500	16	NS	NS	NS	NS	NS	6.3	13 J
			Jan 2014	1400	14	NS	1700	15	0.82 J	200	80	2.3 J
			July 2014	340	57	NS	NS	NS	NS	NS	2.3 J	8.6
			Dec 2014	200	24	0.31 J	2800	12	1.4 J	260	5	4.6 J
			July 2015	66	70	NS	NS	NS	NS	NS	15	4.9 J
			Dec 2015	85	50	2.9 J	2200	9.3	1.7 J	64	35	7.5

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-22
IR SITE 70, UPPER FINES - SOURCE AREA TREATMENT GRID
TRICHLOROETHENE IN GROUNDWATER - 2015

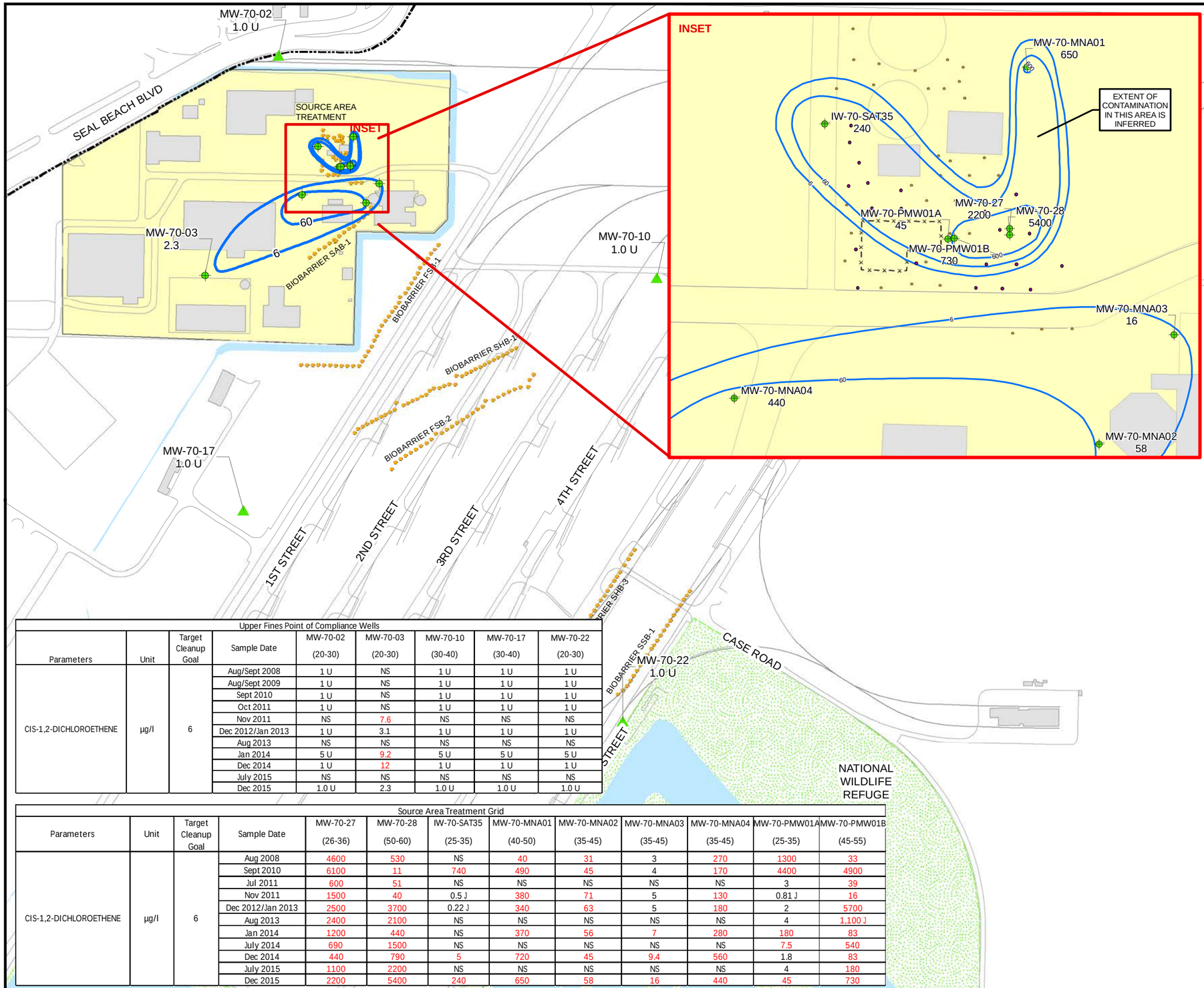
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-22.mxd

NAVFAC
ECC-INSIGHT LLC

Path: P:\Projects\SealBeach\Map Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-MNA02 71	UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L
MW-70-02 1.0 U	UPPER FINES POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L
IW-70-SAT01 0.89J	SAMPLED BIOBARRIER OR SOURCE AREA TREATMENT WELL
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	BUILDING
5	APPROXIMATE ISOCONCENTRATION CONTOUR (ug/L)

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED
VALUE IS THE DETECTION LIMIT

POC - POINT OF COMPLIANCE

CIS-1,2-DCE - CIS-1,2-DICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT
EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

200 100 0 200 400
Feet

N

Upper Fines Point of Compliance Wells

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-02 (20-30)	MW-70-03 (20-30)	MW-70-10 (30-40)	MW-70-17 (30-40)	MW-70-22 (20-30)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	1 U	NS	1 U	1 U	1 U
			Aug/Sept 2009	1 U	NS	1 U	1 U	1 U
			Sept 2010	1 U	NS	1 U	1 U	1 U
			Oct 2011	1 U	NS	1 U	1 U	1 U
			Nov 2011	NS	7.6	NS	NS	NS
			Dec 2012/Jan 2013	1 U	3.1	1 U	1 U	1 U
			Aug 2013	NS	NS	NS	NS	NS
			Jan 2014	5 U	9.2	5 U	5 U	5 U
			Dec 2014	1 U	12	1 U	1 U	1 U
			July 2015	NS	NS	NS	NS	NS
			Dec 2015	1.0 U	2.3	1.0 U	1.0 U	1.0 U

Source Area Treatment Grid

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-27 (26-36)	MW-70-28 (50-60)	IW-70-SAT35 (25-35)	MW-70-MNA01 (40-50)	MW-70-MNA02 (35-45)	MW-70-MNA03 (35-45)	MW-70-MNA04 (35-45)	MW-70-PMW01A (25-35)	MW-70-PMW01B (45-55)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug 2008	4600	530	NS	40	31	3	270	1300	33
			Sept 2010	6100	11	740	490	45	4	170	4400	4900
			Jul 2011	600	51	NS	NS	NS	NS	NS	3	39
			Nov 2011	1500	40	0.5 J	380	71	5	130	0.81 J	16
			Dec 2012/Jan 2013	2500	3700	0.22 J	340	63	5	180	2	5700
			Aug 2013	2400	2100	NS	NS	NS	NS	NS	4	1,100 J
			Jan 2014	1200	440	NS	370	56	7	280	180	83
			July 2014	690	1500	NS	NS	NS	NS	NS	7.5	540
			Dec 2014	440	790	5	720	45	9.4	560	1.8	83
			July 2015	1100	2200	NS	NS	NS	NS	NS	4	180
			Dec 2015	2200	5400	240	650	58	16	440	45	730

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-23

IR SITE 70, UPPER FINES - SOURCE AREA TREATMENT GRID
CIS-1,2-DICHLOROETHENE IN GROUNDWATER - 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

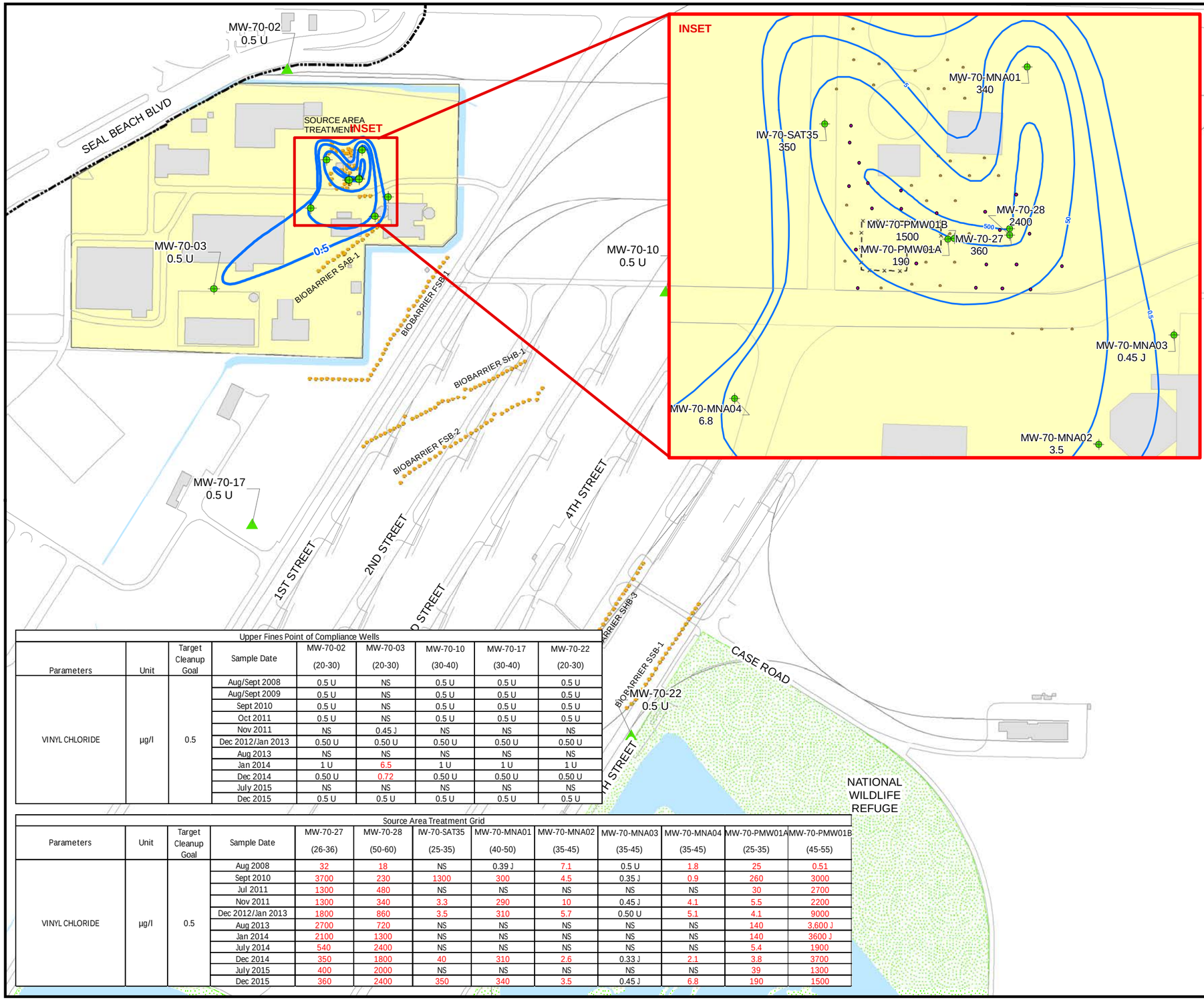
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-23.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map\Documents\FIGURE 2-23.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-MNA02 71	UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L
MW-70-02 1.0 U	UPPER FINES POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L
IW-70-SAT01 0.89J	SAMPLED BIOBARRIER OR SOURCE AREA TREATMENT WELL
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	BUILDING
5	APPROXIMATE ISOCONCENTRATION CONTOUR (ug/L)

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED
VALUE IS THE DETECTION LIMIT

POC - POINT OF COMPLIANCE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT
EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

200 100 0 200 400
Feet

N

Upper Fines Point of Compliance Wells

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-02 (20-30)	MW-70-03 (20-30)	MW-70-10 (30-40)	MW-70-17 (30-40)	MW-70-22 (20-30)
VINYL CHLORIDE	µg/l	0.5	Aug/Sept 2008	0.5 U	NS	0.5 U	0.5 U	0.5 U
			Aug/Sept 2009	0.5 U	NS	0.5 U	0.5 U	0.5 U
			Sept 2010	0.5 U	NS	0.5 U	0.5 U	0.5 U
			Oct 2011	0.5 U	NS	0.5 U	0.5 U	0.5 U
			Nov 2011	NS	0.45 J	NS	NS	NS
			Dec 2012/Jan 2013	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
			Aug 2013	NS	NS	NS	NS	NS
			Jan 2014	1 U	6.5	1 U	1 U	1 U
			Dec 2014	0.50 U	0.72	0.50 U	0.50 U	0.50 U
			July 2015	NS	NS	NS	NS	NS
			Dec 2015	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Source Area Treatment Grid

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-27 (26-36)	MW-70-28 (50-60)	IW-70-SAT35 (25-35)	MW-70-MNA01 (40-50)	MW-70-MNA02 (35-45)	MW-70-MNA03 (35-45)	MW-70-MNA04 (35-45)	MW-70-PMW01A (25-35)	MW-70-PMW01B (45-55)
VINYL CHLORIDE	µg/l	0.5	Aug 2008	32	18	NS	0.39 J	7.1	0.5 U	1.8	25	0.51
			Sept 2010	3700	230	1300	300	4.5	0.35 J	0.9	260	3000
			Jul 2011	1300	480	NS	NS	NS	NS	NS	30	2700
			Nov 2011	1300	340	3.3	290	10	0.45 J	4.1	5.5	2200
			Dec 2012/Jan 2013	1800	860	3.5	310	5.7	0.50 U	5.1	4.1	9000
			Aug 2013	2700	720	NS	NS	NS	NS	NS	140	3,600 J
			Jan 2014	2100	1300	NS	NS	NS	NS	NS	140	3600 J
			July 2014	540	2400	NS	NS	NS	NS	NS	5.4	1900
			Dec 2014	350	1800	40	310	2.6	0.33 J	2.1	3.8	3700
			July 2015	400	2000	NS	NS	NS	NS	NS	39	1300
			Dec 2015	360	2400	350	340	3.5	0.45 J	6.8	190	1500

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-24
IR SITE 70, UPPER FINES - SOURCE AREA TREATMENT GRID
VINYL CHLORIDE IN GROUNDWATER - 2015

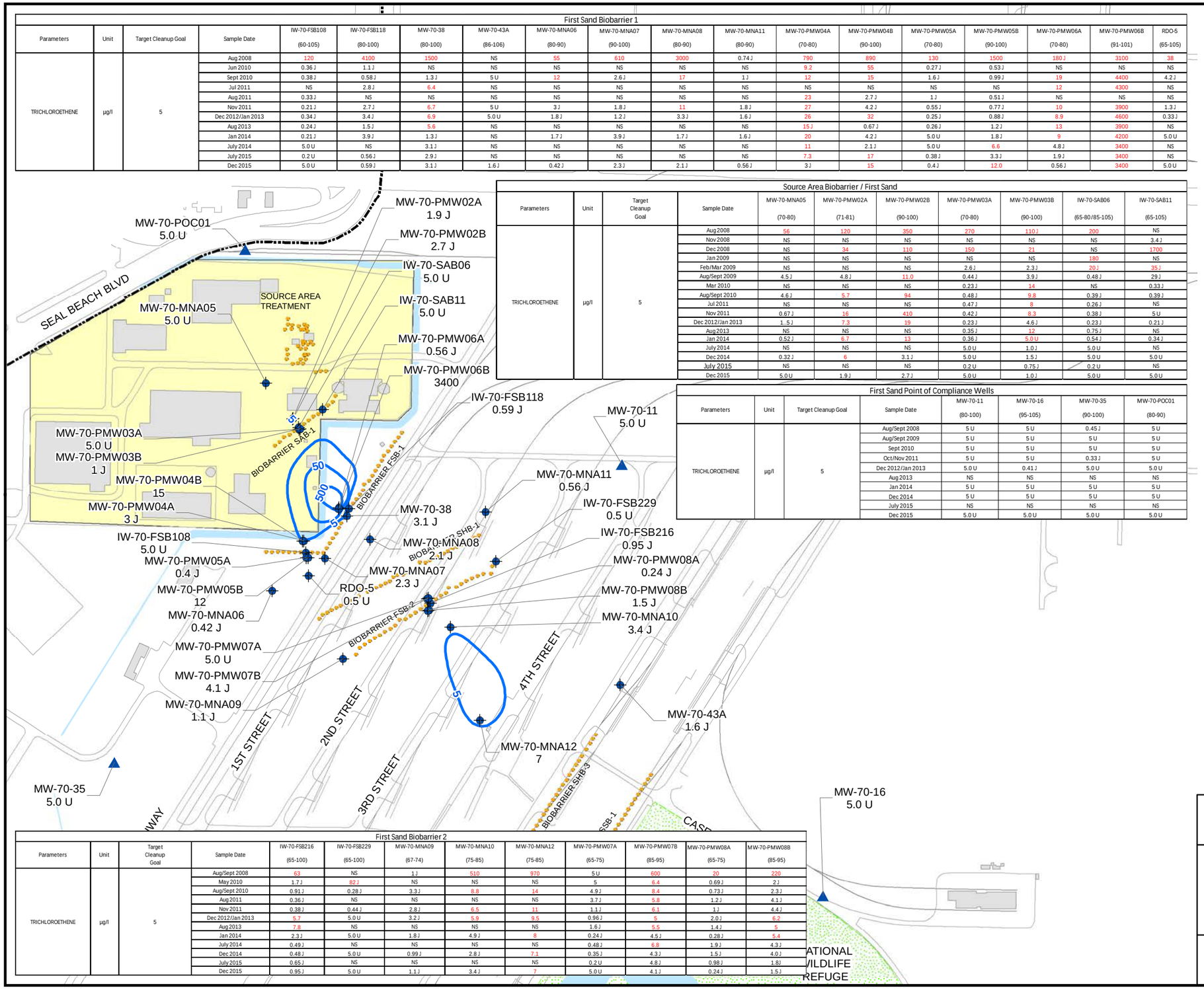
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-24.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank



First Sand Biobarrier 1

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-FSB108 (60-105)	IW-70-FSB118 (80-100)	MW-70-38 (80-100)	MW-70-43A (86-106)	MW-70-MNA06 (80-90)	MW-70-MNA07 (90-100)	MW-70-MNA08 (80-90)	MW-70-MNA11 (80-90)	MW-70-PMW04A (70-80)	MW-70-PMW04B (90-100)	MW-70-PMW05A (70-80)	MW-70-PMW05B (90-100)	MW-70-PMW06A (70-80)	MW-70-PMW06B (91-101)	RDO-5 (65-105)
TRICHLOROETHENE	µg/l	5	Aug 2008	120	4100	1500	NS	55	610	3000	0.74 J	790	890	130	1500	180 J	3100	38
			Jun 2010	0.36 J	1.1 J	NS	NS	NS	NS	NS	NS	9.2	55	0.27 J	0.53 J	NS	NS	NS
			Sept 2010	0.38 J	0.58 J	1.3 J	5 U	12	2.6 J	17	1 J	12	15	1.6 J	0.99 J	19	4400	4.2 J
			Jul 2011	NS	2.8 J	6.4	NS	NS	NS	NS	NS	NS	NS	NS	NS	12	4300	NS
			Aug 2011	0.33 J	NS	NS	NS	NS	NS	NS	NS	23	2.7 J	1 J	0.51 J	NS	NS	NS
			Nov 2011	0.21 J	2.7 J	6.7	5 U	3 J	1.8 J	11	1.8 J	27	4.2 J	0.55 J	0.77 J	10	3900	1.3 J
			Dec 2012/Jan 2013	0.34 J	3.4 J	6.9	5.0 U	1.8 J	1.2 J	3.3 J	1.6 J	26	32	0.25 J	0.88 J	8.9	4600	0.33 J
			Aug 2013	0.24 J	1.5 J	5.6	NS	NS	NS	NS	NS	15 J	0.67 J	0.26 J	1.2 J	13	3900	NS
			Jan 2014	0.21 J	3.9 J	1.3 J	NS	1.7 J	3.9 J	1.7 J	1.6 J	20	4.2 J	5.0 U	1.8 J	9	4200	5.0 U
			July 2014	5.0 U	NS	3.1 J	NS	NS	NS	NS	NS	11	2.1 J	5.0 U	6.6	4.8 J	3400	NS
			July 2015	0.2 U	0.56 J	2.9 J	NS	NS	NS	NS	NS	7.3	17	0.38 J	3.3 J	1.9 J	3400	NS
			Dec 2015	5.0 U	0.59 J	3.1 J	1.6 J	0.42 J	2.3 J	2.1 J	0.56 J	3 J	15	0.4 J	12.0	0.56 J	3400	5.0 U

Source Area Biobarrier / First Sand

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-MNA05 (70-80)	MW-70-PMW02A (71-81)	MW-70-PMW02B (90-100)	MW-70-PMW03A (70-80)	MW-70-PMW03B (90-100)	IW-70-SAB06 (65-80/85-105)	IW-70-SAB11 (65-105)
TRICHLOROETHENE	µg/l	5	Aug 2008	56	120	350	270	110 J	200	NS
			Nov 2008	NS	NS	NS	NS	NS	NS	3.4 J
			Dec 2008	NS	34	110	150	21	NS	1700
			Jan 2009	NS	NS	NS	NS	NS	180	NS
			Feb/Mar 2009	NS	NS	NS	2.6 J	2.3 J	20 J	35 J
			Aug/Sept 2009	4.5 J	4.8 J	11.0	0.44 J	3.9 J	0.48 J	29 J
			Mar 2010	NS	NS	NS	0.23 J	14	NS	0.33 J
			Aug/Sept 2010	4.6 J	5.7	94	0.48 J	9.8	0.39 J	0.39 J
			Jul 2011	NS	NS	NS	0.47 J	8	0.26 J	NS
			Nov 2011	0.67 J	16	410	0.42 J	8.3	0.38 J	5 U
			Dec 2012/Jan 2013	1..5 J	7.3	19	0.23 J	4.6 J	0.23 J	0.21 J
			Aug 2013	NS	NS	NS	0.35 J	12	0.75 J	NS
			Jan 2014	0.52 J	6.7	13	0.36 J	5.0 U	0.54 J	0.34 J
			July 2014	NS	NS	NS	5.0 U	1.0 J	5.0 U	NS
			Dec 2014	0.32 J	6	3.1 J	5.0 U	1.5 J	5.0 U	5.0 U
			July 2015	NS	NS	NS	0.2 U	0.75 J	0.2 U	NS
			Dec 2015	5.0 U	1.9 J	2.7 J	5.0 U	1.0 J	5.0 U	5.0 U

First Sand Point of Compliance Wells

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-11 (80-100)	MW-70-16 (95-105)	MW-70-35 (90-100)	MW-70-POC01 (80-90)
TRICHLOROETHENE	µg/l	5	Aug/Sept 2008	5 U	5 U	0.45 J	5 U
			Aug/Sept 2009	5 U	5 U	5 U	5 U
			Sept 2010	5 U	5 U	5 U	5 U
			Oct/Nov 2011	5 U	5 U	0.33 J	5 U
			Dec 2012/Jan 2013	5.0 U	0.41 J	5.0 U	5.0 U
			Aug 2013	NS	NS	NS	NS
			Jan 2014	5 U	5 U	5 U	5 U
			Dec 2014	5 U	5 U	5 U	5 U
			July 2015	NS	NS	NS	NS
			Dec 2015	5.0 U	5.0 U	5.0 U	5.0 U

First Sand Biobarrier 2

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-FSB216 (65-100)	IW-70-FSB229 (65-100)	MW-70-MNA09 (67-74)	MW-70-MNA10 (75-85)	MW-70-MNA12 (75-85)	MW-70-PMW07A (65-75)	MW-70-PMW07B (85-95)	MW-70-PMW08A (65-75)	MW-70-PMW08B (85-95)
TRICHLOROETHENE	µg/l	5	Aug/Sept 2008	63	NS	1 J	510	970	5 U	600	20	220
			May 2010	1.7 J	82 J	NS	NS	NS	5	6.4	0.69 J	2 J
			Aug/Sept 2010	0.91 J	0.28 J	3.3 J	8.8	14	4.9 J	8.4	0.73 J	2.3 J
			Aug 2011	0.36 J	NS	NS	NS	NS	3.7 J	5.8	1.2 J	4.1 J
			Nov 2011	0.38 J	0.44 J	2.8 J	6.5	11	1.1 J	6.1	1 J	4.4 J
			Dec 2012/Jan 2013	5.7	5.0 U	3.2 J	5.9	9.5	0.96 J	5	2.0 J	6.2
			Aug 2013	7.8	NS	NS	NS	NS	1.6 J	5.5	1.4 J	5
			Jan 2014	2.3 J	5.0 U	1.8 J	4.9 J	8	0.24 J	4.5 J	0.28 J	5.4
			July 2014	0.49 J	NS	NS	NS	NS	0.48 J	6.8	1.9 J	4.3 J
			Dec 2014	0.48 J	5.0 U	0.99 J	2.8 J	7.1	0.35 J	4.3 J	1.5 J	4.0 J
			July 2015	0.65 J	NS	NS	NS	NS	0.2 U	4.8 J	0.98 J	1.8 J
			Dec 2015	0.95 J	5.0 U	1.1 J	3.4 J	7	5.0 U	4.1 J	0.24 J	1.5 J

LEGEND

MW-70-MNA05 0.32J — FIRST SAND/SOURCE AREA TREATMENT MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

MW-70-11 5.0 U — FIRST SAND POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

BIOBARRIER OR SOURCE AREA TREATMENT WELL

IR SITE 70 BOUNDARY

BASE BOUNDARY

ROAD

RAILROAD TRACK

BUILDING

5 — APPROXIMATE ISOCONCENTRATION CONTOUR (ug/L)

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED
VALUE IS THE DETECTION LIMIT

POC - POINT OF COMPLIANCE

TCE - TRICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT
EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-25
IR SITE 70, FIRST SAND - SOURCE AREA BIOBARRIER, FIRST SAND BIOBARRIERS 1 & 2, TRICHLOROETHENE IN GROUNDWATER - 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

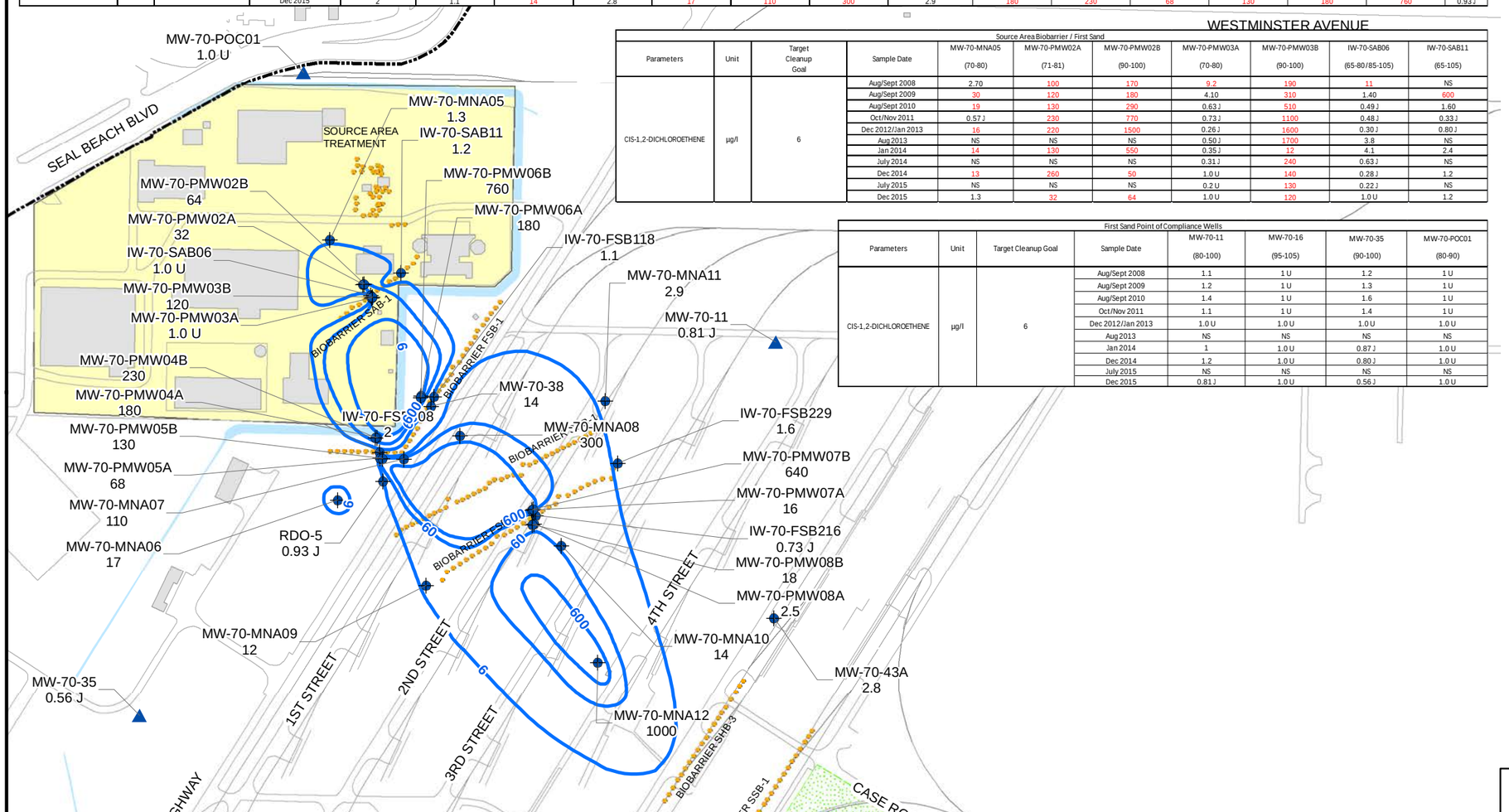
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-25.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank

First Sand Biobarrier 1																			
Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-FSB108 (60-105)	IW-70-FSB118 (80-100)	MW-70-38 (80-100)	MW-70-43A (86-106)	MW-70-MNA06 (80-90)	MW-70-MNA07 (90-100)	MW-70-MNA08 (80-90)	MW-70-MNA11 (80-90)	MW-70-PMW04A (70-80)	MW-70-PMW04B (90-100)	MW-70-PMW05A (70-80)	MW-70-PMW05B (90-100)	MW-70-PMW06A (70-80)	MW-70-PMW06B (91-101)	RDO-5 (65-105)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	10	540	1900	NS	9.9	70	390	0.99 J	49	340	18	93	2500	130	4.2
			Aug/Sept 2009	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Jan/Mar 2010	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Jun 2010	610	1.8	NS	NS	NS	NS	NS	NS	550	1400	1.2	22	NS	NS	NS
			Aug/Sept 2010	1 U	0.98 J	17	1 U	37	20 J	2600 J	0.77 J	450	1400	6.8	4.5	2700	430	12
			Jul 2011	NS	2.8	8.7	NS	NS	NS	NS	NS	NS	NS	NS	NS	1500	620	NS
			Aug/Sept 2011	0.41 J	NS	NS	NS	NS	NS	NS	NS	1300	1400	11	1.9	NS	NS	NS
			Oct/Nov 2011	0.23 J	2.6	8.7	0.22 J	18	7.8	1600	2.2	1500	1500	1	2	1800	550	3.2
			Dec 2012/Jan 2013	0.49 J	4.5	130	1.0 U	23	2.8	610	3.4	1500	1100	19	1.3	730	610	3.5
			Aug 2013	0.55 J	8.1	290 J	NS	NS	NS	NS	NS	920 J	860	57	5.4	780	390	NS
			Jan 2014	0.59 J	260	2	NS	35	270	93	4.6	1400	970	5.3	32	590	470	2.4
			July 2014	0.57 J	NS	4.2	NS	NS	NS	NS	NS	650	1100	24	260	960	510	NS
			July 2015	0.57 J	1.1	2.9 J	NS	NS	NS	NS	NS	350	1000	90	120	570	660	NS
			Dec 2015	2	1.1	14	2.8	17	110	300	2.9	180	230	68	130	180	760	0.93 J



Source Area Biobarrier / First Sand										
Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-MNA05 (70-80)	MW-70-PMW02A (71-81)	MW-70-PMW02B (90-100)	MW-70-PMW03A (70-80)	MW-70-PMW03B (90-100)	IW-70-SAB06 (65-80/85-105)	IW-70-SAB11 (65-105)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	2.70	100	170	9.2	190	11	NS
			Aug/Sept 2009	30	120	180	4.10	310	1.40	600
			Aug/Sept 2010	19	130	290	0.63 J	510	0.49 J	1.60
			Oct/Nov 2011	0.57 J	230	770	0.73 J	1100	0.48 J	0.33 J
			Dec 2012/Jan 2013	16	220	1500	0.26 J	1600	0.30 J	0.80 J
			Aug 2013	NS	NS	NS	0.50 J	1700	3.8	NS
			Jan 2014	14	130	550	0.35 J	12	4.1	2.4
			July 2014	NS	NS	NS	0.31 J	240	0.63 J	NS
			Dec 2014	13	260	50	1.0 U	140	0.28 J	1.2
			July 2015	NS	NS	NS	0.2 U	130	0.22 J	NS
			Dec 2015	1.3	32	64	1.0 U	120	1.0 U	1.2

First Sand Point of Compliance Wells							
Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-11 (80-100)	MW-70-16 (95-105)	MW-70-35 (90-100)	MW-70-POC01 (80-90)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	1.1	1 U	1.2	1 U
			Aug/Sept 2009	1.2	1 U	1.3	1 U
			Aug/Sept 2010	1.4	1 U	1.6	1 U
			Oct/Nov 2011	1.1	1 U	1.4	1 U
			Dec 2012/Jan 2013	1.0 U	1.0 U	1.0 U	1.0 U
			Aug 2013	NS	NS	NS	NS
			Jan 2014	1	1.0 U	0.87 J	1.0 U
			Dec 2014	1.2	1.0 U	0.80 J	1.0 U
			July 2015	NS	NS	NS	NS
			Dec 2015	0.81 J	1.0 U	0.56 J	1.0 U

First Sand Biobarrier 2												
Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-FSB216 (65-100)	IW-70-FSB229 (65-100)	MW-70-MNA09 (67-74)	MW-70-MNA10 (75-85)	MW-70-MNA12 (75-85)	MW-70-PMW07A (65-75)	MW-70-PMW07B (85-95)	MW-70-PMW08A (65-75)	MW-70-PMW08B (85-95)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	7.7	NS	1 J	100	140	1 U	97	3.6	40
			May 2010	2.6	78	NS	NS	NS	4.5	550	140	12
			Aug/Sept 2010	1.2	1.8	5.7	160	720	2.6	880	170	13
			Aug/Sept 2011	0.27 J	NS	NS	NS	NS	8.8	590	49	84
			Oct/Nov 2011	0.36 J	5.1	13	24	950	11	550	33	120
			Dec 2012/Jan 2013	3.2	1.0 U	48	21	910	19	520	99	130
			Aug 2013	2.9	NS	NS	NS	NS	0.54 J	690	100	190
			Jan 2014	73	1.0 U	37	300	730	7.3	760	3	170
			July 2014	0.68 J	NS	NS	NS	NS	2.1	1900	150	230
			Dec 2014	0.36 J	0.37 J	21	90	1000	32	1300	79	180
			July 2015	0.46 J	NS	NS	NS	NS	9.4	810	47	33
			Dec 2015	0.73 J	1.6	12	14	1000	16	640	2.5	18

LEGEND

MW-70-MNA05 0.32J — FIRST SAND/SOURCE AREA TREATMENT MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

MW-70-11 5.0 U — FIRST SAND POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

BIOBARRIER OR SOURCE AREA TREATMENT WELL

IR SITE 70 BOUNDARY

BASE BOUNDARY

ROAD

RAILROAD TRACK

BUILDING

5 — APPROXIMATE ISOCONCENTRATION CONTOUR (ug/L)

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED
VALUE IS THE DETECTION LIMIT

POC - POINT OF COMPLIANCE

CIS-1,2-DCE - CIS-1,2-DICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT
EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-26
IR SITE 70, FIRST SAND - SOURCE AREA BIOBARRIER, FIRST SAND BIOBARRIERS 1 & 2, CIS-1,2-DCE IN GROUNDWATER - 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-26.mxd

NAVFAC

ECC-INSIGHT LLC

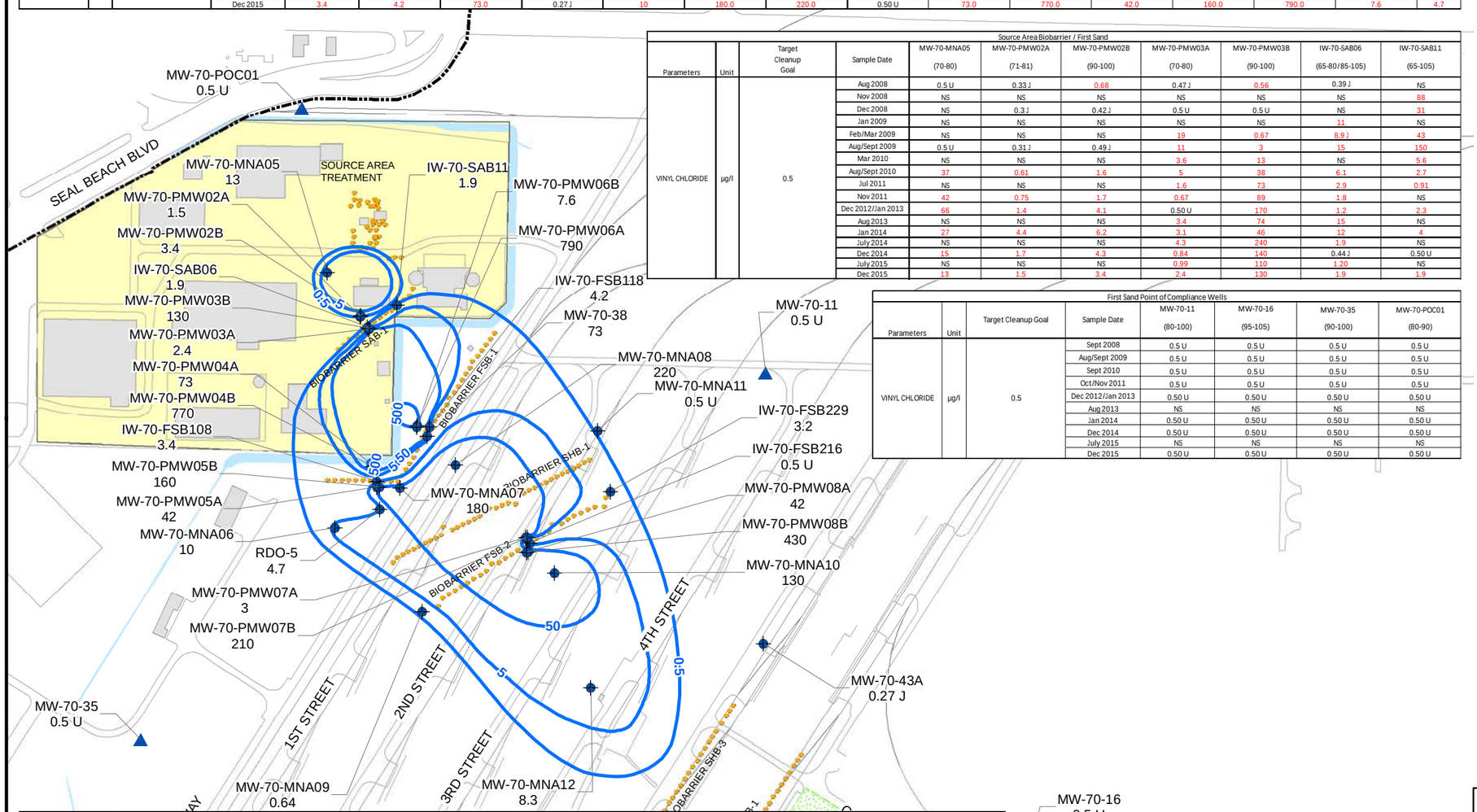
Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank

First Sand Biobarrier 1																			
Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-FSB108 (60-105)	IW-70-FSB118 (80-100)	MW-70-38 (80-100)	MW-70-43A (86-106)	MW-70-MNA06 (80-90)	MW-70-MNA07 (90-100)	MW-70-MNA08 (80-90)	MW-70-MNA11 (80-90)	MW-70-PMW04A (70-80)	MW-70-PMW04B (90-100)	MW-70-PMW05A (70-80)	MW-70-PMW05B (90-100)	MW-70-PMW06A (70-80)	MW-70-PMW06B (91-101)	RDO-5 (65-105)
VINYL CHLORIDE	µg/l	0.5	Aug 2008	0.5 U	5.1	3.7	NS	0.5 U	0.5	5.6	0.5 U	0.34 J	0.47 J	0.5 U	0.6	3.4	4.1	0.5 U
			June 2010	100	16	NS	NS	NS	NS	NS	NS	13	2.2	1.7	270	NS	NS	NS
			Sept 2010	180	22	5.8	0.5 U	0.34 J	2	4.7	0.5 U	31	1.5	2.1	52	95	9.8 J	2.70
			Jul/Aug 2011	4.0	5.6	870	NS	NS	NS	NS	NS	9.7	2.8	24	130	280	6.8	NS
			Nov 2011	3.4	10	850	0.5 U	0.5 U	4.6	97	0.5 U	4.5	3.7	4.1	340	790	9.4	3.30
			Dec 2012/Jan 2013	3.1	22	450	0.50 U	0.41 J	120	690	0.50 U	6.7	37	65	260	850	9.7	14
			Aug 2013	3.2 J	28	460 J	NS	NS	NS	NS	NS	24 J	70	54	250	1000	7.6	NS
			Jan 2014	1.1	22	12	NS	0.75	640	190	0.50 U	15	47	40	290	1300	6.6	6.5
			July 2014	2.1	NS	26	NS	NS	NS	NS	NS	41	19	46	280	980	7.2	NS
			July 2015	1.7	3.4	95.0	NS	NS	NS	NS	NS	98.0	130.0	97 U	330.0	1100.0	7.8	NS
			Dec 2015	3.4	4.2	73.0	0.27 J	10	180.0	220.0	0.50 U	73.0	770.0	42.0	160.0	790.0	7.6	4.7

Source Area Biobarrier / First Sand										
Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-MNA05 (70-80)	MW-70-PMW02A (71-81)	MW-70-PMW02B (90-100)	MW-70-PMW03A (70-80)	MW-70-PMW03B (90-100)	IW-70-SAB06 (65-80/85-105)	IW-70-SAB11 (65-105)
VINYL CHLORIDE	µg/l	0.5	Aug 2008	0.5 U	0.33 J	0.68	0.47 J	0.56	0.39 J	NS
			Nov 2008	NS	NS	NS	NS	NS	NS	88
			Dec 2008	NS	0.3 J	0.42 J	0.5 U	0.5 U	NS	31
			Jan 2009	NS	NS	NS	NS	NS	11	NS
			Feb/Mar 2009	NS	NS	NS	19	0.67	8.9 J	43
			Aug/Sept 2009	0.5 U	0.31 J	0.49 J	11	3	15	150
			Mar 2010	NS	NS	NS	3.6	13	NS	5.6
			Aug/Sept 2010	37	0.61	1.6	5	38	6.1	2.7
			Jul 2011	NS	NS	NS	1.6	73	2.9	0.91
			Nov 2011	42	0.75	1.7	0.67	89	1.8	NS
			Dec 2012/Jan 2013	66	1.4	4.1	0.50 U	170	1.2	2.3
			Aug 2013	NS	NS	NS	3.4	74	15	NS
			Jan 2014	27	4.4	6.2	3.1	46	12	4
			July 2014	NS	NS	NS	4.3	240	1.9	NS
			Dec 2014	15	1.7	4.3	0.84	140	0.44 J	0.50 U
			July 2015	NS	NS	NS	0.99	110	1.20	NS
			Dec 2015	13	1.5	3.4	2.4	130	1.9	1.9

First Sand Point of Compliance Wells							
Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-11 (80-100)	MW-70-16 (95-105)	MW-70-35 (90-100)	MW-70-POC01 (80-90)
VINYL CHLORIDE	µg/l	0.5	Sept 2008	0.5 U	0.5 U	0.5 U	0.5 U
			Aug/Sept 2009	0.5 U	0.5 U	0.5 U	0.5 U
			Sept 2010	0.5 U	0.5 U	0.5 U	0.5 U
			Oct/Nov 2011	0.5 U	0.5 U	0.5 U	0.5 U
			Dec 2012/Jan 2013	0.50 U	0.50 U	0.50 U	0.50 U
			Aug 2013	NS	NS	NS	NS
			Jan 2014	0.50 U	0.50 U	0.50 U	0.50 U
			Dec 2014	0.50 U	0.50 U	0.50 U	0.50 U
			July 2015	NS	NS	NS	NS
			Dec 2015	0.50 U	0.50 U	0.50 U	0.50 U



First Sand Biobarrier 2												
Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-FSB216 (65-100)	IW-70-FSB229 (65-100)	MW-70-MNA09 (67-74)	MW-70-MNA10 (75-85)	MW-70-MNA12 (75-85)	MW-70-PMW07A (65-75)	MW-70-PMW07B (85-95)	MW-70-PMW08A (65-75)	MW-70-PMW08B (85-95)
VINYL CHLORIDE	µg/l	0.5	Aug/Sept 2008	0.45 J	NS	0.5 U	2.4	2	0.5 U	2	0.5 U	0.94
			May 2010	23	10	NS	NS	NS	3.2	1.5	11	350
			Aug/Sept 2010	12	2.5	0.5 U	110	1.6	0.5 U	1.5	20	330
			Aug 2011	3.9	NS	NS	NS	NS	0.5	1.1	45	410
			Nov 2011	2.9	4.1	0.5 U	25	1.5	0.5 U	1.1	39	390
			Dec 2012/Jan 2013	8.1	0.59	1.7	9.4	3.5	0.22 J	1.3	70	470
			Aug 2013	6.9	NS	NS	NS	NS	0.82	3.2	34	290
			Jan 2014	10	0.81	4.6	200	2.2	0.50 U	3.6	20	320
			July 2014	3.7	NS	NS	NS	NS	0.50 U	29	93	280
			Dec 2014	4	0.78	2.4	250	7.5	3.7	130	89	400
			July 2015	0.2 U	NS	NS	NS	NS	1.5	170	96	370
			Dec 2015	0.5 U	3.2	0.64	130	8.3	3	210	42	430

LEGEND

MW-70-MNA05 0.32J — FIRST SAND/SOURCE AREA TREATMENT MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

MW-70-11 5.0 U — FIRST SAND POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

BIOBARRIER OR SOURCE AREA TREATMENT WELL

IR SITE 70 BOUNDARY

BASE BOUNDARY

ROAD

RAILROAD TRACK

BUILDING

5 — APPROXIMATE ISOCONCENTRATION CONTOUR (ug/L)

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED
VALUE IS THE DETECTION LIMIT

POC - POINT OF COMPLIANCE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT
EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-27
IR SITE 70, FIRST SAND - SOURCE AREA BIOBARRIER, FIRST SAND BIOBARRIERS 1 & 2, VINYL CHLORIDE IN GROUNDWATER - 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

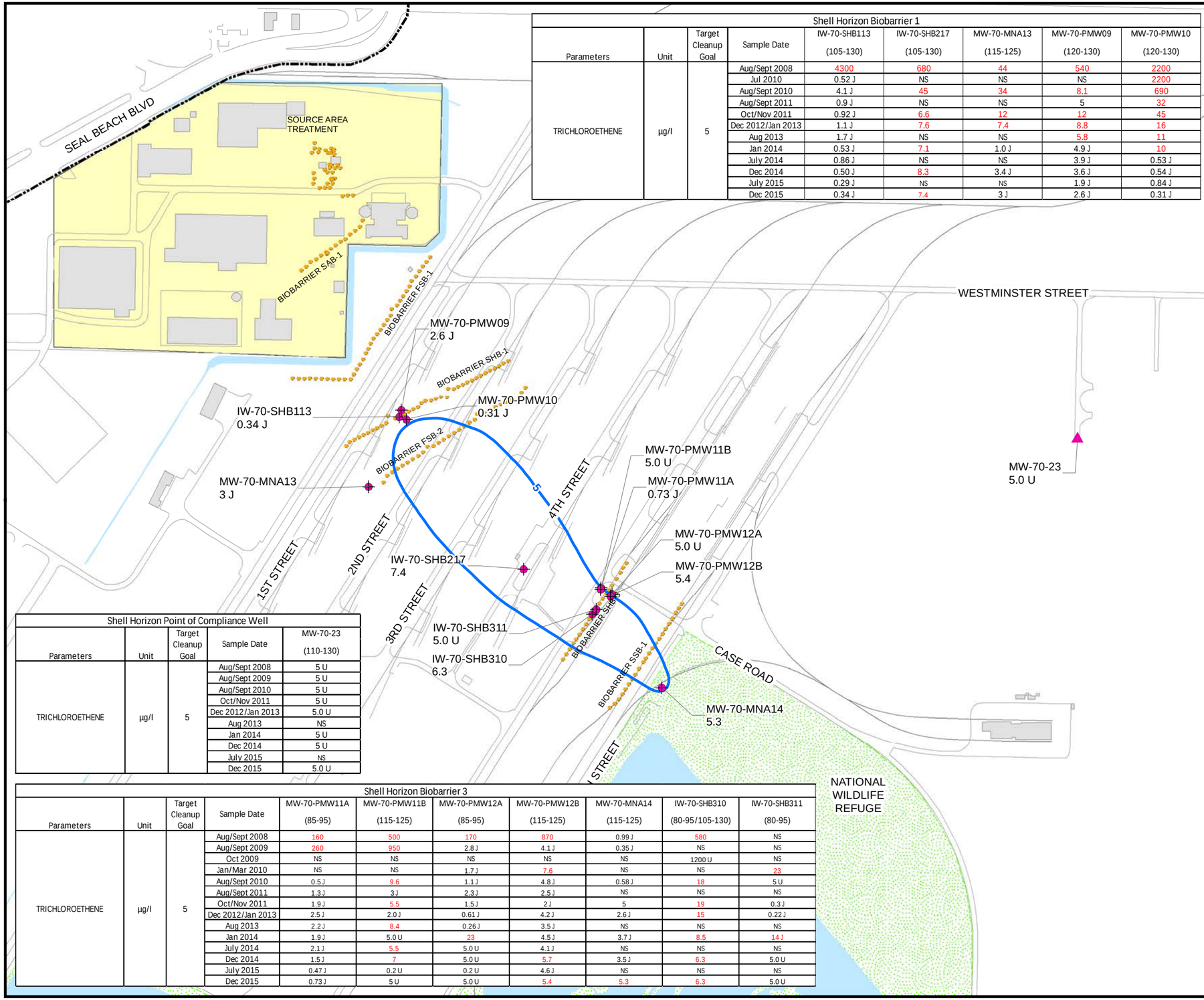
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-27.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map Documents\FIGURE 2-27.mxd

This Page Intentionally Left Blank



Shell Horizon Biobarrier 1								
Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-SHB113 (105-130)	IW-70-SHB217 (105-130)	MW-70-MNA13 (115-125)	MW-70-PMW09 (120-130)	MW-70-PMW10 (120-130)
TRICHLOROETHENE	µg/l	5	Aug/Sept 2008	4300	680	44	540	2200
			Jul 2010	0.52 J	NS	NS	NS	2200
			Aug/Sept 2010	4.1 J	45	34	8.1	690
			Aug/Sept 2011	0.9 J	NS	NS	5	32
			Oct/Nov 2011	0.92 J	6.6	12	12	45
			Dec 2012/Jan 2013	1.1 J	7.6	7.4	8.8	16
			Aug 2013	1.7 J	NS	NS	5.8	11
			Jan 2014	0.53 J	7.1	1.0 J	4.9 J	10
			July 2014	0.86 J	NS	NS	3.9 J	0.53 J
			Dec 2014	0.50 J	8.3	3.4 J	3.6 J	0.54 J
			July 2015	0.29 J	NS	NS	1.9 J	0.84 J
			Dec 2015	0.34 J	7.4	3 J	2.6 J	0.31 J

Shell Horizon Point of Compliance Well				
Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-23 (110-130)
TRICHLOROETHENE	µg/l	5	Aug/Sept 2008	5 U
			Aug/Sept 2009	5 U
			Aug/Sept 2010	5 U
			Oct/Nov 2011	5 U
			Dec 2012/Jan 2013	5.0 U
			Aug 2013	NS
			Jan 2014	5 U
			Dec 2014	5 U
			July 2015	NS
			Dec 2015	5.0 U

Shell Horizon Biobarrier 3										
Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-PMW11A (85-95)	MW-70-PMW11B (115-125)	MW-70-PMW12A (85-95)	MW-70-PMW12B (115-125)	MW-70-MNA14 (115-125)	IW-70-SHB310 (80-95/105-130)	IW-70-SHB311 (80-95)
TRICHLOROETHENE	µg/l	5	Aug/Sept 2008	160	500	170	870	0.99 J	580	NS
			Aug/Sept 2009	260	950	2.8 J	4.1 J	0.35 J	NS	NS
			Oct 2009	NS	NS	NS	NS	NS	1200 U	NS
			Jan/Mar 2010	NS	NS	1.7 J	7.6	NS	NS	23
			Aug/Sept 2010	0.5 J	9.6	1.1 J	4.8 J	0.58 J	18	5 U
			Aug/Sept 2011	1.3 J	3 J	2.3 J	2.5 J	NS	NS	NS
			Oct/Nov 2011	1.9 J	5.5	1.5 J	2 J	5	19	0.3 J
			Dec 2012/Jan 2013	2.5 J	2.0 J	0.61 J	4.2 J	2.6 J	15	0.22 J
			Aug 2013	2.2 J	8.4	0.26 J	3.5 J	NS	NS	NS
			Jan 2014	1.9 J	5.0 U	23	4.5 J	3.7 J	8.5	14 J
			July 2014	2.1 J	5.5	5.0 U	4.1 J	NS	NS	NS
			Dec 2014	1.5 J	7	5.0 U	5.7	3.5 J	6.3	5.0 U
			July 2015	0.47 J	0.2 U	0.2 U	4.6 J	NS	NS	NS
			Dec 2015	0.73 J	5 U	5.0 U	5.4	5.3	6.3	5.0 U

LEGEND

MW-70-MNA13 3.4J — SHELL HORIZON MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

MW-70-23 5.0 U — SHELL HORIZON POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

BIOBARRIER OR SOURCE AREA TREATMENT WELL

IR SITE 70 BOUNDARY

BASE BOUNDARY

ROAD

RAILROAD TRACK

BUILDING

5 — APPROXIMATE ISOCONCENTRATION CONTOUR (ug/L)

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED
VALUE IS THE DETECTION LIMIT

POC - POINT OF COMPLIANCE

TCE - TRICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT
EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-28
IR SITE 70, SHELL HORIZON BIOBARRIERS 1 & 3
TRICHLOROETHENE IN GROUNDWATER - 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

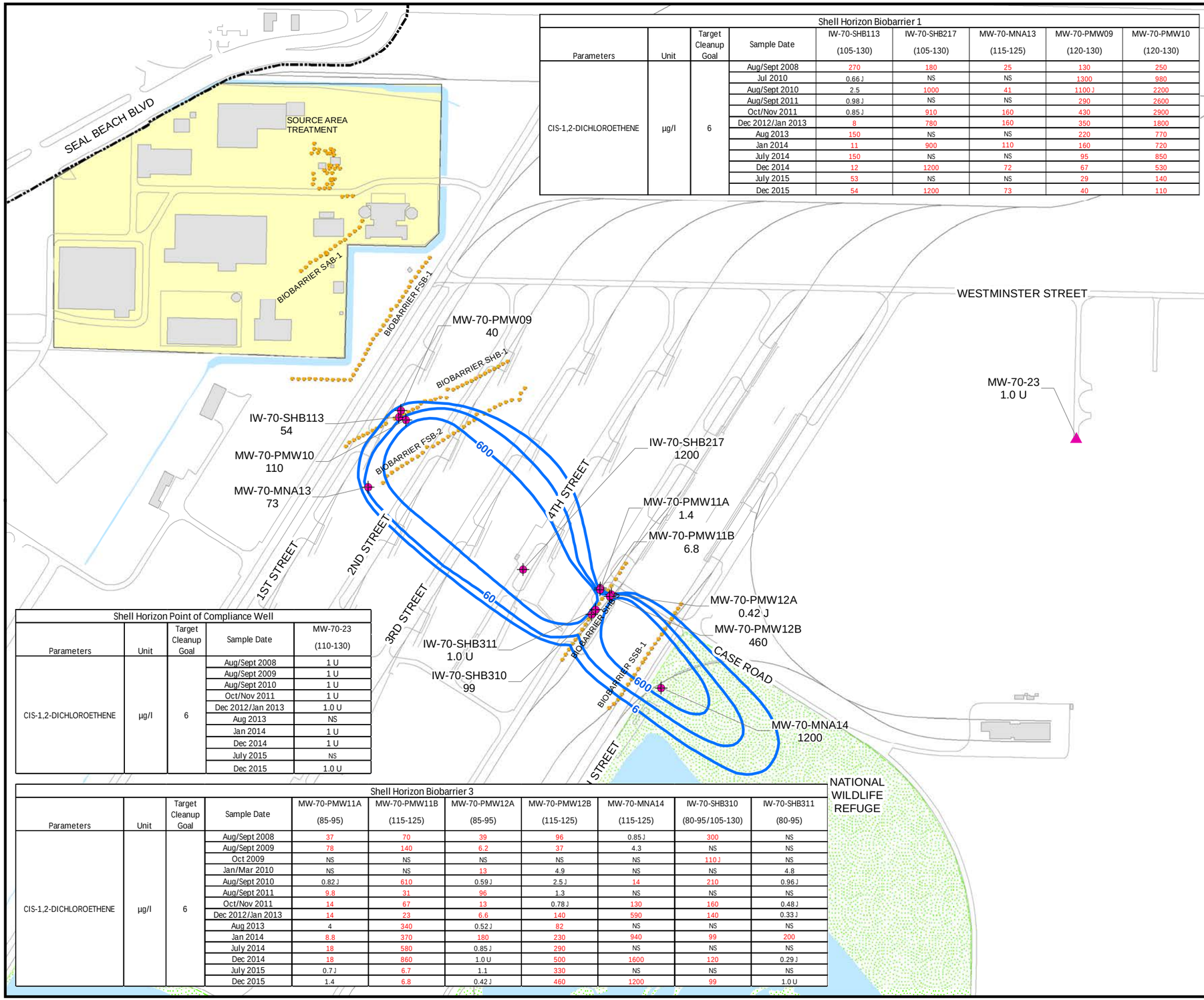
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-28.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



Shell Horizon Biobarrier 1								
Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-SHB113 (105-130)	IW-70-SHB217 (105-130)	MW-70-MNA13 (115-125)	MW-70-PMW09 (120-130)	MW-70-PMW10 (120-130)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	270	180	25	130	250
			Jul 2010	0.66 J	NS	NS	1300	980
			Aug/Sept 2010	2.5	1000	41	1100 J	2200
			Aug/Sept 2011	0.98 J	NS	NS	290	2600
			Oct/Nov 2011	0.85 J	910	160	430	2900
			Dec 2012/Jan 2013	8	780	160	350	1800
			Aug 2013	150	NS	NS	220	770
			Jan 2014	11	900	110	160	720
			July 2014	150	NS	NS	95	850
			Dec 2014	12	1200	72	67	530
			July 2015	53	NS	NS	29	140
			Dec 2015	54	1200	73	40	110

Shell Horizon Point of Compliance Well				
Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-23 (110-130)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	1 U
			Aug/Sept 2009	1 U
			Aug/Sept 2010	1 U
			Oct/Nov 2011	1 U
			Dec 2012/Jan 2013	1.0 U
			Aug 2013	NS
			Jan 2014	1 U
			Dec 2014	1 U
			July 2015	NS
			Dec 2015	1.0 U

Shell Horizon Biobarrier 3										
Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-PMW11A (85-95)	MW-70-PMW11B (115-125)	MW-70-PMW12A (85-95)	MW-70-PMW12B (115-125)	MW-70-MNA14 (115-125)	IW-70-SHB310 (80-95/105-130)	IW-70-SHB311 (80-95)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	37	70	39	96	0.85 J	300	NS
			Aug/Sept 2009	78	140	6.2	37	4.3	NS	NS
			Oct 2009	NS	NS	NS	NS	NS	110 J	NS
			Jan/Mar 2010	NS	NS	13	4.9	NS	NS	4.8
			Aug/Sept 2010	0.82 J	610	0.59 J	2.5 J	14	210	0.96 J
			Aug/Sept 2011	9.8	31	96	1.3	NS	NS	NS
			Oct/Nov 2011	14	67	13	0.78 J	130	160	0.48 J
			Dec 2012/Jan 2013	14	23	6.6	140	590	140	0.33 J
			Aug 2013	4	340	0.52 J	82	NS	NS	NS
			Jan 2014	8.8	370	180	230	940	99	200
			July 2014	18	580	0.85 J	290	NS	NS	NS
			Dec 2014	18	860	1.0 U	500	1600	120	0.29 J
			July 2015	0.7 J	6.7	1.1	330	NS	NS	NS
			Dec 2015	1.4	6.8	0.42 J	460	1200	99	1.0 U

LEGEND

MW-70-MNA13 3.4J — FIRST SAND/SOURCE AREA TREATMENT MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

MW-70-23 5.0 U — FIRST SAND POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

BIOBARRIER OR SOURCE AREA TREATMENT WELL

IR SITE 70 BOUNDARY

BASE BOUNDARY

ROAD

RAILROAD TRACK

BUILDING

5 — APPROXIMATE ISOCONCENTRATION CONTOUR (ug/L)

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED
VALUE IS THE DETECTION LIMIT

POC - POINT OF COMPLIANCE

CIS-1,2-DCE - CIS-1,2-DICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT
EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

200 100 0 200 400
Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-29
IR SITE 70, SHELL HORIZON BIOBARRIERS 1 & 3
CIS-1,2-DCE IN GROUNDWATER - 2015

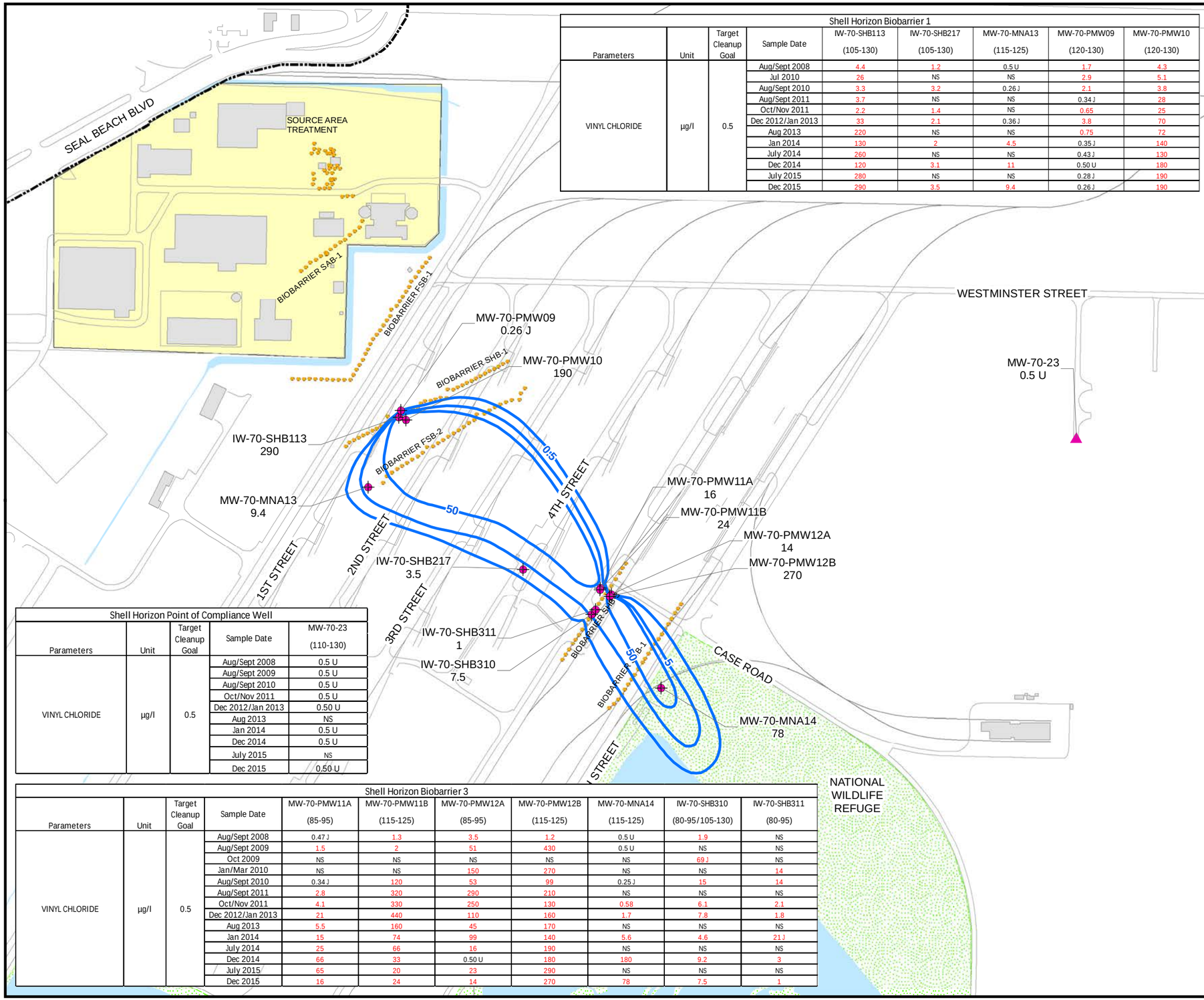
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-29.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank



Shell Horizon Biobarrier 1								
Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-SHB113 (105-130)	IW-70-SHB217 (105-130)	MW-70-MNA13 (115-125)	MW-70-PMW09 (120-130)	MW-70-PMW10 (120-130)
VINYL CHLORIDE	µg/l	0.5	Aug/Sept 2008	4.4	1.2	0.5 U	1.7	4.3
			Jul 2010	26	NS	NS	2.9	5.1
			Aug/Sept 2010	3.3	3.2	0.26 J	2.1	3.8
			Aug/Sept 2011	3.7	NS	NS	0.34 J	28
			Oct/Nov 2011	2.2	1.4	NS	0.65	25
			Dec 2012/Jan 2013	33	2.1	0.36 J	3.8	70
			Aug 2013	220	NS	NS	0.75	72
			Jan 2014	130	2	4.5	0.35 J	140
			July 2014	260	NS	NS	0.43 J	130
			Dec 2014	120	3.1	11	0.50 U	180
			July 2015	280	NS	NS	0.28 J	190
			Dec 2015	290	3.5	9.4	0.26 J	190

Shell Horizon Point of Compliance Well				
Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-23 (110-130)
VINYL CHLORIDE	µg/l	0.5	Aug/Sept 2008	0.5 U
			Aug/Sept 2009	0.5 U
			Aug/Sept 2010	0.5 U
			Oct/Nov 2011	0.5 U
			Dec 2012/Jan 2013	0.50 U
			Aug 2013	NS
			Jan 2014	0.5 U
			Dec 2014	0.5 U
			July 2015	NS
			Dec 2015	0.50 U

Shell Horizon Biobarrier 3										
Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-PMW11A (85-95)	MW-70-PMW11B (115-125)	MW-70-PMW12A (85-95)	MW-70-PMW12B (115-125)	MW-70-MNA14 (115-125)	IW-70-SHB310 (80-95/105-130)	IW-70-SHB311 (80-95)
VINYL CHLORIDE	µg/l	0.5	Aug/Sept 2008	0.47 J	1.3	3.5	1.2	0.5 U	1.9	NS
			Aug/Sept 2009	1.5	2	51	430	0.5 U	NS	NS
			Oct 2009	NS	NS	NS	NS	NS	69 J	NS
			Jan/Mar 2010	NS	NS	150	270	NS	NS	14
			Aug/Sept 2010	0.34 J	120	53	99	0.25 J	15	14
			Aug/Sept 2011	2.8	320	290	210	NS	NS	NS
			Oct/Nov 2011	4.1	330	250	130	0.58	6.1	2.1
			Dec 2012/Jan 2013	21	440	110	160	1.7	7.8	1.8
			Aug 2013	5.5	160	45	170	NS	NS	NS
			Jan 2014	15	74	99	140	5.6	4.6	21 J
			July 2014	25	66	16	190	NS	NS	NS
			Dec 2014	66	33	0.50 U	180	180	9.2	3
			July 2015	65	20	23	290	NS	NS	NS
			Dec 2015	16	24	14	270	78	7.5	1

LEGEND

MW-70-MNA13 3.4J — FIRST SAND/SOURCE AREA TREATMENT MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

MW-70-23 5.0 U — FIRST SAND POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

BIOBARRIER OR SOURCE AREA TREATMENT WELL

IR SITE 70 BOUNDARY

BASE BOUNDARY

ROAD

RAILROAD TRACK

BUILDING

5 — APPROXIMATE ISOCONCENTRATION CONTOUR (ug/L)

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

POC - POINT OF COMPLIANCE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-30
IR SITE 70, SHELL HORIZON BIOBARRIERS 1 & 3
VINYL CHLORIDE IN GROUNDWATER - 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

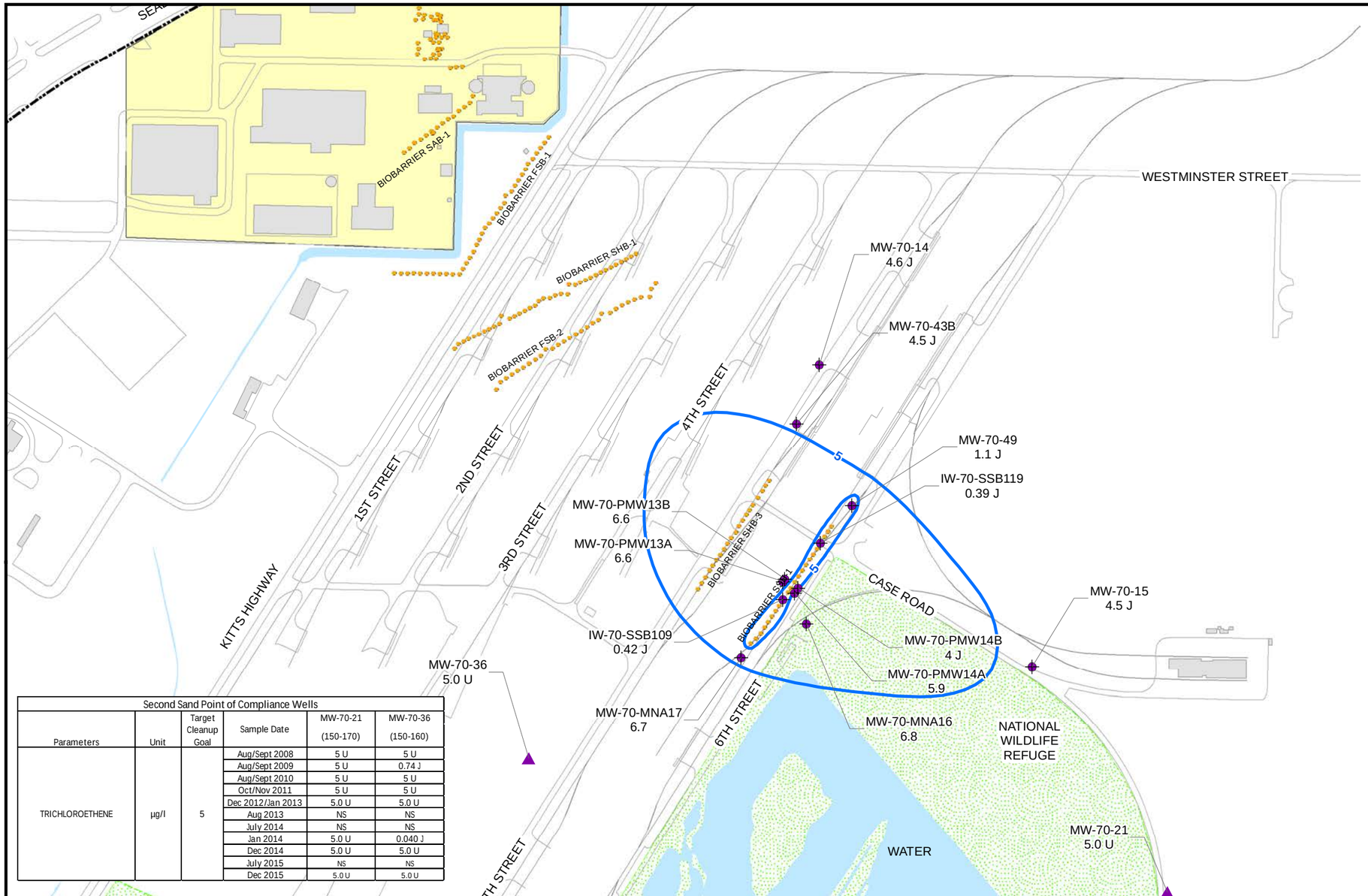
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-30.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-MNA17 1.2 — SECOND SAND MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

MW-70-21 1.0 U — SECOND SAND POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

BIOBARRIER OR SOURCE AREA TREATMENT WELL

IR SITE 70 BOUNDARY

BASE BOUNDARY

ROAD

RAILROAD TRACK

BUILDING

5 — APPROXIMATE ISOCONCENTRATION CONTOUR (ug/L)

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED
VALUE IS THE DETECTION LIMIT

POC - POINT OF COMPLIANCE

TCE - TRICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT
EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

200 100 0 200 400 Feet

N

Second Sand Point of Compliance Wells

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-21 (150-170)	MW-70-36 (150-160)
TRICHLOROETHENE	µg/l	5	Aug/Sept 2008	5 U	5 U
			Aug/Sept 2009	5 U	0.74 J
			Aug/Sept 2010	5 U	5 U
			Oct/Nov 2011	5 U	5 U
			Dec 2012/Jan 2013	5.0 U	5.0 U
			Aug 2013	NS	NS
			July 2014	NS	NS
			Jan 2014	5.0 U	0.040 J
			Dec 2014	5.0 U	5.0 U
			July 2015	NS	NS
			Dec 2015	5.0 U	5.0 U

Second Sand Biobarrier 1

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-SSB109 (126-166)	IW-70-SSB119 (126-166)	MW-70-14 (160-170)	MW-70-15 (161-171)	MW-70-43B (136-146)	MW-70-49 (125-165)	MW-70-MNA15 (140-150)	MW-70-MNA16 (141-151)	MW-70-MNA17 (140-150)	MW-70-PMW13A (125-135)	MW-70-PMW13B (145-155)	MW-70-PMW14A (128-138)	MW-70-PMW14B (149-159)
TRICHLOROETHENE	µg/l	5	Aug/Sept 2008	310	NS	NS	1.6 J	NS	NS	NS	140 J	0.21 J	320	900	1100	530
			Aug/Sept 2009	12	NS	530	6.9	5 U	NS	NS	460	2.4 J	370	1100	180 J	17
			Jan/Mar 2010	1.2 J	59	210	NS	NS	NS	NS	NS	NS	NS	NS	6.6	7.9
			Aug/Sept 2010	0.4 J	0.78 J	260	14	37	NS	NS	510	20	490 J	1300	14	18
			Aug/Sept 2011	NS	0.45 J	5.6	NS	NS	20	NS	NS	NS	200	11	6.3	12
			Oct/Nov 2011	0.3 J	0.24 J	0.89 J	16	180	17	NS	12	65	300	13	5.4	11
			Dec 2012/Jan 2013	0.61 J	1.2 J	4.0 J	9.2	550	130	NS	8.6	27	150	10	5.6	8.9
			Aug 2013	NS	0.91 J	2.0 J	NS	NS	57	6.3	NS	NS	12	8.7	5.7	4.1 J
			Jan 2014	0.70 J	5.0 U	0.2 J	13	170	0.98 J	6.5	11	21	13	11	8.6	7.2
			July 2014	NS	5.0 U	5.4	NS	NS	1.9 J	5.5	NS	NS	13	7.5	4.6 J	4.9 J
			Dec 2014	0.69 J	0.58 J	6.1	8.3	79	5.6	NS	11	9.7	12	8.4	3.0 J	5.9
			July 2015	NS	0.2 U	5.3	NS	NS	2.1 J	NS	NS	NS	10	6.4	6	6
			Dec 2015	0.42 J	0.39 J	4.6 J	4.5 J	4.5 J	1.1 J	NS	6.8	6.7	6.6	6.6	5.9	4 J

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-31
IR SITE 70, SECOND SAND BIOBARRIER 1
TRICHLOROETHENE IN GROUNDWATER - 2015

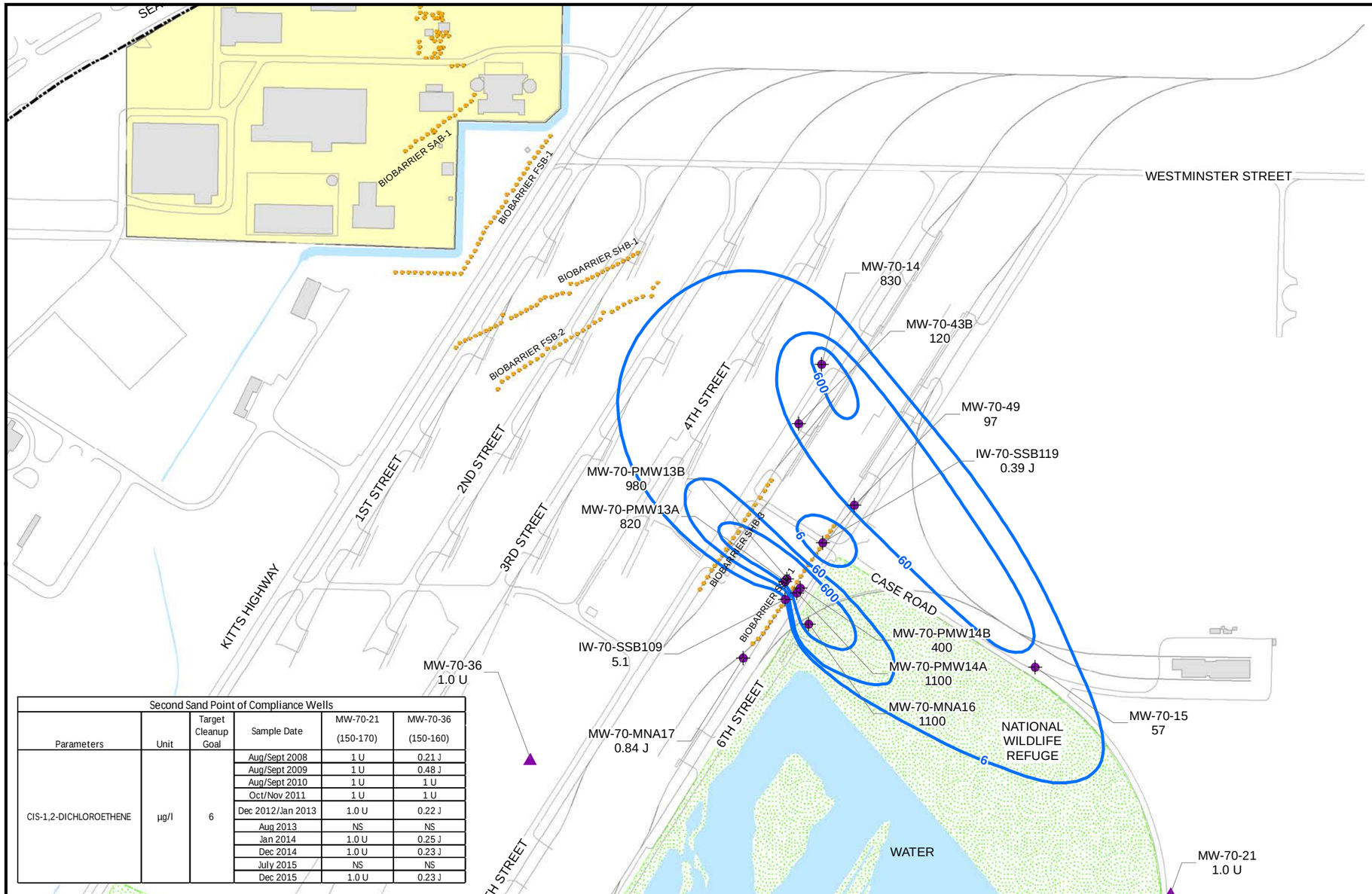
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-31.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-MNA17 1.2 — FIRST SAND/SOURCE AREA TREATMENT MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

MW-70-21 1.0 U — FIRST SAND POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

BIOBARRIER OR SOURCE AREA TREATMENT WELL

IR SITE 70 BOUNDARY

BASE BOUNDARY

ROAD

RAILROAD TRACK

BUILDING

5 — APPROXIMATE ISOCONCENTRATION CONTOUR (ug/L)

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED
VALUE IS THE DETECTION LIMIT

POC - POINT OF COMPLIANCE

CIS-1,2-DCE - CIS-1,2-DICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT
EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

200 100 0 200 400 Feet

N

Second Sand Point of Compliance Wells

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-21 (150-170)	MW-70-36 (150-160)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	1 U	0.21 J
			Aug/Sept 2009	1 U	0.48 J
			Aug/Sept 2010	1 U	1 U
			Oct/Nov 2011	1 U	1 U
			Dec 2012/Jan 2013	1.0 U	0.22 J
			Aug 2013	NS	NS
			Jan 2014	1.0 U	0.25 J
			Dec 2014	1.0 U	0.23 J
			July 2015	NS	NS
			Dec 2015	1.0 U	0.23 J

Second Sand Biobarrier 1

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-SSB109 (126-166)	IW-70-SSB119 (126-166)	MW-70-14 (160-170)	MW-70-15 (161-171)	MW-70-43B (136-146)	MW-70-49 (125-165)	MW-70-MNA15 (140-150)	MW-70-MNA16 (141-151)	MW-70-MNA17 (140-150)	MW-70-PMW13A (125-135)	MW-70-PMW13B (145-155)	MW-70-PMW14A (128-138)	MW-70-PMW14B (149-159)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	44	NS	NS	2	NS	NS	NS	1100	0.79 J	63	180	180	130
			Aug/Sept 2009	110	NS	32	2.7	1 U	NS	NS	1000	1.4	75	360	320	630
			Jan/Mar 2010	40	18	22	NS	NS	NS	NS	NS	NS	NS	NS	35	310
			Aug/Sept 2010	1.4	0.69 J	280	4.2	9	NS	NS	670	7.2	150	270	630	600
			Aug/Sept 2011	NS	7.2	400	NS	NS	8.3	NS	NS	NS	130	940	67	340
			Oct/Nov 2011	0.3 J	0.74 J	450	3.4	16	9.5	NS	1000	9.9	150	1100	9.1	420
			Dec 2012/Jan 2013	0.58 J	0.47 J	200	2.8	46	22	NS	880	4.0	200	1,100	290	670
			Aug 2013	NS	0.51 J	280	NS	NS	22	670	NS	NS	400	890	560	290
			Jan 2014	1.7	0.28 J	1.2	4.2	23	150	360	1200	3	880	860	780	400
			July 2014	NS	0.20 J	450	NS	NS	1.1	210	NS	NS	710	1200	750	210
			Dec 2014	2.3	2.1	1100	39	8.2	280	NS	1500	1.2	770	1000	470	510
			July 2015	NS	0.35 J	1100	NS	NS	160	NS	NS	NS	730	1100	920	920
			Dec 2015	5.1	0.39 J	830	57	120	97	NS	1100	0.84 J	820	980	1100	400

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-32
IR SITE 70, SECOND SAND BIOBARRIER 1
CIS-1,2-DCE IN GROUNDWATER - 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

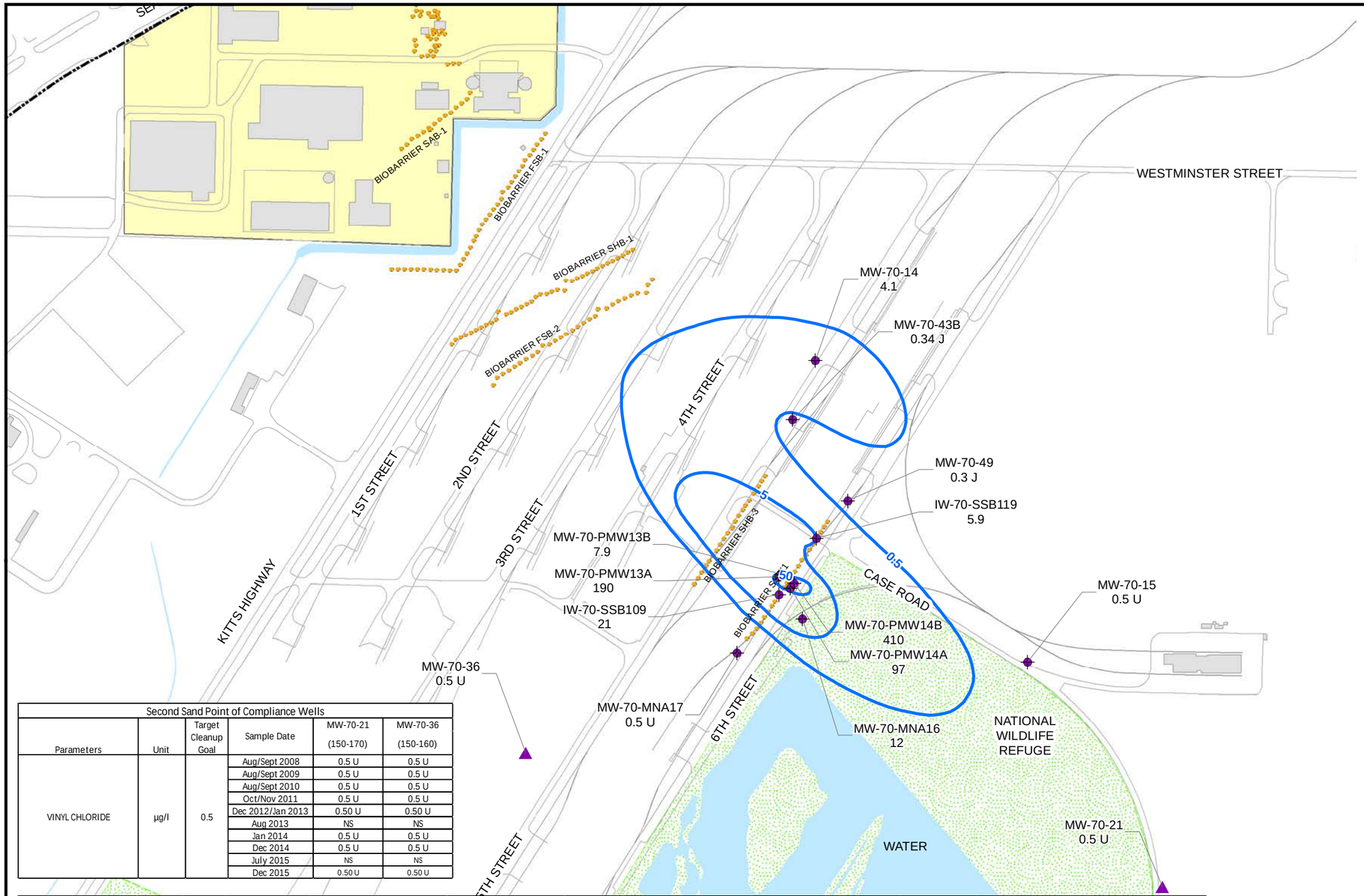
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-32.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-MNA13 3.4J — FIRST SAND/SOURCE AREA TREATMENT MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

MW-70-23 5.0 U — FIRST SAND POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L

BIOBARRIER OR SOURCE AREA TREATMENT WELL

IR SITE 70 BOUNDARY

BASE BOUNDARY

ROAD

RAILROAD TRACK

BUILDING

5 — APPROXIMATE ISOCONCENTRATION CONTOUR (ug/L)

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED
VALUE IS THE DETECTION LIMIT

POC - POINT OF COMPLIANCE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT
EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

200 100 0 200 400 Feet

N

Second Sand Point of Compliance Wells

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-21 (150-170)	MW-70-36 (150-160)
VINYL CHLORIDE	µg/l	0.5	Aug/Sept 2008	0.5 U	0.5 U
			Aug/Sept 2009	0.5 U	0.5 U
			Aug/Sept 2010	0.5 U	0.5 U
			Oct/Nov 2011	0.5 U	0.5 U
			Dec 2012/Jan 2013	0.50 U	0.50 U
			Aug 2013	NS	NS
			Jan 2014	0.5 U	0.5 U
			Dec 2014	0.5 U	0.5 U
			July 2015	NS	NS
			Dec 2015	0.50 U	0.50 U

Second Sand Biobarrier 1

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-SSB109 (126-166)	IW-70-SSB119 (126-166)	MW-70-14 (160-170)	MW-70-15 (161-171)	MW-70-43B (136-146)	MW-70-49 (125-165)	MW-70-MNA15 (140-150)	MW-70-MNA16 (141-151)	MW-70-MNA17 (140-150)	MW-70-PMW13A (125-135)	MW-70-PMW13B (145-155)	MW-70-PMW14A (128-138)	MW-70-PMW14B (149-159)
VINYL CHLORIDE	µg/l	0.5	Aug/Sept 2008	0.34 J	NS	NS	0.5 U	NS	NS	NS	8.3	0.5 U	410	2.9	5.8	2
			Aug/Sept 2009	94	NS	1.5	0.5 U	0.5 U	NS	NS	14	0.5 U	460	59	730	5.1
			Jan/Mar 2010	13	5	0.65	NS	NS	NS	NS	NS	NS	NS	NS	70	28
			Aug/Sept 2010	5.3	3.5	1.1	0.5 U	0.43 J	NS	NS	9.7	0.27 J	350	10	340	430
			Aug/Sept 2011	NS	2.2	1.6	NS	NS	0.5 U	NS	NS	NS	280	26	250	300
			Oct/Nov 2011	1.3	1.7	1.2	0.5 U	0.61	0.33 J	NS	25	0.5 U	300	16	250	300
			Dec 2012/Jan 2013	9.3	9.6	0.72	0.50 U	1.7	1.1	NS	38	0.50 U	370	29	240	200
			Aug 2013	NS	73	7.7	NS	NS	0.68	8.5	NS	NS	420	15	150	130
			Jan 2014	10	42	130	0.50 U	0.76	0.6	38	13	0.50 U	220	6.6	160	310
			July 2014	NS	0.50 U	2.4	NS	NS	0.50 U	61	NS	NS	290	26	100	250
			Dec 2014	35	39	8	0.50 U	0.50 U	0.85	NS	5.2	0.50 U	200	8.2	49	310
			July 2015	NS	0.2 U	6.2	NS	NS	0.4 J	NS	NS	NS	240	15	120	120
			Dec 2015	21	5.9	4.1	0.50 U	0.34 J	0.3 J	NS	12	0.50 U	190	7.9	97	410

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-33
IR SITE 70, SECOND SAND BIOBARRIER 1
VINYL CHLORIDE IN GROUNDWATER - 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

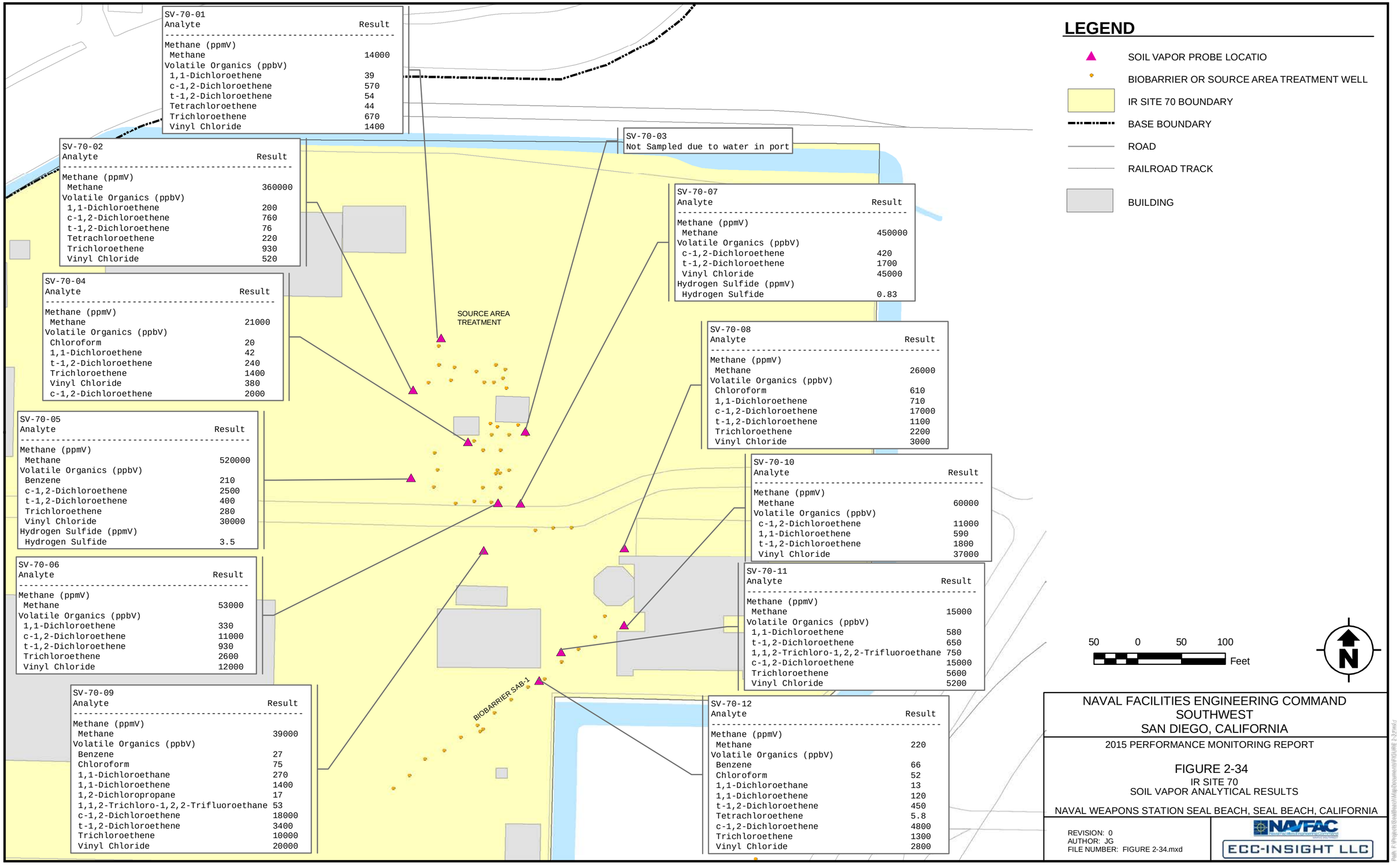
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-33.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



SV-70-01

Analyte	Result
Methane (ppmV)	
Methane	14000
Volatile Organics (ppbV)	
1,1-Dichloroethene	39
c-1,2-Dichloroethene	570
t-1,2-Dichloroethene	54
Tetrachloroethene	44
Trichloroethene	670
Vinyl Chloride	1400

SV-70-02

Analyte	Result
Methane (ppmV)	
Methane	360000
Volatile Organics (ppbV)	
1,1-Dichloroethene	200
c-1,2-Dichloroethene	760
t-1,2-Dichloroethene	76
Tetrachloroethene	220
Trichloroethene	930
Vinyl Chloride	520

SV-70-03
Not Sampled due to water in port

SV-70-04

Analyte	Result
Methane (ppmV)	
Methane	21000
Volatile Organics (ppbV)	
Chloroform	20
1,1-Dichloroethene	42
t-1,2-Dichloroethene	240
Trichloroethene	1400
Vinyl Chloride	380
c-1,2-Dichloroethene	2000

SV-70-05

Analyte	Result
Methane (ppmV)	
Methane	520000
Volatile Organics (ppbV)	
Benzene	210
c-1,2-Dichloroethene	2500
t-1,2-Dichloroethene	400
Trichloroethene	280
Vinyl Chloride	30000
Hydrogen Sulfide (ppmV)	
Hydrogen Sulfide	3.5

SV-70-06

Analyte	Result
Methane (ppmV)	
Methane	53000
Volatile Organics (ppbV)	
1,1-Dichloroethene	330
c-1,2-Dichloroethene	11000
t-1,2-Dichloroethene	930
Trichloroethene	2600
Vinyl Chloride	12000

SV-70-07

Analyte	Result
Methane (ppmV)	
Methane	450000
Volatile Organics (ppbV)	
c-1,2-Dichloroethene	420
t-1,2-Dichloroethene	1700
Vinyl Chloride	45000
Hydrogen Sulfide (ppmV)	
Hydrogen Sulfide	0.83

SV-70-08

Analyte	Result
Methane (ppmV)	
Methane	26000
Volatile Organics (ppbV)	
Chloroform	610
1,1-Dichloroethene	710
c-1,2-Dichloroethene	17000
t-1,2-Dichloroethene	1100
Trichloroethene	2200
Vinyl Chloride	3000

SV-70-10

Analyte	Result
Methane (ppmV)	
Methane	60000
Volatile Organics (ppbV)	
c-1,2-Dichloroethene	11000
1,1-Dichloroethene	590
t-1,2-Dichloroethene	1800
Vinyl Chloride	37000

SV-70-11

Analyte	Result
Methane (ppmV)	
Methane	15000
Volatile Organics (ppbV)	
1,1-Dichloroethene	580
t-1,2-Dichloroethene	650
1,1,2-Trichloro-1,2,2-Trifluoroethane	750
c-1,2-Dichloroethene	15000
Trichloroethene	5600
Vinyl Chloride	5200

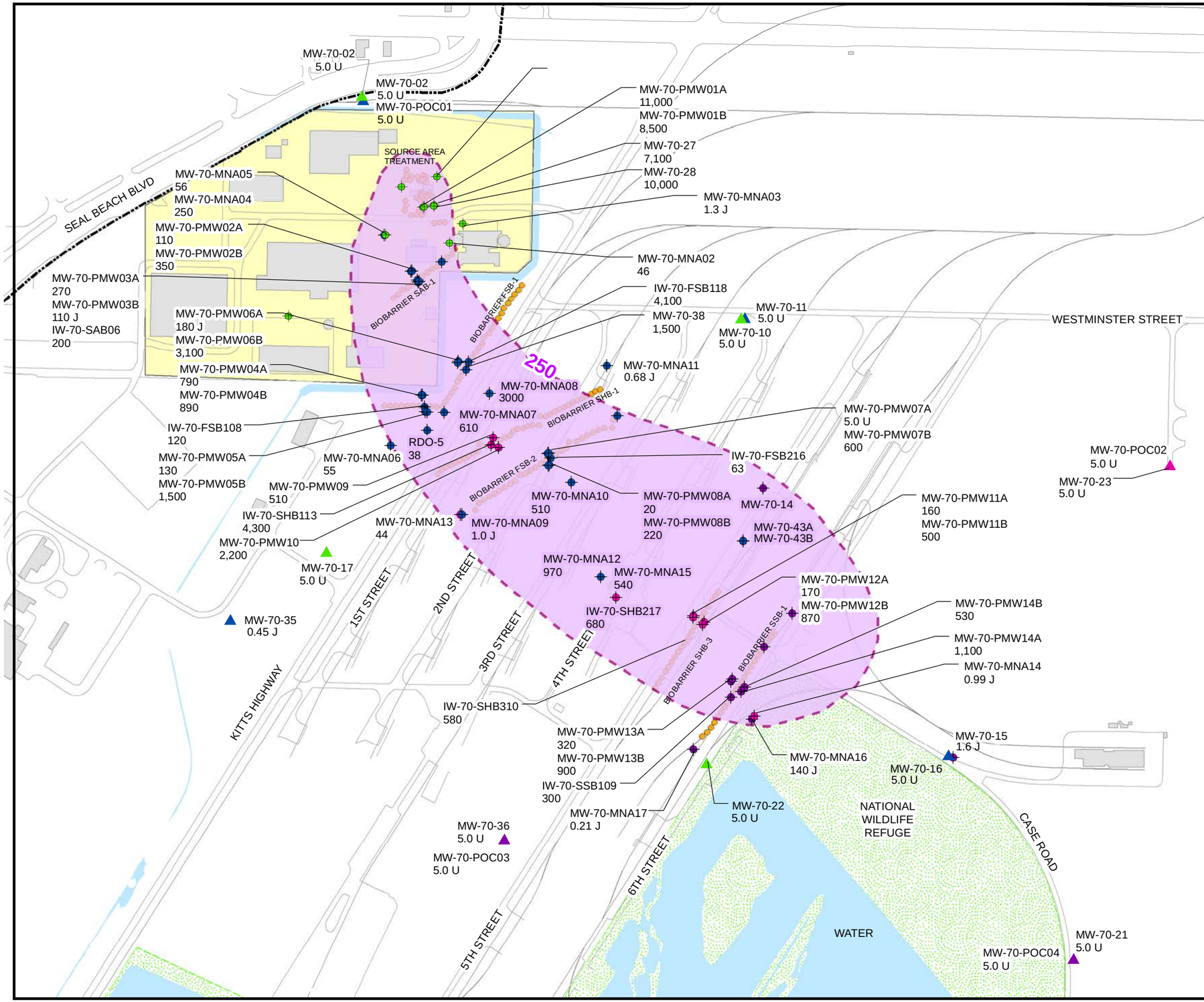
SV-70-09

Analyte	Result
Methane (ppmV)	
Methane	39000
Volatile Organics (ppbV)	
Benzene	27
Chloroform	75
1,1-Dichloroethane	270
1,1-Dichloroethene	1400
1,2-Dichloropropane	17
1,1,2-Trichloro-1,2,2-Trifluoroethane	53
c-1,2-Dichloroethene	18000
t-1,2-Dichloroethene	3400
Trichloroethene	10000
Vinyl Chloride	20000

SV-70-12

Analyte	Result
Methane (ppmV)	
Methane	220
Volatile Organics (ppbV)	
Benzene	66
Chloroform	52
1,1-Dichloroethane	13
1,1-Dichloroethene	120
t-1,2-Dichloroethene	450
Tetrachloroethene	5.8
c-1,2-Dichloroethene	4800
Trichloroethene	1300
Vinyl Chloride	2800

This Page Intentionally Left Blank



LEGEND

MW-70-MNA02	UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-22	UPPER FINES/SOURCE AREA TREATMENT POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-MNA08	FIRST SAND MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-11	FIRST SAND POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-MNA14	SHELL HORIZON MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-23	SHELL HORIZON POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-15	SECOND SAND MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-36	SECOND SAND POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-POC02	DEEP SAND POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	BUILDING
250	APPROXIMATE EXTENT OF 250 ug/L TCE CONCENTRATION IN GROUNDWATER PROJECTED TO SURFACE - FALL 2008

NOTES:

ug/L - MICROGRAMS PER LITER

TCE - TRICHLOROETHYLENE

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-35
IR SITE 70
2008 TCE EXTENT (PROJECTED TO GROUND SURFACE)

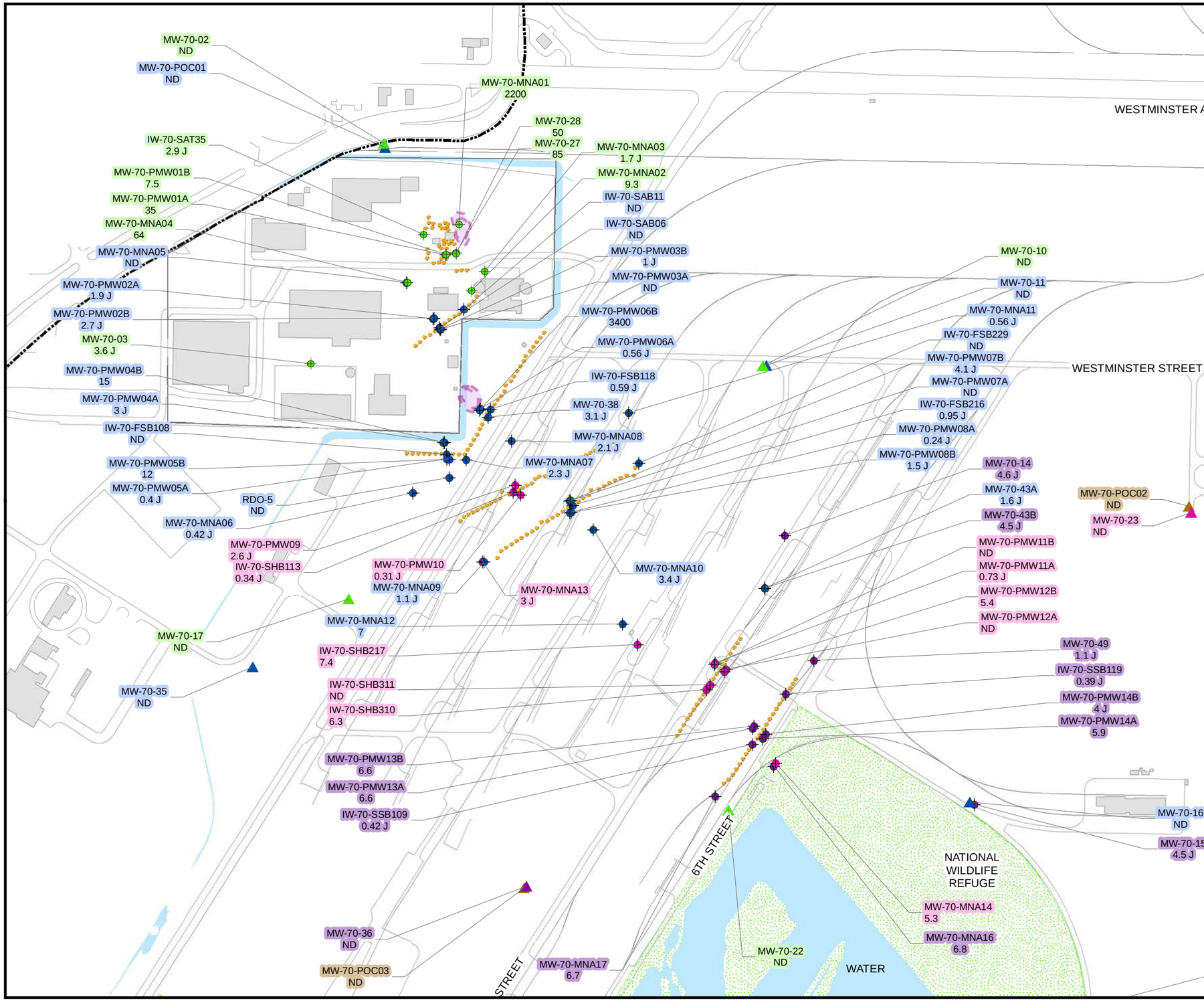
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-22.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-MNA02	UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-22	UPPER FINES/SOURCE AREA TREATMENT POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-MNA08	FIRST SAND MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-11	FIRST SAND POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-MNA14	SHELL HORIZON MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-23	SHELL HORIZON POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-15	SECOND SAND MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-36	SECOND SAND POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-POC02	DEEP SAND POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	BUILDING
250	APPROXIMATE EXTENT OF 250 ug/L TCE CONCENTRATION IN GROUNDWATER PROJECTED TO SURFACE - 2015

NOTES:

ug/L - MICROGRAMS PER LITER

TCE - TRICHLOROETHYLENE

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 2-36
IR SITE 70
2015 TCE EXTENT (PROJECTED TO GROUND SURFACE)

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

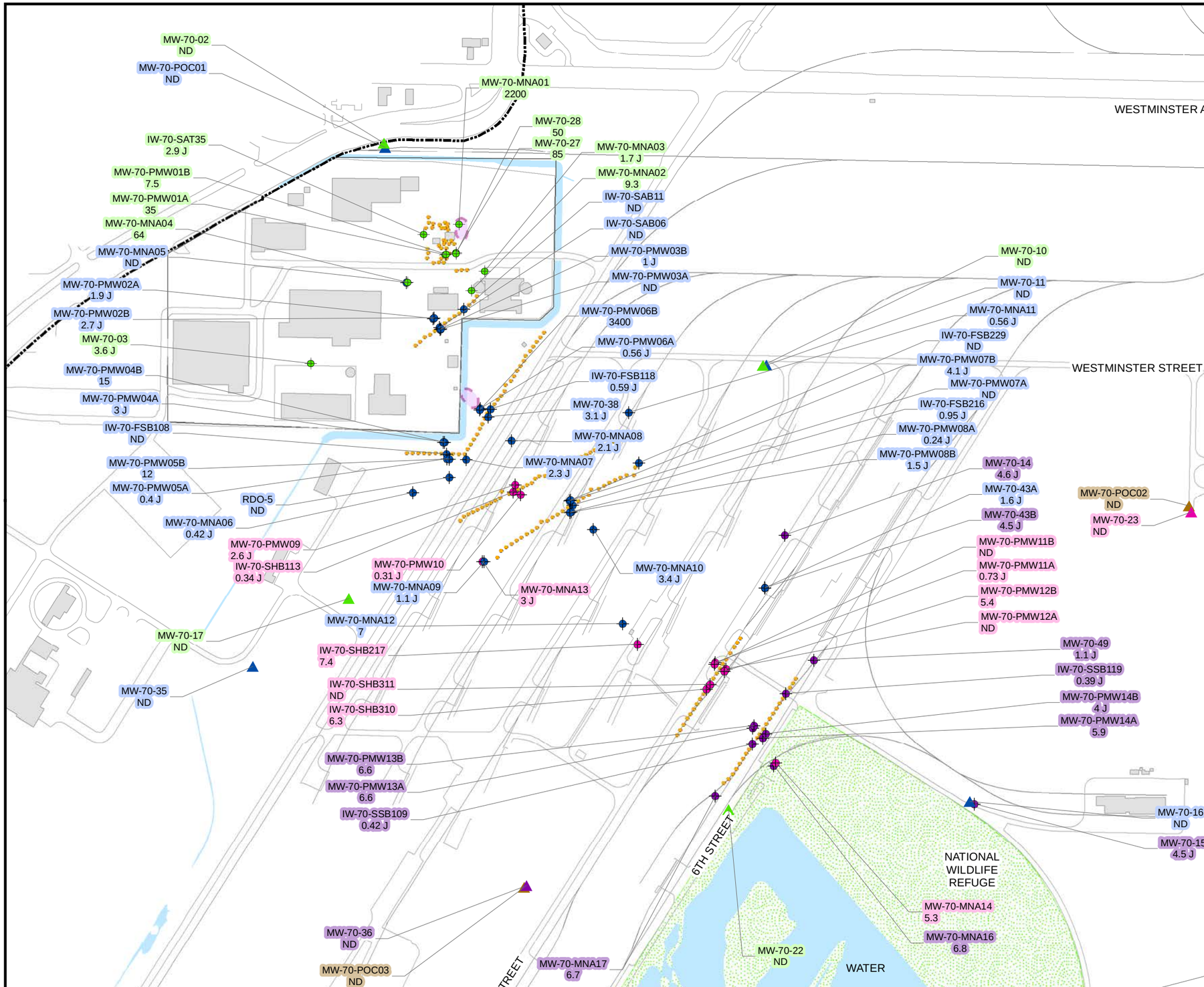
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2-36.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map\Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-MNA02	UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-22	UPPER FINES/SOURCE AREA TREATMENT POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-MNA08	FIRST SAND MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-11	FIRST SAND POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-MNA14	SHELL HORIZON MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-23	SHELL HORIZON POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-15	SECOND SAND MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-36	SECOND SAND POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
MW-70-POC02	DEEP SAND POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	BUILDING
1,000	APPROXIMATE EXTENT OF 1,000 ug/L TCE CONCENTRATION IN GROUNDWATER PROJECTED TO SURFACE - 2015

NOTES:

ug/L - MICROGRAMS PER LITER

TCE - TRICHLOROETHYLENE

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 3-1
TRICHLOROETHENE EXTENT ABOVE 1,000 ug/L
2015 ANNUAL SAMPLING EVENT

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

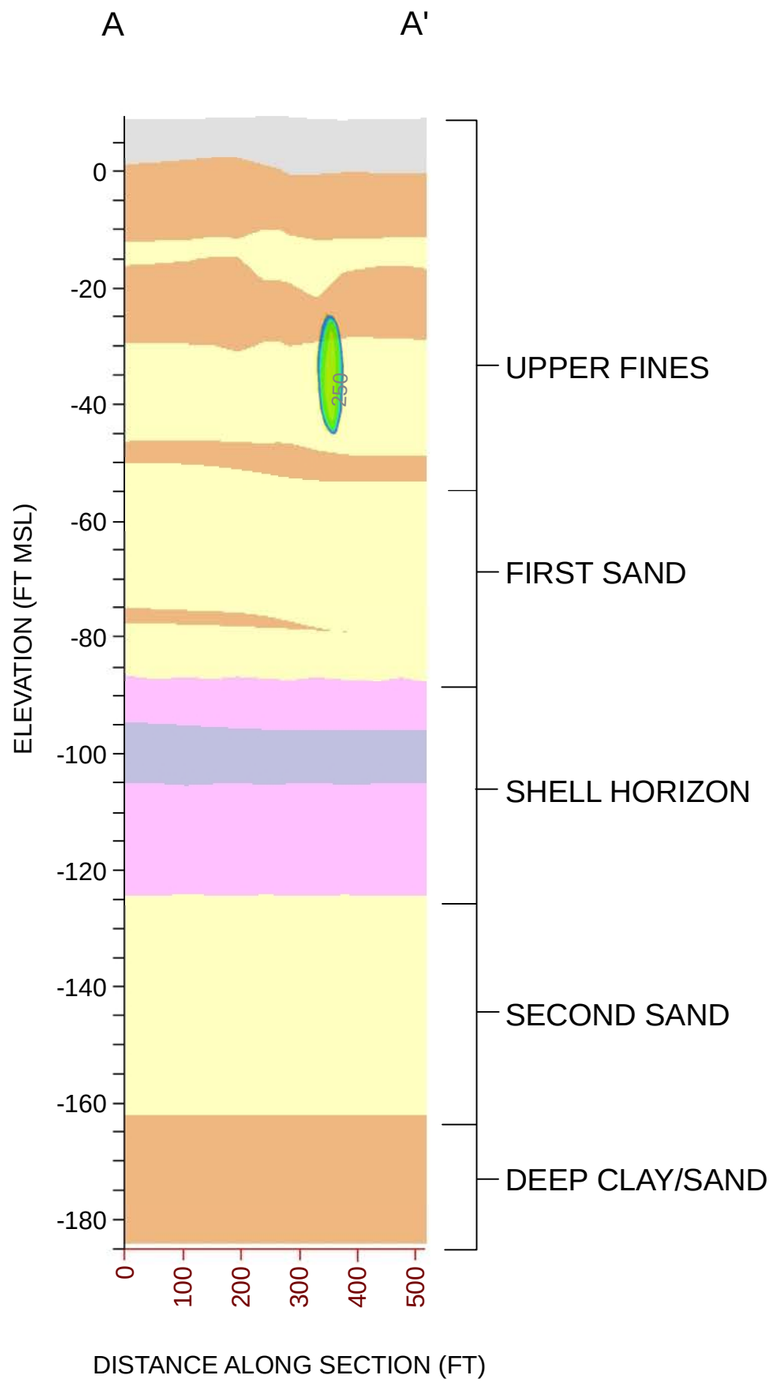
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 3-1.mxd

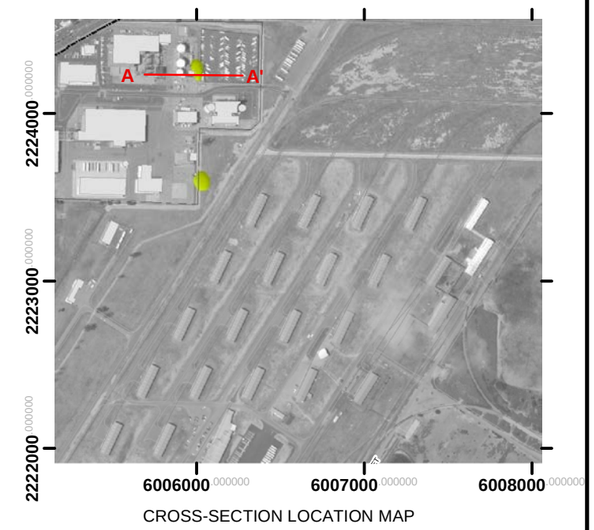
NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map\Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank





CROSS-SECTION LOCATION MAP

LITHOLOGY

- Fill
- Clay1
- Sand1
- Clay2
- Sand2
- Clay3
- FirstSand
- ClayMid
- SandMid
- SHSand1
- SHClay1
- SHSand2
- SHClay2
- SHSand3
- SecondSand
- DeepClay
- DeepSand

TCE (ug/L)

3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0

0 100 200 400 Feet

NOTES:
- EASTING AND NORTHING COORDINATES ARE IN NAD83 STATE PLANE, FEET
- ELEVATIONS ARE RELATIVE TO MEAN SEA LEVEL AS PER NGVD29 FEET
- CHEMISTRY UNITS ARE ug/L
- VERTICAL EXAGGERATION=10X

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 3-2
TRICHLOROETHYLENE EXTENT ABOVE 250 ug/L ALONG CROSSSECTION A-A', 2015 ANNUAL SAMPLING EVENT

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

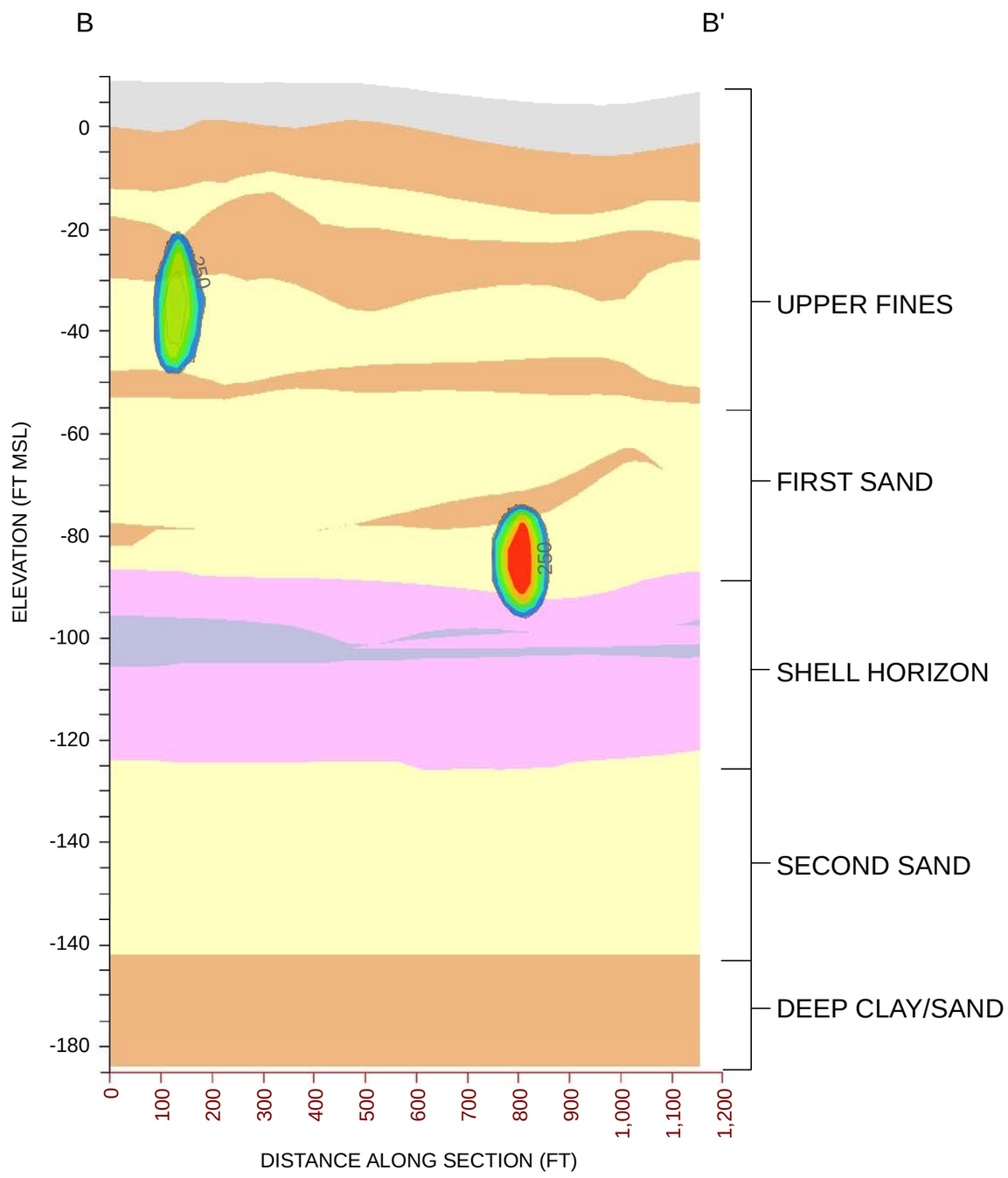
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 3-2.mxd

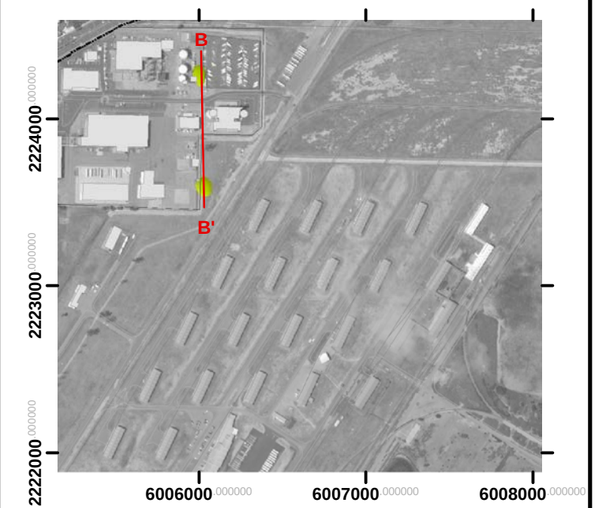
NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map\Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank





CROSS-SECTION LOCATION MAP

LITHOLOGY

- Fill
- Clay1
- Sand1
- Clay2
- Sand2
- Clay3
- FirstSand
- ClayMid
- SandMid
- SHSand1
- SHClay1
- SHSand2
- SHClay2
- SHSand3
- SecondSand
- DeepClay
- DeepSand

TCE (ug/L)

- 3500.0
- 3000.0
- 2500.0
- 2000.0
- 1500.0
- 1000.0
- 500.0
- 0.0

0 100 200 400 Feet

NOTES:
• EASTING AND NORTHING COORDINATES ARE IN NAD83 STATE PLANE, FEET
• ELEVATIONS ARE RELATIVE TO MEAN SEA LEVEL AS PER NGVD29 FEET
• CHEMISTRY UNITS ARE ug/L
• VERTICAL EXAGGERATION=10X

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 3-3
TRICHLOROETHYLENE EXTENT ABOVE 250 ug/L ALONG CROSSSECTION B-B', 2015 ANNUAL SAMPLING EVENT

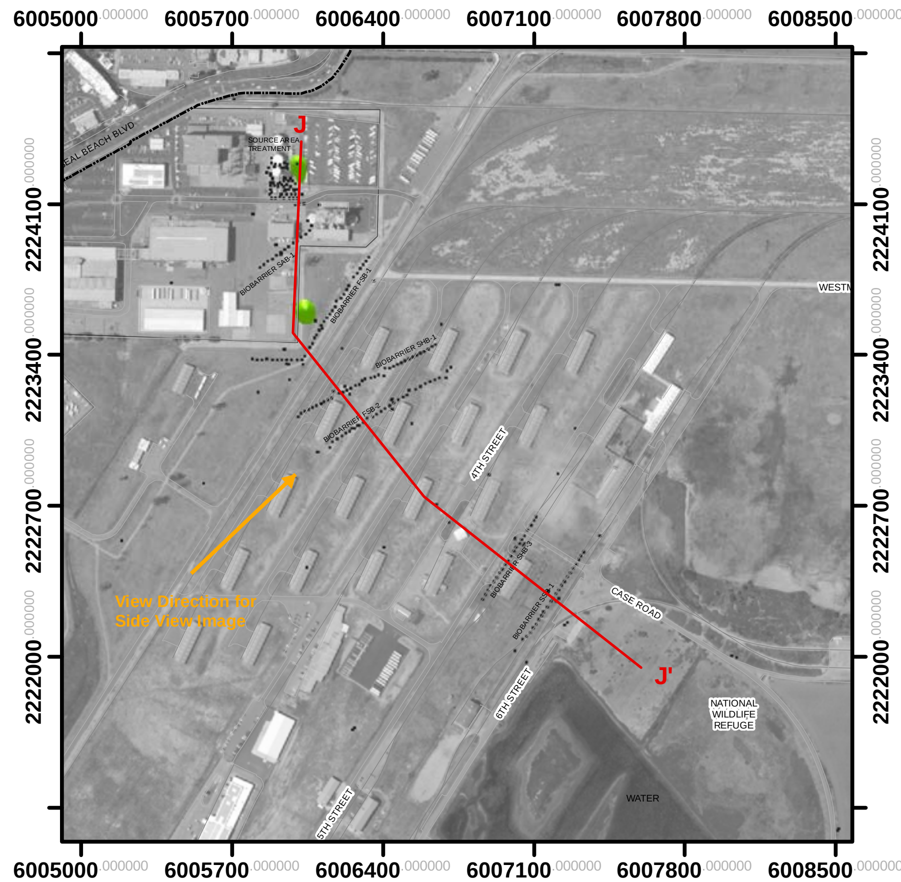
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 3-3.mxd

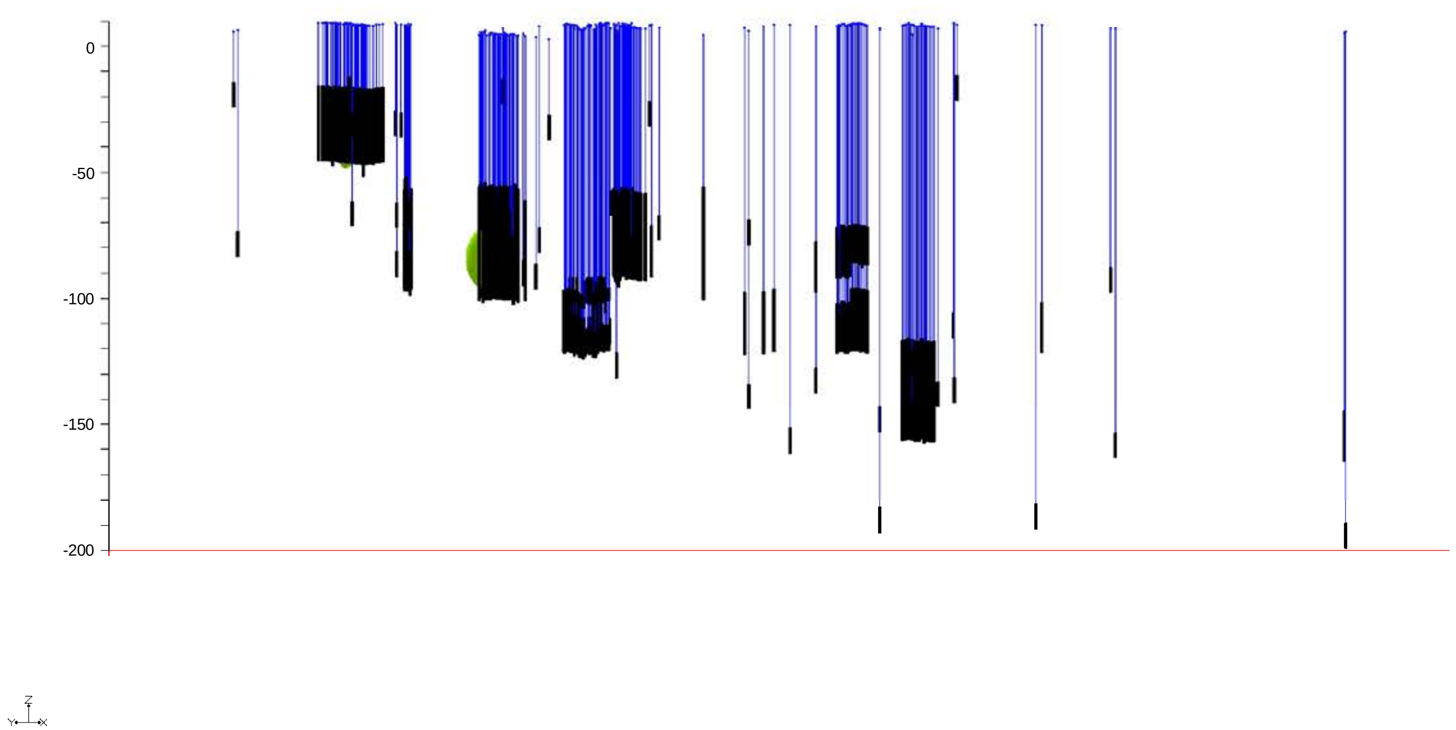
NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



TCE: Iso-level = 250 ug/L, Volume = 8,231 cubic yards



GENERAL LOCATION MAP

WELL RISER

WELL SCREEN

PLUME SHELL

NOTES:
- EASTING AND NORTHING COORDINATES ARE IN NAD83 STATE PLANE, FEET
- ELEVATIONS ARE RELATIVE TO MEAN SEA LEVEL AS PER NGVD29 FEET
- CHEMISTRY UNITS ARE ug/L
- VERTICAL EXAGGERATION=10X
- CROSS-SECTIONVIEW ANGLE TO THE NORTHEAST

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 3-4
TRICHLOROETHENE EXTENT ABOVE 250 ug/L
2015 ANNUAL SAMPLING EVENT

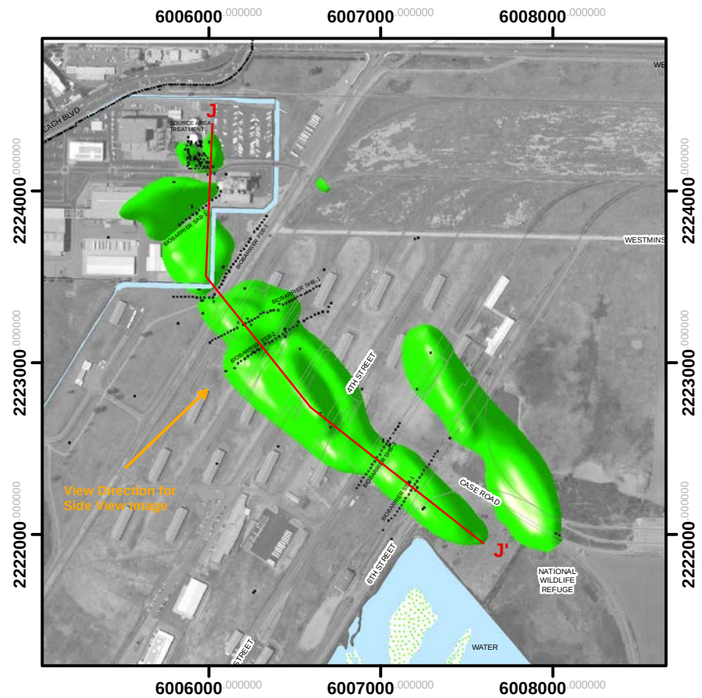
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 3-4.mxd

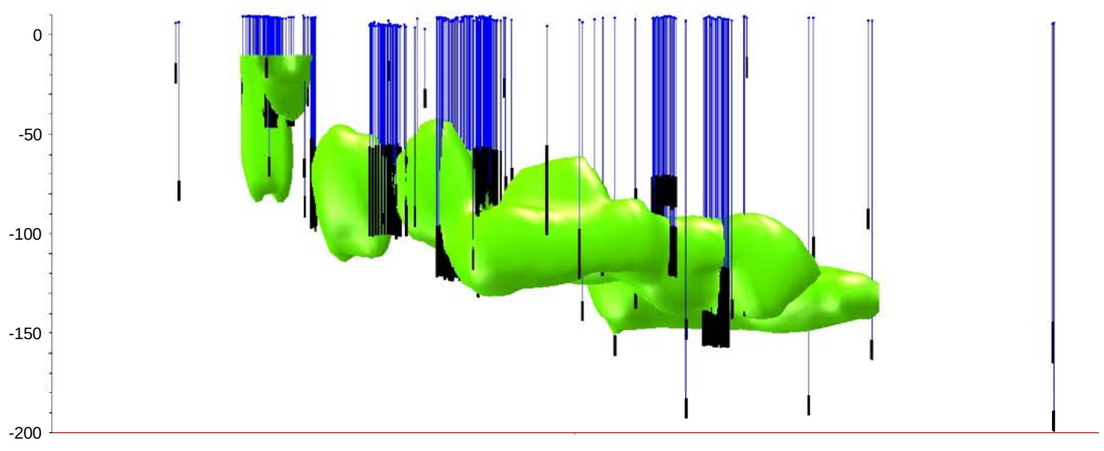
NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



1,2-DCE: Iso-level = 60 ug/L, Volume = 3,085,556 cubic yards



GENERAL LOCATION MAP

WELL RISER

WELL SCREEN

PLUME SHELL

NOTES:
- EASTING AND NORTHING COORDINATES ARE IN NAD83 STATE PLANE, FEET
- ELEVATIONS ARE RELATIVE TO MEAN SEA LEVEL AS PER NGVD29 FEET
- CHEMISTRY UNITS ARE ug/L
- VERTICAL EXAGGERATION=10X
- CROSS-SECTIONVIEW ANGLE TO THE NORTHEAST

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 3-5
CIS-1,2-DICHLOROETHENE EXTENT ABOVE 60 ug/L
2015 ANNUAL SAMPLING EVENT

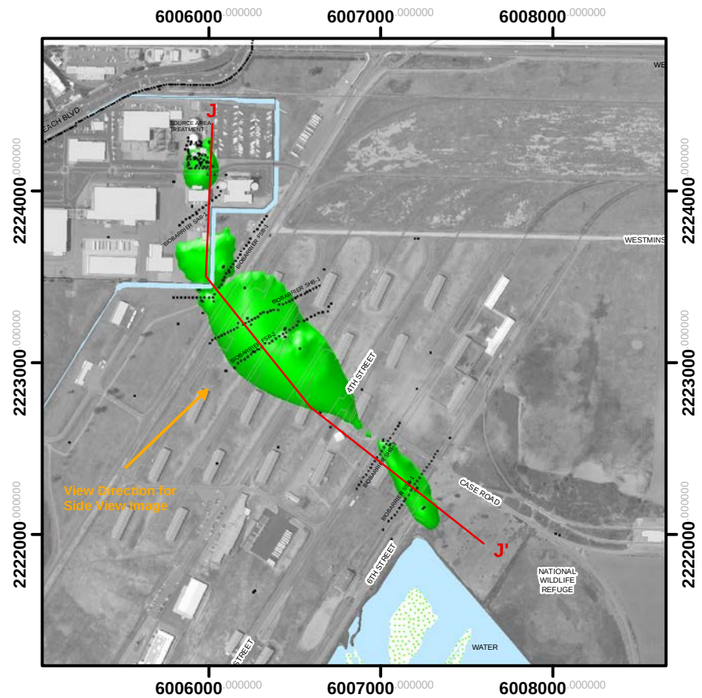
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 3-5.mxd

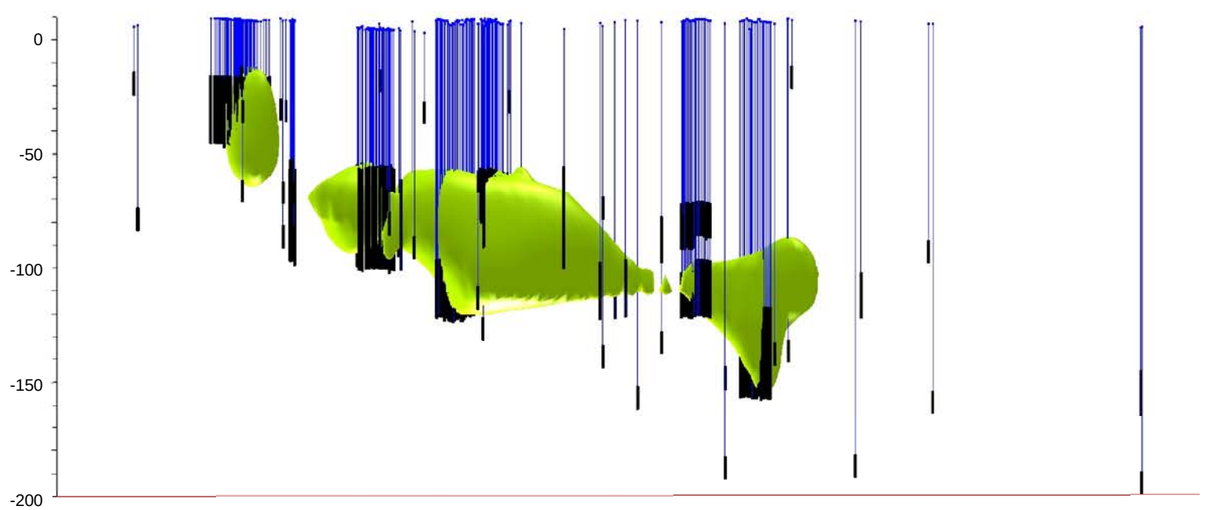
NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



VINYL CHLORIDE: Iso-level = 20 ug/L, Volume = 1,154,815 cubic yards



GENERAL LOCATION MAP

WELL RISER

WELL SCREEN

PLUME SHELL

NOTES:
- EASTING AND NORTHING COORDINATES ARE IN NAD83 STATE PLANE, FEET
- ELEVATIONS ARE RELATIVE TO MEAN SEA LEVEL AS PER NGVD29 FEET
- CHEMISTRY UNITS ARE ug/L
- VERTICAL EXAGGERATION=10X
- CROSS-SECTIONVIEW ANGLE TO THE NORTHEAST

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 3-6
VINYL CHLORIDE EXTENT ABOVE 20 ug/L
2015 ANNUAL SAMPLING EVENT

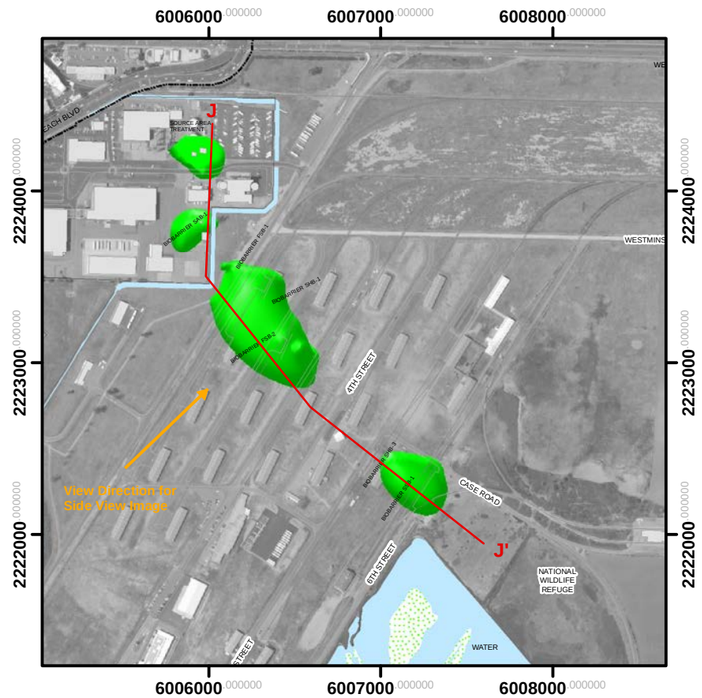
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 3-6.mxd

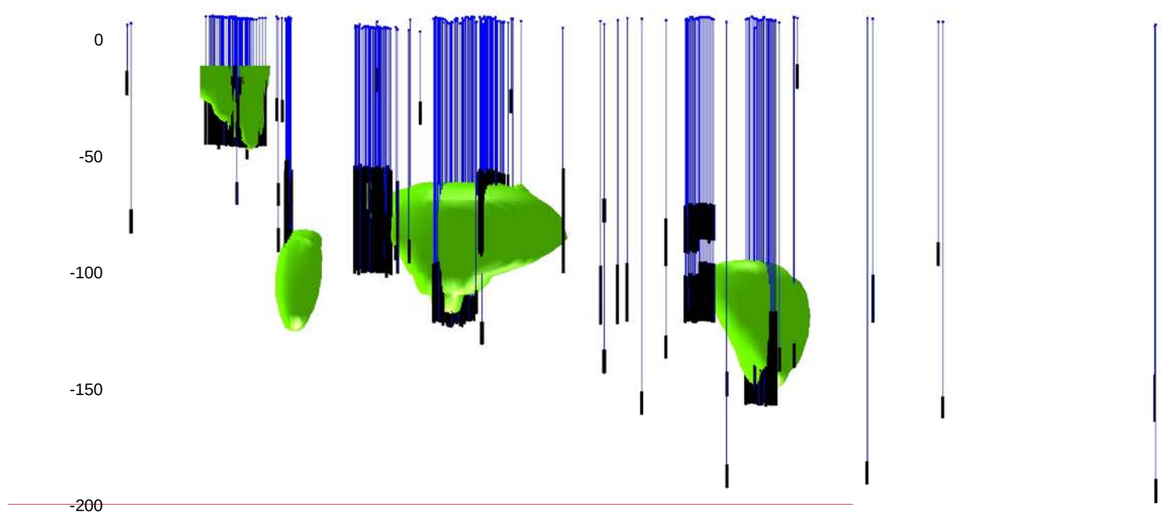
NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



Ethene: Iso-level = 10 ug/L, Volume = 1,734,444 cubic yards



GENERAL LOCATION MAP

WELL RISER

WELL SCREEN

PLUME SHELL

NOTES:
- EASTING AND NORTHING COORDINATES ARE IN NAD83 STATE PLANE, FEET
- ELEVATIONS ARE RELATIVE TO MEAN SEA LEVEL AS PER NGVD29 FEET
- CHEMISTRY UNITS ARE ug/L
- VERTICAL EXAGGERATION=10X
- CROSS-SECTIONVIEW ANGLE TO THE NORTHEAST

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 3-7
ETHENE EXTENT ABOVE 10 ug/L
2015 ANNUAL SAMPLING EVENT

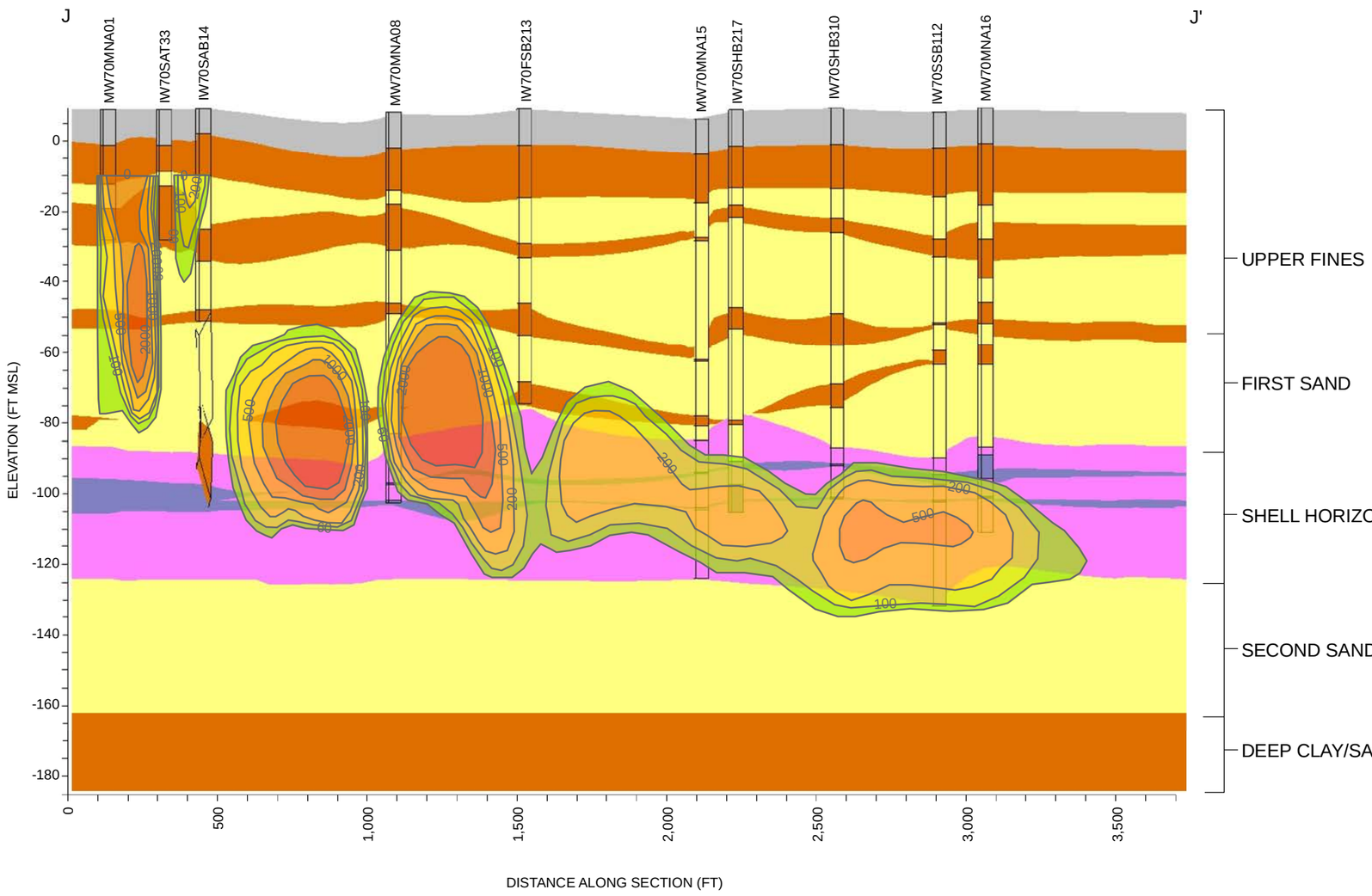
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

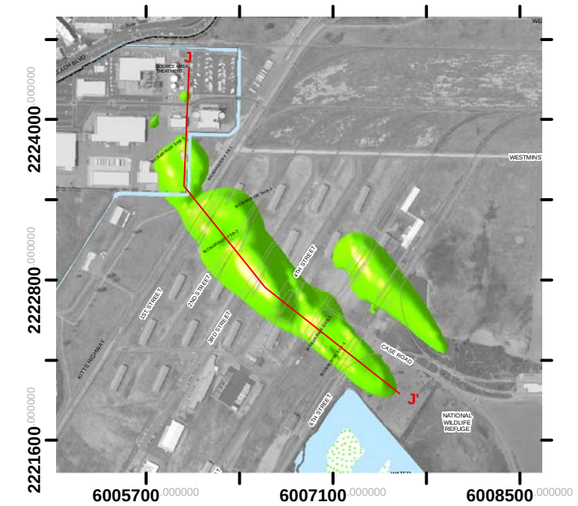
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 3-7.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank





CROSS-SECTION LOCATION MAP

LITHOLOGY

- Fill
- Clay1
- Sand1
- Clay2
- Sand2
- Clay3
- FirstSand
- ClayMid
- SandMid
- SHSand1
- SHClay1
- SHSand2
- SHClay2
- SHSand3
- SecondSand
- DeepClay
- DeepSand

1,2-DCE (ug/L)

- 5500.0
- 2000.0
- 1000.0
- 500.0
- 60.0

0 250 500 1,000 Feet

NOTES:
- EASTING AND NORTHING COORDINATES ARE IN NAD83 STATE PLANE, FEET
- ELEVATIONS ARE RELATIVE TO MEAN SEA LEVEL AS PER NGVD29 FEET
- CHEMISTRY UNITS ARE ug/L
- VERTICAL EXAGGERATION=10X

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 3-8
CIS-1,2-DICHLOROETHYLENE EXTENT ABOVE 60 ug/L ALONG CROSSSECTION J-J', 2015 ANNUAL SAMPLING EVENT

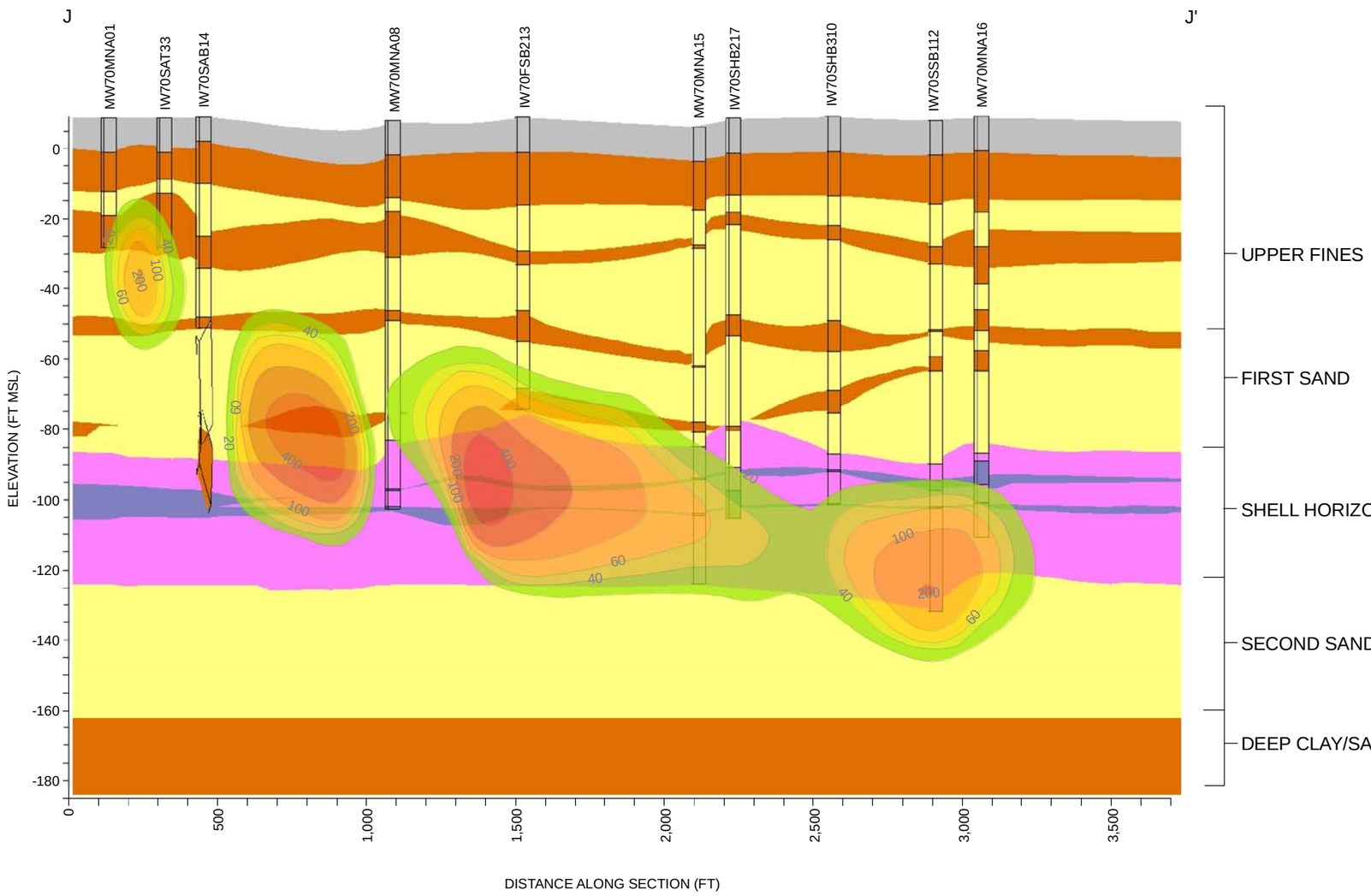
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

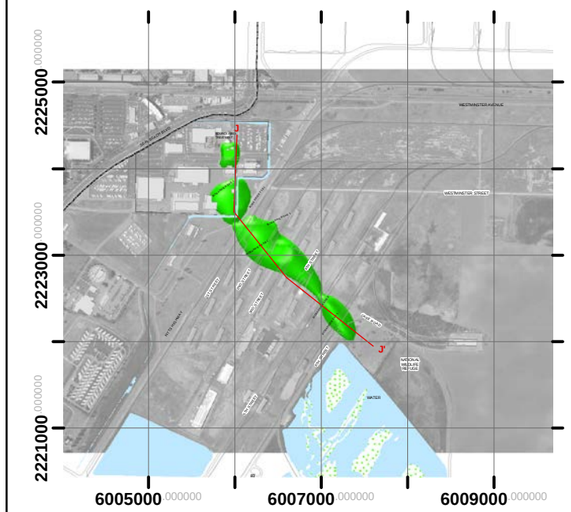
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 3-8.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank





CROSS-SECTION LOCATION MAP

LITHOLOGY

- Fill
- Clay1
- Sand1
- Clay2
- Sand2
- Clay3
- FirstSand
- ClayMid
- SandMid
- SHSand1
- SHClay1
- SHSand2
- SHClay2
- SHSand3
- SecondSand
- DeepClay
- DeepSand

Vinyl Chloride (ug/L)

548.0
200.0
100.0
20.0

0 250 500 1,000 Feet

NOTES:
- EASTING AND NORTHING COORDINATES ARE IN NAD83 STATE PLANE, FEET
- ELEVATIONS ARE RELATIVE TO MEAN SEA LEVEL AS PER NGVD29 FEET
- CHEMISTRY UNITS ARE ug/L
- VERTICAL EXAGGERATION=10X

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 3-9
VINYL CHLORIDE EXTENT ABOVE 20 ug/L ALONG CROSSSECTION J-J', 2015 ANNUAL SAMPLING EVENT

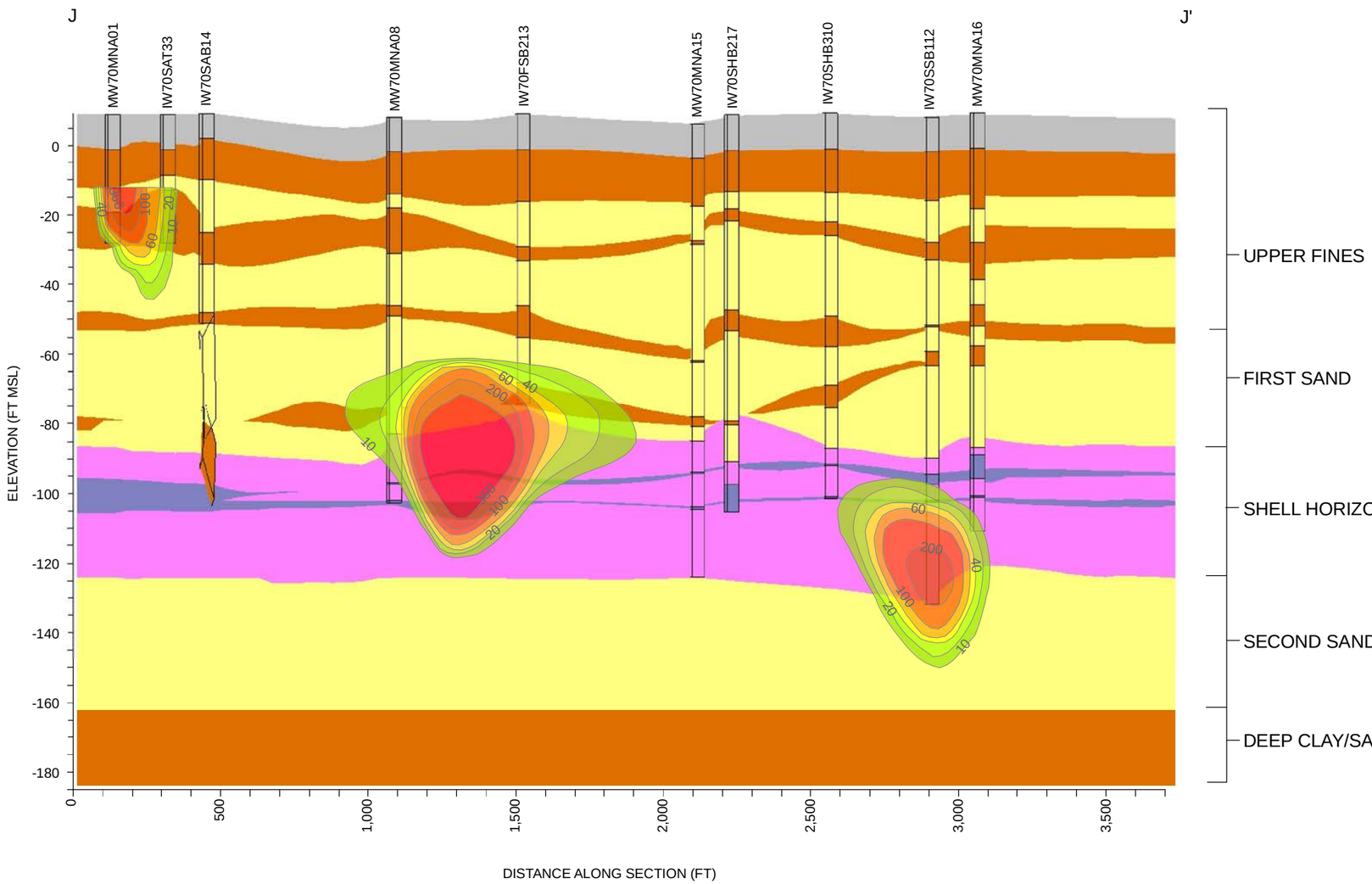
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

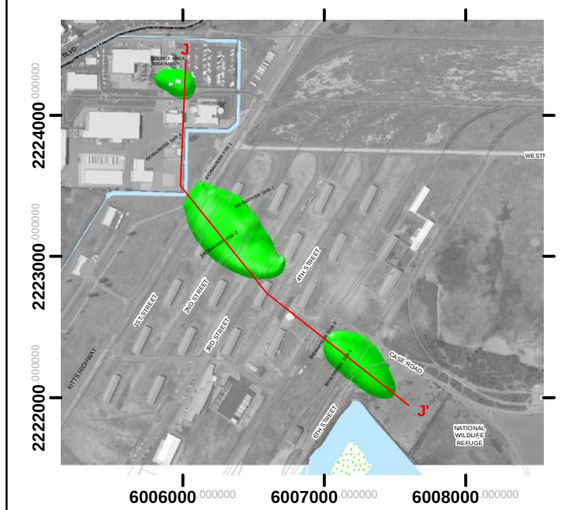
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 3-9.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank





CROSS-SECTION LOCATION MAP

LITHOLOGY

- Fill
- Clay1
- Sand1
- Clay2
- Sand2
- Clay3
- FirstSand
- ClayMid
- SandMid
- SHSand1
- SHClay1
- SHSand2
- SHClay2
- SHSand3
- SecondSand
- DeepClay
- DeepSand

Ethene (ug/L)

- 360.0
- 200.0
- 100.0
- 40.0
- 10.0

0 250 500 1,000 Feet

NOTES:
- EASTING AND NORTHING COORDINATES ARE IN NAD83 STATE PLANE, FEET
- ELEVATIONS ARE RELATIVE TO MEAN SEA LEVEL AS PER NGVD29 FEET
- CHEMISTRY UNITS ARE ug/L
- VERTICAL EXAGGERATION=10X

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 3-10
ETHENE EXTENT ABOVE 10 ug/L ALONG
CROSSSECTION J-J', 2015 ANNUAL SAMPLING EVENT

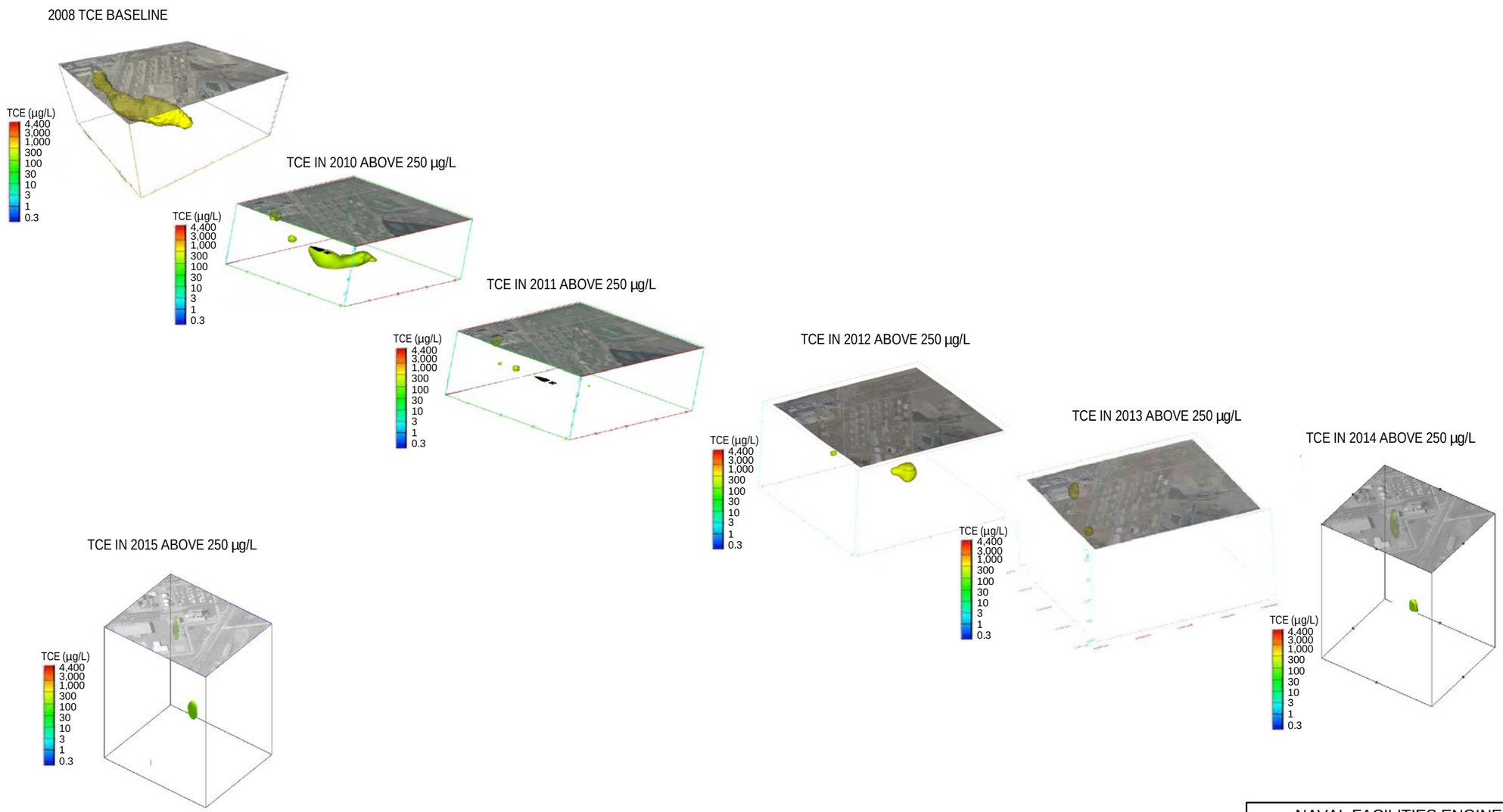
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 3-10.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 3-11
THREE DIMENSIONAL VIEWS OF TRICHLORETHYLENE PLUME
(>250 ug/L) 2008-2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

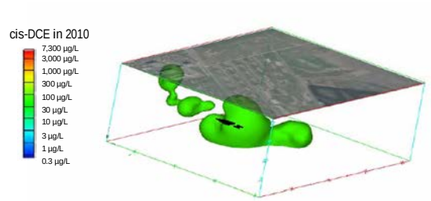
REVISION: 0
AUTHOR: MS
FILE NUMBER: FIGURE 3-11.mxd

ECC-INSIGHT LLC

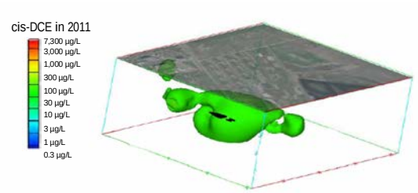
Path: F:\Projects\SealBeach\Map\Documents\FIGURE 3-11_AJ.mxd

This Page Intentionally Left Blank

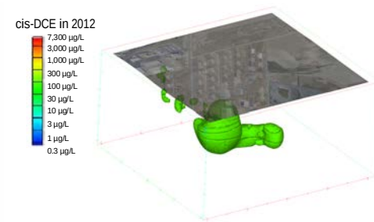
2010 CIS-DCE



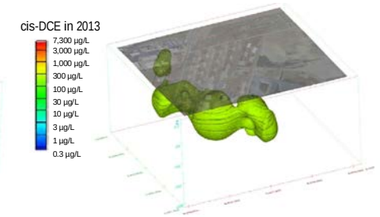
2011 CIS-DCE



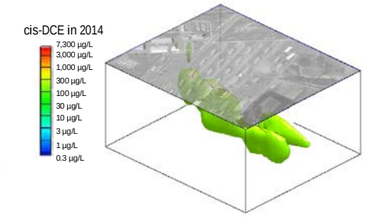
2012 CIS-DCE



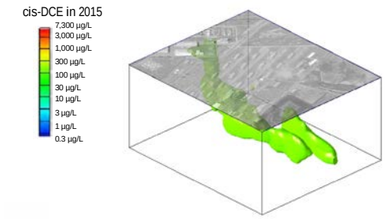
2013 CIS-DCE

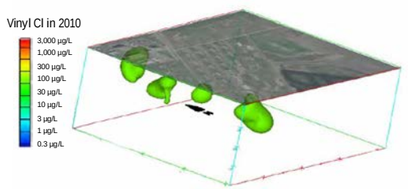


2014 CIS-DCE

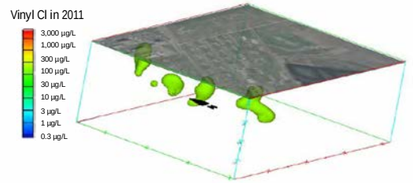


2015 CIS-DCE

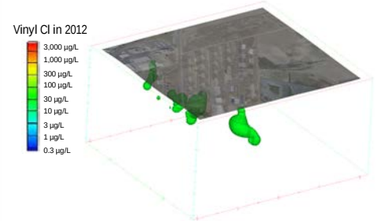




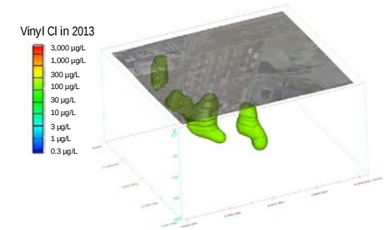
2010 VINYL CHLORIDE



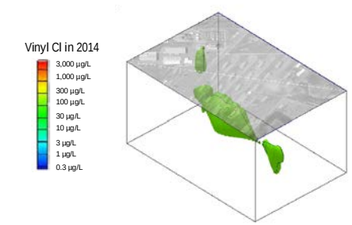
2011 VINYL CHLORIDE



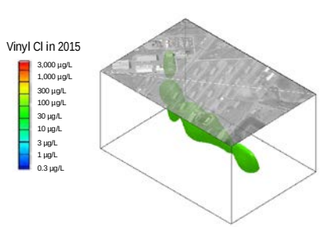
2012 VINYL CHLORIDE



2013 VINYL CHLORIDE



2014 VINYL CHLORIDE



2015 VINYL CHLORIDE

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 3-12

THREE DIMENSIONAL VIEWS OF CIS-1,2-DICHLORETHENE PLUME (>60 ug/L) AND VINYL CHLORIDE PLUME (>20 ug/L) 2010 TO 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: MS
FILE NUMBER: FIGURE 3-12.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map\Documents\FIGURE 3-12_AJ.mxd

This Page Intentionally Left Blank

APPENDIX A

FIELD SAMPLE COLLECTION AND AMBIENT AIR MONITORING LOGS
(on CD only)

This page intentionally left blank

List of Wells for Groundwater Level Mesurements
IR Site 70, Naval Weapons Station Seal Beach, Seal Beach, California

Well Number	Screen Interval (feet bgs)	December 2015 Annual Event				
		Date	Time	Depth to Groundwater (feet below TOC)	Total Depth of the Well (feet)	Comments
Upper Fines						
MW-70-03	20-30	12-14-15	1505	12.53		
Source Area Treatment/Upper Fines						
MW-70-PMW01A	25-35		1015	13.53		
MW-70-PMW01B	45-55		1020	14.40		
MW-70-27	26-36		1031	13.77		
MW-70-28	50-60		1033	14.59		
MW-70-MNA01	40-50		1035	14.55		
MW-70-MNA02	35-45		1039	13.54		
MW-70-MNA03	35-45		1044	14.22		
MW-70-MNA04	35-45		1005	13.49		
Source Area Biobarrier/First Sand						
MW-70-PMW02A	71-81		1050	14.80		
MW-70-PMW02B	90-100		1052	14.82		
IW-70-SAB06	65-80/85-105		1100	14.50		
MW-70-MNA05	70-80		1009	14.83		
MW-70-PMW03A	70-80		1102	14.40		
MW-70-PMW03B	90-100		1103	14.43		
First Sand Biobarrier 1						
MW-70-38	80-100		1127	13.56		
IW-70-FSB118	60-105		1205	11.05		
MW-70-PMW06A	70-80		1125	10.91		
MW-70-PMW06B	91-101		1124	10.95		
MW-70-PMW04A	70-80		1212	11.16		

List of Wells for Groundwater Level Mesurements
IR Site 70, Naval Weapons Station Seal Beach, Seal Beach, California

Well Number	Screen Interval (feet bgs)	December 2015 Annual Event				
		Date	Time	Depth to Groundwater (feet below TOC)	Total Depth of the Well (feet)	Comments
MW-70-PMW04B	90-100	12-14-15	1215	11.25		
IW-70-FSB108	60-105		1220	11.33		
MW-70-PMW05A	70-80		1225	10.91		
MW-70-PMW05B	90-100		1226	11.16		
RDO-5	65-105		1233	12.74		
MW-70-MNA08	80-90		1240	14.48		
MW-70-MNA06	80-90		1230	10.65		
MW-70-MNA11	80-90		1245	15.55		
MW-70-MNA07	90-100		1453	11.43		
First Sand Biobarrier 2						
MW-70-PMW07A	65-75		1256	15.33		
MW-70-PMW07B	85-95		1257	15.85		
IW-70-FSB216	65-100		1305	14.44		
MW-70-PMW08A	65-75		1302	17.15		
MW-70-PMW08B	85-95		1300	18.05		
MW-70-MNA09	64-74		1314	14.03		
MW-70-MNA10	75-85		1332	16.13		
MW-70-MNA12	75-85		1338	15.19		
MW-70-43A	86-106		1350	20.73		
Shell Horizon Biobarrier 1						
MW-70-PMW09	120-130		1324	15.78		
IW-70-SHB113	105-130		1326	15.78		
MW-70-PMW10	120-130		1327	15.78		
IW-70-SHB217	105-130		1345	18.43		
MW-70-MNA13	115-125		1316	15.65		

List of Wells for Groundwater Level Mesurements
IR Site 70, Naval Weapons Station Seal Beach, Seal Beach, California

Well Number	Screen Interval (feet bgs)	December 2015 Annual Event				
		Date	Time	Depth to Groundwater (feet below TOC)	Total Depth of the Well (feet)	Comments
Shell Horizon Biobarrier 3						
MW-70-PMW11A	85-95	12-14-15	12:28	18.53		
MW-70-PMW11B	115-125		12:26	17.75		
IW-70-SHB310	80-95/105-		12:35	N/A		UNABLE TO GAUGE WELL
MW-70-PMW12A	85-95		12:29	17.77		
MW-70-PMW12B	115-125		12:22	17.71		
MW-70-MNA14	115-125		11:18	18.91		
Second Sand Biobarrier 1						
MW-70-PMW13A	125-135		11:32	16.58		
MW-70-PMW13B	145-155		11:31	16.51		
IW-70-SSB109	126-166		11:26	18.22		
MW-70-PMW14A	128-138		11:28	16.50		
MW-70-PMW14B	149-159		11:29	17.15		
MW-70-MNA16	141-151		11:20	18.52		
MW-70-MNA17	140-150		11:54	17.94		
MW-70-MNA15	140-150		1430	1555		
MW-70-15	161-171		11:03	20.44		
MW-70-14	160-170		12:10	20.57		
MW-70-43B	136-146		1352	20.63		
Point of Compliance/Upper Fines						
MW-70-02	20-30		1513	12.54		
MW-70-10	30-40		1440	14.79		
MW-70-17	30-40		1445	8.96		
MW-70-22	20-30		11:24	10.20		

List of Wells for Groundwater Level Mesurements
IR Site 70, Naval Weapons Station Seal Beach, Seal Beach, California

Well Number	Screen Interval (feet bgs)	December 2015 Annual Event				
		Date	Time	Depth to Groundwater (feet below TOC)	Total Depth of the Well (feet)	Comments
Point of Compliance/First Sand						
MW-70-POC01	80-90	12-15-15	1510	14.85		
MW-70-11	80-100		1443	19.05		
MW-70-35	90-100		1447	14.95		
MW-70-16	95-105		11:06	20.32		
Point of Compliance/Shell Horizon						
MW-70-23	110-130		12:02	22.58		
Point of Compliance/Second Sand						
MW-70-36	150-160		12:46	18.77		
MW-70-21	150-170		10:56	20.41		
Point of Compliance/Deep Sand						
MW-70-POC02	190-200		12:04	21.62		
MW-70-POC03	190-200		12:48	18.91		
MW-70-POC04	195-205		10:52	22.03		

Acronyms/Abbreviations:
- bgs - below ground surface
- MSL - mean sea level
- NA - not available
- TOC - top of casing

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: MW-70-02	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 12.52
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other QED

Start Purge Time: 0818 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0821	15.8	6.38	5899	2.9	4.85	59.2	600	12.55
0824	16.0	6.40	5860	1.9	4.01	30.1	1200	12.55
0827	16.0	6.42	5872	1.7	3.54	10.4	1800	12.55
0830	16.0	6.43	5820	1.4	3.50	5.2	2400	12.55
0833	15.9	6.44	5597	1.0	3.21	-9.6	3000	12.55
0836	15.9	6.44	5569	1.0	3.00	-11.9	3600	12.55
0839	15.9	6.45	5409	1.0	1.00	-23.4	4200	12.55
0842	15.9	6.45	5414	0.9	0.99	-23.1	4800	12.55
0845	15.9	6.45	5425	0.7	0.96	-24.9	5400	12.55

Did well dewater? Yes (No)	Amount actually evacuated: 5400
Sampling Time: 0847	Sampling Date: 12/22/15
Sample I.D.: IR70-115-064	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-03	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 12.22
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: YSI 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (BTS) Bladder Pump

Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 0900 Flow Rate: 200 ML/MIN Pump Depth: 25'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0903	22.6	7.65	699	12	0.99	-253	600	12.39
0906	23.2	7.44	622	8	0.81	-255	1200	12.42
0909	23.3	7.34	506	5	0.79	-253	1800	12.44
0912	23.3	7.32	500	5	0.76	-252	2400	12.44
0915	23.3	7.30	497	5	0.74	-252	3000	12.44

Did well dewater? Yes (No)	Amount actually evacuated: 3000
Sampling Time: 0919	Sampling Date: 12-22-15
Sample I.D.: IR70-A15-066	Laboratory: ~~3+3~~ EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: ~~(3+3)~~ (3)
Equipment Blank I.D.: @ Time	Duplicate I.D.: ~~IR70-A15-098~~ P0

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-DF 1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-7010	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 14.79
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated) Tubing New Tubing Other QED

Start Purge Time: 1348 Flow Rate: 300 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1351	21.0	6.85	5929	1.3	0.91	-102.7	900	14.82
1354	20.9	6.84	5935	1.1	0.66	-139.9	1800	14.83
1357	21.0	6.83	5939	1.0	0.63	-166.1	2700	14.83
1400	21.0	6.83	5933	1.8	0.61	-171.9	3600	14.83
1403	21.0	6.83	5929	1.5	0.59	-175.3	4500	14.83

Did well dewater? Yes (No)	Amount actually evacuated: 4500
Sampling Time: 1405	Sampling Date: 12-21-15
Sample I.D.: IR70-A15-066	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.: IR70-A15-048 @ 1415

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70-11	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 19.09
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (X)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump) QED
Sampling Method: Dedicated Tubing New Tubing Other ~~Blag~~

Start Purge Time: 1320 Flow Rate: 300 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1323	20.5	7.10	2615	4.6	0.70	-189.8	900	19.19
1326	20.5	7.08	2600	2.9	0.52	-191.7	1800	19.19
1329	20.6	7.06	2590	2.4	0.50	-190.5	2700	19.19
1332	20.6	7.07	2568	3.7	0.49	-192.0	3600	19.19

Did well dewater? Yes (No)	Amount actually evacuated: 3600
Sampling Time: 1334	Sampling Date: 12-21-15
Sample I.D.: IR70-A15-070	Laboratory: ~~Blag~~
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: Insight
Sampler: PD	Gauging Date: 12.14.15
Well I.D.: MW-70-14	Well Diameter (in.): 2 3 4 6 8 (5)
Total Well Depth (ft.): –	Depth to Water (ft.): 20.91
Depth to Free Product: –	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump BTS)
Sampling Method: (Dedicated Tubing) New Tubing Other _____

Start Purge Time: 0901 Flow Rate: 200 mL/min Pump Depth: 165'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0904	19.7	6.43	9395	8	4.23	-36.5	600	20.92
0907	19.6	6.67	13766	4	1.57	-99.9	1200	20.92
0910	19.6	6.79	13951	4	1.40	-122.6	1800	20.92
0913	19.6	6.82	13957	4	1.36	-133.4	2400	20.92
0916	19.6	6.84	13973	4	1.32	-130.2	3000	20.92
0919	19.6	6.84	13910	4	1.30	-136.2	3600	20.92
0922	19.6	6.95	13740	4	1.29	-139.7	4200	20.92

Did well dewater? Yes (No) Amount actually evacuated: 4200

Sampling Time: 0925 Sampling Date: 12-17-15

Sample I.D.: IR70-A15-061 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: See COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: MW-70-15	Well Diameter (in.): 2 3 4 (6) 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 20.70
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated (Tubing) New Tubing Other (QED)

Start Purge Time: 1440 Flow Rate: 300 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1443	20.0	7.75	26545	9.3	0.99	-51.5	900	20.70
1446	20.0	7.45	26857	5.7	0.72	-85.1	1800	20.70
1449	19.9	7.00	26999	4.3	0.61	-87.7	2700	20.70
1452	19.9	6.83	27339	4.1	0.59	-87.2	3600	20.70
1455	19.9	6.78	27390	4.0	0.57	-93.8	4500	20.70
1458	19.9	6.77	27471	3.8	0.55	-98.2	5400	20.70
1501	19.9	6.77	27692	3.5	0.55	-104.6	6300	20.70

Did well dewater? Yes (No)	Amount actually evacuated: 6300
Sampling Time: 1501	Sampling Date: 12/18/15
Sample I.D.: ~~MW-70-15~~ IR70-A15-063	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE C.O.C.
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: JF	Gauging Date: 12-14-15
Well I.D.: MW-70-16	Well Diameter (in.): 2 3 4 (6) 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 20.57
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated) Tubing New Tubing Other QED

Start Purge Time: 1109 Flow Rate: 300ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1112	19.6	7.14	8722	6.6	1.29	-163.3	900	20.60
1115	19.6	7.08	9160	3.2	0.91	-173.0	1800	20.60
1118	19.6	7.04	9504	3.1	0.84	-184.7	2700	20.60
1121	19.8	7.00	10231	3.2	0.77	-191.3	3600	20.60
1124	19.8	697	11172	3.0	0.78	-188.8	4500	20.60
1127	19.8	689	11248	2.1	0.74	-187.8	~~5400~~ 5400	20.60
1130	19.9	6.85	11899	2.3	0.66	-190.9	6300	20.60
1133	19.9	6.87	11999	2.0	0.64	-195.4	7200	20.60
1136	19.9	6.86	12101	1.7	0.62	-197.1	8100	20.60

Did well dewater? Yes (No)	Amount actually evacuated: 8100 ml
Sampling Time: 1130	Sampling Date: 12/21/15
Sample I.D.: ~~MW~~ IR70-915-072	Laboratory: ~~EMAX~~
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 15/214·PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: MW-70·17	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 9.05
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: (Dedicated) Tubing New Tubing Other ____

Start Purge Time: 1340 Flow Rate: 200ml/MIN Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1343	21.2	6.57	11804	3.8	1.95	-24.9	600	9.10
1346	21.2	6.44	12046	3.5	0.93	-43.9	1200	9.10
1349	21.2	6.46	12125	3.2	0.84	-51.5	1800	9.10
1352	21.2	6.46	12163	3.0	0.82	-55.9	2400	9.10
1355	21.2	6.46	12185	2.7	0.80	-59.1	3000	9.10

Did well dewater? Yes (No)	Amount actually evacuated: 3000ml
Sampling Time: 1357	Sampling Date: 12/18/15
Sample I.D.: IR70·A15·067	Laboratory: ~~SEE CO~~ EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE C.O.C.
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD-1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: MW-70-21	Well Diameter (in.): 2 3 4 (6) 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 20.87
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other QED

Start Purge Time: 1152 Flow Rate: 400 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1155	19.8	7.60	28164	3.9	1.82	-123.4	1200	20.90
1158	19.9	6.84	28260	2.1	1.37	-133.1	2400	20.90
1201	19.9	6.79	28154	2.8	0.95	-151.0	3600	20.90
1204	19.9	6.76	28156	1.8	0.93	-166.9	4800	20.90
1207	19.9	6.74	28300	1.5	0.77	-187.8	6000	20.90
1210	19.8	6.74	28311	1.9	0.74	-193.1	7200	20.90
1213	19.8	6.73	28330	2.3	0.71	-199.9	8400	20.90

Did well dewater? Yes (No)	Amount actually evacuated: 8400 ml
Sampling Time: 1215	Sampling Date: 12/21/15
Sample I.D.: IR70-A15-075	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: see COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-22	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 10.55
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: YSI 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 0940 Flow Rate: 200 mL/min Pump Depth: 25

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0943	20.9	7.09	50226	3	2.53	-141	600	10.55
0946	19.2	6.95	50244	1	0.91	-153	1200	10.55
0949	19.0	6.93	50182	1	0.84	-150	1800	10.55
0952	19.0	6.93	50144	1	0.82	-147	2400	10.55

Did well dewater? Yes (No)	Amount actually evacuated: 2400 mL
Sampling Time: 0955	Sampling Date: 12-22-15
Sample I.D.: IR70-A15-069	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (3)
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70-23	Well Diameter (in.): 2 3 4 (6) 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 22.55
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other QED

Start Purge Time: 1240 Flow Rate: 300ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1243	20.1	7.15	3498	10.7	0.95	-150.1	900	22.59
1246	20.0	7.19	3653	7.1	0.88	-160.3	1800	22.63
1249	20.0	7.19	3710	5.8	0.69	-168.7	2700	22.69
1252	20.0	7.18	3715	4.3	0.65	-181.6	3600	22.73
1255	20.0	7.18	3720	1.5	0.63	-188.8	4500	22.73
1258	20.0	7.18	3718	2.7	0.60	-194.2	5400	27.73

Did well dewater? Yes (No)	Amount actually evacuated: 5400
Sampling Time: 1300	Sampling Date: 12-21-15
Sample I.D.: 1R70-A15-073	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151244-P01	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-27	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 13.73
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: YSI 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1303 Flow Rate: 200 mL/min Pump Depth: 30'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1306	23.3	6.50	18,876	3	0.86	-200	600	13.85
1309	23.2	6.50	18,898	3	0.68	-209	1200	13.85
1312	23.2	6.50	18,885	3	0.62	-211	1,800	13.85
1315	23.2	6.50	18,864	3	0.58	-213	2400	13.85
1318	23.2	6.50	18,867	3	0.55	-215	3000	13.85

Did well dewater? Yes (No) Amount actually evacuated: 3000

Sampling Time: 1321 Sampling Date: 12-21-15

Sample I.D.: IR70-A15-003 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D (Other: (11))

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-28	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): —	Depth to Water (ft.): 14.50
Depth to Free Product: —	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: (YSI 556)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1339 Flow Rate: 200 ML/MIN Pump Depth: 55

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1342	22.0	6.57	11,667	7	1.02	-130	600	14.54
1345	22.8	6.38	6312	5	0.37	-170	1200	1454
1348	22.8	6.36	6193	4	0.32	-183	1800	1454
1351	22.9	6.35	6178	4	0.31	-184	2400	1454
1354	22.9	6.35	6169	4	0.29	-185	3000	14.54

Did well dewater? Yes (No)	Amount actually evacuated: 3000
Sampling Time: 1357	Sampling Date: 12-21-15
Sample I.D.: IR70-A15-004	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (11)
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD	Client: INSIGHT
Sampler: DC	Gauging Date: 12-14-15
Well I.D.: MW-70-35	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 15.18
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1440 Flow Rate: 300 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1443	20.5	6.79	14350	1.3	1.13	-139.9	900	15.25
1446	20.6	6.87	14659	1.9	0.81	-141.4	1800	15.25
1449	20.6	6.85	14884	1.5	0.68	-148.5	2700	15.25
1452	20.7	6.83	14891	1.0	0.64	-157.3	3600	15.25
1455	20.6	6.83	14873	1.0	0.63	-161.0	4500	15.25

Did well dewater? Yes (No)	Amount actually evacuated: 4500
Sampling Time: 1458	Sampling Date: 12-21-15
Sample I.D.: IR70-A15-07	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70-36	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 19.09
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: (Dedicated) Tubing New Tubing Other QED

Start Purge Time: 1028 Flow Rate: 400 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1031	21.4	6.81	20876	5.5	0.97	-222.9	1200	19.11
1034	21.4	6.95	20111	5.0	0.48	-220.7	2400	19.11
1037	21.4	6.98	19919	4.7	0.44	-225.3	3600	19.11
1040	21.4	6.98	19752	4.5	0.47	-215.9	4800	19.11
1043	21.4	6.98	19737	4.1	0.45	-217.6	6000	19.11
1046	21.4	6.98	19744	3.9	0.44	-219.1	7200	19.11

Did well dewater? Yes (No) Amount actually evacuated: 7200 mL

Sampling Time: 1048 Sampling Date: 12-21-15

Sample I.D.: IR70-A15-074 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: INSIGHT
Sampler: PD	Gauging Date: 12.14.15
Well I.D.: MW-70-38	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 13.64
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1026 Flow Rate: 100 mL/min Pump Depth: 90'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or (mL))	Depth to Water (ft.)
1032	17.4	6.96	2649	10	2.29	-96	600	13.64
1035	18.1	6.89	2882	6	1.12	-106	900	13.64
1038	18.1	6.93	3035	5	1.06	-111	1200	13.64
1041	18.1	6.79	3126	5	1.09	-114	1500	13.64
1044	18.1	6.77	3169	5	1.09	-116	1800	13.64
1047	18.1	6.77	3179	5	1.06	-119	2100	13.64
1050	18.1	6.75	3202	5	1.06	-119	2400	13.64

Did well dewater? Yes (No)	Amount actually evacuated: 2400 mL
Sampling Time: 1053	Sampling Date: 12.15.14
Sample I.D.: IR70-A15-016	Laboratory: EMAX.
Analyzed for: TPH-G BTEX MTBE TPH-D	(Other) see COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: ~~12-14-15~~ INSIGHT
Sampler: PJ	Gauging Date: 12-14-15
Well I.D.: MW-70-43A ~~MW-43A~~	Well Diameter (in.) : (2) 3 4 6 8 ____
Total Well Depth (ft.) : –	Depth to Water (ft.) : 21.05
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (BTS Bladder Pump)
Sampling Method: Dedicated Tubing (New Tubing) Other _____

Start Purge Time: 1153 Flow Rate: 300 mL/min Pump Depth: 96'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1156	20.9	12.4	7420	26	2.39	-239	900	21.05
1159	21.1	12.3	6912	23	1.12	-244	1800	21.05
1202	21.1	10.9	6191	22	0.99	-212	2700	21.05
1205	21.1	10.3	6729	20	0.91	-209	3600	21.05
1209	21.1	9.9	6976	20	0.89	-217	4500	21.05
1211	21.1	8.6	7107	19	0.85	-222	5400	21.05
1214	21.1	8.3	7167	19	0.83	-223	6300	21.05
1217	21.1	8.2	7139	18	0.80	-224	7200	21.05
1220	21.1	8.2	7191	17	0.79	-224	8100	21.05

Did well dewater? Yes (No) Amount actually evacuated: 8100

Sampling Time: 1223 Sampling Date: 12-15-15

Sample I.D.: JR70-A15-030 Laboratory: (1) EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D (Other:) see COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-001	Client: INSIGHT
Sampler: PJ	Gauging Date: 12-14-15
Well I.D.: MW-70-433	Well Diameter (in.): (2) 3 4 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 20.91
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: SS6

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 0914 Flow Rate: 200 mL/min Pump Depth: 141'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0917	20.0	7.23	4663	4	2.53	-217	600	20.91
0920	20.4	7.09	5016	4	1.10	-212	1200	20.91
0923	20.4	7.00	5236	4	0.95	-211	1800	20.91
0926	20.4	7.00	5309	4	0.91	-208	2400	20.91
0929	20.4	7.00	5333	4	0.89	-203	3000	20.91
0932	20.4	7.00	5338	4	0.88	-204	3600	20.91
0935	20.4	7.00	5340	4	0.88	-206	4200	20.91

Did well dewater? Yes (No)	Amount actually evacuated: 4200
Sampling Time: 0938	Sampling Date: 12-17-15
Sample I.D.: IR70-A15-062	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	(Other): see COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: MW-72-44	Well Diameter (in.): 2 3 (4) 6 8 ___
Total Well Depth (ft.): 164.93	Depth to Water (ft.): 17.99
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated (Tubing) New Tubing Other ___

Start Purge Time: 1415 Flow Rate: 200 ml/min Pump Depth: 160'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1418	20.5	7.08	9211	43.7	1.81	-155.5	600	18.15
1421	20.5	7.00	8327	30.4	0.99	-150.7	1200	18.16
1424	20.5	6.98	7949	16.9	0.90	-148.0	1800	18.16
1427	20.4	6.94	7781	12.3	0.83	-145.7	2400	18.16
1430	20.4	6.92	7796	10.9	0.79	-147.3	3000	18.16
1433	20.4	6.92	7811	9.5	0.76	-149.2	3600	18.16
1436	20.4	6.93	7808	9.9	0.74	-151.6	4200	18.16

Did well dewater? Yes (No) Amount actually evacuated: 4200ml

Sampling Time: 1438 Sampling Date: 12/17/15

Sample I.D.: IR70-915-060 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151215-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: MW-70-MNA01	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): DED	Depth to Water (ft.): 14.55
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated (Tubing) New Tubing Other_____

Start Purge Time: 1319 Flow Rate: 200 ml/min Pump Depth: DED DED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1322	21.0	6.82	7752	8.1	0.32	-120.5	600	14.67
1325	21.2	6.72	7930	6.3	0.25	-152.9	1200	14.67
1328	21.1	6.70	8020	4.4	0.33	-147.3	1800	14.70
1331	21.3	6.68	8058	4.1	0.32	-145.2	2400	14.70
1334	21.4	6.68	8093	3.7	0.30	-141.2	3000	14.71
1337	21.4	6.67	8099	3.5	0.29	-141.0	3600	14.71

Did well dewater? Yes (No)	Amount actually evacuated: 3600 ml
Sampling Time: 1339	Sampling Date: 12/15/15
Sample I.D.: IR70-A15-005	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.: IR70-A15-091 @ 1600

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSight
Sampler: PD	Gauging Date: 12.14.15
Well I.D.: MW-70-MNA02	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 13.63
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other_____

Start Purge Time: 1322 Flow Rate: 200mL/min Pump Depth: 40'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1325	21.2	6.62	4727	7	1.53	-227	600	13.70
1328	21.3	6.52	4597	3	1.46	-217	1200	13.70
1331	21.3	6.51	4551	3	1.43	-204	1800	13.70
1334	21.3	6.51	4530	3	1.39	-200	2400	13.70
1337	21.3	6.49	4520	3	1.36	-198	3000	13.70
1340	21.3	6.49	4509	3	1.31	-193	3600	13.70

Did well dewater? Yes (No)	Amount actually evacuated: 3600
Sampling Time: 1343	Sampling Date: 12.16.15
Sample I.D.: IR70-A15-006	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	(Other): See COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: INSIGHT
Sampler: PD	Gauging Date: 12.14-15
Well I.D.: MW-70-MNA03	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): —	Depth to Water (ft.): 14.33
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: SS6

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1359 Flow Rate: 200 mL/min Pump Depth: 40'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1402	20.5	6.53	5529	4	2.72	-104	600	14.50
1405	20.9	6.37	6212	4	2.38	-114	1200	14.50
1408	20.8	6.33	6320	4	1.70	-141	1800	14.50
1411	20.8	6.32	6335	3	1.56	-151	2400	14.50
1414	20.8	6.32	6342	3	1.52	-155	3000	14.50
1417	20.8	6.32	6351	3	1.52	-160	3600	14.50

Did well dewater? Yes (No) Amount actually evacuated: 3600

Sampling Time: 1420 Sampling Date: 12.16.15

Sample I.D.: IR70-A15-007 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D (Other:) see COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-MNA04	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 13.46
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1422 Flow Rate: 200 mL/min Pump Depth: 40'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1425	22.5	7.21	5633	5	1.51	-178	600	13.51
1428	22.6	7.17	5653	5	1.15	-172	1200	13.51
1431	22.6	7.17	5662	5	1.06	-169	1800	13.51
1434	22.6	7.17	5664	5	1.05	-170	2400	13.51

Did well dewater? Yes (No) Amount actually evacuated: 2400

Sampling Time: 1437 Sampling Date: 12-15-15

Sample I.D.: IR70-A15-000 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D (Other:) See COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: Insight
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-MNA05	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 14.91
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: YSI 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1234 Flow Rate: 200mL/min Pump Depth: 75'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1237	23.5	7.33	1210	4	1.14	-235	600	14.92
1240	23.4	7.39	1184	4	0.75	-253	1200	14.92
1243	23.5	7.45	1138	4	0.72	-252	1800	14.92
1246	23.5	7.47	1123	4	0.68	-244	2400	14.92
1249	23.5	7.48	1119	4	0.65	-248	3000	14.92

Did well dewater? Yes (No)	Amount actually evacuated: 3000
Sampling Time: 1252	Sampling Date: 12-21-15
Sample I.D.: IR70-A15-013	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	(Other): (7)
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70 MNA06	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 10.80
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other QED

Start Purge Time: 1115 Flow Rate: 300 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1118	21.3	7.08	820	27.8	0.75	-150.2	900	10.89
1121	21.5	7.15	888	25.1	0.56	-160.3	1800	10.89
1124	21.6	7.19	910	12.9	0.54	-170.8	2700	10.89
1127	21.6	7.21	920	12.2	0.53	-173.5	3600	10.91
1130	21.6	7.22	923	11.6	0.51	-179.9	4500	10.91

Did well dewater? Yes (No)	Amount actually evacuated: 4500 ml
Sampling Time: 1132	Sampling Date: 12-15-15
Sample I.D.: IR70-A15-027	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214.P01	Client: INSIGHT
Sampler: JF	Gauging Date: 12.14.15
Well I.D.: MW-70-MW407	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 11.48
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1152 Flow Rate: 300 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1155	21.8	6.59	1394	19.2	0.65	-274.7	900	11.50
1158	21.8	6.41	1538	16.8	0.41	-260.1	1800	11.50
1201	21.9	6.34	1715	14.7	0.39	-230.9	2700	11.50
1204	21.9	6.31	1729	14.2	0.44	-220.1	3600	11.50
1207	22.0	6.31	1736	13.6	0.47	-215.8	4500	11.50

Did well dewater? Yes (No) Amount actually evacuated: 4500 ml

Sampling Time: 1209 Sampling Date: 12.18.15

Sample I.D.: ~~JR~~70-915-029 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PB1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: MW-70-MNA08	Well Diameter (in.): 2 3 4 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 14.49
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: PVC Grade	Flow Cell Type: YSI PRO +

Purge Method: 2" Grundfos Pump Peristaltic Pump Bladder Pump
Sampling Method: Dedicated Tubing New Tubing Other ____

Start Purge Time: 1245 Flow Rate: 200ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1248	21.7	6.80	2929	13.5	1.01	-278.8	600	14.57
1251	21.7	6.74	3230	11.4	0.60	-264.0	1200	14.53
1254	21.6	6.73	3251	11.1	0.62	-254.6	1800	14.53
1257	21.6	6.72	3269	10.8	0.65	-250.3	2400	14.53

Did well dewater? Yes No	Amount actually evacuated: 2400
Sampling Time: 1259	Sampling Date: 12-18-15
Sample I.D.: IR70-A15-026	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: Insight
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-MNA09	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 14.07
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1154 Flow Rate: 200 mL/min Pump Depth: 80'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1157	21.4	6.85	18214	7	1.28	-205	600	14.14
1200	21.4	6.78	18673	5	0.91	-229	1200	14.14
1203	21.5	6.76	18785	5	0.90	-242	1800	14.14
1206	21.5	6.75	18868	5	0.90	-242	2400	14.14
1209	21.5	6.75	18872	5	0.89	-250	3000	14.14
1212	21.5	6.74	18887	5	0.87	-253	3600	14.14

Did well dewater? Yes (No) Amount actually evacuated: 3600

Sampling Time: 1215 Sampling Date: 12-16-15

Sample I.D.: IR70-AIS-037 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D (Other:) See COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70 - MNA10	Well Diameter (in.): 2 3 (4) 6 8 ___
Total Well Depth (ft.): –	Depth to Water (ft.): 16.09
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: YSI 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ___

Start Purge Time: 1123 Flow Rate: 200 mL/min Pump Depth: 80'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1126	20.2	6.96	7795	2	0.81	-262	600	16.09
1129	19.8	6.90	9155	2	0.76	-236	1200	16.09
1132	19.5	6.89	9260	2	0.70	-222	1800	16.09
1135	19.9	6.88	9272	2	0.69	-218	2400	16.09
1138	19.9	6.88	9293	2	0.69	-213	3000	16.09

Did well dewater? Yes (No)	Amount actually evacuated: 3000
Sampling Time: 1141	Sampling Date: 12-22-15
Sample I.D.: IR70-A15-038	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (-)
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: PD	Gauging Date: 12.14.15
Well I.D.: MW-70-MNA11	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 15.71
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1002 Flow Rate: 200 mL/min Pump Depth: 35'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1005	19.5	7.12	2906	3	2.15	-223	600	15.67
1009	19.6	7.12	2937	2	1.26	-246	1200	15.67
1011	19.6	7.11	2920	2	1.22	-229	1800	15.67
1014	19.6	7.11	2947	2	1.18	-231	2400	15.67
1017	19.6	7.10	2952	2	1.16	-229	3000	15.67

Did well dewater? Yes (No) Amount actually evacuated: 3000

Sampling Time: 1020 Sampling Date: 12.17.15

Sample I.D.: IR70-A15-029 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D (Other:) see COC

Equipment Blank I.D.: @ Time Duplicate I.D.: IR70-A15-094 @1530

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: MW-70-MNA12	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 15.42
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated) Tubing New Tubing Other ____

Start Purge Time: 1045 Flow Rate: 200ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1048	21.0	7.00	10618	8.9	0.20	-271.6	600	15.63
1051	20.7	6.97	10901	6.8	0.17	-273.9	1200	15.63
1054	20.4	6.95	10925	4.5	0.15	-272.7	1800	15.63
1057	20.4	6.89	10948	4.2	0.15	-270.6	2400	15.63
1100	20.4	6.90	10972	3.9	0.16	-267.1	3000	15.63

Did well dewater? Yes (No)	Amount actually evacuated: 3000ml
Sampling Time: 1102	Sampling Date: 12/16/15
Sample I.D.: IR70-A15-039	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: INSIGHT
Sampler: PO	Gauging Date: 12.14.15
Well I.D.: MW-70 - MNA13	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 15.98
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1116 Flow Rate: 200 mL/min Pump Depth: 120'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1119	20.9	7.27	4709	10	1.35	-298	600	16.02
1122	21.1	7.30	4931	7	0.98	-299	1200	16.02
1125	21.2	7.31	4990	5	0.80	-292	1800	16.02
1128	21.2	7.33	5227	5	0.75	-280	2400	16.02
1131	21.2	7.33	5251	5	0.71	-277	3000	16.02
1134	21.2	7.34	5221	5	0.68	-270	3600	16.02

Did well dewater? Yes (No) Amount actually evacuated: 3,600

Sampling Time: 1137 Sampling Date: 12-16-15

Sample I.D.: IR70 - A15 - 044 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D (Other): SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-MNA14	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 19.29
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 0726 Flow Rate: 300 mL/min Pump Depth: 120'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0729	18.3	6.93	4607	2	1.92	-230	900	19.29
0732	18.9	6.99	4619	2	1.79	-272	1800	19.29
0735	19.0	7.02	4830	2	1.76	-279	2700	19.29
0738	19.0	7.04	4550	2	1.72	-274	3600	19.29
0741	19.0	7.02	4919	2	1.69	-272	4500	19.29

Did well dewater? Yes (No) Amount actually evacuated: 4500

Sampling Time: 0744 Sampling Date: 12-15-15

Sample I.D.: IR70-A15-~~MNA14~~ 051 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D (Other: (7))

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: INSight
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-MNA16	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 18.94
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 0755 Flow Rate: 300 mL/min Pump Depth: 145'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0801	19.9	7.25	10821	10	1.88	-299	900	18.94
0804	20.1	7.17	10936	6	0.87	-306	1800	18.94
0807	20.1	7.11	11277	4	0.85	-299	2700	18.94
0810	20.1	7.08	11435	4	0.94	-296	3600	18.94
0813	20.2	7.06	11475	4	0.91	-295	4500	18.94

Did well dewater? Yes (No) Amount actually evacuated: 4500 mL

Sampling Time: 0816 Sampling Date: 12.18.15

Sample I.D.: IR70-A15-058 Laboratory: (EMAX)

Analyzed for: TPH-G BTEX MTBE TPH-D (Other: (7))

Equipment Blank I.D.: ~~11-11-12 P7~~ @ Time ~~0940 P7~~ Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70-MNA17	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 18.20
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated (Tubing) New Tubing Other QED

Start Purge Time: 1315 Flow Rate: 300 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1318	21.1	7.20	23544	10.1	0.95	-250.4	900	18.27
1321	21.0	7.24	23817	8.6	0.63	-280.2	1800	18.30
1324	21.0	7.21	24051	7.2	0.55	-275.1	2700	18.31
1327	21.0	7.14	24131	7.0	0.52	-265.5	3600	18.31
1330	21.0	7.10	24211	6.7	0.50	-257.4	4500	18.31
1333	21.0	7.05	24244	6.3	0.48	-243.1	5400	18.31
1336	21.0	7.03	24312	5.9	0.46	-237.9	6300	18.31
1339	21.0	7.03	24375	5.5	0.45	-233.5	7200	18.31

Did well dewater? Yes (No)	Amount actually evacuated: 7200 mL
Sampling Time: 1341	Sampling Date: 12/17/15
Sample I.D.: IR70-A15-059	Laboratory: EMAK
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: see COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214 PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/15/15
Well I.D.: MW-70-PMW01A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 13.50
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated (Tubing) New Tubing Other QED

Start Purge Time: 0958 Flow Rate: 200 ml/min Pump Depth: DED QED

Time	Temp. (°C) or °F)	pH	Cond. (mS/cm or (µS/cm))	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or (mL))	Depth to Water (ft.)
1001	21.9	7.04	9933	39.7	6.22	-315.7	600	14.37
1004	21.7	6.91	9918	23.7	5.31	-316.7	1200	14.38
1007	20.3	6.81	9901	17.6	3.42	-320.0	1800	14.39
1010	20.2	6.72	9885	15.7	2.24	-335.6	2400	14.39
1013	20.2	6.69	9914	15.1	1.10	-342.8	3000	14.39
1016	20.3	6.69	9927	14.8	0.70	-347.9	3600	14.39
1019	20.3	6.70	9931	14.3	0.68	-351.2	4200	14.38

Did well dewater? Yes (No) Amount actually evacuated: 4200

Sampling Time: 1021 Sampling Date: 12/15/15

Sample I.D.: IR70-A15-001 Laboratory: OMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: see COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: MW-70 · PMW01B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 14.36
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO+

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1058 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1101	21.8	6.35	5481	20	1.97	-220.2	600	14.51
1105	22.1	6.32	5456	4.5	1.14	-224.6	1200	14.57
1108	21.6	6.31	5433	3.8	0.30	-225.9	1800	14.60
1111	21.5	6.32	5427	3.2	0.23	-228.1	2400	14.60
1114	21.6	6.31	5420	3.1	0.20	-229.5	3000	14.60
1117	21.5	6.31	5412	2.9	0.19	-231.1	3600	14.60
1120	21.5	6.31	5409	2.9	0.18	-232.2	4200	14.60

Did well dewater? Yes (No) Amount actually evacuated: 4200 mL

Sampling Time: 1122 Sampling Date: 12/15/15

Sample I.D.: IR70-A15-002 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151294.101	Client: INSight
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70 - PMW02A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 14.81
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: YSI 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other_____

Start Purge Time: 0819 Flow Rate: 200 mL/min Pump Depth: 75'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0822	21.1	7.24	1193	3	2.70	-166	600	14.95
0825	21.2	7.42	1167	2	1.96	-209	1200	14.95
0828	21.2	7.46	1180	2	1.82	-191	1800	14.95
0831	21.3	7.47	1197	2	1.80	-187	2400	14.95
0834	21.3	7.47	1199	2	1.78	-182	3000	14.95

Did well dewater? Yes (No)	Amount actually evacuated: 3000
Sampling Time: 0837	Sampling Date: 12-21-15
Sample I.D.: IR70-A15-009	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: see COC
Equipment Blank I.D.: @ Time	Duplicate I.D.: IR70-A15-092 @ 0847

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151219-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70-PMW02B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 14.78
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other QED

Start Purge Time: 1359 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1402	22.7	7.25	1279	12	0.51	-298.2	600	14.88
1405	23.1	7.32	1277	8.2	0.42	-301.2	1200	14.89
1408	23.1	7.35	1282	7.3	0.27	-297.5	1800	14.90
1411	23.2	7.40	1309	5.2	0.21	-290.6	2400	14.90
1414	23.2	7.44	1319	5.0	0.19	-282.8	3000	14.90
1417	23.2	7.47	1339	3.8	0.17	-277.2	3600	14.91
1420	23.1	7.48	1351	3.3	0.18	-267.4	4200	14.91
1423	23.1	7.48	1358	3.1	0.18	-261.4	4800	14.91

Did well dewater? Yes (No)	Amount actually evacuated: 4800
Sampling Time: 1425	Sampling Date: 12/15/15
Sample I.D.: IR70-A15-010	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: see COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-PMW03A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 14.40
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: YSI 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other_____

Start Purge Time: 0942 Flow Rate: 200 mL/min Pump Depth: 75'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0945	21.2	7.21	1390	4	1.23	-247	600	14.41
0948	22.3	7.12	1340	3	0.82	-261	1200	14.41
0951	22.3	7.16	1316	3	0.80	-266	1800	14.41
0954	22.3	7.14	1308	3	0.79	-277	2400	14.41

Did well dewater? Yes (No)	Amount actually evacuated: 2400
Sampling Time: 0957	Sampling Date: 12-21-15
Sample I.D.: IR70-A15-014	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	(Other:) see COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: PD	Gauging Date: 12.14.15
Well I.D.: MW-70-PMW033	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 14.49
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: (Dedicated) Tubing New Tubing Other_____

Start Purge Time: 0920 Flow Rate: 200mL/min Pump Depth: 90'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0923	22.5	7.44	1804	6	0.99	-276	600	14.49
0926	22.9	7.33	1734	5	0.99	-260	1200	14.49
0929	22.9	7.30	1724	5	0.99	-254	1800	14.49
0932	22.9	7.29	1720	5	0.99	-252	2400	14.49

Did well dewater? Yes (No) Amount actually evacuated: 2400

Sampling Time: 0935 Sampling Date: 12.15.15

Sample I.D.: IR70-AIB-015 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D (Other:) see COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-4-15
Well I.D.: MW-70-PMW04A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 11.03
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump Bladder (Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other QED

Start Purge Time: 1052 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1055	21.8	7.30	1090	7.2	0.68	-236.7	600	11.13
1058	22.9	7.26	1077	4.7	0.49	-222.2	1200	11.17
1101	22.1	7.28	1070	3.1	0.46	-219.7	1800	11.17
1104	22.0	7.24	1065	3.9	0.42	-215.4	2400	11.17
1107	21.9	7.21	1069	2.5	0.40	-219.9	3000	11.17
1110	21.9	7.23	1071	1.7	0.39	-221.1	3600	11.17

Did well dewater? Yes (No)	Amount actually evacuated: 3600
Sampling Time: 1112	Sampling Date: 12/22/15
Sample I.D.: IR70-A15-020	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (see COC)
Equipment Blank I.D.: @ Time	Duplicate I.D.: IR70-A15-093 @ 1122

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70-PMW04B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 11.07
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other QED

Start Purge Time: 1020 Flow Rate: 300 mL/MIN Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1023	21.5	7.29	1089	12.8	0.78	-190.1	900	11.15
1026	21.6	7.26	1150	7.3	0.73	-205.4	1800	11.18
1029	21.9	7.25	1159	5.4	0.52	-229.6	2700	11.18
1032	21.9	7.22	1199	3.2	0.51	-231.7	3600	11.19
1035	21.9	7.24	1210	2.5	0.49	-235.2	4500	11.19

Did well dewater? Yes (No) Amount actually evacuated: 4500 mL

Sampling Time: 1037 Sampling Date: 12/21/15

Sample I.D.: ~~A~~ IR70-A15-021 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-PMW05A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 10.99
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump Bladder Pump
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1310 Flow Rate: 200 mL/min Pump Depth: 75'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1313	20.7	7.97	1065	10	1.16	-276	600	10.99
1316	21.1	7.82	1026	6	0.91	-265	1200	10.99
1319	21.1	7.80	1002	5	0.85	-261	1800	10.99
1322	21.1	7.76	992	5	0.85	-253	2400	10.99
1325	21.1	7.74	988	5	0.82	-249	3000	10.99

Did well dewater? Yes (No)	Amount actually evacuated: 3000 mL
Sampling Time: 1328	Sampling Date: 12-15-15
Sample I.D.: IR70-A15-02J	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	(Other:) See COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70-PMW05B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 11.18
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated (Tubing) New Tubing Other____

Start Purge Time: 0951 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0954	21.1	7.02	1459	13.2	0.78	-244.6	600	11.28
0957	21.2	6.90	1401	9.9	0.51	-240.5	1200	11.29
1000	21.2	6.84	1395	7.3	0.45	-220.1	1800	11.29
1003	21.2	6.80	1381	6.5	0.42	-217.3	2400	11.29
1006	21.2	6.79	1362	6.1	0.40	-215.7	3000	11.30
1009	21.2	6.77	1360	5.6	0.39	-213.0	3600	11.30

Did well dewater? Yes (No) Amount actually evacuated: 3600

Sampling Time: 1011 Sampling Date: 12/18/15

Sample I.D.: TR70-A15-24 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: PD	Gauging Date: 12.14.15
Well I.D.: MW-70-PMW06A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 10.94
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump Bladder Pump
Sampling Method: (Dedicated Tubing) New Tubing Other_____

Start Purge Time: 1220 Flow Rate: 300 mL/min Pump Depth: 75'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1223	21.0	7.42	2598	8	1.71	-204	900	10.84
1226	21.2	7.36	2688	4	1.02	-190	1800	10.84
1229	21.2	7.31	2700	4	0.94	-188	2700	10.84
1232	21.2	7.28	2710	4	0.89	-187	3600	10.84

Did well dewater? Yes (No) Amount actually evacuated: 3,600 mL

Sampling Time: 1235 Sampling Date: 12.15.15

Sample I.D.: IR70-AIS-018 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: see COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-PMW06D	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 10.73
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: YSI 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (BTS Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1248 Flow Rate: 200mL/min Pump Depth: 95'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or (µS/cm))	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or (mL))	Depth to Water (ft.)
1251	20.4	7.65	1970	3	1.42	-222	600	10.80
1254	20.6	7.60	1838	2	0.76	-218	1200	10.84
1257	20.7	7.59	1831	2	0.72	-186	1800	10.84
1300	20.6	7.59	1829	2	0.68	-176	2400	10.84
1303	20.7	7.58	1832	2	0.57	-163	3000	10.84
1306	20.6	7.57	1833	2	0.51	-162	3600	10.84

Did well dewater? Yes (No)	Amount actually evacuated: 3600
Sampling Time: 1309	Sampling Date: 12-22-15
Sample I.D.: IR70-A15-019	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	(Other: (11))
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: Insight
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-PMW07A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 15.45
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other_____

Start Purge Time: 1133 Flow Rate: 200mL/min Pump Depth: 70'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or (ml))	Depth to Water (ft.)
1136	20.8	6.47	42682	5	1.09	-269	600	15.55
1139	20.9	6.39	44328	4	0.52	-260	1,200	15.55
1142	20.9	6.36	45061	4	0.50	-225	1,800	15.55
1145	21.0	6.37	44526	4	0.51	-226	2,400	15.55
1148	21.0	6.37	44411	4	0.51	-230	3,000	15.55

Did well dewater? Yes (No) Amount actually evacuated: 3,000

Sampling Time: 1151 Sampling Date: 12-17-15

Sample I.D.: IR70-A15-031 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D (Other:) see COC

Equipment Blank I.D.: @ Time Duplicate I.D.: IR70-A15-095 @1520

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: Insight
Sampler: PD	Gauging Date: 12.14.15
Well I.D.: MW-70-PMW073	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 16.04
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: SS6

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other_____

Start Purge Time: 1041 Flow Rate: 200mL/min Pump Depth: 90'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1044	20.5	7.07	6098	6	1.28	-275	600	16.10
1047	20.6	7.07	6829	4	0.78	-278	1200	16.19
1050	20.6	7.05	6882	4	0.75	-277	1800	16.25
1053	20.6	7.04	6898	4	0.70	-274	2400	16.25
1056	20.6	7.04	6944	4	0.68	-276	3000	16.25

Did well dewater? Yes (No) Amount actually evacuated: 3000

Sampling Time: 1059 Sampling Date: 12-17-15

Sample I.D.: IR70-A15-032 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D (Other:) See COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 135284 - PD 1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: MW-7 & MW08A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 17.30
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: RRO (2)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated Tubing New Tubing Other QED

Start Purge Time: 0941 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0944	18.2	6.62	21744	6.3	0.37	-210.6	600	17.44
0947	20.8	6.60	21784	3.5	0.16	-217.6	1200	17.44
0950	20.7	6.63	21810	2.3	0.24	-225.8	1800	17.44
0953	20.4	6.63	22009	2.2	0.21	-230.6	2400	17.44
0956	20.3	6.64	21954	2.0	0.23	-234.7	3000	17.44
0959	20.3	6.64	21778	1.9	0.22	229.3	3600	17.44

Did well dewater? Yes (No) Amount actually evacuated: 3600 ml

Sampling Time: 1002 Sampling Date: 12/16/14

Sample I.D.: IR70-A15-035 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: (see COC)

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70-PMW08B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 18.31
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO+

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other_____

Start Purge Time: 0810 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0813	17.8	6.70	4860	19.2	0.79	-215.9	600	18.51
0816	17.8	6.73	4832	11.6	0.61	-223.9	1200	18.52
0819	18.9	6.74	4822	9.9	0.36	-249.9	1800	18.52
0822	19.5	6.79	5023	7.3	0.32	-253.7	2400	18.52
0825	20.2	6.84	5150	6.9	0.30	-258.9	3000	18.52
0828	20.3	6.85	5137	6.3	0.29	-260.4	3600	18.52
0831	20.3	6.85	5112	6.0	0.29	-262.4	4200	18.52

Did well dewater? Yes (No) Amount actually evacuated: 4200

Sampling Time: 0833 Sampling Date: 12-14-15

Sample I.D.: ~~1R70~~ MW-A15-036 Laboratory: Eurofins

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-PMW09	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 16.09
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: PVC Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump Bladder Pump
Sampling Method: Dedicated Tubing New Tubing Other_____

Start Purge Time: 0748 Flow Rate: 200 mL/min Pump Depth: 120'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0751	19.4	6.6	761	17	2.23	149	600	16.09
0754	20.1	6.8	727	5	1.56	-8	1200	16.09
0757	20.2	6.9	713	5	1.42	-69	1800	16.09
0800	20.2	7.2	709	5	1.19	-88	2400	16.09
0803	20.2	7.3	707	5	1.13	-93	3000	16.09
0806	20.2	7.3	709	5	1.10	-95	3600	16.09

Did well dewater? Yes (No) Amount actually evacuated: 3600

Sampling Time: 0809 Sampling Date: 12-16-15

Sample I.D.: IR70-A15-040 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: See COC

Equipment Blank I.D.: @ Time Duplicate I.D.: IR70-A15-096 @ 1530

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: MW-70-PMW10	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 15.96
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other_____

Start Purge Time: 0935 Flow Rate: 200 mL/min Pump Depth: 120'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0939	19.0	7.4	1127	2	1.02	-227	600	15.90
0941	19.3	7.4	1145	2	1.02	-266	1200	15.90
0944	19.3	7.3	1190	2	0.89	-261	1800	15.90
0947	19.3	7.3	1211	2	0.83	-245	2400	15.90
0950	19.3	7.3	1215	2	0.80	-241	3000	15.90
0953	19.3	7.3	1220	2	0.79	-232	3600	15.90

Did well dewater? Yes (No)	Amount actually evacuated: 3600
Sampling Time: 0956	Sampling Date: 12.16.15
Sample I.D.: IR70-A15-042	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	(Other:) see COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214 PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70 PMW11A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 18.70
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO+

Purge Method: 2" Grundfos Pump Peristaltic Pump Bladder Pump
Sampling Method: Dedicated Tubing New Tubing Other QED

Start Purge Time: 1420 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1423	19.6	6.96	30501	7.6	0.21	-264.5	600	18.92
1426	19.3	6.88	36767	5.7	0.16	-267.2	1200	18.93
1429	20.7	6.71	38015	3.8	0.15	-245.8	1800	18.93
1432	20.5	6.68	38632	3.2	0.14	-243.1	2400	18.93
1435	20.5	6.70	38449	3.0	0.14	-240.7	3000	18.93

Did well dewater? Yes (No)	Amount actually evacuated: 3000 ml
Sampling Time: 1437	Sampling Date: 12/16/15
Sample I.D.: IR70-415-045	Laboratory: [illegible]
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70-PMW11B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 18.14
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: (Dedicated) Tubing New Tubing Other_____

Start Purge Time: 0820 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0823	18.0	6.67	4955	12.9	2.42	-203.9	600	18.17
0826	19.9	6.85	5270	11.9	1.31	-214.4	1200	18.17
0829	20.0	6.89	5489	9.6	1.00	-207.6	1800	18.17
0832	20.0	6.87	5526	8.5	0.99	-215.3	2400	18.17
0835	20.0	6.93	5779	7.4	0.82	-208.1	3000	18.17
0838	20.1	6.94	5801	7.6	0.79	-207.3	3600	18.17

Did well dewater? Yes (No) Amount actually evacuated: 3600

Sampling Time: 0840 Sampling Date: 12/17/15

Sample I.D.: IR70-915-046 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: See COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: PMW70-PMW129	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 18.02
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YCI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ~~QED~~

Start Purge Time: 1310 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1313	20.2	6.33	17758	10	0.53	-140.0	600	18.05
1316	20.7	6.28	18398	8.2	0.63	-130.7	1200	18.05
1319	20.7	6.28	18626	6.1	0.53	-127.4	1800	18.08
1322	20.9	6.29	18531	4.2	0.51	-129.4	2400	18.11
1325	20.8	6.29	18511	4.0	0.48	-131.9	3000	18.11
1323	20.8	6.31	18501	3.5	0.49	-136.2	3600	18.11

Did well dewater? Yes (No)	Amount actually evacuated: 3600ml
Sampling Time: 1325	Sampling Date: 12/16/15
Sample I.D.: IR70-A15-049	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: IR70-A15-100 @ Time 1504	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70-PMW12B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 17.98
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (F)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: (Dedicated) Tubing New Tubing Other ____

Start Purge Time: 1154 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1157	20.3	6.61	7499	10.1	0.69	-260.1	600	18.20
1200	20.7	6.50	7655	7.3	0.43	-250.9	1200	18.21
1203	20.4	6.55	7816	6.5	0.40	-230.5	1800	18.21
1206	20.5	6.59	7789	5.9	0.39	-227.2	2400	18.21
1209	20.5	6.59	7795	5.7	0.38	-225.8	3000	18.21

Did well dewater? Yes (No)	Amount actually evacuated: 3000 mL
Sampling Time: 1211	Sampling Date: 12/16/15
Sample I.D.: IR70-A15-050	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70 PMW 13A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 16.97
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated) Tubing New Tubing Other QED

Start Purge Time: 1020 Flow Rate: 300ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1023	20.1	7.33	7929	9.2	0.55	-189.1	900	17.08
1026	20.3	7.15	8282	7.6	0.63	-201.7	1800	17.08
1029	20.3	6.98	8499	5.2	0.57	-209.5	2700	17.08
1032	20.3	6.93	8562	5.1	0.45	-213.3	3600	17.08
1035	20.2	6.91	8608	4.8	0.42	-217.2	4500	17.09
1038	20.2	6.90	8616	4.3	0.44	-215.9	5400	17.09

Did well dewater? Yes (No)	Amount actually evacuated: 5400 ml
Sampling Time: 1040	Sampling Date: 12-17-15
Sample I.D.: IR70-A15-052	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70 PMW13B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 16.93
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: (Dedicated) Tubing New Tubing Other QED

Start Purge Time: 0925 Flow Rate: 400mL/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0928	19.9	7.12	12394	6.2	1.36	-240.4	1200	16.95
0931	20.0	7.14	12323	3.0	0.90	-245.2	2400	16.95
0934	20.0	7.14	12352	2.5	0.48	-246.0	3600	16.95
0937	20.1	7.13	12538	2.3	0.39	-239.1	4800	16.95
0940	20.1	7.11	12952	2.3	0.37	-233.6	6000	16.95
0943	20.1	7.10	13292	2.8	0.36	-228.4	7200	16.95
0946	20.1	7.10	13338	2.5	0.36	-225.0	8400	16.95
0949	20.0	7.10	13411	2.0	0.38	-224.7	9600	16.95

Did well dewater? Yes (No) Amount actually evacuated: 9600mL

Sampling Time: 0951 Sampling Date: 12-17-15

Sample I.D.: IR70-A15-053 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: MW-70 PMW144	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 16.85
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated (Tubing) New Tubing Other QED

Start Purge Time: 1155 Flow Rate: 200ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1158	20.9	1.45	7289	8.8	0.69	-238.6	600	16.99
1201	20.7	7.36	7147	5.1	0.54	-229.2	1200	16.99
1204	20.8	7.11	7451	4.9	0.46	-216.5	1800	17.02
1207	20.8	7.07	7570	4.3	0.43	-206.4	2400	17.02
1210	20.9	7.05	7607	3.9	0.41	-204.2	3000	17.02
1213	20.8	7.06	7669	3.8	0.41	-203.2	3600	17.02

Did well dewater? Yes (No) Amount actually evacuated: 3600ml

Sampling Time: 1215 Sampling Date: 12-17-15

Sample I.D.: IR70-A15-RW56 Laboratory: EMAR

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-17-15
Well I.D.: MW-70-PMW14B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 17.49
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump Bladder Pump
Sampling Method: Dedicated Tubing New Tubing Other QED

Start Purge Time: 1111 Flow Rate: 300 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1114	21.2	7.19	14343	13.1	0.90	-290.0	900	17.57
1117	21.1	7.24	14456	9.3	0.47	-302.9	1800	17.59
1120	21.1	7.22	14443	7.8	0.41	-296.9	2700	17.59
1123	21.5	7.00	14067	6.5	0.37	-285.6	3600	17.59
1126	21.5	6.96	13887	6.0	0.35	-274.1	4500	17.59
1129	21.5	6.92	13767	5.7	0.36	-270.0	5400	17.59
1132	21.4	6.90	13695	5.5	0.36	-264.2	6300	17.59

Did well dewater? Yes (No)	Amount actually evacuated: 6300 mL
Sampling Time: 1134	Sampling Date: 12-17-15
Sample I.D.: IR70-A15-057	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 15124-P01	Client: INSIGHT
Sampler: DF	Gauging Date: 12/21/15
Well I.D.: MW-70-POC#1	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 14.79
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: (Dedicated) Tubing New Tubing Other ____

Start Purge Time: 0915 Flow Rate: 200ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0918	16.5	6.99	1101	2.1	1.09	-184.8	600	14.85
0921	16.7	7.21	1122	1.3	0.85	-180.2	1200	14.86
0924	16.8	7.46	1158	0.92	0.71	-175.5	1800	14.86
0927	16.8	7.46	1160	0.90	0.63	-172.1	2400	14.86
0930	16.9	7.45	1163	0.81	0.61	-171.6	3000	14.86
0933	16.9	7.46	1164	0.75	0.60	-173.7	3600	14.86

Did well dewater? Yes (No) Amount actually evacuated: 3600ml

Sampling Time: 0935 Sampling Date: 12/21/15

Sample I.D.: IR70-A15-069 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DP	Gauging Date: 12/14/15
Well I.D.: MW-70-POC02	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 21.54
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other_____

Start Purge Time: 0756 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0759	18.8	7.10	1255	5.2	1.04	-194.8	600	21.62
0802	18.9	7.19	1220	2.8	0.90	-221.8	1200	21.63
0805	19.1	7.28	1229	3.3	0.76	-250.7	1800	21.63
0808	19.1	7.30	1207	2.1	0.72	-252.4	2400	21.63
0811	19.0	7.36	1374	2.0	0.66	-247.9	3000	21.63
0814	19.1	7.39	1409	1.6	0.64	-241.7	3600	21.63
0817	19.1	7.41	1441	1.3	0.61	-238.5	4200	21.63
0820	19.0	7.43	1448	1.1	0.59	-237.2	4800	21.63

Did well dewater? Yes (No)	Amount actually evacuated: 4800
Sampling Time: 0822	Sampling Date: 12/14/15
Sample I.D.: IR70-A15-076	Laboratory: Kmax
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: VOCs
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD-1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: MW-70-POC-73	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 19.09
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: Dedicated Tubing New Tubing Other QED

Start Purge Time: 0953 Flow Rate: 400ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0956	21.7	7.73	17083	2.9	0.73	-163.6	1200	19.27
0959	21.5	7.63	17154	2.3	0.50	-182.9	3600	19.29
1002	21.7	7.00	18202	2.0	0.40	-181.8	4800	19.29
1005	21.6	6.91	18670	1.8	0.37	-185.9	6000	19.29
1008	21.5	6.87	19337	1.5	0.35	-196.2	7200	19.29
1011	21.6	6.86	19376	1.3	0.36	-203.3	8400	19.29
1014	21.6	6.86	19405	1.2	0.38	-207.0	9600	19.29

Did well dewater? Yes (No)	Amount actually evacuated: 9600 ml
Sampling Time: 1015	Sampling Date: 12/14/15
Sample I.D.: IR70-A15-077	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: MW-70-POC04	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 22.13
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated) Tubing New Tubing Other QED

Start Purge Time: 0905 Flow Rate: 300 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0908	19.2	7.50	28563	4.4	1.71	-68.0	900	22.13
0911	19.4	7.53	29935	4.0	0.99	-90.2	1800	22.13
0914	19.4	7.55	30127	3.5	0.85	-111.7	2700	22.13
0917	19.1	7.42	30829	4.2	0.80	-115.3	3600	22.13
0920	19.1	7.09	32426	4.1	0.51	-148.5	4500	22.13
0923	19.1	7.42	32423	4.0	0.40	-185.9	5400	22.13
0926	19.1	7.45	32616	3.7	0.38	-189.7	6300	22.13
0929	19.2	7.48	32811	3.5	0.36	-195.8	7200	22.13

Did well dewater? Yes (No)	Amount actually evacuated: 7200 ml
Sampling Time: 0931	Sampling Date: 12/21/15
Sample I.D.: IR70-A15-078	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (See) bel
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-D1	Client: INSIGHT
Sampler: DF	Gauging Date: 12-14-15
Well I.D.: IW-10-FSB108	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 11.21
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (F)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated (Tubing) New Tubing Other QED

Start Purge Time: 1215 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or (mL))	Depth to Water (ft.)
1218	21.0	6.79	1781	12.1	0.89	-150.2	600	11.39
1221	21.0	6.84	1805	10.7	0.71	-167.1	1200	11.42
1224	20.9	6.88	1824	6.4	0.68	-165.2	1800	11.42
1227	21.0	6.73	1800	4.5	0.55	+69.4	2400	11.45
1230	21.2	6.71	1738	4.1	0.45	-171.8	3000	11.45
1233	21.2	6.72	1714	3.8	0.41	-178.8	3600	11.45
1236	21.3	6.76	1670	3.1	0.39	-181.5	4200	11.45
1239	21.3	6.77	1665	2.3	0.37	-184.2	4800	11.45
1242	21.3	6.77	1662	3.6	0.37	-180.7	5400	11.45

Did well dewater? Yes (No)	Amount actually evacuated: 5400
Sampling Time: 1244	Sampling Date: 12/22/15
Sample I.D.: IW10-A15-022	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/22/15
Well I.D.: ~~IW-FSB~~ IW-70-FSB11B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 11.03
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated (Tubing) New Tubing Other____

Start Purge Time: 1335 Flow Rate: 200 ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1338	19.1	6.28	2892	29	3.57	-234.5	600	11.11
1341	19.1	6.30	2915	18	2.20	-249.0	1200	11.13
1344	18.9	6.30	2929	16	1.95	-251.3	1800	11.13
1347	19.4	6.29	2915	13	1.50	-257.4	2400	11.14
1350	19.5	6.29	2892	11	1.46	-261.0	3000	11.14
1353	19.6	6.29	2898	10	1.40	-260.2	3600	11.14
1356	19.7	6.29	2896	10	1.36	-264.3	4200	11.14
1359	19.6	6.29	2899	9	1.33	-266.1	4800	11.14

Did well dewater? Yes (No)	Amount actually evacuated: 4800
Sampling Time: 1401	Sampling Date: 12.22.15
Sample I.D.: ~~IW70~~ A15-017	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: IW-70-FS8216	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 14.60
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1224 Flow Rate: 100mL/min Pump Depth: 83'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or (mL))	Depth to Water (ft.)
1230	21.1	6.25	31098	30	1.56	-312	600	14.70
1233	21.0	6.17	31760	28	1.36	-315	900	14.75
1236	21.0	6.14	33389	24	1.31	-325	1200	14.78
1239	21.0	6.16	35396	22	1.30	-340	1500	14.82
1242	20.9	6.18	37926	10	1.33	-351	1800	14.84
1245	20.9	6.21	38566	6	1.29	-358	2100	14.84
1248	20.9	6.21	38751	4	1.27	-360	2400	14.84

Did well dewater? Yes (No) Amount actually evacuated: 2400

Sampling Time: 1251 Sampling Date: 12-17-15

Sample I.D.: IW70-A15-033 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D (Other:) -NP VOAS-

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: IW-70-FSB229	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 15.08
Depth to Free Product:	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556 YSI

Purge Method: 2" Grundfos Pump Peristaltic Pump (BTS Bladder Pump)
Sampling Method: Dedicated Tubing New Tubing Other ____

Start Purge Time: 1420 Flow Rate: 200 Pump Depth: 921

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1423	21.4	7.23	5621	13	1.62	-336	600	15.08
1426	21.3	7.20	3621	5	1.36	-339	1200	15.08
1429	21.3	7.18	3548	4	1.31	-340	1800	15.08
1432	21.3	7.12	3434	4	1.28	-340	2400	15.08
1435	21.2	7.11	3412	4	1.26	-341	3000	15.08
1438	21.2	7.10	3382	4	1.22	-340	3600	15.08

Did well dewater? Yes (No)	Amount actually evacuated: 3,600
Sampling Time: 1441	Sampling Date: 12-17-15
Sample I.D.: IR70-A15-034	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	(Other:) see COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-02	Client: Insight
Sampler: PJ	Gauging Date: 12-14-15
Well I.D.: IW-70-SA306	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 14.60
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: SS6

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1016 Flow Rate: 200 Pump Depth: 85'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or ml)	Depth to Water (ft.)
1019	22.4	6.36	1604	10	1.84	-247	600	14.67
1022	22.7	6.19	1494	5	1.80	-249	1200	14.67
1025	22.7	6.15	1463	5	1.78	-252	1800	14.67
1028	22.7	6.13	1429	5	1.72	-259	2400	14.67
1031	22.7	6.11	1422	5	1.68	-263	3000	14.67

Did well dewater? Yes (No) Amount actually evacuated: 3000

Sampling Time: 1033 Sampling Date: 12-21-15

Sample I.D.: IR70-A15-011 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: (11)

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: 12-14-15
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: IW-70-SAB11	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 14.60
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: YSI 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1120 Flow Rate: 200 mL/min Pump Depth: 85'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1123	21.5	6.66	2308	7	0.65	-273	600	14.70
1126	21.5	6.67	2317	4	0.55	-276	1200	14.73
1129	21.5	6.67	2312	4	0.52	-269	1800	14.73
1132	21.5	6.67	2320	4	0.50	-278	2400	14.73

Did well dewater? Yes (No)	Amount actually evacuated: 2400
Sampling Time: 1135	Sampling Date: 12-21-15
Sample I.D.: IR70-A15-012	Laboratory: Emax
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (11)
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: ~~JDNSight~~
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: IW-70-SAT35	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 14.79
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (BTS Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 0800 Flow Rate: 200mL/min Pump Depth: 40'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0803	20.9	6.68	9293	6	2.61	-321	600	14.89
0806	21.2	6.68	9312	4	2.26	-330	1200	14.98
0809	21.3	6.68	9317	4	2.15	-335	1900	15.01
0812	21.3	6.68	9326	4	2.10	-339	2400	15.01
0815	21.2	6.68	9334	4	2.06	-346	3000	15.01

Did well dewater? Yes (No)	Amount actually evacuated: 3000
Sampling Time: 0815	Sampling Date: 12-22-15
Sample I.D.: IR70-A15-115	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (11)
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: Insight
Sampler: PD	Gauging Date: 12.14.15
Well I.D.: IW-70-SHB113	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 15.94
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 0844 Flow Rate: 200 ml/min Pump Depth: 118

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0847	19.0	6.96	2393	3	1.24	-295	600	16.14
0850	18.6	6.96	2411	3	1.19	-283	1200	16.19
0853	18.6	6.95	2409	2	1.17	-275	1800	16.19
0856	18.6	6.94	2406	2	1.17	-275	2400	16.19
0859	18.6	6.94	2404	2	1.16	-272	3000	16.19

Did well dewater? Yes (No) Amount actually evacuated: 3000

Sampling Time: 0902 Sampling Date: 12.16.15

Sample I.D.: IR70-AIS-041 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: see COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: IW-70-SHB217	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 18.33
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: YSI 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1035 Flow Rate: 200 mL/min Pump Depth: 120'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1039	19.6	7.19	11748	4	1.98	-211	600	18.33
1041	19.8	7.12	11318	4	0.79	-256	1200	18.33
1044	20.0	7.10	11237	4	0.73	-267	1800	18.33
1047	20.0	7.07	11261	4	0.65	-253	2400	18.33
1050	20.0	7.06	11292	4	0.64	-250	3000	18.37

Did well dewater? Yes (No)	Amount actually evacuated: 3000
Sampling Time: 1053	Sampling Date: 12-22-15
Sample I.D.: IR70-A15-043	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (11)
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-P01	Client: INSIGHT
Sampler: PD	Gauging Date: 12-14-15
Well I.D.: IW-70-SHB310	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 25.00
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: SS6

Purge Method: 2" Grundfos Pump Peristaltic Pump (BS) Bladder Pump
Sampling Method: Dedicated Tubing (New Tubing) Other ____

Start Purge Time: 1009 Flow Rate: 200 mL/min Pump Depth: 120'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1012	21.1	4.94	0179	21	2.72	-103	600	25.15
1015	21.4	4.94	0259	11	1.22	-120	1200	25.20
1018	21.4	4.94	0276	8	0.81	-129	1800	25.22
1021	21.5	4.94	0291	8	0.80	-130	2400	25.23
1024	21.5	4.94	0303	8	0.79	-134	3000	25.23
1027	21.5	4.94	0296	8	0.76	-139	3600	25.23

Did well dewater? Yes (No) Amount actually evacuated: 3600 mL

Sampling Time: 1030 Sampling Date: 12-18-15

Sample I.D.: IR70-A15-047 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D (Other: (11))

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: PO	Gauging Date: 12-14-15
Well I.D.: IW-70-SHB311	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): –	Depth to Water (ft.): 18.60
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (BTS) Bladder Pump
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 0849 Flow Rate: 200 mL/min Pump Depth: 97'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0851	20.5	6.27	3812	10	1.97	-156	600	18.75
0854	21.1	6.29	3745	6	1.94	-160	1200	18.84
0857	21.1	6.30	3711	5	1.92	-169	1800	18.84
0900	21.1	6.30	3697	5	1.87	-165	2400	18.84

Did well dewater? Yes (No) Amount actually evacuated: 2400

Sampling Time: 0903 Sampling Date: 12-14-15

Sample I.D.: IR70 - A15 - 049 Laboratory: EMAP

Analyzed for: TPH-G BTEX MTBE TPH-D (Other: (11) — NP VOAs —

Equipment Blank I.D.: - 112 @ Time 0840 Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: IW-70-SSB109	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 18.35
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (F)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated) Tubing New Tubing Other ____

Start Purge Time: 0752 Flow Rate: 300ml/min Pump Depth: QED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0755	20.0	6.47	17301	46.1	2.28	-285.4	900	18.38
0758	20.2	6.50	17420	40.7	2.02	-290.6	1800	18.38
0801	20.2	6.58	17513	33.7	1.05	-305.9	2700	18.38
0804	20.1	6.64	17735	30.8	0.72	-327.8	3600	18.38
0807	20.2	6.66	17949	27.5	0.65	-359.5	4500	18.38
0810	20.2	6.68	18302	24.9	0.63	-363.3	5400	18.39
0813	20.2	6.69	18495	23.6	0.61	-365.8	6300	18.39
0816	20.3	6.68	18542	22.4	0.60	-364.3	7200	18.39

Did well dewater? Yes (No) Amount actually evacuated: 7200

Sampling Time: 0818 Sampling Date: 12/18/15

Sample I.D.: IW70-A15-054 Laboratory: SMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.: IW70-A15-097 @0828

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: IW-70-SSB119	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): 165.69	Depth to Water (ft.): 19.86
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 0859 Flow Rate: 200 Pump Depth: 145

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0902	17.9	6.75	10942	32.1	1.19	-291.4	600	19.99
0905	18.3	6.70	11242	23.5	0.65	-310.7	1200	20.01
0908	18.5	6.63	11488	20.8	0.40	-315.9	1800	20.02
0911	18.5	6.60	11502	17.3	0.36	-321.5	2400	20.02
0914	18.6	6.59	11517	16.7	0.35	-331.4	3000	20.02
0917	18.6	6.58	11533	16.4	0.33	-336.0	3600	20.02

Did well dewater? Yes (No) Amount actually evacuated: 3600

Sampling Time: 0919 Sampling Date: 12/18/15

Sample I.D.: IW70-A15-055 Laboratory: Eurofins

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 151214-PD1	Client: INSIGHT
Sampler: DF	Gauging Date: 12/14/15
Well I.D.: RD0.5	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): PED	Depth to Water (ft.): 12.79
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO (+)

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1035 Flow Rate: 200 ml/min Pump Depth: PED

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1038	20.0	7.56	832	11.9	1.60	-208.9	600	12.85
1041	21.1	7.40	880	8.5	0.93	-269.1	1200	12.85
1044	21.3	7.19	959	6.1	0.61	-271.3	1800	12.85
1047	21.3	7.11	1025	5.7	0.53	-265.0	2400	12.85
1050	21.3	7.09	1028	5.3	0.50	-257.8	3000	12.85
1053	21.3	7.10	1026	5.1	0.49	-253.6	3600	12.85

Did well dewater? Yes (No)	Amount actually evacuated: 3600
Sampling Time: 1055	Sampling Date: 12/18/15
Sample I.D.: IR70-415-025	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

TEST EQUIPMENT CALIBRATION LOG

PROJECT NAME INSIGHT @ SEA TEACH				PROJECT NUMBER 15124.80			
EQUIPMENT NAME	EQUIPMENT NUMBER	DATE/TIME OF TEST	STANDARDS USED	EQUIPMENT READING	CALIBRATED TO: OR WITHIN 10%:	TEMP.	INITIALS
YSI 556	10A100055	12.15.15 /0730	pH 7,10,4 Cond 3900 ORP 246 DO	7,10,4 3900 242 101%	✓	13°C	PO
		12.16.15 /0640	pH 7,10,4 Cond 3900 ORP 248 DO	7,10,4 3900 248 100%	✓	12.9°C	PO
		12.17.15 /0640	pH 7,10,4 Cond 3900 ORP 248 DO	7,10,4 3900 246 100%	✓	12.2°C	PO
		12.19.15 /0645	pH 7,10,4 Cond 3900 ORP 252 DO	7,10,4 3900 250 100%	✓	9.9°C	PO
		12.21.15 /0645	pH 7,10,4 Cond 3900 ORP 244 DO	7,10,4 3900 244 100%	✓	15.1°C	PO
		12.22.15 /0750	pH 7,10,4 Cond 3900 ORP 243 DO	7,10,4 3900 243 100%	✓	16.3°C	PO

TEST EQUIPMENT CALIBRATION LOG

PROJECT NAME	INSIGHT @ SEAL BEACH N.W.S.			PROJECT NUMBER	151214-PD1		
EQUIPMENT NAME	EQUIPMENT NUMBER	DATE/TIME OF TEST	STANDARDS USED	EQUIPMENT READING	CALIBRATED TO: OR WITHIN 10%:	TEMP.	INITIALS
YSI PRO	10H100 530	12/15/15 0900	4.00 7.00 10.00 3900	4.00 7.02 10.00 3900	YES	15.1	DF
		↓	ORP 244.3 DO. 100%	244.3 DO. 100%	YES	15.2	DF
		12/16/15 0730	4.00 7.00 10.00 3900	4.00 7.00 10.00 3900	YES	13.4	DF
		↓	DO 100% ORP 246.8	DO 99.1% ORP 246.8	YES	13.8	DF
		12/17/15 0718	4.00 7.00 10.00 3900	3.99 7.00 10.03 3900	YES	14.2	DF
		↓	DO. 100% ORP 245.0	95% 245	↓	14.1	DF
		12/18/15 0720	4.00 7.00 10.00 3900	4.00 7.01 10.03 3890	YES	15.1	DF
		↓	DO. 100% ORP 244.0	100% 244.0	YES	15.0	DF
		12/21/15 0725	4.00 7.00 3900 10.00	4.00 7.05 3900 10.9	YES	13.5	DF
		↓	DO 100% ORP 241	98% 247.1	↓	13.4	DF
		12/22/15 0715	4.00 7.00 3900 10.00	4.01 7.00 10.01 3897	YES	13.8	DF
		↓	DO 100% ORP 239.9	DO 99.9 239.9	YES	10.7	DF

INSIGHT
Environmental, Engineering and Construction, Inc.

METHANE MONITORING LOG

DATE: 01/15/2016 PAGE 1 OF 8
FACILITY: NWS Seal Beach
SITE: IR Site 70
RECORDED BY: SREE AKKENAPALLY

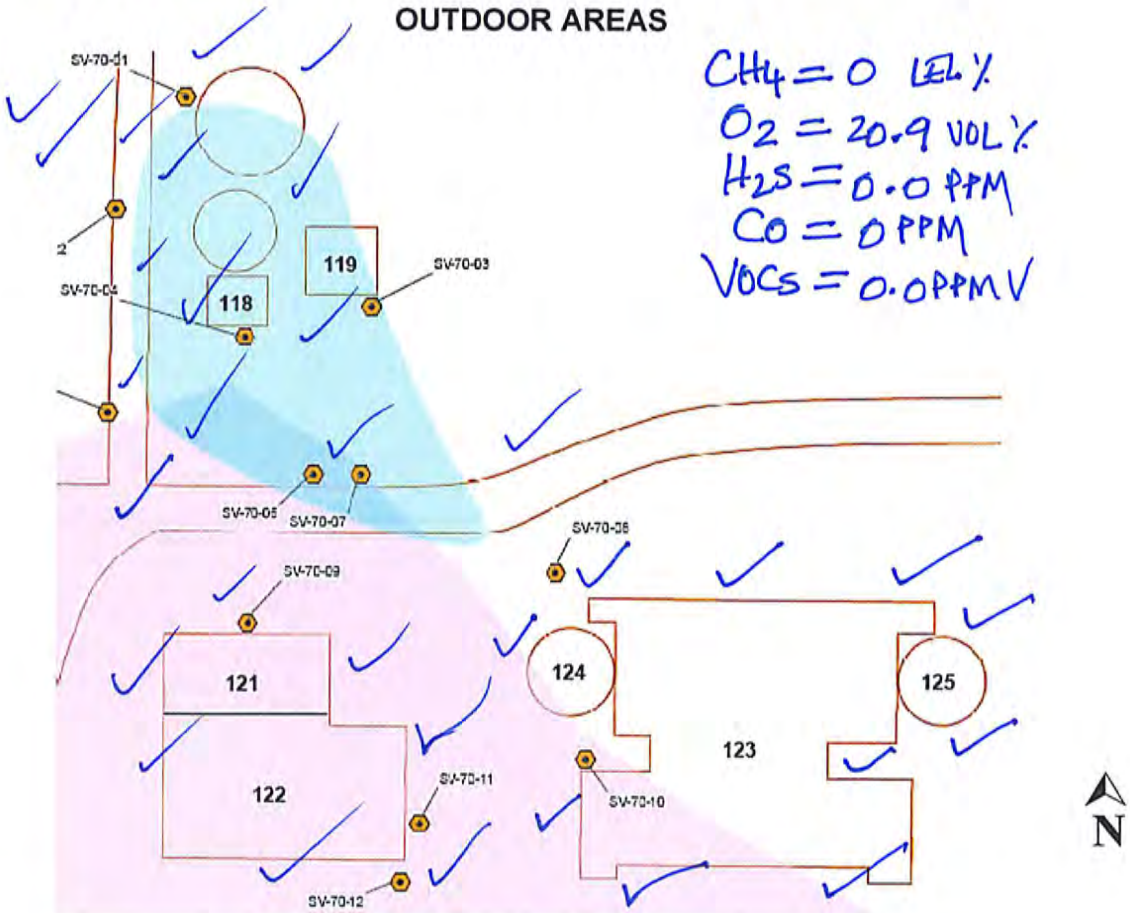
INSTRUMENT TYPE	INSTRUMENT NUMBER	CALIBRATION DATE	COMMENTS
Multi-Gas Monitor (RKI Eagle)	N/A	01/15/2016	CALIBRATION PERFORMED OKAY
PID (MINI RAE 3000)	N/A	01/15/2016	CALIBRATION PERFORMED OKAY.

SURVEY NOTES/OBSERVATIONS:

9:45- CALIBRATED THE GAS MONITORING & PID INSTRUMENTS.
10:30- BEGAN METHANE GAS & VOC MONITORING IN THE SOURCE AREA.
11:55- COMPLETED METHANE GAS MONITORING SURVEY.
METHANE GAS WAS NOT DETECTED IN THE OUTDOOR AREAS/UTILITY CORRIDORS. THE GAS MONITORING INSTRUMENT READING WAS 0.0% LEL IN ALL OUTDOOR AREAS/UTILITY CORRIDORS (NO VOCs WERE DETECTED).

IDENTIFY AREAS SURVEYED AND RECORD INSTRUMENT READINGS ON MAP

OUTDOOR AREAS



$CH_4 = 0$ LEL%
$O_2 = 20.9$ VOL%
$H_2S = 0.0$ PPM
$CO = 0$ PPM
VOCs = 0.0 PPMV

INSIGHT
Environmental, Engineering and Construction, Inc.

METHANE MONITORING LOG

DATE: 01/15/2016 PAGE 2 OF 8
FACILITY: NWS Seal Beach
SITE: IR Site 70
RECORDED BY: SREE AKKENAPALLY

INSTRUMENT TYPE	INSTRUMENT NUMBER	CALIBRATION DATE	COMMENTS
Multi-Gas Monitor (RKI Eagle)			

SURVEY NOTES/OBSERVATIONS:

METHANE GAS WAS NOT DETECTED IN BUILDING 118.

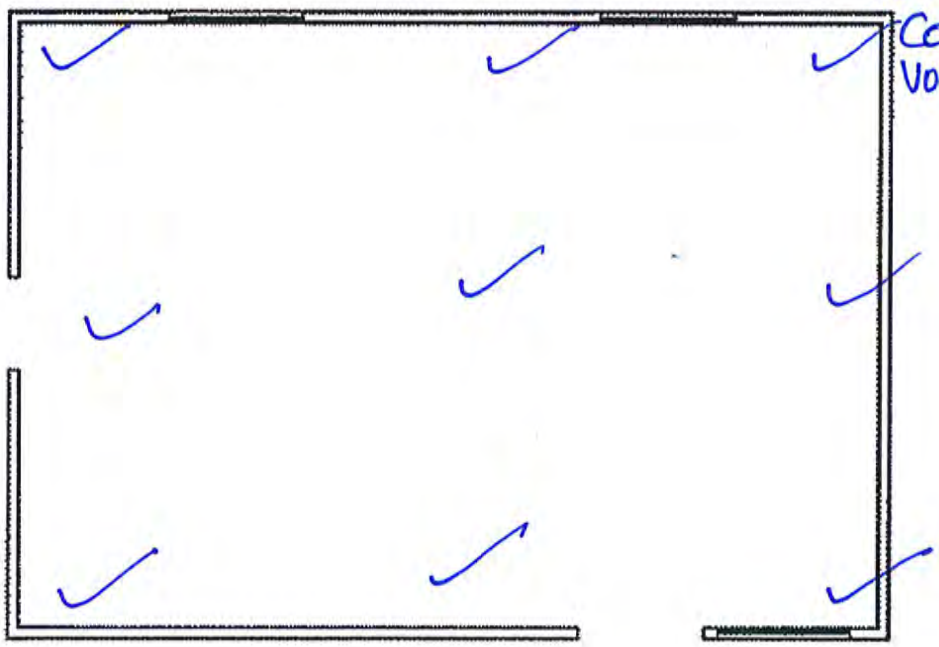
THE GAS MONITORING INSTRUMENT READING WAS 0.0% LEL IN ALL AREAS MONITORED INSIDE THE BUILDING 118.

VOCs WERE NOT DETECTED INSIDE THE BUILDING 118.

IDENTIFY AREAS SURVEYED AND RECORD INSTRUMENT READINGS ON MAP

CH_4 = 0.0 %LEL
O_2 = 20.9 VOL %
H_2S = 0.0 PPM
CO = 0.0 PPM
VOCs = 0.0 PPMV

BUILDING 118



N

INSIGHT
Environmental, Engineering and Construction, Inc.

METHANE MONITORING LOG

DATE: 01/15/2016 PAGE 3 OF 8
FACILITY: NWS Seal Beach
SITE: IR Site 70
RECORDED BY: SREE AKKENAPALLY

INSTRUMENT TYPE	INSTRUMENT NUMBER	CALIBRATION DATE	COMMENTS
Multi-Gas Monitor (RKI Eagle)			

SURVEY NOTES/OBSERVATIONS:

METHANE GAS WAS NOT DETECTED IN BUILDING 119.

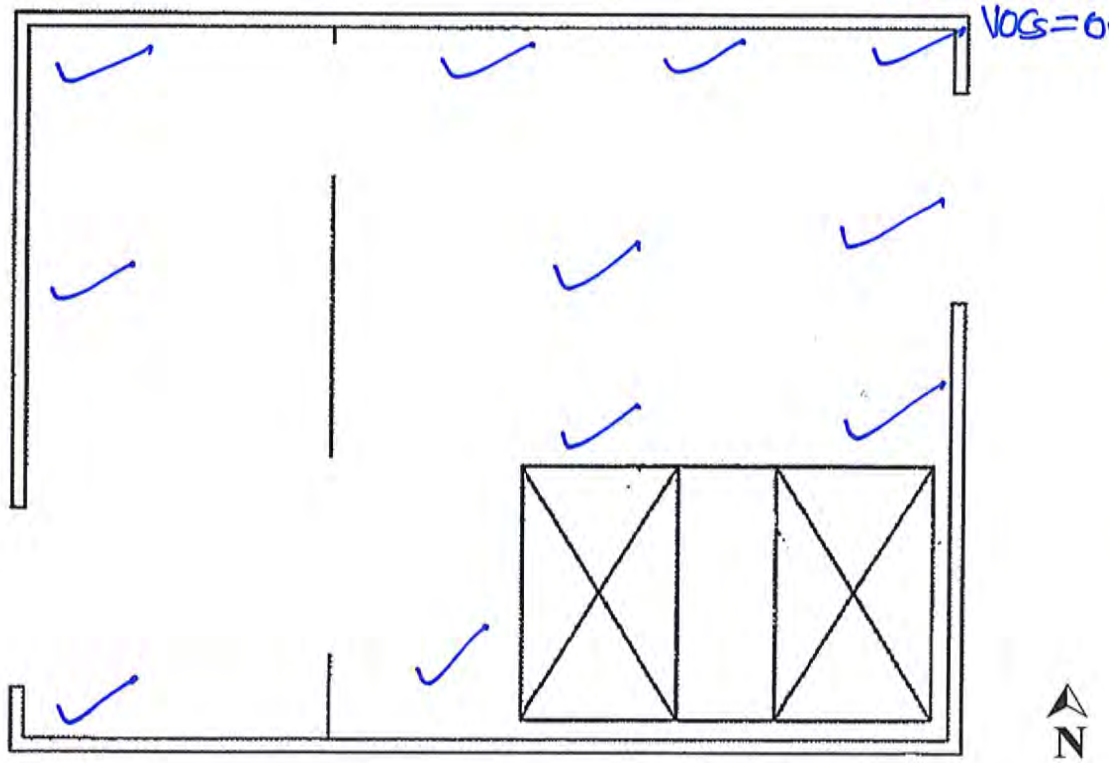
THE GAS MONITORING INSTRUMENT READING WAS 0.0% LEL IN ALL AREAS MONITORED INSIDE THE BUILDING 119.

VOCs WERE NOT DETECTED INSIDE THE BUILDING 119.

IDENTIFY AREAS SURVEYED AND RECORD INSTRUMENT READINGS ON MAP

CH_4 = 0.0% LEL
O_2 = 20.9 VOL%
H_2S = 0.0 PPM
CO = 0.0 PPM
VOCs = 0.0 PPMV

BUILDING 119



INSIGHT
Environmental, Engineering and Construction, Inc.

METHANE MONITORING LOG

DATE: 01/15/2016 PAGE 4 OF 8
FACILITY: NWS Seal Beach
SITE: IR Site 70
RECORDED BY: SREE AKKENAPALLY

INSTRUMENT TYPE	INSTRUMENT NUMBER	CALIBRATION DATE	COMMENTS
Multi-Gas Monitor (RKI Eagle)			

SURVEY NOTES/OBSERVATIONS:

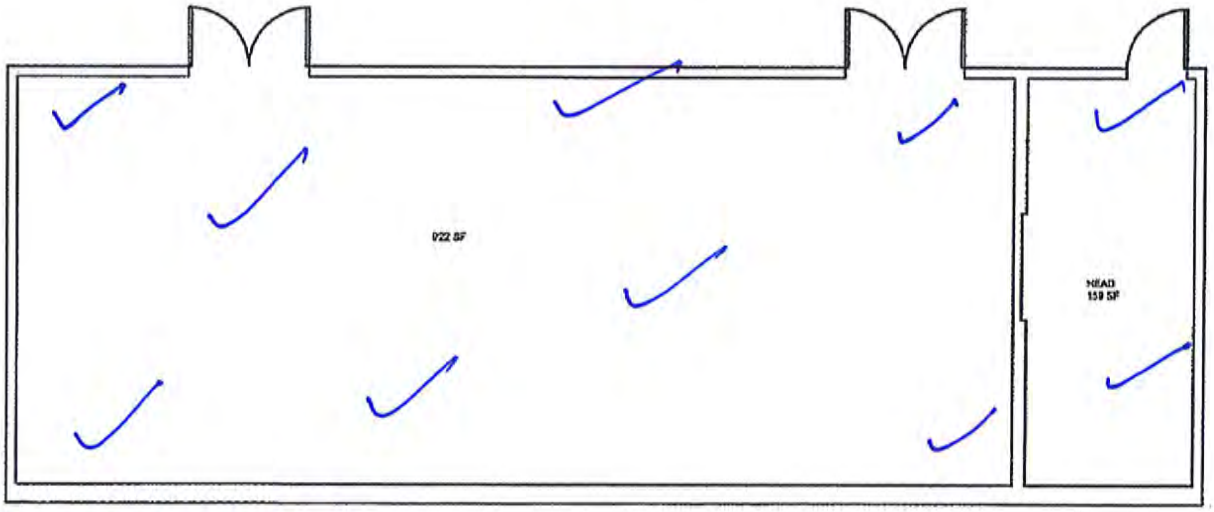
METHANE GAS WAS NOT DETECTED IN BUILDING 121.

THE GAS MONITORING INSTRUMENT READING WAS 0.0% LEL IN ALL AREAS MONITORED INSIDE THE BUILDING 121.

VOCS WERE NOT DETECTED INSIDE THE BUILDING 121.

IDENTIFY AREAS SURVEYED AND RECORD INSTRUMENT READINGS ON MAP

BUILDING 121



CH_4 = 0.0% LEL
O_2 = 20.9 VOL%
H_2S = 0.0 PPM
CO = 0.0 PPM
VOCS = 0.0 PPMV

N

INSIGHT
Environmental, Engineering and Construction, Inc.

METHANE MONITORING LOG

DATE: 01/15/2016 PAGE 5 OF 8
FACILITY: NWS Seal Beach
SITE: IR Site 70
RECORDED BY: SREE AKKENAPALLY

INSTRUMENT TYPE	INSTRUMENT NUMBER	CALIBRATION DATE	COMMENTS
Multi-Gas Monitor (RKI Eagle)			

SURVEY NOTES/OBSERVATIONS:

METHANE GAS WAS NOT DETECTED IN BUILDING 122.

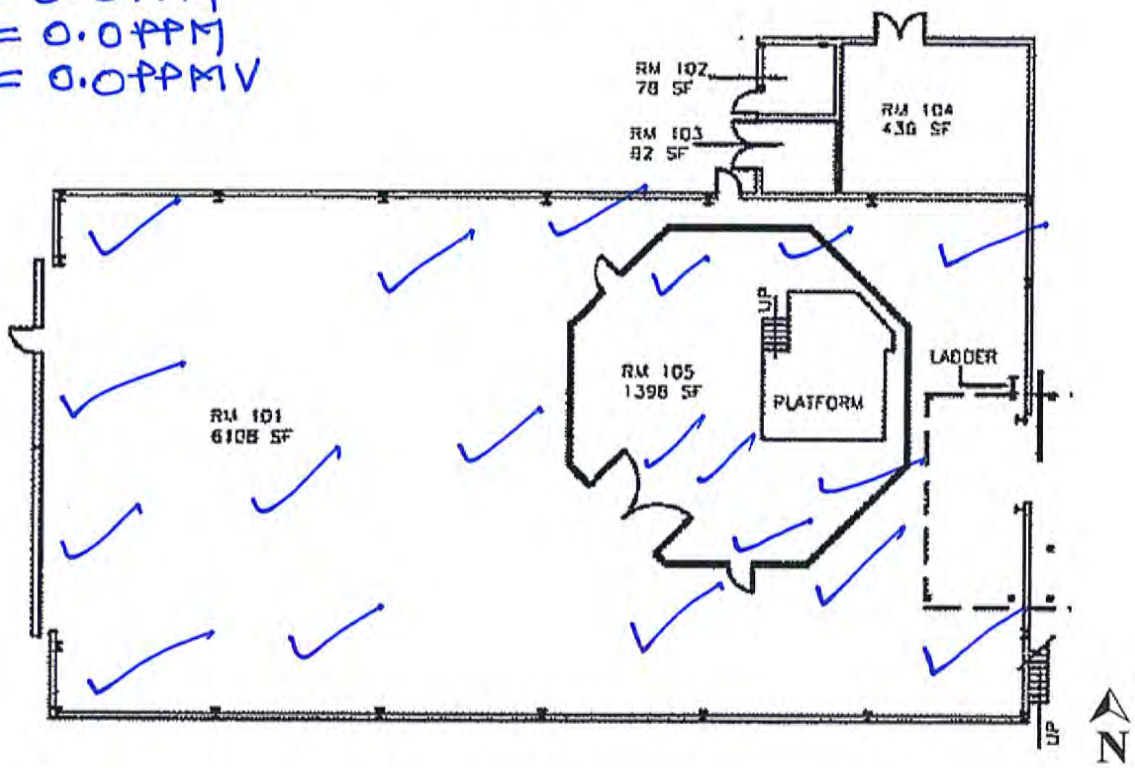
THE GAS MONITORING INSTRUMENT READING WAS 0.0% LEL IN ALL AREAS MONITORED INSIDE THE BUILDING 122

VOCs WERE NOT DETECTED INSIDE THE BUILDING 122.

IDENTIFY AREAS SURVEYED AND RECORD INSTRUMENT READINGS ON MAP

CH_4 = 0.0% LEL
O_2 = 20.9 VOL.%
H_2S = 0.0 PPM
CO = 0.0 PPM
VOCs = 0.0 PPMV

BUILDING 122



INSIGHT
Environmental, Engineering and Construction, Inc.

METHANE MONITORING LOG

DATE: 01/15/2016 PAGE 6 OF 8

FACILITY: NWS Seal Beach

SITE: IR Site 70

RECORDED BY: SREE AKKENAPALLY

INSTRUMENT TYPE	INSTRUMENT NUMBER	CALIBRATION DATE	COMMENTS
Multi-Gas Monitor (RKI Eagle)			

SURVEY NOTES/OBSERVATIONS:

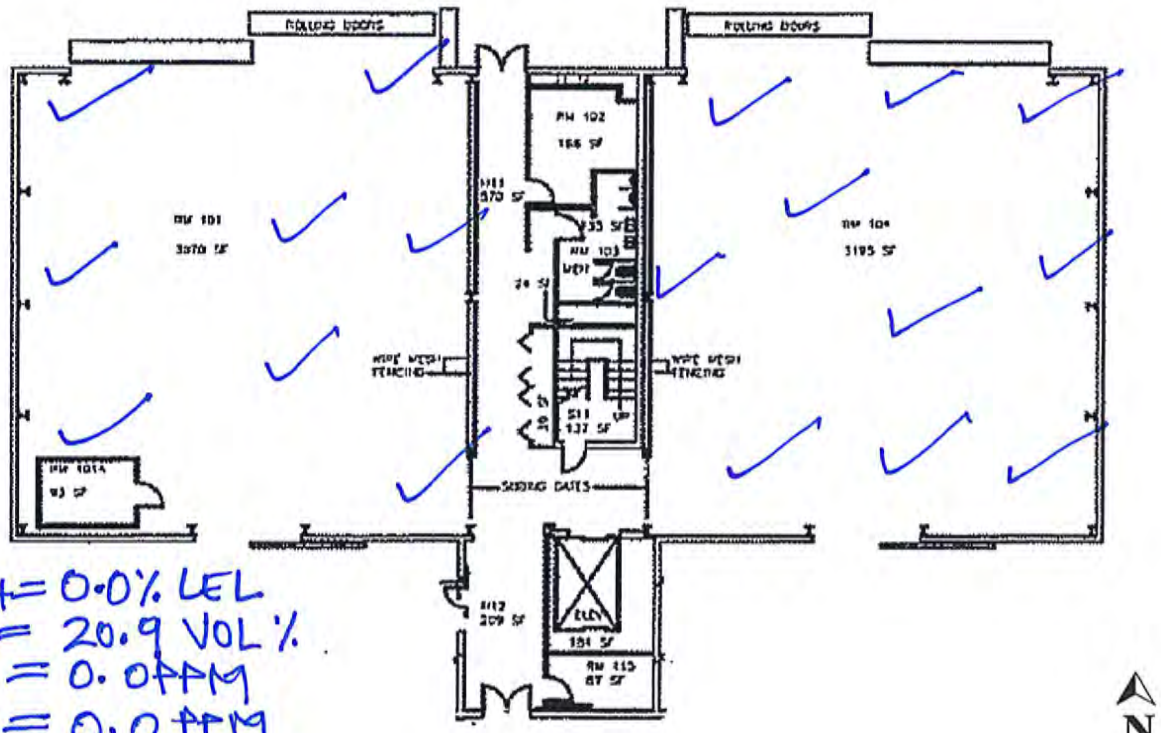
METHANE GAS WAS NOT DETECTED IN BUILDING 123 (NORTH)

THE GAS MONITORING INSTRUMENT READING WAS 0.0% LEL IN ALL AREAS MONITORED INSIDE THE BUILDING 123 (NORTH)

VOCs WERE NOT DETECTED INSIDE THE BUILDING 123 (NORTH)

IDENTIFY AREAS SURVEYED AND RECORD INSTRUMENT READINGS ON MAP

BUILDING 123 (NORTH)



CH_4 = 0.0% LEL
O_2 = 20.9 VOL%
H_2S = 0.0 PPM
CO = 0.0 PPM
VOCs = 0.0 PPMV

INSIGHT
Environmental, Engineering and Construction, Inc.

METHANE MONITORING LOG

DATE: 01/15/2016 PAGE 7 OF 8
FACILITY: NWS Seal Beach
SITE: IR Site 70
RECORDED BY: SREE AKKENAPALLY

INSTRUMENT TYPE	INSTRUMENT NUMBER	CALIBRATION DATE	COMMENTS
Multi-Gas Monitor (RKI Eagle)			

SURVEY NOTES/OBSERVATIONS:

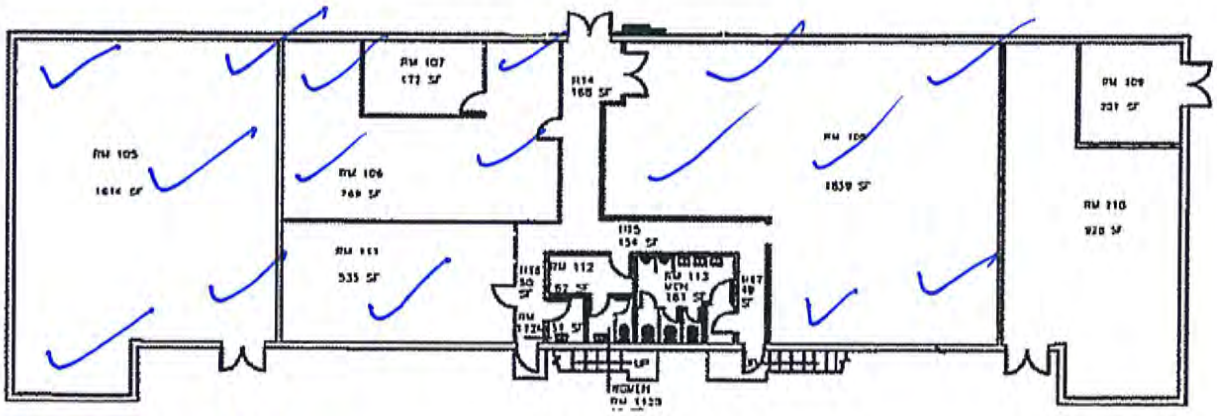
METHANE GAS WAS NOT DETECTED IN BUILDING 123 (SOUTH)

THE GAS MONITORING INSTRUMENT READING WAS 0.0% LEL IN ALL AREAS MONITORED INSIDE THE BUILDING 123 (SOUTH)

VOCs WERE NOT DETECTED INSIDE THE BUILDING 123 (SOUTH)

IDENTIFY AREAS SURVEYED AND RECORD INSTRUMENT READINGS ON MAP

BUILDING 123 (SOUTH)



CH_4 = 0.0% LEL
O_2 = 20.9 VOL %
H_2S = 0.0 PPM
CO = 0.0 PPM
VOCs = 0.0 PPMV

N

INSIGHT
Environmental, Engineering and Construction, Inc.

METHANE MONITORING LOG

DATE: 01/15/2016 PAGE 8 OF 8
FACILITY: NWS Seal Beach
SITE: IR Site 70
RECORDED BY: SREE AKKENAPALLY

INSTRUMENT TYPE	INSTRUMENT NUMBER	CALIBRATION DATE	COMMENTS
Multi-Gas Monitor (RKI Eagle)			

SURVEY NOTES/OBSERVATIONS:

METHANE WAS NOT DETECTED IN BUILDING 124.

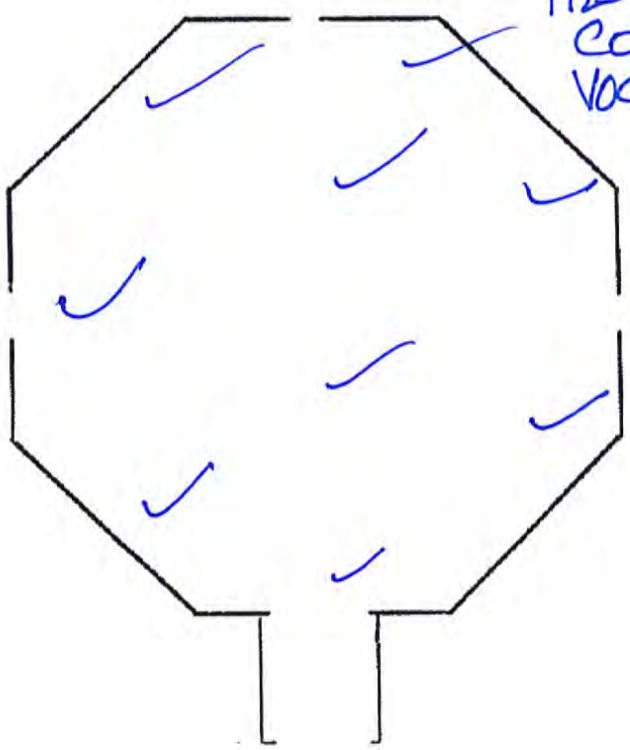
THE GAS MONITORING INSTRUMENT READING WAS 0.0% LEL IN ALL AREAS MONITORED INSIDE THE BUILDING 124.

VOCs WERE NOT DETECTED INSIDE THE BUILDING 124.

IDENTIFY AREAS SURVEYED AND RECORD INSTRUMENT READINGS ON MAP

BUILDING 124

CH_4 = 0.0% LEL
O_2 = 20.9 VOL %
H_2S = 0.0 PPM
CO = 0.0 PPM
VOCs = 0.0 PPM V



N

This page intentionally left blank

APPENDIX B-1

LABORATORY ANALYTICAL REPORTS AND CHAIN-OF-CUSTODY DOCUMENTATION (on CD only)

DHC ANALYSIS

APPENDIX B-2

LABORATORY DATA VALIDATION REPORTS
(on CD only)

This page intentionally left blank

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Environmental Chemical Corp.
1746 Cole Boulevard
Building 21, Suite 350
Lakewood, CO 80401
ATTN: Mr. Ganesh Subramaniam

February 19, 2016

SUBJECT: Seal Beach, IR Site 70, Data Validation

Dear Mr. Subramaniam,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on January 27, 2016. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #35803:

SDG #	Fraction
15L149, 15L154, 15L176 15L186, 15L191, 15L198	Volatiles, Dissolved Metals, Methane, Ethane, & Ethene, Wet Chemistry

The data validation was performed under Level III & IV guidelines. The analyses were validated using the following documents, as applicable to each method:

- Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California, November 2014
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2, October 2010
- USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, June 2008
- USEPA Contract Laboratory National Functional Guidelines for Inorganic Superfund Data Review, January 2010
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; Update IV, February 2007

Please feel free to contact us if you have any questions.

Sincerely,

Shauna McKellar
Project Manager/Chemist

3186 pages-SF

Attachment 1

Client Select

LDC #35803 (ECC-Lakewood, CO / Seal Beach, IR Site 70)

LDC	SDG#	DATE REC'D	(3) DATE DUE	VOA (8260B)		Diss Metals (6010B)		Methane Ethane Ethene		Alk. (2320B)		Br,Cl SO_4 (300.0)		NO_3-N NO_2-N (300.0)		Organic Acids (300.0M)		S= (4500-S2F)		TDS (2540C)		TOC (5310B)																	
Matrix:	Water/Soil			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	15L149	01/27/16	02/17/16	17	0	7	0	20	0	7	0	7	0	7	0	9	0	7	0	7	0	7	0																
A	15L149	01/27/16	02/17/16	2	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0																
B	15L154	01/27/16	02/17/16	20	0	9	0	29	0	8	0	8	0	8	0	13	0	8	0	8	0	8	0																
B	15L154	01/27/16	02/17/16	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0																
C	15L176	01/27/16	02/17/16	24	0	10	0	29	0	9	0	9	0	9	0	14	0	9	0	9	0	9	0																
C	15L176	01/27/16	02/17/16	2	0	1	0	4	0	1	0	1	0	1	0	2	0	1	0	1	0	1	0																
D	15L186	01/27/16	02/17/16	22	0	7	0	28	0	6	0	6	0	6	0	13	0	7	0	7	0	7	0																
D	15L186	01/27/16	02/17/16	1	0	1	0	2	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0																
E	15L191	01/27/16	02/17/16	20	0	7	0	14	0	7	0	7	0	7	0	8	0	7	0	7	0	7	0																
E	15L191	01/27/16	02/17/16	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																
F	15L198	01/27/16	02/17/16	21	0	9	0	20	0	7	0	7	0	7	0	8	0	7	0	7	0	7	0																
F	15L198	01/27/16	02/17/16	2	0	1	0	2	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0																
Total	A/SM			134	0	53	0	151	0	48	0	48	0	48	0	71	0	49	0	49	0	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	700

Shaded cells indicate Level IV validation (all other cells are Level III validation). These sample counts do not include MS, MSD, or DUP's.

L:\ECC\Seal Beach\35803ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 5, 2016

Parameters: Volatiles

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L149

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-001	15L149-01	Water	12/15/15
IR70-A15-001DL	15L149-01DL	Water	12/15/15
IR70-A15-002	15L149-02	Water	12/15/15
IR70-A15-002DL	15L149-02DL	Water	12/15/15
IR70-A15-005	15L149-03	Water	12/15/15
IR70-A15-005DL	15L149-03DL	Water	12/15/15
IR70-A15-091**	15L149-04**	Water	12/15/15
IR70-A15-091DL**	15L149-04DL**	Water	12/15/15
IR70-A15-010	15L149-05	Water	12/15/15
IR70-A15-015	15L149-06	Water	12/15/15
IR70-A15-015DL	15L149-06DL	Water	12/15/15
IR70-A15-016	15L149-07	Water	12/15/15
IR70-A15-016DL	15L149-07DL	Water	12/15/15
IR70-A15-018	15L149-08	Water	12/15/15
IR70-A15-018DL	15L149-08DL	Water	12/15/15
IR70-A15-023	15L149-09	Water	12/15/15
IR70-A15-008	15L149-10	Water	12/15/15
IR70-A15-008DL	15L149-10DL	Water	12/15/15
IR70-A15-101	15L149-11	Water	12/15/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Volatile Organic Compounds (VOCs) by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A bromofluorobenzene (BFB) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

Percent relative standard deviations (%RSD) were less than or equal to 15.0% for each individual compound and less than or equal to 30.0% for calibration check compounds (CCCs).

Average relative response factors (RRF) for all compounds were within validation criteria with the following exceptions:

Date	Compound	RRF (Limits)	Associated Samples	Flag	A or P
12/01/15	2-Butanone	0.008 (≥0.010)	All samples in SDG 15L149	UJ (all non-detects)	A

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria with the following exceptions:

Date	Compound	RRF (Limits)	Associated Samples	Flag	A or P
12/17/15	2-Butanone	0.009 (≥0.010)	IR70-A15-001 IR70-A15-001DL IR70-A15-002 IR70-A15-002DL IR70-A15-005 IR70-A15-005DL IR70-A15-091** IR70-A15-091DL** IR70-A15-010 IR70-A15-015 IR70-A15-015DL IR70-A15-016 IR70-A15-016DL IR70-A15-018 IR70-A15-018DL IR70-A15-008 IR70-A15-008DL	UJ (all non-detects)	A
12/18/15	2-Butanone	0.008 (≥0.010)	IR70-A15-023 IR70-A15-101	UJ (all non-detects)	A

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Sample IR70-A15-101 was identified as a trip blank. No contaminants were found.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples IR70-A15-005 and IR70-A15-091** and samples IR70-A15-005DL and IR70-A15-091DL** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	IR70-A15-005	IR70-A15-091**	
1,1,2-Trichloroethane	0.31	0.39	23
Freon 113	0.82	0.86	5
1,1-Dichloroethane	0.73	0.73	0
1,1-Dichloroethene	3.9	4.0	3
Carbon disulfide	0.38	0.27	34
Chloroform	0.88	0.89	1
cis-1,2-Dichloroethene	510	530	4
Tetrachloroethene	0.75	0.80	6
trans-1,2-Dichloroethene	86	86	0
Trichloroethene	800	820	2
Vinyl chloride	290	300	3

Compound	Concentration (ug/L)		RPD
	IR70-A15-005DL	IR70-A15-091DL**	
cis-1,2-Dichloroethene	650	600	8
trans-1,2-Dichloroethene	96	85	12
Trichloroethene	2200	1900	15
Vinyl chloride	340	310	9

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
IR70-A15-001 IR70-A15-016	Vinyl chloride	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A
IR70-A15-002 IR70-A15-015 IR70-A15-018	cis-1,2-Dichloroethene Vinyl chloride	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects)	A
IR70-A15-005 IR70-A15-091**	cis-1,2-Dichloroethene Trichloroethene Vinyl chloride	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects) J (all detects)	A
IR70-A15-008	cis-1,2-Dichloroethene	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A

Raw data were not reviewed for Level III validation.

XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Compound	Flag	A or P
IR70-A15-001 IR70-A15-016	Vinyl chloride	R	A
IR70-A15-001DL IR70-A15-016DL	All TCL compounds except Vinyl chloride	R	A

Sample	Compound	Flag	A or P
IR70-A15-002 IR70-A15-015 IR70-A15-018	cis-1,2-Dichloroethene Vinyl chloride	R R	A
IR70-A15-002DL IR70-A15-015DL IR70-A15-018DL	All TCL compounds except cis-1,2-Dichloroethene Vinyl chloride	R	A
IR70-A15-005 IR70-A15-091**	cis-1,2-Dichloroethene Trichloroethene Vinyl chloride	R R R	A
IR70-A15-005DL IR70-A15-091DL**	All TCL compounds except cis-1,2-Dichloroethene Trichloroethene Vinyl chloride	R	A
IR70-A15-008	cis-1,2-Dichloroethene	R	A
IR70-A15-008DL	All TCL compounds except cis-1,2-Dichloroethene	R	A

Due to initial and continuing calibration RRF, data were qualified as estimated in eleven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Volatiles - Data Qualification Summary - SDG 15L149

Sample	Compound	Flag	A or P	Reason
IR70-A15-001 IR70-A15-002 IR70-A15-005 IR70-A15-091** IR70-A15-010 IR70-A15-015 IR70-A15-016 IR70-A15-018 IR70-A15-023 IR70-A15-008 IR70-A15-101	2-Butanone	UJ (all non-detects)	A	Initial calibration (RRF)
IR70-A15-001 IR70-A15-002 IR70-A15-005 IR70-A15-091** IR70-A15-010 IR70-A15-015 IR70-A15-016 IR70-A15-018 IR70-A15-023 IR70-A15-008 IR70-A15-101	2-Butanone	UJ (all non-detects)	A	Continuing calibration (RRF)
IR70-A15-001 IR70-A15-016	Vinyl chloride	R	A	Overall assessment of data
IR70-A15-001DL IR70-A15-016DL	All TCL compounds except Vinyl chloride	R	A	Overall assessment of data
IR70-A15-002 IR70-A15-015 IR70-A15-018	cis-1,2-Dichloroethene Vinyl chloride	R R	A	Overall assessment of data
IR70-A15-002DL IR70-A15-015DL IR70-A15-018DL	All TCL compounds except cis-1,2-Dichloroethene Vinyl chloride	R	A	Overall assessment of data
IR70-A15-005 IR70-A15-091**	cis-1,2-Dichloroethene Trichloroethene Vinyl chloride	R R R	A	Overall assessment of data
IR70-A15-005DL IR70-A15-091DL**	All TCL compounds except cis-1,2-Dichloroethene Trichloroethene Vinyl chloride	R	A	Overall assessment of data
IR70-A15-008	cis-1,2-Dichloroethene	R	A	Overall assessment of data
IR70-A15-008DL	All TCL compounds except cis-1,2-Dichloroethene	R	A	Overall assessment of data

Seal Beach, IR Site 70
Volatiles - Laboratory Blank Data Qualification Summary - SDG 15L149

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Volatiles - Field Blank Data Qualification Summary - SDG 15L149

No Sample Data Qualified in this SDG

LDC #: 35803A1

SDG #: 15L149

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 02/03/16

Page: 1 of 2

Reviewer: JVB

2nd Reviewer: DL

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	SW / A	ICAL ≤ 15/30 % ICV ≤ 20%
IV.	Continuing calibration	SW	CCV ≤ 20 %
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 19
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS / D
X.	Field duplicates	SW	D = 5/7, 6/8
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation.
XIII.	Target compound identification	A	Not reviewed for Level III validation.
XIV.	System performance	A	Not reviewed for Level III validation.
XV.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-001	15L149-01	Water	12/15/15
2	IR70-A15-001DL	15L149-01DL	Water	12/15/15
3	IR70-A15-002	15L149-02	Water	12/15/15
4	IR70-A15-002DL	15L149-02DL	Water	12/15/15
5	IR70-A15-005 D1	15L149-03	Water	12/15/15
6	IR70-A15-005DL D2	15L149-03DL	Water	12/15/15
7	IR70-A15-091** D1	15L149-04**	Water	12/15/15
8	IR70-A15-091DL** D2	15L149-04DL**	Water	12/15/15
9	IR70-A15-010	15L149-05	Water	12/15/15
10	IR70-A15-015	15L149-06	Water	12/15/15
11	IR70-A15-015DL	15L149-06DL	Water	12/15/15
12	IR70-A15-016	15L149-07	Water	12/15/15
13	IR70-A15-016DL	15L149-07DL	Water	12/15/15

LDC #: 35803A1

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

SDG #: 15L149

Laboratory: EMAX Laboratories, Inc.

Date: 02/03/16

Page: 2 of 2

Reviewer: JVG

2nd Reviewer: R

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

	Client ID	Lab ID	Matrix	Date
14	IR70-A15-018	15L149-08	Water	12/15/15
15	IR70-A15-018DL	15L149-08DL	Water	12/15/15
16	IR70-A15-023	15L149-09	Water	12/15/15
17	IR70-A15-008	15L149-10	Water	12/15/15
18	IR70-A15-008DL	15L149-10DL	Water	12/15/15
19	IR70-A15-101	15L149-11	Water	12/15/15
20				
21				
22				
23				
24				
25				

Notes:

1	MBLK 1W						
2	↓ 2W						

LDC #: 35803A1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: n

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?		✓		
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) ≥ 0.05?	✓	✓		
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?		✓		
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?	✓			
Were target compounds detected in the field blanks?		✓		
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	✓			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			✓	

LDC #: 75807A1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

TARGET COMPOUND WORKSHEET

METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane
C. Vinyl choride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO.1,1-Difluoroethane	O1. 3-Methylpentane
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3- Trimethylbutane
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methyl cyclohexane	T1. 2-Methylhexane
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.

LDC #: 35803 A1

VALIDATION FINDINGS WORKSHEET
Initial Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Did the laboratory perform a 5 point calibration prior to sample analysis?
Y N N/A Were percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCC's and SPCC's?
Y N N/A Was a curve fit used for evaluation? If yes, what was the acceptance criteria used for evaluation? NA
Y N N/A Did the initial calibration meet the acceptance criteria?
Y N N/A Were all %RSDs and RRFs within the validation criteria of ≤30/15 %RSD and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %RSD (Limit: ≤30/15%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	12/01/15	ICAL-T067	M		0.008 (≥0.010)	All (ND)	J/UJ/A

INICAL.wpd

LDC #: 35803 A1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: R

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?
Y N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?
Y N N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	12/17/15	RLC417	M		0.009 (≥0.010)	1-15, 17, 18, MBLK1W	(ND) J/UJ/A
	12/18/15	RLC456	M		0.008 (≥0.010)	16, 19, MBLK2W	(ND)

CONCAL.wpd

LDC#: 35803A1

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GCMS VOA (EPA SW 846 Method 8260B)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD
	5	7	
U	0.31	0.39	23
G1	0.82	0.86	5
I	0.73	0.73	0
H	3.9	4.0	3
G	0.38	0.27	34
K	0.88	0.89	1
QQQ	510	530	4
AA	0.75	0.80	6
PPP	86	86	0
S	800	820	2
C	290	300	3

Compound	Concentration (ug/L)		RPD
	6	8	
QQQ	650	600	8
PPP	96	85	12
S	2200	1900	15
C	340	310	9

V:\Josephine\FIELD DUPLICATES\35803A1 ecc seal beach.wpd

LDC #: 35803A1

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Date	Sample ID	Compound	Finding	Qualifications
		1, 12	C	> cal range	J dets /A
		3, 10, 14	QQQ, C		
		5, 7	QQQ, S, C		
		17	QQQ		

Comments: See sample calculation verification worksheet for recalculations

LDC #: 35803A1

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: RC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.
Y N N/A Was the overall quality and usability of the data acceptable?

#	Date	Sample ID	Compound	Finding	Qualifications
		1, 12	C	> cal range	R/A
		2, 13	All except C	dil	
		3, 10, 14	QQQ, C	> cal range	
		4, 11, 15	All except above	dil	
		5, 7	QQQ, S, C	> cal range	
		6, 8	All except above	dil	
		17	QQQ	> cal range	
		18	All except above	dil	

Comments:

OVR.wpd

LDC #: 35803A1

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound
S= Standard deviation of the RRFs

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 10 std)	Recalculated RRF (RRF 10 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL TO67	12/01/15	Trichloroethene (IS1)	0.363	0.363	0.369	0.369	4.64	4.64
			Toluene (IS2)	1.664	1.664	1.734	1.734	6.84	6.84
			1,1,2,2-TCA (IS3)	0.589	0.589	0.604	0.604	3.19	3.21

LDC # 35803A1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound	(IS)	Average RRF (Initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported % D	Recalculated %D
1	RLC417	12/17/2015	Trichloroethene	(IS1)	0.369	0.333	0.333	9.8	9.8
			Toluene	(IS2)	1.734	1.645	1.645	5.1	5.1
			1,1,2,2-TCA	(IS3)	0.604	0.596	0.596	1.3	1.3

LDC #: 35803 A1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #7

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4	10.0	11.02	110	110	0
Toluene-d8		9.64	96.4	96.4	
Bromofluorobenzene		9.77	97.7	97.7	

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

LDC #: 35803 A1

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboraotry control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS ID: LCS 7D 1M

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
1,1-Dichloroethene	10.0	10.0	9.78	10.4	98	98	104	104	6	6
Trichloroethene			8.94	9.38	89	89	94	94	5	5
Benzene			9.29	9.71	93	93	97	97	4	4
Toluene			9.27	9.51	93	93	95	95	3	3
Chlorobenzene			9.30	9.63	93	93	96	96	4	4

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803 A1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x = Area of the characteristic ion (EICP) for the compound to be measured

A_{is} = Area of the characteristic ion (EICP) for the specific internal standard

I_s = Amount of internal standard added in nanograms (ng)

RRF = Relative response factor of the calibration standard.

V_o = Volume or weight of sample pruged in milliliters (ml) or grams (g).

Df = Dilution factor.

%S = Percent solids, applicable to soils and solid matrices only.

Example:

Sample I.D. 8, TCE:

Conc. = $\frac{(2029732)(10)(50)}{(1412523)(0.369)(\quad)(\quad)}$

= 1947.09

≈ 1900 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
	8	TCE	1900		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 19, 2016

Parameters: Dissolved Metals

Validation Level: Level III

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L149

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-001	15L149-01	Water	12/15/15
IR70-A15-002	15L149-02	Water	12/15/15
IR70-A15-010	15L149-05	Water	12/15/15
IR70-A15-015	15L149-06	Water	12/15/15
IR70-A15-016	15L149-07	Water	12/15/15
IR70-A15-018	15L149-08	Water	12/15/15
IR70-A15-023	15L149-09	Water	12/15/15

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Arsenic, Iron, and Manganese by Environmental Protection Agency (EPA) SW 846 Method 6010B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Serial Dilution

Serial dilution analysis was performed on an associated project sample. The analysis criteria were met.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Sample Result Verification

Raw data were not reviewed for Level III validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Dissolved Metals - Data Qualification Summary - SDG 15L149

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Dissolved Metals - Laboratory Blank Data Qualification Summary - SDG 15L149

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Dissolved Metals - Field Blank Data Qualification Summary - SDG 15L149

No Sample Data Qualified in this SDG

LDC #: 35803A4 b

SDG #: 15L149

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III

Date: 2-5-16

Page: 1 of 1

Reviewer: MG

2nd Reviewer: AC

METHOD: Metals (EPA SW 846 Method 6010B/~~7470A~~) 7471A

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
~~II.~~	~~ICP/MS Tune~~		
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	client specified
VIII.	Duplicate sample analysis	N	" "
IX.	ICP Serial Dilution	A	
X.	Laboratory control samples	A	LCS/LCSD
XI.	Field Duplicates	N	
~~XII.~~	~~Internal Standard (ICP-MS)~~		
XIII.	Sample Result Verification	N	
XIV.	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-001	15L149-01	Water	12/15/15
2	IR70-A15-002	15L149-02	Water	12/15/15
3	IR70-A15-010	15L149-05	Water	12/15/15
4	IR70-A15-015	15L149-06	Water	12/15/15
5	IR70-A15-016	15L149-07	Water	12/15/15
6	IR70-A15-018	15L149-08	Water	12/15/15
7	IR70-A15-023	15L149-09	Water	12/15/15
8				
9				
10				
11	PBW			

Notes:

LDC #: 35803A4b

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Page: 1 of 1
Reviewer: MG
2nd reviewer: [illegible]

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1 → 7	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
Analysis Method		
ICP	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
ICP-MS		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
GFAA		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-,

Comments: Mercury by CVAA if performed

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 9, 2016

Parameters: Wet Chemistry

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L149

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-001	15L149-01	Water	12/15/15
IR70-A15-002	15L149-02	Water	12/15/15
IR70-A15-005	15L149-03	Water	12/15/15
IR70-A15-091**	15L149-04**	Water	12/15/15
IR70-A15-010	15L149-05	Water	12/15/15
IR70-A15-015	15L149-06	Water	12/15/15
IR70-A15-016	15L149-07	Water	12/15/15
IR70-A15-018	15L149-08	Water	12/15/15
IR70-A15-023	15L149-09	Water	12/15/15
IR70-A15-008	15L149-10	Water	12/15/15
IR70-A15-001MS	15L149-01MS	Water	12/15/15
IR70-A15-001MSD	15L149-01MSD	Water	12/15/15
IR70-A15-002MS	15L149-02MS	Water	12/15/15
IR70-A15-002MSD	15L149-02MSD	Water	12/15/15
IR70-A15-010DUP	15L149-05DUP	Water	12/15/15

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Alkalinity by Standard Method 2320B
Bromide, Chloride, Nitrate as Nitrogen, Nitrite as Nitrogen, and Sulfate by Environmental Protection Agency (EPA) Method 300.0
Organic Acids by EPA Method 300.0 Modified
Sulfide by Standard Method 4500-S2 F
Total Dissolved Solids by Standard Method 2540C
Total Organic Carbon by Standard Method 5310B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

Samples IR70-A15-005 and IR70-A15-091** were identified as field duplicates. No results were detected in any of the samples.

X. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Wet Chemistry - Data Qualification Summary - SDG 15L149

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 15L149

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Wet Chemistry - Field Blank Data Qualification Summary - SDG 15L149

No Sample Data Qualified in this SDG

LDC #: 35803A6

SDG #: 15L149

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 2-5-16

Page: 1 of 2

Reviewer: MG

2nd Reviewer: A

METHOD: (Analyte) Alkalinity (SM2320B), Bromide, Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA Method 300.0), Organic Acids (EPA Method 300.0M), ~~Sulfate~~ Sulfide (SM4500-S2 F), TDS (SM2540C), TOC (SM5310B)

MG

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	MS/MSD
VII.	Duplicate sample analysis	A	DUP
VIII.	Laboratory control samples	A	LCS/LCSD
IX.	Field duplicates	ND	D= 3+4
X.	Sample result verification	A	Not reviewed for Level III validation.
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-001	15L149-01	Water	12/15/15
2	IR70-A15-002	15L149-02	Water	12/15/15
3	IR70-A15-005	15L149-03	Water	12/15/15
4	IR70-A15-091**	15L149-04**	Water	12/15/15
5	IR70-A15-010	15L149-05	Water	12/15/15
6	IR70-A15-015	15L149-06	Water	12/15/15
7	IR70-A15-016	15L149-07	Water	12/15/15
8	IR70-A15-018	15L149-08	Water	12/15/15
9	IR70-A15-023	15L149-09	Water	12/15/15
10	IR70-A15-008	15L149-10	Water	12/15/15
11	IR70-A15-001MS	15L149-01MS	Water	12/15/15
12	IR70-A15-001MSD	15L149-01MSD	Water	12/15/15
13	IR70-A15-002MS	15L149-02MS	Water	12/15/15
14	IR70-A15-002MSD	15L149-02MSD	Water	12/15/15
15	#5 DUP			
16				

LDC #: 35803A6

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 2-5-16

SDG #: 15L149

Page: 2 of 2

Laboratory: EMAX Laboratories, Inc.

Reviewer: MG

2nd Reviewer: A

METHOD: (Analyte) Alkalinity (SM2320B), Bromide, Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA Method 300.0), Organic Acids (EPA Method 300.0M), Sulfate (SM4500-S2 F), TDS (SM2540C), TOC (SM5310B)

	Client ID	Lab ID	Matrix	Date
17				
18				
19	PBW1			
20	PBW2			

Notes:

LDC #: 35803A6

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: ✓

Method: Inorganics (EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	✓			
Were titrant checks performed as required? (Level IV only)			✓	
Were balance checks performed as required? (Level IV only)			✓	
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
IV. Matrix spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL(≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.	✓			
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	✓			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

LDC #: 35803A6

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: M

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were detection limits < RL?	✓			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.		✓		
X. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 35803A6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: MG
2nd reviewer: M

All circled methods are applicable to each sample.

Sample ID	Matrix	Parameter
1, 2, 5→9	W	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Br Org Acid $S^=$
3, 4, 10	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ Org Acid
QC 11, 12	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ Org Acid
13, 14	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
15	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____

Comments:

LDC #: 35803A6

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: MG
2nd Reviewer: RC

METHOD: Inorganics, Method See cover

The correlation coefficient (r) for the calibration of Acetate was recalculated. Calibration date: 12-15-15

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found / True x 100 Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution
True = concentration of each analyte in the ICV or CCV source

Type of Analysis	Analyte	Standard ID	Conc. Found (units)	Area True (units)	Recalculated r or %R	Reported r or %R	Acceptable (Y/N)
Initial calibration	Acetate	Blank	–	–	r^2=0.9997	r^2=0.9997	Y
		Standard 1	0.1 (mg/L)	0.006469			
		Standard 2	0.5 (↓)	0.040822			
		Standard 3	1.0 ( )	0.085370			
		Standard 4	2.0 ( )	0.168510			
		Standard 5	3.0 (↓)	0.259761			
		Standard 6	–	–			
		Standard 7	–	–			
Calibration verification	Butyrate	CCV20	1.494 (mg/L)	1.5 (mg/L)	99.6	99.6	
Calibration verification	Pyruvate	CCV20	1.379 (mg/L)	1.5 (mg/L)	91.9	91.9	
Calibration verification	Lactate	CCV20	1.493 (mg/L)	1.5 (mg/L)	99.5	99.5	↓

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803A6

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: R

METHOD: Inorganics, Method see cover

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$ Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$ Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
1730 LCS	Laboratory control sample	Lactate	15.38 (mg/L)	15 (mg/L)	103	103	Y
1435 11	Matrix spike sample	Propionate	(SSR-SR) 8.97 (mg/L)	10 (mg/L)	90	90	↓
1435/2750 11/12	Duplicate sample	Butyrate	8.92 (mg/L)	9.25 (mg/L)	4	4	↓

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803A6

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: MG
2nd reviewer: R

METHOD: Inorganics, Method See cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments?
Y N N/A Are all detection limits below the CRQL?

Compound (analyte) results for level IV sample = N.D. ~~reported with a positive detect were recalculated and verified using the following equation~~:

Concentration = Recalculation:

#	Sample ID	Analyte	Reported Concentration ( )	Calculated Concentration ( )	Acceptable (Y/N)

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 8, 2016

Parameters: Methane, Ethane, & Ethene

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L149

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-001	15L149-01	Water	12/15/15
IR70-A15-001DL	15L149-01DL	Water	12/15/15
IR70-A15-002	15L149-02	Water	12/15/15
IR70-A15-002DL	15L149-02DL	Water	12/15/15
IR70-A15-005	15L149-03	Water	12/15/15
IR70-A15-005DL	15L149-03DL	Water	12/15/15
IR70-A15-091**	15L149-04**	Water	12/15/15
IR70-A15-091DL**	15L149-04DL**	Water	12/15/15
IR70-A15-010	15L149-05	Water	12/15/15
IR70-A15-010DL	15L149-05DL	Water	12/15/15
IR70-A15-015	15L149-06	Water	12/15/15
IR70-A15-015DL	15L149-06DL	Water	12/15/15
IR70-A15-016	15L149-07	Water	12/15/15
IR70-A15-016DL	15L149-07DL	Water	12/15/15
IR70-A15-018	15L149-08	Water	12/15/15
IR70-A15-018DL1	15L149-08DL1	Water	12/15/15
IR70-A15-023	15L149-09	Water	12/15/15
IR70-A15-023DL	15L149-09DL	Water	12/15/15
IR70-A15-008	15L149-10	Water	12/15/15
IR70-A15-008DL	15L149-10DL	Water	12/15/15
IR70-A15-101	15L149-11	Water	12/15/15
IR70-A15-018DL2	15L149-08DL2	Water	12/15/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Methane, Ethane, and Ethene by Method RSK-175

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Retention time windows were established as required by the method for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

Retention times of all compounds in the calibration standards were within the established retention time windows for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

Sample IR70-A15-101 was identified as a trip blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-101	12/15/15	Methane	0.70 ug/L	IR70-A15-001 IR70-A15-001DL IR70-A15-002 IR70-A15-002DL IR70-A15-005 IR70-A15-005DL IR70-A15-091** IR70-A15-091DL** IR70-A15-010 IR70-A15-010DL IR70-A15-015 IR70-A15-015DL IR70-A15-016 IR70-A15-016DL IR70-A15-018 IR70-A15-018DL IR70-A15-023 IR70-A15-023DL IR70-A15-008 IR70-A15-008DL IR70-A15-018DL2

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated field blanks.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Field Duplicates

Samples IR70-A15-005 and IR70-A15-091** and samples IR70-A15-005DL and IR70-A15-091DL** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	IR70-A15-005	IR70-A15-091**	
Ethene	28	28	0
Methane	210	220	5

Compound	Concentration (ug/L)		RPD
	IR70-A15-005DL	IR70-A15-091DL**	
Methane	2000	1800	11

IX. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
IR70-A15-001 IR70-A15-002 IR70-A15-005 IR70-A15-091** IR70-A15-010 IR70-A15-015 IR70-A15-016 IR70-A15-018DL1 IR70-A15-023 IR70-A15-008	Methane	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A
IR70-A15-018	Ethene Methane	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects)	A

Raw data were not reviewed for Level III validation.

X. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Compound	Flag	A or P
IR70-A15-001 IR70-A15-002 IR70-A15-005 IR70-A15-091** IR70-A15-010 IR70-A15-015 IR70-A15-016 IR70-A15-023 IR70-A15-008	Methane	R	A

Sample	Compound	Flag	A or P
IR70-A15-001DL IR70-A15-002DL IR70-A15-005DL IR70-A15-091DL** IR70-A15-010DL IR70-A15-015DL IR70-A15-016DL IR70-A15-023DL IR70-A15-008DL IR70-A15-018DL2	All TCL compounds except Methane	R	A
IR70-A15-018	Ethene Methane	R R	A
IR70-A15-018DL1	All TCL compounds except Ethene	R	A

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Data Qualification Summary - SDG 15L149

Sample	Compound	Flag	A or P	Reason
IR70-A15-001 IR70-A15-002 IR70-A15-005 IR70-A15-091** IR70-A15-010 IR70-A15-015 IR70-A15-016 IR70-A15-023 IR70-A15-008	Methane	R		Overall assessment of data
IR70-A15-001DL IR70-A15-002DL IR70-A15-005DL IR70-A15-091DL** IR70-A15-010DL IR70-A15-015DL IR70-A15-016DL IR70-A15-023DL IR70-A15-008DL IR70-A15-018DL2	All TCL compounds except Methane	R		Overall assessment of data
IR70-A15-018	Ethene Methane	R R		Overall assessment of data
IR70-A15-018DL1	All TCL compounds except Ethene	R		Overall assessment of data

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Laboratory Blank Data Qualification Summary - SDG 15L149

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Field Blank Data Qualification Summary - SDG 15L149

No Sample Data Qualified in this SDG

LDC #: 35803A51 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/03/16

SDG #: 15L149 Level III/IV Page: 1 of 2

Laboratory: EMAX Laboratories, Inc. Reviewer: JVG

2nd Reviewer: TL

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	ICAL ≤ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	SW	TB = 21
VI.	Surrogate spikes	N	Not reqd.
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LCS D
IX.	Field duplicates	SW	D = 5/7, 6/8
X.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation.
XI.	Target compound identification	A	Not reviewed for Level III validation.
XII.	System performance	A	Not reviewed for Level III validation.
XIII.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER: ER = Equipment Rinse

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-001	15L149-01	Water	12/15/15
2	IR70-A15-001DL	15L149-01DL	Water	12/15/15
3	IR70-A15-002	15L149-02	Water	12/15/15
4	IR70-A15-002DL	15L149-02DL	Water	12/15/15
5	IR70-A15-005 D1	15L149-03	Water	12/15/15
6	IR70-A15-005DL D2	15L149-03DL	Water	12/15/15
7	IR70-A15-091** D1	15L149-04**	Water	12/15/15
8	IR70-A15-091DL** D2	15L149-04DL**	Water	12/15/15
9	IR70-A15-010	15L149-05	Water	12/15/15
10	IR70-A15-010DL	15L149-05DL	Water	12/15/15
11	IR70-A15-015	15L149-06	Water	12/15/15
12	IR70-A15-015DL	15L149-06DL	Water	12/15/15
13	IR70-A15-016	15L149-07	Water	12/15/15
14	IR70-A15-016DL	15L149-07DL	Water	12/15/15
15	IR70-A15-018	15L149-08	Water	12/15/15
16	IR70-A15-018DL	15L149-08DL	Water	12/15/15

LDC #: 35803A51 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/03/16

SDG #: 15L149 Level III/IV Page: 2 of 2

Laboratory: EMAX Laboratories, Inc. Reviewer:

2nd Reviewer:

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

	Client ID	Lab ID	Matrix	Date
17	IR70-A15-023	15L149-09	Water	12/15/15
18	IR70-A15-023DL	15L149-09DL	Water	12/15/15
19	IR70-A15-008	15L149-10	Water	12/15/15
20	IR70-A15-008DL	15L149-10DL	Water	12/15/15
21	IR70-A15-101	15L149-11	Water	12/15/15
22	15DL2	↓ -08DL2	↓	↓
23				
24				
25				

Notes:

1	MBLK1W						
2	2W						
3	3W						

LDC #: 35803 A51

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: JC

Method: ✓ GC _____ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥0.990?		✓		
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. Field Blanks				
Were field blanks identified in this SDG?	✓			
Were target compounds detected in the field blanks?	✓			
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?			✓	
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

LDC #: 75803A51

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: TC

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 35803 A51

VALIDATION FINDINGS WORKSHEET
Field Blanks

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: ✓ **GC** __ **HPLC**

Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?

Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 12/15/15
Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank
Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other:

Associated Samples: All except 21 (>5X)

Compound	Blank ID	Blank ID	Sample Identification							
	21									
Methane	0.70									
CRQL										

Blank units: _____ **Associated sample units:** _____
Sampling date: _____
Field blank type: (circle one) Field Blank / Trip Blank/ Atmospheric Blank/ Ambient Blank
Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other:

Associated Samples:

Compound	Blank ID	Blank ID	Sample Identification							
CRQL										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with compound concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC#: 35803A51

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC MEE (Method RSK-175)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD
	5	7	
Ethene	28	28	0
Methane	210	220	5

Compound	Concentration (ug/L)		RPD
	6	8	
Methane	2000	1800	11

V:\Josephine\FIELD DUPLICATES\35803A51 ecc seal beach.wpd

LDC #: 35803 A51

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer: R

METHOD: ✓ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Level IV/D Only
Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	> cal range	1, 3, 5, 7, 9, 11, 13, 16, 17, 19	J dets A
	Ethene, Methane		15	

Comments: See sample calculation verification worksheet for recalculations

LDC #: 35803 A51

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: ___ GC ___ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

Y N N/A Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	> cal range	1, 3, 5, 7, 9, 11, 13, 17, 19	R
	All except Methane	dil	2, 4, 6, 8, 10, 12, 14, 18, 20, 22	
	Ethene, Methane	> cal range	15	
	All except Ethene	either dil or > cal range	16	✓

Comments:

OVRNew1.wpd

LDC #: 35803A51

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: RL

METHOD: GC ✓ HPLC _____

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C
average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where:
A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported CF (13.56 std)	Recalculated CF (13.56 std)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL GCT010	6/19/2015	Methane	31479.0	31479.4	34528.0	34528.0	13.9	13.9

LDC # 35803A51

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC ✓ HPLC ____

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	FL16002A	12/16/2015	Methane	13.56	13.54	13.54	0	0.1
2	FL18014A	12/18/2015	Methane	13.56	12.80	12.80	6	5.6

LDC #: 35803 A51

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG

2nd Reviewer: 8

METHOD: ✓ GC __HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration
LCS = Laboratory Control Sample
SA = Spike added
LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: LCS/D 2W

Compound		Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
		LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline	(8015)										
Diesel	(8015)										
Benzene	(8021B)										
Methane	(RSK-175)	13.6	13.6	13.7	13.4	101	101	99	99	2	2
2,4-D	(8151)										
Dinoseb	(8151)										
Naphthalene	(8310)										
Anthracene	(8310)										
HMX	(8330)										
2,4,6-Trinitrotoluene	(8330)										
Phorate	(8141A)										
Malathion	(8141A)										
Formaldehyde	(8315A)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803 A5

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: ___ GC ___ HPLC

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

Concentration= (A)(Fv)(Df) / (RF)(Vs or Ws)(%S/100)

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. 8 Compound Name Methane

Concentration = (638281)(100) / (34588.1) = 1848.58

≈ 1800 ug/L

#	Sample ID	Compound	Reported Concentrations (ug/L)	Recalculated Results Concentrations ( )	Qualifications
	8	Methane	1800		

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 8, 2016

Parameters: Volatiles

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L154

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-102	15L154-01	Water	12/16/15
IR70-A15-037	15L154-02	Water	12/16/15
IR70-A15-040	15L154-03	Water	12/16/15
IR70-A15-041	15L154-04	Water	12/16/15
IR70-A15-041DL	15L154-04DL	Water	12/16/15
IR70-A15-042	15L154-05	Water	12/16/15
IR70-A15-042DL	15L154-05DL	Water	12/16/15
IR70-A15-044	15L154-06	Water	12/16/15
IR70-A15-096**	15L154-07**	Water	12/16/15
IR70-A15-006	15L154-08	Water	12/16/15
IR70-A15-007	15L154-09	Water	12/16/15
IR70-A15-036	15L154-10	Water	12/16/15
IR70-A15-036DL	15L154-10DL	Water	12/16/15
IR70-A15-035	15L154-11	Water	12/16/15
IR70-A15-039	15L154-12	Water	12/16/15
IR70-A15-039DL	15L154-12DL	Water	12/16/15
IR70-A15-050	15L154-13	Water	12/16/15
IR70-A15-050DL	15L154-13DL	Water	12/16/15
IR70-A15-049	15L154-14	Water	12/16/15
IR70-A15-045	15L154-15	Water	12/16/15
IR70-A15-109	15L154-16	Water	12/16/15
IR70-A15-036MS	15L154-10MS	Water	12/16/15
IR70-A15-036MSD	15L154-10MSD	Water	12/16/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Volatile Organic Compounds (VOCs) by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A bromofluorobenzene (BFB) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

Percent relative standard deviations (%RSD) were less than or equal to 15.0% for each individual compound and less than or equal to 30.0% for calibration check compounds (CCCs).

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Sample IR70-A15-102 was identified as a trip blank. No contaminants were found.

Sample IR70-A15-109 was identified as an equipment rinsate. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-109	12/16/15	Carbon disulfide	0.21 ug/L	IR70-A15-037 IR70-A15-040 IR70-A15-041 IR70-A15-041DL IR70-A15-042 IR70-A15-042DL IR70-A15-044 IR70-A15-096** IR70-A15-006 IR70-A15-007 IR70-A15-036 IR70-A15-036DL IR70-A15-035 IR70-A15-039 IR70-A15-039DL IR70-A15-050 IR70-A15-050DL IR70-A15-049 IR70-A15-045

Sample IR70-A15-108 (from SDG 15L198) was identified as a source blank. No contaminants were found.

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X for common contaminants, >5X for other contaminants) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
IR70-A15-040	Carbon disulfide	0.24 ug/L	0.24U ug/L
IR70-A15-035	Carbon disulfide	0.63 ug/L	0.63U ug/L

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples IR70-A15-040 and IR70-A15-096** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	IR70-A15-040	IR70-A15-096**	
1,1-Dichloroethene	0.24	0.26	8
Carbon disulfide	0.24	1.0U	Not calculable
cis-1,2-Dichloroethene	40	41	2
trans-1,2-Dichloroethene	0.82	0.88	7
Trichloroethene	2.6	2.7	4
Vinyl chloride	0.26	0.30	14

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
IR70-A15-041 IR70-A15-036	Vinyl chloride	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A
IR70-A15-042 IR70-A15-050	cis-1,2-Dichloroethene Vinyl chloride	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects)	A
IR70-A15-039	cis-1,2-Dichloroethene	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A

Raw data were not reviewed for Level III validation.

XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Compound	Flag	A or P
IR70-A15-041 IR70-A15-036	Vinyl chloride	R	A
IR70-A15-041DL IR70-A15-036DL	All TCL compounds except Vinyl chloride	R	A
IR70-A15-042 IR70-A15-050	cis-1,2-Dichloroethene Vinyl chloride	R R	A
IR70-A15-042DL IR70-A15-050DL	All TCL compounds except cis-1,2-Dichloroethene Vinyl chloride	R	A
IR70-A15-039	cis-1,2-Dichloroethene	R	A
IR70-A15-039DL	All TCL compounds except cis-1,2-Dichloroethene	R	A

Due to equipment rinsate contamination, data were qualified as not detected in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Volatiles - Data Qualification Summary - SDG 15L154

Sample	Compound	Flag	A or P	Reason
IR70-A15-041 IR70-A15-036	Vinyl chloride	R	A	Overall assessment of data
IR70-A15-041DL IR70-A15-036DL	All TCL compounds except Vinyl chloride	R	A	Overall assessment of data
IR70-A15-042 IR70-A15-050	cis-1,2-Dichloroethene Vinyl chloride	R R	A	Overall assessment of data
IR70-A15-042DL IR70-A15-050DL	All TCL compounds except cis-1,2-Dichloroethene Vinyl chloride	R	A	Overall assessment of data
IR70-A15-039	cis-1,2-Dichloroethene	R	A	Overall assessment of data
IR70-A15-039DL	All TCL compounds except cis-1,2-Dichloroethene	R	A	Overall assessment of data

Seal Beach, IR Site 70
Volatiles - Laboratory Blank Data Qualification Summary - SDG 15L154

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Volatiles - Field Blank Data Qualification Summary - SDG 15L154

Sample	Compound	Modified Final Concentration	A or P
IR70-A15-040	Carbon disulfide	0.24U ug/L	A
IR70-A15-035	Carbon disulfide	0.63U ug/L	A

LDC #: 35803B1

SDG #: 15L154

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 02/03/16

Page: 1 of 2

Reviewer: JVG

2nd Reviewer: [illegible]

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 15/30% ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	SW	TB* = 1 ER = 21 SB* = IR70-A15-108 (from 15L198)
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	
X.	Field duplicates	SW	D = 3/9
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation.
XIII.	Target compound identification	A	Not reviewed for Level III validation.
XIV.	System performance	A	Not reviewed for Level III validation.
XV.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; * ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER: ER= Equipment Rinse

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-102	15L154-01	Water	12/16/15
2	IR70-A15-037	15L154-02	Water	12/16/15
3	IR70-A15-040 D	15L154-03	Water	12/16/15
4	IR70-A15-041	15L154-04	Water	12/16/15
5	IR70-A15-041DL	15L154-04DL	Water	12/16/15
6	IR70-A15-042	15L154-05	Water	12/16/15
7	IR70-A15-042DL	15L154-05DL	Water	12/16/15
8	IR70-A15-044	15L154-06	Water	12/16/15
9	IR70-A15-096** D	15L154-07**	Water	12/16/15
10	IR70-A15-006	15L154-08	Water	12/16/15
11	IR70-A15-007	15L154-09	Water	12/16/15
12	IR70-A15-036	15L154-10	Water	12/16/15
13	IR70-A15-036DL	15L154-10DL	Water	12/16/15

LDC #: 35803B1 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/03/16
SDG #: 15L154 Level III/IV Page: 2 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

	Client ID	Lab ID	Matrix	Date
14 2	IR70-A15-035	15L154-11	Water	12/16/15
15 3	IR70-A15-039	15L154-12	Water	12/16/15
16	IR70-A15-039DL	15L154-12DL	Water	12/16/15
17 2	IR70-A15-050	15L154-13	Water	12/16/15
18	IR70-A15-050DL	15L154-13DL	Water	12/16/15
19	IR70-A15-049	15L154-14	Water	12/16/15
20	IR70-A15-045	15L154-15	Water	12/16/15
21	IR70-A15-109	15L154-16	Water	12/16/15
22 2	IR70-A15-036MS	15L154-10MS	Water	12/16/15
23 2	IR70-A15-036MSD	15L154-10MSD	Water	12/16/15
24				
25				
26				
27				

Notes:

1	MBLK1W						
2	2W						
3	3W						

LDC #: 35803 B1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?		✓		
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) ≥ 0.05?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?	✓			
Were target compounds detected in the field blanks?	✓			
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	✓			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			✓	

LDC #: 35803 B1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	✓			
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

TARGET COMPOUND WORKSHEET

METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane
C. Vinyl choride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO.1,1-Difluoroethane	O1. 3-Methylpentane
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3- Trimethylbutane
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methyl cyclohexane	T1. 2-Methylhexane
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.

LDC #: 05803 h1

VALIDATION FINDINGS WORKSHEET
Field Blanks

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?

Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 12/16/15
Field blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: ER Associated Samples: All except 1, 21

Compound	Blank ID	Sample Identification								
	21	(5x)	3	14						
G	0.21	1.05	0.24/U	0.63/U						

Blank units: _____ **Associated sample units:** _____
Sampling date: _____
Field blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as Methylene chloride, Acetone, 2-Butanone and Carbon disulfide that were detected in samples within ten times the associated field blank concentration were qualified as not detected, "U". Other contaminants within five times the field blank concentration were also qualified as not detected, "U".

LDC#: 35803B1

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: A

METHOD: GCMS VOA (EPA SW 846 Method 8260B)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD
	3	9	
H	0.24	0.26	8
G	0.24	1.0U	NC
QQQ	40	41	2
PPP	0.82	0.88	7
S	2.6	2.7	4
C	0.26	0.30	14

V:\Josephine\FIELD DUPLICATES\35803B1 ecc seal beach.wpd

LDC #: 35803B1

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Date	Sample ID	Compound	Finding	Qualifications
		4, 12	C	> cal range	J dets /A
		6, 17	QQQ, C		
		15	QQQ	✓	

Comments: See sample calculation verification worksheet for recalculations

LDC #: 35803B1

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: SK

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.
Y N N/A Was the overall quality and usability of the data acceptable?

#	Date	Sample ID	Compound	Finding	Qualifications
		4, 12	C	> cal range	R /A
		5, 13	All except C	dil	
		6, 17	QQQ, C	> cal range	
		7, 18	All except above	dil	
		15	QQQ	> cal range	
		16	All except QQQ	dil	✓

Comments:

LDC #: 35803B1

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound,
S= Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 10 std)	Recalculated RRF (RRF 10 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL TO06	9/26/2015	cis-1,2-Dichloroethene (IS1)	0.348	0.348	0.322	0.322	6.68	6.71
			Chlorobenzene (IS2)	0.914	0.914	0.859	0.858	7.86	7.86
			1,1,2,2-TCA (IS3)	0.523	0.523	0.488	0.488	7.69	7.72

LDC # 35803B1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported % D	Recalculated %D
1	RLW442	12/17/15	cis-1,2-Dichloroethene (IS1)	0.322	0.327	0.327	1.6	1.6
			Chlorobenzene (IS2)	0.859	0.943	0.943	9.8	9.8
			1,1,2,2-TCA (IS3)	0.488	0.541	0.541	10.9	10.9

LDC #: 35802 B1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: R

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 9

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4	10.0	10.40	104	104	0
Toluene-d8		10.73	107	107	
Bromofluorobenzene		9.98	99.8	99	

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

LDC #: 35803 A1

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA

Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentration

RPD = I MSC - MSC I * 2/(MSC + MSDC)

MSC = Matrix spike concentration; MSDC = Matrix spike duplicate concentration

MS/MSD sample: 22/23

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	-----	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
1,1-Dichloroethene	10.0	10.0	0	8.78	8.46	88	88	85	85	4	4
Trichloroethene			1.51	12.7	12.0	106	106	104	104	2	2
Benzene			0	11.7	10.7	117	117	107	107	4	4
Toluene				10.1	10.7	101	101	107	107	0	0
Chlorobenzene				11.1	11.0	111	111	110	110	1	1

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803 B1

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: JVG
2nd Reviewer: SR

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboraotry control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS ID: LCS/D 1W

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
1,1-Dichloroethene	10.0	10.0	9.71	9.09	97	97	91	91	7	7
Trichloroethene			11.7	11.3	117	117	113	113	3	3
Benzene			11.7	11.4	117	117	114	114	3	3
Toluene			10.7	10.7	109	109	107	107	1	1
Chlorobenzene			11.4	11.4	114	114	114	114	0	0

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803 B1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
RRF	=	Relative response factor of the calibration standard.
V_o	=	Volume or weight of sample pruged in milliliters (ml) or grams (g).
Df	=	Dilution factor.
%S	=	Percent solids, applicable to soils and solid matrices only.

Example:

Sample I.D. 9, QQQ

Conc. = (2320863)(10)( )
(1748825)(0.322)( )( )

= 41.21

≈ 41 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
	9	QQQ	41		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 19, 2016

Parameters: Dissolved Metals

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L154

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-040	15L154-03	Water	12/16/15
IR70-A15-041	15L154-04	Water	12/16/15
IR70-A15-042	15L154-05	Water	12/16/15
IR70-A15-096**	15L154-07**	Water	12/16/15
IR70-A15-036	15L154-10	Water	12/16/15
IR70-A15-035	15L154-11	Water	12/16/15
IR70-A15-050	15L154-13	Water	12/16/15
IR70-A15-049	15L154-14	Water	12/16/15
IR70-A15-045	15L154-15	Water	12/16/15
IR70-A15-109	15L154-16	Water	12/16/15
IR70-A15-036MS	15L154-10MS	Water	12/16/15
IR70-A15-036MSD	15L154-10MSD	Water	12/16/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Arsenic, Iron, and Manganese by Environmental Protection Agency (EPA) SW 846 Method 6010B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

Sample IR70-A15-109 was identified as an equipment rinsate. No contaminants were found.

Sample IR70-A15-108 (from SDG 15L198) was identified as a source blank. No contaminants were found.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Serial Dilution

Serial dilution analysis was performed on an associated project sample. The analysis criteria were met.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples IR70-A15-040 and IR70-A15-096** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD
	IR70-A15-040	IR70-A15-096**	
Iron	0.0520	0.0475	9
Manganese	0.0268	0.0272	1

XI. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Dissolved Metals - Data Qualification Summary - SDG 15L154

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Dissolved Metals - Laboratory Blank Data Qualification Summary - SDG 15L154

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Dissolved Metals - Field Blank Data Qualification Summary - SDG 15L154

No Sample Data Qualified in this SDG

LDC #: 35803B4 b

SDG #: 15L154

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 2-5-16

Page: 1 of 1

Reviewer: MG

2nd Reviewer: [illegible]

METHOD: Metals (EPA SW 846 Method 6010B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
~~II.~~	~~ICP/MS Tune~~		
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	ND	ER = 10 SB = IR70-A15-108 (15L198)
VII.	Matrix Spike/Matrix Spike Duplicates	A	MS/MSD
VIII.	Duplicate sample analysis	N	
IX.	ICP Serial Dilution	A	
X.	Laboratory control samples	A	LCS/LCSD
XI.	Field Duplicates	SW	D = 1+4
~~XII.~~	~~Internal Standard (ICP-MS)~~		
XIII.	Sample Result Verification	A	Not reviewed for Level III validation.
XIV.	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-040	15L154-03	Water	12/16/15
2	IR70-A15-041	15L154-04	Water	12/16/15
3	IR70-A15-042	15L154-05	Water	12/16/15
4	IR70-A15-096**	15L154-07**	Water	12/16/15
5	IR70-A15-036	15L154-10	Water	12/16/15
6	IR70-A15-035	15L154-11	Water	12/16/15
7	IR70-A15-050	15L154-13	Water	12/16/15
8	IR70-A15-049	15L154-14	Water	12/16/15
9	IR70-A15-045	15L154-15	Water	12/16/15
10	IR70-A15-109	15L154-16	Water	12/16/15
11	IR70-A15-036MS	15L154-10MS	Water	12/16/15
12	IR70-A15-036MSD	15L154-10MSD	Water	12/16/15
13				
14				
15	PBW			

LDC #: 35803B46

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: RL

Method: Metals (EPA SW 846 Method 6010/7000/6020)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. ICP/MS Tune				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?			✓	
Were %RSD of isotopes in the tuning solution ≤5%?			✓	
III. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury) QC limits?	✓			
Were all initial calibration correlation coefficients > 0.995?	✓			
IV. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	✓			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	✓			
VI. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were < 5X the RL.	✓			
VII. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% QC limits for water samples and laboratory established QC limits for soils?	✓			

LDC #: 35803B46

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)				
Were all the percent recoveries (%R) within the 30-120% (6020)/60-125% (200.8) of the intensity of the internal standard in the associated initial calibration?			✓	
If the %Rs were outside the criteria, was a reanalysis performed?			✓	
IX. ICP Serial Dilution				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the MDL (ICP)/>100X the MDL(ICP/MS)?	✓			
Were all percent differences (%Ds) < 10%?	✓			
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.		✓		
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XII. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
XIII. Field blanks				
Field blanks were identified in this SDG.	✓			
Target analytes were detected in the field blanks.		✓		

LDC #: 35803B46

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Reviewer: MG
2nd reviewer: M

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1→10	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
OC 11, 12	↓	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
Analysis Method		
ICP	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
ICP-MS		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
GFAA		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____

Comments: Mercury by CVAA if performed

LDC#: 35803B4b

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: MG
2nd Reviewer: NL

METHOD: Metals (EPA Method 6010B/7000)

Analyte	Concentration (mg/L)		RPD	
	1	4		
Iron	0.0520	0.0475	9	
Manganese	0.0268	0.0272	1	

V:\FIELD DUPLICATES\FD_inorganic\35803B4b.WPD

LDC #: 35803B46

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: MG
2nd Reviewer: R

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

An initial and continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

$$\%R = \frac{Found}{True} \times 100$$

Where, Found = concentration (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution
True = concentration (in ug/L) of each analyte in the ICV or CCV source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalculated %R	Reported %R	Acceptable (Y/N)
1513 ICV	ICP (Initial calibration)	Fe	23794	25000	95	95	Y
	ICP/MS (Initial calibration)						↓
	CVAA (Initial calibration)						↓
1820 CCV7	ICP (Continuing calibration)	Mn	2433.3	2500	97	97	↓
	ICP/MS (Continuing calibration)						
	CVAA (Continuing calibration)						
	GFAA (Initial calibration)						
	GFAA (Continuing calibation)						

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803 B46

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Page: 1 of 1
Reviewer: MG
2nd Reviewer: [illegible]

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Percent recoveries (%R) for an ICP interference check sample, a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$

Where, Found = Concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = Concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$

Where, S = Original sample concentration
D = Duplicate sample concentration

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

$\%D = \frac{|I-SDR|}{I} \times 100$

Where, I = Initial Sample Result (mg/L)
SDR = Serial Dilution Result (mg/L) (Instrument Reading x 5)

Sample ID	Type of Analysis	Element	Found / S / I (units)	True / D / SDR (units)	Recalculated %R / RPD / %D	Reported %R / RPD / %D	Acceptable (Y/N)
1529 ICSAB	ICP interference check	Mn	0.470 (mg/L)	0.5 (mg/L)	94	94	Y
1634 LCS	Laboratory control sample	As	0.524 (mg/L)	0.5 (mg/L)	105	105	↓
1650 11	Matrix spike	Fe	(SSR-SR) 4.918 (mg/L)	5 (mg/L)	98	98	↓
1650 / 1653 11 / 12	Duplicate	As	0.555 (mg/L)	0.550 (mg/L)	1	1	↓
1643 / 1647 5	ICP serial dilution	Mn	0.652 (mg/L)	0.670 (mg/L)	3	NA	↓

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

TOTCLC.4SW

LDC #: 35803B46

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: MG
2nd reviewer: M

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments and within the linear range of the ICP?
Y N N/A Are all detection limits below the CRDL?

Detected analyte results for #4, Fe were recalculated and verified using the following equation:

Concentration = (RD)(FV)(Dil) / (In. Vol.)

RD = Raw data concentration
FV = Final volume (ml)
In. Vol. = Initial volume (ml) or weight (G)
Dil = Dilution factor

Recalculation:

$$\frac{(0.04752\ mg/L)(0.050\ L)}{0.050\ L} = 0.04752\ mg/L$$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
1	4	Fe	0.0475	0.0475	Y

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 9, 2016

Parameters: Wet Chemistry

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L154

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-037	15L154-02	Water	12/16/15
IR70-A15-040	15L154-03	Water	12/16/15
IR70-A15-041	15L154-04	Water	12/16/15
IR70-A15-042	15L154-05	Water	12/16/15
IR70-A15-044	15L154-06	Water	12/16/15
IR70-A15-096**	15L154-07**	Water	12/16/15
IR70-A15-006	15L154-08	Water	12/16/15
IR70-A15-007	15L154-09	Water	12/16/15
IR70-A15-036	15L154-10	Water	12/16/15
IR70-A15-035	15L154-11	Water	12/16/15
IR70-A15-039	15L154-12	Water	12/16/15
IR70-A15-050	15L154-13	Water	12/16/15
IR70-A15-049	15L154-14	Water	12/16/15
IR70-A15-045	15L154-15	Water	12/16/15
IR70-A15-036MS	15L154-10MS	Water	12/16/15
IR70-A15-036MSD	15L154-10MSD	Water	12/16/15
IR70-A15-036DUP	15L154-10DUP	Water	12/16/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Alkalinity by Standard Method 2320B
Bromide, Chloride, Nitrate as Nitrogen, Nitrite as Nitrogen, and Sulfate by Environmental Protection Agency (EPA) Method 300.0
Organic Acids by EPA Method 300.0 Modified
Sulfide by Standard Method 4500-S2 F
Total Dissolved Solids by Standard Method 2540C
Total Organic Carbon by Standard Method 5310B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Analyte	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
LCS/LCSD (IR70-A15-040 IR70-A15-041 IR70-A15-042 IR70-A15-096**)	Nitrite as N	202 (90-110)	203 (90-110)	NA	-

LCS ID (Associated Samples)	Analyte	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
LCS/LCSD (IR70-A15-036 IR70-A15-035 IR70-A15-050 IR70-A15-049 IR70-A15-045)	Nitrite as N	203 (90-110)	203 (90-110)	NA	-

Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

Samples IR70-A15-040 and IR70-A15-096** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD
	IR70-A15-040	IR70-A15-096**	
Alkalinity	152	152	0
Bromide	0.287	0.288	0
Chloride	83.4	77.5	7
Nitrate as N	0.101	0.103	2
Sulfate	62.5	52.2	18
Total dissolved solids	355	350	1
Total organic carbon	1.78	0.500U	Not calculable

X. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Wet Chemistry - Data Qualification Summary - SDG 15L154

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 15L154

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Wet Chemistry - Field Blank Data Qualification Summary - SDG 15L154

No Sample Data Qualified in this SDG

LDC #: 35803B6

SDG #: 15L154

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 2-5-16

Page: 1 of 2

Reviewer: MG

2nd Reviewer: [illegible]

METHOD: (Analyte) Alkalinity (SM2320B), Bromide, Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA Method 300.0), Organic Acids (EPA Method 300.0M), ~~Sulfate~~ Sulfide (SM4500-S2 F), TDS (SM2540C), TOC (SM5310B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	MS/MSD
VII.	Duplicate sample analysis	A	DUP
VIII.	Laboratory control samples	SW	LCS/LCSD
IX.	Field duplicates	SW	D = 2+6
X.	Sample result verification	A	Not reviewed for Level III validation.
XI.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-037	15L154-02	Water	12/16/15
2	IR70-A15-040	15L154-03	Water	12/16/15
3	IR70-A15-041	15L154-04	Water	12/16/15
4	IR70-A15-042	15L154-05	Water	12/16/15
5	IR70-A15-044	15L154-06	Water	12/16/15
6	IR70-A15-096**	15L154-07**	Water	12/16/15
7	IR70-A15-006	15L154-08	Water	12/16/15
8	IR70-A15-007	15L154-09	Water	12/16/15
9	IR70-A15-036	15L154-10	Water	12/16/15
10	IR70-A15-035	15L154-11	Water	12/16/15
11	IR70-A15-039	15L154-12	Water	12/16/15
12	IR70-A15-050	15L154-13	Water	12/16/15
13	IR70-A15-049	15L154-14	Water	12/16/15
14	IR70-A15-045	15L154-15	Water	12/16/15
15	IR70-A15-036MS	15L154-10MS	Water	12/16/15
16	IR70-A15-036MSD	15L154-10MSD	Water	12/16/15

LDC #: 35803B6

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 2-5-16

SDG #: 15L154

Page: 2 of 2

Laboratory: EMAX Laboratories, Inc.

Reviewer: MG

2nd Reviewer: [illegible]

METHOD: (Analyte) Alkalinity (SM2320B), Bromide, Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA Method 300.0), Organic Acids (EPA Method 300.0M), Sulfate (SM4500-S2 F), TDS (SM2540C), TOC (SM5310B)

	Client ID	Lab ID	Matrix	Date
17	IR70-A15-036DUP	15L154-10DUP	Water	12/16/15
18	PBW 1			
19	PBW 2			
20	PBW 3			
21	PBW 4			

Notes:

LDC #: 35803B6

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: ML

Method: Inorganics (EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	✓			
Were titrant checks performed as required? (Level IV only)	✓			
Were balance checks performed as required? (Level IV only)	✓			
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
IV. Matrix spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL(≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.	✓			
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?		✓		
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

LDC #: 35803B6

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: DL

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were detection limits < RL?	✓			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
X. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 35803B6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: MG
2nd reviewer: R

All circled methods are applicable to each sample.

Sample ID	Matrix	Parameter
1,5,7, 8,11	W	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Org Acid
2→4,6,9, 10,12→14	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Br Org Acid $S^=$
QC 15		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Br Org Acid
16		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Br Org Acid
↓ 17	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Br $S^=$
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4

Comments:

LDC #: 35803B6

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: MG
2nd Reviewer: JC

METHOD: Trace Metals (EPA SW 846 Method 6010B/6020/7000)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A — Was a laboratory control sample (LCS) analyzed for each matrix in this SDG?

Y (N) N/A — Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?

LEVEL IV ONLY:

(Y) N N/A — Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Date	LCS/LCSD ID	Matrix	Analyte	LCS %R (limits)	LCSD %R (limits)	RPD (limits)	Associated Samples	Qualifications
1		LCS/LCSD	Water	NO_2-N	202 (90-110)	203 (90-110)		2,3,4,6	J dets/P (all ND)
			↓		↓	↓			↓
2		LCS/LCSD		NO_2-N	203 (↓)	203 (↓)		9,10,12→14	(↓)

Comments:

LCSD.wpd

LDC#: 35803B6

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: MG
2nd Reviewer: AL

Inorganics, Method See Cover

Analyte	Concentration (mg/L)		RPD	
	2	6		
Alkalinity	152	152	0	
Bromide	0.287	0.288	0	
Chloride	83.4	77.5	7	
Nitrate as N	0.101	0.103	2	
Sulfate	62.5	52.2	18	
TDS	355	350	1	
Total organic Carbon	1.78	0.500U	NC	

V:\FIELD DUPLICATES\FD_inorganic\35803B6.WPD

LDC #: 35803B6

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: MG
2nd Reviewer: R

METHOD: Inorganics, Method see cover

The correlation coefficient (r) for the calibration of TOC was recalculated. Calibration date: 12-21-15

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found / True x 100 Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution
True = concentration of each analyte in the ICV or CCV source

Type of Analysis	Analyte	Standard ID	Conc. Found (units)	Area True (units)	Recalculated r or %R	Reported r or %R	Acceptable (Y/N)
Initial calibration	TOC	Blank	0 (mg/L)	0.2873	r^2=0.999968	r^2=0.999969	Y
		Standard 1	1 ( )	2.070			
		Standard 2	5 ( )	10.45			
		Standard 3	10 ( )	20.42			
		Standard 4	40 ( )	83.46			
		Standard 5	80 ( )	168.3			
		Standard 6	-	-			
		Standard 7	-	-			
Calibration verification	Acetate	CCV26	1.558 (mg/L)	1.5 (mg/L)	104	104	
Calibration verification	Cl	CCV3	2.006 (mg/L)	2.0 (mg/L)	100.3	100.3	
Calibration verification	NO_3-N	CCV19	0.994 (mg/L)	1.0 (mg/L)	99.4	99.4	

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803B6

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: SR

METHOD: Inorganics, Method See cover

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$ Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$ Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
LCS	Laboratory control sample	TDS	955 (mg/L)	1000 (mg/L)	96	96	Y
1529 15	Matrix spike sample	Lactate	(SSR-SR) 9.50 (mg/L)	10 (mg/L)	95	95	↓
2300/2315 17	Duplicate sample	Cl	1608 (mg/L)	1590 (mg/L)	1	1	↓

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

TOTCLC.6

LDC #: 35803B6

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: MG
2nd reviewer: R

METHOD: Inorganics, Method see cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments?
Y N N/A Are all detection limits below the CRQL?

Compound (analyte) results for #6, Br reported with a positive detect were recalculated and verified using the following equation:

Concentration = $y = mx + b$
where
$m = 0.152959$
$b = 0.0701056$
dil = 1x

Recalculation:

$Br = 0.152959 (1.424) + 0.0701056$

$= 0.288$ mg/L

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
1	6	Br	0.288	0.288	Y
		TDS	350	350	↓
		Alk	152	152	↓

Note: methods 300.0(M), SM4500-S2F and SM5310B are ND for the level IV sample

RECALC.6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 18, 2016

Parameters: Methane, Ethane, & Ethene

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L154

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-102	15L154-01	Water	12/16/15
IR70-A15-037	15L154-02	Water	12/16/15
IR70-A15-037DL	15L154-02DL	Water	12/16/15
IR70-A15-040	15L154-03	Water	12/16/15
IR70-A15-041	15L154-04	Water	12/16/15
IR70-A15-041DL1	15L154-04DL1	Water	12/16/15
IR70-A15-042	15L154-05	Water	12/16/15
IR70-A15-042DL	15L154-05DL	Water	12/16/15
IR70-A15-044	15L154-06	Water	12/16/15
IR70-A15-044DL	15L154-06DL	Water	12/16/15
IR70-A15-096**	15L154-07**	Water	12/16/15
IR70-A15-006	15L154-08	Water	12/16/15
IR70-A15-006DL	15L154-08DL	Water	12/16/15
IR70-A15-007	15L154-09	Water	12/16/15
IR70-A15-007DL	15L154-09DL	Water	12/16/15
IR70-A15-036	15L154-10	Water	12/16/15
IR70-A15-036DL1	15L154-10DL1	Water	12/16/15
IR70-A15-036DL2	15L154-10DL2	Water	12/16/15
IR70-A15-035	15L154-11	Water	12/16/15
IR70-A15-035DL	15L154-11DL	Water	12/16/15
IR70-A15-039	15L154-12	Water	12/16/15
IR70-A15-039DL	15L154-12DL	Water	12/16/15
IR70-A15-050	15L154-13	Water	12/16/15
IR70-A15-050DL	15L154-13DL	Water	12/16/15
IR70-A15-049	15L154-14	Water	12/16/15
IR70-A15-049DL	15L154-14DL	Water	12/16/15
IR70-A15-045	15L154-15	Water	12/16/15

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-045DL	15L154-15DL	Water	12/16/15
IR70-A15-109	15L154-16	Water	12/16/15
IR70-A15-036MS	15L154-10MS	Water	12/16/15
IR70-A15-036MSD	15L154-10MSD	Water	12/16/15
IR70-A15-041DL2	15L154-04DL2	Water	12/16/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Methane, Ethane, and Ethene by Method RSK-175

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Retention time windows were established as required by the method for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

Retention times of all compounds in the calibration standards were within the established retention time windows for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

Sample IR70-A15-102 was identified as a trip blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-102	12/16/15	Methane	0.42 ug/L	IR70-A15-037 IR70-A15-037DL IR70-A15-040 IR70-A15-041 IR70-A15-041DL1 IR70-A15-042 IR70-A15-042DL IR70-A15-044 IR70-A15-044DL IR70-A15-096** IR70-A15-006 IR70-A15-006DL IR70-A15-007 IR70-A15-007DL IR70-A15-036 IR70-A15-036DL1 IR70-A15-036DL2 IR70-A15-035 IR70-A15-035DL IR70-A15-039 IR70-A15-039DL IR70-A15-050 IR70-A15-050DL IR70-A15-049 IR70-A15-049DL IR70-A15-045 IR70-A15-045DL IR70-A15-109 IR70-A15-041DL2

Sample IR70-A15-109 was identified as an equipment rinsate. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-109	12/16/15	Methane	0.67 ug/L	IR70-A15-037 IR70-A15-037DL IR70-A15-040 IR70-A15-041 IR70-A15-041DL1 IR70-A15-042 IR70-A15-042DL IR70-A15-044 IR70-A15-044DL IR70-A15-096** IR70-A15-006 IR70-A15-006DL IR70-A15-007 IR70-A15-007DL IR70-A15-036 IR70-A15-036DL1 IR70-A15-036DL2 IR70-A15-035 IR70-A15-035DL IR70-A15-039 IR70-A15-039DL IR70-A15-050 IR70-A15-050DL IR70-A15-049 IR70-A15-049DL IR70-A15-045 IR70-A15-045DL IR70-A15-041DL2

Sample IR70-A15-108 (from SDG 15L198) was identified as a source blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-108	12/22/15	Methane	0.50 ug/L	IR70-A15-109

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
IR70-A15-109	Methane	0.67 ug/L	0.67U ug/L

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were not within the QC limits for IR70-A15-036MS/MSD. No data were qualified since the parent sample results were greater than 4X the spiked concentration. Relative percent differences (RPD) were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Field Duplicates

Samples IR70-A15-040 and IR70-A15-096** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	IR70-A15-040	IR70-A15-096**	
Methane	11	13	17

IX. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
IR70-A15-037 IR70-A15-041DL1 IR70-A15-042 IR70-A15-044 IR70-A15-006 IR70-A15-007 IR70-A15-036DL1 IR70-A15-035 IR70-A15-039 IR70-A15-050 IR70-A15-049 IR70-A15-045	Methane	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A
IR70-A15-041 IR70-A15-036	Ethene Methane	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects)	A

Raw data were not reviewed for Level III validation.

X. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Compound	Flag	A or P
IR70-A15-037 IR70-A15-042 IR70-A15-044 IR70-A15-006 IR70-A15-007 IR70-A15-035 IR70-A15-039 IR70-A15-050 IR70-A15-049 IR70-A15-045	Methane	R	A
IR70-A15-037DL IR70-A15-042DL IR70-A15-044DL IR70-A15-006DL IR70-A15-007DL IR70-A15-036DL2 IR70-A15-035DL IR70-A15-039DL IR70-A15-050DL IR70-A15-049DL IR70-A15-045DL IR70-A15-041DL2	All TCL compounds except Methane	R	A
IR70-A15-041 IR70-A15-036	Ethene Methane	R R	A
IR70-A15-041DL1 IR70-A15-036DL1	All TCL compounds except Ethene	R	A

Due to trip blank and source blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Data Qualification Summary - SDG 15L154

Sample	Compound	Flag	A or P	Reason
IR70-A15-037 IR70-A15-042 IR70-A15-044 IR70-A15-006 IR70-A15-007 IR70-A15-035 IR70-A15-039 IR70-A15-050 IR70-A15-049 IR70-A15-045	Methane	R	A	Overall assessment of data
IR70-A15-037DL IR70-A15-042DL IR70-A15-044DL IR70-A15-006DL IR70-A15-007DL IR70-A15-036DL2 IR70-A15-035DL IR70-A15-039DL IR70-A15-050DL IR70-A15-049DL IR70-A15-045DL IR70-A15-041DL2	All TCL compounds except Methane	R	A	Overall assessment of data
IR70-A15-041 IR70-A15-036	Ethene Methane	R R	A	Overall assessment of data
IR70-A15-041DL1 IR70-A15-036DL1	All TCL compounds except Ethene	R	A	Overall assessment of data

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Laboratory Blank Data Qualification Summary - SDG 15L154

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Field Blank Data Qualification Summary - SDG 15L154

Sample	Compound	Modified Final Concentration	A or P
IR70-A15-109	Methane	0.67U ug/L	A

LDC #: 35803B51 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/09/16
SDG #: 15L154 Level III/IV Page: 1 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	ICAL ≤ 20 % ICV ≤ 20 %
III.	Continuing calibration	A	CCV ≤ 20 %
IV.	Laboratory Blanks	A	
V.	Field blanks	SW	TB = 1 ER = 29 SB = IR70-A15-108 (from 15L198)
VI.	Surrogate spikes	N	Not req'd.
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	A	LCS / D
IX.	Field duplicates	SW	D = 4 / 11
X.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation.
XI.	Target compound identification	A	Not reviewed for Level III validation.
XII.	System performance	A	Not reviewed for Level III validation.
XIII.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER: ER = Equipment Rinse

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-102	15L154-01	Water	12/16/15
2	IR70-A15-037	15L154-02	Water	12/16/15
3	IR70-A15-037DL	15L154-02DL	Water	12/16/15
4	IR70-A15-040 D	15L154-03	Water	12/16/15
5	IR70-A15-041	15L154-04	Water	12/16/15
6	IR70-A15-041DL	15L154-04DL	Water	12/16/15
7	IR70-A15-042	15L154-05	Water	12/16/15
8	IR70-A15-042DL	15L154-05DL	Water	12/16/15
9	IR70-A15-044	15L154-06	Water	12/16/15
10	IR70-A15-044DL	15L154-06DL	Water	12/16/15
11	IR70-A15-096** D	15L154-07**	Water	12/16/15
12	IR70-A15-006	15L154-08	Water	12/16/15
13	IR70-A15-006DL	15L154-08DL	Water	12/16/15
14	IR70-A15-007	15L154-09	Water	12/16/15
15	IR70-A15-007DL	15L154-09DL	Water	12/16/15
16	IR70-A15-036	15L154-10	Water	12/16/15

LDC #: 35803B51 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/03/16
SDG #: 15L154 Level III/IV Page: 2 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer: JVG
2nd Reviewer: A

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

	Client ID	Lab ID	Matrix	Date
17	IR70-A15-036DL1	15L154-10DL1	Water	12/16/15
18	IR70-A15-036DL2	15L154-10DL2	Water	12/16/15
19	IR70-A15-035	15L154-11	Water	12/16/15
20	IR70-A15-035DL	15L154-11DL	Water	12/16/15
21	IR70-A15-039	15L154-12	Water	12/16/15
22	IR70-A15-039DL	15L154-12DL	Water	12/16/15
23	IR70-A15-050	15L154-13	Water	12/16/15
24	IR70-A15-050DL	15L154-13DL	Water	12/16/15
25	IR70-A15-049	15L154-14	Water	12/16/15
26	IR70-A15-049DL	15L154-14DL	Water	12/16/15
27	IR70-A15-045	15L154-15	Water	12/16/15
28	IR70-A15-045DL	15L154-15DL	Water	12/16/15
29	IR70-A15-109	15L154-16	Water	12/16/15
30	IR70-A15-036MS	15L154-10MS	Water	12/16/15
31	IR70-A15-036MSD	15L154-10MSD	Water	12/16/15
32	5DL2	1-04DL2	↓	↓
33				
34				
35				

Notes:

1	MBLK1W						
✓	2W						

LDC #: 35803 B5/

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: AL

Method: ✓ GC ____ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥0.990?		✓		
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. Field Blanks				
Were field blanks identified in this SDG?	✓			
Were target compounds detected in the field blanks?		✓		
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?			✓	
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?				✓
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?		✓		

LDC #: 35809 D5/

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: A

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 35803B51

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: ✓ GC __ HPLC
Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?
Blank units: ug/L Associated sample units: ug/L
Sampling date: 12/16/15
Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank
Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: _____
Associated Samples: All except 1

Compound	Blank ID	Blank ID	Sample Identification							
	1		29							
Methane	0.42		0.67/U							
CRQL										

Blank units: ug/L Associated sample units: ug/L
Sampling date: 12/16/15
Field blank type: (circle one) Field Blank / Trip Blank/ Atmospheric Blank/ Ambient Blank
Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: ER
Associated Samples: All except 1, 29 (75x)

Compound	Blank ID	Blank ID	Sample Identification							
	29									
Methane	0.67									
CRQL										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with compound concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC #: 35803B51

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: ✓ **GC** __ **HPLC**

Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?

Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 12/22/15
Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank
Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other:_____

Associated Samples: 29

Compound	Blank ID	Blank ID	Sample Identification							
	IRTO-A15-108		29							
Methane	0.50		0.67/U							
CRQL										

Blank units:_____ **Associated sample units:**_____
Sampling date:_____
Field blank type: (circle one) Field Blank / Trip Blank/ Atmospheric Blank/ Ambient Blank
Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other:_____

Associated Samples:_____

Compound	Blank ID	Blank ID	Sample Identification							
CRQL										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with compound concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC #: 35803 D51

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: JVG
2nd Reviewer: SC

METHOD: ✓ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?

Y N N/A Was an MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

Y N N/A Were the MS/MSD percent recoveries (%R) and relative percent differences (RPD) within QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	30/31	Methane	-92108 (10-160)	-92459 (10-160)	( )	16, 17, 18	No qual (Parent conc > 4x SA)
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 35803 B51

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: JVG
2nd reviewer: SC

METHOD: ✓ **GC** __ **HPLC**

Y N N/A Were field duplicate pairs identified in this SDG?
Y N N/A Were target compounds detected in the field duplicate pairs?

Compound	Concentration (ug/L)		%RPD Limit (≤ ✓ %)	Qualification (Parent only)
	4	11		
Methane	11	13	17	

Compound	Concentration ( )		%RPD Limit (≤ %)	Qualification (Parent only)

Compound	Concentration ( )		%RPD Limit (≤ %)	Qualification (Parent only)

LDC #: 35803 D51

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer: SC

METHOD: ✓ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Level IV/D Only
Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	> cal range	2, 6, 7, 9, 12, 14, 17, 19, 21, 23, 25, 27	J dets / A
	Ethene, Methane		5, ~~16~~ 16	

Comments: See sample calculation verification worksheet for recalculations

LDC #: 35803 B51

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: SC

METHOD: ✓ **GC** __ **HPLC**

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

Y N N/A Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	> cal range	2, 7, 9, 12, 14, 19, 21, 23, 25, 27	R/A
	All except Methane	dil	3, 8, 10, 13, 15, 18, 20, 22, 24, 26, 28, 32	
	Ethene, Methane	> cal range	5, 16	
	All except Ethene	either dil or > cal range	6, 17	✓

Comments:

OVRNew1.wpd

LDC #: 35803B51

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: SK

METHOD: GC / HPLC _____

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C
average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where:
A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported CF (13.56 std)	Recalculated CF (13.56 std)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL GCT010	6/19/2015	Methane	31479.0	31479.4	34528.0	34528.0	13.9	13.9

LDC # 35803B51

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: R

METHOD: GC ✓ HPLC ____

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	FL21003A	12/21/2015	Methane	13.56	13.91	13.91	3	2.6
2	FL21027A	12/21/2015	Methane	13.56	13.24	13.24	2	2.4

LDC #: 05803B51

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: ✓ GC ___ HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC - SC)/SA

RPD =(({SSCMS - SSCMSD} * 2) / (SSCMS + SSCMSD))*100

Where SSC = Spiked sample concentration; SC = Sample concentration; SA = Spike added; MS = Matrix spike; MSD = Matrix spike duplicate

MS/MSD samples: 30/31

Compound		Spike Added (ug/L)		Sample Conc. (ug/L)	Spike Sample Concentration (ug/L)		Matrix spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
		MS	MSD	---	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline	(8015)											
Diesel	(8015)											
Benzene	(8021B)											
Methane	(RSK-175)	13.6	13.6	13200	655	610	-921.08	0	-924.34	0	>	>
2,4-D	(8151)											
Dinoseb	(8151)											
Naphthalene	(8310)											
Anthracene	(8310)											
HMX	(8330)											
2,4,6-Trinitrotoluene	(8330)											
Phorate	(8141A)											
Malathion	(8141A)											
Formaldehyde	(8315A)											

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: DS 803 D51

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG

2nd Reviewer: [illegible]

METHOD: ✓ GC __ HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration; LCS = Laboratory Control Sample; SA = Spike added; LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: LCS/D 1W

Compound	Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel (8015)										
Benzene (8021B)										
Methane (RSK-175)	13.6	13.6	14.7	14.2	108	108	104	104	4	4
2,4-D (8151)										
Dinoseb (8151)										
Naphthalene (8310)										
Anthracene (8310)										
HMX (8330)										
2,4,6-Trinitrotoluene (8330)										
Phorate (8141A)										
Malathion (8141A)										
Formaldehyde (8315A)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803B51

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: / **GC** __ **HPLC**

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

Concentration= (A)(Fv)(Df) / (RF)(Vs or Ws)(%S/100)

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. 11 Compound Name Methane

Concentration = (453843) / (34528.1) = 13.1 ug/L

#	Sample ID	Compound	Reported Concentrations (ug/L)	Recalculated Results Concentrations ( )	Qualifications
	11	Methane	13		

Comments:

SAMPCALCnew.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 8, 2016

Parameters: Volatiles

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L176

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-103	15L176-01	Water	12/17/15
IR70-A15-110	15L176-02	Water	12/17/15
IR70-A15-028	15L176-03	Water	12/17/15
IR70-A15-094**	15L176-04**	Water	12/17/15
IR70-A15-031	15L176-05	Water	12/17/15
IR70-A15-095**	15L176-06**	Water	12/17/15
IR70-A15-032	15L176-07	Water	12/17/15
IR70-A15-032DL	15L176-07DL	Water	12/17/15
IR70-A15-033	15L176-08	Water	12/17/15
IR70-A15-034	15L176-09	Water	12/17/15
IR70-A15-061	15L176-10	Water	12/17/15
IR70-A15-061DL	15L176-10DL	Water	12/17/15
IR70-A15-062	15L176-11	Water	12/17/15
IR70-A15-062DL	15L176-11DL	Water	12/17/15
IR70-A15-046	15L176-12	Water	12/17/15
IR70-A15-053	15L176-13	Water	12/17/15
IR70-A15-053DL	15L176-13DL	Water	12/17/15
IR70-A15-052	15L176-14	Water	12/17/15
IR70-A15-052DL	15L176-14DL	Water	12/17/15
IR70-A15-057	15L176-15	Water	12/17/15
IR70-A15-057DL	15L176-15DL	Water	12/17/15
IR70-A15-056	15L176-16	Water	12/17/15
IR70-A15-056DL	15L176-16DL	Water	12/17/15
IR70-A15-059	15L176-17	Water	12/17/15
IR70-A15-060	15L176-18	Water	12/17/15
IR70-A15-060DL	15L176-18DL	Water	12/17/15

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-059MS	15L176-17MS	Water	12/17/15
IR70-A15-059MSD	15L176-17MSD	Water	12/17/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Volatile Organic Compounds (VOCs) by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A bromofluorobenzene (BFB) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

Percent relative standard deviations (%RSD) were less than or equal to 15.0% for each individual compound and less than or equal to 30.0% for calibration check compounds (CCCs).

Average relative response factors (RRF) for all compounds were within validation criteria with the following exceptions:

Date	Compound	RRF (Limits)	Associated Samples	Flag	A or P
12/01/15	2-Butanone	0.008 (≥0.010)	All samples in SDG 15L176	UJ (all non-detects)	A

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria with the following exceptions:

Date	Compound	RRF (Limits)	Associated Samples	Flag	A or P
12/22/15	2-Butanone	0.008 (≥0.010)	IR70-A15-103 IR70-A15-110 IR70-A15-028 IR70-A15-094** IR70-A15-031 IR70-A15-095** IR70-A15-032 IR70-A15-032DL IR70-A15-033 IR70-A15-034 IR70-A15-046 IR70-A15-056 IR70-A15-059	UJ (all non-detects)	A
12/23/15	2-Butanone	0.008 (≥0.010)	IR70-A15-061 IR70-A15-061DL IR70-A15-062 IR70-A15-062DL IR70-A15-053 IR70-A15-053DL IR70-A15-052 IR70-A15-052DL IR70-A15-057 IR70-A15-057DL IR70-A15-056DL IR70-A15-060 IR70-A15-060DL	UJ (all non-detects)	A

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Sample IR70-A15-103 was identified as a trip blank. No contaminants were found.

Sample IR70-A15-110 was identified as an equipment rinsate. No contaminants were found.

Sample IR70-A15-108 (From SDG 15L198) was identified as a source blank. No contaminants were found.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
IR70-A15-031	1,2-Dichloroethane-d4	122 (70-120)	All TCL compounds	J (all detects)	P

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
IR70-A15-095**	1,2-Dichloroethane-d4	123 (70-120)	All TCL compounds	J (all detects)	P
IR70-A15-033	1,2-Dichloroethane-d4	125 (70-120)	All TCL compounds	J (all detects)	P

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples IR70-A15-028 and IR70-A15-094** and samples IR70-A15-031 and IR70-A15-095** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	IR70-A15-028	IR70-A15-094**	
cis-1,2-Dichloroethene	2.9	2.7	7
trans-1,2-Dichloroethene	0.33	0.31	6
Trichloroethene	0.56	0.52	7

Compound	Concentration (ug/L)		RPD
	IR70-A15-031	IR70-A15-095**	
Carbon disulfide	1.0U	0.24	Not calculable
cis-1,2-Dichloroethene	16	15	6
trans-1,2-Dichloroethene	0.26	0.23	12
Vinyl chloride	3.0	2.7	11

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
IR70-A15-032 IR70-A15-052 IR70-A15-057 IR70-A15-056	cis-1,2-Dichloroethene Vinyl chloride	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects)	A
IR70-A15-061 IR70-A15-062 IR70-A15-053 IR70-A15-060	cis-1,2-Dichloroethene	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A

Raw data were not reviewed for Level III validation.

XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Compound	Flag	A or P
IR70-A15-032 IR70-A15-052 IR70-A15-057 IR70-A15-056	cis-1,2-Dichloroethene Vinyl chloride	R R	A
IR70-A15-032DL IR70-A15-052DL IR70-A15-057DL IR70-A15-056DL	All TCL compounds except cis-1,2-Dichloroethene Vinyl chloride	R	A

Sample	Compound	Flag	A or P
IR70-A15-061 IR70-A15-062 IR70-A15-053 IR70-A15-060	cis-1,2-Dichloroethene	R	A
IR70-A15-061DL IR70-A15-062DL IR70-A15-053DL IR70-A15-060DL	All TCL compounds except cis-1,2-Dichloroethene	R	A

Due to initial and continuing calibration RRF and surrogate %R, data were qualified as estimated in eighteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Volatiles - Data Qualification Summary - SDG 15L176

Sample	Compound	Flag	A or P	Reason
IR70-A15-103 IR70-A15-110 IR70-A15-028 IR70-A15-094** IR70-A15-031 IR70-A15-095** IR70-A15-032 IR70-A15-033 IR70-A15-034 IR70-A15-061 IR70-A15-062 IR70-A15-046 IR70-A15-053 IR70-A15-052 IR70-A15-057 IR70-A15-056 IR70-A15-059 IR70-A15-060	2-Butanone	UJ (all non-detects)	A	Initial calibration (RRF)
IR70-A15-103 IR70-A15-110 IR70-A15-028 IR70-A15-094** IR70-A15-031 IR70-A15-095** IR70-A15-032 IR70-A15-033 IR70-A15-034 IR70-A15-061 IR70-A15-062 IR70-A15-046 IR70-A15-053 IR70-A15-052 IR70-A15-057 IR70-A15-056 IR70-A15-059 IR70-A15-060	2-Butanone	UJ (all non-detects)	A	Continuing calibration (RRF)
IR70-A15-031 IR70-A15-095** IR70-A15-033	All TCL compounds	J (all detects)	P	Surrogate spikes (%R)
IR70-A15-032 IR70-A15-052 IR70-A15-057 IR70-A15-056	cis-1,2-Dichloroethene Vinyl chloride	R R	A	Overall assessment of data
IR70-A15-032DL IR70-A15-052DL IR70-A15-057DL IR70-A15-056DL	All TCL compounds except cis-1,2-Dichloroethene Vinyl chloride	R	A	Overall assessment of data
IR70-A15-061 IR70-A15-062 IR70-A15-053 IR70-A15-060	cis-1,2-Dichloroethene	R	A	Overall assessment of data

Sample	Compound	Flag	A or P	Reason
IR70-A15-061DL IR70-A15-062DL IR70-A15-053DL IR70-A15-060DL	All TCL compounds except cis-1,2-Dichloroethene	R	A	Overall assessment of data

Seal Beach, IR Site 70
Volatiles - Laboratory Blank Data Qualification Summary - SDG 15L176

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Volatiles - Field Blank Data Qualification Summary - SDG 15L176

No Sample Data Qualified in this SDG

LDC #: 35803C1

SDG #: 15L176

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 02/03/16

Page: 1 of 2

Reviewer: JVG

2nd Reviewer: [illegible]

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	SW / A	ICAL ≤ 15/30% ICV ≤ 20%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1 ER = 2 * SB = IR70-A15-108 (from 15L198)
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS 1D
X.	Field duplicates	SW	D = 3/4, 5/6
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation.
XIII.	Target compound identification	A	Not reviewed for Level III validation.
XIV.	System performance	A	Not reviewed for Level III validation.
XV.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; * ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER: ER= Equipment Rinse

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-103	15L176-01	Water	12/17/15
2	IR70-A15-110	15L176-02	Water	12/17/15
3	IR70-A15-028 D1	15L176-03	Water	12/17/15
4	IR70-A15-094** D1	15L176-04**	Water	12/17/15
5	IR70-A15-031 D✓	15L176-05	Water	12/17/15
6	IR70-A15-095** D✓	15L176-06**	Water	12/17/15
7	IR70-A15-032	15L176-07	Water	12/17/15
8	IR70-A15-032DL	15L176-07DL	Water	12/17/15
9	IR70-A15-033	15L176-08	Water	12/17/15
10	IR70-A15-034	15L176-09	Water	12/17/15
11 2	IR70-A15-061	15L176-10	Water	12/17/15
12 2	IR70-A15-061DL	15L176-10DL	Water	12/17/15
13 2	IR70-A15-062	15L176-11	Water	12/17/15

LDC #: 35803C1 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/03/16
SDG #: 15L176 Level III/IV Page: 2 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer: JW
2nd Reviewer: TV

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

	Client ID	Lab ID	Matrix	Date
14 2	IR70-A15-062DL	15L176-11DL	Water	12/17/15
15	IR70-A15-046	15L176-12	Water	12/17/15
16 2	IR70-A15-053	15L176-13	Water	12/17/15
17 2	IR70-A15-053DL	15L176-13DL	Water	12/17/15
18 2	IR70-A15-052	15L176-14	Water	12/17/15
19 2	IR70-A15-052DL	15L176-14DL	Water	12/17/15
20 2	IR70-A15-057	15L176-15	Water	12/17/15
21 2	IR70-A15-057DL	15L176-15DL	Water	12/17/15
22	IR70-A15-056	15L176-16	Water	12/17/15
23 2	IR70-A15-056DL	15L176-16DL	Water	12/17/15
24	IR70-A15-059	15L176-17	Water	12/17/15
25 2	IR70-A15-060	15L176-18	Water	12/17/15
26 2	IR70-A15-060DL	15L176-18DL	Water	12/17/15
27	IR70-A15-059MS	15L176-17MS	Water	12/17/15
28	IR70-A15-059MSD	15L176-17MSD	Water	12/17/15
29				
30				
31				
32				

Notes:

1	MBLK 1W						
2	↓ 2W						

LDC #: 35 803 C1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?		✓		
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) ≥ 0.05?		✓		
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?		✓		
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?	✓			
Were target compounds detected in the field blanks?		✓		
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	✓			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			✓	

LDC #: 35803C1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: TL

Validation Area	Yes	No	NA	Findings/Comments
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	✓			
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

TARGET COMPOUND WORKSHEET

METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane
C. Vinyl choride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO.1,1-Difluoroethane	O1. 3-Methylpentane
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3- Trimethylbutane
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methyl cyclohexane	T1. 2-Methylhexane
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.

LDC #: 35803C1

VALIDATION FINDINGS WORKSHEET
Initial Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: X

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Did the laboratory perform a 5 point calibration prior to sample analysis?
Y N N/A Were percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCC's and SPCC's?
Y N N/A Was a curve fit used for evaluation? If yes, what was the acceptance criteria used for evaluation? NA
Y N N/A Did the initial calibration meet the acceptance criteria?
Y N N/A Were all %RSDs and RRFs within the validation criteria of ≤30/15 %RSD and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %RSD (Limit: ≤30/15%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	12/01/15	ICAL - T067	M		0.008 (<0.010)	All	J/UJ/A

LDC #: 35803 C1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: SK

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?
Y N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?
Y N N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit: >0.05)	Associated Samples	Qualifications
	12/22/15	RLC 533	M		0.008 (≥0.010)	1-10, 15, 22, 24, 27, 28	MBLK1W (ND) J/UJ/A
	12/23/15	RLC 570	M		0.008 (≥0.010)	11-14, 16-21, 23, 25, 26, MBLK2W	(ND)

CONCAL.wpd

LDC #: 35803C1

VALIDATION FINDINGS WORKSHEET
Surrogate Spikes

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y (N) N/A Were all surrogate %R within QC limits?

Y (N) N/A If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R out of outside of criteria?

#	Date	Sample ID	Surrogate	%Recovery (Limits)	Qualifications
		5 (ND + Det)	DCE	122 (70-120)	J dets / P
				( )	
		6	↓	123 ( )	↓
				( )	
		9 ↓	↓	125 (↓)	↓
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

	QC Limits (Soil)	QC Limits (Water)
SMC1 (TOL) = Toluene-d8	85-115	85-120
SMC2 (BFB) = Bromofluorobenzene	85-120	75-120
SMC3 (DCE) = 1,2-Dichloroethane-d4	60-120	70-120
SMC4 (DFM) = Dibromofluoromethane	75-125	85-115

LDC#: 35803C1

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GCMS VOA (EPA SW 846 Method 8260B)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD
	3	4	
QQQ	2.9	2.7	7
PPP	0.33	0.31	6
S	0.56	0.52	7

Compound	Concentration (ug/L)		RPD
	5	6	
G	1.0U	0.24	NC
QQQ	16	15	6
PPP	0.26	0.23	12
C	3.0	2.7	11

V:\Josephine\FIELD DUPLICATES\35803C1 ecc seal beach.wpd

LDC #: 35803C1

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Date	Sample ID	Compound	Finding	Qualifications
		7, 18, 20, 22	QQQ, C	> cal range	J dets / X
				↓	↓
		11, 13, 16, 25	QQQ		

Comments: See sample calculation verification worksheet for recalculations

LDC #: 35603C1

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 7
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.
Y N N/A Was the overall quality and usability of the data acceptable?

#	Date	Sample ID	Compound	Finding	Qualifications
		7, 18, 20, 22	QQQ, C	> cal range	R / A
		8, 19, 21, 23	All except above	dil	
		11, 13, 16, 25	QQQ	> cal range	
		12, 14, 17, 26	All except QQQ	dil	✓

Comments:

LDC #: 35803C1

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound
S= Standard deviation of the RRFs

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 10 std)	Recalculated RRF (RRF 10 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL TO67	12/01/15	cis-1,2-DCE (IS1)	0.347	0.347	0.351	0.351	4.56	4.59
			Toluene (IS2)	1.664	1.664	1.734	1.734	6.84	6.84
			1,1,2,2-TCA (IS3)	0.589	0.589	0.604	0.604	3.19	3.21

LDC # 35803C1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound	(IS)	Average RRF (Initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported % D	Recalculated %D
1	RLC533	12/22/2015	cis-1,2-DCE	(IS1)	0.351	0.321	0.321	8.5	8.5
			Toluene	(IS2)	1.734	1.600	1.600	7.7	7.7
			1,1,2,2-TCA	(IS3)	0.604	0.562	0.562	7.0	7.0

LDC #: 35803C1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: # 4

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4	10.0	11.61	116	116	0
Toluene-d8	↓	9.52	95.2	95.2	↓
Bromofluorobenzene	↓	9.85	98.5	98.5	↓

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

LDC #: 35803C1

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentration

RPD = I MSC - MSC I * 2/(MSC + MSDC) MSC = Matrix spike concentration MSDC = Matrix spike duplicate concentration

MS/MSD sample: 27/28

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc.	Reported	Recalc	Reported	Recalculated
1,1-Dichloroethene	10.0	10.0	0	10.3	11.0	103	103	110	110	6	6
Trichloroethene			6.69	16.2	16.7	95	95	100	100	3	3
Benzene			0	9.52	10.1	95	95	101	101	6	6
Toluene				9.16	9.80	92	92	98	98	7	7
Chlorobenzene				9.30	9.91	93	93	99	99	6	6

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803C1

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: JVG
2nd Reviewer: SR

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboraotry control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS ID: LCS/D 1W

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
1,1-Dichloroethene	10.0	10.0 ~~NA~~	10.1	9.90	101	101	99	99	2	2
Trichloroethene			9.05	8.77	90	90	88	88	3	3
Benzene			9.44	9.08	94	94	91	91	4	4
Toluene			9.71	9.44	97	97	94	94	3	3
Chlorobenzene			9.65	9.43	97	97	94	94	2	2

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803 C1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x = Area of the characteristic ion (EICP) for the compound to be measured

A_{is} = Area of the characteristic ion (EICP) for the specific internal standard

I_s = Amount of internal standard added in nanograms (ng)

RRF = Relative response factor of the calibration standard.

V_o = Volume or weight of sample pruged in milliliters (ml) or grams (g).

Df = Dilution factor.

%S = Percent solids, applicable to soils and solid matrices only.

Example:

Sample I.D. 6 , QQQ

Conc. = $\frac{(721135)(10)(\quad)(\quad)}{(138284)(0.351)(\quad)(\quad)}$

= 14.857

≈ 15 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
	6	QQQ	15		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 19, 2016

Parameters: Dissolved Metals

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L176

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-110	15L176-02	Water	12/17/15
IR70-A15-031	15L176-05	Water	12/17/15
IR70-A15-095**	15L176-06**	Water	12/17/15
IR70-A15-032	15L176-07	Water	12/17/15
IR70-A15-033	15L176-08	Water	12/17/15
IR70-A15-034	15L176-09	Water	12/17/15
IR70-A15-046	15L176-12	Water	12/17/15
IR70-A15-053	15L176-13	Water	12/17/15
IR70-A15-052	15L176-14	Water	12/17/15
IR70-A15-057	15L176-15	Water	12/17/15
IR70-A15-056	15L176-16	Water	12/17/15
IR70-A15-110MS	15L176-02MS	Water	12/17/15
IR70-A15-110MSD	15L176-02MSD	Water	12/17/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Arsenic, Iron, and Manganese by Environmental Protection Agency (EPA) SW 846 Method 6010B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

Sample IR70-A15-110 was identified as an equipment rinsate. No contaminants were found.

Sample IR70-A15-108 (from SDG 15L198) was identified as a source blank. No contaminants were found.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Serial Dilution

Serial dilution analysis was performed on an associated project sample. The analysis criteria were met.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples IR70-A15-031 and IR70-A15-095** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD
	IR70-A15-031	IR70-A15-095**	
Iron	7.06	7.05	0
Manganese	6.31	6.31	0

XI. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Dissolved Metals - Data Qualification Summary - SDG 15L176

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Dissolved Metals - Laboratory Blank Data Qualification Summary - SDG 15L176

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Dissolved Metals - Field Blank Data Qualification Summary - SDG 15L176

No Sample Data Qualified in this SDG

LDC #: 35803C4 b

SDG #: 15L176

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 2-5-16

Page: 1 of 1

Reviewer: MG

2nd Reviewer: M

METHOD: Metals (EPA SW 846 Method 6010B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
~~II.~~	~~ICP/MS Tune~~		
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	ND	ER=1 SB-IR70-A15-108 (15L198)
VII.	Matrix Spike/Matrix Spike Duplicates	A	MS/MSD
VIII.	Duplicate sample analysis	N	
IX.	ICP Serial Dilution	A	
X.	Laboratory control samples	A	LCS/LCSD
XI.	Field Duplicates	SW	D=2+3
~~XII.~~	~~Internal Standard (ICP-MS)~~		
XIII.	Sample Result Verification	A	Not reviewed for Level III validation.
XIV.	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-110	15L176-02	Water	12/17/15
2	IR70-A15-031	15L176-05	Water	12/17/15
3	IR70-A15-095**	15L176-06**	Water	12/17/15
4	IR70-A15-032	15L176-07	Water	12/17/15
5	IR70-A15-033	15L176-08	Water	12/17/15
6	IR70-A15-034	15L176-09	Water	12/17/15
7	IR70-A15-046	15L176-12	Water	12/17/15
8	IR70-A15-053	15L176-13	Water	12/17/15
9	IR70-A15-052	15L176-14	Water	12/17/15
10	IR70-A15-057	15L176-15	Water	12/17/15
11	IR70-A15-056	15L176-16	Water	12/17/15
12	IR70-A15-110MS	15L176-02MS	Water	12/17/15
13	IR70-A15-110MSD	15L176-02MSD	Water	12/17/15
14				
15	PBW			

LDC #: 35803C46

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: R

Method: Metals (EPA SW 846 Method 6010/7000/6020)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. ICP/MS Tune				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?			✓	
Were %RSD of isotopes in the tuning solution ≤5%?			✓	
III. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury) QC limits?	✓			
Were all initial calibration correlation coefficients > 0.995?	✓			
IV. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	✓			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	✓			
VI. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were < 5X the RL.	✓			
VII. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% QC limits for water samples and laboratory established QC limits for soils?	✓			

LDC #: 35803C46

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)				
Were all the percent recoveries (%R) within the 30-120% (6020)/60-125% (200.8) of the intensity of the internal standard in the associated initial calibration?			✓	
If the %Rs were outside the criteria, was a reanalysis performed?			✓	
IX. ICP Serial Dilution				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the MDL (ICP)/>100X the MDL(ICP/MS)?	✓			
Were all percent differences (%Ds) < 10%?	✓			
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.		✓		
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XII. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
XIII. Field blanks				
Field blanks were identified in this SDG.	✓			
Target analytes were detected in the field blanks.		✓		

LDC #: 35803C4b

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Reviewer: MG
2nd reviewer: R

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1 → 11	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
QC 12, 13	↓	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
Analysis Method		
ICP	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
ICP-MS		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
GFAA		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____

Comments: Mercury by CVAA if performed

LDC#: 35803C4b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: MG
2nd Reviewer: M

METHOD: Metals (EPA Method 6010B)

Analyte	Concentration (mg/L)		RPD	
	2	3		
Iron	7.06	7.05	0	
Manganese	6.31	6.31	0	

V:\FIELD DUPLICATES\FD_inorganic\35803C4b.WPD

LDC #: 35803C46

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: MG
2nd Reviewer: SC

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

An initial and continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found / True x 100 Where, Found = concentration (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution
True = concentration (in ug/L) of each analyte in the ICV or CCV source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalculated %R	Reported %R	Acceptable (Y/N)
1507 ICV	ICP (Initial calibration)	As	1050.3	1000	105	105	Y
	ICP/MS (Initial calibration)						
	CVAA (Initial calibration)						
1854 CCV7	ICP (Continuing calibration)	Fe	24176	25000	97	97	
	ICP/MS (Continuing calibration)						
	CVAA (Continuing calibration)						
	GFAA (Initial calibration)						
	GFAA (Continuing calibation)						

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803C46

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Page: 1 of 1
Reviewer: MG
2nd Reviewer: JC

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Percent recoveries (%R) for an ICP interference check sample, a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$

Where, Found = Concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = Concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$

Where, S = Original sample concentration
D = Duplicate sample concentration

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

$\%D = \frac{|I-SDR|}{I} \times 100$

Where, I = Initial Sample Result (mg/L)
SDR = Serial Dilution Result (mg/L) (Instrument Reading x 5)

Sample ID	Type of Analysis	Element	Found / S / I (units)	True / D / SDR (units)	Recalculated %R / RPD / %D	Reported %R / RPD / %D	Acceptable (Y/N)
1529 ICSAB	ICP interference check	As	1.069 (mg/L)	1.0 (mg/L)	107	107	Y
1903 LCS	Laboratory control sample	Fe	5.009 (mg/L)	5 (mg/L)	100	100	↓
1918 12	Matrix spike	Mn	(SSR-SR) 0.476 (mg/L)	0.5 (mg/L)	95	95	↓
1918/1921 12/13	Duplicate	Fe	5.029 (mg/L)	4.981 (mg/L)	1	1	↓
1912/1915 1	ICP serial dilution	As	ND (mg/L)	ND (mg/L)	0	0	↓

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

TOTCLC.4SW

LDC #: 35803C46

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: MG
2nd reviewer: TL

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments and within the linear range of the ICP?
Y N N/A Are all detection limits below the CRDL?

Detected analyte results for #3, Mn were recalculated and verified using the following equation:

Concentration = (RD)(FV)(Dil) / (In. Vol.)

RD = Raw data concentration
FV = Final volume (ml)
In. Vol. = Initial volume (ml) or weight (G)
Dil = Dilution factor

Recalculation:

$$\frac{(6.3128\ mg/L)(0.050\ L)}{0.050\ L} = 6.3128\ mg/L$$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
1	3	Mn	6.31	6.31	Y

Note:

RECALC.4SW

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 9, 2016

Parameters: Wet Chemistry

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L176

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-028	15L176-03	Water	12/17/15
IR70-A15-094**	15L176-04**	Water	12/17/15
IR70-A15-031	15L176-05	Water	12/17/15
IR70-A15-095**	15L176-06**	Water	12/17/15
IR70-A15-032	15L176-07	Water	12/17/15
IR70-A15-033	15L176-08	Water	12/17/15
IR70-A15-034	15L176-09	Water	12/17/15
IR70-A15-061	15L176-10	Water	12/17/15
IR70-A15-062	15L176-11	Water	12/17/15
IR70-A15-046	15L176-12	Water	12/17/15
IR70-A15-053	15L176-13	Water	12/17/15
IR70-A15-052	15L176-14	Water	12/17/15
IR70-A15-057	15L176-15	Water	12/17/15
IR70-A15-056	15L176-16	Water	12/17/15
IR70-A15-059	15L176-17	Water	12/17/15
IR70-A15-060	15L176-18	Water	12/17/15
IR70-A15-031MS	15L176-05MS	Water	12/17/15
IR70-A15-031MSD	15L176-05MSD	Water	12/17/15
IR70-A15-095MS	15L176-06MS	Water	12/17/15
IR70-A15-095MSD	15L176-06MSD	Water	12/17/15
IR70-A15-095DUP	15L176-06DUP	Water	12/17/15
IR70-A15-032DUP	15L176-07DUP	Water	12/17/15
IR70-A15-034DUP	15L176-09DUP	Water	12/17/15
IR70-A15-059MS	15L176-17MS	Water	12/17/15
IR70-A15-059MSD	15L176-17MSD	Water	12/17/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Alkalinity by Standard Method 2320B
Bromide, Chloride, Nitrate as Nitrogen, Nitrite as Nitrogen, and Sulfate by Environmental Protection Agency (EPA) Method 300.0
Organic Acids by EPA Method 300.0 Modified
Sulfide by Standard Method 4500-S2 F
Total Dissolved Solids by Standard Method 2540C
Total Organic Carbon by Standard Method 5310B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Chloride	0.14715 mg/L	IR70-A15-031 IR70-A15-095** IR70-A15-032 IR70-A15-033

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
IR70-A15-059MS/MSD (IR70-A15-028 IR70-A15-094** IR70-A15-031 IR70-A15-095** IR70-A15-032 IR70-A15-033 IR70-A15-034 IR70-A15-061 IR70-A15-062 IR70-A15-059)	Acetate	36 (75-135)	32 (75-135)	UJ (all non-detects)	A

Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples IR70-A15-028 and IR70-A15-094** and samples IR70-A15-031 and IR70-A15-095** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD
	IR70-A15-031	IR70-A15-095**	
Alkalinity	277	279	1
Bromide	46.0	44.8	3
Chloride	14500	14000	4
Sulfate	2960	2440	19
Total dissolved solids	27600	27900	1
Total organic carbon	1.72	1.68	2

X. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to MS/MSD %R, data were qualified as estimated in ten samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Wet Chemistry - Data Qualification Summary - SDG 15L176

Sample	Analyte	Flag	A or P	Reason
IR70-A15-028 IR70-A15-094** IR70-A15-031 IR70-A15-095** IR70-A15-032 IR70-A15-033 IR70-A15-034 IR70-A15-061 IR70-A15-062 IR70-A15-059	Acetate	UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R)

Seal Beach, IR Site 70
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 15L176

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Wet Chemistry - Field Blank Data Qualification Summary - SDG 15L176

No Sample Data Qualified in this SDG

LDC #: 35803C6

SDG #: 15L176

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 2-5-16

Page: 1 of 2

Reviewer: MG

2nd Reviewer: [illegible]

METHOD: (Analyte) Alkalinity (SM2320B), Bromide, Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA Method 300.0), Organic Acids (EPA Method 300.0M), ~~Sulfate~~ Sulfide (SM4500-S2 F), TDS (SM2540C), TOC (SM5310B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	MS/MSD
VII.	Duplicate sample analysis	A	DUP
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	D= 1*+2* D=3+4
X.	Sample result verification	A	Not reviewed for Level III validation.
XI.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; * = ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-028	15L176-03	Water	12/17/15
2	IR70-A15-094**	15L176-04**	Water	12/17/15
3	IR70-A15-031	15L176-05	Water	12/17/15
4	IR70-A15-095**	15L176-06**	Water	12/17/15
5	IR70-A15-032	15L176-07	Water	12/17/15
6	IR70-A15-033	15L176-08	Water	12/17/15
7	IR70-A15-034	15L176-09	Water	12/17/15
8	IR70-A15-061	15L176-10	Water	12/17/15
9	IR70-A15-062	15L176-11	Water	12/17/15
10	IR70-A15-046	15L176-12	Water	12/17/15
11	IR70-A15-053	15L176-13	Water	12/17/15
12	IR70-A15-052	15L176-14	Water	12/17/15
13	IR70-A15-057	15L176-15	Water	12/17/15
14	IR70-A15-056	15L176-16	Water	12/17/15
15	IR70-A15-059	15L176-17	Water	12/17/15
16	IR70-A15-060	15L176-18	Water	12/17/15

LDC #: 35803C6

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 2-5-16

SDG #: 15L176

Page: 2 of 2

Laboratory: EMAX Laboratories, Inc.

Reviewer: MG

2nd Reviewer: R

METHOD: (Analyte) Alkalinity (SM2320B), Bromide, Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA Method 300.0), Organic Acids (EPA Method 300.0M), Sulfate (SM4500-S2 F), TDS (SM2540C), TOC (SM5310B)

	Client ID	Lab ID	Matrix	Date
17	IR70-A15-031MS	15L176-05MS	Water	12/17/15
18	IR70-A15-031MSD	15L176-05MSD	Water	12/17/15
19	IR70-A15-095MS	15L176-06MS	Water	12/17/15
20	IR70-A15-095MSD	15L176-06MSD	Water	12/17/15
21	IR70-A15-095DUP	15L176-06DUP	Water	12/17/15
22	IR70-A15-032DUP	15L176-07DUP	Water	12/17/15
23	IR70-A15-034DUP	15L176-09DUP	Water	12/17/15
24	IR70-A15-059MS	15L176-17MS	Water	12/17/15
25	IR70-A15-059MSD	15L176-17MSD	Water	12/17/15
26				
27				
28				
29	PBW1			
30	PBW2			

Notes:

LDC #: 35803C6

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: R

Method: Inorganics (EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	✓			
Were titrant checks performed as required? (Level IV only)	✓			
Were balance checks performed as required? (Level IV only)	✓			
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
IV. Matrix spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.		✓		
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL(≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.	✓			
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	✓			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

LDC #: 35803C6

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: RC

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were detection limits < RL?	✓			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
X. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 35803C6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Page: 1 of 1
Reviewer: MG
2nd reviewer: AC

All circled methods are applicable to each sample.

Sample ID	Matrix	Parameter
1, 2, 8, 9, 15, 16	W	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ Org Acid
3→7, 10→14	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Br Org Acid $S^=$
QC 17, 18	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
19→21	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Br ____
22	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
23	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____
24, 25	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ Org Acid
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____

Comments: _____

LDC #: 35803C6

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: MG
2nd Reviewer: [illegible]

METHOD: Inorganics, Method See Cover

Conc. units: mg/L **Associated Samples:** 3-6 (>5x)

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB	ICB/CCB (mg/L)		No Qual's.									
Cl		0.14715	0.736										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC #: 35803C6

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: MG
2nd Reviewer: R

METHOD: Inorganics, EPA Method see cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a matrix spike analyzed for each matrix in this SDG?

Y N N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for water samples and ≤35% for soil samples?

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
1	24/25	water	Acetate	36 (75-125)	32 (75-125)		1→9, 15	J/UJ/A (all ND)

Comments:

MSD.6

LDC#: 35803C6 **VALIDATION FINDINGS WORKSHEET**

Field Duplicates

Reviewer: MG
2nd Reviewer: [illegible]

Inorganics, Method See Cover

Analyte	Concentration (mg/L)		RPD	
	3	4		
Alkalinity	277	279	1	
Bromide	46.0	44.8	3	
Chloride	14500	14000	4	
Sulfate	2960	2440	19	
TDS	27600	27900	1	
Total organic Carbon	1.72	1.68	2	

V:\FIELD DUPLICATES\FD_inorganic\35803C6.WPD

LDC #: 35803C6

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: MG
2nd Reviewer: R

METHOD: Inorganics, Method See cover

The correlation coefficient (r) for the calibration of Butyrate was recalculated. Calibration date: 12-15-15

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found / True x 100 Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution
True = concentration of each analyte in the ICV or CCV source

Type of Analysis	Analyte	Standard ID	Conc. Found (units)	Area True (units)	Recalculated r or %R	Reported r or %R	Acceptable (Y/N)
Initial calibration	Butyrate	Blank	-	-	$r^2 = 0.9995$	$r^2 = 0.9995$	Y
		Standard 1	0.1 (mg/L)	0.003651			
		Standard 2	0.5 ( )	0.022349			
		Standard 3	1.0 ( )	0.045373			
		Standard 4	2.0 ( )	0.089855			
		Standard 5	3.0 ( )	0.139740			
		Standard 6	-	-			
		Standard 7	-	-			
Calibration verification	Br	CCV78	1.847 (mg/L)	2.0 (mg/L)	92.4	92.3	
Calibration verification	SO_4	CCV82	4.614 (mg/L)	5.0 (mg/L)	92.3	92.3	
Calibration verification	TOC	CCV4	26.04 (mg/L)	25.0 (mg/L)	104	not reported	

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803C6

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: RC

METHOD: Inorganics, Method see cover

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$ Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$ Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
0219 LCS1W	Laboratory control sample	Propionate	15.31 (mg/L)	15.0 (mg/L)	102	102	Y
1718 19	Matrix spike sample	NO_3-N	(SSR-SR) 4.982 (mg/L)	5.0 (mg/L)	100	100	↓
23	Duplicate sample	TDS	2058 (mg/L)	1980 (mg/L)	4	4	↓

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803C6

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: MG
2nd reviewer: R

METHOD: Inorganics, Method See cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments?
Y N N/A Are all detection limits below the CRQL?

Compound (analyte) results for #4, Total Alk. reported with a positive detect were recalculated and verified using the following equation:

Concentration =

Recalculation:

$$Alk = \frac{(6.96\ ml)(0.020\ N)(50000)}{25\ ml} = 278.4\ mg/L$$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
1	4	Cl	14000	14000	Y
		Total Alk	279	278	↓
		TDS	27900	27900	↓
		TOC	1.68	1.68	↓

Note: Sample #2 is N.D.
Methods 300.0 (M), SM4500-S2F are N.D. for level IV samples

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 8, 2016

Parameters: Methane, Ethane, & Ethene

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L154

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-103	15L176-01	Water	12/17/15
IR70-A15-110	15L176-02	Water	12/17/15
IR70-A15-028	15L176-03	Water	12/17/15
IR70-A15-028DL	15L176-03DL	Water	12/17/15
IR70-A15-094**	15L176-04**	Water	12/17/15
IR70-A15-094DL**	15L176-04DL**	Water	12/17/15
IR70-A15-031	15L176-05	Water	12/17/15
IR70-A15-031DL	15L176-05DL	Water	12/17/15
IR70-A15-095**	15L176-06**	Water	12/17/15
IR70-A15-095DL**	15L176-06DL**	Water	12/17/15
IR70-A15-032	15L176-07	Water	12/17/15
IR70-A15-032DL	15L176-07DL	Water	12/17/15
IR70-A15-033	15L176-08	Water	12/17/15
IR70-A15-033DL	15L176-08DL	Water	12/17/15
IR70-A15-034	15L176-09	Water	12/17/15
IR70-A15-034DL	15L176-09DL	Water	12/17/15
IR70-A15-061	15L176-10	Water	12/17/15
IR70-A15-061DL	15L176-10DL	Water	12/17/15
IR70-A15-062	15L176-11	Water	12/17/15
IR70-A15-062DL	15L176-11DL	Water	12/17/15
IR70-A15-046	15L176-12	Water	12/17/15
IR70-A15-046DL	15L176-12DL	Water	12/17/15
IR70-A15-053	15L176-13	Water	12/17/15
IR70-A15-053DL	15L176-13DL	Water	12/17/15
IR70-A15-052	15L176-14	Water	12/17/15
IR70-A15-052DL	15L176-14DL	Water	12/17/15
IR70-A15-057	15L176-15	Water	12/17/15

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-057DL	15L176-15DL	Water	12/17/15
IR70-A15-056	15L176-16	Water	12/17/15
IR70-A15-056DL	15L176-16DL	Water	12/17/15
IR70-A15-059	15L176-17	Water	12/17/15
IR70-A15-060	15L176-18	Water	12/17/15
IR70-A15-060DL	15L176-18DL	Water	12/17/15
IR70-A15-059MS	15L176-17MS	Water	12/17/15
IR70-A15-059MSD	15L176-17MSD	Water	12/17/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Methane, Ethane, and Ethene by Method RSK-175

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Retention time windows were established as required by the method for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

Retention times of all compounds in the calibration standards were within the established retention time windows for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

Sample IR70-A15-103 was identified as a trip blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-103	12/17/15	Methane	0.40 ug/L	IR70-A15-110 IR70-A15-028 IR70-A15-028DL IR70-A15-094** IR70-A15-094DL** IR70-A15-031 IR70-A15-031DL IR70-A15-095** IR70-A15-095DL** IR70-A15-032 IR70-A15-032DL IR70-A15-033 IR70-A15-033DL IR70-A15-034 IR70-A15-034DL IR70-A15-061 IR70-A15-061DL IR70-A15-062 IR70-A15-062DL IR70-A15-046 IR70-A15-046DL IR70-A15-053 IR70-A15-053DL IR70-A15-052 IR70-A15-052DL IR70-A15-057 IR70-A15-057DL IR70-A15-056 IR70-A15-056DL IR70-A15-059 IR70-A15-060 IR70-A15-060DL

Sample IR70-A15-110 was identified as an equipment rinsate. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-110	12/17/15	Methane	0.41 ug/L	IR70-A15-028 IR70-A15-028DL IR70-A15-094** IR70-A15-094DL** IR70-A15-031 IR70-A15-031DL IR70-A15-095** IR70-A15-095DL** IR70-A15-032 IR70-A15-032DL IR70-A15-033 IR70-A15-033DL IR70-A15-034 IR70-A15-034DL IR70-A15-061 IR70-A15-061DL IR70-A15-062 IR70-A15-062DL IR70-A15-046 IR70-A15-046DL IR70-A15-053 IR70-A15-053DL IR70-A15-052 IR70-A15-052DL IR70-A15-057 IR70-A15-057DL IR70-A15-056 IR70-A15-056DL IR70-A15-059 IR70-A15-060 IR70-A15-060DL

Sample IR70-A15-108 (from SDG 15L198) was identified as a source blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-108	12/22/15	Methane	0.50 ug/L	IR70-A15-110

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
IR70-A15-110	Methane	0.41 ug/L	0.41U ug/L

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Field Duplicates

Samples IR70-A15-028 and IR70-A15-094**, samples IR70-A15-028DL and IR70-A15-094DL**, samples IR70-A15-031 and IR70-A15-095**, and samples IR70-A15-031DL and IR70-A15-095DL** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	IR70-A15-028	IR70-A15-094**	
Methane	68	70	3

Compound	Concentration (ug/L)		RPD
	IR70-A15-028DL	IR70-A15-094DL**	
Methane	82	92	11

Compound	Concentration (ug/L)		RPD
	IR70-A15-031	IR70-A15-095**	
Ethene	1.3	1.2	8
Methane	170	160	6

Compound	Concentration (ug/L)		RPD
	IR70-A15-031DL	IR70-A15-095DL**	
Methane	910	790	14

IX. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
IR70-A15-028 IR70-A15-094** IR70-A15-031 IR70-A15-095** IR70-A15-032 IR70-A15-033 IR70-A15-034 IR70-A15-061 IR70-A15-062 IR70-A15-053 IR70-A15-052 IR70-A15-057 IR70-A15-056 IR70-A15-060	Methane	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A
IR70-A15-046	Ethene Methane	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects)	A

Raw data were not reviewed for Level III validation.

X. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Compound	Flag	A or P
IR70-A15-028 IR70-A15-094** IR70-A15-031 IR70-A15-095** IR70-A15-032 IR70-A15-033 IR70-A15-034 IR70-A15-061 IR70-A15-062 IR70-A15-053 IR70-A15-052 IR70-A15-057 IR70-A15-056 IR70-A15-060	Methane	R	A

Sample	Compound	Flag	A or P
IR70-A15-028DL IR70-A15-094DL** IR70-A15-031DL IR70-A15-095DL** IR70-A15-032DL IR70-A15-033DL IR70-A15-034DL IR70-A15-061DL IR70-A15-062DL IR70-A15-053DL IR70-A15-052DL IR70-A15-057DL IR70-A15-056DL IR70-A15-060DL	All TCL compounds except Methane	R	A
IR70-A15-046	Ethene Methane	R R	A
IR70-A15-046DL	All TCL compounds except Ethene Methane	R	A

Due to source blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Data Qualification Summary - SDG 15L154

Sample	Compound	Flag	A or P	Reason
IR70-A15-028 IR70-A15-094** IR70-A15-031 IR70-A15-095** IR70-A15-032 IR70-A15-033 IR70-A15-034 IR70-A15-061 IR70-A15-062 IR70-A15-053 IR70-A15-052 IR70-A15-057 IR70-A15-056 IR70-A15-060	Methane	R	A	Overall assessment of data
IR70-A15-028DL IR70-A15-094DL** IR70-A15-031DL IR70-A15-095DL** IR70-A15-032DL IR70-A15-033DL IR70-A15-034DL IR70-A15-061DL IR70-A15-062DL IR70-A15-053DL IR70-A15-052DL IR70-A15-057DL IR70-A15-056DL IR70-A15-060DL	All TCL compounds except Methane	R	A	Overall assessment of data
IR70-A15-046	Ethene Methane	R R	A	Overall assessment of data
IR70-A15-046DL	All TCL compounds except Ethene Methane	R	A	Overall assessment of data

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Laboratory Blank Data Qualification Summary - SDG 15L154

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Field Blank Data Qualification Summary - SDG 15L154

Sample	Compound	Modified Final Concentration	A or P
IR70-A15-110	Methane	0.41U ug/L	A

LDC #: 35803C51 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/03/16
SDG #: 15L176 Level III/IV Page: 1 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer: JVo
2nd Reviewer: SC

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	ICAL ≤ 20 % ICV ≤ 20 %
III.	Continuing calibration	A	CCV ≤ 20 %
IV.	Laboratory Blanks	A	
V.	Field blanks	SW	TB = 1 ER = 2 SB = IR70-A15-108 (from 15L198)
VI.	Surrogate spikes	N	Not req'd.
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS 1D
IX.	Field duplicates	SW	D = 3/5, 4/6, 7/9, 8/10
X.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation.
XI.	Target compound identification	A	Not reviewed for Level III validation.
XII.	System performance	A	Not reviewed for Level III validation.
XIII.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER: ER = Equipment Rinse

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-103	15L176-01	Water	12/17/15
2	IR70-A15-110	15L176-02	Water	12/17/15
3	IR70-A15-028 D_1	15L176-03	Water	12/17/15
4	IR70-A15-028DL D_2	15L176-03DL	Water	12/17/15
5	IR70-A15-094** D_1	15L176-04**	Water	12/17/15
6	IR70-A15-094DL** D_2	15L176-04DL**	Water	12/17/15
7	IR70-A15-031 D_3	15L176-05	Water	12/17/15
8	IR70-A15-031DL D_4	15L176-05DL	Water	12/17/15
9	IR70-A15-095** D_3	15L176-06**	Water	12/17/15
10	IR70-A15-095DL** D_4	15L176-06DL**	Water	12/17/15
11	IR70-A15-032	15L176-07	Water	12/17/15
12	IR70-A15-032DL	15L176-07DL	Water	12/17/15
13	IR70-A15-033	15L176-08	Water	12/17/15
14	IR70-A15-033DL	15L176-08DL	Water	12/17/15
15	IR70-A15-034	15L176-09	Water	12/17/15
16	IR70-A15-034DL	15L176-09DL	Water	12/17/15

LDC #: 35803C51 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/03/16
SDG #: 15L176 Level III/IV Page: 2 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer: JVB
2nd Reviewer: M

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

	Client ID	Lab ID	Matrix	Date
17	IR70-A15-061	15L176-10	Water	12/17/15
18	IR70-A15-061DL	15L176-10DL	Water	12/17/15
19	IR70-A15-062	15L176-11	Water	12/17/15
20	IR70-A15-062DL	15L176-11DL	Water	12/17/15
21	IR70-A15-046	15L176-12	Water	12/17/15
22	IR70-A15-046DL	15L176-12DL	Water	12/17/15
23	IR70-A15-053	15L176-13	Water	12/17/15
24	IR70-A15-053DL	15L176-13DL	Water	12/17/15
25	IR70-A15-052	15L176-14	Water	12/17/15
26	IR70-A15-052DL	15L176-14DL	Water	12/17/15
27	IR70-A15-057	15L176-15	Water	12/17/15
28	IR70-A15-057DL	15L176-15DL	Water	12/17/15
29	IR70-A15-056	15L176-16	Water	12/17/15
30	IR70-A15-056DL	15L176-16DL	Water	12/17/15
31 2	IR70-A15-059	15L176-17	Water	12/17/15
32 2	IR70-A15-060	15L176-18	Water	12/17/15
33 2	IR70-A15-060DL	15L176-18DL	Water	12/17/15
34 2	IR70-A15-059MS	15L176-17MS	Water	12/17/15
35 2	IR70-A15-059MSD	15L176-17MSD	Water	12/17/15
36				
37				
38				
39				

Notes:

1	MBLK 1W						
2	↓ 2W						

LDC #: 35803 C5

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Method: ✓ GC ____ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?		✓		
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. Field Blanks				
Were field blanks identified in this SDG?	✓			
Were target compounds detected in the field blanks?	✓			
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?			✓	
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	✓			

LDC #: 35803C51

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: AC

Validation Area	Yes	No	NA	Findings/Comments
VII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 35803 C51

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: JVG
2nd Reviewer: SC

METHOD: ✓ **GC** __ **HPLC**
Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?
Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 12/17/15
Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: Associated Samples: All except 1

Compound	Blank ID	Blank ID	Sample Identification							
	1		2							
Methane	0.40		0.41 /U							
CRQL										

Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 12/17/15
Field blank type: (circle one) Field Blank / Trip Blank/ Atmospheric Blank/ Ambient Blank Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: ER Associated Samples: All except 1, 2 (5x)

Compound	Blank ID	Blank ID	Sample Identification							
	2									
Methane	0.41									
CRQL										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with compound concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC #: 35803C51

VALIDATION FINDINGS WORKSHEET
Field Blanks

Page: 2 of 2
Reviewer: JVG
2nd Reviewer: SC

METHOD: ✓ **GC** __ **HPLC**
Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?
Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 12/22/15
Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other:_____ Associated Samples: 2

Compound	Blank ID	Blank ID	Sample Identification							
	1R70-A15-108		2							
Methane	0.50		0.41 /U							
CRQL										

Blank units:_____ **Associated sample units:**_____
Sampling date:_____
Field blank type: (circle one) Field Blank / Trip Blank/ Atmospheric Blank/ Ambient Blank Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other:_____ Associated Samples:_____

Compound	Blank ID	Blank ID	Sample Identification							
CRQL										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with compound concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC#: 35803C51

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC MEE (Method RSK-175)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD
	3	5	
Methane	68	70	3

Compound	Concentration (ug/L)		RPD
	4	6	
Methane	82	92	11

Compound	Concentration (ug/L)		RPD
	7	9	
Ethene	1.3	1.2	8
Methane	170	160	6

Compound	Concentration (ug/L)		RPD
	8	10	
Methane	910	790	14

V:\Josephine\FIELD DUPLICATES\35803C51 ecc seal beach.wpd

LDC #: 35803C51

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer: SC

METHOD: ✓ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Level IV/D Only
Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	> cal range	3, 5, 7, 9, 11, 13, 15, 17, 19, 23, 25, 27, 29, 32	J dets /A
	Ethene, Methane	↓	21	↓

Comments: See sample calculation verification worksheet for recalculations

LDC #: 35803 C51

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: SC

METHOD: ✓ GC ___ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

Y N N/A Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	> cal range	3, 5, 7, 9, 11, 13, 15, 17, 19, 23, 25, 27, 29, 32	R /A
	All except Methane	dil	4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 26, 28, 30, 33	
	Ethene, Methane	> cal range	21	
	All except above	dil	22	✓

Comments: _____

OVRNew1.wpd

LDC #: 35803C51

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC ✓ HPLC _____

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C
average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where:
A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported CF (13.56 std)	Recalculated CF (13.56 std)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL GCT010	6/19/2015	Methane	31479.0	31479.4	34528.0	34528.0	13.9	13.9

LDC # 35803C51

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC / HPLC

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	FL23002A	12/23/2015	Methane	13.56	13.02	13.02	4	3.9
2	FL23015A	12/23/2015	Methane	13.56	12.13	12.13	11	10.5

LDC #: 35803 C51

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: PC

METHOD: ✓ **GC** __ **HPLC**

The percent recoveries (%R) and relative percent differences (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC - SC)/SA

RPD =(({SSCMS - SSCMSD} * 2) / (SSCMS + SSCMSD))*100

Where SSC = Spiked sample concentration; SC = Sample concentration; SA = Spike added; MS = Matrix spike; MSD = Matrix spike duplicate

MS/MSD samples: #7,4 / 35

Compound		Spike Added (ug/L)		Sample Conc. (ug/L)	Spike Sample Concentration (ug/L)		Matrix spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
		MS	MSD	---	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline	(8015)											
Diesel	(8015)											
Benzene	(8021B)											
Methane	(RSK-175)	13.6	13.6	5.76	19.8	18.7	101	101	94	94	5	5
2,4-D	(8151)											
Dinoseb	(8151)											
Naphthalene	(8310)											
Anthracene	(8310)											
HMX	(8330)											
2,4,6-Trinitrotoluene	(8330)											
Phorate	(8141A)											
Malathion	(8141A)											
Formaldehyde	(8315A)											

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803 CS1

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG

2nd Reviewer: PC

METHOD: ✓ GC __HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration
LCS = Laboratory Control Sample
SA = Spike added
LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: LCS/D IW

Compound		Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
		LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline	(8015)										
Diesel	(8015)										
Benzene	(8021B)										
Methane	(RSK-175)	13.6	13.6	13.2	12.8	97	97	94	94	3	3
2,4-D	(8151)										
Dinoseb	(8151)										
Naphthalene	(8310)										
Anthracene	(8310)										
HMX	(8330)										
2,4,6-Trinitrotoluene	(8330)										
Phorate	(8141A)										
Malathion	(8141A)										
Formaldehyde	(8315A)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803 C51

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: ___ GC ___ HPLC

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

Concentration= (A)(Fv)(Df) / (RF)(Vs or Ws)(%S/100)

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. 6 Compound Name Methane

Concentration = (792570)(4) / (34528.1) = 91.82 ≈ 92 ug/L

#	Sample ID	Compound	Reported Concentrations (ug/L)	Recalculated Results Concentrations ( )	Qualifications
	6	Methane	92		

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 8, 2016

Parameters: Volatiles

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-054	15L186-01	Water	12/18/15
IR70-A15-097**	15L186-02**	Water	12/18/15
IR70-A15-055	15L186-03	Water	12/18/15
IR70-A15-024	15L186-04	Water	12/18/15
IR70-A15-024DL	15L186-04DL	Water	12/18/15
IR70-A15-025	15L186-05	Water	12/18/15
IR70-A15-027	15L186-06	Water	12/18/15
IR70-A15-029	15L186-07	Water	12/18/15
IR70-A15-029DL	15L186-07DL	Water	12/18/15
IR70-A15-026	15L186-08	Water	12/18/15
IR70-A15-026DL	15L186-08DL	Water	12/18/15
IR70-A15-067	15L186-09	Water	12/18/15
IR70-A15-063	15L186-10	Water	12/18/15
IR70-A15-104	15L186-11	Water	12/18/15
IR70-A15-111	15L186-12	Water	12/18/15
IR70-A15-030	15L186-13	Water	12/18/15
IR70-A15-047	15L186-14	Water	12/18/15
IR70-A15-047DL	15L186-14DL	Water	12/18/15
IR70-A15-048	15L186-15	Water	12/18/15
IR70-A15-051	15L186-16	Water	12/18/15
IR70-A15-051DL	15L186-16DL	Water	12/18/15
IR70-A15-058	15L186-17	Water	12/18/15
IR70-A15-058DL	15L186-17DL	Water	12/18/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Volatile Organic Compounds (VOCs) by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A bromofluorobenzene (BFB) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

Percent relative standard deviations (%RSD) were less than or equal to 15.0% for each individual compound and less than or equal to 30.0% for calibration check compounds (CCCs).

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Sample IR70-A15-104 was identified as a trip blank. No contaminants were found.

Sample IR70-A15-111 was identified as an equipment rinsate. No contaminants were found.

Sample IR70-A15-108 (From SDG 15L198) was identified as a source blank. No contaminants were found.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples IR70-A15-054 and IR70-A15-097** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	IR70-A15-054	IR70-A15-097**	
cis-1,2-Dichloroethene	5.1	5.2	2
trans-1,2-Dichloroethene	12	12	0
Trichloroethene	0.42	0.41	2
Vinyl chloride	21	20	5

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
IR70-A15-024 IR70-A15-029 IR70-A15-026 IR70-A15-051	cis-1,2-Dichloroethene Vinyl chloride	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects)	A
IR70-A15-047	Acetone	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A
IR70-A15-058	cis-1,2-Dichloroethene	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A

Raw data were not reviewed for Level III validation.

XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Compound	Flag	A or P
IR70-A15-024 IR70-A15-029 IR70-A15-026 IR70-A15-051	cis-1,2-Dichloroethene Vinyl chloride	R R	A
IR70-A15-024DL IR70-A15-029DL IR70-A15-026DL IR70-A15-051DL	All TCL compounds except cis-1,2-Dichloroethene Vinyl chloride	R	A
IR70-A15-047	Acetone	R	A
IR70-A15-047DL	All TCL compounds except Acetone	R	A

Sample	Compound	Flag	A or P
IR70-A15-058	cis-1,2-Dichloroethene	R	A
IR70-A15-058DL	All TCL compounds except cis-1,2-Dichloroethene	R	A

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Volatiles - Data Qualification Summary - SDG 15L186

Sample	Compound	Flag	A or P	Reason
IR70-A15-024 IR70-A15-029 IR70-A15-026 IR70-A15-051	cis-1,2-Dichloroethene Vinyl chloride	R R	A	Overall assessment of data
IR70-A15-024DL IR70-A15-029DL IR70-A15-026DL IR70-A15-051DL	All TCL compounds except cis-1,2-Dichloroethene Vinyl chloride	R	A	Overall assessment of data
IR70-A15-047	Acetone	R	A	Overall assessment of data
IR70-A15-047DL	All TCL compounds except Acetone	R	A	Overall assessment of data
IR70-A15-058	cis-1,2-Dichloroethene	R	A	Overall assessment of data
IR70-A15-058DL	All TCL compounds except cis-1,2-Dichloroethene	R	A	Overall assessment of data

Seal Beach, IR Site 70
Volatiles - Laboratory Blank Data Qualification Summary - SDG 15L186

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Volatiles - Field Blank Data Qualification Summary - SDG 15L186

No Sample Data Qualified in this SDG

LDC #: 35803D1 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/04/16
SDG #: 15L186 Level III/IV Page: 1 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer: JVB
2nd Reviewer: [illegible]

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A, A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A, A	ICAL ≤ 15/30 % ICV ≤ 20 %
IV.	Continuing calibration	A	CCV ≤ 20 %
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 4 ER = 15 SB = IR70-A15-108 (from 15L198)
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	SW	D = 1/2
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation.
XIII.	Target compound identification	A	Not reviewed for Level III validation.
XIV.	System performance	A	Not reviewed for Level III validation.
XV.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER: ER = Equipment Rinse

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-054 D	15L186-01	Water	12/18/15
2	IR70-A15-097** D	15L186-02**	Water	12/18/15
3	IR70-A15-055	15L186-03	Water	12/18/15
4	IR70-A15-024	15L186-04	Water	12/18/15
5	IR70-A15-024DL	15L186-04DL	Water	12/18/15
6	IR70-A15-025	15L186-05	Water	12/18/15
7	2 IR70-A15-027	15L186-06	Water	12/18/15
8	IR70-A15-029	15L186-07	Water	12/18/15
9	IR70-A15-029DL	15L186-07DL	Water	12/18/15
10	IR70-A15-026	15L186-08	Water	12/18/15
11	IR70-A15-026DL	15L186-08DL	Water	12/18/15
12	2 IR70-A15-067	15L186-09	Water	12/18/15
13	2 IR70-A15-063	15L186-10	Water	12/18/15

LDC #: 35803D1 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/04/16
SDG #: 15L186 Level III/IV Page: 2 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer: SVB
2nd Reviewer: R

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

	Client ID	Lab ID	Matrix	Date
14 2	IR70-A15-104	15L186-11	Water	12/18/15
15 2	IR70-A15-111	15L186-12	Water	12/18/15
16 2	IR70-A15-030	15L186-13	Water	12/18/15
17	IR70-A15-047	15L186-14	Water	12/18/15
18 2	IR70-A15-047DL	15L186-14DL	Water	12/18/15
19 2	IR70-A15-048	15L186-15	Water	12/18/15
20	IR70-A15-051	15L186-16	Water	12/18/15
21	IR70-A15-051DL	15L186-16DL	Water	12/18/15
22	IR70-A15-058	15L186-17	Water	12/18/15
23	IR70-A15-058DL	15L186-17DL	Water	12/18/15
24				
25				
26				
27				

Notes:

1	MBLK1W						
2	2W						

LDC #: 35803 D1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?		✓		
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) ≥ 0.05?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?	✓			
Were target compounds detected in the field blanks?		✓		
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	✓			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			✓	

LDC #: 35803D1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?		✓		
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

TARGET COMPOUND WORKSHEET

METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane
C. Vinyl choride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO.1,1-Difluoroethane	O1. 3-Methylpentane
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3- Trimethylbutane
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methyl cyclohexane	T1. 2-Methylhexane
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.

LDC#: 35803D1

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GCMS VOA (EPA SW 846 Method 8260B)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD
	1	2	
QQQ	5.1	5.2	2
PPP	12	12	0
S	0.42	0.41	2
C	21	20	5

V:\Josephine\FIELD DUPLICATES\35803D1 ecc seal beach.wpd

LDC #: 35803D1

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Date	Sample ID	Compound	Finding	Qualifications
		4, 8, 10, 20	QQQ, C	> cal range	J dets
		17	F		
		22	QQQ		

Comments: See sample calculation verification worksheet for recalculations

LDC #: 35803D1

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.
Y N N/A Was the overall quality and usability of the data acceptable?

#	Date	Sample ID	Compound	Finding	Qualifications
		4, 8, 10, 20	QQQ, C	> cal range	R A
		5, 9, 11, 21	All except above	dil	
		17	F	> cal range	
		18	All except F	dil	
		22	QQQ	> cal range	
		23	All except QQQ	dil	✓

Comments:

LDC #: 35803D1

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound,
S= Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 50 std)	Recalculated RRF (RRF 50 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL TOF5	11/9/2015	cis-1,2-DCE (IS1)	0.327	0.327	0.303	0.303	6.92	6.88
			Toluene (IS2)	1.588	1.588	1.481	1.481	7.86	7.86
			1,1,2,2-TCA (IS3)	0.376	0.376	0.356	0.356	6.62	6.60

LDC # 35803D1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported % D	Recalculated %D
1	RLY208 TOF5	12/21/2015	cis-1,2-DCE (IS1)	0.303	0.297	0.297	2.0	2.0
			Toluene (IS2)	1.481	1.426	1.426	3.7	3.7
			1,1,2,2-TCA (IS3)	0.356	0.363	0.363	2.0	2.0

LDC #: 35803D1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: TL

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 2

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4	10.0	10.20	102	102	0
Toluene-d8	✓	10.18	102	102	✓
Bromofluorobenzene	✓	10.04	100	100	✓

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

LDC #: 35803 D1

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboraotry control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS ID: LCS D1V

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
1,1-Dichloroethene	10.0	10.0	9.90	10.6	99	99	106	106	7	7
Trichloroethene			9.95	10.8	99	99	108	108	8	8
Benzene			10.2	10.8	102	102	108	108	6	6
Toluene			9.78	10.5	98	98	105	105	7	7
Chlorobenzene			10.2	10.9	102	102	109	109	6	6

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803D1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
RRF	=	Relative response factor of the calibration standard.
V_o	=	Volume or weight of sample pruged in milliliters (ml) or grams (g).
Df	=	Dilution factor.
%S	=	Percent solids, applicable to soils and solid matrices only.

Example:

Sample I.D. 2, QQQ

Conc. = (25'000 4)(10)( )
(1599127)(0.303)( )( )

= 5.16

≈ 5.2 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
	2	QQQ	5.2		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 19, 2016

Parameters: Dissolved Metals

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-054	15L186-01	Water	12/18/15
IR70-A15-097**	15L186-02**	Water	12/18/15
IR70-A15-055	15L186-03	Water	12/18/15
IR70-A15-024	15L186-04	Water	12/18/15
IR70-A15-025	15L186-05	Water	12/18/15
IR70-A15-111	15L186-12	Water	12/18/15
IR70-A15-047	15L186-14	Water	12/18/15
IR70-A15-048	15L186-15	Water	12/18/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Arsenic, Iron, and Manganese by Environmental Protection Agency (EPA) SW 846 Method 6010B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

Sample IR70-A15-111 was identified as an equipment rinsate. No contaminants were found.

Sample IR70-A15-108 (from SDG 15L198) was identified as a source blank. No contaminants were found.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Serial Dilution

Serial dilution analysis was performed on an associated project sample. The analysis criteria were met.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples IR70-A15-054 and IR70-A15-097** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD
	IR70-A15-054	IR70-A15-097**	
Iron	0.242	0.183	28
Manganese	0.483	0.467	3

XI. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Dissolved Metals - Data Qualification Summary - SDG 15L186

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Dissolved Metals - Laboratory Blank Data Qualification Summary - SDG 15L186

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Dissolved Metals - Field Blank Data Qualification Summary - SDG 15L186

No Sample Data Qualified in this SDG

mg

LDC #: 35803D4b

SDG #: 15L186

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 2-8-16

Page: 1 of 1

Reviewer: MG

2nd Reviewer: R

METHOD: Metals (EPA SW 846 Method 6010B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
~~II.~~	~~ICP/MS Tune~~		
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	ND	ER = 6 SB= IR70-A15-108 (15L198)
VII.	Matrix Spike/Matrix Spike Duplicates	N	client specified
VIII.	Duplicate sample analysis	N	" "
IX.	ICP Serial Dilution	A	
X.	Laboratory control samples	A	LCS/LCSD
XI.	Field Duplicates	SW	D = 1+2
~~XII.~~	~~Internal Standard (ICP-MS)~~		
XIII.	Sample Result Verification	A	Not reviewed for Level III validation.
XIV	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-054	15L186-01	Water	12/18/15
2	IR70-A15-097**	15L186-02**	Water	12/18/15
3	IR70-A15-055	15L186-03	Water	12/18/15
4	IR70-A15-024	15L186-04	Water	12/18/15
5	IR70-A15-025	15L186-05	Water	12/18/15
6	IR70-A15-111	15L186-12	Water	12/18/15
~~7~~	~~IR70-A15-030~~	~~15L186-13~~	~~Water~~	~~12/18/15~~
8	IR70-A15-047	15L186-14	Water	12/18/15
9	IR70-A15-048	15L186-15	Water	12/18/15
10				
11				
12				
13	PBW			

Notes:

LDC #: 35803D4b

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: [illegible]

Method: Metals (EPA SW 846 Method 6010/7000/6020)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. ICP/MS Tune				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?			✓	
Were %RSD of isotopes in the tuning solution ≤5%?			✓	
III. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury) QC limits?	✓			
Were all initial calibration correlation coefficients > 0.995?	✓			
IV. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	✓			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	✓			
VI. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.			✓	
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were ≤ 5X the RL.			✓	
VII. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% QC limits for water samples and laboratory established QC limits for soils?	✓			

LDC #: 35803D4b

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: JL

Validation Area	Yes	No	NA	Findings/Comments
VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)				
Were all the percent recoveries (%R) within the 30-120% (6020)/60-125% (200.8) of the intensity of the internal standard in the associated initial calibration?			✓	
If the %Rs were outside the criteria, was a reanalysis performed?			✓	
IX. ICP Serial Dilution				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the MDL (ICP)/>100X the MDL(ICP/MS)?	✓			
Were all percent differences (%Ds) < 10%?	✓			
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.		✓		
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XII. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
XIII. Field blanks				
Field blanks were identified in this SDG.	✓			
Target analytes were detected in the field blanks.		✓		

LDC #: 35803D4b

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Page: 1 of 1
Reviewer: MG
2nd reviewer: M

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1→6, 8, 9	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
Analysis Method		
ICP	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
ICP-MS		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
GFAA		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____

Comments: Mercury by CVAA if performed

LDC#: 35803D4b

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: MG
2nd Reviewer: AL

METHOD: Metals (EPA Method 6010B)

Analyte	Concentration (mg/L)		RPD	
	1	2		
Iron	0.242	0.183	28	
Manganese	0.483	0.467	3	

V:\FIELD DUPLICATES\FD_inorganic\35803D4b.WPD

LDC #: 35803D46

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: MG
2nd Reviewer: R

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

An initial and continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

$$\%R = \frac{Found}{True} \times 100$$

Where, Found = concentration (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution
True = concentration (in ug/L) of each analyte in the ICV or CCV source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalculated %R	Reported %R	Acceptable (Y/N)
1507 ICV	ICP (Initial calibration)	Mn	2497.0	2500	100	100	Y
	ICP/MS (Initial calibration)						↓
	CVAA (Initial calibration)						↓
2004 CCV9	ICP (Continuing calibration)	Fe	23702	25000	95	95	↓
	ICP/MS (Continuing calibration)						
	CVAA (Continuing calibration)						
	GFAA (Initial calibration)						
	GFAA (Continuing calibation)						

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803D4b

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: [illegible]

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Percent recoveries (%R) for an ICP interference check sample, a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$

Where, Found = Concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = Concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$

Where, S = Original sample concentration
D = Duplicate sample concentration

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

$\%D = \frac{|I-SDR|}{I} \times 100$

Where, I = Initial Sample Result (mg/L)
SDR = Serial Dilution Result (mg/L) (Instrument Reading x 5)

Sample ID	Type of Analysis	Element	Found / S / I (units)	True / D / SDR (units)	Recalculated %R / RPD / %D	Reported %R / RPD / %D	Acceptable (Y/N)
1529 ICSAB	ICP interference check	Mn	0.467 (mg/L)	0.5 (mg/L)	93	93	Y
1903 LCS	Laboratory control sample	As	0.517 (mg/L)	0.5 (mg/L)	103	103	↓
–	Matrix spike	–	(SSR-SR) –	–	–	–	–
–	Duplicate	–	–	–	–	–	–
IR70-A15-1	ICP serial dilution 10	As	ND (mg/L)	ND (mg/L)	0	0	Y

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803D46

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: MG
2nd reviewer: AC

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Have results been reported and calculated correctly?
(Y) N N/A Are results within the calibrated range of the instruments and within the linear range of the ICP?
(Y) N N/A Are all detection limits below the CRDL?

Detected analyte results for #2, Fe were recalculated and verified using the following equation:

Concentration = $\frac{(RD)(FV)(Dil)}{(In.\ Vol.)}$

RD = Raw data concentration
FV = Final volume (ml)
In. Vol. = Initial volume (ml) or weight (G)
Dil = Dilution factor

Recalculation:

$$\frac{(0.18304\ mg/L)(0.050\ L)}{0.050\ L} = 0.18304\ mg/L$$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
1	2	Fe	0.183	0.183	Y

Note:

RECALC.4SW

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 9, 2016

Parameters: Wet Chemistry

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-054	15L186-01	Water	12/18/15
IR70-A15-097**	15L186-02**	Water	12/18/15
IR70-A15-055	15L186-03	Water	12/18/15
IR70-A15-024	15L186-04	Water	12/18/15
IR70-A15-025	15L186-05	Water	12/18/15
IR70-A15-027	15L186-06	Water	12/18/15
IR70-A15-029	15L186-07	Water	12/18/15
IR70-A15-026	15L186-08	Water	12/18/15
IR70-A15-063	15L186-10	Water	12/18/15
IR70-A15-030	15L186-13	Water	12/18/15
IR70-A15-047	15L186-14	Water	12/18/15
IR70-A15-048	15L186-15	Water	12/18/15
IR70-A15-051	15L186-16	Water	12/18/15
IR70-A15-058	15L186-17	Water	12/18/15
IR70-A15-024MS	15L186-04MS	Water	12/18/15
IR70-A15-024MSD	15L186-04MSD	Water	12/18/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Alkalinity by Standard Method 2320B
Bromide, Chloride, Nitrate as Nitrogen, Nitrite as Nitrogen, and Sulfate by Environmental Protection Agency (EPA) Method 300.0
Organic Acids by EPA Method 300.0 Modified
Sulfide by Standard Method 4500-S2 F
Total Dissolved Solids by Standard Method 2540C
Total Organic Carbon by Standard Method 5310B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

Samples IR70-A15-054 and IR70-A15-097** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD
	IR70-A15-054	IR70-A15-097**	
Alkalinity	380	387	2
Bromide	24.6	25.4	3
Chloride	6630	6980	5
Sulfate	750	733	2
Sulfide	63.2	58.4	8
Total dissolved solids	13400	13100	2
Total organic carbon	25.6	28.4	10

X. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Wet Chemistry - Data Qualification Summary - SDG 15L186

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 15L186

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Wet Chemistry - Field Blank Data Qualification Summary - SDG 15L186

No Sample Data Qualified in this SDG

LDC #: 35803D6

SDG #: 15L186

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 2-8-16

Page: 1 of 2

Reviewer: MG

2nd Reviewer: [illegible]

METHOD: (Analyte) Alkalinity (SM2320B), Bromide, Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA Method 300.0), Organic Acids (EPA Method 300.0M), ~~Sulfate~~ Sulfide (SM4500-S2 F), TDS (SM2540C), TOC (SM5310B)

MG

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	MS/MSD
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS/LCSD
IX.	Field duplicates	SW	D= 1+2
X.	Sample result verification	A	Not reviewed for Level III validation.
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-054	15L186-01	Water	12/18/15
2	IR70-A15-097**	15L186-02**	Water	12/18/15
3	IR70-A15-055	15L186-03	Water	12/18/15
4	IR70-A15-024	15L186-04	Water	12/18/15
5	IR70-A15-025	15L186-05	Water	12/18/15
6	IR70-A15-027	15L186-06	Water	12/18/15
7	IR70-A15-029	15L186-07	Water	12/18/15
8	IR70-A15-026	15L186-08	Water	12/18/15
9	IR70-A15-063	15L186-10	Water	12/18/15
10	IR70-A15-030	15L186-13	Water	12/18/15
11	IR70-A15-047	15L186-14	Water	12/18/15
12	IR70-A15-048	15L186-15	Water	12/18/15
13	IR70-A15-051	15L186-16	Water	12/18/15
14	IR70-A15-058	15L186-17	Water	12/18/15
15	IR70-A15-024MS	15L186-04MS	Water	12/18/15
16	IR70-A15-024MSD	15L186-04MSD	Water	12/18/15

LDC #: 35803D6

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 2-8-16

SDG #: 15L186

Page: 2 of 2

Laboratory: EMAX Laboratories, Inc.

Reviewer: MG

2nd Reviewer: [illegible]

METHOD: (Analyte) Alkalinity (SM2320B), Bromide, Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA Method 300.0), Organic Acids (EPA Method 300.0M), Sulfate (SM4500-S2 F), TDS (SM2540C), TOC (SM5310B)

	Client ID	Lab ID	Matrix	Date
17				
18				
19	PBW1			
20	PBW2			

Notes:

LDC #: 35803D6

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: R

Method: Inorganics (EPA Method see cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	✓			
Were titrant checks performed as required? (Level IV only)	✓			
Were balance checks performed as required? (Level IV only)	✓			
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
IV. Matrix spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL(≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.	✓			
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	✓			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

LDC #: 35803D6

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: AL

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were detection limits < RL?	✓			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
X. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 35803D6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: MG
2nd reviewer: N

All circled methods are applicable to each sample.

Sample ID	Matrix	Parameter
1→5, 11, 12	W	pH (TDS) (Cl) F (NO3) (NO2) (SO4) PO4 (ALK) CN- NH3 TKN (TOC) CR6+ ClO4 (Br) (Org Acid) (S=)
6→10, 13, 14	↓	pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ (Org Acid)
QC 15, 16	↓	pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN (TOC) CR6+ ClO4 ____ (Org Acid)
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____
		pH TDS Cl F NO3 NO2 SO4 PO4 ALK CN- NH3 TKN TOC CR6+ ClO4 ____ ____

Comments: _____

LDC#: 35803D6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: MG
2nd Reviewer: [illegible]

Inorganics, Method See Cover

Analyte	Concentration (mg/L)		RPD	
	1	2		
Alkalinity	380	387	2	
Bromide	24.6	25.4	3	
Chloride	6630	6980	5	
Sulfate	750	733	2	
Sulfide	63.2	58.4	8	
TDS	13400	13100	2	
Total organic Carbon	25.6	28.4	10	

V:\FIELD DUPLICATES\FD_inorganic\35803D6.WPD

LDC #: 35803D6

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: MG
2nd Reviewer: SK

METHOD: Inorganics, Method see cover

The correlation coefficient (r) for the calibration of NO_3-N was recalculated. Calibration date: 12-14-15

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found / True x 100 Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution
True = concentration of each analyte in the ICV or CCV source

Type of Analysis	Analyte	Standard ID	Area Found (units)	Conc. True (units)	Recalculated r or %R	Reported r or %R	Acceptable (Y/N)
Initial calibration	NO_3-N	Blank	-	-	r=0.998966	r=0.998967	Y
		Standard 1	1.54	0.05 (mg/L)			
		Standard 2	3.074	0.10 ( )			
		Standard 3	6.439	0.20 ( )			
		Standard 4	17.32	0.50 ( )			
		Standard 5	37.55	1.00 ( )			
		Standard 6	82.11	2.00 ( )			
		Standard 7	-	-			
Calibration verification	Acetate	CCV44	1.575 (mg/L)	1.5 (mg/L)	105	105	
Calibration verification	Propionate	CCV44	1.567 (mg/L)	1.5 (mg/L)	104	104	
Calibration verification	TOC	CCV7	24.44 (mg/L)	25.0 (mg/L)	97.8	not reported	

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803D6

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: R

METHOD: Inorganics, Method see cover

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$ Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$ Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
LCS	Laboratory control sample	Sulfide	1.96 (mg/L)	2.0 (mg/L)	98	98	Y
2308 15	Matrix spike sample	Butyrate	(SSR-SR) 9.40 (mg/L)	10 (mg/L)	94	94	↓
2308/0036 15/16	Duplicate sample	Lactate	10.62 (mg/L)	9.93 (mg/L)	7	7	↓

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803D6

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: MG
2nd reviewer: R

METHOD: Inorganics, Method See cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments?
Y N N/A Are all detection limits below the CRQL?

Compound (analyte) results for #2, Sulfide reported with a positive detect were recalculated and verified using the following equation:

Concentration =

Iodine N = 0.0252
$Na_2S_2O_3$ N = 0.025
ml sample = 5

Recalculation:

$$S = \frac{[(2.5\,ml \times 0.0252\,N) - (1.79\,ml \times 0.025\,N)] \times 16000}{5\,ml}$$

$$= 58.4\ mg/L$$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
1	2	SO4	733	733	Y
		Total Alk	387	386	
		TDS	13100	13100	
		Sulfide	58.4	58.4	
		TOC	28.4	28.4	

Note: method 300.0(M) is N.D. for level IV sample

RECALC.6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 8, 2016

Parameters: Methane, Ethane, & Ethene

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L186

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-054	15L186-01	Water	12/18/15
IR70-A15-054DL	15L186-01DL	Water	12/18/15
IR70-A15-097**	15L186-02**	Water	12/18/15
IR70-A15-097DL**	15L186-02DL**	Water	12/18/15
IR70-A15-055	15L186-03	Water	12/18/15
IR70-A15-055DL	15L186-03DL	Water	12/18/15
IR70-A15-024	15L186-04	Water	12/18/15
IR70-A15-024DL	15L186-04DL	Water	12/18/15
IR70-A15-025	15L186-05	Water	12/18/15
IR70-A15-025DL	15L186-05DL	Water	12/18/15
IR70-A15-027	15L186-06	Water	12/18/15
IR70-A15-027DL	15L186-06DL	Water	12/18/15
IR70-A15-029	15L186-07	Water	12/18/15
IR70-A15-029DL1	15L186-07DL1	Water	12/18/15
IR70-A15-026	15L186-08	Water	12/18/15
IR70-A15-026DL	15L186-08DL	Water	12/18/15
IR70-A15-063	15L186-10	Water	12/18/15
IR70-A15-104	15L186-11	Water	12/18/15
IR70-A15-111	15L186-12	Water	12/18/15
IR70-A15-030	15L186-13	Water	12/18/15
IR70-A15-030DL	15L186-13DL	Water	12/18/15
IR70-A15-047	15L186-14	Water	12/18/15
IR70-A15-047DL	15L186-14DL	Water	12/18/15
IR70-A15-048	15L186-15	Water	12/18/15
IR70-A15-048DL	15L186-15DL	Water	12/18/15
IR70-A15-051	15L186-16	Water	12/18/15
IR70-A15-051DL	15L186-16DL	Water	12/18/15

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-058	15L186-17	Water	12/18/15
IR70-A15-058DL	15L186-17DL	Water	12/18/15
IR70-A15-029DL2	15L186-07DL2	Water	12/18/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Methane, Ethane, and Ethene by Method RSK-175

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Retention time windows were established as required by the method for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

Retention times of all compounds in the calibration standards were within the established retention time windows for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

Sample IR70-A15-104 was identified as a trip blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-104	12/18/15	Methane	0.52 ug/L	IR70-A15-054 IR70-A15-054DL IR70-A15-097** IR70-A15-097DL** IR70-A15-055 IR70-A15-055DL IR70-A15-024 IR70-A15-024DL IR70-A15-025 IR70-A15-025DL IR70-A15-027 IR70-A15-027DL IR70-A15-029 IR70-A15-029DL1 IR70-A15-026 IR70-A15-026DL IR70-A15-063 IR70-A15-111 IR70-A15-030 IR70-A15-030DL IR70-A15-047 IR70-A15-047DL IR70-A15-048 IR70-A15-048DL IR70-A15-051 IR70-A15-051DL IR70-A15-058 IR70-A15-058DL IR70-A15-029DL2

Sample IR70-A15-111 was identified as an equipment rinsate. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-111	12/18/15	Methane	0.47 ug/L	IR70-A15-054 IR70-A15-054DL IR70-A15-097** IR70-A15-097DL** IR70-A15-055 IR70-A15-055DL IR70-A15-024 IR70-A15-024DL IR70-A15-025 IR70-A15-025DL IR70-A15-027 IR70-A15-027DL IR70-A15-029 IR70-A15-029DL1 IR70-A15-026 IR70-A15-026DL IR70-A15-063 IR70-A15-030 IR70-A15-030DL IR70-A15-047 IR70-A15-047DL IR70-A15-048 IR70-A15-048DL IR70-A15-051 IR70-A15-051DL IR70-A15-058 IR70-A15-058DL IR70-A15-029DL2

Sample IR70-A15-108 (from SDG 15L198) was identified as a source blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-108	12/22/15	Methane	0.50 ug/L	IR70-A15-111

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
IR70-A15-111	Methane	0.47 ug/L	0.47U ug/L

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Field Duplicates

Samples IR70-A15-054 and IR70-A15-097** and samples IR70-A15-054DL and IR70-A15-097DL** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	IR70-A15-054	IR70-A15-097**	
Ethane	0.88	0.87	1
Ethene	24	24	0
Methane	690	680	1

Compound	Concentration (ug/L)		RPD
	IR70-A15-054DL	IR70-A15-097DL**	
Methane	19000	22000	15

IX. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
IR70-A15-054 IR70-A15-097** IR70-A15-055 IR70-A15-024 IR70-A15-025 IR70-A15-027 IR70-A15-029DL1 IR70-A15-026 IR70-A15-030 IR70-A15-047 IR70-A15-048 IR70-A15-051 IR70-A15-058	Methane	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A
IR70-A15-029	Ethene Methane	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects)	A

Raw data were not reviewed for Level III validation.

X. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Compound	Flag	A or P
IR70-A15-054 IR70-A15-097** IR70-A15-055 IR70-A15-024 IR70-A15-025 IR70-A15-027 IR70-A15-026 IR70-A15-030 IR70-A15-047 IR70-A15-048 IR70-A15-051 IR70-A15-058	Methane	R	A
IR70-A15-054DL IR70-A15-097DL** IR70-A15-055DL IR70-A15-024DL IR70-A15-025DL IR70-A15-027DL IR70-A15-026DL IR70-A15-030DL IR70-A15-047DL IR70-A15-048DL IR70-A15-051DL IR70-A15-058DL IR70-A15-029DL2	All TCL compounds except Methane	R	A
IR70-A15-029	Ethene Methane	R R	A
IR70-A15-029DL1	All TCL compounds except Ethene	R	A

Due to trip blank and source blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Data Qualification Summary - SDG 15L186

Sample	Compound	Flag	A or P	Reason
IR70-A15-054 IR70-A15-097** IR70-A15-055 IR70-A15-024 IR70-A15-025 IR70-A15-027 IR70-A15-026 IR70-A15-030 IR70-A15-047 IR70-A15-048 IR70-A15-051 IR70-A15-058	Methane	R	A	Overall assessment of data
IR70-A15-054DL IR70-A15-097DL** IR70-A15-055DL IR70-A15-024DL IR70-A15-025DL IR70-A15-027DL IR70-A15-026DL IR70-A15-030DL IR70-A15-047DL IR70-A15-048DL IR70-A15-051DL IR70-A15-058DL IR70-A15-029DL2	All TCL compounds except Methane	R	A	Overall assessment of data
IR70-A15-029	Ethene Methane	R R	A	Overall assessment of data
IR70-A15-029DL1	All TCL compounds except Ethene	R	A	Overall assessment of data

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Laboratory Blank Data Qualification Summary - SDG 15L186

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Field Blank Data Qualification Summary - SDG 15L186

Sample	Compound	Modified Final Concentration	A or P
IR70-A15-111	Methane	0.47U ug/L	A

LDC #: 35803D51 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/03/16
SDG #: 15L186 Level III/IV Page: 1 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	ICAL ≤ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	SW	TB = 18 ER = 19 SB = IR70-A15-108 (from 15L198)
VI.	Surrogate spikes	N	Not reqd.
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LCS/D
IX.	Field duplicates	SW	D = 1/3, 2/4
X.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation.
XI.	Target compound identification	A	Not reviewed for Level III validation.
XII.	System performance	A	Not reviewed for Level III validation.
XIII.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER: ER= Equipment Rinse

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-054 D1	15L186-01	Water	12/18/15
2	IR70-A15-054DL D2	15L186-01DL	Water	12/18/15
3	IR70-A15-097** D1	15L186-02**	Water	12/18/15
4	IR70-A15-097DL** D2	15L186-02DL**	Water	12/18/15
5	IR70-A15-055	15L186-03	Water	12/18/15
6	IR70-A15-055DL	15L186-03DL	Water	12/18/15
7	2 IR70-A15-024	15L186-04	Water	12/18/15
8	2 IR70-A15-024DL	15L186-04DL	Water	12/18/15
9	2 IR70-A15-025	15L186-05	Water	12/18/15
10	2 IR70-A15-025DL	15L186-05DL	Water	12/18/15
11	2 IR70-A15-027	15L186-06	Water	12/18/15
12	2 IR70-A15-027DL	15L186-06DL	Water	12/18/15
13	IR70-A15-029	15L186-07	Water	12/18/15
14	IR70-A15-029DL	15L186-07DL	Water	12/18/15
15	2 IR70-A15-026	15L186-08	Water	12/18/15
16	2 IR70-A15-026DL	15L186-08DL	Water	12/18/15

LDC #: 35803D51 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/03/16
SDG #: 15L186 Level III/IV Page: 2 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer: JG
2nd Reviewer: JC

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

	Client ID	Lab ID	Matrix	Date
17 2	IR70-A15-063	15L186-10	Water	12/18/15
18 2	IR70-A15-104	15L186-11	Water	12/18/15
19 2	IR70-A15-111	15L186-12	Water	12/18/15
20 2	IR70-A15-030	15L186-13	Water	12/18/15
21 2	IR70-A15-030DL	15L186-13DL	Water	12/18/15
22	IR70-A15-047	15L186-14	Water	12/18/15
23	IR70-A15-047DL	15L186-14DL	Water	12/18/15
24	IR70-A15-048	15L186-15	Water	12/18/15
25	IR70-A15-048DL	15L186-15DL	Water	12/18/15
26 2	IR70-A15-051	15L186-16	Water	12/18/15
27 2	IR70-A15-051DL	15L186-16DL	Water	12/18/15
28 2	IR70-A15-058	15L186-17	Water	12/18/15
29 2	IR70-A15-058DL	15L186-17DL	Water	12/18/15
30	13DL 2	↓ -07DL2	↓	↓
31				
32				
33				

Notes:

1	MBLK 1W						
2	↓ 2W						

LDC #: 35803 D51

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: ✓

Method: ✓ GC ____ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥0.990?		✓		
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. Field Blanks				
Were field blanks identified in this SDG?	✓			
Were target compounds detected in the field blanks?	✓			
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?			✓	
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

LDC #: 35803 D51

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 35803 D51

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: / **GC** __ **HPLC**

Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?

Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 12/18/15
Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: _____

Associated Samples: All except 18

Compound	Blank ID	Blank ID	Sample Identification							
	18		19							
Methane	0.52		0.47/U							
CRQL										

Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 12/18/15
Field blank type: (circle one) Field Blank / Trip Blank/ Atmospheric Blank/ Ambient Blank Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: EFR

Associated Samples: All except 18, 19 (> 5x)

Compound	Blank ID	Blank ID	Sample Identification							
	19									
Methane	0.47									
CRQL										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with compound concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC #: 35803 D5

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: / **GC** __ **HPLC**
Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?
Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 12/22/15
Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: Associated Samples: 19

Compound	Blank ID	Blank ID	Sample Identification							
IRT	70-A15-108		19							
Methane	0.50		0.47/U							
CRQL										

Blank units: _____ **Associated sample units:** _____
Sampling date: _____
Field blank type: (circle one) Field Blank / Trip Blank/ Atmospheric Blank/ Ambient Blank Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: Associated Samples: _____

Compound	Blank ID	Blank ID	Sample Identification							
CRQL										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with compound concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC#: 35803D51

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC MEE (Method RSK-175)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD
	1	3	
Ethane	0.88	0.87	1
Ethene	24	24	0
Methane	690	680	1

Compound	Concentration (ug/L)		RPD
	2	4	
Methane	19000	22000	15

V:\Josephine\FIELD DUPLICATES\35803D51 ecc seal beach.wpd

LDC #: 35803 D 51

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer: SC

METHOD: ✓ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Level IV/D Only
Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	> cal range	1, 3, 5, 7, 9, 11, 14, 15, 20, 22, 24, 26, 28	J dets /A
	Ethene, Methane	↓	13	↓

Comments: See sample calculation verification worksheet for recalculations

LDC #: 35803D51

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: ✓ **GC** ___ **HPLC**

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

Y N N/A Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	> cal range	1, 3, 5, 7, 9, 11, 15, 20, 22, 24, 26, 28	R/A
	All except Methane	dil	2, 4, 6, 8, 10, 12, 16, 21, 23, 25, 27, 29, 30	
	Ethene, Methane	> cal range	13	
	All except Ethene	either dil or > cal range	14	

Comments:

OVRNew1.wpd

LDC #: 35803D51

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC / HPLC _____

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C
average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where:
A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported CF (13.56 std)	Recalculated CF (13.56 std)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL GCT010	6/19/2015	Methane	31479.0	31479.4	34528.0	34528.0	13.9	13.9

LDC # 35803D51

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC ✓ HPLC_____

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	FL24002A	12/24/2015	Methane	13.56	14.40	14.40	6	6.2

LDC #: 35803D51

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG

2nd Reviewer: [illegible]

METHOD: ✓ GC __ HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration; LCS = Laboratory Control Sample; SA = Spike added; LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: LCS/D 1W

Compound		Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
		LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline	(8015)										
Diesel	(8015)										
Benzene	(8021B)										
Methane	(RSK-175)	13.6	13.6	14.7	14.4	108	108	106	106	2	2
2,4-D	(8151)										
Dinoseb	(8151)										
Naphthalene	(8310)										
Anthracene	(8310)										
HMX	(8330)										
2,4,6-Trinitrotoluene	(8330)										
Phorate	(8141A)										
Malathion	(8141A)										
Formaldehyde	(8315A)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803D51

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: / **GC** __ **HPLC**

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

Concentration= (A)(Fv)(Df) / (RF)(Vs or Ws)(%S/100)

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. 4 Compound Name Methane

Concentration = (758261)(1000) / (34528) = 219607 ≈ 22 000 ug/L

#	Sample ID	Compound	Reported Concentrations (ug/L)	Recalculated Results Concentrations ( )	Qualifications
	4	Methane	22000		

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 18, 2016

Parameters: Volatiles

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-105	15L191-01	Water	12/21/15
IR70-A15-003	15L191-02	Water	12/21/15
IR70-A15-003DL	15L191-02DL	Water	12/21/15
IR70-A15-004	15L191-03	Water	12/21/15
IR70-A15-004DL	15L191-03DL	Water	12/21/15
IR70-A15-009	15L191-04	Water	12/21/15
IR70-A15-011	15L191-05	Water	12/21/15
IR70-A15-012	15L191-06	Water	12/21/15
IR70-A15-013	15L191-07	Water	12/21/15
IR70-A15-014	15L191-08	Water	12/21/15
IR70-A15-092**	15L191-09**	Water	12/21/15
IR70-A15-076	15L191-10	Water	12/21/15
IR70-A15-078	15L191-11	Water	12/21/15
IR70-A15-077	15L191-12	Water	12/21/15
IR70-A15-074	15L191-13	Water	12/21/15
IR70-A15-072	15L191-14	Water	12/21/15
IR70-A15-075	15L191-15	Water	12/21/15
IR70-A15-073	15L191-16	Water	12/21/15
IR70-A15-070	15L191-17	Water	12/21/15
IR70-A15-066	15L191-18	Water	12/21/15
IR70-A15-098**	15L191-19**	Water	12/21/15
IR70-A15-071	15L191-20	Water	12/21/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Volatile Organic Compounds (VOCs) by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A bromofluorobenzene (BFB) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

Percent relative standard deviations (%RSD) were less than or equal to 15.0% for each individual compound and less than or equal to 30.0% for calibration check compounds (CCCs).

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Sample IR70-A15-105 was identified as a trip blank. No contaminants were found.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
IR70-A15-003	1,2-Dichloroethane-d4	122 (70-120)	All TCL compounds	J (all detects)	A
IR70-A15-004	Bromofluorobenzene	122 (75-120)	All TCL compounds	J (all detects)	A
IR70-A15-011	1,2-Dichloroethane-d4	123 (70-120)	All TCL compounds	J (all detects)	P
IR70-A15-012	Bromofluorobenzene	121 (75-120)	All TCL compounds	J (all detects)	P

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples IR70-A15-009 and IR70-A15-092 and samples IR70-A15-066 and IR70-A15-098** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	IR70-A15-009	IR70-A15-092	
cis-1,2-Dichloroethene	32	30	6
trans-1,2-Dichloroethene	0.38	0.26	38
Trichloroethene	1.9	2.1	10
Vinyl chloride	1.5	1.2	22

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
IR70-A15-003 IR70-A15-004	cis-1,2-Dichloroethene Vinyl chloride	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects)	A

Raw data were not reviewed for Level III validation.

XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Compound	Flag	A or P
IR70-A15-003 IR70-A15-004	cis-1,2-Dichloroethene Vinyl chloride	R R	A
IR70-A15-003DL IR70-A15-004DL	All TCL compounds except cis-1,2-Dichloroethene Vinyl chloride	R	A

Due to surrogate %R, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Volatiles - Data Qualification Summary - SDG 15L191

Sample	Compound	Flag	A or P	Reason
IR70-A15-003 IR70-A15-004 IR70-A15-011 IR70-A15-012	All TCL compounds	J (all detects)	P	Surrogate spikes (%R)
IR70-A15-003 IR70-A15-004	cis-1,2-Dichloroethene Vinyl chloride	R R	A	Overall assessment of data
IR70-A15-003DL IR70-A15-004DL	All TCL compounds except cis-1,2-Dichloroethene Vinyl chloride	R	A	Overall assessment of data

Seal Beach, IR Site 70
Volatiles - Laboratory Blank Data Qualification Summary - SDG 15L191

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Volatiles - Field Blank Data Qualification Summary - SDG 15L191

No Sample Data Qualified in this SDG

LDC #: 35803E1

SDG #: 15L191

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 02/09/16

Page: 1 of 2

Reviewer: SVG

2nd Reviewer: R

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 15/30? ICV ≤ 20?
IV.	Continuing calibration	A	CCV ≤ 20?
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS LD
X.	Field duplicates	SW	D = 6/11, 20/21 *
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation.
XIII.	Target compound identification	A	Not reviewed for Level III validation.
XIV.	System performance	A	Not reviewed for Level III validation.
XV.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; * ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-105	15L191-01	Water	12/21/15
2	IR70-A15-003	15L191-02	Water	12/21/15
3	IR70-A15-003DL	15L191-02DL	Water	12/21/15
4	IR70-A15-004	15L191-03	Water	12/21/15
5	IR70-A15-004DL	15L191-03DL	Water	12/21/15
6	IR70-A15-009 D1	15L191-04	Water	12/21/15
7	IR70-A15-011	15L191-05	Water	12/21/15
8	IR70-A15-012	15L191-06	Water	12/21/15
9	IR70-A15-013	15L191-07	Water	12/21/15
10	IR70-A15-014	15L191-08	Water	12/21/15
11	IR70-A15-092 ** D1	15L191-09	Water	12/21/15
12	IR70-A15-076	15L191-10	Water	12/21/15
13	IR70-A15-078	15L191-11	Water	12/21/15

LDC #: 35803E1 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/04/16
SDG #: 15L191 Level III/IV Page: 2 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer:
2nd Reviewer:

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

	Client ID	Lab ID	Matrix	Date
14 2	IR70-A15-077	15L191-12	Water	12/21/15
15 2	IR70-A15-074	15L191-13	Water	12/21/15
16 2	IR70-A15-072	15L191-14	Water	12/21/15
17 2	IR70-A15-075	15L191-15	Water	12/21/15
18 2	IR70-A15-073	15L191-16	Water	12/21/15
19 2	IR70-A15-070	15L191-17	Water	12/21/15
20 3	IR70-A15-066 D 2	15L191-18	Water	12/21/15
21 3	IR70-A15-098** D ✓	15L191-19**	Water	12/21/15
22 3	IR70-A15-071	15L191-20	Water	12/21/15
23				
24				
25				
26				

Notes:

1	MBLK 1W						
2	2W						
3	3W						

LDC #: 35803 E1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?		✓		
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) ≥ 0.05?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.			✓	
VI. Field blanks				
Were field blanks were identified in this SDG?	✓			
Were target compounds detected in the field blanks?		✓		
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	✓	✓		
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?		✓		

LDC #: 35803 E1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

TARGET COMPOUND WORKSHEET

METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane
C. Vinyl choride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO.1,1-Difluoroethane	O1. 3-Methylpentane
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3- Trimethylbutane
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methyl cyclohexane	T1. 2-Methylhexane
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.

LDC #: 05803 E1

VALIDATION FINDINGS WORKSHEET
Surrogate Spikes

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y (N) N/A Were all surrogate %R within QC limits?

Y (N) N/A If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R out of outside of criteria?

#	Date	Sample ID	Surrogate	%Recovery (Limits)	Qualifications
		2 (ND + Det)	DCE	122 (70-120)	J dets / A
				( )	
		4	BFB	122 (75-120)	
				( )	
		7	DCE	123 (70-120)	J dets / P
				( )	
		8	BFB	121 (75-120)	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

	QC Limits (Soil)	QC Limits (Water)
SMC1 (TOL) = Toluene-d8	85-115	85-120
SMC2 (BFB) = Bromofluorobenzene	85-120	75-120
SMC3 (DCE) = 1,2-Dichloroethane-d4	60-120	70-120
SMC4 (DFM) = Dibromofluoromethane	75-125	85-115

LDC#: 35803E1

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GCMS VOA (EPA SW 846 Method 8260B)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD
	6	11	
QQQ	32	30	6
PPP	0.38	0.26	38
S	1.9	2.1	10
C	1.5	1.2	22

V:\Josephine\FIELD DUPLICATES\35803E1 ecc seal beach.wpd

LDC #: 35803 E1

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Date	Sample ID	Compound	Finding	Qualifications
		2, 4	QQQ, C	> cal range	J dets /A

Comments: See sample calculation verification worksheet for recalculations

LDC #: 35803E1

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.
Y N N/A Was the overall quality and usability of the data acceptable?

#	Date	Sample ID	Compound	Finding	Qualifications
		2,4	QAQ, C	> cal range	RJ ~~dets~~ /A
					↓
		3,5	All except QAQ, C		

Comments:

OVR.wpd

LDC #: 35803E1

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound,
S= Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 50 std)	Recalculated RRF (RRF 50 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL TOF5	11/9/2015	cis-1,2-DCE (IS1)	0.327	0.327	0.303	0.303	6.92	6.88
			Toluene (IS2)	1.588	1.588	1.481	1.481	7.86	7.86
			1,1,2,2-TCA (IS3)	0.376	0.376	0.356	0.356	6.62	6.60

LDC # 35803E1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported % D	Recalculated %D
1	RLY239 TOF5	12/22/2015	cis-1,2-DCE (IS1)	0.303	0.296	0.296	2.3	2.3
			Toluene (IS2)	1.481	1.398	1.398	2.2	5.6
			1,1,2,2-TCA (IS3)	0.356	0.368	0.368	3.4	3.4
2	RLY265 TOF5	12/23/2015	cis-1,2-DCE (IS1)	0.303	0.310	0.310	2.3	2.3
			Toluene (IS2)	1.481	1.482	1.482	0.0	0.0
			1,1,2,2-TCA (IS3)	0.356	0.370	0.370	3.9	3.9

LDC #: 35803E1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: # 21

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4	10.0	10.91	109	109	0
Toluene-d8		10.50	105	105	
Bromofluorobenzene		10.01	100	100	

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

LDC #: 35803E1

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboraotry control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS ID: LCS/D 3W

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
1,1-Dichloroethene	10.0	10.0	9.64	9.38	96	96	94	94	3	3
Trichloroethene			9.47	9.45	95	95	95	95	0	0
Benzene			9.61	9.61	96	96	96	96	0	0
Toluene			9.29	9.44	93	93	94	94	2	2
Chlorobenzene			9.86	10.1	99	99	101	101	2	2

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35809 E1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
RRF	=	Relative response factor of the calibration standard.
V_o	=	Volume or weight of sample pruged in milliliters (ml) or grams (g).
Df	=	Dilution factor.
%S	=	Percent solids, applicable to soils and solid matrices only.

Example:

Sample I.D. 11, QQQ

Conc. = (166562)(10)( )/(1857094)(0.303)( )( )

= 29.59

≈ 30 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
	11	QQQ	30		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 19, 2016

Parameters: Dissolved Metals

Validation Level: Level III

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-003	15L191-02	Water	12/21/15
IR70-A15-004	15L191-03	Water	12/21/15
IR70-A15-009	15L191-04	Water	12/21/15
IR70-A15-011	15L191-05	Water	12/21/15
IR70-A15-012	15L191-06	Water	12/21/15
IR70-A15-014	15L191-08	Water	12/21/15
IR70-A15-092	15L191-09	Water	12/21/15
IR70-A15-003MS	15L191-02MS	Water	12/21/15
IR70-A15-003MSD	15L191-02MSD	Water	12/21/15

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Arsenic, Iron, and Manganese by Environmental Protection Agency (EPA) SW 846 Method 6010B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
IR70-A15-003MS/MSD (IR70-A15-003 IR70-A15-004)	Arsenic	129 (80-120)	123 (80-120)	J (all detects)	A
IR70-A15-003MS/MSD (IR70-A15-009 IR70-A15-011 IR70-A15-012 IR70-A15-014 IR70-A15-092)	Arsenic	129 (80-120)	123 (80-120)	-	-

For IR70-A15-003MS/MSD, no data were qualified for Iron and Manganese percent recoveries (%R) outside the QC limits since the parent sample results were greater than 4X the spike concentration.

Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Serial Dilution

Serial dilution analysis was performed on an associated project sample. The analysis criteria were met.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples IR70-A15-009 and IR70-A15-092 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD
	IR70-A15-009	IR70-A15-092	
Iron	0.365	0.368	1
Manganese	0.170	0.171	1

XI. Sample Result Verification

Raw data were not reviewed for Level III validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to MS/MSD %R, data were qualified as estimated in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Dissolved Metals - Data Qualification Summary - SDG 15L191

Sample	Analyte	Flag	A or P	Reason
IR70-A15-003 IR70-A15-004	Arsenic	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Seal Beach, IR Site 70
Dissolved Metals - Laboratory Blank Data Qualification Summary - SDG 15L191

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Dissolved Metals - Field Blank Data Qualification Summary - SDG 15L191

No Sample Data Qualified in this SDG

gmb

LDC #: 35803E4b

SDG #: 15L191

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III

Date: 2-8-16

Page: 1 of 1

Reviewer: MG

2nd Reviewer: [illegible]

METHOD: Metals (EPA SW 846 Method 6010B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
~~II.~~	~~ICP/MS Tune~~		
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	MS/MSD
VIII.	Duplicate sample analysis	N	
IX.	ICP Serial Dilution	A	
X.	Laboratory control samples	A	LCS/LCSD
XI.	Field Duplicates	SW	D= 3+7
~~XII.~~	~~Internal Standard (ICP-MS)~~		
XIII.	Sample Result Verification	N	
XIV	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-003	15L191-02	Water	12/21/15
2	IR70-A15-004	15L191-03	Water	12/21/15
3	IR70-A15-009	15L191-04	Water	12/21/15
4	IR70-A15-011	15L191-05	Water	12/21/15
5	IR70-A15-012	15L191-06	Water	12/21/15
6	IR70-A15-014	15L191-08	Water	12/21/15
7	IR70-A15-092	15L191-09	Water	12/21/15
8	IR70-A15-003MS	15L191-02MS	Water	12/21/15
9	IR70-A15-003MSD	15L191-02MSD	Water	12/21/15
10				
11				
12				
13	PBW			

Notes:

LDC #: 35803E4b

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Reviewer: MG
2nd reviewer: [illegible]

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1→7	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
QC 8,9	↓	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
Analysis Method		
ICP	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
ICP-MS		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
GFAA		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____

Comments: Mercury by CVAA if performed

LDC #: 35803E4b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: MG
2nd Reviewer: [illegible]

METHOD: Trace metals (EPA SW 846 Method 6010/6020/7000)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a matrix spike analyzed for each matrix in this SDG?

Y N N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for water samples and ≤35% for soil samples?

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
1	8/9	Water	As	129 (80-120)	123 (80-120)		all	J dets/A (det in 1,2)

Comments: #8/9 : Fe, Mn - 4x

MSD.4SW

LDC#: 35803E4b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: MG
2nd Reviewer: AL

METHOD: Metals (EPA Method 6010B)

Analyte	Concentration (mg/~~Kg~~) L		RPD	
	3	7		
Iron	0.365	0.368	1	
Manganese	0.170	0.171	1	

V:\FIELD DUPLICATES\FD_inorganic\35803E4b.WPD

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 9, 2016

Parameters: Wet Chemistry

Validation Level: Level III

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-003	15L191-02	Water	12/21/15
IR70-A15-004	15L191-03	Water	12/21/15
IR70-A15-009	15L191-04	Water	12/21/15
IR70-A15-011	15L191-05	Water	12/21/15
IR70-A15-012	15L191-06	Water	12/21/15
IR70-A15-013	15L191-07	Water	12/21/15
IR70-A15-014	15L191-08	Water	12/21/15
IR70-A15-092	15L191-09	Water	12/21/15
IR70-A15-003MS	15L191-02MS	Water	12/21/15
IR70-A15-003MSD	15L191-02MSD	Water	12/21/15
IR70-A15-009DUP	15L191-04DUP	Water	12/21/15
IR70-A15-092DUP	15L191-09DUP	Water	12/21/15

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Alkalinity by Standard Method 2320B
Bromide, Chloride, Nitrate as Nitrogen, Nitrite as Nitrogen, and Sulfate by Environmental Protection Agency (EPA) Method 300.0
Organic Acids by EPA Method 300.0 Modified
Sulfide by Standard Method 4500-S2 F
Total Dissolved Solids by Standard Method 2540C
Total Organic Carbon by Standard Method 5310B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.8727 mg/L	IR70-A15-003 IR70-A15-004 IR70-A15-011 IR70-A15-012 IR70-A15-014

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
IR70-A15-004	Total organic carbon	3.07 mg/L	3.07U mg/L

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
IR70-A15-003MS/MSD (IR70-A15-003 IR70-A15-004 IR70-A15-009 IR70-A15-011 IR70-A15-012 IR70-A15-014 IR70-A15-092)	Acetate	-	126 (75-125)	NA	-

Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

Samples IR70-A15-009 and IR70-A15-092 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD
	IR70-A15-009	IR70-A15-092	
Alkalinity	189	187	1
Bromide	0.623	0.623	0
Chloride	140	150	7
Sulfate	228	255	11
Total dissolved solids	855	870	2
Total organic carbon	0.698	0.718	3

X. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Wet Chemistry - Data Qualification Summary - SDG 15L191

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 15L191

Sample	Analyte	Modified Final Concentration	A or P
IR70-A15-004	Total organic carbon	3.07U mg/L	A

Seal Beach, IR Site 70
Wet Chemistry - Field Blank Data Qualification Summary - SDG 15L191

No Sample Data Qualified in this SDG

LDC #: 35803E6

SDG #: 15L191

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III

Date: 2-8-16

Page: 1 of 1

Reviewer: MG

2nd Reviewer: M

METHOD: (Analyte) Alkalinity (SM2320B), Bromide, Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA Method 300.0), Organic Acids (EPA Method 300.0M), ~~Sulfate~~ (SM4500-S2 F), TDS (SM2540C), TOC (SM5310B)
Sulfide

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	MS/MSD
VII.	Duplicate sample analysis	A	DUP
VIII.	Laboratory control samples	A	LCS/LCSD
IX.	Field duplicates	SW	D= 3+8
X.	Sample result verification	N	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-003	15L191-02	Water	12/21/15
2	IR70-A15-004	15L191-03	Water	12/21/15
3	IR70-A15-009	15L191-04	Water	12/21/15
4	IR70-A15-011	15L191-05	Water	12/21/15
5	IR70-A15-012	15L191-06	Water	12/21/15
6	IR70-A15-013	15L191-07	Water	12/21/15
7	IR70-A15-014	15L191-08	Water	12/21/15
8	IR70-A15-092	15L191-09	Water	12/21/15
9	IR70-A15-003MS	15L191-02MS	Water	12/21/15
10	IR70-A15-003MSD	15L191-02MSD	Water	12/21/15
11	IR70-A15-009DUP	15L191-04DUP	Water	12/21/15
12	IR70-A15-092DUP	15L191-09DUP	Water	12/21/15
13				
14				
15	PBW1			
16	PBW2			

LDC #: 35803E6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: MG
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Matrix	Parameter
1→5, 7.8	W	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Br Org Acid $S^=$
6	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Org Acid
⊗c 9, 10	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Org Acid
11	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
12	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4

Comments:

LDC #: 35803E6

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: MG
2nd Reviewer: R

METHOD: Inorganics, Method See Cover

Conc. units: mg/L **Associated Samples:** 1,2,4,5,7

Analyte	Blank ID	Blank ID	Blank Action Limit											
	PB	ICB/CCB (mg/L)		2										
TOC		0.8727	4.36	3.07										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC #: 35803E6

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: MG
2nd Reviewer: 8C

METHOD: Inorganics, EPA Method See cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a matrix spike analyzed for each matrix in this SDG?
Y (N) N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.
(Y) N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for water samples and ≤35% for soil samples?

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
1	9/10	water	Acetate		126(75-125)		1→5, 7, 8	Jdets/A (all N.D.)

Comments:

MSD.6

LDC#: 35803E6

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: MG
2nd Reviewer: AL

Inorganics, Method See Cover

Analyte	Concentration (mg/L)		RPD	
	3	8		
Alkalinity	189	187	1	
Bromide	0.623	0.623	0	
Chloride	140	150	7	
Sulfate	228	255	11	
TDS	855	870	2	
Total organic Carbon	0.698	0.718	3	

V:\FIELD DUPLICATES\FD_inorganic\35803E6.WPD

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 8, 2016

Parameters: Methane, Ethane, & Ethene

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L191

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-105	15L191-01	Water	12/21/15
IR70-A15-003	15L191-02	Water	12/21/15
IR70-A15-003DL	15L191-02DL	Water	12/21/15
IR70-A15-004	15L191-03	Water	12/21/15
IR70-A15-004DL	15L191-03DL	Water	12/21/15
IR70-A15-009	15L191-04	Water	12/21/15
IR70-A15-011	15L191-05	Water	12/21/15
IR70-A15-011DL	15L191-05DL	Water	12/21/15
IR70-A15-012	15L191-06	Water	12/21/15
IR70-A15-012DL	15L191-06DL	Water	12/21/15
IR70-A15-013	15L191-07	Water	12/21/15
IR70-A15-014	15L191-08	Water	12/21/15
IR70-A15-014DL	15L191-08DL	Water	12/21/15
IR70-A15-092**	15L191-09**	Water	12/21/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Methane, Ethane, and Ethene by Method RSK-175

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Retention time windows were established as required by the method for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

Retention times of all compounds in the calibration standards were within the established retention time windows for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

Sample IR70-A15-105 was identified as a trip blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-105	12/21/15	Methane	0.62 ug/L	IR70-A15-003 IR70-A15-003DL IR70-A15-004 IR70-A15-004DL IR70-A15-009 IR70-A15-011 IR70-A15-011DL IR70-A15-012 IR70-A15-012DL IR70-A15-013 IR70-A15-014 IR70-A15-014DL IR70-A15-092**

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated field blanks.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Field Duplicates

Samples IR70-A15-009 and IR70-A15-092** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	IR70-A15-009	IR70-A15-092**	
Methane	31	27	14

IX. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
IR70-A15-003 IR70-A15-004 IR70-A15-011 IR70-A15-012 IR70-A15-014	Methane	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A

Raw data were not reviewed for Level III validation.

X. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Compound	Flag	A or P
IR70-A15-003 IR70-A15-004 IR70-A15-011 IR70-A15-012 IR70-A15-014	Methane	R	A
IR70-A15-003DL IR70-A15-004DL IR70-A15-011DL IR70-A15-012DL IR70-A15-014DL	All TCL compounds except Methane	R	A

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Data Qualification Summary - SDG 15L191

Sample	Compound	Flag	A or P	Reason
IR70-A15-003 IR70-A15-004 IR70-A15-011 IR70-A15-012 IR70-A15-014	Methane	R	A	Overall assessment of data
IR70-A15-003DL IR70-A15-004DL IR70-A15-011DL IR70-A15-012DL IR70-A15-014DL	All TCL compounds except Methane	R	A	Overall assessment of data

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Laboratory Blank Data Qualification Summary - SDG 15L191

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Field Blank Data Qualification Summary - SDG 15L191

No Sample Data Qualified in this SDG

LDC #: 35803~~D~~E51 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/03/16

SDG #: 15L1~~86~~-91 Level III/IV Page: 1 of 1

Laboratory: EMAX Laboratories, Inc. Reviewer: JG

2nd Reviewer: RL

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	ICAL ≤ 20% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	SW	TB = 1
VI.	Surrogate spikes	N	Not req'd.
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LCS/D
IX.	Field duplicates	SW	D = 6/14
X.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation.
XI.	Target compound identification	A	Not reviewed for Level III validation.
XII.	System performance	A	Not reviewed for Level III validation.
XIII.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-105	15L191-01	Water	12/21/15
2	IR70-A15-003	15L191-02	Water	12/21/15
3	IR70-A15-003DL	15L191-02DL	Water	12/21/15
4	IR70-A15-004	15L191-03	Water	12/21/15
5	IR70-A15-004DL	15L191-03DL	Water	12/21/15
6	IR70-A15-009 D	15L191-04	Water	12/21/15
7	IR70-A15-011	15L191-05	Water	12/21/15
8	IR70-A15-011DL	15L191-05DL	Water	12/21/15
9	IR70-A15-012	15L191-06	Water	12/21/15
10	IR70-A15-012DL	15L191-06DL	Water	12/21/15
11	IR70-A15-013	15L191-07	Water	12/21/15
12	IR70-A15-014	15L191-08	Water	12/21/15
13	IR70-A15-014DL	15L191-08DL	Water	12/21/15
14	IR70-A15-092 ** D	15L191-09	Water	12/21/15
15				
16				

MB/LCS/W 2W

LDC #: 35803 E5

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: R

Method: ✓ GC ____ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥0.990?		✓		
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. Field Blanks				
Were field blanks identified in this SDG?	✓			
Were target compounds detected in the field blanks?	✓			
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?			✓	
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?				✓
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

LDC #: 35803 E 51

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 35803 E51

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: ✓ **GC** __ **HPLC**
Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?
Blank units: ng/L **Associated sample units:** ng/L
Sampling date: 12/21/15
Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank
Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other:_____
Associated Samples: All except 1 (> 5X)

Compound	Blank ID	Blank ID	Sample Identification							
	1									
Methane	0.62									
CRQL										

Blank units:_____ **Associated sample units:**_____
Sampling date:_____
Field blank type: (circle one) Field Blank / Trip Blank/ Atmospheric Blank/ Ambient Blank
Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other:_____
Associated Samples:_____

Compound	Blank ID	Blank ID	Sample Identification							
CRQL										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with compound concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC#: 35803E51

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: M

METHOD: GC MEE (Method RSK-175)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD
	6	14	
Methane	31	27	14

V:\Josephine\FIELD DUPLICATES\35803E51 ecc seal beach.wpd

LDC #: 35803 E 51

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer: SC

METHOD: ✓ **GC** __ **HPLC**

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Level IV/D Only
Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	> cal range	2, 4, 7, 9, 12	J dets/A

Comments: See sample calculation verification worksheet for recalculations

LDC #: 35803 E51

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: K

METHOD: ✓ **GC** __ **HPLC**

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

Y N N/A Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	> cal range	2, 4, 7, 9, 12	R/A
	All except Methane	dil	3, 5, 8, 10, 13	✓

Comments: _____

OVRNew1.wpd

LDC #: 35803E51

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: X

METHOD: GC / HPLC _____

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C
average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where:
A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported CF (13.56 std)	Recalculated CF (13.56 std)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL GCT010	6/19/2015	Methane	31479.0	31479.4	34528.0	34528.0	13.9	13.9

LDC # 35803E51

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC ✓ HPLC ____

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	FL29002A	12/29/2015	Methane	13.56	13.74	13.74	1	1.3
2	FL29016A	12/29/2015	Methane	13.56	13.25	13.25	2	2.3

LDC #: B5803E5

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG

2nd Reviewer: [illegible]

METHOD: ✓ GC __ HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration
LCS = Laboratory Control Sample
SA = Spike added
LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: LCS/D 2 W

Compound		Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
		LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline	(8015)										
Diesel	(8015)										
Benzene	(8021B)										
Methane	(RSK-175)	13.6	13.6	13.0	12.6	96	96	93	93	3	3
2,4-D	(8151)										
Dinoseb	(8151)										
Naphthalene	(8310)										
Anthracene	(8310)										
HMX	(8330)										
2,4,6-Trinitrotoluene	(8330)										
Phorate	(8141A)										
Malathion	(8141A)										
Formaldehyde	(8315A)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803 E51

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: / GC __ HPLC

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

Concentration= (A)(Fv)(Df) / (RF)(Vs or Ws)(%S/100)

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. 14 Compound Name Methane

Concentration = (923551) / (34528.1) = 26.7

≈ 27 ug/L

#	Sample ID	Compound	Reported Concentrations (ug/L)	Recalculated Results Concentrations ( )	Qualifications
	14	Methane	27		

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 8, 2016

Parameters: Volatiles

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L198

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-064	15L198-01	Water	12/22/15
IR70-A15-069	15L198-02	Water	12/22/15
IR70-A15-021	15L198-03	Water	12/22/15
IR70-A15-021DL	15L198-03DL	Water	12/22/15
IR70-A15-020	15L198-04	Water	12/22/15
IR70-A15-020DL	15L198-04DL	Water	12/22/15
IR70-A15-093**	15L198-05**	Water	12/22/15
IR70-A15-093DL**	15L198-05DL**	Water	12/22/15
IR70-A15-022	15L198-06	Water	12/22/15
IR70-A15-017	15L198-07	Water	12/22/15
IR70-A15-019	15L198-08	Water	12/22/15
IR70-A15-019DL	15L198-08DL	Water	12/22/15
IR70-A15-038	15L198-09	Water	12/22/15
IR70-A15-038DL	15L198-09DL	Water	12/22/15
IR70-A15-043	15L198-10	Water	12/22/15
IR70-A15-043DL	15L198-10DL	Water	12/22/15
IR70-A15-065	15L198-11	Water	12/22/15
IR70-A15-068	15L198-12	Water	12/22/15
IR70-A15-115	15L198-13	Water	12/22/15
IR70-A15-115DL	15L198-13DL	Water	12/22/15
IR70-A15-106	15L198-14	Water	12/22/15
IR70-A15-112	15L198-15	Water	12/22/15
IR70-A15-108	15L198-16	Water	12/22/15
IR70-A15-017MS	15L198-07MS	Water	12/22/15
IR70-A15-017MSD	15L198-07MSD	Water	12/22/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Volatile Organic Compounds (VOCs) by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A bromofluorobenzene (BFB) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

Percent relative standard deviations (%RSD) were less than or equal to 15.0% for each individual compound and less than or equal to 30.0% for calibration check compounds (CCCs).

Average relative response factors (RRF) for all compounds were within validation criteria with the following exceptions:

Date	Compound	RRF (Limits)	Associated Samples	Flag	A or P
12/01/15	2-Butanone	0.008 (≥0.010)	All samples in SDG 15L198	UJ (all non-detects)	A

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
12/30/15	Trichlorofluoromethane	20.1	IR70-A15-019 IR70-A15-019DL IR70-A15-038 IR70-A15-038DL IR70-A15-043DL	UJ (all non-detects)	A

All of the continuing calibration relative response factors (RRF) were within validation criteria with the following exceptions:

Date	Compound	RRF (Limits)	Associated Samples	Flag	A or P
12/23/15	2-Butanone	0.008 (≥0.010)	IR70-A15-022 IR70-A15-017 IR70-A15-115DL	UJ (all non-detects)	A
12/29/15	2-Butanone	0.009 (≥0.010)	IR70-A15-064 IR70-A15-069 IR70-A15-021 IR70-A15-021DL IR70-A15-020 IR70-A15-020DL IR70-A15-093** IR70-A15-093DL** IR70-A15-043 IR70-A15-065 IR70-A15-068 IR70-A15-115 IR70-A15-106 IR70-A15-112 IR70-A15-108	UJ (all non-detects)	A
12/30/15	2-Butanone	0.008 (≥0.010)	IR70-A15-019 IR70-A15-019DL IR70-A15-038 IR70-A15-038DL IR70-A15-043DL	UJ (all non-detects)	A

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Sample IR70-A15-106 was identified as a trip blank. No contaminants were found.

Sample IR70-A15-112 was identified as an equipment rinsate. No contaminants were found.

Sample IR70-A15-108 was identified as a source blank. No contaminants were found.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples IR70-A15-020 and IR70-A15-093** and samples IR70-A15-020DL and IR70-A15-093DL** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	IR70-A15-020	IR70-A15-093**	
1,1-Dichloroethane	0.25	0.27	8
1,1-Dichloroethene	1.7	1.8	6
Carbon disulfide	0.56	1.0U	Not calculable
cis-1,2-Dichloroethene	180	200	11
Dichlorodifluoromethane	0.32	0.37	14
trans-1,2-Dichloroethene	1.9	2.0	5
Trichloroethene	3.0	3.3	10
Vinyl chloride	72	79	9

Compound	Concentration (ug/L)		RPD
	IR70-A15-020DL	IR70-A15-093DL**	
cis-1,2-Dichloroethene	180	180	0
Trichloroethene	3.0	2.9	3
Vinyl chloride	73	72	1

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
IR70-A15-021 IR70-A15-020 IR70-A15-093** IR70-A15-115	cis-1,2-Dichloroethene Vinyl chloride	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects)	A
IR70-A15-019	cis-1,2-Dichloroethene trans-1,2-Dichloroethene Trichloroethene	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects) J (all detects)	A
IR70-A15-038	Vinyl chloride	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A
IR70-A15-043	cis-1,2-Dichloroethene	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A

Raw data were not reviewed for Level III validation.

XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Compound	Flag	A or P
IR70-A15-021 IR70-A15-020 IR70-A15-093** IR70-A15-115	cis-1,2-Dichloroethene Vinyl chloride	R	A
IR70-A15-021DL IR70-A15-020DL IR70-A15-093DL** IR70-A15-115DL	All TCL compounds except cis-1,2-Dichloroethene Vinyl chloride	R	A
IR70-A15-019	cis-1,2-Dichloroethene trans-1,2-Dichloroethene Trichloroethene	R	A
IR70-A15-019DL	All TCL compounds except cis-1,2-Dichloroethene trans-1,2-Dichloroethene Trichloroethene	R	A
IR70-A15-038	Vinyl chloride	R	A
IR70-A15-038DL	All TCL compounds except Vinyl chloride	R	A
IR70-A15-043	cis-1,2-Dichloroethene	R	A
IR70-A15-043DL	All TCL compounds except cis-1,2-Dichloroethene	R	A

Due to initial calibration RRF and continuing calibration %D and RRF, data were qualified as estimated in sixteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Volatiles - Data Qualification Summary - SDG 15L198

Sample	Compound	Flag	A or P	Reason
IR70-A15-064 IR70-A15-069 IR70-A15-021 IR70-A15-020 IR70-A15-093** IR70-A15-022 IR70-A15-017 IR70-A15-019 IR70-A15-038 IR70-A15-043 IR70-A15-065 IR70-A15-068 IR70-A15-115 IR70-A15-106 IR70-A15-112 IR70-A15-108	2-Butanone	UJ (all non-detects)	A	Initial calibration (RRF)
IR70-A15-019 IR70-A15-038	Trichlorofluoromethane	UJ (all non-detects)	A	Continuing calibration (%D)
IR70-A15-064 IR70-A15-069 IR70-A15-021 IR70-A15-020 IR70-A15-093** IR70-A15-022 IR70-A15-017 IR70-A15-019 IR70-A15-038 IR70-A15-043 IR70-A15-065 IR70-A15-068 IR70-A15-115 IR70-A15-106 IR70-A15-112 IR70-A15-108	2-Butanone	UJ (all non-detects)	A	Continuing calibration (RRF)
IR70-A15-021 IR70-A15-020 IR70-A15-093** IR70-A15-115	cis-1,2-Dichloroethene Vinyl chloride	R	A	Overall assessment of data
IR70-A15-021DL IR70-A15-020DL IR70-A15-093DL** IR70-A15-115DL	All TCL compounds except cis-1,2-Dichloroethene Vinyl chloride	R	A	Overall assessment of data
IR70-A15-019	cis-1,2-Dichloroethene trans-1,2-Dichloroethene Trichloroethene	R	A	Overall assessment of data
IR70-A15-019DL	All TCL compounds except cis-1,2-Dichloroethene trans-1,2-Dichloroethene Trichloroethene	R	A	Overall assessment of data

Sample	Compound	Flag	A or P	Reason
IR70-A15-038	Vinyl chloride	R	A	Overall assessment of data
IR70-A15-038DL	All TCL compounds except Vinyl chloride	R	A	Overall assessment of data
IR70-A15-043	cis-1,2-Dichloroethene	R	A	Overall assessment of data
IR70-A15-043DL	All TCL compounds except cis-1,2-Dichloroethene	R	A	Overall assessment of data

Seal Beach, IR Site 70
Volatiles - Laboratory Blank Data Qualification Summary - SDG 15L198

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Volatiles - Field Blank Data Qualification Summary - SDG 15L198

No Sample Data Qualified in this SDG

LDC #: 35803F1

SDG #: 15L198

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 02/04/16

Page: 1 of 2

Reviewer: JVG

2nd Reviewer: M

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	SW / A	ICAL ≤ 15/30 % ICV ≤ 20 %
IV.	Continuing calibration	SW	CCV ≤ 20 %
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 21 ER = 22 SB = 23
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS / D
X.	Field duplicates	SW	D = 5/7 6/8
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation.
XIII.	Target compound identification	A	Not reviewed for Level III validation.
XIV.	System performance	A	Not reviewed for Level III validation.
XV.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER: ER = Equipment Rinse

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-064	15L198-01	Water	12/22/15
2	IR70-A15-069	15L198-02	Water	12/22/15
3	IR70-A15-021	15L198-03	Water	12/22/15
4	IR70-A15-021DL	15L198-03DL	Water	12/22/15
5	IR70-A15-020 D1	15L198-04	Water	12/22/15
6	IR70-A15-020DL D1	15L198-04DL	Water	12/22/15
7	IR70-A15-093** D1	15L198-05**	Water	12/22/15
8	IR70-A15-093DL** D1	15L198-05DL**	Water	12/22/15
9 1	IR70-A15-022	15L198-06	Water	12/22/15
10 1	IR70-A15-017	15L198-07	Water	12/22/15
11 3	IR70-A15-019	15L198-08	Water	12/22/15
12 3	IR70-A15-019DL	15L198-08DL	Water	12/22/15
13 3	IR70-A15-038	15L198-09	Water	12/22/15

LDC #: 35803F1 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/04/16
SDG #: 15L198 Level III/IV Page: 2 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer: SVB
2nd Reviewer: R

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

	Client ID	Lab ID	Matrix	Date
14 3	IR70-A15-038DL	15L198-09DL	Water	12/22/15
15	IR70-A15-043	15L198-10	Water	12/22/15
16 3	IR70-A15-043DL	15L198-10DL	Water	12/22/15
17	IR70-A15-065	15L198-11	Water	12/22/15
18	IR70-A15-068	15L198-12	Water	12/22/15
19	IR70-A15-115	15L198-13	Water	12/22/15
20 1	IR70-A15-115DL	15L198-13DL	Water	12/22/15
21 1	IR70-A15-106	15L198-14	Water	12/22/15
22 1	IR70-A15-112	15L198-15	Water	12/22/15
23 1	IR70-A15-108	15L198-16	Water	12/22/15
24 1	IR70-A15-017MS	15L198-07MS	Water	12/22/15
25 1	IR70-A15-017MSD	15L198-07MSD	Water	12/22/15
26				
27				
28				
29				

Notes:

1	MBLK 1W						
2	2W						
3	3W						

LDC #: 35803F1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: R

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?		✓		
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) ≥ 0.05?		✓		
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?		✓		
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?	✓			
Were target compounds detected in the field blanks?		✓		
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	✓			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			✓	

LDC #: 35803 F1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	✓			
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

TARGET COMPOUND WORKSHEET

METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane
C. Vinyl choride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO.1,1-Difluoroethane	O1. 3-Methylpentane
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3- Trimethylbutane
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methyl cyclohexane	T1. 2-Methylhexane
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.

LDC #: 35803F1

VALIDATION FINDINGS WORKSHEET
Initial Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Did the laboratory perform a 5 point calibration prior to sample analysis?
Y N N/A Were percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCC's and SPCC's?
Y N N/A Was a curve fit used for evaluation? If yes, what was the acceptance criteria used for evaluation? NA
Y N N/A Did the initial calibration meet the acceptance criteria?
Y N N/A Were all %RSDs and RRFs within the validation criteria of ≤30/15 %RSD and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %RSD (Limit: ≤30/15%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	12/01/15	ICAL-T067	M		0.008 (≥0.010)	All (M)	J/UJ A

INICAL.wpd

LDC #: 35803T1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?
Y N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?
Y N N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	12/23/15	RLC 570	M		0.008 (≥0.010)	9, 10, 20, 24, 25, MBLK1W	(ND) J/UJ/A
	12/29/15	RLC607	M		0.009 (≥0.010)	1-8, 15, 17-19, 21-23, MBLK2W	(ND)
	12/30/15	RLC647	M		0.008 (≥0.010)	11-14, 16, MBLK3W	(ND)
			KK	20.1			

CONCAL.wpd

LDC#: 35803F1

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: TL

METHOD: GCMS VOA (EPA SW 846 Method 8260B)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD
	5	7	
I	0.25	0.27	8
H	1.7	1.8	6
G	0.56	1.0U	NC
QQQ	180	200	11
JJ	0.32	0.37	14
PPP	1.9	2.0	5
S	3.0	3.3	10
C	72	79	9

Compound	Concentration (ug/L)		RPD
	6	8	
QQQ	180	180	0
S	3.0	2.9	3
C	73	72	1

V:\Josephine\FIELD DUPLICATES\35803F1 ecc seal beach.wpd

LDC #: 35803F1

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and CRQLs

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Date	Sample ID	Compound	Finding	Qualifications
		3, 5, 7, 19	QQQ, C	> cal range	J dets /A
		11	QQQ, PPP, S		
		13	C		
		15	QQQ	✓	✓

Comments: See sample calculation verification worksheet for recalculations

LDC #: 35803F1

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.
Y N N/A Was the overall quality and usability of the data acceptable?

#	Date	Sample ID	Compound	Finding	Qualifications
		3, 5, 7, 19	QQQ, C	> cal range	R / A
		4, 6, 8, 20	All except above	dil	
		11	QQQ, PPP, S	> cal range	
		12	All except above	dil	
		13	C	> cal range	
		14	All except C	dil	
		15	QQQ	> cal range	
		16	All except QQQ	dil	

Comments:

OVR.wpd

LDC #: 35803F1

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound
S= Standard deviation of the RRFs

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)		Reported RRF (RRF 10 std)	Recalculated RRF (RRF 10 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL TO67	12/01/15	cis-1,2-DCE	(IS1)	0.347	0.347	0.351	0.351	4.56	4.59
			Toluene	(IS2)	1.664	1.664	1.734	1.734	6.84	6.84
			1,1,2,2-TCA	(IS3)	0.589	0.589	0.604	0.604	3.19	3.21

LDC # 35803F1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound	(IS)	Average RRF (Initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported % D	Recalculated %D
1	RLC607	12/29/2015	cis-1,2-DCE	(IS1)	0.351	0.323	0.323	7.9	7.9
			Toluene	(IS2)	1.734	1.593	1.593	8.1	8.1
			1,1,2,2-TCA	(IS3)	0.604	0.613	0.613	1.5	1.5

LDC #: 35803F1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: # 7

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4	10.0	9.56	95.6	95.6	0
Toluene-d8	↓	9.73	97.3	97.3	↓
Bromofluorobenzene	↓	9.25	92.5	92.5	↓

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

LDC #: 35803F1

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: X

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentration

RPD = I MSC - MSC I * 2/(MSC + MSDC) MSC = Matrix spike concentration MSDC = Matrix spike duplicate concentration

MS/MSD sample: 24 / 25

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
1,1-Dichloroethene	10.0	10.0	0	10.2	10.2	102	102	102	102	0	0
Trichloroethene	↓	↓	0.586	9.58	9.54	90	90	90	90	0	0
Benzene	↓	↓	0	9.16	9.16	92	92	92	92	0	0
Toluene	↓	↓	4.22	13.8	13.9	96	96	96	96	1	1
Chlorobenzene	↓	↓	0	9.17	9.29	92	92	93	93	1	1

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803 F1

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboraotry control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS ID: LCS/D 2W

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
1,1-Dichloroethene	10.0	10.0	8.55	9.21	85	85	92	92	7	7
Trichloroethene			8.25	9.09	83	83	91	91	10	10
Benzene			8.53	9.18	85	85	92	92	7	7
Toluene			8.84	9.28	88	88	93	93	5	5
Chlorobenzene			9.03	9.38	90	90	94	94	4	4

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803F1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
RRF	=	Relative response factor of the calibration standard.
V_o	=	Volume or weight of sample pruged in milliliters (ml) or grams (g).
Df	=	Dilution factor.
%S	=	Percent solids, applicable to soils and solid matrices only.

Example:

Sample I.D. 8, QQQ

Conc. = $\frac{(1229976)(10)(10)}{(1998980)(0.351)(\quad)(\quad)}$

= 175.29

≈ 180 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
	8	QQQ	180		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 19, 2016

Parameters: Dissolved Metals

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L198

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-021	15L198-03	Water	12/22/15
IR70-A15-020	15L198-04	Water	12/22/15
IR70-A15-093**	15L198-05**	Water	12/22/15
IR70-A15-022	15L198-06	Water	12/22/15
IR70-A15-017	15L198-07	Water	12/22/15
IR70-A15-019	15L198-08	Water	12/22/15
IR70-A15-043	15L198-10	Water	12/22/15
IR70-A15-115	15L198-13	Water	12/22/15
IR70-A15-112	15L198-15	Water	12/22/15
IR70-A15-108	15L198-16	Water	12/22/15
IR70-A15-017MS	15L198-07MS	Water	12/22/15
IR70-A15-017MSD	15L198-07MSD	Water	12/22/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Arsenic, Iron, and Manganese by Environmental Protection Agency (EPA) SW 846 Method 6010B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

Sample IR70-A15-112 was identified as an equipment rinsate. No contaminants were found.

Sample IR70-A15-108 was identified as a source blank. No contaminants were found.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Serial Dilution

Serial dilution analysis was performed on an associated project sample. The analysis criteria were met.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples IR70-A15-020 and IR70-A15-093** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD
	IR70-A15-020	IR70-A15-093**	
Iron	0.247	0.242	2
Manganese	0.264	0.263	0

XI. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Dissolved Metals - Data Qualification Summary - SDG 15L198

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Dissolved Metals - Laboratory Blank Data Qualification Summary - SDG 15L198

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Dissolved Metals - Field Blank Data Qualification Summary - SDG 15L198

No Sample Data Qualified in this SDG

MG

LDC #: 35803F4 b

SDG #: 15L198

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 2-8-16

Page: 1 of 1

Reviewer: MG

2nd Reviewer: [illegible]

METHOD: Metals (EPA SW 846 Method 6010B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
~~II.~~	~~ICP/MS Tune~~		
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	ND	ER = 9 SB = 10
VII.	Matrix Spike/Matrix Spike Duplicates	A	MS/MSD
VIII.	Duplicate sample analysis	N	
IX.	ICP Serial Dilution	A	
X.	Laboratory control samples	A	LCS/LCSD
XI.	Field Duplicates	SW	D = 2+3
~~XII.~~	~~Internal Standard (ICP-MS)~~		
XIII.	Sample Result Verification	A	Not reviewed for Level III validation.
XIV.	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-021	15L198-03	Water	12/22/15
2	IR70-A15-020	15L198-04	Water	12/22/15
3	IR70-A15-093**	15L198-05**	Water	12/22/15
4	IR70-A15-022	15L198-06	Water	12/22/15
5	IR70-A15-017	15L198-07	Water	12/22/15
6	IR70-A15-019	15L198-08	Water	12/22/15
7	IR70-A15-043	15L198-10	Water	12/22/15
8	IR70-A15-115	15L198-13	Water	12/22/15
9	IR70-A15-112	15L198-15	Water	12/22/15
10	IR70-A15-108	15L198-16	Water	12/22/15
11	IR70-A15-017MS	15L198-07MS	Water	12/22/15
12	IR70-A15-017MSD	15L198-07MSD	Water	12/22/15
13				
14				
15	PBW			

LDC #: 35803F46

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: X

Method: Metals (EPA SW 846 Method 6010/7000/6020)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. ICP/MS Tune				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?			✓	
Were %RSD of isotopes in the tuning solution ≤5%?			✓	
III. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury) QC limits?	✓			
Were all initial calibration correlation coefficients > 0.995?	✓			
IV. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	✓			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	✓			
VI. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were < 5X the RL.	✓			
VII. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% QC limits for water samples and laboratory established QC limits for soils?	✓			

LDC #: 35803F46

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: R

Validation Area	Yes	No	NA	Findings/Comments
VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)				
Were all the percent recoveries (%R) within the 30-120% (6020)/60-125% (200.8) of the intensity of the internal standard in the associated initial calibration?			✓	
If the %Rs were outside the criteria, was a reanalysis performed?			✓	
IX. ICP Serial Dilution				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the MDL (ICP)/>100X the MDL(ICP/MS)?	✓			
Were all percent differences (%Ds) < 10%?	✓			
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.		✓		
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XII. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
XIII. Field blanks				
Field blanks were identified in this SDG.	✓			
Target analytes were detected in the field blanks.		✓		

LDC #: 35803F46

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Reviewer: MG
2nd reviewer: R

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1 → 10	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
QC 11, 12	↓	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
Analysis Method		
ICP	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
ICP-MS		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____
GFAA		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Si, CN^-, ____

Comments: Mercury by CVAA if performed

LDC#: 35803F4b

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: MG
2nd Reviewer: JL

METHOD: Metals (EPA Method 6010B)

Analyte	Concentration (mg/L)		RPD	
	2	3		
Iron	0.247	0.242	2	
Manganese	0.264	0.263	0	

V:\FIELD DUPLICATES\FD_inorganic\35803F4b.WPD

LDC #: 35803F46

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: MG
2nd Reviewer: RL

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

An initial and continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

$$\%R = \frac{Found}{True} \times 100$$

Where, Found = concentration (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution
True = concentration (in ug/L) of each analyte in the ICV or CCV source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalculated %R	Reported %R	Acceptable (Y/N)
1546 ICV	ICP (Initial calibration)	As	1049.1	1000	105	105	Y
	ICP/MS (Initial calibration)						
	CVAA (Initial calibration)						
1801 CCV5	ICP (Continuing calibration)	Fe	24047	25000	96	96	
	ICP/MS (Continuing calibration)						
	CVAA (Continuing calibration)						
	GFAA (Initial calibration)						
	GFAA (Continuing calibation)						

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803F46

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: SC

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Percent recoveries (%R) for an ICP interference check sample, a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$

Where, Found = Concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = Concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$

Where, S = Original sample concentration
D = Duplicate sample concentration

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

$\%D = \frac{|I-SDR|}{I} \times 100$

Where, I = Initial Sample Result (mg/L)
SDR = Serial Dilution Result (mg/L) (Instrument Reading x 5)

Sample ID	Type of Analysis	Element	Found / S / I (units)	True / D / SDR (units)	Recalculated %R / RPD / %D	Reported %R / RPD / %D	Acceptable (Y/N)
1502 ICSAB	ICP interference check	As	1.084 (mg/L)	1.0 (mg/L)	108	108	Y
1728 LCS	Laboratory control sample	Fe	4.999 (mg/L)	5 (mg/L)	100	100	↓
1749 11	Matrix spike	Mn	(SSR-SR) 0.453 (mg/L)	0.5 (mg/L)	91	90	↓
1749 / 1752 11 / 12	Duplicate	As	0.543 (mg/L)	0.539 (mg/L)	1	1	↓
1743 / 1746 5	ICP serial dilution	Fe	3.511 (mg/L)	3.572 (mg/L)	2	2	↓

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803 F46

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: MG
2nd reviewer: [illegible]

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments and within the linear range of the ICP?
Y N N/A Are all detection limits below the CRDL?

Detected analyte results for #3, Mn were recalculated and verified using the following equation:

Concentration = (RD)(FV)(Dil) / (In. Vol.)

RD = Raw data concentration
FV = Final volume (ml)
In. Vol. = Initial volume (ml) or weight (G)
Dil = Dilution factor

Recalculation:

$$\frac{(0.26272\ mg/L)(0.050\ L)}{0.050\ L} = 0.26272\ mg/L$$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
1	3	Mn	0.263	0.263	Y

Note:

RECALC.4SW

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 16, 2016

Parameters: Wet Chemistry

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L198

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-021	15L198-03	Water	12/22/15
IR70-A15-020	15L198-04	Water	12/22/15
IR70-A15-093**	15L198-05**	Water	12/22/15
IR70-A15-022	15L198-06	Water	12/22/15
IR70-A15-017	15L198-07	Water	12/22/15
IR70-A15-019	15L198-08	Water	12/22/15
IR70-A15-038	15L198-09	Water	12/22/15
IR70-A15-043	15L198-10	Water	12/22/15
IR70-A15-115	15L198-13	Water	12/22/15
IR70-A15-017MS	15L198-07MS	Water	12/22/15
IR70-A15-017MSD	15L198-07MSD	Water	12/22/15
IR70-A15-017DUP	15L198-07DUP	Water	12/22/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Alkalinity by Standard Method 2320B
Bromide, Chloride, Nitrate as Nitrogen, Nitrite as Nitrogen, and Sulfate by Environmental Protection Agency (EPA) Method 300.0
Organic Acids by EPA Method 300.0 Modified
Sulfide by Standard Method 4500-S2 F
Total Dissolved Solids by Standard Method 2540C
Total Organic Carbon by Standard Method 5310B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.8727 mg/L	IR70-A15-022 IR70-A15-017
ICB/CCB	Total organic carbon	0.7058 mg/L	IR70-A15-115
ICB/CCB	Total organic carbon	0.6117 mg/L	IR70-A15-019 IR70-A15-043

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
IR70-A15-019	Total organic carbon	0.842 mg/L	0.842U mg/L
IR70-A15-043	Total organic carbon	1.31 mg/L	1.31U mg/L

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

Samples IR70-A15-020 and IR70-A15-093** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD
	IR70-A15-020	IR70-A15-093**	
Alkalinity	194	196	1
Bromide	0.508	0.508	0
Chloride	126	128	2
Nitrate as N	0.0909	0.0611	39
Sulfate	171	173	1
Total dissolved solids	611	620	1
Total organic carbon	0.609	0.618	1

X. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to laboratory blank contamination, data were qualified as not detected in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Wet Chemistry - Data Qualification Summary - SDG 15L198

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 15L198

Sample	Analyte	Modified Final Concentration	A or P
IR70-A15-019	Total organic carbon	0.842U mg/L	A
IR70-A15-043	Total organic carbon	1.31U mg/L	A

Seal Beach, IR Site 70
Wet Chemistry - Field Blank Data Qualification Summary - SDG 15L198

No Sample Data Qualified in this SDG

LDC #: 35803F6

SDG #: 15L198

Laboratory: EMAX Laboratories, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 2-8-16

Page: 1 of 1

Reviewer: MG

2nd Reviewer: [illegible]

METHOD: (Analyte) Alkalinity (SM2320B), Bromide, Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA Method 300.0), Organic Acids (EPA Method 300.0M), ~~Sulfate~~ (SM4500-S2 F), TDS (SM2540C), TOC (SM5310B)
Sulfide
mH

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	MS/MSD
VII.	Duplicate sample analysis	A	DUP
VIII.	Laboratory control samples	A	LCS/LCSD
IX.	Field duplicates	SW	D = 2+3
X.	Sample result verification	A	Not reviewed for Level III validation.
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	IR70-A15-021	15L198-03	Water	12/22/15
2	IR70-A15-020	15L198-04	Water	12/22/15
3	IR70-A15-093**	15L198-05**	Water	12/22/15
4	IR70-A15-022	15L198-06	Water	12/22/15
5	IR70-A15-017	15L198-07	Water	12/22/15
6	IR70-A15-019	15L198-08	Water	12/22/15
7	IR70-A15-038	15L198-09	Water	12/22/15
8	IR70-A15-043	15L198-10	Water	12/22/15
9	IR70-A15-115	15L198-13	Water	12/22/15
~~10~~	~~IR70-A15-112~~	~~15L198-15~~	~~Water~~	~~12/22/15~~
11	IR70-A15-017MS	15L198-07MS	Water	12/22/15
12	IR70-A15-017MSD	15L198-07MSD	Water	12/22/15
13	IR70-A15-017DUP	15L198-07DUP	Water	12/22/15
14	PBW 1			
15	PBW 2			
16	PBW 3			

LDC #: 35803F6

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: M

Method: Inorganics (EPA Method see cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	✓			
Were titrant checks performed as required? (Level IV only)	✓			
Were balance checks performed as required? (Level IV only)	✓			
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
IV. Matrix spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL(≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.	✓			
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	✓			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

LDC #: 35803F6

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were detection limits < RL?	✓			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
X. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 35803F6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Page: 1 of 1
Reviewer: MG
2nd reviewer: DL

All circled methods are applicable to each sample.

Sample ID	Matrix	Parameter
1→6,8,9	W	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Br Org Acid $S^=$
7	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Org Acid
QC 11	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Br Org Acid
12	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Br Org Acid
13	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Br $S^=$
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4

Comments:

LDC #: 35803F6

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: MG
2nd Reviewer: SC

METHOD: Inorganics, Method See Cover

Conc. units: mg/L **Associated Samples:** 4,5 (>5x)

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB	ICB/CCB (mg/L)		No Qual's.									
TOC		0.8727	4.36										

Conc. units: mg/L **Associated Samples:** 9 (>5x)

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB	ICB/CCB (mg/L)		No Qual's.									
TOC		0.7058	3.53										

Conc. units: mg/L **Associated Samples:** 6,8

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB	ICB/CCB (mg/L)		6	8								
TOC		0.6117	3.06	0.842	1.31								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC#: 35803F6

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: MG
2nd Reviewer: JL

Inorganics, Method See Cover

Analyte	Concentration (mg/L)		RPD	
	2	3		
Alkalinity	194	196	1	
Bromide	0.508	0.508	0	
Chloride	126	128	2	
Nitrate as N	0.0909	0.0611	39	
Sulfate	171	173	1	
TDS	611	620	1	
Total organic Carbon	0.609	0.618	1	

V:\FIELD DUPLICATES\FD_inorganic\35803F6.WPD

LDC #: 35803 F6

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: MG
2nd Reviewer: &

METHOD: Inorganics, Method see cover

The correlation coefficient (r) for the calibration of TOC was recalculated. Calibration date: 1-11-16

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

$\%R = \frac{Found}{True} \times 100$ Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution
True = concentration of each analyte in the ICV or CCV source

Type of Analysis	Analyte	Standard ID	Conc. Found (units)	Area True (units)	Recalculated r or %R	Reported r or %R	Acceptable (Y/N)
Initial calibration	TOC	Blank	0 (mg/L)	0.3199	$r^2 = 0.999979$	$r^2 = 0.999980$	Y
		Standard 1	1 ( )	2.329			
		Standard 2	5 ( )	11.34			
		Standard 3	10 ( )	21.43			
		Standard 4	40 ( )	86.60			
		Standard 5	80 ( )	174.0			
		Standard 6	-	-			
		Standard 7	-	-			
Calibration verification	Acetate	CCV58	1.606 (mg/L)	1.5 (mg/L)	107	107	
Calibration verification	NO_2-N	CCV21	2.005 (mg/L)	2.0 (mg/L)	100.2	100.2	
Calibration verification	Cl	CCV33	1.926 (mg/L)	2.0 (mg/L)	96.3	96.3	

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803F6

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: X

METHOD: Inorganics, Method See cover

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$$\%R = \frac{Found}{True} \times 100$$

Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$$RPD = \frac{|S-D|}{(S+D)/2} \times 100$$

Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
LCS	Laboratory control sample	Alk	67.47 (mg/L)	74.7 (mg/L)	90	90	Y
2359 11	Matrix spike sample	Br	(SSR-SR) 9.63 (mg/L)	10 (mg/L)	96	97	↓
13	Duplicate sample	TDS	1682 (mg/L)	1695 (mg/L)	1	1	↓

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803F6

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: MG
2nd reviewer: M

METHOD: Inorganics, Method see cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments?
Y N N/A Are all detection limits below the CRQL?

Compound (analyte) results for # 3, TOC reported with a positive detect were recalculated and verified using the following equation:

Concentration =

$y = mx + b$

where
m = 2.170
b = 0.000
dil = 1x

Recalculation:

$1.342 = 2.170(x) + 0.000$

$0.6184 \text{ mg/L} = X$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
1	3	NO_3-N	0.0611	0.0611	Y
		Total Alk	196	196	↓
		TDS	620	620	↓
		TOC	0.618	0.618	↓

Note: methods 300.0(M), SM4500-S2F are N.D. for level IV sample

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Seal Beach, IR Site 70

LDC Report Date: February 8, 2016

Parameters: Methane, Ethane, & Ethene

Validation Level: Level III & IV

Laboratory: EMAX Laboratories, Inc.

Sample Delivery Group (SDG): 15L198

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
IR70-A15-021	15L198-03	Water	12/22/15
IR70-A15-021DL	15L198-03DL	Water	12/22/15
IR70-A15-020	15L198-04	Water	12/22/15
IR70-A15-020DL	15L198-04DL	Water	12/22/15
IR70-A15-093**	15L198-05**	Water	12/22/15
IR70-A15-093DL**	15L198-05DL**	Water	12/22/15
IR70-A15-022	15L198-06	Water	12/22/15
IR70-A15-022DL	15L198-06DL	Water	12/22/15
IR70-A15-017	15L198-07	Water	12/22/15
IR70-A15-017DL	15L198-07DL	Water	12/22/15
IR70-A15-019	15L198-08	Water	12/22/15
IR70-A15-019DL	15L198-08DL	Water	12/22/15
IR70-A15-038	15L198-09	Water	12/22/15
IR70-A15-038DL1	15L198-09DL1	Water	12/22/15
IR70-A15-038DL2	15L198-09DL2	Water	12/22/15
IR70-A15-115	15L198-13	Water	12/22/15
IR70-A15-115DL	15L198-13DL	Water	12/22/15
IR70-A15-106	15L198-14	Water	12/22/15
IR70-A15-112	15L198-15	Water	12/22/15
IR70-A15-108	15L198-16	Water	12/22/15
IR70-A15-017MS	15L198-07MS	Water	12/22/15
IR70-A15-017MSD	15L198-07MSD	Water	12/22/15
IR70-A15-043-043	15L198-10	Water	12/22/15
IR70-A15-043-043DL	15L198-10DL	Water	12/22/15

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Addendum 5 to the Final Sampling and Analysis Plan for Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach California (November 2014), the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 (October 2010), and a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Methane, Ethane, and Ethene by Method RSK-175

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

Retention time windows were established as required by the method for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

Retention times of all compounds in the calibration standards were within the established retention time windows for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

Sample IR70-A15-106 was identified as a trip blank. No contaminants were found.

Sample IR70-A15-112 was identified as an equipment rinsate. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-112	12/22/15	Methane	0.56 ug/L	IR70-A15-021 IR70-A15-021DL IR70-A15-020 IR70-A15-020DL IR70-A15-093** IR70-A15-093DL** IR70-A15-022 IR70-A15-022DL IR70-A15-017 IR70-A15-017DL IR70-A15-019 IR70-A15-019DL IR70-A15-038 IR70-A15-038DL1 IR70-A15-038DL2 IR70-A15-115 IR70-A15-115DL IR70-A15-043-043 IR70-A15-043-043DL

Sample IR70-A15-108 was identified as a source blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
IR70-A15-108	12/22/15	Methane	0.50 ug/L	IR70-A15-112

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
IR70-A15-112	Methane	0.56 ug/L	0.56U ug/L

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were not within the QC limits for IR70-A15-017MS/MSD. No data were qualified since the parent sample results were greater than 4X the spiked concentration. Relative percent differences (RPD) were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Field Duplicates

Samples IR70-A15-020 and IR70-A15-093** and samples IR70-A15-020DL and IR70-A15-093DL** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	IR70-A15-020	IR70-A15-093**	
Ethene	2.0U	2.9	Not calculable
Methane	250	250	0

Compound	Concentration (ug/L)		RPD
	IR70-A15-020DL	IR70-A15-093DL**	
Methane	2300	2300	0

IX. Compound Quantitation

All compound quantitations met validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
IR70-A15-021 IR70-A15-020 IR70-A15-093** IR70-A15-022 IR70-A15-017 IR70-A15-019 IR70-A15-038DL1 IR70-A15-115 IR70-A15-043	Methane	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A
IR70-A15-038	Ethene Methane	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects)	A

Raw data were not reviewed for Level III validation.

X. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the method.
In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Compound	Flag	A or P
IR70-A15-021 IR70-A15-020 IR70-A15-093** IR70-A15-022 IR70-A15-017 IR70-A15-019 IR70-A15-115 IR70-A15-043	Methane	R	A
IR70-A15-021DL IR70-A15-020DL IR70-A15-093DL** IR70-A15-022DL IR70-A15-017DL IR70-A15-019DL IR70-A15-038DL2 IR70-A15-115DL IR70-A15-043DL	All TCL compounds except Methane	R	A
IR70-A15-038	Ethene Methane	R R	A
IR70-A15-038DL1	Ethane Methane	R R	A

Due to source blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Based upon the data validation all other results are considered valid and usable for all purposes.

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Data Qualification Summary - SDG 15L198

Sample	Compound	Flag	A or P	Reason
IR70-A15-021 IR70-A15-020 IR70-A15-093** IR70-A15-022 IR70-A15-017 IR70-A15-019 IR70-A15-115 IR70-A15-043	Methane	R	A	Overall assessment of data
IR70-A15-021DL IR70-A15-020DL IR70-A15-093DL** IR70-A15-022DL IR70-A15-017DL IR70-A15-019DL IR70-A15-038DL2 IR70-A15-115DL IR70-A15-043DL	All TCL compounds except Methane	R	A	Overall assessment of data
IR70-A15-038	Ethene Methane	R R	A	Overall assessment of data
IR70-A15-038DL1	Ethane Methane	R R	A	Overall assessment of data

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Laboratory Blank Data Qualification Summary - SDG 15L198

No Sample Data Qualified in this SDG

Seal Beach, IR Site 70
Methane, Ethane, & Ethene - Field Blank Data Qualification Summary - SDG 15L198

Sample	Compound	Modified Final Concentration	A or P
IR70-A15-112	Methane	0.56U ug/L	A

LDC #: 35803F51 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/03/16
SDG #: 15L198 Level III/IV Page: 1 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer: NG
2nd Reviewer: [illegible]

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	ICAL ≤ 20 % ICV ≤ 20 %
III.	Continuing calibration	A	CCV ≤ 20 %
IV.	Laboratory Blanks	A	
V.	Field blanks	SW	TB* = 18 ER = 19 SB ≥ 20
VI.	Surrogate spikes	N	Not req'd
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	A	LCS/D
IX.	Field duplicates	SW	D = 3/5, 4/6
X.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation.
XI.	Target compound identification	A	Not reviewed for Level III validation.
XII.	System performance	A	Not reviewed for Level III validation.
XIII.	Overall assessment of data	SW	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; * ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER: ER = Equipment Rinse

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1 2	IR70-A15-021	15L198-03	Water	12/22/15
2 2	IR70-A15-021DL	15L198-03DL	Water	12/22/15
3 2	IR70-A15-020 D1	15L198-04	Water	12/22/15
4 2	IR70-A15-020DL D2	15L198-04DL	Water	12/22/15
5 2	IR70-A15-093** D1	15L198-05**	Water	12/22/15
6 2	IR70-A15-093DL** D2	15L198-05DL**	Water	12/22/15
7 1	IR70-A15-022	15L198-06	Water	12/22/15
8 1	IR70-A15-022DL	15L198-06DL	Water	12/22/15
9 1	IR70-A15-017	15L198-07	Water	12/22/15
10 1	IR70-A15-017DL	15L198-07DL	Water	12/22/15
11 2	IR70-A15-019	15L198-08	Water	12/22/15
12 2	IR70-A15-019DL	15L198-08DL	Water	12/22/15
13 2	IR70-A15-038	15L198-09	Water	12/22/15
14 2	IR70-A15-038DL1	15L198-09DL1	Water	12/22/15
15 2	IR70-A15-038DL2	15L198-09DL2	Water	12/22/15
16 1	IR70-A15-115	15L198-13	Water	12/22/15

LDC #: 35803F51 **VALIDATION COMPLETENESS WORKSHEET** Date: 02/03/16
SDG #: 15L198 Level III/IV Page: 2 of 2
Laboratory: EMAX Laboratories, Inc. Reviewer: JG
2nd Reviewer: [illegible]

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

	Client ID	Lab ID	Matrix	Date
17 1	IR70-A15-115DL	15L198-13DL	Water	12/22/15
18 3	IR70-A15-106	15L198-14	Water	12/22/15
19 3	IR70-A15-112	15L198-15	Water	12/22/15
20 3	IR70-A15-108	15L198-16	Water	12/22/15
21 1	IR70-A15-017MS	15L198-07MS	Water	12/22/15
22 1	IR70-A15-017MSD	15L198-07MSD	Water	12/22/15
23 2	IR70-A15-043	-10		
24 2	-043DL	-10DL		
25				
26				

Notes:

1	MB 4K 1W						
2	2W						
3	3W						

LDC #: 35803F51

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Method: ✓ GC ____ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?		✓		
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. Field Blanks				
Were field blanks identified in this SDG?	✓			
Were target compounds detected in the field blanks?	✓			
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?			✓	
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?		✓		

LDC #: 35803 FS1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?		✓		
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 35803F51

VALIDATION FINDINGS WORKSHEET
Field Blanks

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: DC

METHOD: / **GC** __ **HPLC**

Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?

Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 12/22/15
Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank
Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: ER

Associated Samples: All except 18, 19, 20 (>5X)

Compound	Blank ID	Blank ID	Sample Identification							
	19									
Methane	0.56									
CRQL										

Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 12/22/15
Field blank type: (circle one) Field Blank / Trip Blank/ Atmospheric Blank/ Ambient Blank
Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: ____

Associated Samples: 19

Compound	Blank ID	Blank ID	Sample Identification							
	20		19							
Methane	0.50		0.56/U							
CRQL										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with compound concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC #: 35803F51

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: ✓ GC ___ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?
Y N N/A Was an MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed?
Y N N/A Were the MS/MSD percent recoveries (%R) and relative percent differences (RPD) within QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	21/22	Methane	-170000 (10-160)	-170000 (10-160)	( )	9, 10	No qual (parent conc 74x SA)
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#: 35803F51

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC MEE (Method RSK-175)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD
	3	5	
Ethene	2.0U	2.9	NC
Methane	250	250	0

Compound	Concentration (ug/L)		RPD
	4	6	
Methane	2300	2300	0

V:\Josephine\FIELD DUPLICATES\35803F51 ecc seal beach.wpd

LDC #: 35803 F51

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: / **GC** __ **HPLC**

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Level IV/D Only
Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	> cal range	1, 3, 5, 7, 9, 11, 14, 16, 23	J detects / A
	Ethene, Methane		13	

Comments: See sample calculation verification worksheet for recalculations

COMQUANew.wpd

LDC #: 35803 F51

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: SC

METHOD: ✓ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

Y N N/A Was the overall quality and usability of the data acceptable?

#	Compound Name	Finding	Associated Samples	Qualifications
	Methane	> cal range	1, 3, 5, 7, 9, 11, 16, 23	R A
	All except Methane	dil	2, 4, 6, 8, 10, 12, 15, 17, 24	
	Ethene, Methane	> cal range	13	
	Ethane, Methane	either dil or > cal range	14	✓

Comments:

OVRNew1.wpd

LDC #: 35803F51

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC ✓ HPLC _____

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C
average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where:
A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported CF (13.56 std)	Recalculated CF (13.56 std)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL GCT010	6/19/2015	Methane	31479.0	31479.4	34528.0	34528.0	13.9	13.9

LDC # 35803F51

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: GC ✓ HPLC ____

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	FL29002A	12/29/2015	Methane	13.56	13.74	13.74	1	1.3
2	FL29016A	12/29/2015	Methane	13.56	13.25	13.25	2	2.3

LDC #: 35803F51

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: / **GC** __**HPLC**

The percent recoveries (%R) and relative percent differences (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC - SC)/SA

RPD =(({SSCMS - SSCMSD} * 2) / (SSCMS + SSCMSD))*100

Where SSC = Spiked sample concentration; SC = Sample concentration; SA = Spike added; MS = Matrix spike; MSD = Matrix spike duplicate

MS/MSD samples: 21/22

Compound	Spike Added (ug/L)		Sample Conc. (ug/L)	Spike Sample Concentration (ug/L)		Matrix spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	---	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)											
Diesel (8015)											
Benzene (8021B)											
Methane (RSK-175)	13.6	13.6	24000	650	646	~170000	0	~170000	0	1	1
2,4-D (8151)											
Dinoseb (8151)											
Naphthalene (8310)											
Anthracene (8310)											
HMX (8330)											
2,4,6-Trinitrotoluene (8330)											
Phorate (8141A)											
Malathion (8141A)											
Formaldehyde (8315A)											

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803 F51

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: SC

METHOD: / **GC** __ **HPLC**

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration; LCS = Laboratory Control Sample; SA = Spike added; LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: LCS/D 2W

Compound		Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
		LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline	(8015)										
Diesel	(8015)										
Benzene	(8021B)										
Methane	(RSK-175)	13.6	13.6	13.0	12.6	96	96	93	93	3	3
2,4-D	(8151)										
Dinoseb	(8151)										
Naphthalene	(8310)										
Anthracene	(8310)										
HMX	(8330)										
2,4,6-Trinitrotoluene	(8330)										
Phorate	(8141A)										
Malathion	(8141A)										
Formaldehyde	(8315A)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35803F51

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd Reviewer: SR

METHOD: ✓ GC ___ HPLC

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

Concentration= (A)(Fv)(Df) / (RF)(Vs or Ws)(%S/100)

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. 6 Compound Name Methane

Concentration = (804668)(100) / (34528.1) = 2330.47

≈ 2300 ug/L

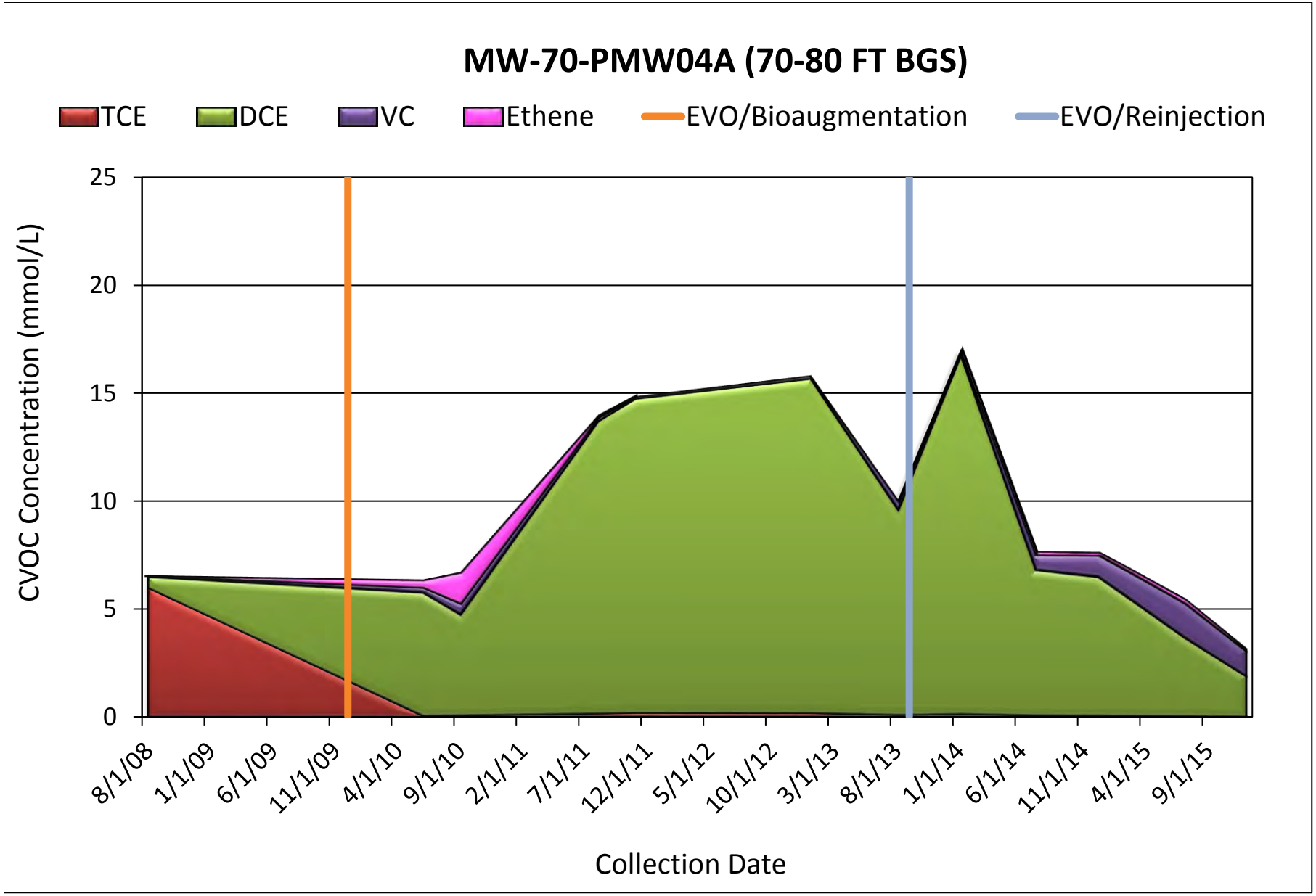
#	Sample ID	Compound	Reported Concentrations (ug/L)	Recalculated Results Concentrations ( )	Qualifications
	6	Methane	2 300		

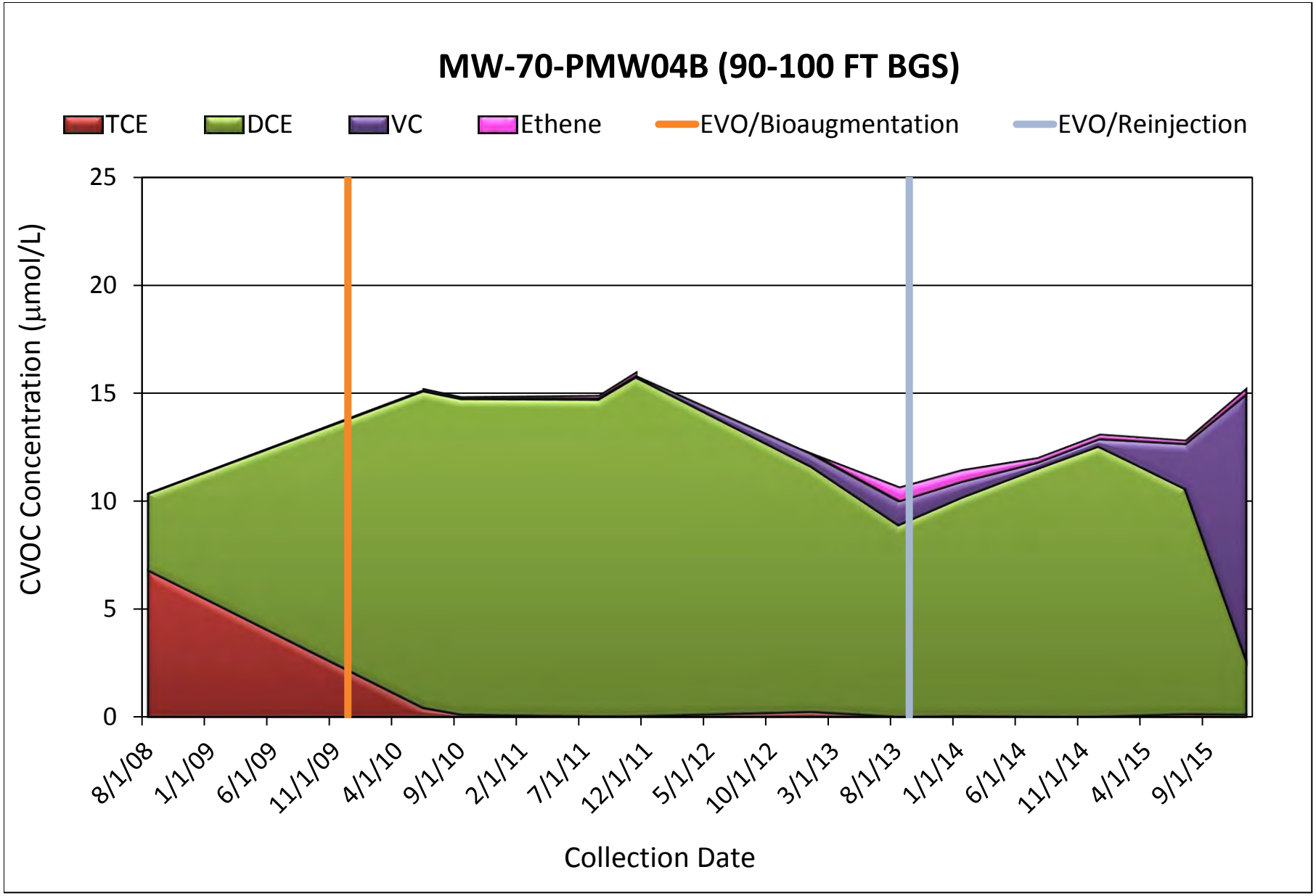
Comments:

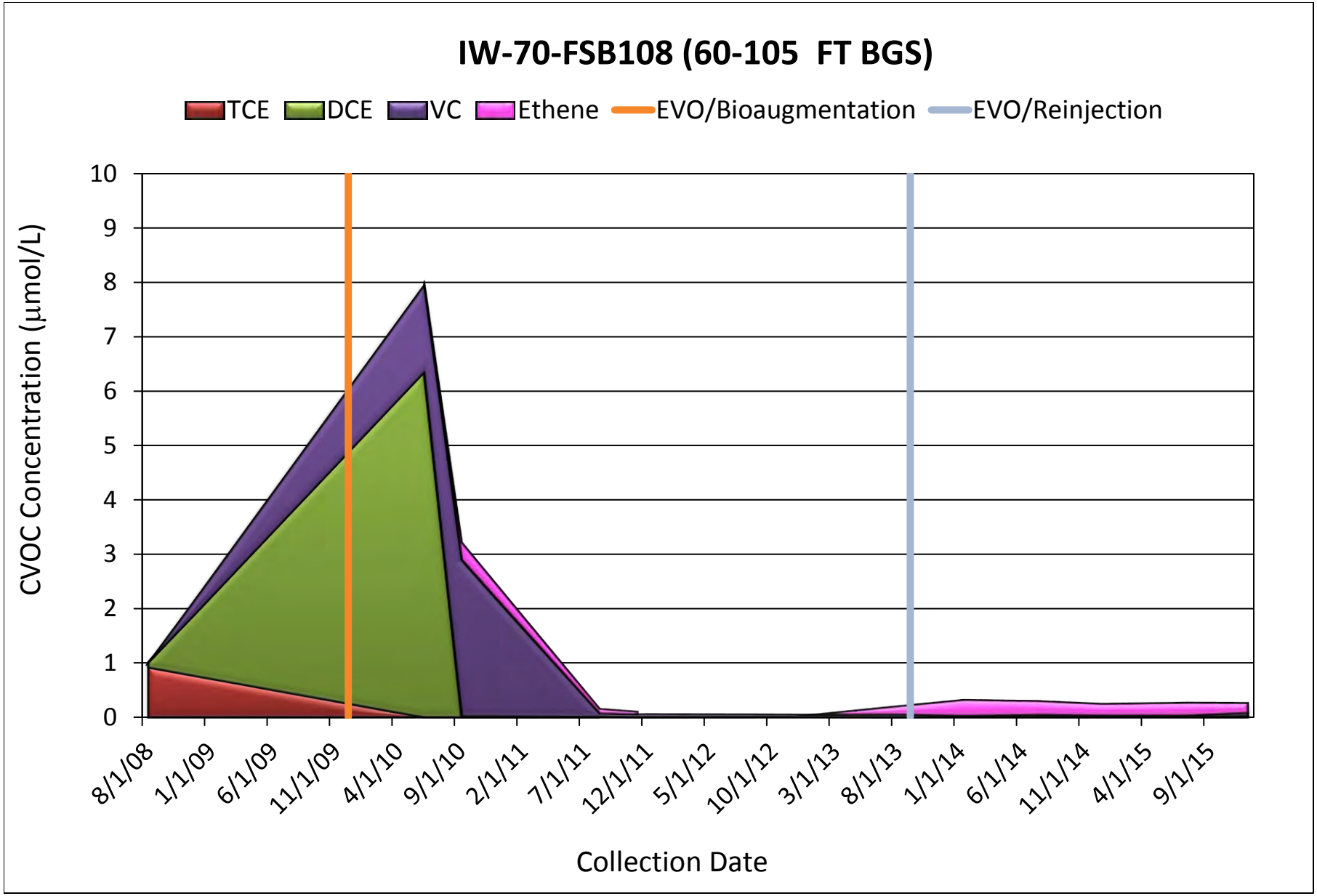
APPENDIX C

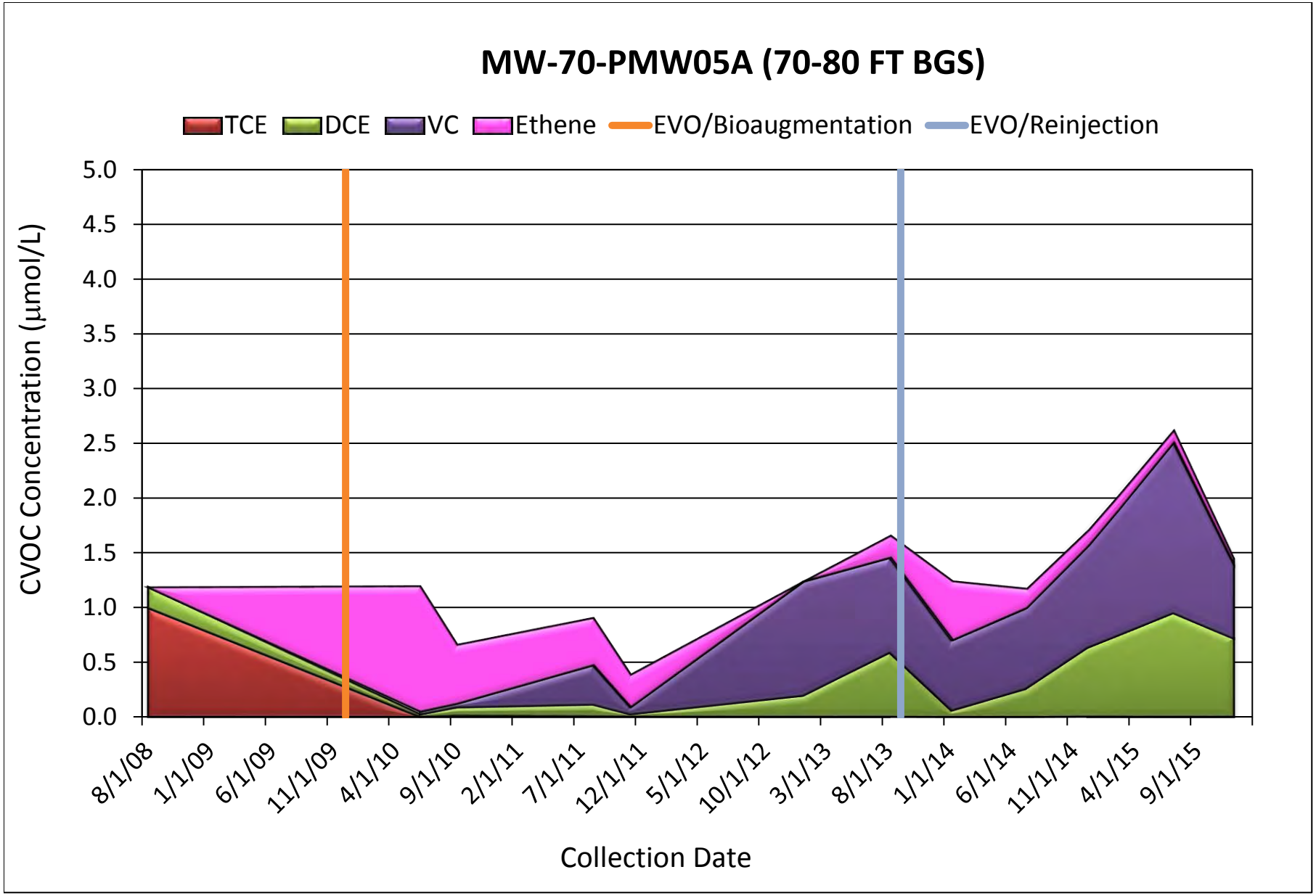
PERFORMANCE MONITORING DETAILED TREND GRAPHS
(on CD only)

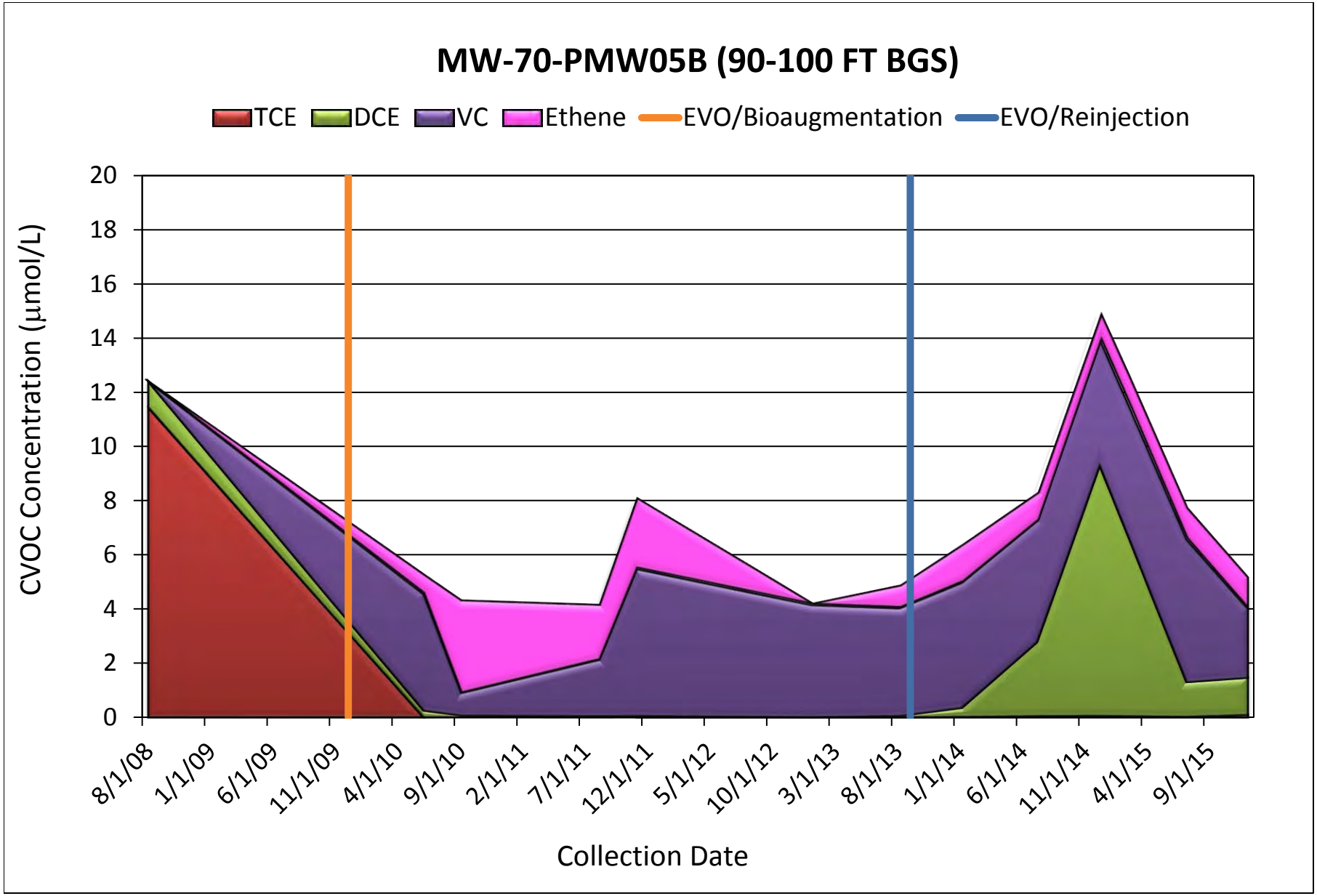
CVOC Trend Graphs

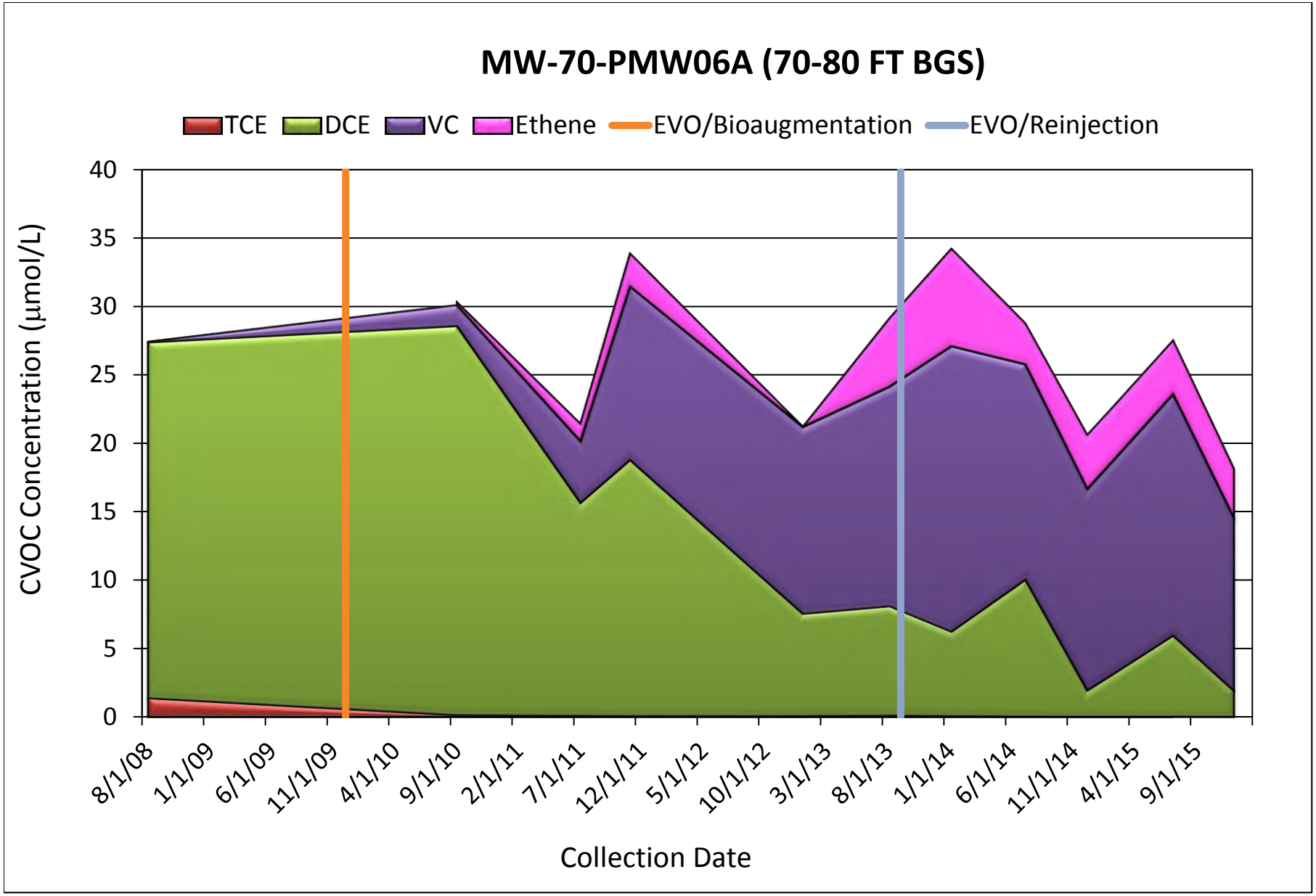

MW-70-PMW04A (70-80 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (mmol/L)
25
20
15
10
5
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

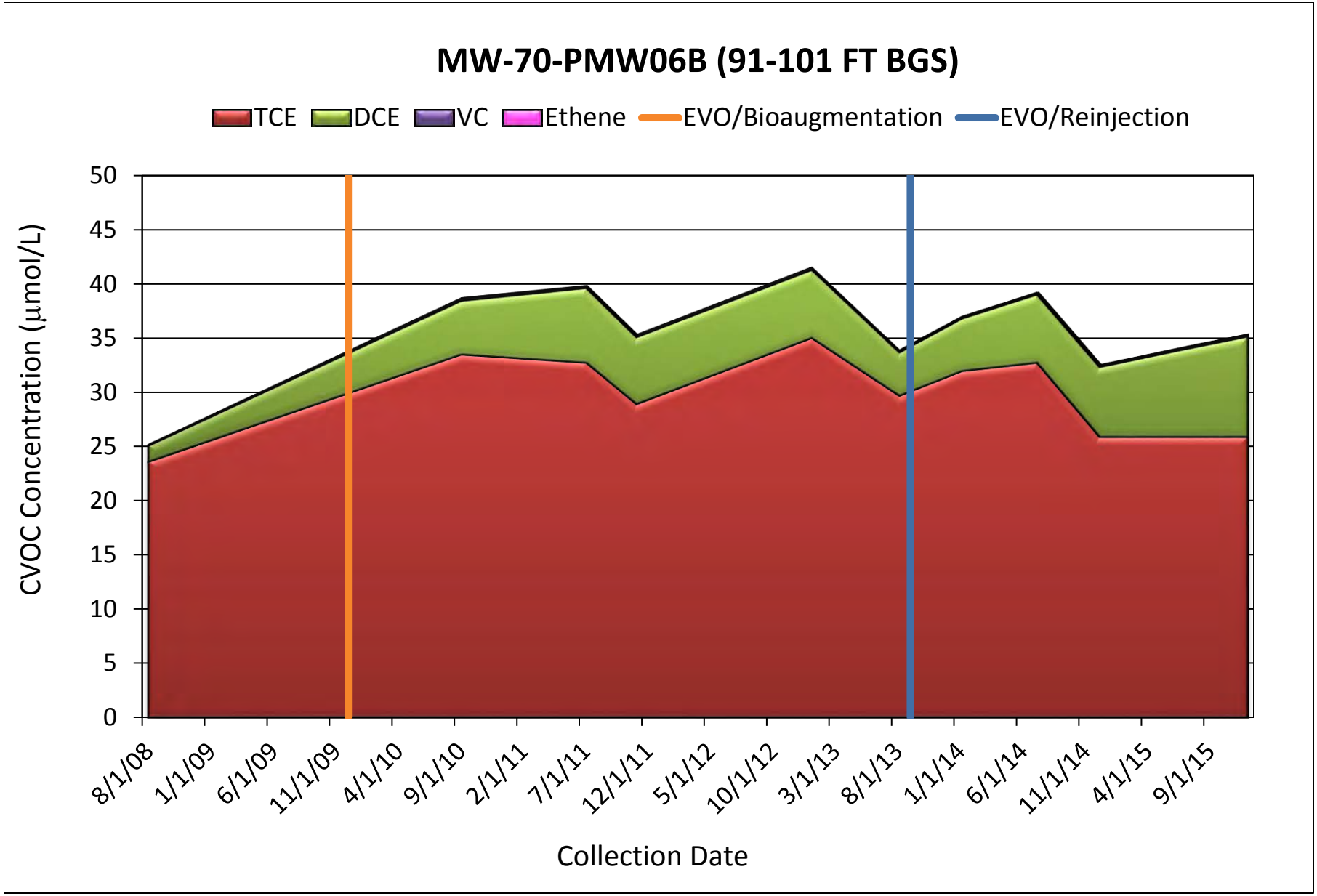

MW-70-PMW04B (90-100 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
25
20
15
10
5
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

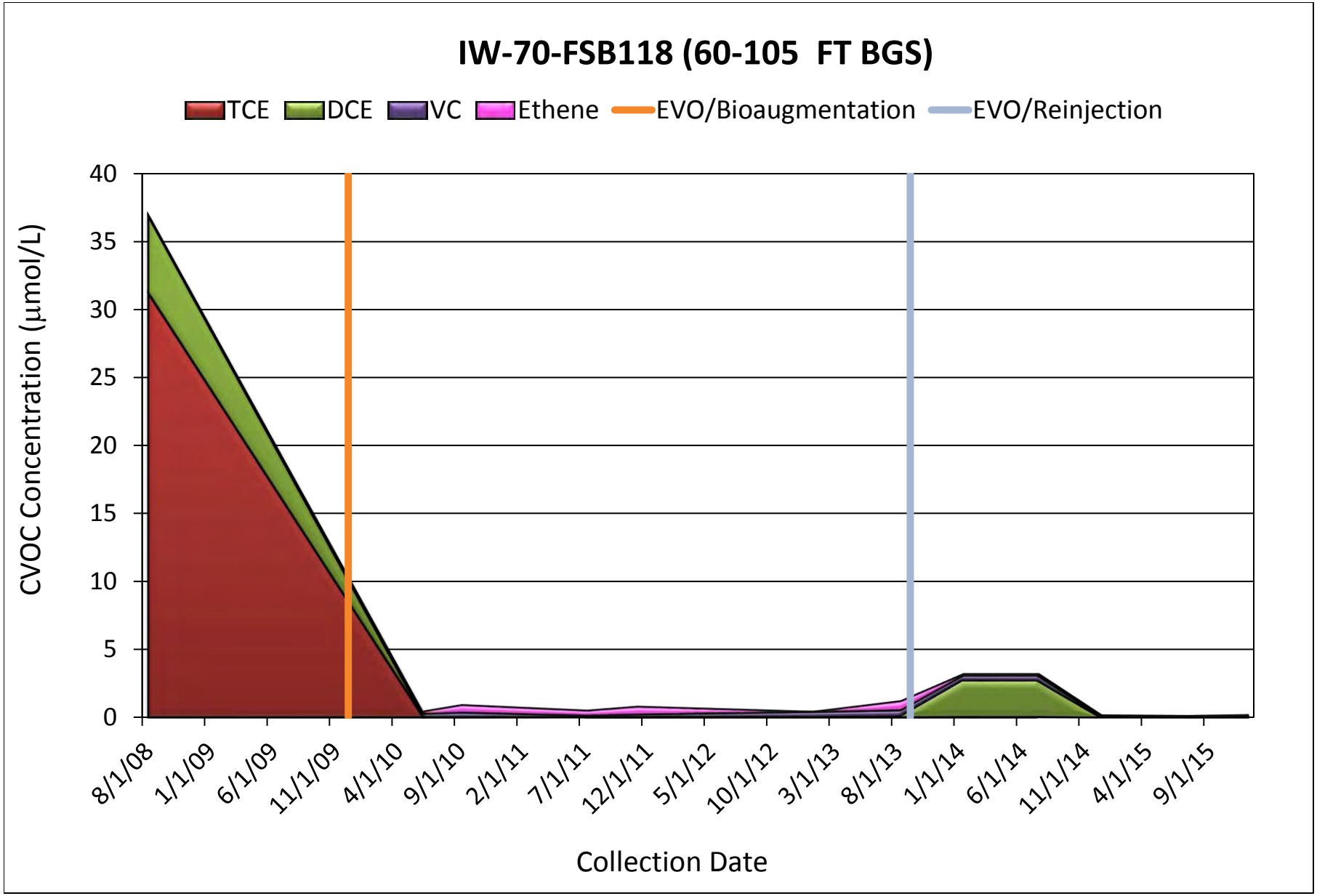

IW-70-FSB108 (60-105 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
10
9
8
7
6
5
4
3
2
1
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

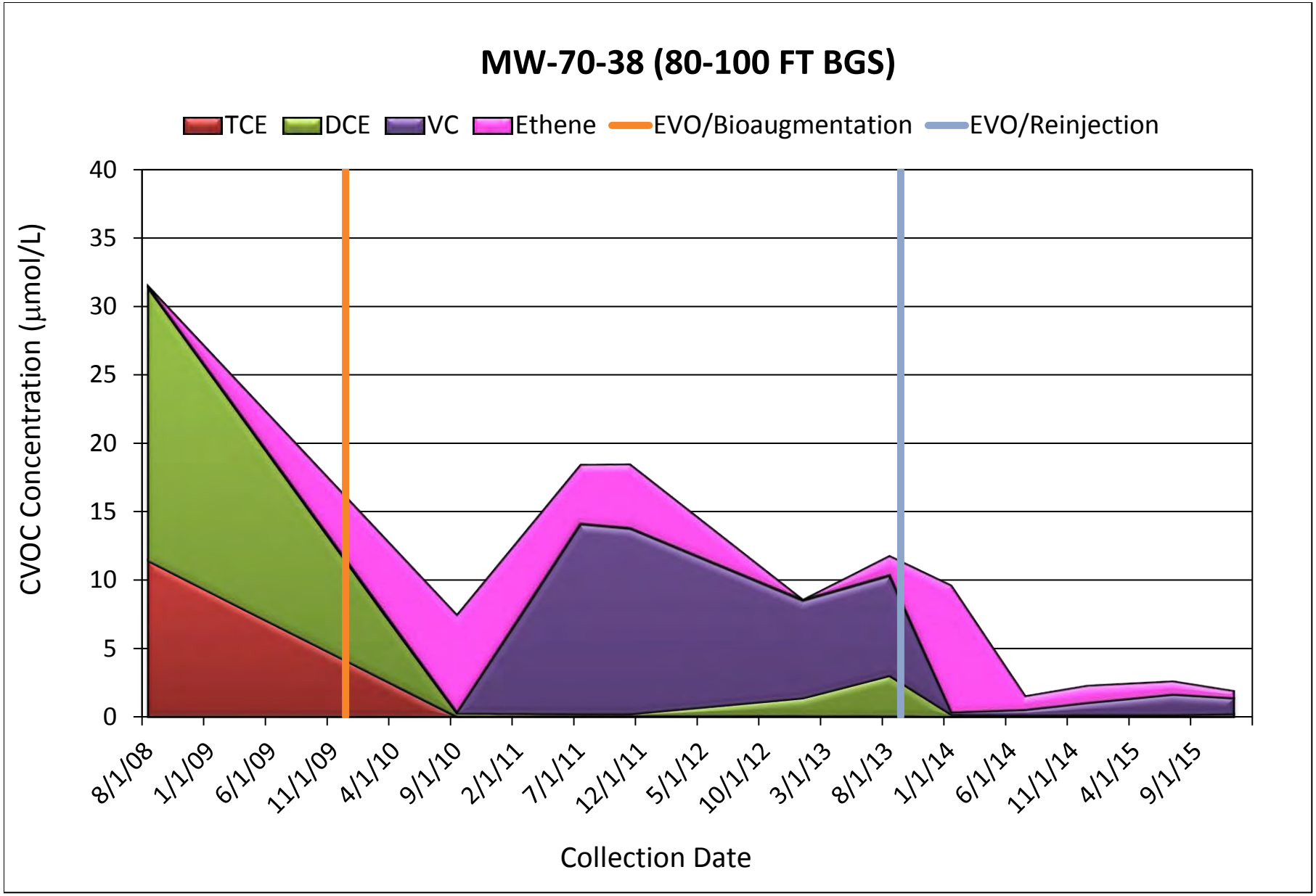

MW-70-PMW05A (70-80 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

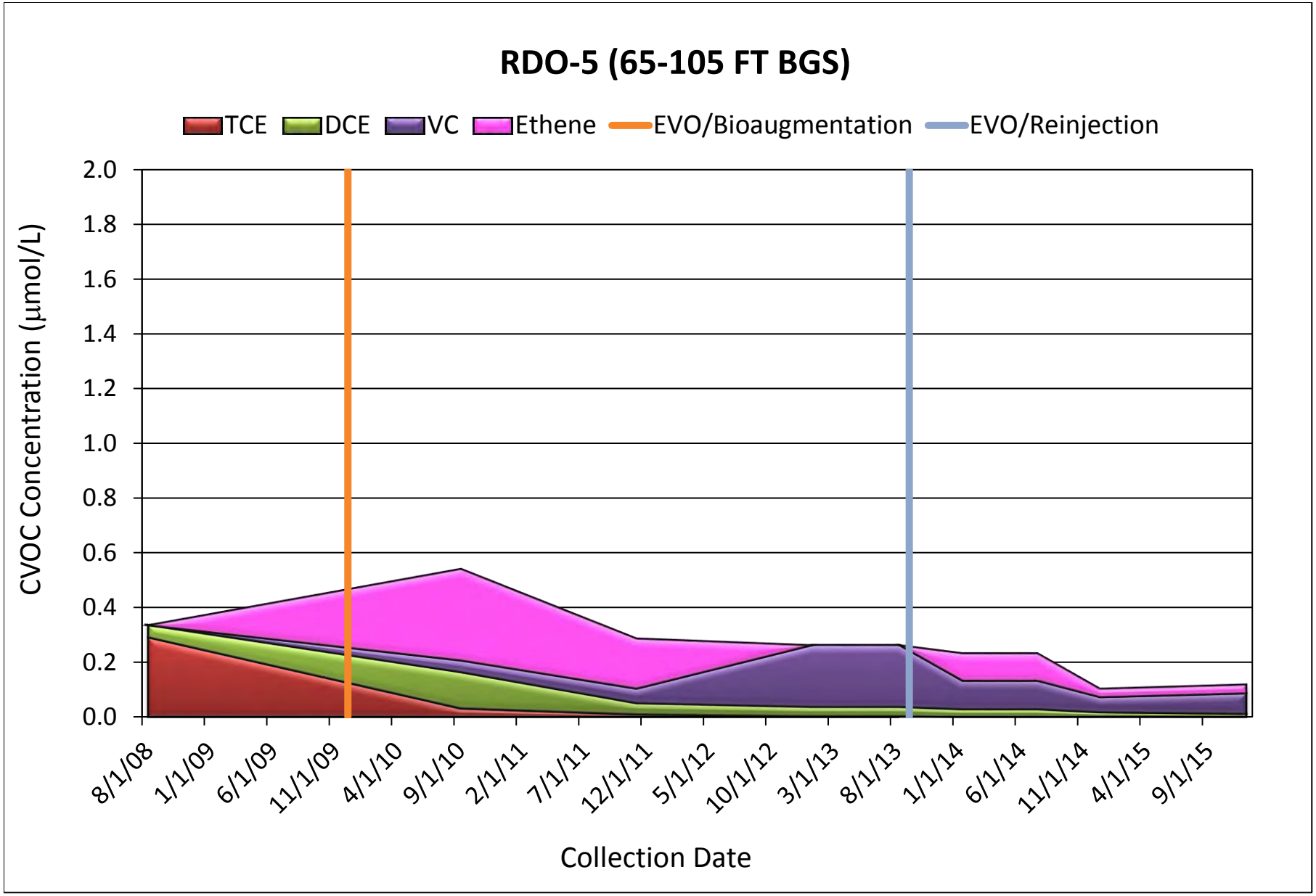

MW-70-PMW05B (90-100 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

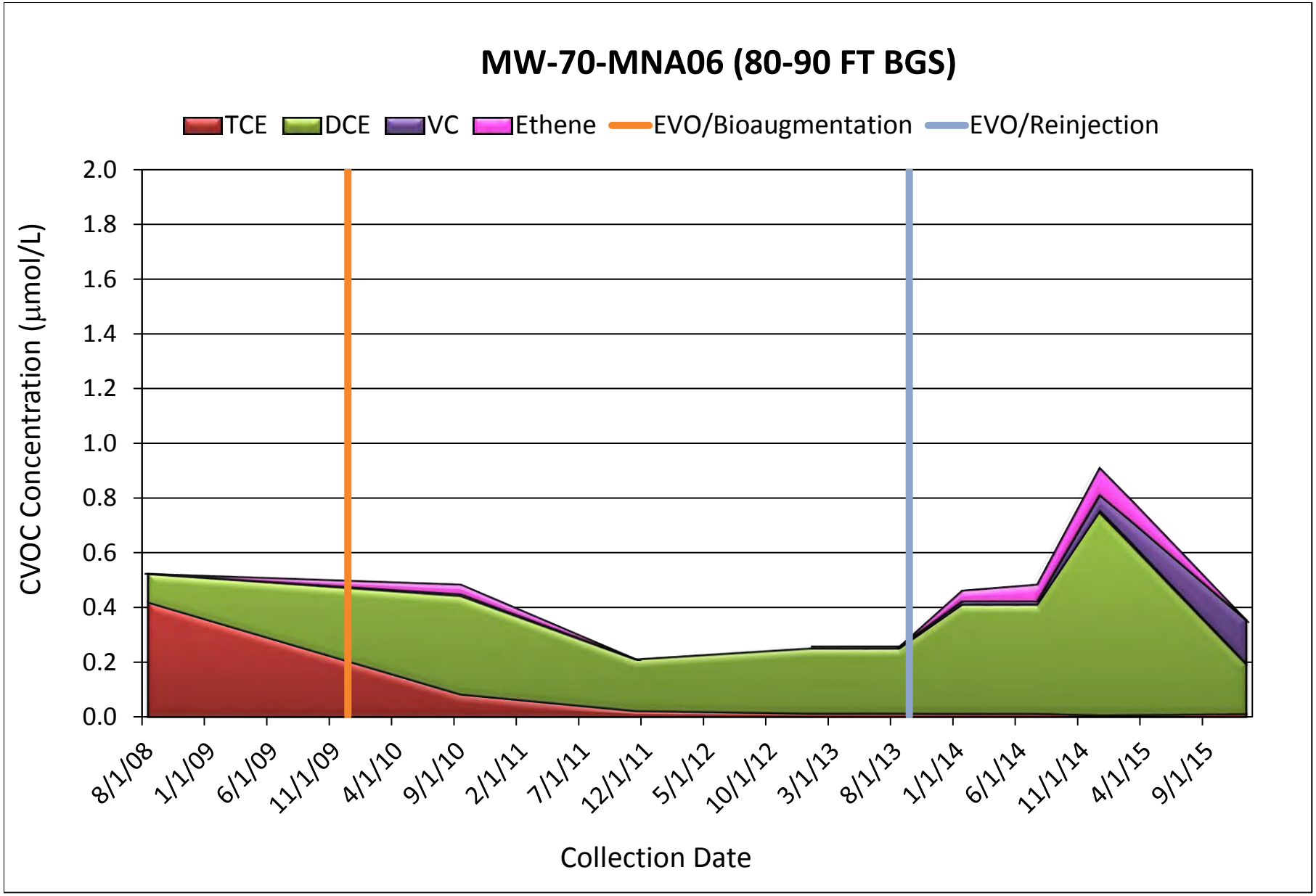

MW-70-PMW06A (70-80 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
40
35
30
25
20
15
10
5
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

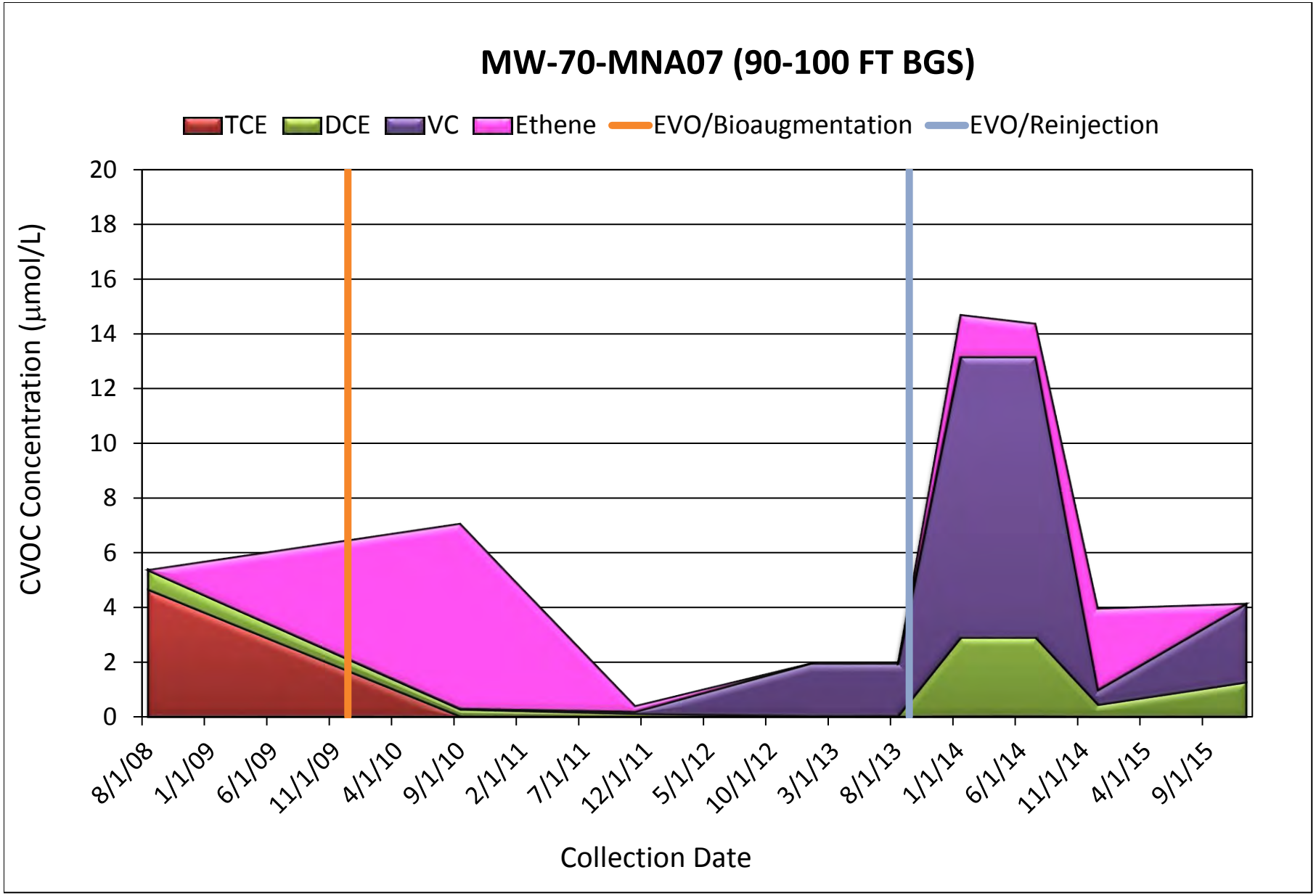

MW-70-PMW06B (91-101 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
50
45
40
35
30
25
20
15
10
5
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

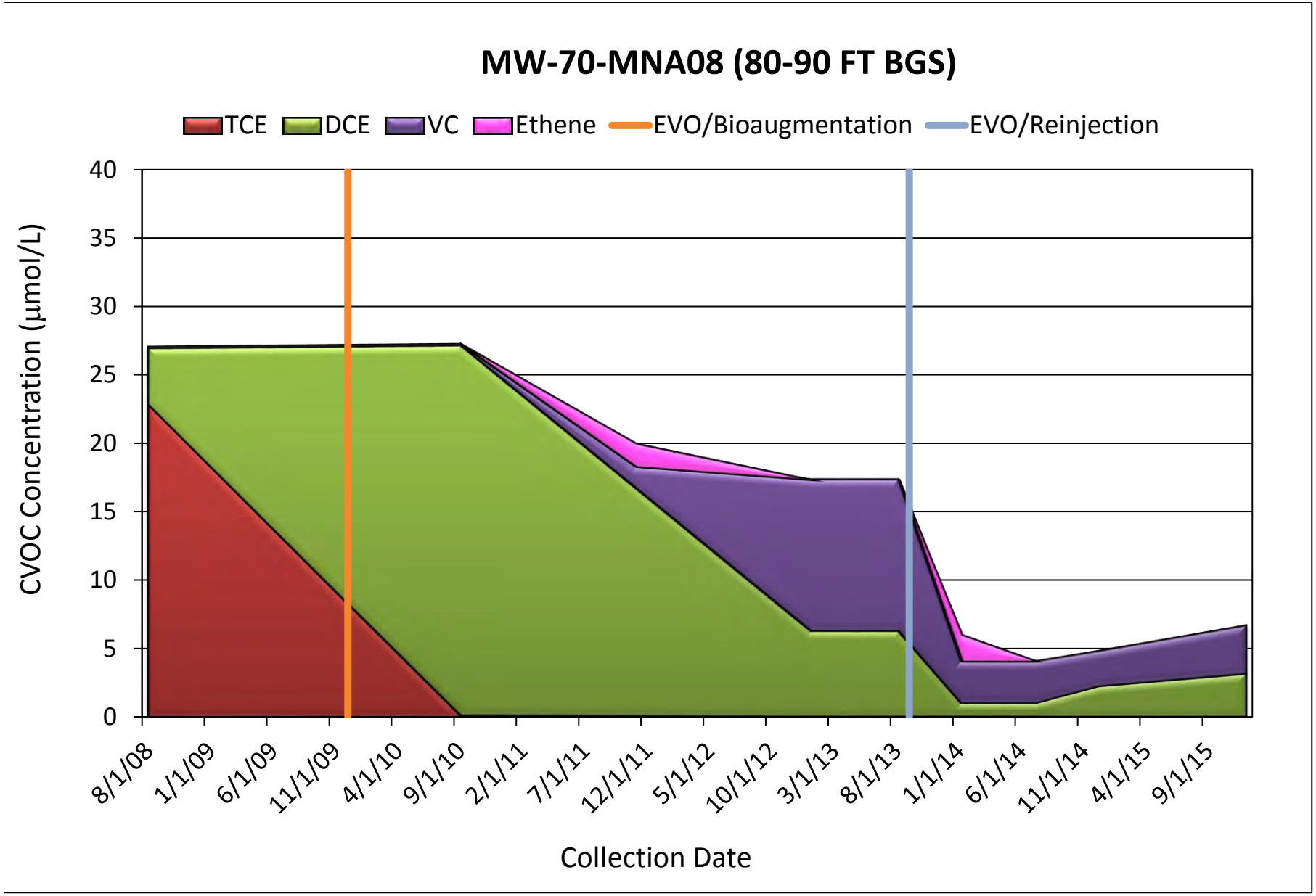

IW-70-FSB118 (60-105 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
40
35
30
25
20
15
10
5
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

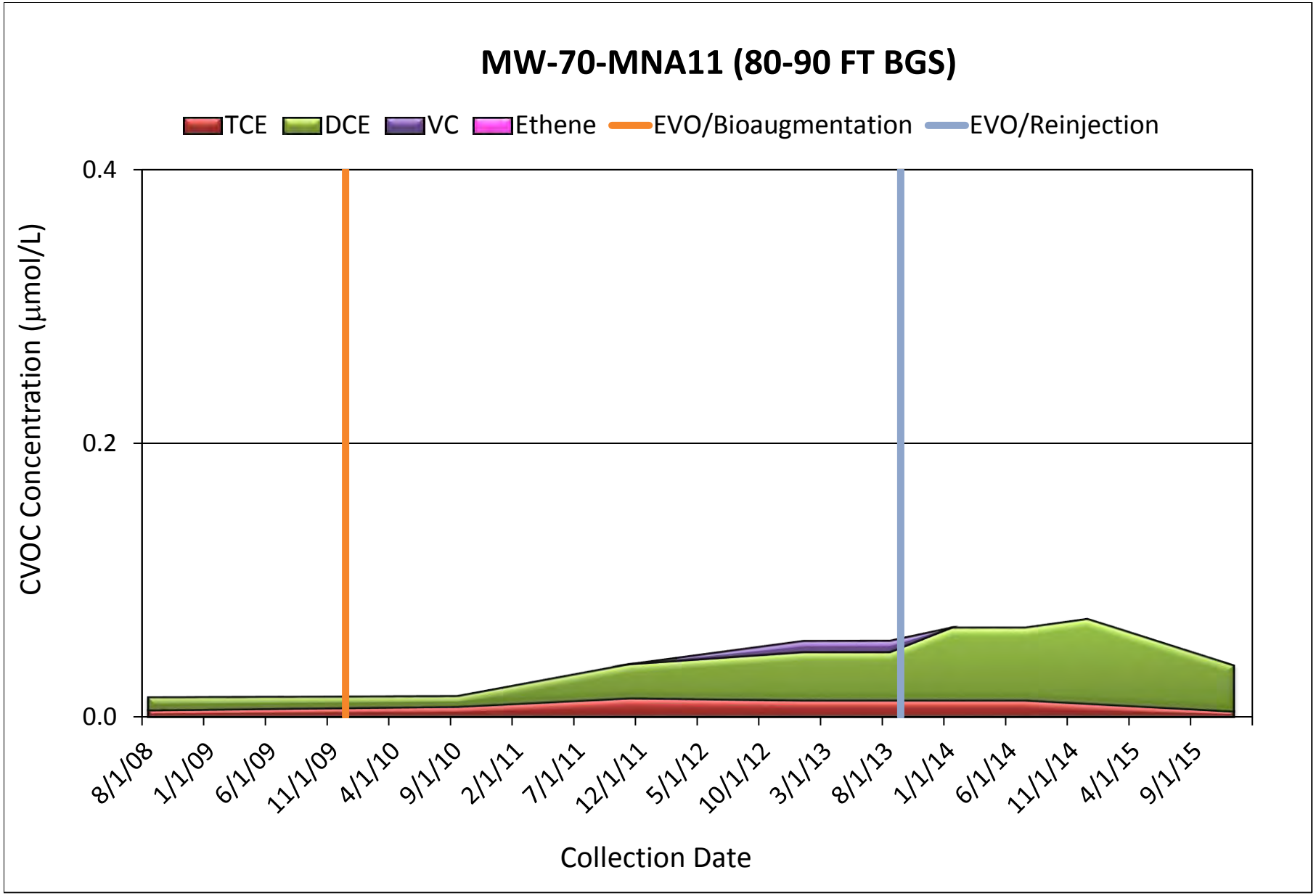

MW-70-38 (80-100 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
40
35
30
25
20
15
10
5
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

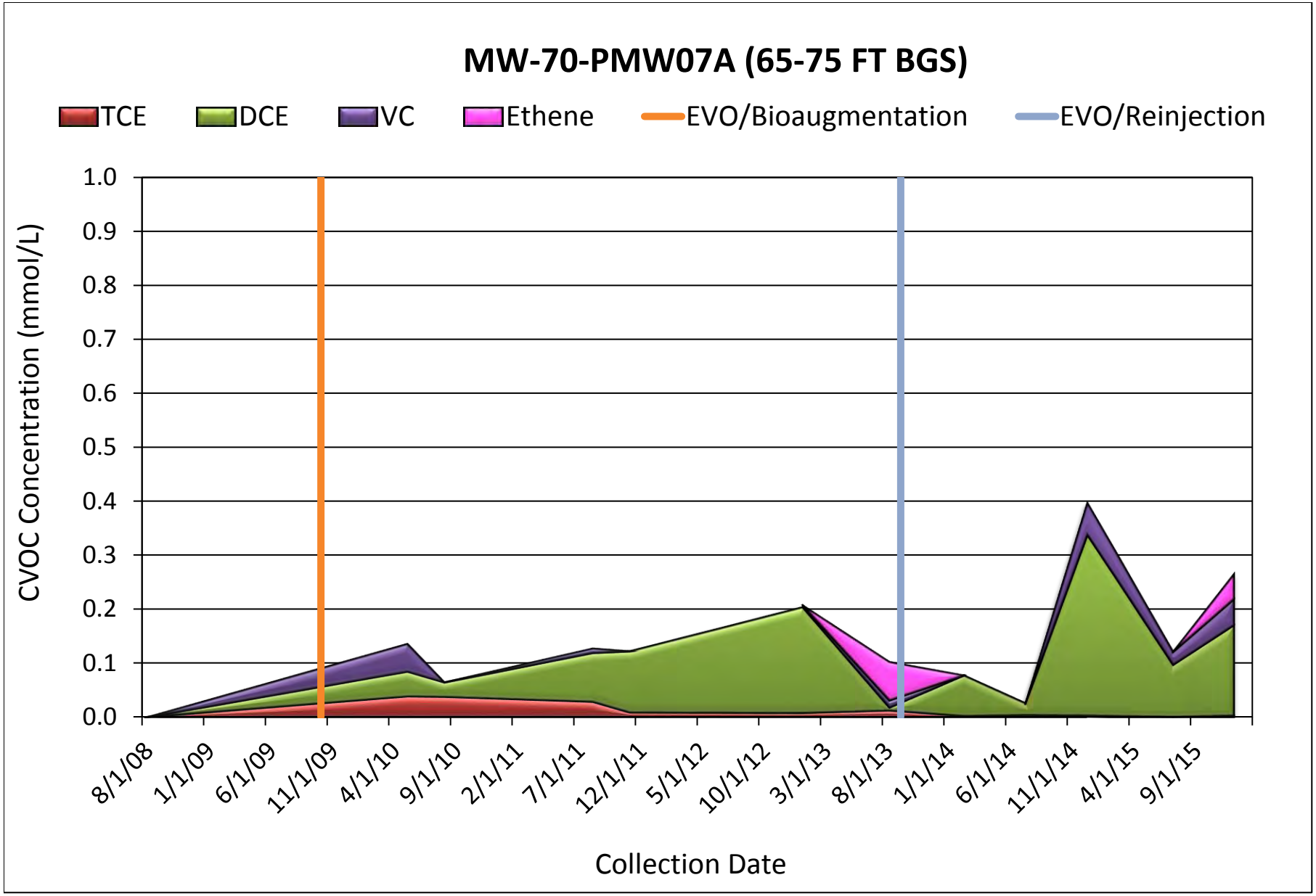

RDO-5 (65-105 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

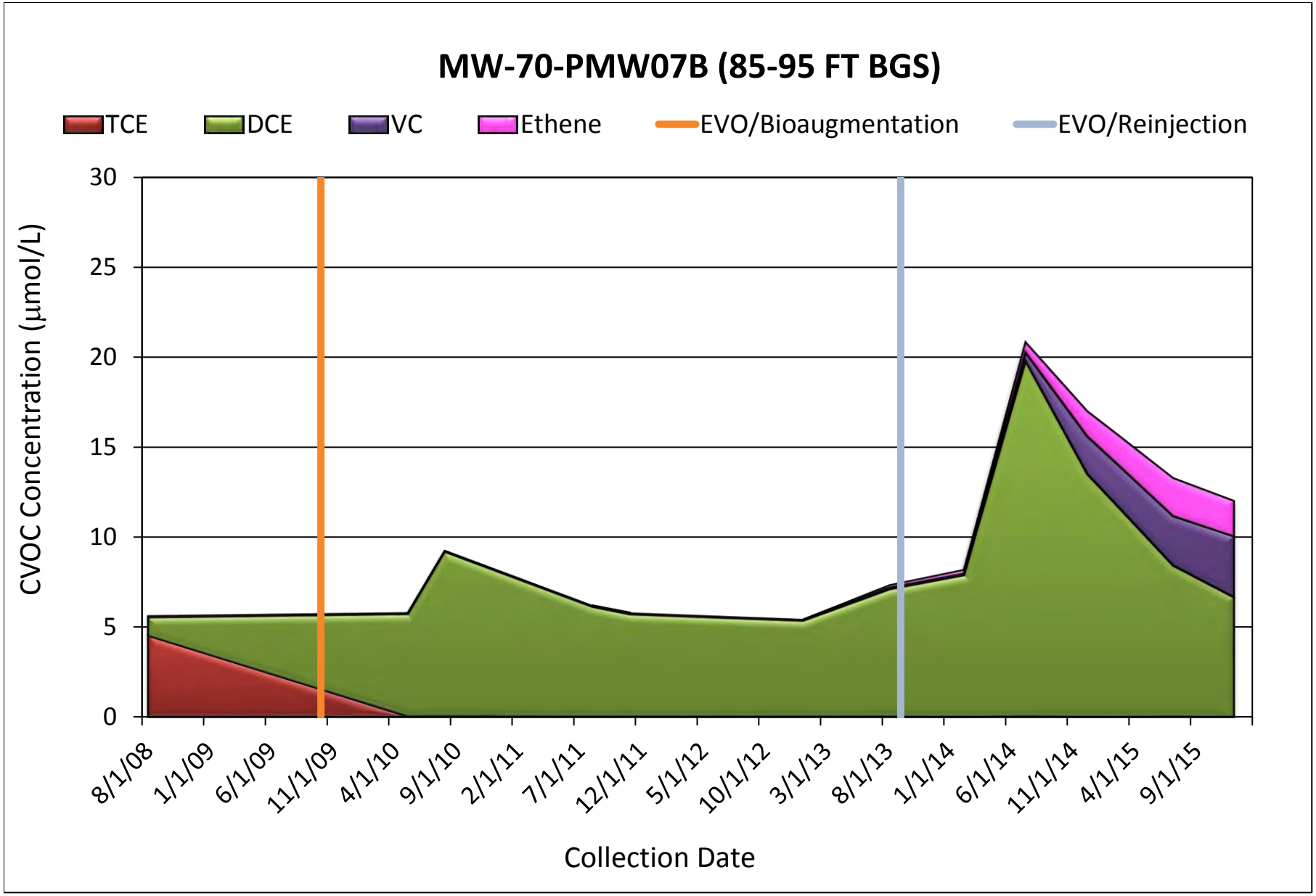

MW-70-MNA06 (80-90 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

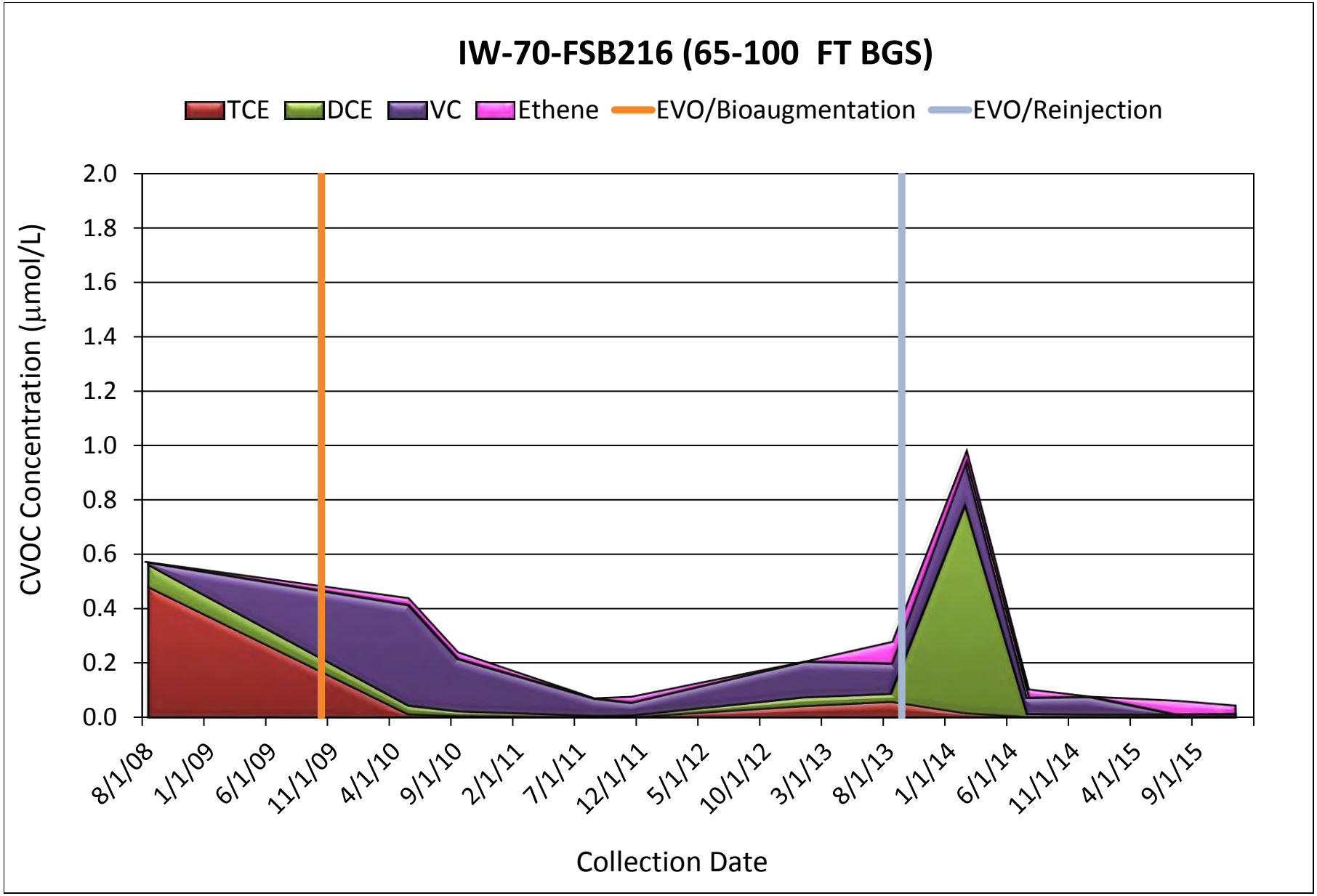

MW-70-MNA07 (90-100 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

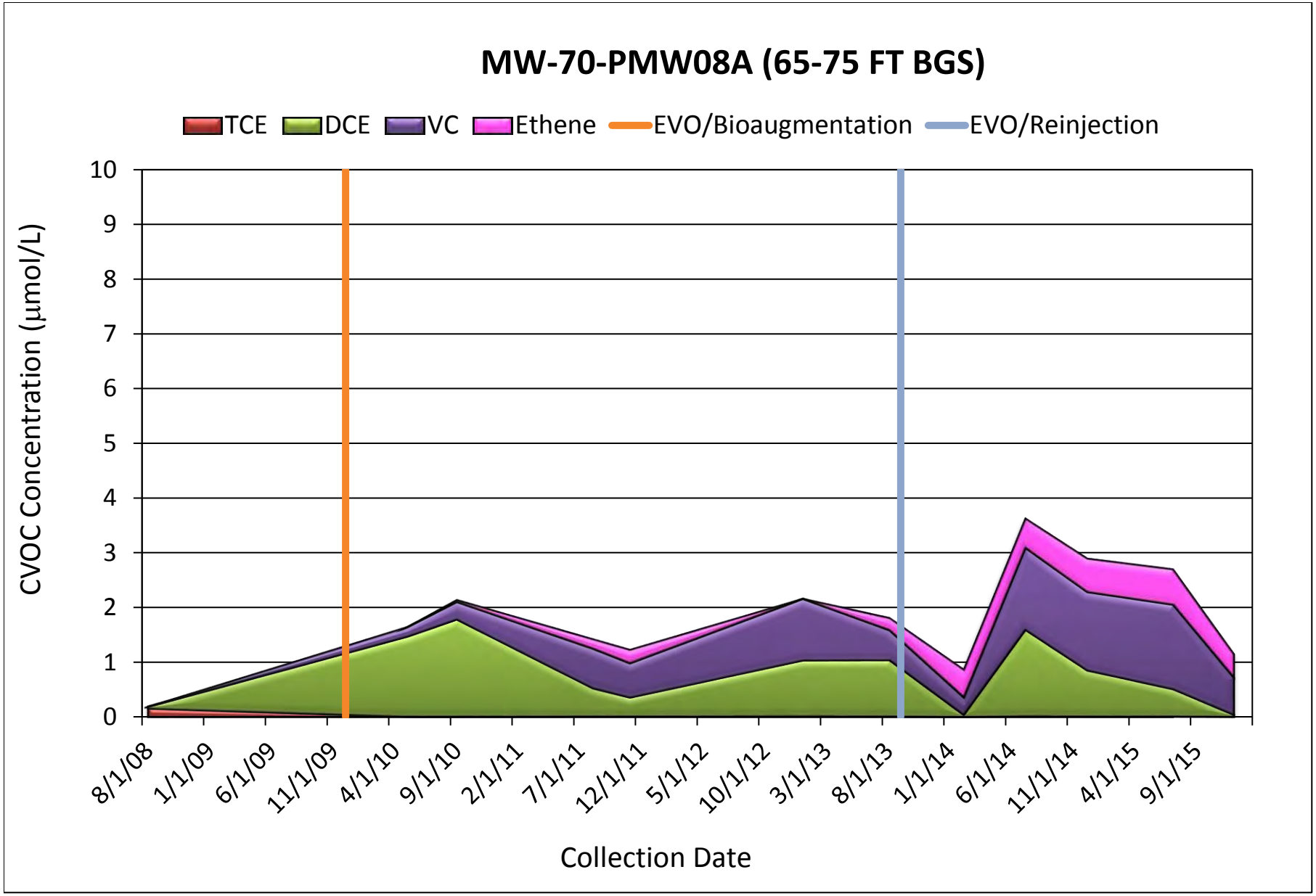

MW-70-MNA08 (80-90 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
40
35
30
25
20
15
10
5
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

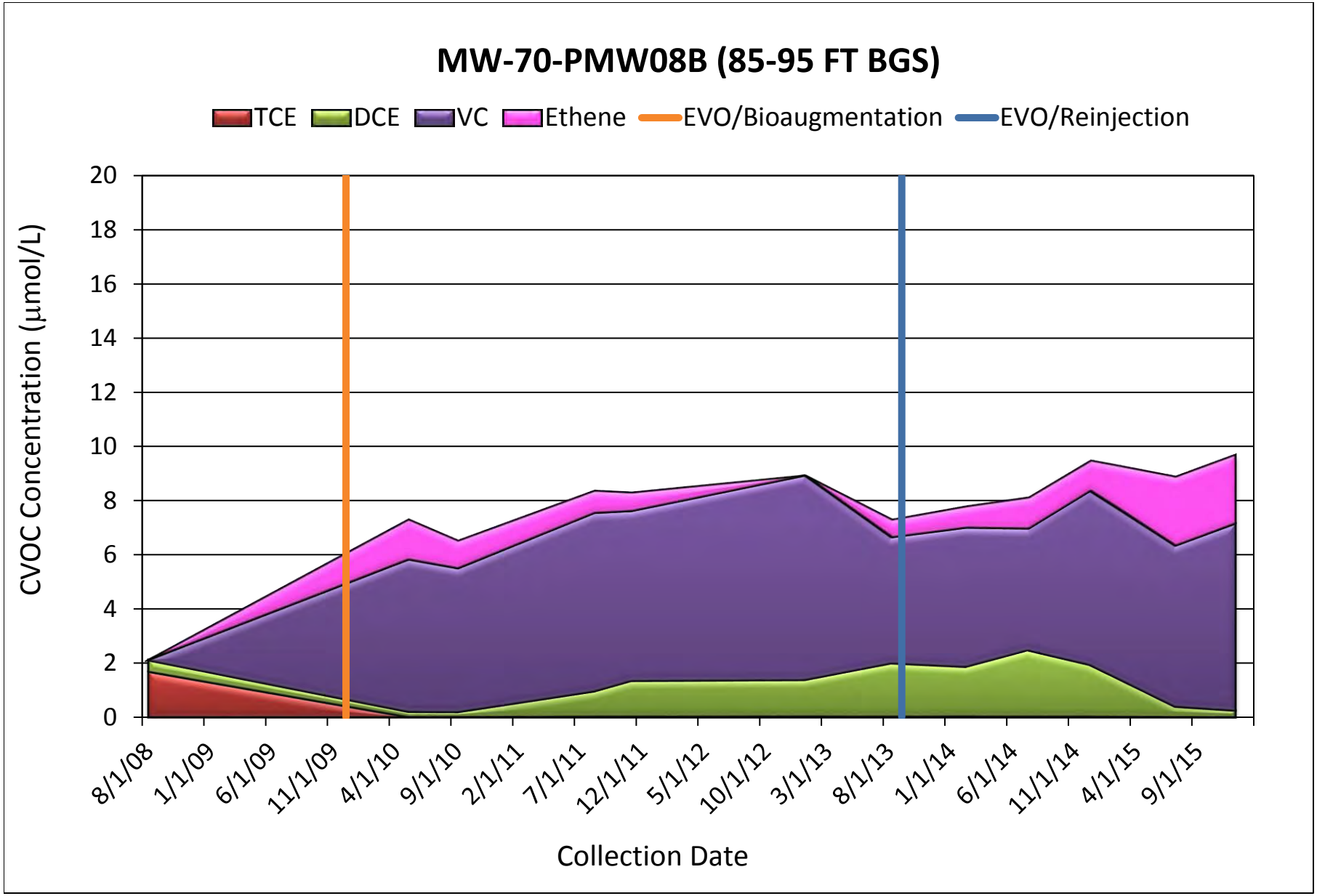

MW-70-MNA11 (80-90 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
0.4
0.2
0.0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

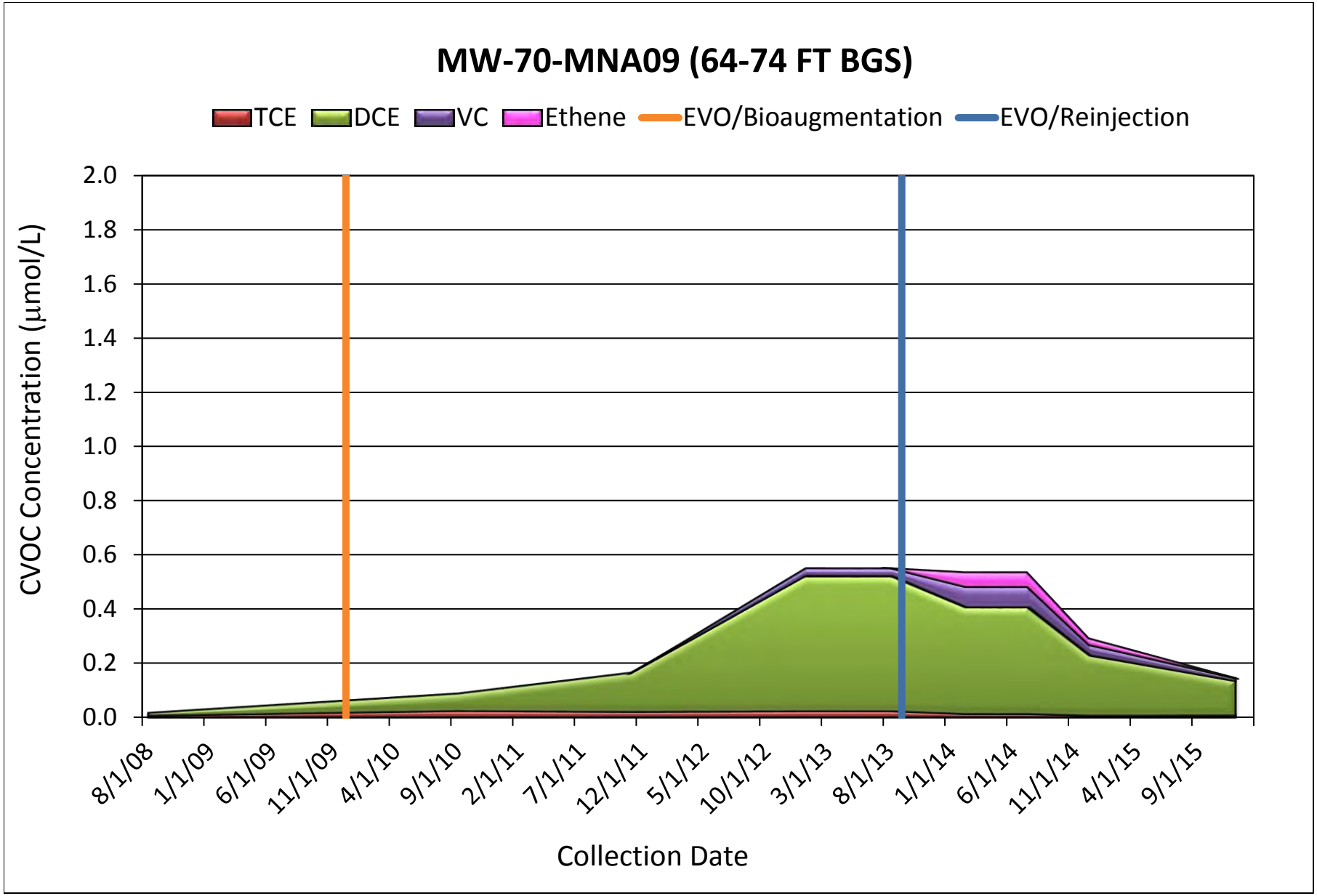

MW-70-PMW07A (65-75 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (mmol/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

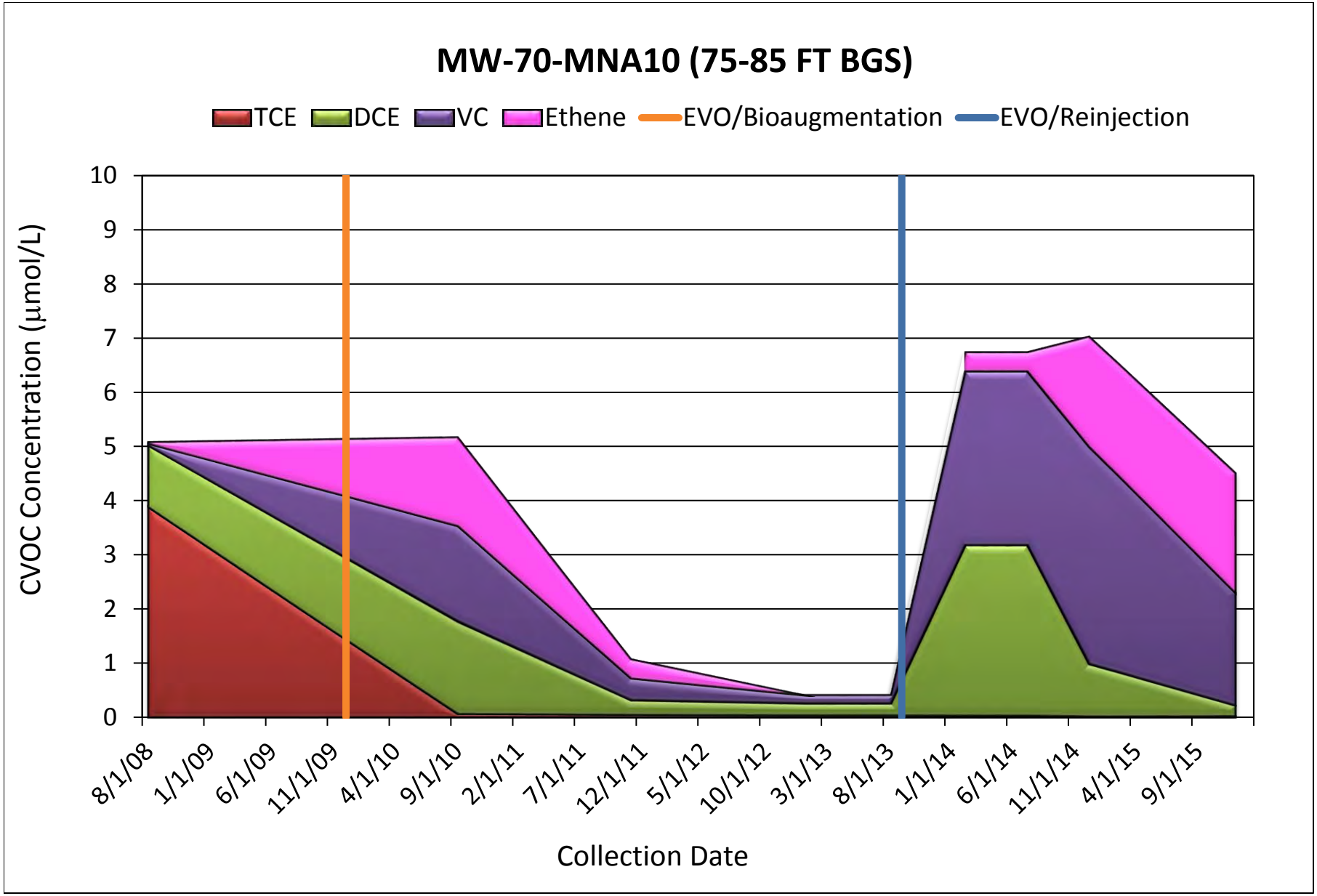

MW-70-PMW07B (85-95 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
30
25
20
15
10
5
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

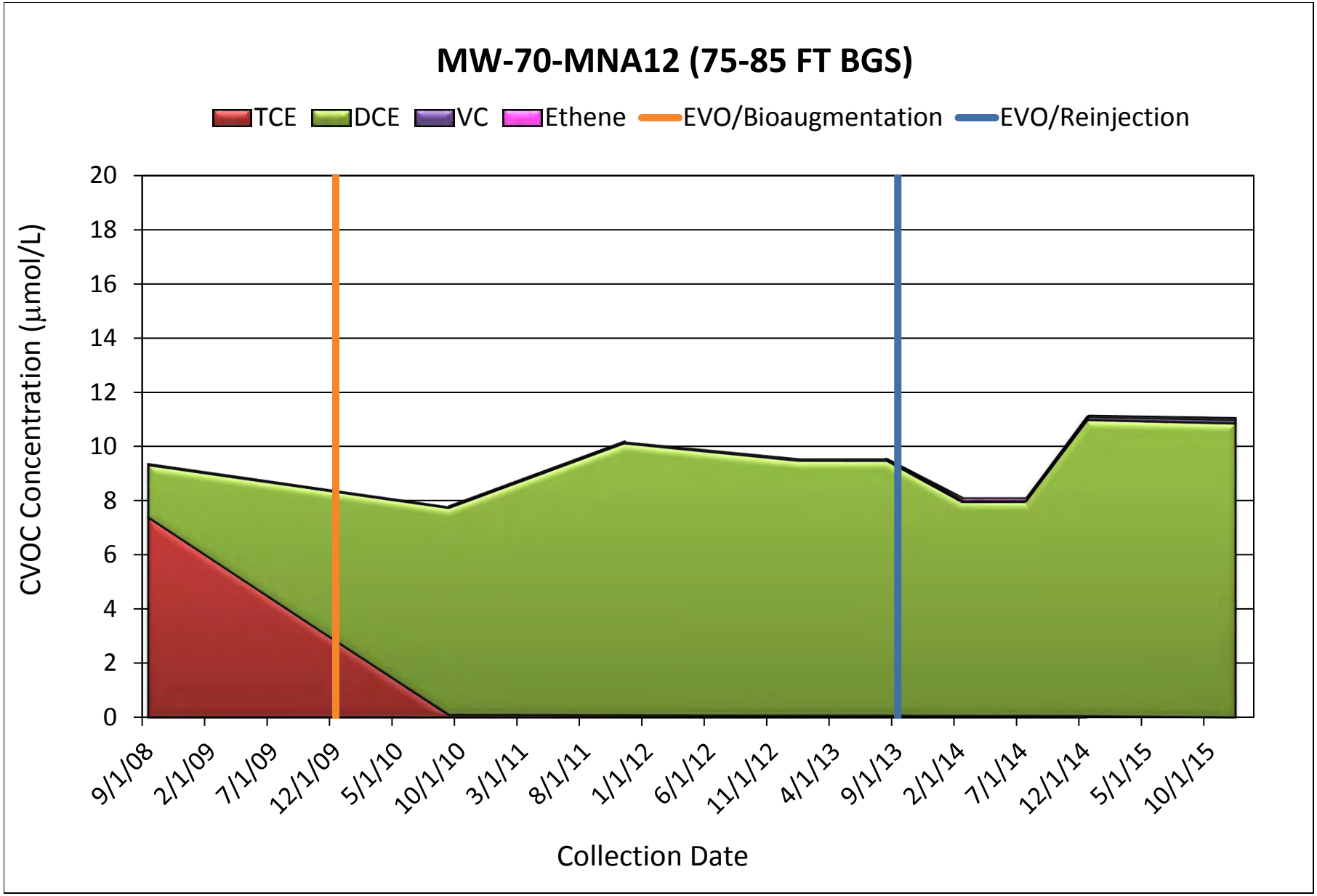

IW-70-FSB216 (65-100 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

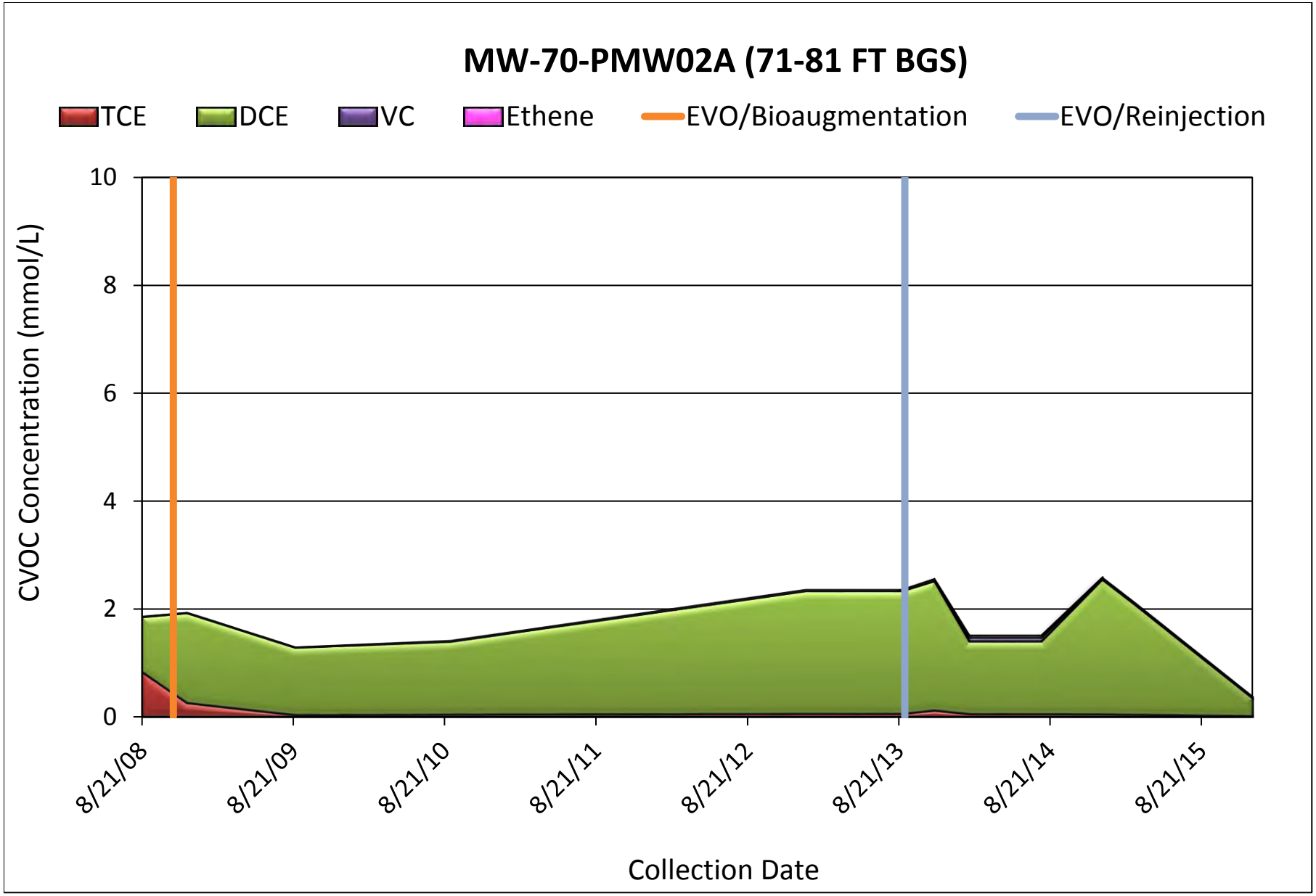

MW-70-PMW08A (65-75 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
10
9
8
7
6
5
4
3
2
1
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

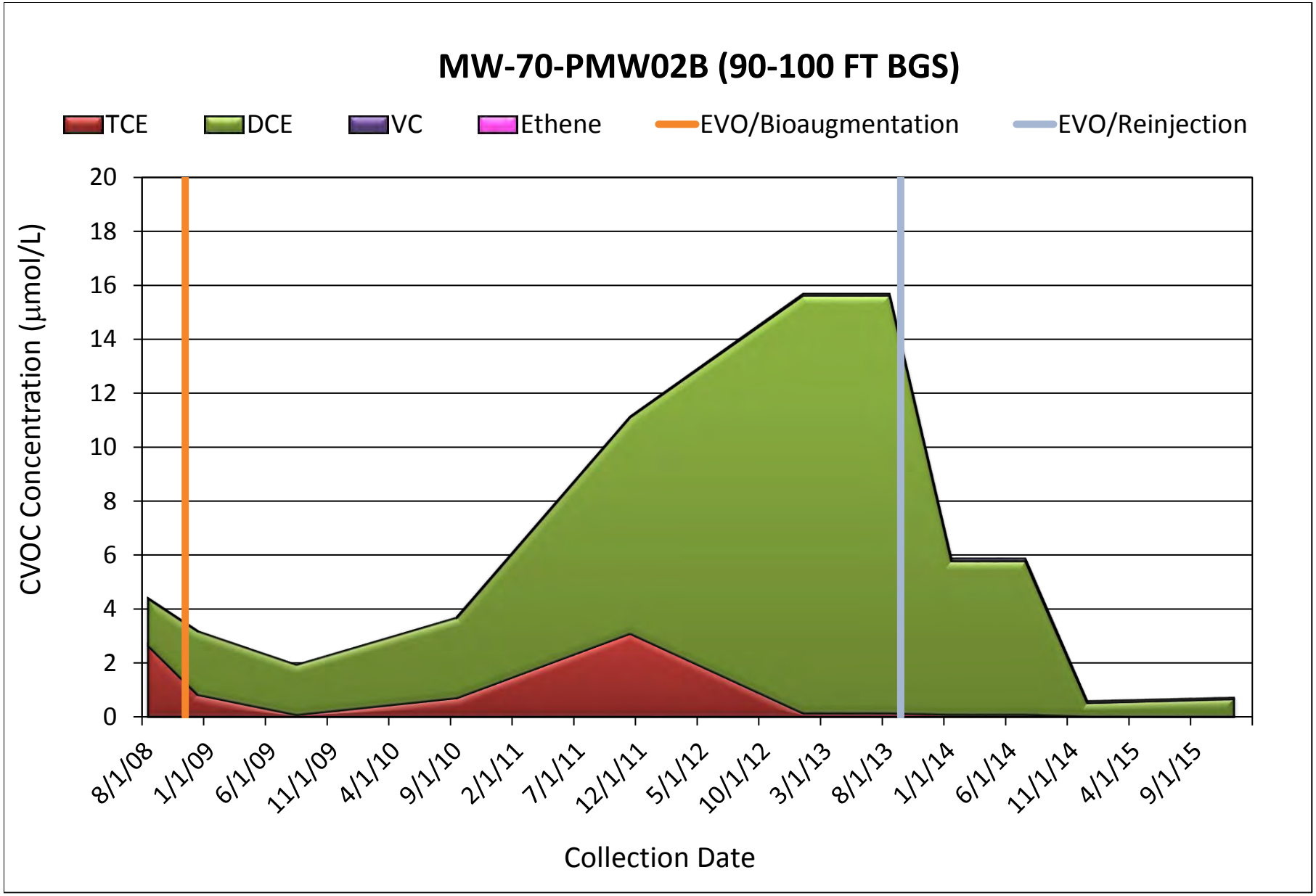

MW-70-PMW08B (85-95 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

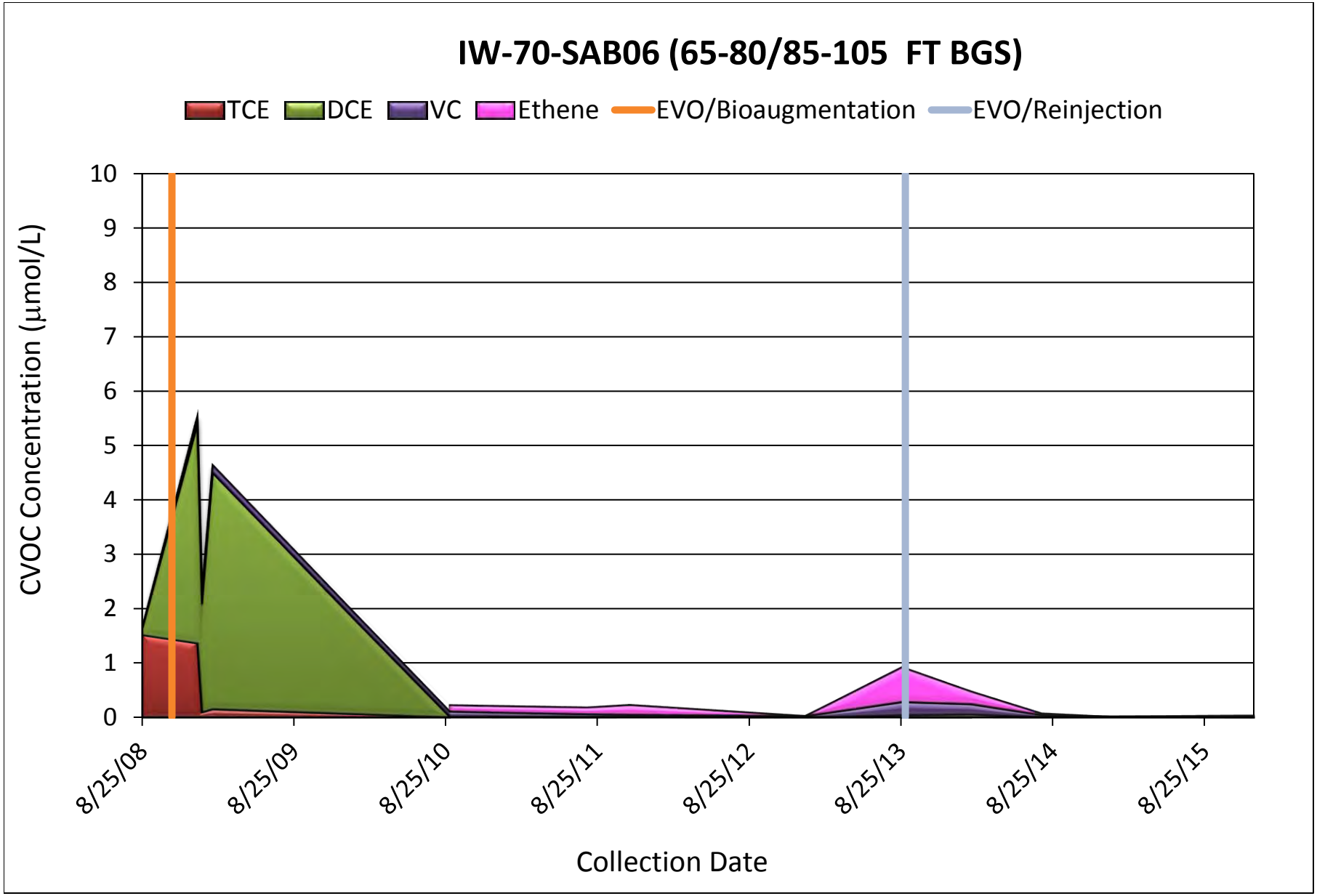

MW-70-MNA09 (64-74 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

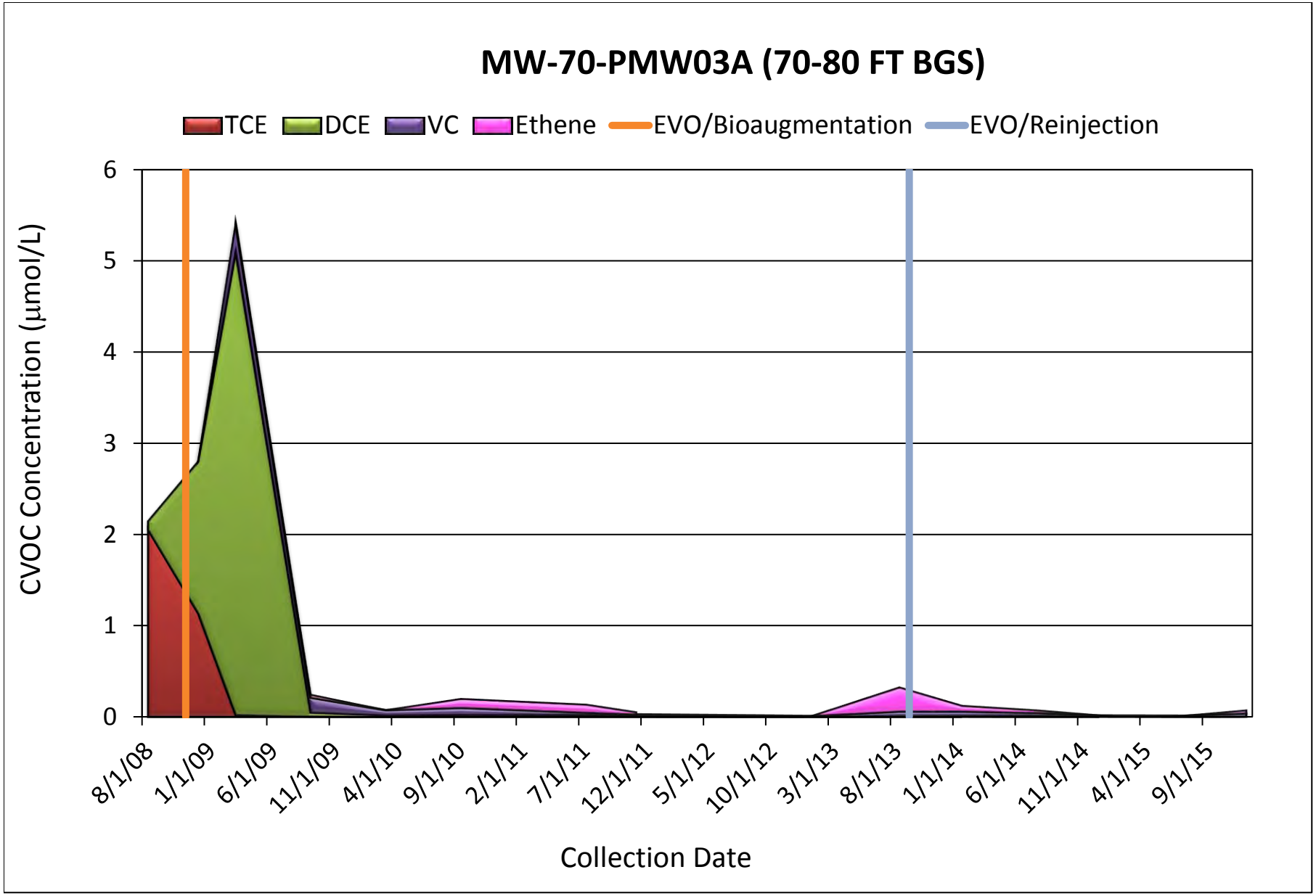

MW-70-MNA10 (75-85 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
10
9
8
7
6
5
4
3
2
1
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

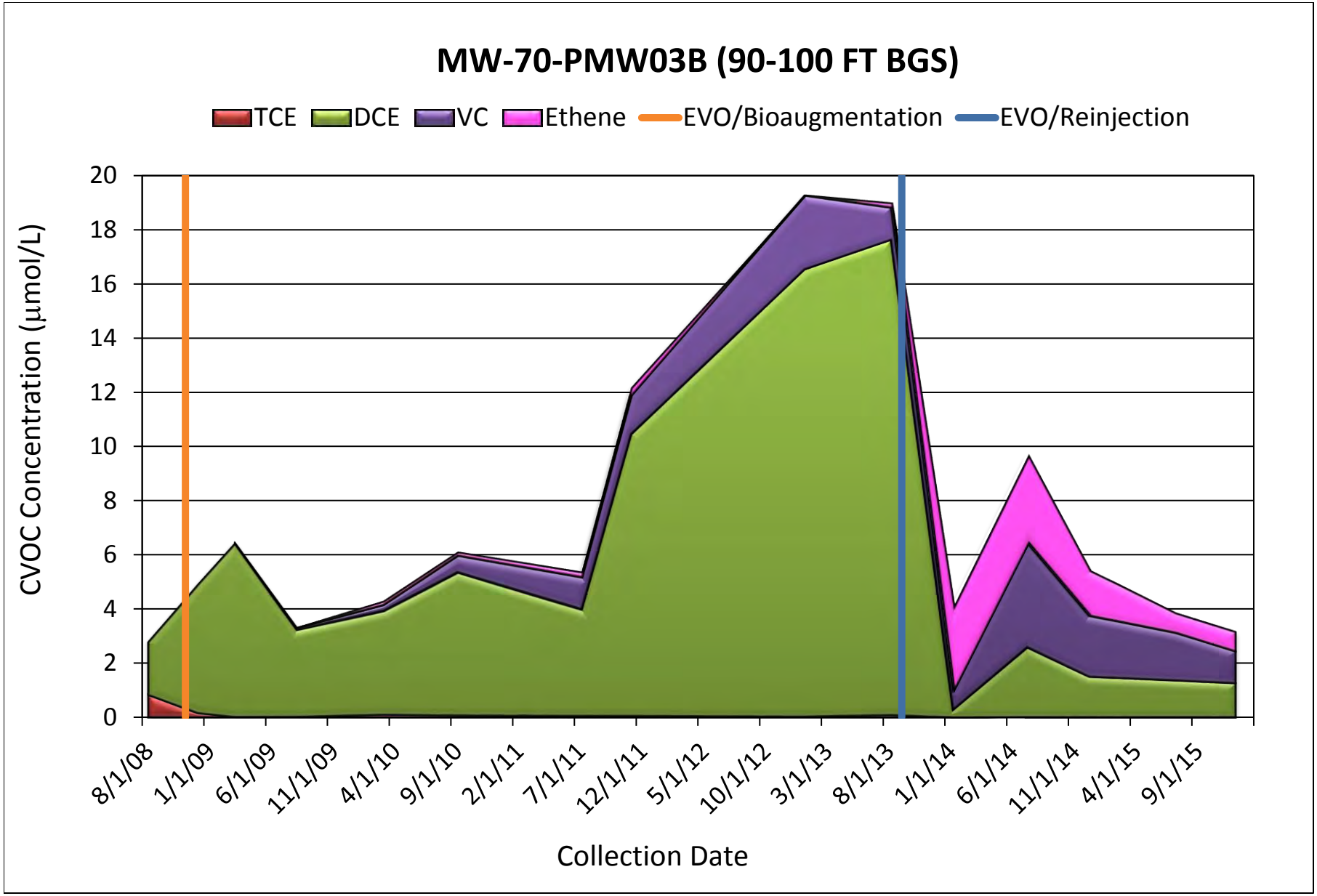

MW-70-MNA12 (75-85 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
9/1/08
2/1/09
7/1/09
12/1/09
5/1/10
10/1/10
3/1/11
8/1/11
1/1/12
6/1/12
11/1/12
4/1/13
9/1/13
2/1/14
7/1/14
12/1/14
5/1/15
10/1/15
Collection Date

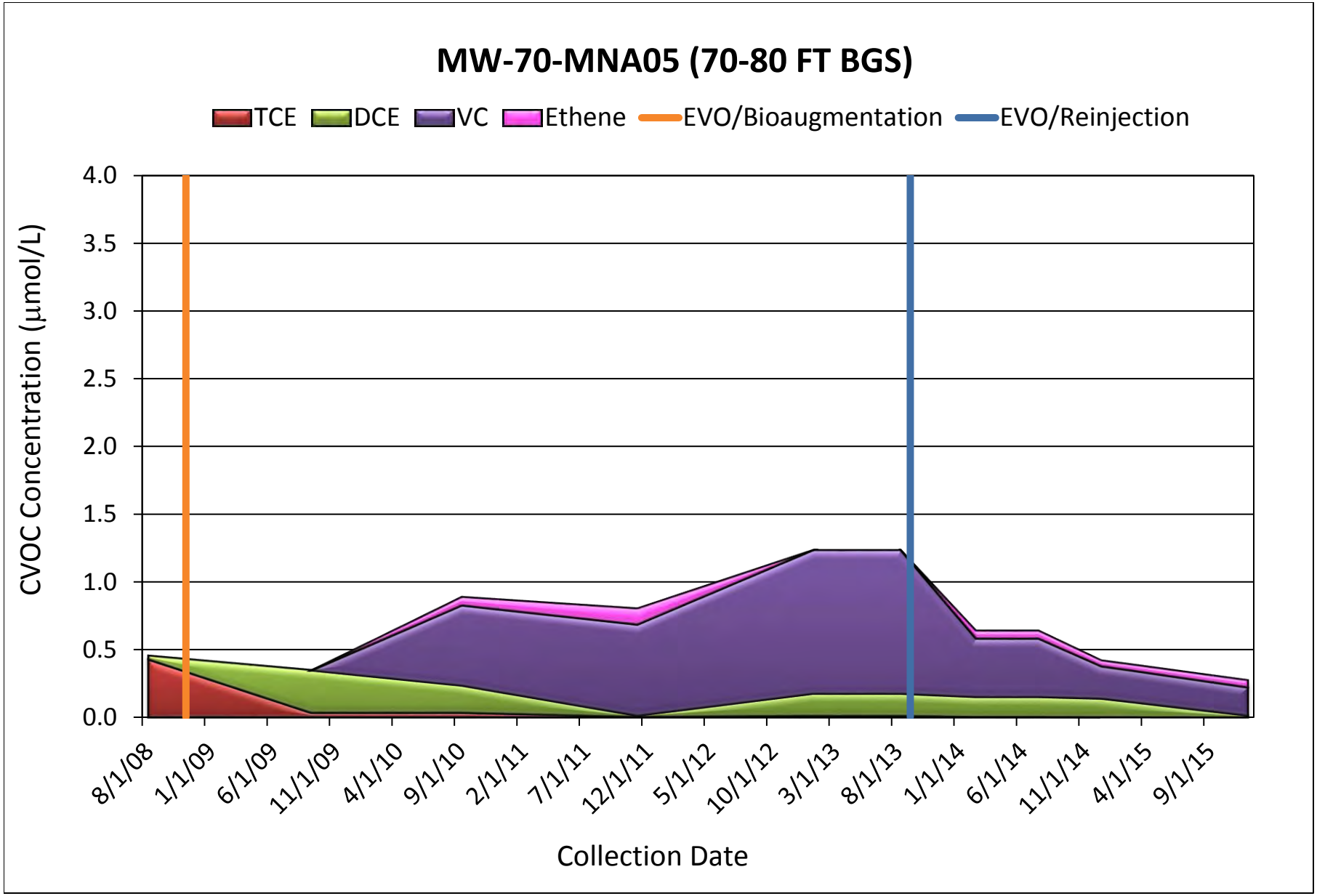

MW-70-PMW02A (71-81 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (mmol/L)
10
8
6
4
2
0
8/21/08
8/21/09
8/21/10
8/21/11
8/21/12
8/21/13
8/21/14
8/21/15
Collection Date

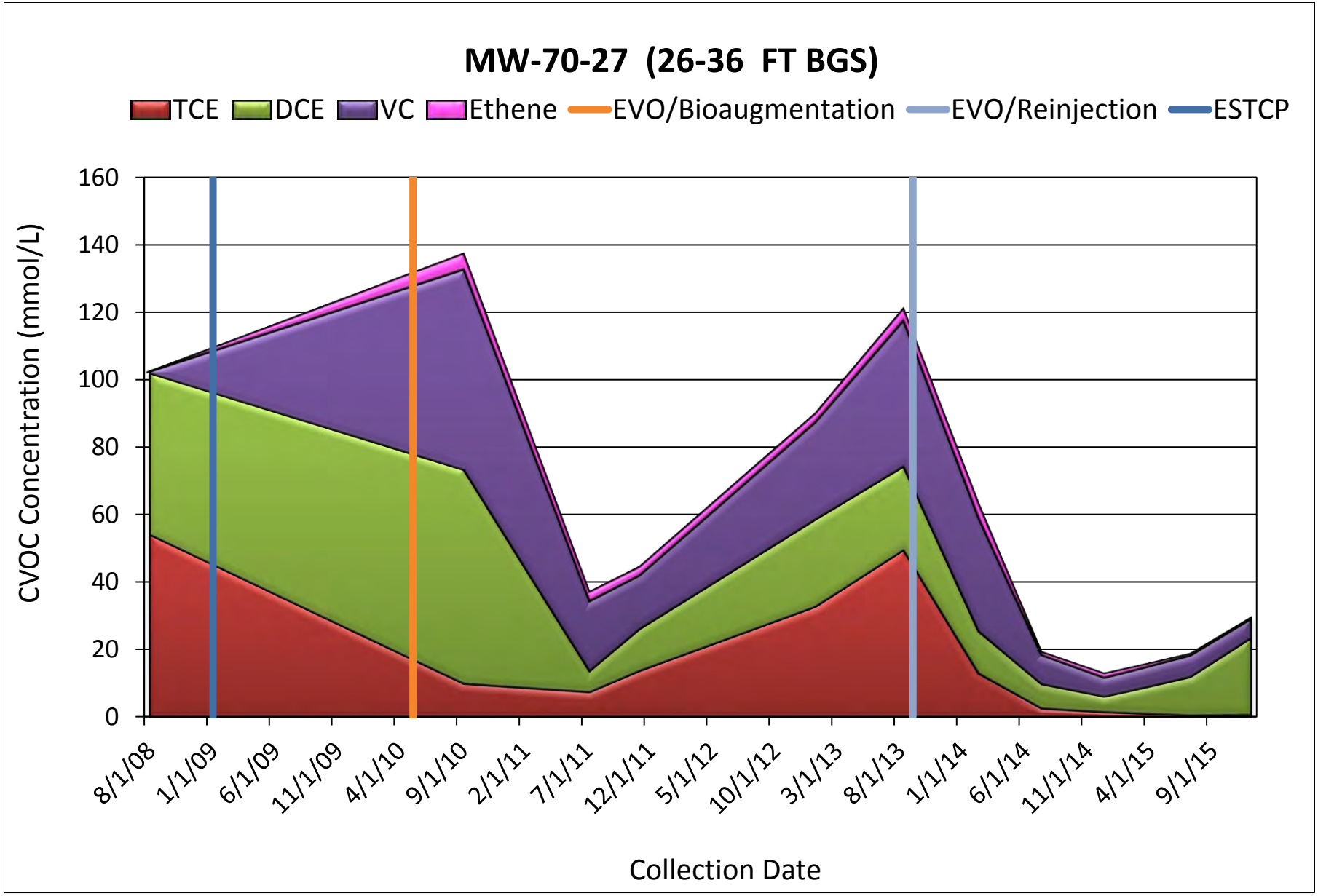

MW-70-PMW02B (90-100 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

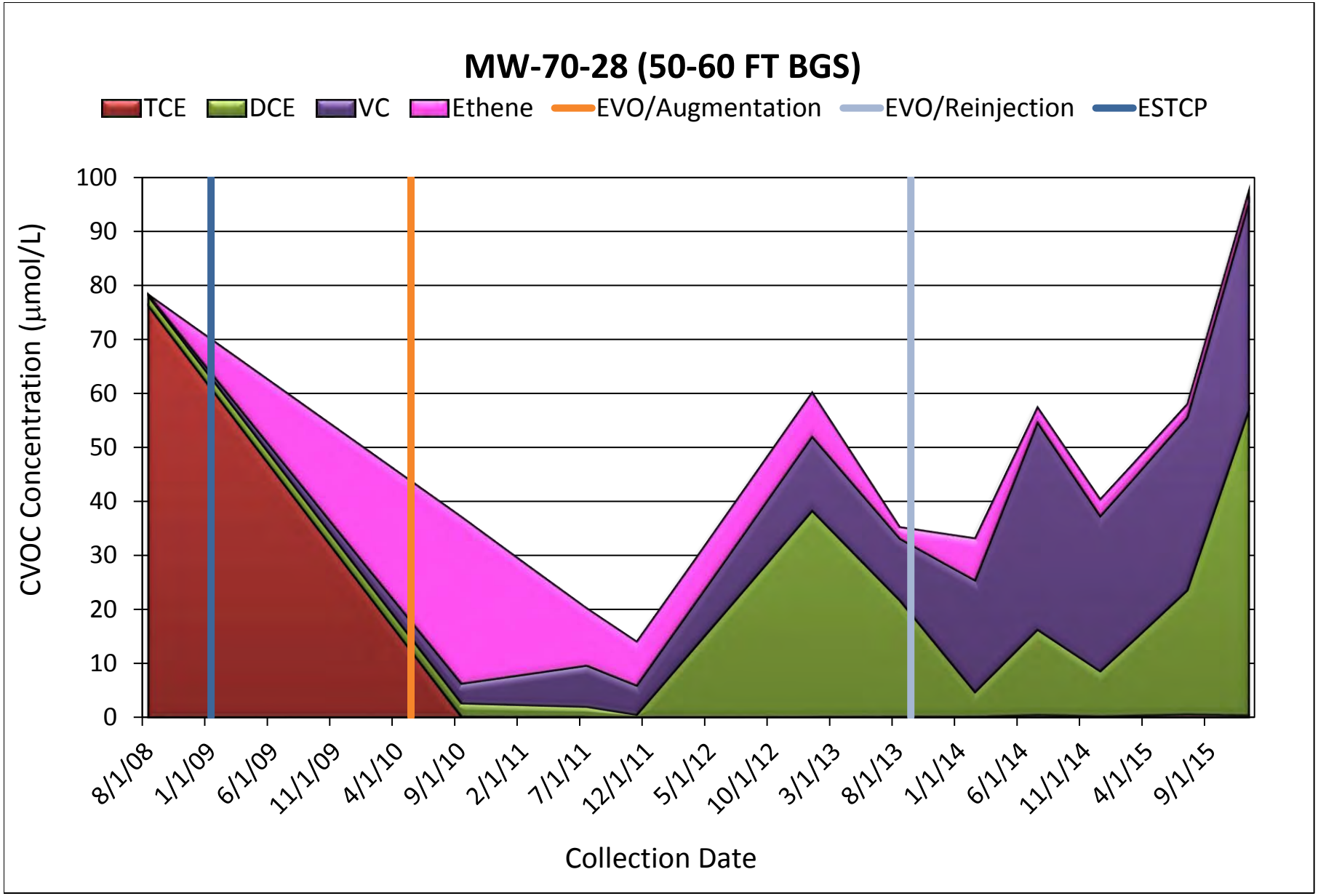

IW-70-SAB06 (65-80/85-105 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
10
9
8
7
6
5
4
3
2
1
0
8/25/08
8/25/09
8/25/10
8/25/11
8/25/12
8/25/13
8/25/14
8/25/15
Collection Date

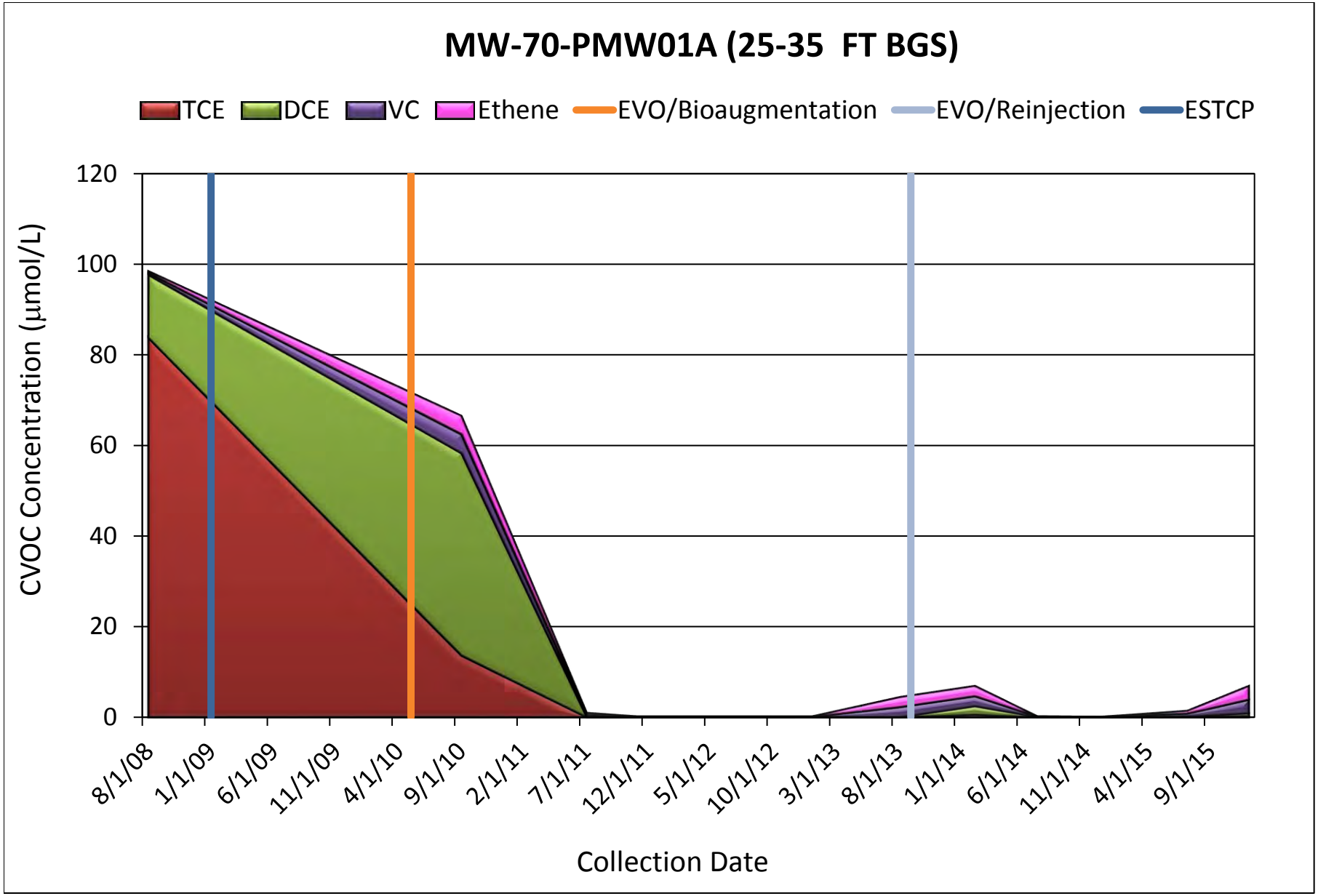

MW-70-PMW03A (70-80 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
0
1
2
3
4
5
6
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

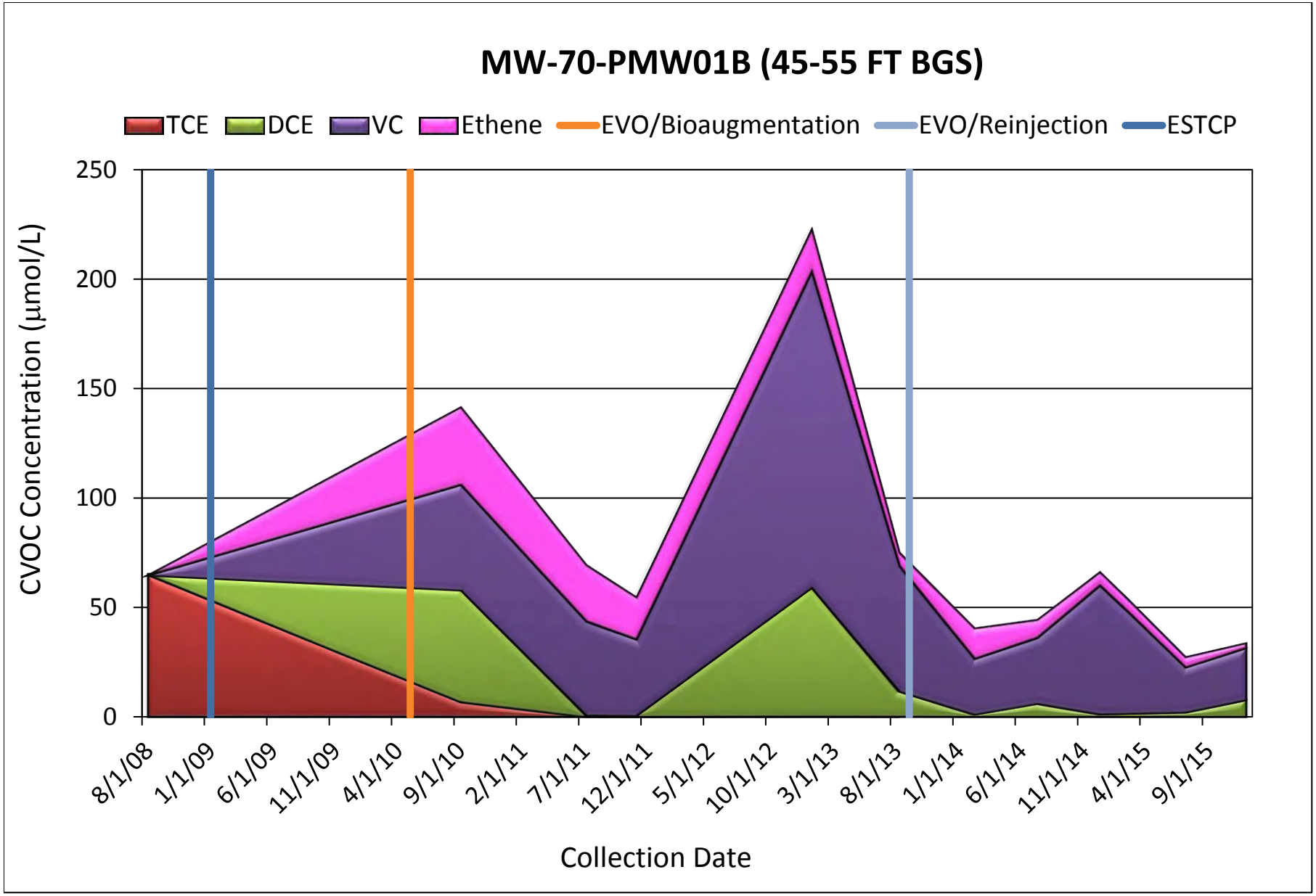

MW-70-PMW03B (90-100 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

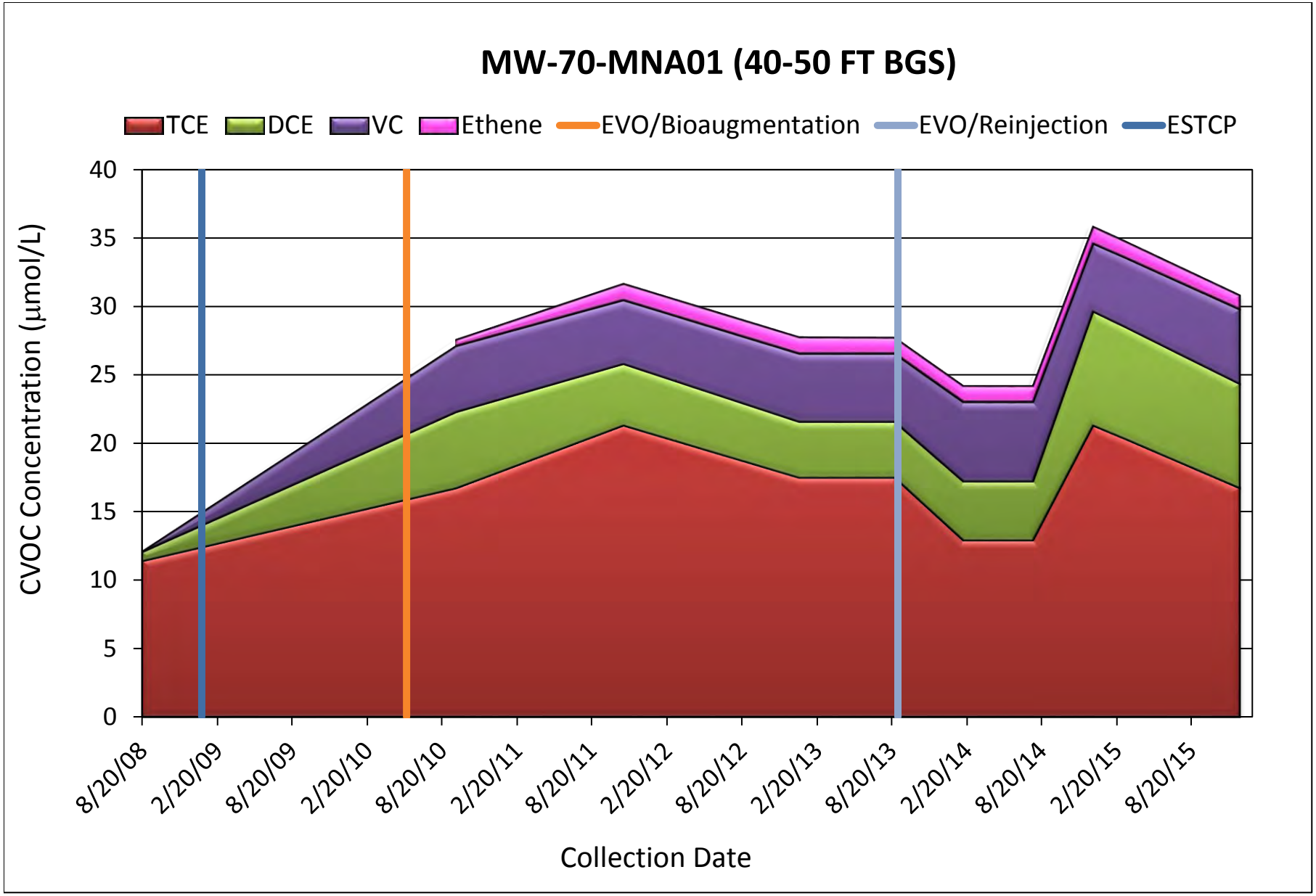

MW-70-MNA05 (70-80 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

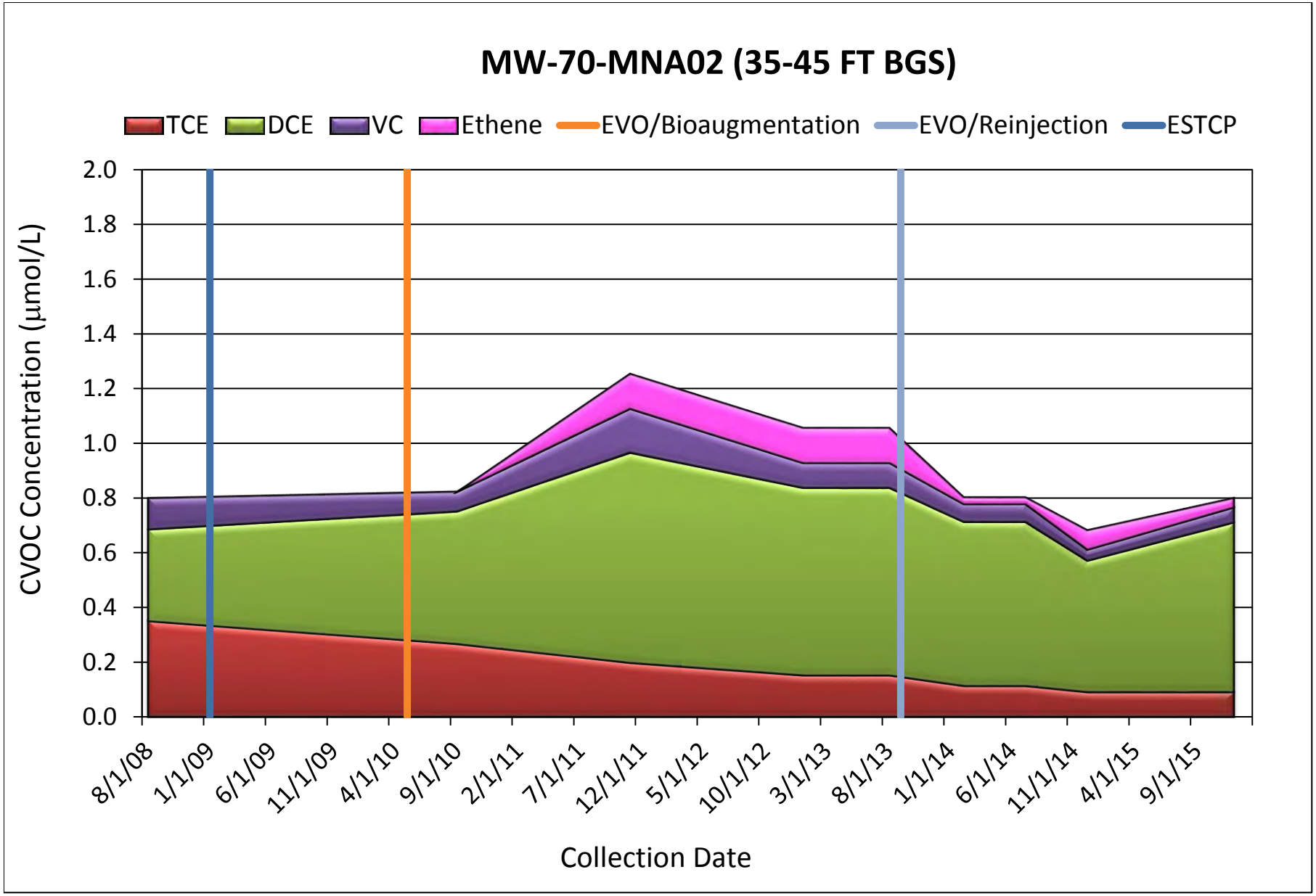

MW-70-27 (26-36 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
ESTCP
CVOC Concentration (mmol/L)
160
140
120
100
80
60
40
20
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

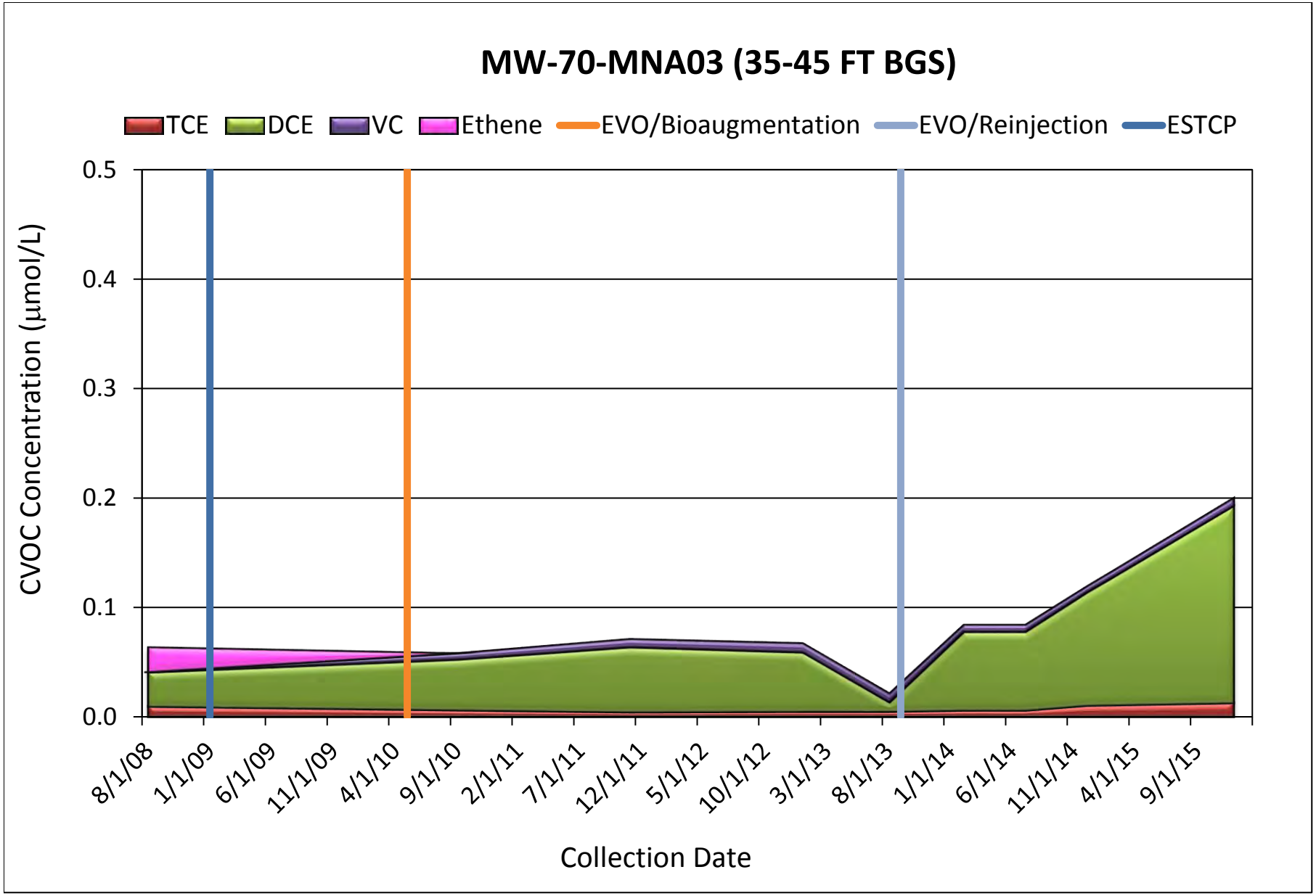

MW-70-28 (50-60 FT BGS)
TCE
DCE
VC
Ethene
EVO/Augmentation
EVO/Reinjection
ESTCP
CVOC Concentration (µmol/L)
100
90
80
70
60
50
40
30
20
10
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

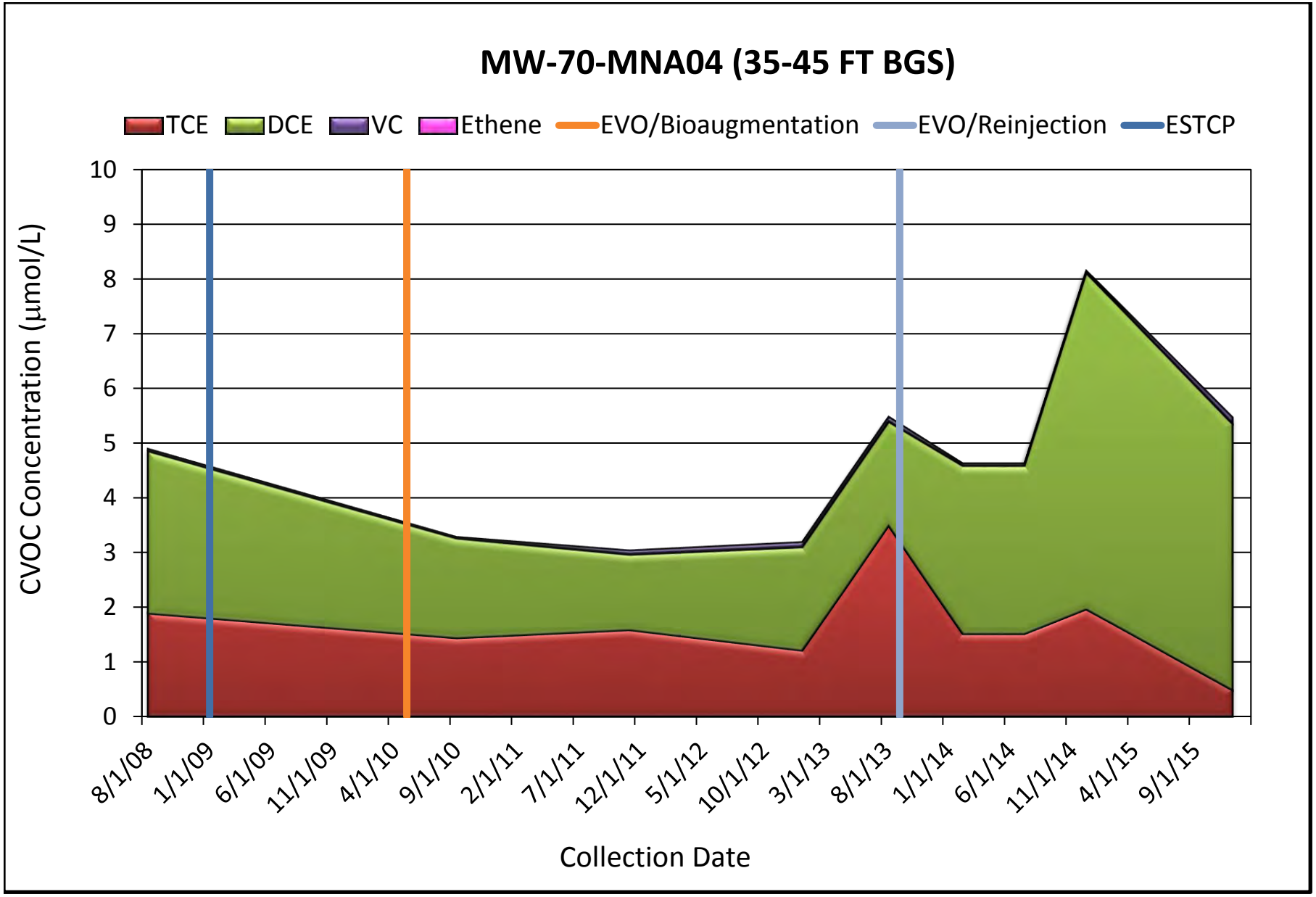

MW-70-PMW01A (25-35 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
ESTCP
CVOC Concentration (µmol/L)
120
100
80
60
40
20
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

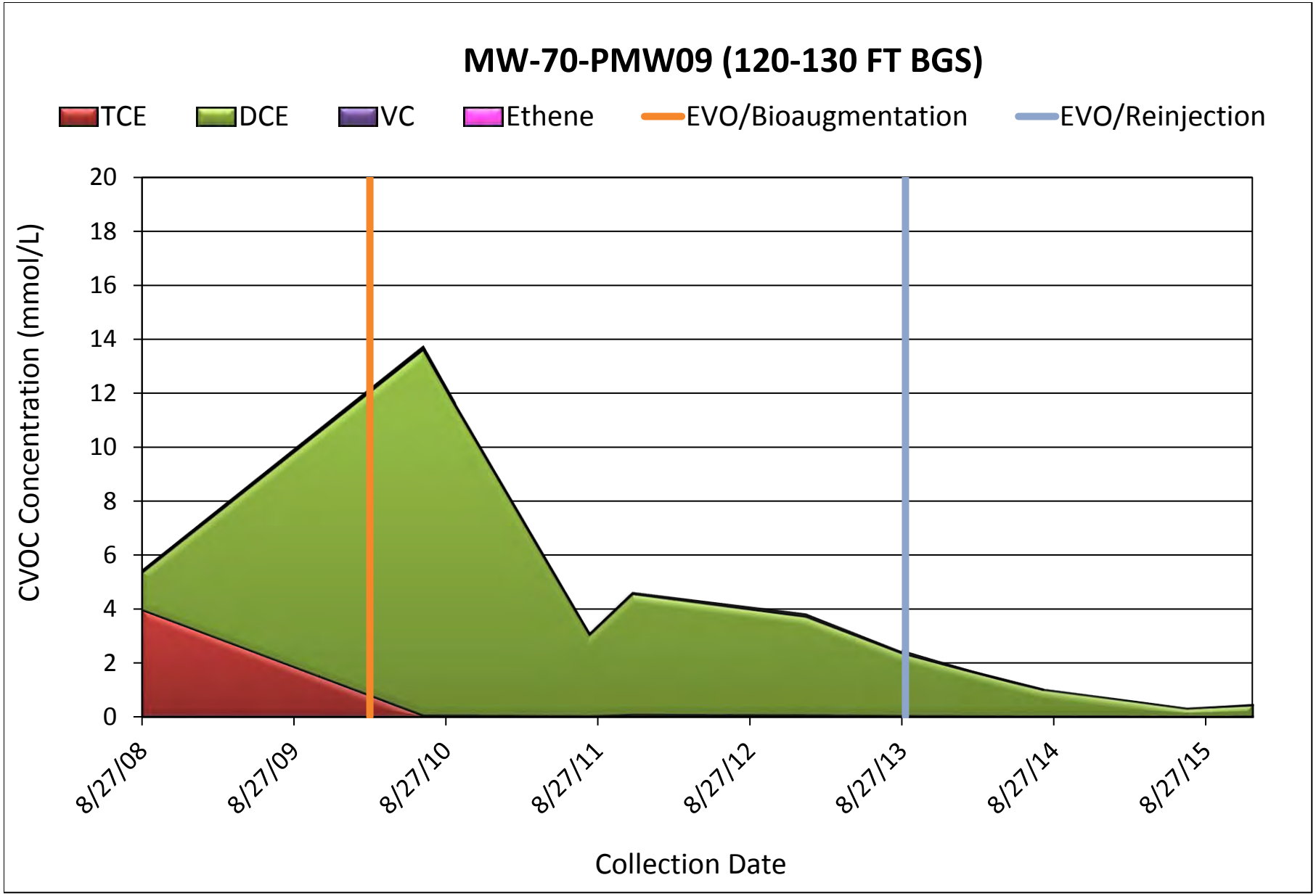

MW-70-PMW01B (45-55 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
ESTCP
CVOC Concentration (µmol/L)
250
200
150
100
50
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

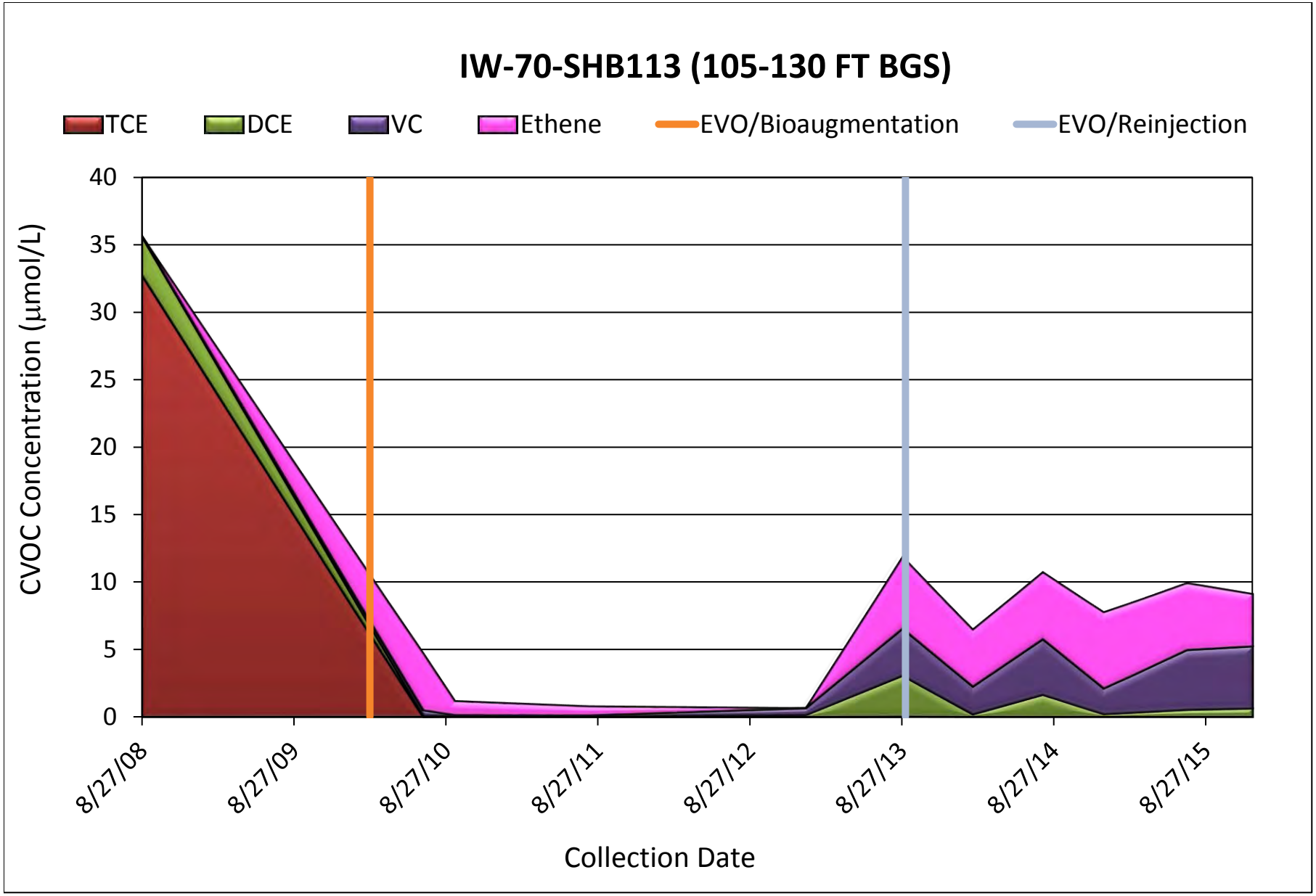

MW-70-MNA01 (40-50 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
ESTCP
CVOC Concentration (µmol/L)
40
35
30
25
20
15
10
5
0
8/20/08
2/20/09
8/20/09
2/20/10
8/20/10
2/20/11
8/20/11
2/20/12
8/20/12
2/20/13
8/20/13
2/20/14
8/20/14
2/20/15
8/20/15
Collection Date

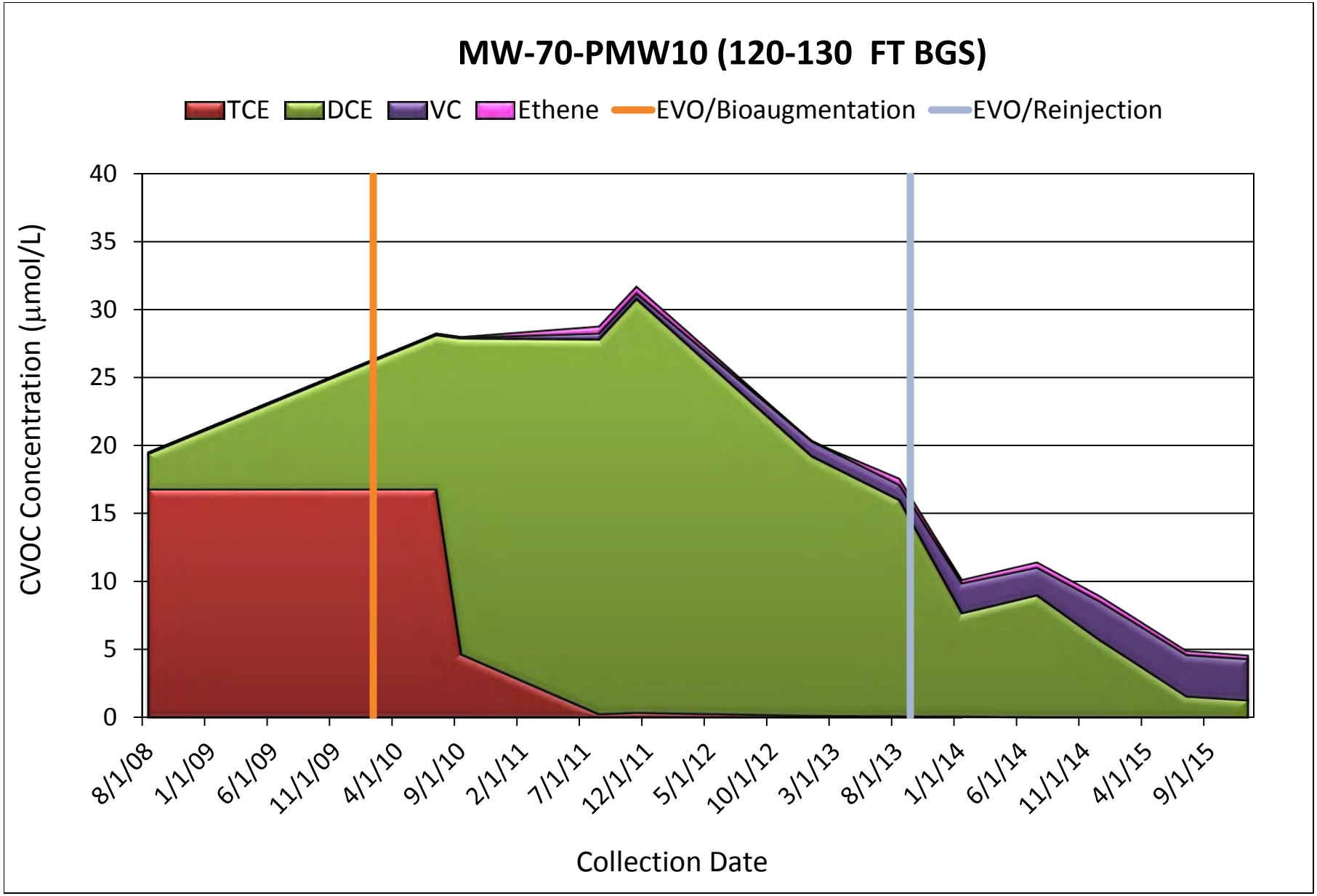

MW-70-MNA02 (35-45 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
ESTCP
CVOC Concentration (µmol/L)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

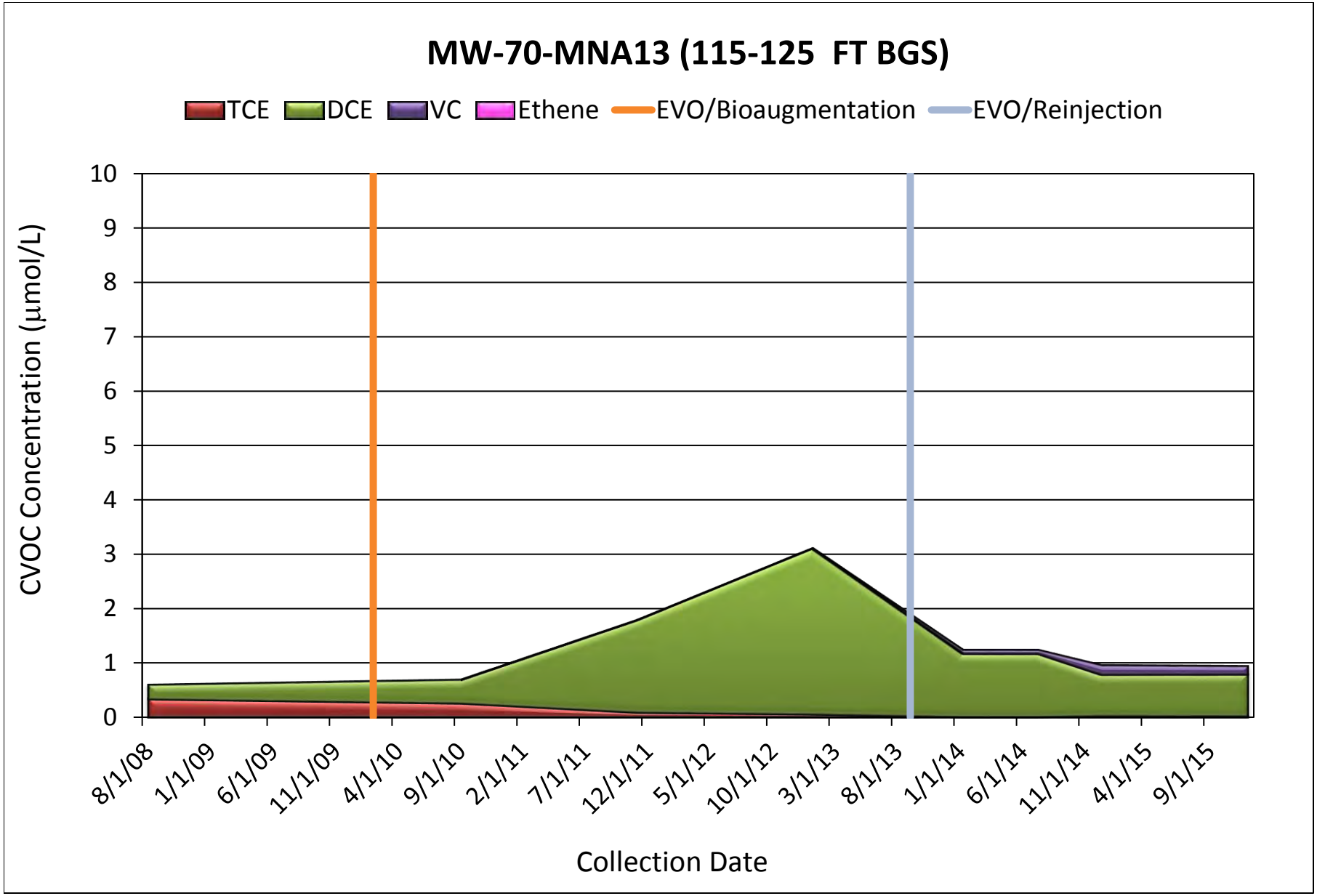

MW-70-MNA03 (35-45 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
ESTCP
CVOC Concentration (µmol/L)
0.5
0.4
0.3
0.2
0.1
0.0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

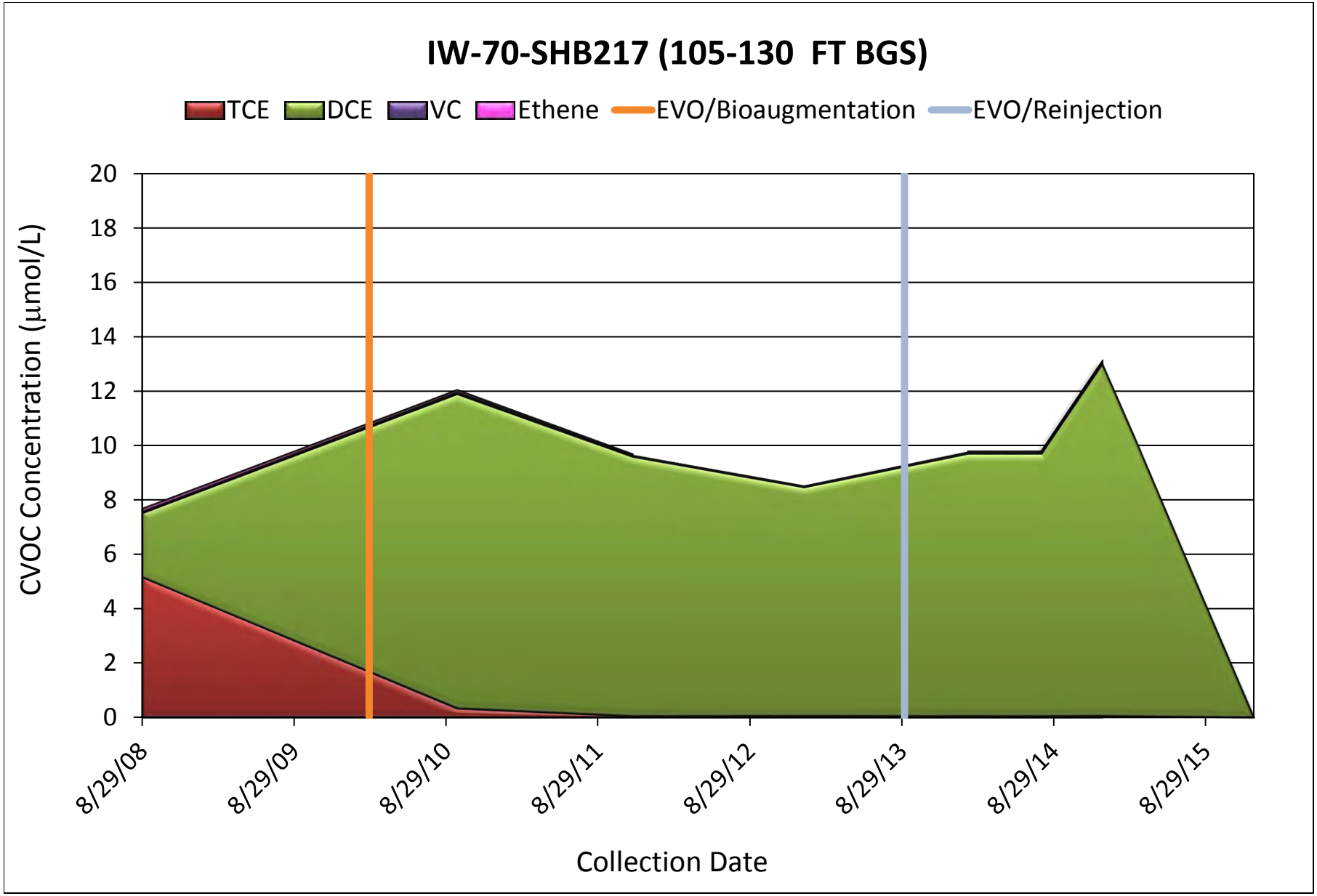

MW-70-MNA04 (35-45 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
ESTCP
CVOC Concentration (µmol/L)
10
9
8
7
6
5
4
3
2
1
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

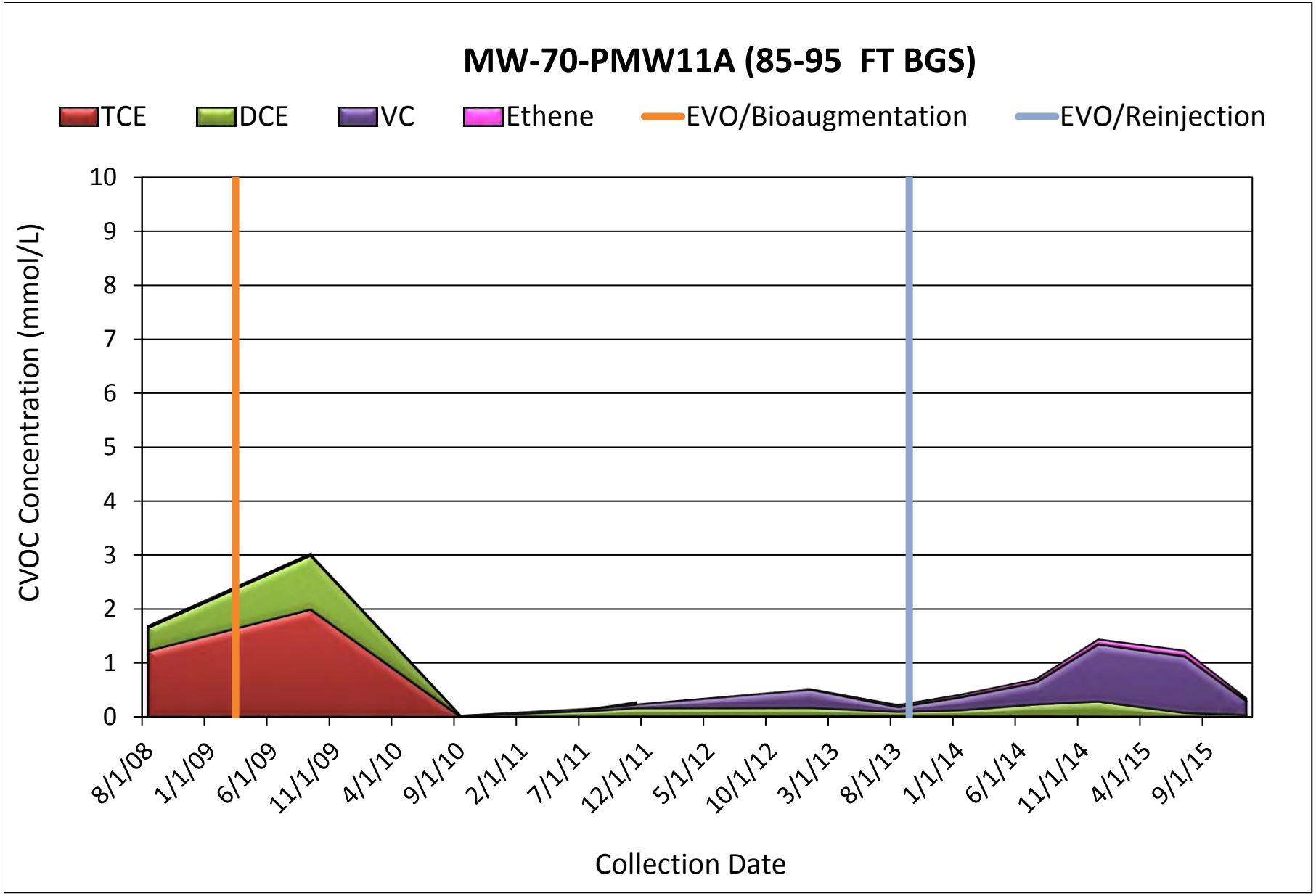

MW-70-PMW09 (120-130 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (mmol/L)
20
18
16
14
12
10
8
6
4
2
0
8/27/08
8/27/09
8/27/10
8/27/11
8/27/12
8/27/13
8/27/14
8/27/15
Collection Date

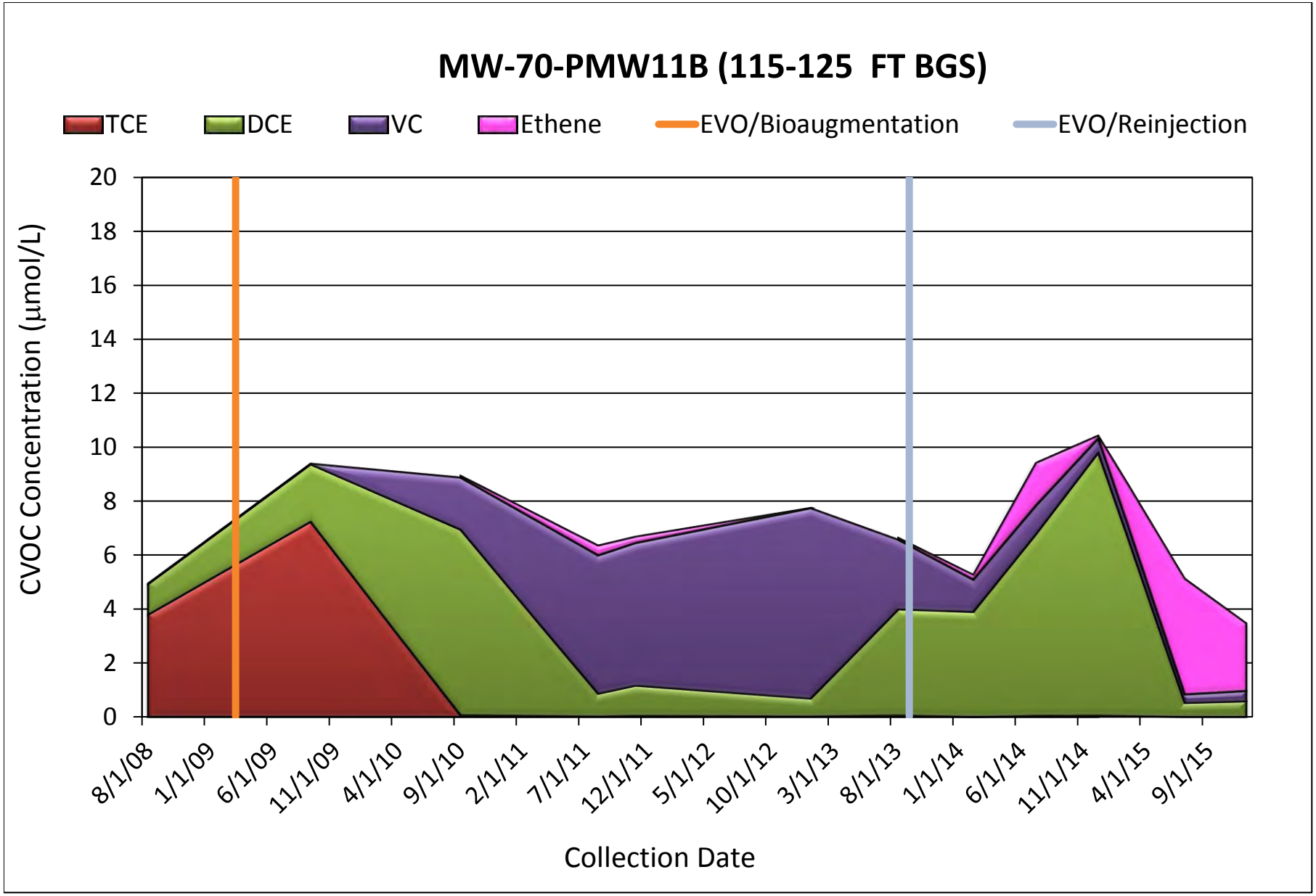

IW-70-SHB113 (105-130 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
40
35
30
25
20
15
10
5
0
8/27/08
8/27/09
8/27/10
8/27/11
8/27/12
8/27/13
8/27/14
8/27/15
Collection Date

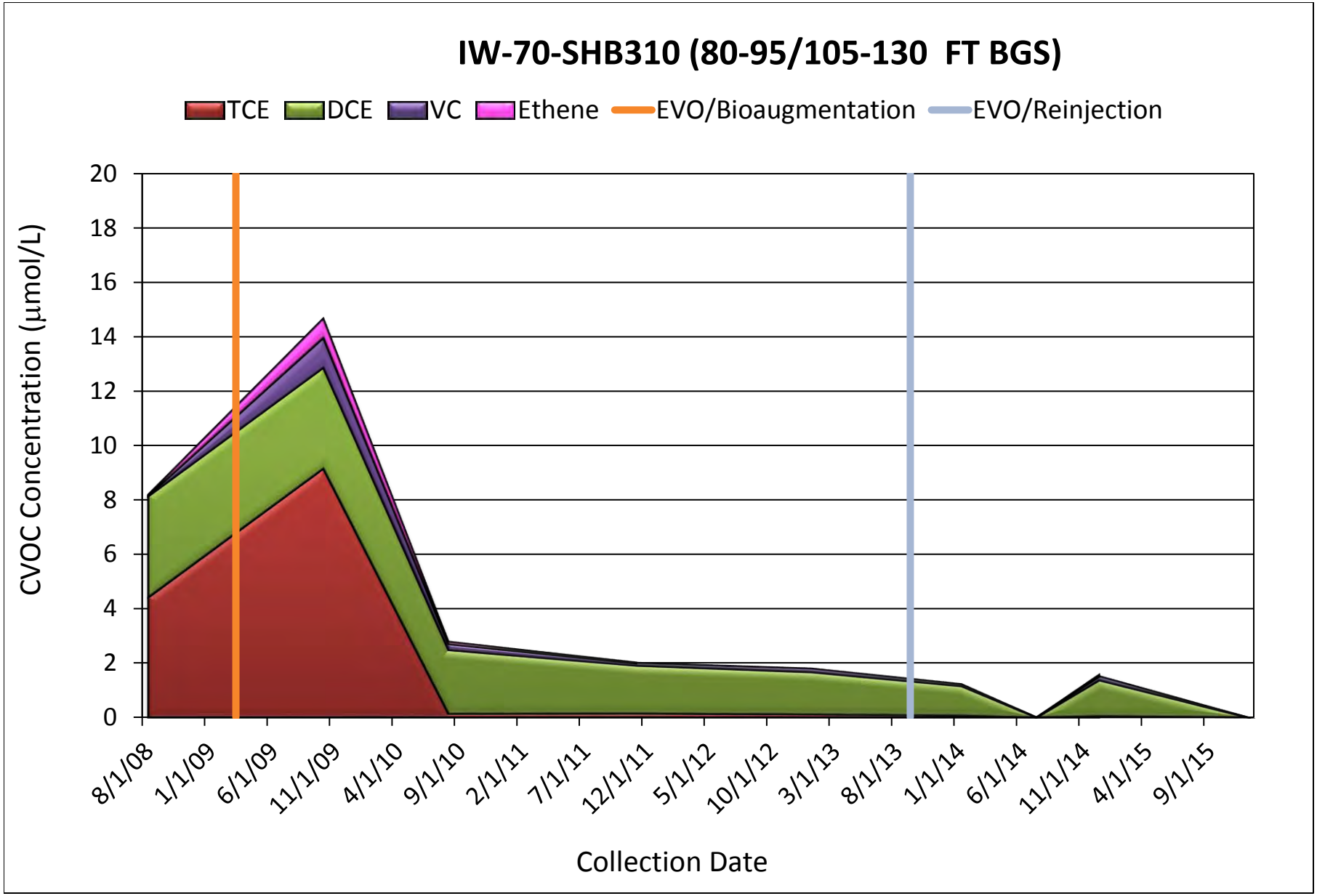

MW-70-PMW10 (120-130 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
40
35
30
25
20
15
10
5
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

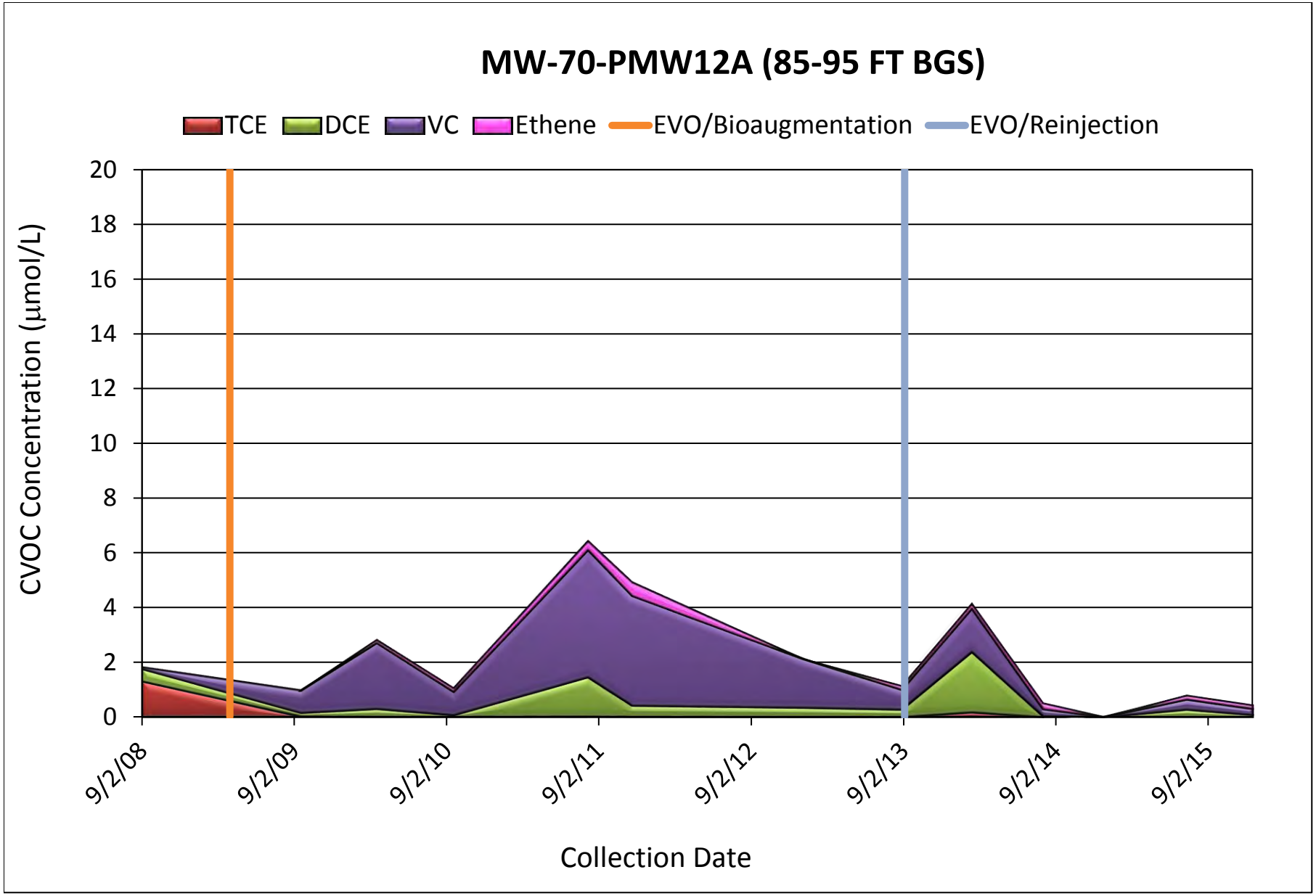

MW-70-MNA13 (115-125 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
10
9
8
7
6
5
4
3
2
1
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

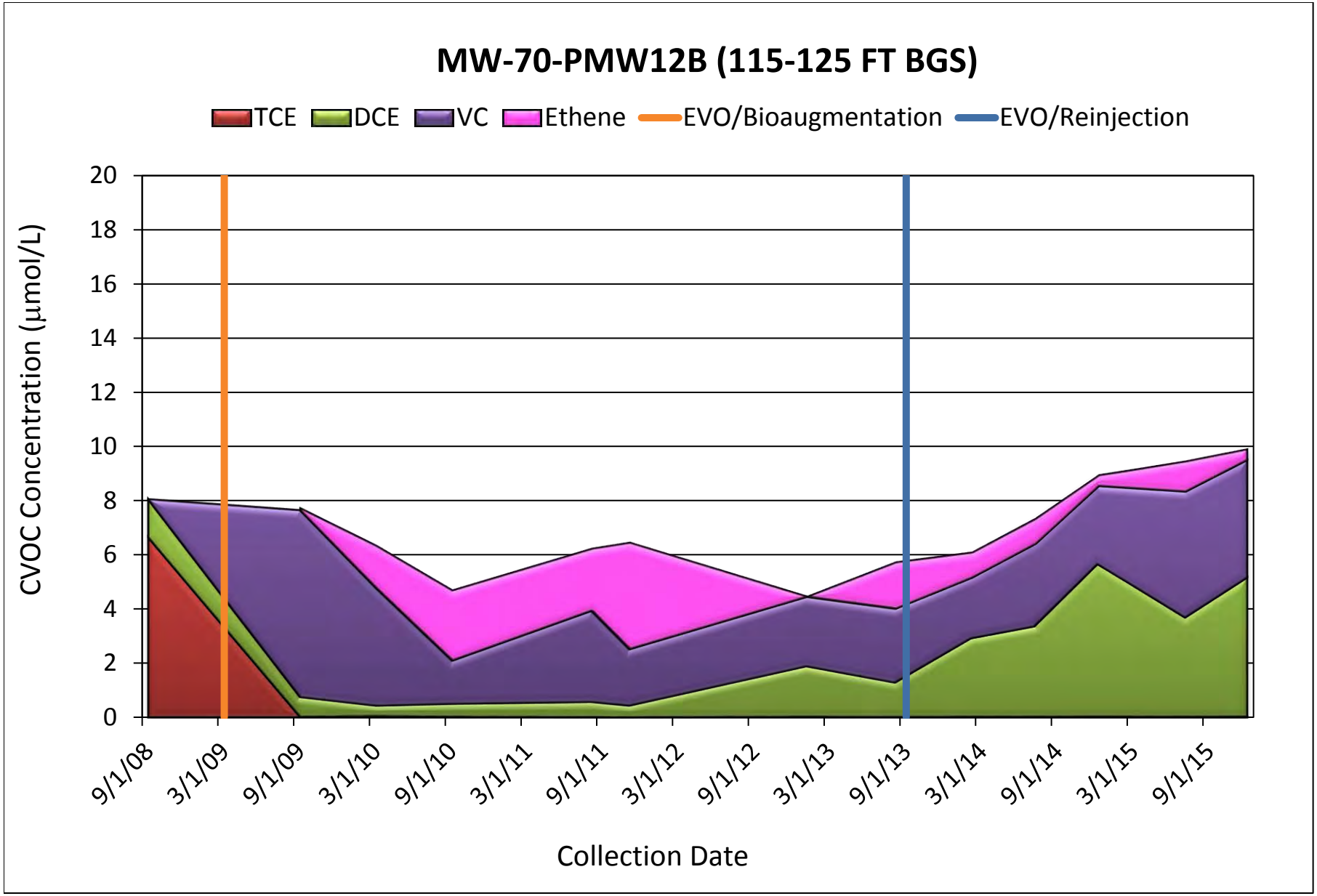

IW-70-SHB217 (105-130 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
8/29/08
8/29/09
8/29/10
8/29/11
8/29/12
8/29/13
8/29/14
8/29/15
Collection Date

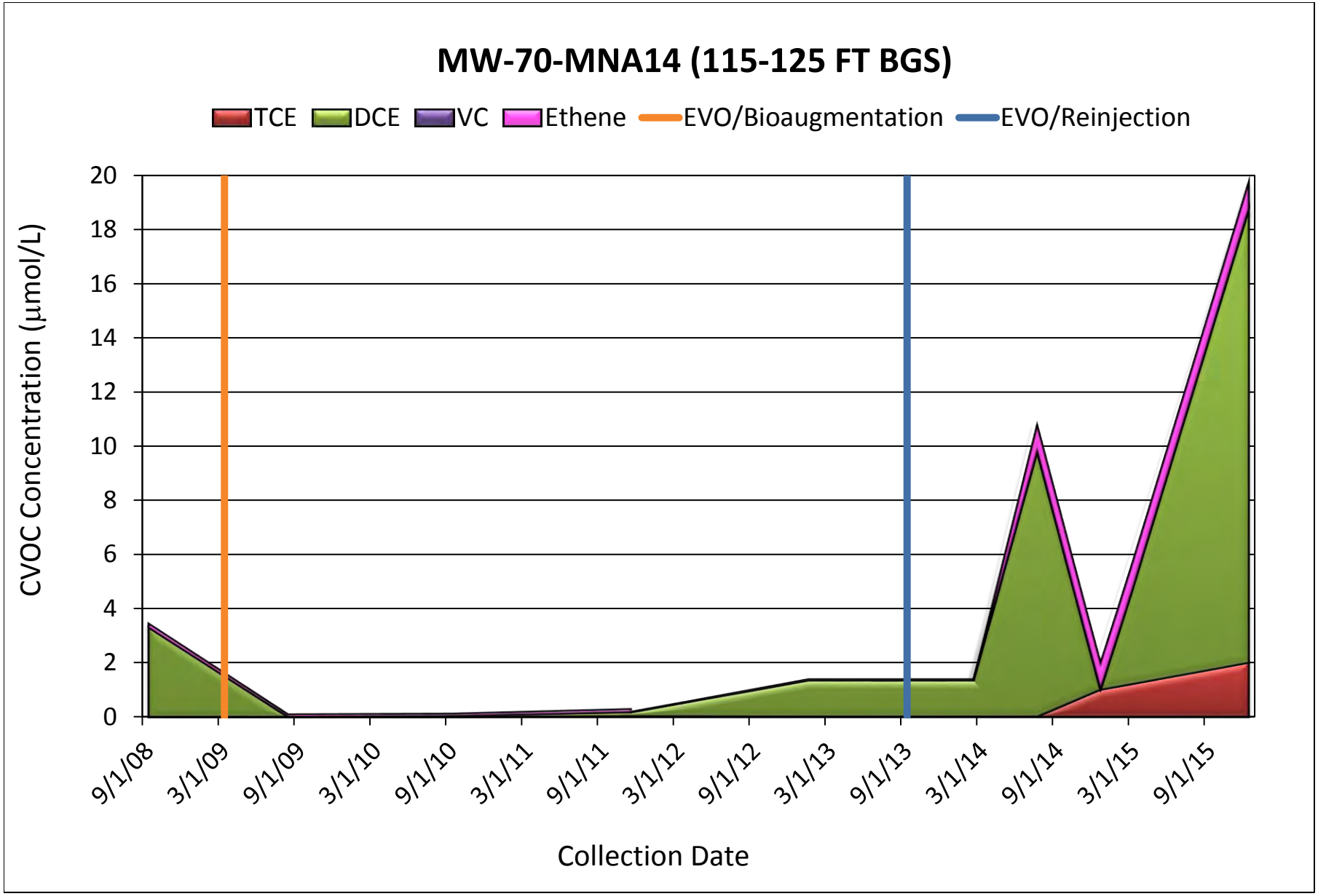

MW-70-PMW11A (85-95 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (mmol/L)
10
9
8
7
6
5
4
3
2
1
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

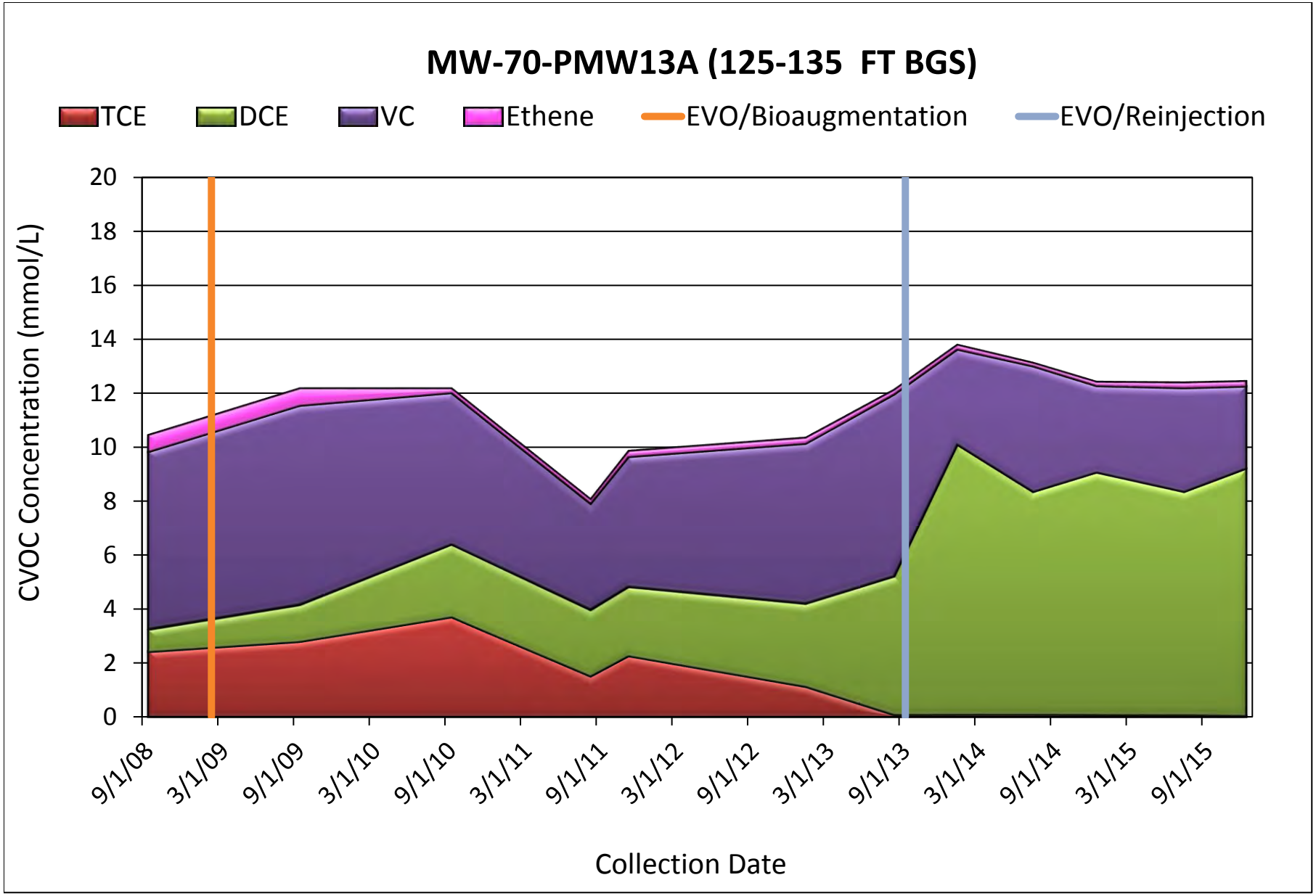

MW-70-PMW11B (115-125 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

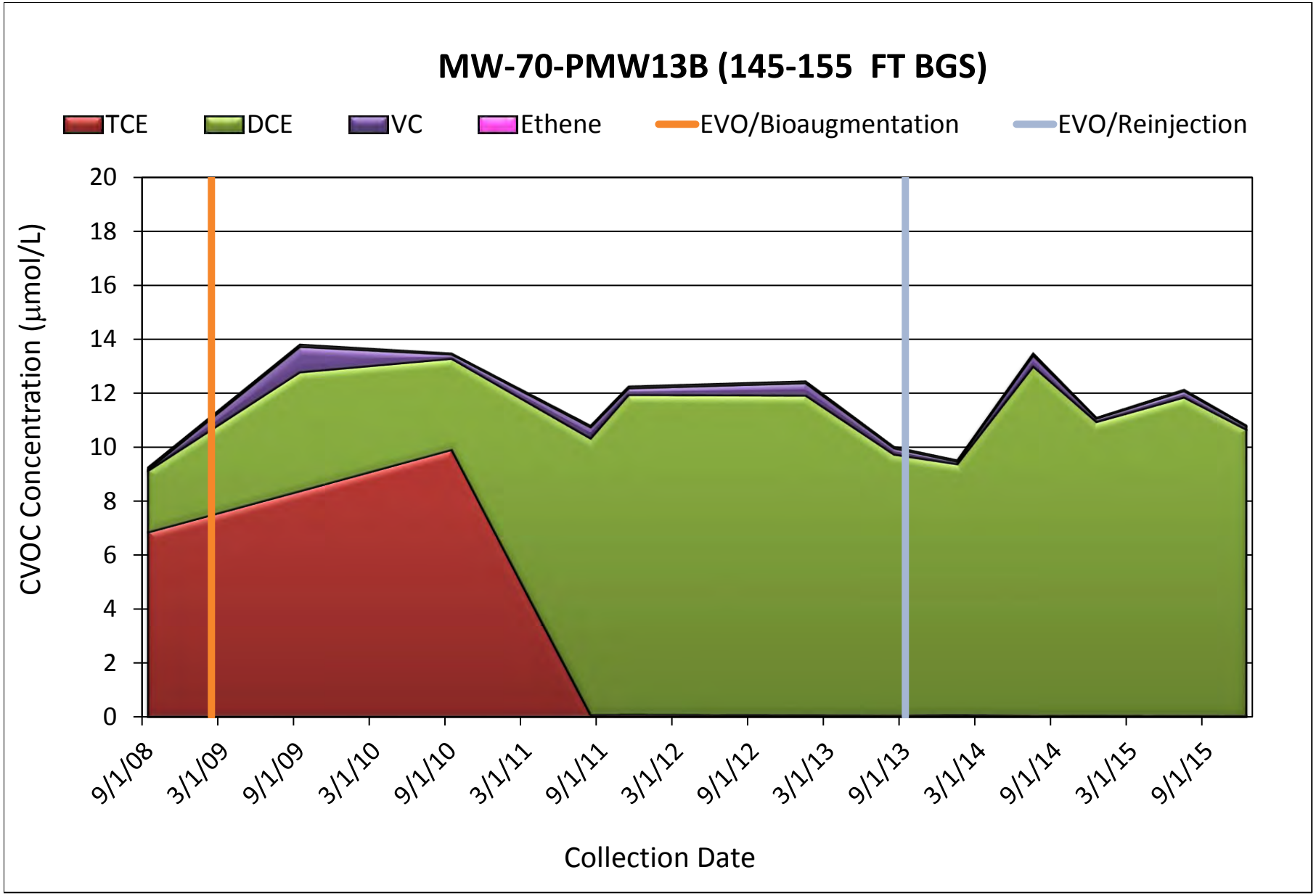

IW-70-SHB310 (80-95/105-130 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

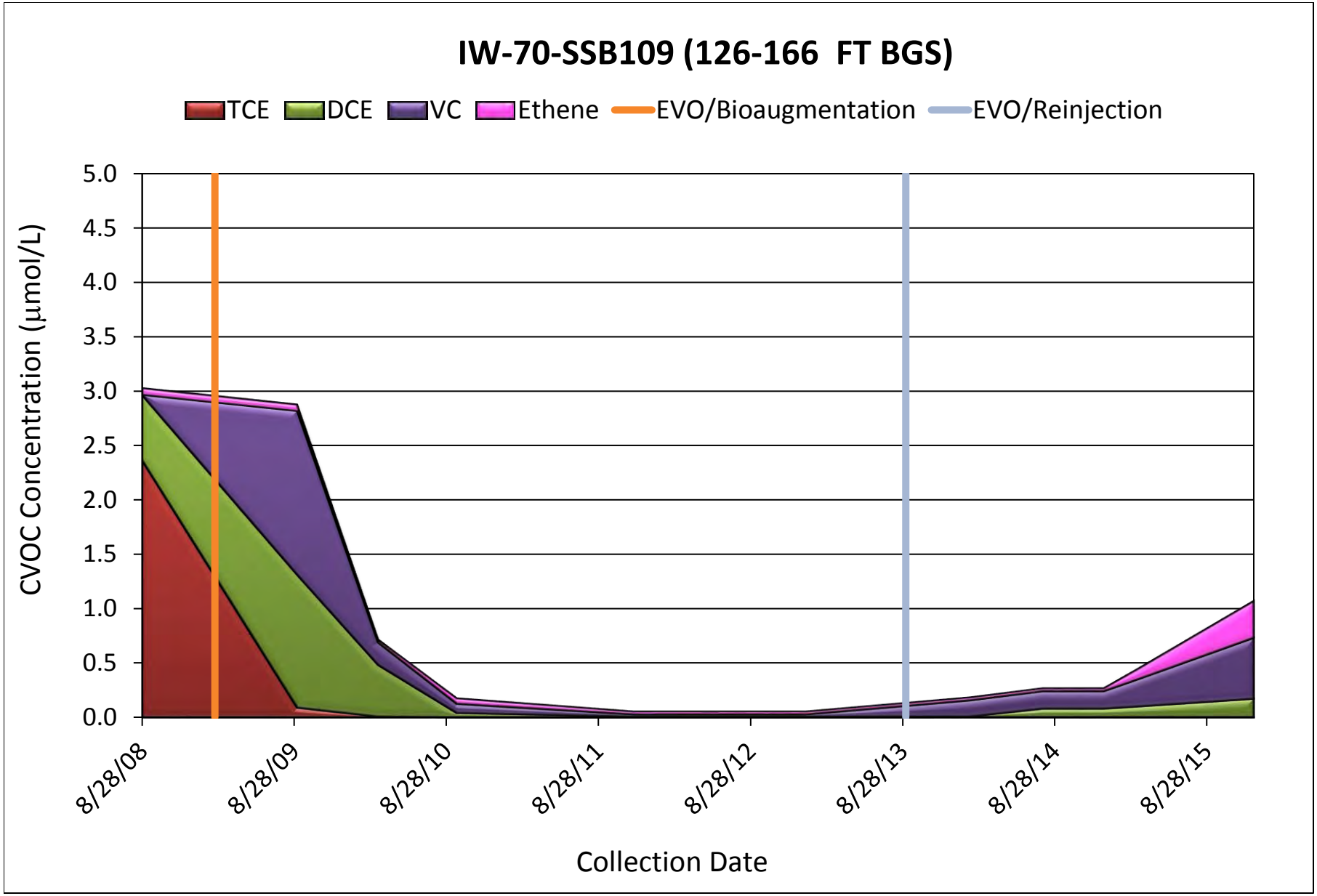

MW-70-PMW12A (85-95 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
9/2/08
9/2/09
9/2/10
9/2/11
9/2/12
9/2/13
9/2/14
9/2/15
Collection Date

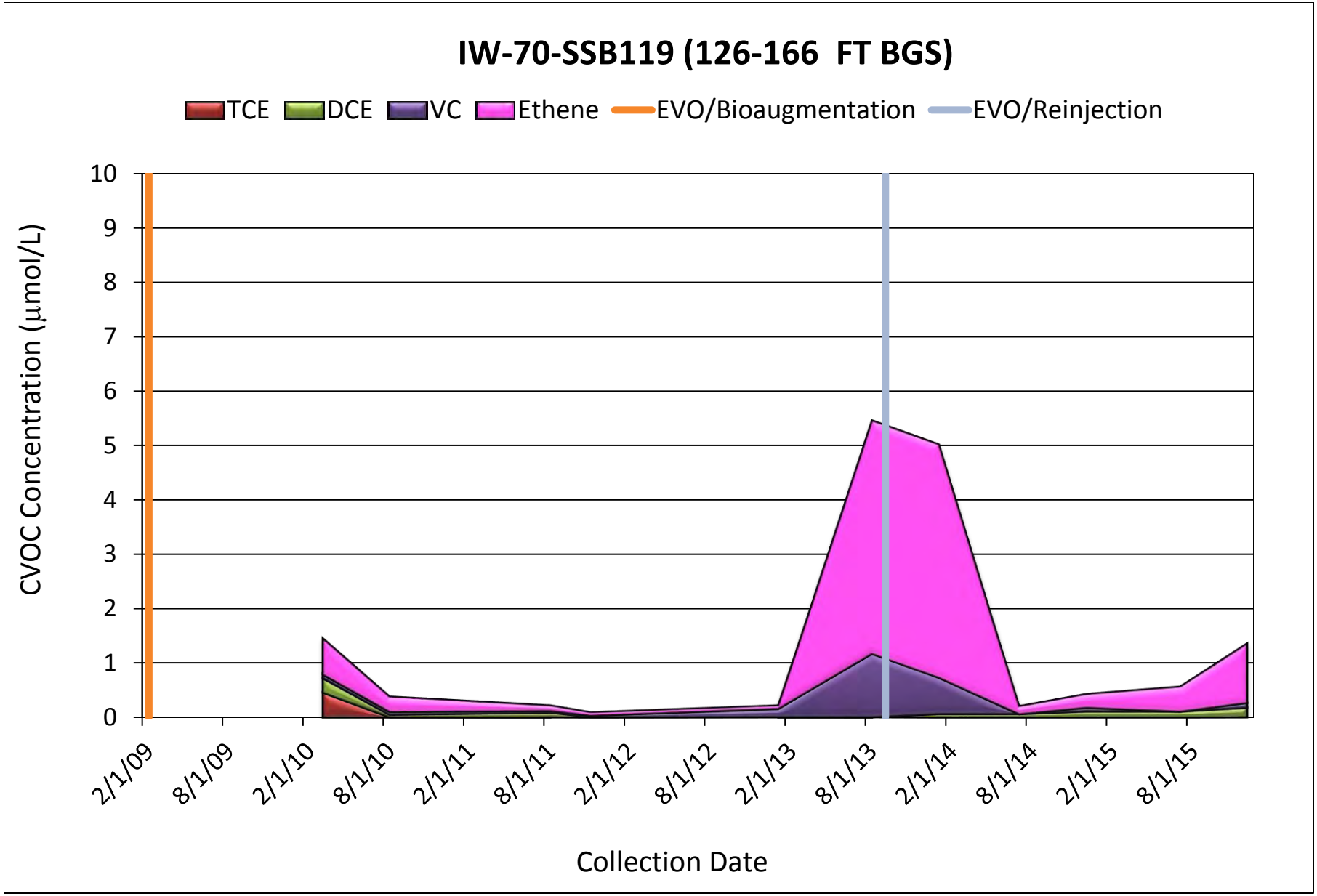

MW-70-PMW12B (115-125 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
9/1/08
3/1/09
9/1/09
3/1/10
9/1/10
3/1/11
9/1/11
3/1/12
9/1/12
3/1/13
9/1/13
3/1/14
9/1/14
3/1/15
9/1/15
Collection Date

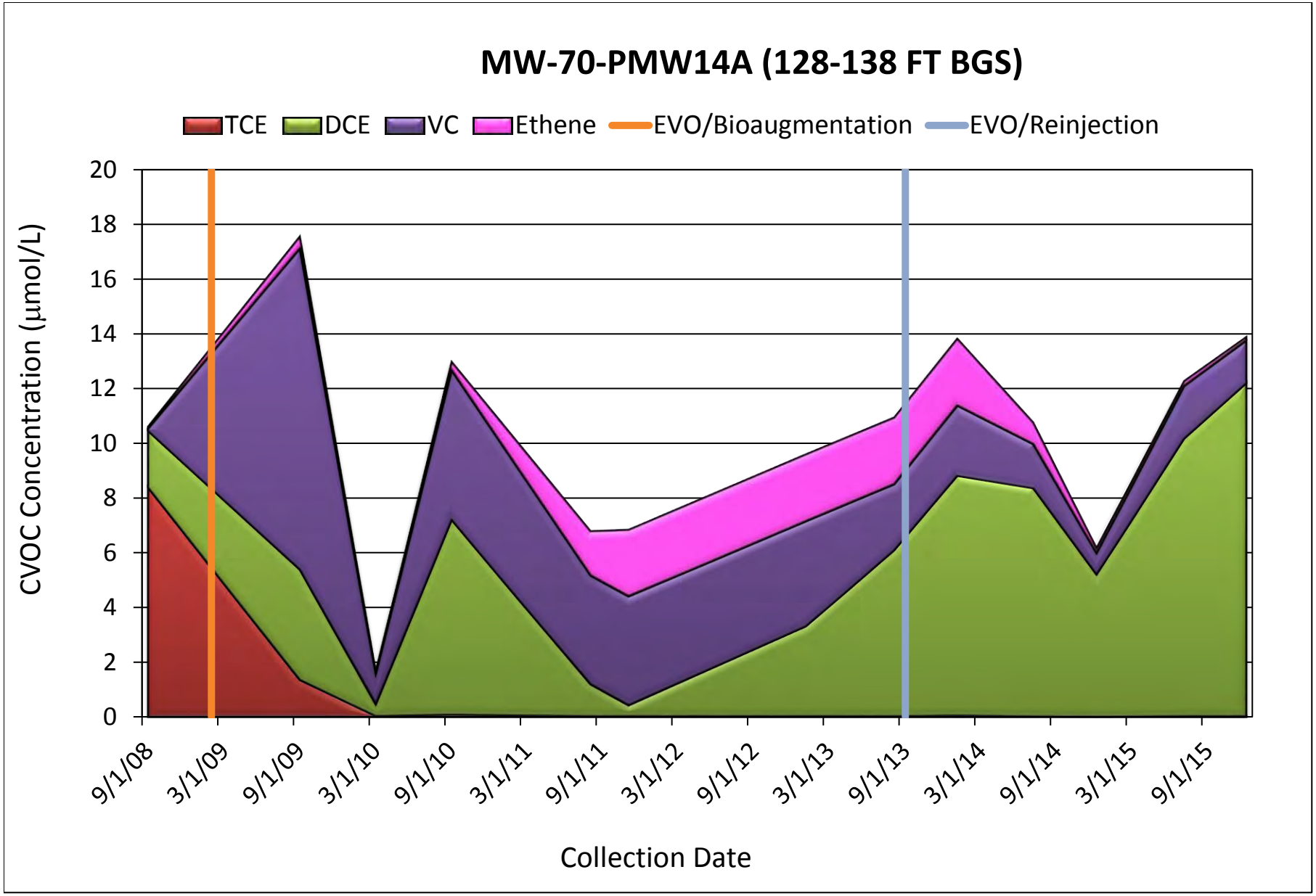

MW-70-MNA14 (115-125 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
9/1/08
3/1/09
9/1/09
3/1/10
9/1/10
3/1/11
9/1/11
3/1/12
9/1/12
3/1/13
9/1/13
3/1/14
9/1/14
3/1/15
9/1/15
Collection Date

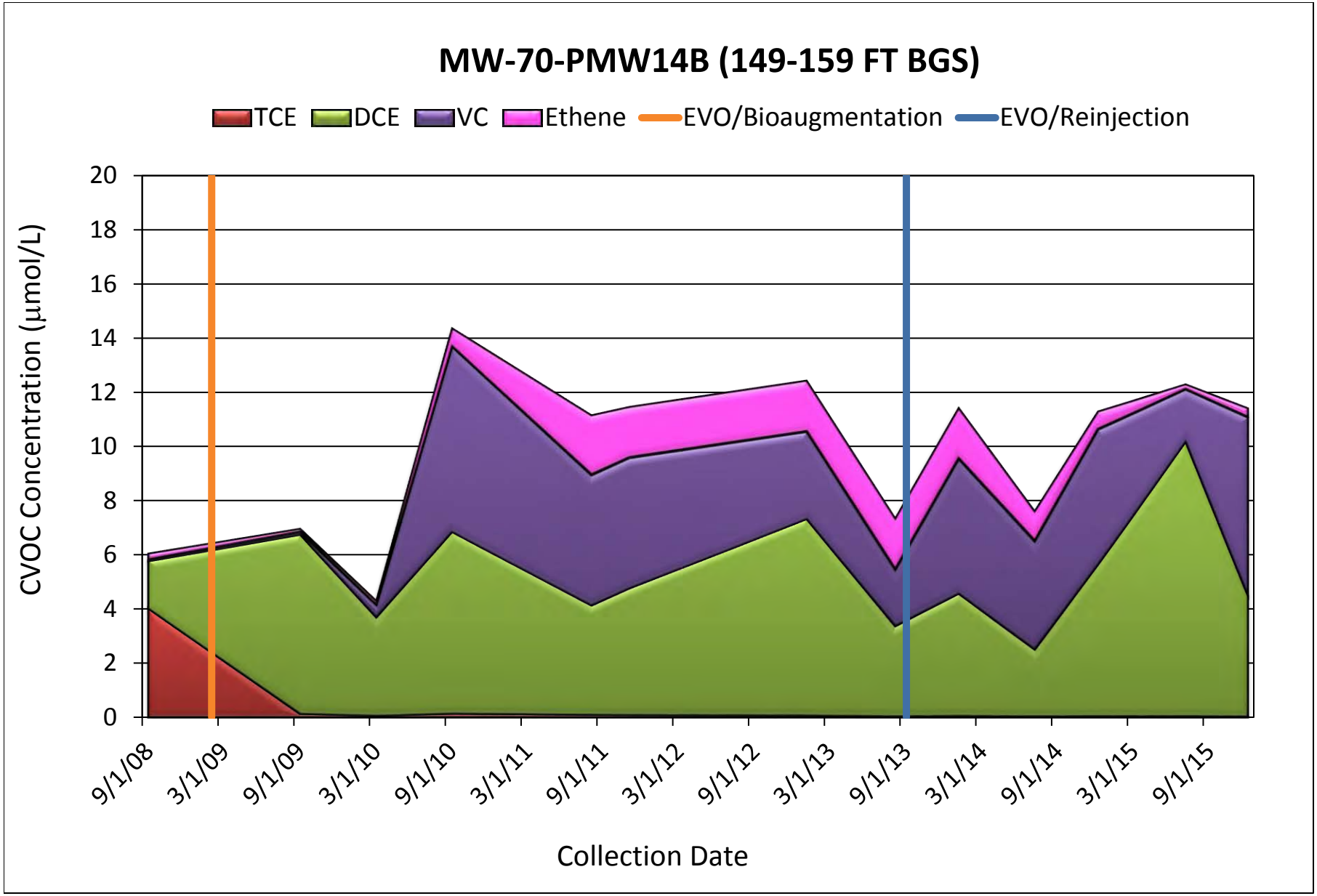

MW-70-PMW13A (125-135 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (mmol/L)
20
18
16
14
12
10
8
6
4
2
0
9/1/08
3/1/09
9/1/09
3/1/10
9/1/10
3/1/11
9/1/11
3/1/12
9/1/12
3/1/13
9/1/13
3/1/14
9/1/14
3/1/15
9/1/15
Collection Date

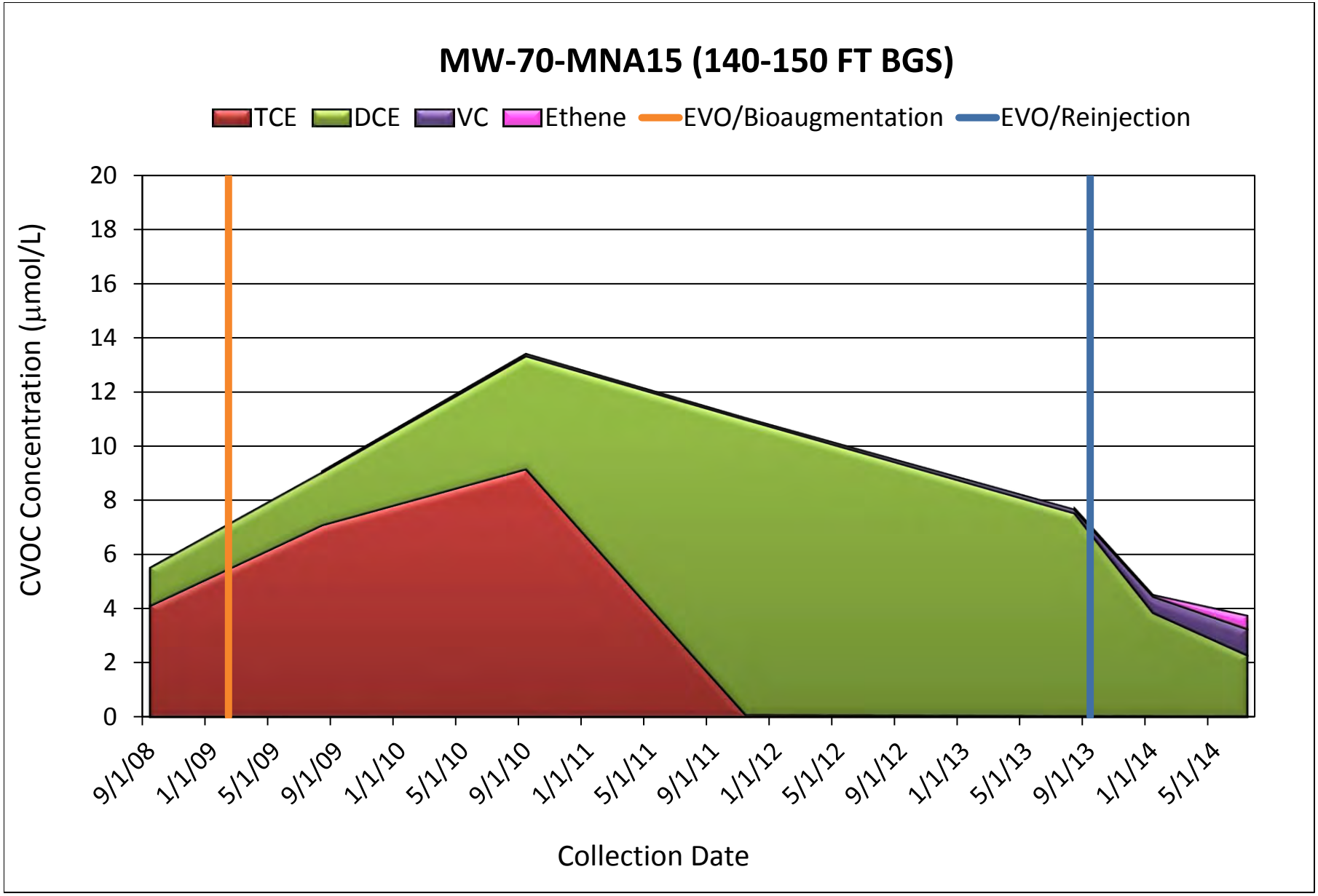

MW-70-PMW13B (145-155 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
9/1/08
3/1/09
9/1/09
3/1/10
9/1/10
3/1/11
9/1/11
3/1/12
9/1/12
3/1/13
9/1/13
3/1/14
9/1/14
3/1/15
9/1/15
Collection Date

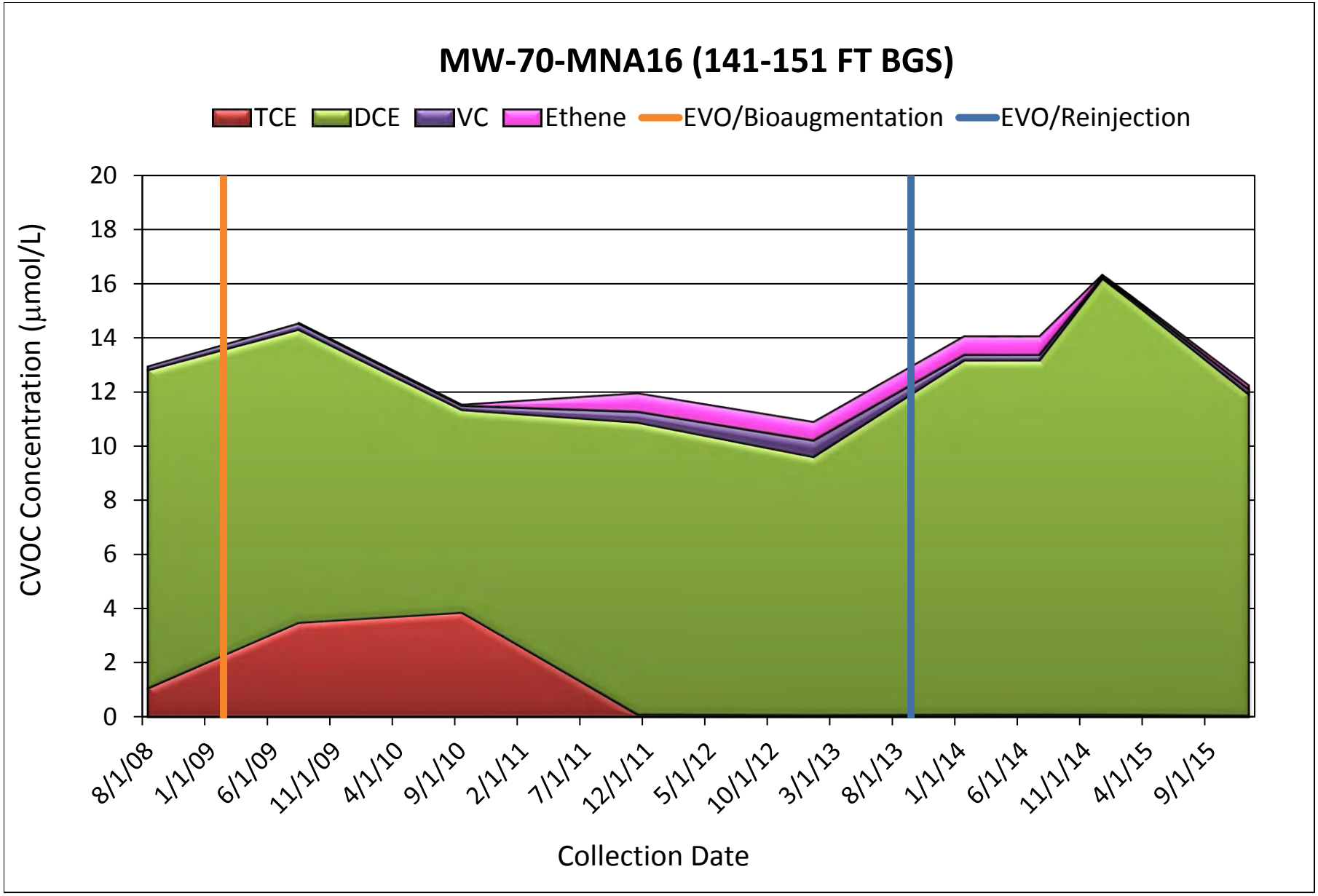

IW-70-SSB109 (126-166 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
8/28/08
8/28/09
8/28/10
8/28/11
8/28/12
8/28/13
8/28/14
8/28/15
Collection Date

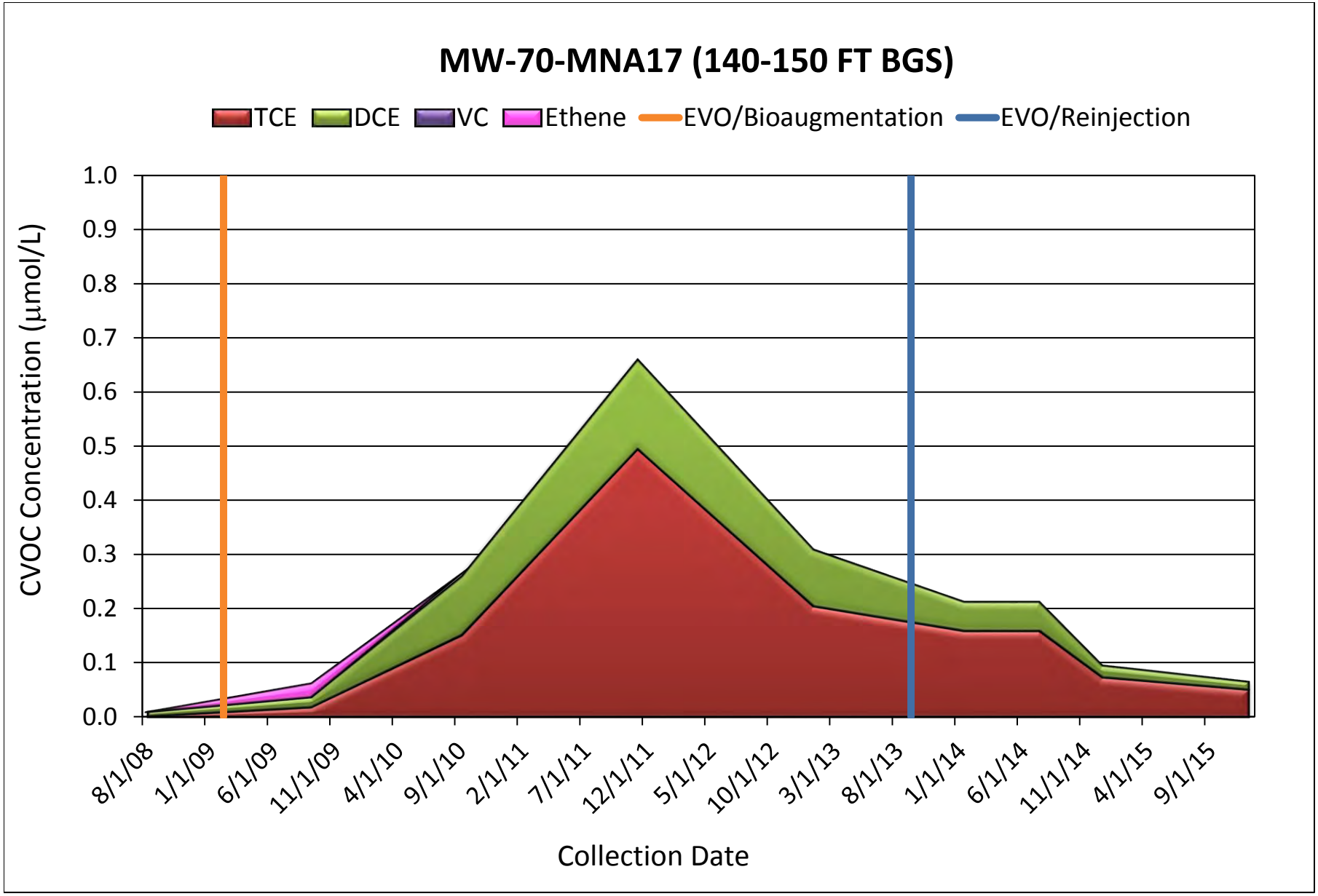

IW-70-SSB119 (126-166 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
10
9
8
7
6
5
4
3
2
1
0
2/1/09
8/1/09
2/1/10
8/1/10
2/1/11
8/1/11
2/1/12
8/1/12
2/1/13
8/1/13
2/1/14
8/1/14
2/1/15
8/1/15
Collection Date


MW-70-PMW14A (128-138 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
9/1/08
3/1/09
9/1/09
3/1/10
9/1/10
3/1/11
9/1/11
3/1/12
9/1/12
3/1/13
9/1/13
3/1/14
9/1/14
3/1/15
9/1/15
Collection Date

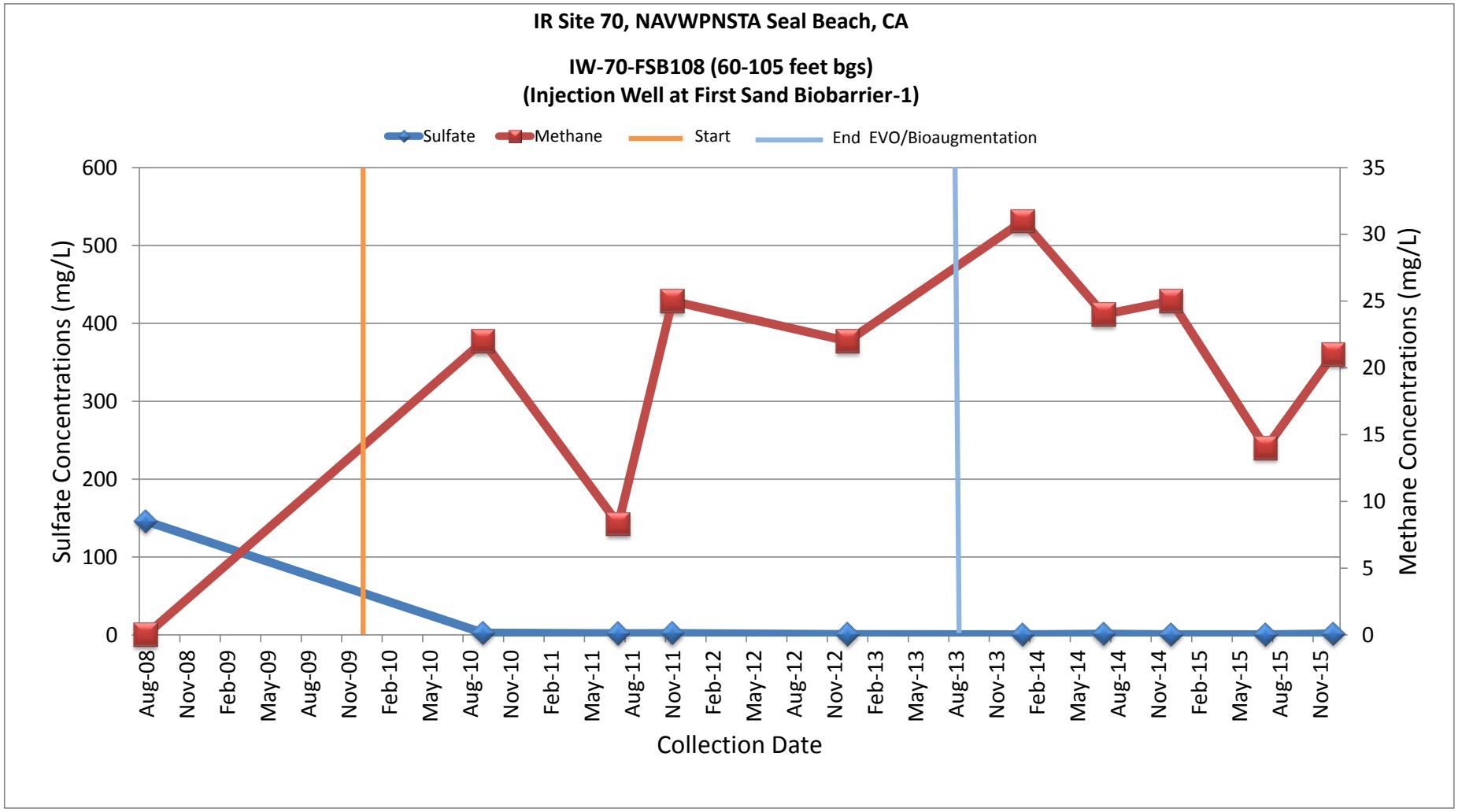

MW-70-PMW14B (149-159 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
9/1/08
3/1/09
9/1/09
3/1/10
9/1/10
3/1/11
9/1/11
3/1/12
9/1/12
3/1/13
9/1/13
3/1/14
9/1/14
3/1/15
9/1/15
Collection Date

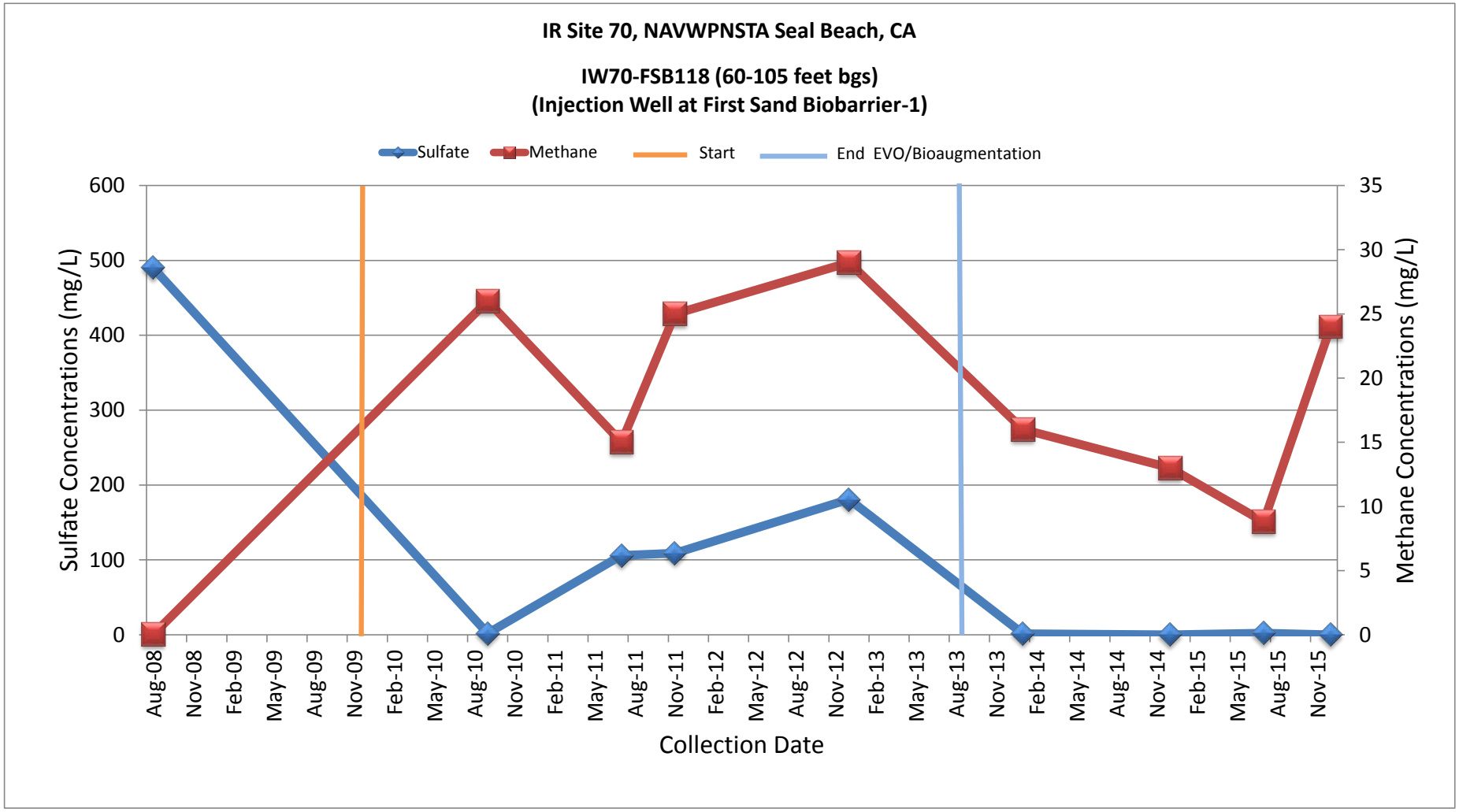

MW-70-MNA15 (140-150 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
9/1/08
1/1/09
5/1/09
9/1/09
1/1/10
5/1/10
9/1/10
1/1/11
5/1/11
9/1/11
1/1/12
5/1/12
9/1/12
1/1/13
5/1/13
9/1/13
1/1/14
5/1/14
Collection Date

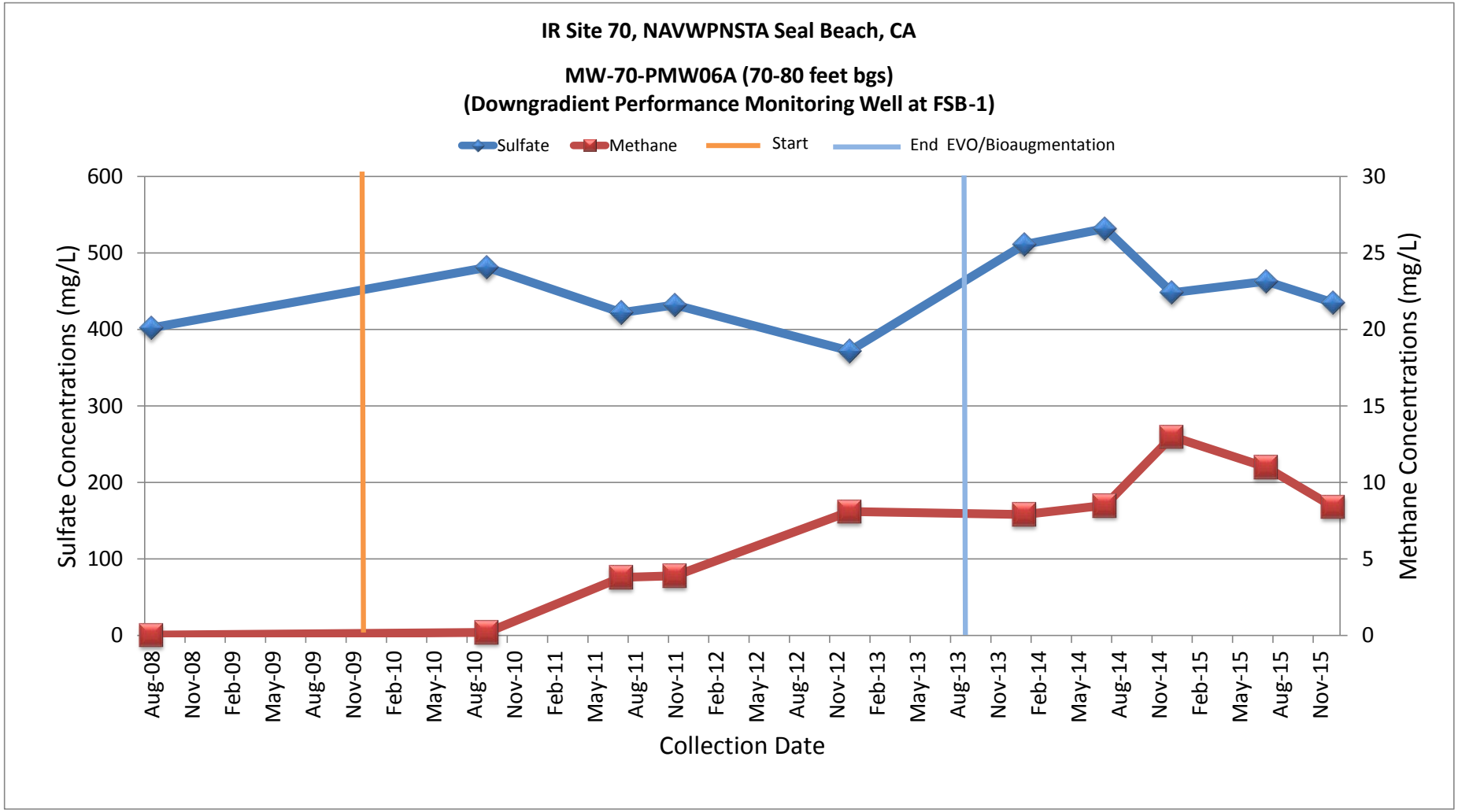

MW-70-MNA16 (141-151 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
20
18
16
14
12
10
8
6
4
2
0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

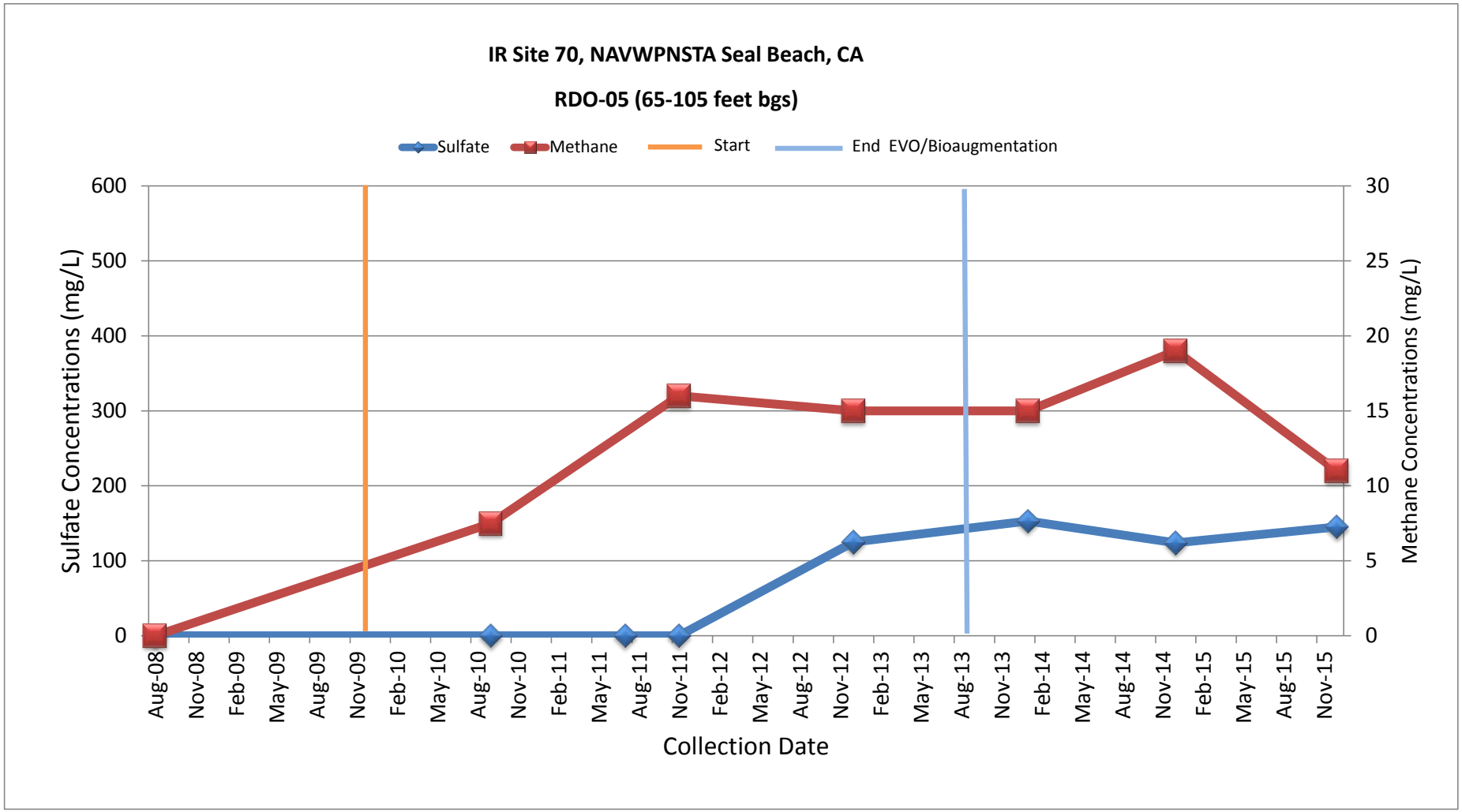

MW-70-MNA17 (140-150 FT BGS)
TCE
DCE
VC
Ethene
EVO/Bioaugmentation
EVO/Reinjection
CVOC Concentration (µmol/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
8/1/08
1/1/09
6/1/09
11/1/09
4/1/10
9/1/10
2/1/11
7/1/11
12/1/11
5/1/12
10/1/12
3/1/13
8/1/13
1/1/14
6/1/14
11/1/14
4/1/15
9/1/15
Collection Date

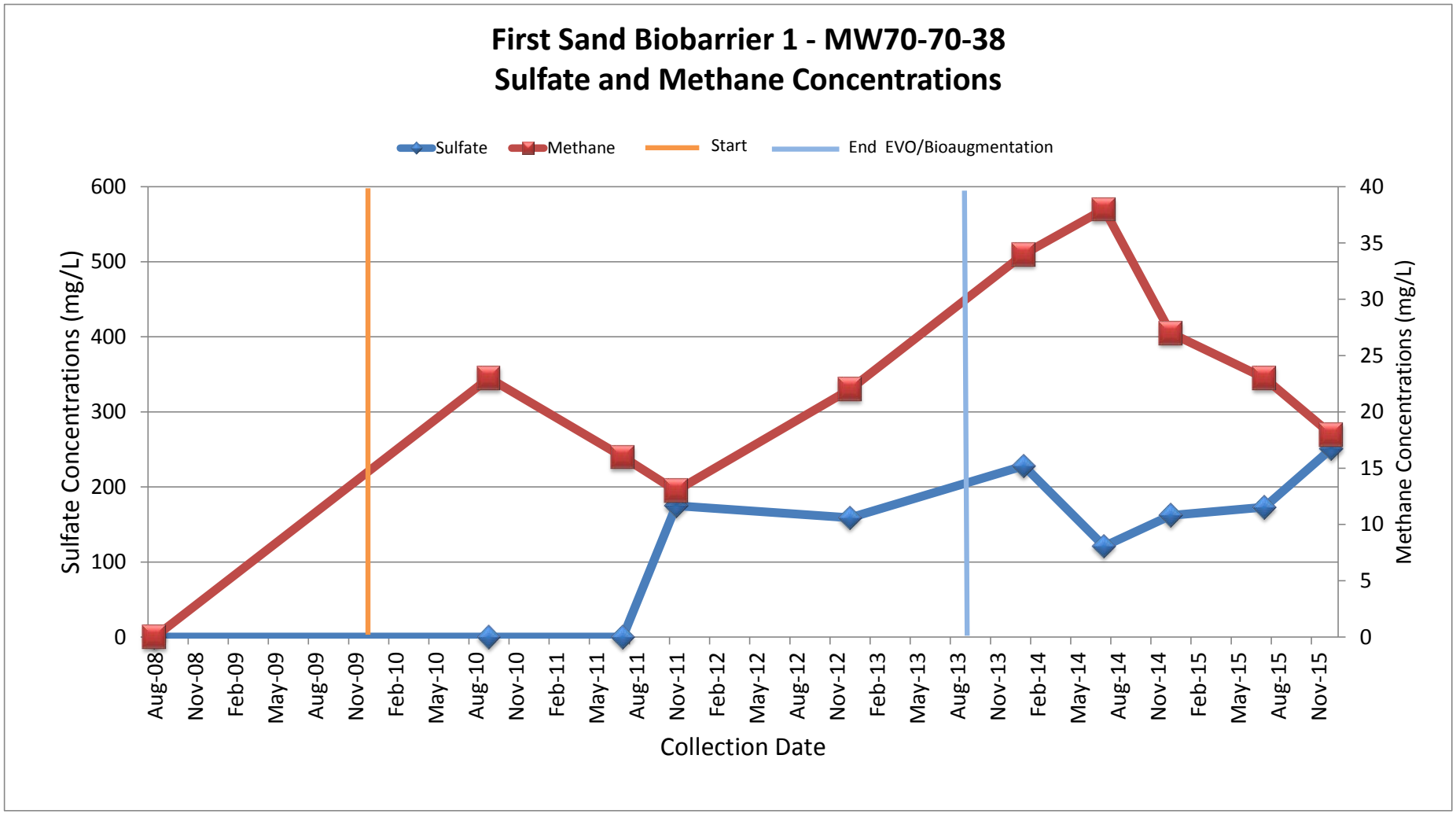
Sulfate/Methane Trend Graphs

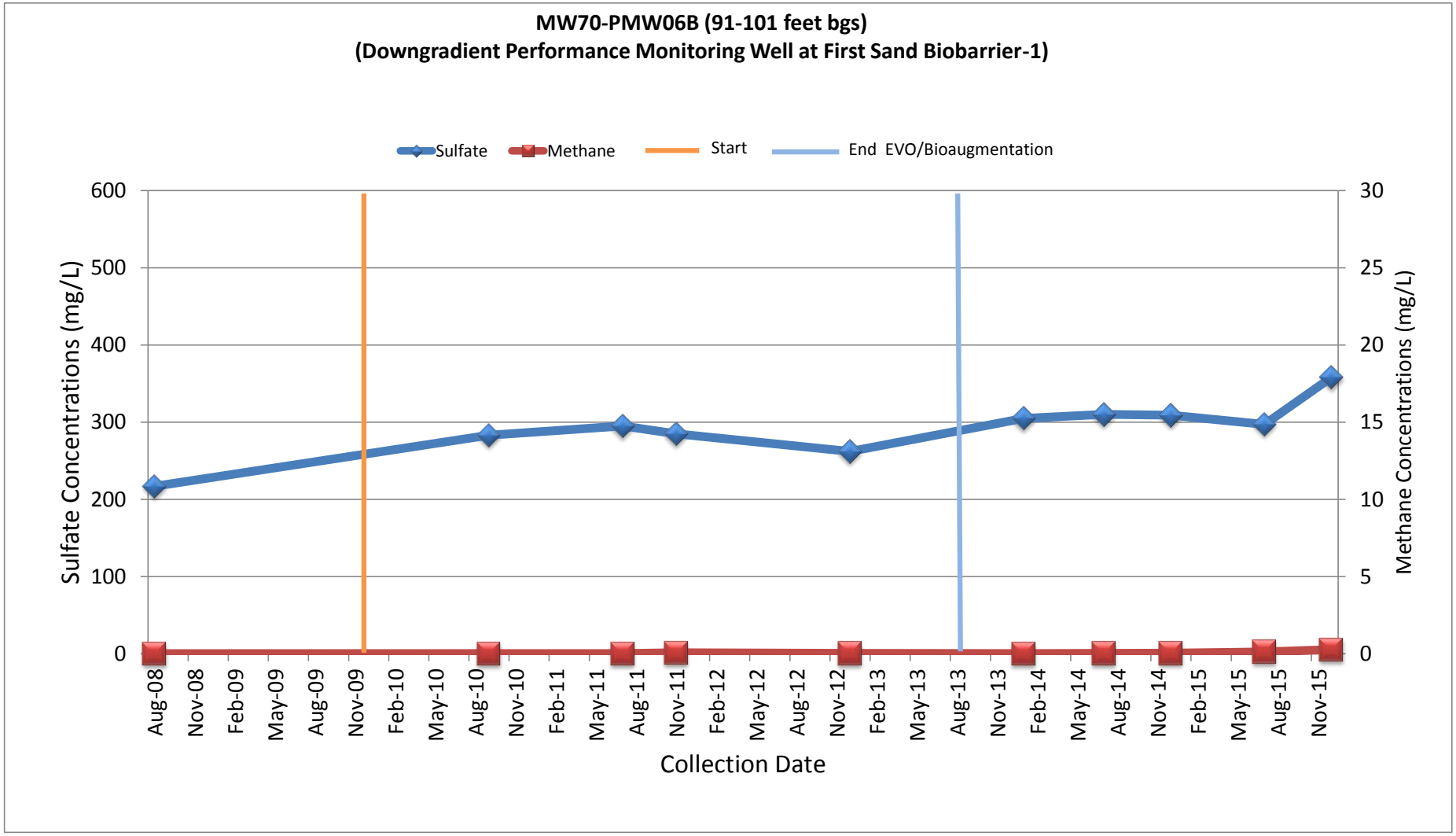

IR Site 70, NAVWPNSTA Seal Beach, CA
IW-70-FSB108 (60-105 feet bgs)
(Injection Well at First Sand Biobarrier-1)
Sulfate
Methane
Start
End EVO/Bioaugmentation
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
Collection Date
0
100
200
300
400
500
600
0
5
10
15
20
25
30
35
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15

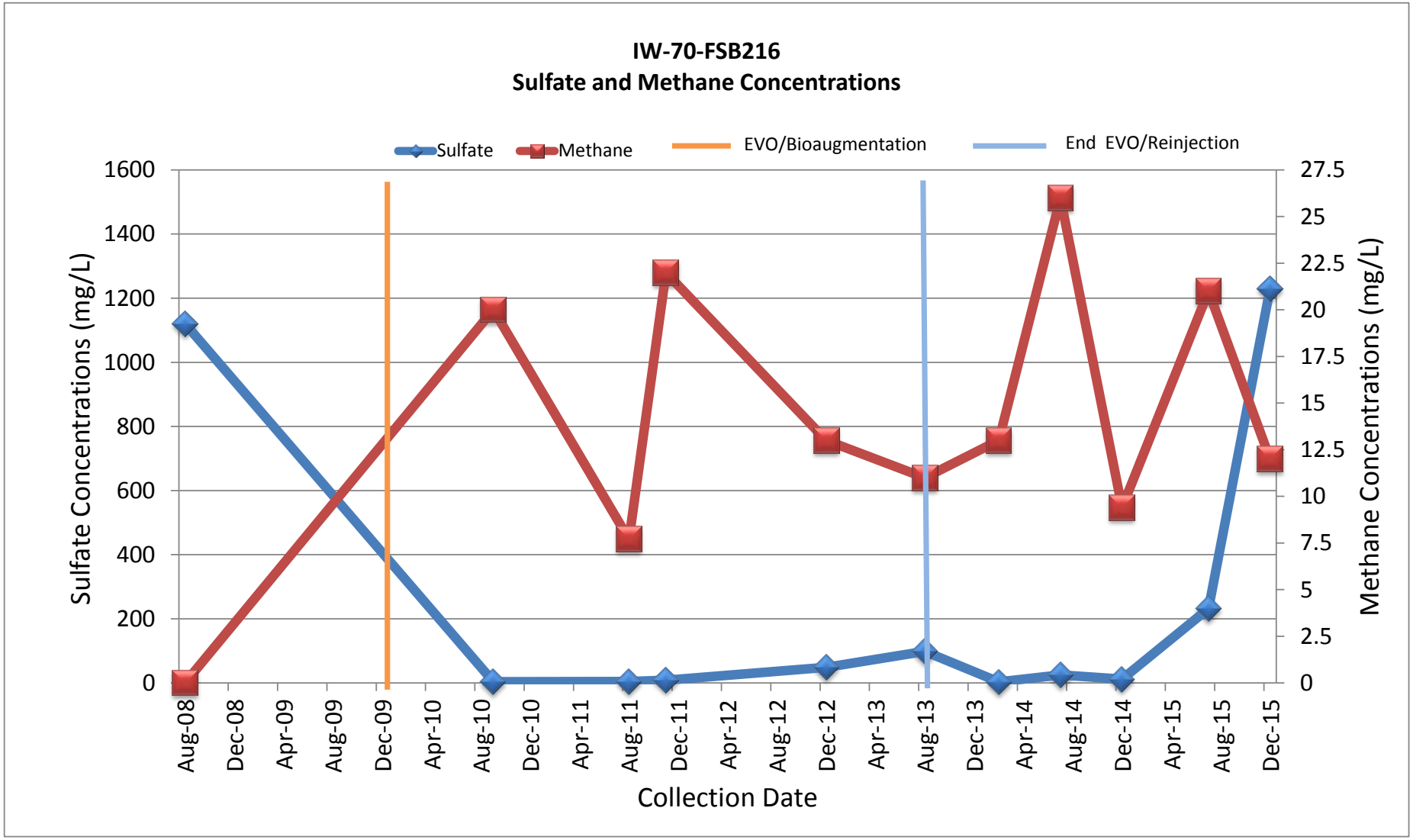

IR Site 70, NAVWPNSTA Seal Beach, CA
IW70-FSB118 (60-105 feet bgs)
(Injection Well at First Sand Biobarrier-1)
Sulfate
Methane
Start
End EVO/Bioaugmentation
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
600
500
400
300
200
100
0
35
30
25
20
15
10
5
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

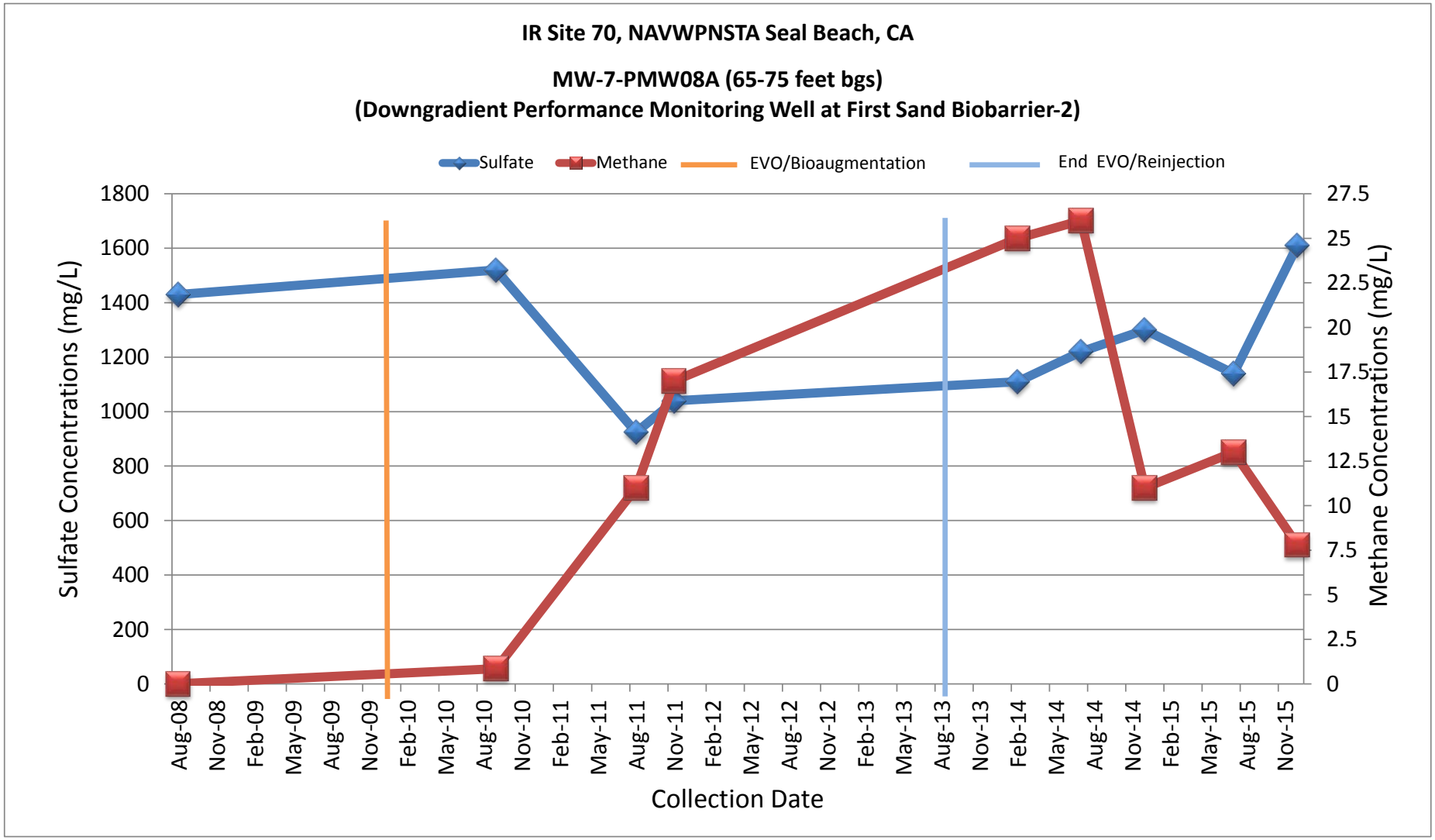

IR Site 70, NAVWPNSTA Seal Beach, CA
MW-70-PMW06A (70-80 feet bgs)
(Downgradient Performance Monitoring Well at FSB-1)
Sulfate
Methane
Start
End EVO/Bioaugmentation
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
600
500
400
300
200
100
0
30
25
20
15
10
5
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

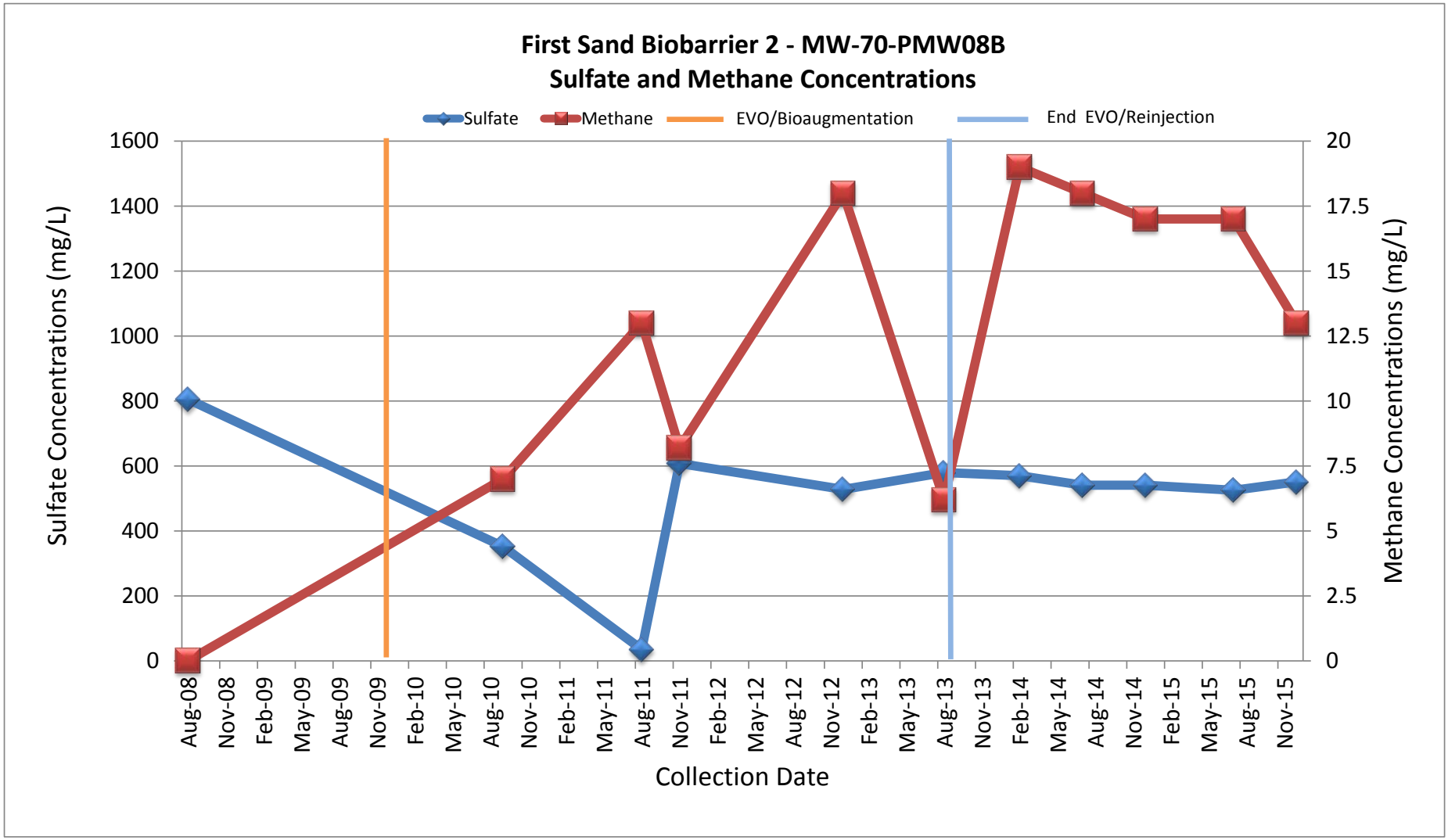

IR Site 70, NAVWPNSTA Seal Beach, CA
RDO-05 (65-105 feet bgs)
Sulfate
Methane
Start
End EVO/Bioaugmentation
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
600
500
400
300
200
100
0
30
25
20
15
10
5
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

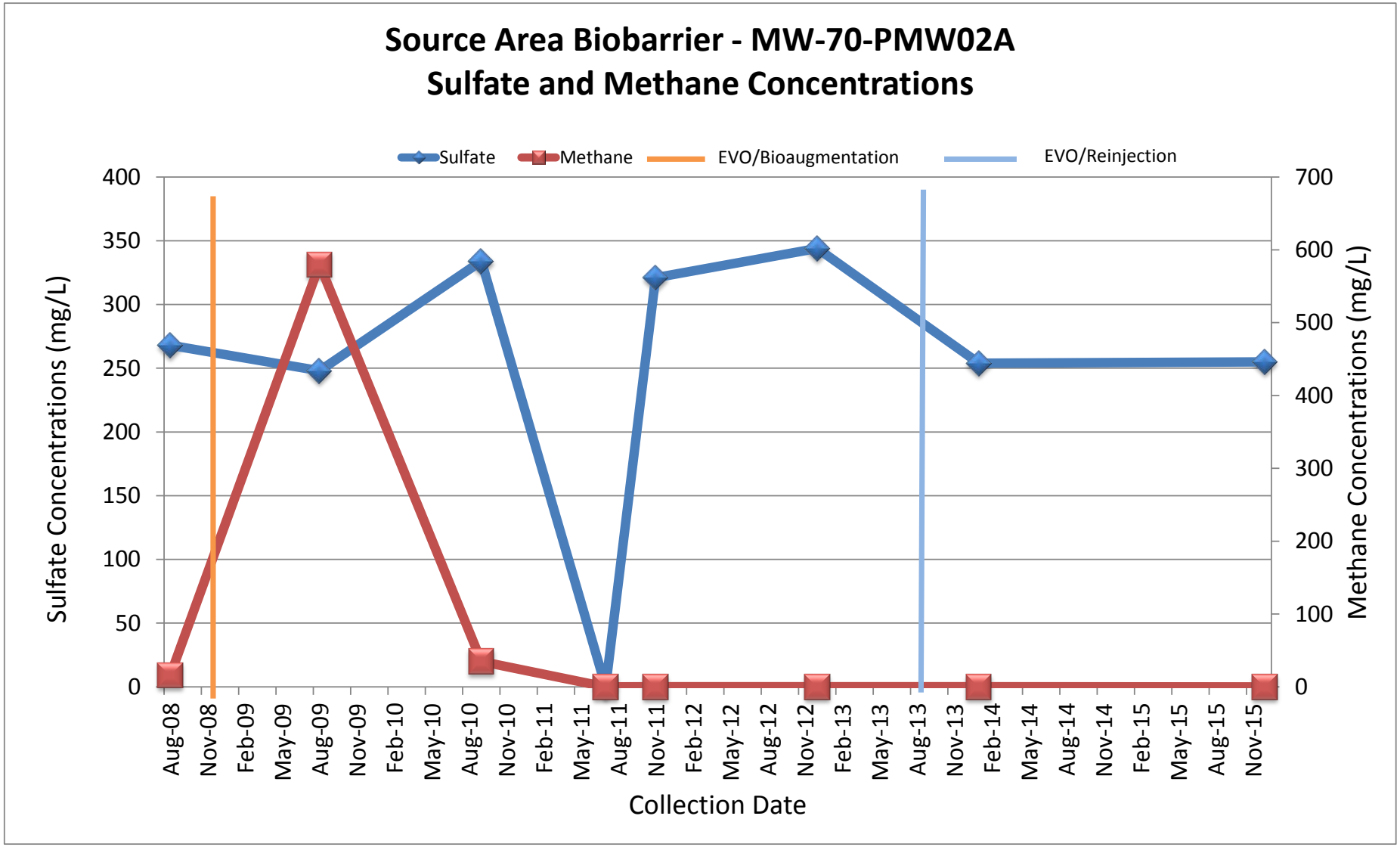

First Sand Biobarrier 1 - MW70-70-38
Sulfate and Methane Concentrations
Sulfate
Methane
Start
End EVO/Bioaugmentation
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
Collection Date
0
100
200
300
400
500
600
0
5
10
15
20
25
30
35
40
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15

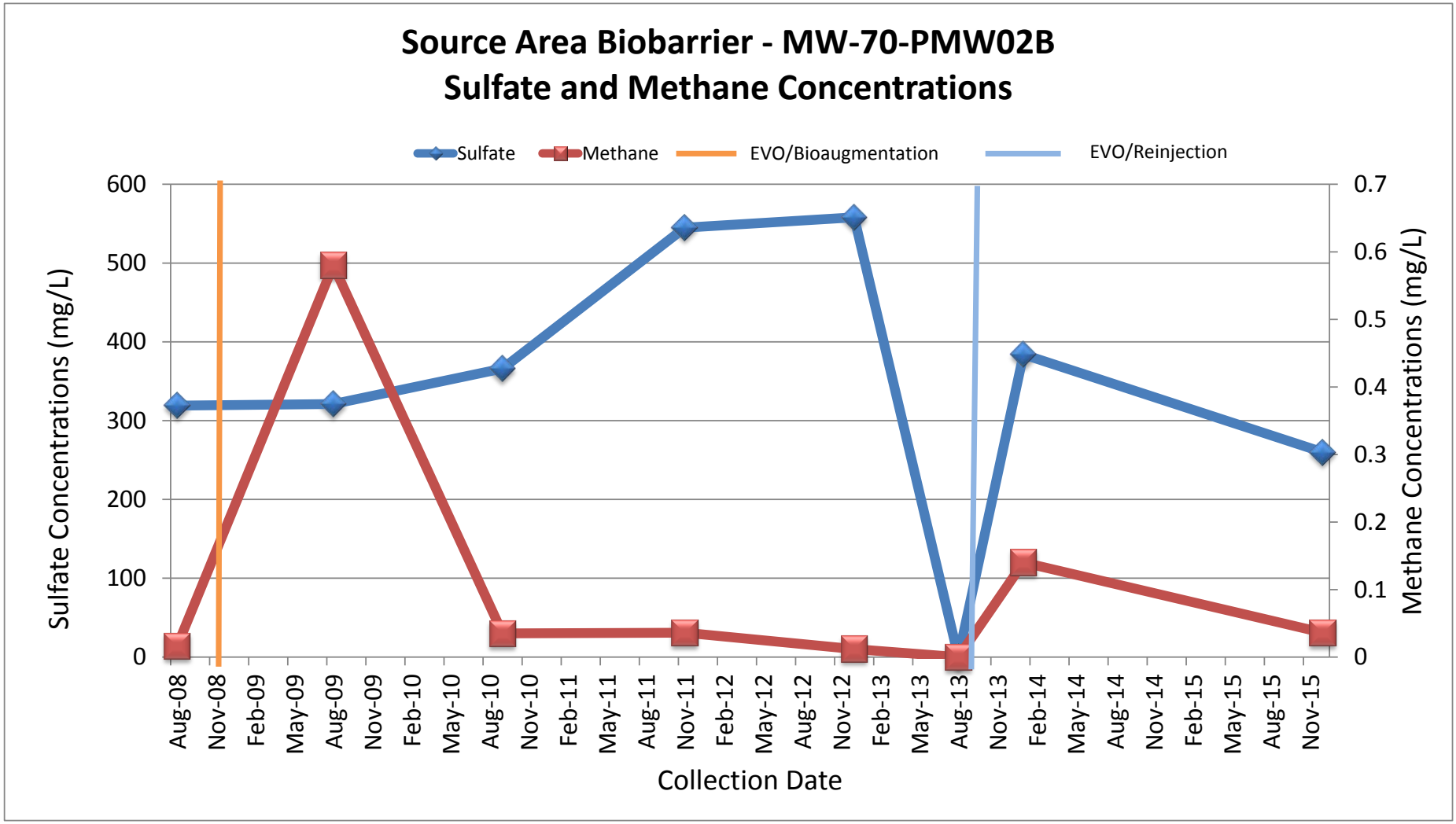

MW70-PMW06B (91-101 feet bgs)
(Downgradient Performance Monitoring Well at First Sand Biobarrier-1)
Sulfate
Methane
Start
End EVO/Bioaugmentation
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
600
500
400
300
200
100
0
30
25
20
15
10
5
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

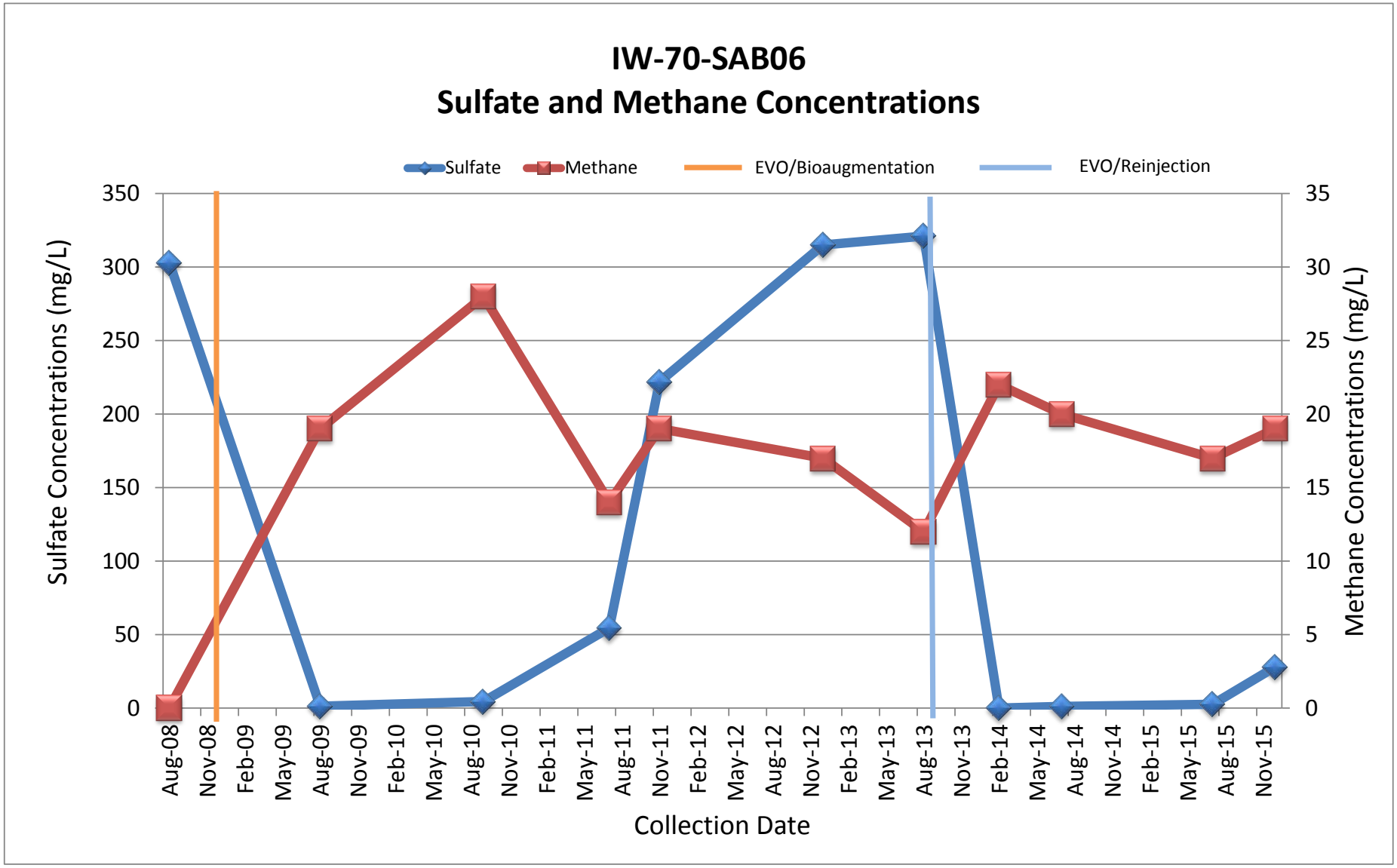

IW-70-FSB216
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
End EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
1600
1400
1200
1000
800
600
400
200
0
27.5
25
22.5
20
17.5
15
12.5
10
7.5
5
2.5
0
Aug-08
Dec-08
Apr-09
Aug-09
Dec-09
Apr-10
Aug-10
Dec-10
Apr-11
Aug-11
Dec-11
Apr-12
Aug-12
Dec-12
Apr-13
Aug-13
Dec-13
Apr-14
Aug-14
Dec-14
Apr-15
Aug-15
Dec-15
Collection Date

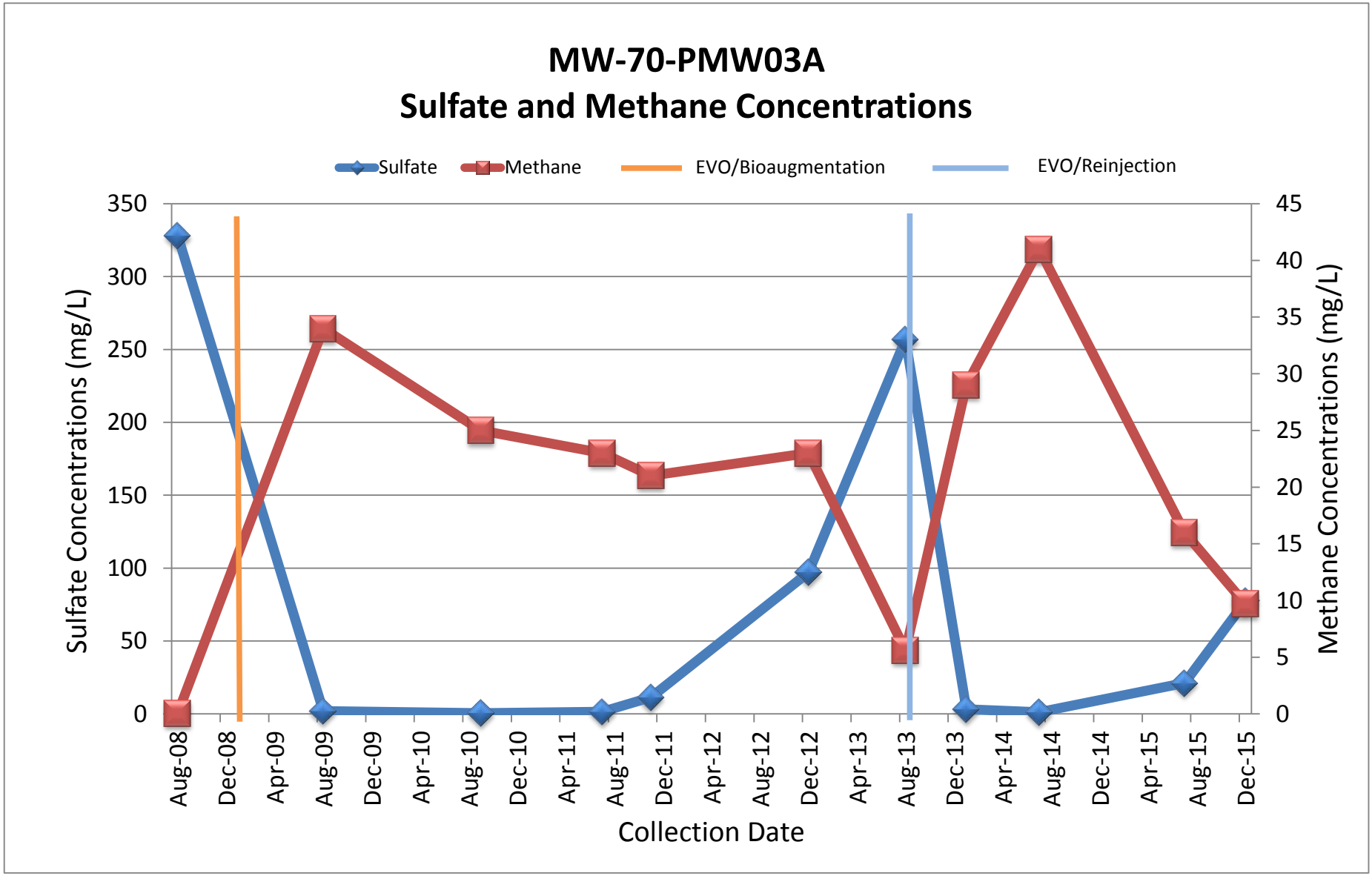

IR Site 70, NAVWPNSTA Seal Beach, CA
MW-7-PMW08A (65-75 feet bgs)
(Downgradient Performance Monitoring Well at First Sand Biobarrier-2)
Sulfate
Methane
EVO/Bioaugmentation
End EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
Collection Date
1800
1600
1400
1200
1000
800
600
400
200
0
27.5
25
22.5
20
17.5
15
12.5
10
7.5
5
2.5
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15

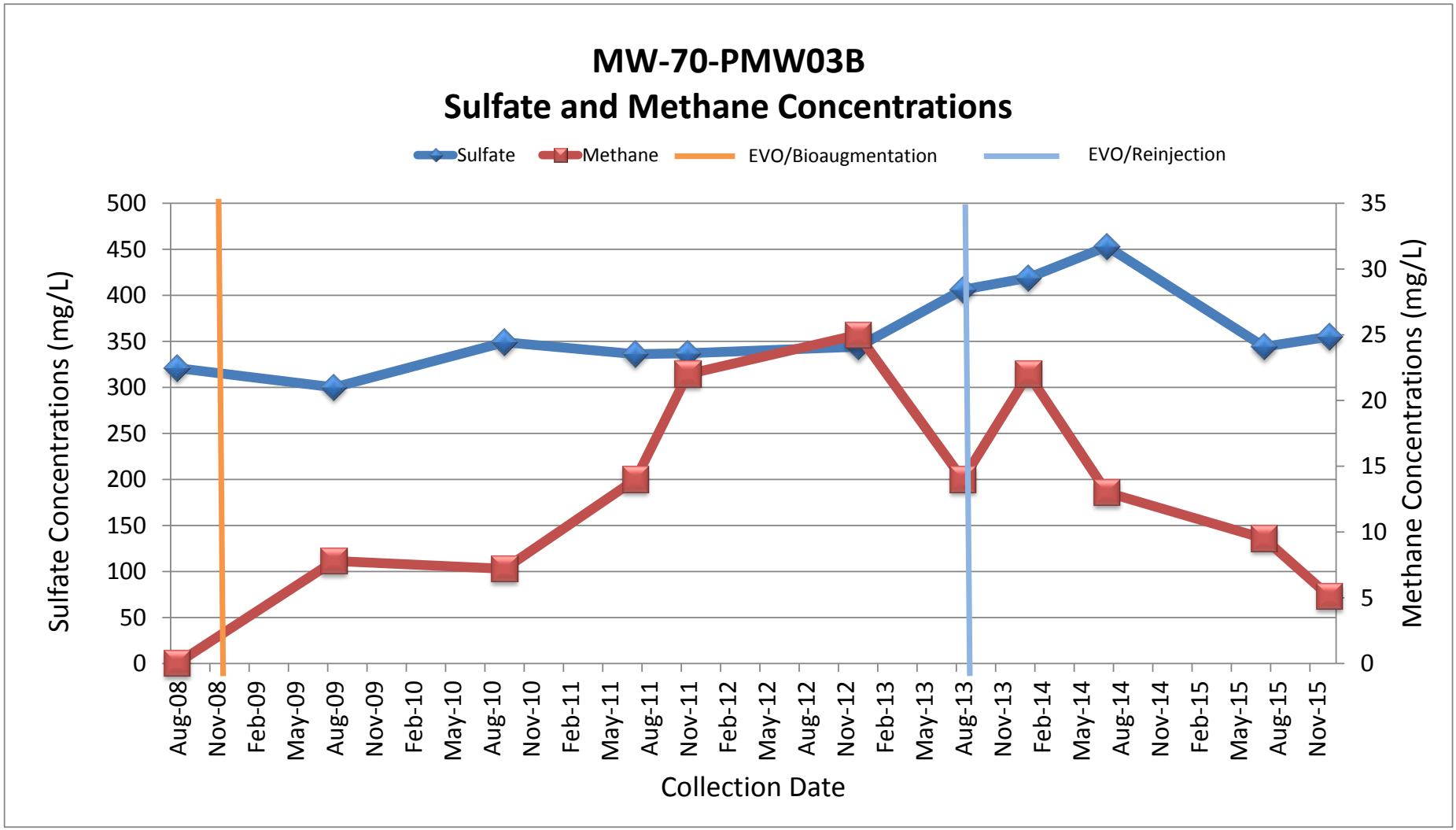

First Sand Biobarrier 2 - MW-70-PMW08B
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
End EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
1600
1400
1200
1000
800
600
400
200
0
20
17.5
15
12.5
10
7.5
5
2.5
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

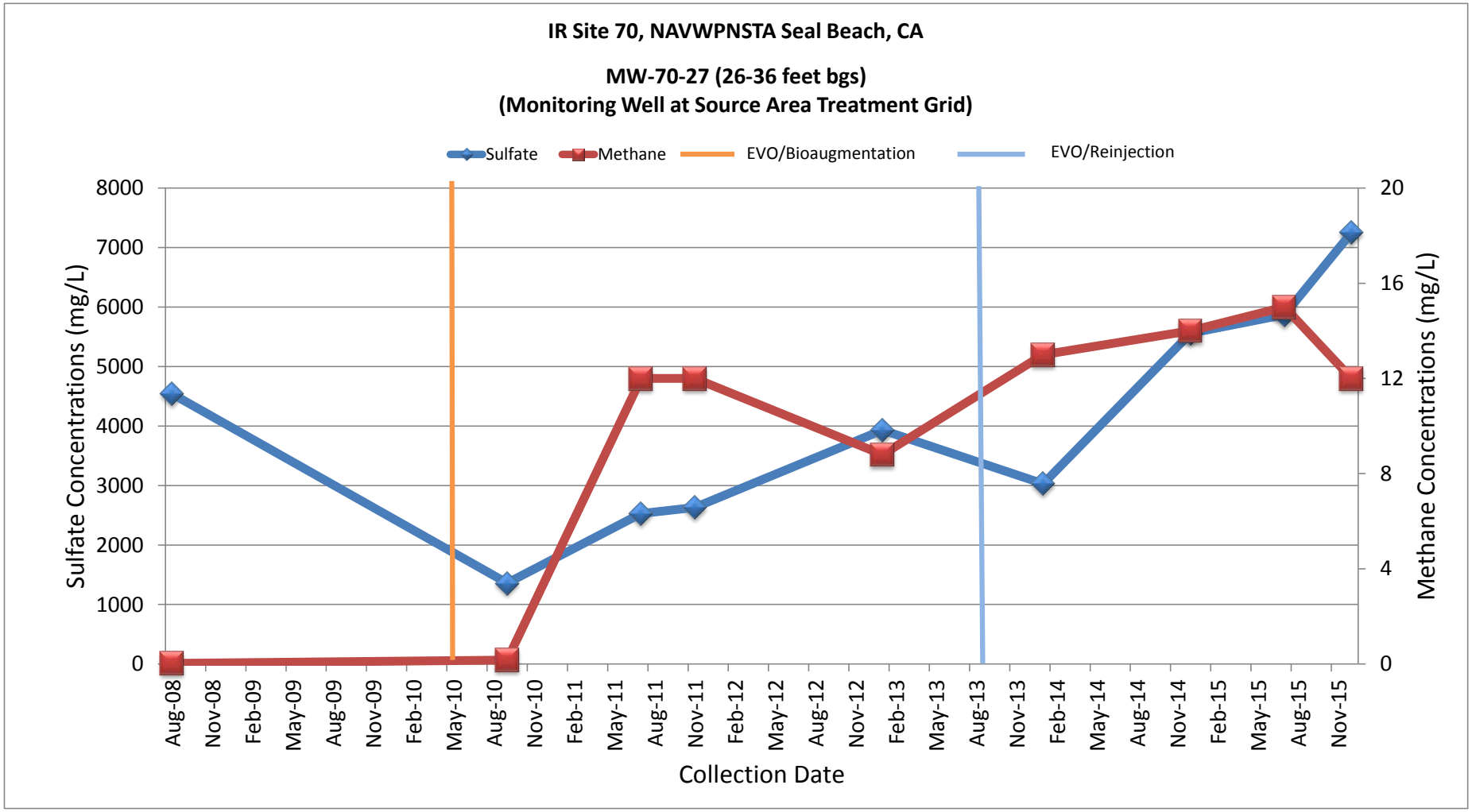

Source Area Biobarrier - MW-70-PMW02A
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
400
350
300
250
200
150
100
50
0
700
600
500
400
300
200
100
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

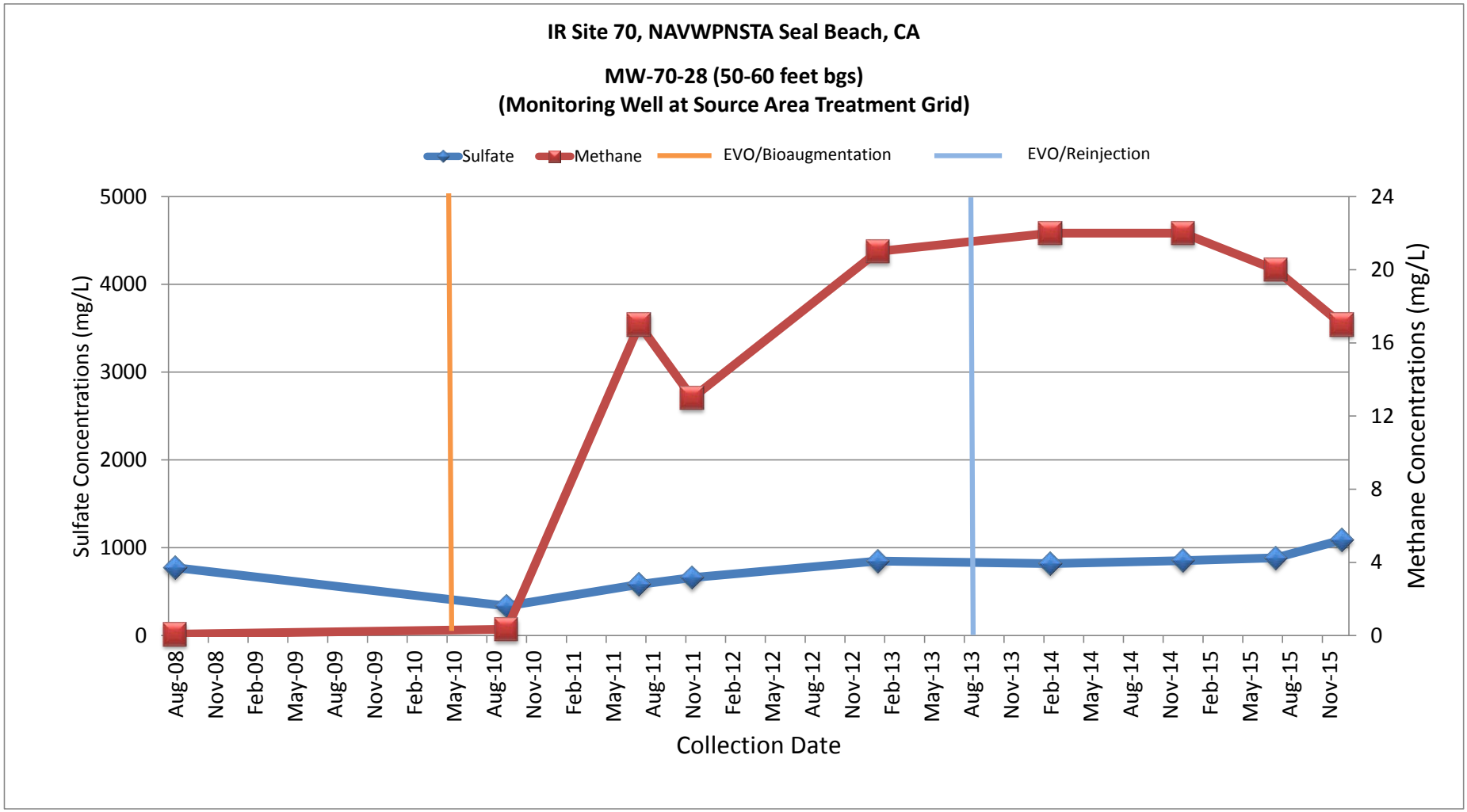

Source Area Biobarrier - MW-70-PMW02B
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
600
500
400
300
200
100
0
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

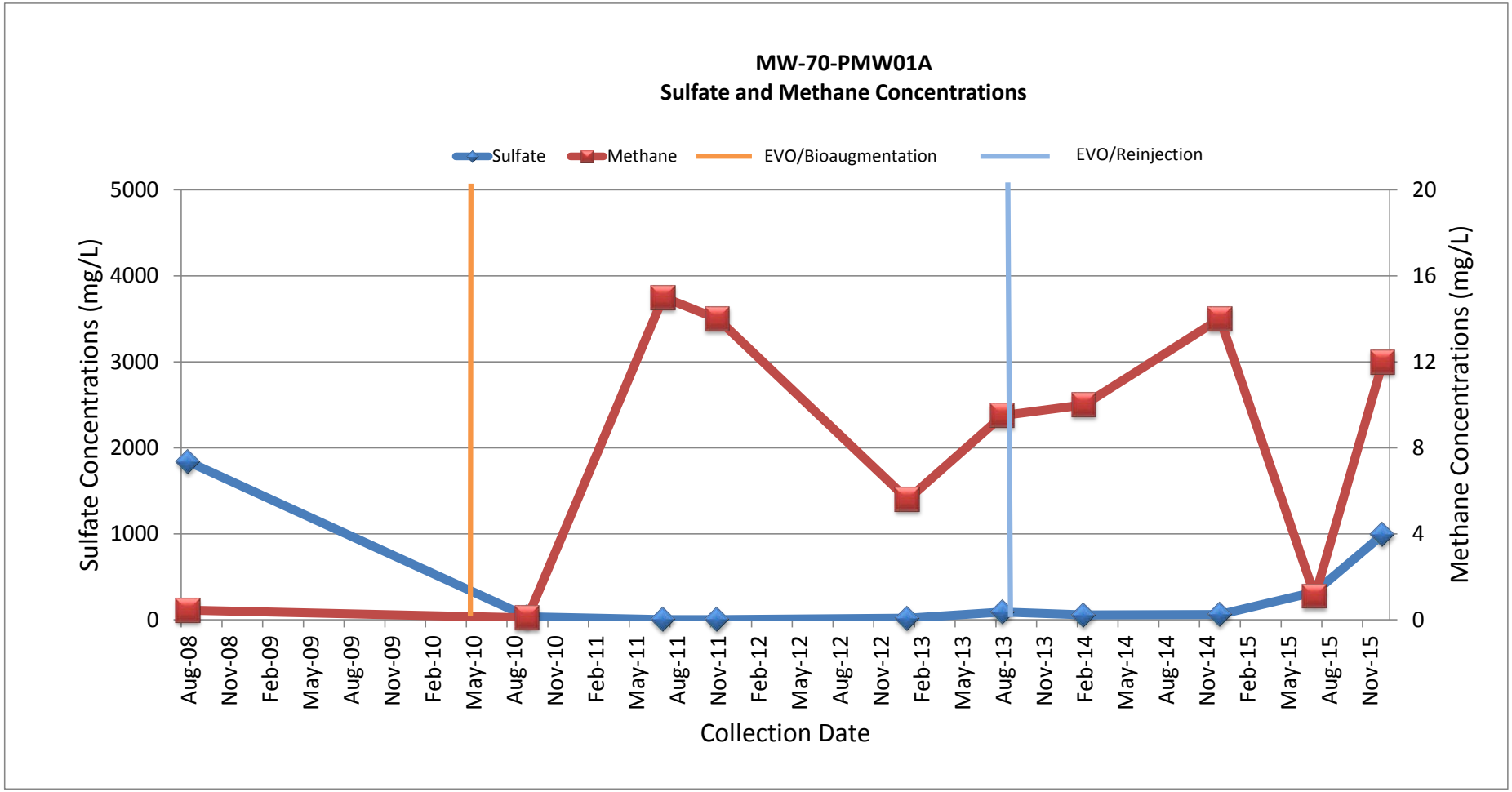

IW-70-SAB06
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
350
300
250
200
150
100
50
0
35
30
25
20
15
10
5
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

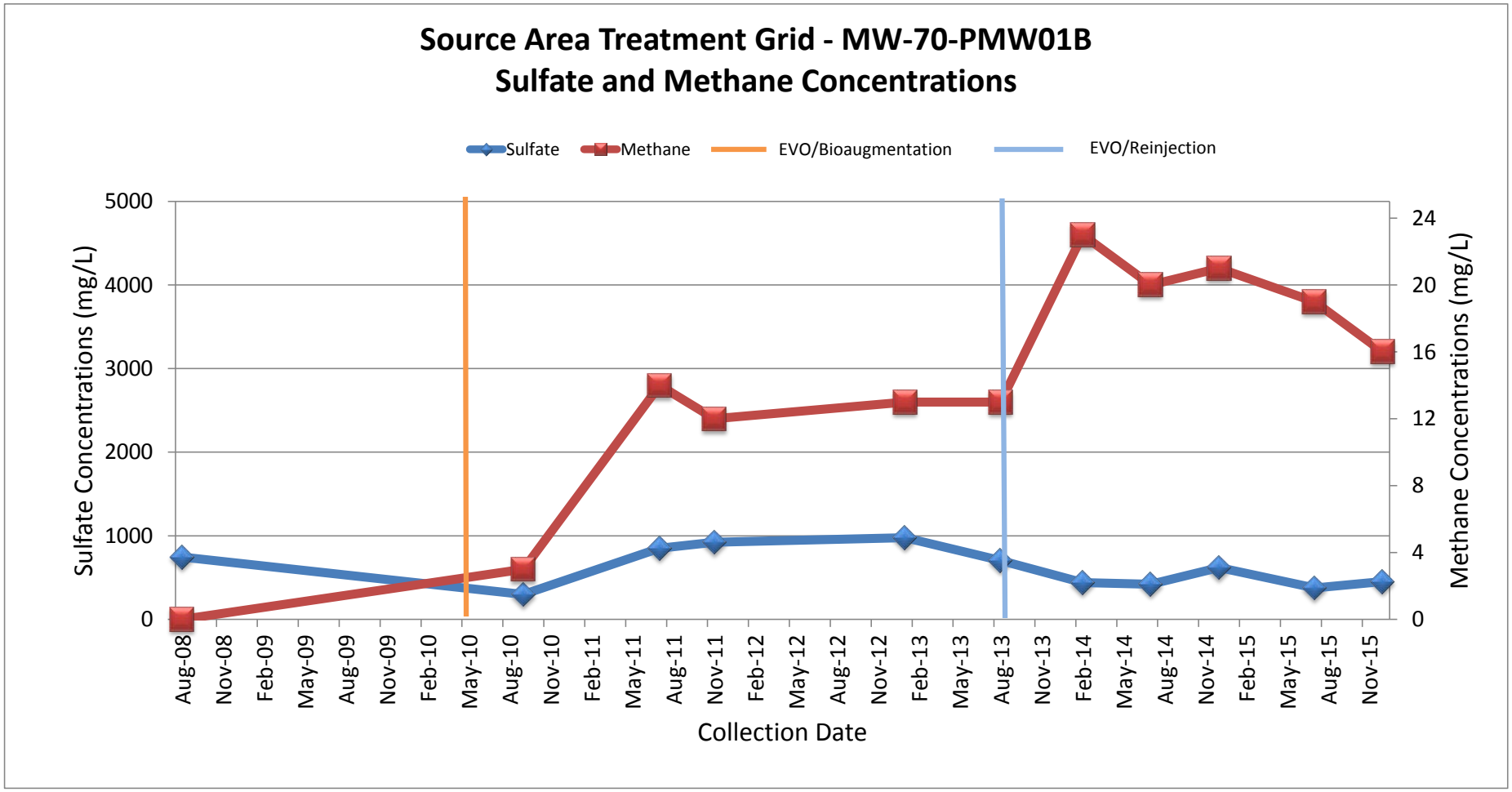

MW-70-PMW03A
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
350
300
250
200
150
100
50
0
45
40
35
30
25
20
15
10
5
0
Aug-08
Dec-08
Apr-09
Aug-09
Dec-09
Apr-10
Aug-10
Dec-10
Apr-11
Aug-11
Dec-11
Apr-12
Aug-12
Dec-12
Apr-13
Aug-13
Dec-13
Apr-14
Aug-14
Dec-14
Apr-15
Aug-15
Dec-15
Collection Date

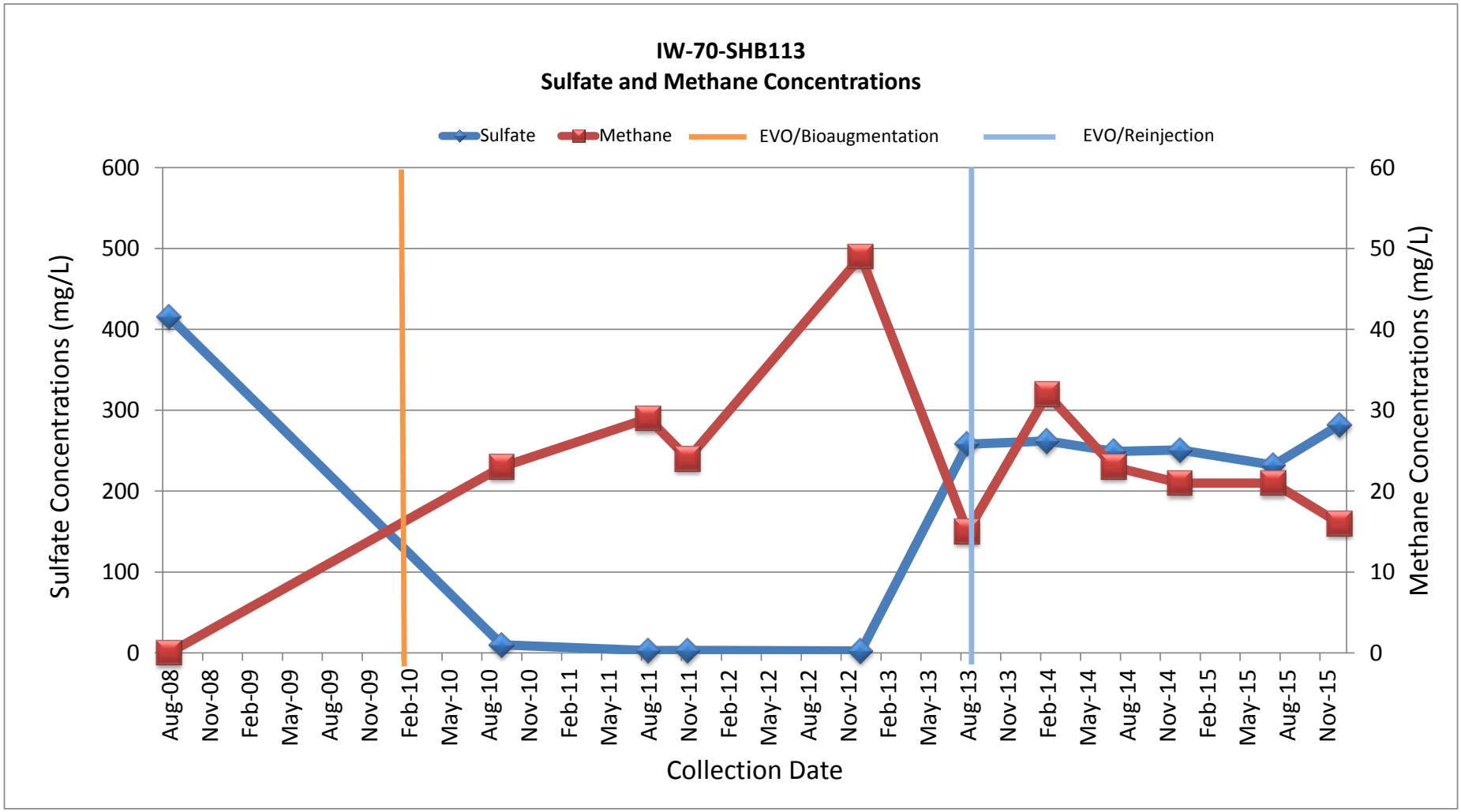

MW-70-PMW03B
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
500
450
400
350
300
250
200
150
100
50
0
35
30
25
20
15
10
5
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

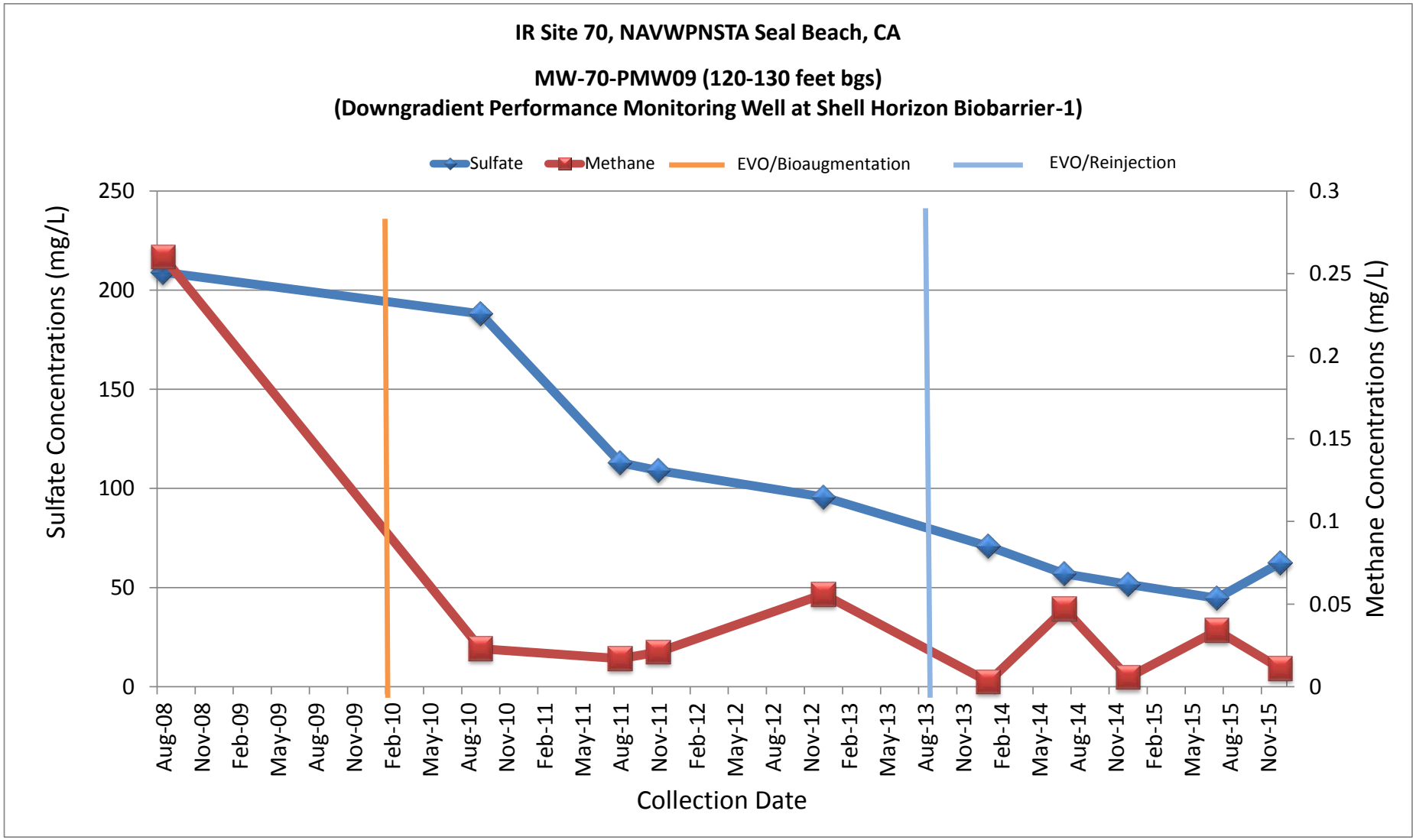

IR Site 70, NAVWPNSTA Seal Beach, CA
MW-70-27 (26-36 feet bgs)
(Monitoring Well at Source Area Treatment Grid)
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
8000
7000
6000
5000
4000
3000
2000
1000
0
20
16
12
8
4
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

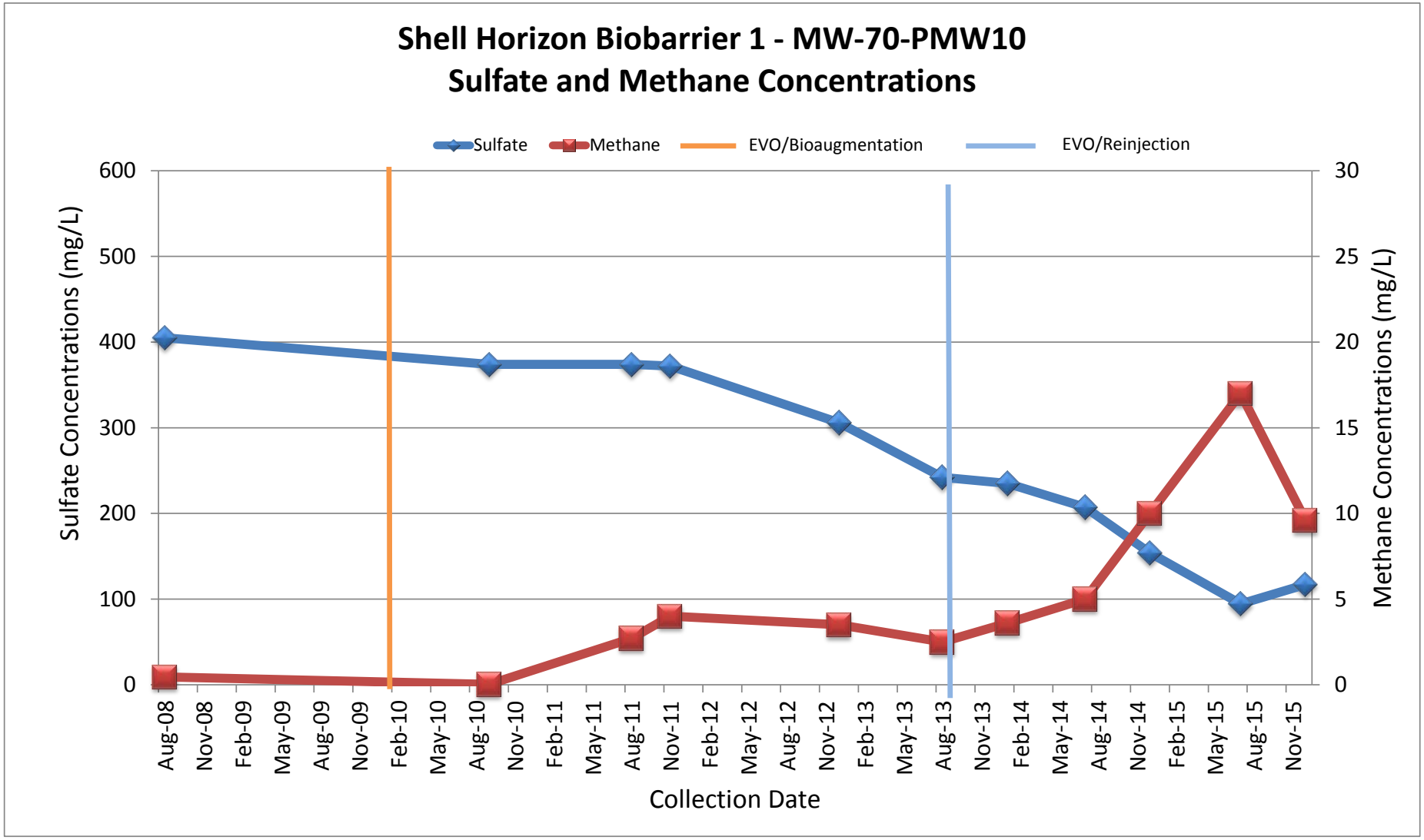

IR Site 70, NAVWPNSTA Seal Beach, CA
MW-70-28 (50-60 feet bgs)
(Monitoring Well at Source Area Treatment Grid)
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
5000
4000
3000
2000
1000
0
24
20
16
12
8
4
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

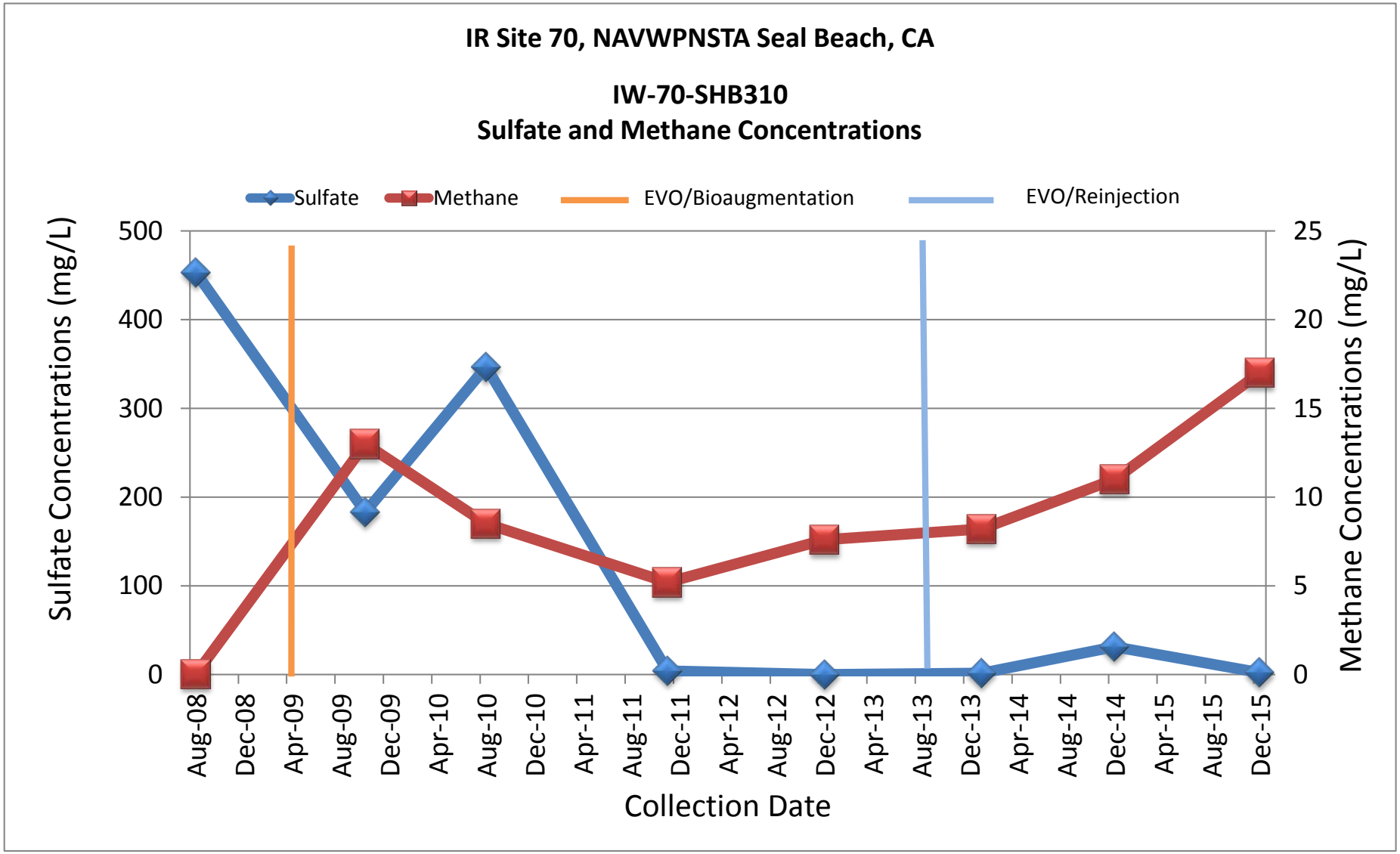

MW-70-PMW01A
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
5000
4000
3000
2000
1000
0
20
16
12
8
4
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

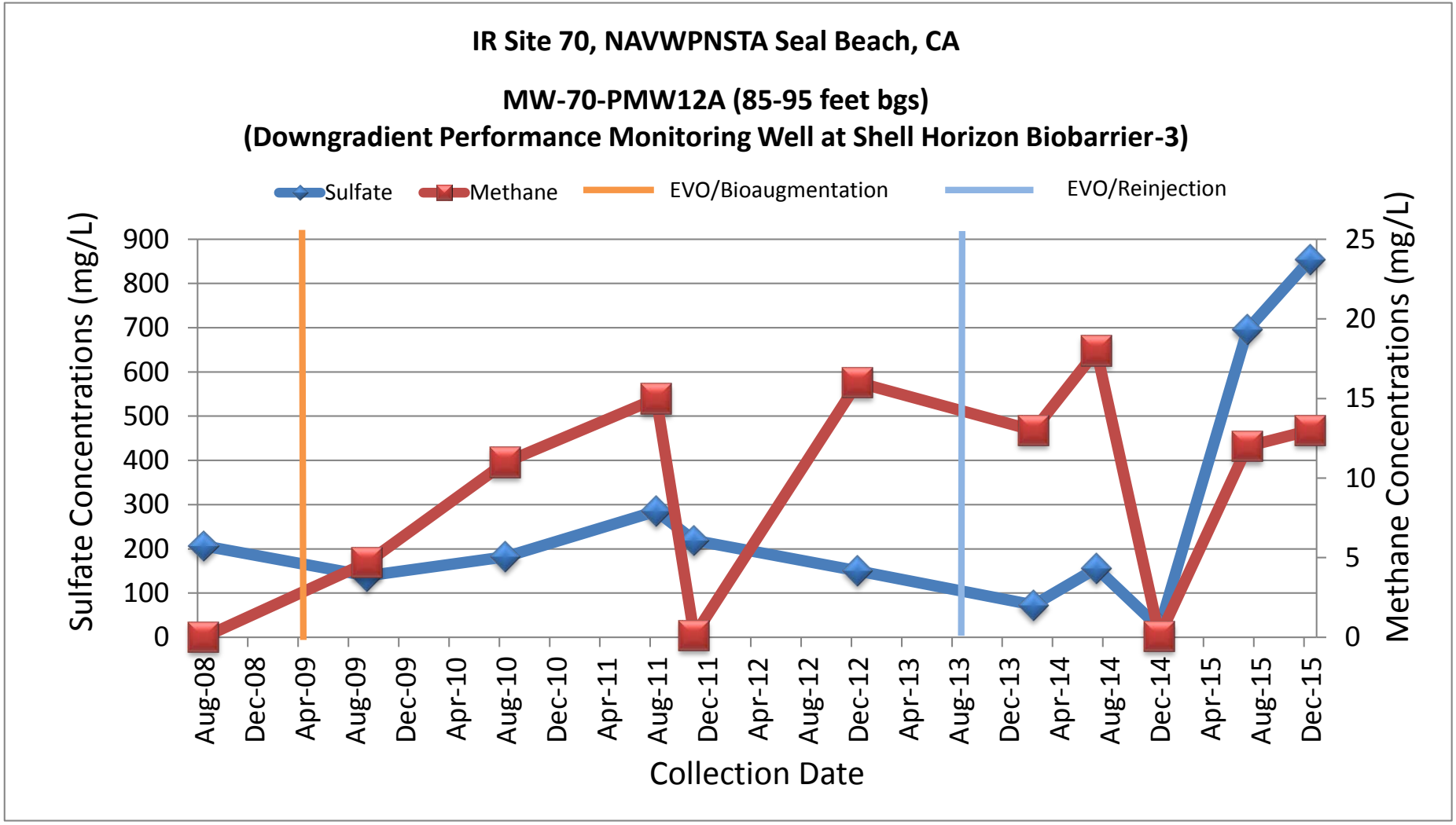

Source Area Treatment Grid - MW-70-PMW01B
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
5000
4000
3000
2000
1000
0
24
20
16
12
8
4
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

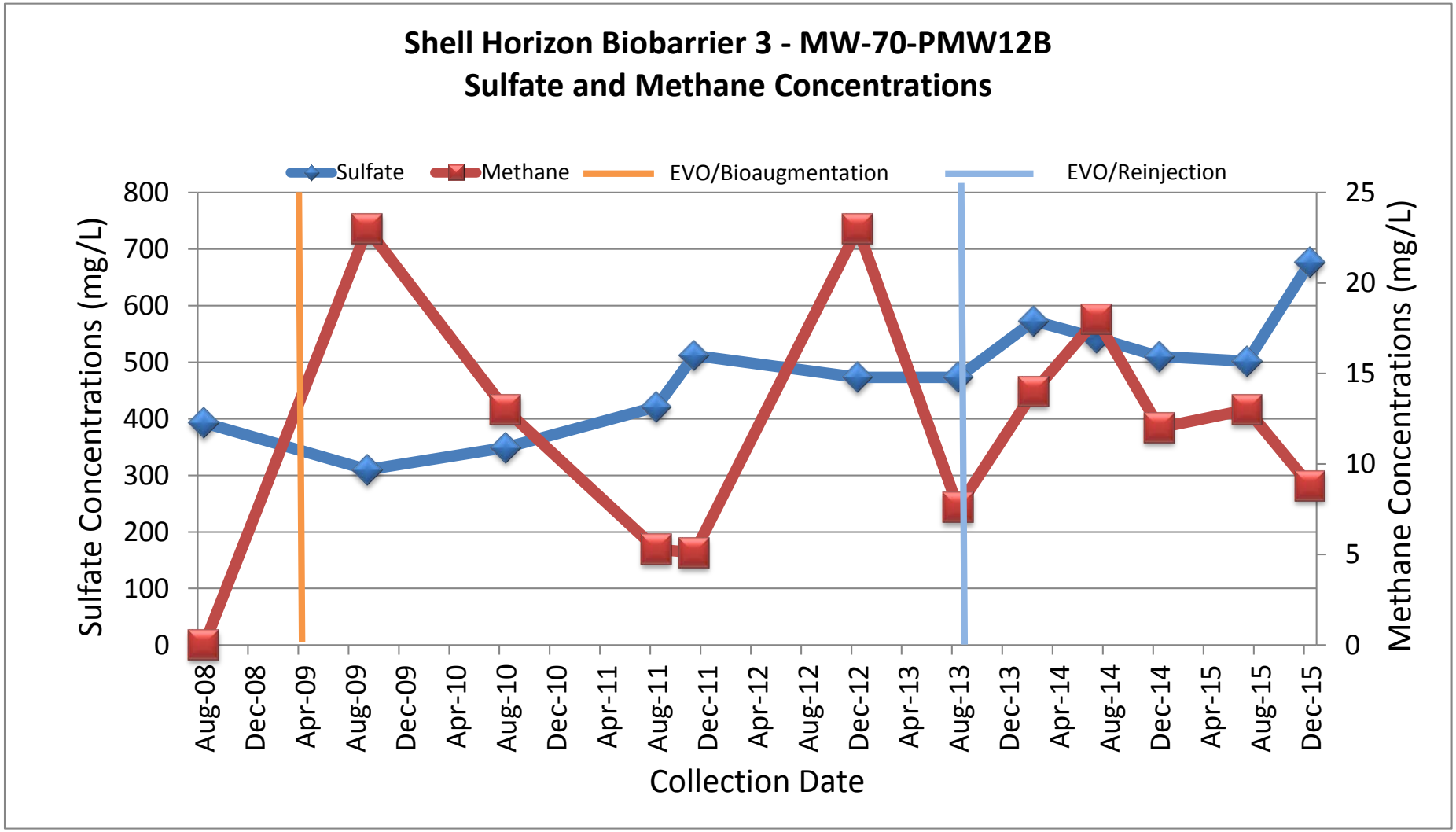

IW-70-SHB113
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
600
500
400
300
200
100
0
60
50
40
30
20
10
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

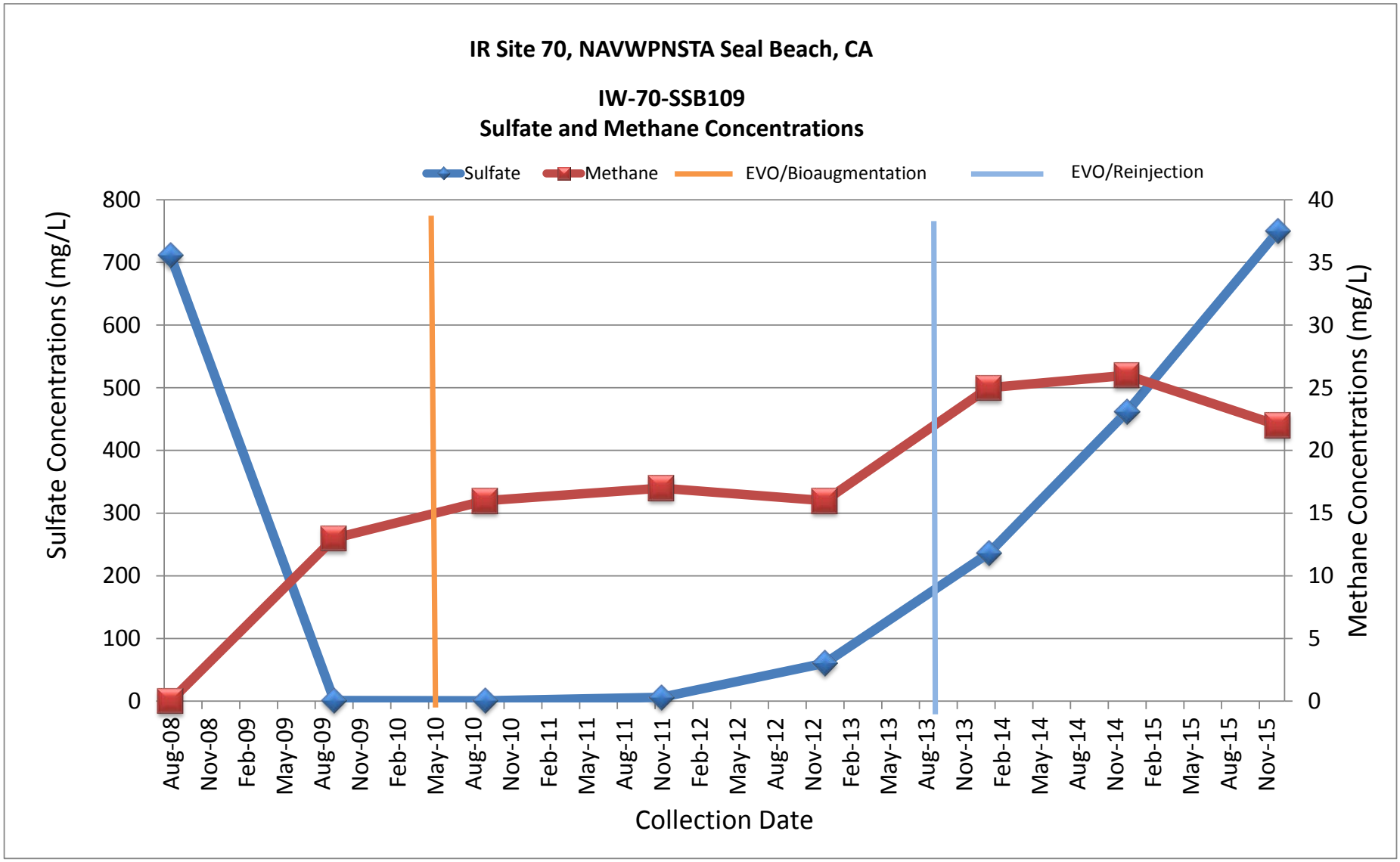

IR Site 70, NAVWPNSTA Seal Beach, CA
MW-70-PMW09 (120-130 feet bgs)
(Downgradient Performance Monitoring Well at Shell Horizon Biobarrier-1)
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
250
200
150
100
50
0
0.3
0.25
0.2
0.15
0.1
0.05
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

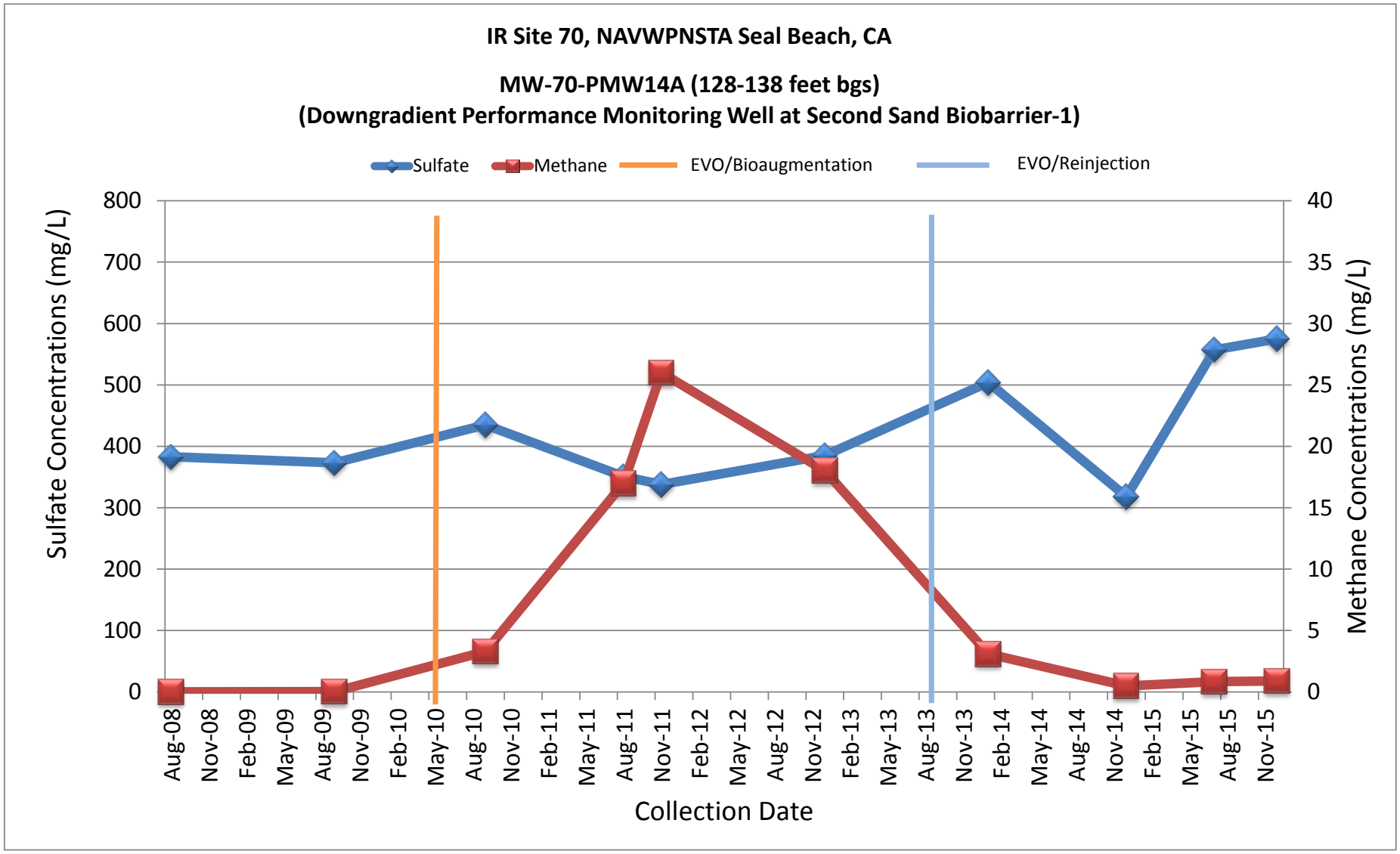

Shell Horizon Biobarrier 1 - MW-70-PMW10
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
600
500
400
300
200
100
0
30
25
20
15
10
5
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date

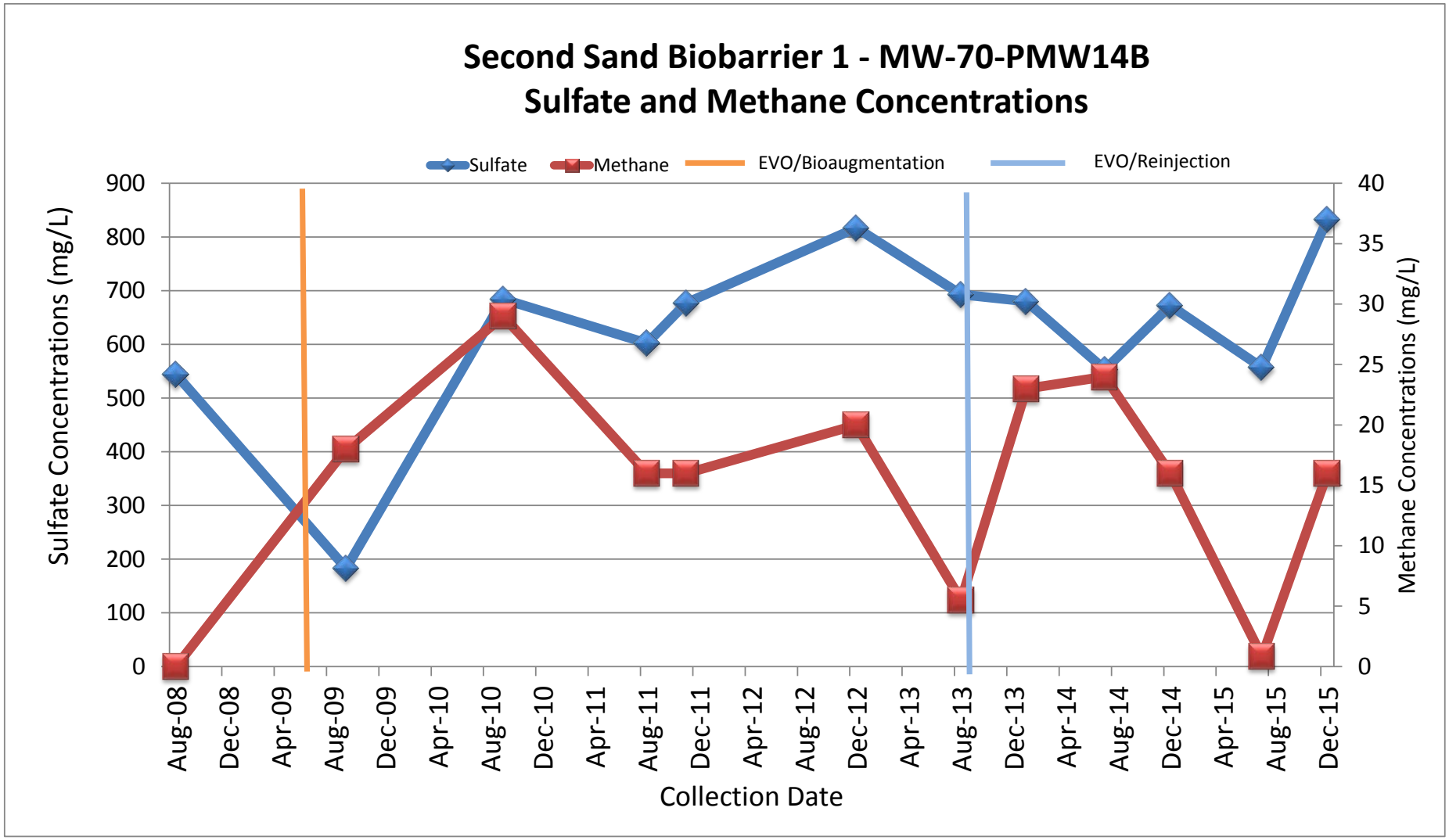

IR Site 70, NAVWPNSTA Seal Beach, CA
IW-70-SHB310
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
500
400
300
200
100
0
25
20
15
10
5
0
Aug-08
Dec-08
Apr-09
Aug-09
Dec-09
Apr-10
Aug-10
Dec-10
Apr-11
Aug-11
Dec-11
Apr-12
Aug-12
Dec-12
Apr-13
Aug-13
Dec-13
Apr-14
Aug-14
Dec-14
Apr-15
Aug-15
Dec-15
Collection Date


IR Site 70, NAVWPNSTA Seal Beach, CA
MW-70-PMW12A (85-95 feet bgs)
(Downgradient Performance Monitoring Well at Shell Horizon Biobarrier-3)
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
900
800
700
600
500
400
300
200
100
0
25
20
15
10
5
0
Aug-08
Dec-08
Apr-09
Aug-09
Dec-09
Apr-10
Aug-10
Dec-10
Apr-11
Aug-11
Dec-11
Apr-12
Aug-12
Dec-12
Apr-13
Aug-13
Dec-13
Apr-14
Aug-14
Dec-14
Apr-15
Aug-15
Dec-15
Collection Date


Shell Horizon Biobarrier 3 - MW-70-PMW12B
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
800
700
600
500
400
300
200
100
0
25
20
15
10
5
0
Aug-08
Dec-08
Apr-09
Aug-09
Dec-09
Apr-10
Aug-10
Dec-10
Apr-11
Aug-11
Dec-11
Apr-12
Aug-12
Dec-12
Apr-13
Aug-13
Dec-13
Apr-14
Aug-14
Dec-14
Apr-15
Aug-15
Dec-15
Collection Date

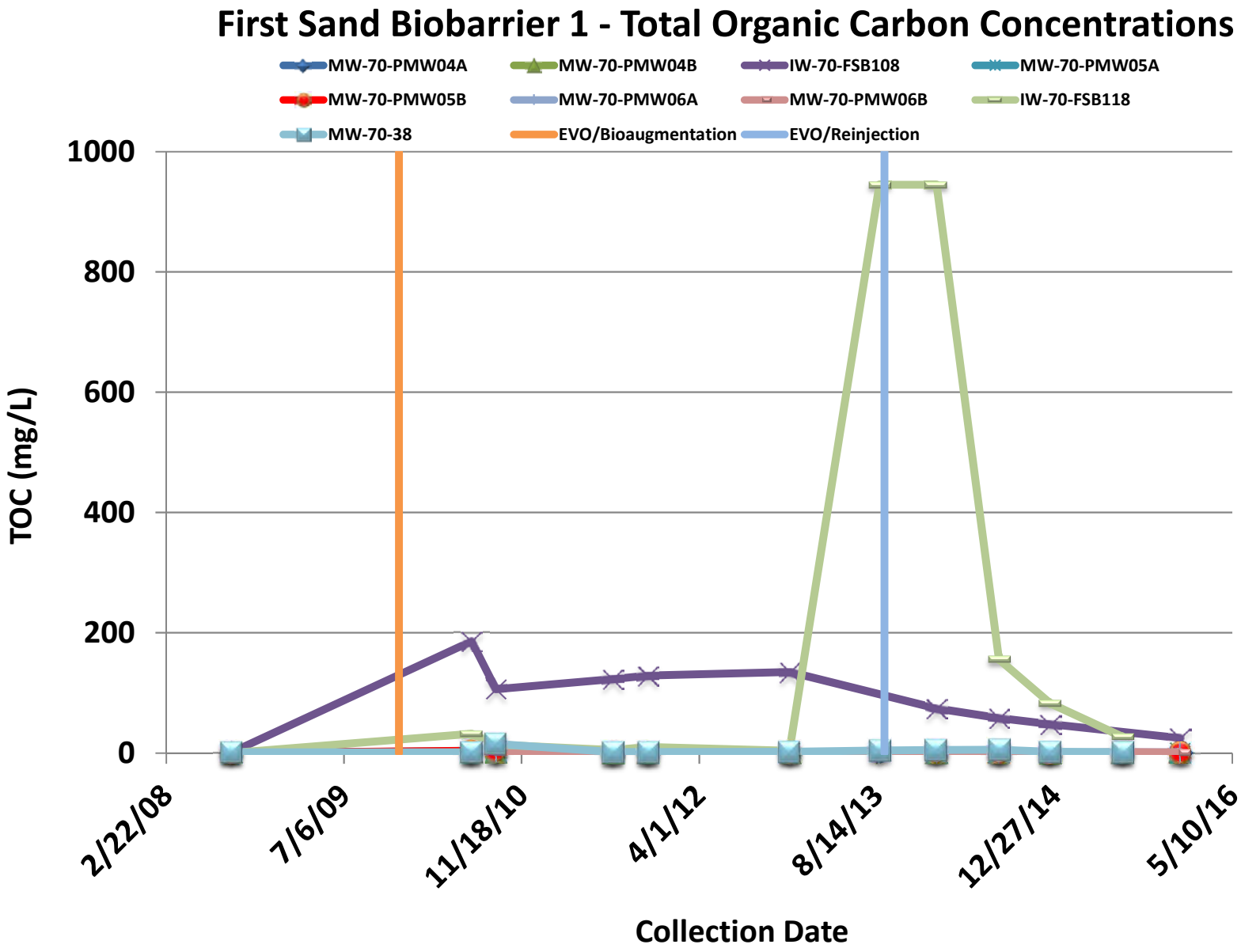

IR Site 70, NAVWPNSTA Seal Beach, CA
IW-70-SSB109
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
Collection Date
0
100
200
300
400
500
600
700
800
0
5
10
15
20
25
30
35
40
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15


IR Site 70, NAVWPNSTA Seal Beach, CA
MW-70-PMW14A (128-138 feet bgs)
(Downgradient Performance Monitoring Well at Second Sand Biobarrier-1)
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
800
700
600
500
400
300
200
100
0
40
35
30
25
20
15
10
5
0
Aug-08
Nov-08
Feb-09
May-09
Aug-09
Nov-09
Feb-10
May-10
Aug-10
Nov-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
May-12
Aug-12
Nov-12
Feb-13
May-13
Aug-13
Nov-13
Feb-14
May-14
Aug-14
Nov-14
Feb-15
May-15
Aug-15
Nov-15
Collection Date


Second Sand Biobarrier 1 - MW-70-PMW14B
Sulfate and Methane Concentrations
Sulfate
Methane
EVO/Bioaugmentation
EVO/Reinjection
Sulfate Concentrations (mg/L)
Methane Concentrations (mg/L)
900
800
700
600
500
400
300
200
100
0
40
35
30
25
20
15
10
5
0
Aug-08
Dec-08
Apr-09
Aug-09
Dec-09
Apr-10
Aug-10
Dec-10
Apr-11
Aug-11
Dec-11
Apr-12
Aug-12
Dec-12
Apr-13
Aug-13
Dec-13
Apr-14
Aug-14
Dec-14
Apr-15
Aug-15
Dec-15
Collection Date

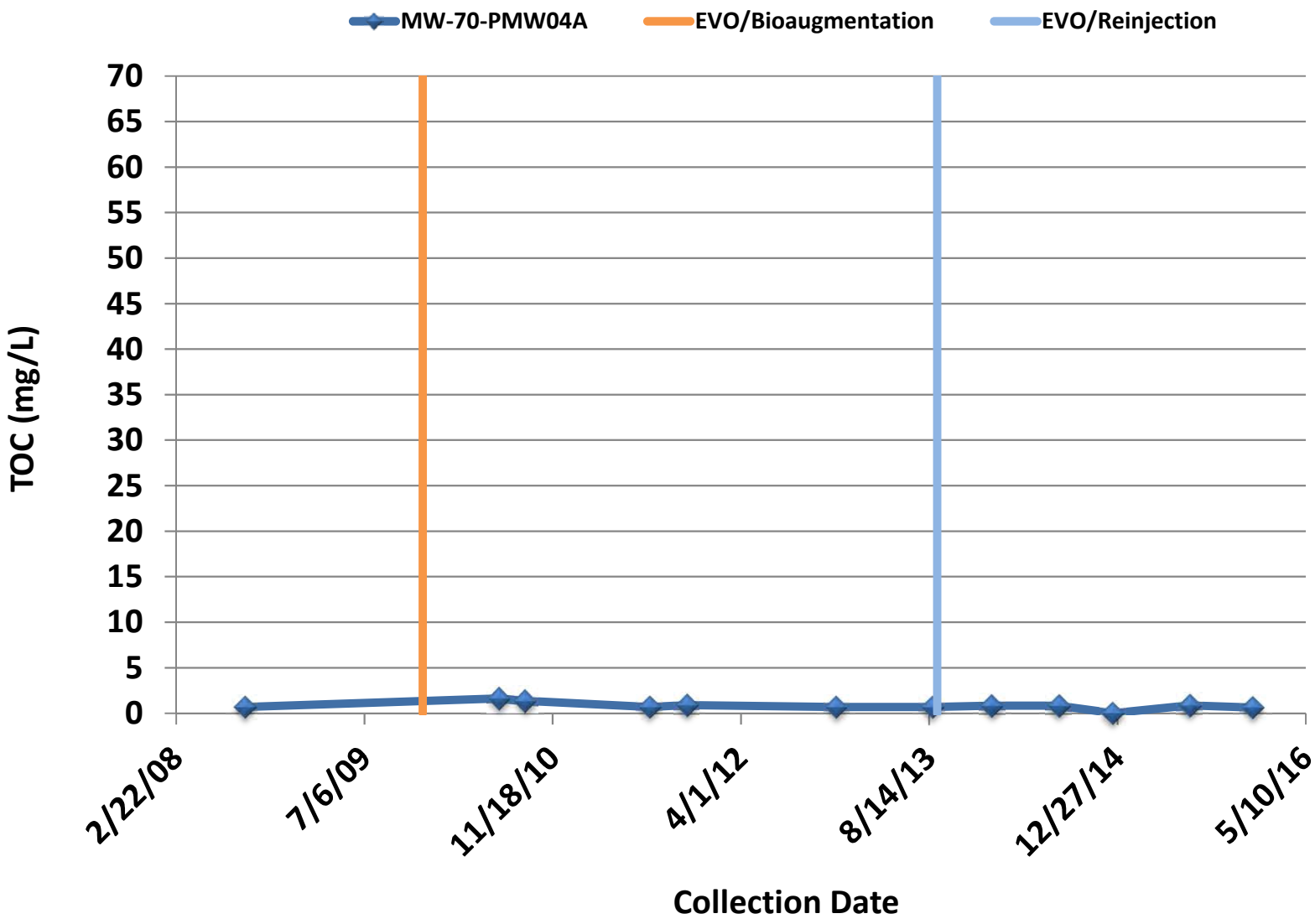
TOC Trend Graphs

Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



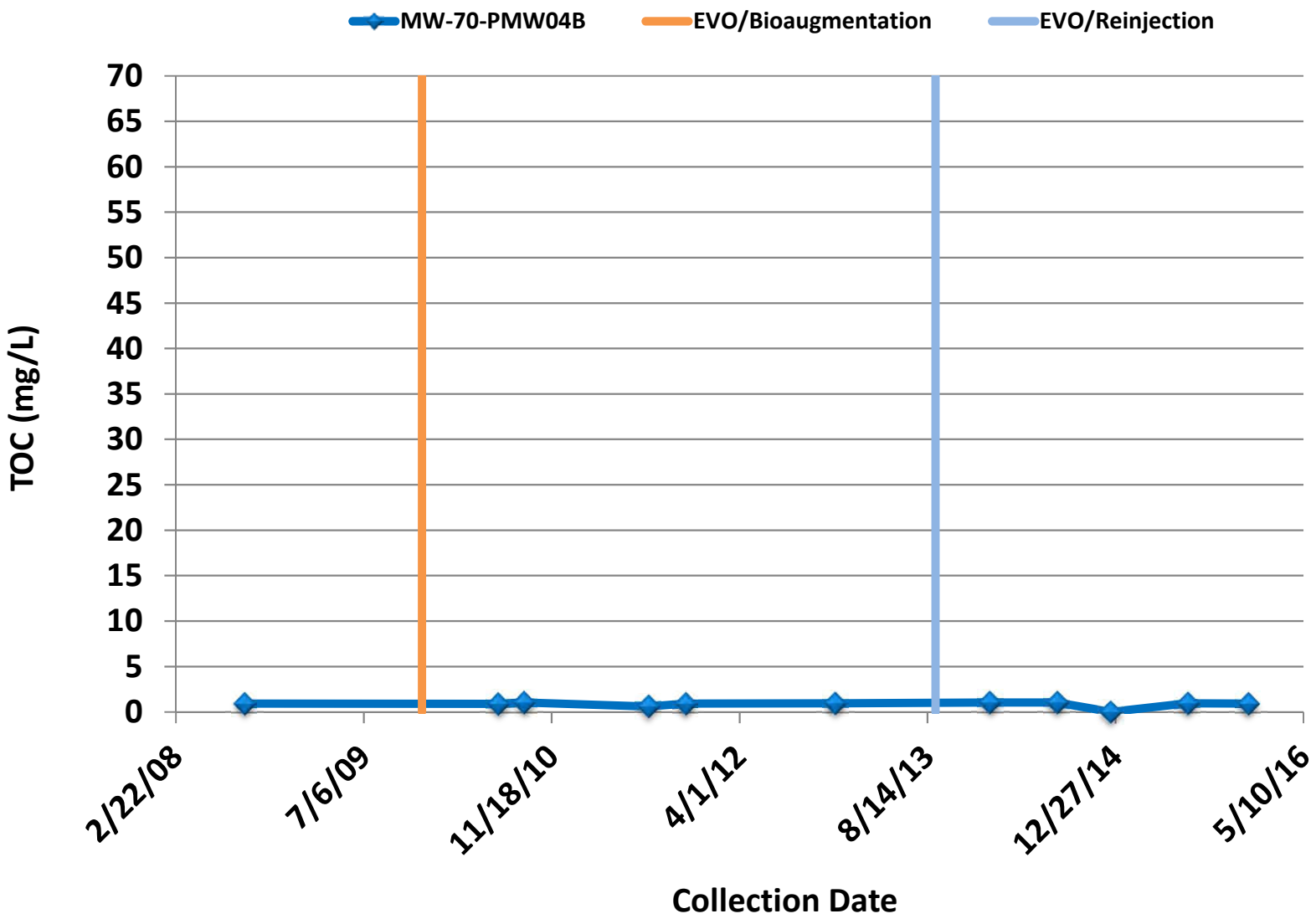
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

FSB1, MW-70-PMW04A - Total Organic Carbon Concentrations



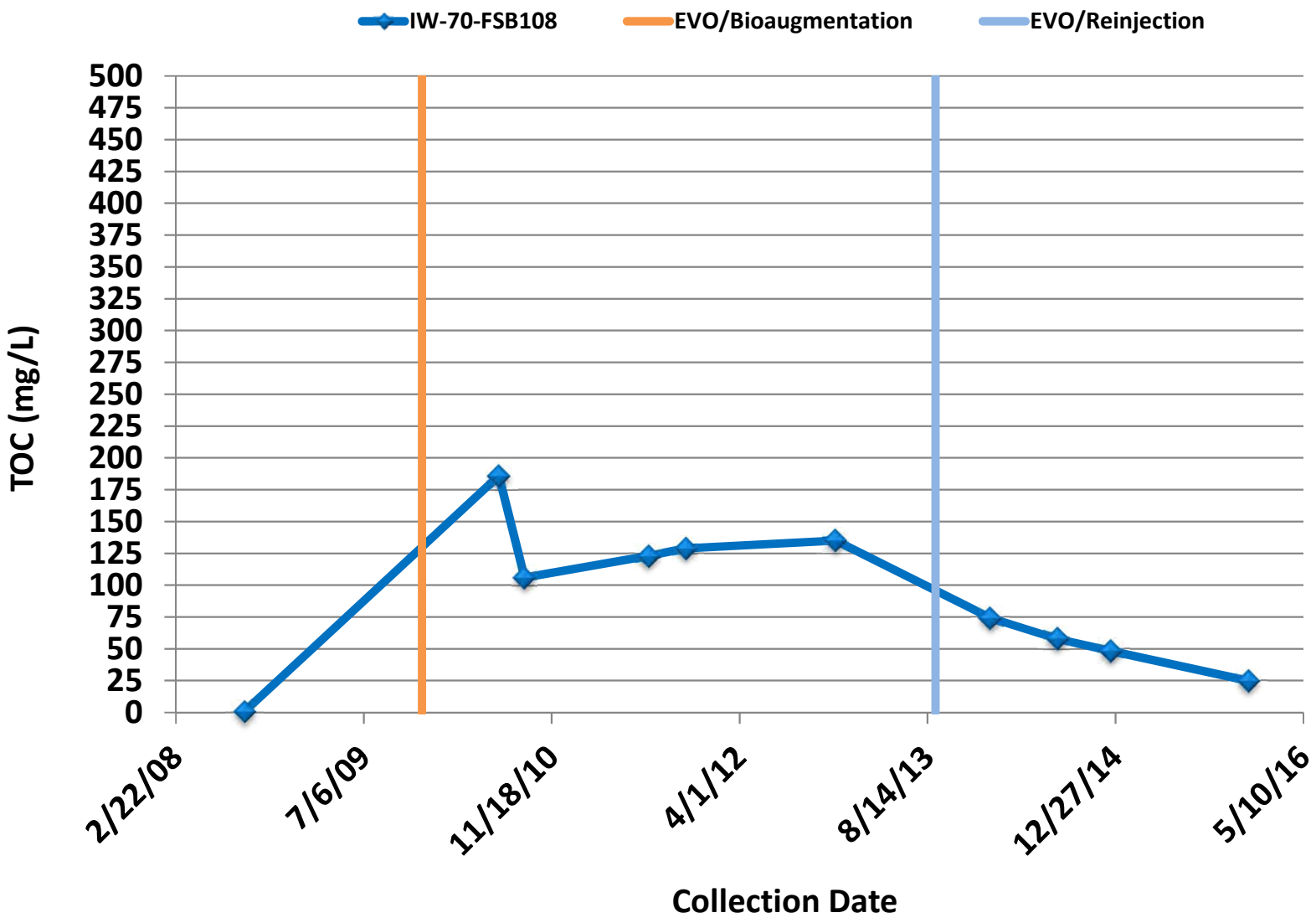
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

FSB1, MW-70-PMW04B - Total Organic Carbon Concentrations



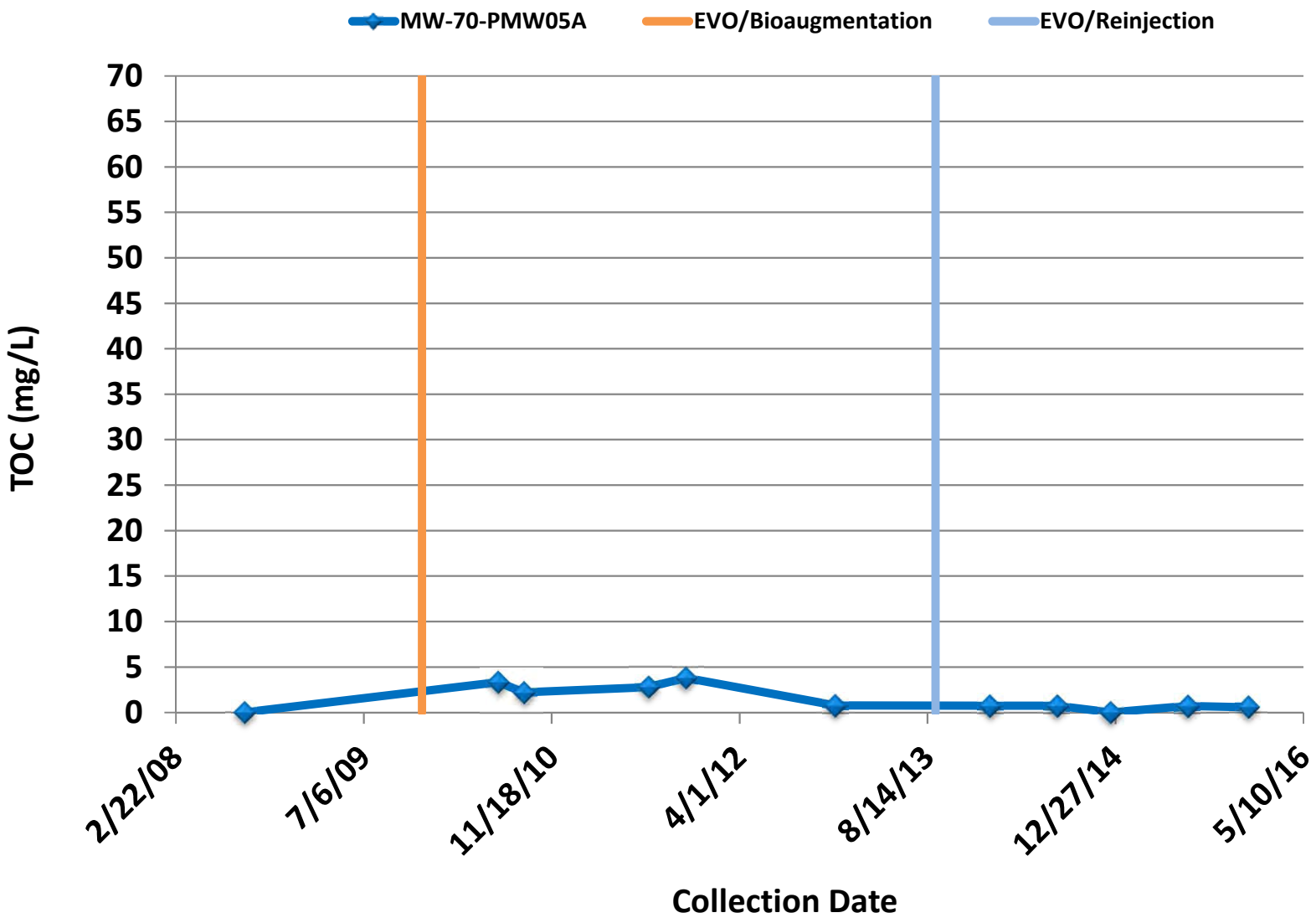
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

FSB1, IW-70-FSB108 - Total Organic Carbon Concentrations



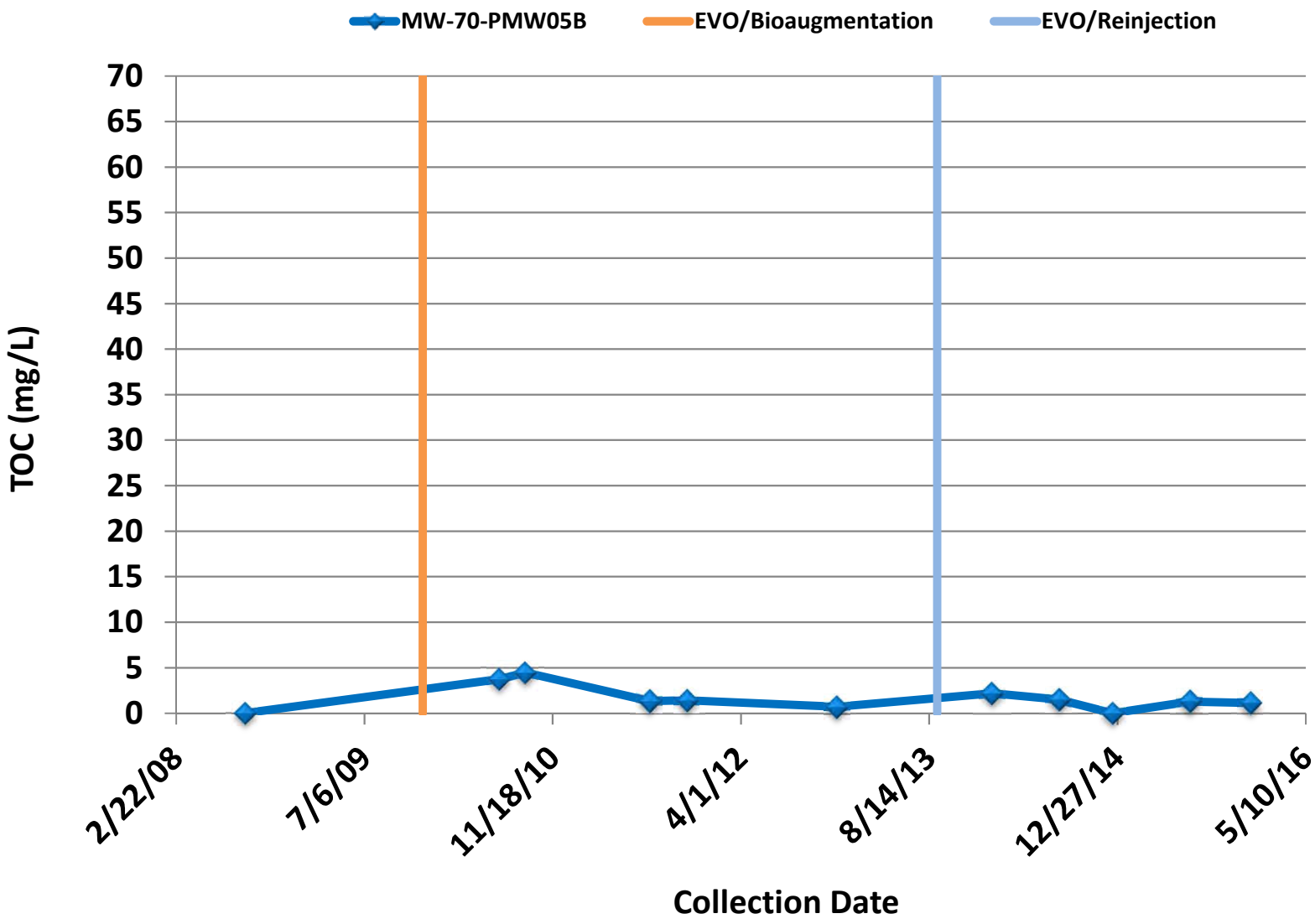
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

FSB1, MW-70-PMW05A - Total Organic Carbon Concentrations



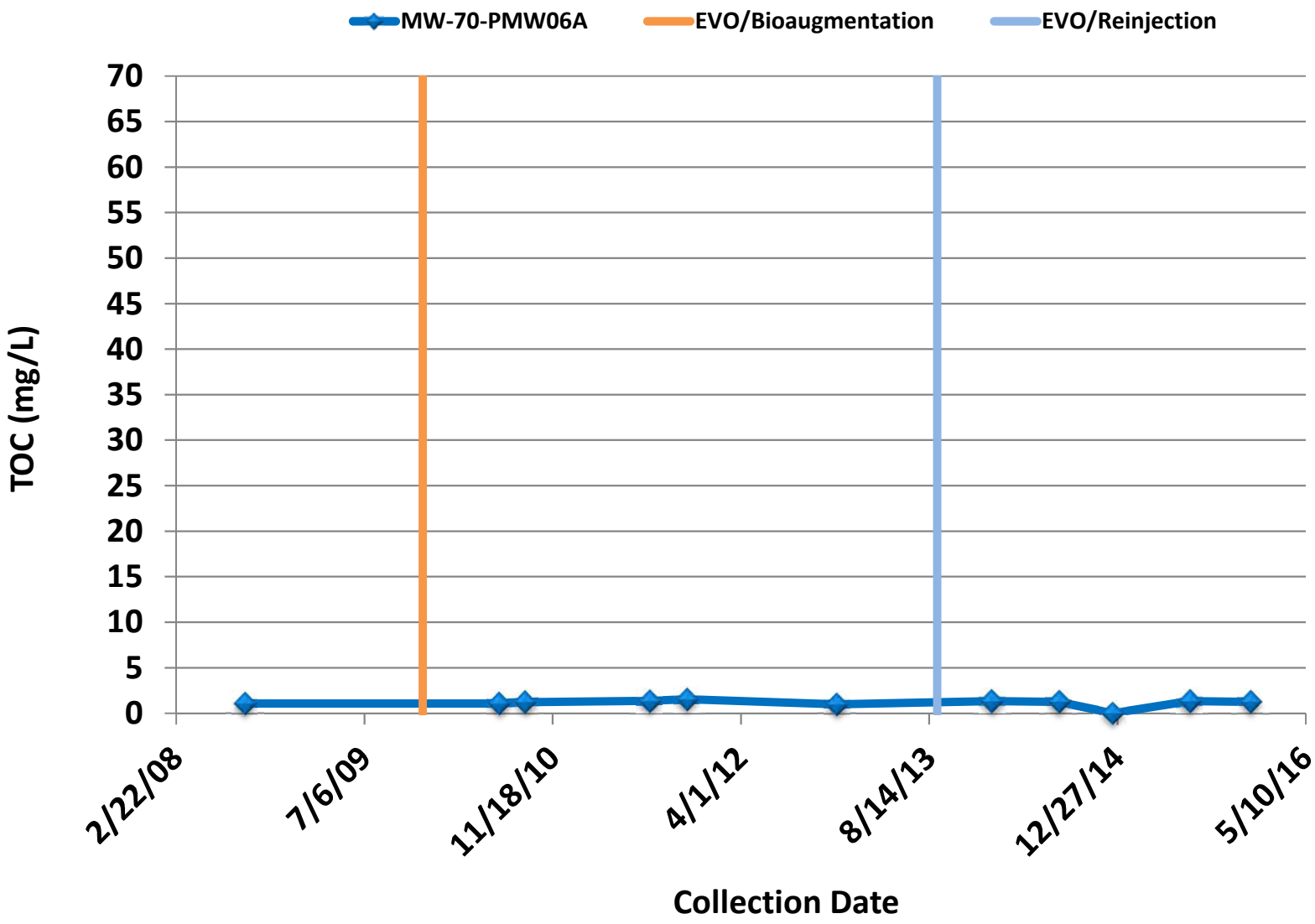
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

FSB1, MW-70-PMW05B - Total Organic Carbon Concentrations



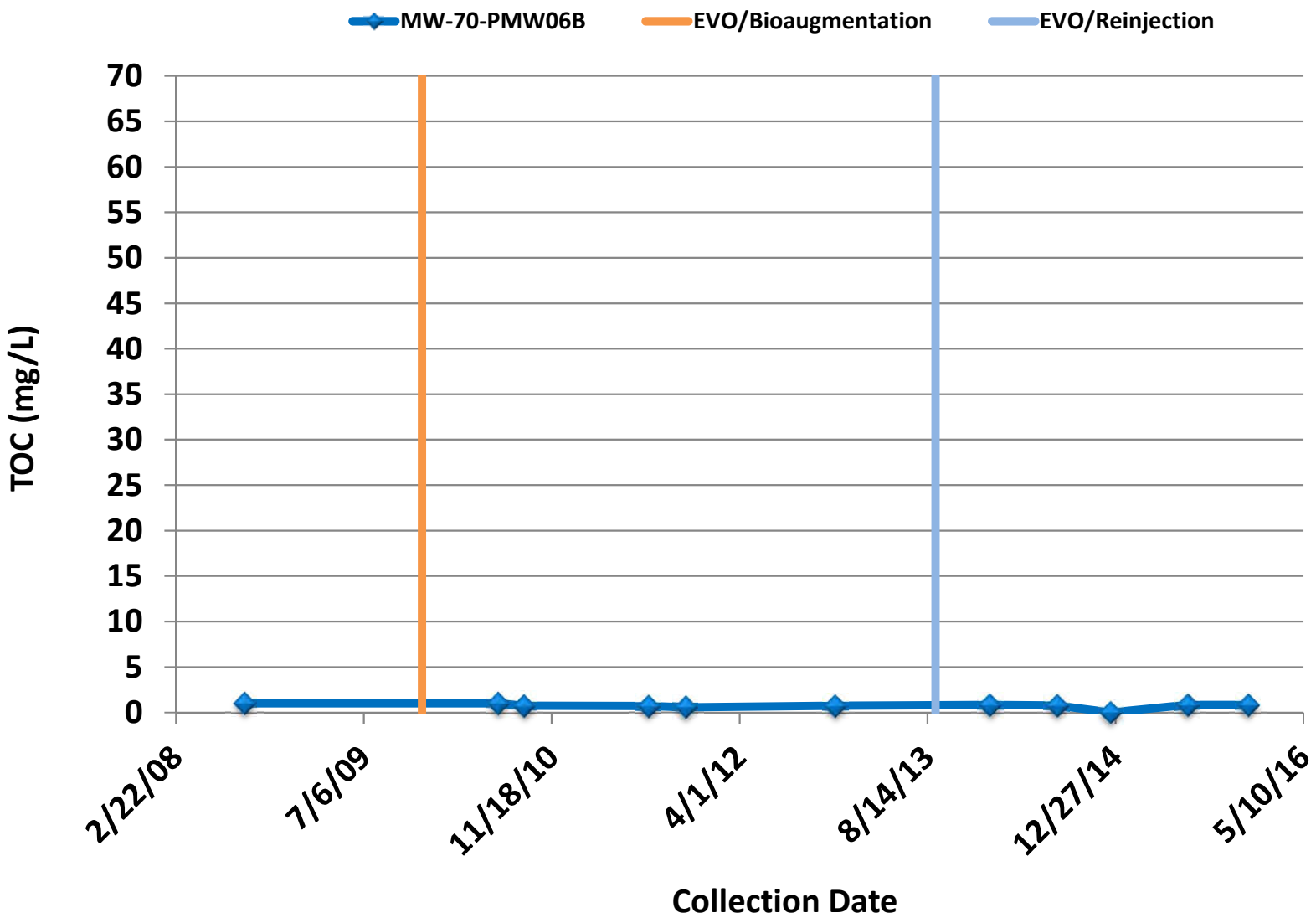
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

FSB1, MW-70-PMW06A - Total Organic Carbon Concentrations

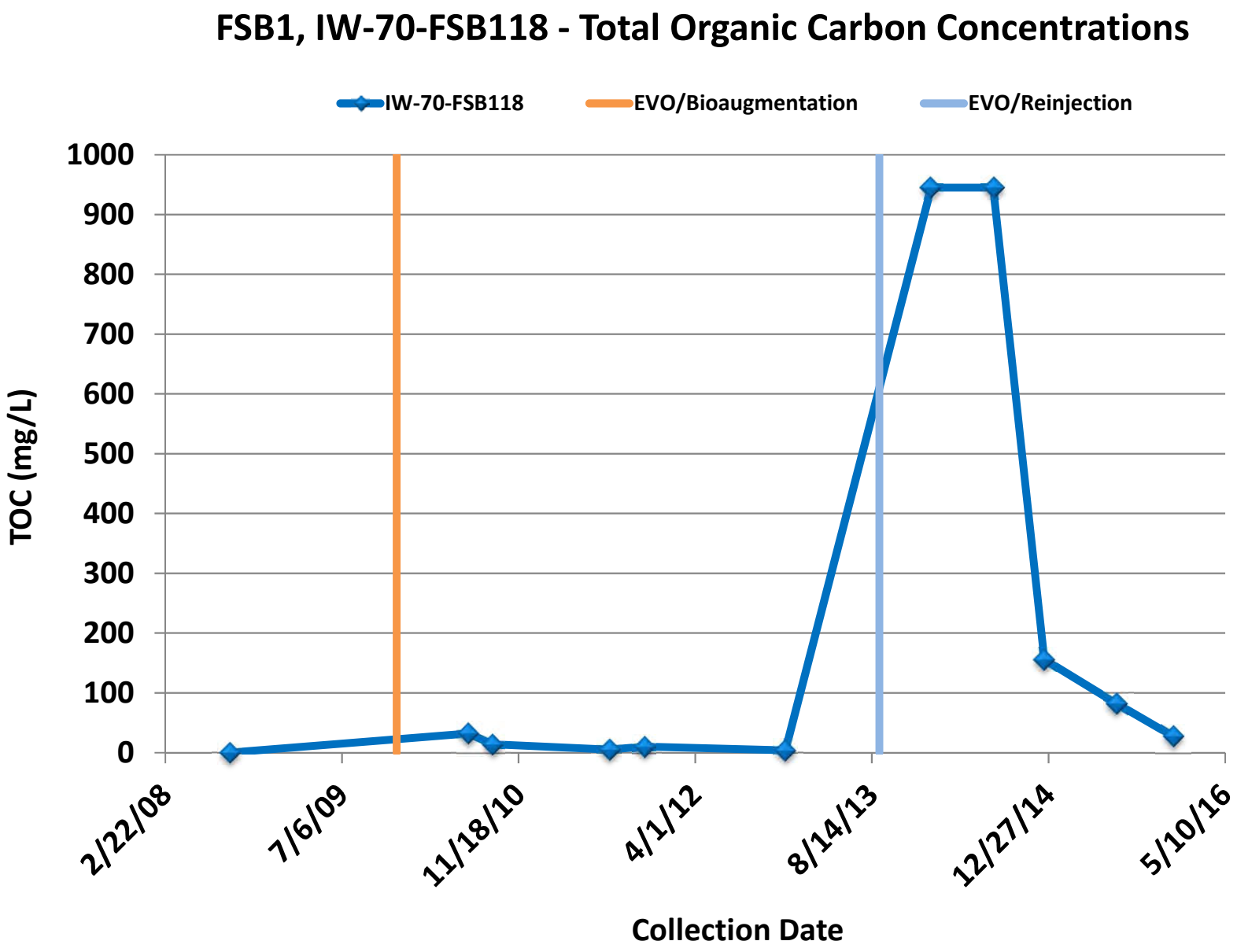


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

FSB1, MW-70-PMW06B - Total Organic Carbon Concentrations

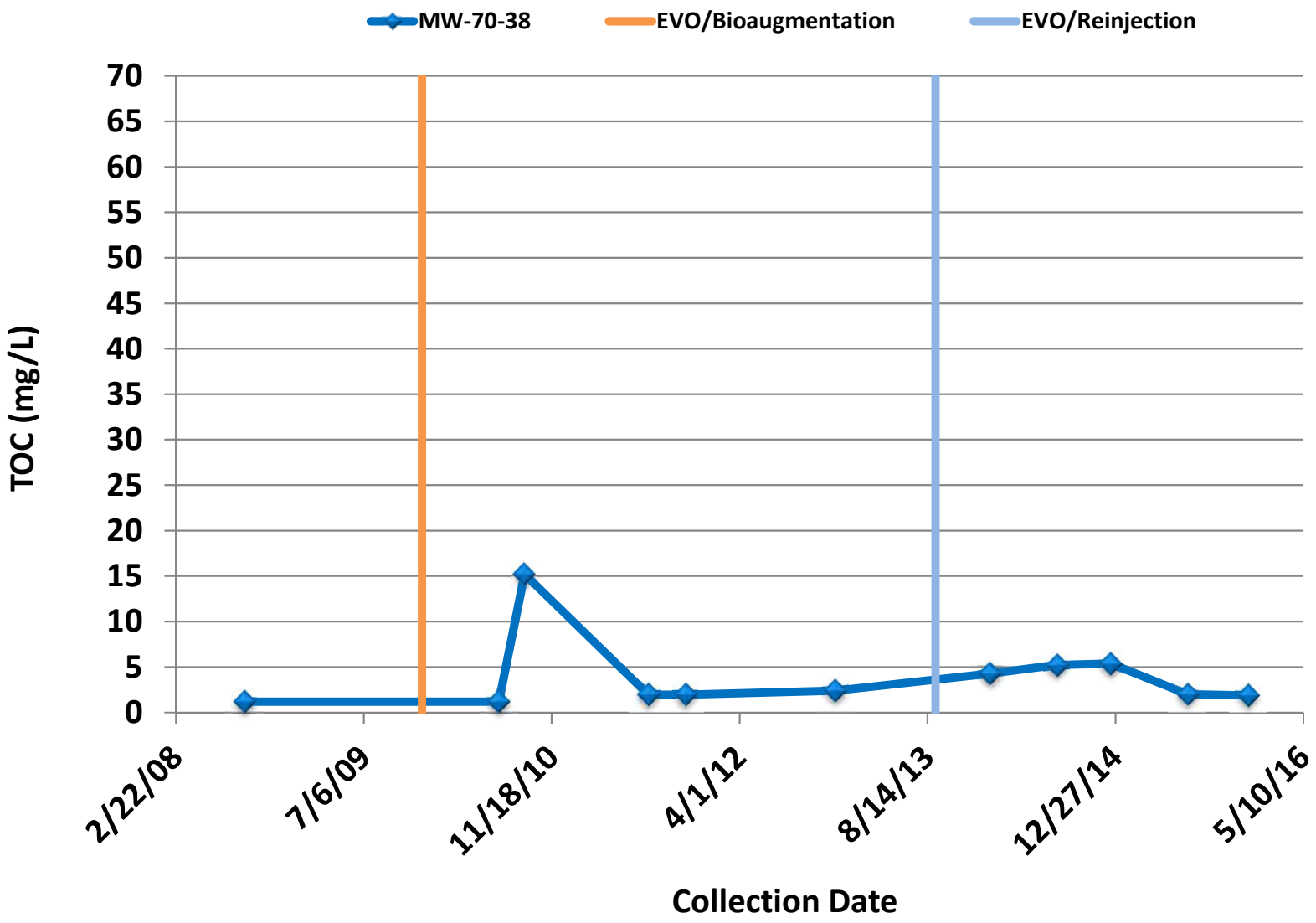


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

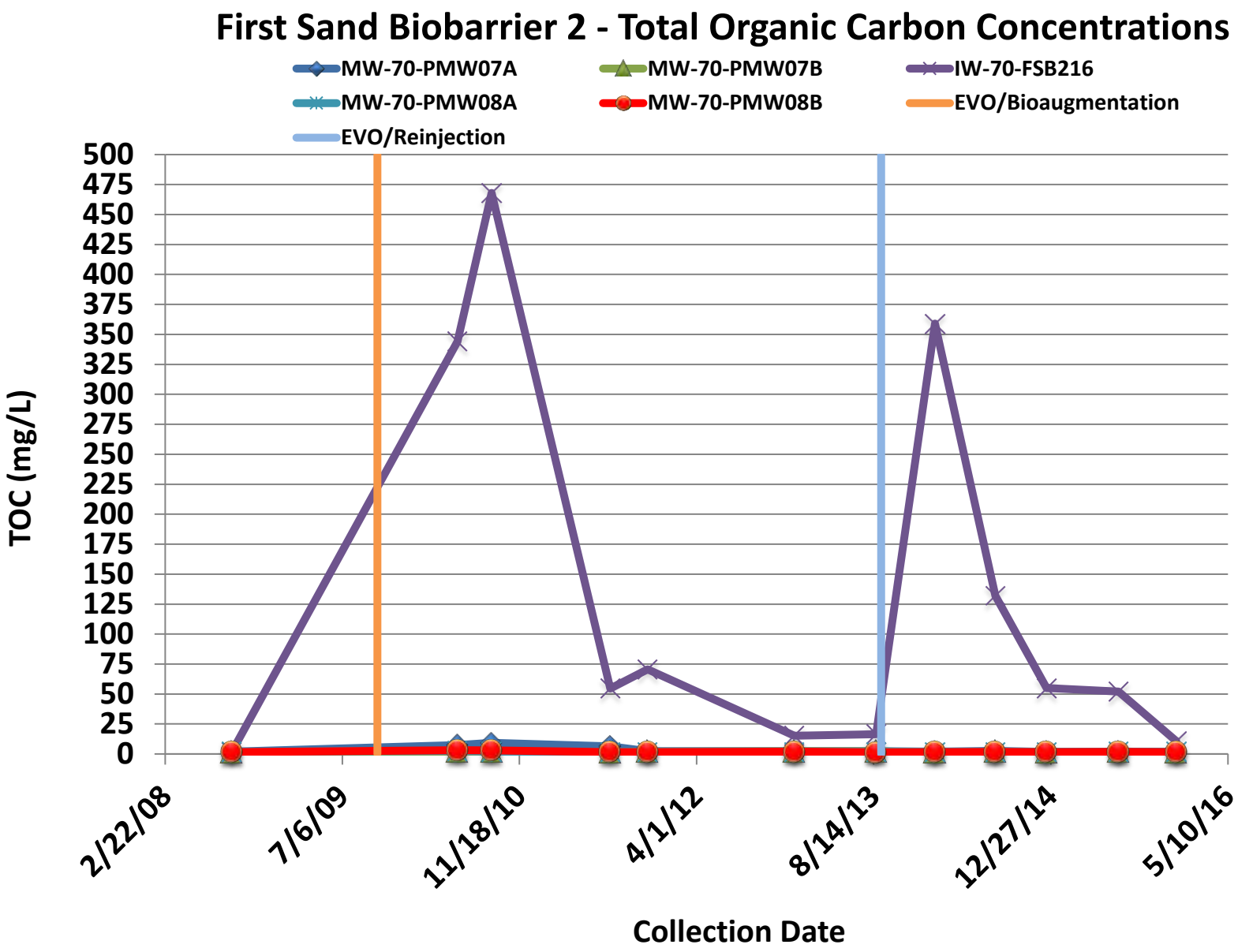


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

FSB1, MW-70-38 - Total Organic Carbon Concentrations

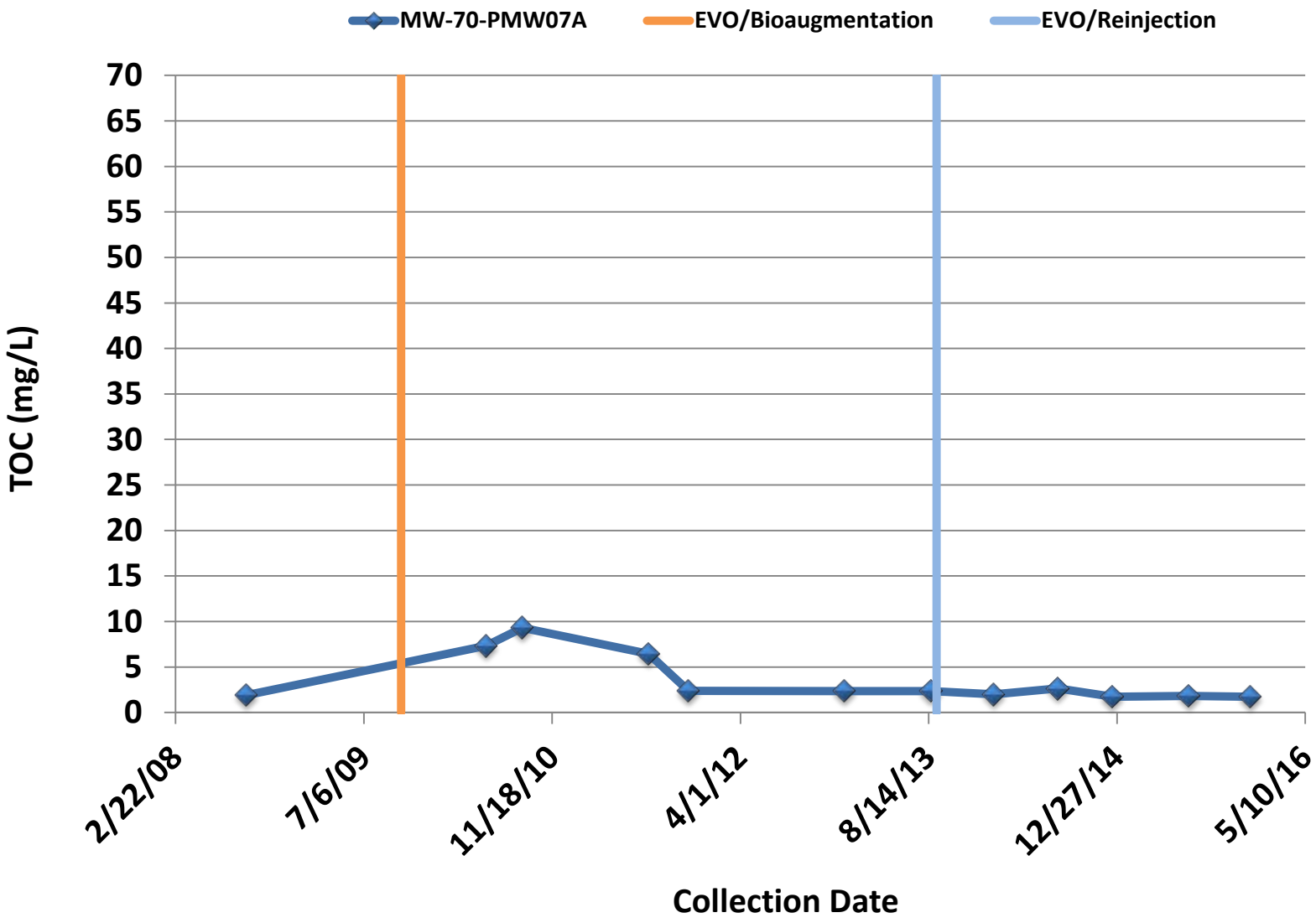


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



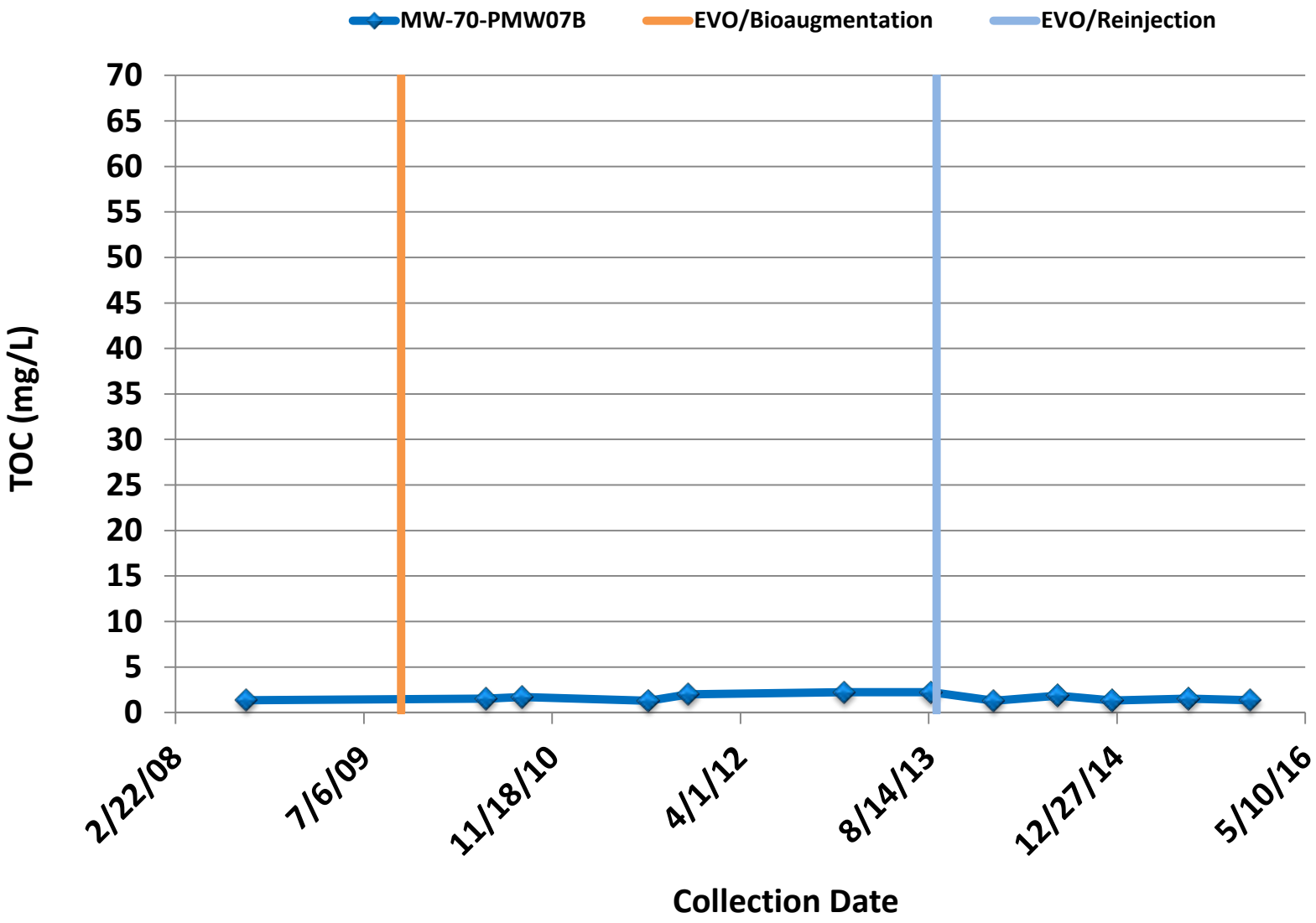
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

FSB2, MW-70-PMW07A - Total Organic Carbon Concentrations



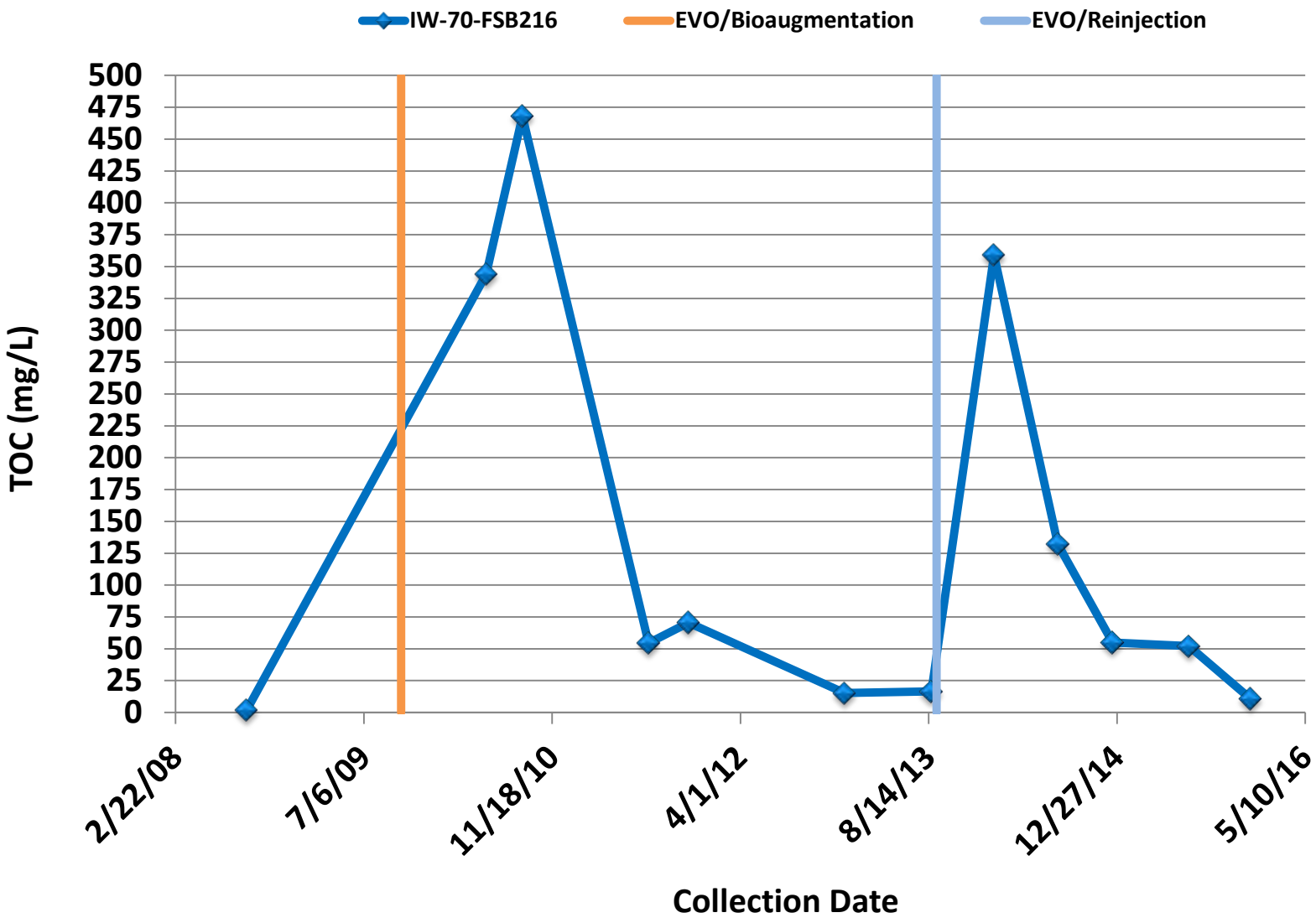
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

FSB2, MW-70-PMW07B - Total Organic Carbon Concentrations



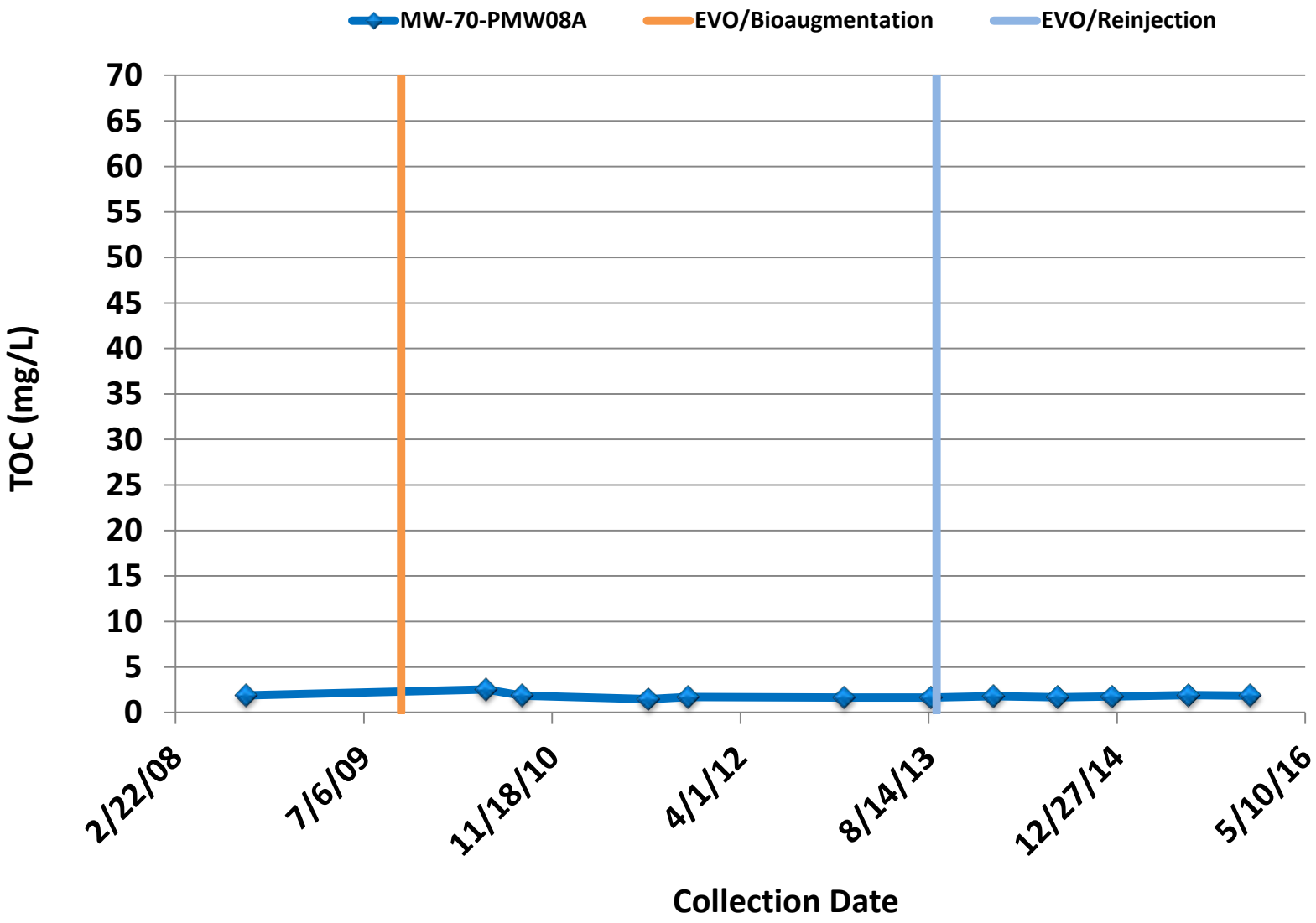
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

FSB2, IW-70-FSB216 - Total Organic Carbon Concentrations



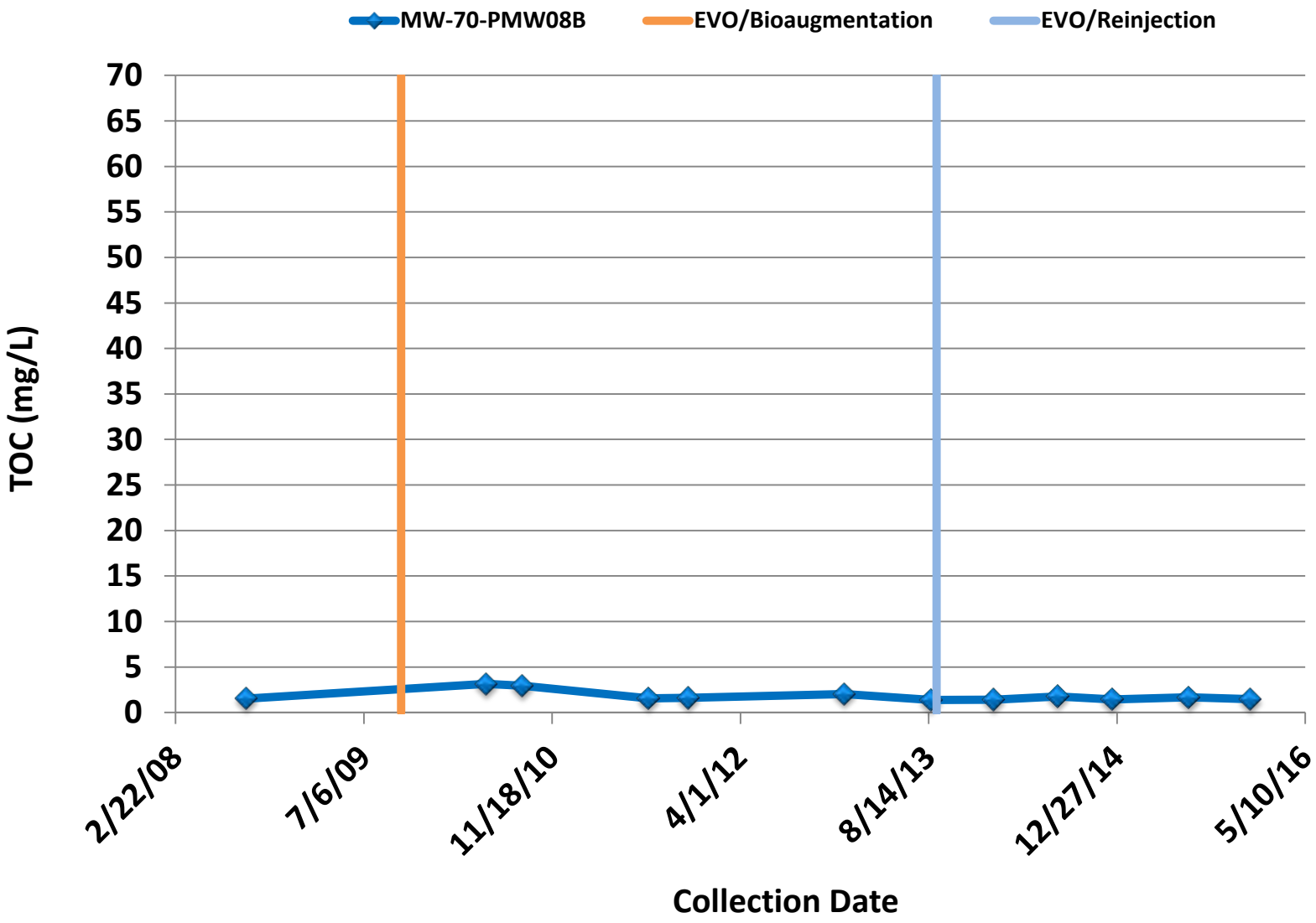
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

FSB2, MW-70-PMW08A - Total Organic Carbon Concentrations

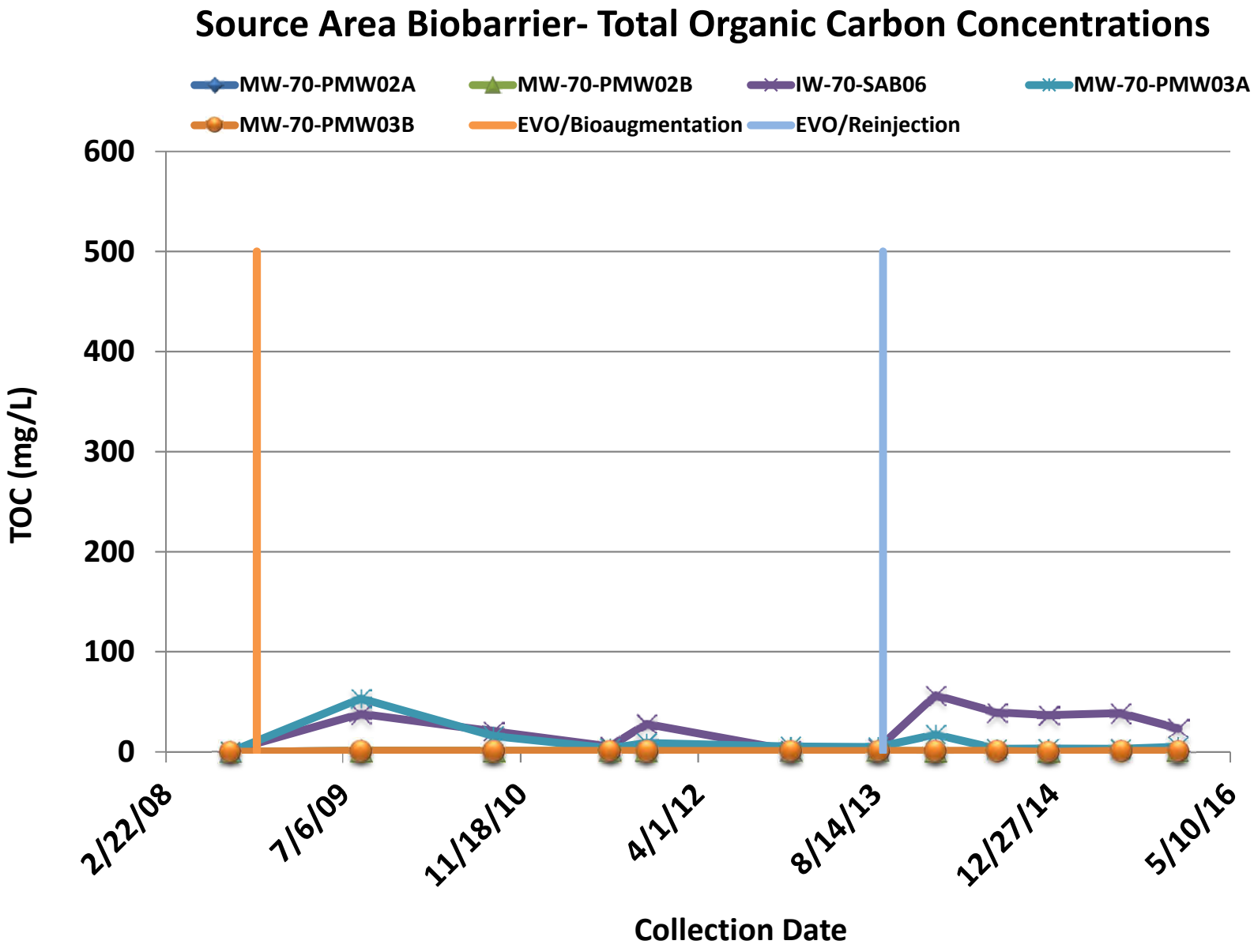


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

FSB2, MW-70-PMW08B - Total Organic Carbon Concentrations

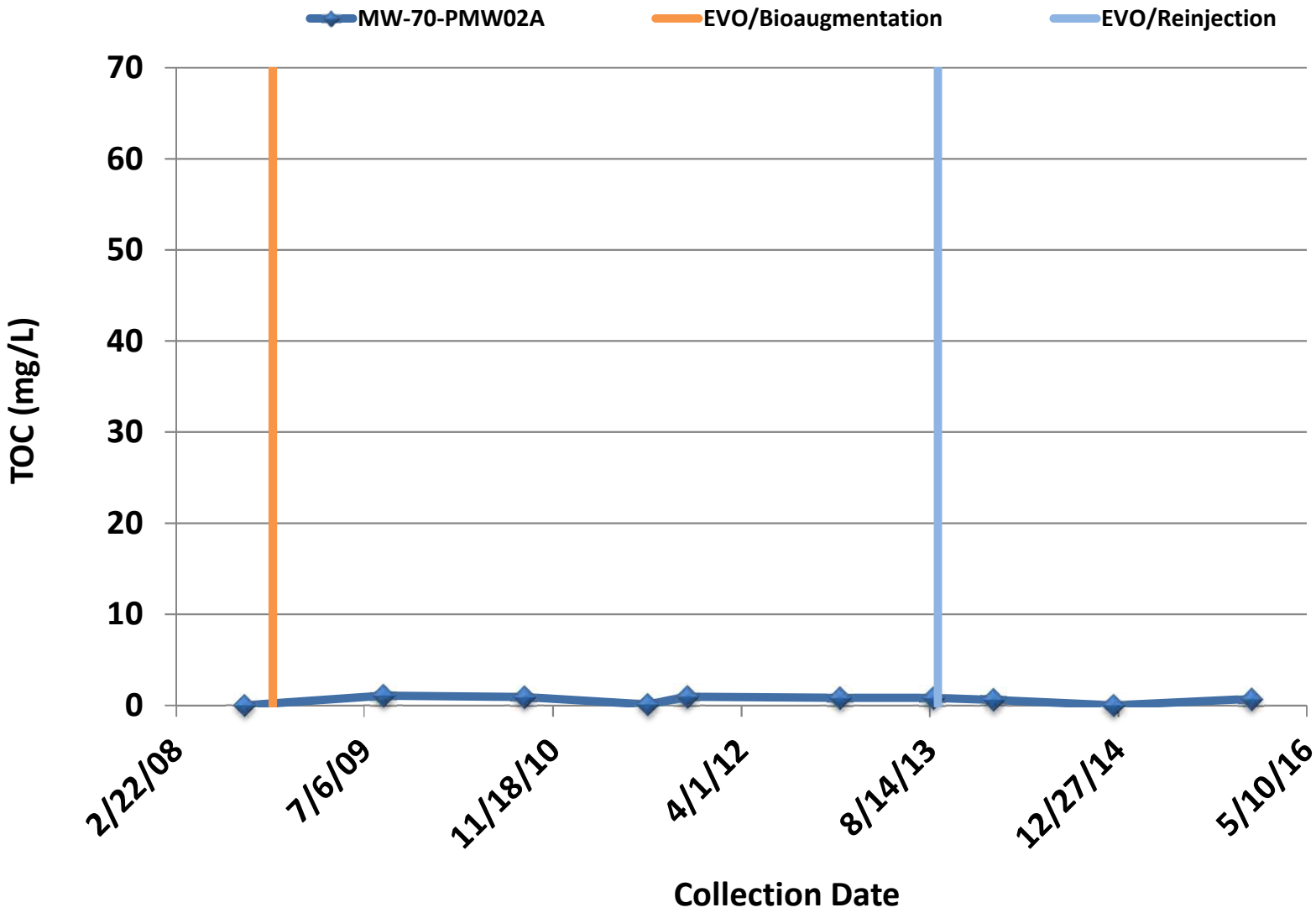


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



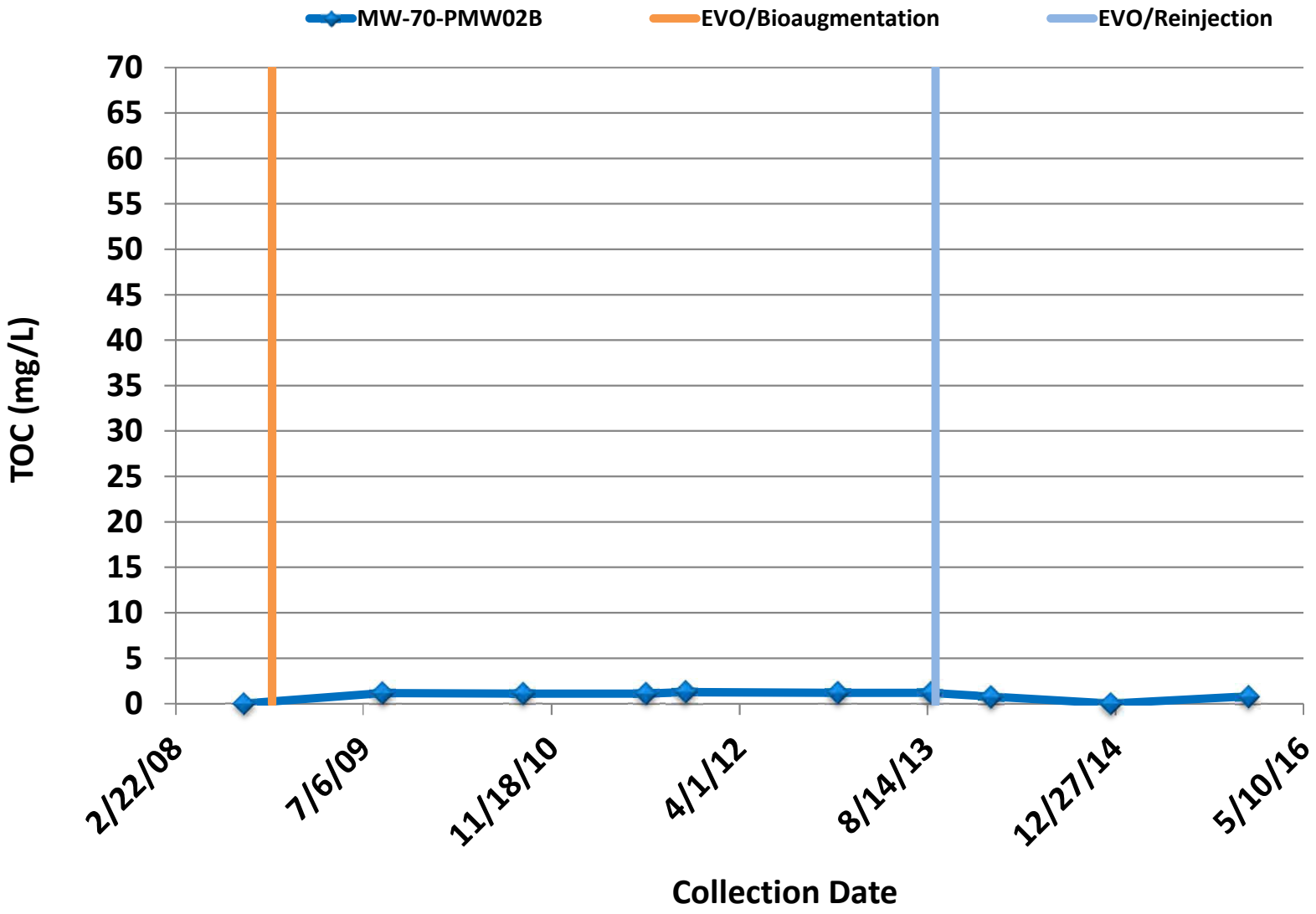
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

SAB, MW-70-PMW02A - Total Organic Carbon Concentrations

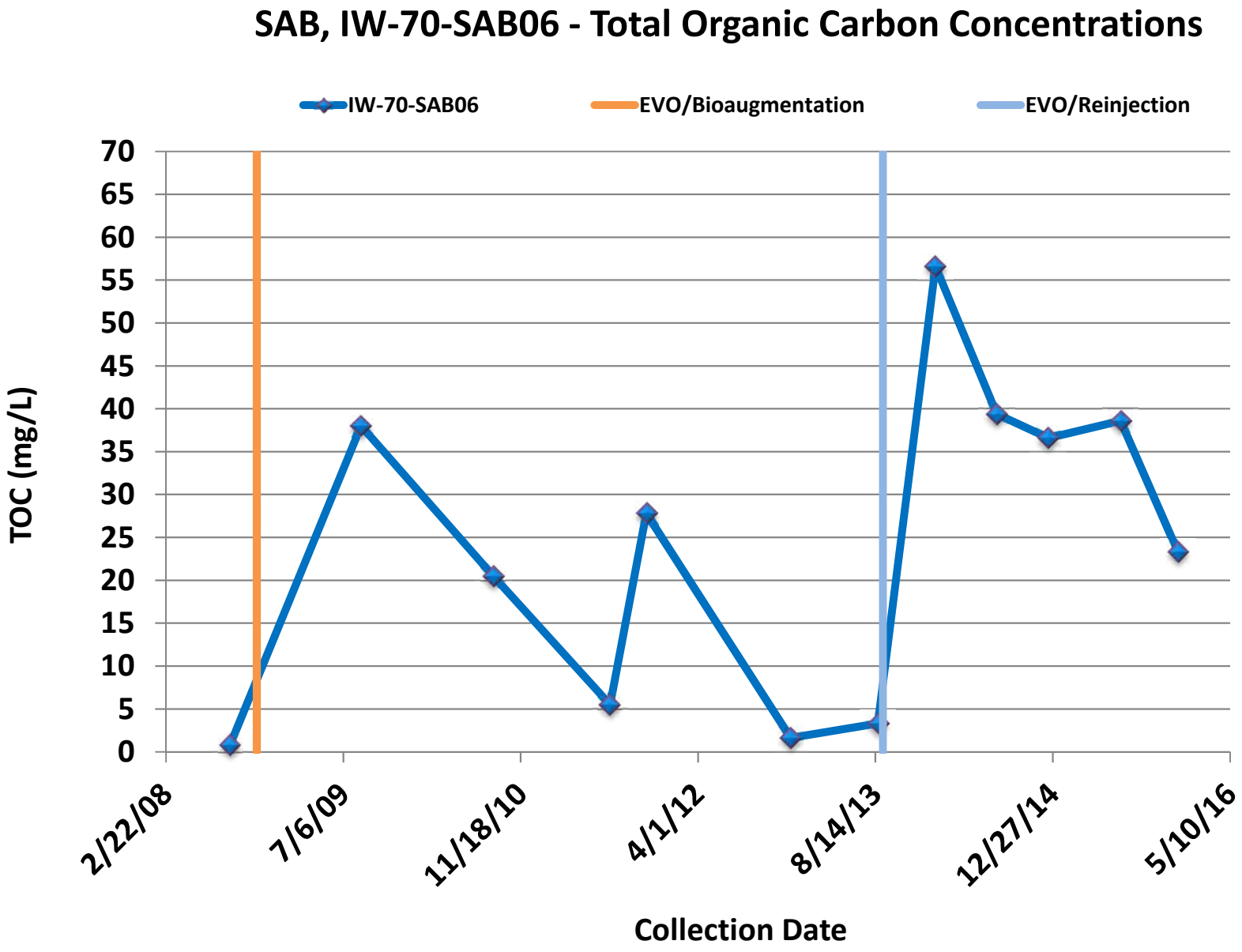


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

SAB, MW-70-PMW02B - Total Organic Carbon Concentrations

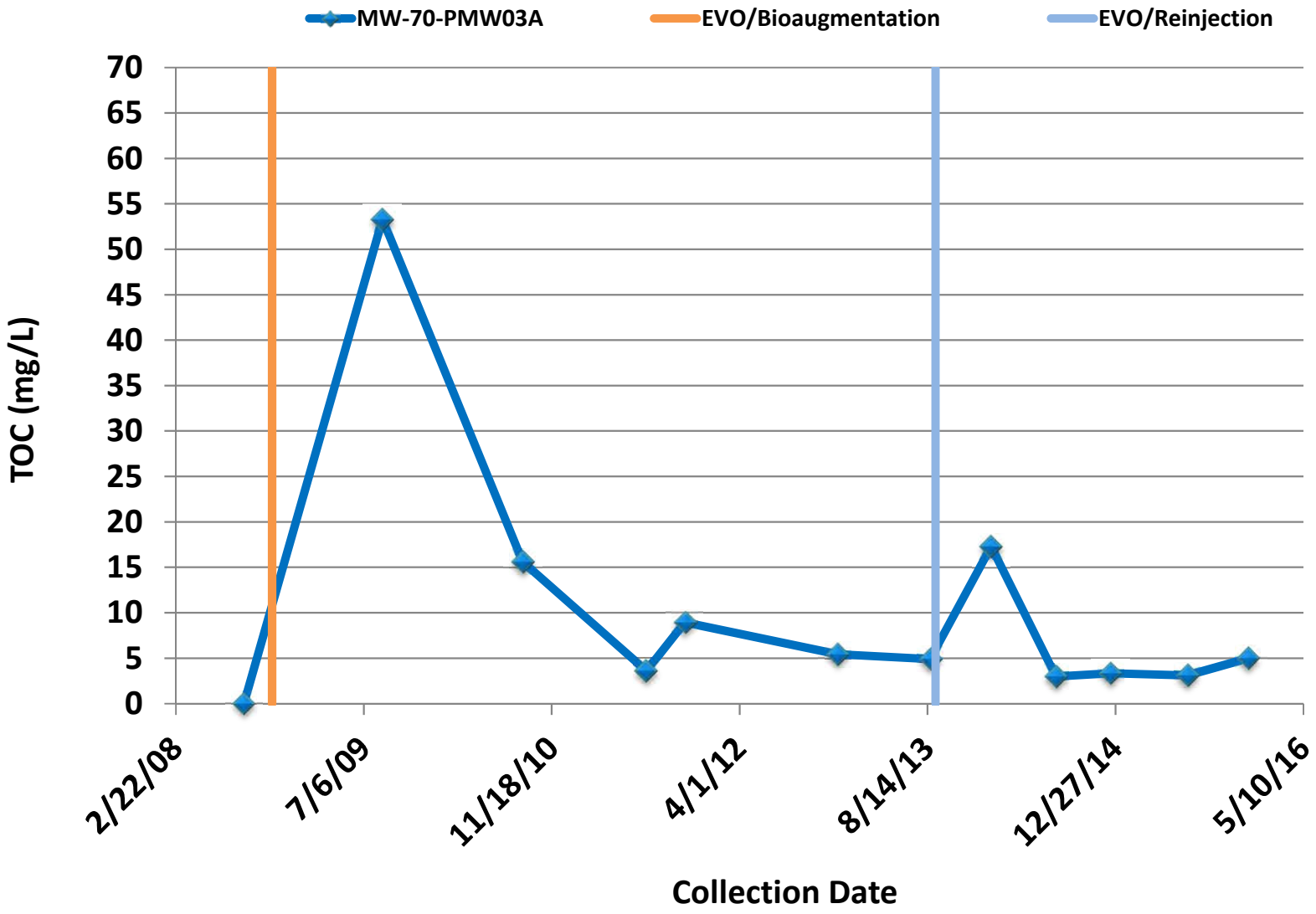


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



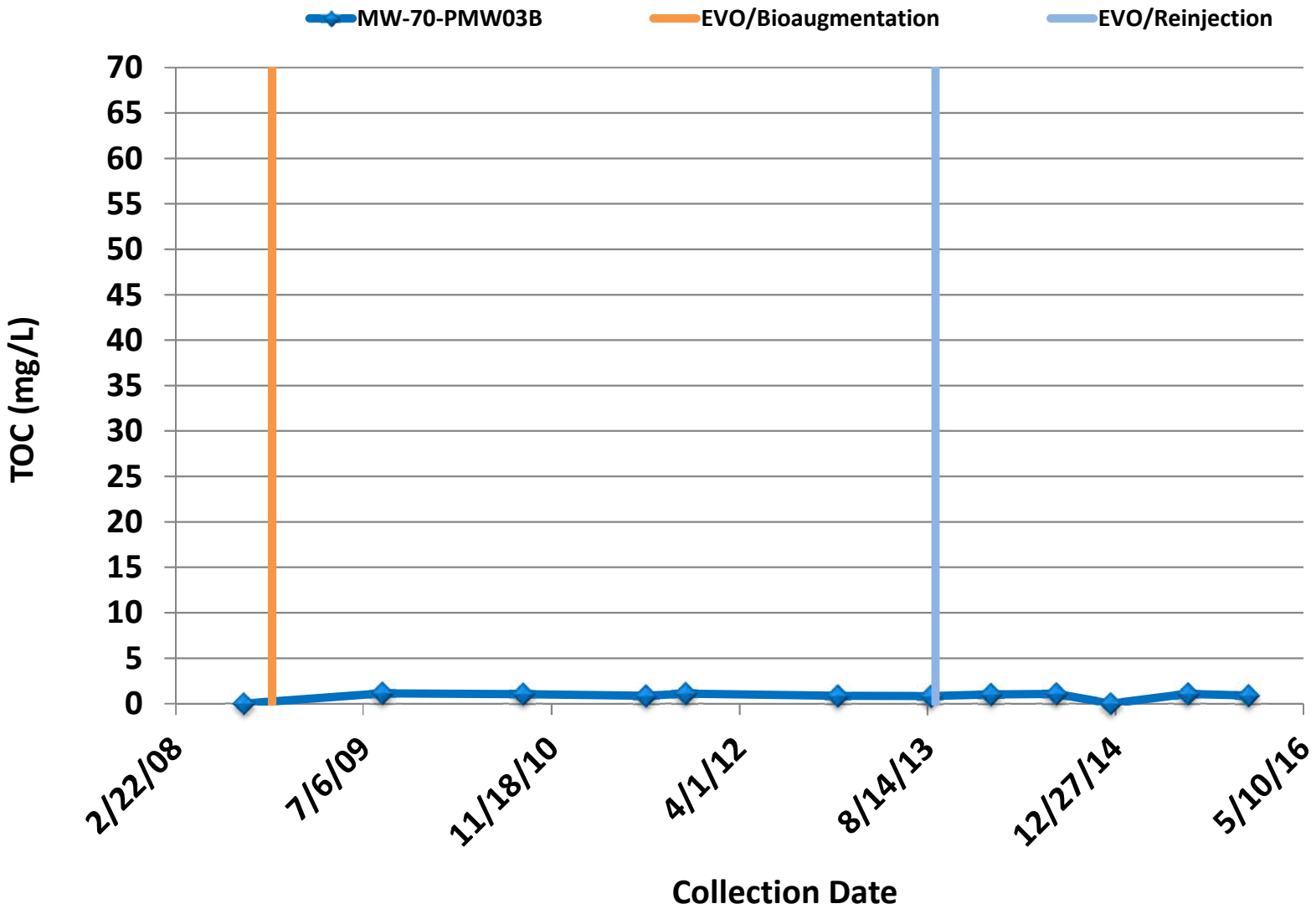
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

SAB, MW-70-PMW03A - Total Organic Carbon Concentrations

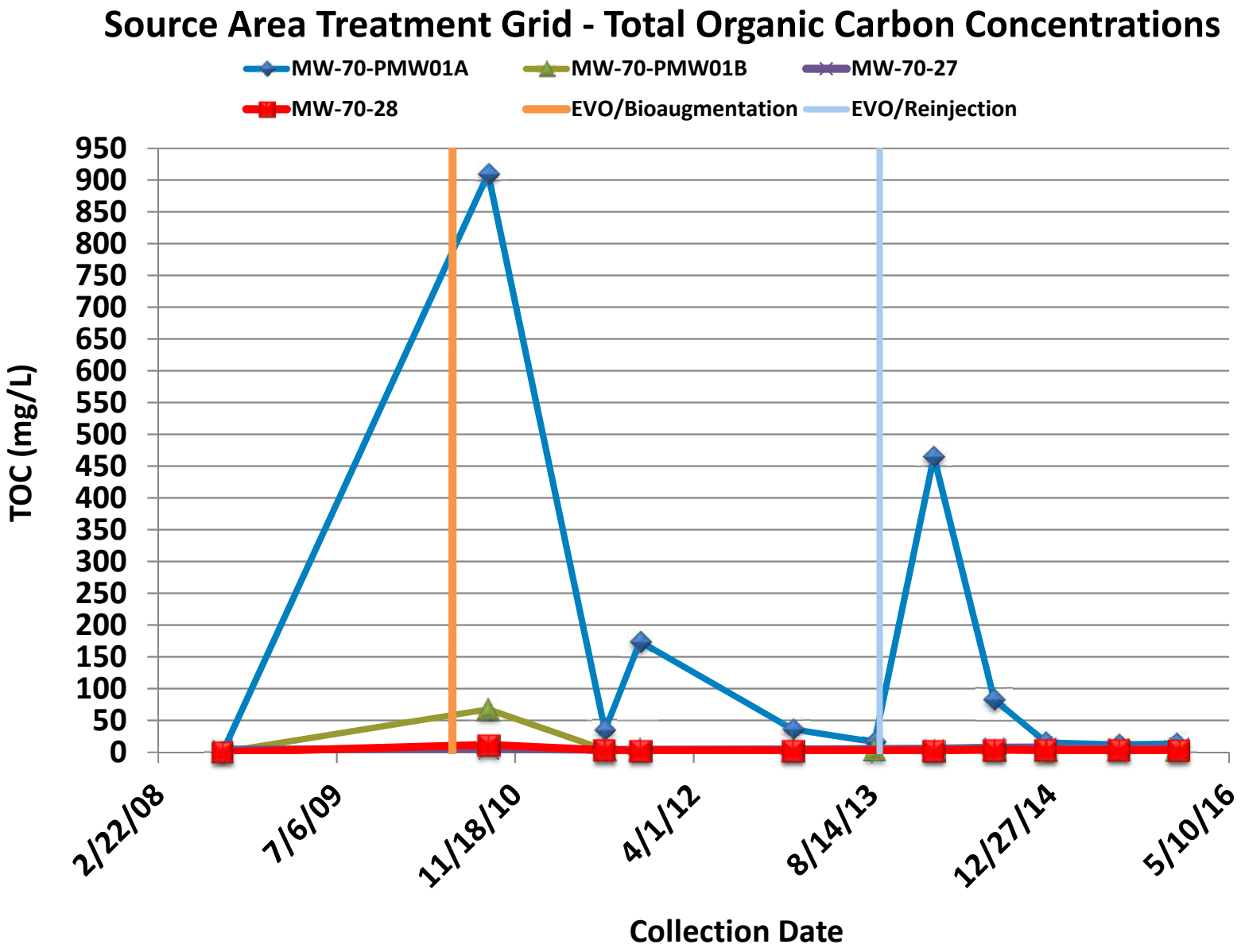


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

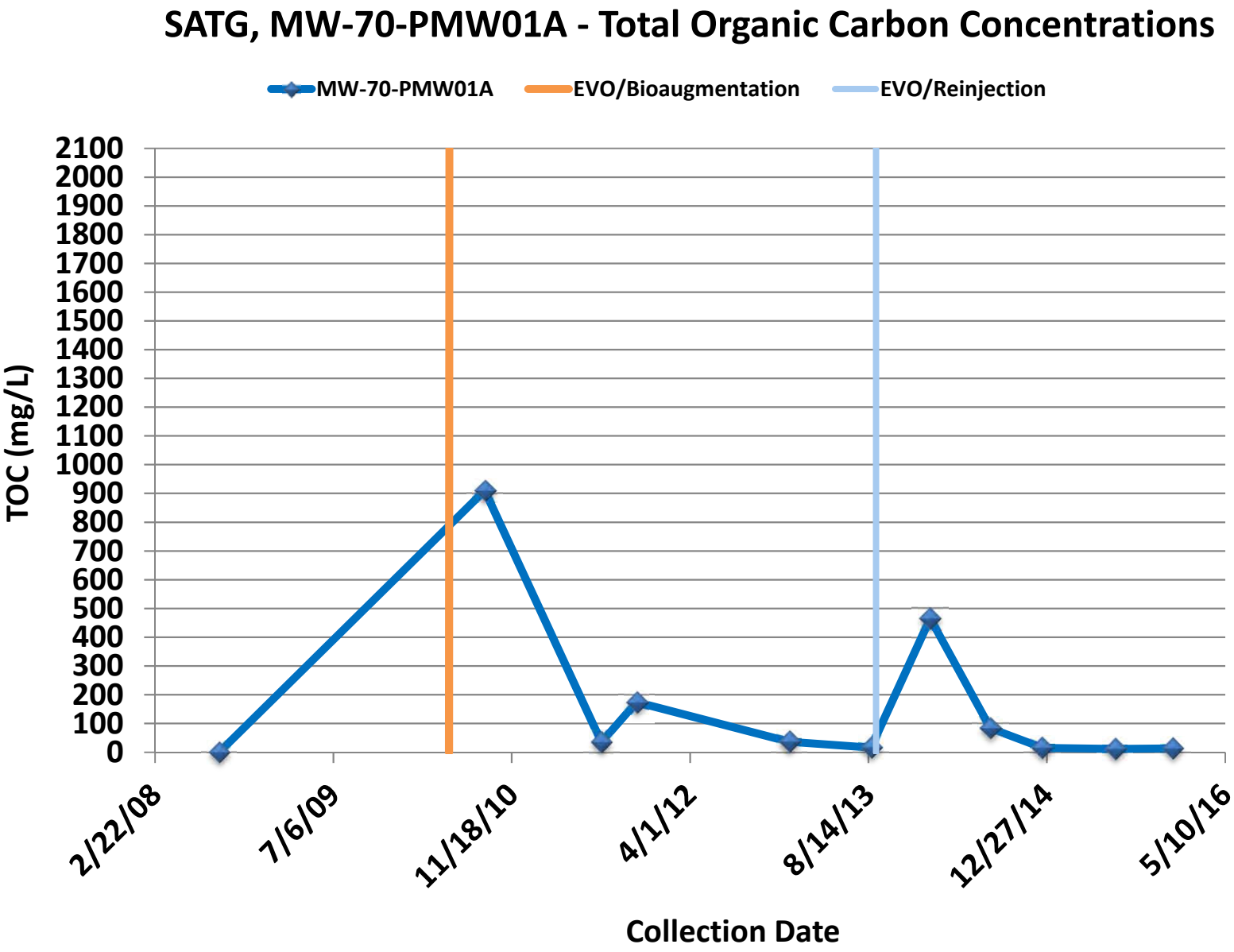
SAB, MW-70-PMW03B - Total Organic Carbon Concentrations



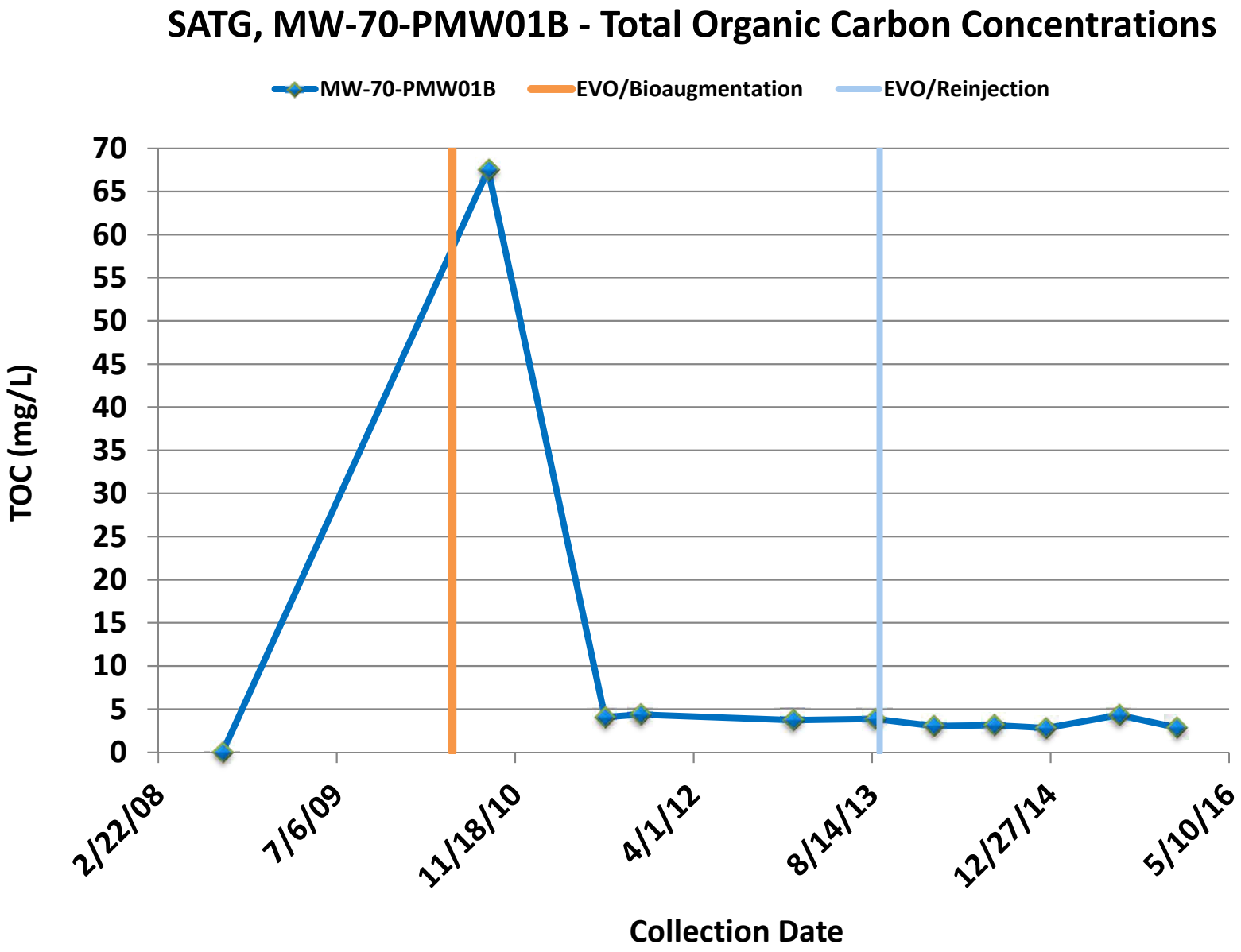
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



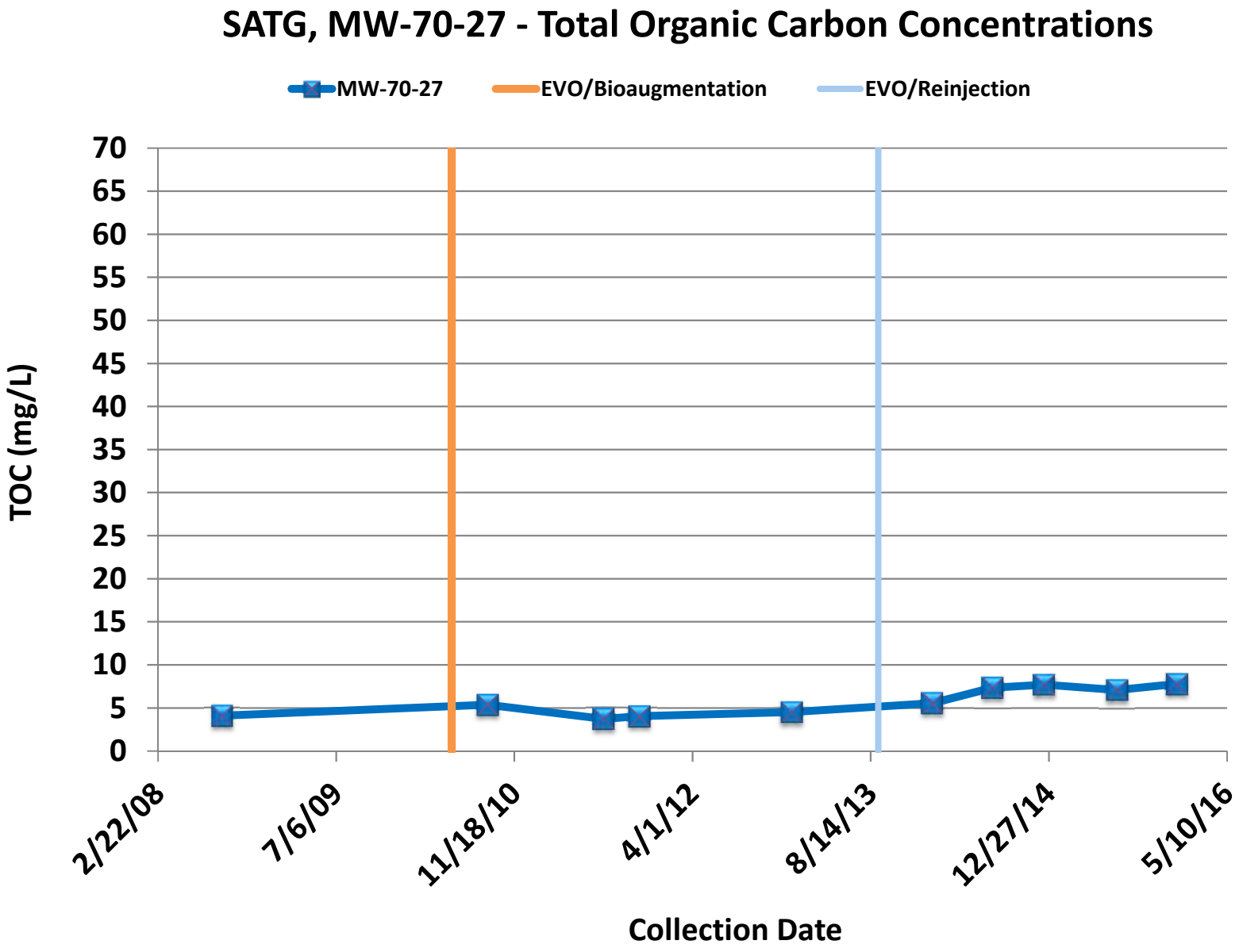
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



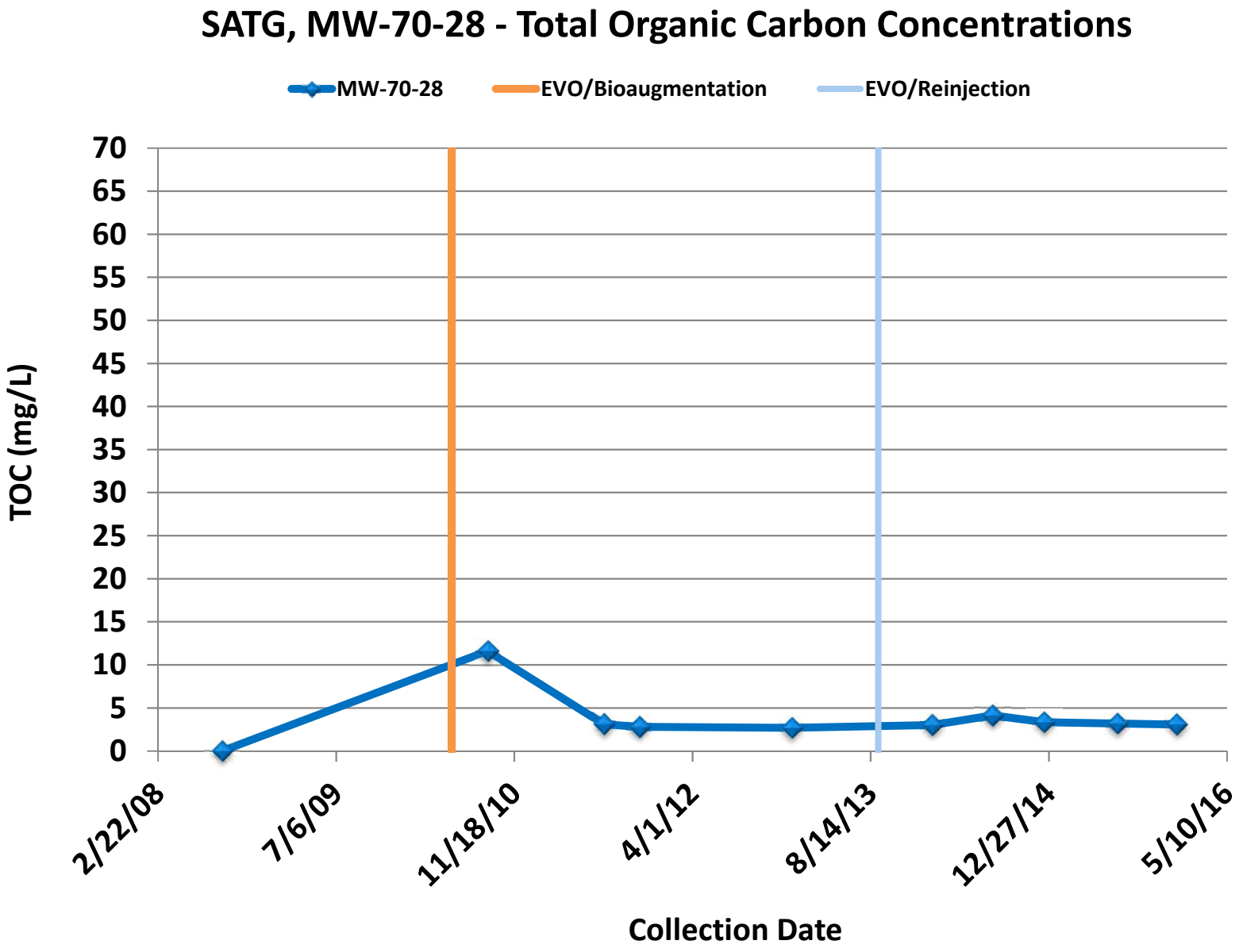
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



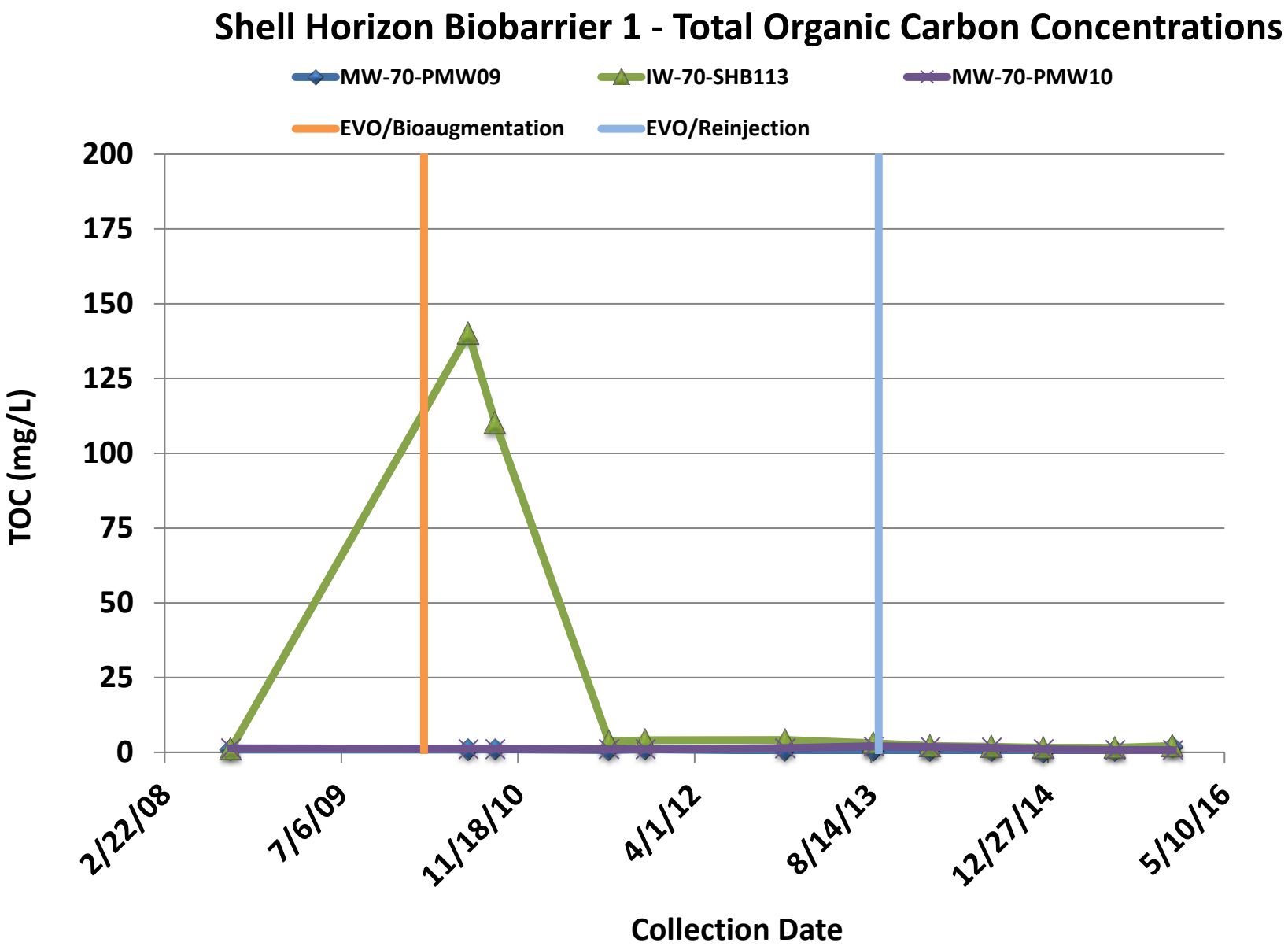
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

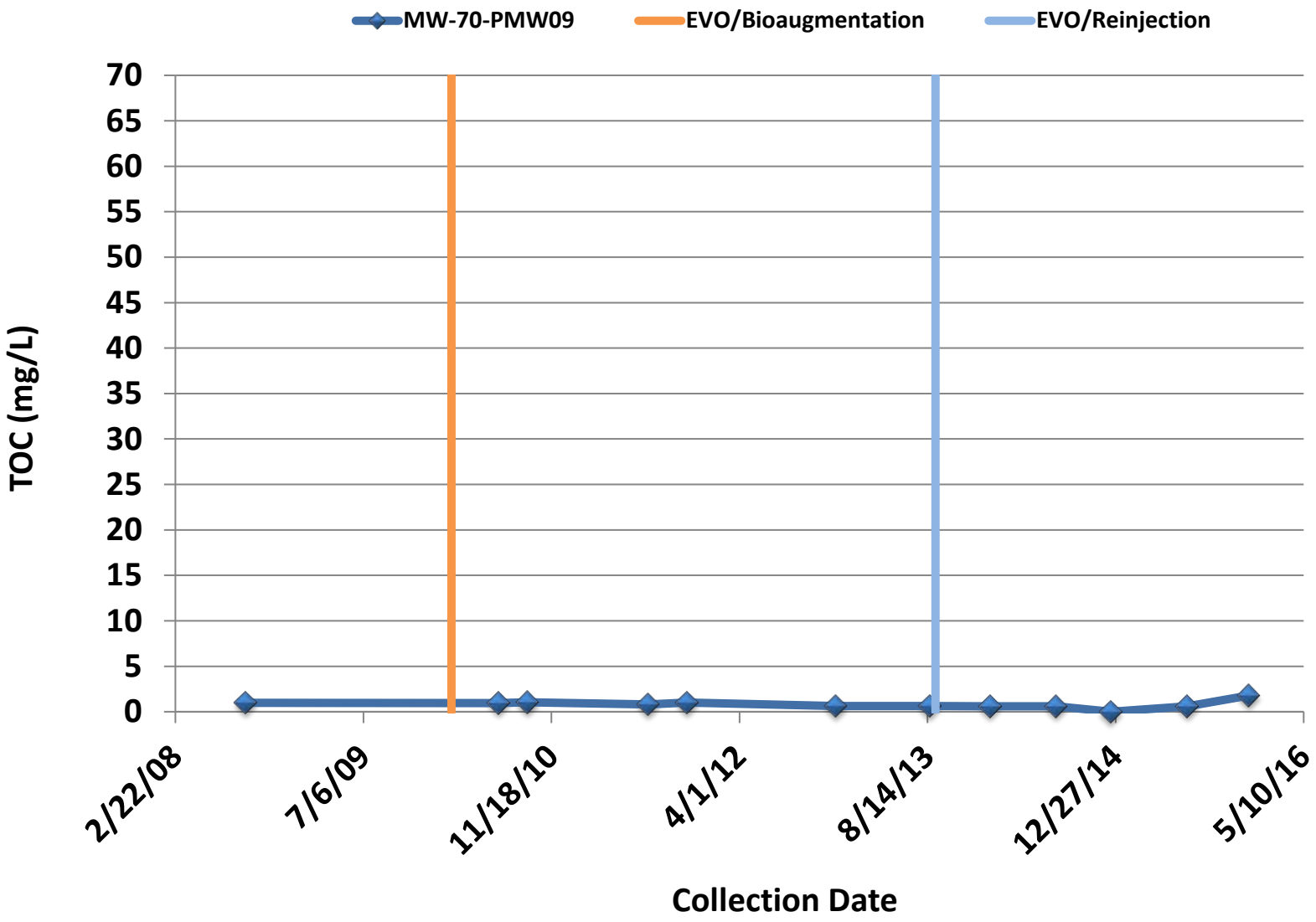


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



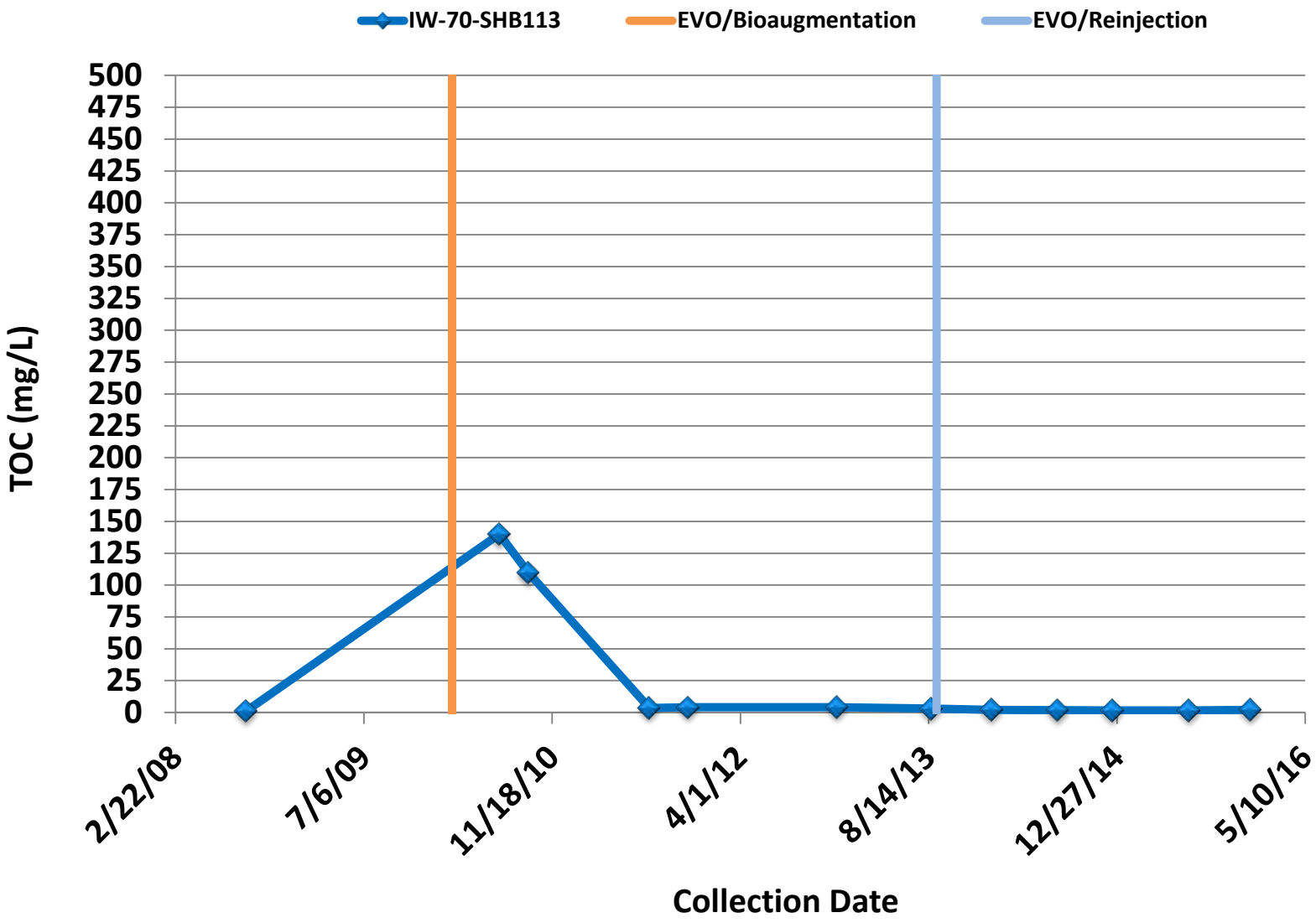
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

SHB1, MW-70-PMW09 - Total Organic Carbon Concentrations



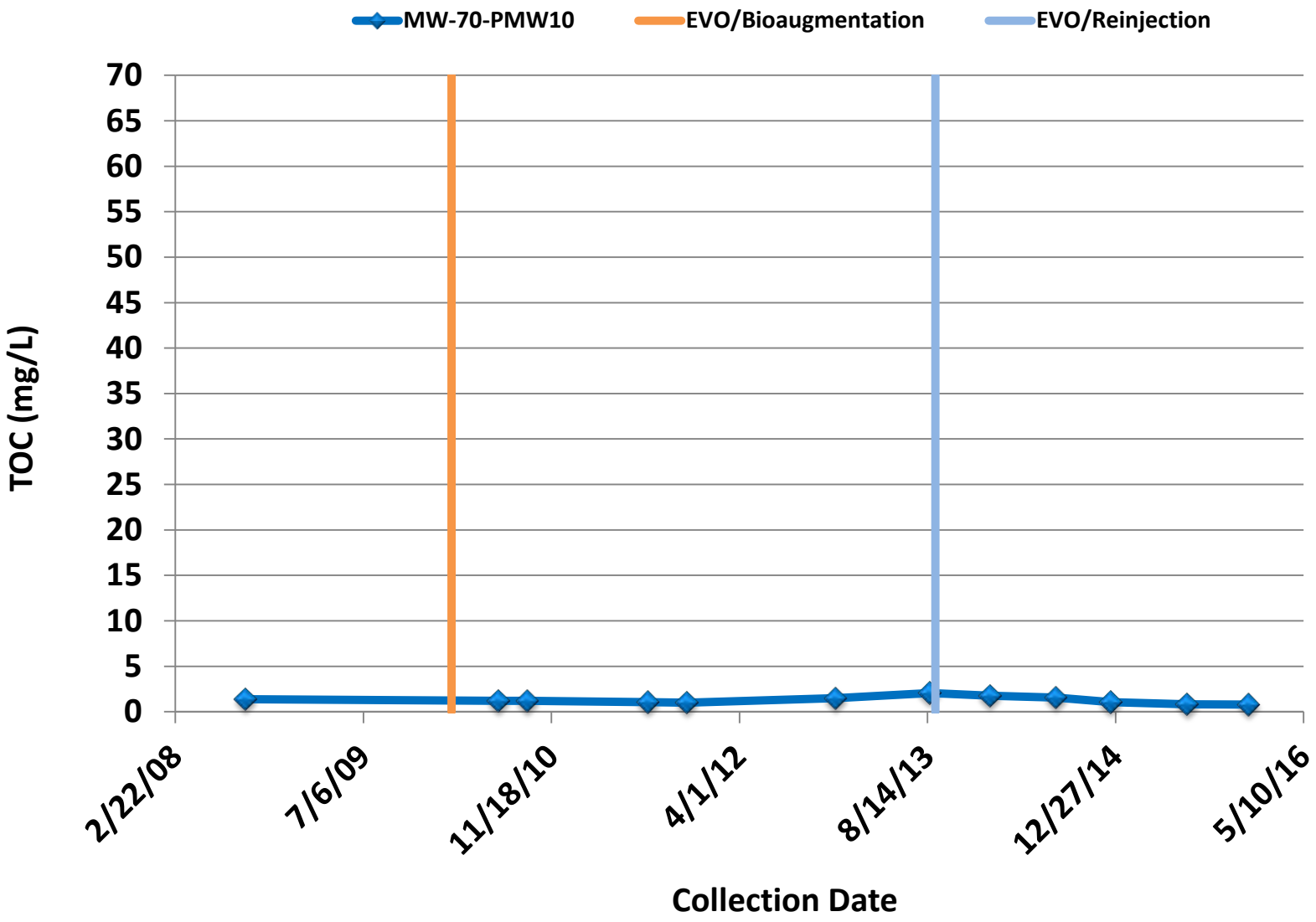
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

SHB1, MW-70-SHB113 - Total Organic Carbon Concentrations

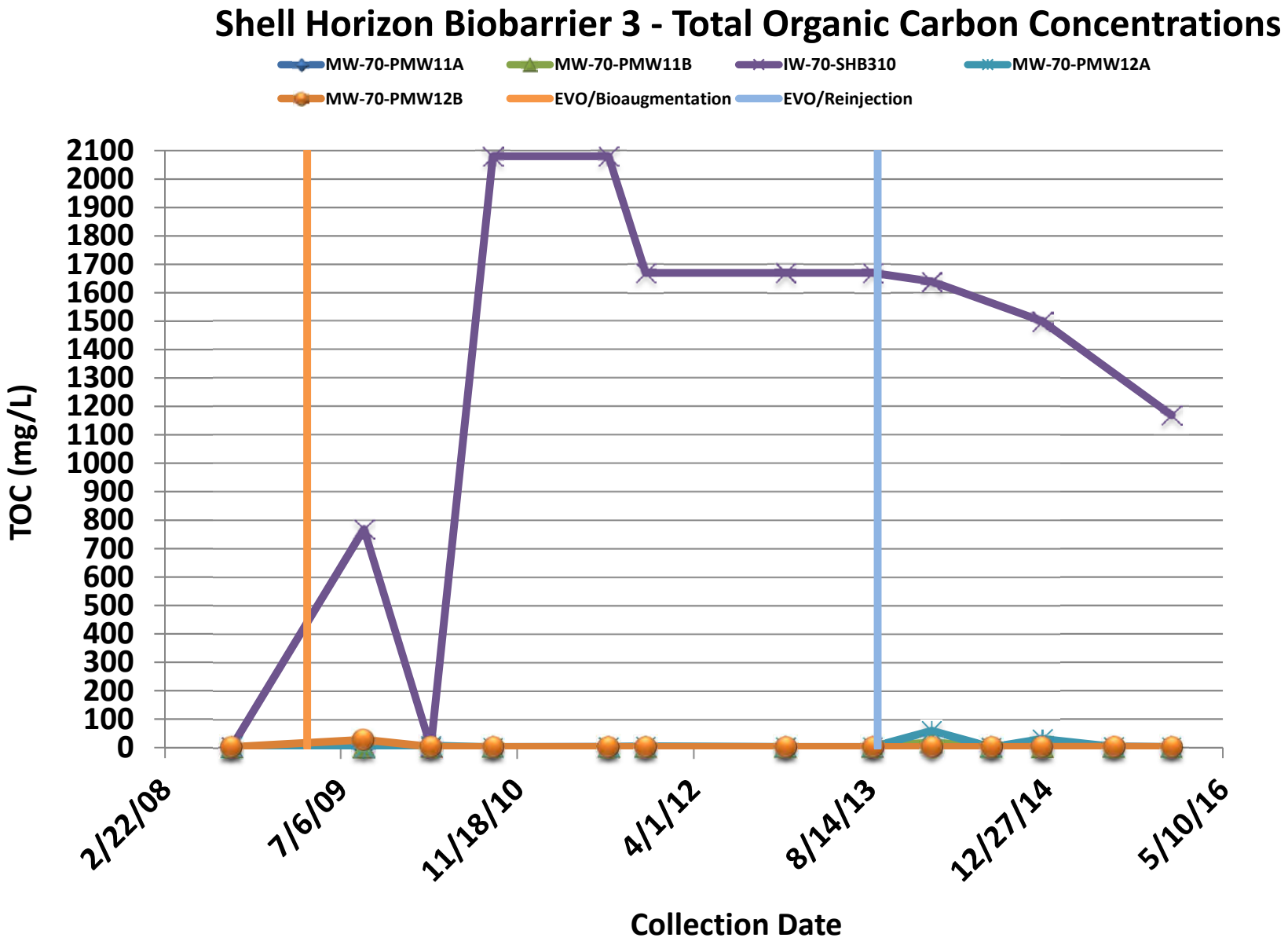


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

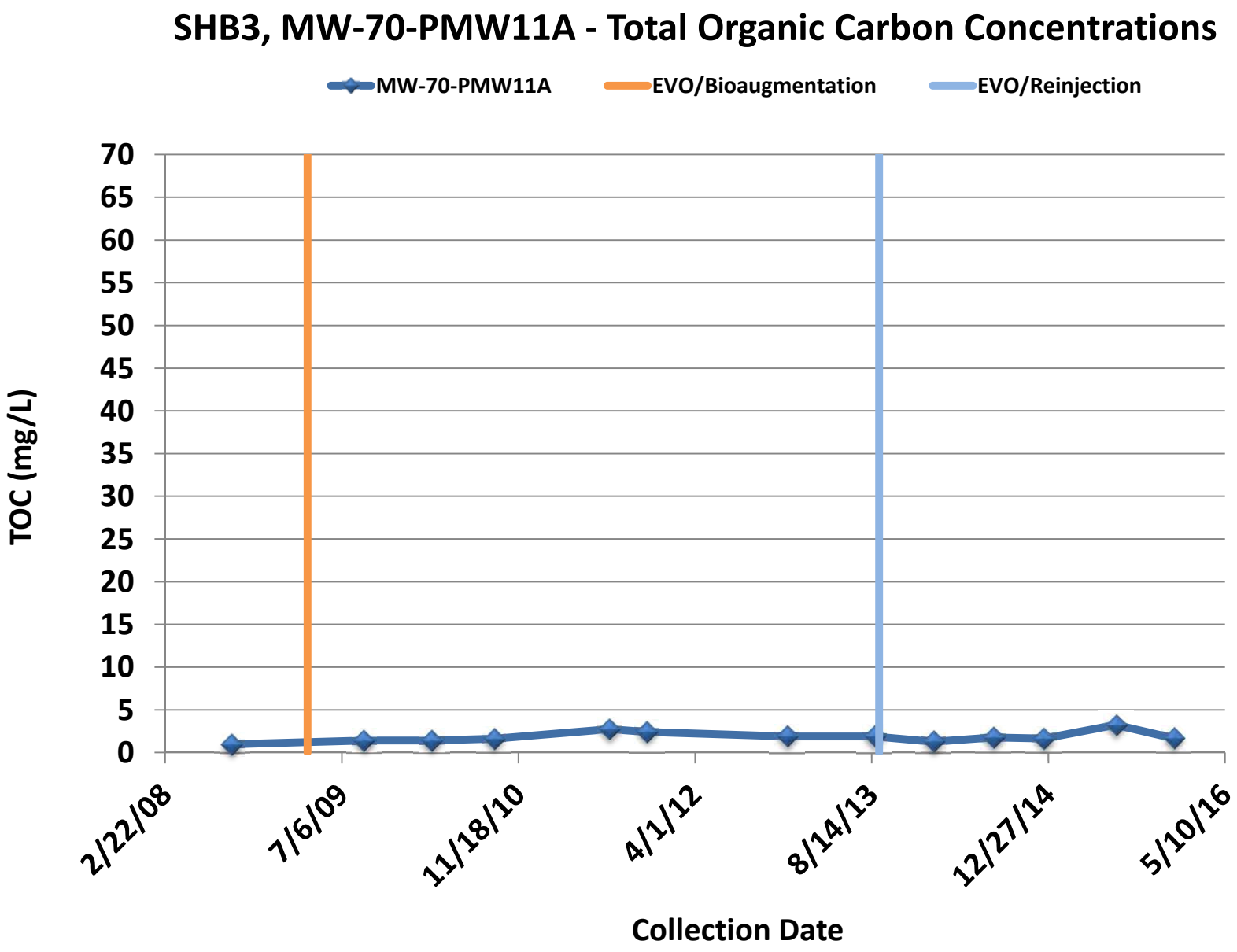
SHB1, MW-70-PMW10 - Total Organic Carbon Concentrations



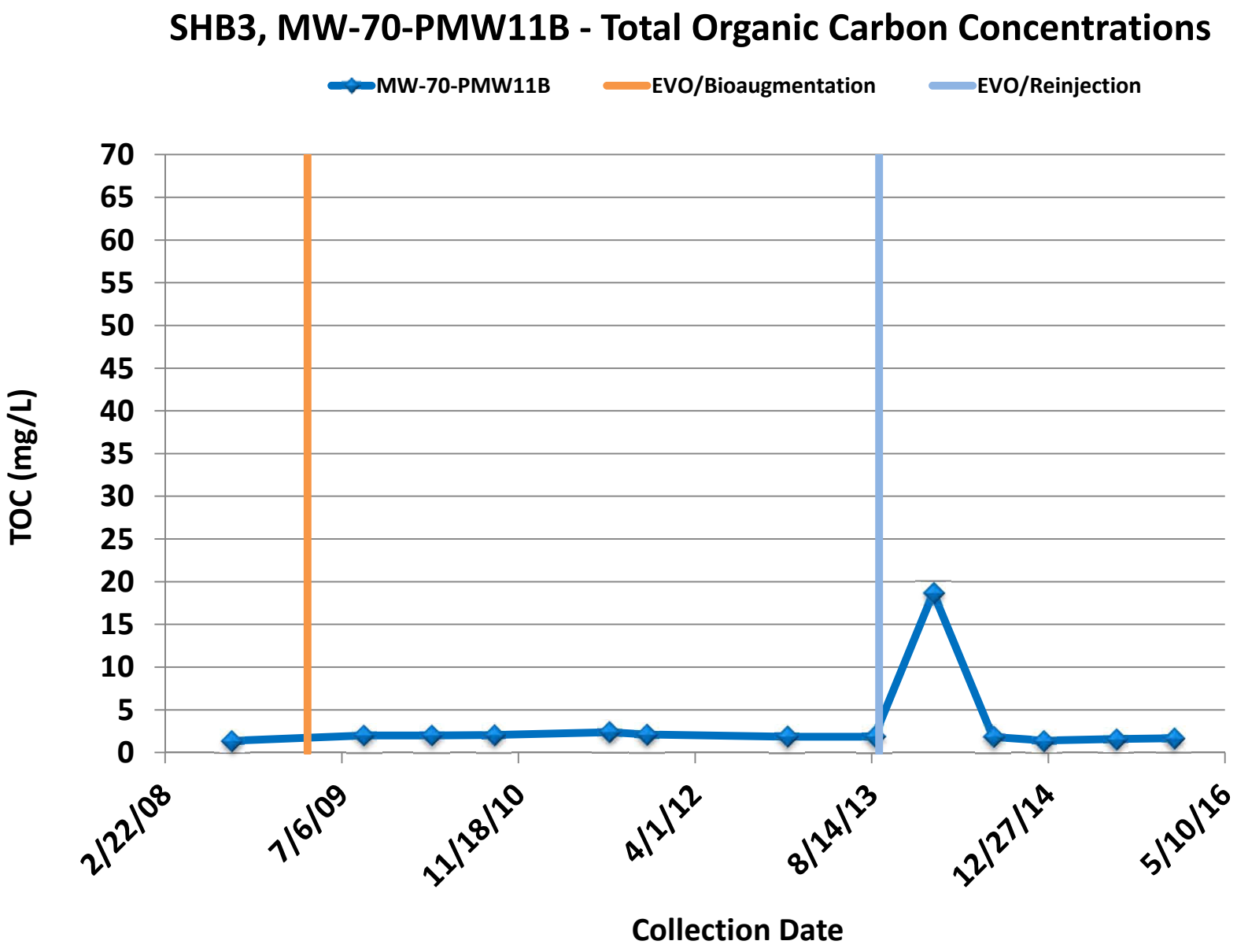
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



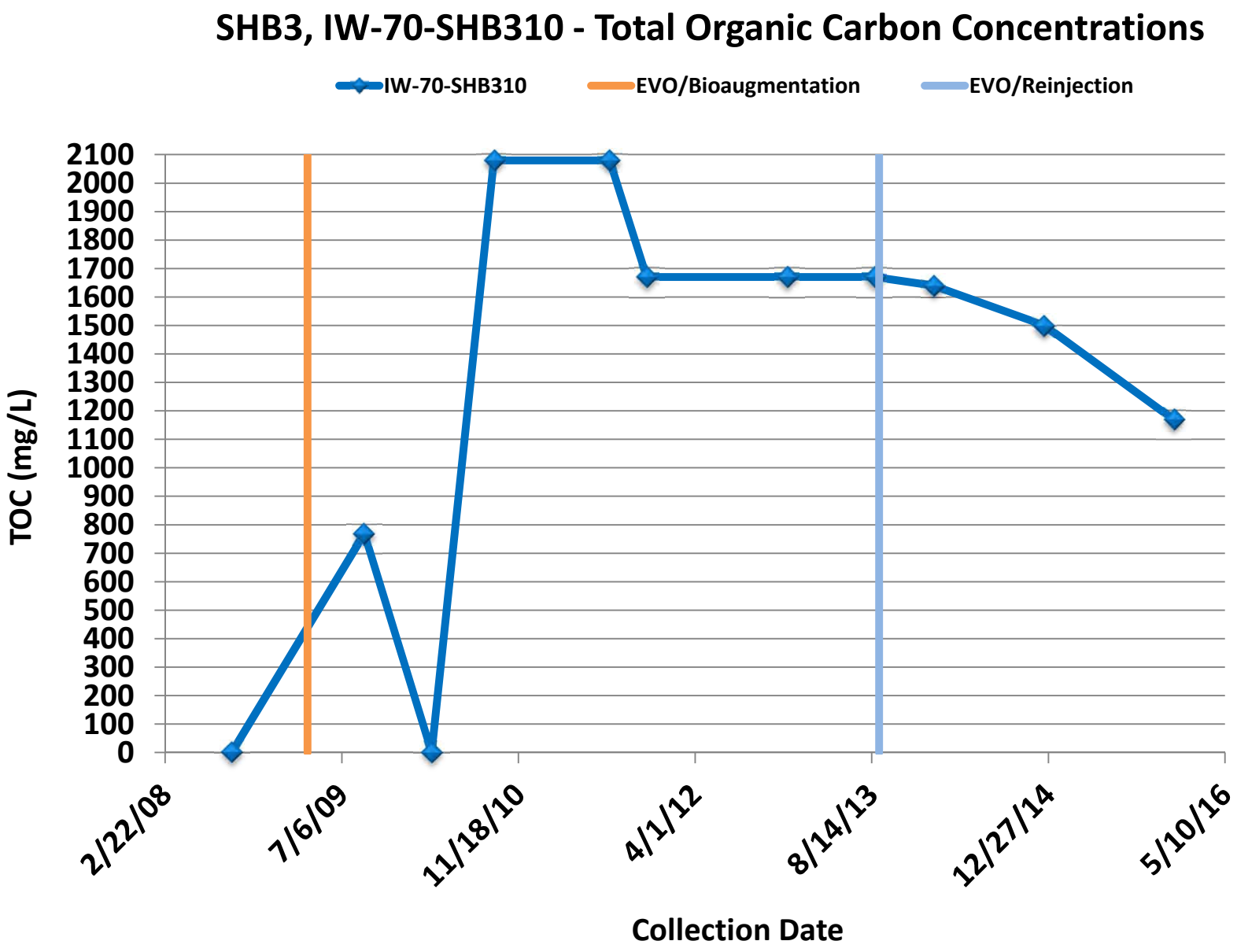
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



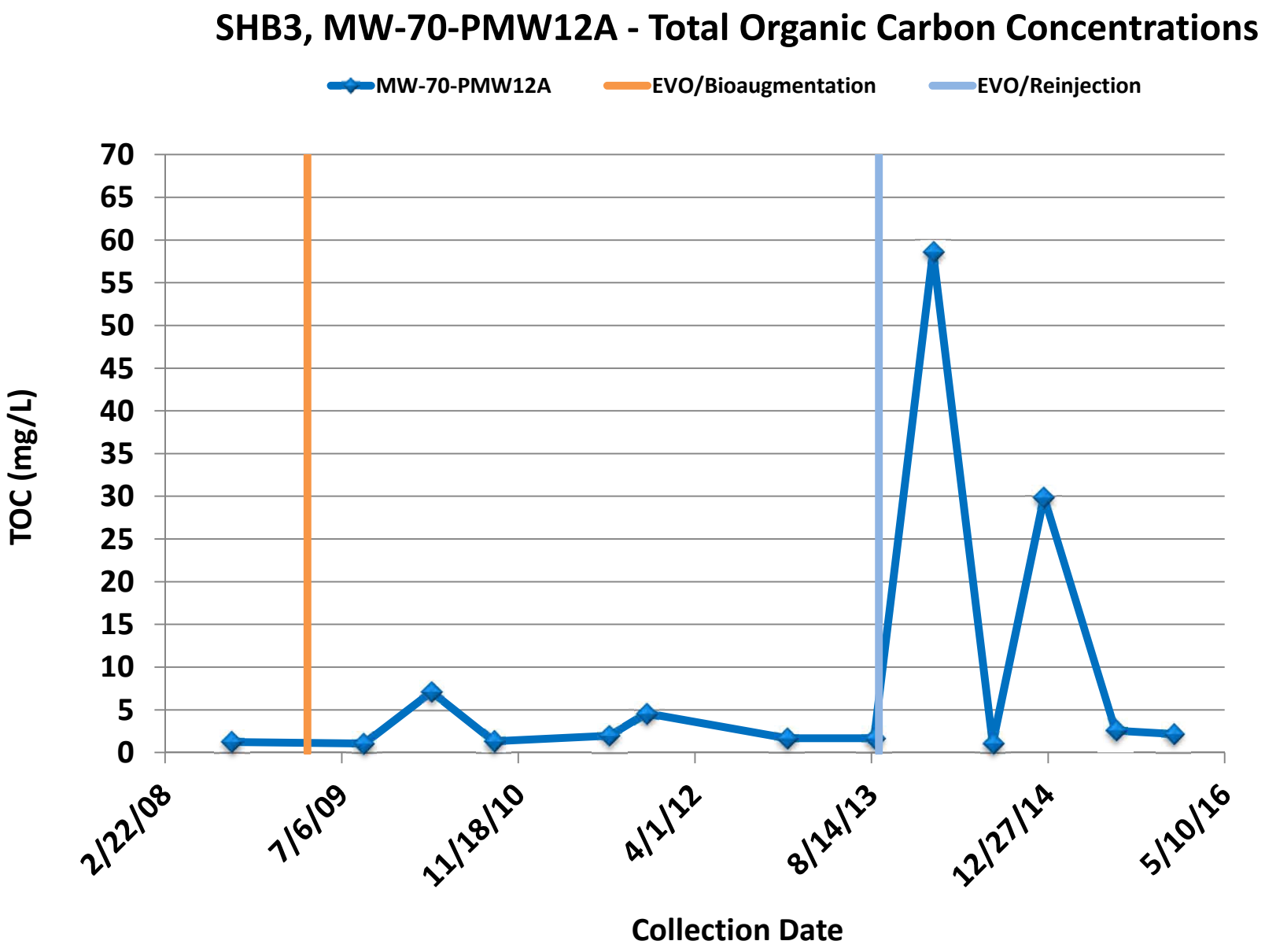
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



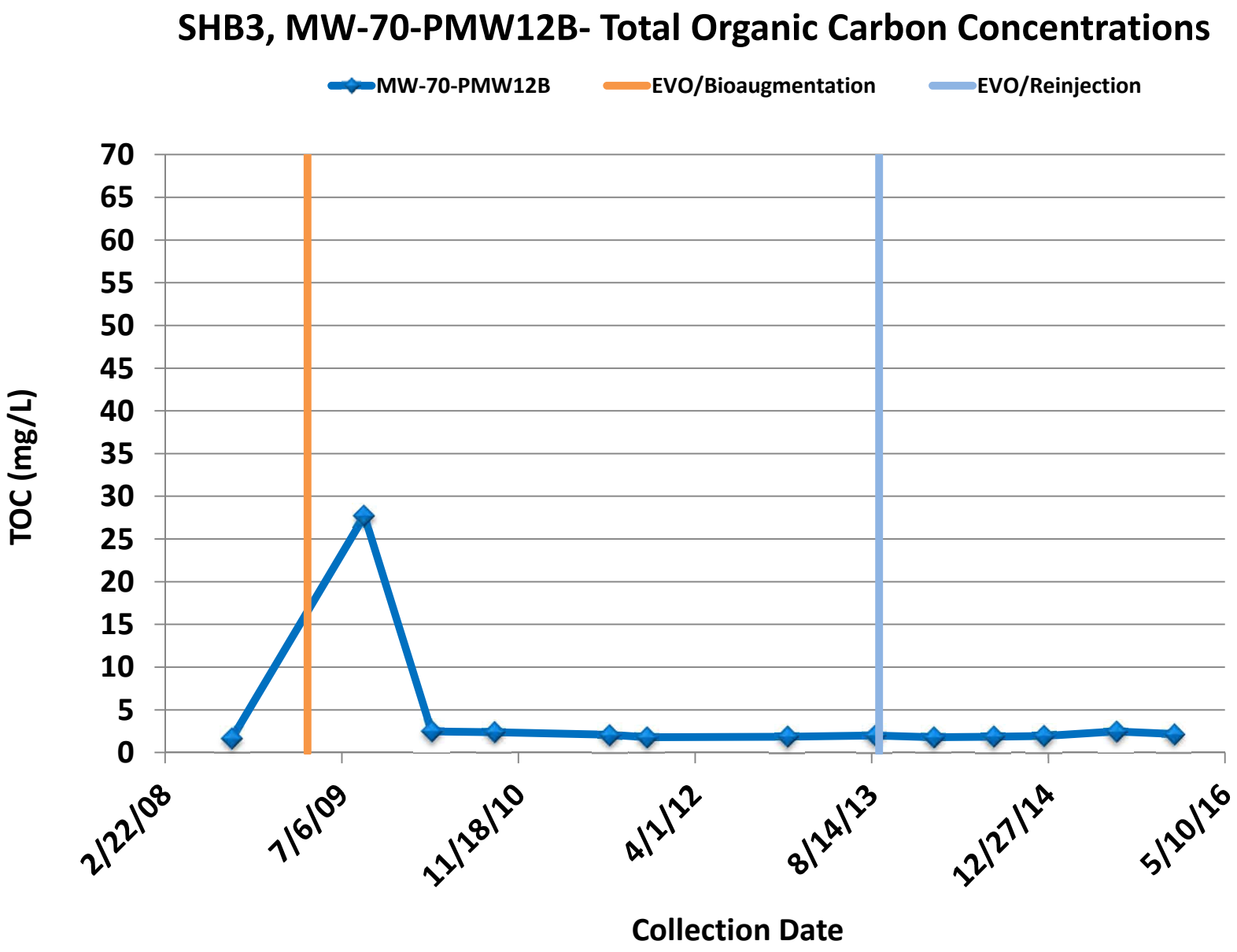
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



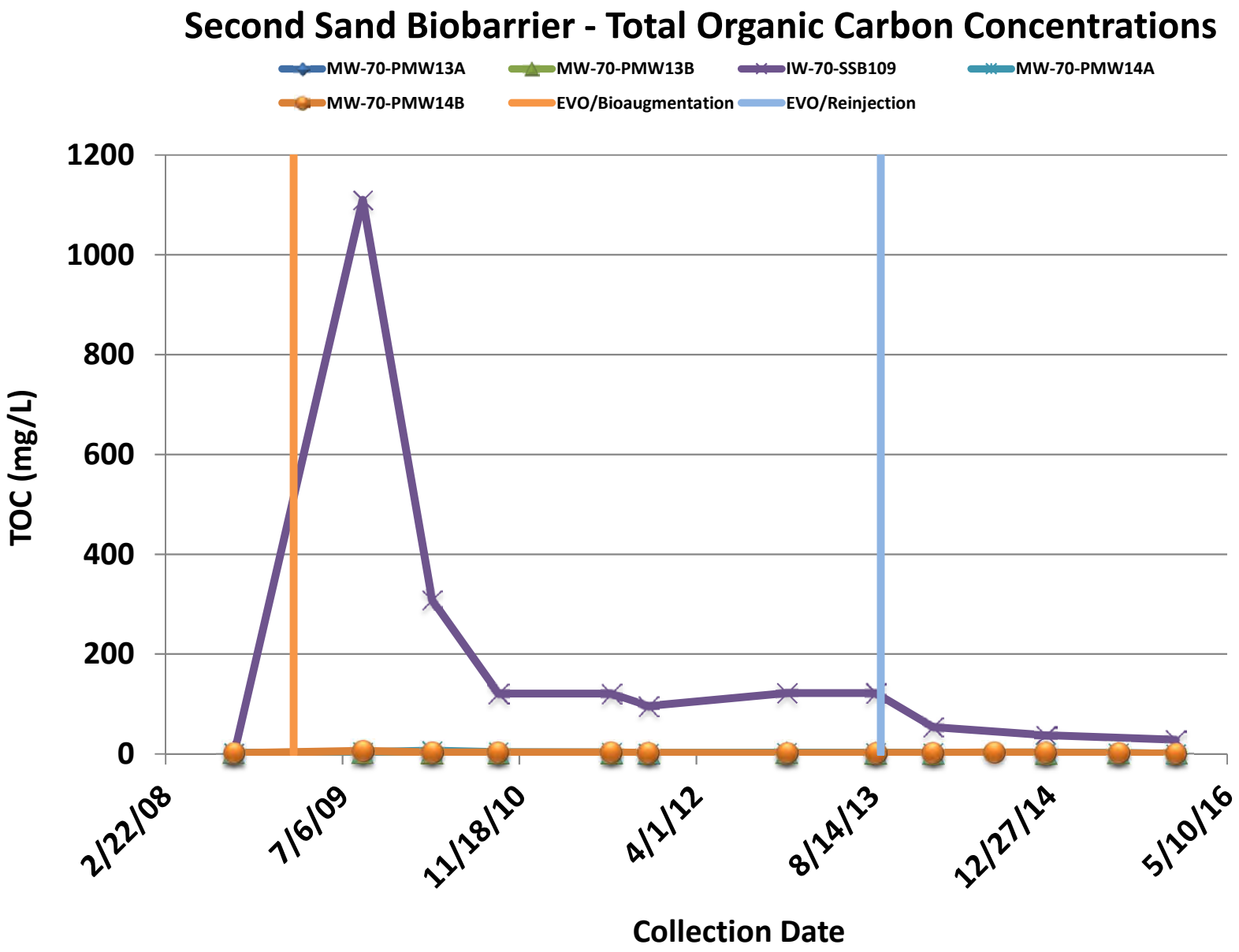
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

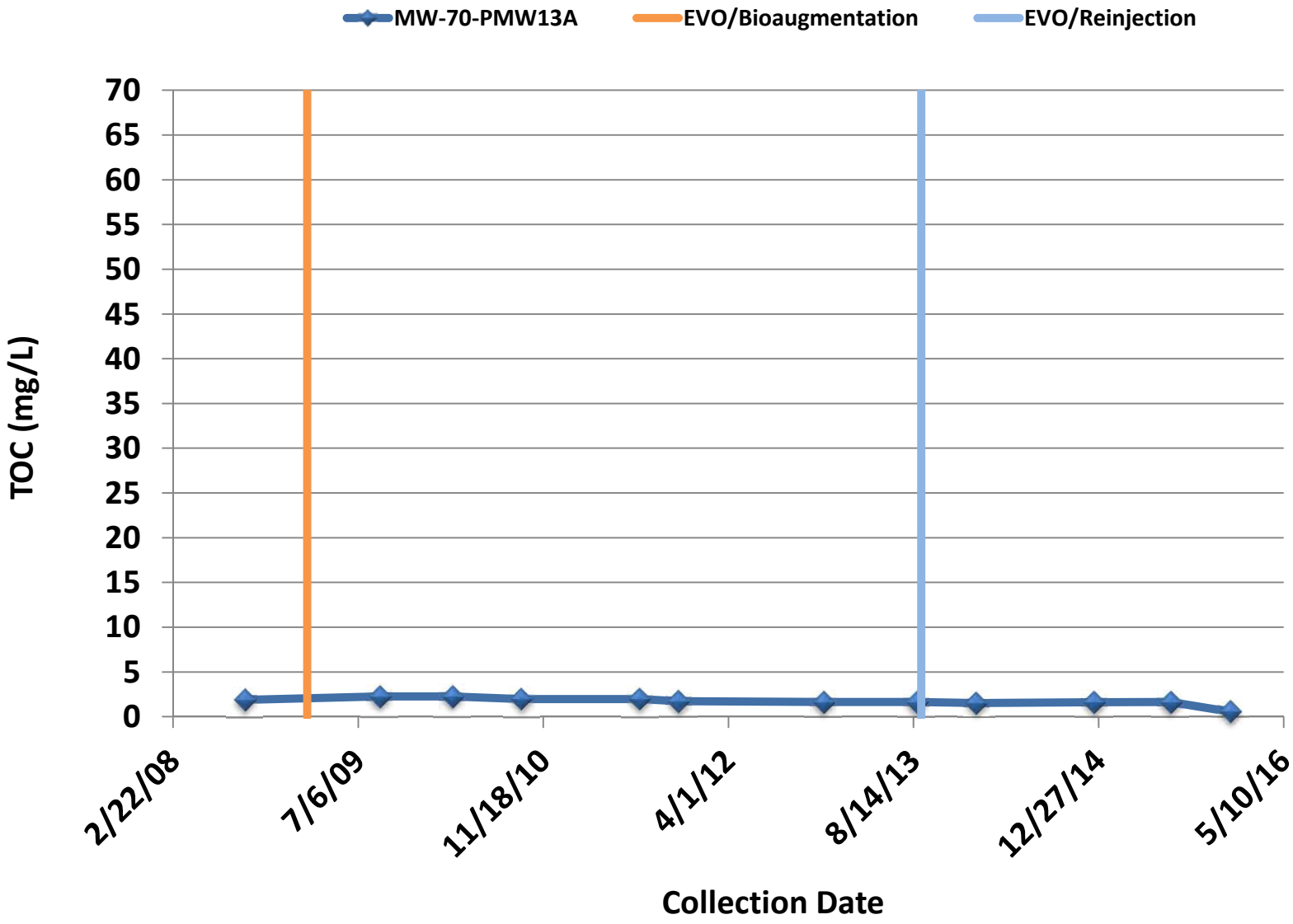


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA



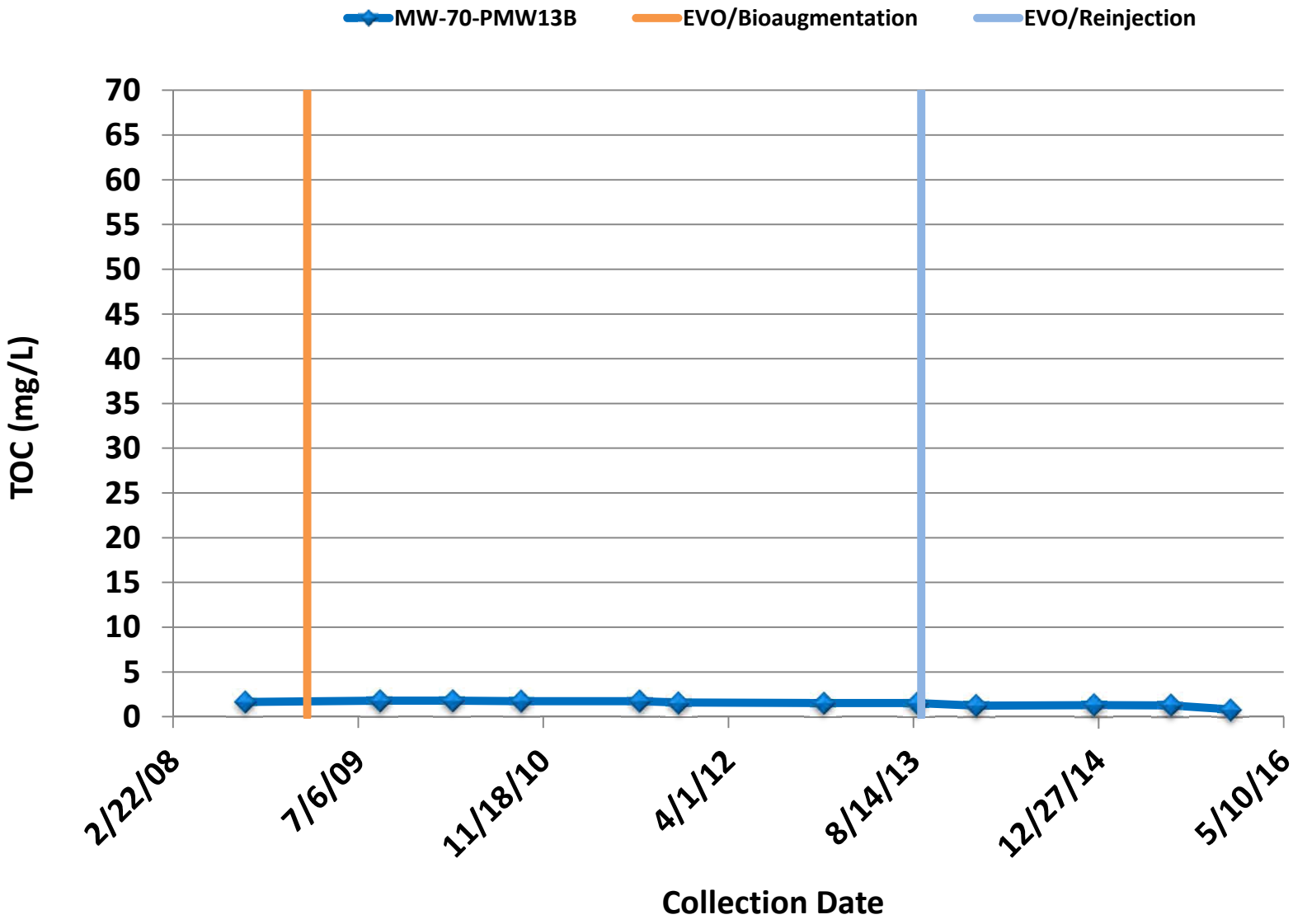
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

SSB, MW-70-PMW13A - Total Organic Carbon Concentrations

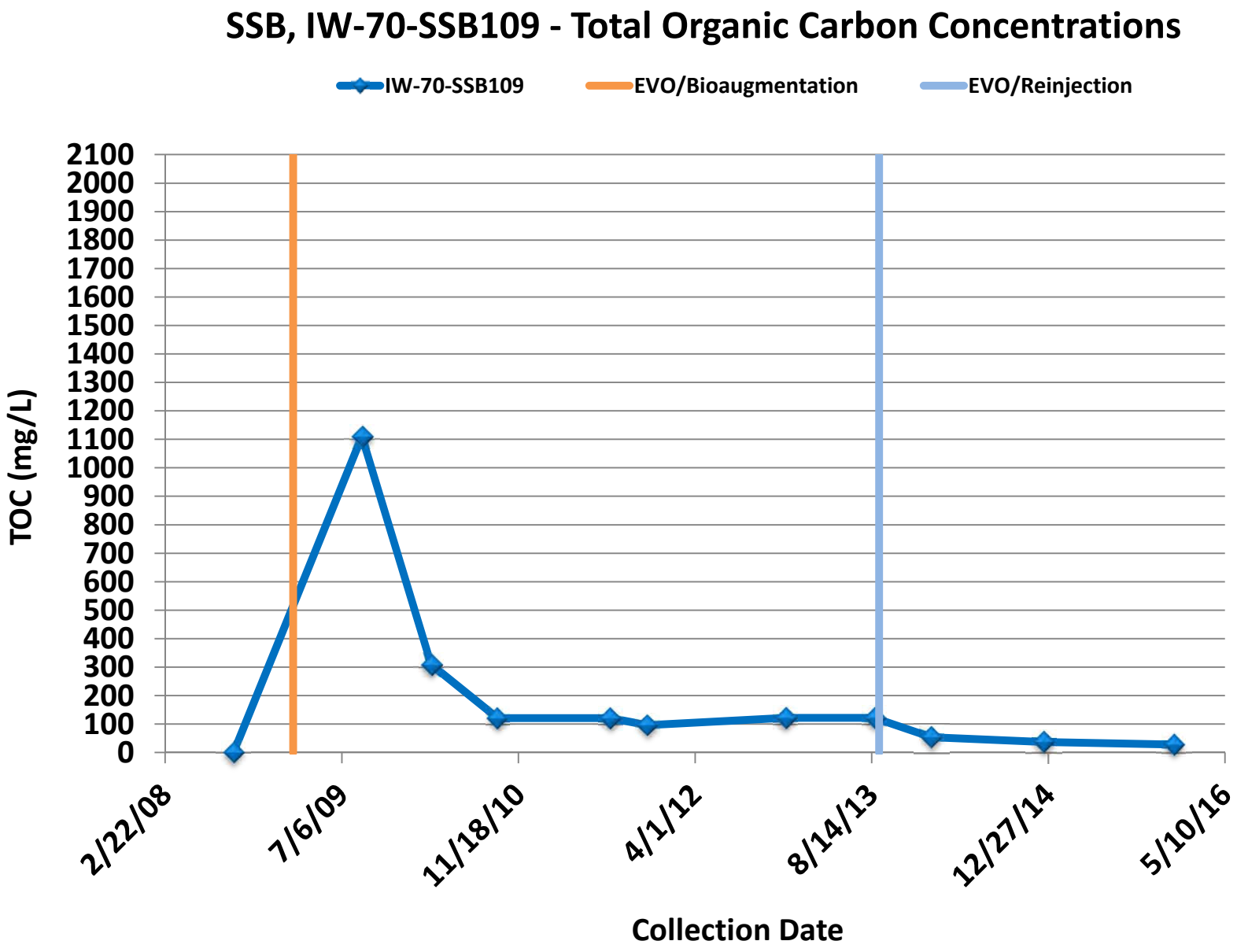


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

SSB, MW-70-PMW13B - Total Organic Carbon Concentrations

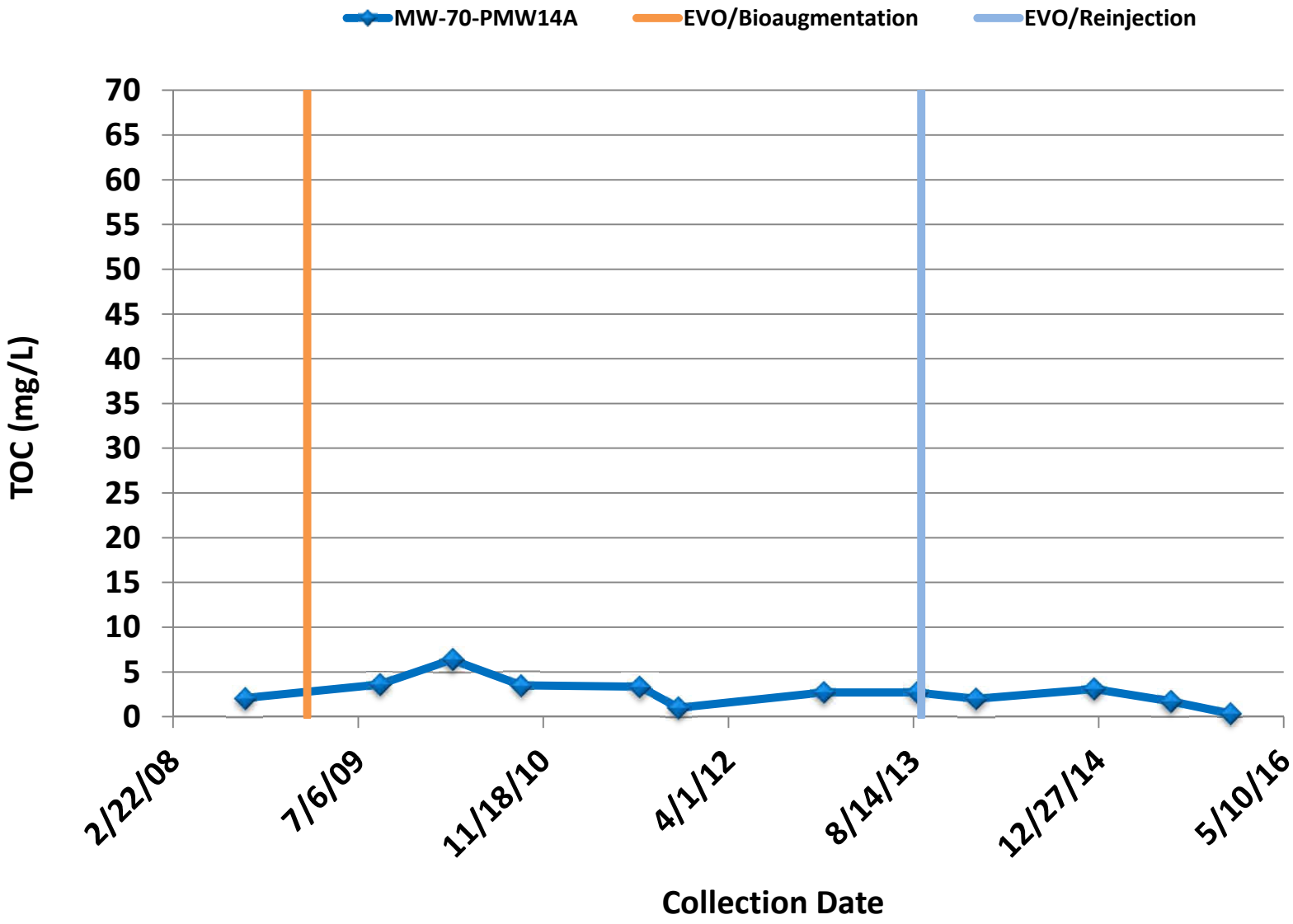


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

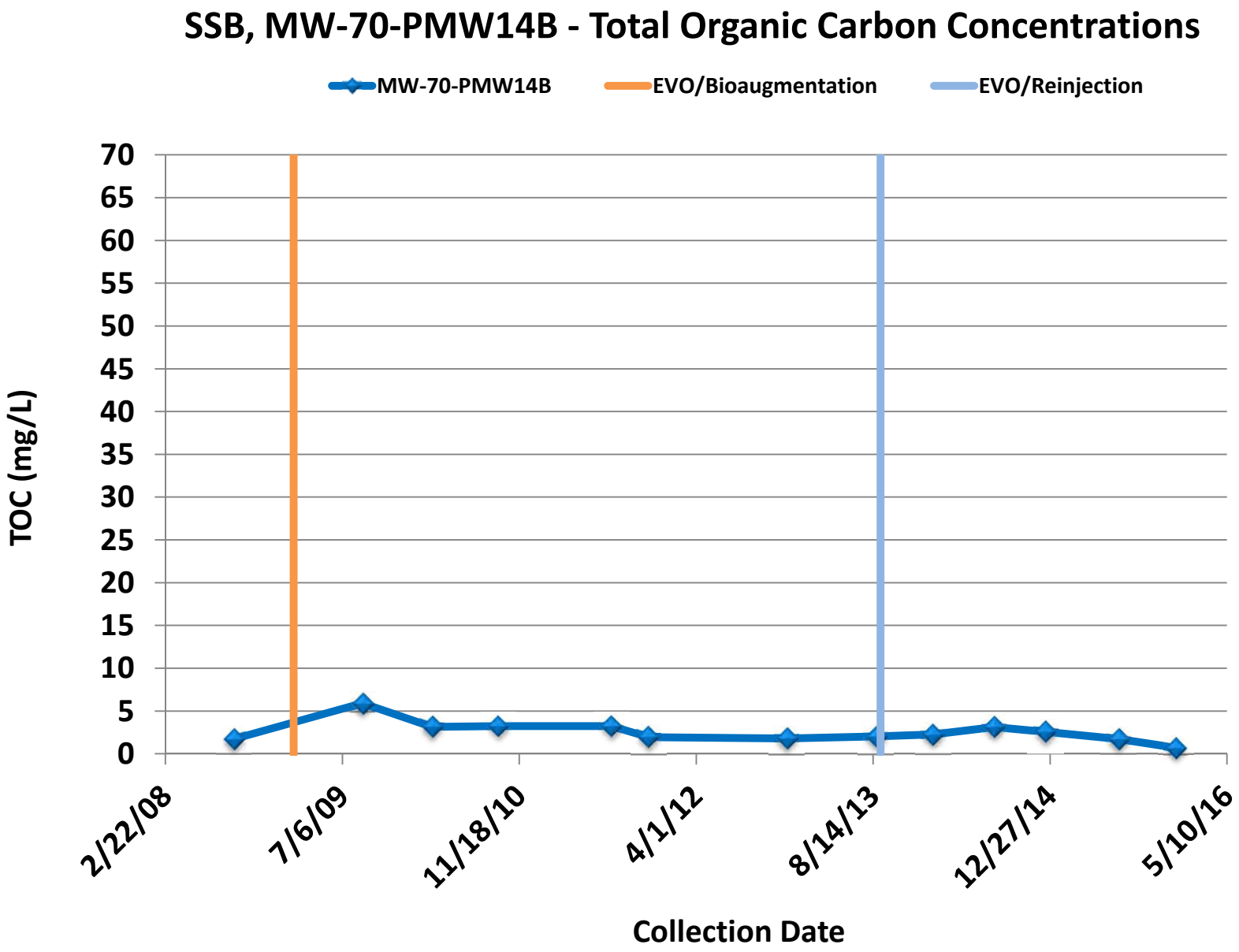


Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

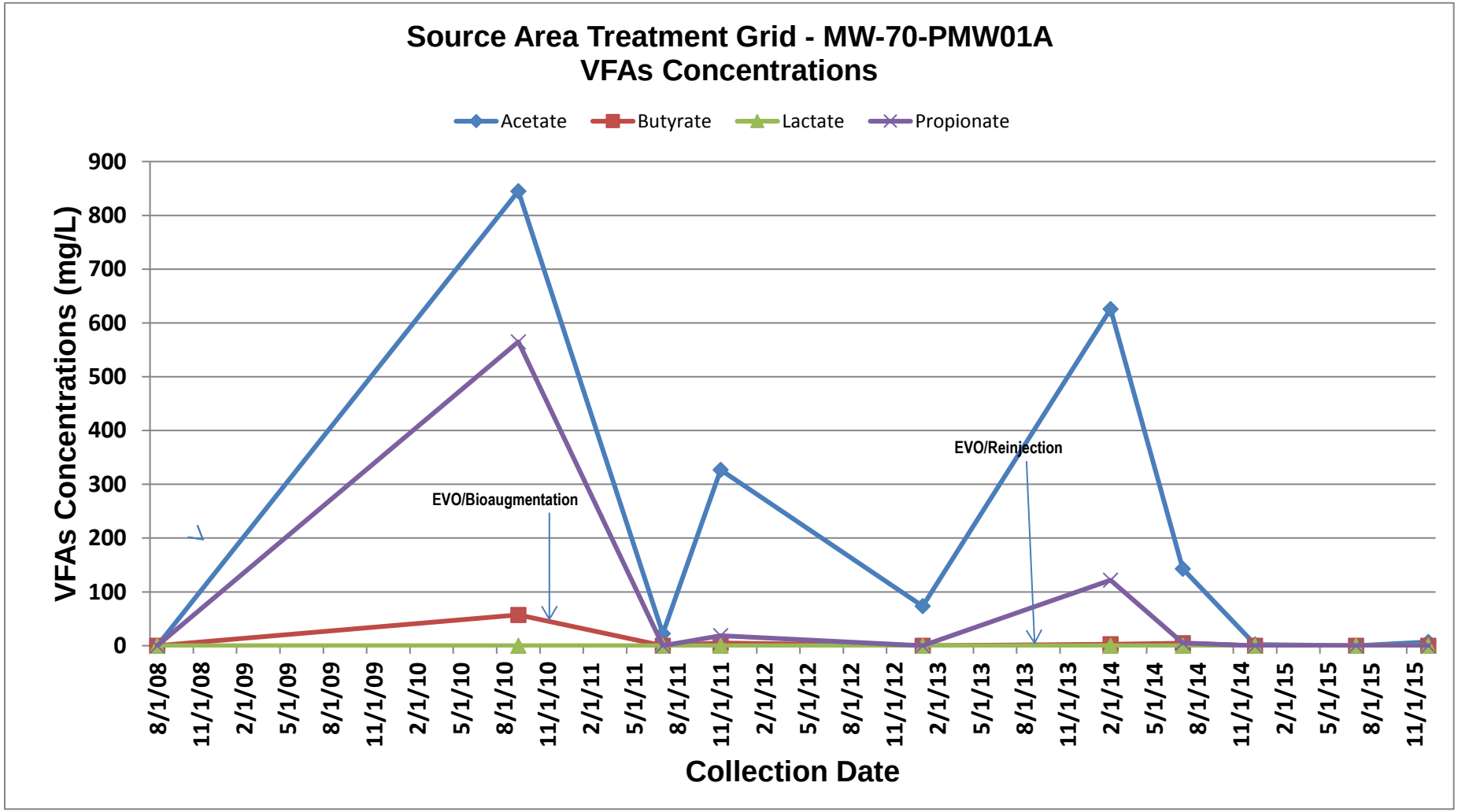
SSB, MW-70-PMW14A - Total Organic Carbon Concentrations

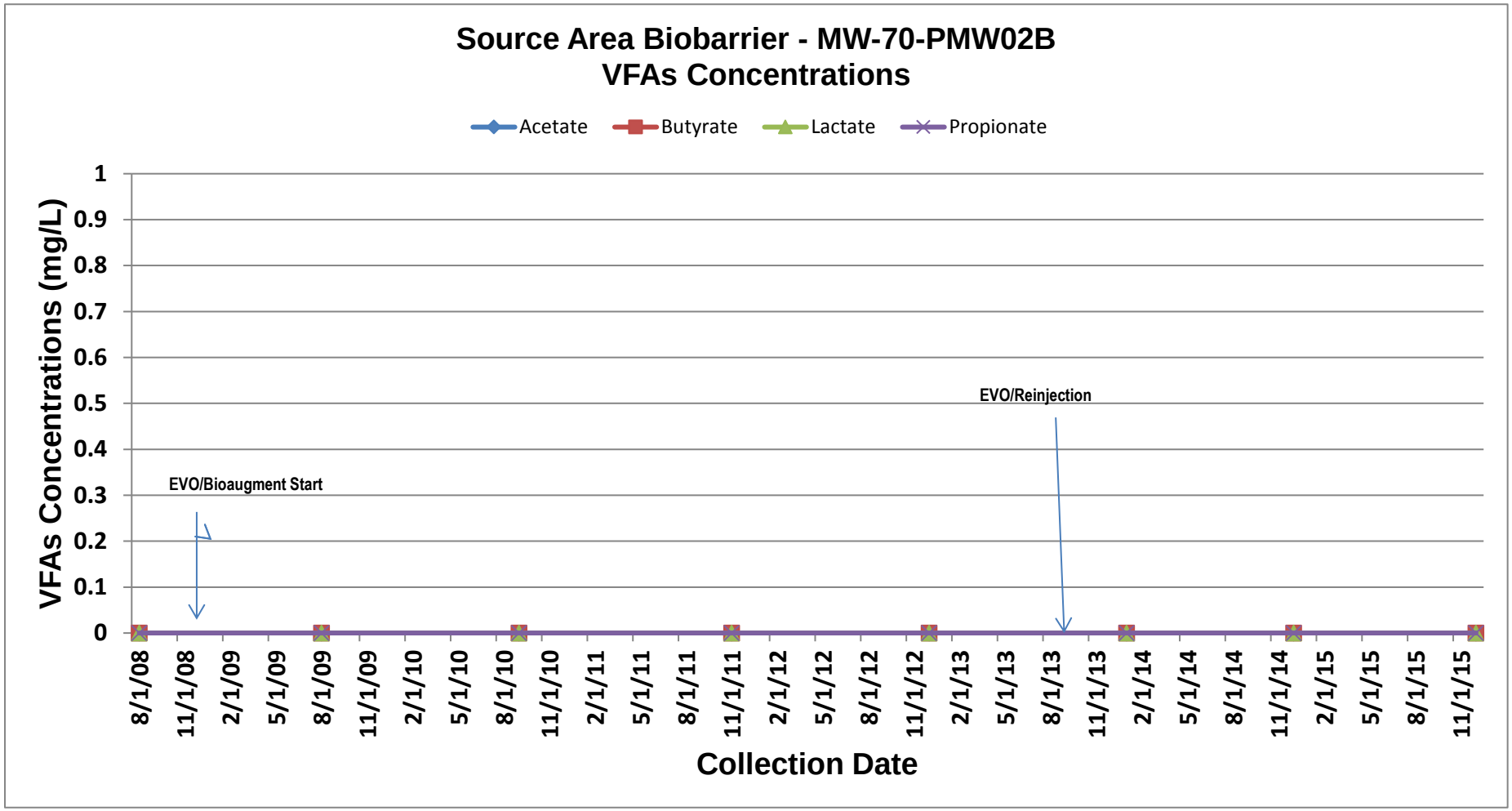


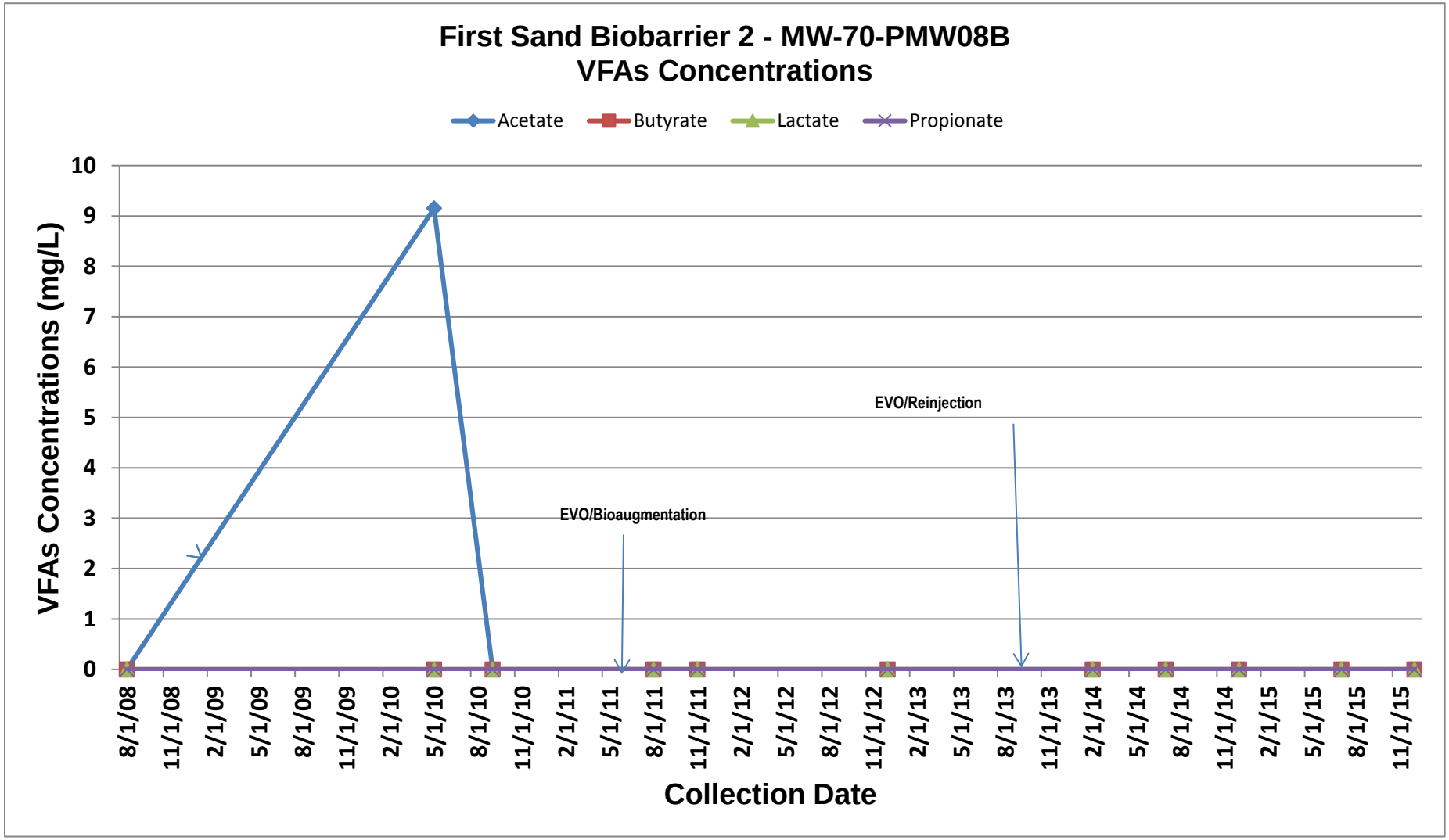
Installation Restoration Program Site 70
Naval Weapons Station Seal Beach, Seal Beach, CA

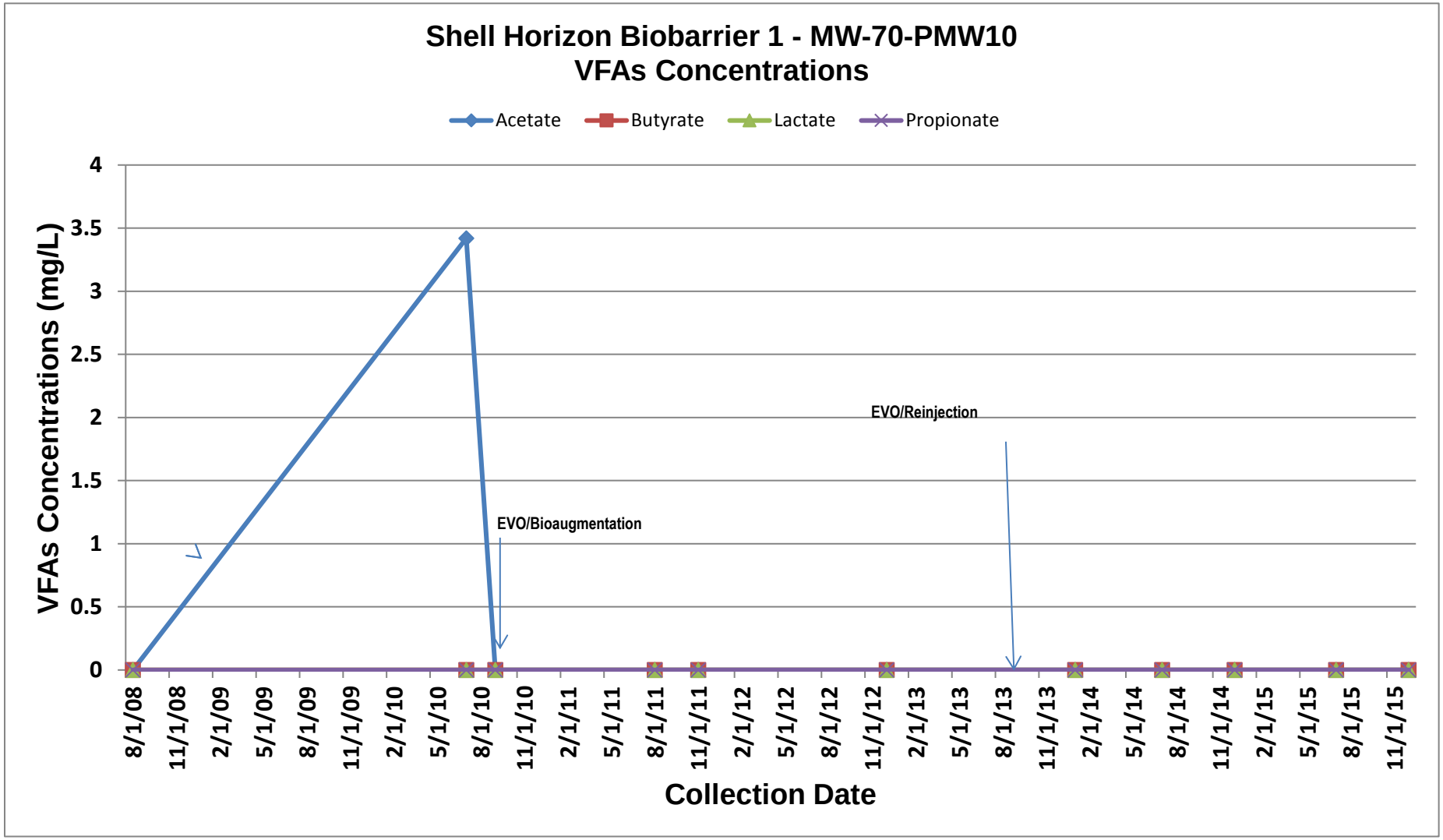


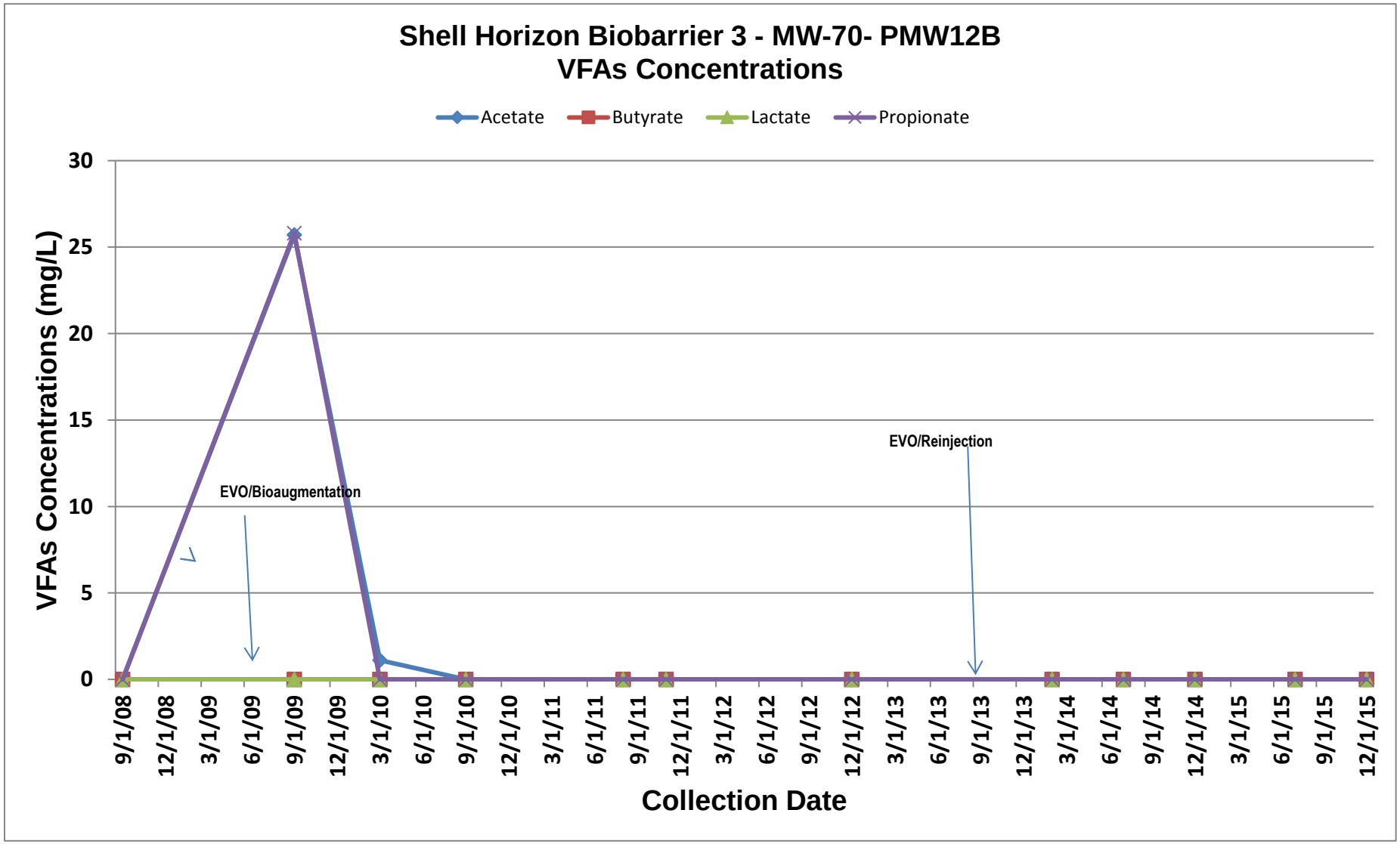
VFA Trend Graphs

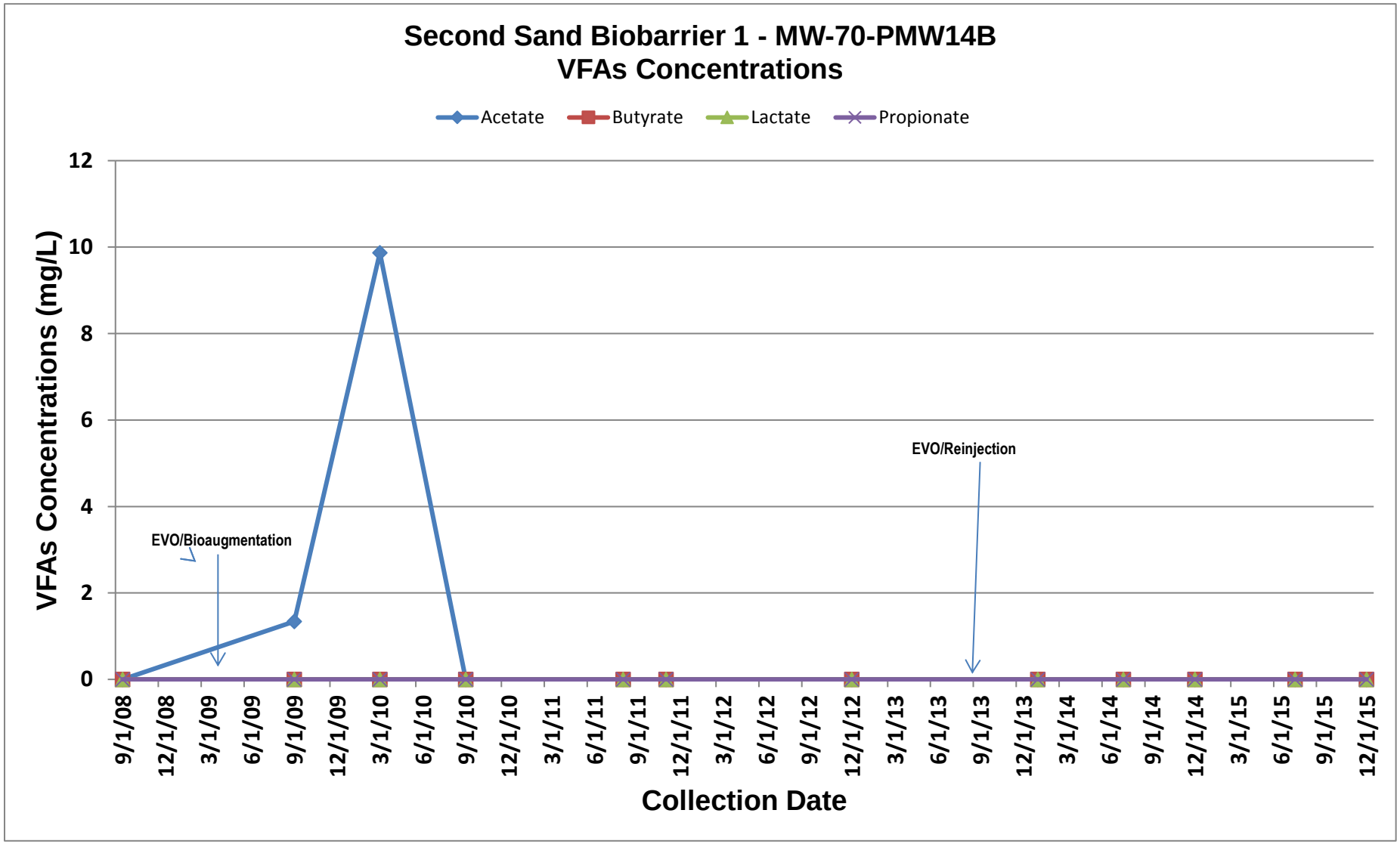

Source Area Treatment Grid - MW-70-PMW01A
VFAs Concentrations
Acetate
Butyrate
Lactate
Propionate
VFAs Concentrations (mg/L)
900
800
700
600
500
400
300
200
100
0
EVO/Bioaugmentation
EVO/Reinjection
8/1/08
11/1/08
2/1/09
5/1/09
8/1/09
11/1/09
2/1/10
5/1/10
8/1/10
11/1/10
2/1/11
5/1/11
8/1/11
11/1/11
2/1/12
5/1/12
8/1/12
11/1/12
2/1/13
5/1/13
8/1/13
11/1/13
2/1/14
5/1/14
8/1/14
11/1/14
2/1/15
5/1/15
8/1/15
11/1/15
Collection Date


Source Area Biobarrier - MW-70-PMW02B
VFAs Concentrations
Acetate
Butyrate
Lactate
Propionate
VFAs Concentrations (mg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
EVO/Bioaugment Start
EVO/Reinjection
8/1/08
11/1/08
2/1/09
5/1/09
8/1/09
11/1/09
2/1/10
5/1/10
8/1/10
11/1/10
2/1/11
5/1/11
8/1/11
11/1/11
2/1/12
5/1/12
8/1/12
11/1/12
2/1/13
5/1/13
8/1/13
11/1/13
2/1/14
5/1/14
8/1/14
11/1/14
2/1/15
5/1/15
8/1/15
11/1/15
Collection Date


First Sand Biobarrier 2 - MW-70-PMW08B
VFAs Concentrations
Acetate
Butyrate
Lactate
Propionate
VFAs Concentrations (mg/L)
10
9
8
7
6
5
4
3
2
1
0
EVO/Reinjection
EVO/Bioaugmentation
8/1/08
11/1/08
2/1/09
5/1/09
8/1/09
11/1/09
2/1/10
5/1/10
8/1/10
11/1/10
2/1/11
5/1/11
8/1/11
11/1/11
2/1/12
5/1/12
8/1/12
11/1/12
2/1/13
5/1/13
8/1/13
11/1/13
2/1/14
5/1/14
8/1/14
11/1/14
2/1/15
5/1/15
8/1/15
11/1/15
Collection Date


Shell Horizon Biobarrier 1 - MW-70-PMW10
VFAs Concentrations
Acetate
Butyrate
Lactate
Propionate
VFAs Concentrations (mg/L)
4
3.5
3
2.5
2
1.5
1
0.5
0
EVO/Bioaugmentation
EVO/Reinjection
8/1/08
11/1/08
2/1/09
5/1/09
8/1/09
11/1/09
2/1/10
5/1/10
8/1/10
11/1/10
2/1/11
5/1/11
8/1/11
11/1/11
2/1/12
5/1/12
8/1/12
11/1/12
2/1/13
5/1/13
8/1/13
11/1/13
2/1/14
5/1/14
8/1/14
11/1/14
2/1/15
5/1/15
8/1/15
11/1/15
Collection Date


Shell Horizon Biobarrier 3 - MW-70- PMW12B
VFAs Concentrations
Acetate
Butyrate
Lactate
Propionate
VFAs Concentrations (mg/L)
30
25
20
15
10
5
0
EVO/Bioaugmentation
EVO/Reinjection
9/1/08
12/1/08
3/1/09
6/1/09
9/1/09
12/1/09
3/1/10
6/1/10
9/1/10
12/1/10
3/1/11
6/1/11
9/1/11
12/1/11
3/1/12
6/1/12
9/1/12
12/1/12
3/1/13
6/1/13
9/1/13
12/1/13
3/1/14
6/1/14
9/1/14
12/1/14
3/1/15
6/1/15
9/1/15
12/1/15
Collection Date

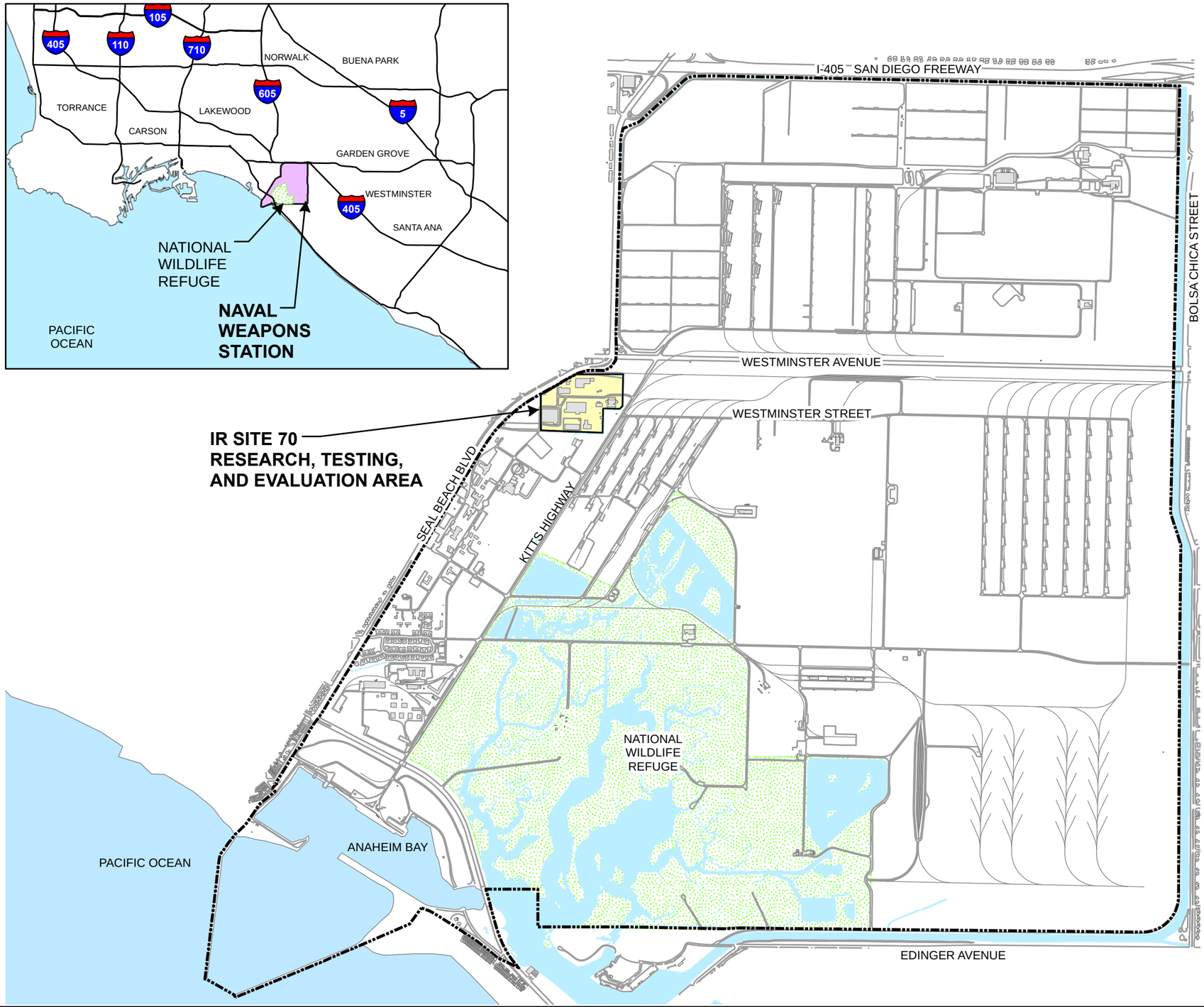

Second Sand Biobarrier 1 - MW-70-PMW14B
VFAs Concentrations
Acetate
Butyrate
Lactate
Propionate
VFAs Concentrations (mg/L)
12
10
8
6
4
2
0
EVO/Bioaugmentation
EVO/Reinjection
9/1/08
12/1/08
3/1/09
6/1/09
9/1/09
12/1/09
3/1/10
6/1/10
9/1/10
12/1/10
3/1/11
6/1/11
9/1/11
12/1/11
3/1/12
6/1/12
9/1/12
12/1/12
3/1/13
6/1/13
9/1/13
12/1/13
3/1/14
6/1/14
9/1/14
12/1/14
3/1/15
6/1/15
9/1/15
12/1/15
Collection Date

This page intentionally left blank

APPENDIX D

2008 BASELINE SAMPLING MAPS
(on CD only)

This page intentionally left blank



LEGEND

- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- BUILDING

N

0 1,000 2,000 4,000 Feet

Baseline Groundwater Monitoring Report

Figure 1

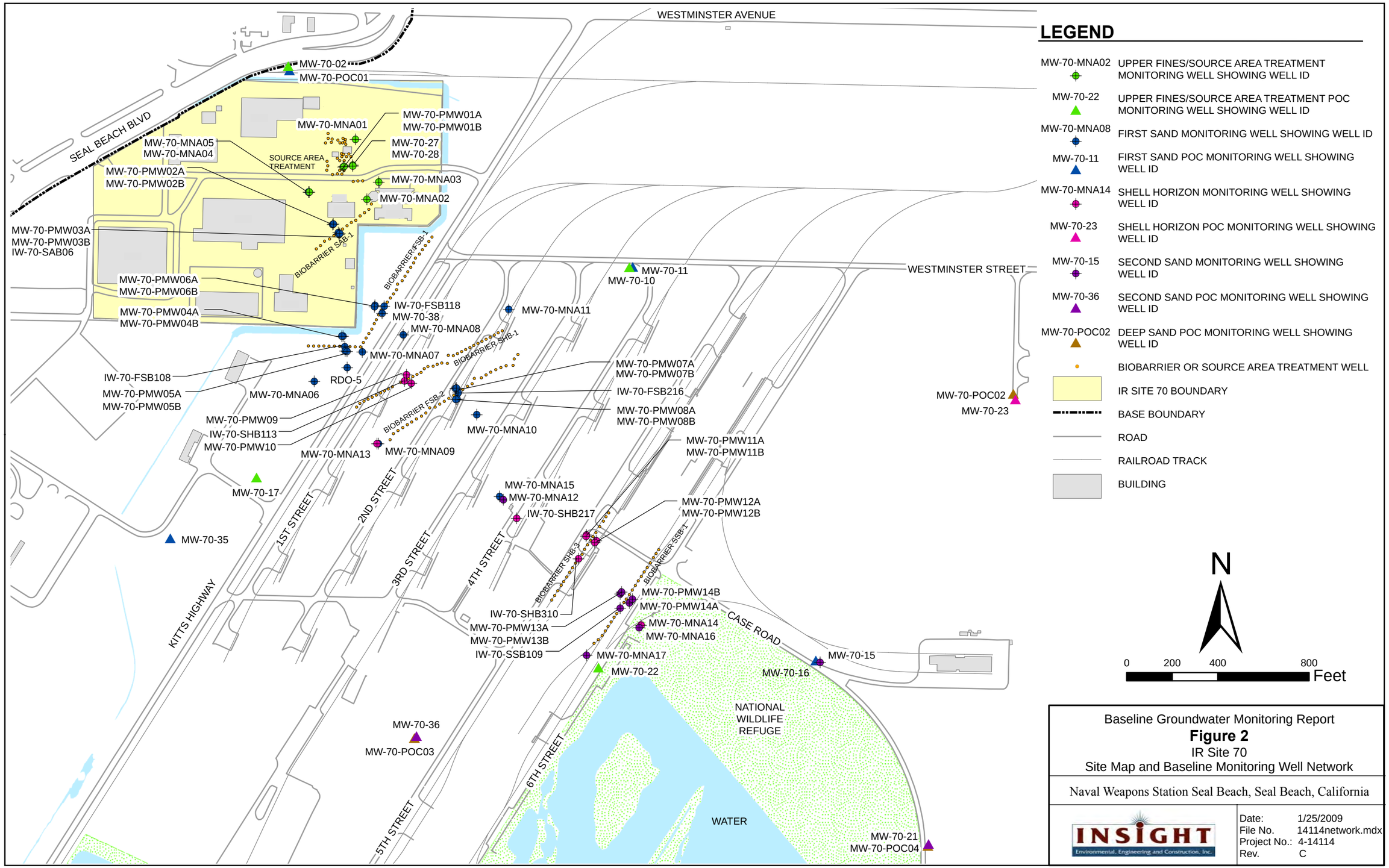
IR Site 70

Site Location Map

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT Environmental, Engineering and Construction, Inc.

Date:	12/14/2008
File No.	14114vic.mdx
Project No.:	4-14114
Rev.	A



Baseline Groundwater Monitoring Report

Figure 2

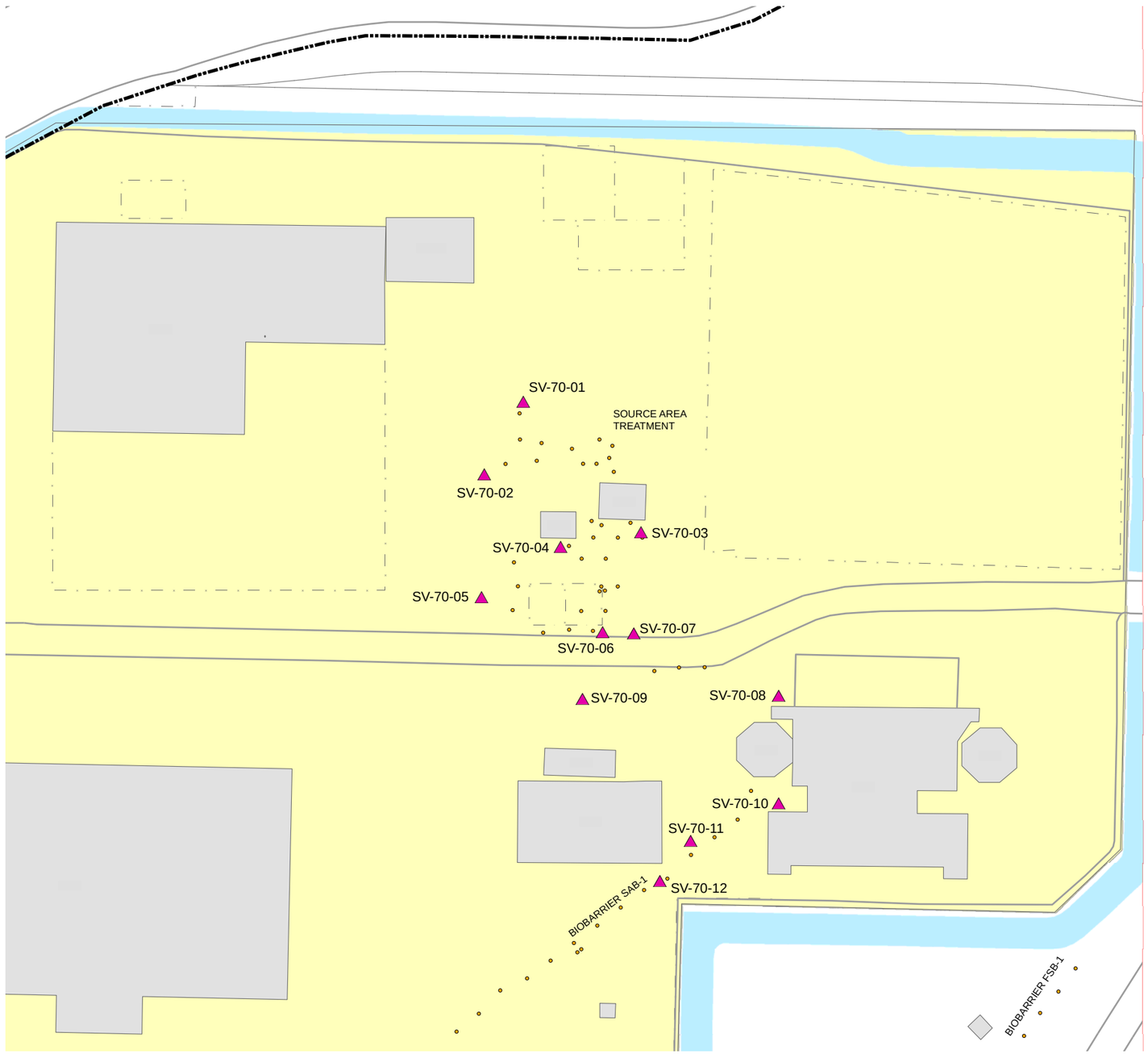
IR Site 70

Site Map and Baseline Monitoring Well Network

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT Environmental, Engineering and Construction, Inc.

Date:	1/25/2009
File No.	14114network.mdx
Project No.:	4-14114
Rev.	C



LEGEND

- SV-70-09 — SOIL VAPOR PROBE LOCATION SHOWING ID
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- FENCE
- BUILDING

N

0 50 100 200 Feet

Baseline Groundwater Monitoring Report

Figure 3

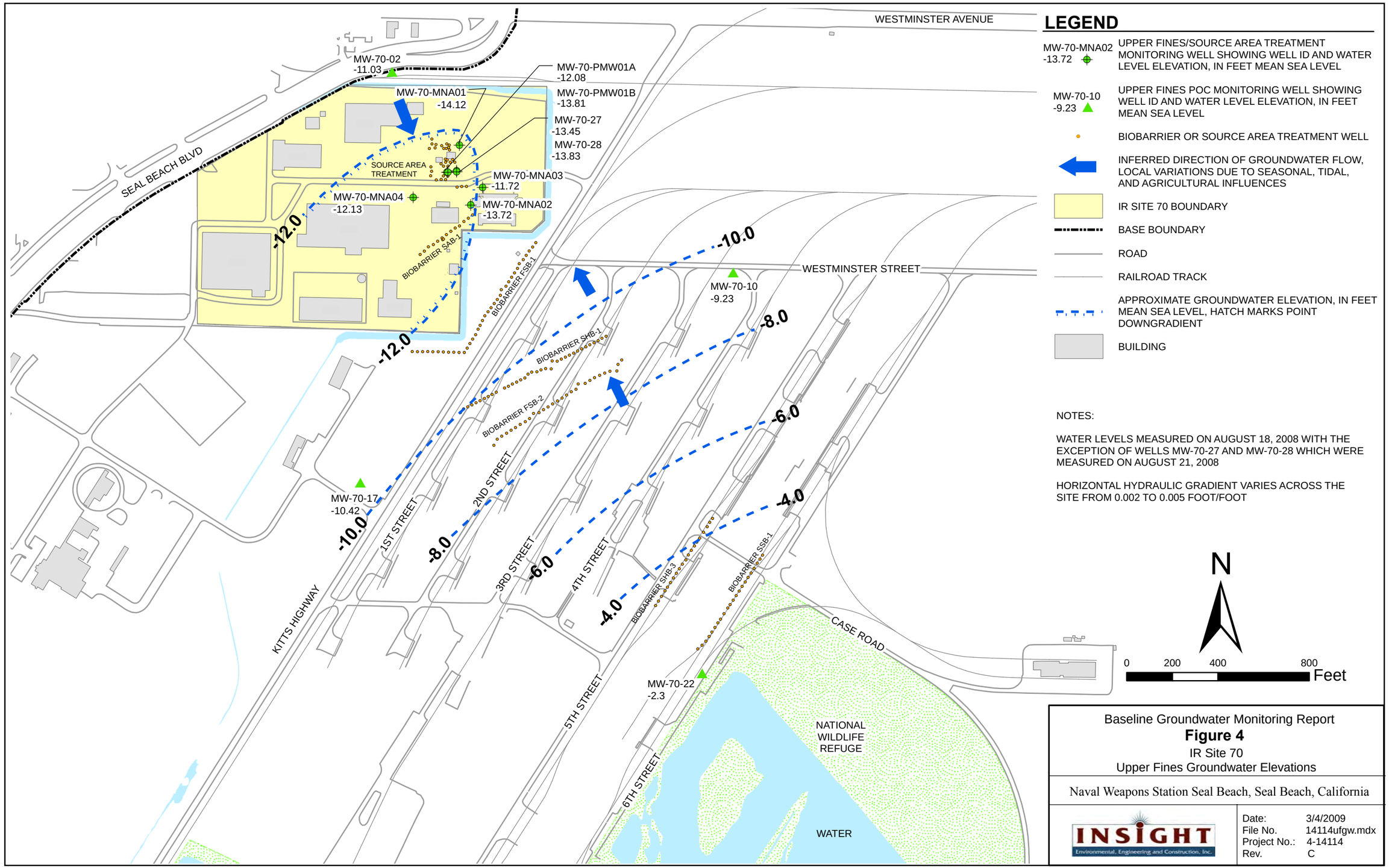
IR Site 70

Soil Vapor Location Map

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT Environmental, Engineering and Construction, Inc.

Date:	1/18/2009
File No.	14114sv.mdx
Project No.:	4-14114
Rev.	B



Baseline Groundwater Monitoring Report

Figure 4

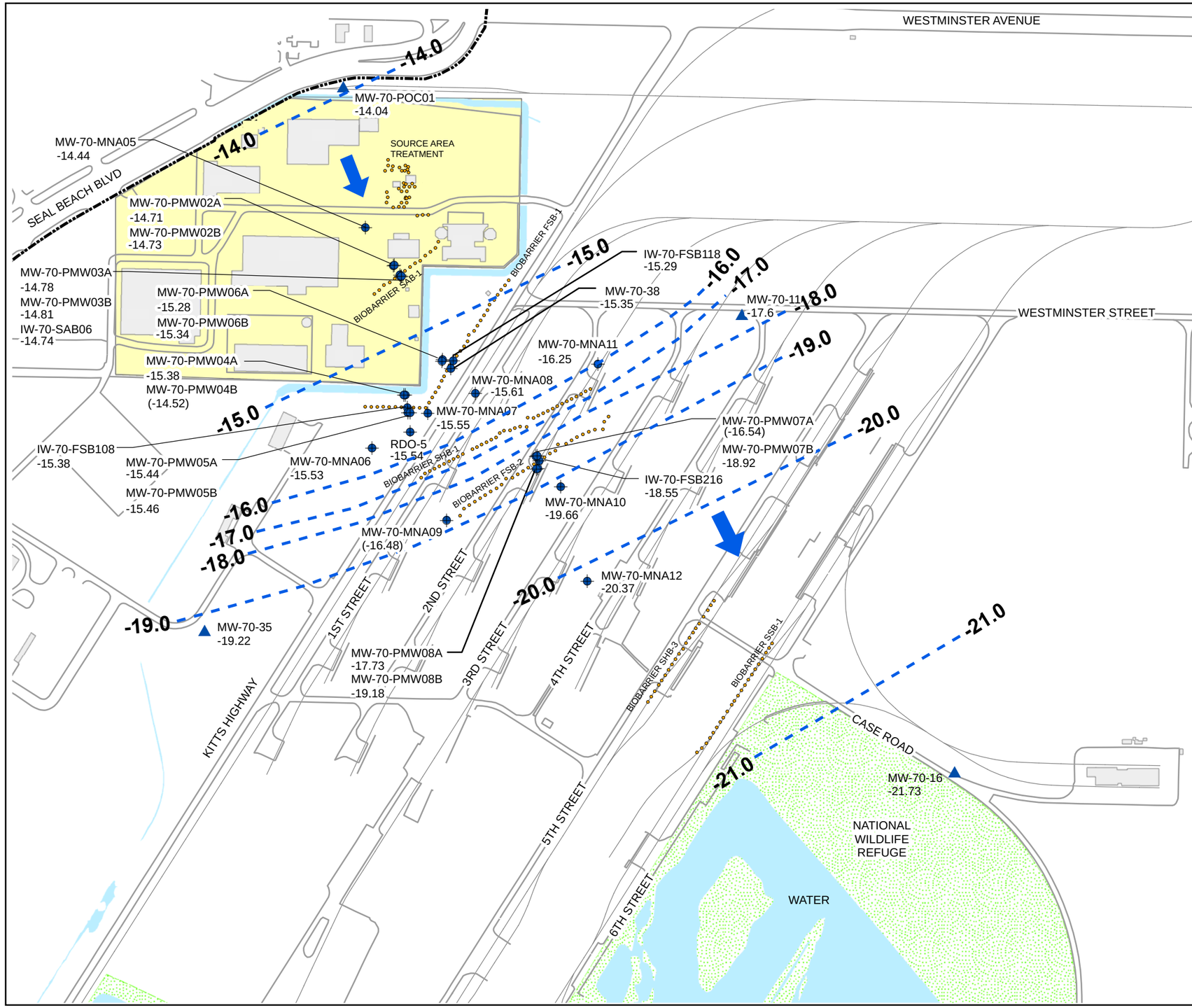
IR Site 70

Upper Fines Groundwater Elevations

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date:	3/4/2009
File No.	14114ufgw.mdx
Project No.:	4-14114
Rev.	C



LEGEND

MW-70-MNA08 -15.61	FIRST SAND MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET BGS MEAN SEA LEVEL
MW-70-16 -21.73	FIRST SAND POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET BGS MEAN SEA LEVEL
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
	INFERRED DIRECTION OF GROUNDWATER FLOW, LOCAL VARIATIONS DUE TO SEASONAL, TIDAL, AND AGRICULTURAL INFLUENCES
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL
	BUILDING

NOTES:

( ) - PARENTHESES INDICATE THAT THE GROUNDWATER ELEVATION WAS NOT INCLUDED IN CONTOUR DUE TO SCREEN INTERVAL

WATER LEVELS MEASURED ON AUGUST 18, 2008

HORIZONTAL HYDRAULIC GRADIENT VARIES ACROSS THE SITE FROM 0.0007 TO 0.009 FOOT/FOOT

N

0 200 400 800 Feet

Baseline Groundwater Monitoring Report

Figure 5

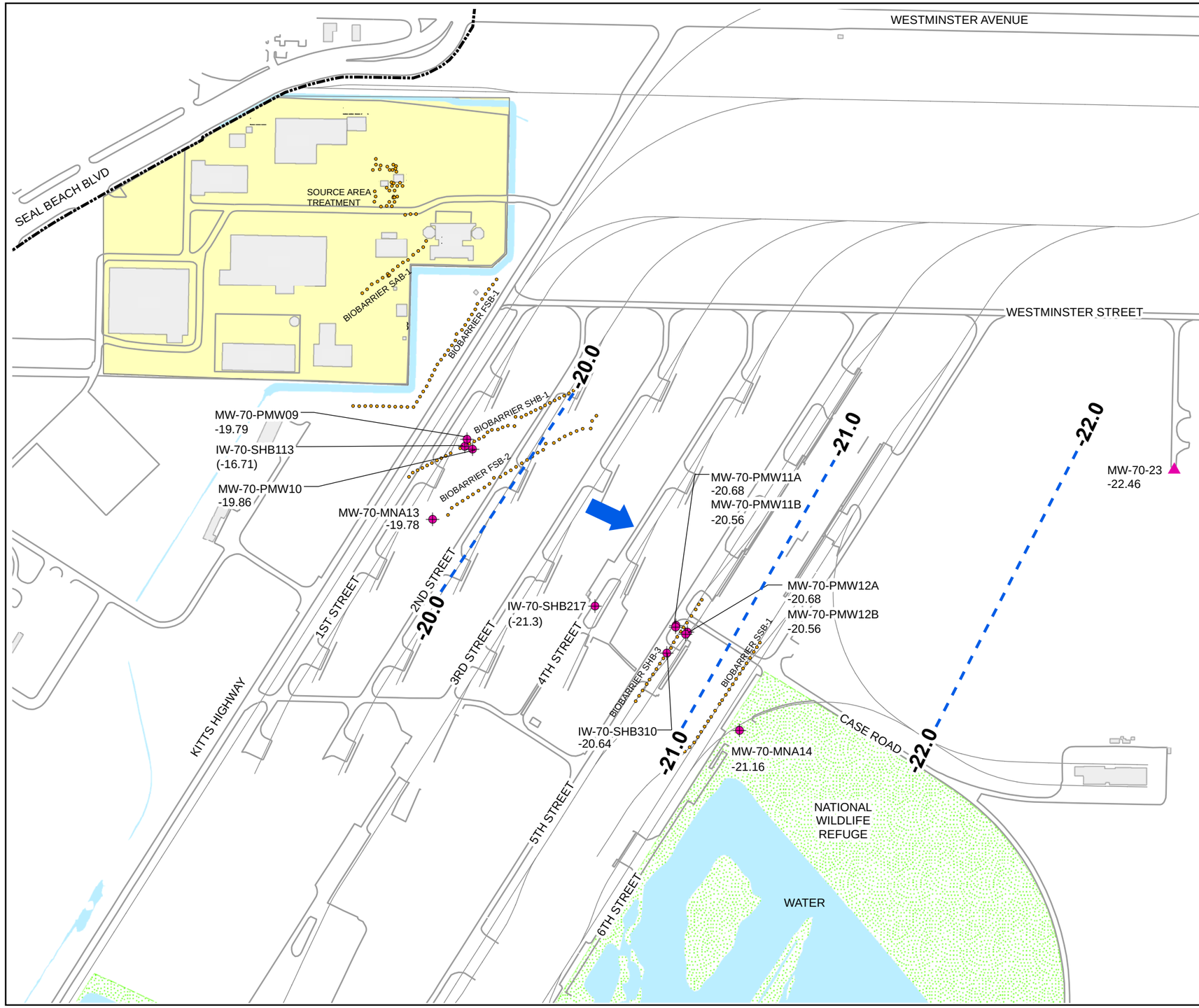
IR Site 70

First Sand Groundwater Elevations

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT Environmental, Engineering and Construction, Inc.

Date:	3/4/2009
File No.	14114fsgw.mdx
Project No.:	4-14114
Rev.	C



LEGEND

MW-70-MNA14 -21.16	SHELL HORIZON MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
MW-70-23 -22.46	SHELL HORIZON POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
	INFERRED DIRECTION OF GROUNDWATER FLOW, LOCAL VARIATIONS DUE TO SEASONAL, TIDAL, AND AGRICULTURAL INFLUENCES
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL
	BUILDING

NOTES:

( ) - PARENTHESES INDICATE THAT THE GROUNDWATER ELEVATION WAS NOT INCLUDED IN CONTOUR DUE TO SCREEN INTERVAL

WATER LEVELS MEASURED ON AUGUST 18, 2008

HORIZONTAL HYDRAULIC GRADIENT ACROSS THE SITE IS APPROXIMATELY 0.001 FOOT/FOOT

N

0 200 400 800 Feet

Baseline Groundwater Monitoring Report

Figure 6

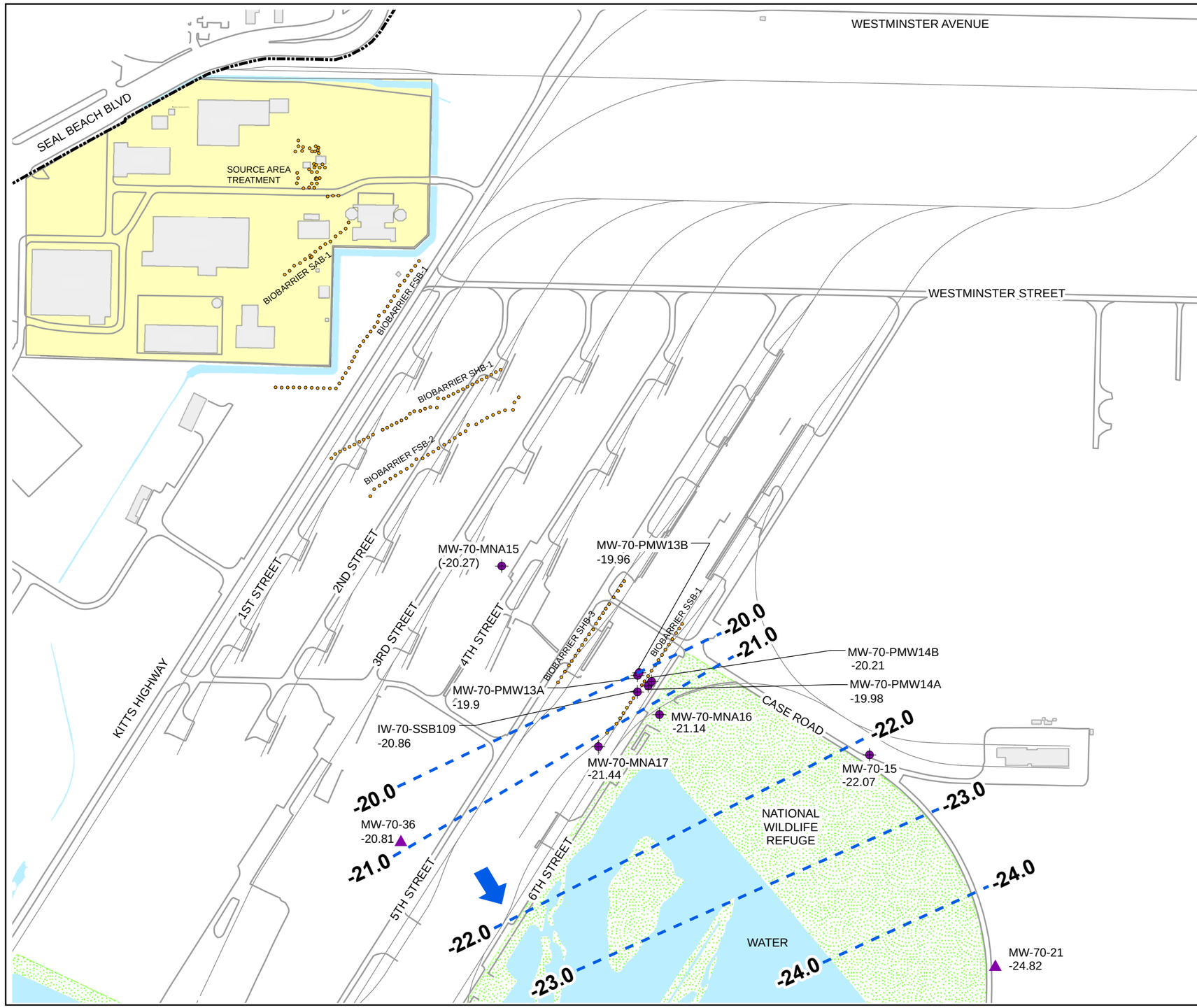
IR Site 70

Shell Horizon Groundwater Elevations

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date:	3/4/2009
File No.	14114shgw.mdx
Project No.:	4-14114
Rev.	D



LEGEND

MW-70-15 -22.07	SECOND SAND MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
MW-70-36 -20.81	SECOND SAND POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
	INFERRED DIRECTION OF GROUNDWATER FLOW, LOCAL VARIATIONS DUE TO SEASONAL, TIDAL, AND AGRICULTURAL INFLUENCES
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL
	BUILDING

NOTES:

( ) - PARENTHESES INDICATE THAT THE GRONDWATER ELEVATION WAS NOT INCLUDED IN CONTOUR DUE TO SCREEN INTERVAL

WATER LEVELS MEASURED ON AUGUST 18, 2008

HORIZONTAL HYDRAULIC GRADIENT ACROSS THE SITE IS APPROXIMATELY 0.001 FOOT/FOOT

N

0 200 400 800 Feet

Baseline Groundwater Monitoring Report

Figure 7

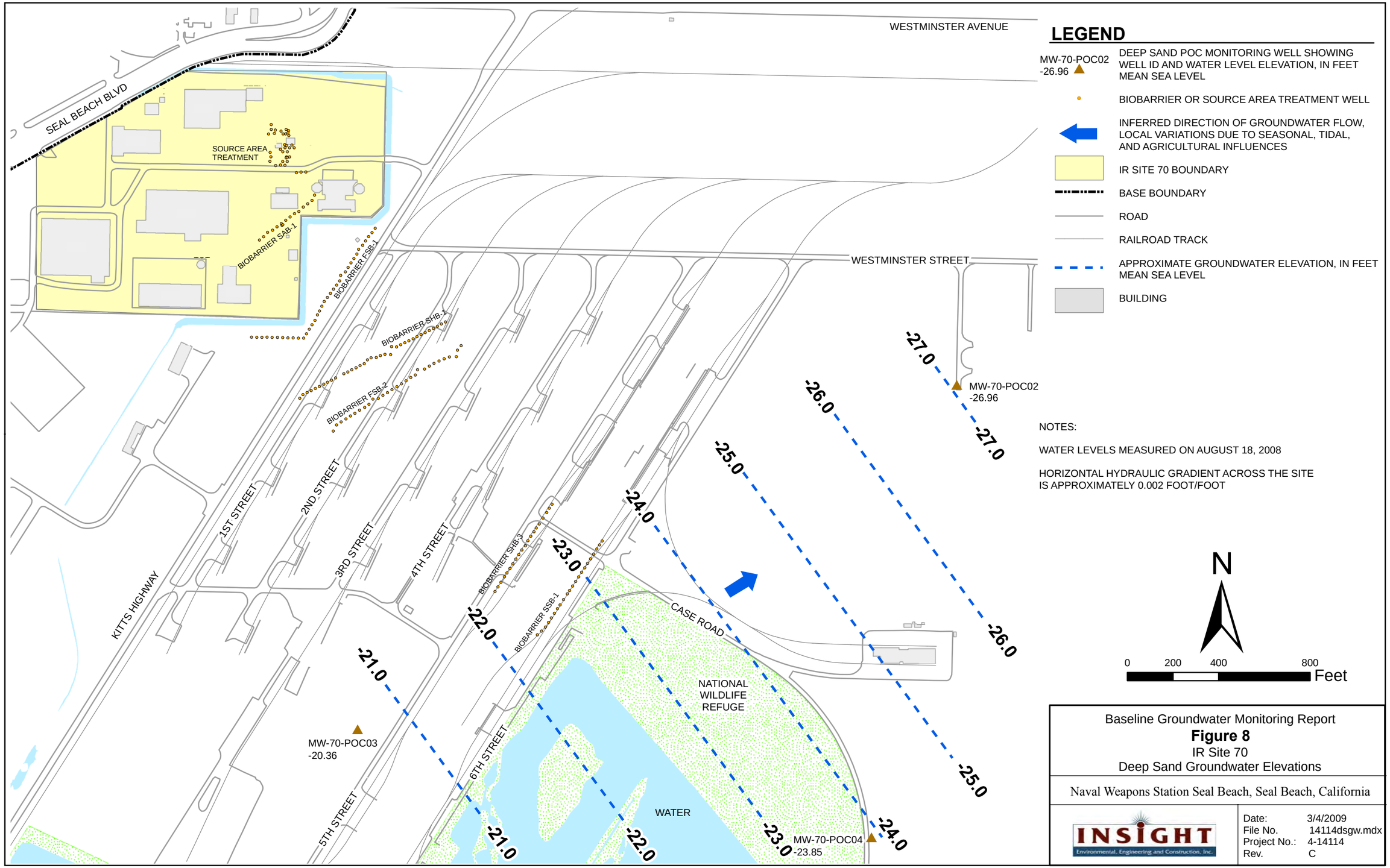
IR Site 70

Second Sand Groundwater Elevations

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT Environmental, Engineering and Construction, Inc.

Date: 3/4/2009
File No. 14114ssgw.mdx
Project No.: 4-14114
Rev. D



Baseline Groundwater Monitoring Report

Figure 8

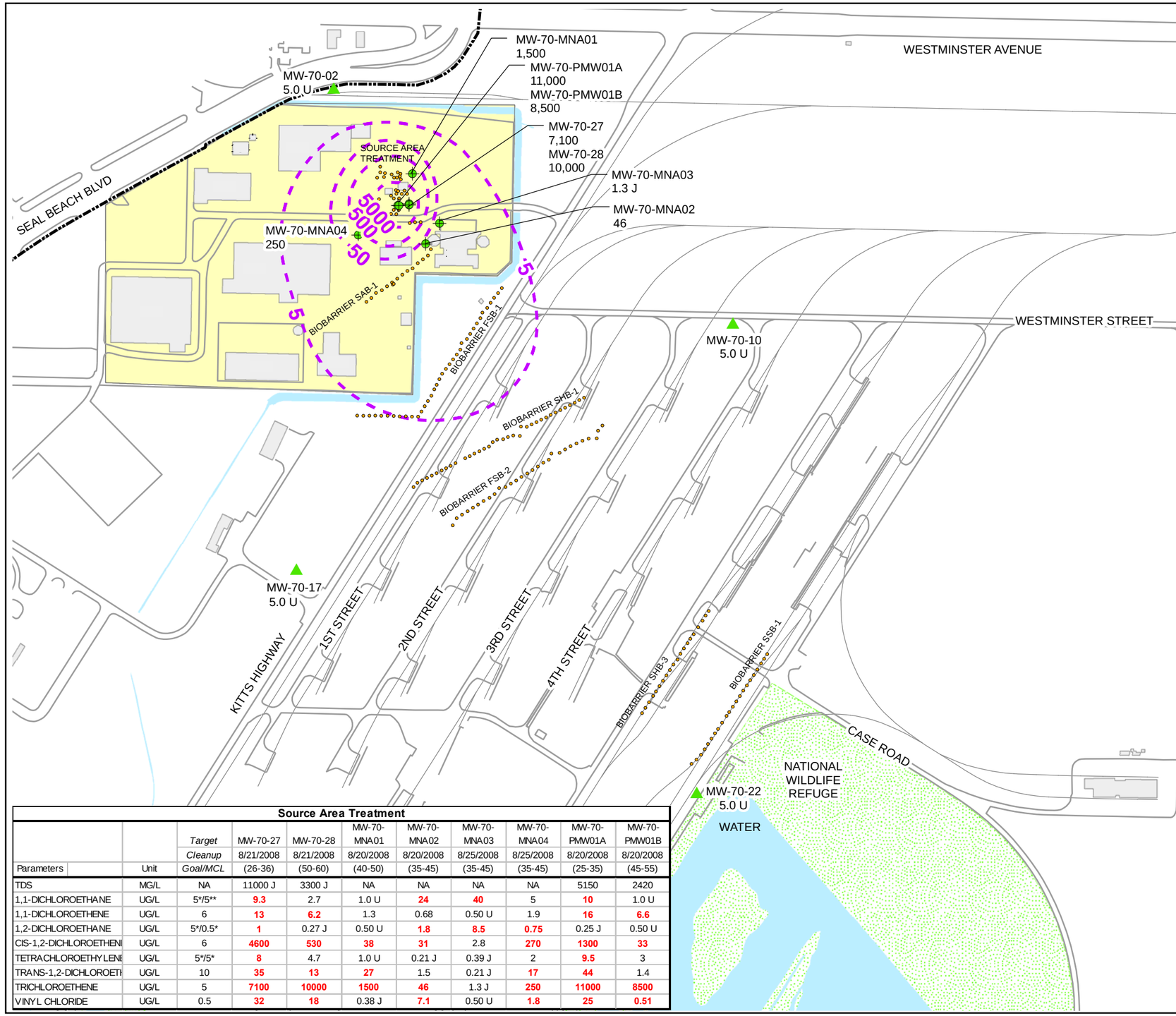
IR Site 70

Deep Sand Groundwater Elevations

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT Environmental, Engineering and Construction, Inc.

Date: 3/4/2009
File No. 14114dsgw.mdx
Project No.: 4-14114
Rev. C



LEGEND

MW-70-MNA02 46	UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L
MW-70-02 5.0 U	UPPER FINES POC MONITORING WELL SHOWING STATION ID AND TCE CONCENTRATION IN ug/L
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	BUILDING
5	APPROXIMATE TCE ISOCONCENTRATION CONTOUR (ug/L), DASHED WHERE INFERRED

NOTES:

ug/L - MICROGRAMS PER LITER
MCL - MAXIMUM CONTAMINANT LEVEL
mg/L - MILLIGRAMS PER LITER
NA - NOT ANALYZED
5.0 U - NOT DETECTED LESS THAN REPORTING LIMIT OF 5 ug/L
1.3 J - ESTIMATED VALUE OF 1.3 ug/L

TCE - TRICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

* - U.S. EPA MCL

** - Cal/EPA MCL

ADDITIONAL INTERPRETATION BASED ON BEI (2006) FINAL FIFTH ANNUAL GROUNDWATER MONITORING REPORT, IR SITE 40 AND 70, NAVAL WEAPONS STATION, SEAL BEACH, CA, APRIL

N

0 200 400 800 Feet

Source Area Treatment

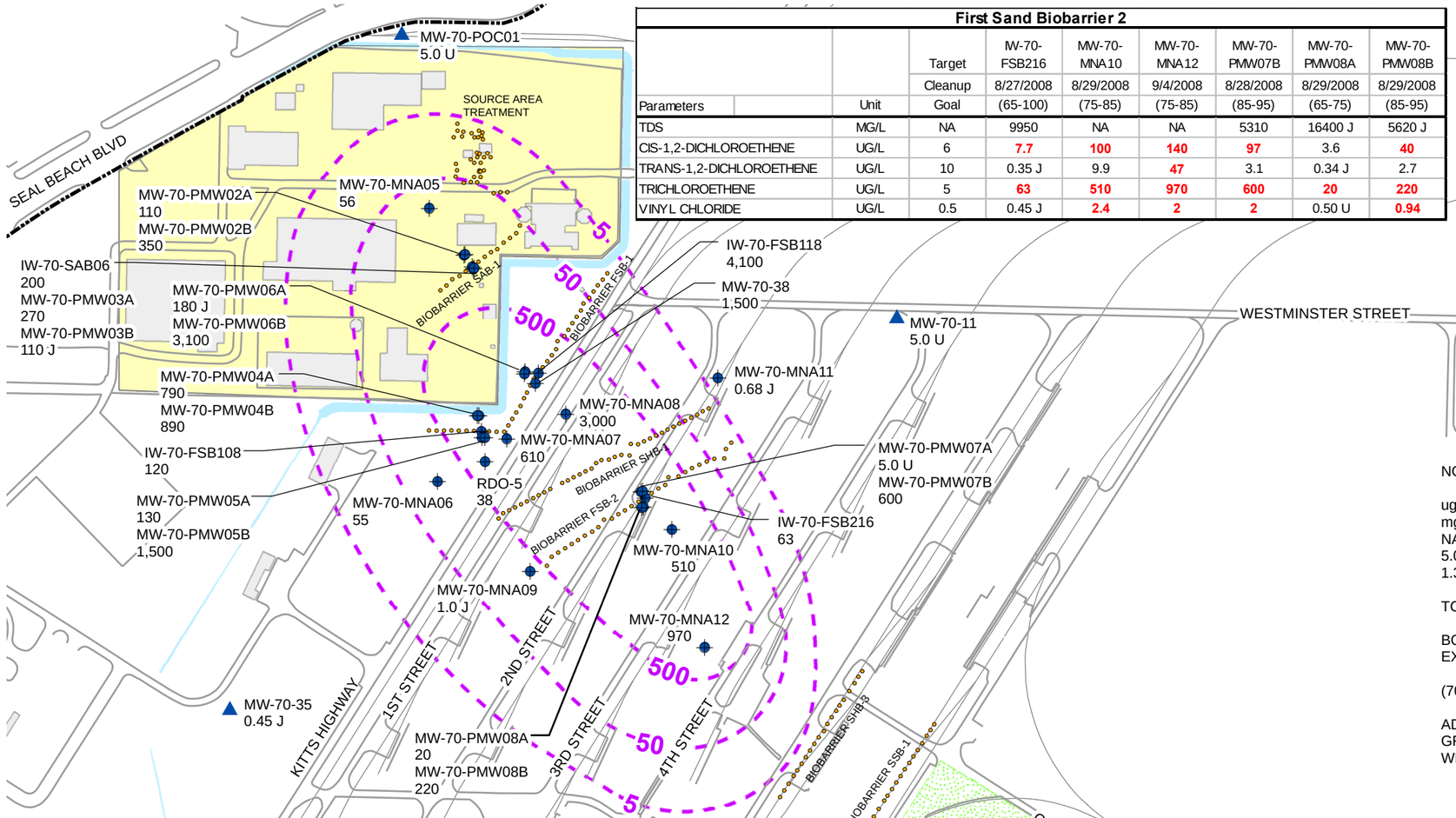
Parameters	Unit	Target Cleanup Goal/MCL	MW-70-27 8/21/2008 (26-36)	MW-70-28 8/21/2008 (50-60)	MW-70-MNA01 8/20/2008 (40-50)	MW-70-MNA02 8/20/2008 (35-45)	MW-70-MNA03 8/25/2008 (35-45)	MW-70-MNA04 8/25/2008 (35-45)	MW-70-PMW01A 8/20/2008 (25-35)	MW-70-PMW01B 8/20/2008 (45-55)
TDS	MG/L	NA	11000 J	3300 J	NA	NA	NA	NA	5150	2420
1,1-DICHLOROETHANE	UG/L	5*/5**	**9.3**	2.7	1.0 U	**24**	**40**	5	**10**	1.0 U
1,1-DICHLOROETHENE	UG/L	6	**13**	**6.2**	1.3	0.68	0.50 U	1.9	**16**	**6.6**
1,2-DICHLOROETHANE	UG/L	5*/0.5*	**1**	0.27 J	0.50 U	**1.8**	**8.5**	**0.75**	0.25 J	0.50 U
CIS-1,2-DICHLOROETHENE	UG/L	6	**4600**	**530**	**38**	**31**	2.8	**270**	**1300**	**33**
TETRACHLOROETHYLENE	UG/L	5*/5*	**8**	4.7	1.0 U	0.21 J	0.39 J	2	**9.5**	3
TRANS-1,2-DICHLOROETH	UG/L	10	**35**	**13**	**27**	1.5	0.21 J	**17**	**44**	1.4
TRICHLOROETHENE	UG/L	5	**7100**	**10000**	**1500**	**46**	1.3 J	**250**	**11000**	**8500**
VINYL CHLORIDE	UG/L	0.5	**32**	**18**	0.38 J	**7.1**	0.50 U	**1.8**	**25**	**0.51**

Baseline Groundwater Monitoring Report
Figure 9
IR Site 70
Upper Fines Groundwater Sampling Results

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 3/4/2009
File No. 14114ufcoc.mdx
Project No.: 4-14114
Rev. C



First Sand Biobarrier 2

Parameters	Unit	Target Cleanup Goal	IW-70-FSB216 8/27/2008 (65-100)	MW-70-MNA10 8/29/2008 (75-85)	MW-70-MNA12 9/4/2008 (75-85)	MW-70-PMW07B 8/28/2008 (85-95)	MW-70-PMW08A 8/29/2008 (65-75)	MW-70-PMW08B 8/29/2008 (85-95)
TDS	MG/L	NA	9950	NA	NA	5310	16400 J	5620 J
CIS-1,2-DICHLOROETHENE	UG/L	6	**7.7**	**100**	**140**	**97**	3.6	**40**
TRANS-1,2-DICHLOROETHENE	UG/L	10	0.35 J	9.9	**47**	3.1	0.34 J	2.7
TRICHLOROETHENE	UG/L	5	**63**	**510**	**970**	**600**	**20**	**220**
VINYL CHLORIDE	UG/L	0.5	0.45 J	**2.4**	**2**	**2**	0.50 U	**0.94**

LEGEND

- MW-70-MNA08 3,000 — FIRST SAND MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION (ug/L)
- MW-70-11 5.0 U — FIRST SAND POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION (ug/L)
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- BUILDING
- -5- APPROXIMATE TCE ISOCONCENTRATION CONTOUR (ug/L), DASHED WHERE INFERRED

NOTES:

ug/L - MICROGRAMS PER LITER
mg/L - MILLIGRAMS PER LITER
NA - NOT ANALYZED
5.0 U - NOT DETECTED LESS THAN REPORTING LIMIT OF 5 ug/L
1.3 J - ESTIMATED VALUE OF 1.3 ug/L

TCE - TRICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(70-80) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

ADDITIONAL INTERPRETATION BASED ON BEI (2006) FINAL FIFTH ANNUAL GROUNDWATER MONITORING REPORT, IR SITE 40 AND 70, NAVAL WEAPONS STATION, SEAL BEACH, CA, APRIL

N

0 200 400 800 Feet

Source Area Biobarrier / First Sand

Parameters	Unit	Target Cleanup Goal	IW-70-SAB06 8/25/2008 (65-80/85-105)	MW-70-MNA05 8/25/2008 (70-80)	MW-70-PMW02A 8/21/2008 (71-81)	MW-70-PMW02B 8/21/2008 (90-100)	MW-70-PMW03A 8/21/2008 (70-80)	MW-70-PMW03B 8/21/2008 (90-100)
TDS	MG/L	NA	995	NA	1010 J	1110 J	1210 J	1130 J
CIS-1,2-DICHLOROETHENE	UG/L	6	**11**	2.7	**97**	**170**	**9.2**	**190**
TRICHLOROETHENE	UG/L	5	**200**	**56**	**110**	**350**	**270**	**110 J**
VINYL CHLORIDE	UG/L	0.5	0.39 J	0.50 U	0.30 J	**0.68**	0.47 J	**0.56**

First Sand Biobarrier 1

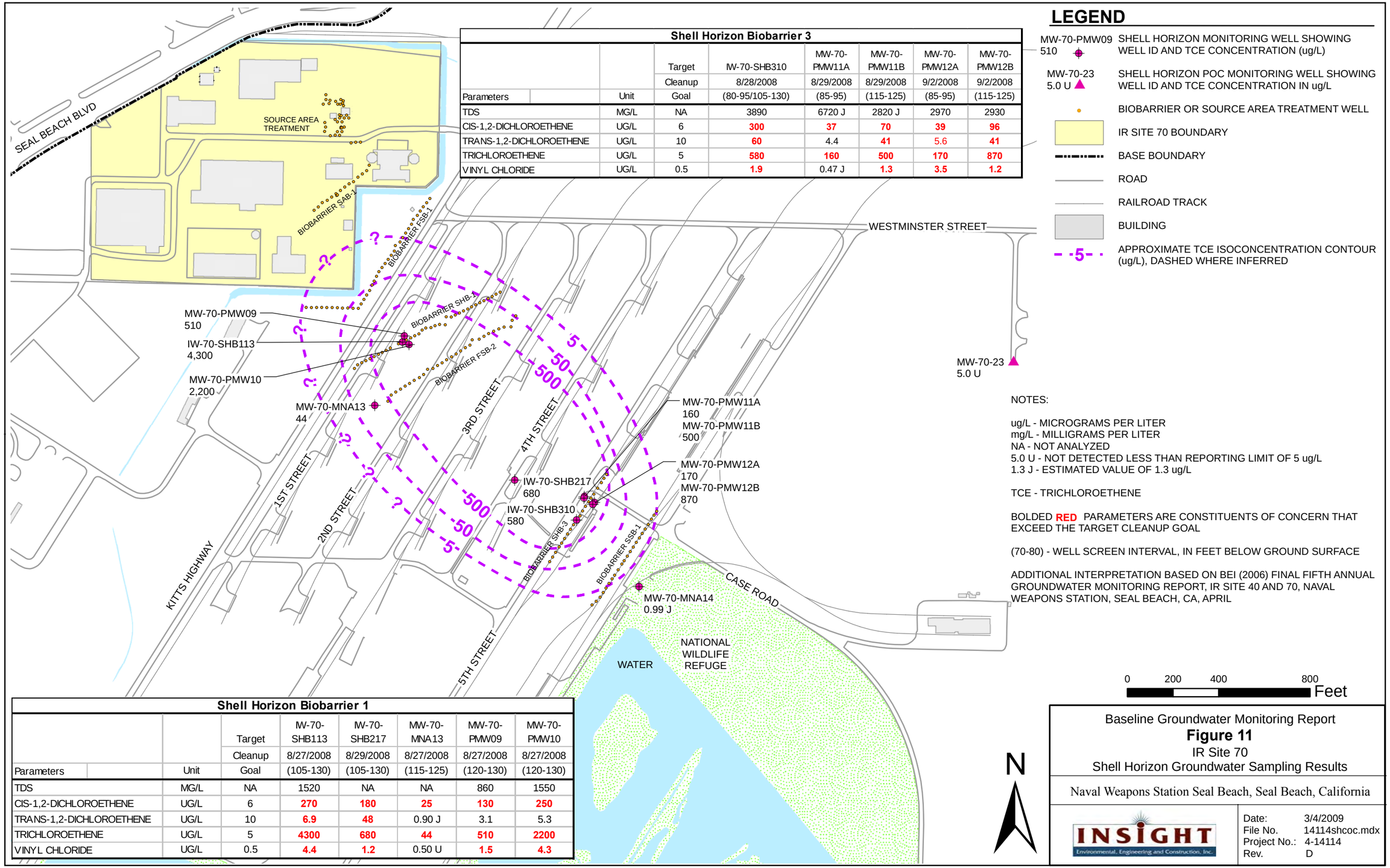
Parameters	Unit	Target Cleanup Goal	IW-70-FSB108 8/25/2008 (60-105)	IW-70-FSB118 8/26/2008 (60-105)	MW-70-38 8/25/2008 (80-100)	MW-70-MNA06 8/26/2008 (80-90)	MW-70-MNA07 8/22/2008 (90-100)	MW-70-MNA08 8/27/2008 (80-90)	MW-70-PMW04A 8/22/2008 (70-80)	MW-70-PMW04B 8/22/2008 (90-100)	MW-70-PMW05A 8/22/2008 (70-80)	MW-70-PMW05B 8/22/2008 (90-100)	MW-70-PMW06A 8/22/2008 (70-80)	MW-70-PMW06B 8/22/2008 (91-101)	RDO-5 8/25/2008 (65-105)
TDS	MG/L	NA	530	1740	1500	NA	NA	NA	680	850	685	620	1500	1000	NA
1,1-DICHLOROETHENE	UG/L	6	0.39 J	**6.2**	**7.5**	0.59	1.1	3.8	3.4	4.8	0.48 J	**7.3**	**10**	4.6	0.22 J
CIS-1,2-DICHLOROETHENE	UG/L	6	**10**	**540**	**1900**	9.9	**70**	**390**	**49**	**340**	**18**	**93**	**2500**	**130**	4.2
TRANS-1,2-DICHLOROETHENE	UG/L	10	0.22 J	8.7	**29**	0.25 J	1.5	7.9	0.85 J	5	0.65 J	1.3	**21**	**15**	0.23 J
TRICHLOROETHENE	UG/L	5	**120**	**4100**	**1500**	**55**	**610**	**3000**	**790**	**890**	**130**	**1500**	**180 J**	**3100**	**38**
VINYL CHLORIDE	UG/L	0.5	0.50 U	**5.1**	**3.7**	0.50 U	**0.51**	**5.6**	0.34 J	0.47 J	0.50 U	**0.56**	**3.4**	**4.1**	0.50 U

Baseline Groundwater Monitoring Report
Figure 10
IR Site 70
First Sand Groundwater Sampling Results

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT Environmental, Engineering and Construction, Inc.

Date: 1/17/2009
File No. 14114fscoc.mdx
Project No.: 4-14114
Rev. B



LEGEND

MW-70-PMW09 510 — SHELL HORIZON MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION (ug/L)

MW-70-23 5.0 U — SHELL HORIZON POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION IN ug/L

BIOBARRIER OR SOURCE AREA TREATMENT WELL

IR SITE 70 BOUNDARY

BASE BOUNDARY

ROAD

RAILROAD TRACK

BUILDING

5 — APPROXIMATE TCE ISOCONCENTRATION CONTOUR (ug/L), DASHED WHERE INFERRED

Shell Horizon Biobarrier 3

Parameters	Unit	Target Cleanup Goal	IW-70-SHB310 8/28/2008 (80-95/105-130)	MW-70-PMW11A 8/29/2008 (85-95)	MW-70-PMW11B 8/29/2008 (115-125)	MW-70-PMW12A 9/2/2008 (85-95)	MW-70-PMW12B 9/2/2008 (115-125)
TDS	MG/L	NA	3890	6720 J	2820 J	2970	2930
CIS-1,2-DICHLOROETHENE	UG/L	6	**300**	**37**	**70**	**39**	**96**
TRANS-1,2-DICHLOROETHENE	UG/L	10	**60**	4.4	**41**	5.6	**41**
TRICHLOROETHENE	UG/L	5	**580**	**160**	**500**	**170**	**870**
VINYL CHLORIDE	UG/L	0.5	**1.9**	0.47 J	**1.3**	**3.5**	**1.2**

Shell Horizon Biobarrier 1

Parameters	Unit	Target Cleanup Goal	IW-70-SHB113 8/27/2008 (105-130)	IW-70-SHB217 8/29/2008 (105-130)	MW-70-MNA13 8/27/2008 (115-125)	MW-70-PMW09 8/27/2008 (120-130)	MW-70-PMW10 8/27/2008 (120-130)
TDS	MG/L	NA	1520	NA	NA	860	1550
CIS-1,2-DICHLOROETHENE	UG/L	6	**270**	**180**	**25**	**130**	**250**
TRANS-1,2-DICHLOROETHENE	UG/L	10	**6.9**	**48**	0.90 J	3.1	5.3
TRICHLOROETHENE	UG/L	5	**4300**	**680**	**44**	**510**	**2200**
VINYL CHLORIDE	UG/L	0.5	**4.4**	**1.2**	0.50 U	**1.5**	**4.3**

NOTES:

ug/L - MICROGRAMS PER LITER
mg/L - MILLIGRAMS PER LITER
NA - NOT ANALYZED
5.0 U - NOT DETECTED LESS THAN REPORTING LIMIT OF 5 ug/L
1.3 J - ESTIMATED VALUE OF 1.3 ug/L

TCE - TRICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(70-80) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

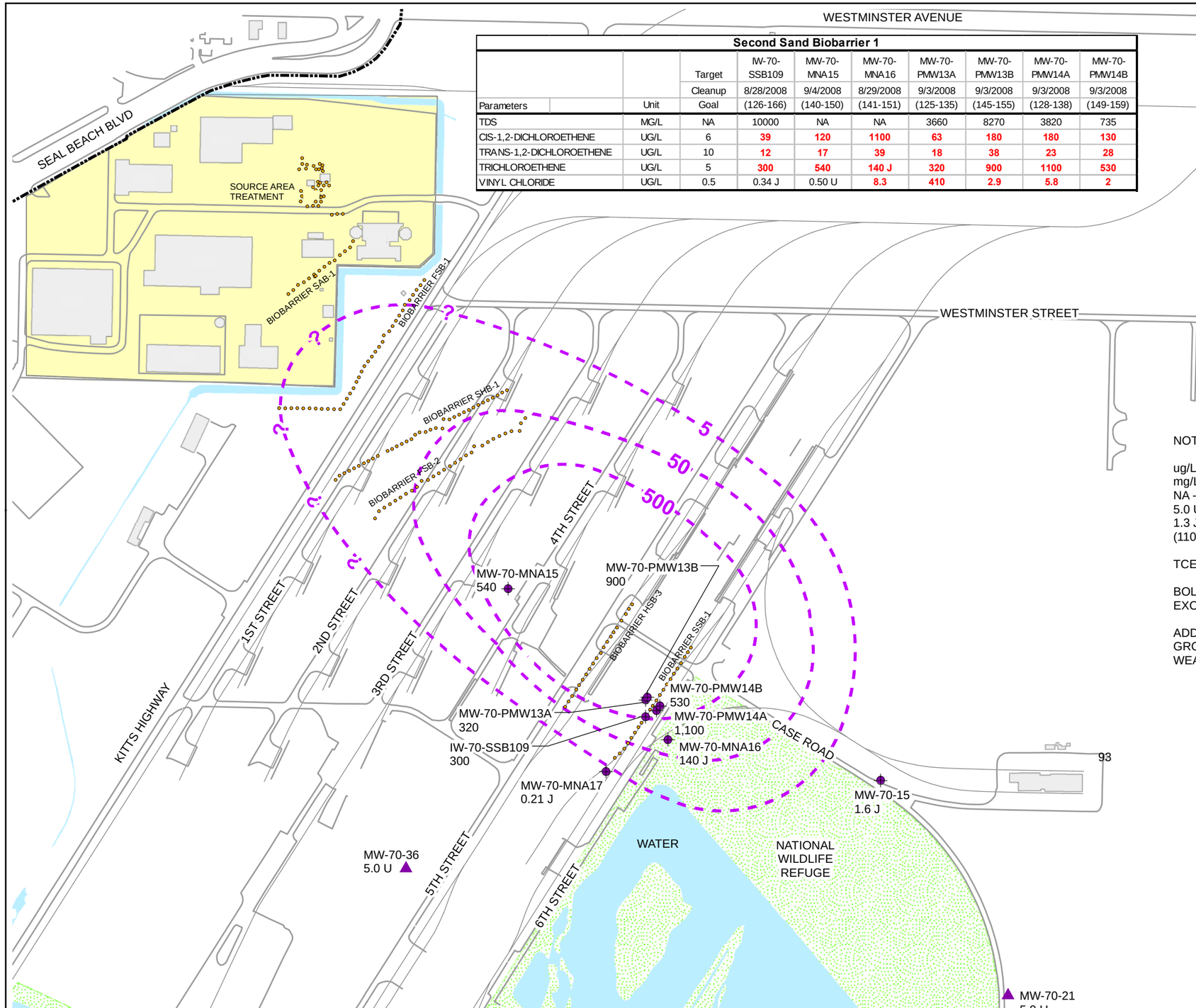
ADDITIONAL INTERPRETATION BASED ON BEI (2006) FINAL FIFTH ANNUAL GROUNDWATER MONITORING REPORT, IR SITE 40 AND 70, NAVAL WEAPONS STATION, SEAL BEACH, CA, APRIL

Baseline Groundwater Monitoring Report
Figure 11
IR Site 70
Shell Horizon Groundwater Sampling Results

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT Environmental, Engineering and Construction, Inc.

Date: 3/4/2009
File No. 14114shcoc.mdx
Project No.: 4-14114
Rev. D



Second Sand Biobarrier 1

Parameters	Unit	Target Cleanup Goal	IW-70-SSB109 8/28/2008 (126-166)	MW-70-MNA15 9/4/2008 (140-150)	MW-70-MNA16 8/29/2008 (141-151)	MW-70-PMW13A 9/3/2008 (125-135)	MW-70-PMW13B 9/3/2008 (145-155)	MW-70-PMW14A 9/3/2008 (128-138)	MW-70-PMW14B 9/3/2008 (149-159)
TDS	MG/L	NA	10000	NA	NA	3660	8270	3820	735
CIS-1,2-DICHLOROETHENE	UG/L	6	**39**	**120**	**1100**	**63**	**180**	**180**	**130**
TRANS-1,2-DICHLOROETHENE	UG/L	10	**12**	**17**	**39**	**18**	**38**	**23**	**28**
TRICHLOROETHENE	UG/L	5	**300**	**540**	**140 J**	**320**	**900**	**1100**	**530**
VINYL CHLORIDE	UG/L	0.5	0.34 J	0.50 U	**8.3**	**410**	**2.9**	**5.8**	**2**

LEGEND

MW-70-MNA15 500 — SECOND SAND MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION (ug/L)

MW-70-36 5.0 U — SECOND SAND POC MONITORING WELL SHOWING WELL ID AND TCE CONCENTRATION (ug/L)

BIOBARRIER OR SOURCE AREA TREATMENT WELL

IR SITE 70 BOUNDARY

BASE BOUNDARY

ROAD

RAILROAD TRACK

BUILDING

-5- APPROXIMATE TCE ISOCONCENTRATION CONTOUR (ug/L), DASHED WHERE INFERRED

NOTES:

ug/L - MICROGRAMS PER LITER
mg/L - MILLIGRAMS PER LITER
NA - NOT ANALYZED
5.0 U - NOT DETECTED LESS THAN REPORTING LIMIT OF 5 ug/L
1.3 J - ESTIMATED VALUE OF 1.3 ug/L
(110 - 170) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

TCE - TRICHLOROETHENE

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

ADDITIONAL INTERPRETATION BASED ON BEI (2006) FINAL FIFTH ANNUAL GROUNDWATER MONITORING REPORT, IR SITE 40 AND 70, NAVAL WEAPONS STATION, SEAL BEACH, CA, APRIL

N

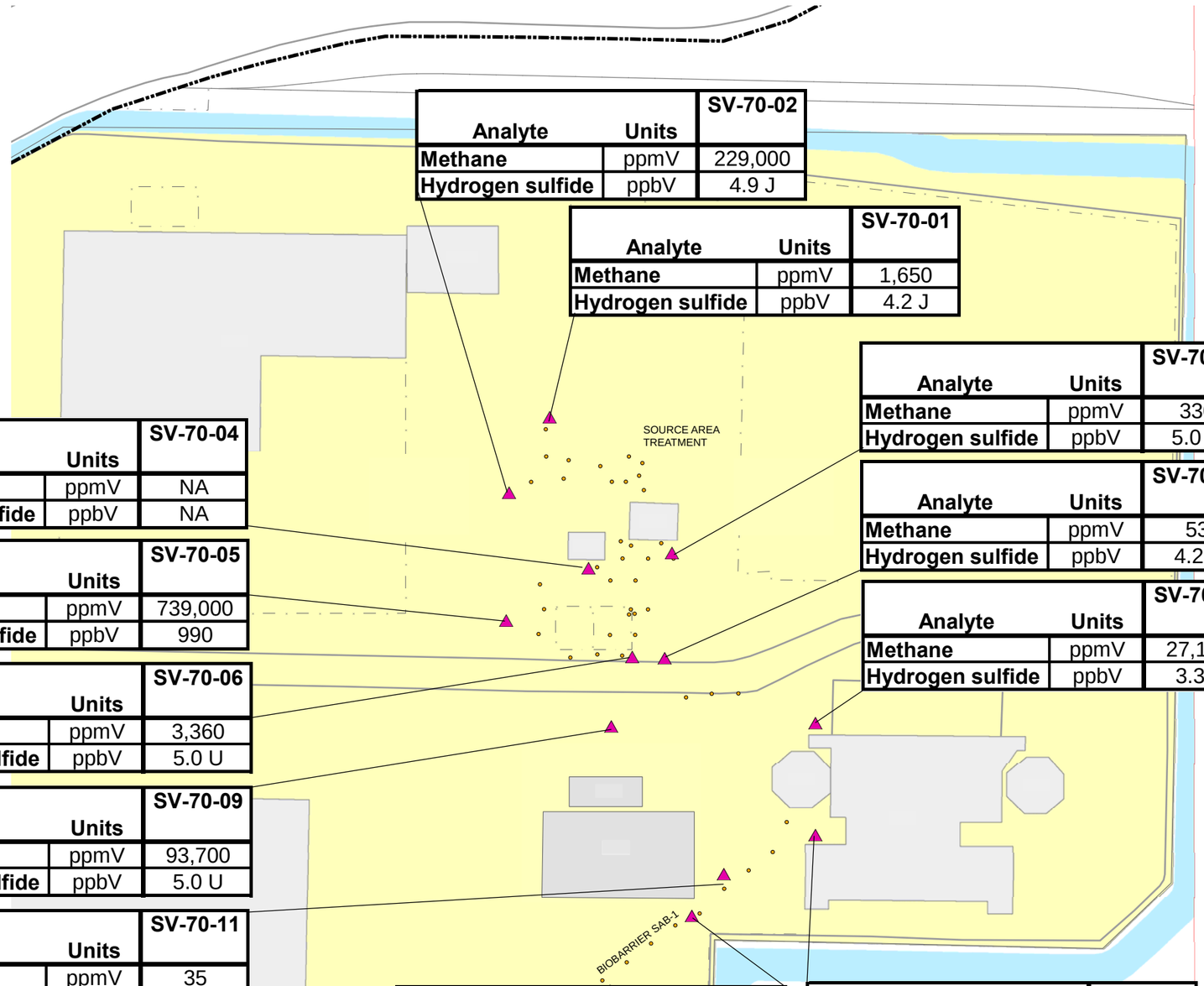
0 200 400 800 Feet

Baseline Groundwater Monitoring Report
Figure 12
IR Site 70
Second Sand Groundwater Sampling Results

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT Environmental, Engineering and Construction, Inc.

Date: 1/25/2009
File No. 14114sscoc.mdx
Project No.: 4-14114
Rev. C



Analyte	Units	SV-70-02
Methane	ppmV	229,000
Hydrogen sulfide	ppbV	4.9 J

Analyte	Units	SV-70-01
Methane	ppmV	1,650
Hydrogen sulfide	ppbV	4.2 J

Analyte	Units	SV-70-03
Methane	ppmV	330
Hydrogen sulfide	ppbV	5.0 U

Analyte	Units	SV-70-04
Methane	ppmV	NA
Hydrogen sulfide	ppbV	NA

Analyte	Units	SV-70-07
Methane	ppmV	53
Hydrogen sulfide	ppbV	4.2 J

Analyte	Units	SV-70-05
Methane	ppmV	739,000
Hydrogen sulfide	ppbV	990

Analyte	Units	SV-70-08
Methane	ppmV	27,100
Hydrogen sulfide	ppbV	3.3 J

Analyte	Units	SV-70-06
Methane	ppmV	3,360
Hydrogen sulfide	ppbV	5.0 U

Analyte	Units	SV-70-09
Methane	ppmV	93,700
Hydrogen sulfide	ppbV	5.0 U

Analyte	Units	SV-70-11
Methane	ppmV	35
Hydrogen sulfide	ppbV	3.6 J

Analyte	Units	SV-70-12
Methane	ppmV	610
Hydrogen sulfide	ppbV	5.0 U

Analyte	Units	SV-70-10
Methane	ppmV	3,600
Hydrogen sulfide	ppbV	4.4 J

LEGEND

- SOIL VAPOR PROBE LOCATION
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- FENCE
- BUILDING

NOTES:

SOIL VAPOR SAMPLES WERE COLLECTED ON AUGUST 26, 2008

NA - NOT APPLICABLE; SAMPLE WAS NOT COLLECTED DUE TO THE PRESENCE OF WATER IN SAMPLE TUBING

ppmV - PARTS PER MILLION BY VOLUME

ppbV - PARTS PER BILLION BY VOLUME

J - ESTIMATED VALUE

U - NOT DETECTED

N

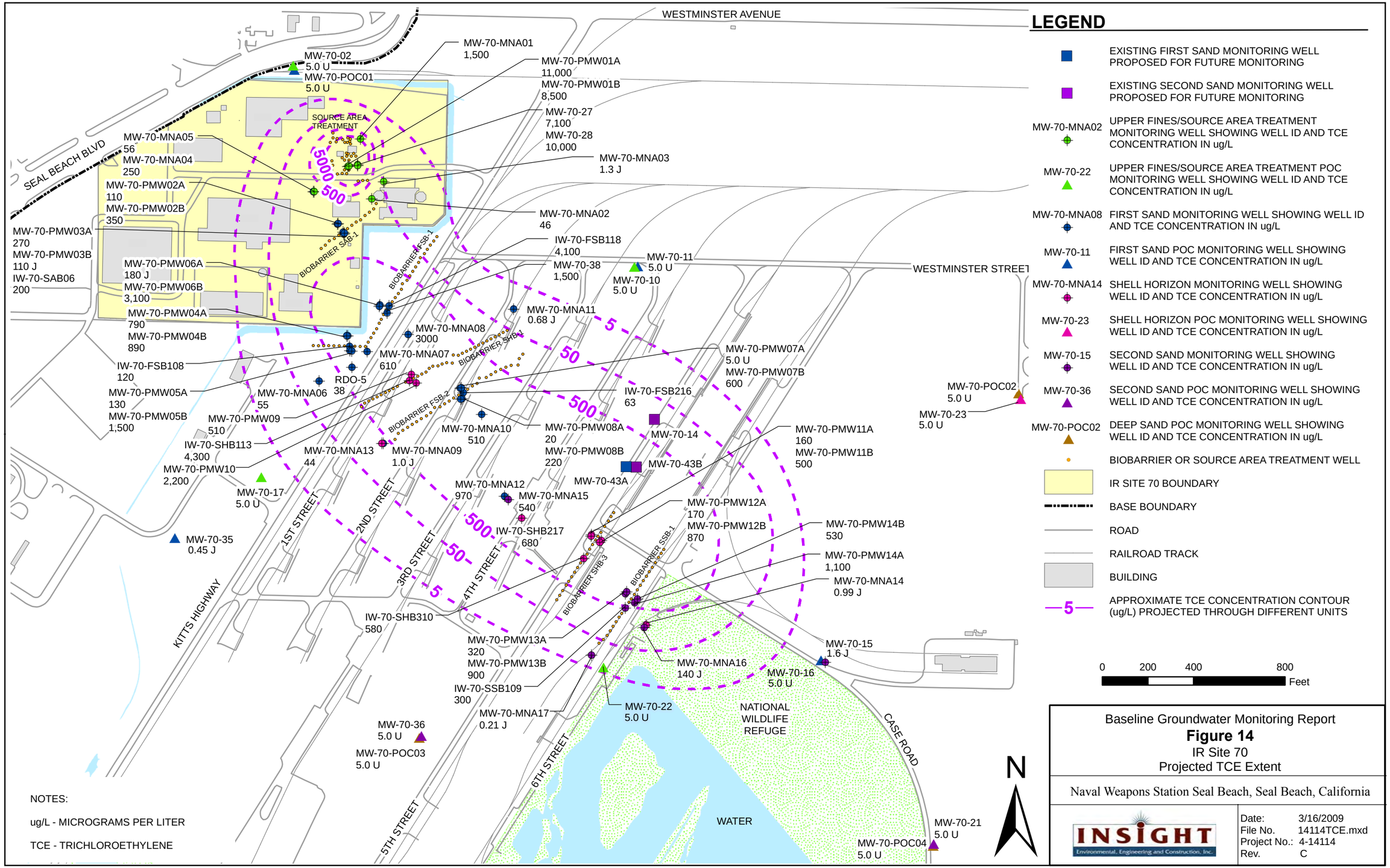
0 50 100 200 Feet

Baseline Groundwater Monitoring Report
Figure 13
IR Site 70
Soil Vapor Analytical Results

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT Environmental, Engineering and Construction, Inc.

Date: 1/18/2009
File No. 14114svbox.mdx
Project No.: 4-14114
Rev. B



Baseline Groundwater Monitoring Report

Figure 14

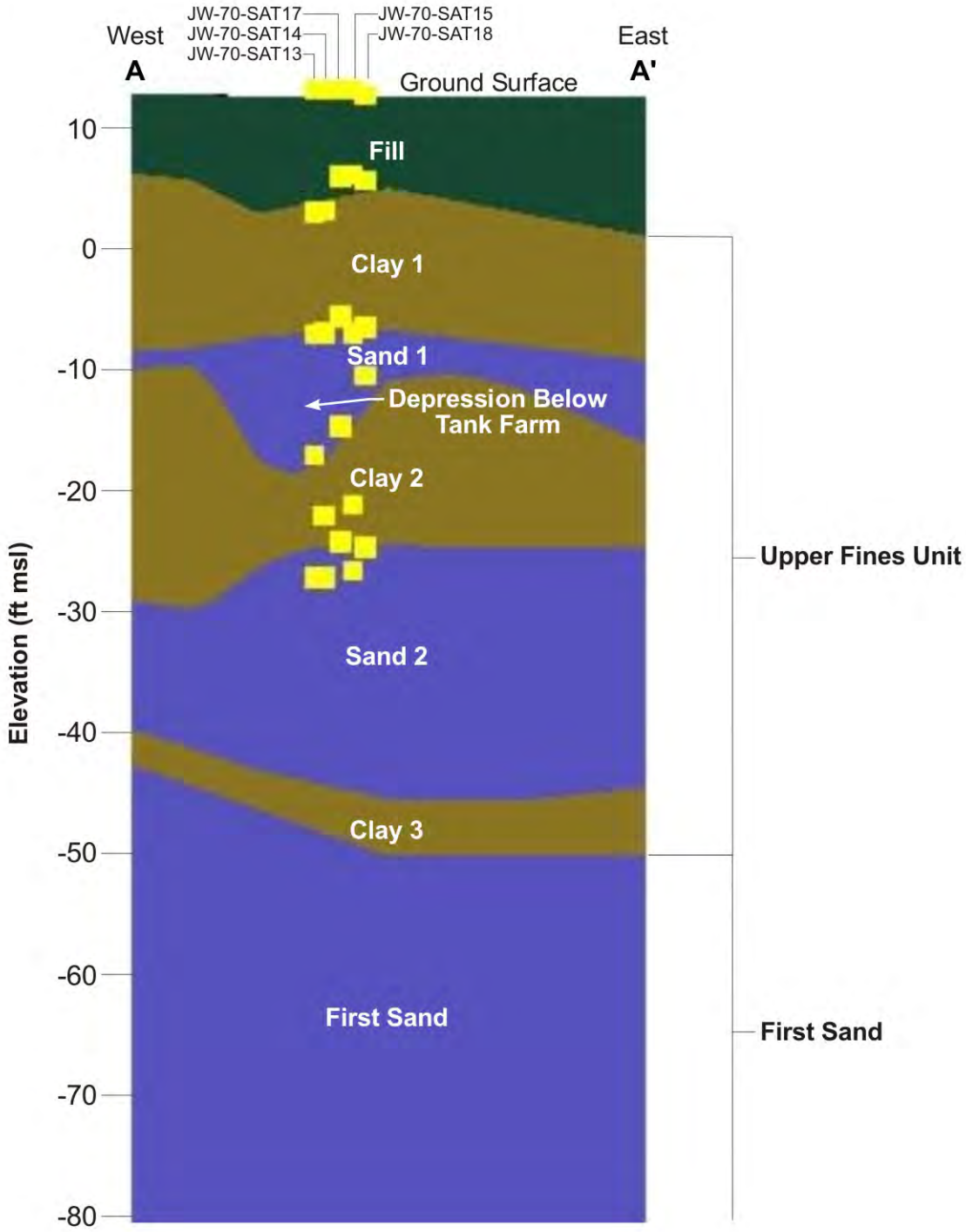
IR Site 70

Projected TCE Extent

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT Environmental, Engineering and Construction, Inc.

Date: 3/16/2009
File No. 14114TCE.mxd
Project No.: 4-14114
Rev. C



LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 100 200 300 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 15

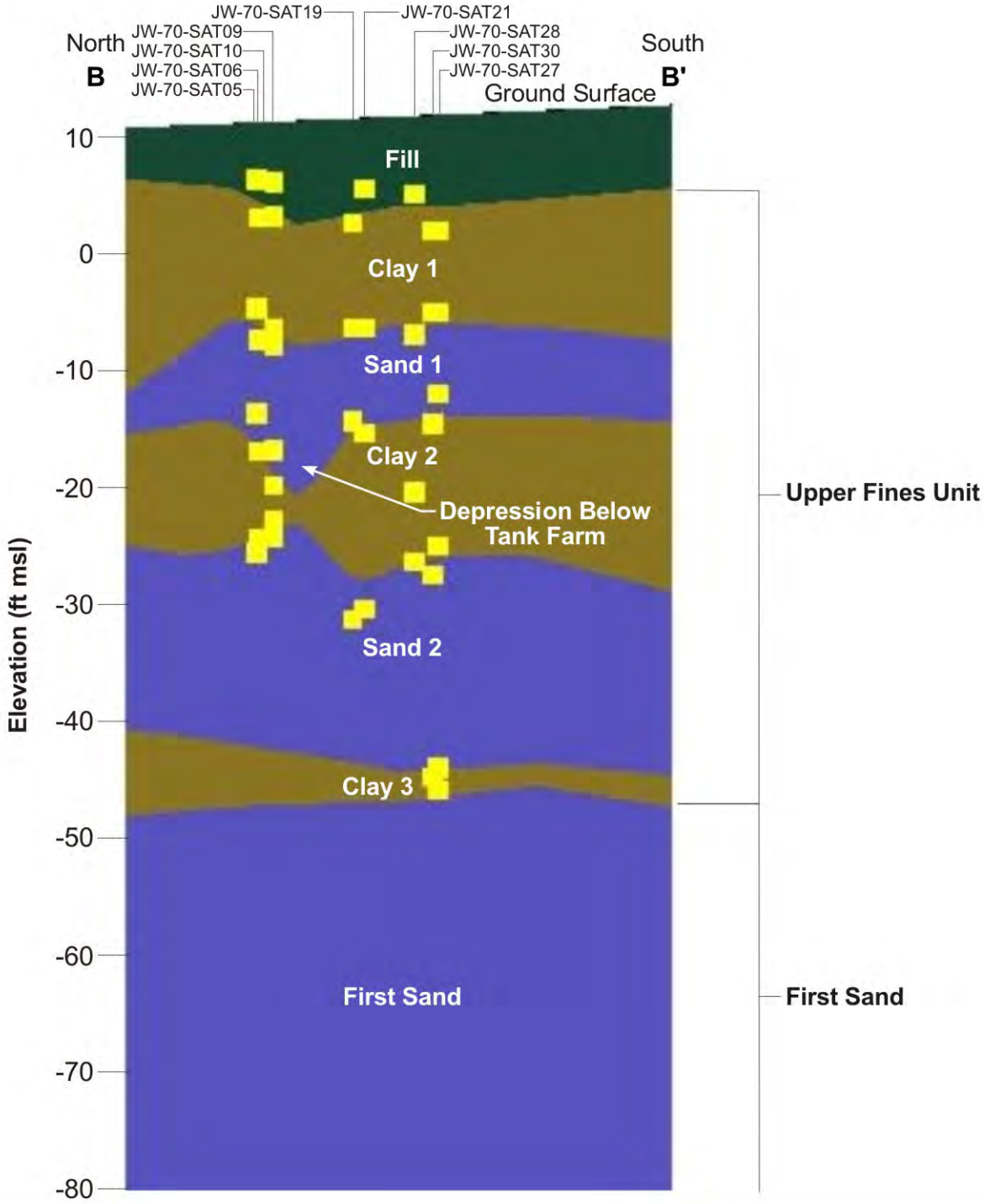
IR Site 70

Cross Section A-A'

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/09/2009
File No.: SB03-01_A-A'.CDR
Project No.: G006104-01
Rev. VJS



LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 100 200 300 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 16

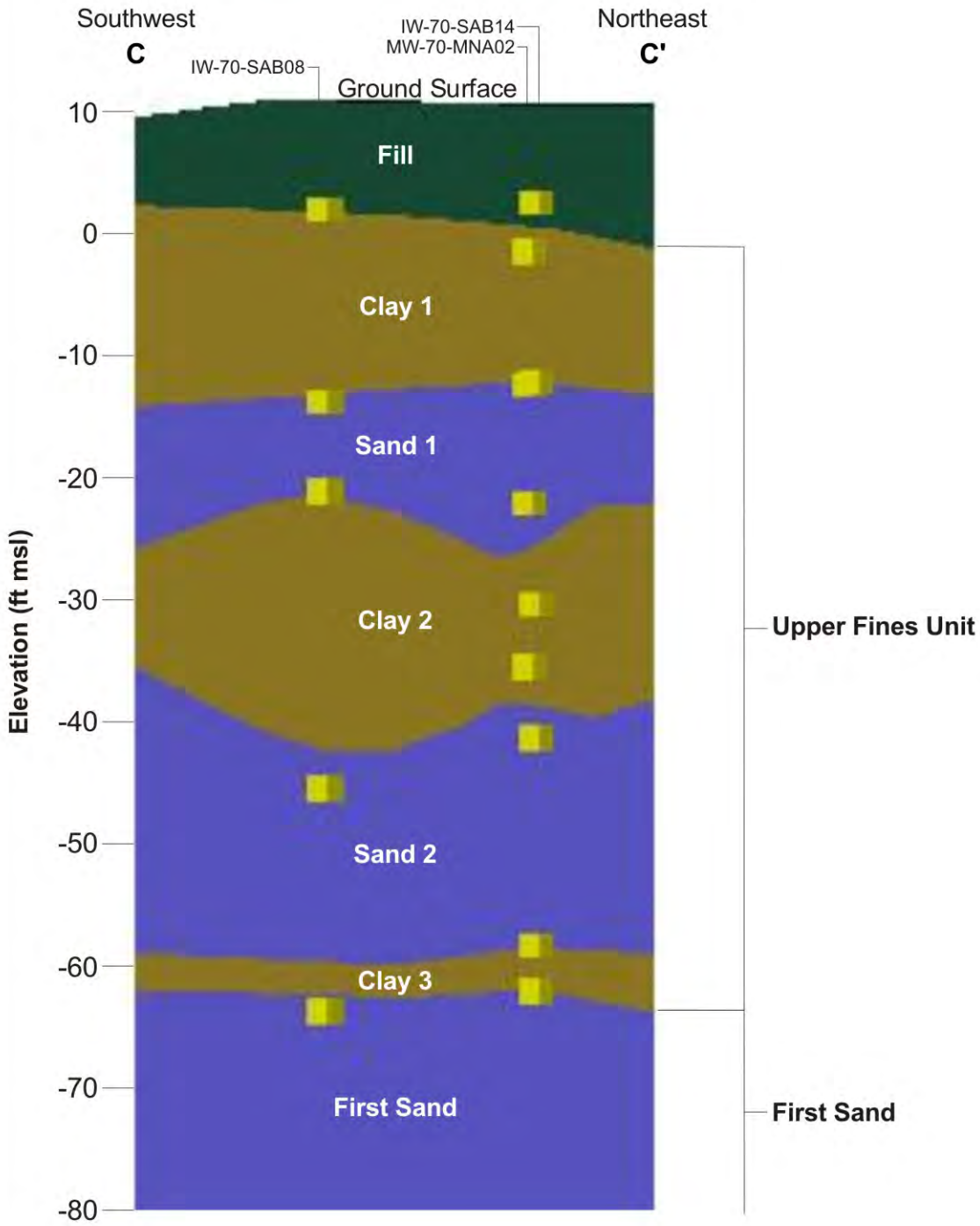
IR Site 70

Cross Section B-B'

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/10/2009
File No.: SB03-02_B-B.CDR
Project No.: G006104-01
Rev. VJS



LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 100 200 300 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 17

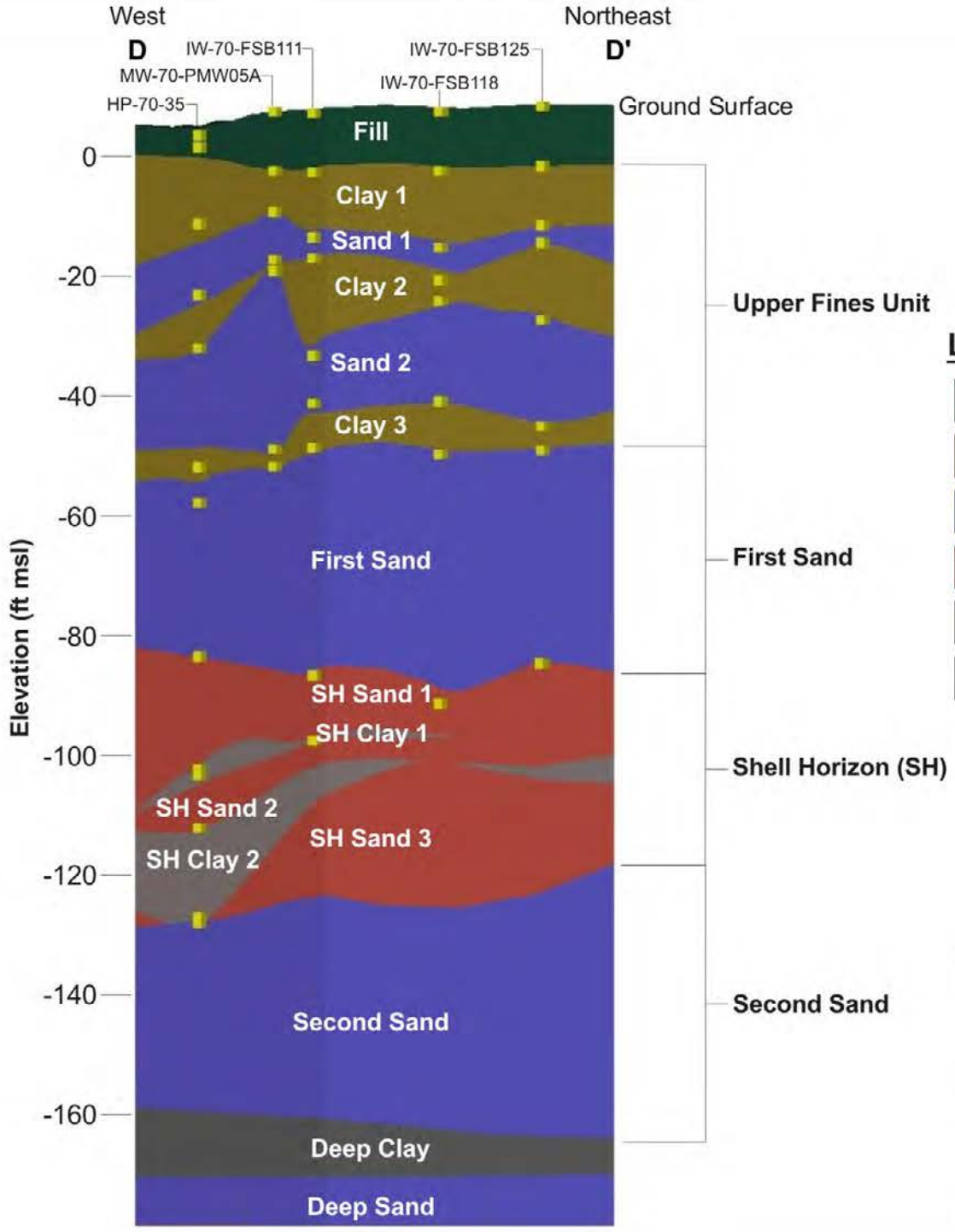
IR Site 70

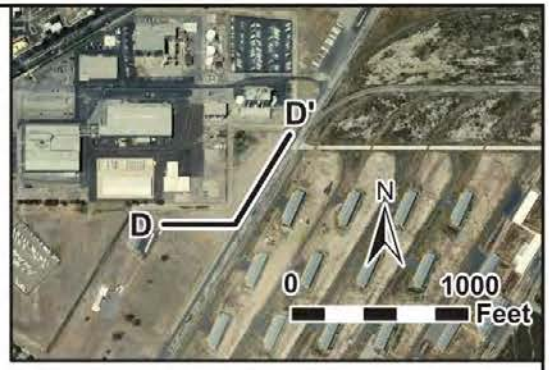
Cross Section C-C'

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/10/2009
File No.: SB03-03_C-C'.CDR
Project No.: G006104-01
Rev. VJS





LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON LOWER CONDUCTIVITY UNIT
- DEEP SAND LOWER CONDUCTIVITY UNIT

ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 18

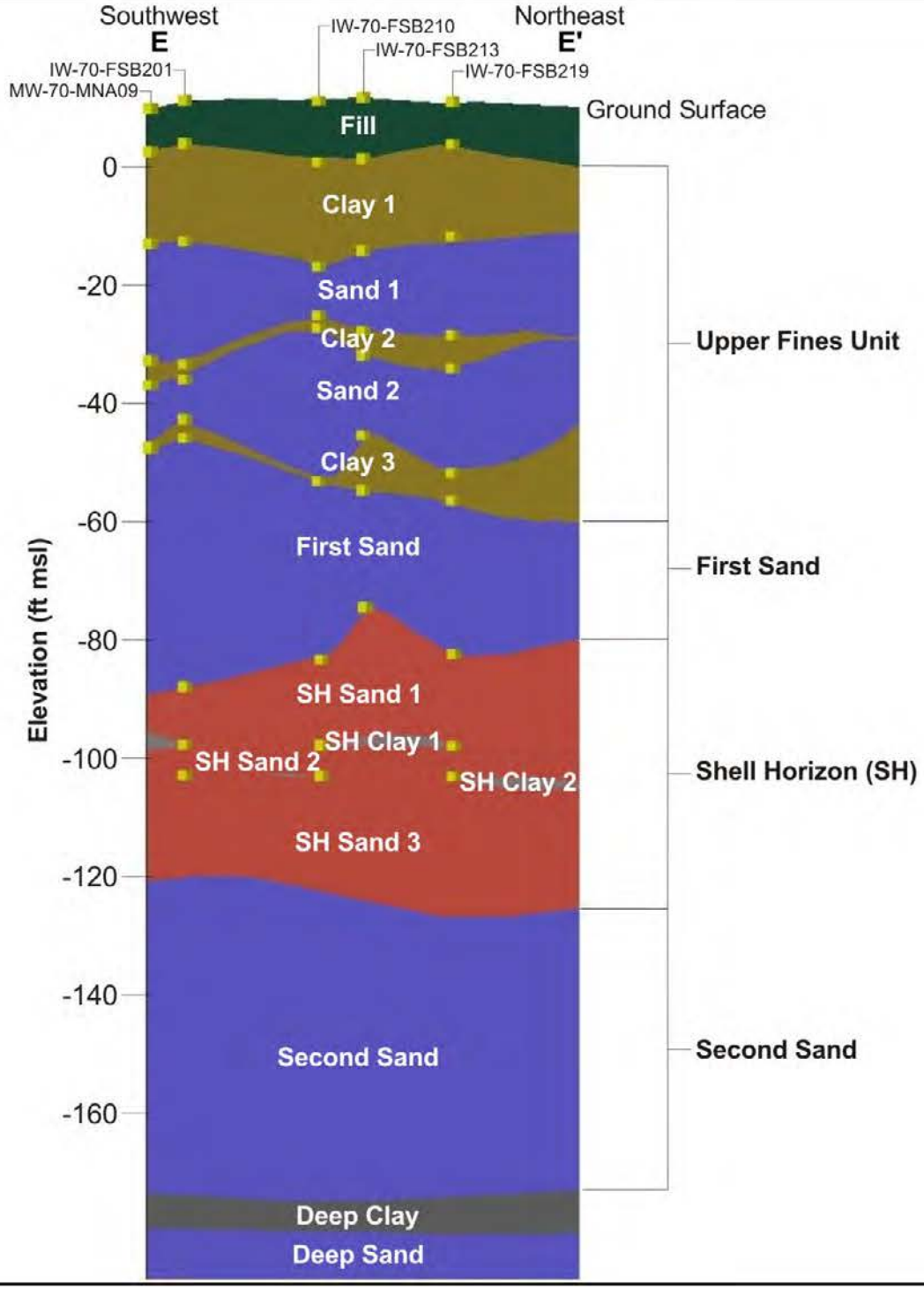
IR Site 70

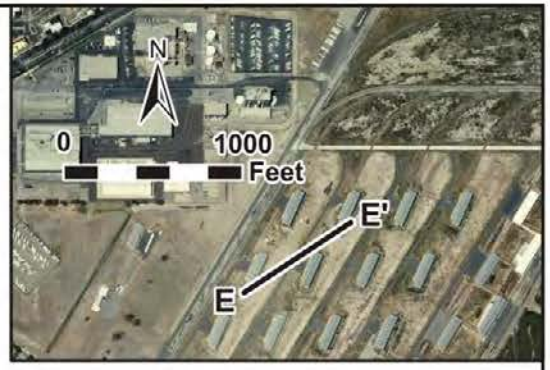
Cross Section D-D' – First Sand Biobarrier 1

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-04_D-D'.CDR
Project No.: G006104-01
Rev. VJS





LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON LOWER CONDUCTIVITY UNIT
- DEEP SAND LOWER CONDUCTIVITY UNIT

ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 19

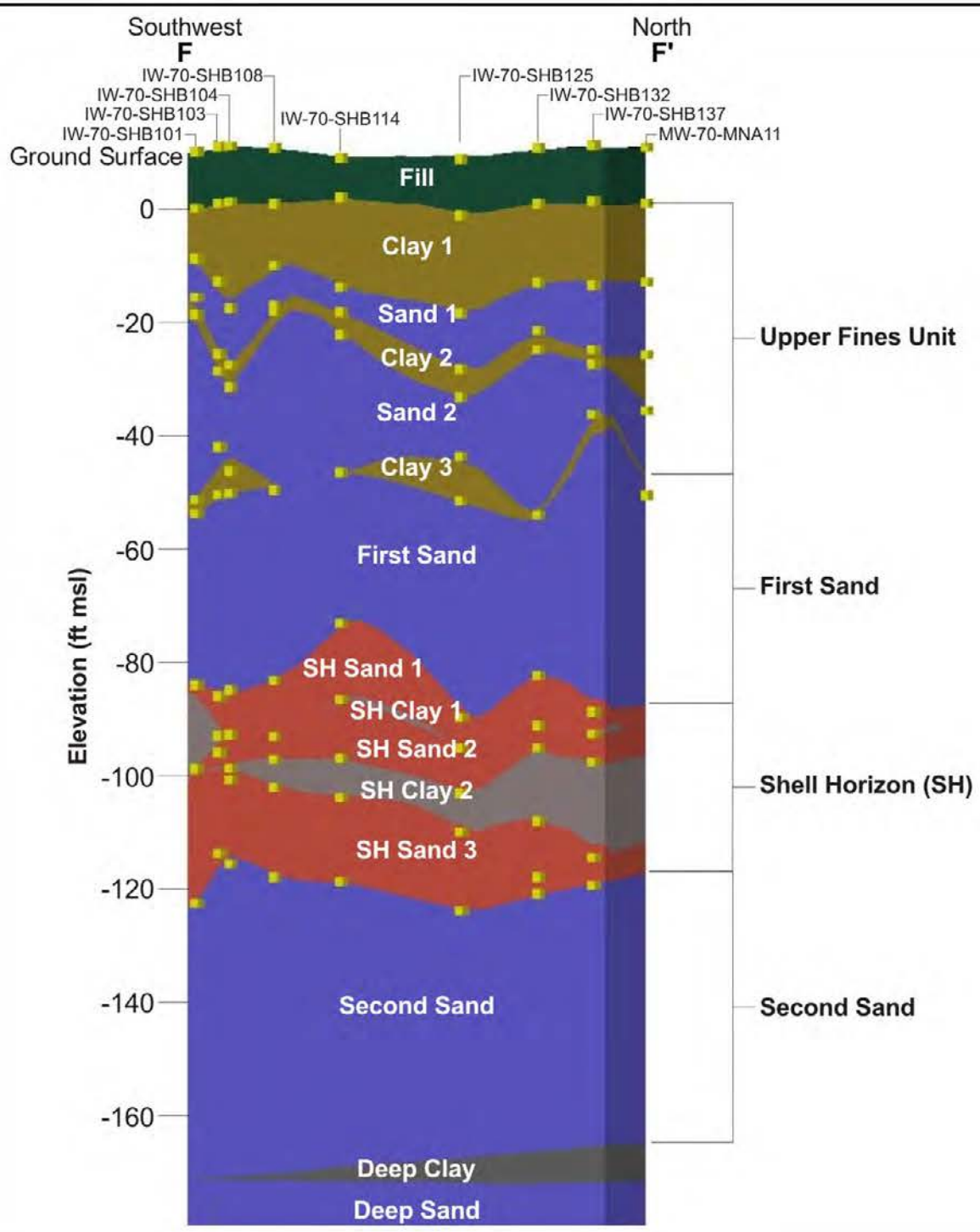
IR Site 70

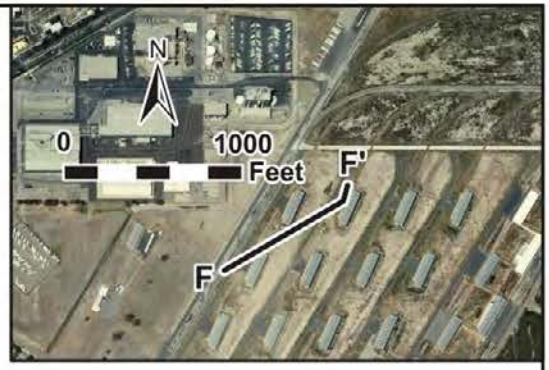
Cross Section E-E' – First Sand Biobarrier 2

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-05_E-E'.CDR
Project No.: G006104-01
Rev. VJS





LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON LOWER CONDUCTIVITY UNIT
- DEEP SAND LOWER CONDUCTIVITY UNIT
- ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 20

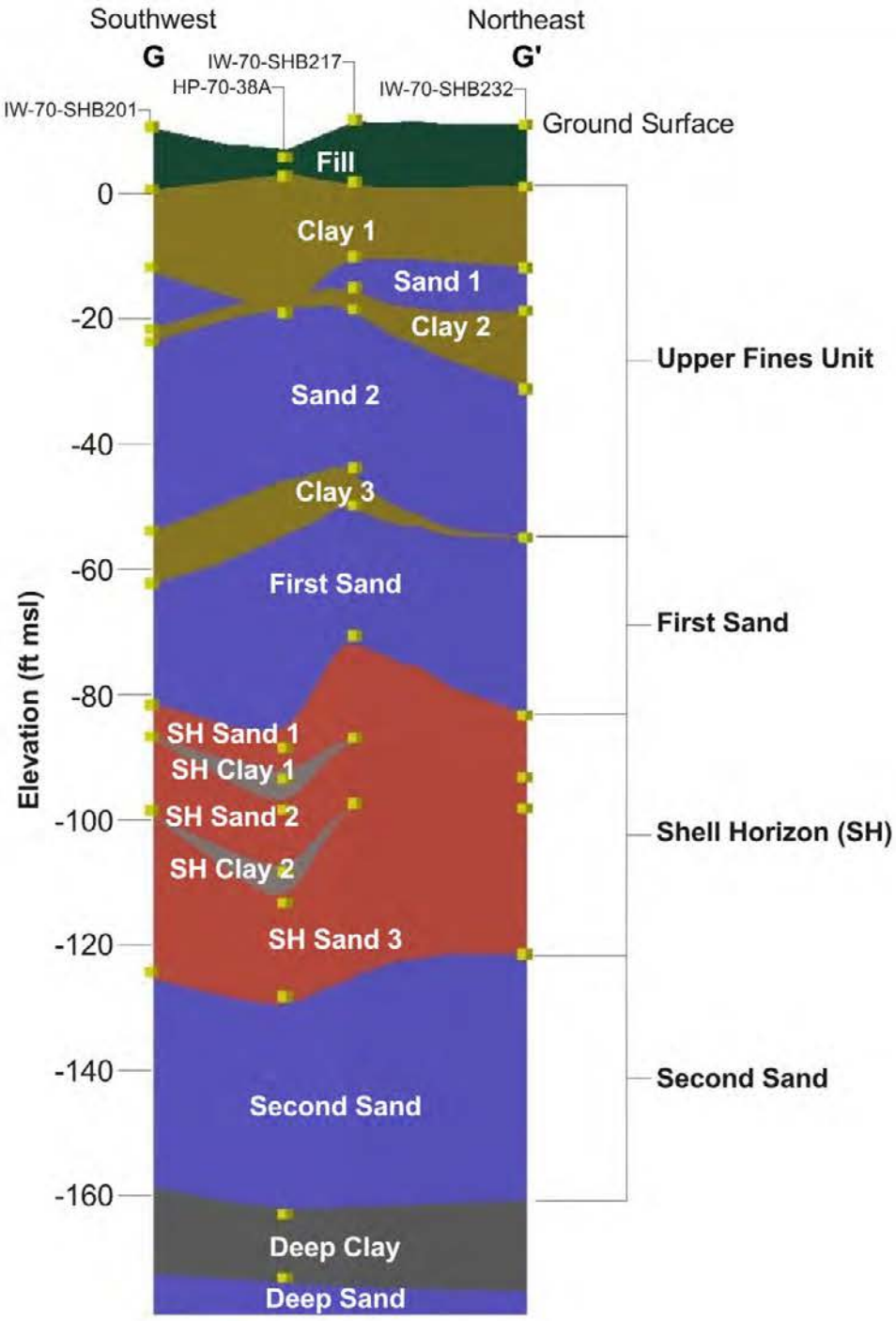
IR Site 70

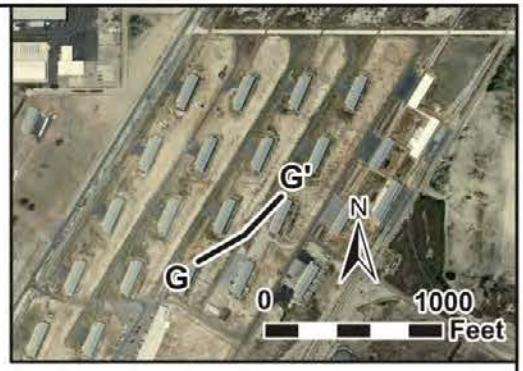
Cross Section F-F' – Shell Horizon Biobarrier 1

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-06_F-F'.CDR
Project No.: G006104-01
Rev. VJS





LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON LOWER CONDUCTIVITY UNIT
- DEEP SAND LOWER CONDUCTIVITY UNIT

ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 21

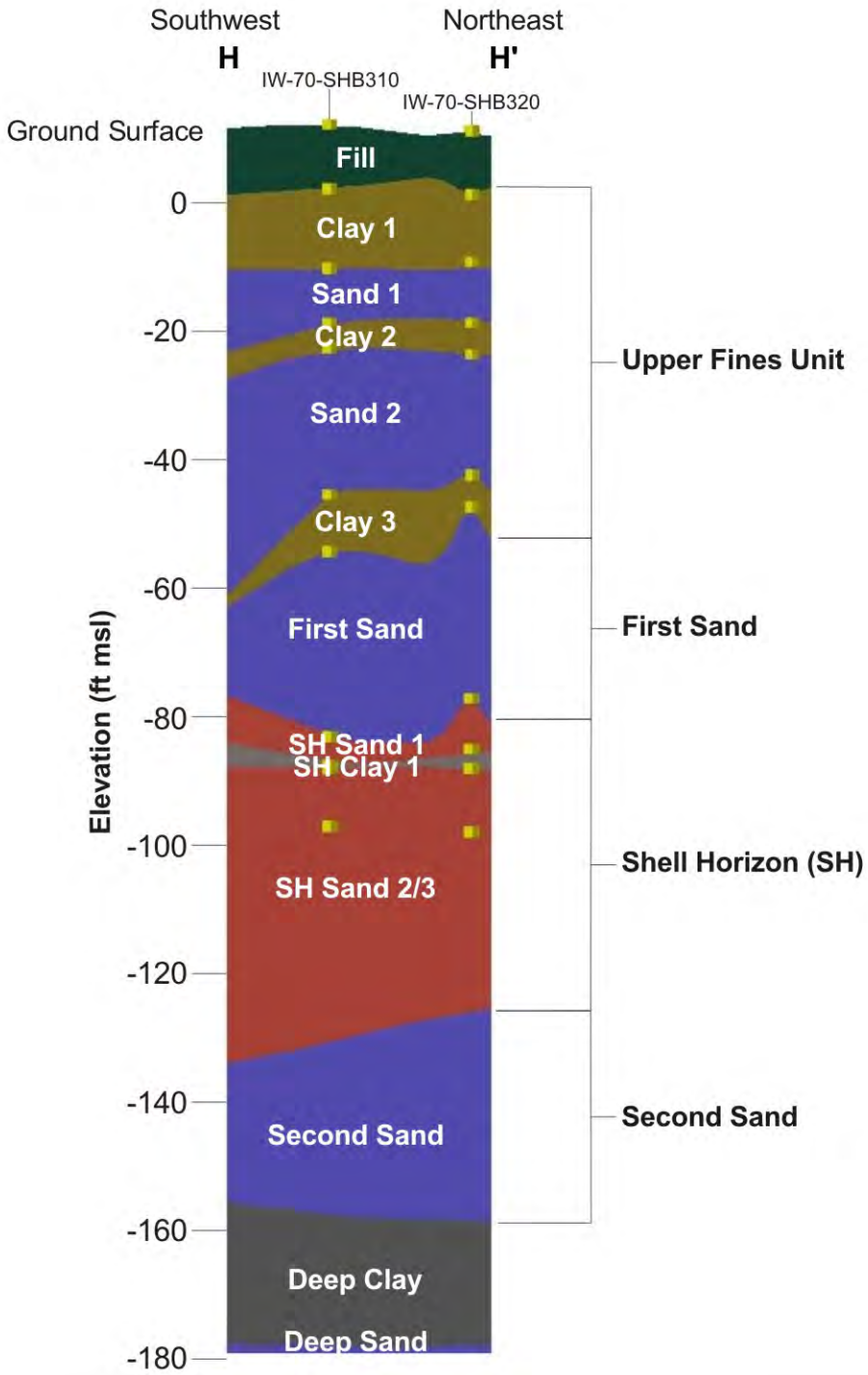
IR Site 70

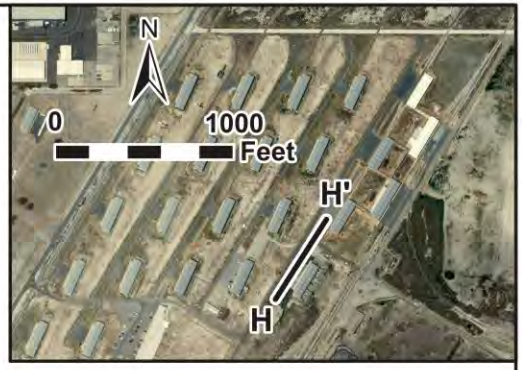
Cross Section G-G' – Shell Horizon Biobarrier 2

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-07_G-G'.CDR
Project No.: G006104-01
Rev. VJS





LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON LOWER CONDUCTIVITY UNIT
- DEEP SAND LOWER CONDUCTIVITY UNIT
- ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 22

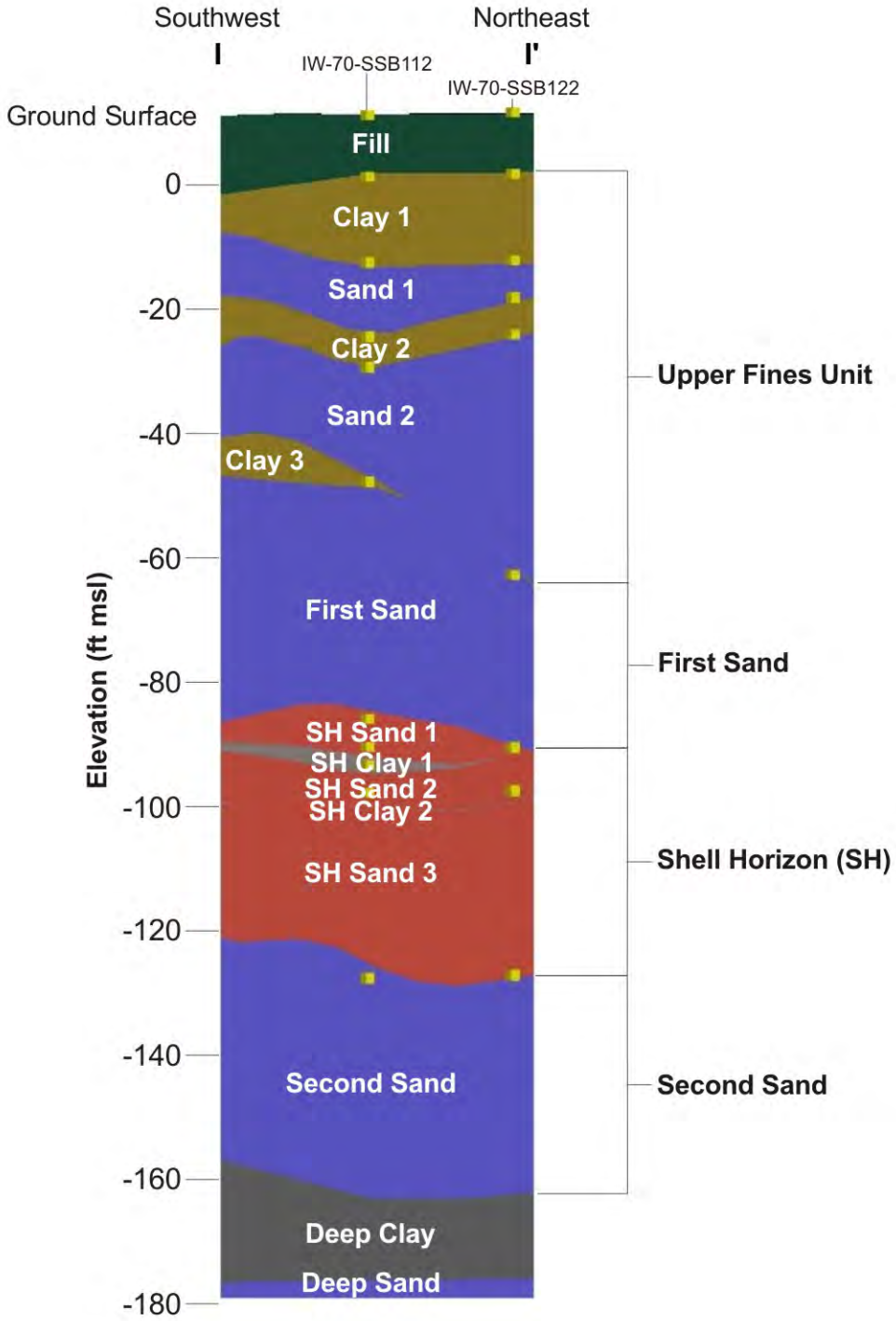
IR Site 70

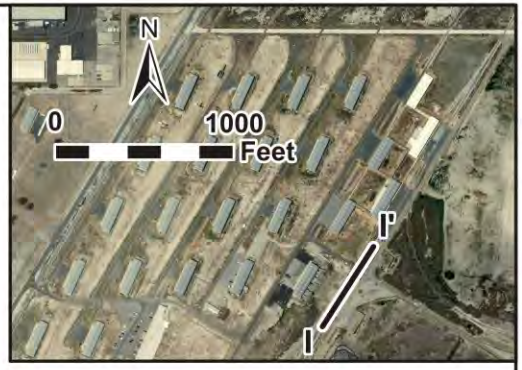
Cross Section H-H' – Shell Horizon Biobarrier 3

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-08_H-H'.CDR
Project No.: G006104-01
Rev. VJS





LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON LOWER CONDUCTIVITY UNIT
- DEEP SAND LOWER CONDUCTIVITY UNIT

ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 23

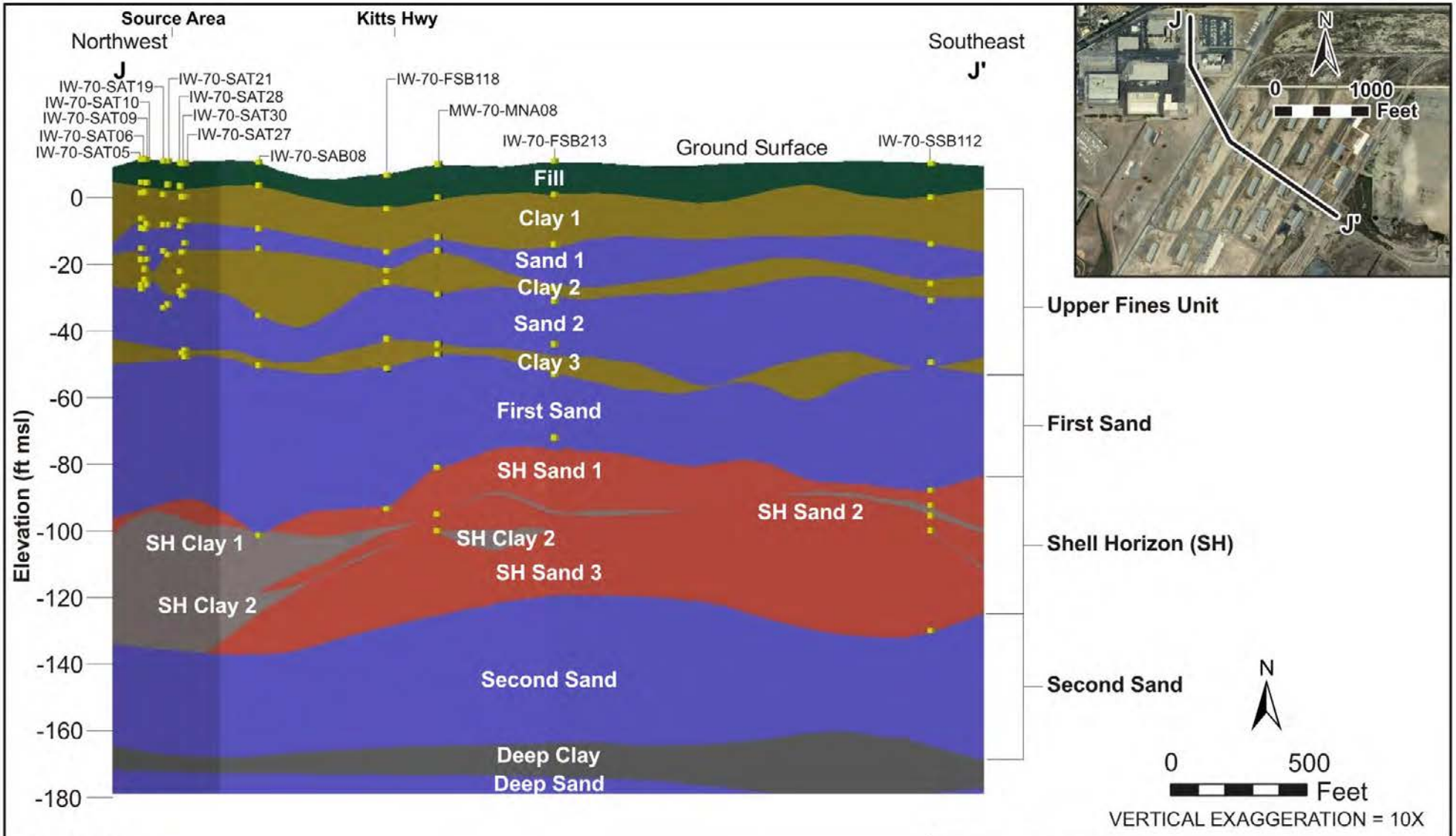
IR Site 70

Cross Section I-I' – Second Sand Biobarrier 1

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-09_I-I'.CDR
Project No.: G006104-01
Rev. VJS



LEGEND

- FILL UNIT
- UPPER FINES LOWER CONDUCTIVITY UNIT
- HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON HIGHER CONDUCTIVITY UNIT
- SHELL HORIZON LOWER CONDUCTIVITY UNIT
- DEEP SAND LOWER CONDUCTIVITY UNIT
- ft msl — ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET

Baseline Groundwater Monitoring Report

Figure 24

IR Site 70

Cross Section J-J'

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-10_J-J'.CDR
Project No.: G006104-01
Rev. VJS

LEGEND

APPROXIMATE 1,000-µG/L TCE PLUME EXTENT (2008)

µg/L MICROGRAMS PER LITER

TCE TRICHLOROETHENE

N

0 250 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 25

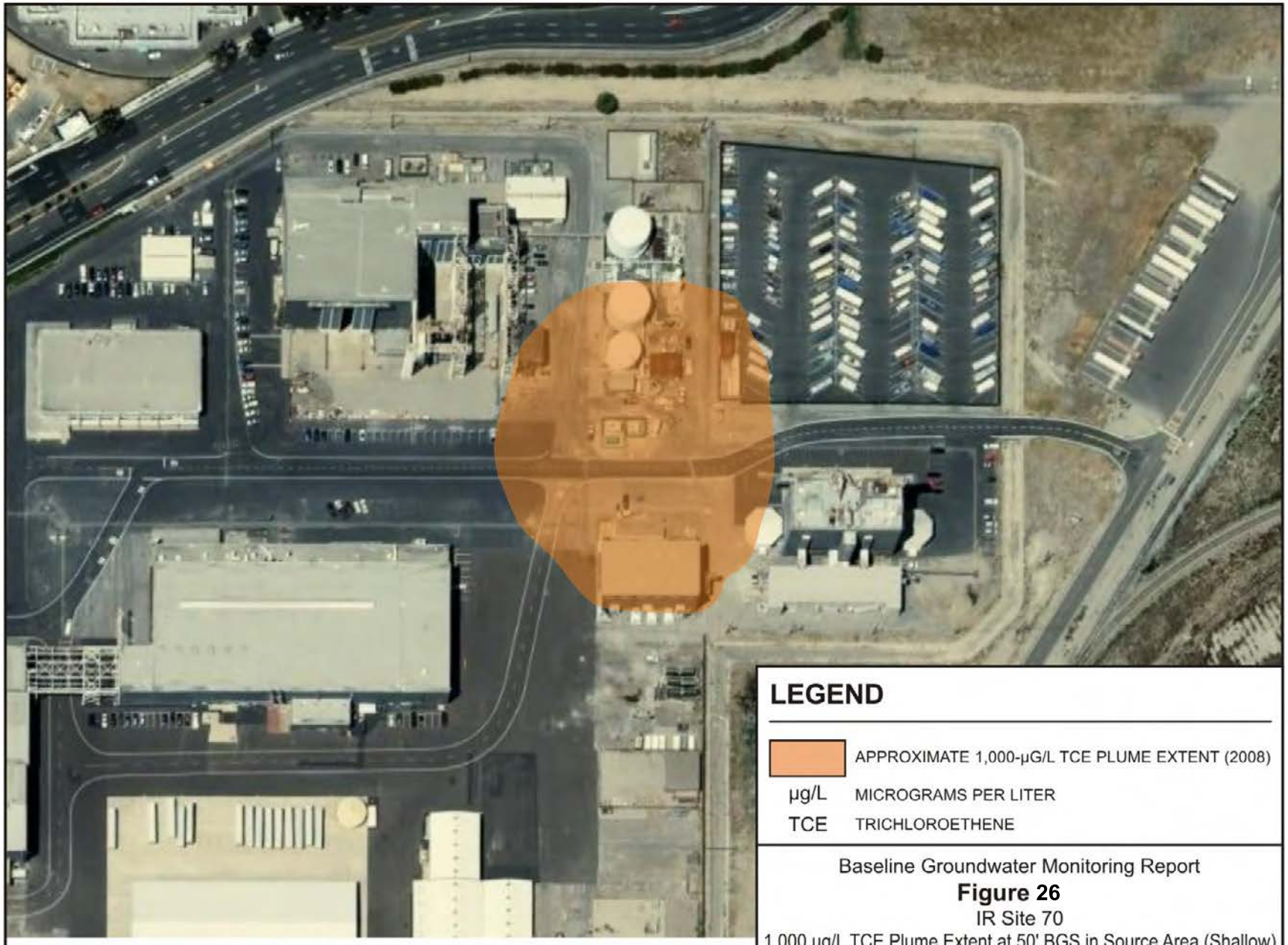
IR Site 70

1,000 µg/L TCE Plume Extent at 35' BGS in Source Area (Shallow)

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/25/2009
File No.: SB03-11_TCE_1000_35FTBGS_BL.CDR
Project No.: G006104-01
Rev. VJS



LEGEND

APPROXIMATE 1,000-µG/L TCE PLUME EXTENT (2008)

µg/L MICROGRAMS PER LITER

TCE TRICHLOROETHENE

Baseline Groundwater Monitoring Report

Figure 26

IR Site 70

1,000 µg/L TCE Plume Extent at 50' BGS in Source Area (Shallow)

Naval Weapons Station Seal Beach, Seal Beach, California

N

Scale in Feet

0 125 250

INSIGHT

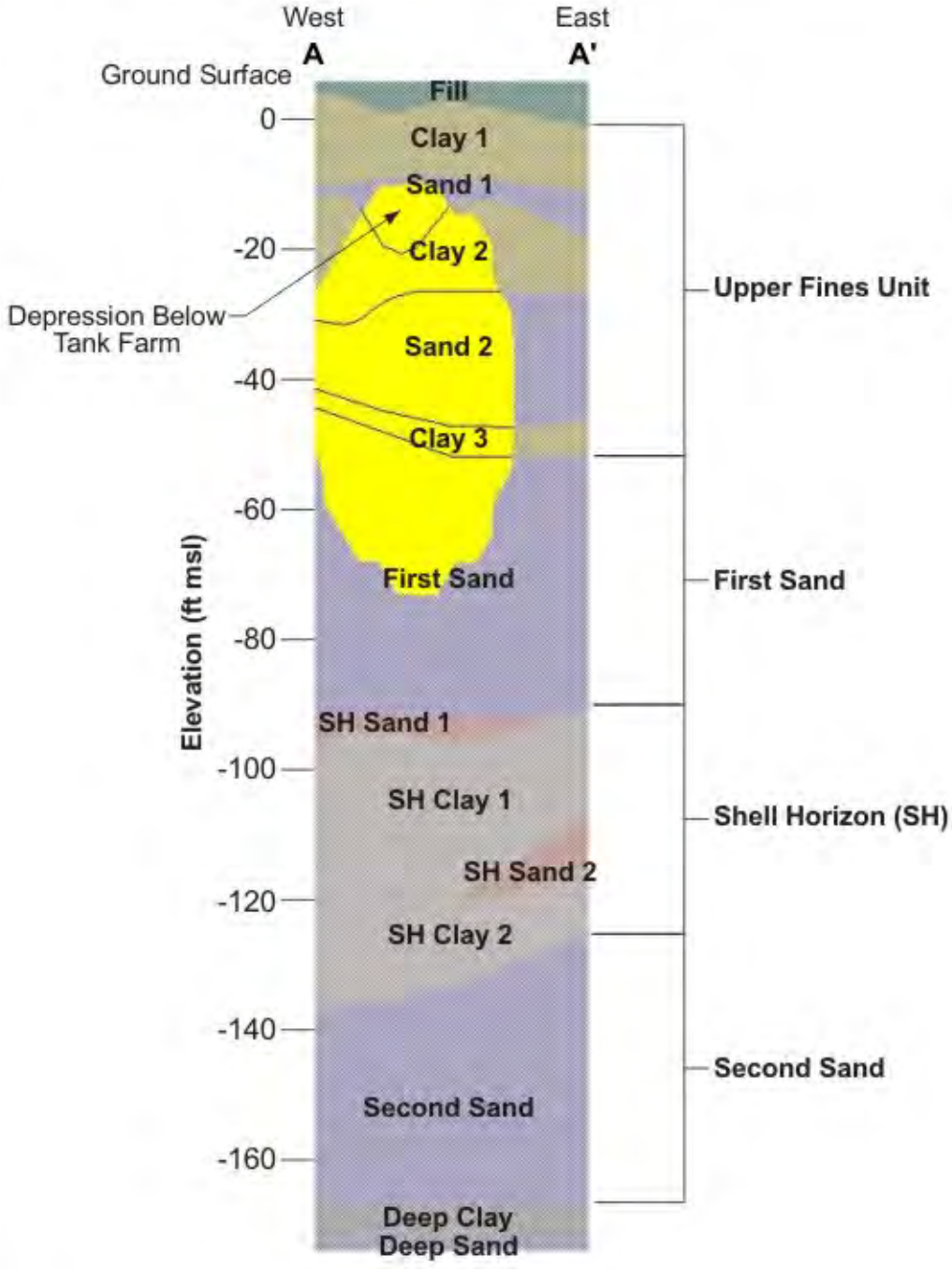
Environmental, Engineering and Construction, Inc.

Date: 03/25/2009

File No.: SB03-11_TCE_1000_50FTBGS_BL.CDR

Project No.: G006104-01

Rev. VJS



LEGEND

	250 µg/L TCE PLUME, 2008
µg/L	MICROGRAMS PER LITER
ft msl	ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET
TCE	TRICHLOROETHENE

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 27

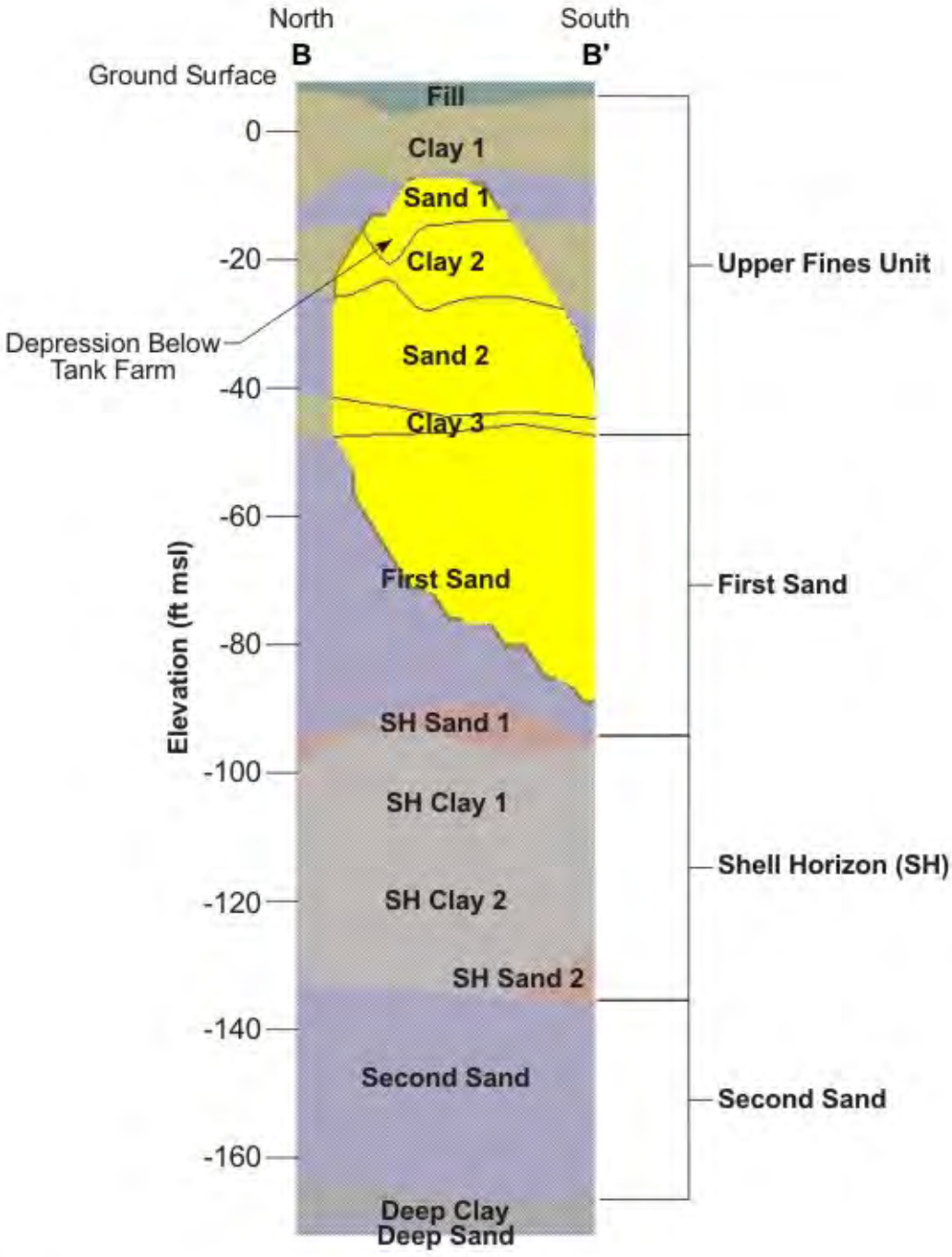
IR Site 70

Cross Section A-A' With 250 µg/L TCE Plume

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-12_A-A'_TCE_wNDHPs_BL.CDR
Project No.: G006104-01
Rev. VJS



LEGEND

	250 µg/L TCE PLUME, 2008
µg/L	MICROGRAMS PER LITER
ft msl	ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET
TCE	TRICHLOROETHENE

N

0 500 Feet

VERTICAL EXAGGERATION = 10X

Baseline Groundwater Monitoring Report

Figure 28

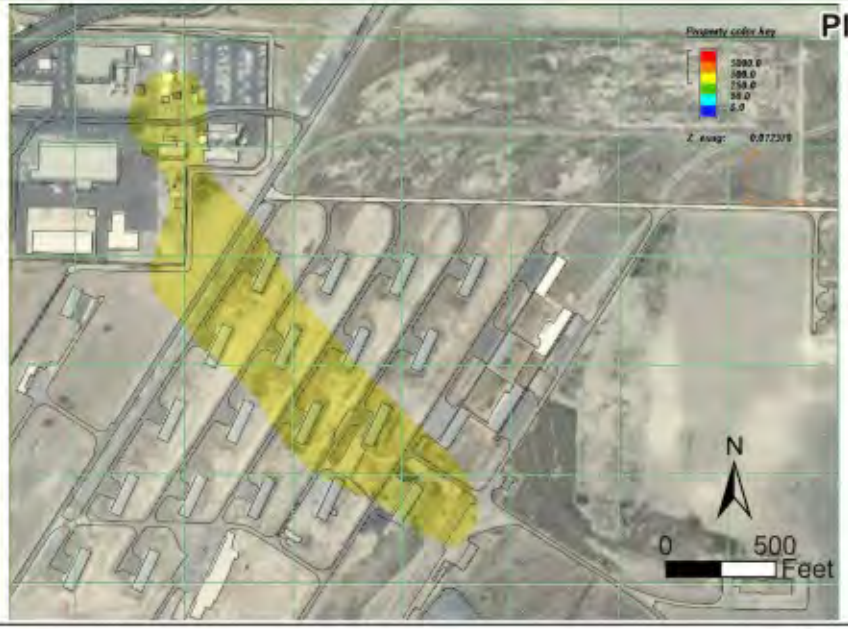
IR Site 70

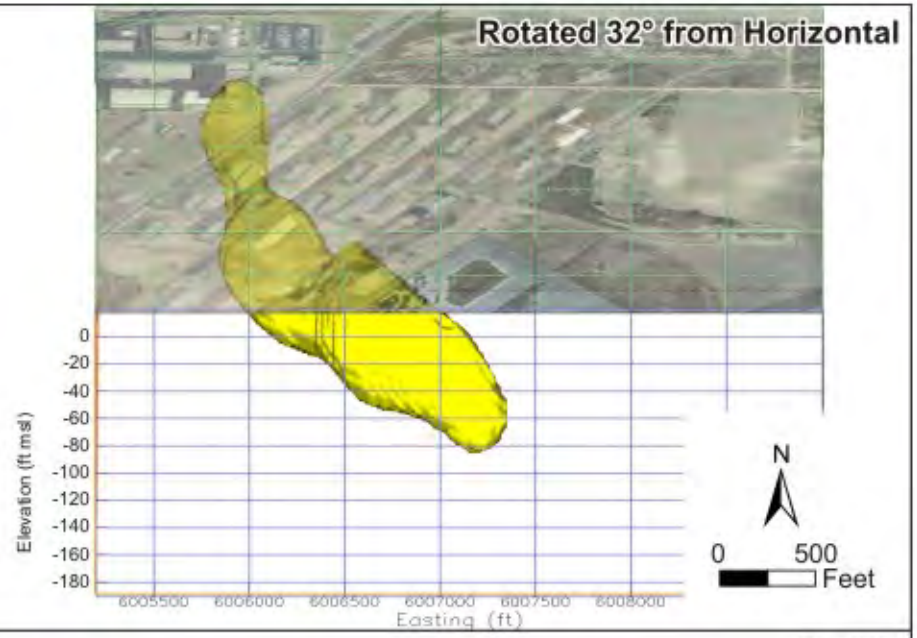
Cross Section B-B' With 250 µg/L TCE Plume

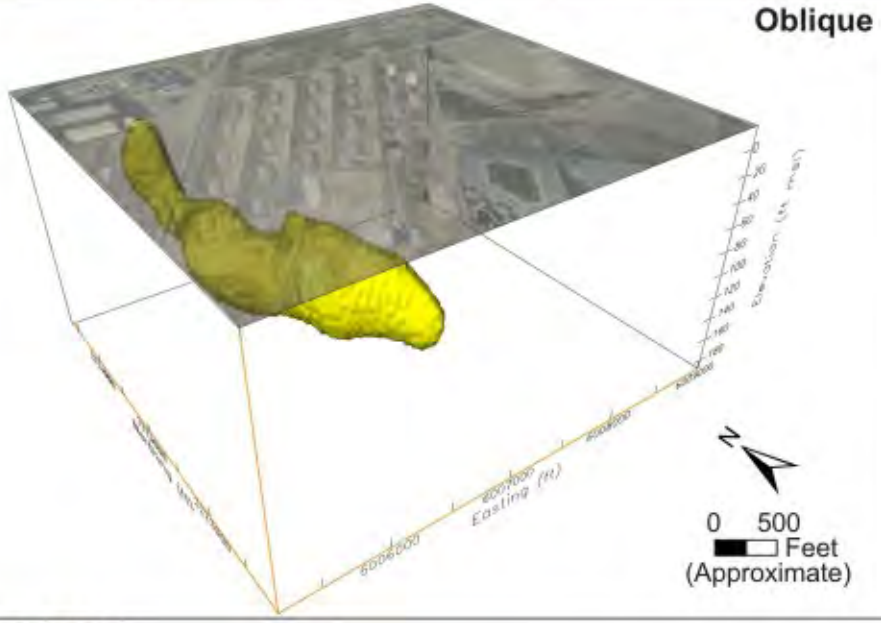
Naval Weapons Station Seal Beach, Seal Beach, California

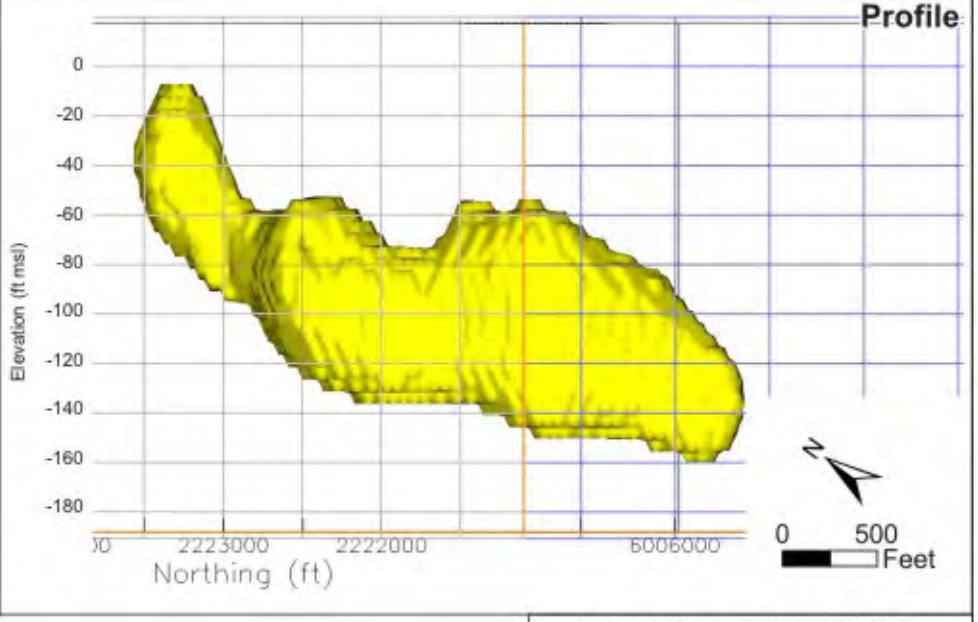
INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-13_B-B'_TCE_wNDHPs_BLCDR
Project No.: G006104-01
Rev. VJS









LEGEND

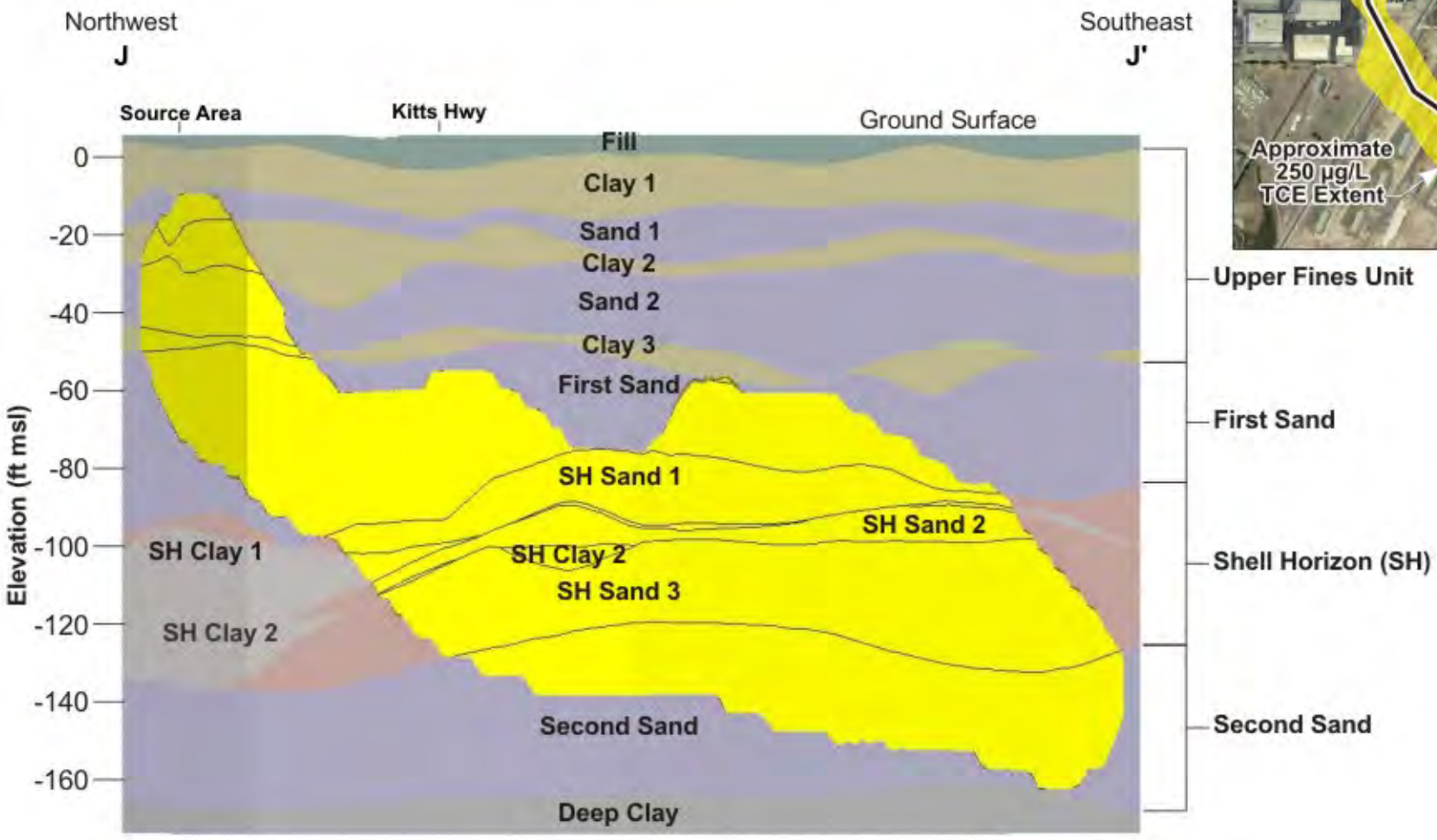
- APPROXIMATE 250 µG/L TCE PLUME, 2008
- µg/L MICROGRAMS PER LITER
- TCE TRICHLOROETHENE

Baseline Groundwater Monitoring Report
Figure 29
IR Site 70
Oblique Views of 250 µg/L TCE Plume

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT

Date: 03/11/2009
File No.: S803-14_TCE_250_BL.CDR
Project No.: G006104-01
Rev. VJS



N

0 500 Feet

VERTICAL EXAGGERATION = 10X

LEGEND

	250 µg/L TCE PLUME, 2008
µg/L	MICROGRAMS PER LITER
ft msl	ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET
TCE	TRICHLOROETHENE

Baseline Groundwater Monitoring Report

Figure 30

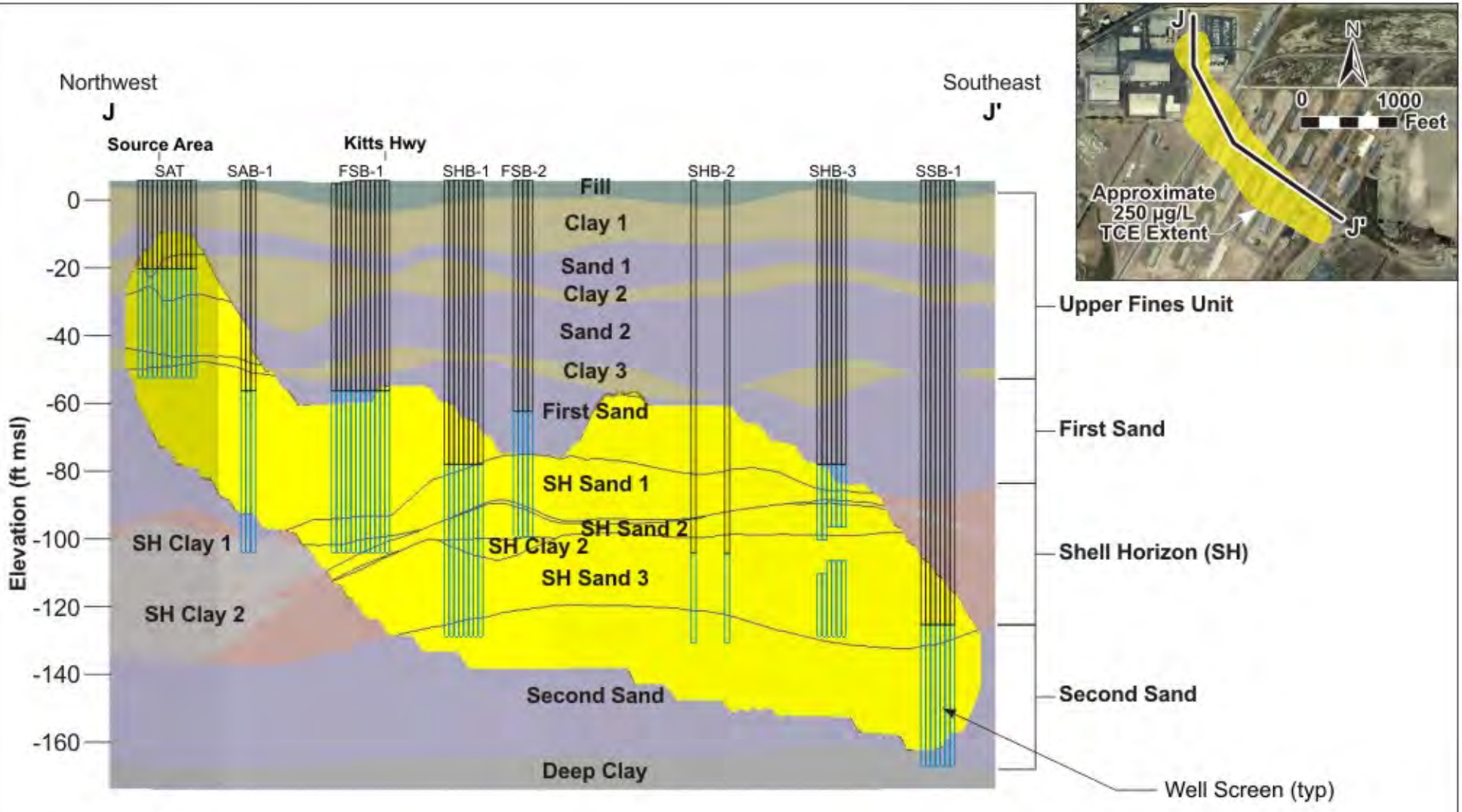
IR Site 70

Cross Section J-J' With 250 µg/L TCE Plume

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-15_J-J'_TCE_wNDHPs_BL.CDR
Project No.: G006104-01
Rev. VJS



N

0 500 Feet

VERTICAL EXAGGERATION = 10X

LEGEND

	250 µg/L TCE PLUME, 2008
µg/L	MICROGRAMS PER LITER
ft msl	ELEVATION RELATIVE TO MEAN SEA LEVEL, IN FEET
TCE	TRICHLOROETHENE

Baseline Groundwater Monitoring Report

Figure 31

IR Site 70

Complete Injection System Cross Section

Naval Weapons Station Seal Beach, Seal Beach, California

INSIGHT
Environmental, Engineering and Construction, Inc.

Date: 03/11/2009
File No.: SB03-16_J-J'_TCE_INJ_wNDHPs_BLCOR
Project No.: G006104-01
Rev. VJS

This page intentionally left blank

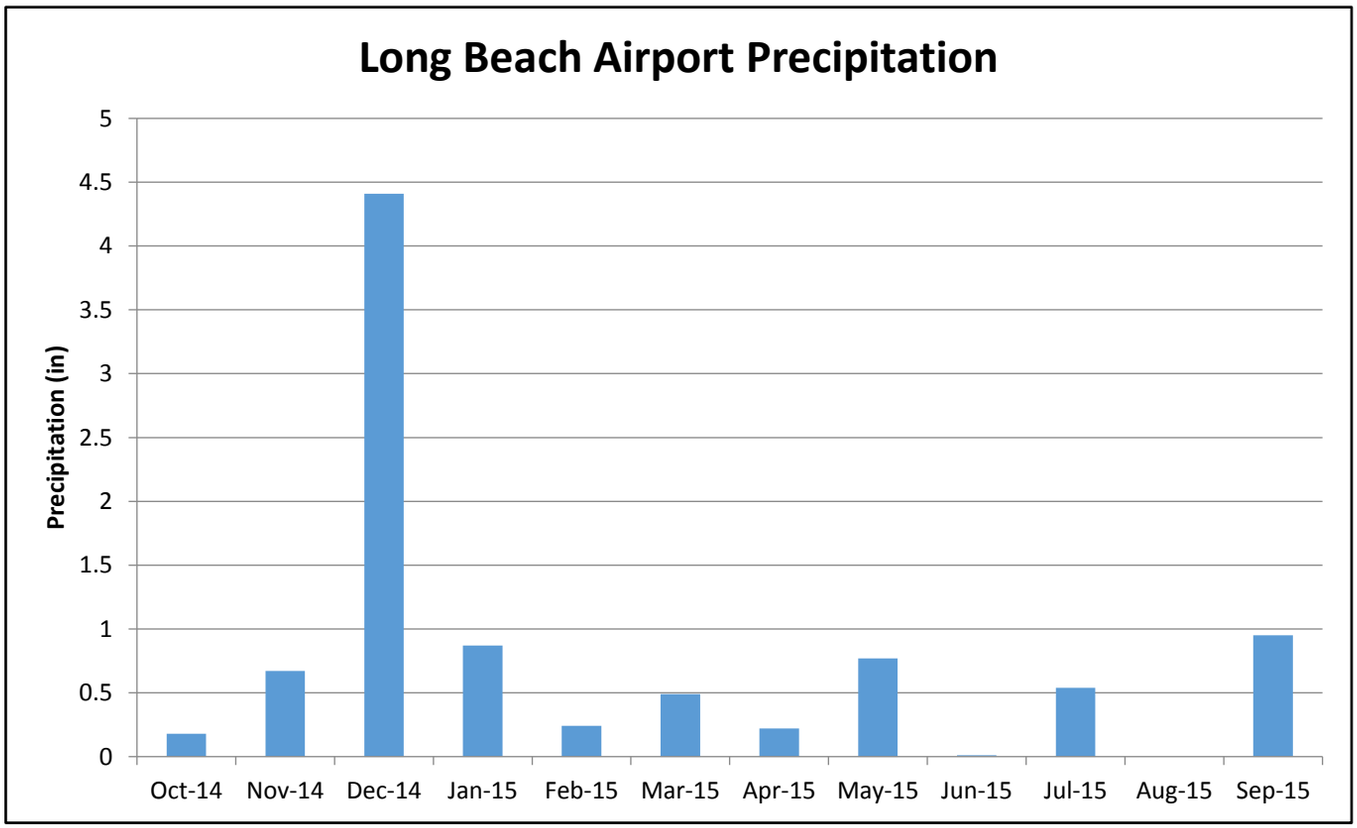
APPENDIX E

LONG BEACH AIRPORT PRECIPITATION DATA
(on CD only)

This page intentionally left blank

Long Beach Airport												
Precipitation Data for Water Year 2015 (in)												
Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Grand Total
0.18	0.67	4.41	0.87	0.24	0.49	0.22	0.77	0.01	0.54	0	0.95	9.35

Notes:
The water year starts on October 1, 2014 and ends on September 30, 2015. All units of precipitation are in inches.
Total water year 2015 precipitation is 9.35 inches.



This page intentionally left blank

APPENDIX F

SEAL BEACH CONSTANT-DISCHARGE PUMPING TEST RESULTS FOR ORANGE COUNTY SANITATION DISTRICT SEAL BEACH PUMP STATION

(on CD only)

This page intentionally left blank

Serving:
Anaheim
Brea
Buena Park
Cypress
Fountain Valley
Fullerton
Garden Grove
Huntington Beach
Irvine
La Habra
La Palma
Los Alamitos
Newport Beach
Orange
Placentia
Santa Ana
Seal Beach
Stanton
Tustin
Villa Park
County of Orange
Costa Mesa Sanitary District
Midway City Sanitary District
Irvine Ranch Water District
Yorba Linda Water District

Orange County Sanitation District

10844 Ellis Avenue, Fountain Valley, CA 92708
714.962.2411 • www.ocsewers.com

October 21, 2015

CAPT Martin H. Hardy III
Commanding Officer
Naval Weapons Station Seal Beach
800 Seal Beach Blvd.
Seal Beach, CA 90740

SUBJECT: Seal Beach Pump Station Rehabilitation, Project No. 3-62
Re: Request for Approval Expedition

The Orange County Sanitation District (Sanitation District) owns and operates a major wastewater pumping station located at the intersection of Seal Beach Boulevard and Westminster Boulevard in Seal Beach. This pump station and its associated force mains, constructed below Westminster Boulevard, are critical to the Sanitation District's mission to protect public health and the environment by providing effective wastewater collection, treatment, and recycling.

The Seal Beach Pump Station was initially constructed 45 years ago and serves the City of Seal Beach, the Naval Weapons Station Seal Beach (NWS), and communities to the north, providing the capability to pump up to 21,000 gallons per minute of wastewater to the Sanitation District's treatment facilities in Huntington Beach and Fountain Valley. Given its age, the station, its appurtenant equipment, and force mains in Westminster Boulevard are in need of major rehabilitation, and possible replacement to maintain effective and reliable service for both the public and NWS. In fact, one of the two force mains is no longer serviceable which eliminates the ability to have redundant infrastructure in case of an emergency.

Project Status

The Sanitation District has been discussing this project with the Naval Facilities and Engineering Command Southwest (NAVFAC SW) for several months and in July 2015 issued a Notice to Proceed to our Design Consultant, MWH Americas, located in Irvine. As part of their preliminary work, MWH has identified the need for some basic civil engineering data requirements. This includes the need to set surveying targets on-base at NWS inside the fence along Westminster Boulevard, and the need to conduct a series of geotechnical borings in Westminster Boulevard itself to determine soil conditions for a possible new force main.

Staff at the NAVFAC SW, Rob Haines, and NWS, FMD Director Salim Rahemtulla, and Deputy PWO Don Crabb, have been very helpful and cooperative in providing guidance to our team. However, during a meeting on-base with MWH Project Manager, Joe Lauria, and MWH Naval Liaison CDR Stephen Tompkins, USN (Ret.), it was disclosed that gaining approval for access to set surveying targets and approval to complete geotechnical borings in Westminster Boulevard could take two calendar months. This is a significant adverse impact on the Sanitation District's schedule to stabilize and improve our critical infrastructure.

Request to Expedite USN Approval

The Sanitation District recognizes that the Navy operates within timeline constraints, as do all agencies. However, the request for access to set surveying targets and the request to complete borings in Westminster Boulevard should have no impact on operations at NWS. Moreover, the completion of geotechnical borings in Westminster Boulevard are no different than other public works activities that may occur in the street subject to traffic control restrictions imposed by the prevailing municipal jurisdiction.

Inasmuch as a 60-day delay in our schedule will have significant adverse impact to the project and extends the risk already present in aging infrastructure, we respectfully request that the Navy expedite its approval process so that the Sanitation District may proceed with the work at this time.

In addition, it was discovered during a records search at the County of Orange that the Sanitation District does not have an easement for the force mains in Westminster Boulevard which have been installed and operating for over 40 years. Westminster Boulevard is a public right of way and NWS is the underlying property owner. The Sanitation District believes that easements are not necessary since the force mains are located in the public right of way. However, we have begun the internal process to coordinate a mutually agreeable outcome.

If you have any questions or desire additional information, please feel free to call me at (714) 593-7110.

James D. Herberg
General Manager

JDH:AN:dm

TODD GROUNDWATER

October 13, 2015

TECHNICAL MEMORANDUM

To: Larry Jansen
Principal Geologist, Ninyo & Moore
ljansen@ninyoandmoore.com

From: Edwin Lin, PG, CHG, Senior Hydrogeologist
Daniel Craig, PG, CHG, Senior Hydrogeologist

Re: **Constant-Discharge Pumping Test Results for OCSD Seal Beach Pump Station**

To support evaluation of dewatering requirements for the proposed excavation and expansion of the Orange County Sanitation District (OCSD) Seal Beach Pump Station, Todd Groundwater conducted a constant-discharge groundwater pumping test. The test was conducted at the site on September 22-23, 2015 and was performed to characterize hydraulic conditions of the local shallow aquifer. This technical memorandum describes the field activities, results, and key findings associated with the pumping test.

WELL CONSTRUCTION

Three wells were drilled at the subject property on August 19-20, 2015 for the pumping test. **Figure 1** shows the locations of the pumping well (PW1) and two monitoring wells (MW1 and MW2). The boring diameter is 12 inches for PW1 and 8 inches for MW1 and MW2. All wells were constructed with PVC casing (2-inch diameter Schedule 40 for MW1 and MW2; 6-inch diameter Schedule 80 for PW1). The three wells are constructed with 45 feet of slotted PVC pipe (0.020-inch slot size) from 5 to 50 feet below ground surface (feet-bgs). A combination of cement bentonite grout and hydrated bentonite chips were used to seal each well to 5 feet-bgs. Monterey sand (#2/12) was used to gravel-pack the annulus between the PVC casing and soil boring wall. The wells were developed by surging/bailing and pumping (up to 20 gallons per minute [gpm]) prior to initiation of the pumping test.

FIELD ACTIVITIES

On the morning of September 22, 2015, Todd Groundwater measured the well depth and static water level (SWL) in each well. The distances from PW1 to MW1 and from PW1 to MW2 were also confirmed. Details are provided in **Table 1** below.

Table 1. OCSD Seal Beach Pump Station Wells

Well	Well Depth (feet-bgs)	Screen Interval (feet-bgs)	Depth to Water (feet TOC)	Distance from PW1 (feet)
PW1	50	5- 50	12.69	
MW1	50	5- 50	12.59	55
MW2	50	5- 50	14.91	36

feet TOC = feet below top of casing
feet-bgs = feet below ground surface
Depth to water measured September 22, 2015.

It is noted that the depth to water in MW2 is greater, because the PVC casing rises approximately 3 feet above the vegetated ground surface within a stovepipe completion, while the other two wells were completed below the asphalt grade on the property.

Gregg Drilling installed a 4-inch diameter, 7.5 horsepower Grundfos submersible pump in PW1. The pump intake was set at a depth of 45 feet-bgs to ensure adequate water flow past the pump motor during the test. A pressure transducer/datalogger (In-Situ LevelTroll 700, 15 psi) was placed in each well to record water level response during the pumping test. Temporary discharge piping was installed to direct water to the nearest inlet of the OCSD sewer system. A butterfly valve and totalizing flowmeter were used to control and measure the discharge rate during the test.

At 12:32 pm on September 22, the pump was turned on, and the discharge rate was measured at 102 gpm[1]. Pumping continued uninterrupted for 900 minutes (15 hours). At 3:32 am on September 23, the water level in PW-1 had reached maximum drawdown (42.1 feet TOC), and the pump was turned off to prevent air suction in the pump. Water level recovery in all three wells was recorded for 5 hours following shutoff of the pump.

PUMPING TEST RESULTS

Figure 2 shows the water level responses in PW1, MW1, and MW2 during pumping (upper chart) and recovery after cessation of pumping (lower chart). As shown on the upper chart, water level drawdown plots along a typical straight line (on semi-logarithmic paper) for all three wells for the initial approximately 180 minutes of the pumping test. An increase in the rate of drawdown was observed in PW1 after approximately 3 hours of pumping (180 minutes). The response indicates the presence of a discharge boundary which could be caused by a low-permeability boundary or pinching out of permeable alluvial sediments at the leading edge of the expanding cone of depression. Water level drawdown curves for MW1 and MW2 follow along the same straight line for the duration of the test. Given the

[1]At 11:30, a short-term pumping test was performed with a discharge rate of 67 gpm, resulting in water level drawdown of 12 feet after 25 minutes. A higher discharge rate was necessary to produce a measurable time-drawdown curve. The water level in PW1 was allowed to recover fully prior to the start of formal test at 12:32 pm.

information provided, it is not possible to confirm the exact characteristics of the apparent discharge boundary. For the purpose of designing a dewatering system, relying on the initial water level response unaffected by the apparent discharge boundary and associated higher aquifer transmissivity (see below) is recommended. As shown in the lower chart, water level recovery curves for all three wells plot effectively along the same straight line.

PUMPING TEST ANALYSIS

The water level drawdown and recovery data were evaluated using the Cooper-Jacob method (Driscoll, 1986) to estimate aquifer hydraulic properties including transmissivity, hydraulic conductivity, and storativity. **Table 2** summarizes the estimated aquifer hydraulic properties for the pumping test. Based on the range of observed delta S values (1.0 to 1.3 feet per log cycle) from the drawdown and recovery curves, the estimated aquifer transmissivity ranges from 19,800 to 26,400 gallons per day per foot (gpd/ft) [or 2,650 to 3,530 feet^2/day], and the hydraulic conductivity of the shallow aquifer ranges from 73 to 98 feet/day. The estimated aquifer storativity is 2.55×10^{-3}, indicative of an unconfined alluvial aquifer. The well efficiency of PW1 is calculated at 66 percent, based on the projected 24-hour specific capacity (unaffected by the discharge boundary) of 7.14 gallons per minute per foot of drawdown (gpm/ft of dd) versus a theoretical specific capacity of 10.75 gpm/ft of dd.

Table 2. Pumping Test Results

Well	Curve	delS[1]	Transmissivity, T[2]		Saturated Thickness, b	Hydraulic Conductivity, K[3]		Storativity, S[4]
		(feet)	(gpd/ft)	ft^2/day	(feet)	(gpd/ft^2)	ft/day	
PW1	Drawdown	1.33	19,800	2,650	36.1	548	73	
MW1	Drawdown	1.10	24,000	3,210		665	89	2.55E-03
MW2	Drawdown							
PW1	Recovery	1.00	26,400	3,530	36.1	731	98	
MW1	Recovery							
MW2	Recovery							

1 - delS = water level drawdown per log cycle (see Figure 2)
2 - calculated using Cooper-Jaccob straight line method (Driscoll, 1986)
3 - K = T/b
4 - storativity is measured from the water level drawdown curve in an observation well.

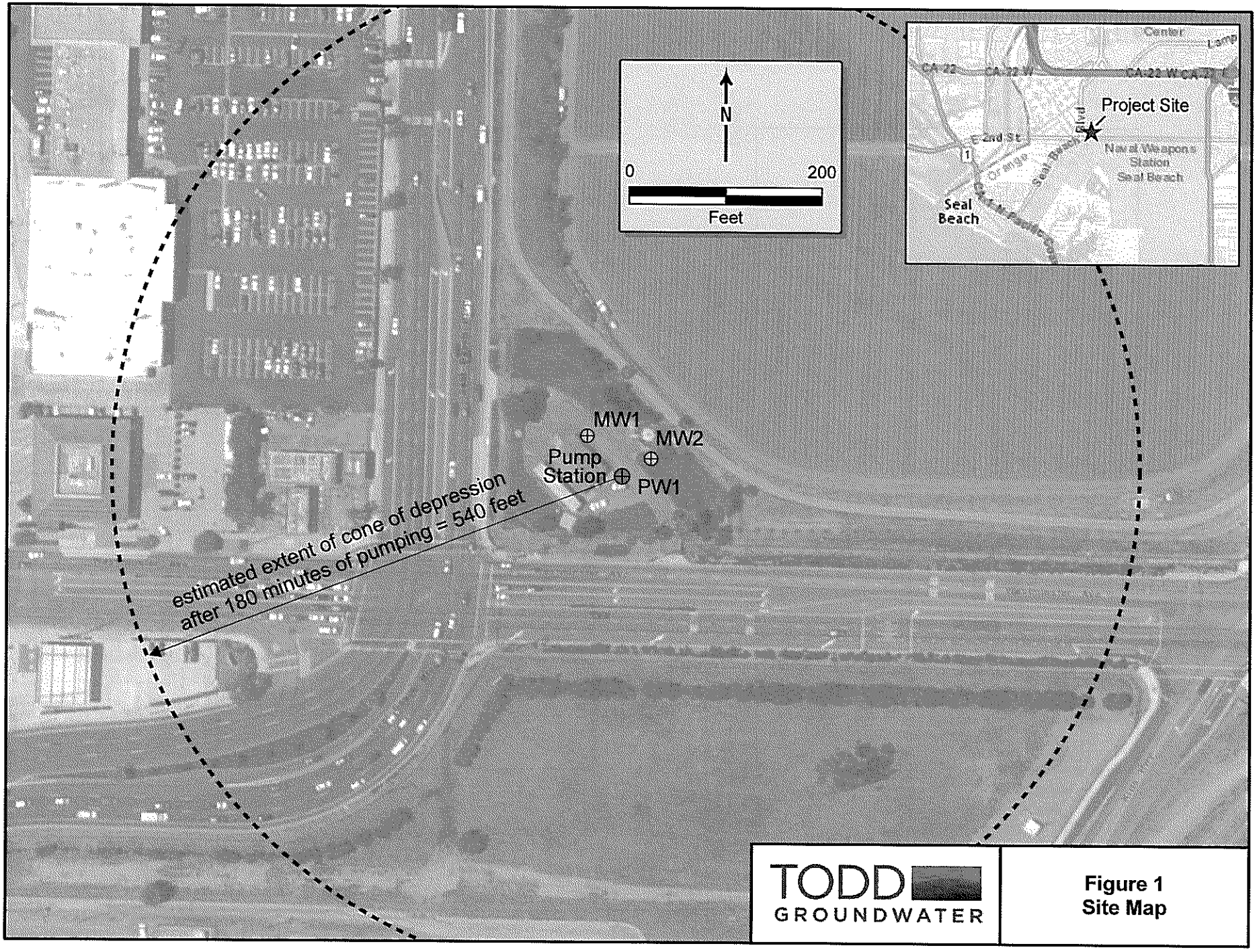
Based on the transmissivity calculated from the PW1 drawdown curve, the distance to the apparent discharge boundary (corresponding to the curve inflection observed at 180 minutes in PW1) is approximately 540 feet from PW1 (as shown on Figure 1).

CONCLUSIONS AND RECOMMENDATIONS

Reliable estimates of aquifer hydraulic properties were obtained from the constant-discharge pumping test conducted at the OCSD Seal Beach Pump Station on September 22-23, 2015. While an apparent discharge boundary was observed during the test on the drawdown curve for PW1, it is recommended that the upper estimates of aquifer

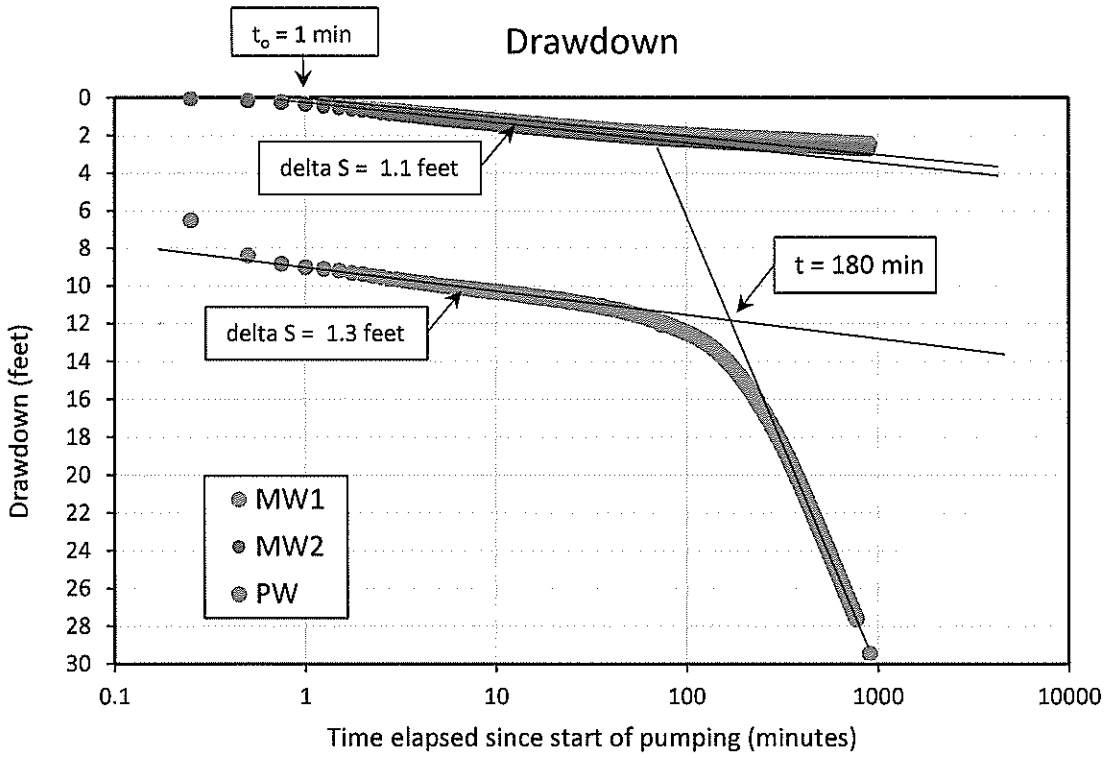
transmissivity (3,530 $feet^2$/day) and hydraulic conductivity (98 feet/day) and estimated aquifer storativity (2.55×10^{-3}) be used to estimate the rate of groundwater inflow into the proposed excavation and design an adequate dewatering system of wells or sump pumps.

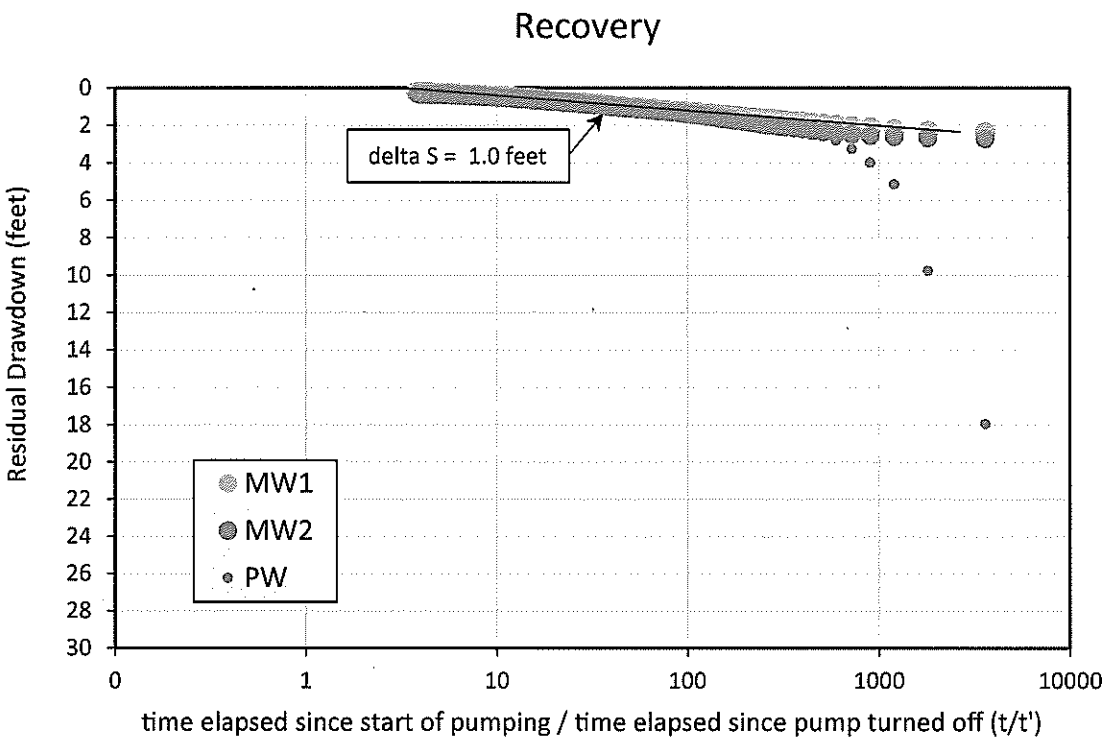
The apparent groundwater discharge boundary in the vicinity of the project site may provide benefits in the form of decreased groundwater inflow, which can be confirmed following installation and operation of initial dewatering wells or sump pumps.



TODD GROUNDWATER

Figure 1
Site Map





October 2015

TODD GROUNDWATER

Figure 2
Drawdown and Recovery Chart

Boring Sample Locations

Google earth

miles 1

km 2

This page intentionally left blank

ATTACHMENT 1

FINAL DATA SUBMITTAL FOR THE JULY 2015 SEMIANNUAL PERFORMANCE MONITORING EVENT – ENHANCED IN SITU BIOREMEDIATION (EISB) AT IR SITE 70, NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CA

(on CD only)

This page intentionally left blank

ECC-INSIGHT LLC

September 30, 2015
ECIN-2004-0007-0006

Ms. Brenda Reese
Naval Facilities Engineering Command Southwest
1220 Pacific Highway
San Diego, California 92132-5190

SUBJECT: DRAFT INFORMAL DATA SUBMITTAL FOR THE JULY 2015 SEMIANNUAL PERFORMANCE MONITORING EVENT – ENHANCED IN SITU BIOREMEDIATION (EISB) AT IR SITE 70, NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA NAVFAC SOUTHWEST CONTRACT NO.: N62473-12-D-2004, Task Order: 0007

Dear Ms. Reese:

This letter report presents the results of the July 2015 semiannual performance monitoring event at IR Site 70.

Introduction

IR Site 70 is located south of Westminster Boulevard and east of Seal Beach Boulevard and encompasses approximately 40 acres (Figure 1). Groundwater at IR Site 70 is impacted by chlorinated solvents, including trichloroethene (TCE) and associated degradation products. The Remedial Design approach consisted of EISB injection activities in one grid and six biobarriers along four hydrostratigraphic zones: the Upper Fines, First Sand, Shell Horizon, and Second Sand (ECC/Geosyntec 2008). These activities were documented in the Baseline Groundwater Monitoring Report (Insight 2009), 2009 Performance Monitoring Report (Insight 2010), the 2010 Performance Monitoring Report (Insight 2011), the 2013 Annual Performance Monitoring Report (TtEC 2014) and the 2014 Semi-Annual Informal Data Submittal (TtEC 2014).

The EISB at IR Site 70 consisted of injection of the KB-1® culture and an electron donor using Newman Zone®, an emulsified vegetable oil (EVO) containing soybean oil, sodium lactate, and emulsifying agents. The EVO/bioaugmentation process commenced in November 2008 and was completed in August 2010. The EVO/reinjection process began in September 2013 and was complete in December 2013. The target volumes and sequencing of injections are summarized in Table 1. Figure 2 depicts the well locations and biobarriers across IR Site 70.

Summary of Field Activities

In July 2015, groundwater samples were collected, preserved, labeled, and packaged in accordance with the Sampling and Analysis Plan (SAP) Addendum (ECC-Insight 2014). Table 2 summarizes the 2015 performance monitoring schedule. Water level elevations were measured

1746 Cole Blvd, Bldg 21, Suite 350, Lakewood, CO 80401
Tel. 303.298.7607 Fax. 303.298.7837

in 74 wells and are presented in Table 3. Groundwater samples were collected and field parameters were measured in 44 wells, as shown in Table 4. The groundwater samples that were collected were submitted for the following laboratory analyses per the schedule in Table 2:

Laboratory Analyses Methods

- Volatile organic compounds (VOCs) by EPA 8260B
- Dissolved Hydrogen Gases by RSK-175
- Anions by EPA 300.0
- Volatile fatty acids (VFAs) by EPA 300.0M
- Total dissolved solid (TDS) by EPA 2540C
- Alkalinity by EPA 2320B
- Total organic carbon (TOC) by EPA 5310B

In accordance with the SAP Addendum, laboratory quality control samples (trip blanks, equipment blanks, and duplicates) were collected. The data were validated at 80 percent U.S. EPA Level III and 20 percent U.S. EPA Level IV. Groundwater sampling purge logs are presented in Appendix A (on compact disk). Laboratory analytical reports are presented in Appendix B (on compact disk).

Water Level Elevations

Water level contours, hydraulic gradients, and flow directions were determined for the Upper Fines, First Sand, Shell Horizon, Second Sand, and Deep Sand units, and are depicted on Figures 3 through 7. The hydraulic gradient and flow directions have remained relatively consistent from 2008 through July 2015. Although groundwater elevations have been decreasing since 2011, groundwater elevations have increased overall in each hydrostratigraphic unit by approximately 6 feet since the 2008 baseline sampling event, likely the result of changes to the amount of precipitation and agricultural pumping in the vicinity. Figures 8 and 9 depict the groundwater elevation changes through the different hydrostratigraphic units between 2008 and 2015.

Water Quality Monitoring

The water quality field parameter data recorded during sampling are summarized in Table 4. A summary of analytical results for the July 2015 sampling event is provided in Tables 5 through 11 and on Figures 10 through 24. Molar contaminant concentration graphs for the Source Area Treatment Grid (SATG), Source Area Biobarrier-1 (SAB-1), First Sand Biobarrier-1 (FSB-1), First Sand Biobarrier-2 (FSB-2), Shell Horizon Biobarrier-3 (SHB-3), and Second Sand Biobarrier-1 (SSB-1) are summarized in upgradient, injection, and performance monitoring wells in Figures 25 through 31.

In general, compared to the results from the December 2014 Performance Monitoring Event (ECC-Insight 2015), TCE concentrations were relatively stable, with the concentrations in some wells increasing and in others decreasing. One of the most notable changes was the TCE concentration in well MW-70-27, located in the most impacted area of the SATG, which decreased from 200 micrograms per liter (µg/L) to 66 µg/L. Compared to the results from the December 2014 Performance Monitoring Event, cis-1,2- dichloroethene (DCE) and vinyl

chloride concentration trends were also mixed, with some concentrations increasing and others decreasing. Probably the most notable changes in cis-1,2-DCE concentrations were in SATG wells MW-70-27 and MW-70-28, located adjacent to each other, where the cis-1,2-DCE concentration increased from 440 to 1,100 µg/L in MW-70-27 (well with shallower screen), and in MW-70-28 (adjacent well with deeper screen) increased from 790 to 2,200 µg/L. Another notable change was the cis-1,2-DCE concentration in well MW-70-PWW11B, located in the Shell Horizon Biobarrier 3, which decreased from 860 to 6.7 µg/L. Notable changes in vinyl concentrations include wells MW-70-27 and MW-70-28 where the vinyl chloride concentration increased from 350 to 400 µg/L in well MW-70-27 (well with shallower screen), and increased from 1,800 to 2,000 µg/L in well MW-70-28 (well with deeper screen). Well MW-70-PMW01B decreased in concentrations from 3,700 to 1,300 µg/L.

TOC concentrations, oxidation-reduction indicators, VFAs, sulfate, and methane were also evaluated along with the chlorinated VOC data for each of the biobarriers (Figures 32 through 50). As expected, TOC concentrations were highest in the injection wells but have shown a general overall decreasing trend. The presence of reducing conditions required for reductive dechlorination is indicated by the continued low levels of dissolved oxygen and the oxidation-reduction potential. The depletion of sulfate and the presence or increase in methane can indicate that anaerobic microbial respiration is occurring. Overall, sulfate and methane levels were relatively stable, with some sulfate concentrations slightly increasing, and some methane concentrations slightly decreasing.

Conclusions

The EVO injection that took place between September and December 2013 has reinforced the overall presence of TOC in the aquifer. The groundwater sampling data, overall, indicate there are generally stable levels of TCE in the aquifer with mixed trends in the concentrations of the breakdown by-products cis-1,2-DCE and vinyl chloride (not clearly decreasing trends). The highest concentrations of TCE, cis-1,2-DCE, and vinyl chloride are located at the eastern end of the SATG, and in areas immediately upgradient of First Sand Biobarrier 1. In general, conditions in the aquifer remain conducive to reductive dechlorination.

If you have any questions, please do not hesitate to contact me at (714) 678-6704.

Sincerely,

Anthony Ford

Anthony Ford, Project Manager

c.c. Ms. Pei-Fen Tamashiro, NAVWPNSTA Seal Beach

References

ECC-Geosyntec (Environmental Chemical Corporation/Geosyntec Consultants). 2008. Final Remedial Action Work Plan, Implementation of Enhanced In-Situ Bioremediation, Installation Restoration Program Site 70, Naval Weapons Station Seal Beach, Seal Beach, California. March.

ECC-Insight. 2014a. Addendum Number 5 to the Final Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan), Installation Restoration Site 70, Naval Weapons Station Seal Beach, Seal Beach, California

————. 2015. 2014 Draft Annual Performance Monitoring Report, Enhanced In Situ Bioremediation Installation Restoration Program Site 70, Naval Weapons Station, Seal Beach, Seal Beach, California. June.

Insight (Insight EEC, Inc.). 2009. Baseline Groundwater Monitoring Report. Installation Restoration Program Site 70, Naval Weapons Station, Seal Beach, Seal Beach, California. April.

————. 2010. 2009 Performance Monitoring Report, Enhanced In Situ Bioremediation Installation Restoration Program Site 70, Naval Weapons Station, Seal Beach, Seal Beach, California. May.

————. 2011. 2010 Performance Monitoring Report, Enhanced In Situ Bioremediation Installation Restoration Program Site 70, Naval Weapons Station, Seal Beach, Seal Beach, California. August.

TtEC (Tetra Tech EC, Inc.). 2014. Final 2013 Annual Performance Monitoring Report. Enhanced In Situ Bioremediation, Installation Restoration Program Site 70, Naval Weapons Station Seal Beach, Seal Beach, California. November.

————. 2014. Final Informal Data Submittal for the July 2014 Semi-Annual Performance Monitoring Event – Enhanced In-situ Bioremediation (EISB) at IR SITE 70, Naval Weapons Station Seal Beach, Seal Beach, California. December

TABLES

Table 1 IR Site 70 Injection Summary
Table 2 July 2014 Groundwater and Performance Monitoring Schedule
Table 3 July 2014 Groundwater Levels
Table 4 Field Parameter Data
Table 5 Source Area Treatment Grid Analytical Results, July 2015
Table 6 Source Area Biobarrier Analytical Results, July 2015
Table 7 First Sand Biobarrier 1 Analytical Results, July 2015
Table 8 First Sand Biobarrier 2 Analytical Results, July 2015
Table 9 Shell Horizon Biobarrier 1 Analytical Results, July 2015
Table 10 Shell Horizon Biobarrier 3 Analytical Results, July 2015
Table 11 Second Sand Biobarrier Analytical Results, July 2015

FIGURES

Figure 1 IR Site 70 Site Location Map
Figure 2 IR Site 70 Well Location Map
Figure 3 Upper Fines Groundwater Level Elevations – July 2015
Figure 4 First Sand Groundwater Elevations – July 2015
Figure 5 Shell Horizon Groundwater Elevations – July 2015
Figure 6 Second Sand Groundwater Elevations – July 2015
Figure 7 Deep Sand Groundwater Elevations – July 2015
Figure 8 Water Level Trends – Upper Fines and First Sand
Figure 9 Water Level Trends – Shell Horizon, Second Sand and Deep Sand
Figure 10 Source Area Treatment Grid– Trichloroethene
Figure 11 Source Area Treatment Grid – Cis-1,2-Dichloroethene
Figure 12 Source Area Treatment Grid – Vinyl Chloride
Figure 13 Source Area Biobarrier (SAB-1) – Trichloroethene
Figure 14 Source Area Biobarrier (SAB-1) – Cis-1,2-Dichloroethene
Figure 15 Source Area Biobarrier (SAB-1) – Vinyl Chloride
Figure 16 First Sand Biobarriers – Trichloroethene
Figure 17 First Sand Biobarriers – Cis-1,2-Dichloroethene
Figure 18 First Sand Biobarriers – Vinyl Chloride
Figure 19 Shell Horizon Biobarriers – Trichloroethene
Figure 20 Shell Horizon Biobarriers – Cis-1,2-Dichloroethene
Figure 21 Shell Horizon Biobarriers – Vinyl Chloride
Figure 22 Second Sand Biobarrier 1 (SSB-1) – Trichloroethene
Figure 23 Second Sand Biobarrier 1 (SSB-1) – Cis-1,2-Dichloroethene
Figure 24 Second Sand Biobarrier 1 (SSB-1) – Vinyl Chloride
Figure 25 CVOC Molar Concentrations – Source Area Treatment Grid
Figure 26 CVOC Molar Concentrations – Source Area Biobarrier (SAB-1)
Figure 27 CVOC Molar Concentrations – First Sand Biobarrier 1
Figure 28 CVOC Molar Concentrations – First Sand Biobarrier 2
Figure 29 CVOC Molar Concentrations – Shell Horizon Biobarrier 1

Figure 30 CVOC Molar Concentrations – Shell Horizon Biobarrier 3
Figure 31 CVOC Molar Concentrations – Second Sand Biobarrier 1 (SSB-1)
Figure 32 Water Quality Trends – Source Area Treatment Grid – MW-70-PMW01A (25-35 Ft bgs)
Figure 33 Water Quality Trends – Source Area Treatment Grid – MW-70-PMW01B (45-55 Ft bgs)
Figure 34 Water Quality Trends – Source Area Biobarrier – MW-70-PMW03A (70-80 Ft bgs)
Figure 35 Water Quality Trends – Source Area Biobarrier – MW-70-PMW03B (90-100 Ft bgs)
Figure 36 Water Quality Trends – Source Area Biobarrier – IW-70-SAB06 (65-85/85-105 Ft bgs)
Figure 37 Water Quality Trends – First Sand Biobarrier 2 – IW-70-FSB216 (65-100 Ft bgs)
Figure 38 Water Quality Trends – First Sand Biobarrier 2 – MW-70-PMW08B (85-95 Ft bgs)
Figure 39 Water Quality Trends – Shell Horizon Biobarrier 1 – IW-70-SHB113 (105-130 Ft bgs)
Figure 40 Water Quality Trends – Shell Horizon Biobarrier 1 – MW-70-PMW10 (120-130 Ft bgs)
Figure 41 Water Quality Trends – Shell Horizon Biobarrier 3 – IW-70-SHB310 (80-95/105-130 Ft bgs)
Figure 42 Water Quality Trends – Shell Horizon Biobarrier 3 – MW-70-PMW12B (115-125 Ft bgs)
Figure 43 Water Quality Trends – Second Sand Biobarrier 1 – IW-70-SSB109 (126-166 Ft bgs)
Figure 44 Water Quality Trends – Second Sand Biobarrier 1 – MW-70-PMW14B (149-159 Ft bgs)
Figure 45 DO/ORP Trends – Source Area Treatment Grid
Figure 46 DO/ORP Trends – Source Area Biobarrier
Figure 47 DO/ORP Trends – First Sand Biobarrier 1
Figure 48 DO/ORP Trends – First Sand Biobarrier 2
Figure 49 DO/ORP Trends – Shell Horizon Biobarrier 1
Figure 50 DO/ORP Trends – Second Sand Biobarrier 1

APPENDICES
(on CD only)

Appendix A Field Sampling Logs
Appendix B Laboratory Analytical Reports

TABLES

This page intentionally left blank.

Table 1
IR Site 70 Injection Summary

Barrier	Total No. of Injection Wells	Volume of EVO per Well (gallons)	Total EVO (gallons)	Total Amended Volume (gallons)	EVO/Reinjection Start-End
SAB	8	222.3	1,778	178,292	October 2013- October2013 (2 weeks)
SSB1	13	226.8	2,948	294,865	September 2013 – September 2013 (2.5 weeks)
SHB3	7	251.3	1,447	176,486	December 2013 – Decemebr 2013 (2 weeks)
FSB2	12	169.2	1,983	199,381	September 2013-October 2013 (2 weeks)
FSB1	17	222.3	3,779	381,073	October 2013- November2013 (3.5 weeks)
SATG	14	168.16	2,091	223,208	Novemebr 2013 – December 2013 (3 weeks)

Acronyms/Abbreviations:
EVO = Emulsified Vegetable Oil

This page intentionally left blank

Table 2
Seal Beach IR Site 70
July 2015 Groundwater and Performance Monitoring Schedule

						EMAX - Analytical Methods for COC						
					Collect field parameters ONLY; no sampling	VOCs/8260B	DHGs/RSK 175	Anions/300.0	TDS/2540C	Alkalinity/2320B	VFAs/300.0M	TOC/5310B
Well Locations	Sample ID	Screen Interval (Start and End Depth on COC)	Level 3/4	Field QC		Three 40-mL VOA vials with HCl (if bubbles during sampling, use no HCl vials)	Three 40-mL VOA vials with HCl (if bubbles during sampling, use no HCl vials)	One 1-Liter Plastic				One 125-mL Plastic with HCl
Source Area Treatment Grid												
IW-70-SAT35	not applicable	25-55			X							
MW-70-PMW01A	IR70-SA15-001	25-35	3	N		X	X	X	X	X	X	X
MW-70-PMW01B	IR70-SA15-002	45-55	3	N		X	X	X	X	X	X	X
MW-70-27	IR70-SA15-003	25.5-35.5	3	N		X	X	X	X	X	X	X
MW-70-28	IR70-SA15-004	50.3-60.3	3	N		X	X	X	X	X	X	X
MW-70-28	IR70-SA15-005	50.3-60.3	4	FD		X	X	X	X	X	X	X
Source Area Biobarrier/First Sand												
IW-70-SAB06	IR70-SA15-006	**65-80/85-105 ****	3	N		X	X	X	X	X	X	X
IW-70-SAB11	not applicable	65-105			X							
MW-70-PMW02A	not applicable	70.5-80.5			X							
MW-70-PMW02B	not applicable	90-100			X							
MW-70-PMW03A	IR70-SA15-007	70-80	3	N		X	X	X	X	X	X	X
MW-70-PMW03B	IR70-SA15-008	90-100	3	MS/MSD		XXX	XXX	XXX	XXX	XXX	XXX	XXX
First Sand Biobarrier 1												
MW-70-38	IR70-SA15-009	80-100	3	N		X	X	X	X	X	X	X
IW-70-FSB108	IW-70-FSB108-TT2014	60-105	3	N		X	X	X	X	X	X	X
IW-70-FSB118	IR70-SA15-010	60-105	3	N		X	X	X	X	X	X	X
MW-70-PMW04A	IR70-SA15-013	70-80	3	N		X	X	X	X	X	X	X
MW-70-PMW04B	IR70-SA15-014	90-100	3	N		X	X	X	X	X	X	X
MW-70-PMW04B	IR70-SA15-015	90-100	3	FD		X	X	X	X	X	X	X
MW-70-PMW05A	IR70-SA15-017	70-80	3	N		X	X	X	X	X	X	X
MW-70-PMW05B	IR70-SA15-018	90-100	3	N		X	X	X	X	X	X	X
MW-70-PMW06A	IR70-SA15-011	69.5-79.5	3	N		X	X	X	X	X	X	X
MW-70-PMW06B	IR70-SA15-012	91-101	3	N		X	X	X	X	X	X	X
RDO-5	not applicable	65-105			X							
MW-70-MNA08	not applicable	80-90			X							
MW-70-MNA07	not applicable	90-100			X							
First Sand Biobarrier 2												
IW-70-FSB216	IR70-SA15-021	65-100	3	N		X	X	X	X	X	X	X
IW-70-FSB229	not applicable	65-100			X							
MW-70-PMW07A	IR70-SA15-019	65-75	3	N		X	X	X	X	X	X	X
MW-70-PMW07B	IR70-SA15-020	85-95	3	N		X	X	X	X	X	X	X
MW-70-PMW08A	IR70-SA15-022	65-75	3	N		X	X	X	X	X	X	X
MW-70-PMW08B	IR70-SA15-023	85-95	3	MS/MSD		XXX	XXX	XXX	XXX	XXX	XXX	XXX
MW-70-MNA09	not applicable	64-74			X							
Shell Horizon Biobarrier 1												
IW-70-SHB113	IR70-SA15-027	105-130	3	N		X	X	X	X	X	X	X
MW-70-PMW09	IR70-SA15-025	120-130	3	N		X	X	X	X	X	X	X
MW-70-PMW09	IR70-SA15-026	120-130	3	FD		X	X	X	X	X	X	X
MW-70-PMW10	IR70-SA15-028	120-130	3	N		X	X	X	X	X	X	X
Shell Horizon Biobarrier 3												
IW-70-SHB310	not applicable	**80-95/105-130 ****			X							
IW-70-SHB311 *	not applicable	**80-95/105-130 ****			X							
MW-70-PMW11A	IR70-SA15-029	85-95	3	N		X	X	X	X	X	X	X
MW-70-PMW11B	IR70-SA15-030	115-125	3	N		X	X	X	X	X	X	X
MW-70-PMW12A	IR70-SA15-031	85-95	3	N		X	X	X	X	X	X	X
MW-70-PMW12B	IR70-SA15-032	115-125	3	N		X	X	X	X	X	X	X

Table 2
Seal Beach IR Site 70
July 2015 Groundwater and Performance Monitoring Schedule

						EMAX - Analytical Methods for COC						
					Collect field parameters ONLY; no sampling	VOCs/8260B	DHGs/RSK 175	Anions/300.0	TDS/2540C	Alkalinity/2320B	VFAs/300.0M	TOC/5310B
Well Locations	Sample ID	Screen Interval (Start and End Depth on COC)	Level 3/4	Field QC		Three 40-mL VOA vials with HCl (if bubbles during sampling, use no HCl vials)	Three 40-mL VOA vials with HCl (if bubbles during sampling, use no HCl vials)	One 1-Liter Plastic				One 125-mL Plastic with HCl
Second Sand Biobarrier 1												
IW-70-SSB109		125.75-165.75			X							
IW-70-SSB119 *	IW-70-SSB119-TT2014	125-165	3	N		X	X	X	X	X	X	X
MW-70-PMW13A	IR70-SA15-033	125-135	3	N		X	X	X	X	X	X	X
MW-70-PMW13A	IR70-SA15-034	125-135	3	FD		X	X	X	X	X	X	X
MW-70-PMW13B	IR70-SA15-035	145-155	3	N		X	X	X	X	X	X	X
MW-70-PMW14A	IR70-SA15-037	128-138	3	N		X	X	X	X	X	X	X
MW-70-PMW14B	IR70-SA15-038	149-159	3	N		X	X	X	X	X	X	X
MW-70-MNA15	MW-70-MNA15-TT2014	140-150	3	N		X	X	X	X	X	X	X
MW-70-MNA16	not applicable	141-151			X							
MW-70-MNA17	not applicable	140-150			X							
MW-70-14 *	IR70-SA15-040	160-170	3	N		X	X	—	—	—	—	—
MW-70-49	IR70-SA15-039	125-165	3	N		X	X	X	X	X	X	X
Blank Samples												
Source Blank	IR70-SA15-048	—	3	SB		X	X	—	—	—	—	—
Trip Blank Day 1	IR70-SA15-041	—	3	TB		X	X	—	—	—	—	—
Trip Blank Day 2	IR70-SA15-042	—	3	TB		X	X	—	—	—	—	—
Trip Blank Day 3	IR70-SA15-043	—	3	TB		X	X	—	—	—	—	—
Trip Blank Day 4	IR70-SA15-044	—	3	TB		X	X	—	—	—	—	—
Trip Blank Day 5	IR70-SA15-045	—	3	TB		X	X	—	—	—	—	—
Trip Blank Day 6	IR70-SA15-046	—	3	TB		X	X	—	—	—	—	—
Trip Blank Day 7	IR70-SA15-047	—	3	TB		X	X	—	—	—	—	—
Equpment Rinse 1	IR70-SA15-049	—	3	EB		X	X	—	—	—	—	—
Equpment Rinse 2	IR70-SA15-050	—	3	EB		X	X	—	—	—	—	—
Equpment Rinse 3	IR70-SA15-051	—	3	EB		X	X	—	—	—	—	—
Equpment Rinse 4	IR70-SA15-052	—	3	EB		X	X	—	—	—	—	—
Equpment Rinse 5	IR70-SA15-053	—	3	EB		X	X	—	—	—	—	—
Equpment Rinse 6	IR70-SA15-054	—	3	EB		X	X	—	—	—	—	—

Notes:
MW-70-MNA15 added per FCR to provide add'l information on what is happening between biobarriers.
*** Based on historical sampling logs, these wells are anticipated to need portable pumps for sampling. All other wells listed (that are not shaded as indicated above) are assumed to have dedicated pumps for sampling.**
**** Although two screen intervals are listed for these wells, the sample will be collected from the top well interval ONLY. For example, 85-105/110-130 means that the sample will be collected from the 85-105 interval.**
— analysis not required or depth not applicable
All wells will be monitored for pH, DO, ORP, conductivity, temperature, and turbidity prior to sampling as indicated above. In addition, some of the wells listed will only be measured for field parameters and no samples will be collected.
One source blank will be collected one the first day of sampling. The source blank is collected by using laboratory provided water and filling up containers as required above.
One trip blank (consisting of three 40-mL trip blanks vials provided by laboratory) will be included in each cooler with VOCs/8260B analysis.
One equipment blank will be collected per day that portable/non-disposable equipment is used for sampling wells that do not have dedicated pumps. The equipment blank will be analyzed for all parameters regardless of what analyses are required for the wells for that day.

SB = source blank
TB = trip blank
EB = equipment blank
FD = field duplicate
N = normal sample
QC = quality control
ID = identification
VOC = volatile organic compounds
MS/MSD = matrix spike/matrix spike duplicate
COC = chemical of concern
VOA = volatile organic analysis
TOC = total organic compound
HCL = hydrocloric acid
DHG = dissolved hydrocarbon gases
ml= milliliter
VFA = volatile fatty acids

Table 3
July 2015 Groundwater Levels

Well No.	Screen Interval (feet above MSL)	TOC Elevation (feet above MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)
Upper Fines																	
MW-70-03	20-30	8.03	8/18/2008	NA	NA	8/24/2009	19.19	-11.16	8/25/2010	13.7	-5.67	7/25/2011	9.50	-1.47	10/26/2011	9.61	-1.58
Source Area Treatment/Upper Fines																	
MW-70-PMW01A	25-35	8.23	8/18/2008	20.31	-12.08	8/24/2009	21.60	-13.37	8/25/2010	15.21	-6.98	7/25/2011	8.95	-0.72	10/26/2011	9.06	-0.83
MW-70-PMW01B	45-55	8.21	8/18/2008	22.02	-13.81	8/24/2009	22.04	-13.83	8/25/2010	16.25	-8.04	7/25/2011	9.21	--1.00	10/26/2011	9.30	-1.09
MW-70-27[a]	26-36	8.25	8/21/2008	21.70	-13.45	8/24/2009	21.78	-13.53	8/25/2010	15.20	-6.95	7/25/2011	9.10	-0.85	10/26/2011	9.20	-0.95
MW-70-28[a]	50-60	8.30	8/21/2008	22.13	-13.83	8/24/2009	21.81	-13.51	8/25/2010	17.02	-8.72	7/25/2011	9.43	-1.13	10/26/2011	9.54	-1.24
MW-70-MNA01	40-50	8.36	8/18/2008	22.48	-14.12	8/24/2009	22.32	-13.96	8/25/2010	17.07	-8.71	7/25/2011	9.57	-1.21	10/26/2011	9.68	-1.32
MW-70-MNA02	35-45	8.51	8/18/2008	22.23	-13.72	8/24/2009	20.45**	-11.94	8/25/2010	15.13	-6.62	7/25/2011	9.23	-0.72	10/26/2011	9.33	-0.82
MW-70-MNA03	35-45	9.18	8/18/2008	20.90	-11.72	8/24/2009	21.46	-12.28	8/25/2010	15.73	-6.55	7/25/2011	9.85	-0.67	10/26/2011	9.96	-0.78
MW-70-MNA04	35-45	8.39	8/18/2008	20.52	-12.13	8/24/2009	21.06	-12.67	8/25/2010	15.37	-6.98	7/25/2011	9.20	-0.81	10/26/2011	9.32	-0.93
Source Area Biobarrier/First Sand																	
MW-70-PMW02A	71-81	8.35	8/18/2008	23.06	-14.71	8/24/2009	22.82	-14.47	8/25/2010	17.45	--9.10	7/25/2011	9.52	-1.17	10/26/2011	9.63	-1.28
MW-70-PMW02B	90-100	8.38	8/18/2008	23.11	-14.73	8/24/2009	22.88	--14.50	8/25/2010	17.50	-9.12	7/25/2011	9.57	-1.19	10/26/2011	9.67	-1.29
IW-70-SAB06	65-80/85-105	8.07	8/18/2008	22.81	-14.74	8/24/2009	22.60	-14.53	8/25/2010	17.22	-9.15	7/25/2011	9.27	--1.20	10/26/2011	9.38	-1.31
MW-70-MNA05	70-80	8.46	8/18/2008	22.90	-14.44	8/24/2009	22.79	-14.33	8/25/2010	17.45	-8.99	7/25/2011	9.55	-1.09	10/26/2011	9.65	-1.19
MW-70-PMW03A	70-80	7.94	8/18/2008	22.72	-14.78	8/24/2009	22.49	-14.55	8/25/2010	17.05	-9.11	7/25/2011	9.56	-1.62	10/26/2011	9.67	-1.73
MW-70-P MW03B	90-100	7.88	8/18/2008	22.69	-14.81	8/24/2009	22.44	-14.56	8/25/2010	17.05	-9.17	7/25/2011	9.07	-1.19	10/26/2011	9.18	--1.30
First Sand Biobarrier 1																	
MW-70-38	80-100	6.85	8/18/2008	22.20	-15.35	8/24/2009	21.80	-14.95	8/25/2010	16.32	-9.47	7/25/2011	8.10	-1.25	10/26/2011	8.60	-1.75
IW-70-FSB118	60-105	4.42	8/18/2008	19.71	-15.29	8/24/2009	19.30	-14.88	8/25/2010	13.97	-9.55	7/25/2011	5.79	-1.37	10/26/2011	6.20	-1.78
MW-70-PMW06A	70-80	4.14	8/18/2008	19.42	-15.28	8/24/2009	19.04	--14.90	8/25/2010	13.68	-9.54	7/25/2011	5.50	-1.36	10/26/2011	6.00	-1.86
MW-70-PMW06B	91-101	4.16	8/18/2008	19.50	-15.34	8/24/2009	19.05	-14.89	8/25/2010	13.68	-9.52	7/25/2011	5.47	-1.31	10/26/2011	6.02	-1.86
MW-70-PMW04A	70-80	4.52	8/18/2008	19.90	-15.38	8/24/2009	19.47	-14.95	8/25/2010	14.03	-9.51	7/25/2011	5.78	-1.26	10/26/2011	6.24	-1.72
MW-70-PMW04B	90-100	4.53	8/18/2008	19.05	-14.52	8/24/2009	19.51	-14.98	8/25/2010	14.05	-9.52	7/25/2011	5.82	-1.29	10/26/2011	6.36	-1.83
IW-70-FSB108	60-105	4.64	8/18/2008	20.02	-15.38	8/24/2009	19.63	-14.99	8/25/2010	14.21	-9.57	7/25/2011	6.11	-1.47	10/26/2011	6.55	-1.91
MW-70-PMW05A	70-80	4.21	8/18/2008	19.65	-15.44	8/24/2009	19.21	--15.00	8/25/2010	13.82	-9.61	7/25/2011	5.51	--1.30	10/26/2011	6.06	-1.85
MW-70-PMW05B	90-100	4.34	8/18/2008	19.80	-15.46	8/24/2009	19.34	--15.00	8/25/2010	14.00	-9.66	7/25/2011	5.68	-1.34	10/26/2011	6.11	-1.77
RDO-5	65-105	6.01	8/18/2008	21.55	-15.54	8/24/2009	21.05	-15.04	8/25/2010	15.58	-9.57	7/25/2011	7.33	-1.32	10/26/2011	7.73	-1.72
MW-70-MNA08	80-90	7.66	8/18/2008	23.27	-15.61	8/24/2009	22.74		8/25/2010	17.21	-9.55	7/25/2011	8.99	-1.33	10/26/2011	9.41	-1.75
MW-70-MNA06	80-90	3.95	8/18/2008	19.48	-15.53	8/24/2009	19.03	-15.08	8/25/2010	13.58	-9.63	7/25/2011	5.30	-1.35	10/26/2011	5.70	-1.75
MW-70-MNA11	80-90	8.30	8/18/2008	24.55	-16.25	8/24/2009	23.90	--15.60	8/25/2010	18.35	-10.05	7/25/2011	9.73	-1.43	10/26/2011	10.25	-1.95
MW-70-MNA07	90-100	4.63	8/18/2008	20.18	-15.55	8/24/2009	19.74	-15.11	8/25/2010	14.29	-9.66	7/25/2011	5.97	-1.34	10/26/2011	6.43	--1.80
First Sand Biobarrier 2																	
MW-70-PMW07A	65-75	7.89	8/18/2008	24.43	-16.54	8/24/2009	23.61	-15.72	8/25/2010	17.97	-10.08	7/25/2011	9.10	-1.21	10/26/2011	9.97	-2.08
MW-70-PMW07B	85-95	7.52	8/18/2008	26.44	-18.92	8/24/2009	25.43	-17.91	8/25/2010	19.60	-12.08	7/25/2011	9.44	-1.92	10/26/2011	9.95	-2.43
IW-70-FSB216	65-100	8.34	8/18/2008	26.89	-18.55	8/24/2009	26.50	-18.16	8/25/2010	19.13	-10.79	7/25/2011	10.75	-2.41	10/26/2011	11.34	--3.00
MW-70-PMW08A	65-75	9.04	8/18/2008	26.77	-17.73	8/24/2009	25.98	-16.94	8/25/2010	20.30	-11.26	7/25/2011	10.96	-1.92	10/26/2011	11.50	-2.46
MW-70-PMW08B	85-95	9.08	8/18/2008	28.26	-19.18	8/24/2009	27.32	-18.24	8/25/2010	21.58	--12.50	7/25/2011	11.24	-2.16	10/26/2011	11.84	-2.76
MW-70-MNA09	64-74	6.82	8/18/2008	23.30	-16.48	8/24/2009	22.68	-15.86	8/25/2010	17.08	-10.26	7/25/2011	8.53	-1.71	10/26/2011	9.00	-2.18
MW-70-MNA10	75-85	7.01	8/18/2008	26.67	-19.66	8/24/2009	25.63	-18.62	8/25/2010	19.69	-12.68	7/25/2011	9.24	-2.23	10/26/2011	9.85	-2.84
MW-70-MNA12	75-85	5.85	8/18/2008	26.22	-20.37	8/24/2009	25.07	-19.22	8/25/2010	19.23	-13.38	7/25/2011	8.33	-2.48	10/26/2011	8.91	-3.06
MW-70-43A	86-106	10.76	8/18/2008	NA	NA	8/24/2009	30.44	-19.68	8/25/2010	24.20	-13.44	7/26/2011	13.37	-2.61	10/26/2011	14.04	-3.28
Shell Horizon Biobarrier 1																	
MW-70-PMW09	120-130	6.82	8/18/2008	26.61	-19.79	8/24/2009	25.39	-18.57	8/25/2010	19.47	-12.65	7/25/2011	8.75	-1.93	10/26/2011	9.35	-2.53
IW-70-SHB113	105-130	7.49	8/18/2008	24.20	-16.71	8/24/2009	23.44	-15.95	8/25/2010	20.00	-12.51	7/25/2011	9.64	-2.15	10/26/2011	10.25	-2.76
MW-70-PMW10	120-130	6.60	8/18/2008	26.46	-19.86	8/24/2009	25.20	--18.60	8/25/2010	19.29	-12.69	7/25/2011	8.61	-2.01	10/26/2011	9.26	-2.66
IW-70-SHB217	105-130	8.67	8/18/2008	29.97	--21.30	8/24/2009	27.80	-19.13	8/25/2010	21.82	-13.15	7/25/2011	11.10	-2.43	10/26/2011	11.80	-3.13
MW-70-MNA13	115-125	6.64	8/18/2008	26.42	-19.78	8/24/2009	25.24	--18.60	8/25/2010	19.38	-12.74	7/25/2011	8.75	-2.11	10/26/2011	9.37	-2.73
Shell Horizon Biobarrier 3																	
MW-70-PMW11A	85-95	8.13	8/18/2008	28.81	-20.68	8/24/2009	27.51	-19.38	8/25/2010	22.19	-14.06	7/26/2011	10.10	-1.97	10/26/2011	11.68	-3.55
MW-70-PMW11B	115-125	7.95	8/18/2008	28.51	-20.56	8/24/2009	27.12	-19.17	8/25/2010	21.20	-13.25	7/26/2011	10.22	-2.27	10/26/2011	10.90	-2.95
IW-70-SHB310	~~80-95/105-130~~	8.73	8/18/2008	29.37	-20.64	8/24/2009	25.54	-16.81	8/25/2010	22.34	-13.61	7/26/2011	10.12	-1.39	10/26/2011	12.95	-4.22

Table 3
July 2015 Groundwater Levels

Well No.	Screen Interval (feet above MSL)	TOC Elevation (feet above MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)
MW-70-PMW12A	85-95	7.86	8/18/2008	28.54	-20.68	8/24/2009	27.20	-19.34	8/25/2010	22.28	-14.42	7/26/2011	10.21	-2.35	10/26/2011	10.97	-3.11
MW-70-PMW12B	115-125	8.09	8/18/2008	28.65	-20.56	8/24/2009	27.30	-19.21	8/25/2010	21.35	-13.26	7/26/2011	10.43	-2.34	10/26/2011	10.83	-2.74
MW-70-MNA14	115-125	8.86	8/18/2008	30.02	-21.16	8/24/2009	28.47	-19.61	8/25/2010	23.67	-14.81	7/26/2011	11.35	-2.49	10/26/2011	12.20	-3.34
Second Sand Biobarrier 1																	
MW-70-PMW13A	125-135	7.47	8/18/2008	27.37	--19.90	8/24/2009	26.16	-18.69	8/25/2010	20.25	-12.78	7/26/2011	9.11	-1.64	10/26/2011	9.93	-2.46
MW-70-PMW13B	145-155	7.48	8/18/2008	27.44	-19.96	8/24/2009	26.09	-18.61	8/25/2010	20.16	-12.68	7/26/2011	9.10	-1.62	10/26/2011	9.90	-2.42
IW-70-SSB109	126-166	7.96	8/18/2008	28.82	-20.86	8/24/2009	28.10	-20.14	8/25/2010	21.83	-13.87	7/26/2011	10.95	-2.99	10/26/2011	11.52	-3.56
MW-70-PMW14A	128-138	7.64	8/18/2008	27.62	-19.98	8/24/2009	26.05	-18.41	8/25/2010	20.10	-12.46	7/26/2011	8.97	-1.33	10/26/2011	9.80	-2.16
MW-70-PMW14B	149-159	7.92	8/18/2008	28.13	-20.21	8/24/2009	26.37	-18.45	8/25/2010	20.45	-12.53	7/26/2011	9.35	-1.43	10/26/2011	10.05	-2.13
MW-70-MNA16	141-151	8.65	8/18/2008	29.79	-21.14	8/24/2009	27.27	-18.62	8/25/2010	22.43	-13.78	7/26/2011	11.09	-2.44	10/26/2011	11.93	-3.28
MW-70-MNA17	140-150	6.80	8/18/2008	28.24	-21.44	8/24/2009	27.04	-20.24	8/25/2010	21.33	-14.53	7/26/2011	9.50	--2.70	10/26/2011	10.76	-3.96
MW-70-MNA15	140-150	5.96	8/18/2008	26.23	-20.27	8/24/2009	24.60	-18.64	8/25/2010	18.97	-13.01	7/25/2011	7.92	-1.96	10/26/2011	8.65	-2.69
MW-70-15	161-171	9.41	8/18/2008	31.48	-22.07	8/24/2009	29.97	-20.56	8/25/2010	23.97	-14.56	7/26/2011	12.44	-3.03	10/26/2011	13.35	-3.94
MW-70-14*	160-170	11.01	8/18/2008	NA	NA	8/24/2009	30.19	-19.18	8/25/2010	24.24	-13.23	7/26/2011	13.21	--2.20	10/26/2011	13.85	-2.84
MW-70-43B*	136-146	10.58	8/18/2008	NA	NA	8/24/2009	30.41	-19.83	8/25/2010	24.25	-13.67	7/26/2011	13.17	-2.59	10/26/2011	13.85	-3.27
MW-70-49	125-165	7.89	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10/26/2011	11.00	-3.11
Point of Compliance/Upper Fines																	
MW-70-02	20-30	7.85	8/18/2008	18.88	-11.03	8/24/2009	19.77	-11.92	8/25/2010	14.28	-6.43	7/25/2011	8.33	-0.48	10/26/2011	8.32	-0.47
MW-70-10	30-40	10.10	8/18/2008	19.33	-9.23	8/24/2009	20.29	-10.19	8/25/2010	15.44	-5.34	7/25/2011	10.41	-0.31	10/26/2011	10.73	-0.63
MW-70-17	30-40	4.58	8/18/2008	15.00	-10.42	8/24/2009	15.39	-10.81	8/25/2010	11.39	-6.81	7/25/2011	5.85	-1.27	10/26/2011	6.03	-1.45
MW-70-22	20-30	10.21	8/18/2008	12.51	--2.30	8/24/2009	12.65	-2.44	8/25/2010	11.85	-1.64	7/26/2011	10.37	-0.16	10/26/2011	10.16	0.05
Point of Compliance/First Sand																	
MW-70-POC01	80-90	8.88	8/18/2008	22.92	-14.04	8/24/2009	22.80	-13.92	8/25/2010	17.55	-8.67	7/25/2011	9.81	-0.93	10/26/2011	10.15	-1.27
MW-70-11	80-100	11.07	8/18/2008	28.67	--17.60	8/24/2009	27.76	-16.69	8/25/2010	22.10	-11.03	7/25/2011	12.73	-1.66	10/26/2011	13.35	-2.28
MW-70-35	90-100	6.31	8/18/2008	25.53	-19.22	8/24/2009	24.34	-18.03	8/25/2010	18.66	-12.35	7/25/2011	8.45	-2.14	10/26/2011	9.11	--2.80
MW-70-16	95-105	9.76	8/18/2008	31.49	-21.73	8/24/2009	30.01	-20.25	8/25/2010	23.99	-14.23	7/26/2011	12.45	-2.69	10/26/2011	13.36	--3.60
Point of Compliance/Shell Horizon																	
MW-70-23	110-130	11.17	8/18/2008	33.63	-22.46	8/24/2009	32.39	-21.22	8/25/2010	26.05	-14.88	7/26/2011	14.12	-2.95	10/26/2011	14.85	-3.68
Point of Compliance/Second Sand																	
MW-70-36	150-160	9.04	8/18/2008	29.85	-20.81	8/24/2009	28.41	-19.37	8/25/2010	22.57	-13.53	7/25/2011	11.62	-2.58	10/26/2011	12.64	--3.60
MW-70-21	150-170	7.70	8/18/2008	32.52	-24.82	8/24/2009	30.46	-22.76	8/25/2010	24.10	--16.40	7/26/2011	11.60	--3.90	10/26/2011	12.35	-4.65
Point of Compliance/Deep Sand																	
MW-70-POC02	190-200	8.25	8/18/2008	35.21	-26.96	8/24/2009	32.90	-24.65	8/25/2010	25.80	-17.55	7/26/2011	11.76	-3.51	10/26/2011	12.69	-4.44
MW-70-POC03	190-200	9.64	8/18/2008	30.00	-20.36	8/24/2009	28.39	-18.75	8/25/2010	22.34	--12.70	7/25/2011	10.25	-0.61	10/26/2011	12.30	-2.66
MW-70-POC04	195-205	8.50	8/18/2008	32.35	-23.85	8/24/2009	32.71	-24.21	8/25/2010	26.08	-17.58	7/26/2011	12.94	-4.44	10/26/2011	14.13	-5.63

Notes
NA = not applicable
MSL = mean sea level
TOC = top of casing

Table 3
July 2015 Groundwater Levels

Well No.	Screen Interval (feet above MSL)	TOC Elevation (feet above MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)
Upper Fines														
MW-70-03	20-30	8.03	12/10/2013	NA	NA	8/22/2013	10.81	-2.78	7/21/2014	13	-4.97	7/6/2015	12.7	-4.67
Source Area Treatment/Upper Fines														
MW-70-PMW01A	25-35	8.23	12/10/2013	10.28	-2.05	8/22/2013	12.03	-3.80	7/21/2014	13.99	-5.76	7/6/2015	13.66	-5.43
MW-70-PMW01B	45-55	8.21	12/10/2013	10.6	-2.39	8/22/2013	13.16	-4.95	7/21/2014	15.75	-7.54	7/6/2015	14.84	-6.63
MW-70-27[a]	26-36	8.25	12/10/2013	10.31	-2.06	8/22/2013	11.84	-3.59	7/21/2014	14.16	-5.91	7/6/2015	13.88	-5.63
MW-70-28[a]	50-60	8.30	12/10/2013	10.9	-2.60	8/22/2013	13.39	-5.09	7/21/2014	16.17	-7.87	7/6/2015	15.06	-6.76
MW-70-MNA01	40-50	8.36	12/10/2013	10.95	-2.59	8/22/2013	13.42	-5.06	7/21/2014	16.18	-7.82	7/6/2015	15.04	-6.68
MW-70-MNA02	35-45	8.51	12/10/2013	10.1	-1.59	8/22/2013	11.72	-3.21	7/21/2014	14.28	-5.77	7/6/2015	13.82	-5.31
MW-70-MNA03	35-45	9.18	12/10/2013	10.8	-1.62	8/22/2013	12.39	-3.21	7/21/2014	14.99	-5.81	7/6/2015	14.48	-5.30
MW-70-MNA04	35-45	8.39	12/10/2013	10.26	-1.87	8/22/2013	11.75	-3.36	7/21/2014	14.14	-5.75	7/6/2015	13.61	-5.22
Source Area Biobarrier/First Sand														
MW-70-PMW02A	71-81	8.35	12/10/2013	10.03	-1.68	8/22/2013	13.78	-5.43	7/21/2014	16.65	-8.30	7/6/2015	15.39	-7.04
MW-70-PMW02B	90-100	8.38	12/10/2013	11.05	-2.67	8/22/2013	13.82	-5.44	7/21/2014	16.7	-8.32	7/6/2015	15.45	-7.07
IW-70-SAB06	65-80/85-105	8.07	12/10/2013	10.8	-2.73	8/22/2013	13.68	-5.61	7/21/2014	16.46	-8.39	7/6/2015	15.13	-7.06
MW-70-MNA05	70-80	8.46	12/10/2013	11.02	-2.56	8/22/2013	13.81	-5.35	7/21/2014	16.57	-8.11	7/6/2015	14.83	-6.37
MW-70-PMW03A	70-80	7.94	12/10/2013	10.56	-2.62	8/22/2013	13.51	-5.57	7/21/2014	16.27	-8.33	7/6/2015	15.05	-7.11
MW-70-P MW03B	90-100	7.88	12/10/2013	10.57	-2.69	8/22/2013	13.46	-5.58	7/21/2014	16.28	-8.40	7/6/2015	15.05	-7.17
First Sand Biobarrier 1														
MW-70-38	80-100	6.85	12/10/2013	9.77	-2.92	8/22/2013	12.72	-5.87	7/21/2014	15.73	-8.88	7/6/2015	14.28	-7.43
IW-70-FSB118	60-105	4.42	12/10/2013	7.27	-2.85	8/22/2013	10.27	-5.85	7/21/2014	14.28	-9.86	7/6/2015	8.67	-4.25
MW-70-PMW06A	70-80	4.14	12/10/2013	7.09	-2.95	8/22/2013	10.05	-5.91	7/21/2014	13.06	-8.92	7/6/2015	11.49	-7.35
MW-70-PMW06B	91-101	4.16	12/10/2013	7.08	-2.92	8/22/2013	10.04	-5.88	7/21/2014	12.98	-8.82	7/6/2015	11.54	-7.38
MW-70-PMW04A	70-80	4.52	12/10/2013	7.39	-2.87	8/22/2013	10.39	-5.87	7/21/2014	13.32	-8.80	7/6/2015	11.89	-7.37
MW-70-PMW04B	90-100	4.53	12/10/2013	7.4	-2.87	8/22/2013	10.41	-5.88	7/21/2014	13.33	-8.80	7/6/2015	11.88	-7.35
IW-70-FSB108	60-105	4.64	12/10/2013	7.68	-3.04	8/22/2013	10.63	-5.99	7/21/2014	13.55	-8.91	7/6/2015	12	-7.36
MW-70-PMW05A	70-80	4.21	12/10/2013	7.13	-2.92	8/22/2013	10.11	-5.90	7/21/2014	13.05	-8.84	7/6/2015	11.62	-7.41
MW-70-PMW05B	90-100	4.34	12/10/2013	7.25	-2.91	8/22/2013	10.25	-5.91	7/21/2014	13.18	-8.84	7/6/2015	11.72	-7.38
RDO-5	65-105	6.01	12/10/2013	7.58	-1.57	8/22/2013				14.77	-8.76	7/6/2015	13.43	-7.42
MW-70-MNA08	80-90	7.66	12/10/2013	10.78	-3.12	8/22/2013	13.6	-5.94	7/21/2014	16.54	-8.88	7/6/2015	15.09	-7.43
MW-70-MNA06	80-90	3.95	12/10/2013	6.87	-2.92	8/22/2013	9.94	-5.99	7/21/2014	12.86	-8.91	7/6/2015	11.43	-7.48
MW-70-MNA11	80-90	8.30	12/10/2013	11.42	-3.12	8/22/2013	14.69	-6.39	7/21/2014	17.86	-9.56	7/6/2015	16.31	-8.01
MW-70-MNA07	90-100	4.63	12/10/2013	7.58	-2.95	8/22/2013	10.66	-6.03	7/21/2014	13.59	-8.96	7/6/2015	12.14	-7.51
First Sand Biobarrier 2														
MW-70-PMW07A	65-75	7.89	12/10/2013	11	-3.11	8/22/2013	14.39	-6.50	7/21/2014	17.52	-9.63	7/6/2015	16.15	-8.26
MW-70-PMW07B	85-95	7.52	12/10/2013	11.34	-3.82	8/22/2013	15.64	-8.12	7/21/2014	18.35	-10.83	7/6/2015	16.84	-9.32
IW-70-FSB216	65-100	8.34	12/10/2013	12.54	-4.20	8/22/2013	15.75	-7.41	7/21/2014	13.48	-5.14	7/6/2015	16.08	-7.74
MW-70-PMW08A	65-75	9.04	12/10/2013	12.6	-3.56	8/22/2013	16.46	-7.42	7/21/2014	19.85	-10.81	7/6/2015	18.11	-9.07
MW-70-PMW08B	85-95	9.08	12/10/2013	13.09	-4.01	8/22/2013	17.71	-8.63	7/21/2014	21.43	-12.35	7/6/2015	19.39	-10.31
MW-70-MNA09	64-74	6.82	12/10/2013	10.19	-3.37	8/22/2013	13.49	-6.67	7/21/2014	16.49	-9.67	7/6/2015	14.9	-8.08
MW-70-MNA10	75-85	7.01	12/10/2013	11.4	-4.39	8/22/2013	15.79	-8.78	7/21/2014	19.58	-12.57	7/6/2015	17.48	-10.47
MW-70-MNA12	75-85	5.85	12/10/2013	9.84	-3.99	8/22/2013	14.88	-9.03	7/21/2014	18.88	-13.03	7/6/2015	16.63	-10.78
MW-70-43A	86-106	10.76	12/10/2013	10.78	-0.02	8/22/2013	20.36	-9.60	7/21/2014	24.48	-13.72	7/6/2015	22.14	-11.38
Shell Horizon Biobarrier 1														
MW-70-PMW09	120-130	6.82	12/10/2013	10.71	-3.89	8/22/2013	15.6	-8.78	7/21/2014	19.42	-12.60	7/6/2015	17.13	-10.31
IW-70-SHB113	105-130	7.49	12/10/2013	11.44	-3.95	8/22/2013	16.09	-8.60	7/21/2014	19.07	-11.58	7/6/2015	16.74	-9.25
MW-70-PMW10	120-130	6.60	12/10/2013	10.53	-3.93	8/22/2013	15.47	-8.87	7/21/2014	19.27	-12.67	7/6/2015	16.95	-10.35
IW-70-SHB217	105-130	8.67	12/10/2013	12.97	-4.30	8/22/2013	16.04	-7.37	7/21/2014	22.24	-13.57	7/6/2015	19.81	-11.14
MW-70-MNA13	115-125	6.64	12/10/2013	11.08	-4.44	8/22/2013	15.48	-8.84	7/21/2014	19.14	-12.50	7/6/2015	16.94	-10.30
Shell Horizon Biobarrier 3														
MW-70-PMW11A	85-95	8.13	12/10/2013	12.95	-4.82	8/22/2013	18.21	-10.08	7/21/2014	21.6	-13.47	7/6/2015	19.78	-11.65
MW-70-PMW11B	115-125	7.95	12/10/2013	12.02	-4.07	8/22/2013	17.28	-9.33	7/21/2014	22.25	-14.30	7/6/2015	19.2	-11.25
IW-70-SHB310	~~80-95/105-130~~	8.73	12/10/2013	15.6	-6.87	8/22/2013	NS	NS	NS	NS	NS	NS	NS	NS

Table 3
July 2015 Groundwater Levels

Well No.	Screen Interval (feet above MSL)	TOC Elevation (feet above MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet +/- MSL)
MW-70-PMW12A	85-95	7.86	12/10/2013	12.16	-4.30	8/22/2013	17.36	-9.64	7/21/2014	21.49	-13.63	7/6/2015	19.24	-11.38
MW-70-PMW12B	115-125	8.09	12/10/2013	12.36	-4.27	8/22/2013	17.5	-10.59	7/21/2014	22.52	-14.43	7/6/2015	19.16	-11.07
MW-70-MNA14	115-125	8.86	12/10/2013	13.34	-4.48	8/22/2013	18.68	-9.82	7/21/2014	22.93	-14.07	7/6/2015	20.37	-11.51
Second Sand Biobarrier 1														
MW-70-PMW13A	125-135	7.47	12/10/2013	11.04	-3.57	8/22/2013	16.29	-8.82	7/21/2014	20.52	-13.05	7/6/2015	18	-10.53
MW-70-PMW13B	145-155	7.48	12/10/2013	11.02	-3.54	8/22/2013	16.26	-8.78	7/21/2014	20.4	-12.92	7/6/2015	17.95	-10.47
IW-70-SSB109	126-166	7.96	12/10/2013	12.98	-5.02	8/22/2013	18.1	-10.14	7/21/2014	22.21	-14.25	7/6/2015	19.89	-11.93
MW-70-PMW14A	128-138	7.64	12/10/2013	11.12	-3.48	8/22/2013	16.17	-9.07	7/21/2014	20.41	-12.77	7/6/2015	17.92	-10.28
MW-70-PMW14B	149-159	7.92	12/10/2013	11.59	-3.67	8/22/2013	16.71	-10.40	7/21/2014	21	-13.08	7/6/2015	18.54	-10.62
MW-70-MNA16	141-151	8.65	12/10/2013	12.97	-4.32	8/22/2013	18.32	-8.94	7/21/2014	22.62	-13.97	7/6/2015	20.04	-11.39
MW-70-MNA17	140-150	6.80	12/10/2013	12.31	-5.51	8/22/2013	17.59	-11.04	7/21/2014	21.87	-15.07	7/6/2015	19.43	-12.63
MW-70-MNA15	140-150	5.96	12/10/2013	14.2	-8.24	8/22/2013	17.84	-14.28	7/21/2014	19.17	-13.21	7/6/2015	16.39	-10.43
MW-70-15	161-171	9.41	12/10/2013	14.2	-4.79	8/22/2013	20.24	-10.83	7/21/2014	24.52	-15.11	7/6/2015	21.86	-12.45
MW-70-14*	160-170	11.01	12/10/2013	14.98	-3.97	8/22/2013	20.3	-9.27	7/21/2014	24.42	-13.41	7/6/2015	21.98	-10.97
MW-70-43B*	136-146	10.58	12/10/2013	14.86	-4.28	8/22/2013	20.28	-9.70	7/21/2014	24.41	-13.83	7/6/2015	22.02	-11.44
MW-70-49	125-165	7.89	12/10/2013	12.23	-4.34	8/22/2013	17.47	-9.58	7/21/2014	22.67	-14.78	7/6/2015	19.36	-11.47
Point of Compliance/Upper Fines														
MW-70-02	20-30	7.85	12/10/2013	9.11	-1.26	8/22/2013	10.66	-2.81	7/21/2014	12.85	-5.00	7/6/2015	12.66	-4.81
MW-70-10	30-40	10.10	12/10/2013	11.64	-1.54	8/22/2013	12.7	-2.60	7/21/2014	14.92	-4.82	7/6/2015	14.61	-4.51
MW-70-17	30-40	4.58	12/10/2013	6.49	-1.91	8/22/2013	8.21	-3.63	7/21/2014	10.42	-5.84	7/6/2015	9.37	-4.79
MW-70-22	20-30	10.21	12/10/2013	10.61	-0.40	8/22/2013	10.75	-0.54	7/21/2014	9.66	0.55	7/6/2015	11.25	-1.04
Point of Compliance/First Sand														
MW-70-POC01	80-90	8.88	12/10/2013	NA	NA	8/22/2013	13.87	-4.99	7/21/2014	16.6	-7.72	7/6/2015	15.44	-6.56
MW-70-11	80-100	11.07	12/10/2013	NA	NA	8/22/2013	18.38	-7.31	7/21/2014	21.88	-10.81	7/6/2015	20.04	-8.97
MW-70-35	90-100	6.31	12/10/2013	NA	NA	8/22/2013	14.85	-8.54	7/21/2014	18.27	-11.96	7/6/2015	16.08	-9.77
MW-70-16	95-105	9.76	12/10/2013	NA	NA	8/22/2013	20.02	-10.26	7/21/2014	24.51	-14.75	7/6/2015	21.73	-11.97
Point of Compliance/Shell Horizon														
MW-70-23	110-130	11.17	12/10/2013	15.77	-4.60	8/22/2013	22.11	-10.94	7/21/2014	26.85	-15.68	7/6/2015	23.94	-12.77
Point of Compliance/Second Sand														
MW-70-36	150-160	9.04	12/10/2013	13.58	-4.54	8/22/2013	18.71	-9.67	7/21/2014	22.52	-13.48	7/6/2015	20.08	-11.04
MW-70-21	150-170	7.70	12/10/2013	13.52	-5.82	8/22/2013	20.41	-12.71	7/21/2014	25.15	-17.45	7/6/2015	21.86	-14.16
Point of Compliance/Deep Sand														
MW-70-POC02	190-200	8.25	12/10/2013	13.52	-5.27	8/22/2013	21.4	-13.15	7/21/2014	26.93	-18.68	7/6/2015	23.51	-15.26
MW-70-POC03	190-200	9.64	12/10/2013	13.56	-3.92	8/22/2013	18.65	-9.01	7/21/2014	22.56	-12.92	7/6/2015	20.08	-10.44
MW-70-POC04	195-205	8.50	12/10/2013	14.8	-6.30	8/22/2013	21.52	-13.02	7/21/2014	26.63	-18.13	7/6/2015	23.56	-15.06

Notes
NA = not applicable
MSL = mean sea level
TOC = top of casing

TABLE 4
FIELD PARAMETER DATA

Well ID	Date	pH	Conductivity (µs/cm)	Turbidity (NTU)	DO (mg/L)	Temperature (°C)	ORP (mV)
SOURCE AREA TREATMENT GRID							
IW-70-SAT35	7/6/2015	7	8,941	8	1.48	22.4	-303.8
MW-70-PMW01A	7/6/2015	6.61	8,989	7	0.27	22.9	-299.4
MW-70-PMW01B	7/6/2015	6.41	6,121	4	0.93	22.9	-156.8
MW-70-27	7/6/2015	6.51	19,354	6	0.24	23.8	-92.7
MW-70-28	7/6/2015	6.42	6,888	5	0.28	23.7	-126.8
SOURCE AREA BIOBARRIER/FIRST SAND							
IW-70-SAB06	7/6/2015	6.23	1,996	4	0.16	23.9	-371.8
IW-70-SAB11	7/6/2015	6.92	2,687	5	0.9	22	-297.1
MW-70-PMW02A	7/6/2015	7.33	1,519	2	0.4	24.3	-338.9
MW-70-PMW02B	7/6/2015	7.8	1,438	3	0.6	23.6	-292.8
MW-70-PMW03A	7/6/2015	6.57	1,771	2	0.28	24.3	-348.2
MW-70-PMW03B	7/6/2015	6.71	2,128	3	0.3	23.8	-348.2
FIRST SAND BIOBARRIER 1							
MW-70-38	7/6/2015	6.43	3,377	2.3	0.25	21.4	-170.1
IW-70-FSB108	7/6/2015	6.54	2,115	8	0.56	22.2	-308.3
IW-70-FSB118	7/6/2015	6.08	3,391	79	0.43	21.5	-170.1
MW-70-PMW04A	7/6/2015	7.28	1,383	4	0.21	22.7	-303.6
MW-70-PMW04B	7/6/2015	7.16	1,529	4	0.23	23.0	-317.6
MW-70-PMW05A	7/6/2015	7.24	1,285	3	0.25	21.9	-284.6
MW-70-PMW05B	7/6/2015	6.6	1,672	2	0.66	21.9	-268.6
MW-70-PMW06A	7/6/2015	6.91	3,006	5	0.32	22.4	-242.1
MW-70-PMW06B	7/6/2015	7.37	2,210	4	0.27	22.0	-274
RDO-5	7/6/2015	7.46	1,168	2	0.49	21.3	-268.5
MW-70-MNA07	7/6/2015	6.7	1,889	1	0.55	21.8	-268.9
MW-70-MNA08	7/6/2015	7.04	3,408	2	0.46	22	-277.1
FIRST SAND BIOBARRIER 2							
IW-70-FSB216	7/9/2015	6.39	26,612	39.9	0.28	21.6	-315.2
IW-70-FSB229	7/6/2015	7.29	3,139	5	0.76	21.9	-318.9
MW-70-PMW07A	7/6/2015	6.47	44,559	2	0.33	22.2	-291.3
MW-70-PMW08A	7/6/2015	6.75	19,424	1	0.18	22.1	-287.3
MW-70-PMW07B	7/6/2015	7.23	6,612	2	0.24	22.7	-346.7
MW-70-PMW08B	7/6/2015	6.84	6,350	1.9	0.19	21.8	-175.3
MW-70-MNA09	7/6/2015	6.99	16,912	2	0.39	22.1	-302.4
SHELL HORIZON BIOBARRIER 1							
IW-70-SHB113	7/6/2015	6.77	2,426	1.2	0.16	22.5	-340.6
MW-70-PMW09	7/6/2015	7.58	705	1	0.22	22.4	-302.6
MW-70-PMW10	7/6/2015	7.19	1,285	1	0.13	21.8	-302
SHELL HORIZON BIOBARRIER 3							
IW-70-SHB310	7/9/2015	4.98	8,815	111	0.26	22.5	116.5
IW-70-SHB311	7/9/2015	6.24	4,151	12	0.46	22.4	-154.8
MW-70-PMW11B	7/6/2015	6.84	5,929	11.5	0.46	22.3	-291.1
MW-70-PMW11A	7/6/2015	7.04	34,559	3	0.11	22.7	-335.1
MW-70-PMW12A	7/6/2015	6.27	16,467	13.9	0.23	21.8	-254.5
MW-70-PMW12B	7/6/2015	6.63	7,662	1.9	0.15	22.9	-339.9
SECOND SAND BIOBARRIER 1							
IW-70-SSB109	7/9/2015	6.54	18,801	2.1	0.2	22.6	-295.4
IW-70-SSB119	7/9/2015	6.54	10,468	28	0.26	22.4	-319.6

TABLE 4
FIELD PARAMETER DATA

Well ID	Date	pH	Conductivity (µs/cm)	Turbidity (NTU)	DO (mg/L)	Temperature (°C)	ORP (mV)
MW-70-PMW13A	7/8/2015	6.80	8,333	6	0.18	21.5	-327
MW-70-PMW13B	7/8/2015	7.02	12,618	1.0	0.17	21.5	-329.5
MW-70-PMW14A	7/6/2015	6.9	8,419	9	0.17	22.3	-298.2
MW-70-PMW14B	7/6/2015	6.68	12,737	4	0.2	22.8	-321.6
MW-70-MNA15	NA	NA	NA	NA	NA	NA	NA
MW-70-MNA16	7/6/2015	7.31	11,225	3	0.52	22.4	-314.3
MW-70-MNA17	7/6/2015	7.32	26,018	2	0.81	21.6	-312.9
MW-70-14	7/8/2015	6.78	7,583	12.6	0.69	22.1	-235.4
MW-70-49	7/9/2015	6.87	8,819	8	0.65	22.4	-139.9

Notes:

°C – degrees Celsius

DO – dissolved oxygen

mS/cm – milli siemens per centimeter

mg/L – milligrams per liter

mV – millivolt

NTU – nephelometric turbidity unit

ORP – oxidation-reduction potential

pH – potential of hydrogen

* DO from Chemets field instrument

Injection wells included in sampling event

Table 5
Source Area Treatment Grid Analytical Results, July 2015
Source Area Treatment Grid

		LOCATION	MW-70-27	MW-70-28	MW-70-28 - Dup	MW-70-PMW01A	MW-70-PMW01B
		SAMPLE ID	IR70-SA15-003	IR70-SA15-004	IR70-SA15-005	IR70-SA15-001	IR70-SA15-002
		SAMPLE DATE	7/6/2015	7/6/2015	7/6/2015	7/6/2015	7/6/2015
		WELL SCREEN INTERVAL IN FEET	25.5 - 35.5	50.3 - 60.3	50.3 - 60.3	25 - 35	45 - 55
Parameters	**Method**	**Unit**					
Wet Chemistry							
TOTAL ALKALINITY	2320B	mg/L	1100	727	722	1960	738
TDS	2540C	mg/L	13100	4410	4210	4360	3520
BROMIDE	300.0	mg/L	5.41	3.77	3.7	2.93	3.79
CHLORIDE-CL	300.0	mg/L	2530	1180	1180	1280	1190
NITRITE-N	300.0	mg/L	0.5 U	0.25 U	0.25 U	0.25 U	0.25 U
Nitrate-N	300.0	mg/L	0.05 U	0.05 U	0.05 U	0.25 U	0.05 U
SULFATE	300.0	mg/L	5870	884	886	322 U	376
ACETATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
BUTYRATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
LACTATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
PROPIONATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
TOC	5310B	mg/L	7.07	3.18	3.16	12	4.32
Volatile Organic Compounds							
1,1,1-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,1,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2-Trichloroethane	8260B	µg/L	0.31 J	0.28 J	0.28 J	0.2 U	0.38 J
Freon113	8260B	µg/L	6.3	5.8	6.1	0.3 U	0.64 J
1,1-Dichloroethane	8260B	µg/L	1.7	5.8	6	1.1	1
1,1-Dichloroethene	8260B	µg/L	2.4	27	28	0.2 U	2.7
1,1-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dibromoethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloroethane	8260B	µg/L	0.2 U	0.54	0.57	0.2 U	0.2 U
1,2-Dichloropropane	8260B	µg/L	0.2 U	0.48 J	0.47 J	0.2 U	0.2 U
1,2,3-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
1,2,3-Trichloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
1,2,4-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3,5-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Butanone	8260B	µg/L	4 U	4 U	4 U	4 U	4 U
2-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Hexanone	8260B	µg/L	4 U	4 U	4 U	4 U	4 U
2,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Methyl-2-Pentanone	8260B	µg/L	4 U	4 U	4 U	4 U	4 U
n-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
n-Propylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
p-Isopropyltoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Sec-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tert-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Acetone	8260B	µg/L	5 U	5 U	5 U	5 U	5 U
Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

Table 5
Source Area Treatment Grid Analytical Results, July 2015
Source Area Treatment Grid

		LOCATION	MW-70-27	MW-70-28	MW-70-28 - Dup	MW-70-PMW01A	MW-70-PMW01B
		SAMPLE ID	IR70-SA15-003	IR70-SA15-004	IR70-SA15-005	IR70-SA15-001	IR70-SA15-002
		SAMPLE DATE	7/6/2015	7/6/2015	7/6/2015	7/6/2015	7/6/2015
		WELL SCREEN INTERVAL IN FEET	25.5 - 35.5	50.3 - 60.3	50.3 - 60.3	25 - 35	45 - 55
Parameters	**Method**	**Unit**					
Bromobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trans-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromomethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Bromoform	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Carbon Disulfide	8260B	µg/L	0.31 J	0.2 U	0.2 U	1.2	0.29 J
Carbon Tetrachloride	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloroethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Chloroform	8260B	µg/L	2.7	4.6	5	0.21 J	1.7
Chloromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
cis-1,2-Dichloroethene	8260B	µg/L	1100	2100	2200	4	180
Dichlorodifluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Dibromochloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Dibromomethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Hexachlorobutadiene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Isopropyl Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Methylene Chloride	8260B	µg/L	0.52 J	0.57 J	0.72 J	0.67 J	0.52 J
MTBE	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Styrene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethylene	8260B	µg/L	0.26 J	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	8260B	µg/L	0.2 U	0.25 J	0.27 J	0.25 J	0.28 J
Trans-1,2-Dichloroethene	8260B	µg/L	11	40	42	9.5	22
Trichloroethene	8260B	µg/L	66	69	70	15	4.9 J
Trichlorofluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Vinyl Chloride	8260B	µg/L	400	2000	2000	39	1300
Xylenes (Total)	8260B	µg/L	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
m/p-Xylenes	8260B	µg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
o-Xylene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Dissolved Hydrocarbon Gases							
ETHANE	RSK175	µg/L	4.5	13	14	21	26
ETHENE	RSK175	µg/L	14	69	70	91	130
METHANE	RSK175	µg/L	15000	20000	16000	1100	19000

Notes:
DUP - field duplicate sample ID
J - estimated value
µg/L - micrograms per liter
mg/L - milligrams per liter
U - not detected at stated limit

Table 6
Source Area Biobarrier Analytical Results, July 2015
Source Area Biobarrier

		LOCATION	IW-70-SAB06	MW-70-PMW03A	MW-70-PMW03B
		SAMPLE ID	IR70-SA15-006	IR70-SA15-007	IR70-SA15-008
		SAMPLE DATE	7/6/2015	7/6/2015	7/6/2015
		WELL SCREEN INTERVAL IN FEET	65 - 80	70 - 80	90 - 100
Parameters	**Method**	**Unit**			
Wet Chemistry					
TOTAL ALKALINITY	2320B	mg/L	639	497	252
TDS	2540C	mg/L	1010	877	1210
BROMIDE	300.0	mg/L	0.678	0.684	0.88
CHLORIDE-CL	300.0	mg/L	160	160	230
NITRITE-N	300.0	mg/L	0.05 U	0.05 U	0.05 U
NITRATE-N	300.0	mg/L	0.05 U	0.05 U	0.05 U
SULFATE	300.0	mg/L	2.59	21.2	344
ACETATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U
BUTYRATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U
LACTATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U
PROPIONATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U
TOC	5310B	mg/L	38.6	3.09	1.07
Volatile Organic Compounds					
1,1,1-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,1,1,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,1,2-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
Freon113	8260B	µg/L	0.3 U	0.3 U	0.3 U
1,1-Dichloroethane	8260B	µg/L	0.2 U	0.2 U	0.5 J
1,1-Dichloroethene	8260B	µg/L	0.2 U	0.2 U	0.38 J
1,1-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U
1,2-Dibromoethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,2-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,2-Dichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,2,3-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U
1,2,3-Trichloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U
1,2,4-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,3,5-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
2-Butanone	8260B	µg/L	4 U	4 U	4 U
2-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U
2-Hexanone	8260B	µg/L	4 U	4 U	4 U
2,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U
4-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U
4-Methyl-2-Pentanone	8260B	µg/L	4 U	4 U	4 U
n-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
n-Propylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
p-Isopropyltoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Sec-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Tert-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Acetone	8260B	µg/L	5 U	5 U	5 U
Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Bromobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U

Table 6
Source Area Biobarrier Analytical Results, July 2015
Source Area Biobarrier

		LOCATION	IW-70-SAB06	MW-70-PMW03A	MW-70-PMW03B
		SAMPLE ID	IR70-SA15-006	IR70-SA15-007	IR70-SA15-008
		SAMPLE DATE	7/6/2015	7/6/2015	7/6/2015
		WELL SCREEN INTERVAL IN FEET	65 - 80	70 - 80	90 - 100
Parameters	**Method**	**Unit**			
Bromodichloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
cis-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Trans-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Bromomethane	8260B	µg/L	0.3 U	0.3 U	0.3 U
Bromoform	8260B	µg/L	0.3 U	0.3 U	0.3 U
Carbon Disulfide	8260B	µg/L	0.2 U	0.2 U	0.2 U
Carbon Tetrachloride	8260B	µg/L	0.2 U	0.2 U	0.2 U
Chlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Chloroethane	8260B	µg/L	0.3 U	0.3 U	0.3 U
Chloroform	8260B	µg/L	0.2 U	0.2 U	0.2 U
Chloromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U
cis-1,2-Dichloroethene	8260B	µg/L	0.22 J	0.2 U	130
Dichlorodifluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U
Dibromochloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
Dibromomethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
Ethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Hexachlorobutadiene	8260B	µg/L	0.3 U	0.3 U	0.3 U
Isopropyl Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Methylene Chloride	8260B	µg/L	0.5 U	0.5 U	0.5 U
MTBE	8260B	µg/L	0.2 U	0.2 U	0.2 U
Styrene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Tetrachloroethylene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Toluene	8260B	µg/L	0.81 J	0.2 U	0.2 U
Trans-1,2-Dichloroethene	8260B	µg/L	0.51 J	0.2 U	3.6
Trichloroethene	8260B	µg/L	0.2 U	0.2 U	0.75 J
Trichlorofluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U
Vinyl Chloride	8260B	µg/L	1.2	0.99	110
Xylenes (Total)	8260B	µg/L	0.6 U	0.6 U	0.6 U
m/p-Xylenes	8260B	µg/L	0.4 U	0.4 U	0.4 U
o-Xylene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Dissolved Hydrocarbon Gases					
ETHANE	RSK175	µg/L	1.1 J	0.64 U	0.64 U
ETHENE	RSK175	µg/L	0.6 U	0.6 U	20
METHANE	RSK175	µg/L	17000	16000	9500

Notes:

DUP - field duplicate sample ID

J - estimated value

µg/L - micrograms per liter

mg/L - milligrams per liter

U - not detected at stated limit

Table 7
First Sand Biobarrier 1 Analytical Results, July 2015
First Sand Biobarrier 1

		LOCATION	IW-70-FSB118	IW-70-FSB108	MW-70-38	MW-70-PMW04A	MW-70-PMW04B	MW-70-PMW04B - DUP	MW-70-PMW05A
		SAMPLE ID	IR70-SA15-010	IR70-SA15-016	IR70-SA15-009	IR70-SA15-013	IR70-SA15-014	IR70-SA15-015	IR70-SA15-017
		SAMPLE DATE	7/6/2015	7/6/2015	7/6/2015	7/6/2015	7/6/2015	7/6/2015	7/6/2015
WELL SCREEN INTERVAL IN FEET			60-105	60 - 105	80 - 100	70 - 80	90 - 100	90 - 100	70 - 80
Parameters	**Method**	**Unit**							
Wet Chemistry									
TOTAL ALKALINITY	2320B	mg/L	874	827	759	202	213	213	187
TDS	2540C	mg/L	1990	1100	2040	680	785	801	646
BROMIDE	300.0	mg/L	1.59 J	0.474 J	1.6	0.536	0.551	0.552	0.49 J
CHLORIDE-CL	300.0	mg/L	503	124	535	141	165	164	117
NITRITE-N	300.0	mg/L	0.25 U	0.05 U	0.1 U	0.05 U	0.05 U	0.05 U	0.05 U
NITRATE-N	300.0	mg/L	0.25 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
SULFATE	300.0	mg/L	2.12 J	0.486 J	173	193	179	176	152
ACETATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
BUTYRATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
LACTATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
PROPIONATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
TOC	5310B	mg/L	82.7	38.6	2.02	0.869	0.945	0.869	0.728 J
Volatile Organic Compounds									
1,1,1-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,1,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Freon113	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
1,1-Dichloroethane	8260B	µg/L	0.2 U	0.2 U	0.79 J	0.34 J	0.64 J	0.59 J	0.28 J
1,1-Dichloroethene	8260B	µg/L	0.2 U	0.2 U	0.2 U	3.3	6.1	6	1.5
1,1-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dibromoethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2,3-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
1,2,3-Trichloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
1,2,4-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3,5-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Butanone	8260B	µg/L	4 U	4 U	4 U	4 U	4 U	4 U	4 U
2-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Hexanone	8260B	µg/L	4 U	4 U	4 U	4 U	4 U	4 U	4 U
2,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Methyl-2-Pentanone	8260B	µg/L	4 U	4 U	4 U	4 U	4 U	4 U	4 U
n-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
n-Propylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
p-Isopropyltoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Sec-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tert-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

Table 7
First Sand Biobarrier 1 Analytical Results, July 2015
First Sand Biobarrier 1

		LOCATION	IW-70-FSB118	IW-70-FSB108	MW-70-38	MW-70-PMW04A	MW-70-PMW04B	MW-70-PMW04B - DUP	MW-70-PMW05A
		SAMPLE ID	IR70-SA15-010	IR70-SA15-016	IR70-SA15-009	IR70-SA15-013	IR70-SA15-014	IR70-SA15-015	IR70-SA15-017
		SAMPLE DATE	7/6/2015	7/6/2015	7/6/2015	7/6/2015	7/6/2015	7/6/2015	7/6/2015
WELL SCREEN INTERVAL IN FEET			60-105	60 - 105	80 - 100	70 - 80	90 - 100	90 - 100	70 - 80
Parameters	**Method**	**Unit**							
Acetone	8260B	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trans-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromomethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Bromoform	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Carbon Disulfide	8260B	µg/L	0.56 J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Carbon Tetrachloride	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloroethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Chloroform	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
cis-1,2-Dichloroethene	8260B	µg/L	1.1	0.57 J	7.2	350	980	1000	90
Dichlorodifluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.53 J	0.47 J	0.52 J	0.3 U
Dibromochloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Dibromomethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Hexachlorobutadiene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Isopropyl Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Methylene Chloride	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MTBE	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Styrene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethylene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	8260B	µg/L	2.6	0.46 J	0.21 J	0.2 U	0.2 U	0.2 U	0.2 U
Trans-1,2-Dichloroethene	8260B	µg/L	1.3	0.99 J	5.3	3.1	11	11	1.8
Trichloroethene	8260B	µg/L	0.56 J	0.2 U	2.9 J	7.3	16	17	0.38 J
Trichlorofluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Vinyl Chloride	8260B	µg/L	3.4	1.7	95	98	130	130	97 U
Xylenes (Total)	8260B	µg/L	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
m/p-Xylenes	8260B	µg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
o-Xylene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2
Dissolved Hydrocarbon Gases									
ETHANE	RSK175	µg/L	0.64 U	0.64 U	5.7	0.64 U	0.64 U	0.64 U	0.64 U
ETHENE	RSK175	µg/L	0.99 J	6.6	27	5.4	4	4	3.1
METHANE	RSK175	µg/L	8800	14000	23000	4000	9800	7100	2900

Notes:

DUP - field duplicate sample ID

J - estimated value

mg/L - micrograms per liter

mg/L - milligrams per liter

U - not detected at stated limit

Table 7
First Sand Biobarrier 1 Analytical Results, July 2015
First Sand Biobarrier 1

		LOCATION	MW-70-PMW05B	MW-70-PMW06A	MW-70-PMW06B
		SAMPLE ID	IR70-SA15-018	IR70-SA15-011	IR70-SA15-012
		SAMPLE DATE	7/6/2015	7/6/2015	7/6/2015
WELL SCREEN INTERVAL IN FEET			90 - 100	69.5 - 79.5	91 - 101
Parameters	**Method**	**Unit**			
Wet Chemistry					
TOTAL ALKALINITY	2320B	mg/L	432	354	163
TDS	2540C	mg/L	840	1940	1290
BROMIDE	300.0	mg/L	0.528	1.3	0.858
CHLORIDE-CL	300.0	mg/L	138	422	336
NITRITE-N	300.0	mg/L	0.05 U	0.05 U	0.05 U
NITRATE-N	300.0	mg/L	0.05 U	0.05 U	0.05 U
SULFATE	300.0	mg/L	93.2	463	297
ACETATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U
BUTYRATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U
LACTATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U
PROPIONATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U
TOC	5310B	mg/L	1.28	1.34	0.839
Volatile Organic Compounds					
1,1,1-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,1,1,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,1,2-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
Freon113	8260B	µg/L	0.3 U	0.3 U	0.3 U
1,1-Dichloroethane	8260B	µg/L	0.47 J	0.85 J	1.8
1,1-Dichloroethene	8260B	µg/L	1.5	4.3	8.4
1,1-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U
1,2-Dibromoethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,2-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,2-Dichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,2,3-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U
1,2,3-Trichloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U
1,2,4-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,3,5-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
2-Butanone	8260B	µg/L	4 U	4 U	4 U
2-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U
2-Hexanone	8260B	µg/L	4 U	4 U	4 U
2,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U
4-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U
4-Methyl-2-Pentanone	8260B	µg/L	4 U	4 U	4 U
n-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
n-Propylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
p-Isopropyltoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Sec-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Tert-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U

Table 7
First Sand Biobarrier 1 Analytical Results, July 2015
First Sand Biobarrier 1

		LOCATION	MW-70-PMW05B	MW-70-PMW06A	MW-70-PMW06B
		SAMPLE ID	IR70-SA15-018	IR70-SA15-011	IR70-SA15-012
		SAMPLE DATE	7/6/2015	7/6/2015	7/6/2015
WELL SCREEN INTERVAL IN FEET			90 - 100	69.5 - 79.5	91 - 101
Parameters	**Method**	**Unit**			
Acetone	8260B	µg/L	5 U	5 U	5 U
Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Bromobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Bromodichloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
cis-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Trans-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Bromomethane	8260B	µg/L	0.3 U	0.3 U	0.3 U
Bromoform	8260B	µg/L	0.3 U	0.3 U	0.3 U
Carbon Disulfide	8260B	µg/L	0.2 U	0.2 U	0.88 J
Carbon Tetrachloride	8260B	µg/L	0.2 U	0.2 U	0.2 U
Chlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Chloroethane	8260B	µg/L	0.3 U	0.3 U	0.3 U
Chloroform	8260B	µg/L	0.2 U	0.2 U	0.2 U
Chloromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U
cis-1,2-Dichloroethene	8260B	µg/L	120	570	660
Dichlorodifluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U
Dibromochloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
Dibromomethane	8260B	µg/L	0.2 U	0.2 U	0.2 U
Ethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Hexachlorobutadiene	8260B	µg/L	0.3 U	0.3 U	0.3 U
Isopropyl Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Methylene Chloride	8260B	µg/L	0.5 U	0.5 U	0.5 U
MTBE	8260B	µg/L	0.2 U	0.2 U	0.2 U
Styrene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Tetrachloroethylene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Toluene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Trans-1,2-Dichloroethene	8260B	µg/L	6	10	130
Trichloroethene	8260B	µg/L	3.3 J	1.9 J	3400
Trichlorofluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U
Vinyl Chloride	8260B	µg/L	330	1100	7.8
Xylenes (Total)	8260B	µg/L	0.6 U	0.6 U	0.6 U
m/p-Xylenes	8260B	µg/L	0.4 U	0.4 U	0.4 U
o-Xylene	8260B	µg/L	0.2 U	0.2 U	0.2 U
Dissolved Hydrocarbon Gases					
ETHANE	RSK175	µg/L	0.64 U	1.8 J	0.64 U
ETHENE	RSK175	µg/L	31	110	0.79 J
METHANE	RSK175	µg/L	26000	11000	120

Notes:

DUP - field duplicate sample ID

J - estimated value

mg/L - micrograms per liter

mg/L - milligrams per liter

U - not detected at stated limit

Table 8
First Sand Biobarrier 2 Analytical Results, July 2015
First Sand Biobarrier 2

		LOCATION	IW-70-FSB216	MW-70-PMW07A	MW-70-PMW07B	MW-70-PMW08A	MW-70-PMW08B
		SAMPLE ID	IR70-SA15-021	IR70-SA15-019	IR70-SA15-020	IR70-SA15-022	IR70-SA15-023
		SAMPLE DATE	7/9/2015	7/6/2015	7/6/2015	7/6/2015	7/6/2015
		WELL SCREEN INTERVAL IN FEET	65 - 100	65 - 75	85 - 95	65 - 75	85 - 95
Parameters	**Method**	**Unit**					
Wet Chemistry							
TOTAL ALKALINITY	2320B	mg/L	1130	290	281	318	328
TDS	2540C	mg/L	17600	27700	3810	12200	3640
BROMIDE	300.0	mg/L	34.7	47.2	4.84	21.6	4.82
CHLORIDE-CL	300.0	mg/L	10500	15400	1510	5750	1520
NITRITE-N	300.0	mg/L	2 U	2.5 U	0.25 U	1 U	0.3 U
NITRATE-N	300.0	mg/L	0.1 U	0.25 U	0.05 U	0.05 U	0.05 U
SULFATE	300.0	mg/L	232	2480	652	1140	525
ACETATE	300.0M	mg/L	0.1 U	0.25 U	0.05 U	0.05 U	0.05 U
BUTYRATE	300.0M	mg/L	0.05 U	0.1 U	0.05 U	0.05 U	0.05 U
LACTATE	300.0M	mg/L	0.1 U	0.25 U	0.05 U	0.05 U	0.05 U
PROPIONATE	300.0M	mg/L	0.05 U	0.1 U	0.05 U	0.05 U	0.05 U
TOC	5310B	mg/L	52.1	1.82	1.51	1.9	1.66
Volatile Organic Compounds							
1,1,1-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,1,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Freon113	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
1,1-Dichloroethane	8260B	µg/L	0.2 U	0.2 U	0.81 J	0.37 J	0.64 J
1,1-Dichloroethene	8260B	µg/L	0.2 U	0.2 U	3.2	0.22 J	0.2 U
1,1-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dibromoethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2,3-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
1,2,3-Trichloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
1,2,4-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3,5-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Butanone	8260B	µg/L	4 U	4 U	4 U	4 U	4 U
2-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Hexanone	8260B	µg/L	4 U	4 U	4 U	4 U	4 U
2,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Methyl-2-Pentanone	8260B	µg/L	9.1 J	4 U	4 U	4 U	4 U
n-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
n-Propylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
p-Isopropyltoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Sec-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tert-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

Table 8
First Sand Biobarrier 2 Analytical Results, July 2015
First Sand Biobarrier 2

		LOCATION	IW-70-FSB216	MW-70-PMW07A	MW-70-PMW07B	MW-70-PMW08A	MW-70-PMW08B
		SAMPLE ID	IR70-SA15-021	IR70-SA15-019	IR70-SA15-020	IR70-SA15-022	IR70-SA15-023
		SAMPLE DATE	7/9/2015	7/6/2015	7/6/2015	7/6/2015	7/6/2015
		WELL SCREEN INTERVAL IN FEET	65 - 100	65 - 75	85 - 95	65 - 75	85 - 95
Parameters	**Method**	**Unit**					
Acetone	8260B	µg/L	6.3 J	5 U	5 U	5 U	5 U
Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trans-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromomethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Bromoform	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Carbon Disulfide	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Carbon Tetrachloride	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloroethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Chloroform	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
cis-1,2-Dichloroethene	8260B	µg/L	0.46 J	9.4	810	47	33
Dichlorodifluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Dibromochloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Dibromomethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Hexachlorobutadiene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Isopropyl Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Methylene Chloride	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MTBE	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Styrene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethylene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	8260B	µg/L	0.34 J	0.2 U	0.2 U	0.2 U	0.2 U
Trans-1,2-Dichloroethene	8260B	µg/L	0.28 J	0.2 U	7.2	2.2	5.3
Trichloroethene	8260B	µg/L	0.65 J	0.2 U	4.8 J	0.98 J	1.8 J
Trichlorofluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Vinyl Chloride	8260B	µg/L	0.2 U	1.5	170	96	370
Xylenes (Total)	8260B	µg/L	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
m/p-Xylenes	8260B	µg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
o-Xylene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Dissolved Hydrocarbon Gases							
ETHANE	RSK175	µg/L	0.64 U	0.64 U	1.1 J	0.88 J	0.82 J
ETHENE	RSK175	µg/L	1.4 J	0.6 U	59	18	71
METHANE	RSK175	µg/L	21000	590	9900	13000	17000

Notes:
DUP - field duplicate sample ID
J - estimated value
µg/L - micrograms per liter
mg/L - milligrams per liter
U - not detected at stated limit

Table 9
Shell Horizon Biobarrier 1 Analytical Results, July 2015
Shell Horizon Biobarrier 1

		LOCATION	IW-70-SHB113	MW-70-PMW09	MW-70-PMW09 - DUP	MW-70-PMW10
		SAMPLE ID	IR70-SA15-027	IR70-SA15-025	IR70-SA15-026	IR70-SA15-028
		SAMPLE DATE	7/6/2015	7/6/2015	7/6/2015	7/6/2015
		WELL SCREEN INTERVAL IN FEET	105 - 130	120 - 130	120 - 130	120 - 130
Parameters	**Method**	**Unit**				
Wet Chemistry						
TOTAL ALKALINITY	2320B	mg/L	490	160	161	364
TDS	2540C	mg/L	1560	401	404	741
BROMIDE	300.0	mg/L	1	0.284 J	0.281 J	0.385 J
CHLORIDE-CL	300.0	mg/L	339	77.5	78.7	121
NITRATE-N	300.0	mg/L	0.05 U	0.05 U	0.05 U	0.05 U
NITRITE-N	300.0	mg/L	0.05 U	0.05 U	0.0597 J	0.05 U
SULFATE	300.0	mg/L	232	43	44.6	94.4
ACETATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U	0.05 U
BUTYRATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U	0.05 U
LACTATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U	0.05 U
PROPIONATE	300.0M	mg/L	0.05 U	0.05 U	0.05 U	0.05 U
TOC	5310B	mg/L	1.54	0.596	0.554 J	0.808 J
Volatile Organic Compounds						
1,1,1-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,1,1,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Freon113	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
1,1-Dichloroethane	8260B	µg/L	0.77 J	0.2 U	0.2 U	0.25 J
1,1-Dichloroethene	8260B	µg/L	0.2 U	0.25 J	0.24 J	0.66
1,1-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dibromoethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,2,3-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
1,2,3-Trichloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
1,2,4-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,3,5-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
2-Butanone	8260B	µg/L	4 U	4 U	4 U	4 U
2-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
2-Hexanone	8260B	µg/L	4 U	4 U	4 U	4 U
2,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
4-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
4-Methyl-2-Pentanone	8260B	µg/L	4 U	4 U	4 U	4 U
n-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
n-Propylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
p-Isopropyltoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Sec-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Tert-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Acetone	8260B	µg/L	5 U	5 U	5 U	5 U

Table 9
Shell Horizon Biobarrier 1 Analytical Results, July 2015
Shell Horizon Biobarrier 1

		LOCATION	IW-70-SHB113	MW-70-PMW09	MW-70-PMW09 - DUP	MW-70-PMW10
		SAMPLE ID	IR70-SA15-027	IR70-SA15-025	IR70-SA15-026	IR70-SA15-028
		SAMPLE DATE	7/6/2015	7/6/2015	7/6/2015	7/6/2015
		WELL SCREEN INTERVAL IN FEET	105 - 130	120 - 130	120 - 130	120 - 130
Parameters	**Method**	**Unit**				
Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Bromobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Trans-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Bromomethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
Bromoform	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
Carbon Disulfide	8260B	µg/L	0.2 U	0.2 U	0.56 J	0.3 J
Carbon Tetrachloride	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Chloroethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
Chloroform	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
cis-1,2-Dichloroethene	8260B	µg/L	53	29	26	140
Dichlorodifluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
Dibromochloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Dibromomethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Hexachlorobutadiene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
Isopropyl Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Methylene Chloride	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U
MTBE	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Styrene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethylene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Trans-1,2-Dichloroethene	8260B	µg/L	9	0.52 J	0.44 J	11
Trichloroethene	8260B	µg/L	0.29 J	1.9 J	1.3 J	0.84 J
Trichlorofluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
Vinyl Chloride	8260B	µg/L	280	0.28 J	0.27 J	190
Xylenes (Total)	8260B	µg/L	0.6 U	0.6 U	0.6 U	0.6 U
m/p-Xylenes	8260B	µg/L	0.4 U	0.4 U	0.4 U	0.4 U
o-Xylene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Dissolved Hydrocarbon Gases						
ETHANE	RSK175	µg/L	2.6	0.64 U	0.64 U	0.64 U
ETHENE	RSK175	µg/L	140	0.6 U	0.6 U	8.2
METHANE	RSK175	µg/L	21000	34	30	17000

Notes:

DUP - field duplicate sample ID

J - estimated value

µg/L - micrograms per liter

mg/L - milligrams per liter

U - not detected at stated limit

Table 10
Shell Horizon Biobarrier 3 Analytical Results, July 2015
Shell Horizon Biobarrier 3

		LOCATION	MW-70-PMW11A	MW-70-PMW11B	MW-70-PMW12A	MW-70-PMW12B
		SAMPLE ID	IR70-SA15-029	IR70-SA15-030	IR70-SA15-031	IR70-SA15-032
		SAMPLE DATE	7/6/2015	7/6/2015	7/6/2015	7/6/2015
		WELL SCREEN INTERVAL IN FEET	85 - 95	115 - 125	85 - 95	115 - 125
Parameters	**Method**	**Unit**				
Wet Chemistry						
TOTAL ALKALINITY	2320B	mg/L	263	209	371	223
TDS	2540C	mg/L	19400	3910	9600	4650
BROMIDE	300.0	mg/L	36.7	5.76	18.7	6.65
CHLORIDE-CL	300.0	mg/L	11200	1780	5110	2060
NITRITE-N	300.0	mg/L	2 U	0.25 U	1 U	0.4 U
NITRATE-N	300.0	mg/L	0.25 U	0.05 U	0.05 U	0.0552 J
SULFATE	300.0	mg/L	1590	539	696	502
ACETATE	300.0M	mg/L	0.1 U	0.05 U	0.05 U	0.05 U
BUTYRATE	300.0M	mg/L	0.1 U	0.05 U	0.05 U	0.05 U
LACTATE	300.0M	mg/L	0.1 U	0.05 U	0.05 U	0.05 U
PROPIONATE	300.0M	mg/L	0.1 U	0.05 U	0.05 U	0.05 U
TOC	5310B	mg/L	3.23 J	1.57	2.56	2.46
Volatile Organic Compounds						
1,1,1-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,1,1,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Freon113	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
1,1-Dichloroethane	8260B	µg/L	0.2 U	0.47 J	0.2 U	0.47 J
1,1-Dichloroethene	8260B	µg/L	0.2 U	0.2 U	0.2 U	1.4
1,1-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dibromoethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,2,3-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
1,2,3-Trichloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
1,2,4-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,3,5-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
2-Butanone	8260B	µg/L	4 U	4 U	4 U	4 U
2-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
2-Hexanone	8260B	µg/L	4 U	4 U	4 U	4 U
2,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
4-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
4-Methyl-2-Pentanone	8260B	µg/L	4 U	4 U	4 U	4 U
n-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
n-Propylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
p-Isopropyltoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Sec-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Tert-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U

Table 10
Shell Horizon Biobarrier 3 Analytical Results, July 2015
Shell Horizon Biobarrier 3

		LOCATION	MW-70-PMW11A	MW-70-PMW11B	MW-70-PMW12A	MW-70-PMW12B
		SAMPLE ID	IR70-SA15-029	IR70-SA15-030	IR70-SA15-031	IR70-SA15-032
		SAMPLE DATE	7/6/2015	7/6/2015	7/6/2015	7/6/2015
		WELL SCREEN INTERVAL IN FEET	85 - 95	115 - 125	85 - 95	115 - 125
Parameters	**Method**	**Unit**				
Acetone	8260B	µg/L	5 U	5 U	5 U	5 U
Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Bromobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Trans-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Bromomethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
Bromoform	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
Carbon Disulfide	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.21 J
Carbon Tetrachloride	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Chloroethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
Chloroform	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
cis-1,2-Dichloroethene	8260B	µg/L	0.7 J	6.7	1.1	330
Dichlorodifluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
Dibromochloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Dibromomethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Hexachlorobutadiene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
Isopropyl Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Methylene Chloride	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U
MTBE	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Styrene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethylene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	8260B	µg/L	0.2 U	0.2 J	0.2 U	0.2 U
Trans-1,2-Dichloroethene	8260B	µg/L	6.5	46	6.6	25
Trichloroethene	8260B	µg/L	0.47 J	0.2 U	0.2 U	4.6 J
Trichlorofluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U
Vinyl Chloride	8260B	µg/L	65	20	23	290
Xylenes (Total)	8260B	µg/L	0.6 U	0.6 U	0.6 U	0.6 U
m/p-Xylenes	8260B	µg/L	0.4 U	0.4 U	0.4 U	0.4 U
o-Xylene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U
Dissolved Hydrocarbon Gases						
ETHANE	RSK175	µg/L	0.64 U	0.64 U	5.6	1.4 J
ETHENE	RSK175	µg/L	3	120	4.1	31
METHANE	RSK175	µg/L	1100	520	12000	13000

Notes:

DUP - field duplicate sample ID

J - estimated value

µg/L - micrograms per liter

mg/L - milligrams per liter

U - not detected at stated limit

Table 11
Second Sand Biobarrier Analytical Results, July 2015
Second Sand Biobarrier

		LOCATION	IW-70-SSB119	MW-70-14	MW-70-49	MW-70-PMW13A	MW-70-PMW13A-DUP	MW-70-PMW13B	MW-70-PMW14A	MW-70-PMW14B
SAMPLE ID			**IR70-SA15-036**	**IR70-SA15-040**	**IR70-SA15-039**	**IR70-SA15-033**	**IR70-SA15-034**	**IR70-SA15-035**	**IR70-SA15-037**	**IR70-SA15-038**
		SAMPLE DATE	**7/9/2015**	**7/8/2015**	**7/9/2015**	**7/8/2015**	**7/8/2015**	**7/8/2015**	**7/6/2015**	**7/6/2015**
		WELL SCREEN INTERVAL IN FEET	**125 - 165**	**160 - 170**	**125 - 165**	**125 - 135**	**125 - 135**	**145 -155**	**128 - 138**	**149 - 159**
Parameters	**Method**	**Unit**								
Wet Chemistry										
TOTAL ALKALINITY	2320B	mg/L	1070	NA	208	285	286	196	192	192
TDS	2540C	mg/L	6150	NA	5080	5230	5350	8770	4690	4690
BROMIDE	300.0	mg/L	14.2 (11.1)	NA	8.68	8.06	8.22	15.1	7.62	7.62
CHLORIDE-CL	300.0	mg/L	3490	NA	2720	2350	2360	4780	2360	2360
NITRITE-N	300.0	mg/L	0.5 U	NA	0.5 U	0.4 U	0.4 U	0.5 U	0.4 U	0.4 U
NITRATE-N	300.0	mg/L	0.1 U	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
SULFATE	300.0	mg/L	5.08	NA	779	558	545	880	557	557
ACETATE	300.0M	mg/L	0.05 U	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
BUTYRATE	300.0M	mg/L	0.05 U	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
LACTATE	300.0M	mg/L	0.05 U	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
PROPIONATE	300.0M	mg/L	0.05 U	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
TOC	5310B	mg/L	49.8	NA	1.74	1.58	1.63	1.26	1.73	1.73
Volatile Organic Compounds										
1,1,1-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,1,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2-Trichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Freon113	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
1,1-Dichloroethane	8260B	µg/L	0.2 U	0.57 J	0.2 U	0.37 J	0.39 J	0.5 J	0.45 J	0.45 J
1,1-Dichloroethene	8260B	µg/L	0.2 U	3.8	0.57	3.4	3.7	4.5	3.4	3.4
1,1-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dibromo-3-chloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dibromoethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloroethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2,3-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
1,2,3-Trichloropropane	8260B	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
1,2,4-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3,5-Trimethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Butanone	8260B	µg/L	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
2-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Hexanone	8260B	µg/L	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
2,2-Dichloropropane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Chlorotoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-Methyl-2-Pentanone	8260B	µg/L	8.4 J	4 U	4 U	4 U	4 U	4 U	4 U	4 U
n-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
n-Propylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
p-Isopropyltoluene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Sec-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tert-Butylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Acetone	8260B	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trans-1,3-Dichloropropene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromomethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U

Table 11
Second Sand Biobarrier Analytical Results, July 2015
Second Sand Biobarrier

LOCATION			IW-70-SSB119	MW-70-14	MW-70-49	MW-70-PMW13A	MW-70-PMW13A-DUP	MW-70-PMW13B	MW-70-PMW14A	MW-70-PMW14B
SAMPLE ID			**IR70-SA15-036**	**IR70-SA15-040**	**IR70-SA15-039**	**IR70-SA15-033**	**IR70-SA15-034**	**IR70-SA15-035**	**IR70-SA15-037**	**IR70-SA15-038**
SAMPLE DATE			**7/9/2015**	**7/8/2015**	**7/9/2015**	**7/8/2015**	**7/8/2015**	**7/8/2015**	**7/6/2015**	**7/6/2015**
WELL SCREEN INTERVAL IN FEET			**125 - 165**	**160 - 170**	**125 - 165**	**125 - 135**	**125 - 135**	**145 -155**	**128 - 138**	**149 - 159**
Parameters	**Method**	**Unit**								
Bromoform	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Carbon Disulfide	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Carbon Tetrachloride	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloroethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Chloroform	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
cis-1,2-Dichloroethene	8260B	µg/L	0.35 J	1100	160	680	730	1100	920	920
Dichlorodifluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Dibromochloromethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Dibromomethane	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Hexachlorobutadiene	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Isopropyl Benzene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Methylene Chloride	8260B	µg/L	0.5 U	0.5 U	0.59 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MTBE	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Styrene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethylene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	8260B	µg/L	0.3 J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trans-1,2-Dichloroethene	8260B	µg/L	11	51	8	66	72	43	63	63
Trichloroethene	8260B	µg/L	0.2 U	5.3	2.1 J	9	10	6.4	6	6
Trichlorofluoromethane	8260B	µg/L	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Vinyl Chloride	8260B	µg/L	0.2 U	6.2	0.4 J	200	240	15	120	120
Xylenes (Total)	8260B	µg/L	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
m/p-Xylenes	8260B	µg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
o-Xylene	8260B	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Dissolved Hydrocarbon Gases										
ETHANE	RSK175	µg/L	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U
ETHENE	RSK175	µg/L	13	0.6 U	1.4 J	5.9	6.2	1.1 J	4.7	4.7
METHANE	RSK175	µg/L	460 E	760	500	2000	2100	350	840	840

Notes:

DUP - field duplicate sample ID

J - estimated value

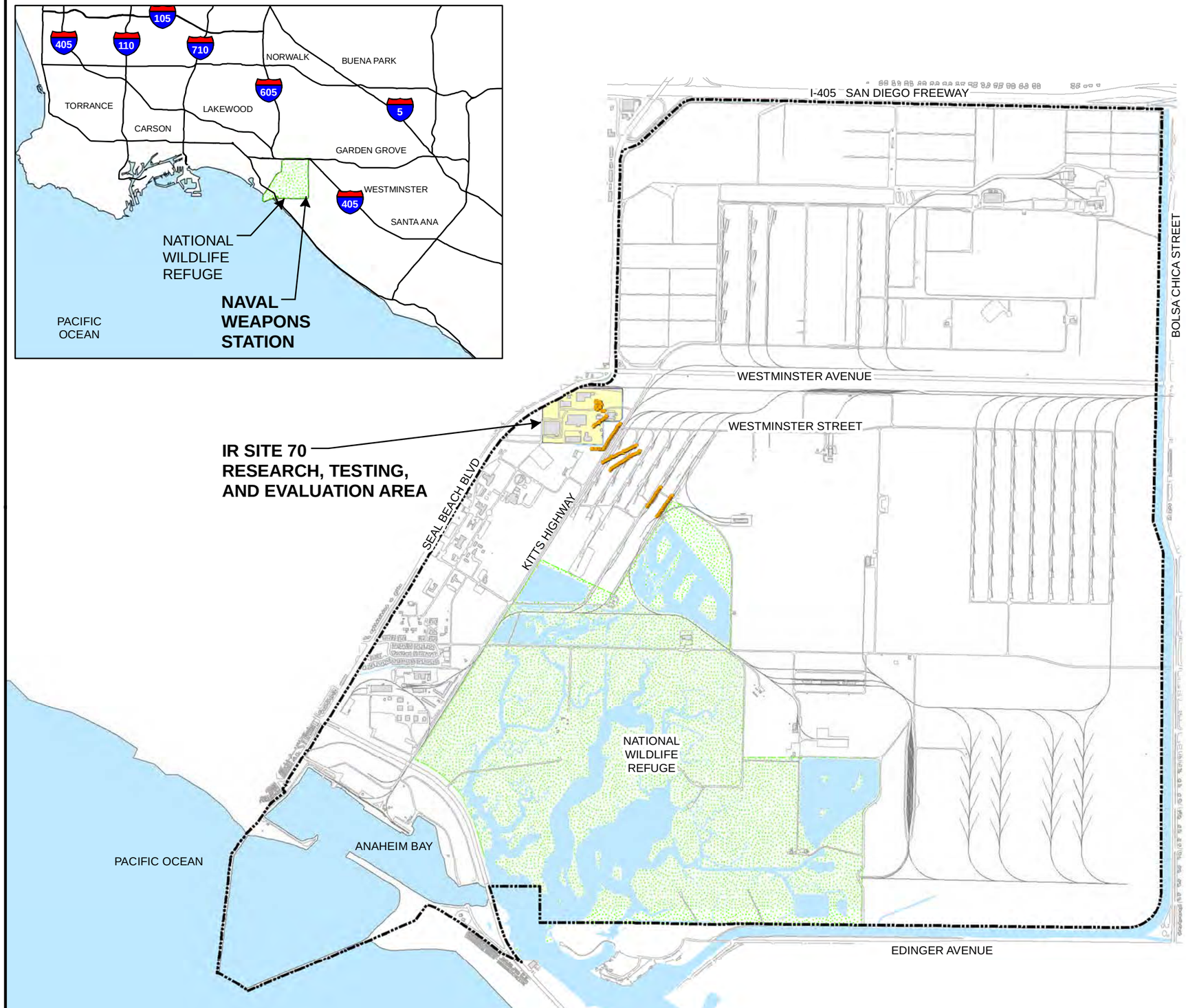
µg/L - micrograms per liter

mg/L - milligrams per liter

U - not detected at stated limit

FIGURES

This page intentionally left blank.



LEGEND

- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- BUILDING

1,000 0 1,000 2,000 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 1
IR SITE 70
SITE LOCATION MAP

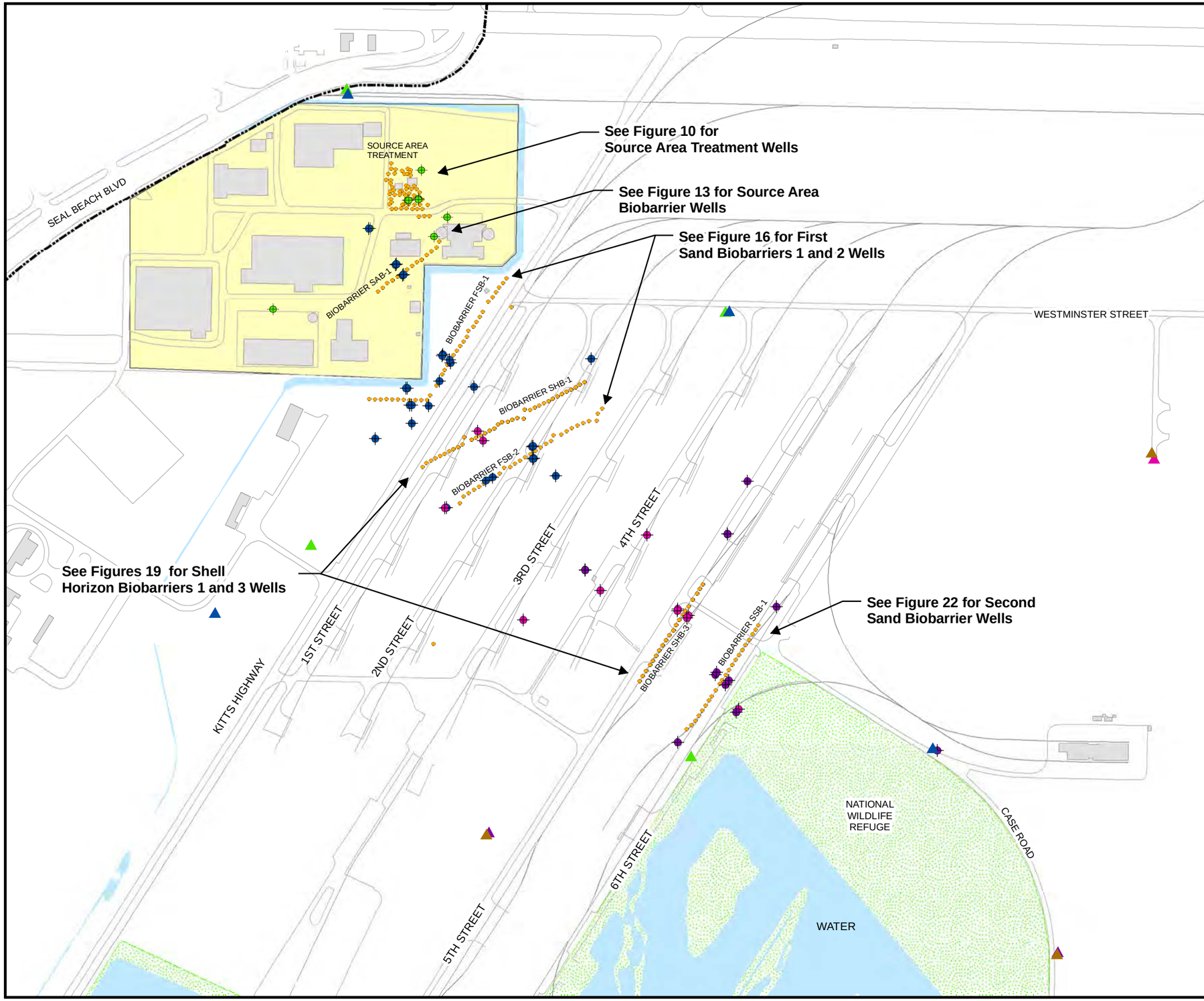
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 1.mxd

NAVFAC

ECC-INSIGHT LLC

This Page Intentionally Left Blank



LEGEND

- SOURCE AREA TREATMENT/UPPER FINES MONITORING WELL
- UPPER FINES POC MONITORING WELL
- FIRST SAND MONITORING WELL
- FIRST SAND POC MONITORING WELL
- SHELL HORIZON MONITORING WELL
- SHELL HORIZON POC MONITORING WELL
- SECOND SAND POC MONITORING WELL
- SECOND SAND MONITORING WELL
- DEEP SAND POC MONITORING WELL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- ROAD
- RAILROAD TRACK
- BUILDING
- IR 70 SITE BOUNDARY
- BASE BOUNDARY

NOTES:

POC = POINT OF COMPLIANCE

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 2
WELL LOCATION MAP

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

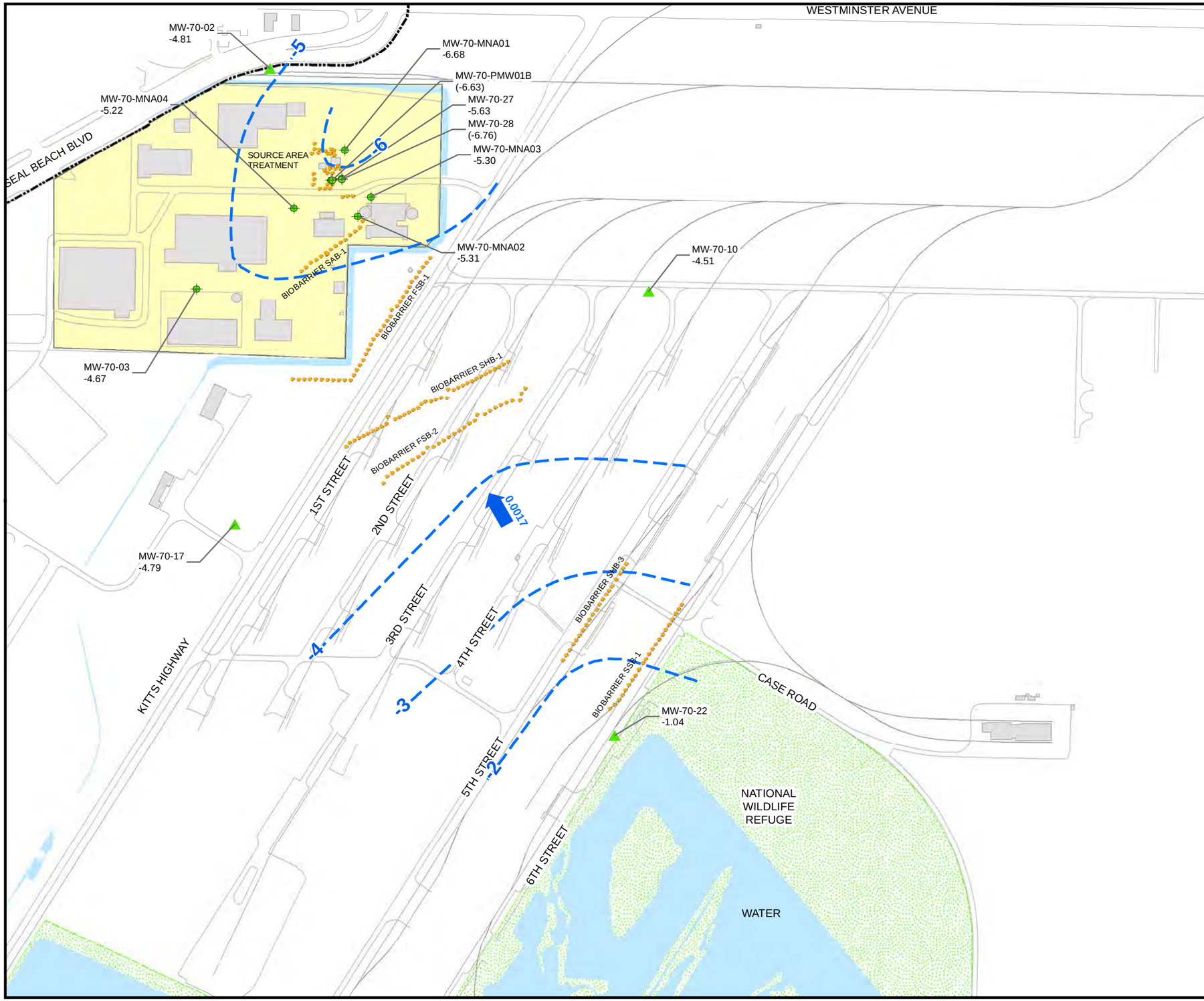
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 2.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map\Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-MNA02 -0.82	UPPER FINES/SOURCE AREA TREATMENT MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
MW-70-10 -0.63	UPPER FINES POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
0.0025	INFERRED DIRECTION OF GROUNDWATER FLOW WITH GRADIENT
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	APPROXIMATE GROUNDWATER ELEVATION IN FEET MEAN SEA LEVEL
	BUILDING

NOTES:

WATER LEVELS MEASURED ON DECEMBER 15, 2014

( ) - PARENTHESES INDICATE GROUNDWATER ELEVATION AT THIS WELL WAS NOT USED FOR CONTOURING DUE TO THE DIFFERENCE IN THE ELEVATION OF ITS SCREEN INTERVAL RELATIVE TO THOSE OF NEARBY WELLS.

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 3
UPPER FINES GROUNDWATER ELEVATIONS
JULY 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

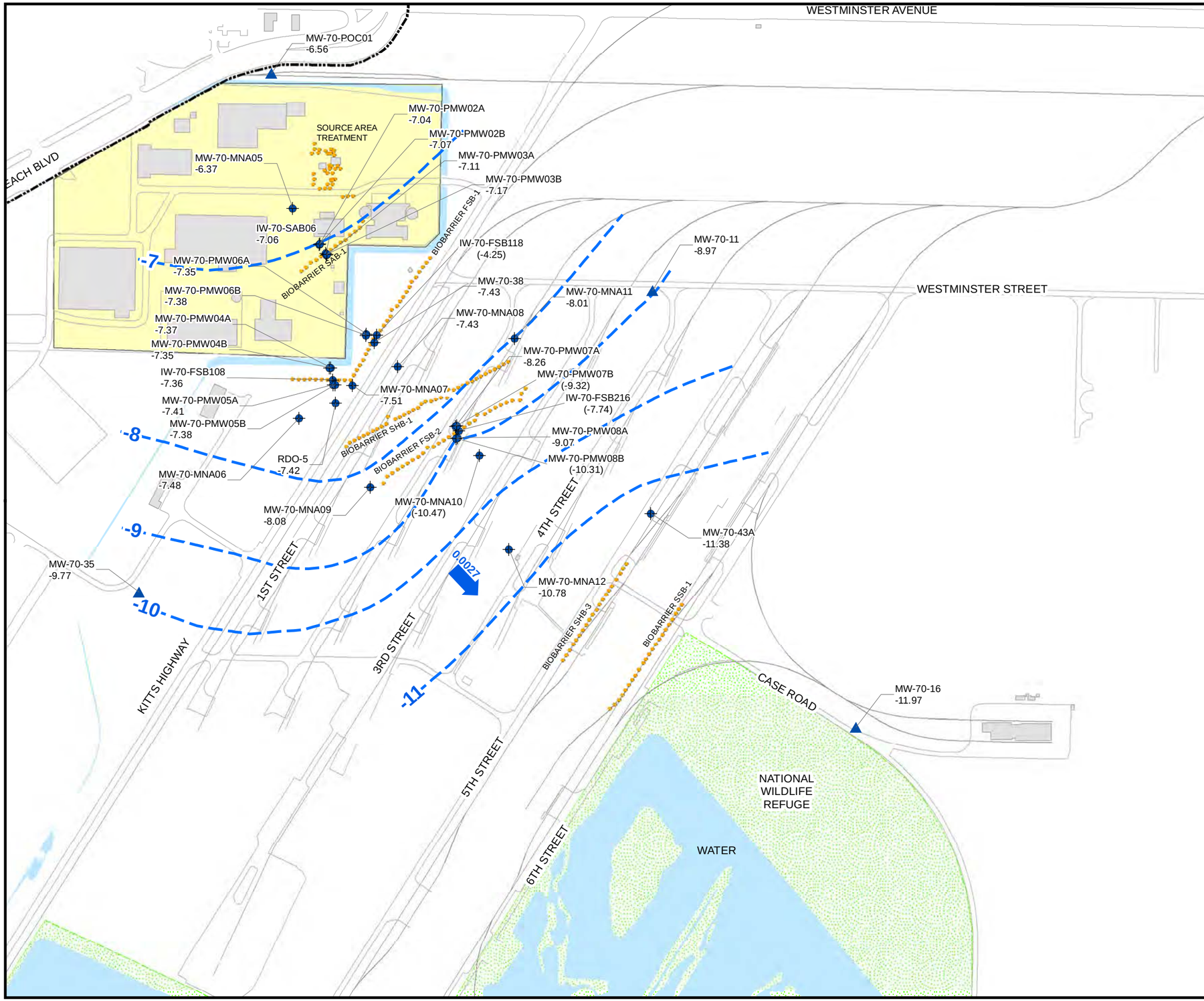
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 3.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-12.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-MNA08 -1.75	FIRST SAND MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET BGS MEAN SEA LEVEL
MW-70-16 -3.60	FIRST SAND POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET BGS MEAN SEA LEVEL
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
0.0027	INFERRED DIRECTION OF GROUNDWATER FLOW WITH GRADIENT
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL
	BUILDING

NOTES:

WATER LEVELS MEASURED ON DECEMBER 15, 2014

( ) - PARENTHESES INDICATE GROUNDWATER ELEVATION AT THIS WELL WAS NOT USED FOR CONTOURING DUE TO THE DIFFERENCE IN THE ELEVATION OF ITS SCREEN INTERVAL RELATIVE TO THOSE OF NEARBY WELLS.

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 4
FIRST SAND GROUNDWATER ELEVATIONS
JULY 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

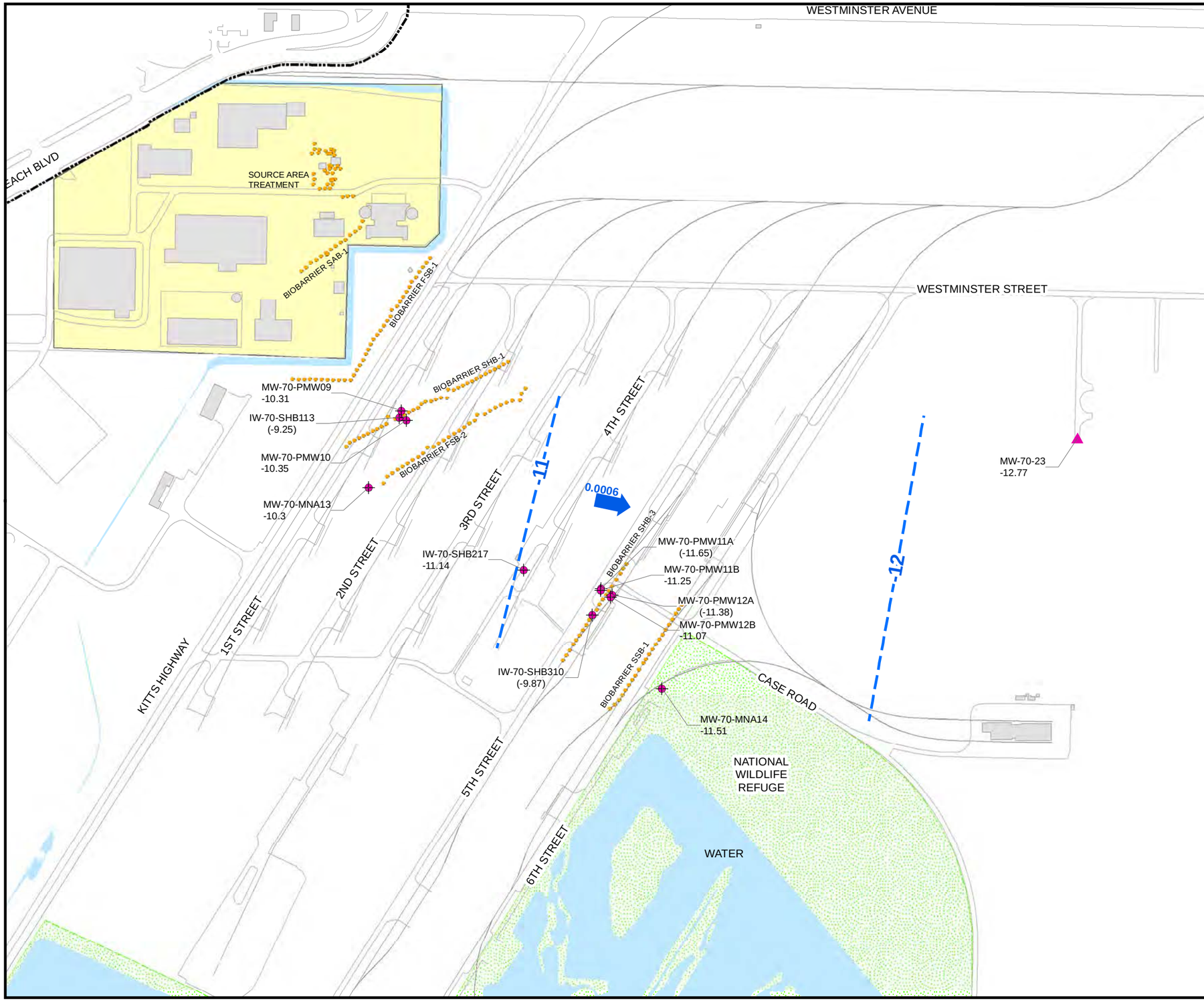
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 4.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-2.mxd

This Page Intentionally Left Blank



LEGEND

MW-70-MNA14 -3.34	SHELL HORIZON MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
MW-70-23 -3.68	SHELL HORIZON POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
	BIOBARRIER OR SOURCE AREA TREATMENT WELL
0.0036	INFERRED DIRECTION OF GROUNDWATER FLOW WITH GRADIENT
	IR SITE 70 BOUNDARY
	BASE BOUNDARY
	ROAD
	RAILROAD TRACK
	APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL
	BUILDING

NOTES:

WATER LEVELS MEASURED ON DECEMBER 15, 2014

( ) - PARENTHESES INDICATE GROUNDWATER ELEVATION AT THIS WELL WAS NOT USED FOR CONTOURING DUE TO THE DIFFERENCE IN THE ELEVATION OF ITS SCREEN INTERVAL RELATIVE TO THOSE OF NEARBY WELLS.

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 5
SHELL HORIZON GROUNDWATER ELEVATIONS
JULY 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

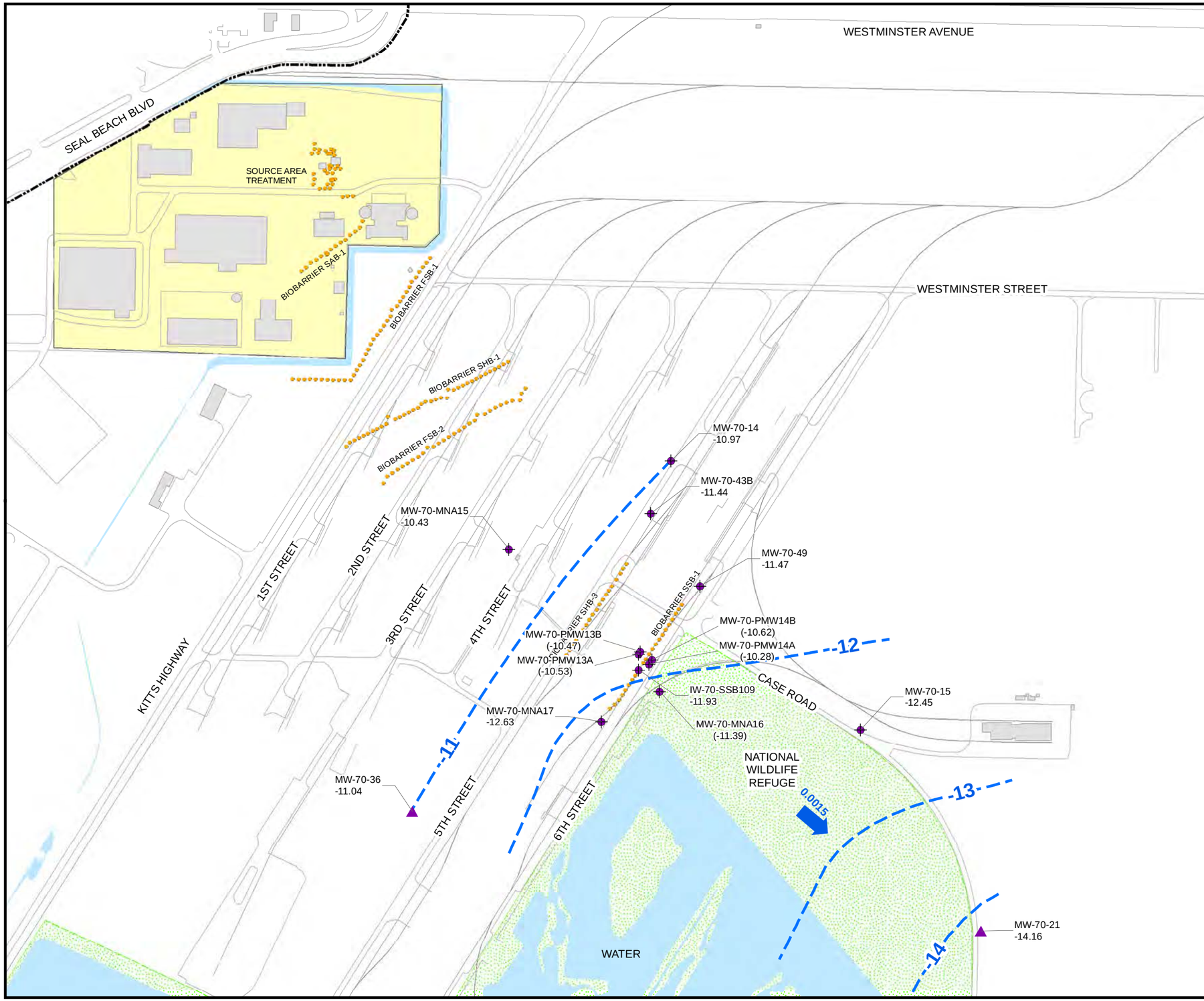
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 5.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-2.mxd

This Page Intentionally Left Blank



LEGEND

- MW-70-15 -3.94 — SECOND SAND MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
- MW-70-36 -3.60 — SECOND SAND POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- 0.0013 — INFERRED DIRECTION OF GROUNDWATER FLOW, WITH GRADIENT
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL
- BUILDING

NOTES:

WATER LEVELS MEASURED ON DECEMBER 15, 2014

( ) - PARENTHESES INDICATE GROUNDWATER ELEVATION AT THIS WELL WAS NOT USED FOR CONTOURING DUE TO THE DIFFERENCE IN THE ELEVATION OF ITS SCREEN INTERVAL RELATIVE TO THOSE OF NEARBY WELLS.

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 6
SECOND SAND GROUNDWATER ELEVATIONS
JULY 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

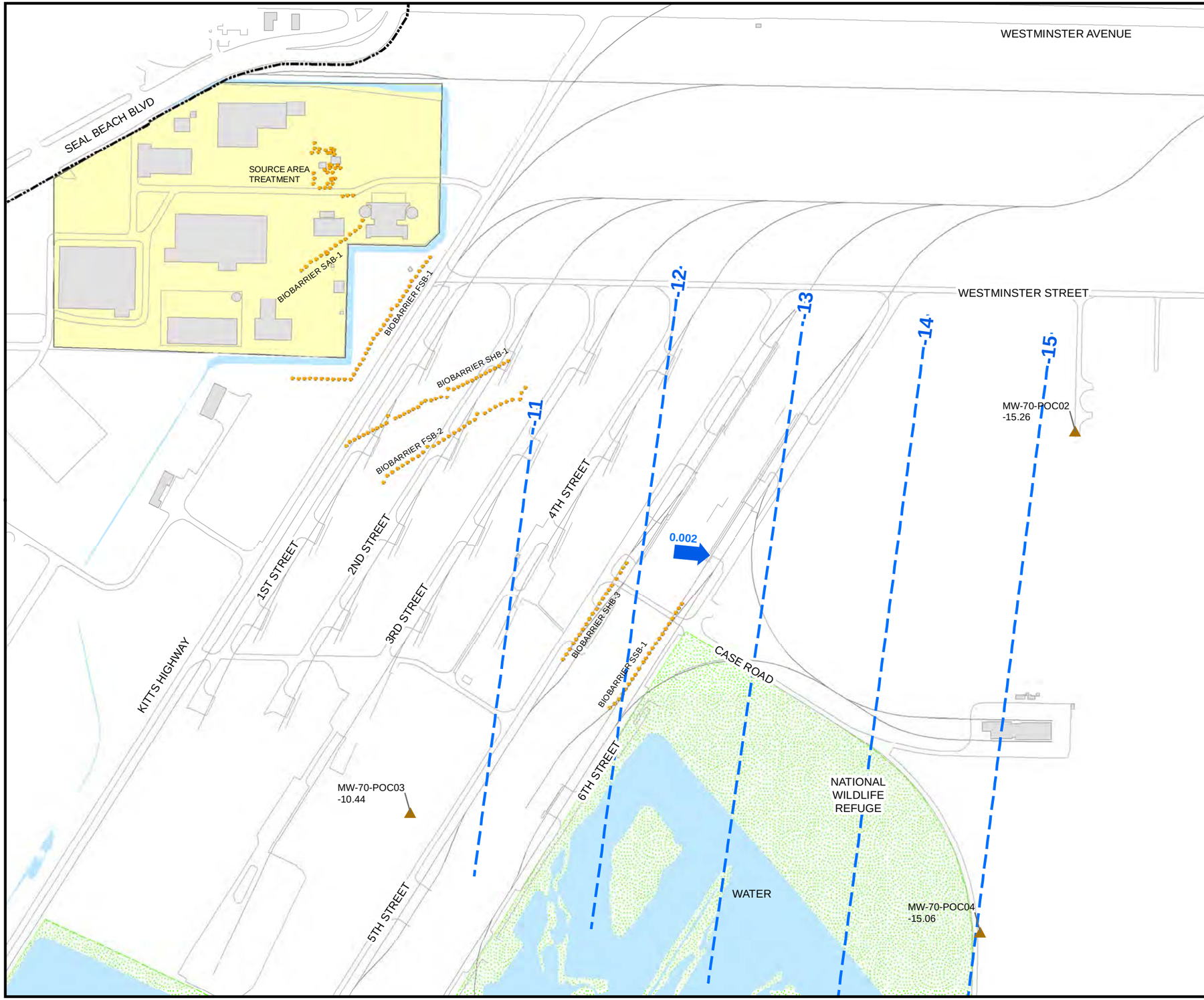
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 6.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-2.mxd

This Page Intentionally Left Blank



LEGEND

- MW-70-POC02 -4.44 — DEEP SAND POC MONITORING WELL SHOWING WELL ID AND WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
- BIOBARRIER OR SOURCE AREA TREATMENT WELL
- 0.0017 — INFERRED DIRECTION OF GROUNDWATER FLOW, WITH GRADIENT
- IR SITE 70 BOUNDARY
- BASE BOUNDARY
- ROAD
- RAILROAD TRACK
- APPROXIMATE GROUNDWATER ELEVATION, IN FEET MEAN SEA LEVEL
- BUILDING

NOTES:

WATER LEVELS MEASURED ON DECEMBER 15, 2014

200 100 0 200 400 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 PERFORMANCE MONITORING REPORT

FIGURE 7
DEEP SAND GROUNDWATER ELEVATIONS
JULY 2015

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 7.mxd

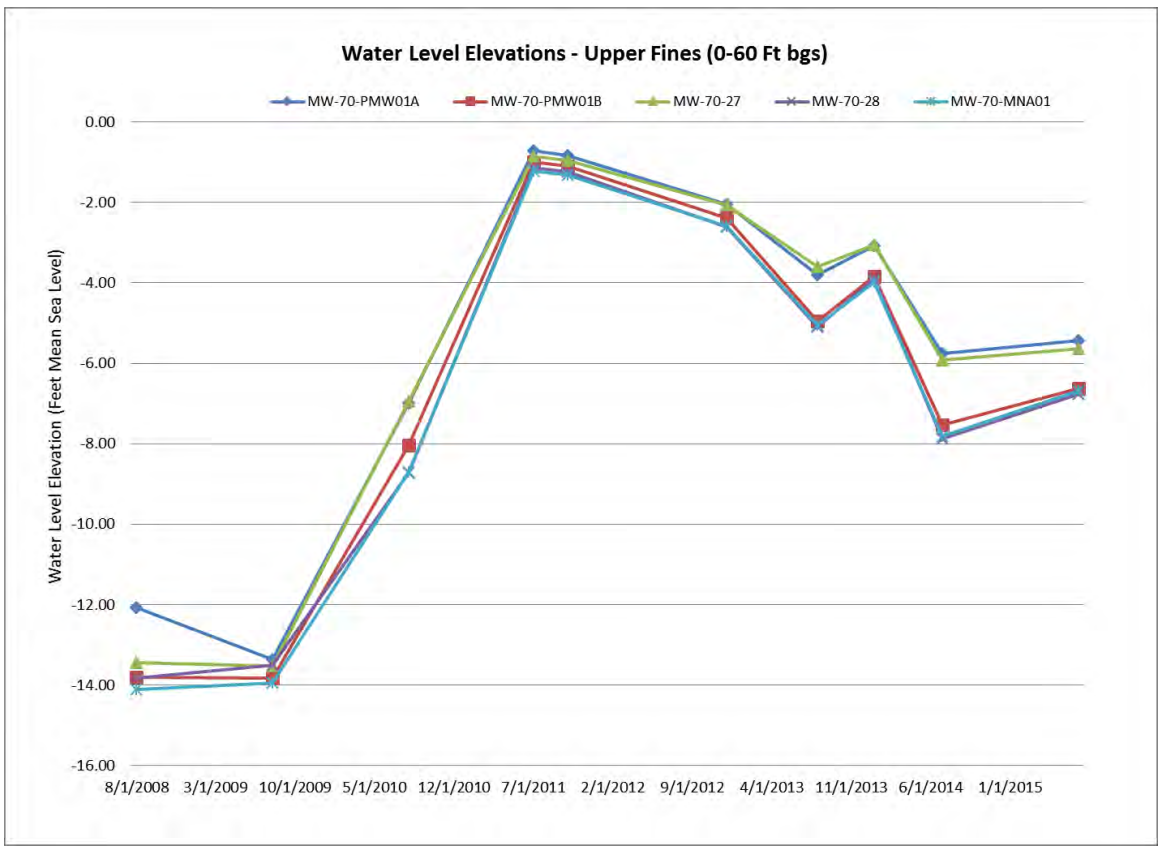
NAVFAC

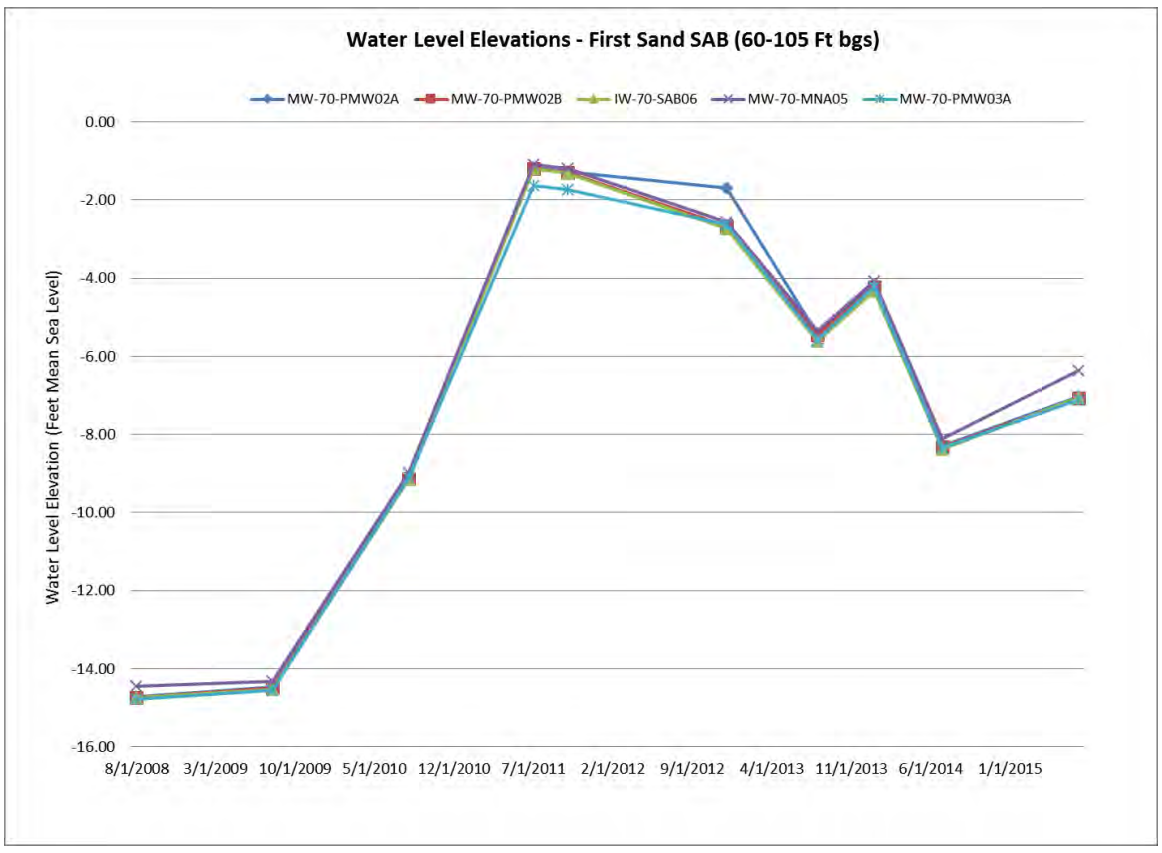
ECC-INSIGHT LLC

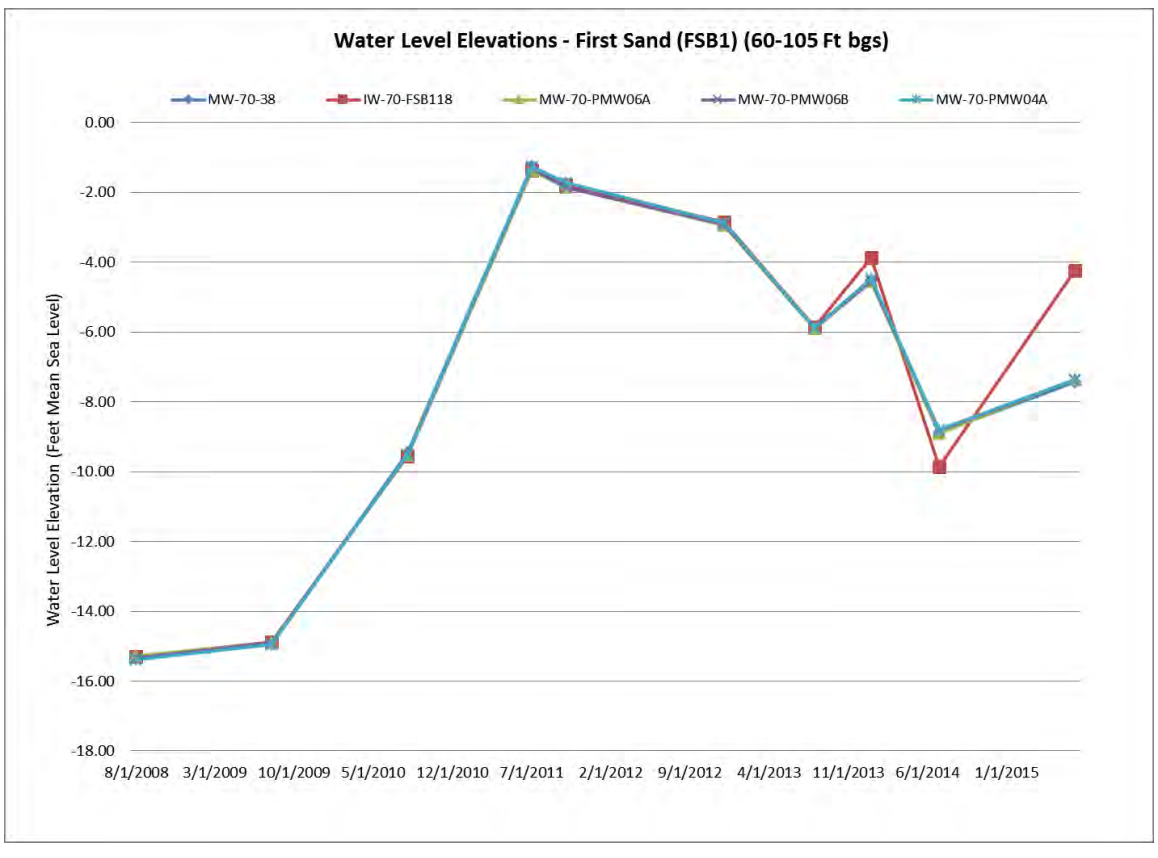
Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-2.mxd

This Page Intentionally Left Blank

Figure 8 - Water Level Trends – Upper Fines and First Sand
IR Site 70, Naval Weapons Station Seal Beach

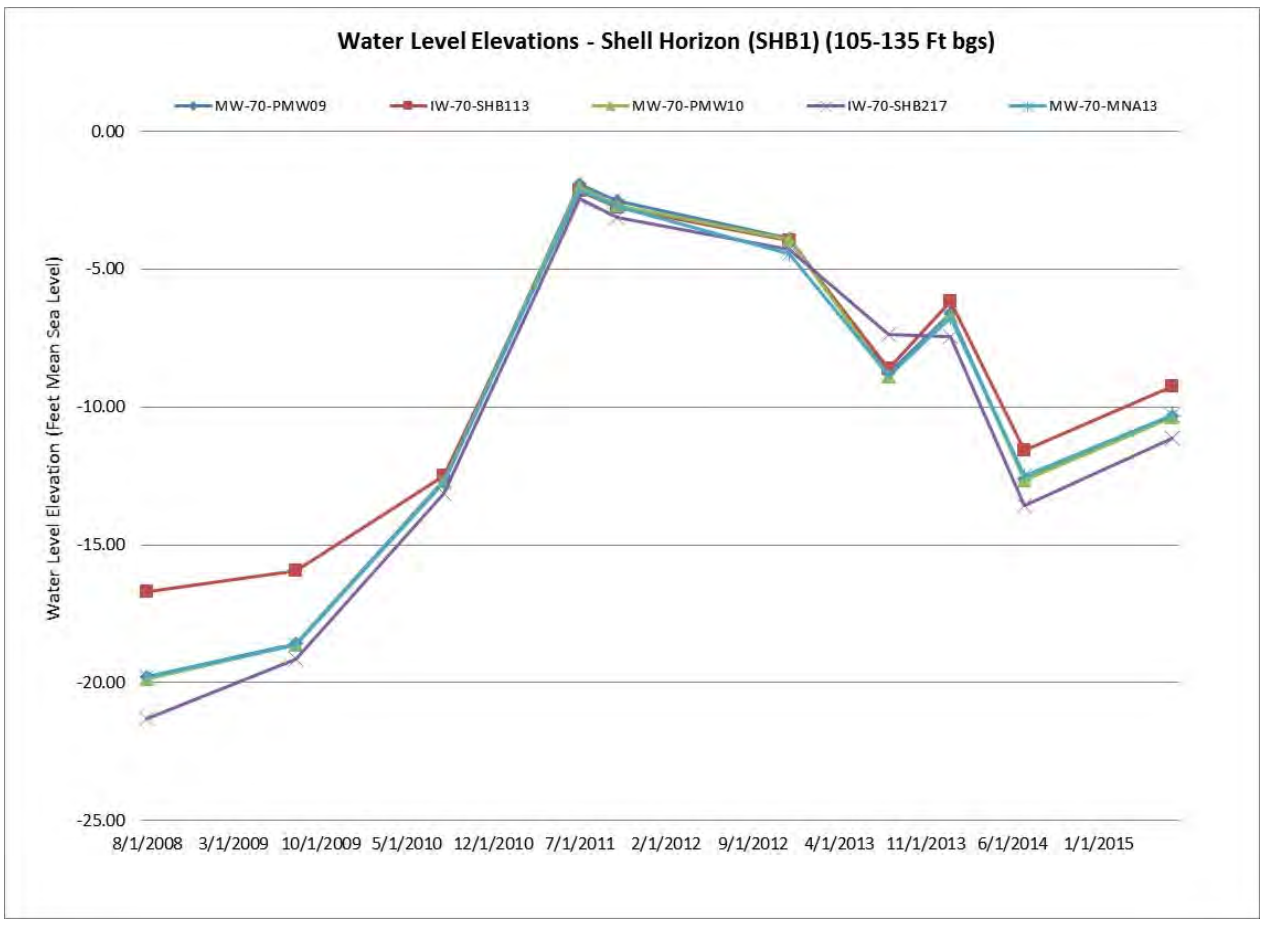


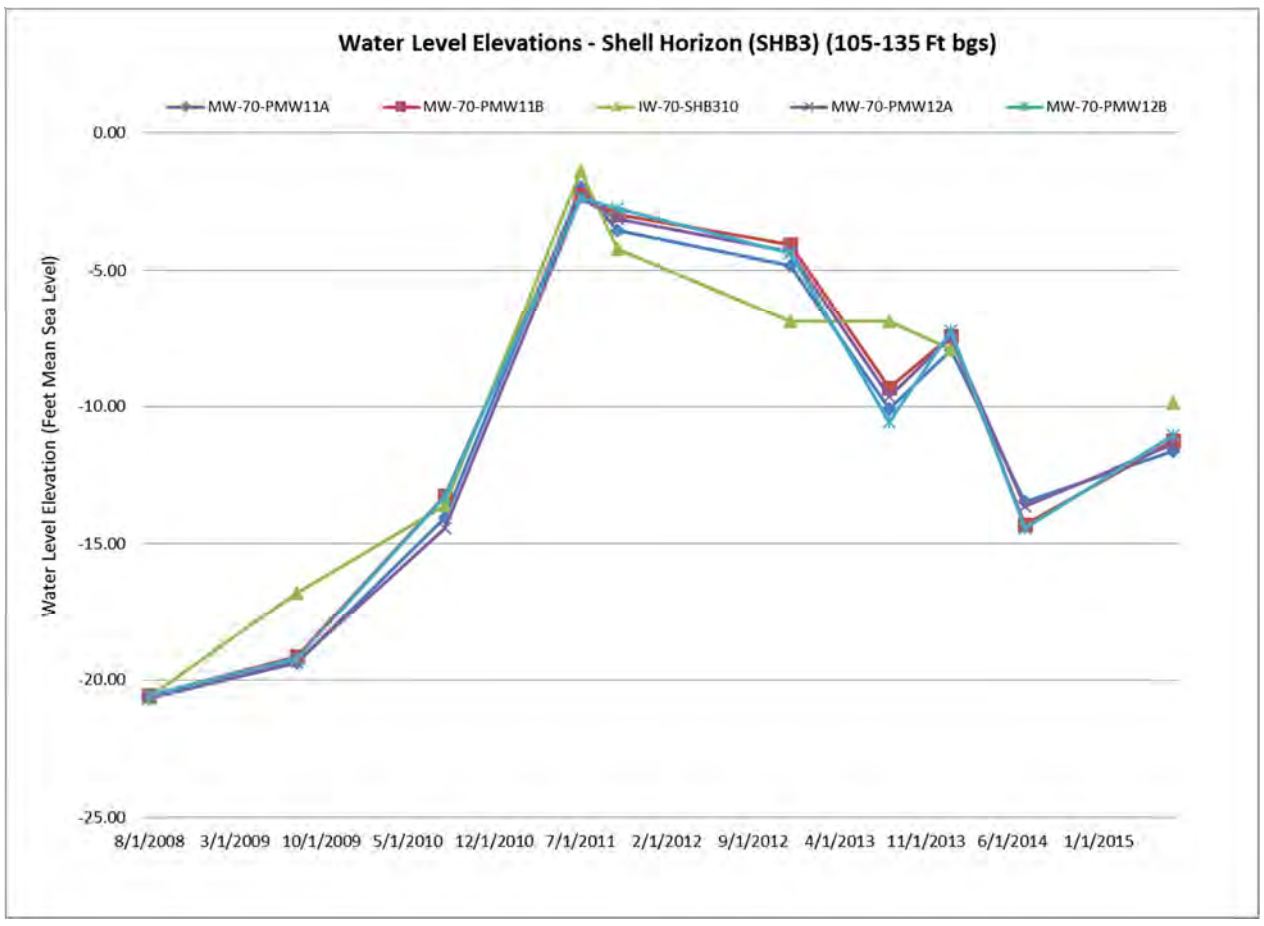


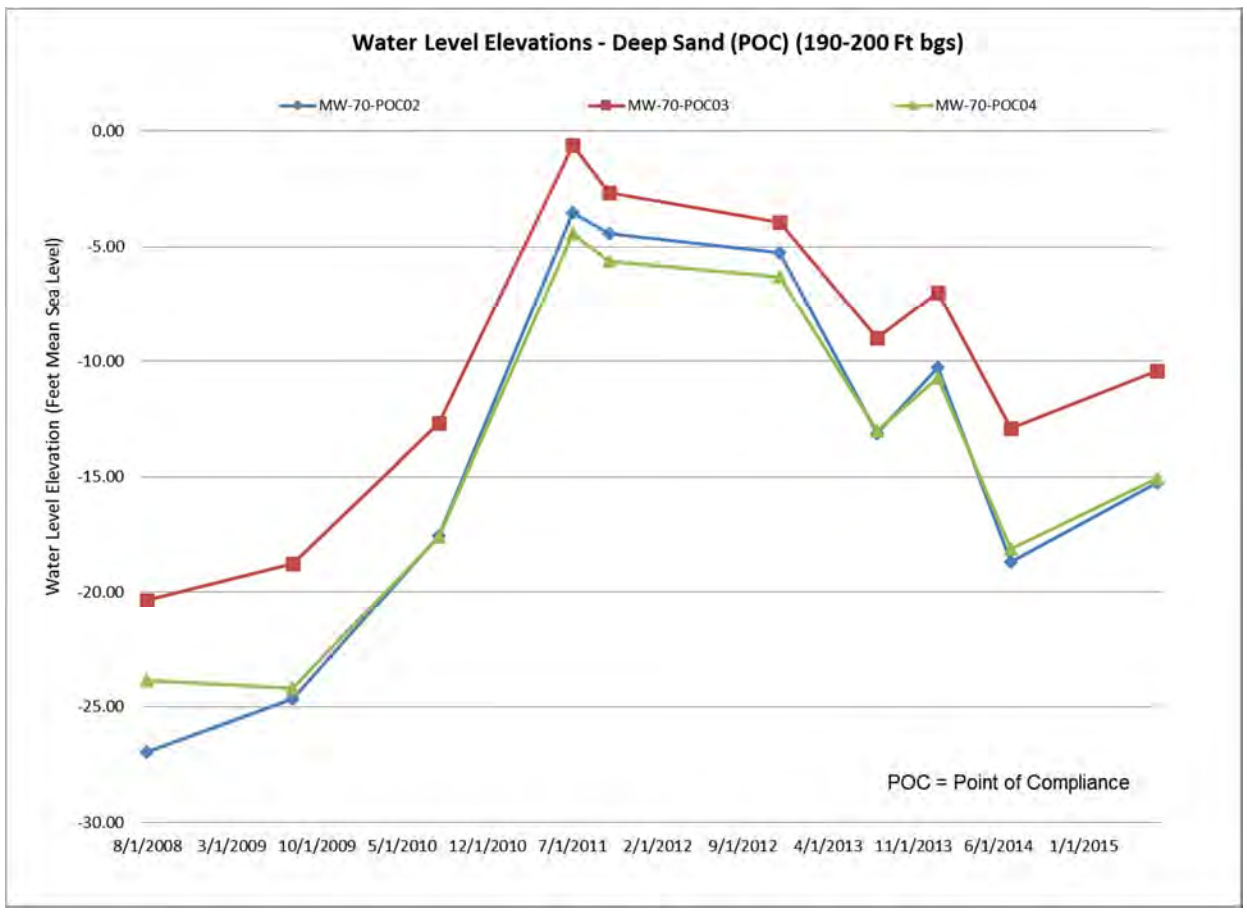


This Page Intentionally Left Blank

Figure 9 - Water Level Trends – Shell Horizon, Second and Deep Sand
IR Site 70, Naval Weapons Station Seal Beach



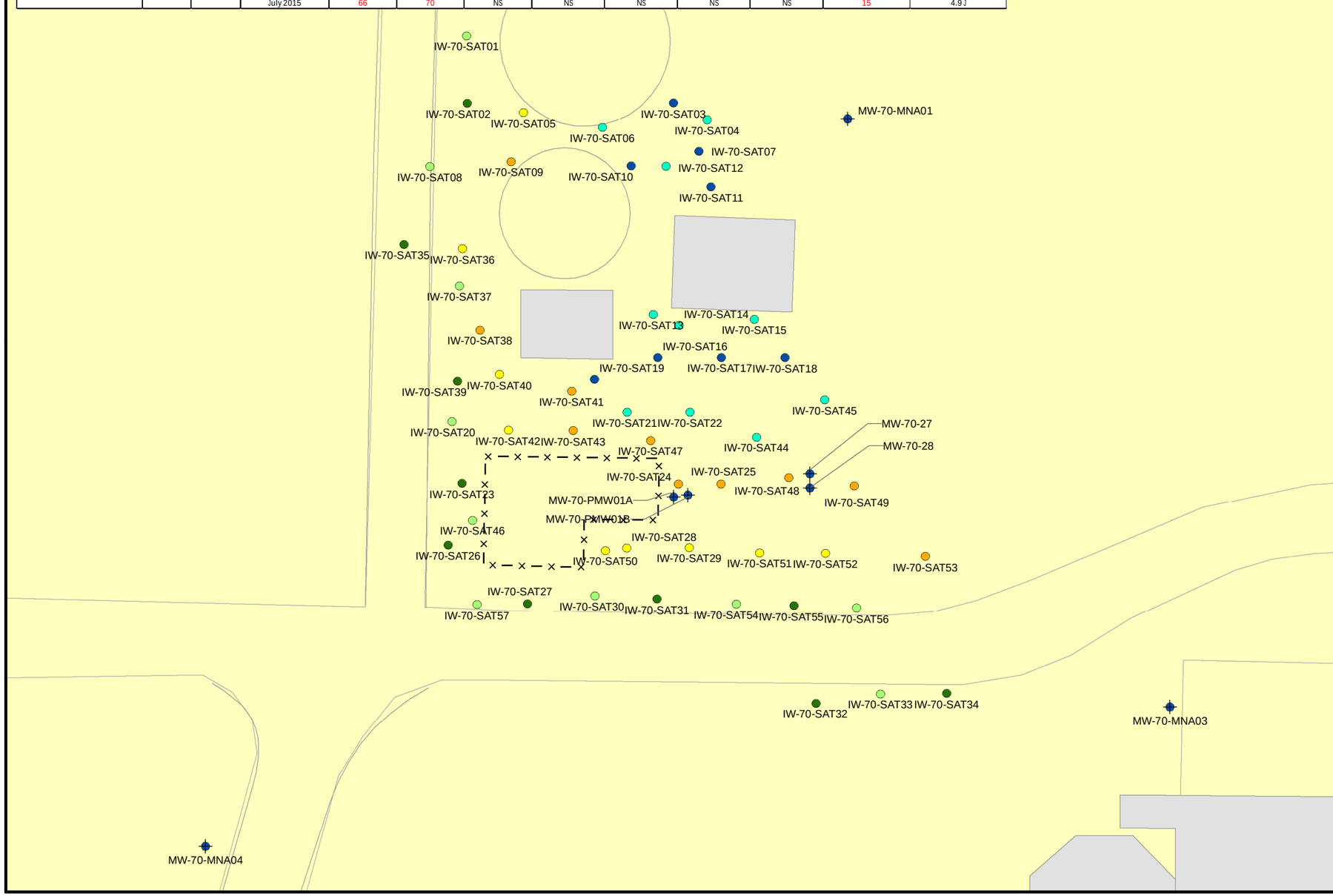




This Page Intentionally Left Blank

Source Area Treatment Grid

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-27 (26-36)	MW-70-28 (50-60)	IW-70-SAT35 (25-35)	MW-70-MNA01 (40-50)	MW-70-MNA02 (35-45)	MW-70-MNA03 (35-45)	MW-70-MNA04 (35-45)	MW-70-PMW01A (25-35)	MW-70-PMW01B (45-55)
TRICHLOROETHENE	µg/l	5	Aug 2008	7100	10000	NS	1500	46	1.3 J	250	11000	8500
			Sept 2010	1300	12	5.3	2200	35 J	0.85 J	190 J	1800	900
			Jul 2011	980	7	NS	NS	NS	NS	NS	1.3 J	7.9
			Nov 2011	2100	4.3 J	0.47 J	2800	26	0.61 J	210	1 J	4.4 J
			Dec 2012/Jan 2013	4300	10	0.29 J	2300	20	0.68 J	160	4.5 J	31
			Aug 2013	6500	16	NS	NS	NS	NS	NS	6.3	13 J
			Jan 2014	1400	14	NS	1700	15	0.82 J	200	80	2.3 J
			July 2014	340	57	NS	NS	NS	NS	NS	2.3 J	8.6
			Dec 2014	200	24	0.31 J	2800	12	1.4 J	260	5	4.6 J
			July 2015	66	70	NS	NS	NS	NS	NS	15	4.9 J



LEGEND

SOURCE AREA TREATMENT/UPPER FINES MONITORING WELL

TREATMENT WELL

- SECTION 1 GROUP 1
- SECTION 1 GROUP 2
- SECTION 2 GROUP 1
- SECTION 2 GROUP 2
- SECTION 3 GROUP 1
- SECTION 3 GROUP 2

ROAD

BUILDING

IR 70 SITE BOUNDARY

ELECTRICAL TRANSFORMER ENCLOSURE

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

20 10 0 20 40 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 10
SOURCE AREA TREATMENT GRID
TRICHLOROETHENE

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 10.mxd

NAVFAC

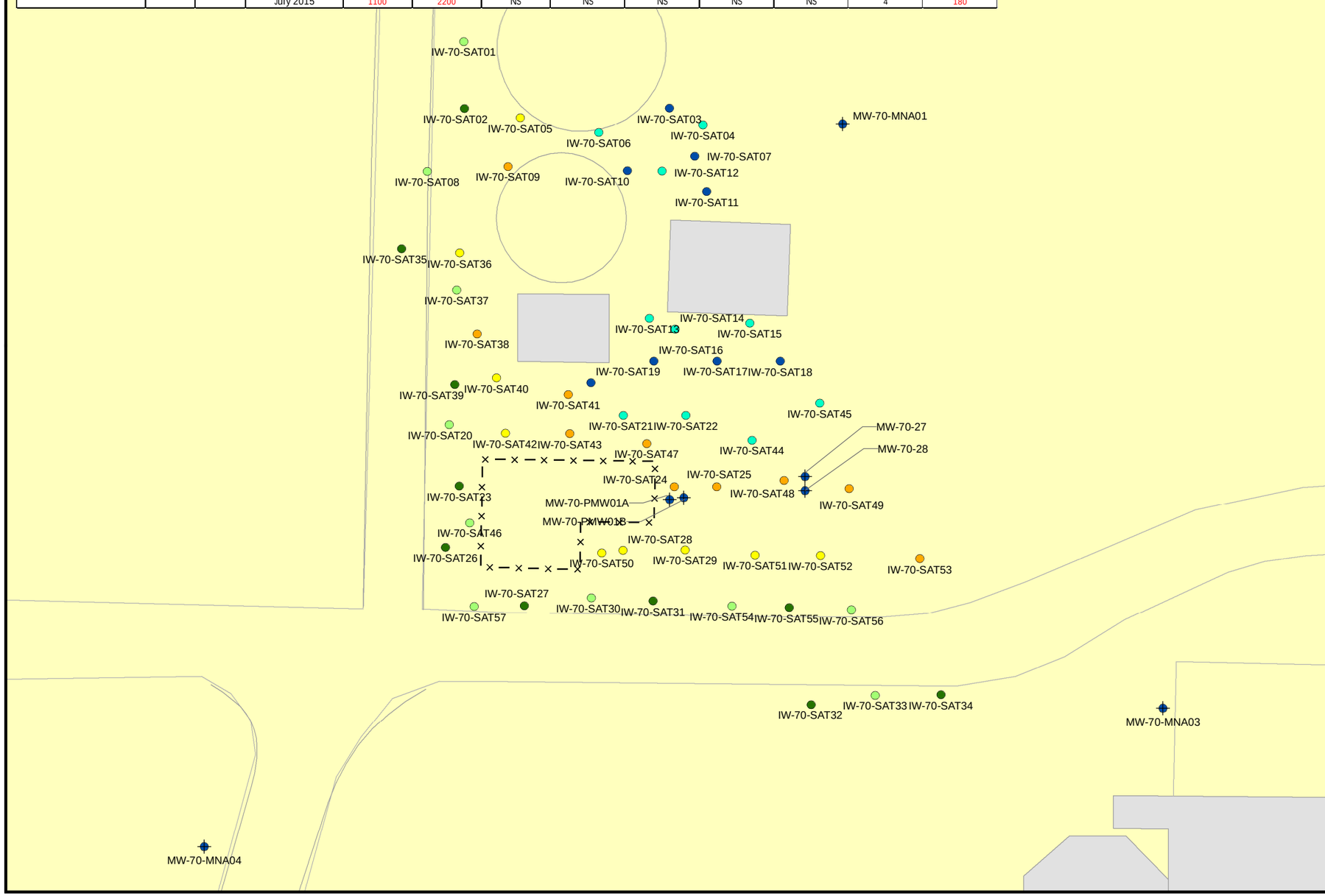
ECC-INSIGHT LLC

Path: F:\Projects\Seabeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank

Source Area Treatment Grid

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-27 (26-36)	MW-70-28 (50-60)	IW-70-SAT35 (25-35)	MW-70-MNA01 (40-50)	MW-70-MNA02 (35-45)	MW-70-MNA03 (35-45)	MW-70-MNA04 (35-45)	MW-70-PMW01A (25-35)	MW-70-PMW01B (45-55)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug 2008	4600	530	NS	40	31	3	270	1300	33
			Sept 2010	6100	11	740	490	45	4	170	4400	4900
			Jul 2011	600	51	NS	NS	NS	NS	NS	3	39
			Nov 2011	1500	40	0.5 J	380	71	5	130	0.81 J	16
			Dec 2012/Jan 2013	2500	3700	0.22 J	340	63	5	180	2	5700
			Aug 2013	2400	2100	NS	NS	NS	NS	NS	4	1,100 J
			Jan 2014	1200	440	NS	370	56	7	280	180	83
			July 2014	690	1500	NS	NS	NS	NS	NS	7.5	540
			Dec 2014	440	790	5	720	45	9.4	560	1.8	83
			July 2015	1100	2200	NS	NS	NS	NS	NS	4	180



LEGEND

SOURCE AREA TREATMENT/UPPER FINES MONITORING WELL

TREATMENT WELL

SECTION 1 GROUP 1

SECTION 1 GROUP 2

SECTION 2 GROUP 1

SECTION 2 GROUP 2

SECTION 3 GROUP 1

SECTION 3 GROUP 2

ROAD

BUILDING

IR 70 SITE BOUNDARY

ELECTRICAL TRANSFORMER ENCLOSURE

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

20 10 0 20 40 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 11
SOURCE AREA TREATMENT GRID
CIS-1,2-DICHLOROETHENE

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 11.mxd

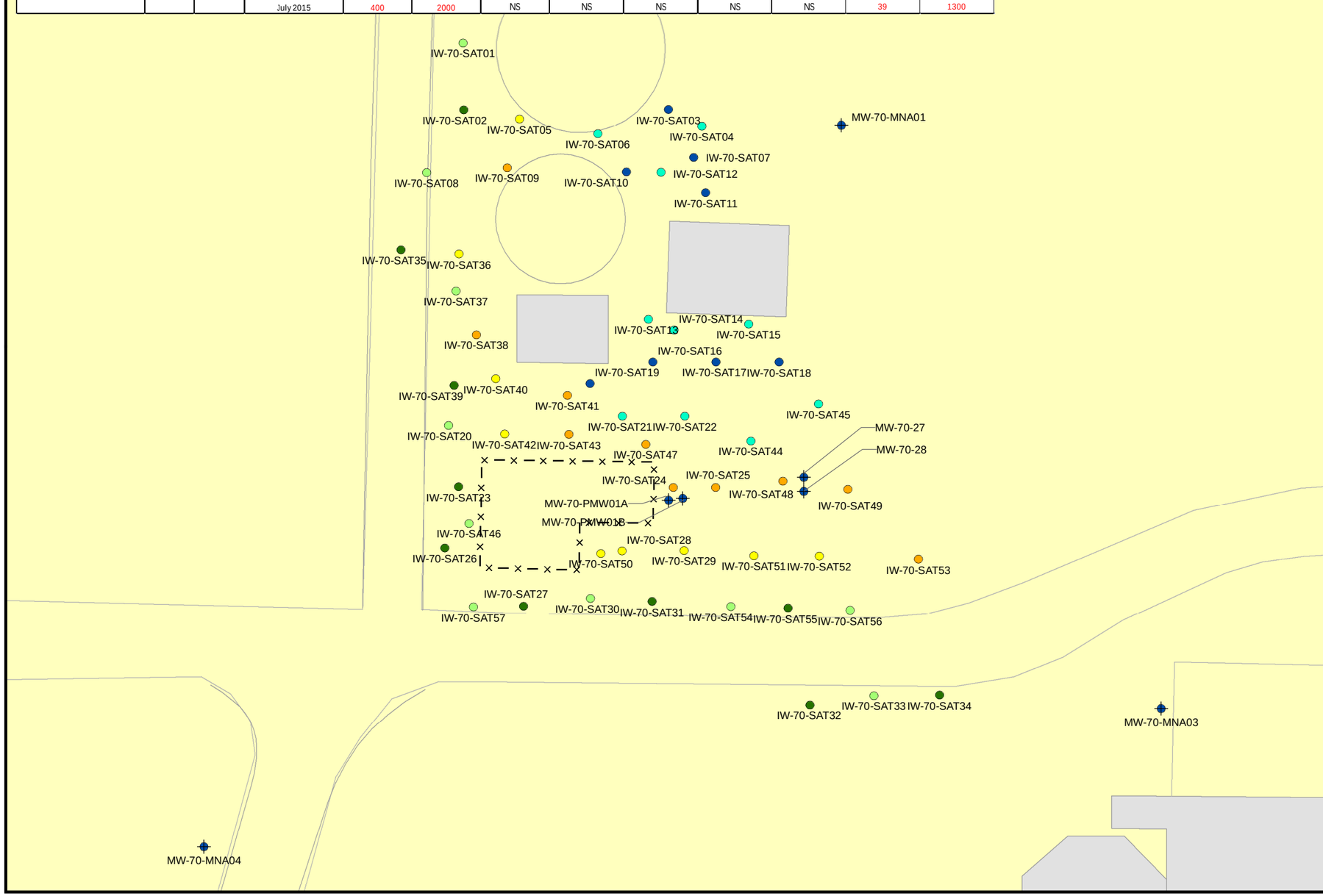
NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map\Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank

Source Area Treatment Grid												
Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-27 (26-36)	MW-70-28 (50-60)	IW-70-SAT35 (25-35)	MW-70-MNA01 (40-50)	MW-70-MNA02 (35-45)	MW-70-MNA03 (35-45)	MW-70-MNA04 (35-45)	MW-70-PMW01A (25-35)	MW-70-PMW01B (45-55)
VINYL CHLORIDE	µg/l	0.5	Aug 2008	32	18	NS	0.39 J	7.1	0.5 U	1.8	25	0.51
			Sept 2010	3700	230	1300	300	4.5	0.35 J	0.9	260	3000
			Jul 2011	1300	480	NS	NS	NS	NS	NS	30	2700
			Nov 2011	1300	340	3.3	290	10	0.45 J	4.1	5.5	2200
			Dec 2012/Jan 2013	1800	860	3.5	310	5.7	0.50 U	5.1	4.1	9000
			Aug 2013	2700	720	NS	NS	NS	NS	NS	140	3,600 J
			Jan	2100	1300	NS	NS	NS	NS	NS	140	3600 J
			July 2014	540	2400	NS	NS	NS	NS	NS	5.4	1900
			Dec 2014	350	1800	40	310	2.6	0.33 J	2.1	3.8	3700
			July 2015	400	2000	NS	NS	NS	NS	NS	39	1300



LEGEND

SOURCE AREA TREATMENT/UPPER FINES MONITORING WELL

TREATMENT WELL

- SECTION 1 GROUP 1
- SECTION 1 GROUP 2
- SECTION 2 GROUP 1
- SECTION 2 GROUP 2
- SECTION 3 GROUP 1
- SECTION 3 GROUP 2

ROAD

BUILDING

IR 70 SITE BOUNDARY

ELECTRICAL TRANSFORMER ENCLOSURE

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED **RED** PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

20 10 0 20 40 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 12
SOURCE AREA TREATMENT GRID
VINYL CHLORIDE

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 12.mxd

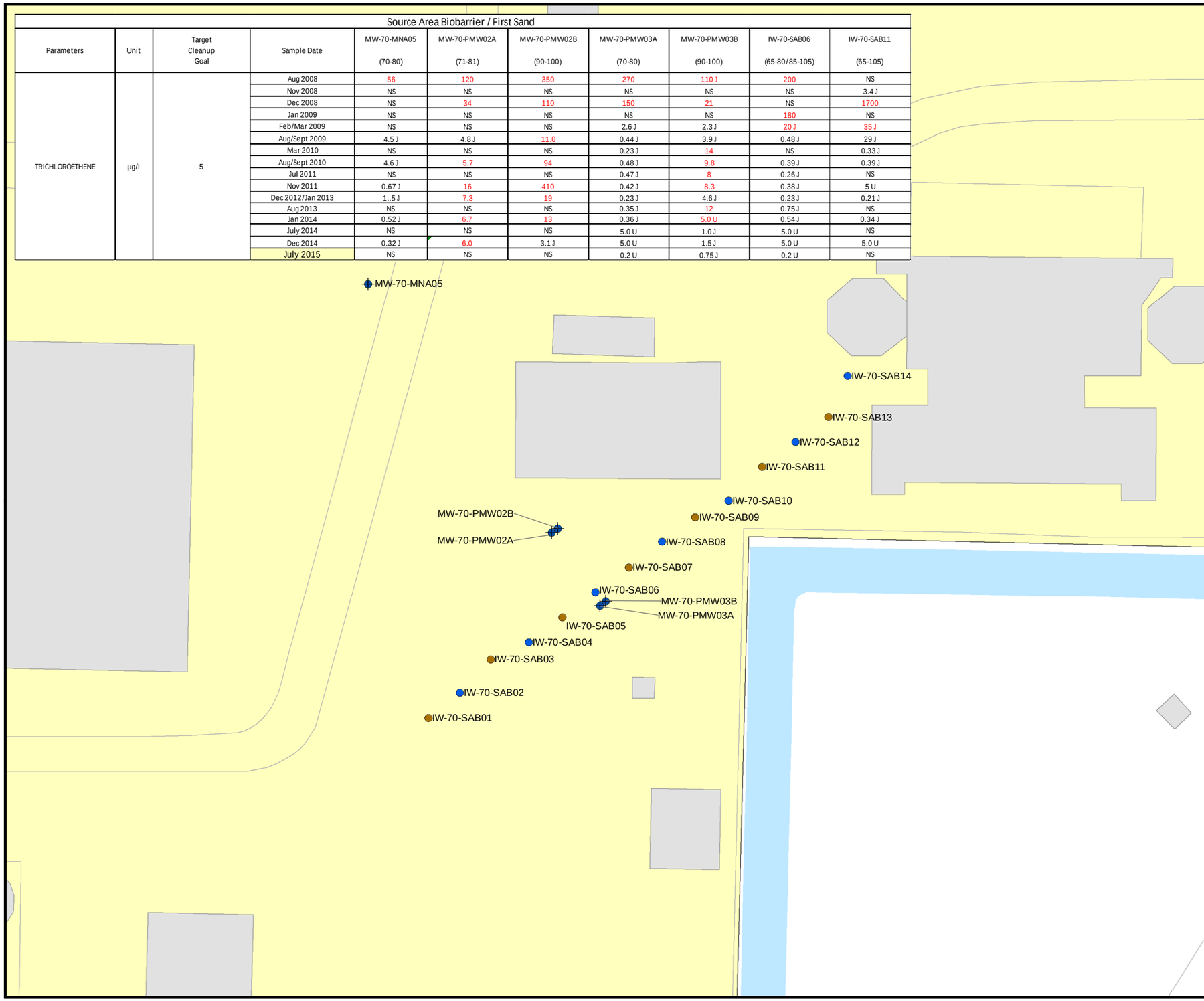
NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map\Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank

Source Area Biobarrier / First Sand										
Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-MNA05 (70-80)	MW-70-PMW02A (71-81)	MW-70-PMW02B (90-100)	MW-70-PMW03A (70-80)	MW-70-PMW03B (90-100)	IW-70-SAB06 (65-80/85-105)	IW-70-SAB11 (65-105)
TRICHLOROETHENE	µg/l	5	Aug 2008	56	120	350	270	110 J	200	NS
			Nov 2008	NS	NS	NS	NS	NS	NS	3.4 J
			Dec 2008	NS	34	110	150	21	NS	1700
			Jan 2009	NS	NS	NS	NS	NS	180	NS
			Feb/Mar 2009	NS	NS	NS	2.6 J	2.3 J	20 J	35 J
			Aug/Sept 2009	4.5 J	4.8 J	11.0	0.44 J	3.9 J	0.48 J	29 J
			Mar 2010	NS	NS	NS	0.23 J	14	NS	0.33 J
			Aug/Sept 2010	4.6 J	5.7	94	0.48 J	9.8	0.39 J	0.39 J
			Jul 2011	NS	NS	NS	0.47 J	8	0.26 J	NS
			Nov 2011	0.67 J	16	410	0.42 J	8.3	0.38 J	5 U
			Dec 2012/Jan 2013	1..5 J	7.3	19	0.23 J	4.6 J	0.23 J	0.21 J
			Aug 2013	NS	NS	NS	0.35 J	12	0.75 J	NS
			Jan 2014	0.52 J	6.7	13	0.36 J	5.0 U	0.54 J	0.34 J
			July 2014	NS	NS	NS	5.0 U	1.0 J	5.0 U	NS
			Dec 2014	0.32 J	6.0	3.1 J	5.0 U	1.5 J	5.0 U	5.0 U
			July 2015	NS	NS	NS	0.2 U	0.75 J	0.2 U	NS



LEGEND

FIRST SAND MONITORING WELL

TREATMENT WELL

GROUP 1

GROUP 2

ROAD

BUILDING

IR 70 SITE BOUNDARY

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED RED PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

30 15 0 30 60 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 13
SOURCE AREA BIOBARRIER (SAB-1)
TRICHLOROETHENE

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 13.mxd

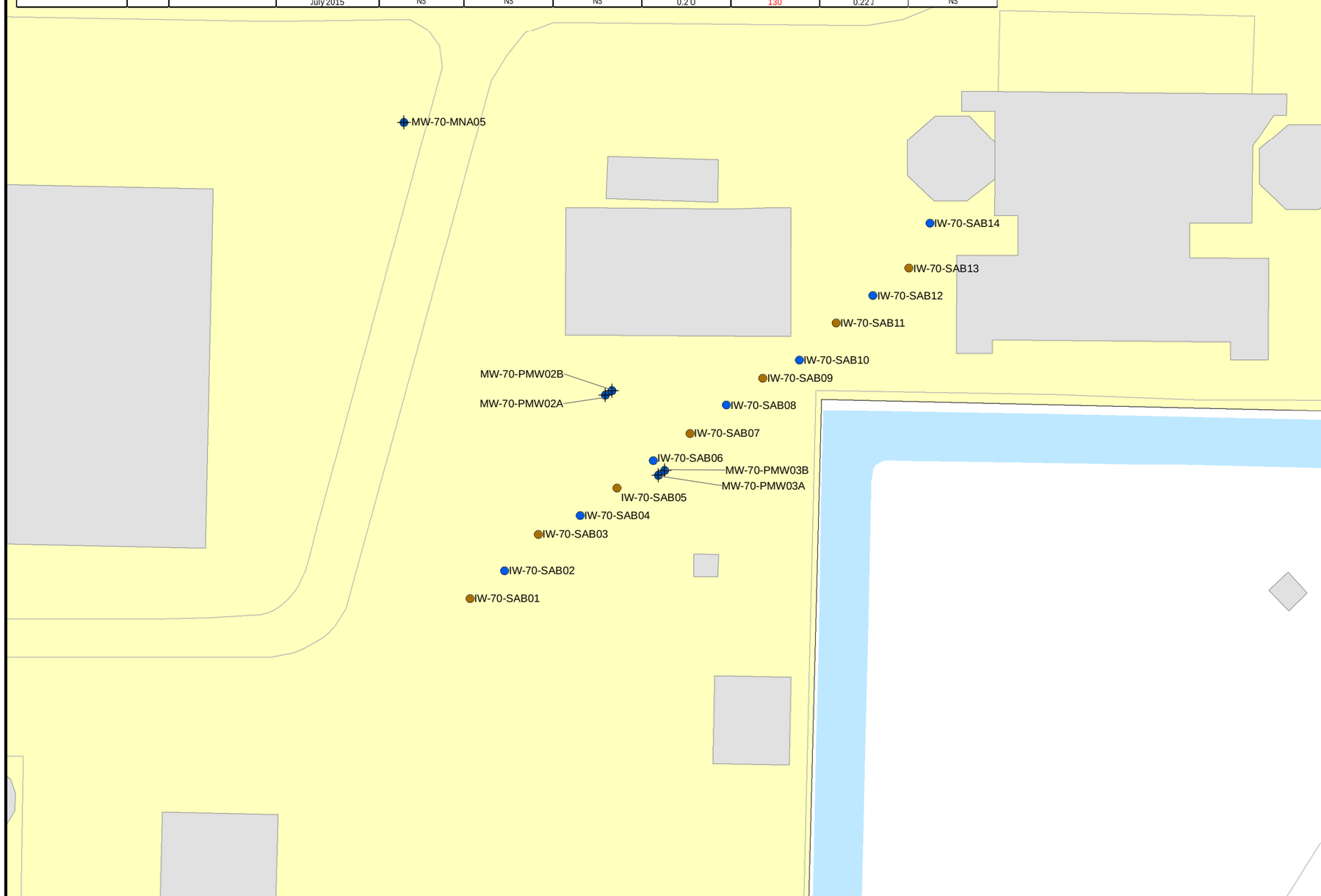
NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank

Source Area Biobarrier / First Sand										
Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-MNA05 (70-80)	MW-70-PMW02A (71-81)	MW-70-PMW02B (90-100)	MW-70-PMW03A (70-80)	MW-70-PMW03B (90-100)	IW-70-SAB06 (65-80/85-105)	IW-70-SAB11 (65-105)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	2.70	100	170	9.2	190	11	NS
			Aug/Sept 2009	30	120	180	4.10	310	1.40	600
			Aug/Sept 2010	19	130	290	0.63 J	510	0.49 J	1.60
			Oct/Nov 2011	0.57 J	230	770	0.73 J	1100	0.48 J	0.33 J
			Dec 2012/Jan 2013	16	220	1500	0.26 J	1600	0.30 J	0.80 J
			Aug 2013	NS	NS	NS	0.50 J	1700	3.8	NS
			Jan 2014	14	130	550	0.35 J	12	4.1	2.4
			July 2014	NS	NS	NS	0.31 J	240	0.63 J	NS
			Dec 2014	13	260	50	1.0 U	140	0.28 J	1.2
			July 2015	NS	NS	NS	0.2 U	130	0.22 J	NS



LEGEND

FIRST SAND MONITORING WELL

TREATMENT WELL

GROUP 1

GROUP 2

ROAD

BUILDING

IR 70 SITE BOUNDARY

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED RED PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

30 15 0 30 60 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 14
SOURCE AREA BIOBARRIER (SAB-1)
CIS-1,2-DICHLOROETHENE

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 14.mxd

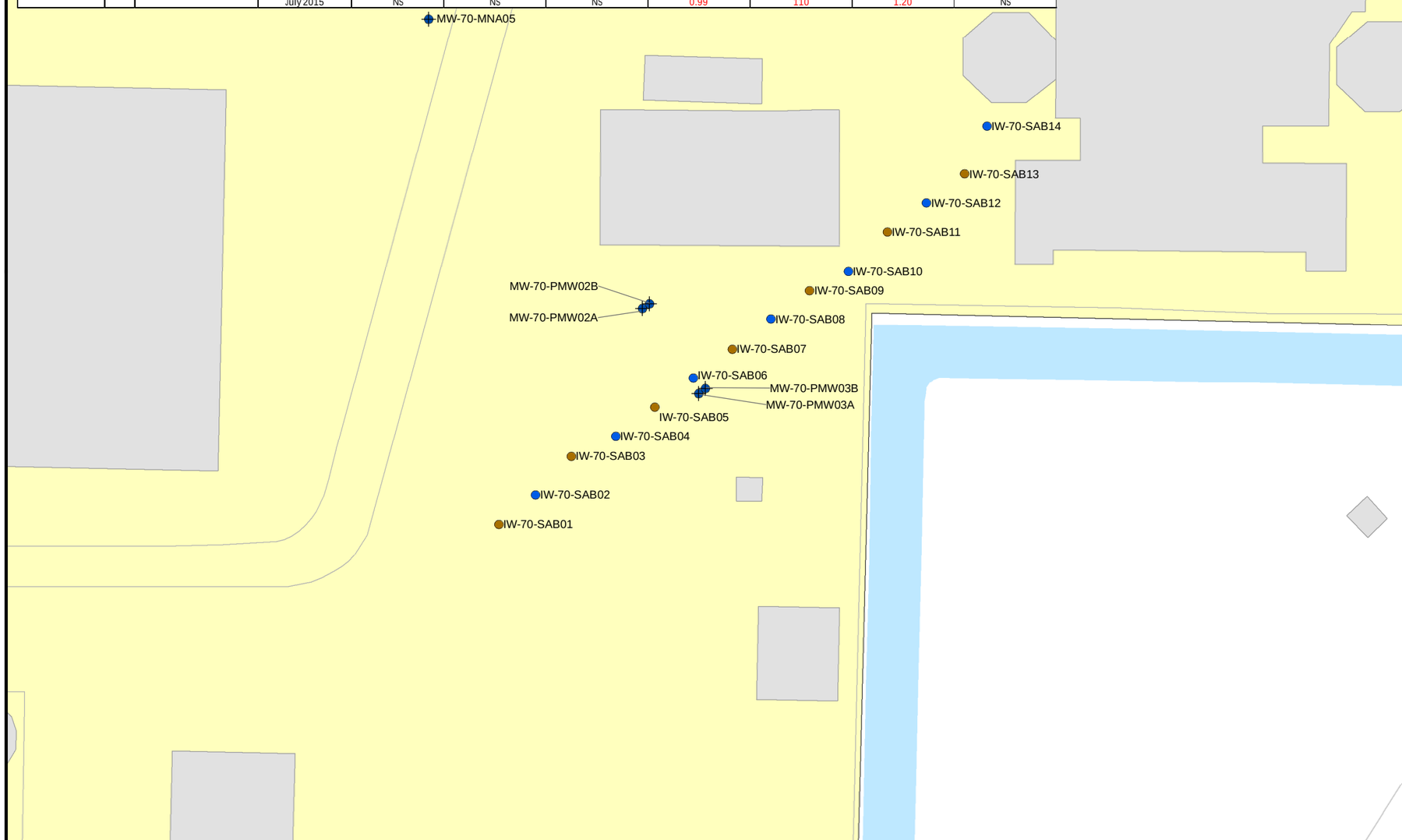
NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map\Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-MNA05 (70-80)	MW-70-PMW02A (71-81)	MW-70-PMW02B (90-100)	MW-70-PMW03A (70-80)	MW-70-PMW03B (90-100)	IW-70-SAB06 (65-80/85-105)	IW-70-SAB11 (65-105)
				Source Area Biobarrier / First Sand						
VINYL CHLORIDE	µg/l	0.5	Aug 2008	0.5 U	0.33 J	0.68	0.47 J	0.56	0.39 J	NS
			Nov 2008	NS	NS	NS	NS	NS	NS	88
			Dec 2008	NS	0.3 J	0.42 J	0.5 U	0.5 U	NS	31
			Jan 2009	NS	NS	NS	NS	NS	11	NS
			Feb/Mar 2009	NS	NS	NS	19	0.67	8.9 J	43
			Aug/Sept 2009	0.5 U	0.31 J	0.49 J	11	3	15	150
			Mar 2010	NS	NS	NS	3.6	13	NS	5.6
			Aug/Sept 2010	37	0.61	1.6	5	38	6.1	2.7
			Jul 2011	NS	NS	NS	1.6	73	2.9	0.91
			Nov 2011	42	0.75	1.7	0.67	89	1.8	NS
			Dec 2012/Jan 2013	66	1.4	4.1	0.50 U	170	1.2	2.3
			Aug 2013	NS	NS	NS	3.4	74	15	NS
			Jan 2014	27	4.4	6.2	3.1	46	12	4
			July 2014	NS	NS	NS	4.3	240	1.9	NS
			Dec 2014	15	1.7	4.3	0.84	140	0.44 J	0.50 U
			July 2015	NS	NS	NS	0.99	110	1.20	NS



LEGEND

FIRST SAND MONITORING WELL

TREATMENT WELL

GROUP 1

GROUP 2

ROAD

BUILDING

IR 70 SITE BOUNDARY

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED RED PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

30 15 0 30 60 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 15
SOURCE AREA BIOBARRIER (SAB-1)
VINYL CHLORIDE

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

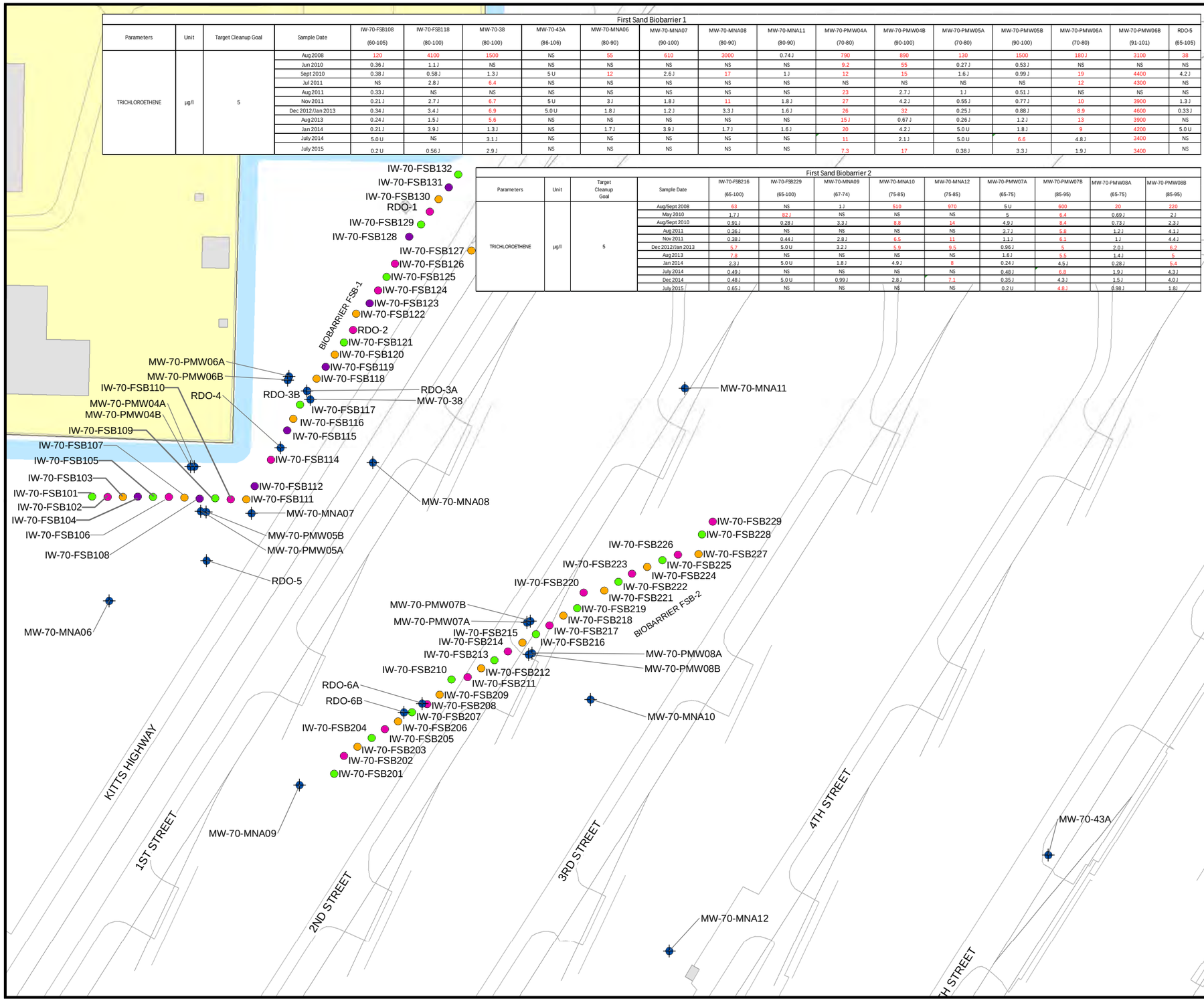
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 15.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



First Sand Biobarrier 1

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-FSB108 (60-105)	IW-70-FSB118 (80-100)	MW-70-38 (80-100)	MW-70-43A (86-106)	MW-70-MNA06 (80-90)	MW-70-MNA07 (90-100)	MW-70-MNA08 (80-90)	MW-70-MNA11 (80-90)	MW-70-PMW04A (70-80)	MW-70-PMW04B (90-100)	MW-70-PMW05A (70-80)	MW-70-PMW05B (90-100)	MW-70-PMW06A (70-80)	MW-70-PMW06B (91-101)	RDO-5 (65-105)
TRICHLOROETHENE	µg/l	5	Aug 2008	120	4100	1500	NS	55	610	3000	0.74 J	790	890	130	1500	180 J	3100	38
			Jun 2010	0.36 J	1.1 J	NS	NS	NS	NS	NS	NS	9.2	55	0.27 J	0.53 J	NS	NS	NS
			Sept 2010	0.38 J	0.58 J	1.3 J	5 U	12	2.6 J	17	1 J	12	15	1.6 J	0.99 J	19	4400	4.2 J
			Jul 2011	NS	2.8 J	6.4	NS	NS	NS	NS	NS	NS	NS	NS	NS	12	4300	NS
			Aug 2011	0.33 J	NS	NS	NS	NS	NS	NS	NS	23	2.7 J	1 J	0.51 J	NS	NS	NS
			Nov 2011	0.21 J	2.7 J	6.7	5 U	3 J	1.8 J	1.8 J	1.8 J	27	4.2 J	0.55 J	0.77 J	10	3900	1.3 J
			Dec 2012/Jan 2013	0.34 J	3.4 J	6.9	5.0 U	1.8 J	1.2 J	3.3 J	1.6 J	26	32	0.25 J	0.88 J	8.9	4600	0.33 J
			Aug 2013	0.24 J	1.5 J	5.6	NS	NS	NS	NS	NS	15 J	0.67 J	0.26 J	1.2 J	13	3900	NS
			Jan 2014	0.21 J	3.9 J	1.3 J	NS	1.7 J	3.9 J	1.7 J	1.6 J	20	4.2 J	5.0 U	1.8 J	9	4200	5.0 U
			July 2014	5.0 U	NS	3.1 J	NS	NS	NS	NS	NS	11	2.1 J	5.0 U	6.6	4.8 J	3400	NS
			July 2015	0.2 U	0.56 J	2.9 J	NS	NS	NS	NS	NS	7.3	17	0.38 J	3.3 J	1.9 J	3400	NS

First Sand Biobarrier 2

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-FSB216 (65-100)	IW-70-FSB229 (65-100)	MW-70-MNA09 (67-74)	MW-70-MNA10 (75-85)	MW-70-MNA12 (75-85)	MW-70-PMW07A (65-75)	MW-70-PMW07B (85-95)	MW-70-PMW08A (65-75)	MW-70-PMW08B (85-95)
TRICHLOROETHENE	µg/l	5	Aug/Sept 2008	63	NS	1 J	510	970	5 U	600	20	220
			May 2010	1.7 J	82 J	NS	NS	NS	5	6.4	0.69 J	2 J
			Aug/Sept 2010	0.91 J	0.28 J	3.3 J	8.8	14	4.9 J	8.4	0.73 J	2.3 J
			Aug 2011	0.36 J	NS	NS	NS	NS	3.7 J	5.8	1.2 J	4.1 J
			Nov 2011	0.38 J	0.44 J	2.8 J	6.5	11	1.1 J	6.1	1 J	4.4 J
			Dec 2012/Jan 2013	5.7	5.0 U	3.2 J	5.9	9.5	0.96 J	5	2.0 J	6.2
			Aug 2013	7.8	NS	NS	NS	NS	1.6 J	5.5	1.4 J	5
			Jan 2014	2.3 J	5.0 U	1.8 J	4.9 J	8	0.24 J	4.5 J	0.28 J	5.4
			July 2014	0.49 J	NS	NS	NS	NS	0.48 J	6.8	1.9 J	4.3 J
			Dec 2014	0.48 J	5.0 U	0.99 J	2.8 J	7.1	0.35 J	4.3 J	1.5 J	4.0 J
			July 2015	0.65 J	NS	NS	NS	NS	0.2 U	4.8 J	0.98 J	1.8 J

LEGEND

FIRST SAND MONITORING WELL

TREATMENT WELL

GROUP 1

GROUP 2

GROUP 3

GROUP 4

ROAD

BUILDING

IR 70 SITE BOUNDARY

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED RED PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

100 50 0 100 200 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 16
FIRST SAND BIOBARRIERS
TRICHLOROETHENE

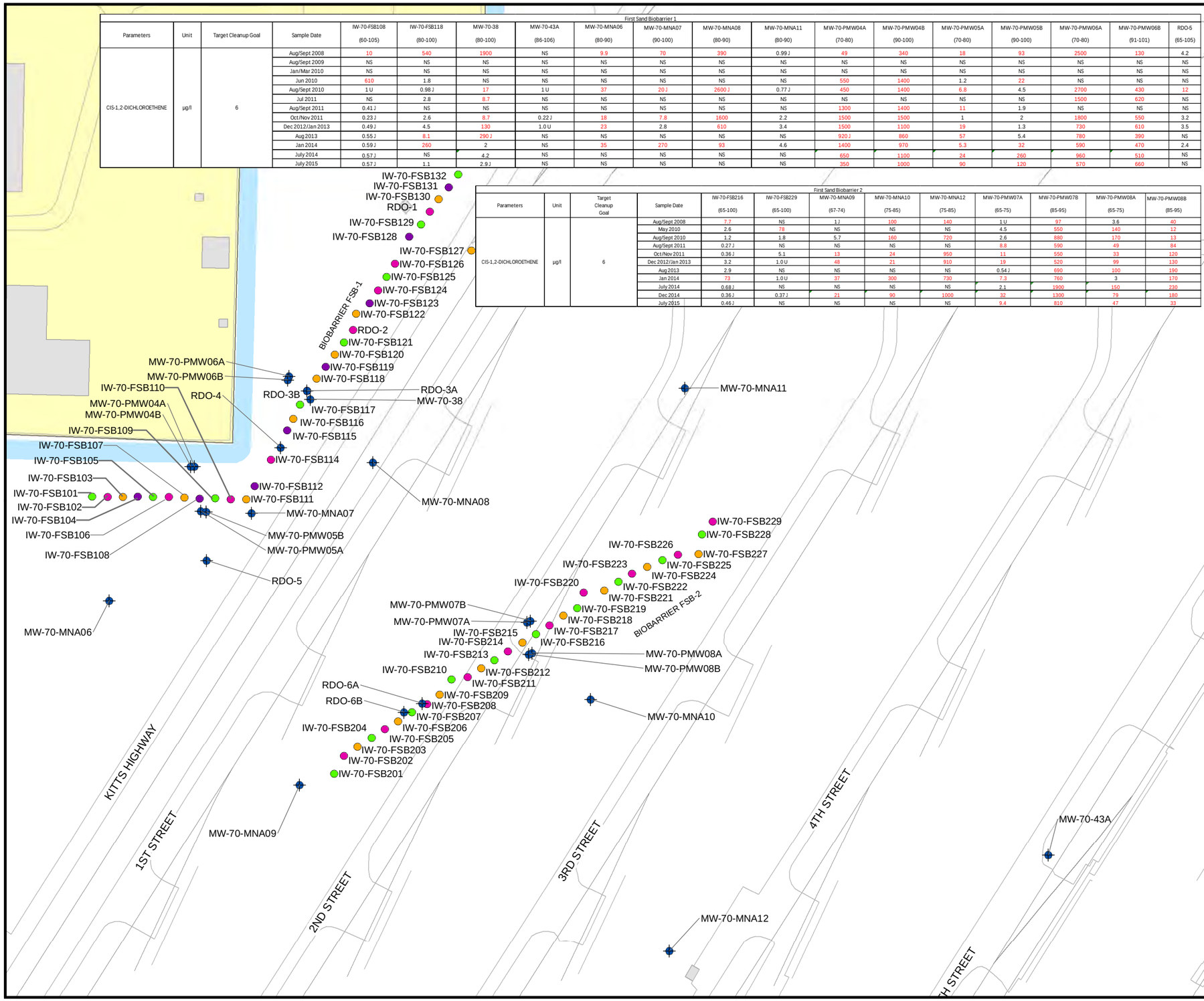
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 16.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



First Sand Biobarrier 1

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-FSB108 (60-105)	IW-70-FSB118 (80-100)	MW-70-38 (80-100)	MW-70-43A (86-106)	MW-70-MNA06 (80-90)	MW-70-MNA07 (90-100)	MW-70-MNA08 (80-90)	MW-70-MNA11 (80-90)	MW-70-PMW04A (70-80)	MW-70-PMW04B (90-100)	MW-70-PMW05A (70-80)	MW-70-PMW05B (90-100)	MW-70-PMW06A (70-80)	MW-70-PMW06B (91-101)	RDO-5 (65-105)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	10	540	1900	NS	9.9	70	390	0.99 J	49	340	18	93	2500	130	4.2
			Aug/Sept 2009	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Jan/Mar 2010	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Jun 2010	610	1.8	NS	NS	NS	NS	NS	NS	550	1400	1.2	22	NS	NS	NS
			Aug/Sept 2010	1 U	0.98 J	17	1 U	37	20 J	2600 J	0.77 J	450	1400	6.8	4.5	2700	430	12
			Jul 2011	NS	2.8	8.7	NS	NS	NS	NS	NS	NS	NS	NS	NS	1500	620	NS
			Aug/Sept 2011	0.41 J	NS	NS	NS	NS	NS	NS	NS	1300	1400	11	1.9	NS	NS	NS
			Oct/Nov 2011	0.23 J	2.6	8.7	0.22 J	18	7.8	1600	2.2	1500	1500	1	2	1800	550	3.2
			Dec 2012/Jan 2013	0.49 J	4.5	130	1.0 U	23	2.8	610	3.4	1500	1100	19	1.3	730	610	3.5
			Aug 2013	0.55 J	8.1	290 J	NS	NS	NS	NS	NS	920 J	860	57	5.4	780	390	NS
			Jan 2014	0.59 J	260	2	NS	35	270	93	4.6	1400	970	5.3	32	590	470	2.4
			July 2014	0.57 J	NS	4.2	NS	NS	NS	NS	NS	650	1100	24	260	960	510	NS
			July 2015	0.57 J	1.1	2.9 J	NS	NS	NS	NS	NS	350	1000	90	120	570	660	NS

First Sand Biobarrier 2

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-FSB216 (65-100)	IW-70-FSB229 (65-100)	MW-70-MNA09 (67-74)	MW-70-MNA10 (75-85)	MW-70-MNA12 (75-85)	MW-70-PMW07A (65-75)	MW-70-PMW07B (85-95)	MW-70-PMW08A (65-75)	MW-70-PMW08B (85-95)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	7.7	NS	1 J	100	140	1 U	97	3.6	40
			May 2010	2.6	78	NS	NS	NS	4.5	550	140	12
			Aug/Sept 2010	1.2	1.8	5.7	160	720	2.6	880	170	13
			Aug/Sept 2011	0.27 J	NS	NS	NS	NS	8.8	590	49	84
			Oct/Nov 2011	0.36 J	5.1	13	24	950	11	550	33	120
			Dec 2012/Jan 2013	3.2	1.0 U	48	21	910	19	520	99	130
			Aug 2013	2.9	NS	NS	NS	NS	0.54 J	690	100	190
			Jan 2014	73	1.0 U	37	300	730	7.3	760	3	170
			July 2014	0.68 J	NS	NS	NS	NS	2.1	1900	150	230
			Dec 2014	0.36 J	0.37 J	21	90	1000	32	1300	79	180
			July 2015	0.46 J	NS	NS	NS	NS	9.4	810	47	33

LEGEND

FIRST SAND MONITORING WELL

TREATMENT WELL

GROUP 1

GROUP 2

GROUP 3

GROUP 4

ROAD

BUILDING

IR 70 SITE BOUNDARY

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED RED PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

100 50 0 100 200 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 17
FIRST SAND BIOBARRIERS
CIS-1,2-DICHLOROETHENE

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 17.mxd

NAVFAC

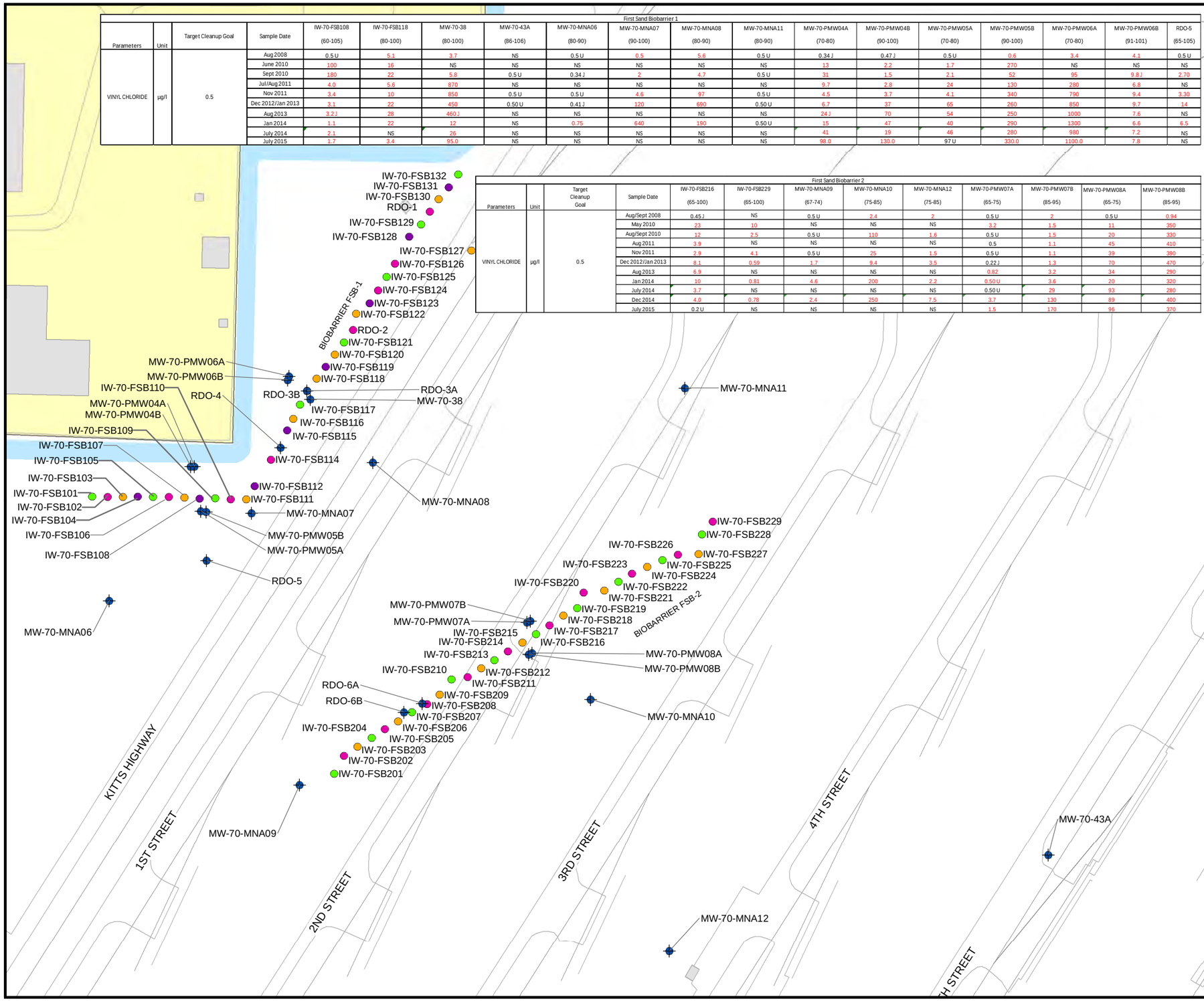
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-FSB108 (60-105)	IW-70-FSB118 (80-100)	MW-70-38 (80-100)	MW-70-43A (86-106)	MW-70-MNA06 (80-90)	MW-70-MNA07 (90-100)	MW-70-MNA08 (80-90)	MW-70-MNA11 (80-90)	MW-70-PMW04A (70-80)	MW-70-PMW04B (90-100)	MW-70-PMW05A (70-80)	MW-70-PMW05B (90-100)	MW-70-PMW06A (70-80)	MW-70-PMW06B (91-101)	RDO-5 (65-105)
				First Sand Biobarrier 1														
VINYL CHLORIDE	µg/l	0.5	Aug 2008	0.5 U	5.1	3.7	NS	0.5 U	0.5	5.6	0.5 U	0.34 J	0.47 J	0.5 U	0.6	3.4	4.1	0.5 U
			June 2010	100	16	NS	NS	NS	NS	NS	NS	13	2.2	1.7	270	NS	NS	NS
			Sept 2010	180	22	5.8	0.5 U	0.34 J	2	4.7	0.5 U	31	1.5	2.1	52	95	9.8 J	2.70
			Jul/Aug 2011	4.0	5.6	870	NS	NS	NS	NS	NS	9.7	2.8	24	130	280	6.8	NS
			Nov 2011	3.4	10	850	0.5 U	0.5 U	4.6	97	0.5 U	4.5	3.7	4.1	340	790	9.4	3.30
			Dec 2012/Jan 2013	3.1	22	450	0.50 U	0.41 J	120	690	0.50 U	6.7	37	65	260	850	9.7	14
			Aug 2013	3.2 J	28	460 J	NS	NS	NS	NS	NS	24 J	70	54	250	1000	7.6	NS
			Jan 2014	1.1	22	12	NS	0.75	640	190	0.50 U	15	47	40	290	1300	6.6	6.5
			July 2014	2.1	NS	26	NS	NS	NS	NS	NS	41	19	46	280	980	7.2	NS
			July 2015	1.7	3.4	95.0	NS	NS	NS	NS	NS	98.0	130.0	97 U	330.0	1100.0	7.8	NS

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-FSB216 (65-100)	IW-70-FSB229 (65-100)	MW-70-MNA09 (67-74)	MW-70-MNA10 (75-85)	MW-70-MNA12 (75-85)	MW-70-PMW07A (65-75)	MW-70-PMW07B (85-95)	MW-70-PMW08A (65-75)	MW-70-PMW08B (85-95)
				First Sand Biobarrier 2								
VINYL CHLORIDE	µg/l	0.5	Aug/Sept 2008	0.45 J	NS	0.5 U	2.4	2	0.5 U	2	0.5 U	0.94
			May 2010	23	10	NS	NS	NS	3.2	1.5	11	350
			Aug/Sept 2010	12	2.5	0.5 U	110	1.6	0.5 U	1.5	20	330
			Aug 2011	3.9	NS	NS	NS	NS	0.5	1.1	45	410
			Nov 2011	2.9	4.1	0.5 U	25	1.5	0.5 U	1.1	39	390
			Dec 2012/Jan 2013	8.1	0.59	1.7	9.4	3.5	0.22 J	1.3	70	470
			Aug 2013	6.9	NS	NS	NS	NS	0.82	3.2	34	290
			Jan 2014	10	0.81	4.6	200	2.2	0.50 U	3.6	20	320
			July 2014	3.7	NS	NS	NS	NS	0.50 U	29	93	280
			Dec 2014	4.0	0.78	2.4	250	7.5	3.7	130	89	400
			July 2015	0.2 U	NS	NS	NS	NS	1.5	170	96	370



LEGEND

FIRST SAND MONITORING WELL

TREATMENT WELL

GROUP 1

GROUP 2

GROUP 3

GROUP 4

ROAD

BUILDING

IR 70 SITE BOUNDARY

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED RED PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

100 50 0 100 200 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 18
FIRST SAND BIOBARRIERS
VINYL CHLORIDE

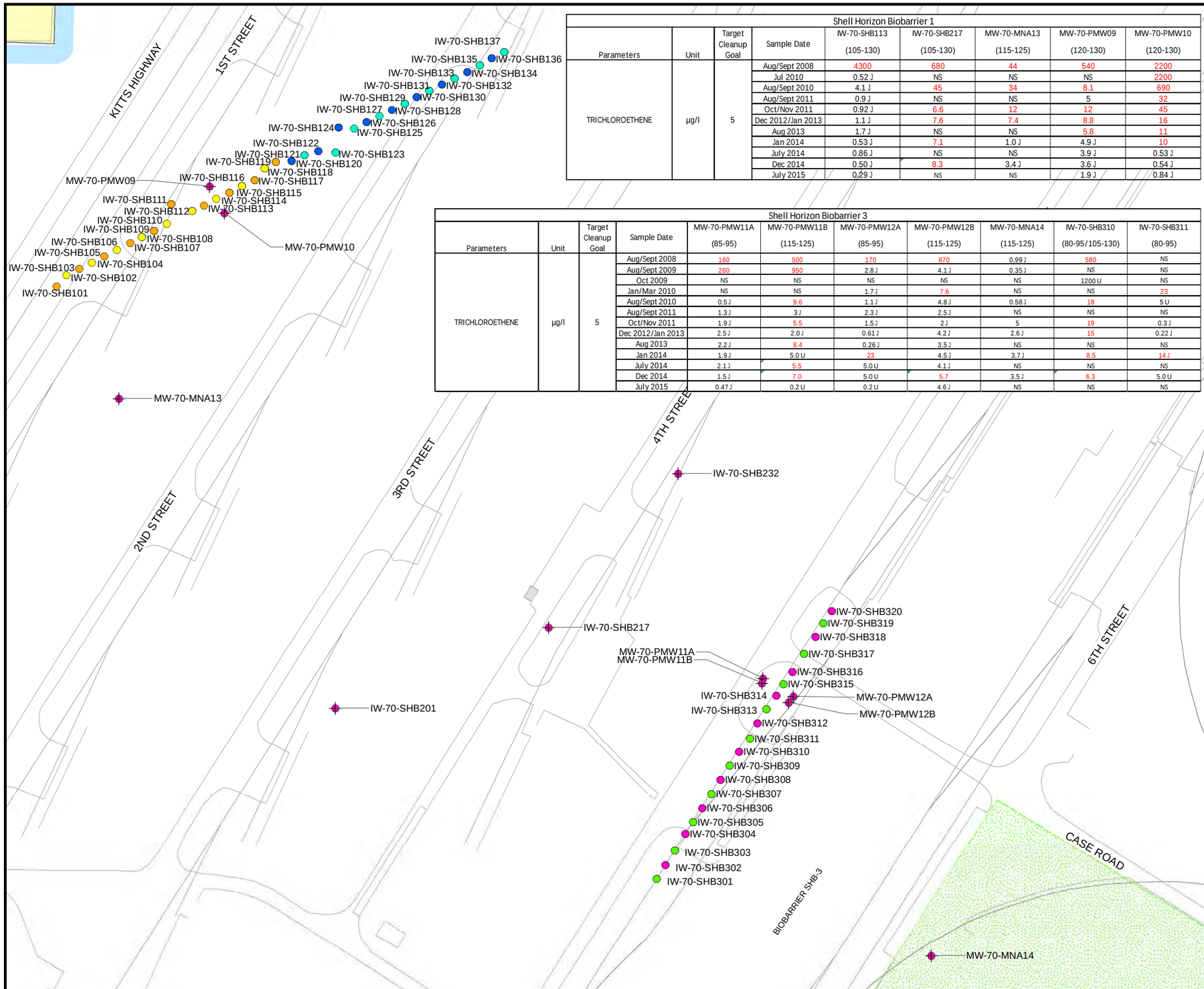
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 18.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



Shell Horizon Biobarrier 1

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-SHB113 (105-130)	IW-70-SHB217 (105-130)	MW-70-MNA13 (115-125)	MW-70-PMW09 (120-130)	MW-70-PMW10 (120-130)
TRICHLOROETHENE	µg/l	5	Aug/Sept 2008	4300	680	44	540	2200
			Jul 2010	0.52 J	NS	NS	NS	2200
			Aug/Sept 2010	4.1 J	45	34	8.1	690
			Aug/Sept 2011	0.9 J	NS	NS	5	32
			Oct/Nov 2011	0.92 J	6.6	12	12	45
			Dec 2012/Jan 2013	1.1 J	7.6	7.4	8.8	16
			Aug 2013	1.7 J	NS	NS	5.8	11
			Jan 2014	0.53 J	7.1	1.0 J	4.9 J	10
			July 2014	0.86 J	NS	NS	3.9 J	0.53 J
			Dec 2014	0.50 J	8.3	3.4 J	3.6 J	0.54 J
			July 2015	0.29 J	NS	NS	1.9 J	0.84 J

Shell Horizon Biobarrier 3

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-PMW11A (85-95)	MW-70-PMW11B (115-125)	MW-70-PMW12A (85-95)	MW-70-PMW12B (115-125)	MW-70-MNA14 (115-125)	IW-70-SHB310 (80-95/105-130)	IW-70-SHB311 (80-95)
TRICHLOROETHENE	µg/l	5	Aug/Sept 2008	160	500	170	870	0.99 J	580	NS
			Aug/Sept 2009	260	950	2.8 J	4.1 J	0.35 J	NS	NS
			Oct 2009	NS	NS	NS	NS	NS	1200 U	NS
			Jan/Mar 2010	NS	NS	1.7 J	7.6	NS	NS	23
			Aug/Sept 2010	0.5 J	9.6	1.1 J	4.8 J	0.58 J	18	5 U
			Aug/Sept 2011	1.3 J	3 J	2.3 J	2.5 J	NS	NS	NS
			Oct/Nov 2011	1.9 J	5.5	1.5 J	2 J	5	19	0.3 J
			Dec 2012/Jan 2013	2.5 J	2.0 J	0.61 J	4.2 J	2.6 J	15	0.22 J
			Aug 2013	2.2 J	8.4	0.26 J	3.5 J	NS	NS	NS
			Jan 2014	1.9 J	5.0 U	23	4.5 J	3.7 J	8.5	14 J
			July 2014	2.1 J	5.5	5.0 U	4.1 J	NS	NS	NS
			Dec 2014	1.5 J	7.0	5.0 U	5.7	3.5 J	6.3	5.0 U
			July 2015	0.47 J	0.2 U	0.2 U	4.6 J	NS	NS	NS

LEGEND

- SHELL HORIZON MONITORING WELL

TREATMENT WELL

- GROUP 1
- GROUP 2
- SECTION 1 GROUP 1
- SECTION 1 GROUP 2
- SECTION 2 GROUP 1
- SECTION 2 GROUP 2
- ROAD
- BUILDING
- IR 70 SITE BOUNDARY

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED RED PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

100 50 0 100 200 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 19
SHELL HORIZON BIOBARRIERS
TRICHLOROETHENE

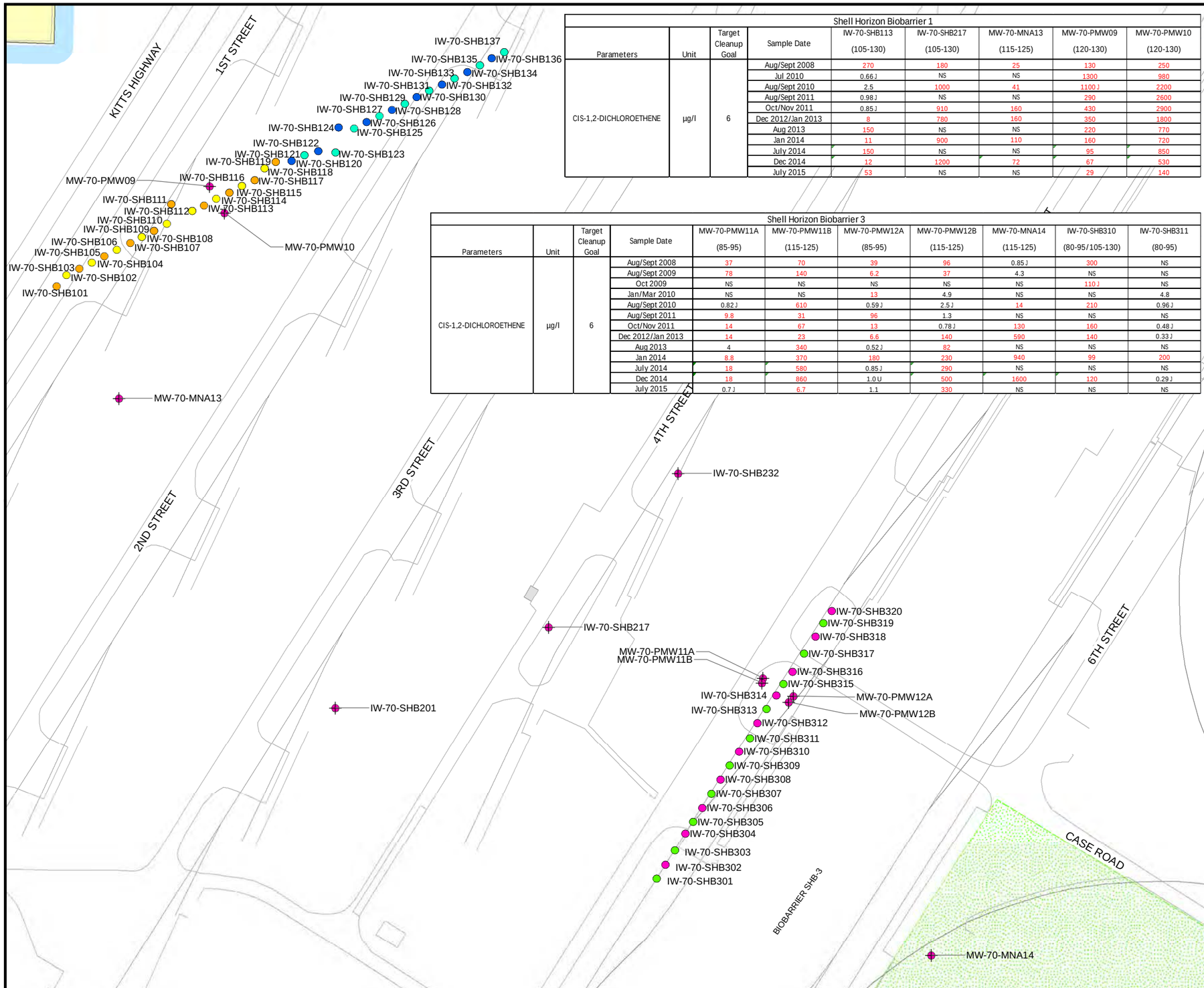
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 19.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



Shell Horizon Biobarrier 1

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-SHB113 (105-130)	IW-70-SHB217 (105-130)	MW-70-MNA13 (115-125)	MW-70-PMW09 (120-130)	MW-70-PMW10 (120-130)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	270	180	25	130	250
			Jul 2010	0.66 J	NS	NS	1300	980
			Aug/Sept 2010	2.5	1000	41	1100 J	2200
			Aug/Sept 2011	0.98 J	NS	NS	290	2600
			Oct/Nov 2011	0.85 J	910	160	430	2900
			Dec 2012/Jan 2013	8	780	160	350	1800
			Aug 2013	150	NS	NS	220	770
			Jan 2014	11	900	110	160	720
			July 2014	150	NS	NS	95	850
			Dec 2014	12	1200	72	67	530
			July 2015	53	NS	NS	29	140

Shell Horizon Biobarrier 3

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-PMW11A (85-95)	MW-70-PMW11B (115-125)	MW-70-PMW12A (85-95)	MW-70-PMW12B (115-125)	MW-70-MNA14 (115-125)	IW-70-SHB310 (80-95/105-130)	IW-70-SHB311 (80-95)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	37	70	39	96	0.85 J	300	NS
			Aug/Sept 2009	78	140	6.2	37	4.3	NS	NS
			Oct 2009	NS	NS	NS	NS	NS	110 J	NS
			Jan/Mar 2010	NS	NS	13	4.9	NS	NS	4.8
			Aug/Sept 2010	0.82 J	610	0.59 J	2.5 J	14	210	0.96 J
			Aug/Sept 2011	9.8	31	96	1.3	NS	NS	NS
			Oct/Nov 2011	14	67	13	0.78 J	130	160	0.48 J
			Dec 2012/Jan 2013	14	23	6.6	140	590	140	0.33 J
			Aug 2013	4	340	0.52 J	82	NS	NS	NS
			Jan 2014	8.8	370	180	230	940	99	200
			July 2014	18	580	0.85 J	290	NS	NS	NS
			Dec 2014	18	860	1.0 U	500	1600	120	0.29 J
			July 2015	0.7 J	6.7	1.1	330	NS	NS	NS

LEGEND

- SHELL HORIZON MONITORING WELL

TREATMENT WELL

- GROUP 1
- GROUP 2
- SECTION 1 GROUP 1
- SECTION 1 GROUP 2
- SECTION 2 GROUP 1
- SECTION 2 GROUP 2
- ROAD
- BUILDING
- IR 70 SITE BOUNDARY

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED RED PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

100 50 0 100 200 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 20
SHELL HORIZON BIOBARRIERS
CIS-1,2-DICHLOROETHENE

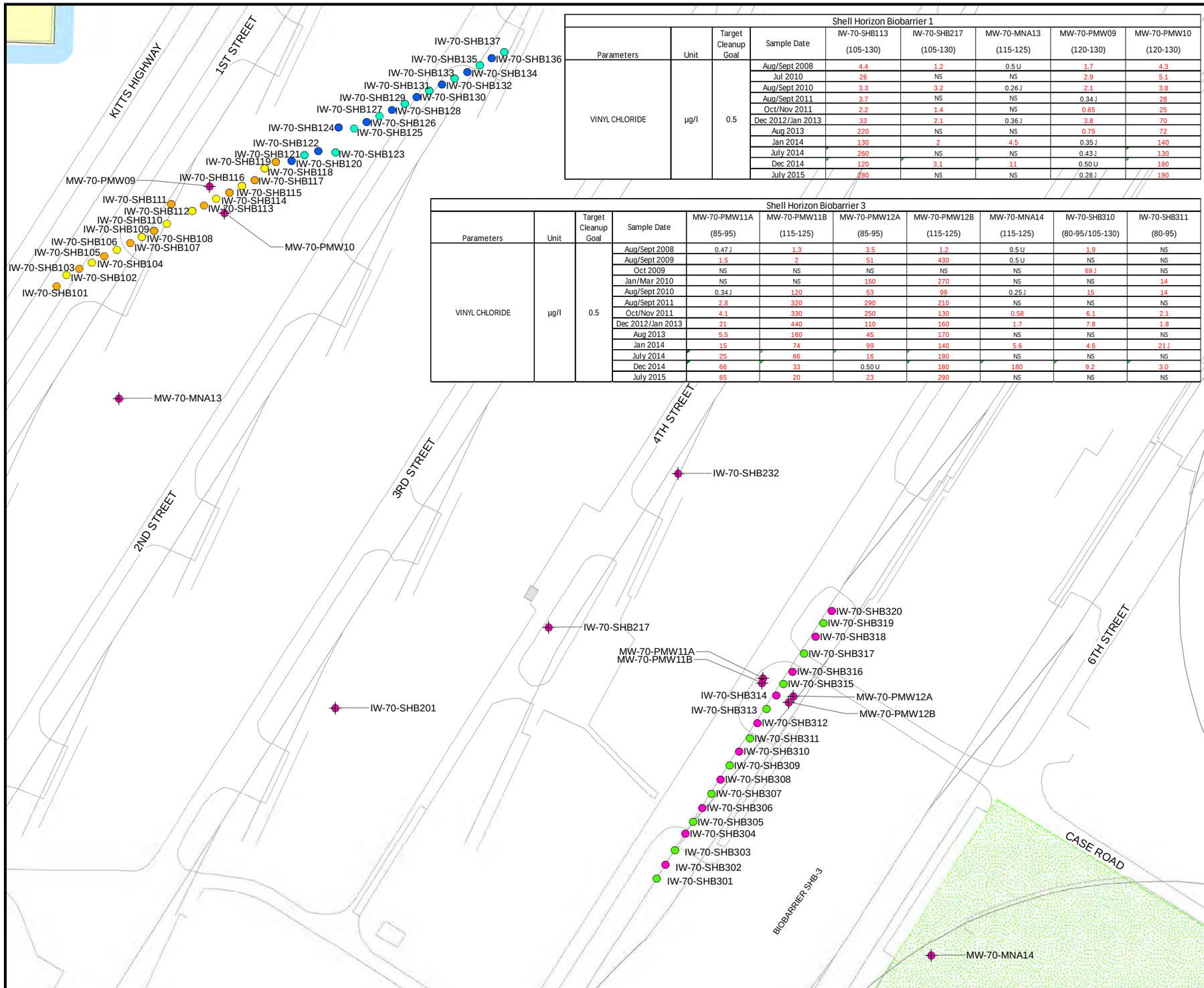
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 20.mxd

NAVFAC
ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



Shell Horizon Biobarrier 1

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-SHB113 (105-130)	IW-70-SHB217 (105-130)	MW-70-MNA13 (115-125)	MW-70-PMW09 (120-130)	MW-70-PMW10 (120-130)
VINYL CHLORIDE	µg/l	0.5	Aug/Sept 2008	4.4	1.2	0.5 U	1.7	4.3
			Jul 2010	26	NS	NS	2.9	5.1
			Aug/Sept 2010	3.3	3.2	0.26 J	2.1	3.8
			Aug/Sept 2011	3.7	NS	NS	0.34 J	28
			Oct/Nov 2011	2.2	1.4	NS	0.65	25
			Dec 2012/Jan 2013	33	2.1	0.36 J	3.8	70
			Aug 2013	220	NS	NS	0.75	72
			Jan 2014	130	2	4.5	0.35 J	140
			July 2014	260	NS	NS	0.43 J	130
			Dec 2014	120	3.1	11	0.50 U	180
			July 2015	280	NS	NS	0.28 J	190

Shell Horizon Biobarrier 3

Parameters	Unit	Target Cleanup Goal	Sample Date	MW-70-PMW11A (85-95)	MW-70-PMW11B (115-125)	MW-70-PMW12A (85-95)	MW-70-PMW12B (115-125)	MW-70-MNA14 (115-125)	IW-70-SHB310 (80-95/105-130)	IW-70-SHB311 (80-95)
VINYL CHLORIDE	µg/l	0.5	Aug/Sept 2008	0.47 J	1.3	3.5	1.2	0.5 U	1.9	NS
			Aug/Sept 2009	1.5	2	51	430	0.5 U	NS	NS
			Oct 2009	NS	NS	NS	NS	NS	69 J	NS
			Jan/Mar 2010	NS	NS	150	270	NS	NS	14
			Aug/Sept 2010	0.34 J	120	53	99	0.25 J	15	14
			Aug/Sept 2011	2.8	320	290	210	NS	NS	NS
			Oct/Nov 2011	4.1	330	250	130	0.58	6.1	2.1
			Dec 2012/Jan 2013	21	440	110	160	1.7	7.8	1.8
			Aug 2013	5.5	160	45	170	NS	NS	NS
			Jan 2014	15	74	99	140	5.6	4.6	21 J
			July 2014	25	66	16	190	NS	NS	NS
			Dec 2014	66	33	0.50 U	180	180	9.2	3.0
			July 2015	65	20	23	290	NS	NS	NS

LEGEND

SHELL HORIZON MONITORING WELL

TREATMENT WELL

GROUP 1

GROUP 2

SECTION 1 GROUP 1

SECTION 1 GROUP 2

SECTION 2 GROUP 1

SECTION 2 GROUP 2

ROAD

BUILDING

IR 70 SITE BOUNDARY

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED RED PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

100 50 0 100 200 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 21
SHELL HORIZON BIOBARRIERS
VINYL CHLORIDE

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

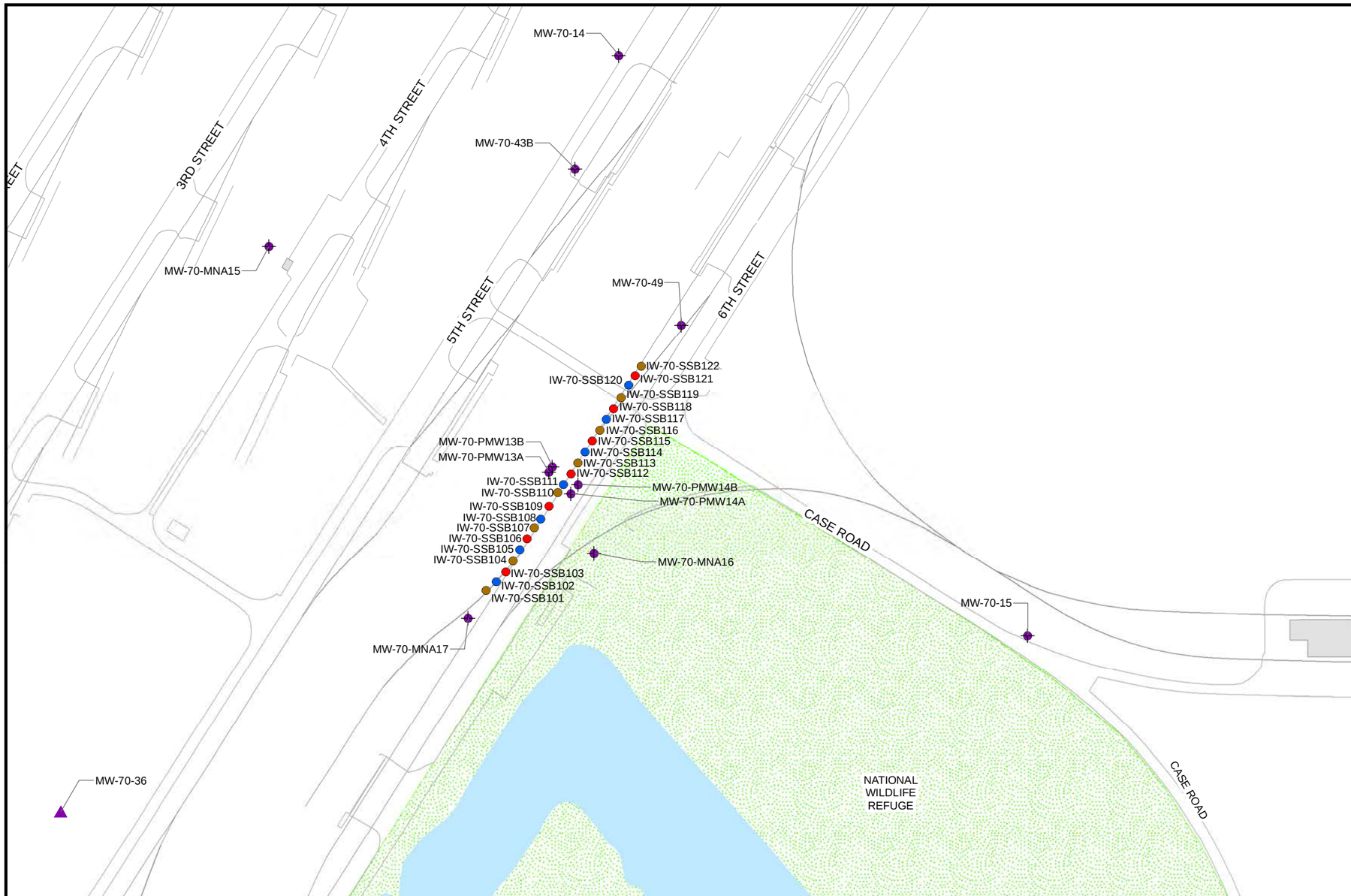
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 21.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

- SECOND SAND MONITORING WELL
- SECOND SAND POC MONITORING WELL

TREATMENT WELL

- GROUP 1
- GROUP 2
- GROUP 3
- ROAD
- BUILDING
- IR 70 SITE BOUNDARY

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED RED PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

100 50 0 100 200 Feet

N

Second Sand Biobarrier 1

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-SSB109 (126-166)	IW-70-SSB119 (126-166)	MW-70-14 (160-170)	MW-70-15 (161-171)	MW-70-43B (136-146)	MW-70-49 (125-165)	MW-70-MNA15 (140-150)	MW-70-MNA16 (141-151)	MW-70-MNA17 (140-150)	MW-70-PMW13A (125-135)	MW-70-PMW13B (145-155)	MW-70-PMW14A (128-138)	MW-70-PMW14B (149-159)
TRICHLOROETHENE	µg/l	5	Aug/Sept 2008	310	NS	NS	1.6 J	NS	NS	NS	140 J	0.21 J	320	900	1100	530
			Aug/Sept 2009	12	NS	530	6.9	5 U	NS	NS	460	2.4 J	370	1100	180 J	17
			Jan/Mar 2010	1.2 J	59	210	NS	NS	NS	NS	NS	NS	NS	NS	6.6	7.9
			Aug/Sept 2010	0.4 J	0.78 J	260	14	37	NS	NS	510	20	490 J	1300	14	18
			Aug/Sept 2011	NS	0.45 J	5.6	NS	NS	20	NS	NS	NS	200	11	6.3	12
			Oct/Nov 2011	0.3 J	0.24 J	0.89 J	16	180	17	NS	12	65	300	13	5.4	11
			Dec 2012/Jan 2013	0.61 J	1.2 J	4.0 J	9.2	550	130	NS	8.6	27	150	10	5.6	8.9
			Aug 2013	NS	0.91 J	2.0 J	NS	NS	57	6.3	NS	NS	12	8.7	5.7	4.1 J
			Jan 2014	0.70 J	5.0 U	0.2 J	13	170	0.98 J	6.5	11	21	13	11	8.6	7.2
			July 2014	NS	5.0 U	5.4	NS	NS	1.9 J	5.5	NS	NS	13	7.5	4.6 J	4.9 J
			Dec 2014	0.69 J	0.58 J	6.1	8.3	79	5.6	NS	11	9.7	12	8.4	3.0 J	5.9
			July 2015	NS	0.2 U	5.3	NS	NS	2.1 J	NS	NS	NS	10	6.4	6	6

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 22
SECOND SAND BIOBARRIER 1 (SSB-1)
TRICHLOROETHENE

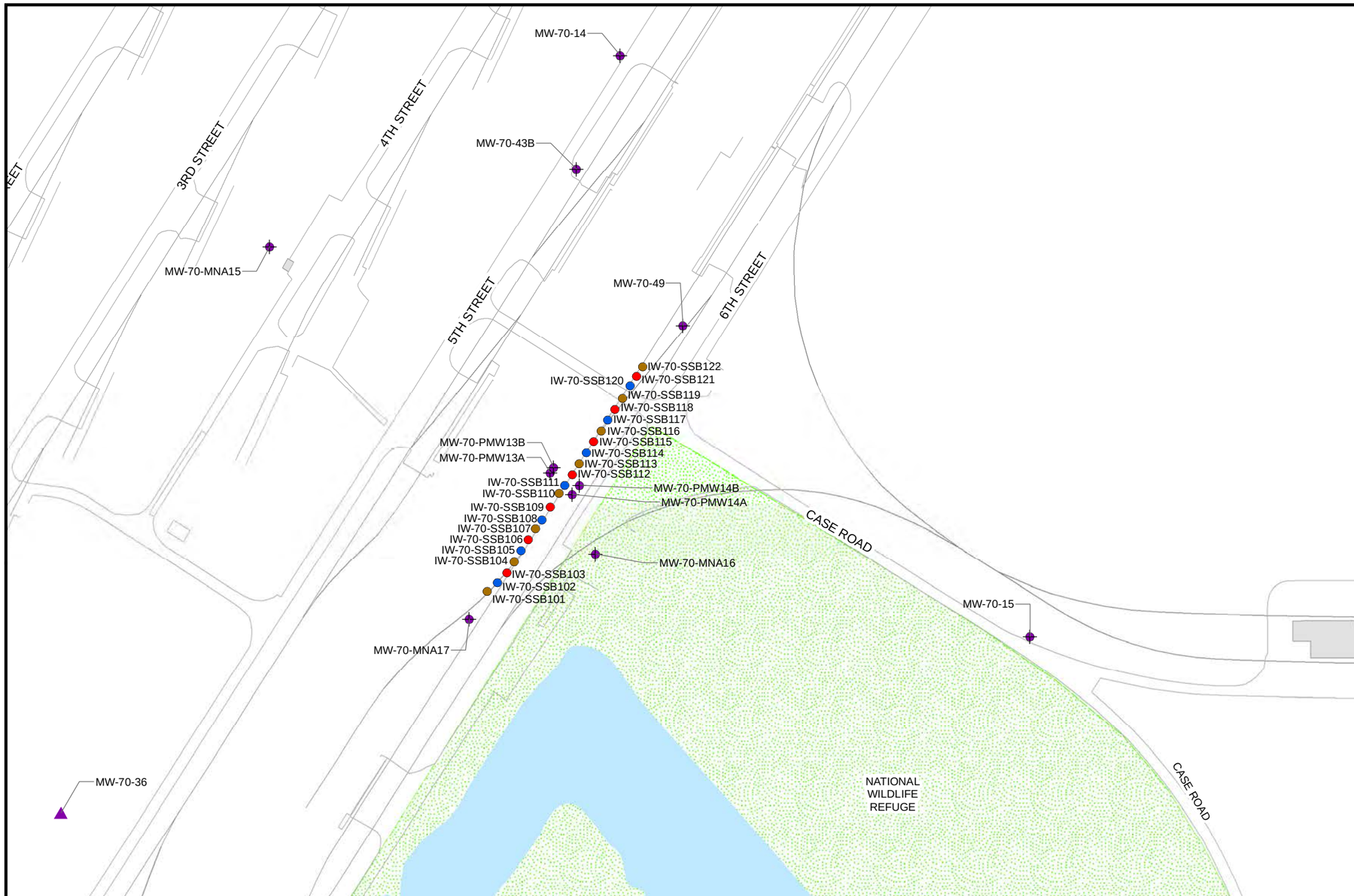
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 22.mxd

NAVFAC
ECC-INSIGHT LLC

Path: P:\Projects\SealBeach\Map Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

- SECOND SAND MONITORING WELL
- SECOND SAND POC MONITORING WELL

TREATMENT WELL

- GROUP 1
- GROUP 2
- GROUP 3
- ROAD
- BUILDING
- IR 70 SITE BOUNDARY

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED RED PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

100 50 0 100 200 Feet

N

Second Sand Biobarrier 1

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-SSB109 (126-166)	IW-70-SSB119 (126-166)	MW-70-14 (160-170)	MW-70-15 (161-171)	MW-70-43B (136-146)	MW-70-49 (125-165)	MW-70-MNA15 (140-150)	MW-70-MNA16 (141-151)	MW-70-MNA17 (140-150)	MW-70-PMW13A (125-135)	MW-70-PMW13B (145-155)	MW-70-PMW14A (128-138)	MW-70-PMW14B (149-159)
CIS-1,2-DICHLOROETHENE	µg/l	6	Aug/Sept 2008	44	NS	NS	2	NS	NS	NS	1100	0.79 J	63	180	180	130
			Aug/Sept 2009	110	NS	32	2.7	1 U	NS	NS	1000	1.4	75	360	320	630
			Jan/Mar 2010	40	18	22	NS	NS	NS	NS	NS	NS	NS	NS	35	310
			Aug/Sept 2010	1.4	0.69 J	280	4.2	9	NS	NS	670	7.2	150	270	630	600
			Aug/Sept 2011	NS	7.2	400	NS	NS	8.3	NS	NS	NS	130	940	67	340
			Oct/Nov 2011	0.3 J	0.74 J	450	3.4	16	9.5	NS	1000	9.9	150	1100	9.1	420
			Dec 2012/Jan 2013	0.58 J	0.47 J	200	2.8	46	22	NS	880	4.0	200	1,100	290	670
			Aug 2013	NS	0.51 J	280	NS	NS	22	670	NS	NS	400	890	560	290
			Jan 2014	1.7	0.28 J	1.2	4.2	23	150	360	1200	3	880	860	780	400
			July 2014	NS	0.20 J	450	NS	NS	1.1	210	NS	NS	710	1200	750	210
			Dec 2014	2.3	2.1	1100	39	8.2	280	NS	1500	1.2	770	1000	470	510
			July 2015	NS	0.35 J	1100	NS	NS	160	NS	NS	NS	730	1100	920	920

MW-70-21

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 23
SECOND SAND BIOBARRIER 1 (SSB-1)
CIS-1,2-DICHLOROETHENE

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

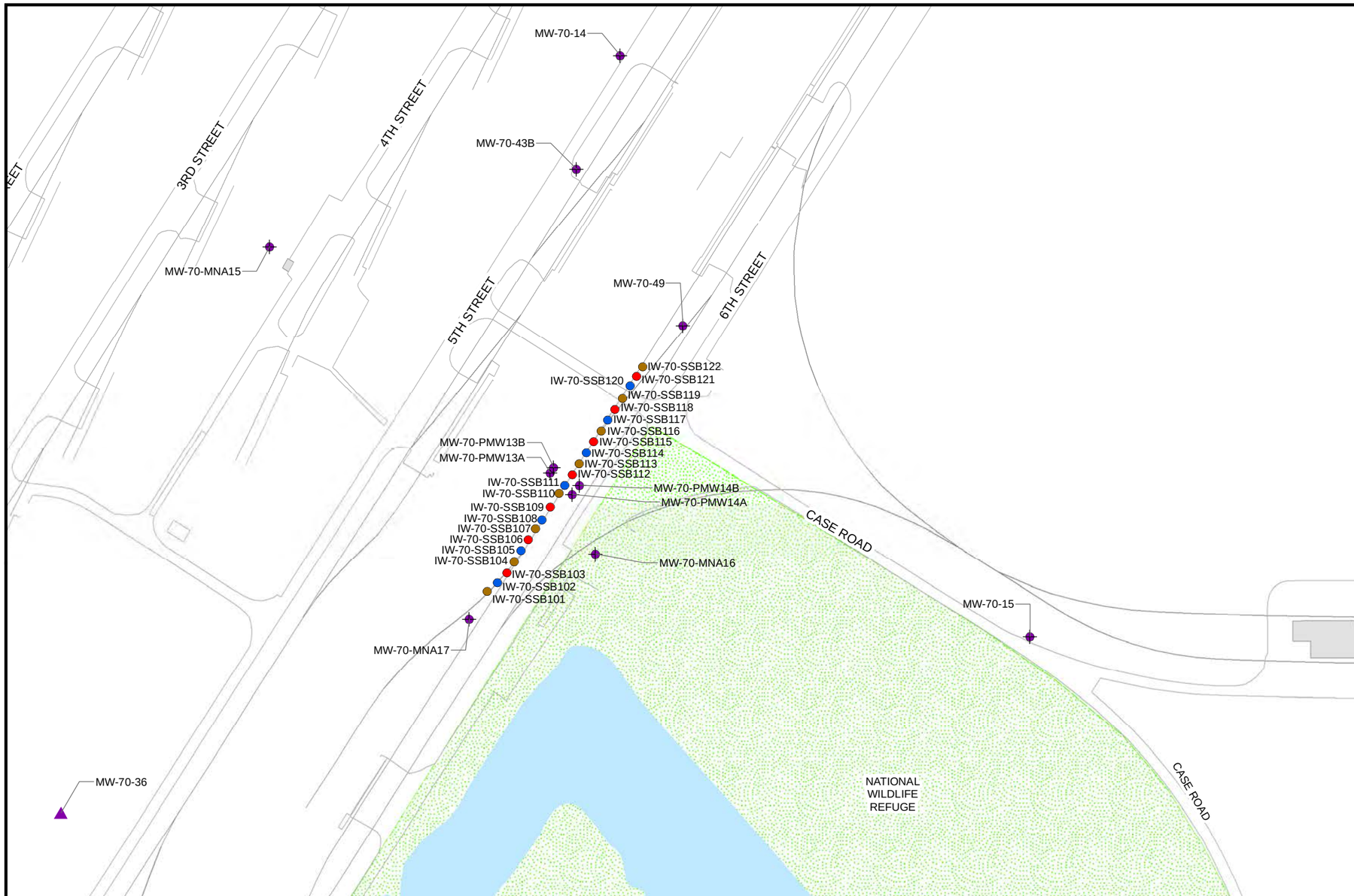
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 23.mxd

NAVFAC

ECC-INSIGHT LLC

Path: P:\Projects\SealBeach\Map Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

- SECOND SAND MONITORING WELL
- SECOND SAND POC MONITORING WELL

TREATMENT WELL

- GROUP 1
- GROUP 2
- GROUP 3
- ROAD
- BUILDING
- IR 70 SITE BOUNDARY

NOTES:

(D) - DUPLICATE SAMPLE
J - ESTIMATED VALUE
ug/L - MICROGRAMS PER LITER
NA - NOT ANALYZED
NE - NOT ESTABLISHED
U - ANALYTE NOT DETECTED ABOVE THE DETECTION LIMIT: ASSOCIATED VALUE IS THE DETECTION LIMIT

BOLDED RED PARAMETERS ARE CONSTITUENTS OF CONCERN THAT EXCEED THE TARGET CLEANUP GOAL

(25-35) - WELL SCREEN INTERVAL, IN FEET BELOW GROUND SURFACE

100 50 0 100 200 Feet

N

Second Sand Biobarrier 1

Parameters	Unit	Target Cleanup Goal	Sample Date	IW-70-SSB109 (126-166)	IW-70-SSB119 (126-166)	MW-70-14 (160-170)	MW-70-15 (161-171)	MW-70-43B (136-146)	MW-70-49 (125-165)	MW-70-MNA15 (140-150)	MW-70-MNA16 (141-151)	MW-70-MNA17 (140-150)	MW-70-PMW13A (125-135)	MW-70-PMW13B (145-155)	MW-70-PMW14A (128-138)	MW-70-PMW14B (149-159)
VINYL CHLORIDE	µg/l	0.5	Aug/Sept 2008	0.34 J	NS	NS	0.5 U	NS	NS	NS	8.3	0.5 U	410	2.9	5.8	2
			Aug/Sept 2009	94	NS	1.5	0.5 U	0.5 U	NS	NS	14	0.5 U	460	59	730	5.1
			Jan/Mar 2010	13	5	0.65	NS	NS	NS	NS	NS	NS	NS	NS	70	28
			Aug/Sept 2010	5.3	3.5	1.1	0.5 U	0.43 J	NS	NS	9.7	0.27 J	350	10	340	430
			Aug/Sept 2011	NS	2.2	1.6	NS	NS	0.5 U	NS	NS	NS	280	26	250	300
			Oct/Nov 2011	1.3	1.7	1.2	0.5 U	0.61	0.33 J	NS	25	0.5 U	300	16	250	300
			Dec 2012/Jan 2013	9.3	9.6	0.72	0.50 U	1.7	1.1	NS	38	0.50 U	370	29	240	200
			Aug 2013	NS	73	7.7	NS	NS	0.68	8.5	NS	NS	420	15	150	130
			Jan 2014	10	42	130	0.50 U	0.76	0.6	38	13	0.50 U	220	6.6	160	310
			July 2014	NS	0.50 U	2.4	NS	NS	0.50 U	61	NS	NS	290	26	100	250
			Dec 2014	35	39	8.0	0.50 U	0.50 U	0.85	NS	5.2	0.50 U	200	8.2	49	310
			July 2015	NS	0.2 U	6.2	NS	NS	0.4 J	NS	NS	NS	240	15	120	120

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 24
SECOND SAND BIOBARRIER 1 (SSB-1)
VINYL CHLORIDE

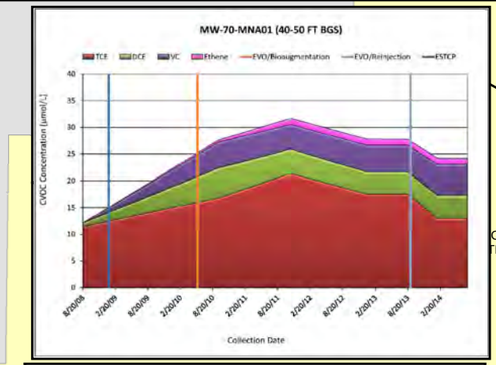
NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

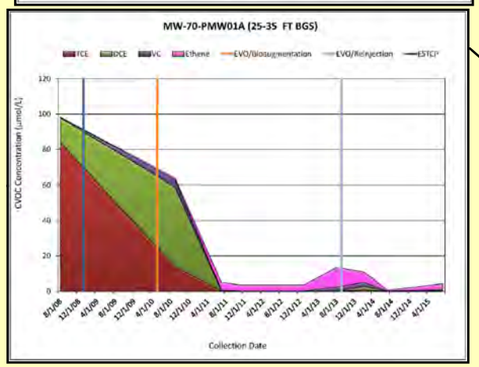
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 24.mxd

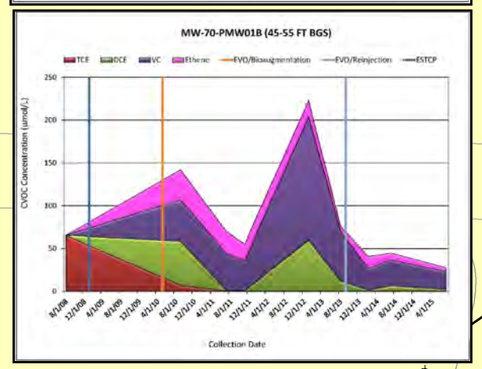
NAVFAC
ECC-INSIGHT LLC

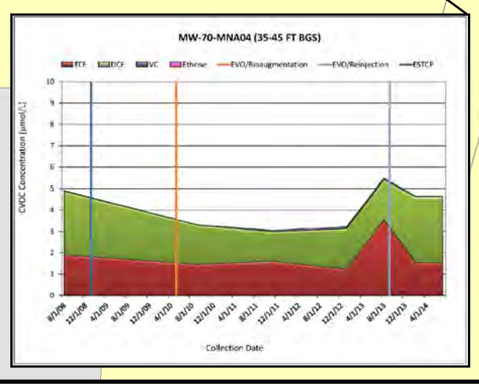
Path: P:\Projects\SealBeach\Map Documents\FIGURE 2-22.mxd

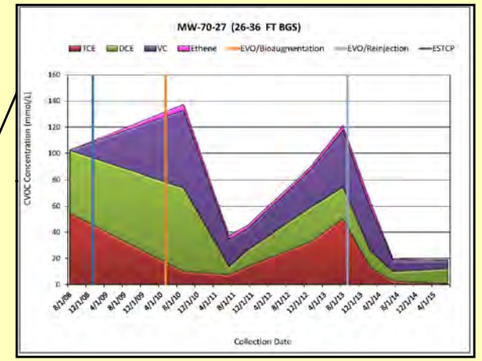
This Page Intentionally Left Blank

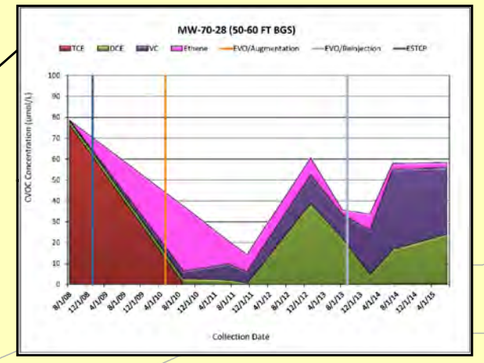


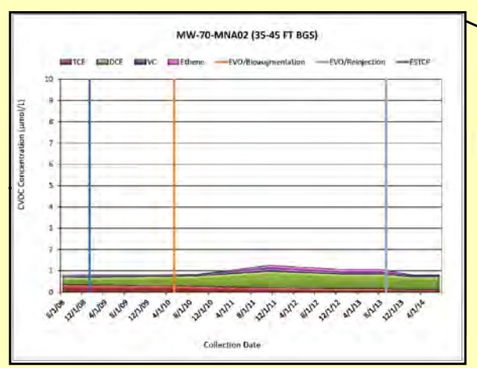


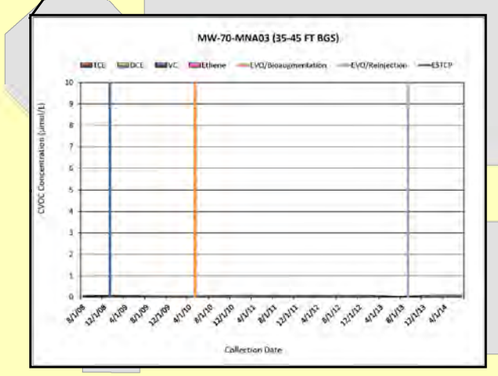


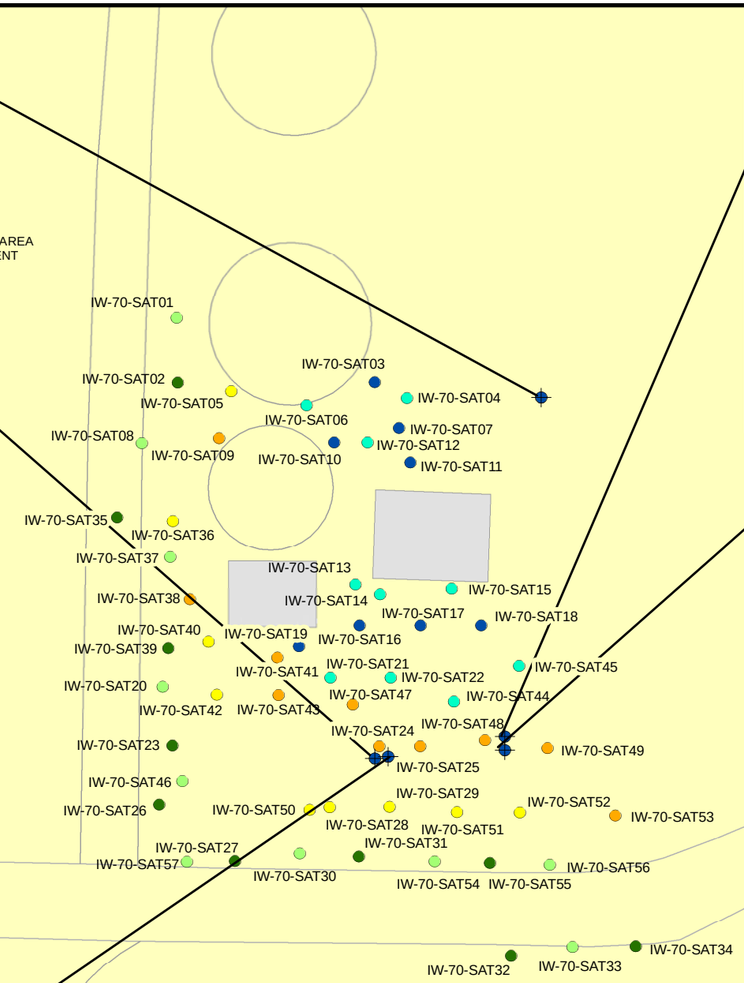












LEGEND

SOURCE AREA TREATMENT/UPPER FINES MONITORING WELL

TREATMENT WELL

- SECTION 1 GROUP 1
- SECTION 1 GROUP 2
- SECTION 2 GROUP 1
- SECTION 2 GROUP 2
- SECTION 3 GROUP 1
- SECTION 3 GROUP 2

BUILDING

IRSITES

20 10 0 20 40 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 25
CVOC MOLAR CONCENTRATIONS
SOURCE AREA TREATMENT GRID

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

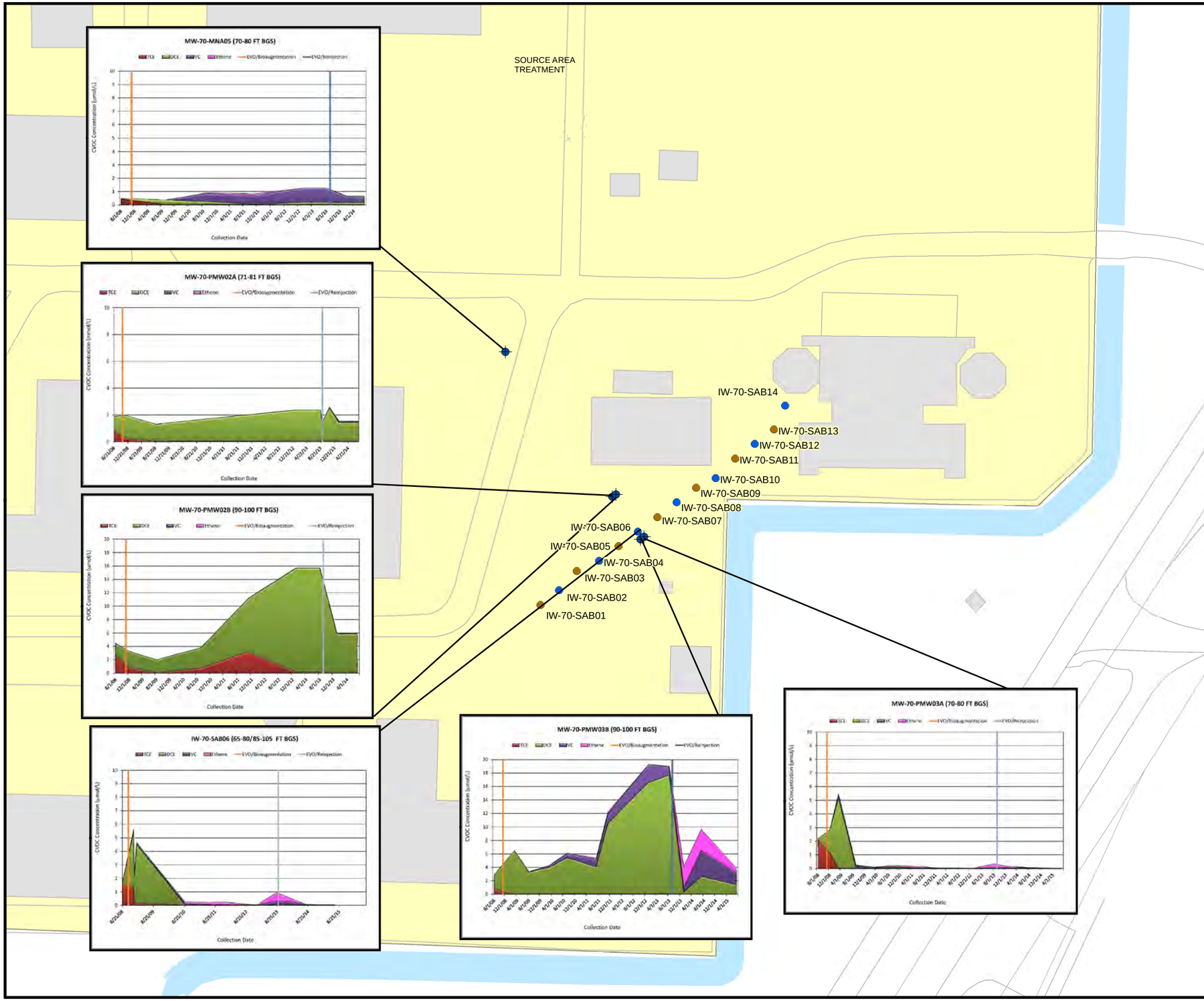
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 25.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

FIRST SAND MONITORING WELL

TREATMENT WELL

GROUP 1

GROUP 2

ROAD

BUILDING

IR 70 SITE BOUNDARY

60 30 0 60 120 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 26
CVOC MOLAR CONCENTRATIONS
SOURCE AREA BIOBARRIER (SAB-1)

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

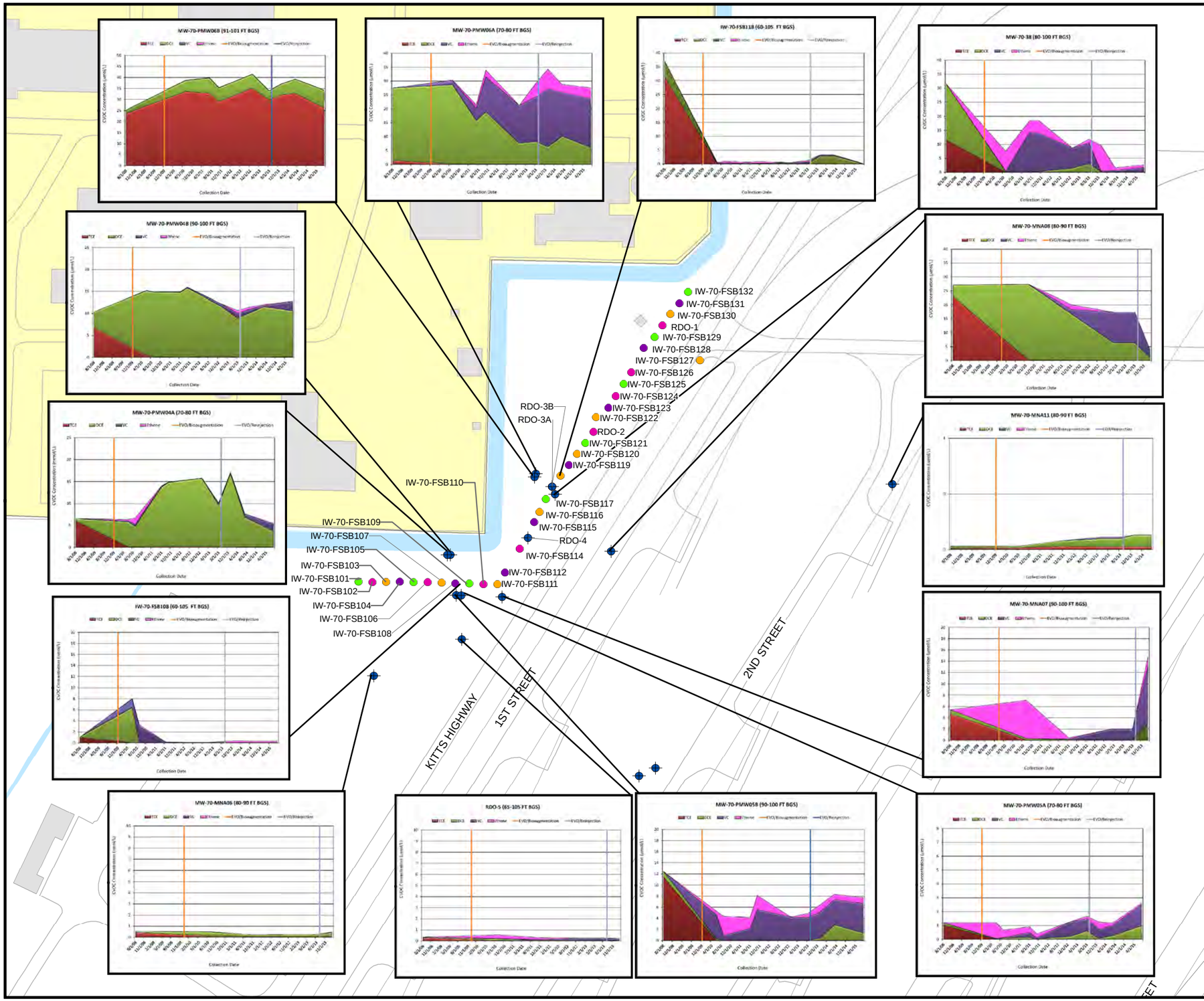
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 26.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

- FIRST SAND MONITORING WELL

TREATMENT WELL

- GROUP 1
- GROUP 2
- GROUP 3
- GROUP 4
- ROAD
- BUILDING
- IR 70 SITE BOUNDARY

100 50 0 100 200 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 27
CVOC MOLAR CONCENTRATIONS
FIRST SAND BIOBARRIER 1

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

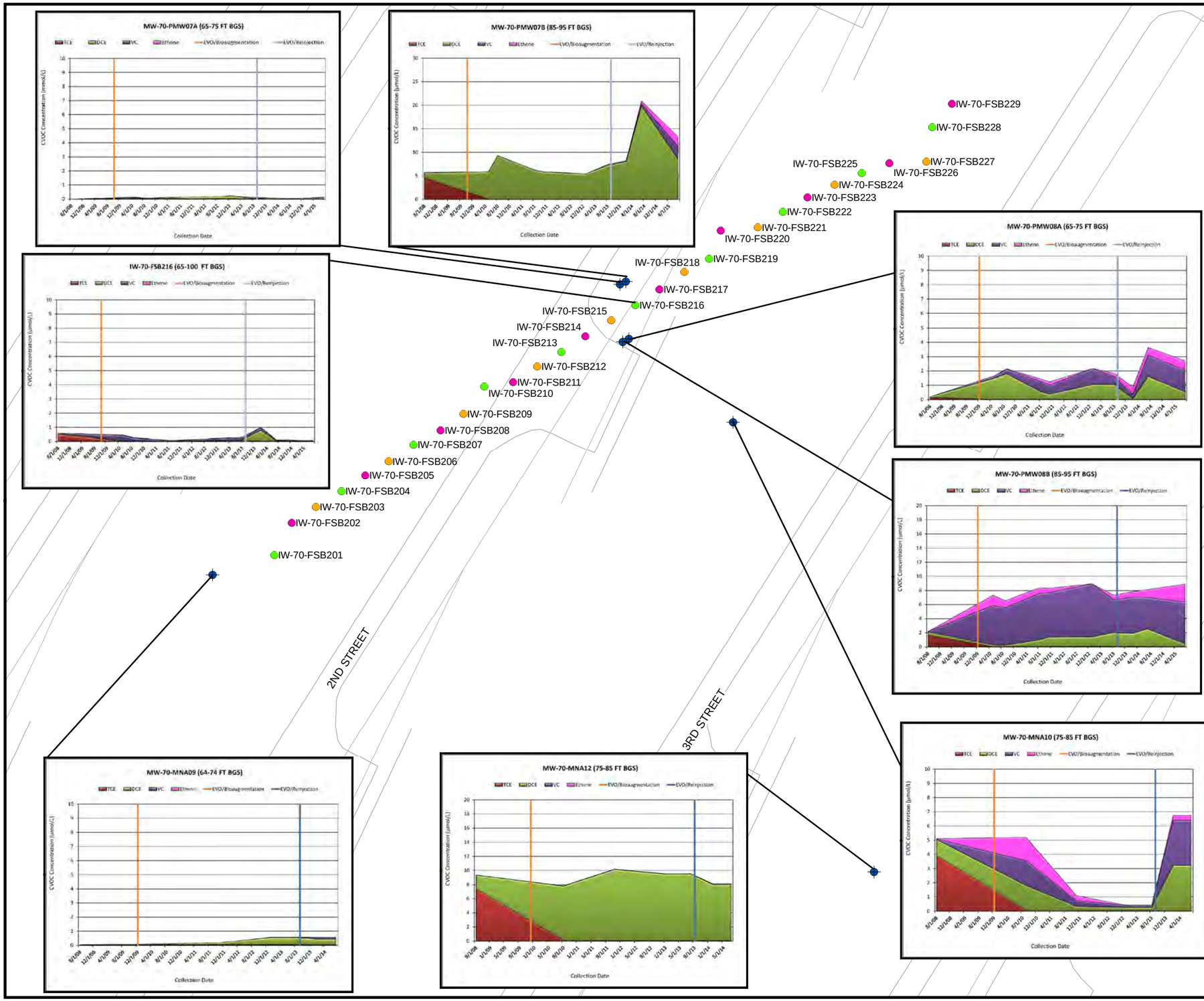
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 27.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\Map\Documents\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

FIRST SAND MONITORING WELL

TREATMENT WELL

GROUP 1

GROUP 2

GROUP 3

GROUP 4

ROAD

BUILDING

IR 70 SITE BOUNDARY

50 25 0 50 100 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 28
CVOC MOLAR CONCENTRATIONS
FIRST SAND BIOBARRIER 2

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

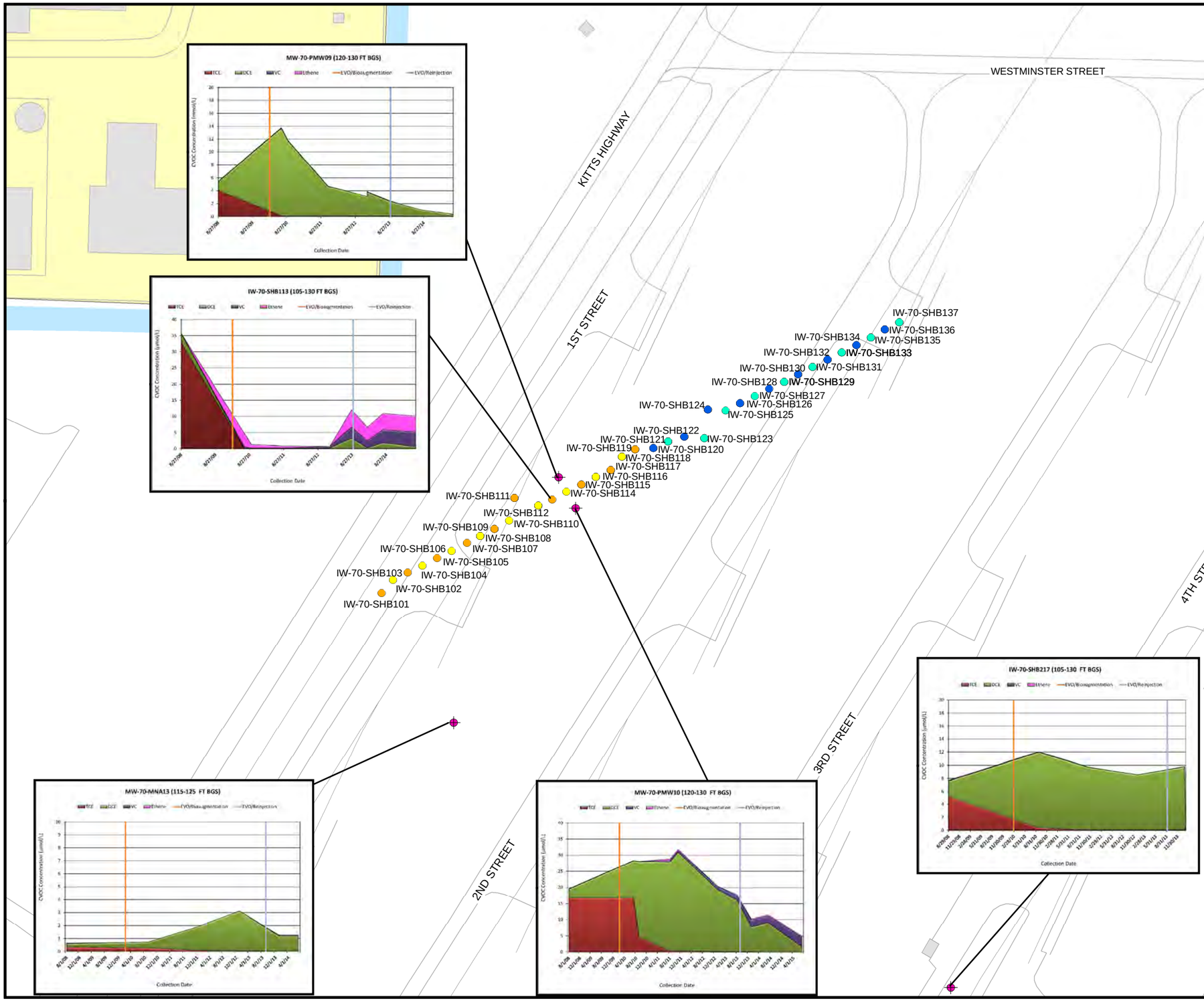
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 28.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-2c.mxd

This Page Intentionally Left Blank



LEGEND

- SHELL HORIZON MONITORING WELL

TREATMENT WELL

- GROUP 1
- GROUP 2
- SECTION 1 GROUP 1
- SECTION 1 GROUP 2
- SECTION 2 GROUP 1
- SECTION 2 GROUP 2
- ROAD
- BUILDING
- IR 70 SITE BOUNDARY

100 50 0 100 200 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 29
CVOC MOLAR CONCENTRATIONS
SHELL HORIZON BIOBARRIER 1

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

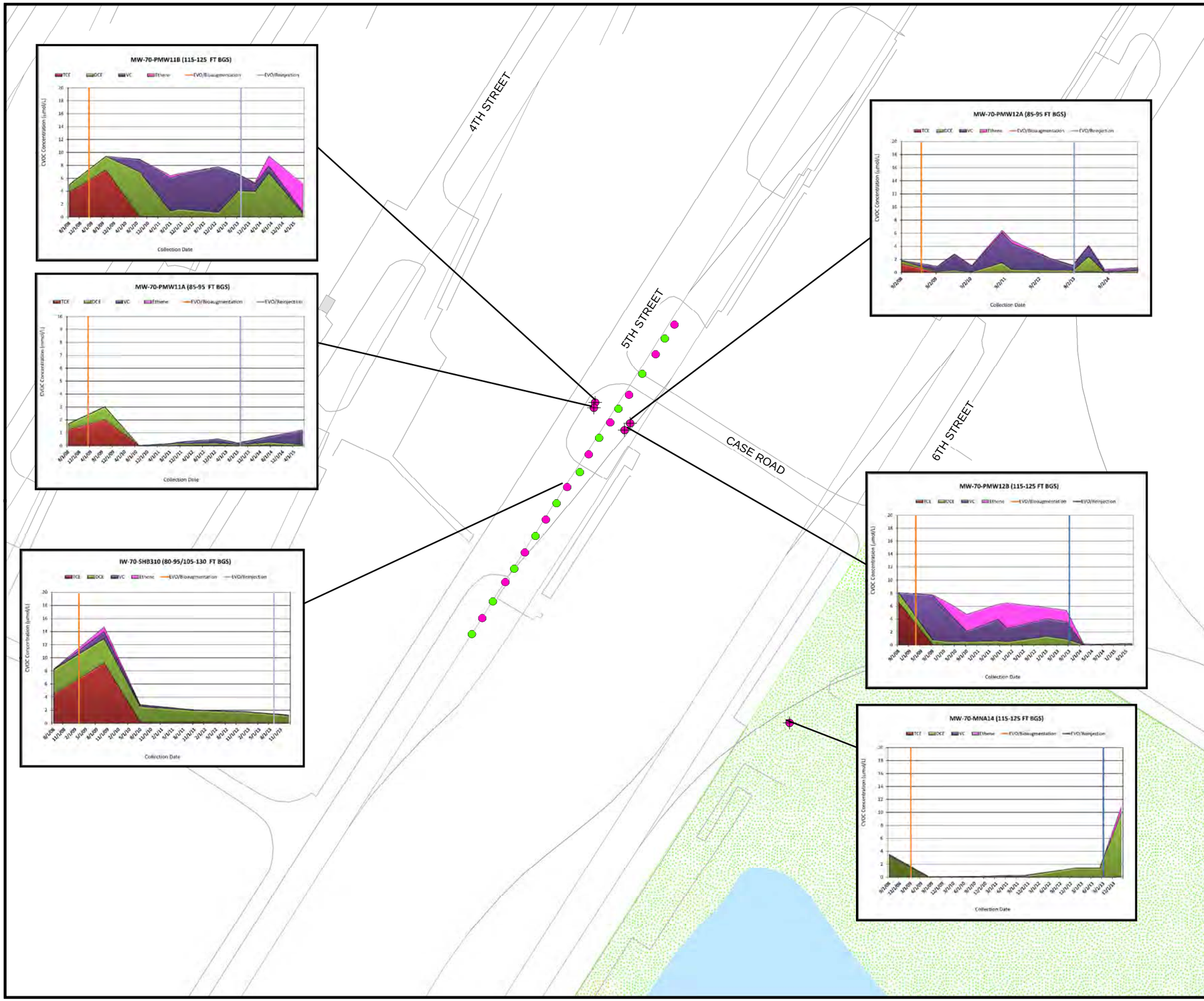
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 29.mxd

NAVFAC

ECC-INSIGHT LLC

Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

- SHELL HORIZON MONITORING WELL

TREATMENT WELL

- GROUP 1
- GROUP 2
- SECTION 1 GROUP 1
- SECTION 1 GROUP 2
- SECTION 2 GROUP 1
- SECTION 2 GROUP 2
- ROAD
- BUILDING
- IR 70 SITE BOUNDARY

100 50 0 100 200 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 30
CVOC MOLAR CONCENTRATIONS
SHELL HORIZON BIOBARRIER 3

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

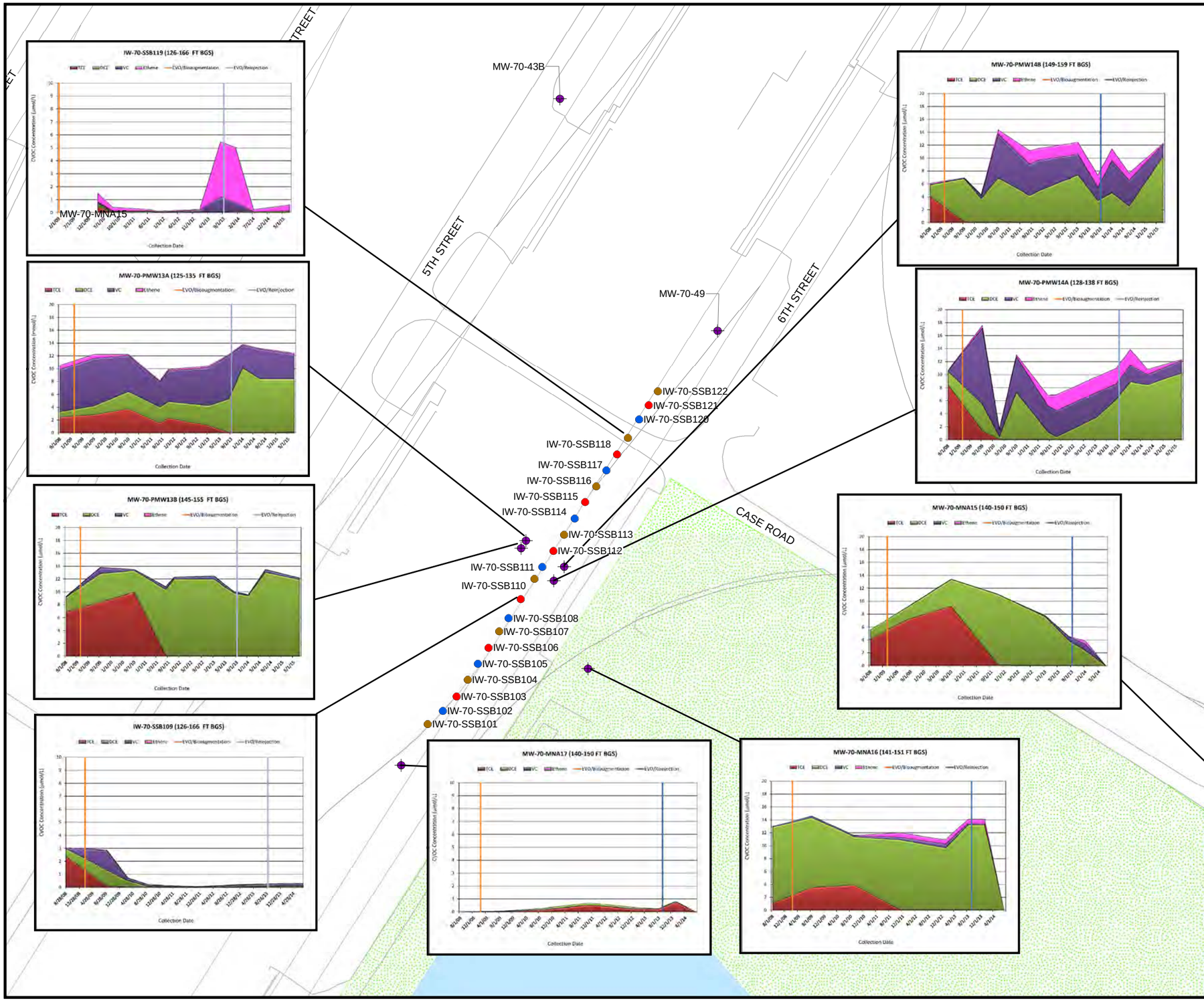
REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 30.mxd

NAVFAC

ECC-INSIGHT LLC

Path: P:\Projects\SealBeach\MapDocuments\FIGURE 2-22.mxd

This Page Intentionally Left Blank



LEGEND

- SECOND SAND MONITORING WELL

TREATMENT WELL

- GROUP 1
- GROUP 2
- GROUP 3
- ROAD
- BUILDING
- IR 70 SITE BOUNDARY

100 50 0 100 200 Feet

N

NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST
SAN DIEGO, CALIFORNIA

2015 SEMIANNUAL PERFORMANCE MONITORING REPORT

FIGURE 31
CVOC MOLAR CONCENTRATIONS
SECOND SAND BIOBARRIER 1 (SSB-1)

NAVAL WEAPONS STATION SEAL BEACH, SEAL BEACH, CALIFORNIA

REVISION: 0
AUTHOR: JG
FILE NUMBER: FIGURE 31.mxd

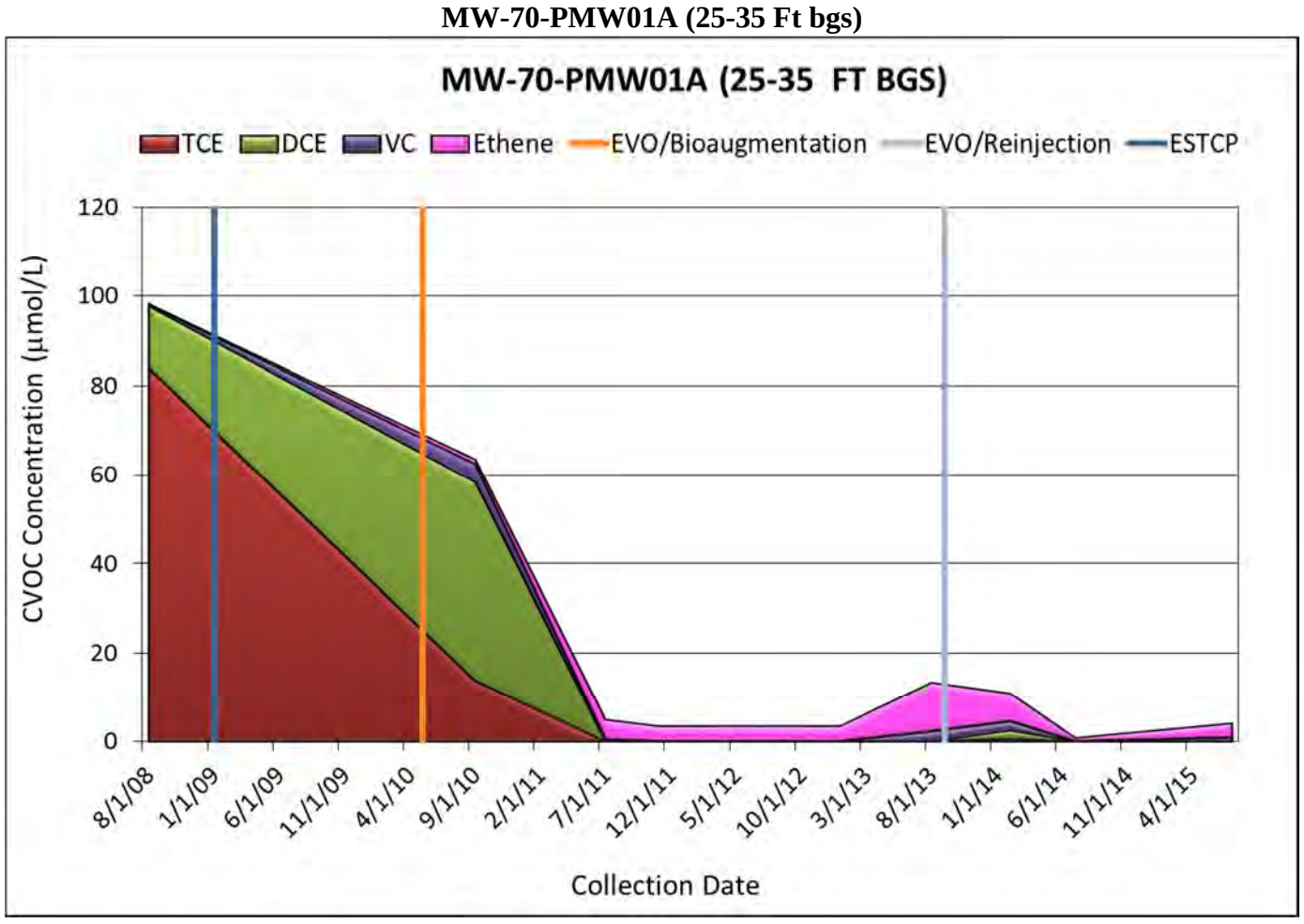
NAVFAC

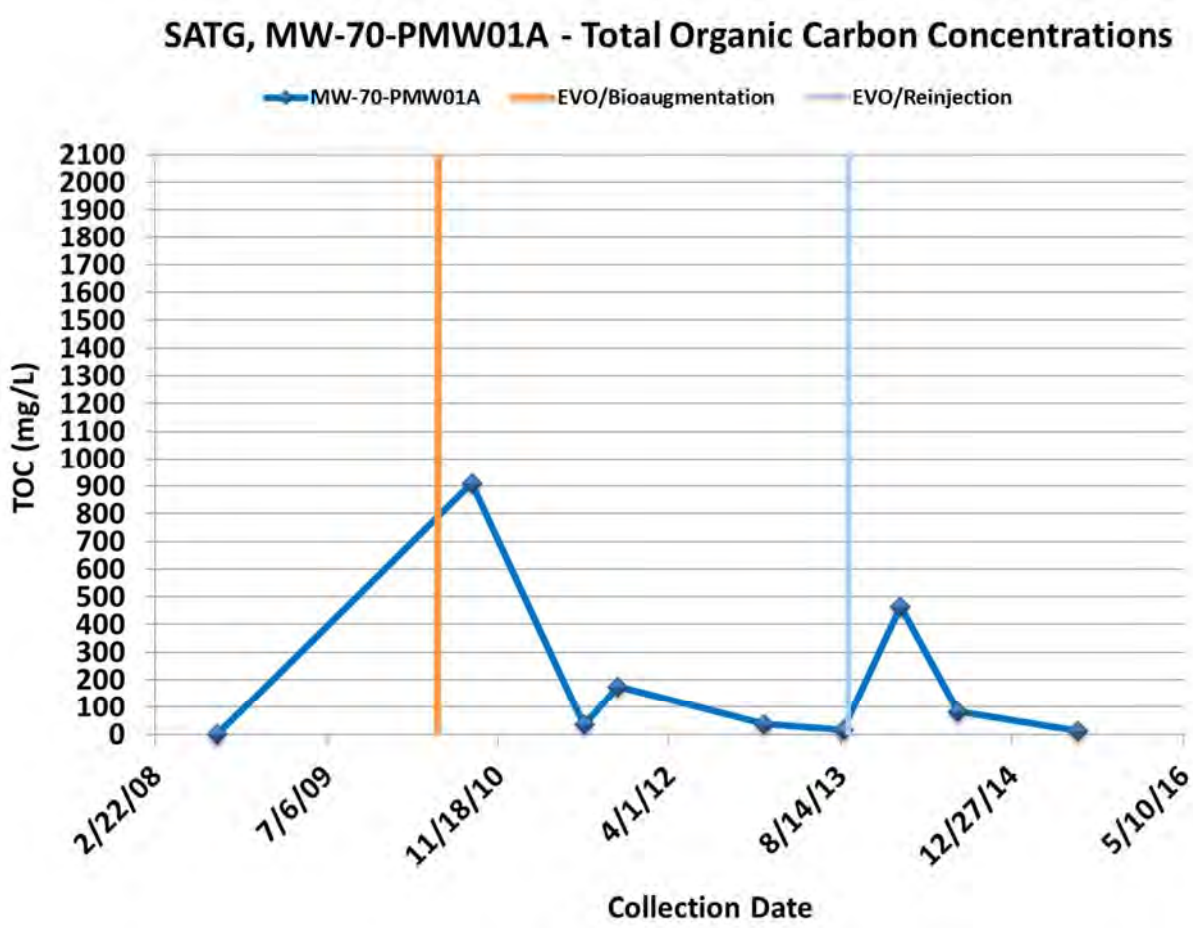
ECC-INSIGHT LLC

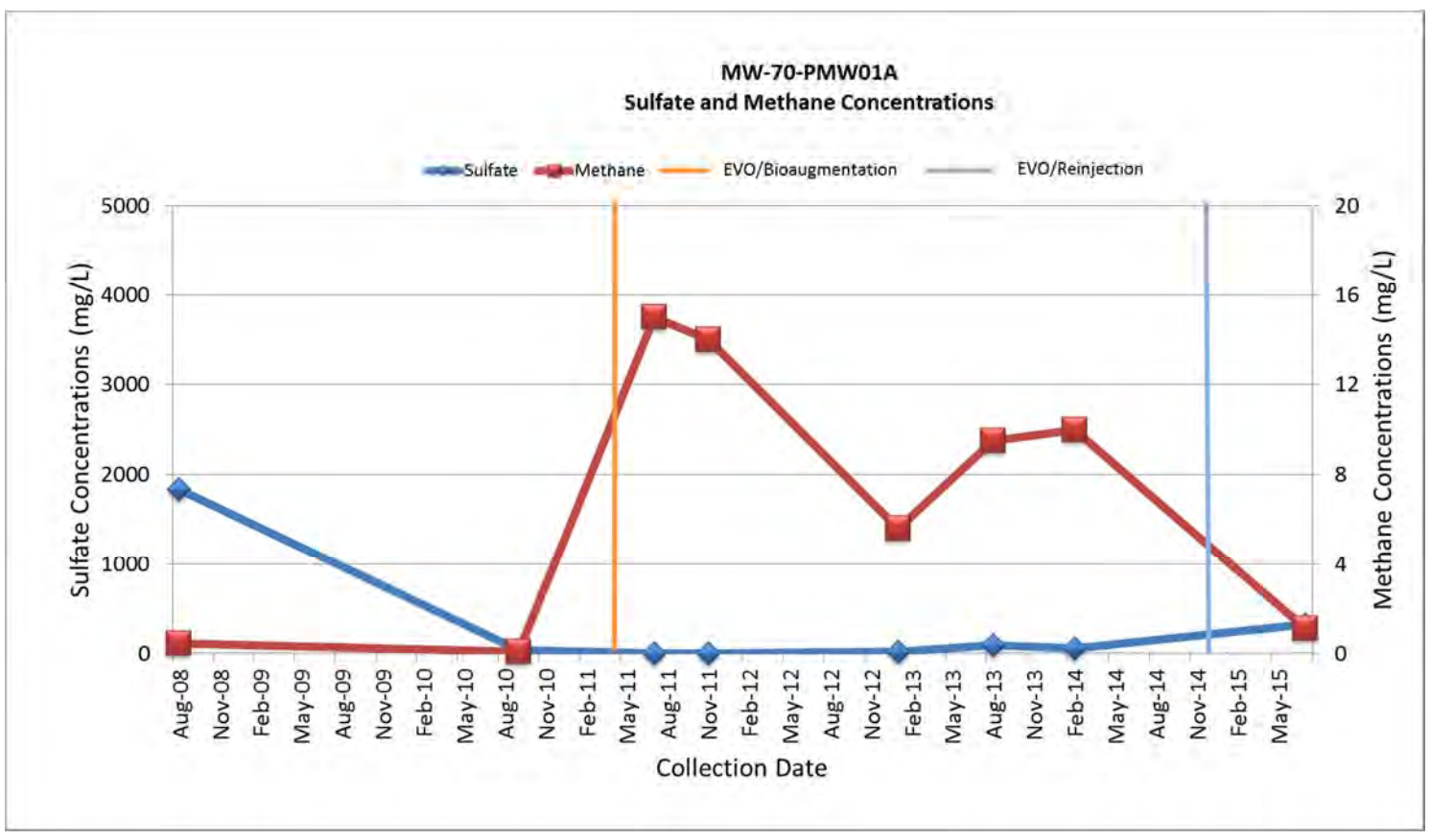
Path: F:\Projects\SealBeach\MapDocuments\FIGURE 2-2b.mxd

This Page Intentionally Left Blank

Figure 32 - Water Quality Trends – Source Area Treatment Grid
MW-70-PMW01A (25-35 Ft bgs)

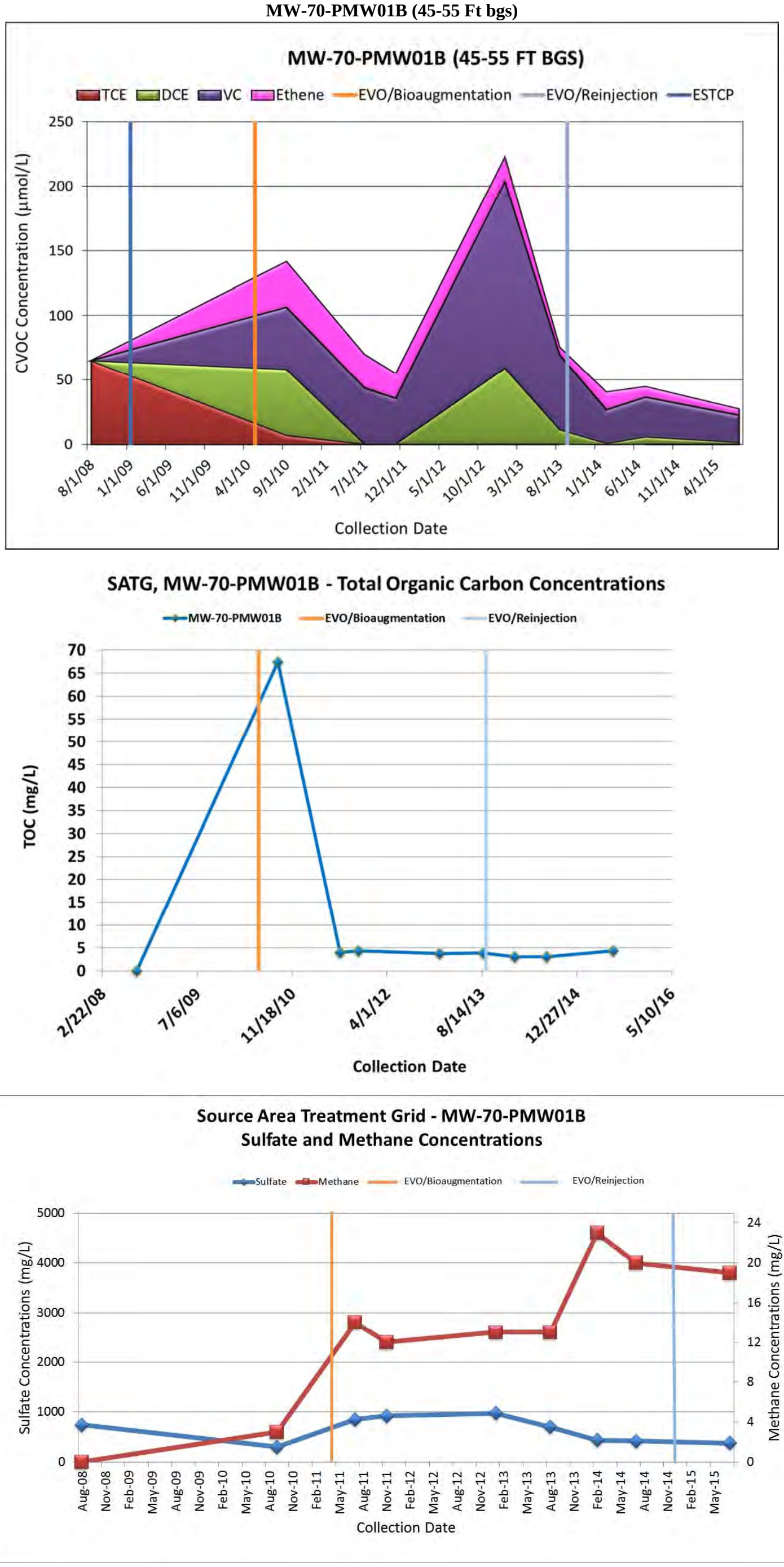






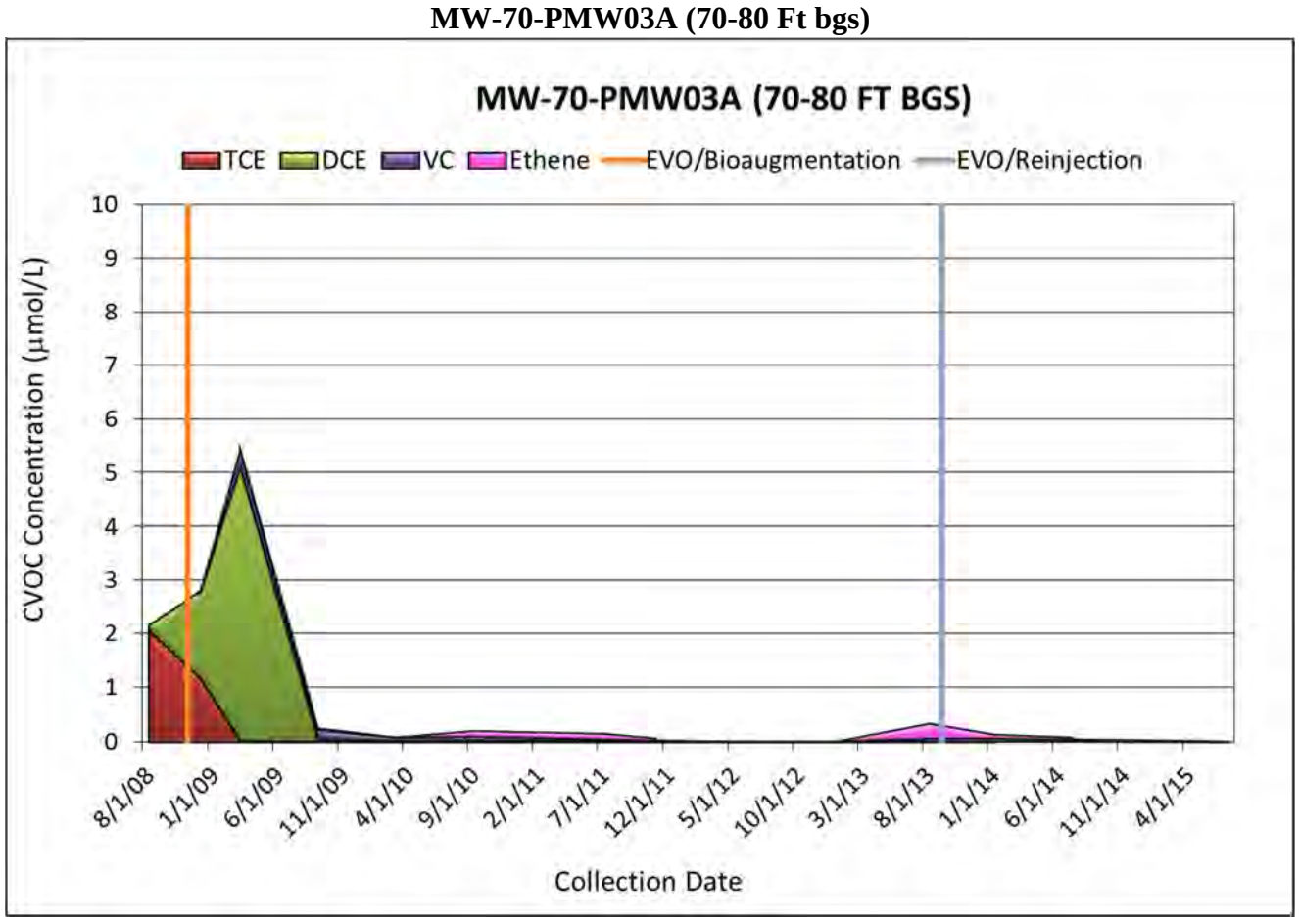
This Page Intentionally Left Blank

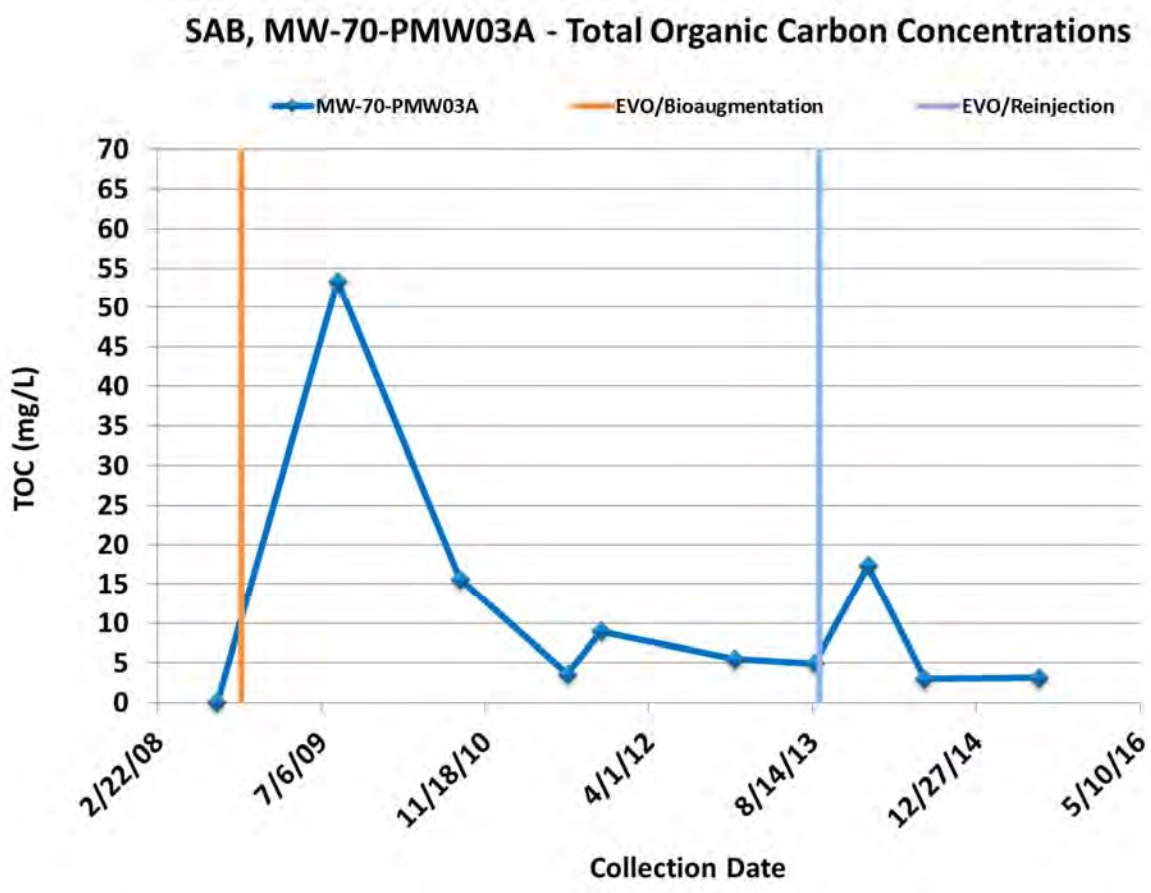
Figure 33 - Water Quality Trends – Source Area Treatment Grid
MW-70-PMW01B (45-55 Ft bgs)

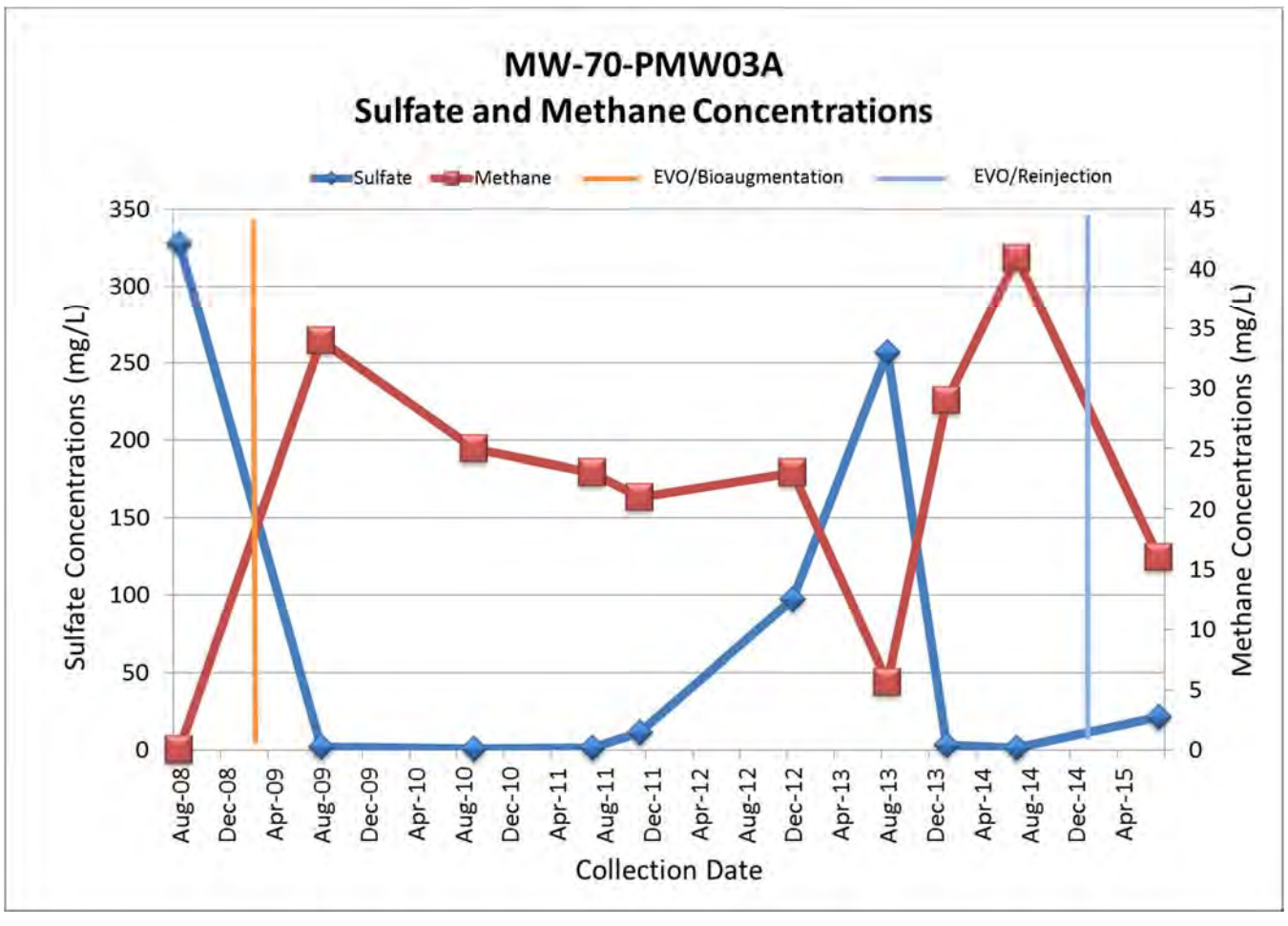


This Page Intentionally Left Blank

Figure 34 - Water Quality Trends – Source Area Biobarrier
MW-70-PMW03A (70-80 Ft bgs)

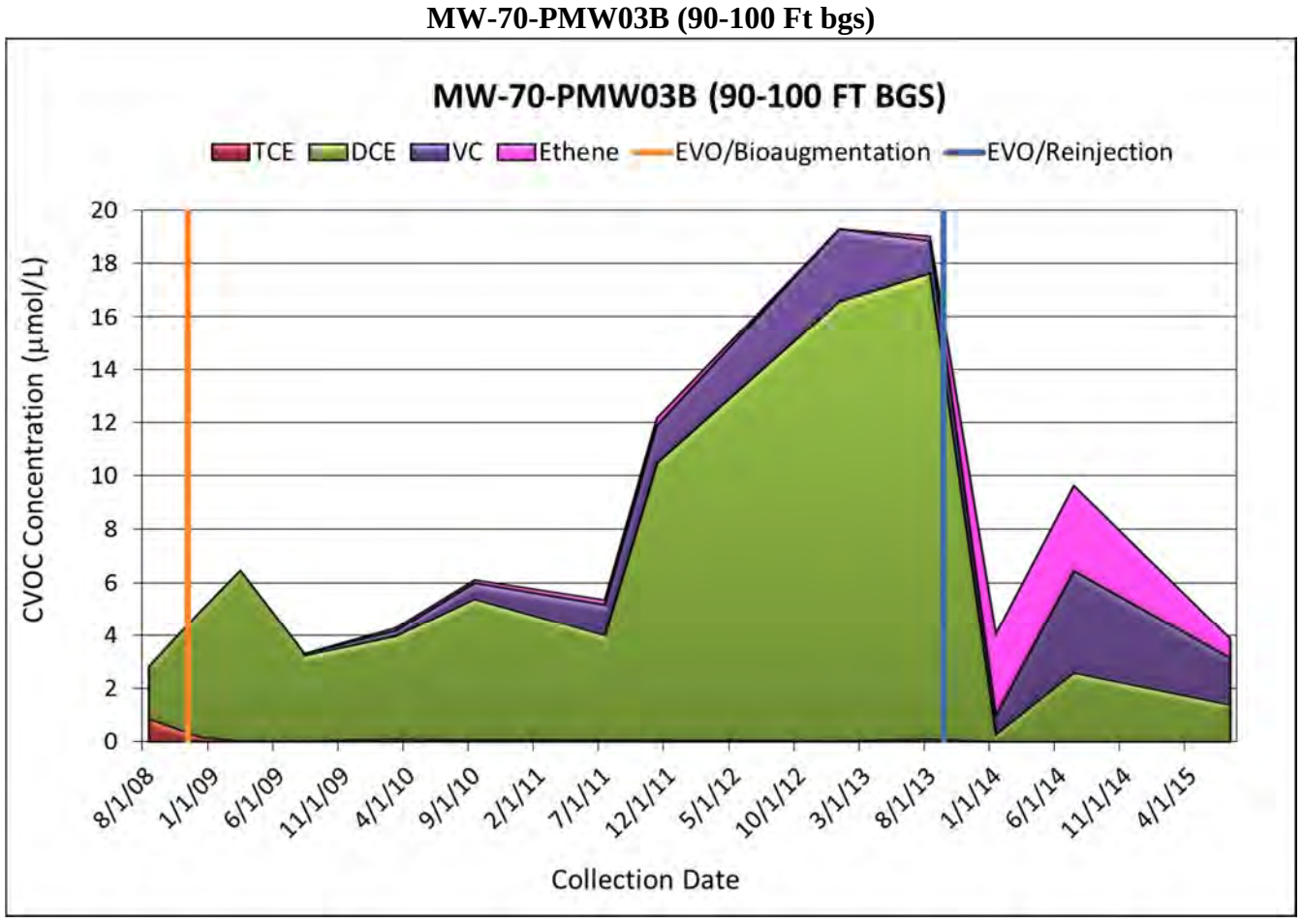


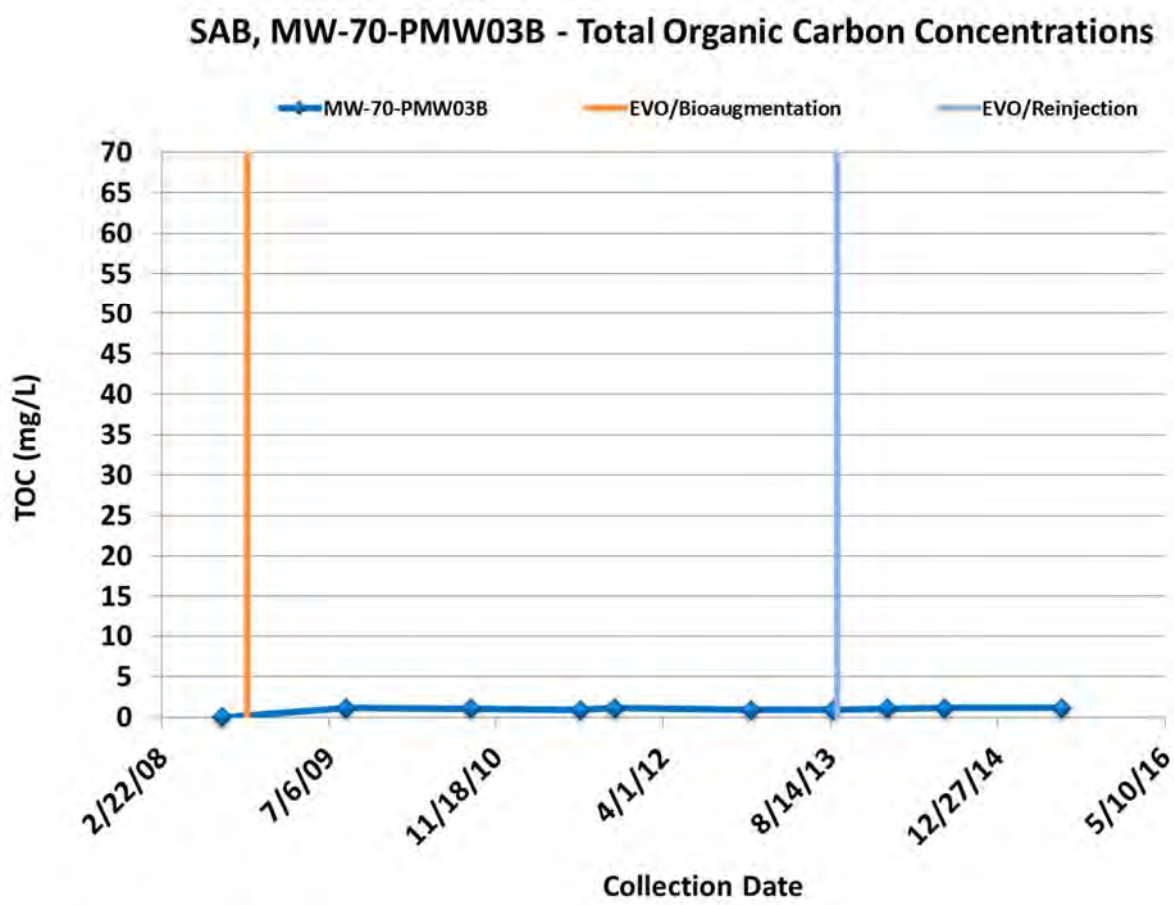


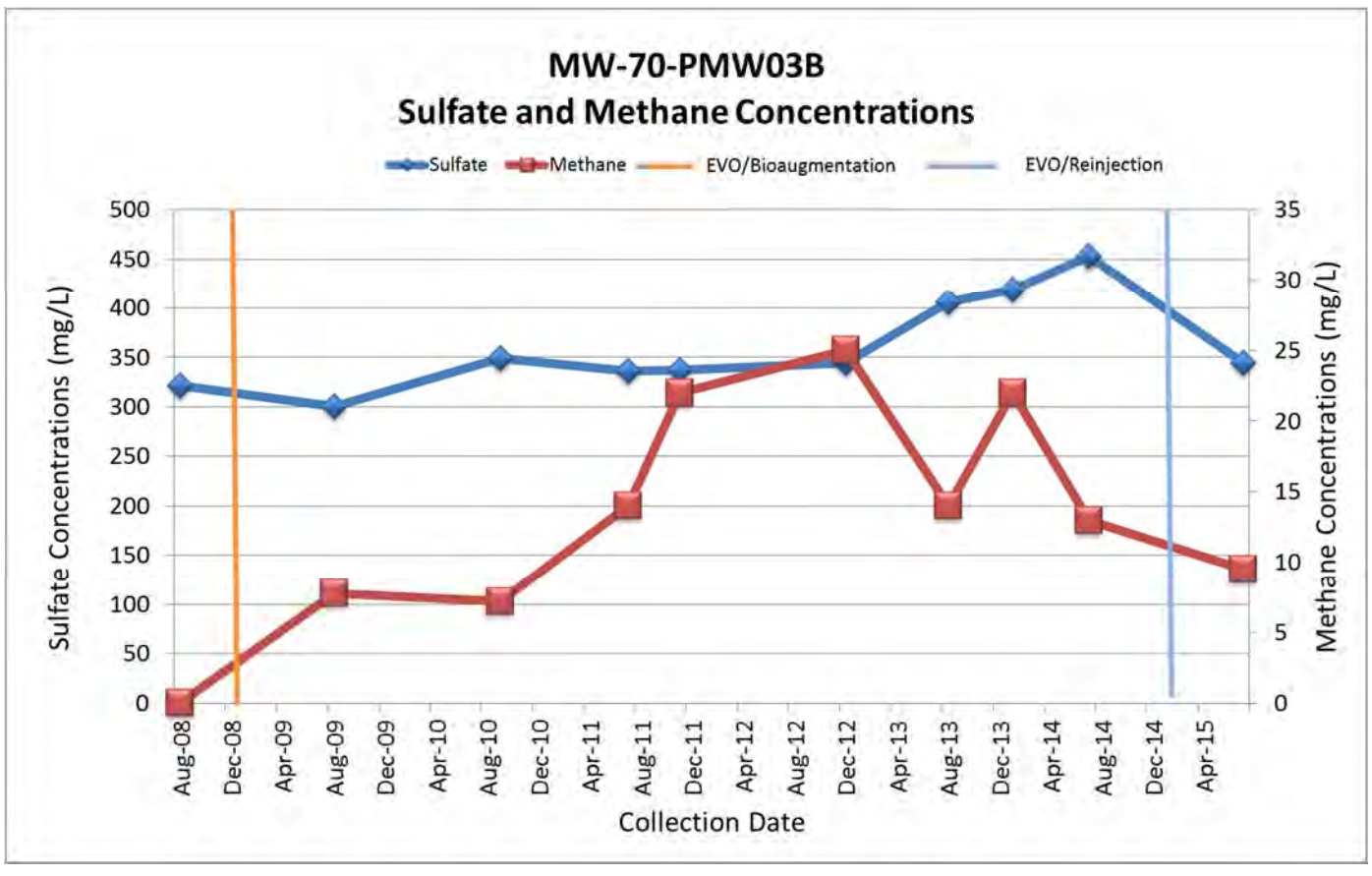


This Page Intentionally Left Blank

Figure 35 - Water Quality Trends – Source Area Biobarrier
MW-70-PMW03B (90-100 Ft bgs)

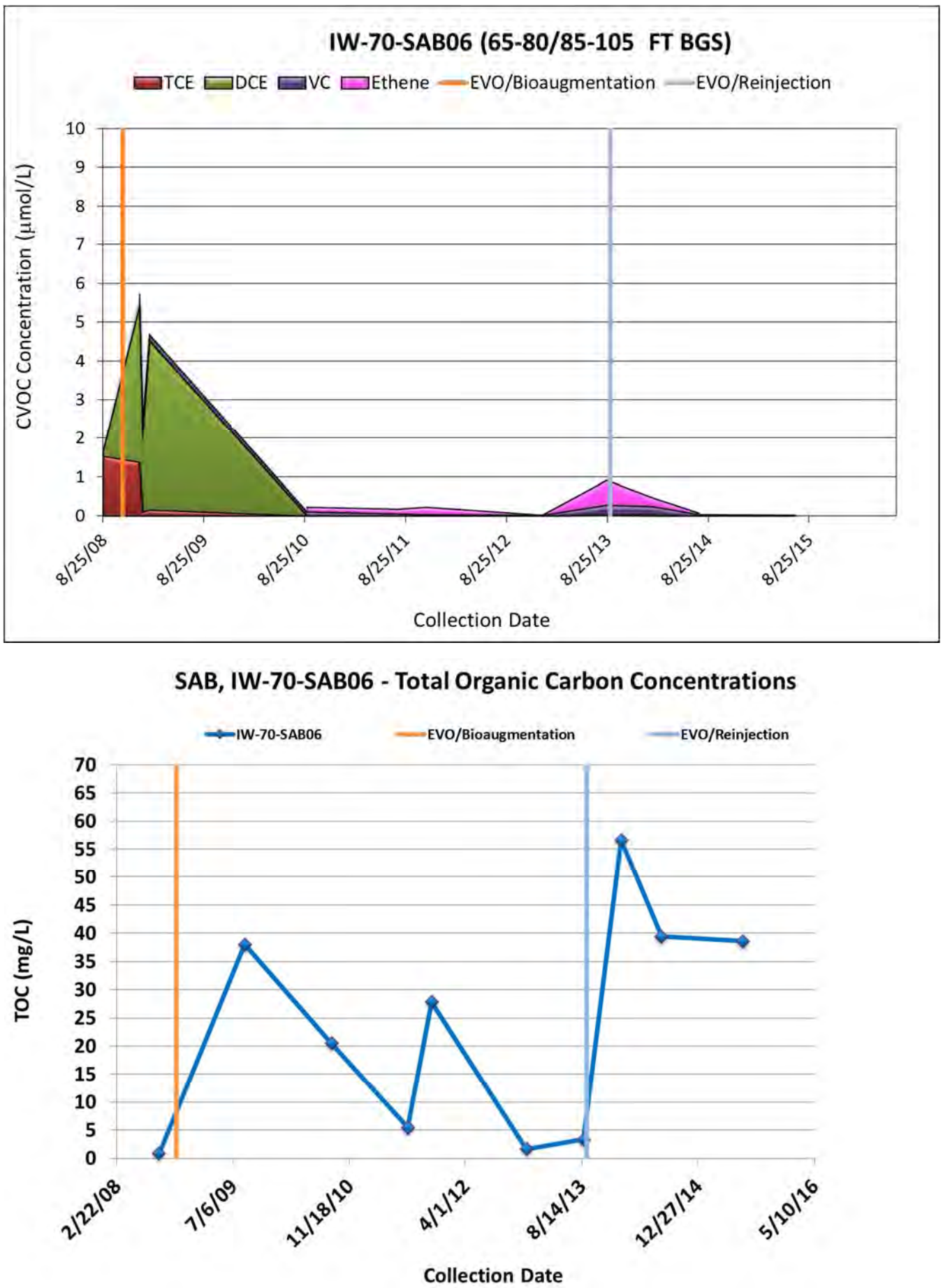






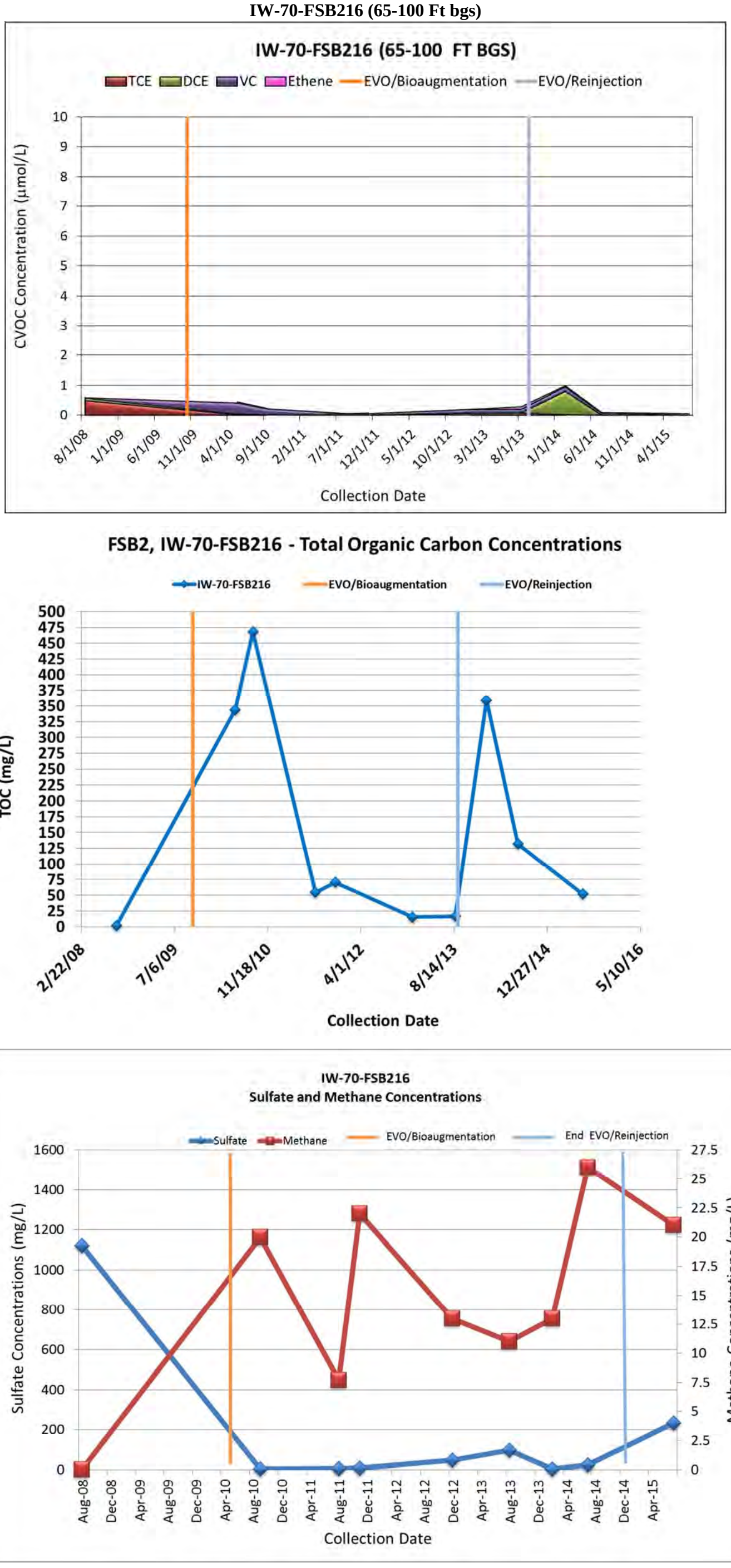
This Page Intentionally Left Blank

Figure 36 - Water Quality Trends – Source Area Biobarrier
IW-70-SAB06 (65-85/85-105 Ft bgs)



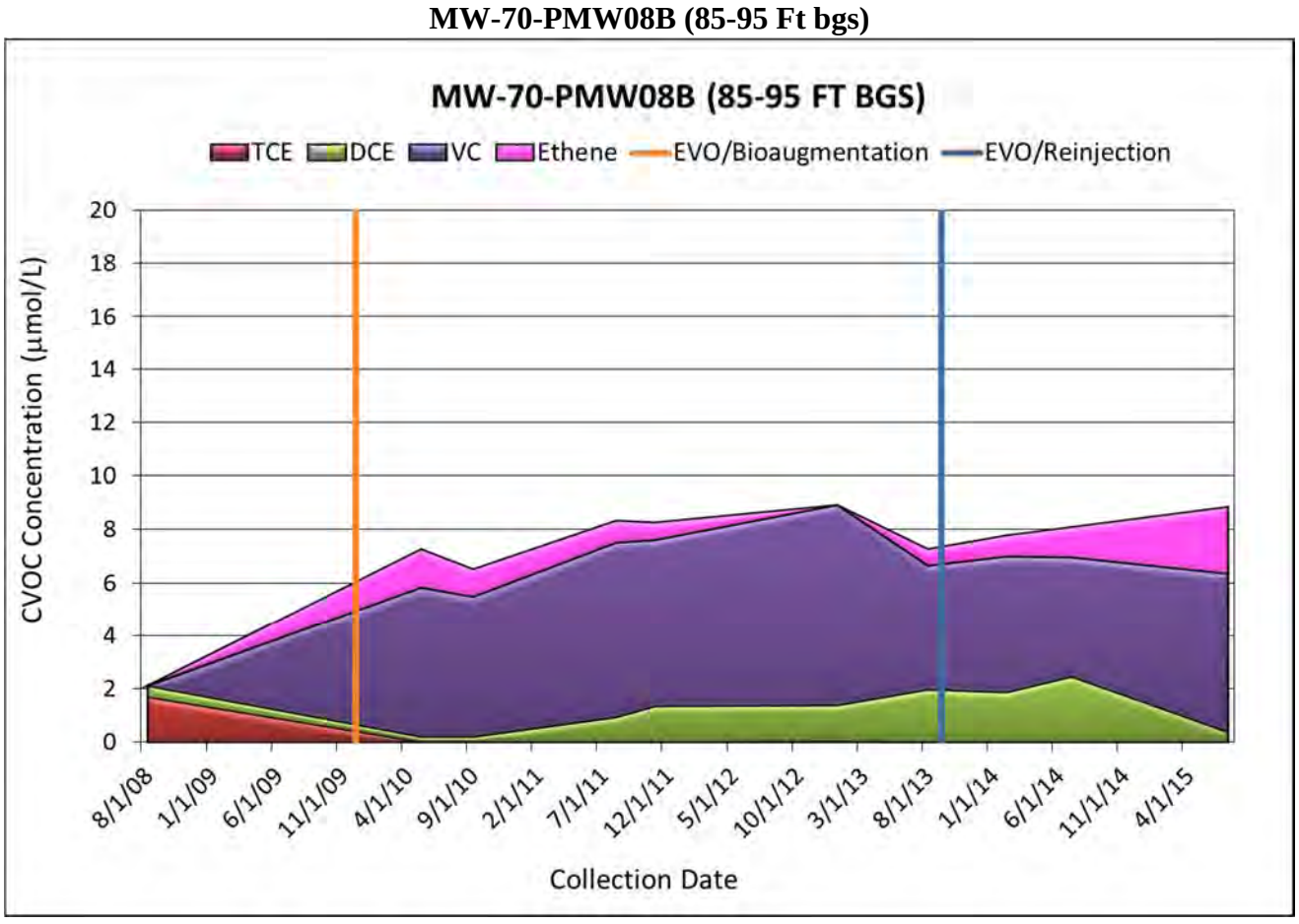
This Page Intentionally Left Blank

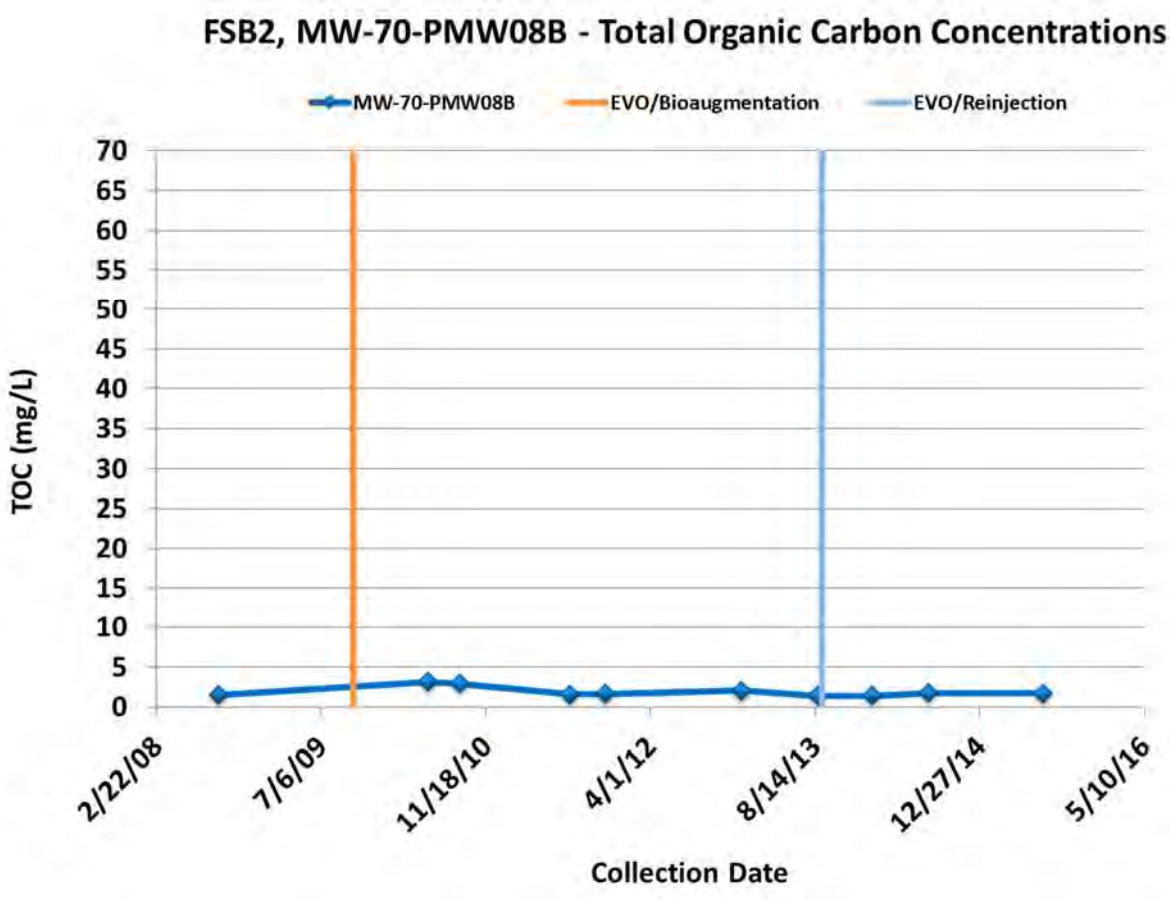
Figure 37 - Water Quality Trends – First Sand Biobarrier 2
IW-70-FSB216 (65-100 Ft bgs)

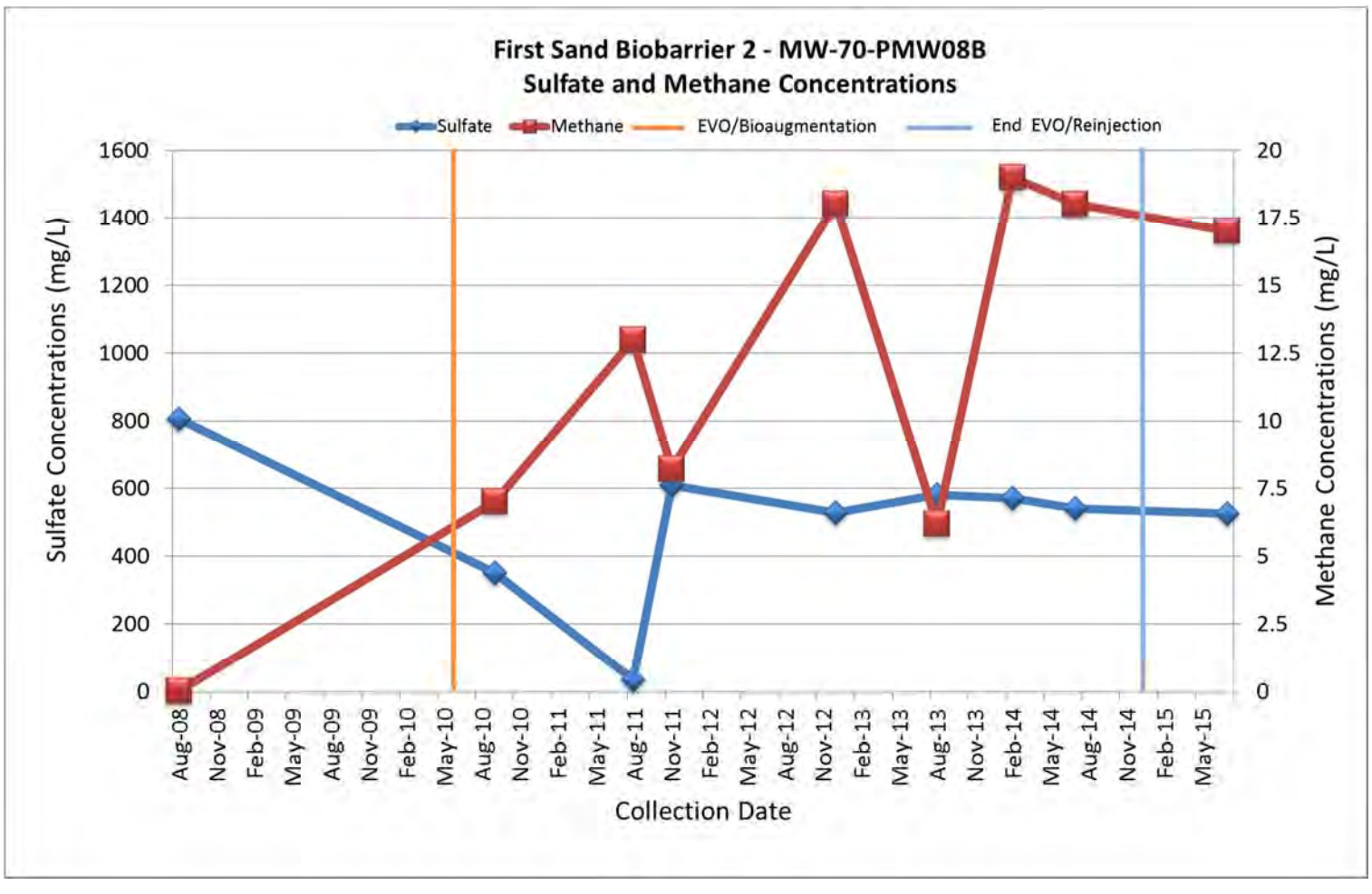


This Page Intentionally Left Blank

Figure 38 - Water Quality Trends – First Sand Biobarrier 2
MW-70-PMW08B (85-95 Ft bgs)

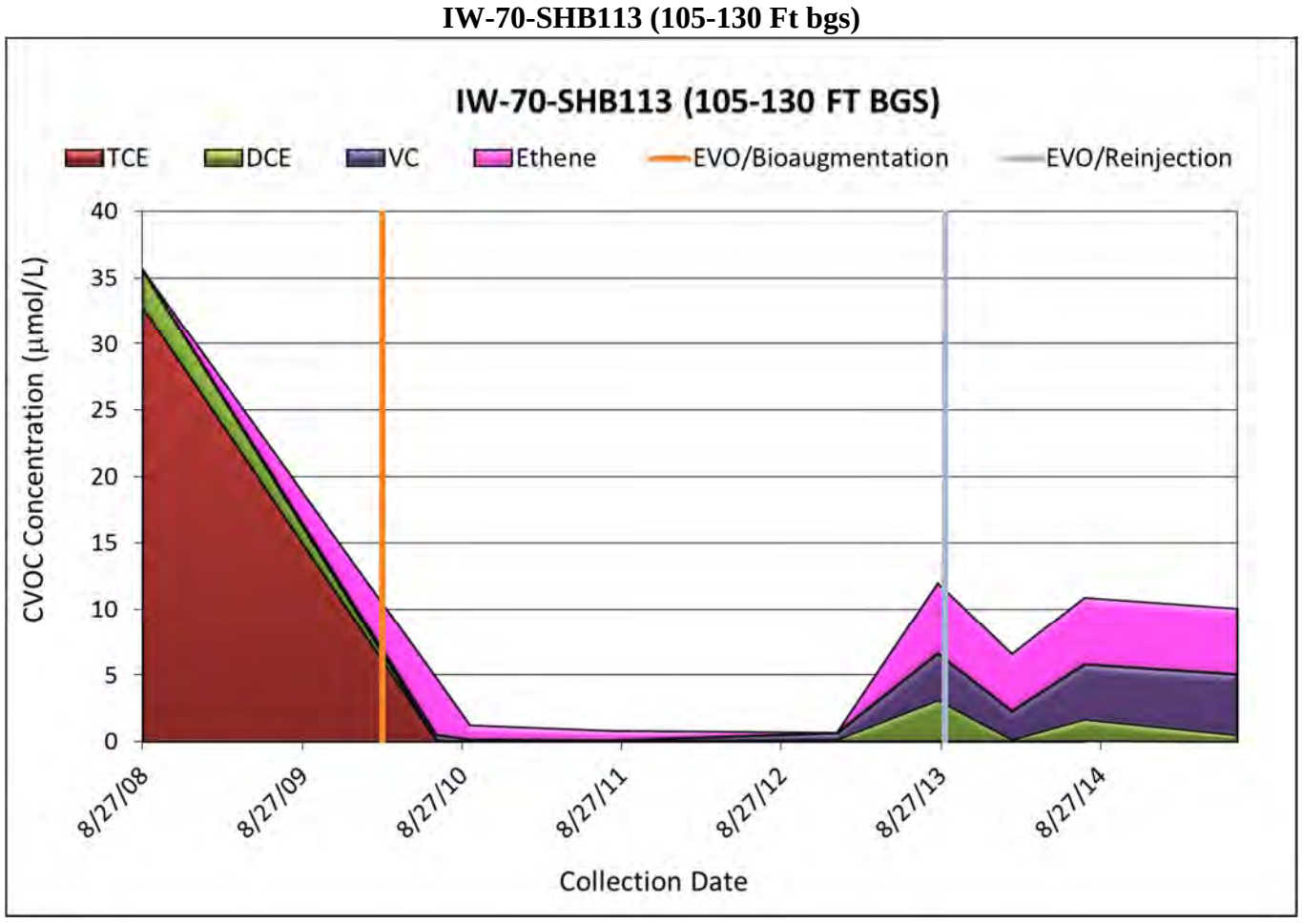


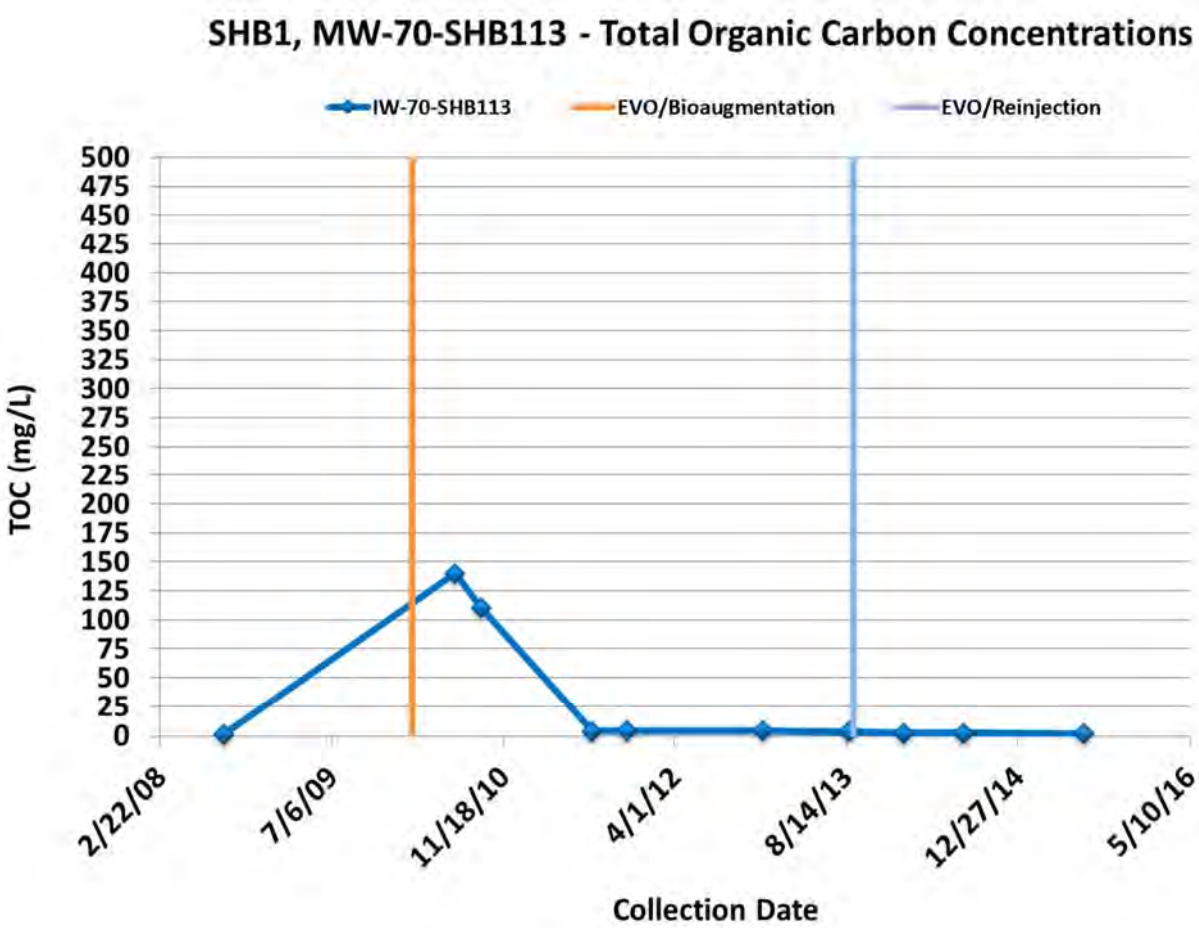


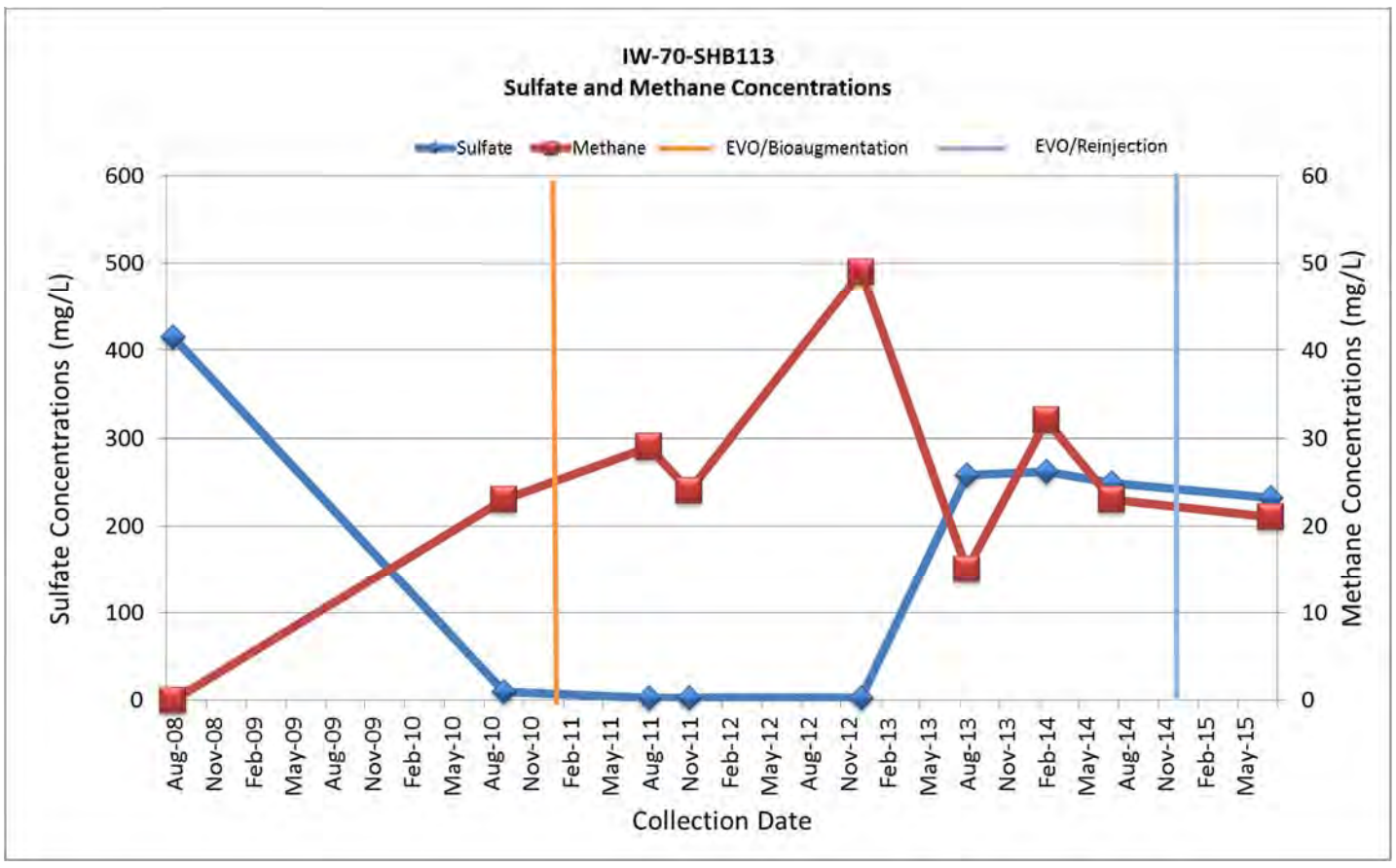


This Page Intentionally Left Blank

Figure 39 - Water Quality Trends – Shell Horizon Biobarrier 1
IW-70-SHB113 (105-130 Ft bgs)

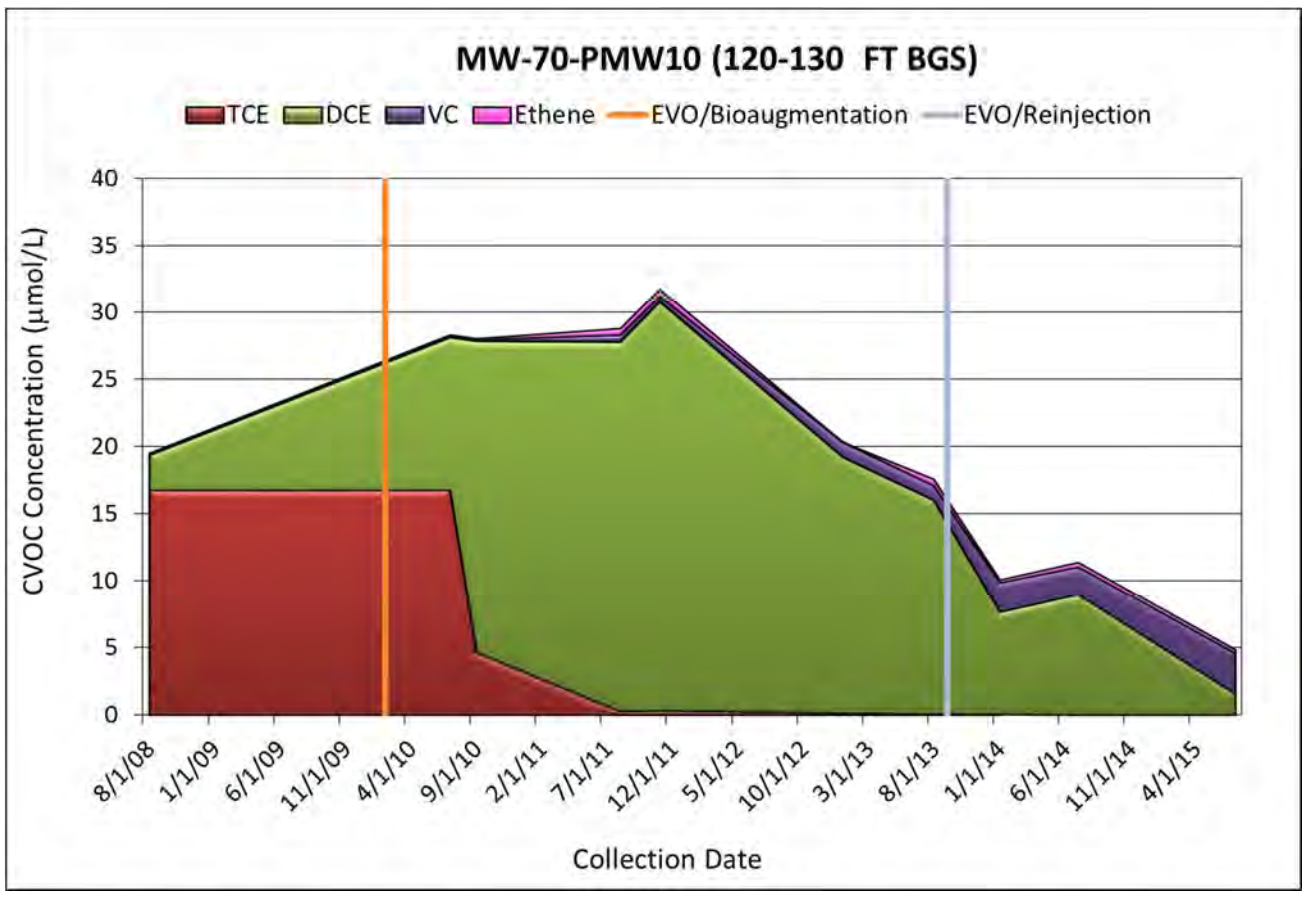


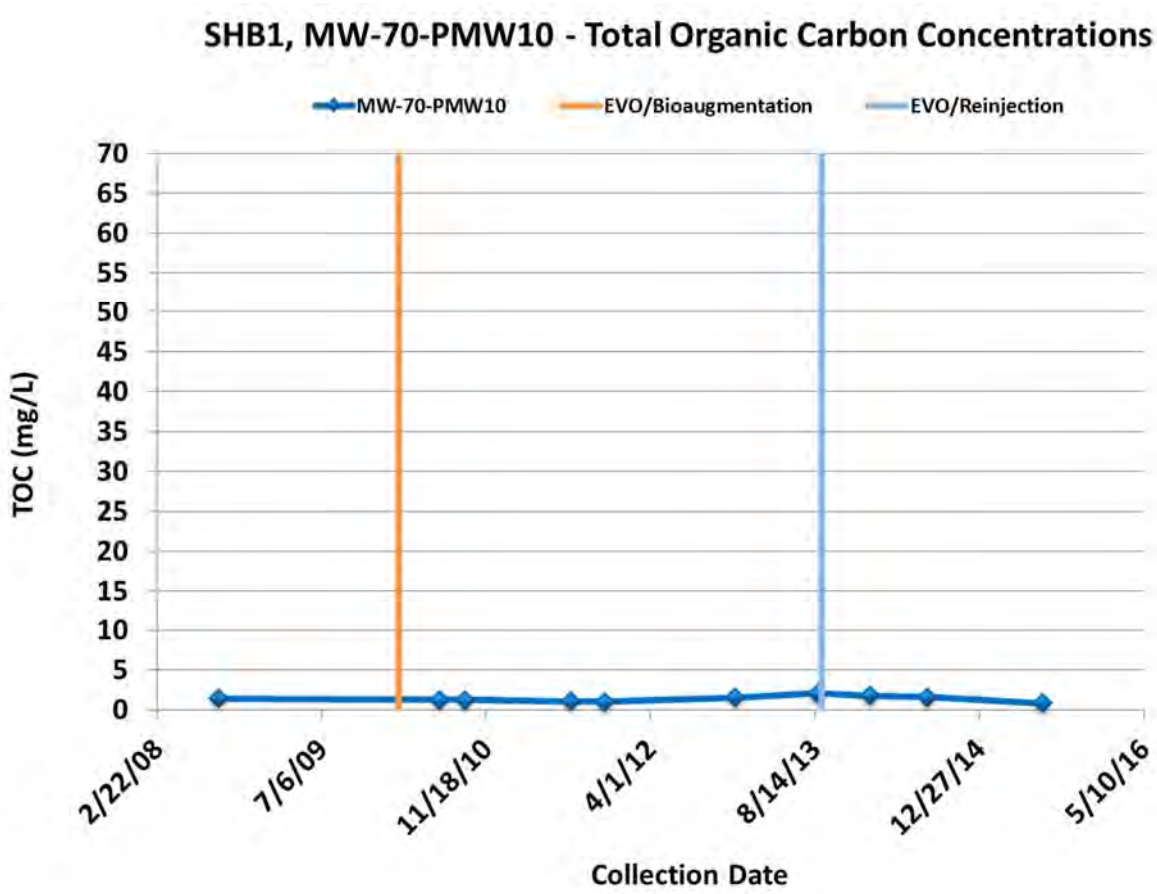


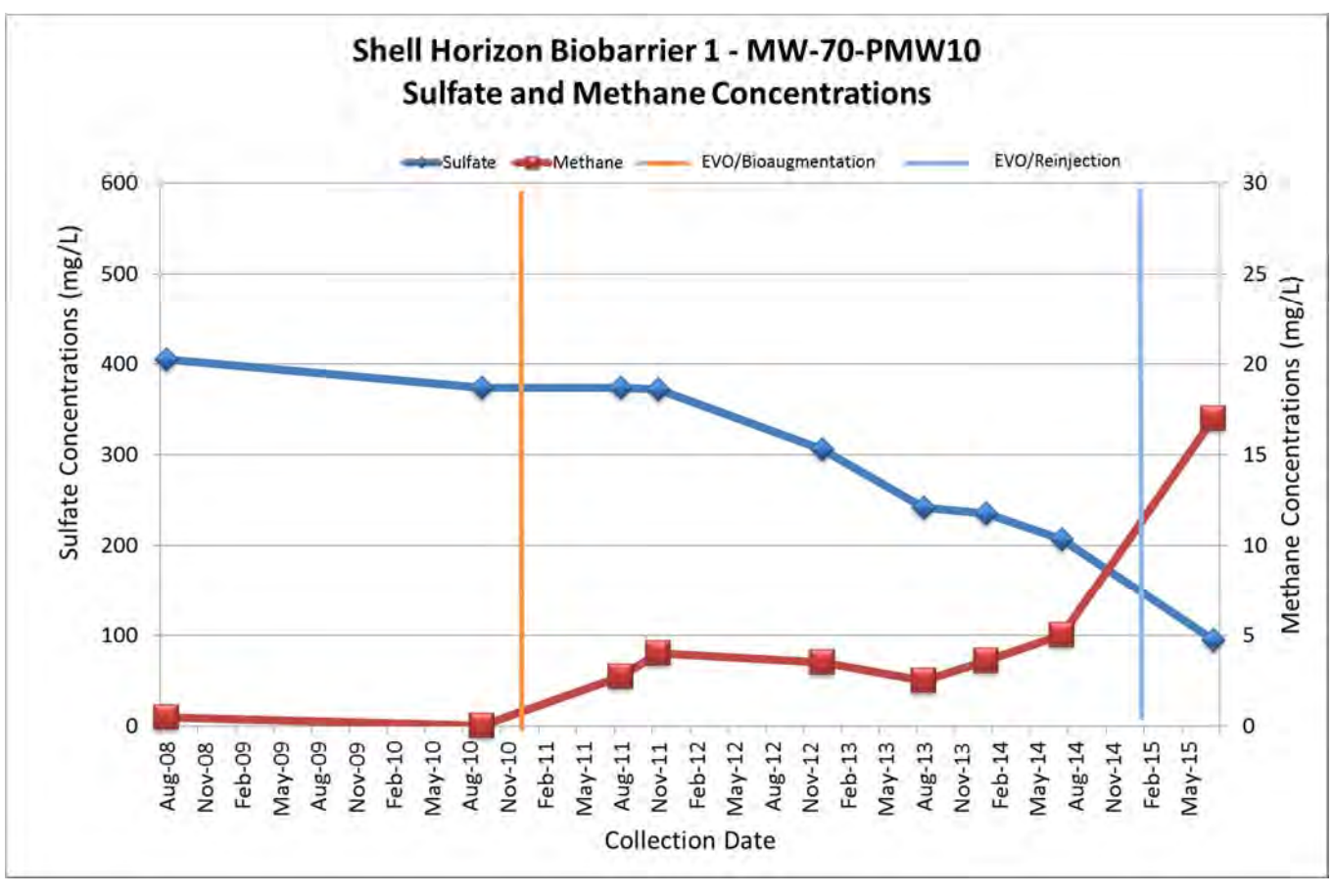


This Page Intentionally Left Blank

Figure 40 - Water Quality Trends – Shell Horizon Biobarrier 1
MW-70-PMW10 (120-130 Ft bgs)

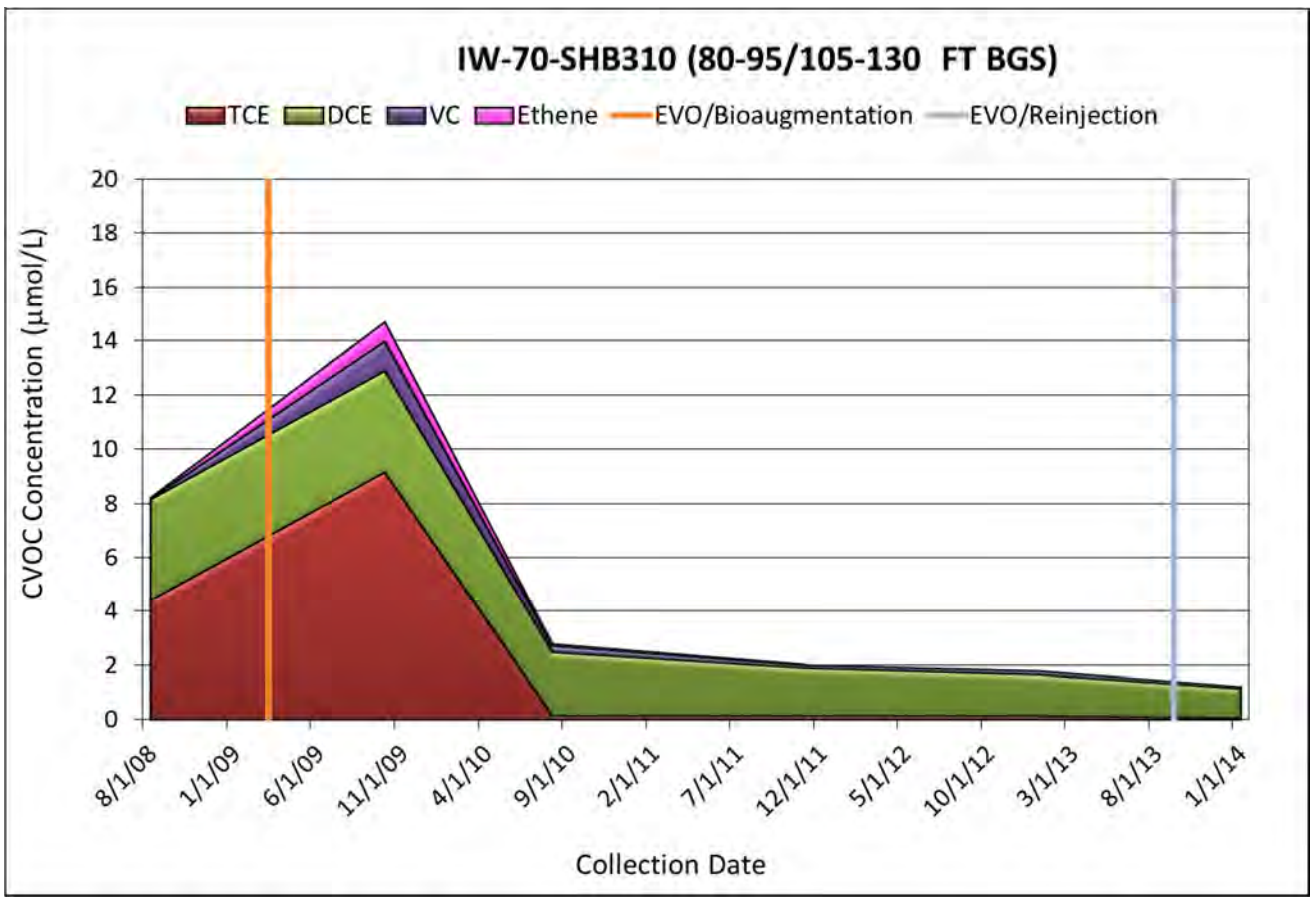


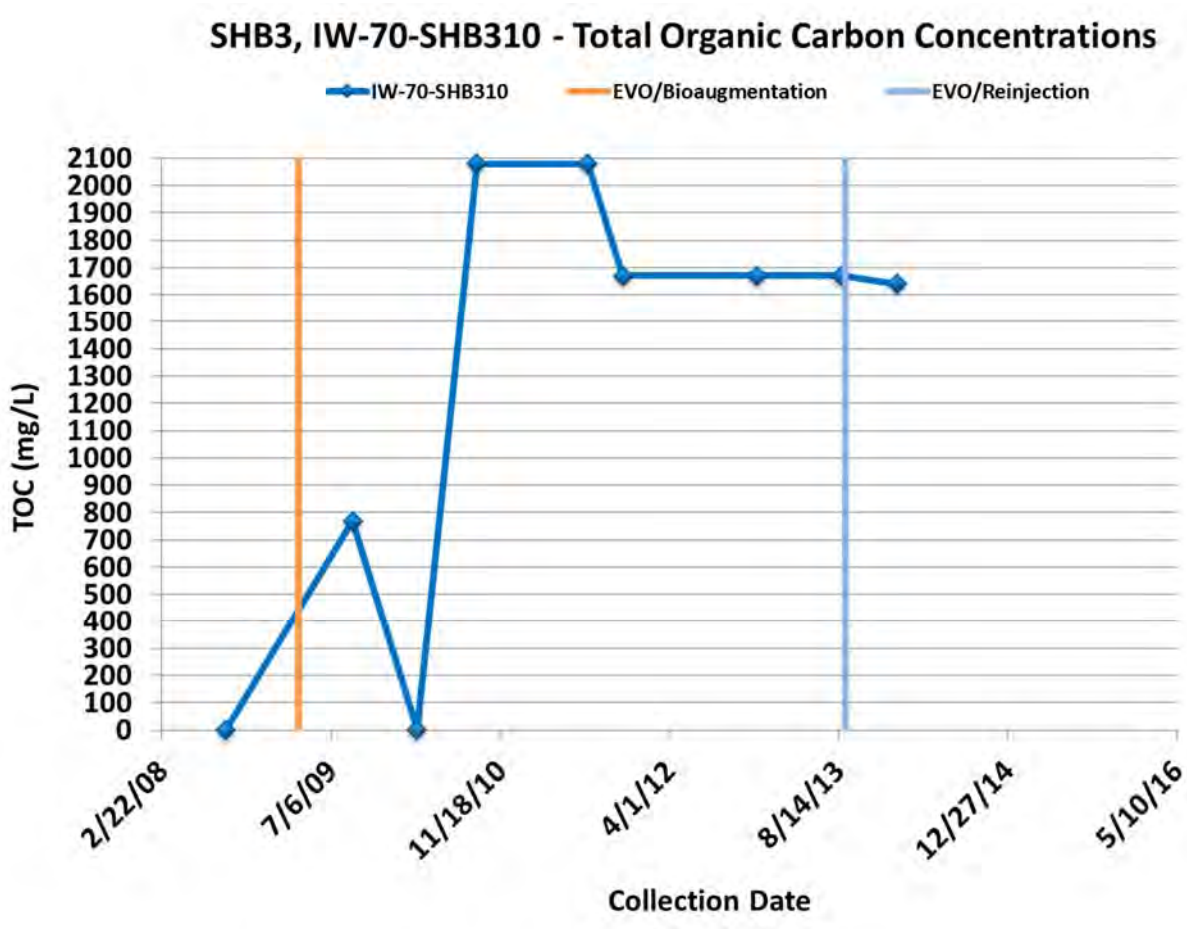


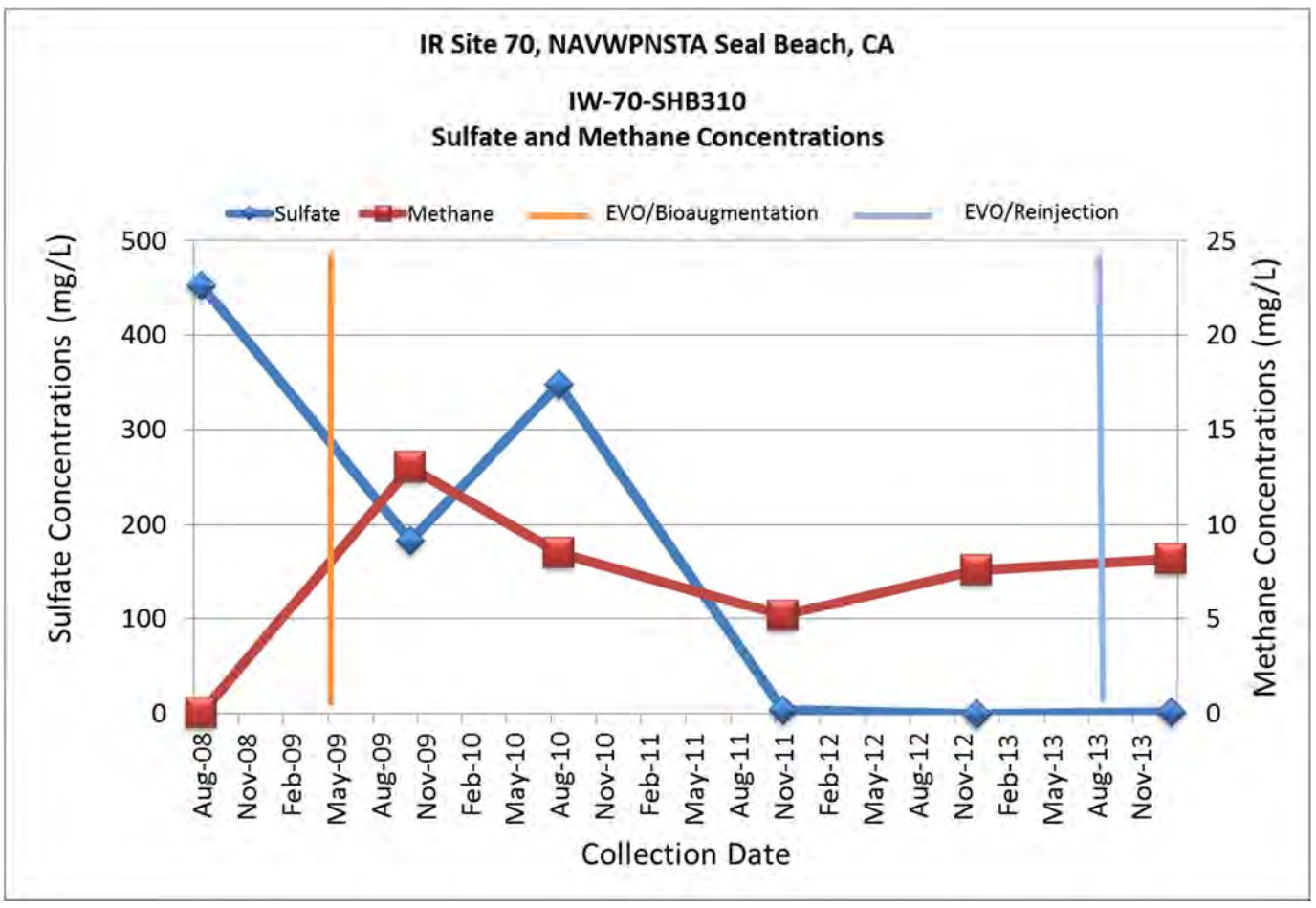


This Page Intentionally Left Blank

Figure 41 - Water Quality Trends – Shell Horizon Biobarrier 3
IW-70-SHB310 (80-95/105-130 Ft bgs)

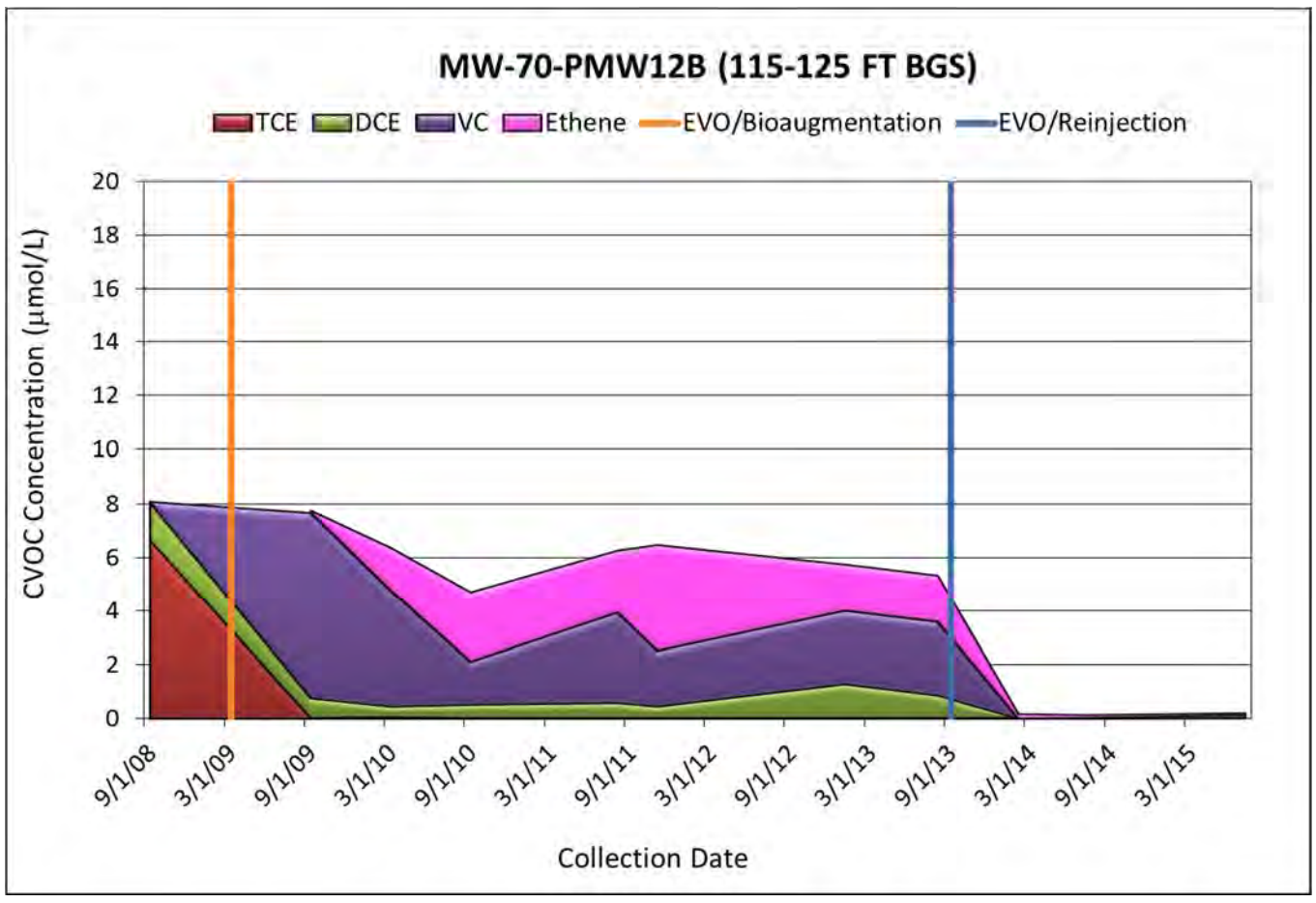


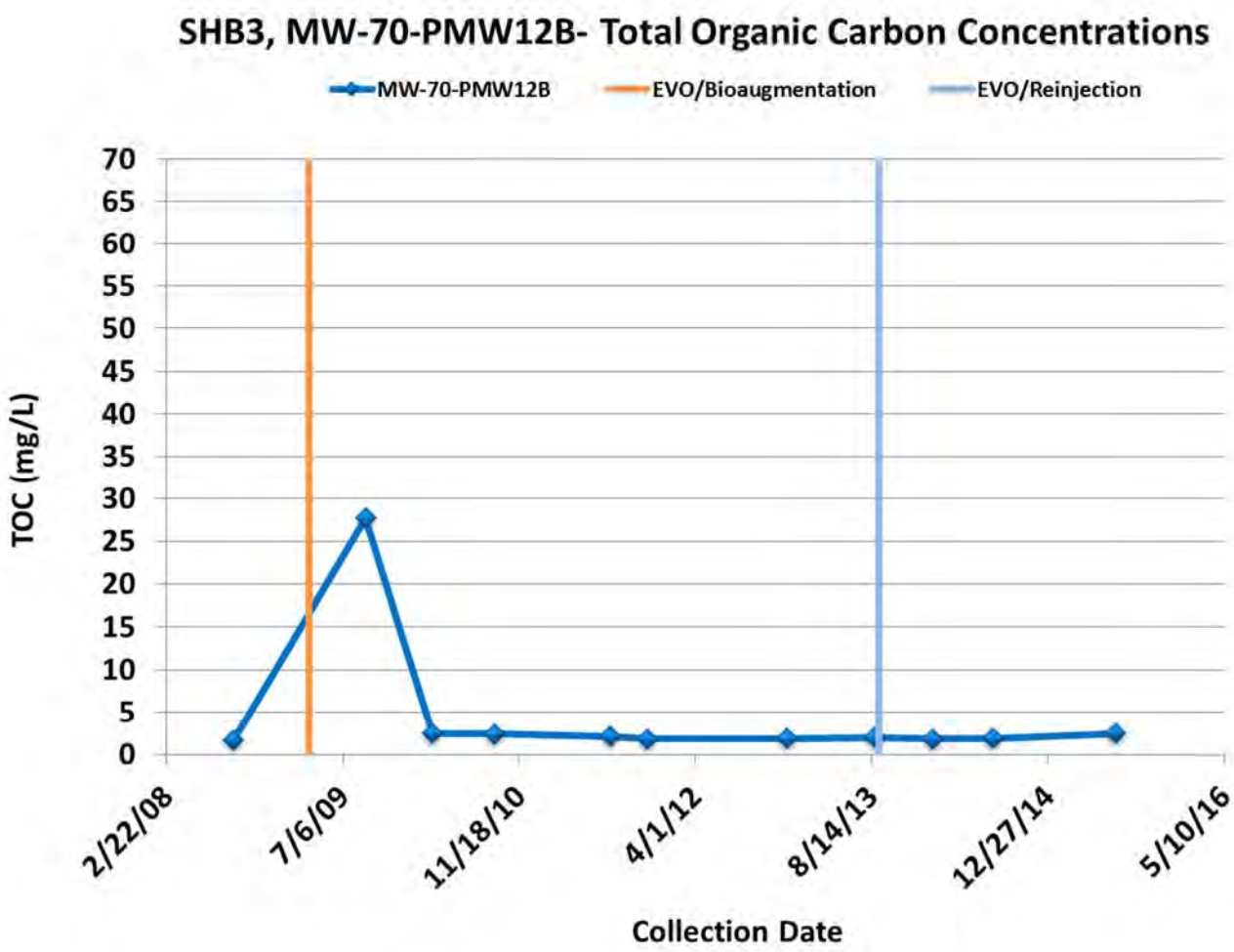


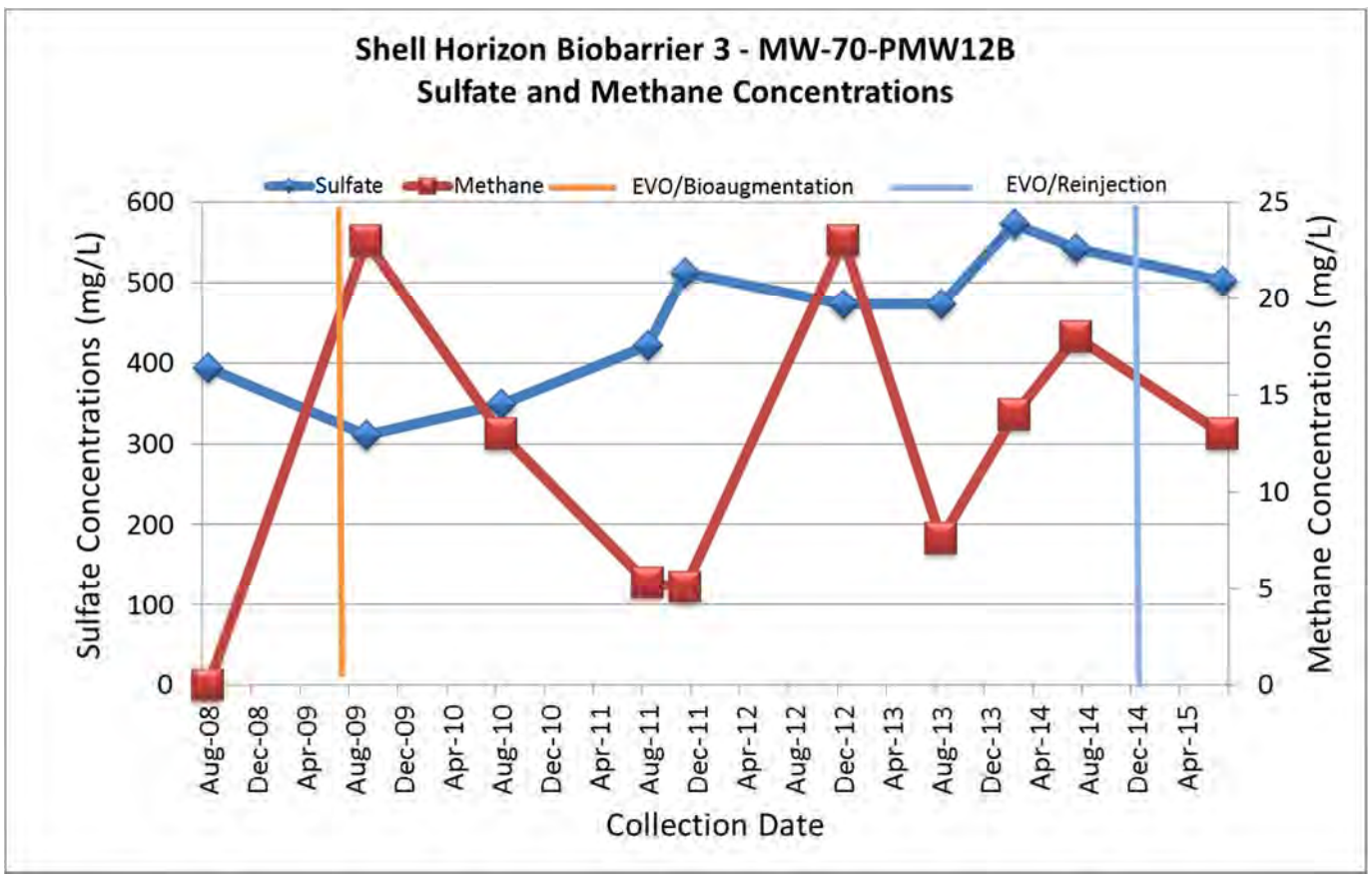


This Page Intentionally Left Blank

Figure 42 - Water Quality Trends – Shell Horizon Biobarrier 3
MW-70-PMW12B (115-125 Ft bgs)

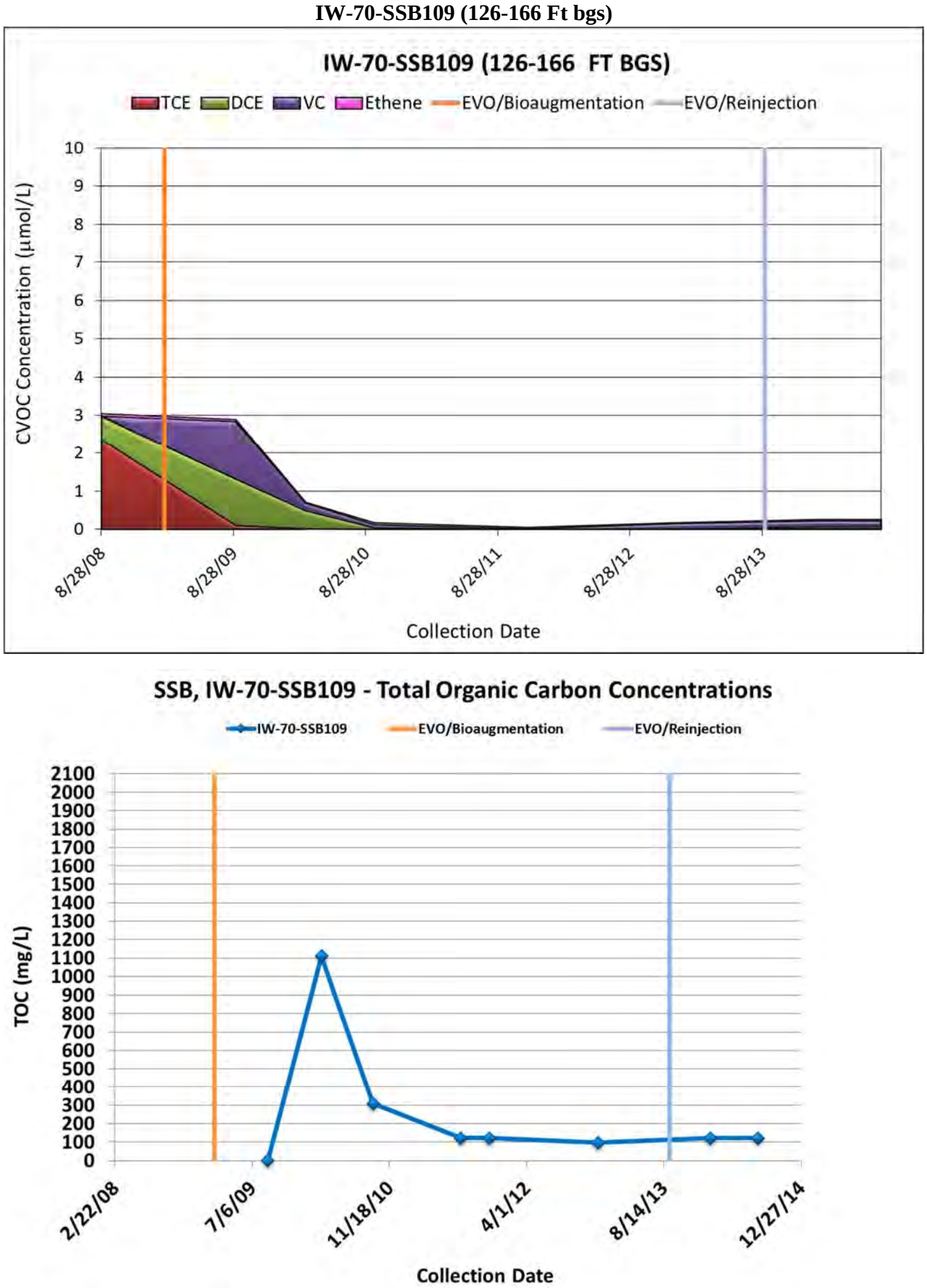






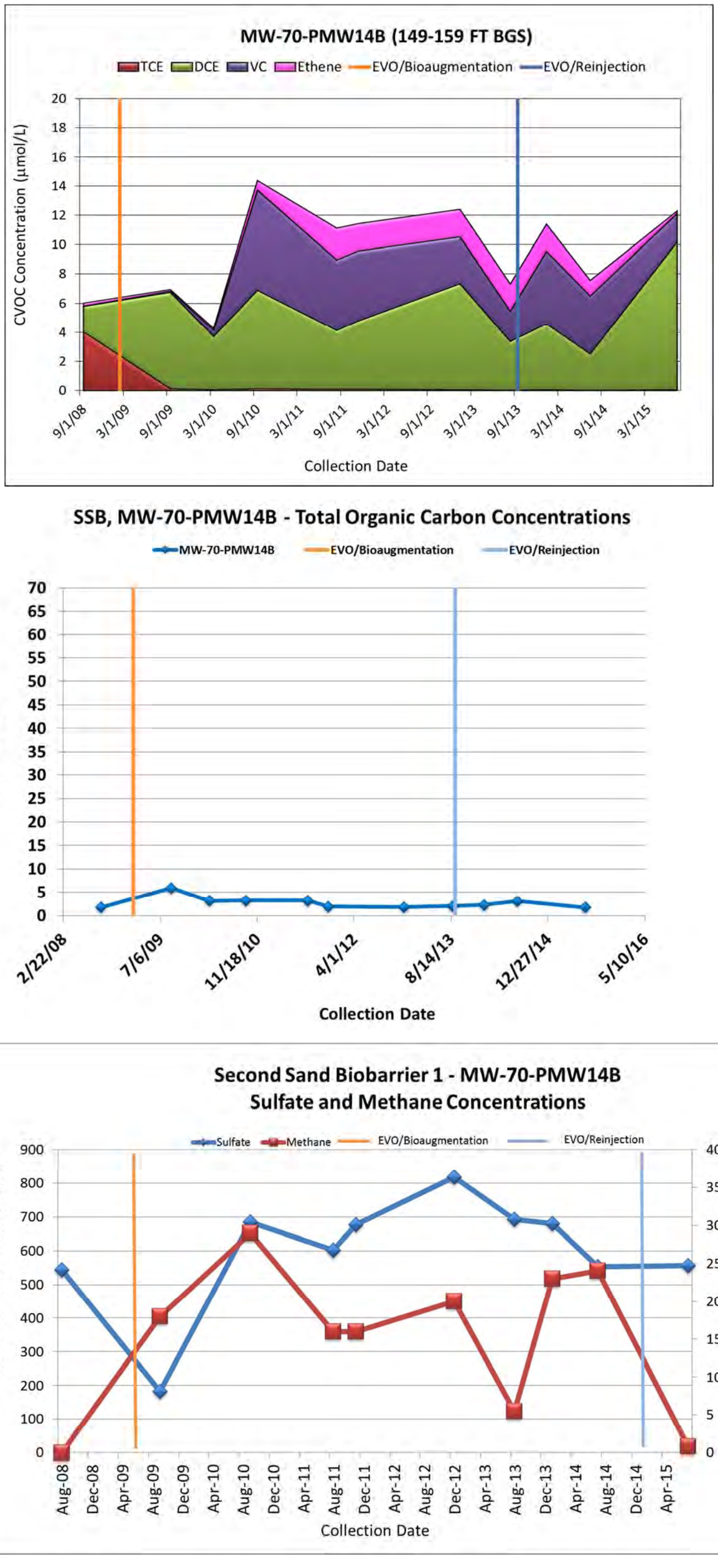
This Page Intentionally Left Blank

Figure 43 - Water Quality Trends – Second Sand Biobarrier 1
IW-70-SSB109 (126-166 Ft bgs)



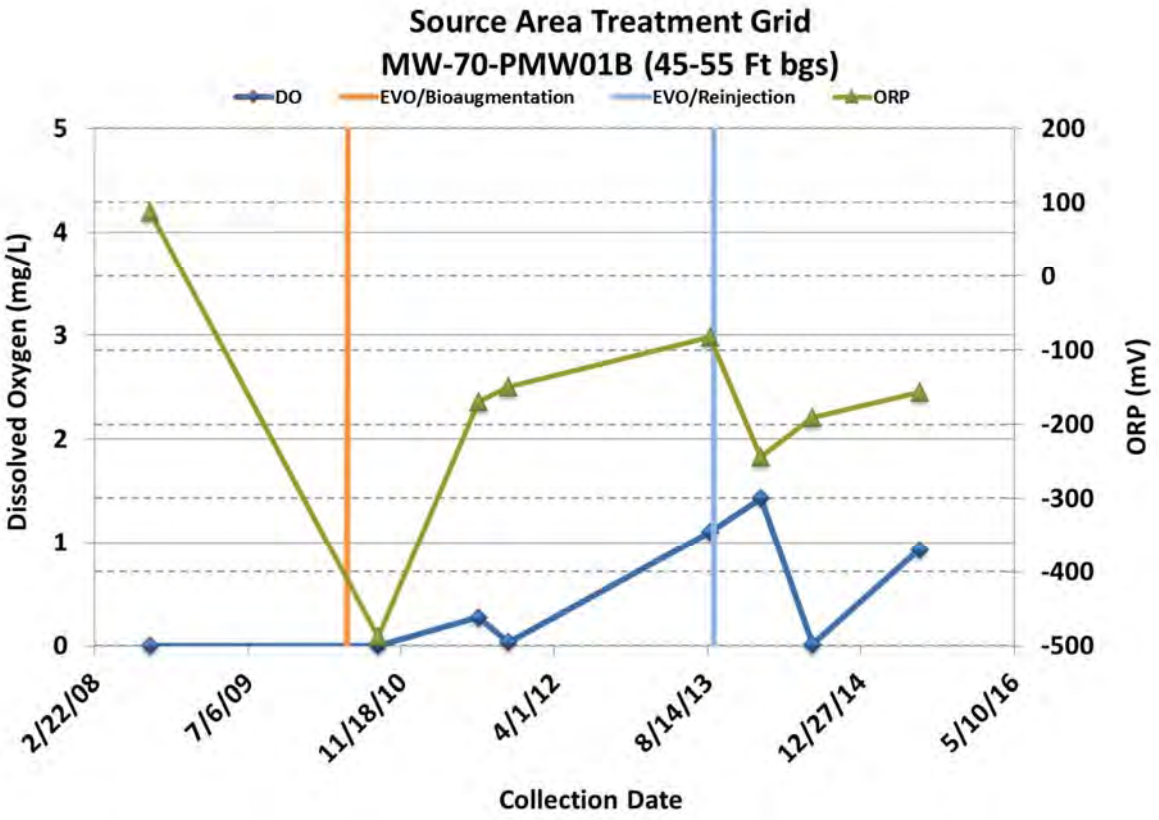
This Page Intentionally Left Blank

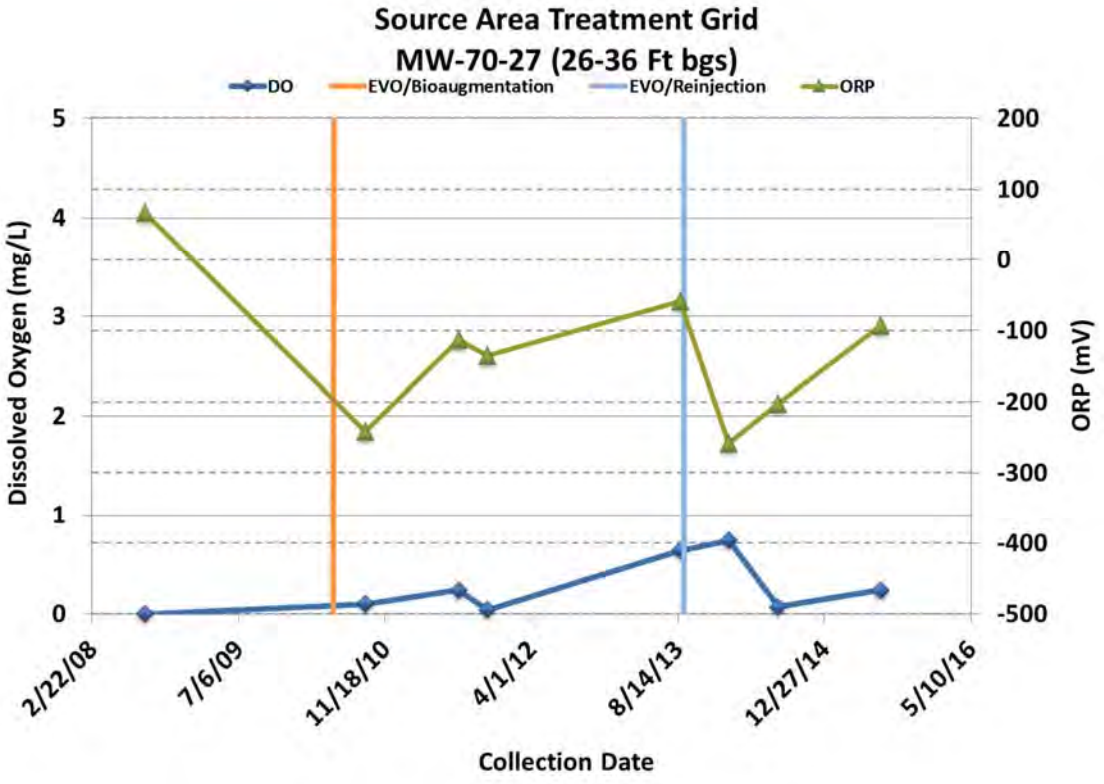
Figure 44 - Water Quality Trends – Second Sand Biobarrier 1
MW-70-PMW14B (149-159 Ft bgs)



This Page Intentionally Left Blank

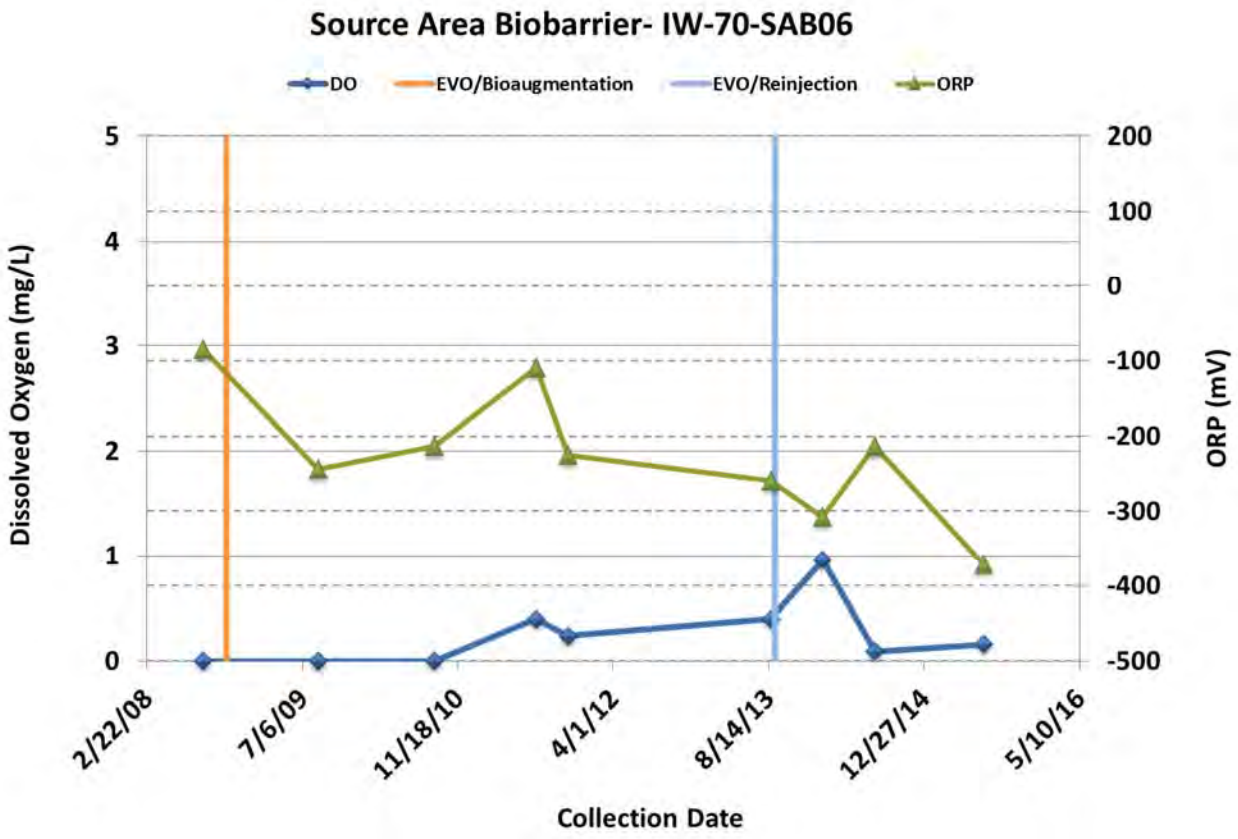
Figure 45 - DO/ORP Trends – Source Area Treatment Grid

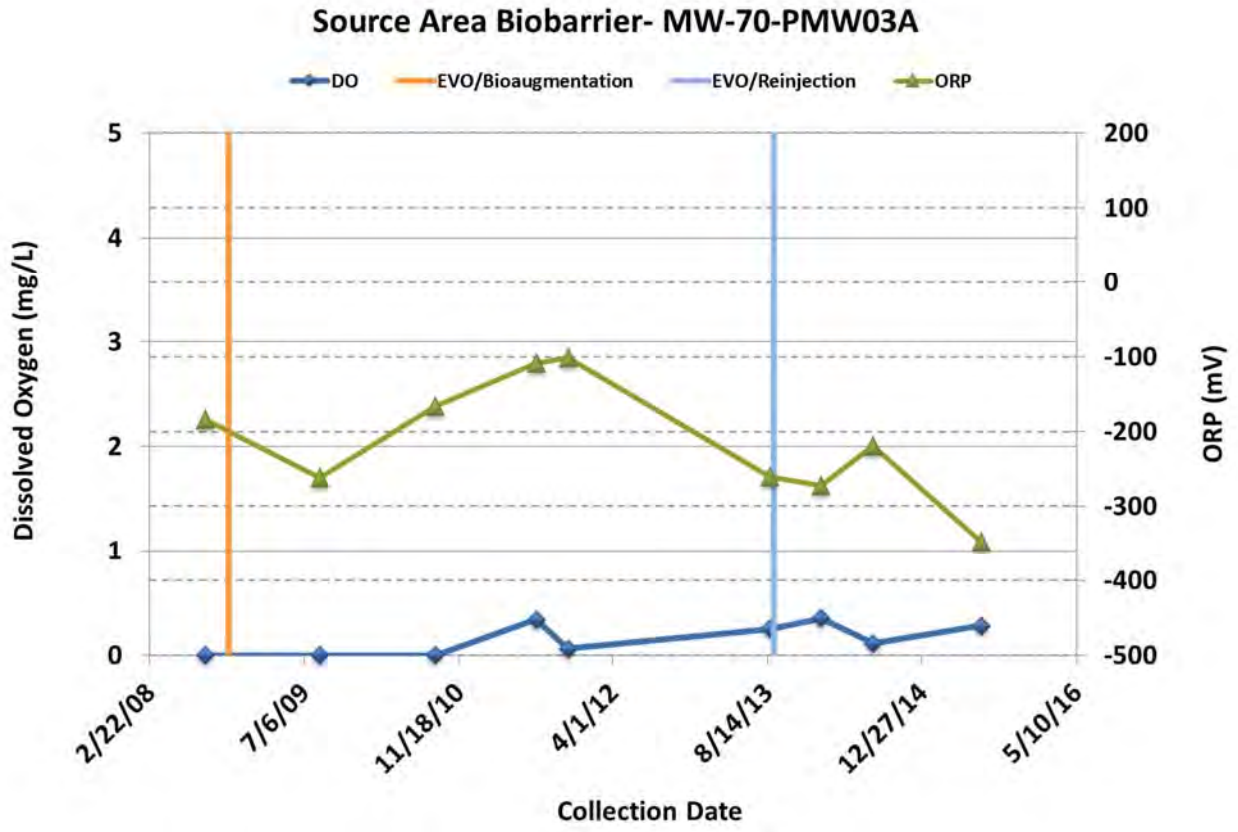




This page intentionally left blank

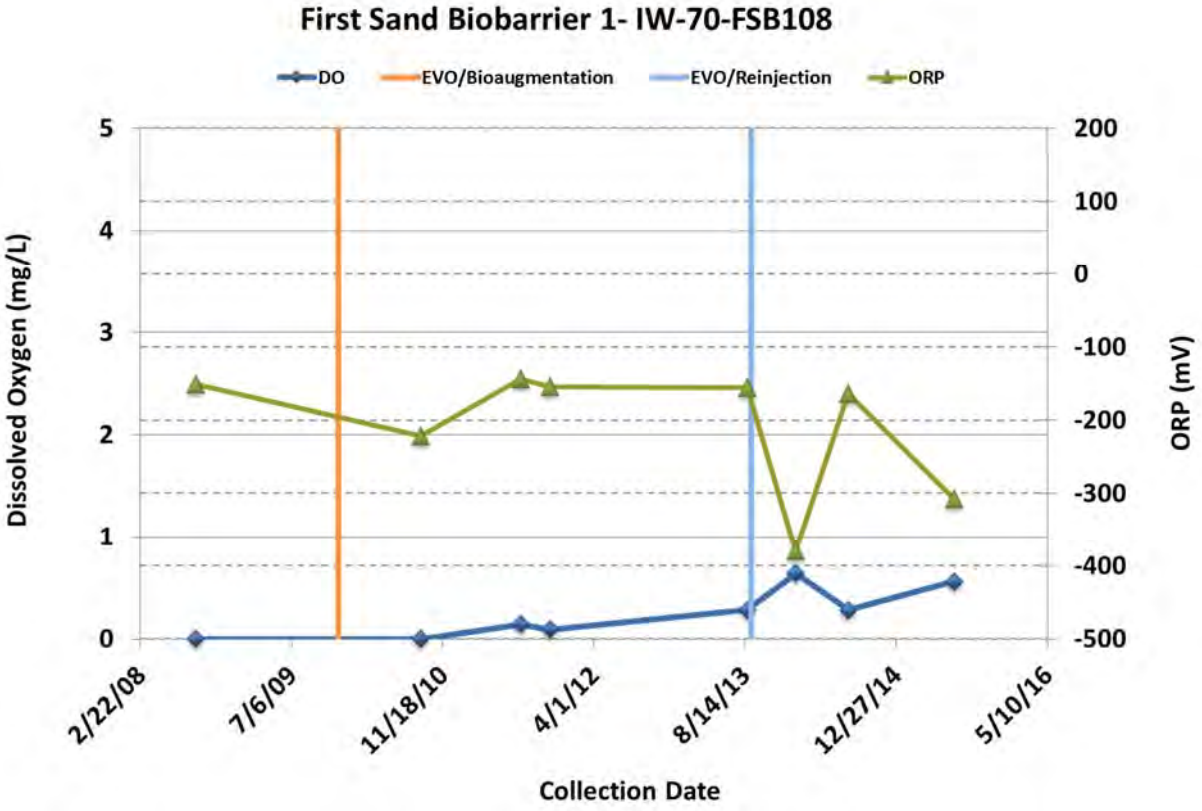
Figure 46 - DO/ORP Trends –Source Area Biobarrier

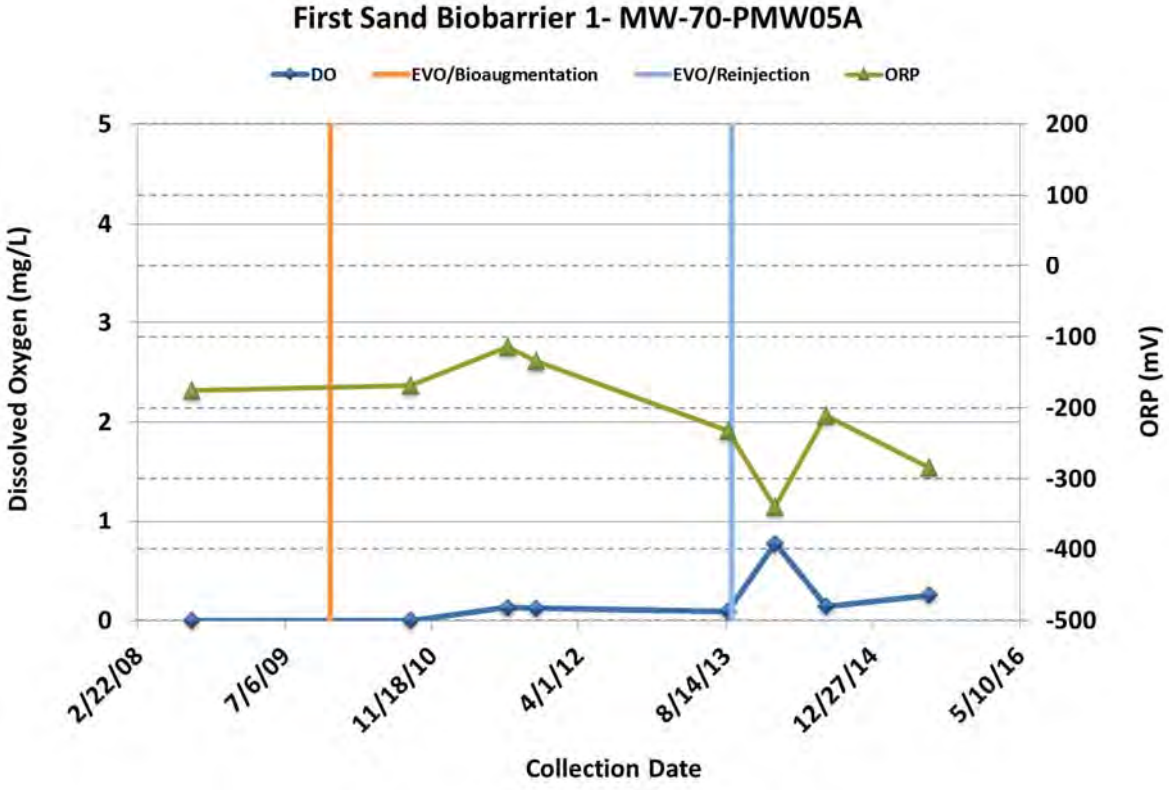




This page intentionally left blank

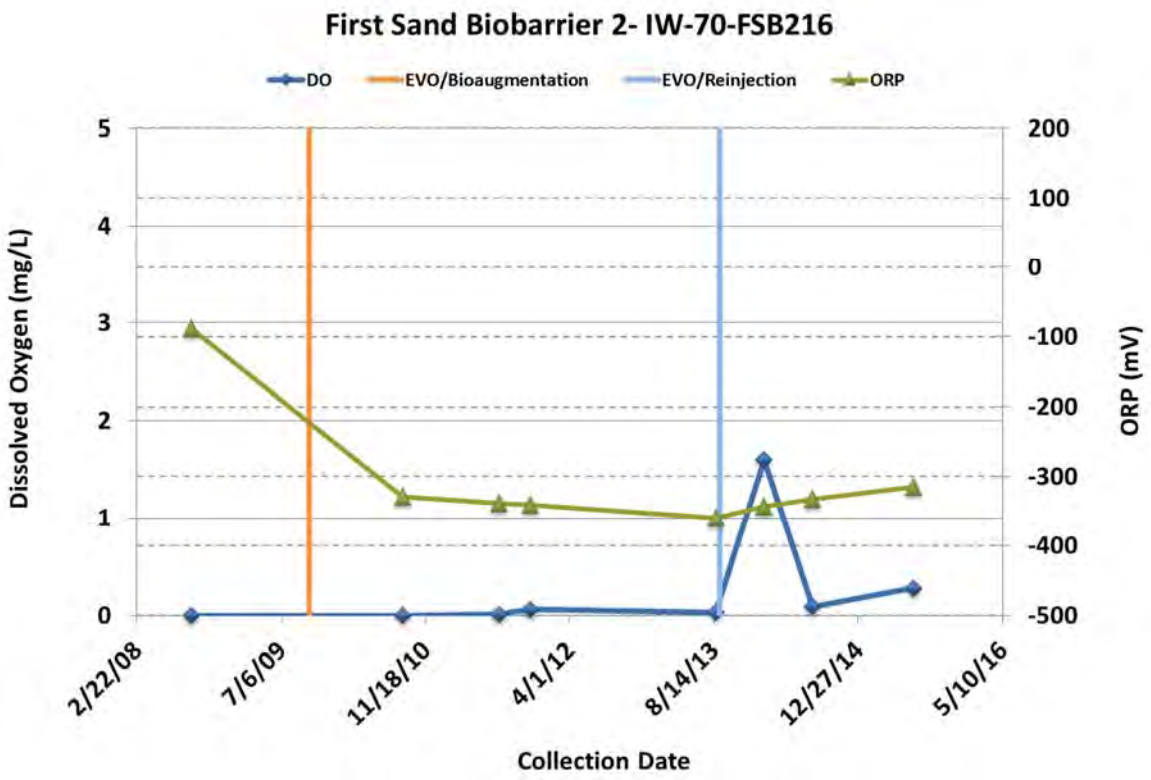
Figure 47 - DO/ORP Trends –First Sand Biobarrier 1

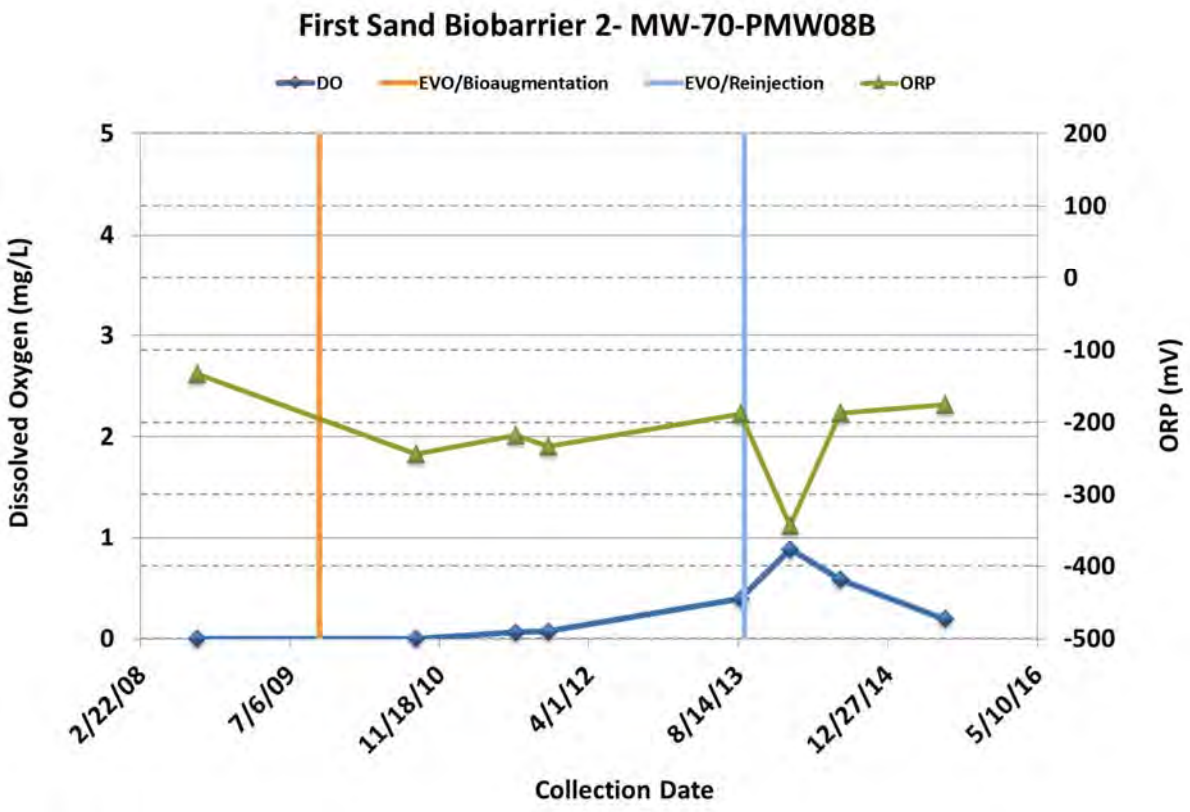




This page intentionally left blank

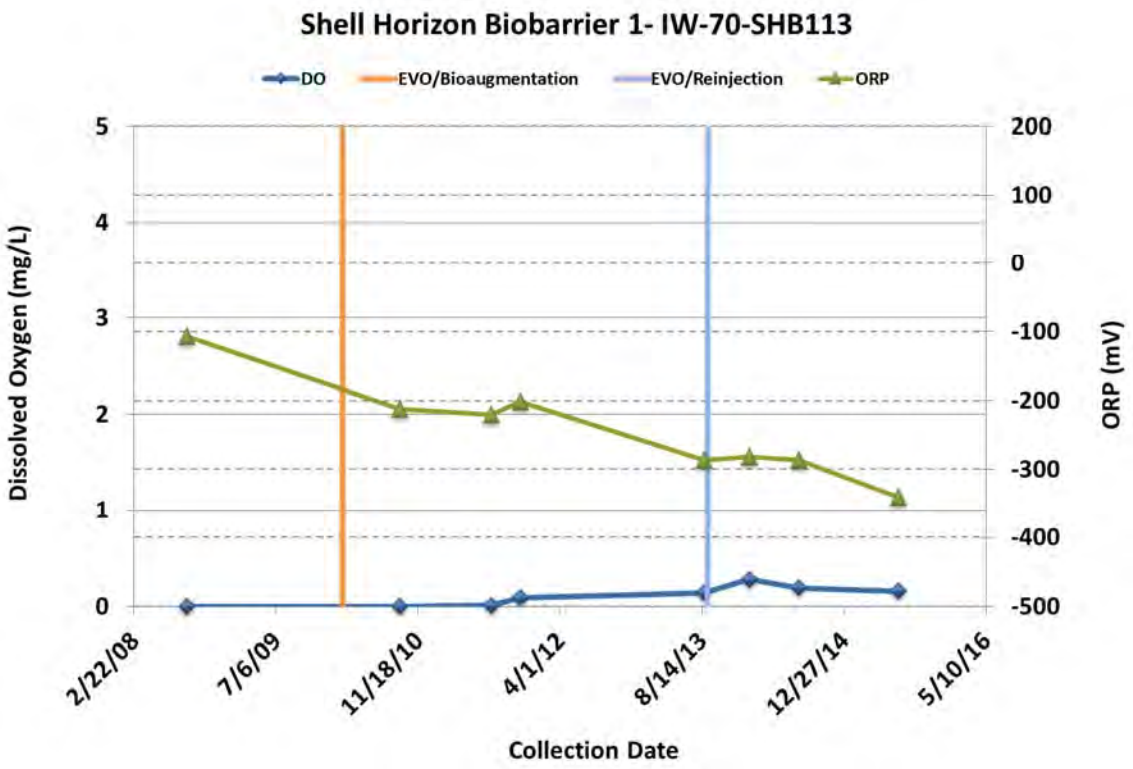
Figure 48 - DO/ORP Trends –First Sand Biobarrier 2

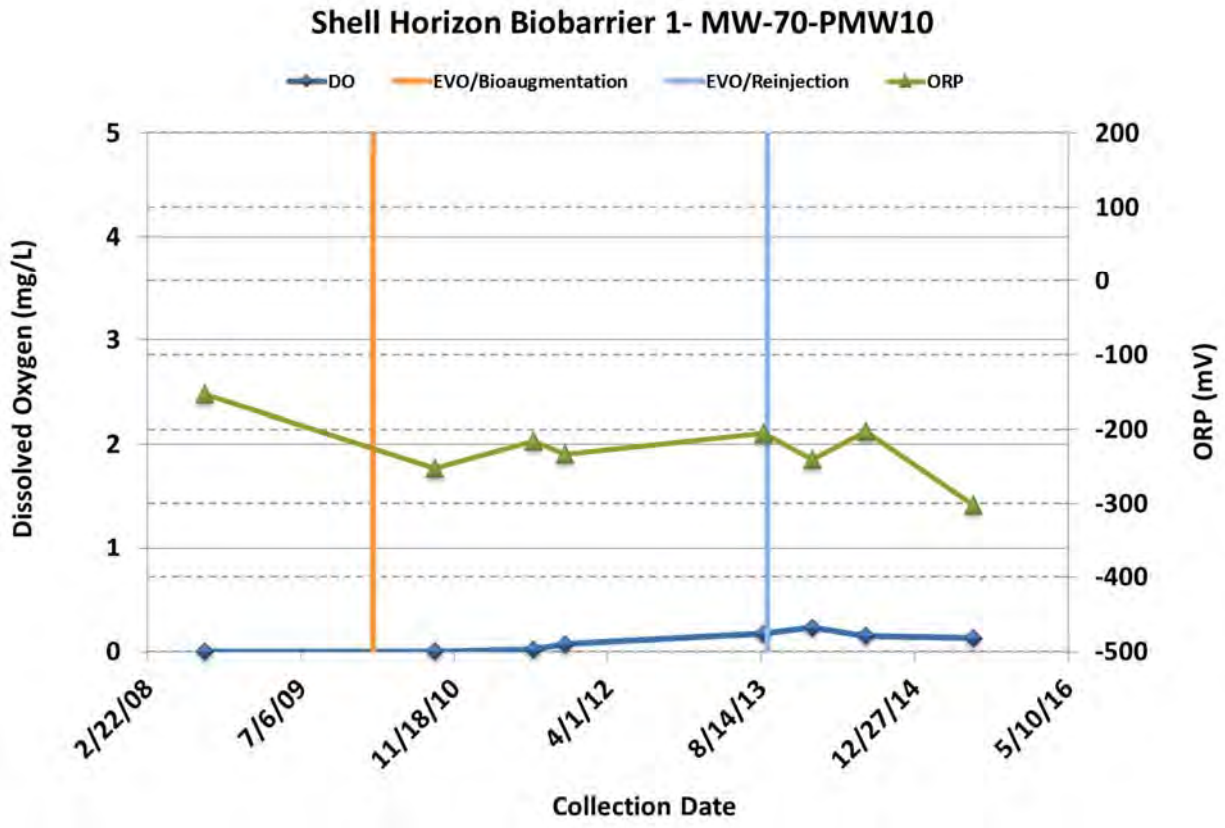




This page intentionally left blank

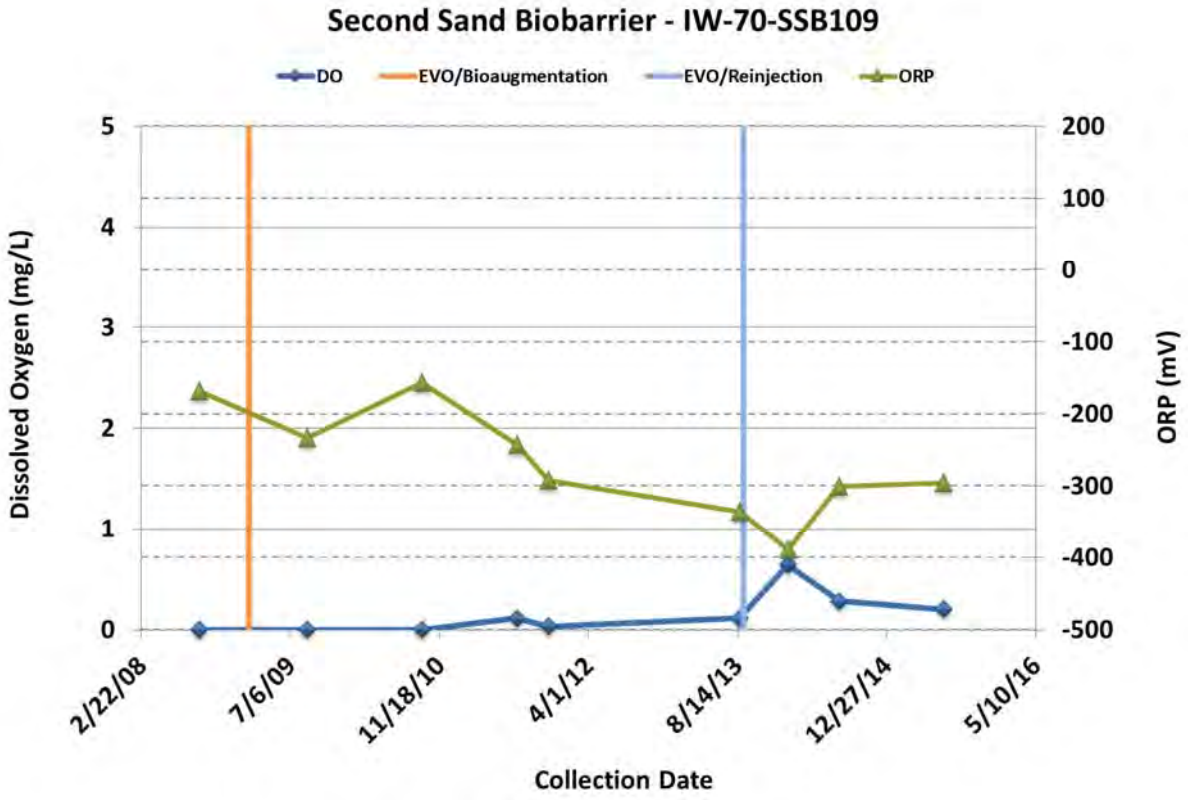
Figure 49 - DO/ORP Trends –Shell Horizon Biobarrier 1

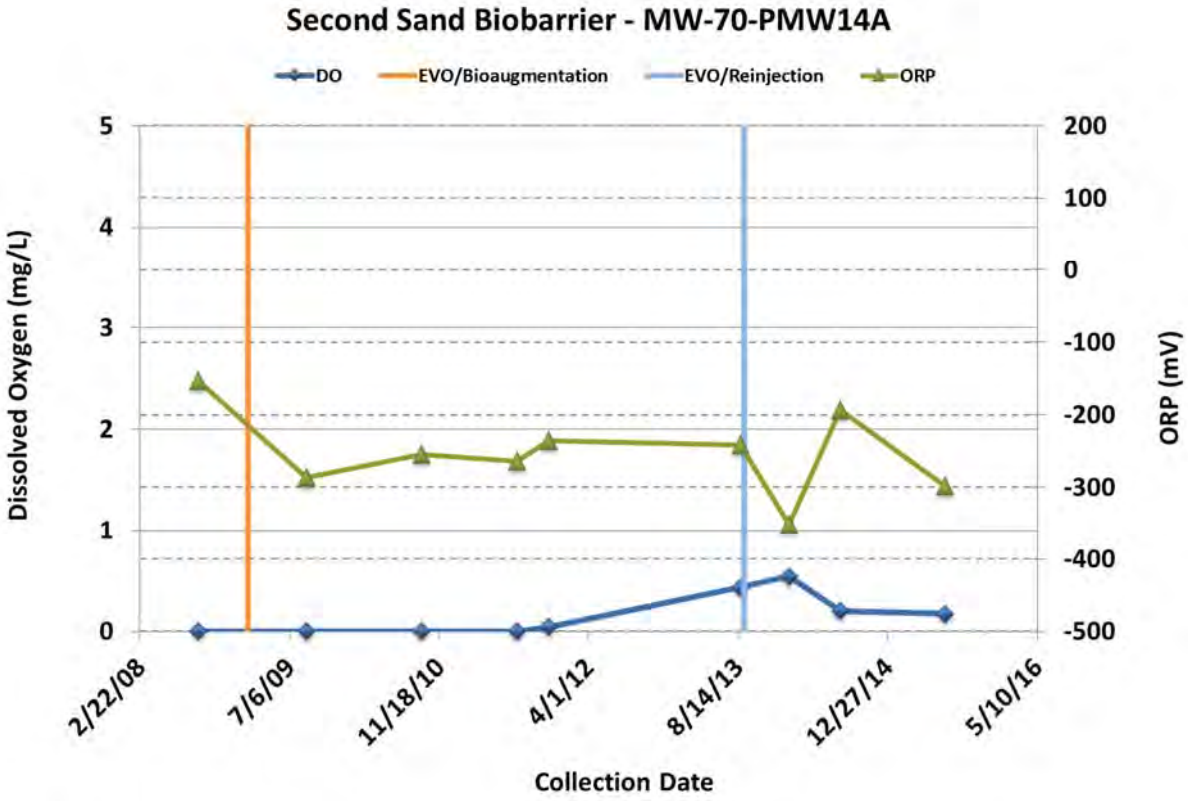




This page intentionally left blank

Figure 50 - DO/ORP Trends –Second Sand Biobarrier 1





This page intentionally left blank

APPENDIX A
FIELD SAMPLING LOGS
(on CD only)

This page intentionally left blank.

List of Wells for Groundwater Level Mesurements
IR Site 70, Naval Weapons Station Seal Beach, Seal Beach, California

Well Number	Screen Interval (feet bgs)	July 2015 Semi-Annual Event				
		Date	Time	Depth to Groundwater (feet below TOC)	Total Depth of the Well (feet)	Comments
Upper Fines		7-6-15				
MW-70-03	20-30	↓	1433	12.70		
Source Area Treatment/Upper Fines						
MW-70-PMW01A	25-35	7-6-15	0900	13.66		
MW-70-PMW01B	45-55		0902	14.84		
MW-70-27	26-36		0908	13.88		
MW-70-28	50-60		0910	15.06		
MW-70-MNA01	40-50		0916	15.04		
MW-70-MNA02	35-45		0842	13.82		
MW-70-MNA03	35-45		0850	14.48		
MW-70-MNA04	35-45	↓	0835	13.61		
Source Area Biobarrier/First Sand						
MW-70-PMW02A	71-81	7-6-15	0930	15.39		
MW-70-PMW02B	90-100		0932	15.45		
IW-70-SAB06	65-80/85-105		0948	15.13		
MW-70-MNA05	70-80		0938	14.83		
MW-70-PMW03A	70-80		0944	15.05		
MW-70-PMW03B	90-100	↓	0945	15.05		
First Sand Biobarrier 1						
MW-70-38	80-100	7-6-15	0901	14.28		
IW-70-FSB118	60-105		0906	8.67		
MW-70-PMW06A	70-80		0915	11.49		
MW-70-PMW06B	91-101		0920	11.54		
MW-70-PMW04A	70-80	↓	0936	11.89		

List of Wells for Groundwater Level Mesurements
IR Site 70, Naval Weapons Station Seal Beach, Seal Beach, California

Well Number	Screen Interval (feet bgs)	July 2015 Semi-Annual Event				
		Date	Time	Depth to Groundwater (feet below TOC)	Total Depth of the Well (feet)	Comments
MW-70-PMW04B	90-100	7-6-15	0943	11.99		
IW-70-FSB108	60-105		0948	12.00		
MW-70-PMW05A	70-80		0953	11.62		
MW-70-PMW05B	90-100		0958	11.72		
RDO-5	65-105					
MW-70-MNA08	80-90					
MW-70-MNA06	80-90					
MW-70-MNA11	80-90		1027	16.31		
MW-70-MNA07	90-100					
First Sand Biobarrier 2						
MW-70-PMW07A	65-75	7-6-15	1040	16.15		
MW-70-PMW07B	85-95		1038	16.84		
IW-70-FSB216	65-100		1042	15.98		
MW-70-PMW08A	65-75		1050	18.11		
MW-70-PMW08B	85-95		1052	19.39		
MW-70-MNA09	64-74		1106	14.90		
MW-70-MNA10	75-85		1100	17.48		
MW-70-MNA12	75-85		1118	16.63		
MW-70-43A	86-106		1135	22.14		
Shell Horizon Biobarrier 1						
MW-70-PMW09	120-130	7-6-15				
IW-70-SHB113	105-130					
MW-70-PMW10	120-130					
IW-70-SHB217	105-130					
MW-70-MNA13	115-125					

3

List of Wells for Groundwater Level Mesurements
IR Site 70, Naval Weapons Station Seal Beach, Seal Beach, California

Well Number	Screen Interval (feet bgs)	July 2015 Semi-Annual Event				
		Date	Time	Depth to Groundwater (feet below TOC)	Total Depth of the Well (feet)	Comments
Shell Horizon Biobarrier 3						
MW-70-PMW11A	85-95	7-6-15	1145	19.79		
MW-70-PMW11B	115-125		1147	19.20		
IW-70-SHB310	80-95/105-		~~1150~~ 1212		18.60	
MW-70-PMW12A	85-95		1152	19.24		
MW-70-PMW12B	115-125		1150	19.16		
MW-70-MNA14	115-125					
Second Sand Biobarrier 1						
MW-70-PMW13A	125-135	7-6-15				
MW-70-PMW13B	145-155					
IW-70-SSB109	126-166					
MW-70-PMW14A	128-138					
MW-70-PMW14B	149-159					
MW-70-MNA16	141-151		1230	20.04		
MW-70-MNA17	140-150					
MW-70-MNA15	140-150					
MW-70-15	161-171		1236	21.86		
MW-70-14	160-170					
MW-70-43B	136-146		1137	22.02		
Point of Compliance/Upper Fines						
MW-70-02	20-30	7-6-15				
MW-70-10	30-40					
MW-70-17	30-40					
MW-70-22	20-30		1348	11.25		

4

List of Wells for Groundwater Level Mesurements
IR Site 70, Naval Weapons Station Seal Beach, Seal Beach, California

Well Number	Screen Interval (feet bgs)	July 2015 Semi-Annual Event				
		Date	Time	Depth to Groundwater (feet below TOC)	Total Depth of the Well (feet)	Comments
Point of Compliance/First Sand						
MW-70-POC01	80-90	7-6-15				
MW-70-11	80-100					
MW-70-35	90-100					
MW-70-16	95-105		1320	21.73		
Point of Compliance/Shell Horizon						
MW-70-23	110-130	7-6-15				
Point of Compliance/Second Sand						
MW-70-36	150-160	7-6-15	1419	20.08		
MW-70-21	150-170		1400	21.86		
Point of Compliance/Deep Sand						
MW-70-POC02	190-200	7-6-15				
MW-70-POC03	190-200		1415	20.08		
MW-70-POC04	195-205		1358	23.56		

Acronyms/Abbreviations:
- bgs - below ground surface
- MSL - mean sea level
- NA - not available
- TOC - top of casing

5

List of Wells for Groundwater Level Mesurements
IR Site 70, Naval Weapons Station Seal Beach, Seal Beach, California

Well Number	Screen Interval (feet bgs)	July 2015 Semi-Annual Event				
		Date	Time	Depth to Groundwater (feet below TOC)	Total Depth of the Well (feet)	Comments
Upper Fines						
MW-70-03 D	20-30					
Source Area Treatment/Upper Fines						
MW-70-PMW01A	25-35					
MW-70-PMW01B	45-55					
MW-70-27	26-36					
MW-70-28	50-60					
MW-70-MNA01	40-50					
MW-70-MNA02	35-45					
MW-70-MNA03	35-45					
MW-70-MNA04	35-45					
Source Area Biobarrier/First Sand						
MW-70-PMW02A	71-81					
MW-70-PMW02B	90-100					
IW-70-SAB06	65-80/85-105					
MW-70-MNA05	70-80					
MW-70-PMW03A	70-80					
MW-70-PMW03B	90-100					
First Sand Biobarrier 1						
MW-70-38	80-100	7/6/15	0901	14.28		
IW-70-FSB118	60-105	"	0906	8.67		THICK SUBSTANCE / MADE BY POSSIBLE INJECTION REACTION ON TOP OF
MW-70-PMW06A	70-80	"	0915	11.49		
MW-70-PMW06B	91-101	"	0920	11.54		
MW-70-PMW04A	70-80	"	0936	11.89		

List of Wells for Groundwater Level Mesurements
IR Site 70, Naval Weapons Station Seal Beach, Seal Beach, California

Well Number	Screen Interval (feet bgs)	July 2015 Semi-Annual Event				
		Date	Time	Depth to Groundwater (feet below TOC)	Total Depth of the Well (feet)	Comments
MW-70-PMW04B	90-100	7/6/15	0943	11.88		
IW-70-FSB108	60-105	"	0948	12.00		
MW-70-PMW05A	70-80	"	0953	11.62		
MW-70-PMW05B	90-100	"	0958	11.72		
RDO-5	65-105	"	1059	13.43		
MW-70-MNA08	80-90	"	1052	15.09		
MW-70-MNA06	80-90	"	1025	11.43		
MW-70-MNA11	80-90	"	1140	16.25		
MW-70-MNA07	90-100	"	1035	12.14		
First Sand Biobarrier 2						
MW-70-PMW07A	65-75					
MW-70-PMW07B	85-95					
IW-70-FSB216	65-100					
MW-70-PMW08A	65-75					
MW-70-PMW08B	85-95	7/6/15	1052	19.39		
MW-70-MNA09	64-74					
MW-70-MNA10	75-85					
MW-70-MNA12	75-85					
MW-70-43A	86-106					
Shell Horizon Biobarrier 1						
MW-70-PMW09	120-130	"	1110	17.13		
IW-70-SHB113	105-130	"	1115	16.74		
MW-70-PMW10	120-130	"	1120	16.95		
IW-70-SHB217	105-130	"	1148	19.51		
MW-70-MNA13	115-125	"	1125	16.94		

List of Wells for Groundwater Level Mesurements
IR Site 70, Naval Weapons Station Seal Beach, Seal Beach, California

Well Number	Screen Interval (feet bgs)	July 2015 Semi-Annual Event				
		Date	Time	Depth to Groundwater (feet below TOC)	Total Depth of the Well (feet)	Comments
Shell Horizon Biobarrier 3						
MW-70-PMW11A	85-95					
MW-70-PMW11B	115-125					
IW-70-SHB310	80-95/105-					
MW-70-PMW12A	85-95	7/6/15	1152	19.24		
MW-70-PMW12B	115-125	"	1150	19.16		
MW-70-MNA14	115-125	"	1153	20.37		
Second Sand Biobarrier 1						
MW-70-PMW13A	125-135	"	1200	18.00		
MW-70-PMW13B	145-155	"	1204	17.95		
IW-70-SSB109	126-166	"	1212	19.62		
MW-70-PMW14A	128-138	"	1216	17.92		
MW-70-PMW14B	149-159	"	1221	18.54		
MW-70-MNA16	141-151	"				
MW-70-MNA17	140-150	"	1231	19.43		
MW-70-MNA15	140-150	"	1409	16.39		
MW-70-15	161-171					
MW-70-14	160-170	"	1235	21.98		
MW-70-43B	136-146					
Point of Compliance/Upper Fines						
MW-70-02	20-30	"	1418	12.66		
MW-70-10	30-40	"	1345	14.67		
MW-70-17	30-40	"	1400	9.37		
MW-70-22	20-30					

8

List of Wells for Groundwater Level Mesurements
IR Site 70, Naval Weapons Station Seal Beach, Seal Beach, California

Well Number	Screen Interval (feet bgs)	July 2015 Semi-Annual Event				
		Date	Time	Depth to Groundwater (feet below TOC)	Total Depth of the Well (feet)	Comments
Point of Compliance/First Sand						
MW-70-POC01	80-90	7/6/15	0842	15.44		
MW-70-11 D	80-100	"	1350	20.04		
MW-70-35 D	90-100	"	1405	16.08		
MW-70-16 P	95-105					
Point of Compliance/Shell Horizon						
MW-70-23	110-130	"	1320	23.94		
Point of Compliance/Second Sand						
MW-70-36 P	150-160					
MW-70-21 P	150-170					
Point of Compliance/Deep Sand						
MW-70-POC02	190-200	"	1325	23.51		
MW-70-POC03 P	190-200					
MW-70-POC04 P	195-205					

Acronyms/Abbreviations:
- bgs - below ground surface
- MSL - mean sea level
- NA - not available
- TOC - top of casing

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW01A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 13.66
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump X Bladder Pump
Sampling Method: X Dedicated Tubing New Tubing Other ____

Start Purge Time: 0758 Flow Rate: 200mL/min Pump Depth: 30'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0801	23.1	6.52	7194	17	1.52	-311.3	600	14.24
0804	23.0	6.56	7829	9	0.53	-311.1	1200	14.28
0807	23.0	6.55	8382	7	0.32	-308.1	1800	14.32
0810	22.9	6.59	8467	7	0.30	-304.3	2400	14.38
0813	23.0	6.60	8505	7	0.28	-300.6	3000	14.40
0816	22.9	6.61	8499	7	0.27	-299.4	3600	14.40

Did well dewater? Yes (No)	Amount actually evacuated: 3600mL
Sampling Time: 0819	Sampling Date: 7-7-15
Sample I.D.: IR70-SA15-001	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (SEE SOW) - (9)
Equipment Blank I.D.: @ Time	Duplicate I.D.:

TB: IR70-SA15-041 @ 0745

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: Insight
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW01B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 14.94
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump x Bladder Pump
Sampling Method: x Dedicated Tubing New Tubing Other ____

Start Purge Time: 0844 Flow Rate: 200 mL/min Pump Depth: 50'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0847	23.3	7.06	5849	5	0.90	-197.7	600	14.99
0850	23.1	6.73	6047	4	0.77	-178.6	1200	15.02
0853	23.0	6.46	6102	4	0.94	-171.0	1800	15.08
0856	23.0	6.44	6112	4	0.89	-160.6	2400	15.09
0859	23.0	6.43	6119	4	0.91	-158.7	3000	15.10
0902	22.9	6.41	6121	4	0.93	-156.8	3600	15.10

Did well dewater? Yes (No)	Amount actually evacuated: 3,600 mL
Sampling Time: 0905	Sampling Date: 7-7-15
Sample I.D.: IR70-SA15-002	Laboratory: E MAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE SOW (9)
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-27	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 13.88
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: PVC Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump ☒Bladder Pump
Sampling Method: ☒Dedicated Tubing New Tubing Other_____

Start Purge Time: 0947 Flow Rate: 200 mL/min Pump Depth: 30'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0950	24.9	6.75	17,577	18	0.43	-100.2	600	13.98
0953	23.9	6.54	18,966	10	0.30	-94.4	1,200	14.10
0956	23.8	6.53	19,291	7	0.28	-88.3	1,800	14.16
0959	23.8	6.52	19,321	6	0.25	-89.6	2,400	14.18
1002	23.8	6.51	19,348	6	0.24	-90.1	3,000	14.20
1005	23.8	6.51	19,354	6	0.24	-92.7	3,600	14.20

Did well dewater? Yes (No)	Amount actually evacuated: 3,600
Sampling Time: 1005	Sampling Date: 7-7-15
Sample I.D.: IR70-SA15-003	Laboratory: E-MAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE SOW
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-29	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 15.06
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump ×Bladder Pump

Sampling Method: ×Dedicated Tubing New Tubing Other ____

Start Purge Time: 1037 Flow Rate: 200 mL/MIN Pump Depth: 55'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1041	23.4	6.75	6529	14	0.69	-90.6	600	15.06
1044	23.3	6.49	6779	9	0.47	-124.2	1200	15.08
1047	23.5	6.45	6871	5	0.31	-129.2	1800	15.09
1050	23.7	6.43	6884	6	0.29	-129.4	2400	15.09
1053	23.7	6.42	6885	5	0.28	-126.9	3000	15.09

Did well dewater? Yes (No)	Amount actually evacuated: 3000 mL
Sampling Time: 1056	Sampling Date: 7-7-15
Sample I.D.: IR70-SA15-004	Laboratory: G-MAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE SOW
Equipment Blank I.D.: @ Time	Duplicate I.D.: IR70-SA15-005 @ 1435

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: IW-70-SAB06	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 15.13
Depth to Free Product: -	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump ✗ Bladder Pump
Sampling Method: ✗ Dedicated Tubing New Tubing Other ____

Start Purge Time: 1147 Flow Rate: 200 ml/min Pump Depth: 95'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1150	24.4	6.60	2463	10	0.39	-288.2	600	15.30
1153	24.0	6.42	2334	9	0.24	-340.2	1200	15.32
1156	24.0	6.31	2096	5	0.21	-355.2	1800	15.33
1159	23.9	6.26	2010	5	0.19	-365.4	2400	15.33
1202	23.9	6.24	1997	4	0.16	-370.1	3000	15.33
1205	23.9	6.23	1996	4	0.16	-371.9	3600	15.33

Did well dewater? Yes (No)	Amount actually evacuated: 3,600
Sampling Time: 1508	Sampling Date: 7-7-15
Sample I.D.: IR70-SA15-006	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (SEE SOW)
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW03A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 15.05
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: PVC Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump ×Bladder Pump
Sampling Method: ×Dedicated Tubing New Tubing Other ____

Start Purge Time: 1257 Flow Rate: 300 mL/min Pump Depth: 75'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1300	24.3	6.63	1911	3	0.25	-337.4	900	15.11
1303	24.3	6.58	1780	3	0.31	-342.5	1,800	15.10
1306	24.4	6.57	1772	2	0.29	-346.0	2,700	15.10
1309	24.3	6.57	1771	2	0.29	-348.2	3,600	15.10

Did well dewater? Yes (No)	Amount actually evacuated: 3,600
Sampling Time: 1312	Sampling Date: 7-7-15
Sample I.D.: IR70-SA15-007	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (See SOW)
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW033	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 15.05
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump Bladder Pump
Sampling Method: Dedicated Tubing New Tubing Other ____

Start Purge Time: 1322 Flow Rate: 300 Pump Depth: 95'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1325	24.3	7.21	2344	17	0.19	-316.7	900	15.12
1328	23.8	6.80	2182	4	0.30	-340.2	1,800	15.12
1331	23.9	6.76	2125	3	0.33	-344.6	2,700	15.12
1334	23.8	6.71	2128	3	0.30	-348.2	3,600	15.12

Did well dewater? Yes (No)	Amount actually evacuated: 3600 mL
Sampling Time: 1337	Sampling Date: 7-7-15
Sample I.D.: IR70-SA15-008	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: See Sow
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: IW-70-FSB11C	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): -	Depth to Water (ft.): 8.67
Depth to Free Product: -	Thickness of Free Product (feet): -
Referenced to: (PVC) Grade	Flow Cell Type: SS6

Purge Method: 2" Grundfos Pump Peristaltic Pump *Bladder Pump
Sampling Method: Dedicated Tubing *New Tubing Other_____

Start Purge Time: 0800 Flow Rate: 200mL/min Pump Depth: 8.5'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0807	21.5	6.04	3235	91	1.90	-132.5	600	8.81
0810	21.5	6.06	3373	96	0.45	-163.2	1200	8.92
0813	21.5	6.06	3388	84	0.44	-165.4	1800	8.94
0816	21.5	6.07	3390	81	0.43	-168.6	2400	8.95
0819	21.5	6.08	3391	79	0.43	-170.1	3000	8.95

Did well dewater? Yes (No)	Amount actually evacuated: 3,000 mL
Sampling Time: 0822	Sampling Date: 7-8-15
Sample I.D.: IR70-SA15-010	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: See SOW
Equipment Blank I.D.: IR70-SA15-049 @ Time 0840	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW06A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 11.49
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump X Bladder Pump

Sampling Method: X Dedicated Tubing New Tubing Other ____

Start Purge Time: 0912 Flow Rate: 300mL/min Pump Depth: 75'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0915	22.5	7.00	2733	10	0.49	-249.7	900	11.65
0919	22.4	6.93	2950	5	0.30	-247.2	1800	11.67
0921	22.4	6.92	2981	5	0.32	-243.6	2700	11.67
0924	22.4	6.91	3006	5	0.32	-242.1	3600	11.67

Did well dewater? Yes (No)	Amount actually evacuated: 3600
Sampling Time: 0927	Sampling Date: 7-8-15
Sample I.D.: IR70-SP15-011	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE SOW
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: Insight
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW06B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 11.54
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: SS6

Purge Method: 2" Grundfos Pump Peristaltic Pump ×Bladder Pump
Sampling Method: ×Dedicated Tubing New Tubing Other ____

Start Purge Time: 1004 Flow Rate: 300 mL/min Pump Depth: 95'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1007	22.0	7.33	2189	4	0.29	-270.4	900	11.76
1010	22.0	7.33	2191	4	0.29	-270.4	1800	11.76
1013	22.0	7.35	2207	4	0.27	-270.5	2700	11.76
1016	22.0	7.37	2210	4	0.27	-274.0	3600	11.76

Did well dewater? Yes (No)	Amount actually evacuated: 3600
Sampling Time: 1019	Sampling Date: 7-9-15
Sample I.D.: IR70-SA15-012	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (See Sow)
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70 (MW04A)	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 11.89
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: SS6

Purge Method: 2" Grundfos Pump Peristaltic Pump ☒Bladder Pump

Sampling Method: ☒Dedicated Tubing New Tubing Other ____

Start Purge Time: 1252 Flow Rate: 300 mL/min Pump Depth: 75'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1255	23.3	7.28	1447	7	0.98	-274.9	900	12.04
1258	22.8	7.36	1398	4	0.27	-288.4	1,800	12.08
1301	22.7	7.30	1384	4	0.22	-300.4	2,700	12.08
1304	22.7	7.28	1383	4	0.21	-303.6	3,600	12.08

Did well dewater? Yes (No)	Amount actually evacuated: 3600
Sampling Time: 1307	Sampling Date: 7-8-15
Sample I.D.: IR70-SA15-013	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE SOW
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD ~~MW-70-PMW04B~~	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW04B	Well Diameter (in.): 2 3 (4) 6 8 ___
Total Well Depth (ft.): QED	Depth to Water (ft.): 11.88
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: SS6

Purge Method: 2" Grundfos Pump Peristaltic Pump *Bladder Pump

Sampling Method: *Dedicated Tubing New Tubing Other ___

Start Purge Time: 1318 Flow Rate: 300 ml/min Pump Depth: 95'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1321	24.0	7.21	1548	11	0.41	-307.4	900	12.10
1324	23.0	7.21	1541	5	0.25	-325.6	1,800	12.11
1327	23.0	7.18	1532	4	0.24	-316.2	2,700	12.11
1330	23.0	7.16	1529	4	0.23	-317.6	3,600	12.11

Did well dewater? Yes (No)	Amount actually evacuated: 3,600
Sampling Time: 1333	Sampling Date: 7-6-15
Sample I.D.: IR70-SA15-014	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (SEE SOW)
Equipment Blank I.D.: @ Time	Duplicate I.D.: IR70-SA15-015 @1520

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: Insight
Sampler: ~~IW-70-FSB105~~ PD	Gauging Date: 7-6-15
Well I.D.: IW-70-FSB 109	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 8.67 12.00
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (X) Bladder Pump
Sampling Method: (X) Dedicated Tubing New Tubing Other ____

Start Purge Time: 1144 Flow Rate: 300 mL/min – ~~*~~ 200 mL/min Pump Depth: 85'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1147	22.0	6.63	2117	17	0.27	-258.6	900	12.24
1150	22.1	6.50	2111	9	0.63	-304.9	1800	12.28
1153	22.1	6.57	2111	8	0.59	-305.1	2,400	12.30 *
1156	22.1	6.53	2114	8	0.59	-306.7	3,000	12.30
1159	22.2	6.54	2115	8	0.56	-308.3	3,600	12.30

Did well dewater? Yes (No)	Amount actually evacuated: 3,600
Sampling Time: 1202	Sampling Date: 7-8-15
Sample I.D.: IR70-SA15-016	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: (SEE SOW)
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150600-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW05A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 11.62
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump ☒Bladder Pump

Sampling Method: ☒Dedicated Tubing New Tubing Other_____

Start Purge Time: 1030 Flow Rate: 300mL/min Pump Depth: 75'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1033	21.9	7.40	1283	9	0.28	-310.2	900	11.78
1036	21.9	7.27	1296	3	0.25	-279.6	1800	11.80
1039	21.9	7.24	1296	3	0.26	-282.4	2700	11.80
1042	21.9	7.24	1295	3	0.25	-284.6	3600	11.80

Did well dewater? Yes (No)	Amount actually evacuated: 3600 mL
Sampling Time: 1045	Sampling Date: 7-8-15
Sample I.D.: IR70-SA15-017	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other:
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW0513	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 11.72
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump ✗ Bladder Pump
Sampling Method: ✗ Dedicated Tubing New Tubing Other ____

Start Purge Time: 1111 Flow Rate: 300 mL/min Pump Depth: 95'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1114	22.1	6.57	1589	2	0.37	-250.3	900	11.90
1117	21.9	6.62	1665	2	0.59	-265.2	1,800	11.91
1120	21.9	6.60	1670	2	0.65	-268.2	2,700	11.91
1123	21.9	6.60	1672	2	0.66	-268.6	3,600	11.91

Did well dewater? Yes (No)	Amount actually evacuated: 3,600 mL
Sampling Time: 1126	Sampling Date: 7-9-15
Sample I.D.: IR70-SA15-018	Laboratory: E Max
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE SOW
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW07A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 16.15
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: SS6

Purge Method: 2" Grundfos Pump Peristaltic Pump ×Bladder Pump
Sampling Method: ×Dedicated Tubing New Tubing Other ____

Start Purge Time: 1410 Flow Rate: 300 mL/min Pump Depth: 70'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1421	22.5	6.67	35008	2	0.33	-269.7	900	16.35
1424	22.3	6.49	44601	2	0.29	-277.0	1,800	16.36
1427	22.2	6.47	44613	2	0.31	-288.0	2,700	16.36
1430	22.2	6.47	44559	2	0.33	-291.3	3,600	16.36

Did well dewater? Yes (No)	Amount actually evacuated: 3,600
Sampling Time: 1433	Sampling Date: 7-8-15
Sample I.D.: IR70-SA15-019	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SCESOV
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW073	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 16.84
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump *Bladder Pump
Sampling Method: *Dedicated Tubing New Tubing Other ____

Start Purge Time: 1446 Flow Rate: 300 mL/min - *200 mL/min Pump Depth: 90'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1451	22.5	7.33	5343	3	0.30	-332.7	900	16.92
1454	22.4	7.28	5986	2	0.26	-369.9	1800	17.02 *
1457	22.5	7.25	6598	2	0.23	-344.6	2400	17.08
1500	22.8	7.23	6608	2	0.24	-345.6	3,000	17.09
1503	22.7	7.23	6612	2	0.24	-346.7	3,600	17.09

Did well dewater? Yes (No)	Amount actually evacuated: 3600 mL
Sampling Time: 1506	Sampling Date: 7-8-15
Sample I.D.: IR70-SA15-020	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEESON
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7/9/15
Well I.D.: IN-70-FSB 2/6	Well Diameter (in.): 2 3 (4) 6 8 ___
Total Well Depth (ft.): QEO	Depth to Water (ft.): 16.08
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated) Tubing New Tubing Other ___

Start Purge Time: 0810 Flow Rate: 300 ML/MIN Pump Depth: 83'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0813	21.6	6.11	26500	49.5	1.02	-281.5	900	16.18
0816	21.6	6.39	26631	46.2	0.73	-298.4	1800	16.19
0819	21.6	6.42	26577	44.2	0.55	-303.2	2700	16.19
0822	21.6	6.43	26619	42.1	0.30	-310.6	3600	16.19
0825	21.6	6.40	26631	39.8	0.28	-313.9	4500	16.19
0828	21.6	6.39	26612	39.9	0.28	-315.2	5400	16.19

Did well dewater? Yes (No) Amount actually evacuated: 5400 ML/MIN

Sampling Time: 0830 Sampling Date: 7/9/15

Sample I.D.: IP70-S15-021 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706 DF	Client: INSIGHT
Sampler: DF	Gauging Date: 7/9/15
Well I.D.: IW-70-SSB119	Well Diameter (in.): 2 3 (4) 6 8 ___
Total Well Depth (ft.): 165.67	Depth to Water (ft.): 20.99
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: Dedicated Tubing (New) Tubing Other ___

Start Purge Time: 0923 Flow Rate: 200ml/min Pump Depth: 145'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0927	22.6	6.62	10392	40	0.61	-313.6	800	21.17
0931	22.5	6.60	10336	37	0.52	-314.9	1600	21.20
0935	22.5	6.58	10399	30	0.27	-320.2	2400	21.21
0939	22.4	6.55	10424	29	0.25	-323.8	3200	21.21
0943	22.4	6.54	10468	28	0.26	-319.6	~~3800~~ 4000	21.21

Did well dewater? Yes (No) Amount actually evacuated: 4.0 L

Sampling Time: 0945 Sampling Date: 7/9/15

Sample I.D.: IW70-SA15-036 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: ~~SEE~~ COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7/9/15
Well I.D.: MW-70-49	Well Diameter (in.): 2 3 (4) 6 8 ___
Total Well Depth (ft.): 165.38	Depth to Water (ft.): 19.36
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated Tubing New (Tubing) Other ___

Start Purge Time: 1130 Flow Rate: 250 ml/min Pump Depth: 155

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1133	22.4	6.86	8800	10	1.01	-111.9	750	19.40
1136	22.4	6.83	8814	17	0.90	-120.6	1500	19.40
1139	22.4	6.81	8799	11	0.81	-127.6	2250	19.40
1142	22.4	6.85	8810	9	0.71	-131.2	3000	19.40
1145	22.4	6.87	8813	8	0.67	-135.8	3750	19.40
1148	22.4	6.87	8819	8	0.65	-139.9	4500	19.40

Did well dewater? Yes (No) Amount actually evacuated: 4500 ml

Sampling Time: 1150 Sampling Date: 7/9/15

Sample I.D.: IR70-SA15-039 Laboratory: Empax

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE C.O.C.

Equipment Blank I.D.: IR70-SA15-038 @ Time 1225 Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW12A	Well Diameter (in.): 2 3 (4) 6 8 ___
Total Well Depth (ft.): 94.75	Depth to Water (ft.): 19.24
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: Dedicated (Tubing) New Tubing Other ___

Start Purge Time: 0811 Flow Rate: 200 ml/min Pump Depth: 90'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0814	21.9	6.21	16317	38.3	0.64	-150.2	600	19.31
0817	21.8	6.23	16445	21.3	0.41	-182.9	1200	19.34
0820	21.8	6.25	16487	18.4	0.34	-178.3	1800	19.36
0823	21.8	6.25	16467	15.3	0.29	-207.0	2400	19.36
0826	21.8	6.26	16470	14.7	0.25	-239.5	3000	19.36
0829	21.8	6.26	16474	14.1	0.23	-244.0	3600	19.36
0831	21.8	6.27	16467	13.9	0.23	-254.5	4200	19.36

Did well dewater? Yes (No)	Amount actually evacuated: 4.2 L
Sampling Time: 0833	Sampling Date: 7-8-15
Sample I.D.: IR70-SA15-031	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other:
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF-1	Client: INSIGHT
Sampler: DF	Gauging Date: 7-8-15
Well I.D.: MW-70-14	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): 17.72	Depth to Water (ft.): 21.98
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated Tubing New (Tubing) Other ____

Start Purge Time: 0934 Flow Rate: 200 ml/min Pump Depth: 16.5'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0937	22.3	8.70	1631	54.4	1.83	-216.2	600	22.05
0940	22.1	6.95	6690	54.3	1.73	-192.3	1200	22.05
0943	22.2	6.78	7372	39.1	0.92	-212.3	1800	22.05
0946	22.1	6.78	7411	33.6	0.85	-215.3	2400	22.05
0949	22.2	6.77	7467	13.6	0.76	-222.5	3000	22.05
0952	22.1	6.78	7571	12.8	0.71	-231.6	3600	22.05
0955	22.1	6.78	7583	12.6	0.69	-235.4	4200	22.05

Did well dewater? Yes (No)	Amount actually evacuated: 4200 mL
Sampling Time: 0957	Sampling Date: 7/8/15
Sample I.D.: IR70SA15-040	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW11B	Well Diameter (in.): 2 3 (4) 6 8 ___
Total Well Depth (ft.): QED	Depth to Water (ft.): 19.20
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ___

Start Purge Time: 1112 Flow Rate: 300 ml/min Pump Depth: 120'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1115	22.3	6.82	5761	18.4	1.17	-247.3	900	19.27
1118	22.2	6.84	5892	12.3	0.86	-270.4	1800	19.27
1121	22.2	6.84	5911	12.6	0.69	-281.3	2700	19.28
1124	22.3	6.85	5926	12.3	0.47	-289.7	3600	19.28
1127	22.3	6.84	5929	11.9	0.43	-293.1	4500	19.28
1130	22.3	6.84	5932	11.5	0.46	-291.1	5400	19.29

Did well dewater? Yes (No)	Amount actually evacuated: 5400
Sampling Time: 1132	Sampling Date: 7-8-15
Sample I.D.: IR70-SA15-030	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150708-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7/8/15
Well I.D.: MW-70 PMW-13B	Well Diameter (in.): 2 3 (4) 6 8 ___
Total Well Depth (ft.): QED	Depth to Water (ft.): 17.95
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump Bladder Pump
Sampling Method: Dedicated Tubing New Tubing Other ___

Start Purge Time: 1229 Flow Rate: 400 ml/min Pump Depth: 155'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1232	21.4	7.00	13976	1.9	0.24	-303.2	1200	17.99
1235	21.4	7.01	12806	1.3	0.18	-317.5	2400	18.02
1238	21.4	7.02	12538	1.2	0.18	-325.1	3600	18.02
1241	21.4	7.02	12563	1.0	0.17	-328.2	4800	18.03
1244	21.5	7.02	12618	1.0	0.17	-329.5	6000	18.03

Did well dewater? Yes (No)	Amount actually evacuated: 6000 mL
Sampling Time: 1246	Sampling Date: 7/8/15
Sample I.D.: IR70SA15.035	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7/8/15
Well I.D.: MW-70-PMW-13A	Well Diameter (in.): 2 3 4 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 18.00
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: PVC Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump Bladder Pump
Sampling Method: Dedicated Tubing New Tubing Other_____

Start Purge Time: 1308 Flow Rate: 300 ml/min Pump Depth: 135'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1311	21.6	6.81	8199	8	0.25	-289.1	900	18.23
1314	21.6	6.85	8263	7	0.20	-299.2	1800	18.23
1317	21.5	6.87	8295	7	0.18	-318.1	2700	18.23
1320	21.5	6.83	8317	7	0.17	-321.6	3600	18.25
1323	21.5	6.80	8333	6	0.18	-327.0	4500	18.25

Did well dewater? Yes No	Amount actually evacuated: 4500 mL
Sampling Time: 1325	Sampling Date: 7/8/15
Sample I.D.: IR70-SA15-033	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other:
Equipment Blank I.D.: @ Time	Duplicate I.D.: IR70-SA15-034 @ 1600

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150708-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7/6/15
Well I.D.: MW-70-PMW14A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 17.92
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO+

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump

Sampling Method: Dedicated (Tubing) New Tubing Other ____

Start Purge Time: 1345 Flow Rate: 200 mL/min Pump Depth: 135'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1349	23.6	7.21	4697	20	0.61	-259.5	800	17.99
1353	23.7	7.20	4750	13	0.26	-302.4	1600	18.06
1357	22.4	~~7~~6.89	8219	10	0.19	-299.6	2400	18.06
1400	22.3	6.84	8715	9	0.17	-283.6	3200	18.06
1405	22.3	6.90	8419	9	0.17	-298.2	~~3800~~ 4000	18.06

Did well dewater? Yes (No) Amount actually evacuated: ~~3800 mL~~ 4000 mL

Sampling Time: 1407 Sampling Date: 7/8/15

Sample I.D.: IR70-SA15-037 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7/6/15
Well I.D.: MW-70-PMW148	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 18.54
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: Dedicated (Tubing) New Tubing Other ____

Start Purge Time: 1426 Flow Rate: 200 ml/min ↑ 300 ml/min Pump Depth: 155'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or (mL))	Depth to Water (ft.)
1430	23.6	6.93	133401	10	1.03	-261.3	800	18.54
1433	22.7	6.80	13431	7	0.42	-320.4	1700	18.59
1436	22.7	6.72	13009	5	0.19	-311.9	2600	18.59
1439	22.8	6.69	12541	5	0.19	-314.7	3500	18.59
1442	22.8	6.68	12737	4	0.20	-321.6	4400	18.59

Did well dewater? Yes (No)	Amount actually evacuated: 4.4 L
Sampling Time: 1444	Sampling Date: 7/8/15
Sample I.D.: IR70-SA15-038	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: IR70-SA15-039 @ 1530 Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7/6/15
Well I.D.: MW-70-38	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): DED PUMP	Depth to Water (ft.): 14.28
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: (Dedicated) Tubing New Tubing Other ____

Start Purge Time: 0804 Flow Rate: 350 mL/min Pump Depth: 90'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or (mL))	Depth to Water (ft.)
0807	21.4	6.41	3386	2.7	0.32	-116.0	1,050	14.31
0810	21.3	6.42	3381	3.7	0.38	-133.0	2100	14.31
0813	21.4	6.42	3378	2.9	0.27	-153.8	3150	14.31
0816	21.5	6.43	3370	2.6	0.24	-168.9	4200	14.31
0819	21.4	6.43	3377	2.3	0.25	-170.1	5250	14.31

Did well dewater? Yes (No)	Amount actually evacuated: 5250 mL
Sampling Time: 0821	Sampling Date: 7/7/15
Sample I.D.: IR70-SA15-009	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7/6/15
Well I.D.: MW-70 PMW 08B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): 0.ED	Depth to Water (ft.): 19.39
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: Dedicated (Tubing) New Tubing Other ____

Start Purge Time: 0831 Flow Rate: 300 ML/MIN Pump Depth: 90'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or (mL))	Depth to Water (ft.)
0934	21.8	6.86	6391	2.4	0.16	-196.6	900	19.41
0937	21.9	6.85	6378	1.8	0.14	-171.2	1800	19.41
0940	21.9	6.85	6380	1.6	0.15	-165.6	2700	19.41
0943	21.8	6.84	6363	1.5	0.21	-168.4	3600	19.41
0946	21.8	6.84	6356	1.8	0.18	-172.4	4500	19.41
0949	21.8	6.84	6350	1.9	0.19	-175.3	5400	19.41

Did well dewater? Yes (No)	Amount actually evacuated: 5400 ML
Sampling Time: 0951	Sampling Date: 7/6/15
Sample I.D.: IR70-GA15-023	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7/6/15
Well I.D.: MW-70-PMW08A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 18.11
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated) Tubing New Tubing Other ____

Start Purge Time: 1024 Flow Rate: 275 ml/min Pump Depth: 70'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1027	22.1	6.73	19187	1.6	0.18	-234.7	825	18.22
1030	22.1	6.75	19651	1.3	0.15	-254.9	1650	18.22
1033	22.1	6.76	19663	1.1	0.18	-289.0	3300	18.22
1036	22.1	6.75	19462	1.1	0.17	-284.9	4125	18.22
1039	22.1	6.75	19424	1.0	0.18	-287.3	4950	18.22

Did well dewater? Yes (No)	Amount actually evacuated: 4.95 L
Sampling Time: 1042	Sampling Date: 7-7-15
Sample I.D.: IR70-SA15-022	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other: SEE COC
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7/6/15
Well I.D.: MW-70-PMW10	Well Diameter (in.): 2 3 (4) 6 8 ___
Total Well Depth (ft.): QED	Depth to Water (ft.): 16.95
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated (Tubing) New Tubing Other ___

Start Purge Time: 1100 Flow Rate: 300 ml/min Pump Depth: 120'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1103	21.9	7.39	1310	3.1	0.14	-329.1	900	17.00
1106	21.9	7.31	1297	1.4	0.14	-321.0	1800	17.00
1109	21.9	7.26	1289	1.1	0.14	-320.7	2700	17.00
1112	21.8	7.20	1284	1.0	0.13	-308.1	3600	17.00
1115	21.8	7.19	1285	1.0	0.13	-302.0	4500	17.00

Did well dewater? Yes (No) Amount actually evacuated: 4500 ml

Sampling Time: 1117 Sampling Date: 7-7-15

Sample I.D.: IR70-SA15-028 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other:

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150700-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7-6-15
Well I.D.: IW-70-SHB113	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 16.74
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated (Tubing) New Tubing Other ____

Start Purge Time: 1157 Flow Rate: 250 ml Pump Depth: 118'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1200	22.0	6.75	2137	2.8	0.18	-286.7	750	17.00
1203	22.0	6.86	2447	2.3	0.14	-318.6	1500	17.00
1206	22.4	6.82	2455	1.9	0.19	-303.0	2250	17.00
1209	22.4	6.78	2435	1.6	0.17	-330.9	3000	17.00
1212	22.5	6.77	2431	1.4	0.16	-338.7	3750	17.01
1215	22.5	6.77	2426	1.2	0.16	-340.6	4500	17.01

Did well dewater? Yes (No)	Amount actually evacuated: 4500ml
Sampling Time: 1217	Sampling Date: 7-7-15
Sample I.D.: IW70-GA15-027	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other:
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7-6-15
Well I.D.: MW70-PMW09	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 17.13
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: Dedicated (Tubing) New Tubing Other_____

Start Purge Time: 1255 Flow Rate: 300 mL/min Pump Depth: 120

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1258	22.3	7.31	703	2	0.40	-260.6	900	17.20
1301	22.3	7.43	705	1	0.31	-293.6	1800	17.23
1304	22.3	7.55	705	1	0.23	-301.2	2700	17.23
1307	22.3	7.58	706	1	0.22	-300.5	3600	17.23
1310	22.4	7.58	705	1	0.22	-302.6	4500	17.23

Did well dewater? Yes (No)	Amount actually evacuated: 4500 mL
Sampling Time: 1312	Sampling Date: 7-7-15
Sample I.D.: ~~IR70~~ SA15-025	Laboratory: EMAX
Analyzed for: TPH-G BTEX MTBE TPH-D	Other:
Equipment Blank I.D.: @ Time	Duplicate I.D.: ~~IRSA~~ IR70-SA15-026 @ 1555

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW12B	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 19.16
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 1350 Flow Rate: 200ml/min Pump Depth: 120'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1353	23.4	6.74	7534	3.4	0.29	-291.3	600	19.25
1356	23.1	6.68	7574	2.6	0.17	-313.6	1200	19.25
1359	23.0	6.66	7603	2.4	0.16	-319.4	1800	19.25
1402	23.1	6.66	7610	2.0	0.17	-322.4	2400	19.25
1405	22.9	6.65	7631	2.0	0.16	-332.1	3000	19.25
1408	22.9	6.63	7658	1.9	0.15	-336.4	3600	19.25
1410	22.9	6.63	7662	1.9	0.15	-339.9	4200	19.25

Did well dewater? Yes (No) Amount actually evacuated: 4200ml

Sampling Time: 1412 Sampling Date: 7/7/15

Sample I.D.: IR70-SA15-032 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other:

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706·DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7·6·15
Well I.D.: MW·70·PMW~~1~~A	Well Diameter (in.): 2 3 (4) 6 8 ___
Total Well Depth (ft.): QED	Depth to Water (ft.): 19.78
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder) Pump
Sampling Method: (Dedicated) Tubing New Tubing Other ___

Start Purge Time: 1510 Flow Rate: 300 mL/min Pump Depth: 90'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1513	22.4	7.05	33447	5.1	0.14	-291.9	900	19.88
1516	22.5	7.03	33467	3.5	0.12	-287.9	1800	19.88
1519	22.5	7.03	34521	3.8	0.12	-294.4	2700	19.89
1522	22.7	7.04	34566	2.9	0.13	-320.8	3600	19.89
1525	22.7	7.04	34553	3.1	0.12	-333.3	4500	19.89
1528	22.7	7.04	34559	3.0	0.11	-335.1	5400	19.89

Did well dewater? Yes (No) Amount actually evacuated: 5400mL

Sampling Time: 1530 Sampling Date: 7·7·15

Sample I.D.: IR70SA15-029 Laboratory: EMAX

Analyzed for: TPH-G BTEX MTBE TPH-D Other: SEE COC

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7/9/15
Well I.D.: LW-70-SSB109	Well Diameter (in.): 2 3 4 6 8 ____
Total Well Depth (ft.): DED	Depth to Water (ft.): 19.89
Depth to Free Product:	Thickness of Free Product (feet):
Referenced to: PVC Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump Bladder Pump
Sampling Method: Dedicated Tubing New Tubing Other ____

Start Purge Time: 1020 Flow Rate: 200 Pump Depth: 145'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1028	23.4	6.51	18736	25	0.29	-265.3	800	19.99
1028	23.1	6.57	19301	22	0.27	-271.8	1600	19.99
1032	22.8	6.53	18991	20	0.21	-285.9	2400	19.99
1036	22.5	6.55	18895	21	0.19	-289.9	3200	20.00
1040	22.6	6.54	18801	21	0.20	-295.4	4000	20.00
			~~188~~					
	—	FIELD	PARAMETERS	ONLY		—		

Did well dewater? Yes No	Amount actually evacuated: 4.0 L
Sampling Time: —	Sampling Date:
Sample I.D.:	Laboratory:
Analyzed for: TPH-G BTEX MTBE TPH-D	Other:
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150709-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7/9/15
Well I.D.: ~~MW~~ DW-70-SHB311	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 20.15
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: Dedicated Tubing New (Tubing) Other ____

Start Purge Time: 1310 Flow Rate: 200 Pump Depth: 87'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1313	22.5	6.27	4143	25	0.37	-132.5	600	20.19
1316	22.5	6.27	4138	18	0.62	-148.9	1200	20.19
1319	22.4	6.27	4147	13	0.49	-156.3	1800	20.19
1322	22.4	6.27	4152	12	0.47	-159.2	2400	20.19
1325	22.4	6.29	4157	12	0.46	-154.8	3000	20.20
		→	FIELD	PARAMETER	ONLY	—		

Did well dewater? Yes No Amount actually evacuated: 5.0

Sampling Time: Sampling Date:

Sample I.D.: Laboratory:

Analyzed for: TPH-G BTEX MTBE TPH-D Other:

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: DF	Gauging Date: 7/9/15
Well I.D.: ~~IW-SHB~~ IW-70-SHB311	Well Diameter (in.): 2 3 (4) 6 8 ___
Total Well Depth (ft.): QED	Depth to Water (ft.): 18.60
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: YSI PRO PLUS

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ___

Start Purge Time: 1348 Flow Rate: 200ml/min Pump Depth: 120'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1351	22.5	5.11	8781	141	4.26	-139.5	600	18.81
1354	22.3	5.05	8741	128	2.11	-127.2	1200	18.83
1357	22.4	5.01	8720	119	0.78	121.3	1800	18.84
1400	22.4	4.90	8779	115	0.30	117.6	2400	18.84
1403	22.5	4.92	8797	113	0.28	119.8	3000	18.84
1407	22.5	4.98	8815	111	0.26	116.5	3600	18.86
—		FIELD PARAMETER ONLY						

Did well dewater? Yes No Amount actually evacuated: 3.6 L

Sampling Time: Sampling Date:

Sample I.D.: Laboratory:

Analyzed for: TPH-G BTEX MTBE TPH-D Other:

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: IW-70-SAT35	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): 54.74	Depth to Water (ft.): 15.25
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump * Bladder Pump
Sampling Method: Dedicated Tubing *New Tubing Other ____

Start Purge Time: 0728 Flow Rate: 300 mL/min Pump Depth: 40'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0731	22.7	6.92	8921	233	2.14	-306.5	900	14.91
0734	22.4	6.99	8930	21	1.61	-302.4	1,800	14.84
0737	22.5	6.99	8912	9	1.58	-299.6	2,700	14.84
0740	22.5	6.99	8932	8	1.52	-301.1	3,600	14.84
0743	22.4	7.00	8941	8	1.48	-303.8	4,500	14.84
	—		PARAMETERS	ONLY		—		
	—			NO SAMPLES		TAKEN	—	

Did well dewater? Yes (No) Amount actually evacuated: –

Sampling Time: — Sampling Date: –

Sample I.D.: – Laboratory: –

Analyzed for: TPH-G BTEX MTBE TPH-D Other:

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: Insight
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW02A	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 15.39
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump
Sampling Method: Dedicated Tubing New Tubing Other ____

Start Purge Time: 1443 Flow Rate: 200mL/min Pump Depth: 75'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1446	24.8	7.30	1461	5	0.55	-324.5	600	15.51
1449	24.5	7.35	1498	2	0.41	-355.2	1,200	15.54
1452	24.4	7.36	1520	2	0.40	-337.7	1,800	15.54
1455	24.4	7.35	1522	2	0.41	-337.8	2,400	15.54
1458	24.3	7.33	1519	2	0.40	-338.9	3,000	15.54
		– Field Parameters Only –						

Did well dewater? Yes (No)	Amount actually evacuated: –
Sampling Time: N/A	Sampling Date: N/A
Sample I.D.: N/A	Laboratory: N/A
Analyzed for: TPH-G BTEX MTBE TPH-D	Other:
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-PMW023	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 15.45
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump *Bladder Pump

Sampling Method: *Dedicated Tubing New Tubing Other_____

Start Purge Time: 0804 Flow Rate: 300mL/min Pump Depth: 95'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0807	24.9	8.07	1610	12	0.88	-287.3	900	15.61
0810	24.0	7.80	1414	3	0.63	-308.2	1,800	15.61
0813	23.8	7.82	1434	3	0.62	-296.2	2,700	15.61
0816	23.6	7.80	1438	3	0.60	-292.8	3,600	15.61
	—		PARAMETERS		ONLY	—		
	—			NO SAMPLES	TAKEN		—	

Did well dewater? Yes ~~No~~	Amount actually evacuated: —
Sampling Time: —	Sampling Date: —
Sample I.D.: —	Laboratory: —
Analyzed for: TPH-G BTEX MTBE TPH-D	Other:
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DFI	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: IW-70-SAB11	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 15.35
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: PVC Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump X Bladder Pump
Sampling Method: Dedicated Tubing New Tubing Other ____

Start Purge Time: 0535 Flow Rate: 300 mL/min Pump Depth: 35'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0539	21.9	7.01	2654	16	0.80	-271.9	900	15.54
0541	21.9	7.00	2685	6	0.88	-292.3	1,800	15.60
0544	21.9	6.94	2692	5	0.92	-295.8	2,700	15.60
0547	22.0	6.92	2697	5	0.93	-297.1	3,600	15.60
		– PARAMETERS ONLY –						
		– NO SAMPLES TAKEN –						

Did well dewater? Yes (No)	Amount actually evacuated: –
Sampling Time: –	Sampling Date: –
Sample I.D.: –	Laboratory: –
Analyzed for: TPH-G BTEX MTBE TPH-D	Other:
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DEI	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: RDO-5	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 13.43
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: SS6

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)
Sampling Method: (Dedicated Tubing) New Tubing Other ____

Start Purge Time: 0904 Flow Rate: 300 ml/min Pump Depth: 85'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0907	21.5	7.94	963	2	0.70	-283.3	900	13.59
0910	21.4	7.75	1133	2	0.53	-294.0	1,800	13.60
0913	21.4	7.60	1172	2	0.51	-272.1	2700	13.60
0916	21.3	7.47	1169	2	0.50	-269.7	3600	13.61
0919	21.3	7.46	1168	2	0.49	-268.5	4,500	13.61
		–	PARAMETERS		ONLY	–		
		–		NO SAMPLES	TAKEN	–		

Did well dewater? Yes (No)	Amount actually evacuated: 4,500 mL
Sampling Time: –	Sampling Date: –
Sample I.D.: –	Laboratory: –
Analyzed for: TPH-G BTEX MTBE TPH-D	Other:
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-MNA05	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 15.09
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump * Bladder Pump
Sampling Method: *Dedicated Tubing New Tubing Other ____

Start Purge Time: 0927 Flow Rate: 300mL/min Pump Depth: 95'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
0930	21.9	7.15	3339	4	0.40	-266.4	900	15.35
0933	21.9	7.05	3399	2	0.43	-271.1	1800	15.36
0936	21.9	7.05	3405	2	0.44	-275.6	2700	15.36
0939	22.0	7.04	3408	2	0.46	-277.1	3600	15.36
			—	PARAMETERS	ONLY	—		
			—	NO	SAMPLES	TAKEN	—	

Did well dewater? Yes (No)	Amount actually evacuated: 3,600mL
Sampling Time: —	Sampling Date: —
Sample I.D.: —	Laboratory: —
Analyzed for: TPH-G BTEX MTBE TPH-D	Other:
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: SENSIGHT
Sampler: PS	Gauging Date: 7-6-15
Well I.D.: MW-70-MNA07	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 12.14
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump (Bladder Pump)

Sampling Method: Dedicated Tubing New Tubing Other ____

Start Purge Time: 0958 Flow Rate: 300 mL/min Pump Depth: 35'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1001	21.8	7.53	1440	8	0.48	-255.9	900	12.39
1004	21.7	6.81	1919	1	0.51	-245.0	1,800	12.35
1007	21.8	6.75	1906	1	0.55	-261.0	2,700	12.35
1010	21.8	6.74	1901	1	0.52	-265.0	3,600	12.35
1013	21.8	6.70	1889	1	0.55	-268.9	4,500	12.35
		–	PARAMETERS		ONLY	–		
		–		NO SAMPLES	TAKEN	–		

Did well dewater? Yes (No) Amount actually evacuated: –

Sampling Time: – Sampling Date: –

Sample I.D.: – Laboratory: –

Analyzed for: TPH-G BTEX MTBE TPH-D Other:

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-MNA09	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 14.90
Depth to Free Product: –	Thickness of Free Product (feet): –
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump *Bladder Pump

Sampling Method: *Dedicated Tubing New Tubing Other_____

Start Purge Time: 1035 Flow Rate: 300 mL/min Pump Depth: 90

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1038	21.9	6.94	16,144	3	0.31	-260.7	900	15.05
1041	22.0	6.96	16,602	2	0.31	-273.9	1,800	15.04
1044	22.0	6.98	16,848	2	0.36	-295.1	2,700	15.04
1047	22.0	6.99	16,877	2	0.38	-299.3	3,600	15.04
1050	22.1	6.99	16,912	2	0.39	-302.4	4,500	15.04
		—	PARAMETER ONLY			—		
		—	NO SAMPLES	TAKEN		—		

Did well dewater? Yes (No) Amount actually evacuated: 4500 mL

Sampling Time: — Sampling Date: –

Sample I.D.: — Laboratory: –

Analyzed for: TPH-G BTEX MTBE TPH-D Other:

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: INSIGHT
Sampler: RD	Gauging Date: 7-6-15
Well I.D.: IW-90-FS3229	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): 99.94	Depth to Water (ft.): 16.11
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump *Bladder Pump

Sampling Method: Dedicated Tubing *New Tubing Other ____

Start Purge Time: 1129 Flow Rate: 300 mL/min Pump Depth: 82'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1132	22.2	7.45	3324	7	1.30	-297.3	900	16.09
1135	22.0	7.40	3220	5	0.95	-297.7	1,800	16.09
1138	21.8	7.36	3154	5	0.80	-308.0	2,700	16.09
1141	21.9	7.34	3143	5	0.78	-316.6	3,600	16.09
1144	21.9	7.29	3139	5	0.76	-316.9	4,500	16.09
		—	PARAMETERS		ONLY	—		
		—		NO SAMPLES	TAKEN	—		

Did well dewater? Yes (No) Amount actually evacuated: —

Sampling Time: — Sampling Date: —

Sample I.D.: — Laboratory: —

Analyzed for: TPH-G BTEX MTBE TPH-D Other:

Equipment Blank I.D.: @ Time Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: Insight
Sampler: DD	Gauging Date: 7-6-15
Well I.D.: MW-70-MNA16	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QGD	Depth to Water (ft.): 20.04
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: 556

Purge Method: 2" Grundfos Pump Peristaltic Pump ✓Bladder Pump

Sampling Method: ✓Dedicated Tubing New Tubing Other_____

Start Purge Time: 1209 Flow Rate: 300 mL/min Pump Depth: 145

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1212	23.1	7.55	11033	11	0.83	-291.6	900	20.24
1215	22.6	7.40	11129	3	0.59	-310.8	1,800	20.26
1219	22.6	7.36	11195	3	0.55	-310.3	2,700	20.26
1221	22.4	7.31	11225	3	0.52	-314.3	3,600	20.26
		—	PARAMETER		ONLY	—		
		—	NO	SAMPLES	TAKEN	—		

Did well dewater? Yes (No)	Amount actually evacuated: 3,600
Sampling Time: —	Sampling Date: —
Sample I.D.: —	Laboratory: —
Analyzed for: TPH-G BTEX MTBE TPH-D	Other:
Equipment Blank I.D.: @ Time	Duplicate I.D.:

LOW FLOW WELL MONITORING DATA SHEET

Project #: 150706-DF1	Client: Insight
Sampler: PD	Gauging Date: 7-6-15
Well I.D.: MW-70-MW417	Well Diameter (in.): 2 3 (4) 6 8 ____
Total Well Depth (ft.): QED	Depth to Water (ft.): 19.43
Depth to Free Product: —	Thickness of Free Product (feet): —
Referenced to: (PVC) Grade	Flow Cell Type: SS6

Purge Method: 2" Grundfos Pump Peristaltic Pump *Bladder Pump
Sampling Method: *Dedicated Tubing New Tubing Other____

Start Purge Time: 1232 Flow Rate: 300 mL/min Pump Depth: 145'

Time	Temp. (°C or °F)	pH	Cond. (mS/cm or µS/cm)	Turbidity (NTUs)	D.O. (mg/L)	ORP (mV)	Water Removed (gals. or mL)	Depth to Water (ft.)
1235	22.9	7.50	22,533	6	1.49	-269.3	900	19.62
1238	22.0	7.46	22,002	3	0.94	-309.9	1,900	19.63
1241	21.9	7.45	22,880	3	0.90	-310.4	2,700	19.63
1244	21.8	7.40	25,879	3	0.87	-305.1	3,600	19.63
1247	21.7	7.34	25,983	2	0.85	-309.6	4,500	19.63
1250	21.6	7.32	26,018	2	0.81	-312.9	5,400	19.63
	—		PARAMETER ONLY		—			
	—		NO SAMPLES TAKEN		—			

Did well dewater? Yes (No) Amount actually evacuated: —

Sampling Time: — Sampling Date: —

Sample I.D.: — Laboratory: —

Analyzed for: TPH-G BTEX MTBE TPH-D Other:

Equipment Blank I.D.: @ Time Duplicate I.D.:

TEST EQUIPMENT CALIBRATION LOG

PROJECT NAME INSIGHT @ SEAL BEACH				PROJECT NUMBER 150706-DF1			
EQUIPMENT NAME	EQUIPMENT NUMBER	DATE/TIME OF TEST	STANDARDS USED	EQUIPMENT READING	CALIBRATED TO: OR WITHIN 10%:	TEMP.	INITIALS
YSi 556	12H101388	7-7-15 / 0600	pH 7,10,4 COND 3900 ORP 233 DO	7,10,4 3900 235 99.6%	✓	21.9	PD
↓	↓	7-8-15 / 0650	pH 7,10,4 COND 3900 ORP 232 DO 100%	7,10,4 3900 232 100%	✓	22.4	PD
↓	↓	7-9-15 / 0700	pH 7,10,4 COND 3900 ORP 234 DO 100%	7,10,4 3900 233.2 96.9%	✓	23.3	PD

TEST EQUIPMENT CALIBRATION LOG

PROJECT NAME Insight @ Seal Beach				PROJECT NUMBER 150706-DF1			
EQUIPMENT NAME	EQUIPMENT NUMBER	DATE/TIME OF TEST	STANDARDS USED	EQUIPMENT READING	CALIBRATED TO: OR WITHIN 10%:	TEMP.	INITIALS
YSI Pro +	10E102051	6/7/15 0700	4.00 7.00 10.00 3900	3.99 7.01 10.03 3924	YES	23.8	DR
↓	↓	↓	DO. 100% ORP 233.9	DO 98% ORP 233.9	YES	23.7	
YSI Pro +	10E102051	6/8/15 0700	4.00 7.00 10.00 3900	4.01 7.00 10.02 3907	YES	23.6	
↓	↓	↓	DO. 100% ORP 233.8	DO. 99.1% ORP 233.8	YES	23.6	

This page intentionally left blank

APPENDIX B
LABORATORY ANALYTICAL REPORTS
(on CD only)

This page intentionally left blank.