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FINAL

EXTENDED REMEDIAL INVESTIGATION REPORT
Installation Restoration Program Site 27

NAVAL WEAPON STATION SEAL BEACH
DETACHMENT FALLBROOK
FALLBROOK, CALIFORNIA

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July 2014

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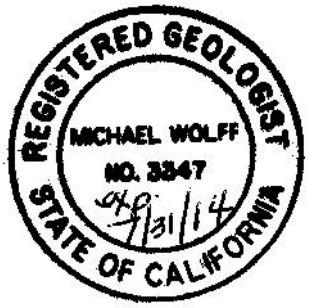
SIGNATURES

This *Extended Remedial Investigation Report* was reviewed and approved by:



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LIMITATIONS

The services described in this report were performed consistent with generally accepted professional principles and practices for environmental consulting firms. Except as set forth herein, no other warranty, expressed or implied, is made. Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the purposes, locations, time frames, and project parameters indicated. Professional opinions are based, in part, on interpretation of data from discrete monitoring or sampling locations that may not represent actual conditions at other locations that were not monitored or sampled. In some cases, interpretations may have been based on information supplied by others.

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Acronyms and Abbreviations

amsl	above mean sea level
ARAR	applicable or relevant and appropriate requirements
bgs	below ground surface
˚C	degrees Celsius
CHHSLs	California human health screening levels
COPC	constituents of potential concern
CSM	conceptual site model
Det. Fallbrook	Detachment Fallbrook
DHS	California Department of Health Services
DO	dissolved oxygen
DoN	United States Department of the Navy
DOT	United States Department of Transportation
DTSC	California Department of Toxic Substances Control
EC	Electrical Conductivity
ECS	Enviro Compliance Solutions, Inc.
EMAX	EMAX Laboratory
EPA	United States Environmental Protection Agency
ESLs	environmental screening levels
˚F	degrees Fahrenheit
FS	feasibility study
ft	feet
ft^2	square feet
gpm	gallons per minute
gpm/ft	gallons per minute per foot (or feet)
HHRA	human health risk assessment
HQ	hazard quotient
HSA	hollow-stem continuous-flight auger
IAS	initial assessment study
IDW	investigation-derived waste
IRP	Installation Restoration Program
km	kilometers

LDC	Laboratory Data Consultants, Inc.
MARRS	MARRS Services, Inc.
µg/L	micrograms per liter
mg/L	milligrams per liter
mg/kg	milligrams per kilogram
MCB	Marine Corps Base
MCL	maximum contaminant levels
msl	mean sea level
ng/L	nanograms per liter
NAVFAC SW	Naval Facilities Engineering Command, Southwest
NAVWPNSTA	Naval Weapons Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDMA	N-nitrosodimethylamine
NEESA	Naval Energy and Environmental Support Activity
NELAP	National Environmental Laboratory Accreditation Program
ORP	oxidation-reduction potential
PCBs	polychlorinated biphenyls
pH	potential hydrogen (acidity)
QC	quality control
RI	remedial investigation
ROICC	resident officer in charge of construction
RWQCB	California Regional Water Quality Control Board
SAP	sampling and analysis plan
SES-TECH	Sealaska Environmental Services, LLC and Tetra Tech EC, Inc.
SLERA	screening level ecological risk assessment
STLC	soluble threshold limit concentration
SVOC	semivolatile organic compound
TPH	total petroleum hydrocarbons
UCL	upper confidence limit
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound
yd^3	cubic yard

1.0 Introduction

The Extended Remedial Investigation (RI) Report presents the findings, conclusions and recommendations for activities conducted at Naval Weapons Station (NAVWPNSTA) Seal Beach, Detachment Fallbrook, Installation Restoration Program (IRP) Site 27, Eucalyptus Grove Landfill in Fallbrook, California (Det. Fallbrook) (Figures 1, 2 and 3).

The Extended RI has been prepared by Enviro Compliance Solutions, Inc. (ECS) on behalf of the United States Department of the Navy (DoN) Naval Facilities Engineering Command Southwest Division (NAVFAC SW) under Contract Number N62583-09-D-0143, Contract Delivery Order No. 0003.

1.1 Purpose

The purpose of the Extended RI is to address data gaps remaining from the *Final Remedial Investigation Report* (SEST-TECH 2012c). Two additional soil borings were agreed to by the DoN and the regulatory agencies (California Regional Water Quality Control Board - San Diego Region [RWQCB], and the California Department of Toxic Substances Control [DTSC]) in a meeting on July 26, 2012 (SES-TECH 2012b). It was agreed by the parties that the southwest boundary of the IRP Site 27 landfill needed additional delineation and that two soil borings should prove sufficient to accomplish this purpose. IRP Site 27 landfill limits and locations of soil borings and groundwater monitoring wells are presented in Figure 4.

ECS also conducted two additional rounds of groundwater sampling: a dry season round in November 2012 and a wet season round in May 2013.

The previous investigations of the IRP Site 27 landfill are documented in the Final Site Inspection (SI) Report by MARRS Services, Inc. (MARRS) (MARRS 2009) and in the Final RI Report by SES-TECH's subcontractor Geosyntec Consulting, Inc. (SES-TECH/Geosyntec) (SES-TECH 2012c).

The additional soil boring installation and the two additional rounds of groundwater sampling are supplemental to the RI and as such, were performed pursuant to the methodology and procedures of the Final Remedial Investigation Work Plan and Sampling and Analysis Plan (SAP) (SES-TECH 2010), and the Technical Memorandum Work Plan – Extended Remedial Investigation and associated SAP (ECS 2012c).

1.2 Report Format and Organization

The Extended RI report is organized as follows:

- Section 1 presents the introduction and the purpose, objectives, and scope of the Extended RI.
- Section 2 provides a description of the site, its environmental setting and history and background, including previous investigations.
- Section 3 discusses the installation of two supplemental soil borings, a summary of field activities and its findings.
- Section 4 discusses the groundwater monitoring activities.
- Section 5 discusses the groundwater monitoring results.
- Section 6 presents a summary of the Extended RI field activities and findings.
- Section 7 presents an updated conceptual site model
- Section 8 presents the references cited in this report.

Key site data are summarized in tabular format and are illustrated on Figures following the text. Copies of all supporting data are attached as appendices. For convenience, all the appendices are provided on a CD located in the pocket. Responses to the Comments received from the DTSC and RWQCB on the Draft version of Extended RI Report are included in Appendix G.

Appendix A	Technical Memorandum – Results of Supplemental Soil Boring Installation
Appendix B	Groundwater Sample Logs – November 2012
Appendix C	Groundwater Sample Logs – May 2013
Appendix D	Laboratory Analytical Results and Validation Reports – November 2012
Appendix E	Laboratory Analytical Results and Validation Reports – May 2013
Appendix F	Investigation-Derived Waste Manifest
Appendix G	Responses to DTSC and RWQCB Comments on the Draft version of Extended RI Report for Site 27

2.0 Site Description and Background

2.1 IRP 27 Site Description

Based on historical information presented in the initial assessment study (IAS), the Site was up to 1,000 ft. long by 300 ft. wide with a depth of up to four feet. Records indicate that the total estimated volume of refuse in the landfill is approximately 24,000 cubic yards (yd^3) (MARRS 2009). The landfill was operated from the late 1960s until 1974 when the DoN began shipping waste off site and the landfill was closed (MARRS 2009). RI evaluation of the Site refined the Site surface dimensions to an approximate area of 80,902 square ft (ft^2) based on the revised inferred landfill extent. Depth to waste encountered in the potholes, soil gas probes, and soil sampling conducted in the RI ranged from approximately one to three feet, indicating an average cover thickness of approximately two feet. Maximum potential waste volume within the ravine was estimated based on thickness differentials present before the existence of the landfill and after the closure of the landfill. The maximum potential waste volume including daily cover is estimated at 65,728 yd^3 based on revised three-dimensional modeling of the landfill extent performed for the RI.

The potential for groundwater, soil, and soil vapor impacts to IRP Site 27 were identified based on the disposal of small quantities of hazardous waste, including empty paint cans with dried paint residues, fluorescent lights, fluorescent light ballasts, spent silica sandblast grit containing paint chips, paint booth residue, rags with solvent residue, used paint brushes, and asbestos. Wooden pallets that were potentially treated with pentachlorophenol were also disposed of at IRP Site 27 (MARRS 2009).

The RI for IRP Site 27 was completed in 2012 (SES-TECH 2012c). The sole remaining unresolved question arising from the RI investigations was the precise location of the landfill boundary in the southwest portion of the Site (Figure 2). The purpose of the two additional soil borings described in this report was the delineation of the southwest portion of the landfill boundary.

2.2 Past Investigation and Reports

In 1985, NEESA conducted an IAS of NAVWPNSTA Seal Beach sites, including 12 located at Det. Fallbrook. The IAS recommended additional evaluation at each of the Det. Fallbrook sites. In response to the IAS, the United States Environmental Protection Agency (U.S. EPA) and the California Department of Health Services (DHS) recommended additional soil and groundwater investigations to evaluate contaminants of concern, contaminant migration, and the potential exposure pathways (MARRS 2009).

In response to these comments, NAVWPNSTA Seal Beach Det. Fallbrook requested NEESA to prepare an addendum to the IAS. The addendum (completed in 1990) evaluated the

recommendations of the U.S. EPA and DHS and recommended an SI be conducted at IRP Site 27 because hazardous wastes had been disposed of at the landfill.

In 2007, MARRS implemented the SI to determine the extent of the landfill and to assess the presence of constituents of potential concern (COPCs) and their potential risk to human health and ecological receptors. As part of the SI, MARRS developed a conceptual site model (CSM) that included the geology and hydrogeology of IRP Site 27 and the exposure pathways for humans and other ecological receptors. In the basic hydrogeologic conceptual model presented in the SI, groundwater is migrating along the soil-bedrock interface and accumulating in the topographically low portion of the landfill at the northern extent. According to the SI, COPCs have been detected in the soil at IRP Site 27, but it is unlikely that the COPCs present health risks or significant risks to ecological receptors. However, the Final SI Report as well as a letter from the RWQCB dated July 3, 2008 recommend that an investigation be conducted at IRP Site 27 to address remaining data gaps (MARRS 2009). The RI was conducted to address these data gaps.

During the RI investigation, five new wells were added to the groundwater monitoring well network. These wells, MW-4A, MW-5A, MW-7, MW-9A, and MW-12 in conjunction with the existing well MW-3 provided a six well monitoring well network that provides a point of compliance well network downgradient of the landfill within the first water bearing unit. Within this well network MW-12 and possibly MW-9A provide upgradient water quality results.

The RI field activities addressed these data gaps and developed a 3D assessment of the waste volume from the available data (SES-TECH 2012c). following regulatory agency review of the RI report, it was agreed by the DoN and agencies that the southwest boundary of the IRP Site 27 landfill needed additional delineation. Two additional soil borings were deemed sufficient to accomplish this purpose.

3.0 Supplemental Soil Boring Installation

The purpose of the Extended RI was to address data gaps remaining from the *Final Remedial Investigation Report* (SEST-TECH 2012c). In a meeting on July 26, 2012, the DoN and the RWQCB and DTSC agreed to two additional soil borings to better delineate the southwest boundary of the landfill (SES-TECH 2012b). ECS also conducted two additional rounds of groundwater sampling to fulfill the required four quarters of groundwater sampling. The dry season round was conducted in November 2012 and the wet season round was conducted in May 2013.

Field activities for the installation of two supplemental soil borings were completed per the Technical Memorandum Work Plan – Extended Remedial Investigation (ECS 2012c). The results of the investigation are described below. All field activities were conducted in accordance with the approved Site Safety and Health Plan (SSHP) and Accident Prevention Plan (APP) (ECS 2012a).

3.1 Summary of Field Activities

Each exploratory boring was initially hand-augered to an approximate depth of 5 ft. below ground surface (bgs) to minimize the potential damage to subsurface obstructions/utilities. Once each boring location was cleared, the exploratory soil borings were drilled a few feet away from the hand-auger locations by using a CME-75 drill rig using hollow-stem continuous-flight auger (HSA) drilling equipment provided by JDK Drilling, Inc. of Orange, California. The augers were steam-cleaned prior to and in between drilling each boring.

Both borings were continuously cored using a split barrel sampler within the HSA flight. Following each advance, the continuous core was retrieved and placed on visqueen were it was visually inspected, logged, and photographed. A qualified geologist, working under the supervision of a California-registered Professional Geologist, logged the cores using the lithologic descriptions of the Unified Soil Classification System. The soil cores were logged in detail paying particular attention to visual or olfactory evidence of landfilled waste. The borings were drilled through approximately 10 ft. of alluvial deposits to overlying weathered bedrock to a total depth of approximately 25 ft. bgs where refusal was encountered.

Each boring was sealed by backfilling with cement grout (5% bentonite), and the upper five feet of each boring was backfilled with hydrated bentonite pellets to prevent the borings from becoming conduits for percolation of rainfall at future times. Copies of the soil boring logs and soil core photographs are presented in the *Technical Memorandum – Results of Supplemental Soil Boring Installation Extended Remedial Investigation* (ECS 2013) (Appendix A.)

The exploratory soil borings were surveyed for location and elevation by a California licensed surveyor. A copy of the Land Survey Report is presented as part of the Technical Memorandum in Appendix A.

Investigation-derived waste (IDW) in the form of soil cuttings was stored in 55-gallon, steel U.S. Department of Transportation (DOT) approved drums and secured with ring lids. The drum contents were properly labeled pending waste profiling. A composite sample was collected from each drum sent to EMAX Laboratories for analysis. The samples were analyzed for total petroleum hydrocarbons as diesel by U.S. Environmental Protection Agency (EPA) modified EPA Method 8015B, for volatile organic compounds (VOCs) by EPA Method 8260B, and by Title 22 metals by EPA Methods 6020A/7471A. The analytical results indicated that the soil was non-hazardous with the possible exception of chromium which had a concentration of 51.5 milligrams per kilogram (mg/kg). The soluble threshold limit concentration (STLC) for chromium is 5 milligrams per liter (mg/L) by EPA Method 6010B and the results showed an STLC concentration of chromium at 0.158 mg/L, which is below the hazardous threshold of 5 mg/L. A copy of the laboratory report is included in Appendix D. The soil cuttings were characterized as non-hazardous soil, and after discussion and approval from the Navy and ROICC, the soil cuttings were spread onsite at IRP Site 27.

3.2 Findings

No evidence of groundwater was encountered, and no evidence of landfilled waste was observed visually or by photoionization detector readings in either of the borings.

4.0 Groundwater Monitoring Activities

This section summarizes IRP Site 27 groundwater monitoring activities for the two monitoring events, the dry season round in November 2012 and the wet season round in May 2013. Field activities were conducted in accordance with the approved SSHP and APP (ECS 2012a).

The program consists of monitoring eight wells. The locations of these wells are shown on Figure 4, and the well construction details are provided in Table 1.

4.1 Groundwater Elevation

Groundwater levels were measured from each well using an electronic water level sounding probe with an accuracy of 0.01 ft. Table 2 summarizes the groundwater levels collected from the two monitoring events, and Figures 5 and 6 provide groundwater elevation contour maps for the November 2012 and May 2013 monitoring events, respectively.

4.2 Monitoring Well Sampling Procedures

Groundwater samples were collected from monitoring wells following procedures outlined in the Addendum 1 to the Final Sampling and Analysis Plan (ECS 2012b). Monitoring wells were purged and sampled using bladder pumps following procedures outlined in the U.S. EPA guidance for low-flow sampling (U.S. EPA 1996).

During purging, field parameters including acidity (pH), electric conductivity (EC), water temperature in degrees Celsius (˚C), dissolved oxygen (DO), and oxidation-reduction potential (ORP) were monitored using a QED Environmental Systems MP-20 water quality monitor and flow-through cell. Turbidity measurements were collected using LaMotte Meter and all the field parameters readings were recorded on groundwater sampling logs. The QED monitor electronically records the field parameters and signals the field technician when field parameter measurements have stabilized and groundwater samples are ready to be collected.

A summary of the field parameter measurements for both events are provided in Table 3. Tables 5 through 8 summarize the groundwater analytical results for IRP Site 27. Groundwater sampling logs for the November 2012 and May 2013 sampling events are provided in Appendices B and C, respectively.

Quality control samples for the sampling events included field duplicates, equipment blanks, trip blanks, and temperature blanks. Sufficient sample volumes were collected for matrix spike/matrix spike duplicate analyses.

Groundwater samples were stored in coolers packed with ice and delivered with chain of custody documentation to EMAX for analyses. EMAX subcontracted the hydrazine analysis to Columbia Analytical Services, and NDMA analysis to Maxxam Analytics International. All three laboratories are National Environmental Laboratory Accreditation Program (NELAP) and National Environmental Laboratory Accreditation Conference – accredited laboratories.

All samples were analyzed for VOCs by EPA Method 8260B; for total petroleum hydrocarbons by purge and trap (TPH-P) and for TPH by extraction (TPH-E) by EPA Modified Method 8015; for pesticides and polychlorinated biphenyls (PCBs) by EPA Methods 8081A/8082; for SVOCs by EPA Method 8270C, for dissolved metals/mercury by EPA Methods 6020A/7470A; for nitrate/nitrite/sulfate by EPA Method 300.0; for sulfide by EPA Method 376.1; for ammonia by EPA Method 350.2; and hydrazine by ASTM D1385. During both rounds of sampling, samples were collected for NDMA by EPA Method 1625C. NDMA analysis was performed from the interior wells first, while groundwater samples from the exterior wells were held for analysis. Since the NDMA concentrations from the interior wells were less than the screening level of 10 nanograms per liter (ng/L), the samples from the exterior wells were not analyzed. Copies of the certified analytical reports and chain-of-custody documentation for the November 2012 and May 2013 sampling events are included in Appendices D and E, respectively. Table 4 summarizes the analytes evaluated during the SI, RI, and Extended RI.

4.3 Quality Assurance

Laboratory Data Consultants, Inc. (LDC), an independent analytical data validation company, validated the analytical data from both rounds of sampling. The findings of the LDC data validation report are based upon a Level III data package review for up to 90 percent of the data, and a Level IV review of at least 10 percent of the data. Specific elements reviewed during the validation process are identified in the data validation reports contained in Appendix D for the November 2012 event and Appendix E for the May 2013 event. The overall assessment of the data was acceptable, but some data required qualifying statements.

4.4 Investigation-Derived Waste

IDW in the form of purged groundwater was stored in a 55-gallon, steel U.S. Department of Transportation (DOT) approved drums and secured with ring lids. The drum contents were properly labeled pending waste profiling. Approximately 40 gallons of purged groundwater disposed offsite to a State of California approved facility (Demenno Kerdoon) in Compton, California as a non-hazardous waste liquid. A copy of the manifest is provided in Appendix F.

5.0 Groundwater Monitoring Results

5.1 Groundwater Elevations

Water level elevation contours were prepared using water level data collected from monitoring wells within IRP Site 27 during the November 2012 and May 2013 monitoring events.

Water level elevation contour maps for each event are provided as Figures 5 and 6. These maps were created to show the general groundwater flow in a northeasterly direction. The November 2012 groundwater gradient ranged from 0.0024 ft/ft to 0.0079 ft/ft (Figure 5). The May 2013 groundwater gradient ranged from 0.0033 ft/ft to 0.0065 ft/ft (Figure 6).

5.2 Groundwater Sampling Results

In the RI, the screening level for N-nitrosodimethylamine (NDMA) was set at 10 nanograms per liter (ng/L). The DoN and the agencies subsequently concurred on a revised lower screening level of 3 ng/L (SES-Tech 2012c). The extended RI employed an addendum to the RI SAP that maintains the original screening level of 10 ng/L. All groundwater samples collected in the extended RI had NDMA results well below the original 10 ng/L screening level. Well MW-3 exhibited an NDMA concentration that slightly exceeded the revised screening level of 3 ng/L (3.85 ng/L) in the November 2012 sampling round, but this concentration had dropped to 0.517 ng/L by the May 2013 event (Figures 7 and 8). The slight exceedence of the revised screening level in the November round is not a concern because NDMA concentrations have historically fluctuated and have been consistently below the revised screening level both before and after the November sampling event. No other samples exceeded the revised screening level for NDMA in either sampling round.

Hydrazine concentrations in groundwater samples collected in the extended RI ranged from 1.1 to 5.3 mg/L, with the highest detection occurring at background well MW-12. Hydrazine has previously been detected in both surface water and groundwater samples collected at IRP Site 27, both upgradient and downgradient of the former landfill. There is neither an MCL nor a project action level established for hydrazine. During the RI (SES-Tech, 2012), hydrazine was detected in surface water at concentrations ranging from 38 to 44 mg/L, but was dismissed as a concern due to low precipitation and the low residence time of surface water runoff at IRP Site 27. The reporting limit for hydrazine using ASTM Method D1385 is 2 mg/L, which exceeds the EPA Region 9 regional screening level (RSL) for tap water (0.022 mg/L). While the hydrazine concentrations in groundwater at some IRP Site 27 wells exceed the RSL, there is no known source on site, and the compound is present upgradient of the former landfill. Institutional controls being considered in Feasibility Study alternatives would prevent exposure to hydrazine in groundwater.

The only other groundwater concentrations above screening levels detected during the November and May sampling events were three metals – arsenic, iron, and manganese. Arsenic, iron, and manganese concentrations above screening levels only occurred in the sample from well MW-2 (Table 8 and Figures 7 and 8). Tables 5 - 8 and Figures 7 and 8 present a summary of the analytical results in groundwater from the November 2012 and May 2013 rounds. No other COPCs were detected above the screening levels.

6.0 Summary of Findings

The purpose of the Extended RI was to address data gaps remaining from the RI. Two soil borings were drilled on the southwest boundary of the IRP Site 27 landfill to further delineate the southwestern limits of the IRP Site 27 landfill and two additional rounds of groundwater sampling were collected in November 2012 (dry season) and in May 2013 (wet season). The findings of this Extended RI are summarized below:

- No evidence of groundwater was encountered, and no evidence of landfilled waste was observed visually or by photoionization detector readings in either of the soil borings.
- Well MW-3 exhibited an NDMA concentration of 3.85 ng/L that slightly exceeded the revised screening level of 3 ng/L, but was well below the SAP screening level of 10 ng/L, in the November 2012 sampling round. This concentration had dropped to 0.517 ng/L by the May 2013 event, which is well below the revised screening level. The slight exceedence of the revised screening level in the November round is considered an anomaly.
- Hydrazine concentrations in groundwater samples collected in the extended RI ranged from 1.1 to 5.3 mg/L, with the highest detection occurring at background well MW-12. Hydrazine has previously been detected in both surface water and groundwater samples collected at IRP Site 27, both upgradient and downgradient of the former landfill. There is no known source on site, and the compound is present upgradient of the former landfill at greater concentrations than within or downgradient of the former landfill; therefore, it is concluded that IRP Site 27 is not the source of the observed hydrazine. There is neither an MCL nor a project action level established for hydrazine. During the RI (SES-Tech, 2012), hydrazine was detected in surface water at concentrations ranging from 38 to 44 mg/L, but was dismissed as a concern due to low precipitation and the low residence time of surface water runoff at IRP Site 27. The reporting limit for hydrazine using ASTM Method D1385 is 2 mg/L, which exceeds the EPA Region 9 regional screening level (RSL) for tap water (0.022 mg/L). While the hydrazine concentrations in groundwater at some IRP Site 27 wells exceed the RSL. Institutional controls being considered in Feasibility Study alternatives would prevent exposure to hydrazine in groundwater.
- The only other groundwater concentrations above screening levels detected during the November and May sampling events were three metals – arsenic, iron, and manganese. Arsenic, iron, and manganese concentrations above screening levels only occurred in the sample from well MW-2. These metals concentrations could be the result of localized geochemical effects of the landfill waste on the aquifer as discussed further in Section 7.4, or from the well having been installed by drilling through the waste prism, or both. Since no other wells around the landfill perimeter exhibit elevated metals

concentrations, the MW-2 result represents an anomaly. This well and MW-1, which is also installed through the landfill prism, should be properly sealed and destroyed to prevent them from becoming conduits for contaminant migration in the future.

7.0 Updated Conceptual Site Model

This section presents the updated conceptual site model for IRP Site 27. The updated CSM is based on information presented in the RI as well as the results of the extended RI. Figures 9 through 16 provide graphic illustrations of various aspects of the CSM.

7.1 Site Setting

The IRP Site 27 landfill is approximately 1,000 ft long and is located within the dry ravine extending south (640 ft above mean sea level [amsl]) to north (580 ft amsl), with an approximate surface grade of 6%. IRP Site 27 is located in the Upper Ysidora Area of the Santa Margarita River Basin, which, according to the Water Quality Control Board Plan for the San Diego Basin, includes municipal, domestic, and industrial beneficial uses of groundwater. Recharge of site groundwater is from rainwater infiltration during and after rain events. Based on the elevation contours for the area surrounding IRP Site 27, the catchment basin in which IRP Site 27 resides is approximately 43 acres. The direction of surface water runoff has been conceptualized in Figure 11 according to the ground surface elevation contours within the catchment basin. Based on observations during storm water sampling and elevation contours of the ground surface, surface water generally drains from south to north. The IRP Site 27 catchment basin (shown in Figure 11) is approximately 43 acres (compared to a landfill area of approximately 2.7 acres), is bounded to the south by a topographical high of approximately 700 ft amsl, and drains in a northerly direction to a ravine located at the northern end of the catchment basin at approximately 570 ft amsl. This ravine is heavily vegetated and would be expected to drain to the northwest, though the ravine has been dry during site visits conducted in 2009, 2010, and 2011.

As shown in the three-dimensional geologic cross section presented in Figure 12, site lithology consists of an upper layer of alluvium, comprised of clays, silts, sands, and landfill waste. The landfill cover consists of well compacted weathered soil ranging in thickness from 1 to 3 ft, with hydraulic conductivities ranging from 1.47×10^{-6} to 1.79×10^{-7} cm/sec. Alluvium is underlain by an interval of moderately to highly weathered bedrock, which is then underlain by competent bedrock consisting of quartz-granodiorite to tonalite. Bedrock is found approximately 5 to 41 ft. bgs.

Detachment Fallbrook lies within the Santa Margarita River watershed (MARRS 2009). The Santa Margarita River watershed contains alluvial river basins with a source of water-bearing sediments bounded by hills of non-water-bearing crystalline rocks (MARRS 2009). As part of the Water Quality Control Board Plan developed for the San Diego Basin, the RWQCB defines the Santa Margarita watershed as the Santa Margarita Hydraulic Unit (MARRS 2009). IRP Site 27 is located in the Upper Ysidora Area, which has beneficial uses for municipal, domestic, and industrial water supplies (MARRS 2009).

Groundwater within the Santa Margarita Hydrologic Unit is mainly unconfined; however, some areas have been identified as being under pressure (MARRS 2009). The most developed regions are those within the alluvial basins, such as the Santa Margarita River Basin within Marine Corps Base (MCB) Camp Pendleton to the west and southwest (MARRS 2009). The average yield of wells that are completed in the Santa Margarita River Basin, within the Chappo Subarea of the Upper Ysidora Area, ranges from 600 to 1,800 gallons per minute (gpm) with specific capacities ranging from 10 to 21 gpm per foot (gpm/ft.) (MARRS 2009).

IRP Site 27 drains into the Santa Margarita River watershed; however, the river is approximately 2.5 miles away and the site itself is a thin veneer of residuum over hard bedrock. Evidence suggests that groundwater occurs in perched and discontinuous zones. The IRP Site 27 catchment basin does not produce or store a significant quantity of groundwater, with an estimated 23 acre-feet of groundwater stored in the aquifer and only approximately 1.8 acre-feet of groundwater (or 8% of groundwater in the catchment basin) underlying the landfill. Due to the limited and discontinuous nature of the perched groundwater, and the slow recharge, IRP Site 27 would be expected to have an insignificant impact on the overall watershed. The IRP Site 27 catchment basin is approximately 43 acres while the drainage to the east for the upstream watershed which is approximately 500 acres. Monitoring wells at the site produce an average of 0.46 gpm. Production wells further east at MCB Camp Pendleton produce 600 to 1,800 gpm. Based on the location and characteristics of the aquifer, it is not used for beneficial purposes and it is unlikely that it would be used in the future. Monitoring wells have consistently indicated a groundwater gradient ranging from 0.0038 to 0.0128 in a north-northeasterly direction. As shown in Figure 13, groundwater appears to migrate along the soil-bedrock interface, where it accumulates north of the landfill in a bedrock trough in the lowest topographical area of the catchment basin.

7.2 Contaminant Source and Release Information

Waste material was accepted for approximately 5 years and it is estimated that a total of 24,000 yd^3 of refuse was placed in the IRP Site 27 landfill; the estimated extent of waste (see Figure 4) in the subsurface is approximately 65,000 cy^3. The waste layer may contain potential sources of contamination, including small quantities of potentially hazardous waste (e.g., empty paint cans with dried paint residues, fluorescent lights, fluorescent light ballasts, spent silica sandblast grit containing paint chips, paint booth residue, rags with solvent residue, used paint brushes, and asbestos), metal scrap, and pallets that were potentially treated with pentachlorophenol and were also disposed of at IRP Site 27. Naturally-occurring metals are also associated with the site geology.

7.3 Exposure Pathways

Based on the RI screening level human health risk assessment (HHRA) and the screening level ecological risk assessment (SLERA), no risks were identified for IRP Site 27 based on human health and ecological effects.

7.3.1 HHRA Results

During the RI, a soil sample was collected at the location where the maximum arsenic concentration was observed during the SI. Arsenic was detected at this location during the RI at a concentration of 2.79 mg/kg. Arsenic concentrations are consistent with background metals concentrations determined in the Basewide Background Metals Soil Study conducted for Det. Fallbrook (SES-Tech 2012a). Therefore, it is unlikely that this COPC presents a human health risk above background. VOCs were detected at concentrations at or below residential soil gas California human health screening levels (CHHSLs), suggesting the cancer risk estimates do not exceed the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) acceptable risk range of 1×10^{-6} and 1×10^{-4}, nor the DTSC target risk level for unrestricted land use. Therefore, these VOCs are unlikely to present a human health risk for the vapor intrusion pathway.

Groundwater is not used as a public water supply and is not expected to be in the future. However, if a potable water supply well were to be installed, groundwater could become a complete pathway. The groundwater occurs in perched, discontinuous zones, and migration of elevated metals is considered highly unlikely. No elevated concentrations have been detected downgradient of the landfill limits. There are no potable water supply wells at Det. Fallbrook, and the nearest downgradient potable water supply wells are located approximately 3.6 miles to the west on neighboring MCB Camp Pendleton (Figure 9). Therefore, ingestion of groundwater is not considered a complete exposure pathway and the chemicals detected are unlikely to pose a human health risk.

Ingestion of storm water is not considered a complete exposure pathway since the average annual precipitation is minimal, residence time of storm water is limited, and workers are seldom at the site; therefore, the chemicals detected are unlikely to pose a significant human health risk.

7.3.2 SLERA Results

The inhalation pathway from soil gas for ecological exposures is generally negligible relative to the ingestion pathway. Maximum detected concentrations of soil gas were one or more orders of magnitude below the calculated environmental screening levels (ESLs). There is a small seasonal pond located approximately 1,200 feet north of the landfill (Figure 3). Other than this feature, there are no surface water bodies, such as rivers, streams, or lakes, on or near IRP Site 27; therefore, the habitat is not suitable to support benthic or aquatic receptors. All hazard quotients (HQs) were estimated well below 1, indicating a limited potential for ecological risk from consumption of storm water. Further, the conservative assumptions of this evaluation are likely to overestimate risks. No source COPCs have been in place since the 1970s and will not be transported elsewhere due to the lack of surface water and the presence of vegetation cover that reduces the mobility of detected constituents in soil.

7.4 Contaminant Fate and Transport Factors

Elevated concentrations of arsenic, iron, and manganese have been detected in groundwater at IRP Site 27. Historically, these elevated detections have been observed in groundwater samples from MW-2. The phase (dissolved or solid) and mobility of the three metals of concern (i.e., arsenic, iron, and manganese) are dependent on the oxidation states of the metals. In each case, these elements can occur in solid and aqueous phases, depending on whether the metal speciation is oxidized or reduced, as follows:

- As^{+5} (Oxidized: Solid) ↔ As^{+3} (Reduced: Aqueous)
- Fe^{+3} (Oxidized: Solid) ↔ Fe^{+2} (Reduced: Aqueous)
- Mn^{+3} (Oxidized: Solid) ↔ Mn^{+2} (Reduced: Aqueous)

Therefore, it is possible for changes in the aquifer geochemistry (e.g., a transition from oxidizing to reducing conditions) to cause metals that are naturally occurring in soil to mobilize, or dissolve, in groundwater.

As shown in Figure 14, MW-2 is located and screened in an area of IRP Site 27 in which there is an interaction between the aquifer and the waste layer. The presence of organic matter associated with the waste layer would be expected to cause reduced DO and a transition to overall reducing geochemical conditions in groundwater. Based on the redox chemistry of arsenic, iron, and manganese, this change in geochemistry could result in the mobilization or dissolution of metals in the area of reducing conditions. Figure 15 provides a summary of DO, ORP, and groundwater results for arsenic, iron, and manganese along a transect of monitoring wells down the centerline of the waste layer in the general direction of groundwater flow (i.e., north-northeast). As shown in Figure 15, upgradient of the intersection of the waste layer and aquifer, geochemical conditions at MW-1 are aerobic and oxidizing. Dissolved concentrations of arsenic, iron, and manganese at MW-1 suggest that oxidizing conditions favor solid phase, oxidized species of the three metals of concern. As shown in Figure 14, there is an interaction between the aquifer and the waste layer at MW-2 and, as would be expected, conditions in groundwater at MW-2 transition to anaerobic and reducing. The groundwater results for arsenic, iron, and manganese at MW-2 also exhibit a corresponding increase in concentrations, suggesting a shift in the speciation of naturally occurring metals towards reduced species (i.e., As^{+3}, Fe^{+2}, and Mn^{+2}) that are soluble in groundwater. Downgradient of MW-2 (i.e., at MW-3 and MW-7), groundwater conditions return to aerobic/oxidizing and concentrations of arsenic, iron, and manganese decrease to levels that are comparable to those observed in MW-1.

In order to determine whether it is reasonable for naturally-occurring metals in soil to contribute enough mass to produce the elevated concentrations of arsenic, iron, and manganese observed in MW-2, a mass balance has been conducted assuming that naturally occurring metals in site soils are the only source of chemical mass to groundwater. The results of this evaluation are a presented in Figure 16. A 95% upper confidence limit (UCL) for arsenic, iron, and manganese was calculated using all soil results for IRP Site 27. The 95% UCLs used for this evaluation were 1.5 mg/kg, 18,587 mg/kg, and 208.9 mg/kg for arsenic, iron, and

manganese, respectively. The soil concentrations were evaluated against the MW-2 groundwater results from the November 2012 sampling event (i.e., 0.025 mg/L, 3.5 mg/L, and 4 mg/L for arsenic, iron, and manganese, respectively). The results of the evaluation are as follows:

- Assuming an arsenic concentration of 1.5 mg/kg in soil, only 0.28% of total arsenic would be required in a reduced state (i.e., soluble As^{+3}) to produce a groundwater concentration of 0.025 mg/L at MW-2.
- Assuming an iron concentration of 18,587 mg/kg in soil, only 0.0033% of total iron would be required in a reduced state (i.e., soluble Fe^{+2}) to produce a groundwater concentration of 3.5 mg/L at MW-2.
- Assuming a manganese concentration of 208.9 mg/kg in soil, only 0.33% of total manganese would be required in a reduced state (i.e., soluble Mn^{+2}) to produce a groundwater concentration of 4 mg/L at MW-2.

There is sufficient naturally occurring mass of arsenic, iron, and manganese near IRP Site 27 to produce the elevated metals results observed in groundwater at MW-2. Furthermore, only a small fraction of the total mass of arsenic, iron, and manganese is required in a reduced form to produce the corresponding metals results observed in MW-2. The site soil data and redox changes observed in groundwater from MW-2 suggest that the elevated detections in MW-2 are attributable to the dissolution of naturally occurring metals in site soil as a result of the geochemical effects of the landfill waste on the aquifer. Additionally, results from upgradient and downgradient monitoring wells suggest that these changes in geochemistry occur in a localized area and there is no potential for elevated concentrations of arsenic, iron, and manganese to persist downgradient of the localized area in which groundwater and waste interact. This conclusion is supported by the limited and discontinuous nature of the perched groundwater zones.

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8.0 References

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TABLES

TABLE 1
WELL COMPLETION DATA

IRP Site 27, NAVWPNSTA Seal Bach, Detachment Fallbrook
Fallbrook, California

WELL INSTALLATION						COMPLETION DATA																STATUS	COMPLETION DATA REFERENCE
Well Number	Date Completed	Location*		Elevation*		Hole Diam (in)	Casing Diam (in)	Screen		Depth (ft)						Elevation (ft msl)							
		Northing	Easting	Grd	TOC			Slot	Length	Sand Pack		Slotted		Total Depth		Sand Pack		Slotted		Total Depth			
		(ft)		ft (msl)				(in)	(ft)	Top	Bottom	Top	Bottom	Casing	Hole	Top	Bottom	Top	Bottom	Casing	Hole		
IRP27-MW-1	10/19/2006	2,072,615.42	6,248,713.01	608.90	612.06	10	4	0.010	20	18.5	41	20.5	40.5	41	41	590	568	588	568	571	568	Monitor	Exploratory Log
IRP27-MW-2	10/23/2006	2,072,743.37	6,248,797.68	600.07	602.11	10	4	0.010	10	18.5	31	20.5	30.5	31	31	582	569	580	570	571	569	Monitor	Exploratory Log
IRP27-MW-3	10/23/2006	2,072,802.00	6,248,905.41	594.65	598.02	10	4	0.010	10	18	30	19.5	29.5	30	30	577	565	575	565	568	565	Monitor	Exploratory Log
IRP27-MW-4A	10/27/2010	2,072,686.67	6,248,664.14	610.99	613.21	10	4	0.010	10	31.5	45	33.5	43.5	44	45	579	566	577	567	569	566	Monitor	Exploratory Log
IRP27-MW-5A	10/27/2010	2,072,891.67	6,248,844.14	594.86	596.95	10	4	0.010	10	11	24.5	13.5	23.5	24	24.5	584	570	581	571	573	570	Monitor	Exploratory Log
IRP27-MW-7	10/21/2010	2,072,951.47	6,248,950.74	587.60	589.77	10	4	0.010	10	10	23	12	22	22.5	23	578	565	576	566	567	565	Monitor	Exploratory Log
IRP27-MW-9A	10/26/2010	2,072,652.28	6,248,783.40	605.99	608.54	10	4	0.010	10	24	37	25.5	35.5	36	37	582	569	580	570	573	569	Monitor	Exploratory Log
IRP27-MW-12	5/24/2011	2,072,488.23	6,248,546.28	622.76	624.49	8	4	0.010	10	30	42.5	32	42	42.5	42.5	593	580	591	581	582	580	Monitor	Exploratory Log

Abbreviations

bgs = below ground surface
Diam. = diameter
ft = feet
Grd = ground
in = inches
msl = mean sea level
NAVWPNSTA = Naval Weapon Station
TOC = top of casing

Symbols

- = Not applicable or data not available

* = Surveyed to: Horizontal: North American Datum of 1983, (NAD '83), CCS83, Zone VI, (1991.35 epoch), Vertical: North American Vertical Datum of 1988, (NAVD '88). The elevations shown hereon are based upon the CSRC Data Point No. P476. Elevation = 1126.31 (NAVD '88).

TABLE 2
SUMMARY OF GROUNDWATER LEVELS

IRP Site 27, NAVWPNSTA Seal Beach, Detachment Fallbrook
Fallbrook, California

Location	Well ID	Date of Measurement	Top of Casing Elevation (ft msl)	Depth to Water (ft btoc)	Water Level Elevation (ft msl)
IPR-27	MW-1	10/14/10	612.06	34.90	577.16
IPR-27	MW-1	11/08/10	612.06	35.03	577.03
IPR-27	MW-1	02/11/11	612.06	32.13	579.93
IPR-27	MW-1	05/26/11	612.06	30.95	581.11
IPR-27	MW-1	05/31/11	612.06	14.75	597.31
IPR-27	MW-1	10/06/11	612.06	31.29	580.77
IPR-27	MW-1	11/13/12	612.06	32.93	579.13
IPR-27	MW-1	05/14/13	612.06	33.85	578.21
IPR-27	MW-2	10/14/10	602.11	25.70	576.41
IPR-27	MW-2	11/08/10	602.11	25.81	576.30
IPR-27	MW-2	02/11/11	602.11	22.82	579.29
IPR-27	MW-2	05/26/11	602.11	-	-
IPR-27	MW-2	05/31/11	602.11	21.88	580.23
IPR-27	MW-2	10/06/11	602.11	22.48	579.63
IPR-27	MW-2	11/13/12	602.11	23.98	578.13
IPR-27	MW-2	05/14/13	602.11	24.78	577.33
IPR-27	MW-3	10/14/10	598.02	22.92	575.10
IPR-27	MW-3	11/08/10	598.02	22.04	575.98
IPR-27	MW-3	02/11/11	598.02	18.86	579.16
IPR-27	MW-3	05/26/11	598.02	-	-
IPR-27	MW-3	05/31/11	598.02	18.14	579.88
IPR-27	MW-3	10/06/11	598.02	18.70	579.32
IPR-27	MW-3	11/13/12	598.02	20.29	577.73
IPR-27	MW-3	05/14/13	598.02	21.03	576.99
IPR-27	MW-4A	10/14/10	613.21	-	-
IPR-27	MW-4A	11/08/10	613.21	36.39	576.82
IPR-27	MW-4A	02/11/11	613.21	33.51	579.70
IPR-27	MW-4A	05/26/11	613.21	32.30	580.91
IPR-27	MW-4A	05/31/11	613.21	32.29	580.92
IPR-27	MW-4A	10/06/11	613.21	32.63	580.58
IPR-27	MW-4A	11/13/12	613.21	34.33	578.88
IPR-27	MW-4A	05/14/13	613.21	35.24	577.97
IPR-27	MW-5A	10/14/10	596.95	-	-
IPR-27	MW-5A	11/08/10	596.95	21.20	575.75
IPR-27	MW-5A	02/11/11	596.95	18.10	578.85
IPR-27	MW-5A	05/26/11	596.95	-	-
IPR-27	MW-5A	05/31/11	596.95	17.40	579.55
IPR-27	MW-5A	10/06/11	596.95	18.00	578.95
IPR-27	MW-5A	11/13/12	596.95	19.56	577.39
IPR-27	MW-5A	05/14/13	596.95	20.26	576.69
IPR-27	MW-7	10/14/10	589.77	-	-
IPR-27	MW-7	11/08/10	589.77	14.87	574.90
IPR-27	MW-7	02/11/11	589.77	11.53	578.24
IPR-27	MW-7	05/26/11	589.77	-	-
IPR-27	MW-7	05/31/11	589.77	11.28	578.49
IPR-27	MW-7	10/06/11	589.77	12.20	577.57
IPR-27	MW-7	11/13/12	589.77	13.49	576.28
IPR-27	MW-7	05/14/13	589.77	14.09	575.68
IPR-27	MW-9A	10/14/10	608.54	-	-
IPR-27	MW-9A	11/08/10	608.54	31.84	576.70
IPR-27	MW-9A	02/11/11	608.54	28.90	579.64

TABLE 2
SUMMARY OF GROUNDWATER LEVELS

IRP Site 27, NAVWPNSTA Seal Beach, Detachment Fallbrook
Fallbrook, California

Location	Well ID	Date of Measurement	Top of Casing Elevation (ft msl)	Depth to Water (ft btoc)	Water Level Elevation (ft msl)
IPR-27	MW-9A	05/26/11	608.54	-	-
IPR-27	MW-9A	05/31/11	608.54	27.82	580.72
IPR-27	MW-9A	10/06/11	608.54	28.25	580.29
IPR-27	MW-9A	11/13/12	608.54	29.91	578.63
IPR-27	MW-9A	05/14/13	608.54	30.77	577.77
IPR-27	MW-12	10/14/10	624.49	-	-
IPR-27	MW-12	11/08/10	624.49	-	-
IPR-27	MW-12	02/11/11	624.49	-	-
IPR-27	MW-12	05/26/11	624.49	41.95	582.54
IPR-27	MW-12	05/31/11	624.49	41.89	582.60
IPR-27	MW-12	10/06/11	624.49	40.96	583.53
IPR-27	MW-12	11/13/12	624.49	42.20	582.29
IPR-27	MW-12	05/14/13	624.49	43.29	581.20

Notes:

All coordinates are provided in the California Coordinate System, Zone VI, 1983 North American Datum (191.35 EPOCH OCS GPS adjustment)

Acronyms and Abbreviations:

btoc = below top of casing

ft = feet

ID = identification

IRP = Installation Restoration Program

msl = mean sea level

NAVWPNSTA = Naval Weapon Station

TABLE 3
SUMMARY OF FIELD PARAMETER MEASUREMENTS IN GROUNDWATER

IRP Site 27, NAVWPNSTA Seal Beach, Detachment Fallbrook
Fallbrook, California

Location	Well ID	Sampling Date	pH	EC (mS/cm)	Temp (°C)	DO (mg/L)	Turbidity (NTU)*	Salinity (%)	ORP (mV)	Initial Water Depth (ft-btoc)	Discharge Rate (ml/min)	Final Water Depth (ft-btoc)	Filtered (Y/N)	Purge Time			Draw-down (ft)	Pump Type
														Begin	End	Duration (min)		
IRP Site 27	MW-1	11/8/2010	7.12	0.587	21.04	0.23	9.6	-	76.7	35.03	-	35.56	N	-	-	-	0.53	BLADR
IRP Site 27	MW-1	6/1/2011	6.41	1.402	22.56	1.99	0.04	-	130.4	30.99	-	31.03	N	-	-	-	0.04	BLADR
IRP Site 27	MW-1	11/14/2012	6.53	0.486	22.93	1.75	0.65	0.23	165	32.86	100	33.02	N	13:45	14:55	1:10	0.16	BLADR
IRP Site 27	MW-1	5/15/2013	6.55	0.395	23.56	1.73	3.29	0.19	124	38.89	100	38.94	N	10:45	12:05	1:20	0.05	BLADR
IRP Site 27	MW-2	11/8/2010	6.58	1.166	21.22	0.39	32.4	-	88.9	25.81	-	25.85	N	-	-	-	0.04	BLADR
IRP Site 27	MW-2	6/1/2011	6.45	1.702	24.60	0.76	20.6	-	-83.2	21.9	-	21.98	N	-	-	-	0.08	BLADR
IRP Site 27	MW-2	11/15/2012	6.63	1.098	20.88	0.41	2.26	0.54	-35	24.04	100	24.12	N	9:10	10:30	1:20	0.08	BLADR
IRP Site 27	MW-2	5/15/2013	6.64	0.835	24.17	0.26	3.81	0.41	-110	24.75	100	24.85	N	14:20	15:30	1:10	0.10	BLADR
IRP Site 27	MW-3	11/9/2010	6.83	0.718	19.14	5.06	0.38	-	196.5	22.04	-	22.09	N	-	-	-	0.05	BLADR
IRP Site 27	MW-3	6/1/2011	6.64	0.919	20.54	0.93	17	-	104.5	18.14	-	18.14	N	-	-	-	0	BLADR
IRP Site 27	MW-3	11/14/2012	6.75	0.587	23.93	2.78	3.75	0.29	146	20.25	100	20.39	N	11:50	12:55	1:05	0.14	BLADR
IRP Site 27	MW-3	5/15/2013	6.77	0.480	22.40	3.56	7.03	0.23	106	21.04	100	21.14	N	9:25	10:35	1:10	0.10	BLADR
IRP Site 27	MW-4A	11/9/2010	7.15	1.163	22.03	2.67	2.06	-	75	36.37	-	36.46	N	-	-	-	0.09	BLADR
IRP Site 27	MW-4A	6/1/2011	6.75	0.84	23.20	2.2	1	-	99.3	32.38	-	32.38	N	-	-	-	0.00	BLADR
IRP Site 27	MW-4A	11/14/2012	6.76	0.750	21.60	2.32	1.97	0.37	157	34.23	100	34.43	N	15:20	16:25	1:05	0.20	BLADR
IRP Site 27	MW-4A	5/15/2013	6.73	0.625	22.74	2.31	4.81	0.30	113	35.16	100	35.36	N	12:20	13:20	1:00	0.20	BLADR
IRP Site 27	MW-5A	11/9/2010	7.13	0.847	22.01	3.24	3.1	-	58.7	21.21	-	21.70	N	-	-	-	0.49	BLADR
IRP Site 27	MW-5A	5/31/2011	7.18	0.691	29.49	2.63	0.04	-	64.5	17.47	-	17.52	N	-	-	-	0.05	BLADR
IRP Site 27	MW-5A	11/13/2012	6.80	0.736	23.57	0.46	0.53	0.36	130	19.50	100	19.70	N	14:55	17:00	2:05	0.20	BLADR
IRP Site 27	MW-5A	5/14/2013	6.87	0.641	23.24	2.24	2.58	0.31	96	20.19	100	20.41	N	15:55	17:55	2:00	0.22	BLADR
IRP Site 27	MW-7	11/9/2010	7.39	0.786	22.09	4.28	3.31	-	77.2	14.9	-	15.17	N	-	-	-	0.27	BLADR
IRP Site 27	MW-7	5/31/2011	6.9	0.604	22.85	2.41	3	-	57.8	11.28	-	11.28	N	-	-	-	0.00	BLADR
IRP Site 27	MW-7	11/14/2012	6.86	0.506	22.73	2.92	0.47	0.25	133	13.47	100	13.57	N	8:40	11:25	2:45	0.10	BLADR
IRP Site 27	MW-7	5/14/2013	6.85	0.408	21.68	3.69	5.75	0.19	104	14.09	100	14.18	N	18:15	19:15	1:00	0.09	BLADR
IRP Site 27	MW-9A	11/9/2010	7.22	0.678	21.45	4.93	14.5	-	170.1	31.89	-	32.96	N	-	-	-	1.07	BLADR
IRP Site 27	MW-9A	5/31/2011	7.26	0.051	23.33	2.33	0.03	-	62.2	27.82	-	28.78	N	-	-	-	0.96	BLADR
IRP Site 27	MW-9A	11/13/2012	6.88	0.425	25.19	4.15	3.03	0.20	151	29.90	100	30.06	N	13:05	14:30	1:25	0.16	BLADR
IRP Site 27	MW-9A	5/14/2013	6.77	0.348	26.80	4.39	3.07	0.17	104	30.69	100	30.99	N	13:55	15:35	1:40	0.30	BLADR
IRP Site 27	MW-12	5/31/2011	6.87	0.754	24.45	4.15	1	-	56.6	41.89	-	41.89	N	-	-	-	0.00	BLADR
IRP Site 27	MW-12	11/13/2012	6.69	0.814	26.01	3.49	5.95	0.40	192	42.23	100	42.63	N	10:25	12:20	1:55	0.40	BLADR
IRP Site 27	MW-12	5/14/2013	6.78	0.678	27.00	3.85	4.92	0.33	107	43.29	100	43.74	N	9:45	13:25	3:40	0.45	BLADR

Minimum	6.41	0.051	19.14	0.23	0.03	0.17	-110	-	-	-	-	-	-	1:00	0.00
Average	6.83	0.733	23.18	2.53	5.22	0.30	94	-	-	-	-	-	-	1:36	0.21
Maximum	7.39	1.702	29.49	5.06	32.40	0.54	197	-	-	-	-	-	-	3:40	1.07

TABLE 3
SUMMARY OF FIELD PARAMETER MEASUREMENTS IN GROUNDWATER

IRP Site 27, NAVWPNSTA Seal Beach, Detachment Fallbrook
Fallbrook, California

Location	Well ID	Sampling Date	pH	EC (mS/cm)	Temp (°C)	DO (mg/L)	Turbidity (NTU)*	Salinity (%)	ORP (mV)	Initial Water Depth (ft-btoc)	Discharge Rate (ml/min)	Final Water Depth (ft-btoc)	Filtered (Y/N)	Purge Time			Draw-down (ft)	Pump Type
														Begin	End	Duration (min)		

Notes:

Symbols:
- = Not applicable or available

Acronyms/Abbreviations:

BTOC = below top of casing
BLADR = bladder Pump
°C = degrees Celsius
DO = dissolved oxygen
EC = electrical conductance
ft = feet
ID = identification
mg/L = milligrams per liter
ml/min = milliliters per minute
mS/cm = milliSiemens per centimeter
mV = millivolt
min = minute
NTU = nephelometric turbidity unit
ORP = oxidation-reduction potential
pH = acidity
Temp = Temperature

Table 4
Analytes Evaluated during SI, RI, and Extended RI
IRP Site 27, NAVWPNSTA Seal Beach, Detachment Fallbrook, Fallbrook, California

Extended RI Analyte	Method
VOCs	EPA 8260B
TPH-P	EPA 8015M
TPH-E	EPA 8015M
Pesticide/PCBs	EPA 8081A/8082
SVOCs	EPA 8270C
Dissolved Metals/Mercury	EPA 6020A/7470A
Nitrate/Nitrite/Sulfate	EPA 300.0
Sulfide	EPA 376.1
Ammonia	EPA 350.2
Hydrazine	ASTM D1385
NDMA	EPA 1625 C
RI Analyte	**Method**
VOCs	EPA 8260B
TPH-P	EPA 8015
TPH-E	EPA 8015
Pesticide/PCBs	EPA 8081/8082
SVOCs	EPA 8270
Dissolved Metals	EPA 6020/7470
Ammonia/Nitrate	EPA 350.2/353.3
Sulfide	EPA 376.1
Sulfate/Nitrite	EPA 300
Hydrazine	ASTM D1385
NDMA	EPA 1625 C
SI Analyte	**Method**
VOCs	EPA 8260B
Perchlorate	EPA 314.0
SVOCs	EPA 8270C and 8270C SIM
Metals	EPA 6020A
Mercury	EPA 7471A
Hexavalent chromium	EPA 7196A
Organics (including diesel and motor oil)	EPA 8015B
Pesticides	EPA 8081A
PCBs	EPA 8082
Inorganics (including nitrate-N and nitrite-N)	EPA 300.0
Ammonia	EPA 350.2
TKN	EPA 351.3
Sulfide	EPA 376.1
pH	EPA 9045C

NOTES:

EPA = Environmental Protection Agency
IRP = Installation Restoration Program
NAVWPNSTA = Naval Weapon Station
NDMA = N-nitrosodimethylamine
PCBs = Polychlorinated Biphenyls
pH = potential Hydrogen
RI = Remedial Investigation
SI = Site Inspection
SIM = Selected Ion Monitoring
SVOCs = Semivolatile Organic Compounds
TKN = Total Kjeldahl Nitrogen
TPH-E = Total Petroleum Hydrocarbons - by Extraction
TPH-P = Total Petroleum Hydrocarbons - by Purge and Trap
VOCs = Volatile Organic Compounds

TABLE 5
Summary of Analytical Results in Groundwater - Hydrazine, NDMA, Wet Chemistry, TPH, and VOCs
IRP Site 27, NAVWPNSTA Seal Beach Fallbrook Detachment
Fallbrook, California

Sample Number			IRP 27-MW-1		IRP 27-MW-1		IRP 27-MW-2		IRP 27-MW-2		IRP 27-MW-3		IRP 27-MW-3		IRP 27-MW-4A		IRP 27-MW-4A	
Sample Date		PAL	11/14/2012		5/15/2013		11/15/2012		5/15/2013		11/14/2012		5/15/2013		11/14/2012		5/15/2013	
Parameter	PAL	Reference	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Hydrazine - ASTM D1385 (µg/L)																		
Hydrazine	NE	NE	2.0	U	1.2	J	1.9	J	3.8		2.0	U	2.4		2.0	U	2.0	U
NDMA - EPA 1625C (ng/L)																		
N-nitrosodimethylamine (NDMA)	3	CNL	0.619	UJ	0.334	U	2.75		0.338	U	**3.85**		0.517	U	NA		NA	
Wet Chemical Analysis (mg/L)																		
Nitrate (EPA 300.0)	45	MCL	14.2		13.6		0.229	J	0.433	U	18.2		19.6		17.0		16.1	
Nitrite (EPA 300.0)	1	MCL	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U
Sulfate (EPA 300.0)	250	Sec. MCL	24.7		22.6		62.7		47.4		35.3		34.0		39.0		36.8	
Ammonia (NH_3 as N - EPA 350.2)	NE	NE	0.1	U	0.1	U	0.376		0.103		0.1	U	0.1	U	0.1	U	0.1	U
Sulfide (EPA 376.1)	NE	NE	1.00	U	1	U	1.00	U	1	U	1.00	U	1	U	1.00	U	1	U
TPH - EPA 8015B (mg/L)																		
Gasoline-Range Organics	NE	NE	0.020	U	0.020	U	0.020	U	0.020	U	0.020	U	0.020	U	0.020	U	0.020	U
Stoddard Solvent	NE	NE	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
Diesel-Range Organics	NE	NE	0.094	U	0.10	U	0.33		0.23		0.095	U	0.11	U	0.097	U	0.10	U
Motor Oil	NE	NE	0.094	U	0.10	U	0.11		0.20		0.095	U	0.11	U	0.097	U	0.10	U
VOCs - EPA 8260B (µg/L)																		
1,1,1-Trichloroethane	200	MCL	1.0	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	1	MCL	1.0	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	5	MCL	1.0	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	5	MCL	1.0	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	5	MCL	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
1,1-Dichloroethene	6	MCL	1.0	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	0.5	MCL	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	5	MCL	1.0	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	5	MCL	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	NE	NE	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
2-Hexanone	NE	NE	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
4-Methyl-2-Pentanone	NE	NE	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Acetone	NE	NE	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Benzene	1	MCL	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	NE	NE	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	NE	NE	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	NE	NE	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Carbon Tetrachloride	0.5	MCL	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	70	MCL	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	NE	NE	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chloroform	NE	NE	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	NE	NE	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Cis-1,2-Dichloroethene	6	MCL	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Cis-1,3-Dichloropropene	0.5	MCL	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Dibromochloromethane	NE	NE	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Ethylbenzene	300	MCL	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	NE	NE	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
O-Xylene	NE	NE	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Methyl Tert-Butyl Ether	5	Sec. MCL	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	5	MCL	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Naphthalene	NE	NE	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Styrene	100	MCL	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Tetrachloroethene	5	MCL	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	150	MCL	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	10	MCL	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-1,3-Dichloropropene	0.5	MCL	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Trichloroethene	5	MCL	0.22	J	0.50	U	0.23	J	0.50	U	0.30	J	0.50	U	0.50	U	0.50	U
Trichlorofluoromethane	150	MCL	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Freon 113	1.2	MCL	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Vinyl Chloride	0.5	MCL	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Total Xylenes	1750	MCL	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U

TABLE 5
Summary of Analytical Results in Groundwater - Hydrazine, NDMA, Wet Chemistry, TPH, and VOCs
IRP Site 27, NAVWPNSTA Seal Beach Fallbrook Detachment
Fallbrook, California

Sample Number			IRP 27-MW-1		IRP 27-MW-1		IRP 27-MW-2		IRP 27-MW-2		IRP 27-MW-3		IRP 27-MW-3		IRP 27-MW-4A		IRP 27-MW-4A	
Sample Date		PAL	11/14/2012		5/15/2013		11/15/2012		5/15/2013		11/14/2012		5/15/2013		11/14/2012		5/15/2013	
Parameter	PAL	Reference	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual

Definitions:

CNL: California Notification Level
EPA: U.S. Environmental Protection Agency
IRP: Installation Restoration Program
MCL: Maximum Contaminant Level
µg/L: microgram(s) per liter
mg/L: milligram(s) per liter
ng/L: nanogram(s) per liter
NA: not analyzed
NAVWPNSTA: Naval Weapon Station
NDMA: N-nitrosodimethylamine
NE: MCL is not established
Sec. MCL: Secondary Maximum Contaminant Level
Qual: laboratory and validation qualifiers
TPH: Total Petroleum Hydrocarbons
VOCs: Volatile Organic Compounds

Laboratory and Validation Qualifiers:

J: indicates that the associated numerical value is an estimate
U: indicates compound was analyzed for, but not detected at the specified detection limit.
UJ indicates that the analyte was not detected, the reported quantitation limit is an estimate

Notes:

- NDMA analysis was performed on groundwater samples from the interior wells first, while groundwater samples from the exterior wells were held for analysis. The NDMA concentrations from interior wells were less than 0.01 ug/L (10.0 ng/L), therefore the groundwater samples from the exterior wells were not analyzed.
- IRP27-MW-X is a duplicate sample of IRP27-MW-7

Bold results indicate the analyte exceeded the PAL

TABLE 5
Summary of Analytical Results in Groundwater - Hydrazine, NDMA, Wet Chemistry, TPH, and VOCs
IRP Site 27, NAVWPNSTA Seal Beach Fallbrook Detachment
Fallbrook, California

Sample Number		IRP 27-MW-5A		IRP 27-MW-5A		IRP 27-MW-7		IRP 27-MW-X		IRP 27-MW-7		IRP 27-MW-9A		IRP 27-MW-9A		IRP 27-MW-X		IRP 27-MW-12		IRP 27-MW-12	
Sample Date		11/13/2012		5/14/2013		11/14/2012		11/14/2012		5/14/2013		11/13/2012		5/14/2013		5/14/2013		11/13/2012		5/14/2013	
Parameter	PAL	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Hydrazine - ASTM D1385 (µg/L)																					
Hydrazine	NE	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.7		1.1	J	2.0	U	2.0	U	5.3	
NDMA - EPA 1625C (ng/L)																					
N-nitrosodimethylamine (NDMA)	3	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Wet Chemical Analysis (mg/L)																					
Nitrate (EPA 300.0)	45	13.6		15.7		18.6		18.7		19.3		17.6		18.3		18.3		11.6		12.2	
Nitrite (EPA 300.0)	1	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U	0.100	U
Sulfate (EPA 300.0)	250	57.3		62.3		33.3		33.3		30.1		21.0		21.2		21.4		38.9		38.7	
Ammonia (NH_3 as N - EPA 350.2)	NE	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Sulfide (EPA 376.1)	NE	1.00	U	1	U	1.00	U	1.00	U	1	U	1.00	U	1	U	1	U	1.00	U	1	U
TPH - EPA 8015B (mg/L)																					
Gasoline-Range Organics	NE	0.020	U	0.020	U	0.020	U	0.020	U	0.020	U	0.020	U	0.020	U	0.020	U	0.020	U	0.020	U
Stoddard Solvent	NE	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
Diesel-Range Organics	NE	0.095	U	0.096	U	0.097	U	0.097	U	0.096	U	0.098	U	0.097	U	0.097	U	0.10	U	0.10	U
Motor Oil	NE	0.095	U	0.096	U	0.097	U	0.097	U	0.096	U	0.098	U	0.097	U	0.097	U	0.10	U	0.10	U
VOCs - EPA 8260B (µg/L)																					
1,1,1-Trichloroethane	200	1.0	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	1	1.0	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	5	1.0	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	5	1.0	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	5	1.0	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-Dichloroethene	6	1.0	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	0.5	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	5	1.0	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	5	1.0	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	NE	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
2-Hexanone	NE	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
4-Methyl-2-Pentanone	NE	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Acetone	NE	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Benzene	1	1.0	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	NE	1.0	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	NE	1.0	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	NE	1.0	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
Carbon Tetrachloride	0.5	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	70	1.0	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	NE	1.0	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
Chloroform	NE	1.0	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	NE	1.0	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
Cis-1,2-Dichloroethene	6	1.0	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
Cis-1,3-Dichloropropene	0.5	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
Dibromochloromethane	NE	1.0	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
Ethylbenzene	300	1.0	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	NE	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
O-Xylene	NE	1.0	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
Methyl Tert-Butyl Ether	5	1.0	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	5	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
Naphthalene	NE	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	UJ
Styrene	100	1.0	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
Tetrachloroethene	5	1.0	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	150	1.0	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
Trans-1,2-Dichloroethene	10	1.0	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
Trans-1,3-Dichloropropene	0.5	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
Trichloroethene	5	0.50	U	0.50	U	0.47	J	0.46	J	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	**0.34**	**J**
Trichlorofluoromethane	150	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
Freon 113	1.2	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
Vinyl Chloride	0.5	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
Total Xylenes	1750	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

TABLE 5
Summary of Analytical Results in Groundwater - Hydrazine, NDMA, Wet Chemistry, TPH, and VOCs
IRP Site 27, NAVWPNSTA Seal Beach Fallbrook Detachment
Fallbrook, California

Sample Number		IRP 27-MW-5A		IRP 27-MW-5A		IRP 27-MW-7		IRP 27-MW-X		IRP 27-MW-7		IRP 27-MW-9A		IRP 27-MW-9A		IRP 27-MW-X		IRP 27-MW-12		IRP 27-MW-12	
Sample Date		11/13/2012		5/14/2013		11/14/2012		11/14/2012		5/14/2013		11/13/2012		5/14/2013		5/14/2013		11/13/2012		5/14/2013	
Parameter	PAL	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual

Definitions:

CNL: California Notification Level
EPA: U.S. Environmental Protection Agency
IRP: Installation Restoration Program
MCL: Maximum Contaminant Level
µg/L: microgram(s) per liter
mg/L: milligram(s) per liter
ng/L: nanogram(s) per liter
NA: not analyzed
NAVWPNSTA: Naval Weapon Station
NDMA: N-nitrosodimethylamine
NE: MCL is not established
Sec. MCL: Secondary Maximum Contaminant Level
Qual: laboratory and validation qualifiers
TPH: Total Petroleum Hydrocarbons
VOCs: Volatile Organic Compounds

Laboratory and Validation Qualifiers:

J: indicates that the associated numerical value is an estimate
U: indicates compound was analyzed for, but not detected at the specified detection limit.
UJ indicates that the analyte was not detected, the reported quantitation limit is an estimate

Notes:

- NDMA analysis was performed on groundwater samples from the interior wells first, while groundwater samples from the exterior wells were held for analysis. The NDMA concentrations from interior wells were less than 0.01 ug/L (10.0 ng/L), therefore the groundwater samples from the exterior wells were not analyzed.
- IRP27-MW-X is a duplicate sample of IRP27-MW-7

Bold results indicate the analyte exceeded the PAL

TABLE 6
Summary of Analytical Results in Groundwater - SVOCs
IRP Site 27, NAVWPNSTA Seal Beach Fallbrook Detachment
Fallbrook, California

Parameter	PAL	PAL Reference	IRP 27-MW-1 11/14/2012		IRP 27-MW-1 5/15/2013		IRP 27-MW-2 11/15/2012		IRP 27-MW-2 5/15/2013		IRP 27-MW-3 11/14/2012		IRP 27-MW-3 5/15/2013		IRP 27-MW-4A 11/14/2012		IRP 27-MW-4A 5/15/2013		IRP 27-MW-5A 11/13/2012		IRP 27-MW-5A 5/14/2013		IRP 27-MW-7 11/14/2012		IRP 27-MW-X 11/14/2012		IRP 27-MW-7 5/14/2013		IRP 27-MW-9A 11/13/2012		IRP 27-MW-9A 5/14/2013		IRP 27-MW-X 5/14/2013		IRP 27-MW-12 11/13/2012		IRP 27-MW-12 5/14/2013	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
SVOCS - EPA 8270C (µg/L)																																								
1,2-Dichlorobenzene	600	MCL	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
1,3-Dichlorobenzene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
2,4,5-Trichlorophenol	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
2,4,6-Trichlorophenol	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
2,4-Dichlorophenol	NE	NE	19	U	20	U	22	U	19	U	21	U	22	U	19	U	20	U	21	U	21	U	22	U	19	U	21	U	19	U	20	U	19	U	19	U	20	U
2,4-Dimethylphenol	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
2,4-Dinitrophenol	NE	NE	19	U	20	U	22	U	19	U	21	U	22	U	19	U	20	U	21	U	21	U	22	U	19	U	21	U	19	U	20	U	19	U	19	U	20	U
2,4-Dinitrotoluene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
2,6-Dinitrotoluene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
2-Chloronaphthalene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
2-Chlorophenol	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
2-Methylnaphthalene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
2-Methylphenol	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
2-Nitroaniline	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
2-Nitrophenol	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
3,3'-Dichlorobenzidine	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
3-Nitroaniline	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
4,6-Dinitro-2-Methylphenol	NE	NE	19	U	20	U	22	U	19	U	21	U	22	U	19	U	20	U	21	U	21	U	22	U	19	U	21	U	19	U	20	U	19	U	19	U	20	U
4-Bromophenyl-Phenyl Ether	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
4-Chloro-3-Methylphenol	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
4-Chloroaniline	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
4-Chlorophenyl-Phenyl Ether	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
4-Methylphenol (1)	NE	NE	19	U	20	U	22	U	19	U	21	U	22	U	19	U	20	U	21	U	21	U	22	U	19	U	21	U	19	U	20	U	19	U	19	U	20	U
4-Nitroaniline	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
4-Nitrophenol	NE	NE	19	U	20	U	22	U	19	U	21	U	22	U	19	U	20	U	21	U	21	U	22	U	19	U	21	U	19	U	20	U	19	U	19	U	20	U
Acenaphthene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Acenaphthylene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Anthracene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Benzo(a)anthracene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Benzo(a)pyrene	0.2	MCL	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Benzo(b)fluoranthene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Benzo(g,h,i)perylene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Benzo(k)fluoranthene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
bis(2-Chloroethoxy)methane	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
bis(2-Chloroethyl)ether	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
bis(2-Chloroisopropyl)ether	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
bis(2-Ethylhexyl)phthalate	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	9.0	J	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Butylbenzylphthalate	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Chrysene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Dibenzo(a,h)anthracene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Dibenzofuran	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Diethylphthalate	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Dimethylphthalate	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
di-n-Butylphthalate	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
di-n-Octylphthalate	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Fluoranthene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Fluorene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Hexachlorobenzene	1	MCL	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Hexachlorobutadiene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U

TABLE 6
Summary of Analytical Results in Groundwater - SVOCs
IRP Site 27, NAVWPNSTA Seal Beach Fallbrook Detachment
Fallbrook, California

Parameter	PAL	PAL Reference	IRP 27-MW-1 11/14/2012		IRP 27-MW-1 5/15/2013		IRP 27-MW-2 11/15/2012		IRP 27-MW-2 5/15/2013		IRP 27-MW-3 11/14/2012		IRP 27-MW-3 5/15/2013		IRP 27-MW-4A 11/14/2012		IRP 27-MW-4A 5/15/2013		IRP 27-MW-5A 11/13/2012		IRP 27-MW-5A 5/14/2013		IRP 27-MW-7 11/14/2012		IRP 27-MW-X 11/14/2012		IRP 27-MW-7 5/14/2013		IRP 27-MW-9A 11/13/2012		IRP 27-MW-9A 5/14/2013		IRP 27-MW-X 5/14/2013		IRP 27-MW-12 11/13/2012		IRP 27-MW-12 5/14/2013	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
SVOCS - EPA 8270C (µg/L)																																						
Hexachlorocyclopentadiene	NE	NE	19	U	20	U	22	U	19	U	21	U	22	U	19	U	20	U	21	U	21	U	22	U	19	U	21	U	19	U	20	U	19	U	19	U	20	U
Hexachloroethane	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Indeno(1,2,3-cd)pyrene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Isophorone	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Naphthalene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Nitrobenzene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
n-Nitroso-di-n-Propylamine	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
n-Nitrosodiphenylamine (2)	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Pentachlorophenol	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Phenanthrene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Phenol	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U
Pyrene	NE	NE	9.5	U	9.8	U	11	U	9.7	U	10	U	11	U	9.6	U	10	U	11	U	11	U	11	U	9.5	U	11	U	9.6	U	10	U	9.7	U	9.6	U	10	U

Definitions:

EPA: U.S. Environmental Protection Agency
IRP: Installation Restoration Program
MCL: Maxumum Contaminant Level
NAVWPNSTA: Naval Weapon Station
NE: MCL is not established
Qual: Laboratory and Validation Qualifiers
SVOCs: semivolatile organic compounds
µg/L: microgram(s) per liter

Laboratory and Validation Qualifiers:

J: indicates that the associated numerical value is an estimate
U: indicates compound was analyzed for, but not detected at the specified detection limit.
UJ indicates that the analyte was not detected, the reported quantitation limit is an estimate

Notes:

- IRP27-MW-X i - IRP27-MW-X is a duplicate sample of IRP27-MW-7
Bold results indic **Bold** results indicate the analyte exceeded the PAL

TABLE 7
Summary of Analytical Results in Groundwater - Pesticides and PCBs
IRP Site 27, NAVWPNSTA Seal Beach Fallbrook Detachment
Fallbrook, California

Parameter	PAL	PAL Reference	IRP 27-MW-1 11/14/2012		IRP 27-MW-1 5/15/2013		IRP 27-MW-2 11/15/2012		IRP 27-MW-2 5/15/2013		IRP 27-MW-3 11/14/2012		IRP 27-MW-3 5/15/2013		IRP 27-MW-4A 11/14/2012		IRP 27-MW-4A 5/15/2013		IRP 27-MW-5A 11/13/2012		IRP 27-MW-5A 5/14/2013		IRP 27-MW-7 11/14/2012		IRP 27-MW-X 11/14/2012		IRP 27-MW-7 5/14/2013		IRP 27-MW-9A 11/13/2012		IRP 27-MW-9A 5/14/2013		IRP 27-MW-X 5/14/2013		IRP 27-MW-12 11/13/2012		IRP 27-MW-12 5/14/2013	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Pesticides - EPA 8081A (µg/L)																																						
Alpha-BHC	NE	NE	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Gamma-BHC (Lindane)	0.2	MCL	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Beta-BHC	NE	NE	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Heptachlor	0.01	MCL	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Delta-BHC	NE	NE	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Aldrin	NE	NE	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Heptachlor Epoxide	0.01	MCL	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Gamma-Chlordane	0.1	MCL	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Alpha-Chlordane	0.1	MCL	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Endosulfan I	NE	NE	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
4,4'-DDE	NE	NE	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Dieldrin	NE	NE	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Endrin	2	MCL	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
4,4'-DDD	NE	NE	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Endosulfan II	NE	NE	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
4,4'-DDT	NE	NE	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Endrin Aldehyde	NE	NE	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Endosulfan Sulfate	NE	NE	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Endrin Ketone	NE	NE	0.052	U	0.051	U	0.048	U	0.052	U	0.055	U	0.051	U	0.052	U	0.050	U	0.050	U	0.050	U	0.052	U	0.051	U	0.048	U	0.052	U	0.050	U	0.049	U	0.051	U	0.051	U
Methoxychlor	30	MCL	0.52	U	0.51	U	0.48	U	0.52	U	0.55	U	0.51	U	0.52	U	0.50	U	0.50	U	0.50	U	0.52	U	0.51	U	0.48	U	0.52	U	0.50	U	0.49	U	0.51	U	0.51	U
Toxaphene	3	MCL	1.0	U	1.0	U	0.95	U	1.0	U	1.1	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	0.95	U	1.0	U	1.0	U	0.98	U	1.0	U	1.0	U
PCBs - EPA 8082 (µg/L)																																						
PCB-1016	0.5	MCL	0.52	U	0.51	U	0.48	U	0.52	U	0.55	U	0.51	U	0.52	U	0.50	U	0.50	U	0.50	U	0.52	U	0.51	U	0.48	U	0.52	U	0.50	U	0.49	U	0.51	U	0.51	U
PCB-1221	0.5	MCL	0.52	U	0.51	U	0.48	U	0.52	U	0.55	U	0.51	U	0.52	U	0.50	U	0.50	U	0.50	U	0.52	U	0.51	U	0.48	U	0.52	U	0.50	U	0.49	U	0.51	U	0.51	U
PCB-1232	0.5	MCL	0.52	U	0.51	U	0.48	U	0.52	U	0.55	U	0.51	U	0.52	U	0.50	U	0.50	U	0.50	U	0.52	U	0.51	U	0.48	U	0.52	U	0.50	U	0.49	U	0.51	U	0.51	U
PCB-1242	0.5	MCL	0.52	U	0.51	U	0.48	U	0.52	U	0.55	U	0.51	U	0.52	U	0.50	U	0.50	U	0.50	U	0.52	U	0.51	U	0.48	U	0.52	U	0.50	U	0.49	U	0.51	U	0.51	U
PCB-1248	0.5	MCL	0.52	U	0.51	U	0.48	U	0.52	U	0.55	U	0.51	U	0.52	U	0.50	U	0.50	U	0.50	U	0.52	U	0.51	U	0.48	U	0.52	U	0.50	U	0.49	U	0.51	U	0.51	U
PCB-1254	0.5	MCL	0.52	U	0.51	U	0.48	U	0.52	U	0.55	U	0.51	U	0.52	U	0.50	U	0.50	U	0.50	U	0.52	U	0.51	U	0.48	U	0.52	U	0.50	U	0.49	U	0.51	U	0.51	U
PCB-1260	0.5	MCL	0.52	U	0.51	U	0.48	U	0.52	U	0.55	U	0.51	U	0.52	U	0.50	U	0.50	U	0.50	U	0.52	U	0.51	U	0.48	U	0.52	U	0.50	U	0.49	U	0.51	U	0.51	U

Definitions:

EPA: U.S. Environmental Protection Agency
IRP: Installation Restoration Program
MCL: Maximum Contaminant Level
NAVWPNSTA: Naval Weapon Station
NE: MCL is not established
PAL: Project Action Limit
PCBs: polychlorinated biphenyl(s)
Qual: laboratory and validation qualifiers
SVOCs: semivolatile organic compounds
µg/L: microgram(s) per liter

Laboratory and Validation Qualifiers:

J: indicates that the associated numerical value is an estimate
U: indicates compound was analyzed for, but not detected at the specified detection limit.
UJ indicates that the analyte was not detected, the reported quantitation limit is an estimate

Notes:

- IRP27-MW-X i - IRP27-MW-X is a duplicate sample of IRP27-MW-7
Bold results indicate the analyte exceeded the PAL

TABLE 8
Summary of Analytical Results in Groundwater - Metals
IRP Site 27, NAVWPNSTA Seal Beach Fallbrook Detachment
Fallbrook, California

Sample Number			IRP27-MW-1			IRP27-MW-1			IRP27-MW-2			IRP27-MW-2			IRP27-MW-3			IRP27-MW-3			IRP27-MW-4A			IRP27-MW-4A			IRP27-MW-5A		
Sample Date		PAL	11/14/2012			5/15/2013			11/15/2012			5/15/2013			11/14/2012			5/15/2013			11/14/2012			5/15/2013			11/13/2012		
Parameter	PAL	Reference	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL
Metals -EPA 6010B/7470A (µg/L)																													
Aluminum	200	Sec. MCL	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0
Antimony	6	MCL	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Arsenic	**10**	MCL	1.03	1.00	0.500	0.928 J	1.00	0.500	**25.1**	1.00	0.500	**20.4**	1.00	0.500	2.30	1.00	0.500	2.25	1.00	0.500	1.25	1.00	0.500	1.13	1.00	0.500	2.53	1.00	0.500
Barium	1000	MCL	16.3	1.00	0.500	15.8	1.00	0.500	48.1	1.00	0.500	35.0	1.00	0.500	15.6	1.00	0.500	14.1	1.00	0.500	24.2	1.00	0.500	25.1	1.00	0.500	9.45	1.00	0.500
Beryllium	4	MCL	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Cadmium	5	MCL	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Chromium	50	MCL	2.21	1.00	0.500	2.27	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	2.48	1.00	0.500	2.45	1.00	0.500	1.02	1.00	0.500	1.08	1.00	0.500	0.961 J	1.00	0.500
Cobalt	NE	NE	ND	1.00	0.500	ND	1.00	0.500	5.90	1.00	0.500	4.98	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Copper	1000	Sec. MCL	0.517 J	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	0.624 J	1.00	0.500	0.711 J	1.00	0.500	0.546 J	1.00	0.500	ND	1.00	0.500	0.621 J	1.00	0.500
Iron	**300**	Sec. MCL	ND	100	20.0	ND	100	20.0	**3510**	100	20.0	**1480**	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0
Lead	15	MCL	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Manganese	**50**	Sec. MCL	ND	1.00	0.500	0.682 J	1.00	0.500	**4050**	1.00	0.500	**3630**	5.00	2.50	1.83	1.00	0.500	1.05	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	15.6	1.00	0.500
Mercury	2	MCL	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100
Molybdedum	NE	NE	5.61	2.00	0.500	5.45	2.00	0.500	3.99	2.00	0.500	4.18	2.00	0.500	3.67	2.00	0.500	3.51	2.00	0.500	0.638 J	2.00	0.500	0.597 J	2.00	0.500	3.67	2.00	0.500
Nickel	100	MCL	ND	1.00	0.500	0.506 J	1.00	0.500	1.28	1.00	0.500	1.28	1.00	0.500	0.564 J	1.00	0.500	0.630 J	1.00	0.500	1.28	1.00	0.500	0.956 J	1.00	0.500	0.640 J	1.00	0.500
Selenium	50	MCL	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	0.732 J	1.00	0.500	0.665 J	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Silver	100	Sec. MCL	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Thallium	2	MCL	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Vanadium	NE	NE	22.2	1.00	0.500	22.6	1.00	0.500	2.19	1.00	0.500	1.44	1.00	0.500	53.0	1.00	0.500	52.6	1.00	0.500	32.6	1.00	0.500	33.5	1.00	0.500	29.5	1.00	0.500
Zinc	5000	Sec. MCL	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0

Definitions:
EPA: U.S. Environmental Protection Agency
IRP: Installation Restoration Program
MCL: Maximum Contaminant Level
MDL: Method Detection Limit
NAVWPNSTA: Naval Weapon Station
NE: MCL is not established
PAL: Project Action Limit
Qual: Laboratory and Validation Qualifiers
RL: Reporting Limit
Sec. MCL: Secondary Maximum Contaminant Level
µg/L: micrograms per liter

Laboratory and Validation Qualifiers:
J: indicates that the associated numerical value is an estimate
U: indicates compound was analyzed for, but not detected at the specified detection limit.
UJ indicates that the analyte was not detected, the reported quantitation limit is an estimate

Notes:
- IRP27-MW-X is a duplicate sample of IRP27-MW-7
Bold and highlighted results indicate the analyte exceeded the PAL

TABLE 8
Summary of Analytical Results in Groundwater - Metals
IRP Site 27, NAVWPNSTA Seal Beach Fallbrook Detachment
Fallbrook, California

Sample Number		IRP27-MW-5A			IRP27-MW-7			IRP27-MW-X			IRP27-MW-7			IRP27-MW-9A			IRP27-MW-9A			IRP27-MW-X			IRP27-MW-12			IRP27-MW-12		
Sample Date		5/14/2013			11/14/2012			11/14/2012			5/14/2013			11/13/2012			5/14/2013			5/14/2013			11/13/2012			5/14/2013		
Parameter	PAL	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL	Result	RL	MDL
Metals -EPA 6010B/7470A (µg/L)																												
Aluminum	200	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0
Antimony	6	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Arsenic	**10**	2.44	1.00	0.500	2.39	1.00	0.500	2.42	1.00	0.500	2.13	1.00	0.500	3.02	1.00	0.500	2.91	1.00	0.500	2.96	1.00	0.500	0.693 J	1.00	0.500	0.714 J	1.00	0.500
Barium	1000	10.3	1.00	0.500	25.8	1.00	0.500	25.5	1.00	0.500	24.3	1.00	0.500	21.0	1.00	0.500	20.8	1.00	0.500	20.9	1.00	0.500	22.6	1.00	0.500	27.9	1.00	0.500
Beryllium	4	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Cadmium	5	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Chromium	50	1.25	1.00	0.500	1.27	1.00	0.500	1.20	1.00	0.500	1.32	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	1.09	1.00	0.500	1.22	1.00	0.500
Cobalt	NE	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Copper	1000	0.682 J	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	0.512 J	1.00	0.500	ND	1.00	0.500	0.501 J	1.00	0.500	1.17	1.00	0.500	1.87	1.00	0.500
Iron	**300**	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0	ND	100	20.0
Lead	15	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Manganese	**50**	2.44	1.00	0.500	0.949 J	1.00	0.500	1.30 J	1.00	0.500	0.961 J	1.00	0.500	0.696UJ	1.00	0.500	1.23	1.00	0.500	1.25	1.00	0.500	29.5	1.00	0.500	12.8	1.00	0.500
Mercury	2	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100	ND	0.500	0.100
Molybdedum	NE	3.18	2.00	0.500	5.66	2.00	0.500	5.70	2.00	0.500	5.23	2.00	0.500	5.70	2.00	0.500	5.65	2.00	0.500	5.67	2.00	0.500	2.35	2.00	0.500	2.47	2.00	0.500
Nickel	100	0.574 J	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	0.708 J	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	0.788 J	1.00	0.500	10.8	1.00	0.500
Selenium	50	ND	1.00	0.500	0.818 J	1.00	0.500	0.818 J	1.00	0.500	0.858 J	1.00	0.500	0.730 J	1.00	0.500	0.755 J	1.00	0.500	0.798 J	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Silver	100	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Thallium	2	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500	ND	1.00	0.500
Vanadium	NE	29.4	1.00	0.500	51.2	1.00	0.500	49.4	1.00	0.500	46.2	1.00	0.500	16.5	1.00	0.500	18.5	1.00	0.500	18.6	1.00	0.500	32.0	1.00	0.500	29.7	1.00	0.500
Zinc	5000	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0	ND	20.0	10.0

Definitions:
EPA: U.S. Environmental Protection Agency
IRP: Installation Restoration Program
MCL: Maximum Contaminant Level
MDL: Method Detection Limit
NAVWPNSTA: Naval Weapon Station
NE: MCL is not established
PAL: Project Action Limit
Qual: Laboratory and Validation Qualifiers
RL: Reporting Limit
Sec. MCL: Secondary Maximum Contaminant Leve
µg/L: micrograms per liter

Laboratory and Validation Qualifiers:
J: indicates that the associated numerical value is an estimate
U: indicates compound was analyzed for, but not detected at the specified detection limit.
UJ indicates that the analyte was not detected, the reported quantitation limit is an estimate

Notes:
- IRP27-MW-X is a duplicate sample of IRP27-MW-7
Bold and highlighted results indicate the analyte exceeded the PAL

FIGURES

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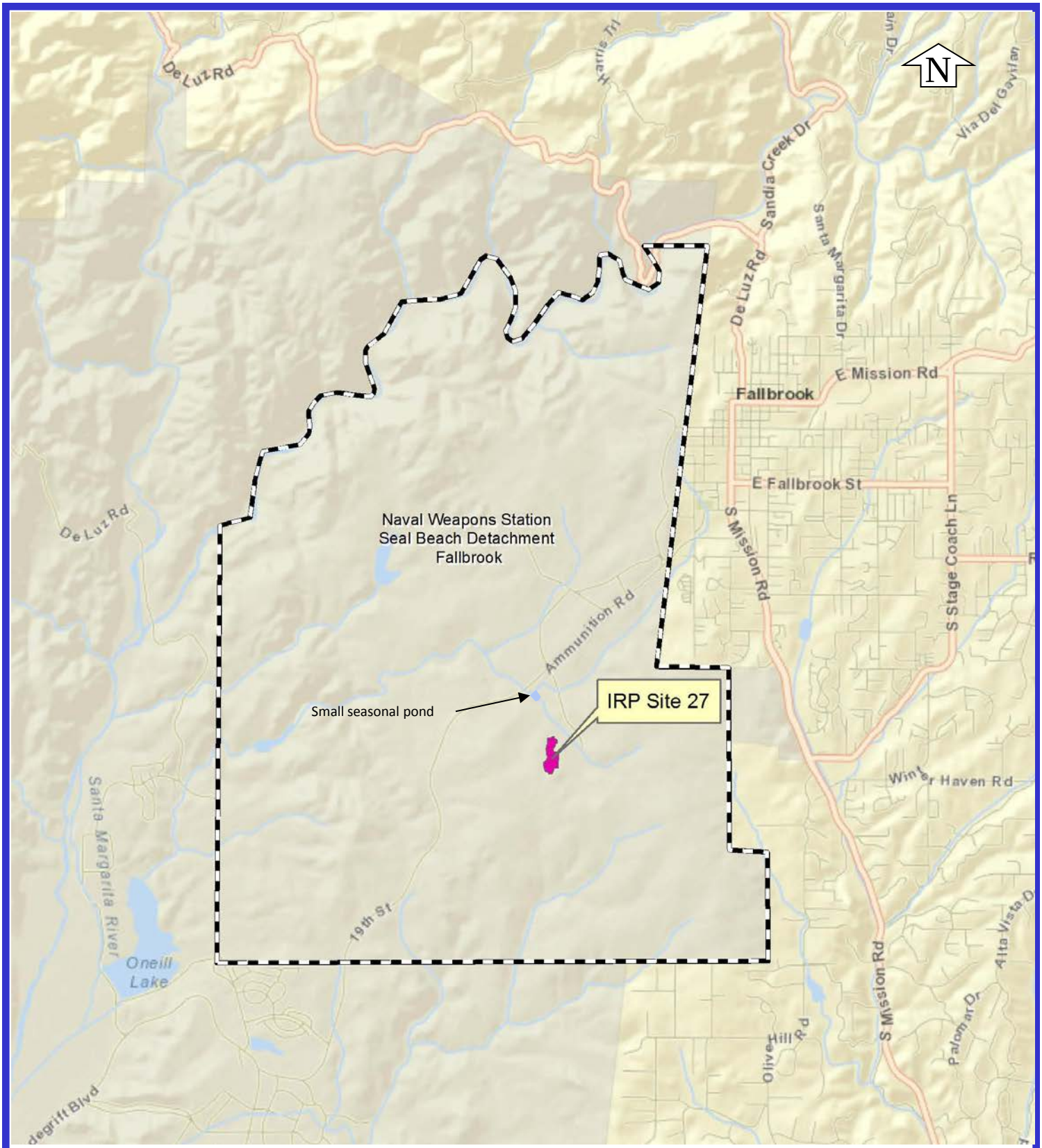
DET. FALLBROOK LOCATION MAP

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 1



Reference: adapted from RI Report (Geosyntec, August 2012)

NOT TO SCALE

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IRP SITE 27 LOCATION MAP

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 2

NOT TO SCALE

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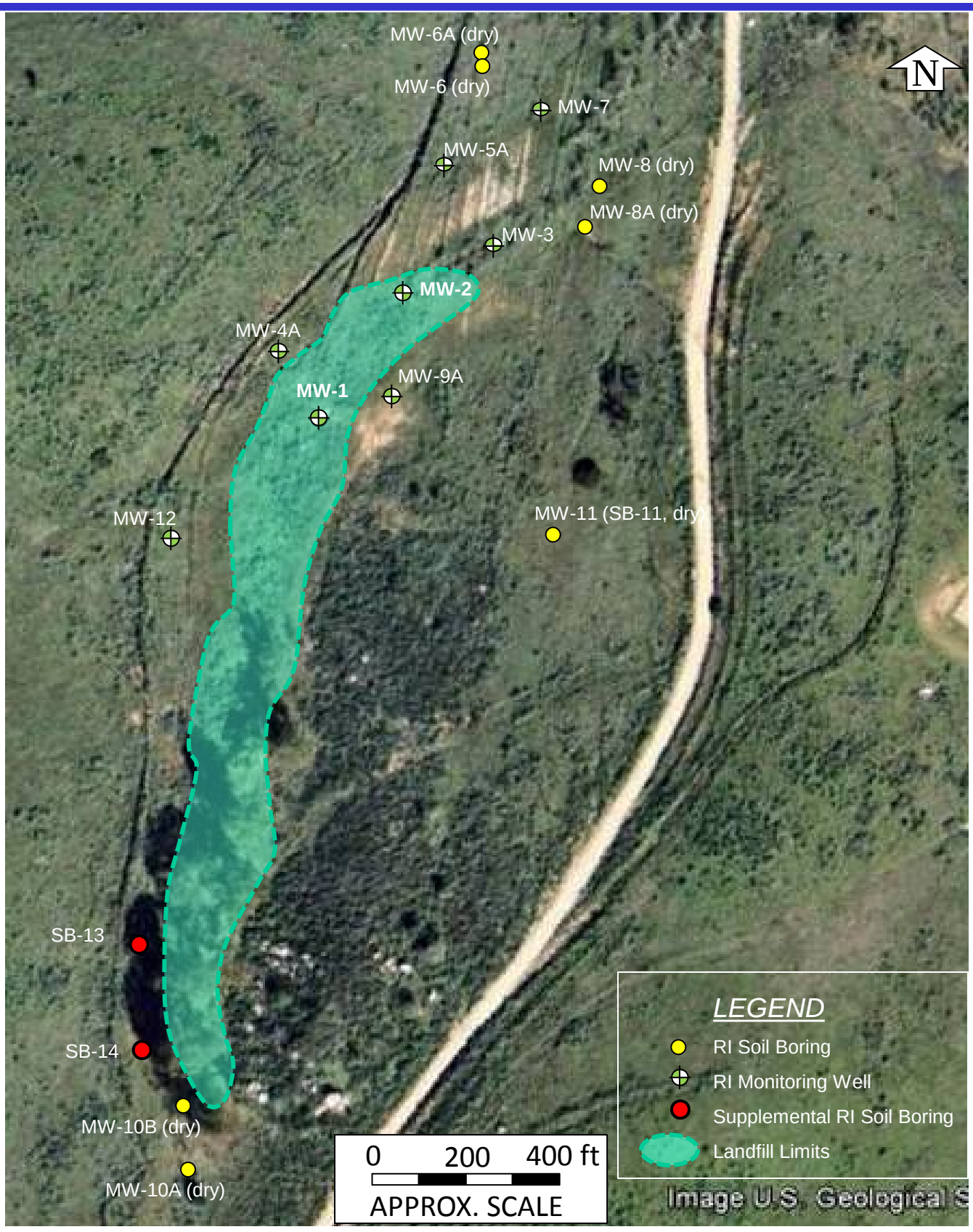
IRP SITE 27 VICINITY MAP

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 3



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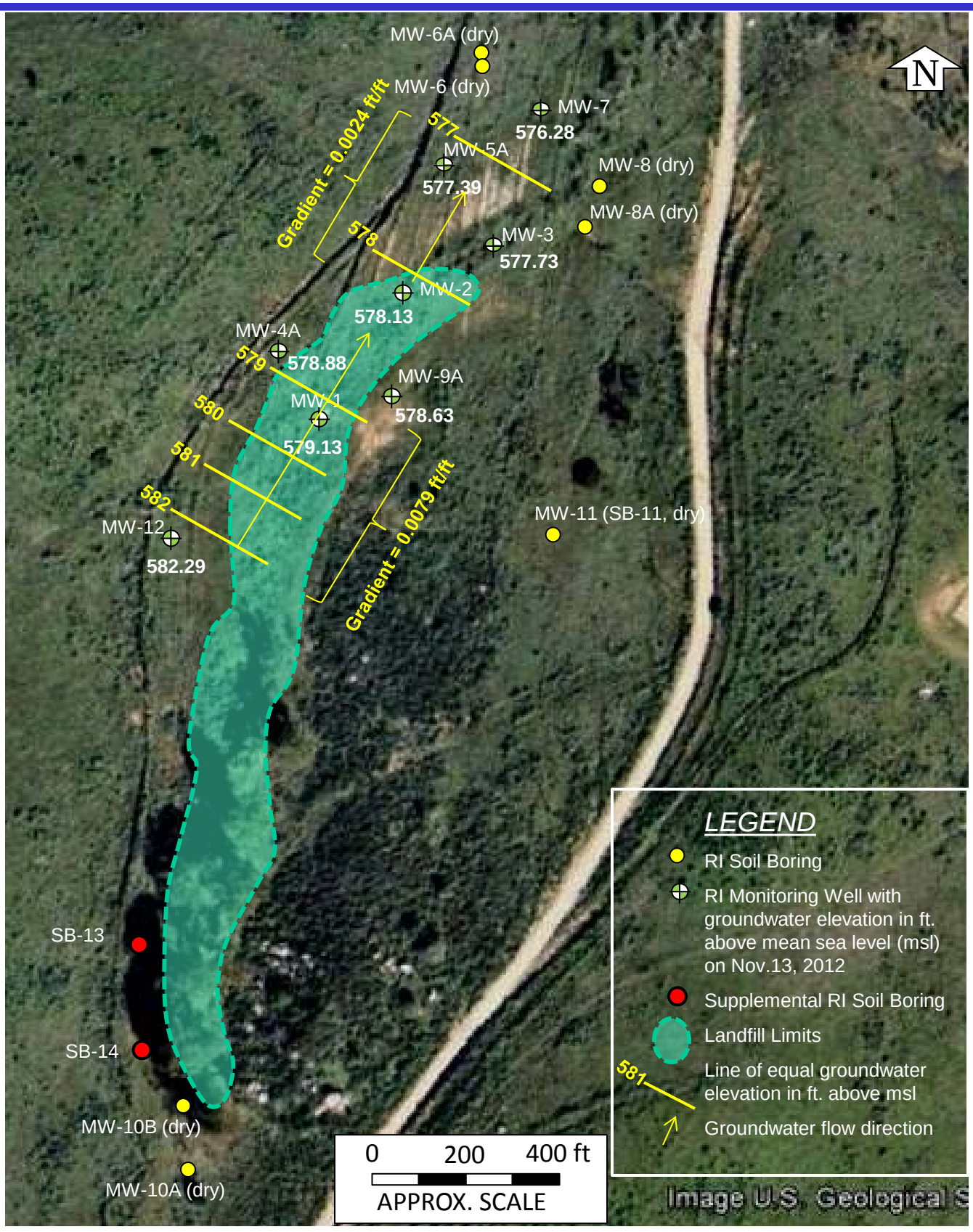
Tustin, CA 92780

IRP SITE 27 LANDFILL LIMITS

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 4



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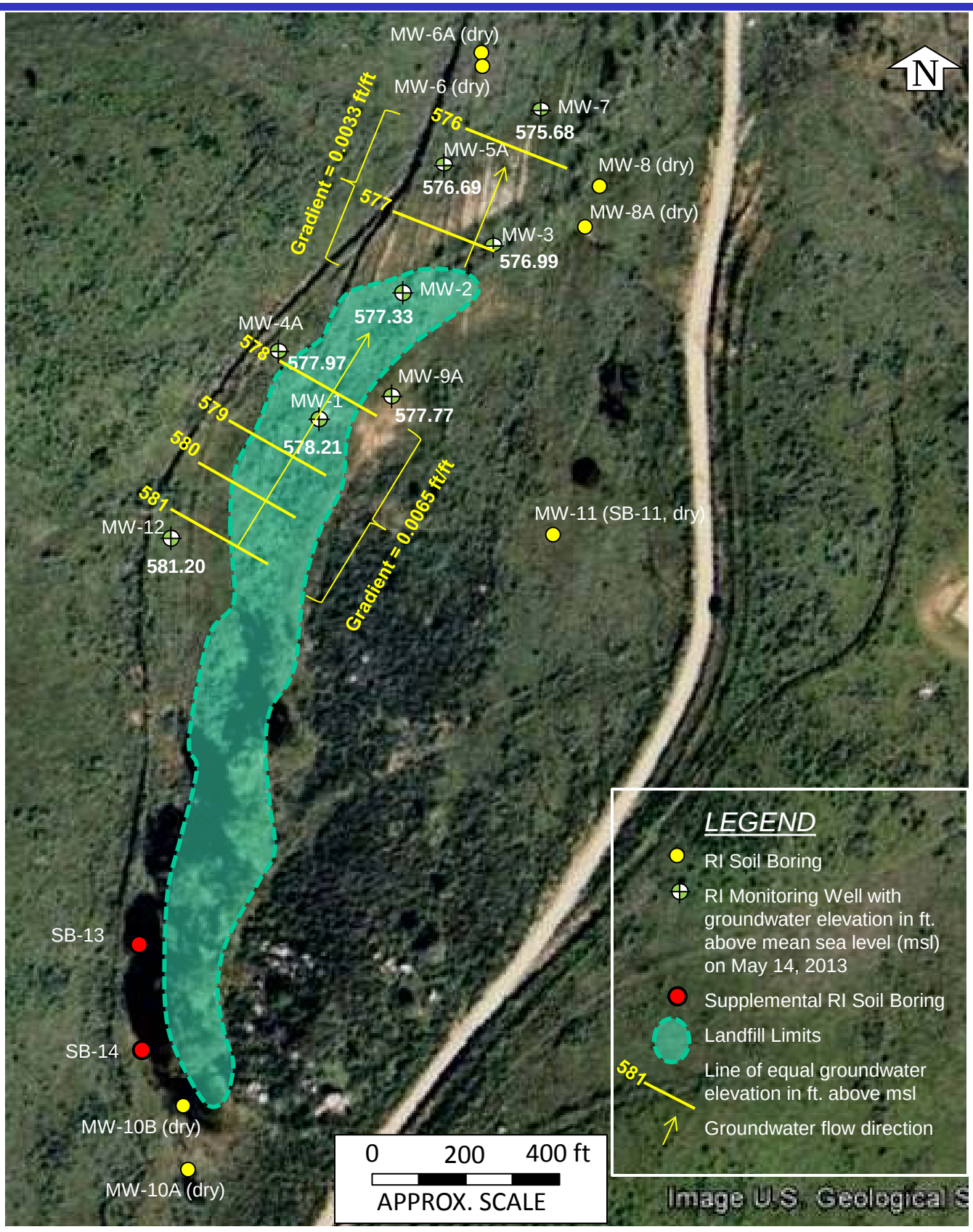
IRP SITE 27 GROUNDWATER ELEVATION CONTOURS – NOVEMBER 2012

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 5



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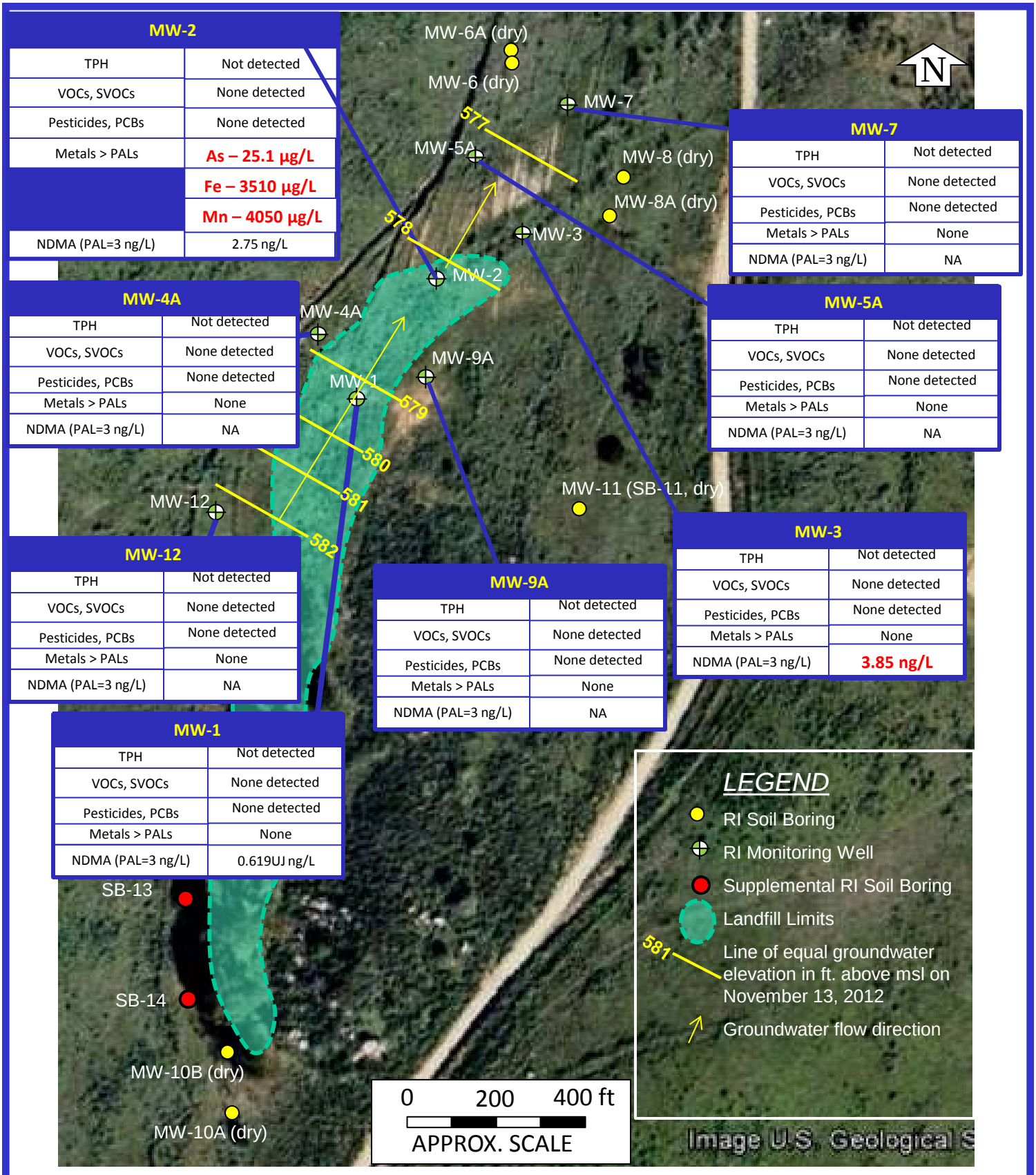
IRP SITE 27 GROUNDWATER ELEVATION CONTOURS – MAY 2013

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 6



MW-2

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	As – 25.1 µg/L
	Fe – 3510 µg/L
	Mn – 4050 µg/L
NDMA (PAL=3 ng/L)	2.75 ng/L

MW-7

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=3 ng/L)	NA

MW-4A

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=3 ng/L)	NA

MW-5A

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=3 ng/L)	NA

MW-3

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=3 ng/L)	3.85 ng/L

MW-12

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=3 ng/L)	NA

MW-9A

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=3 ng/L)	NA

MW-1

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=3 ng/L)	0.619UJ ng/L

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IRP SITE 27 GROUNDWATER COC CONCENTRATIONS – NOVEMBER 2012

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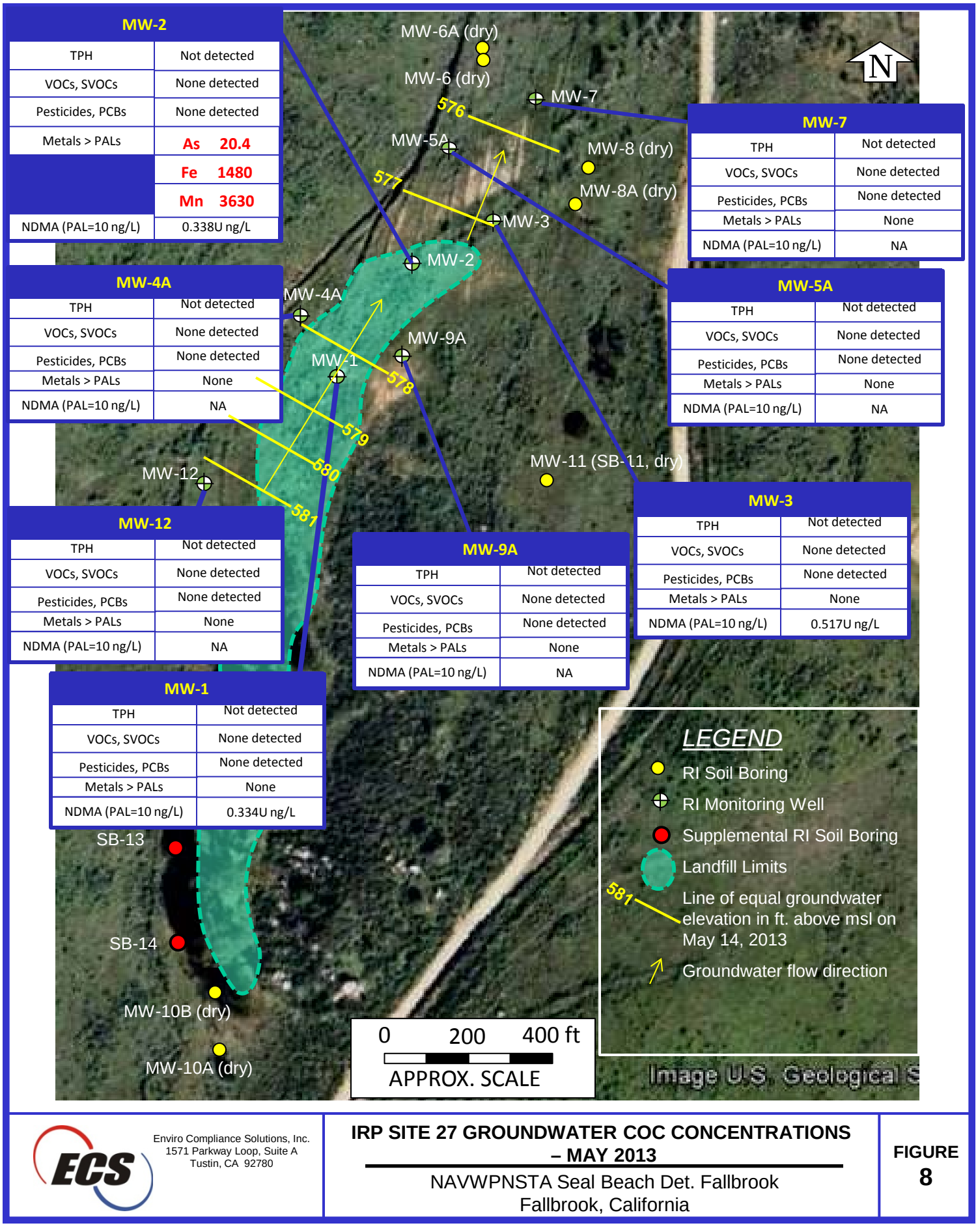
Fallbrook, California

FIGURE 7



MW-2

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	As 20.4
	Fe 1480
	Mn 3630
NDMA (PAL=10 ng/L)	0.338U ng/L

MW-7

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=10 ng/L)	NA

MW-4A

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=10 ng/L)	NA

MW-5A

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=10 ng/L)	NA

MW-3

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=10 ng/L)	0.517U ng/L

MW-12

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=10 ng/L)	NA

MW-9A

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=10 ng/L)	NA

MW-1

TPH	Not detected
VOCs, SVOCs	None detected
Pesticides, PCBs	None detected
Metals > PALs	None
NDMA (PAL=10 ng/L)	0.334U ng/L

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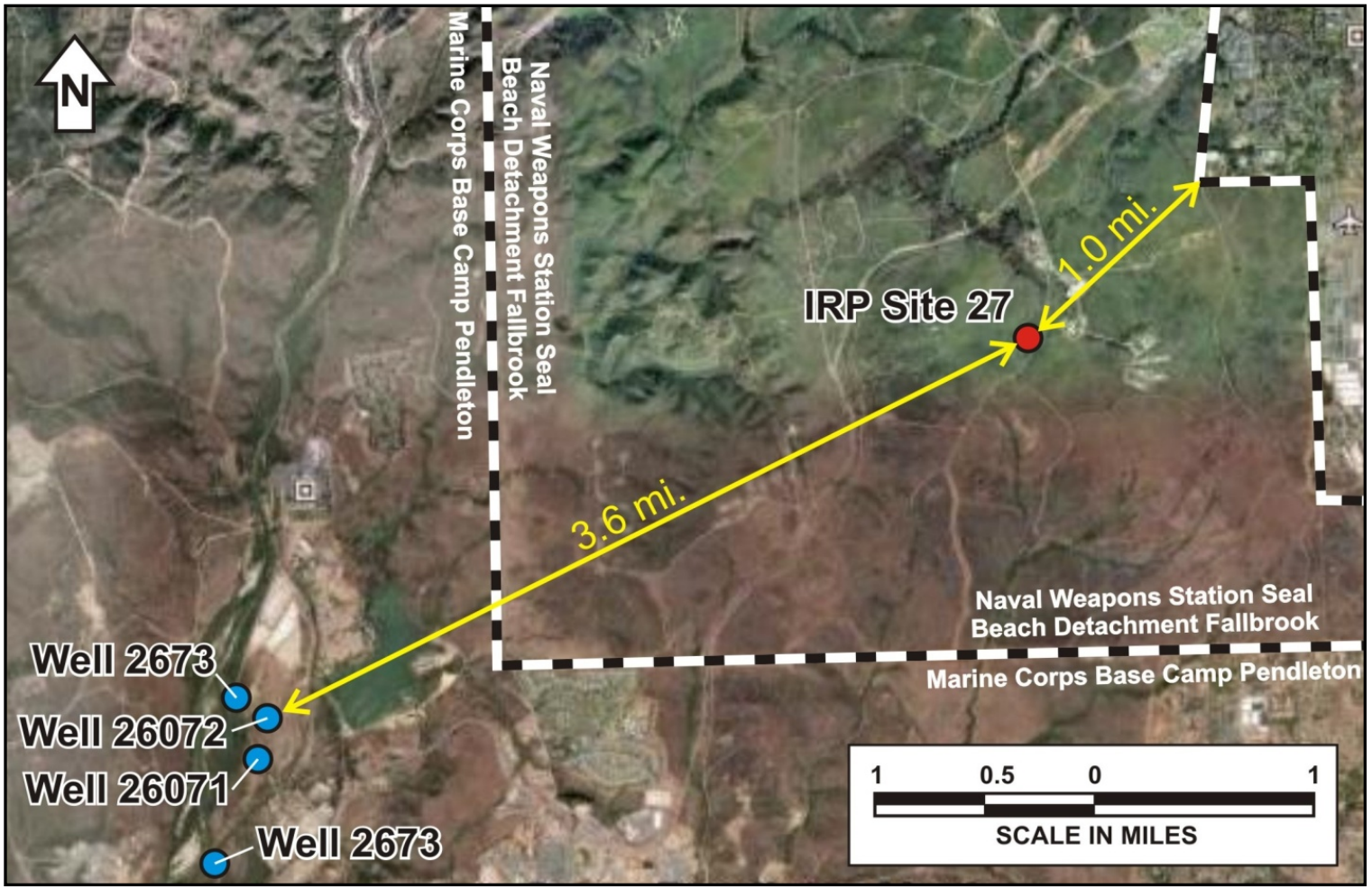
IRP SITE 27 GROUNDWATER COC CONCENTRATIONS – MAY 2013

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 8



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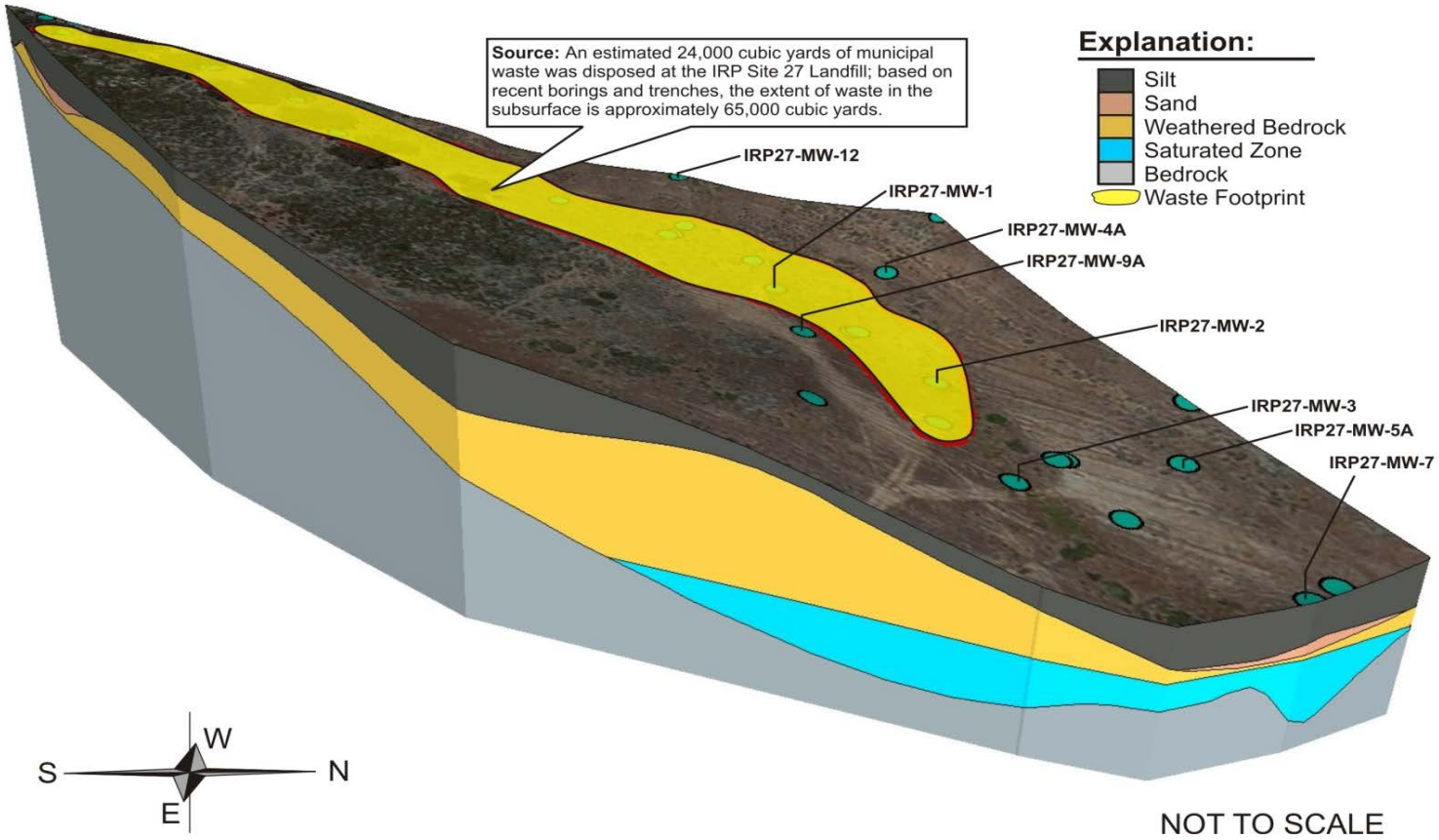
IRP SITE 27 – DISTANCE TO CLOSEST DOWNGRADIENT WATER SUPPLY WELL

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 9



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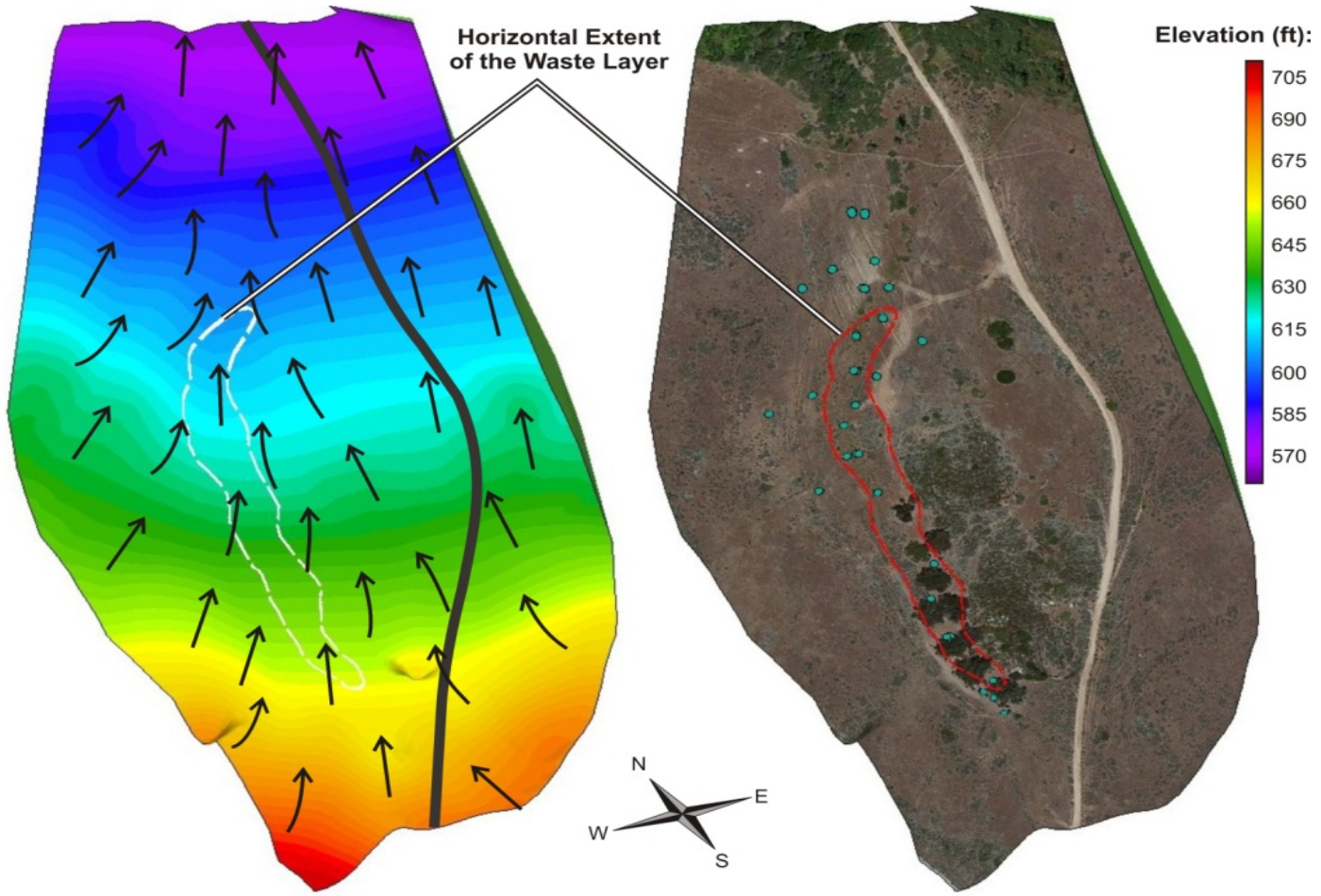
IRP SITE 27 – THREE DIMENSIONAL MODEL SHOWING HORIZONTAL EXTENT OF WASTE FOOTPRINT

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 10



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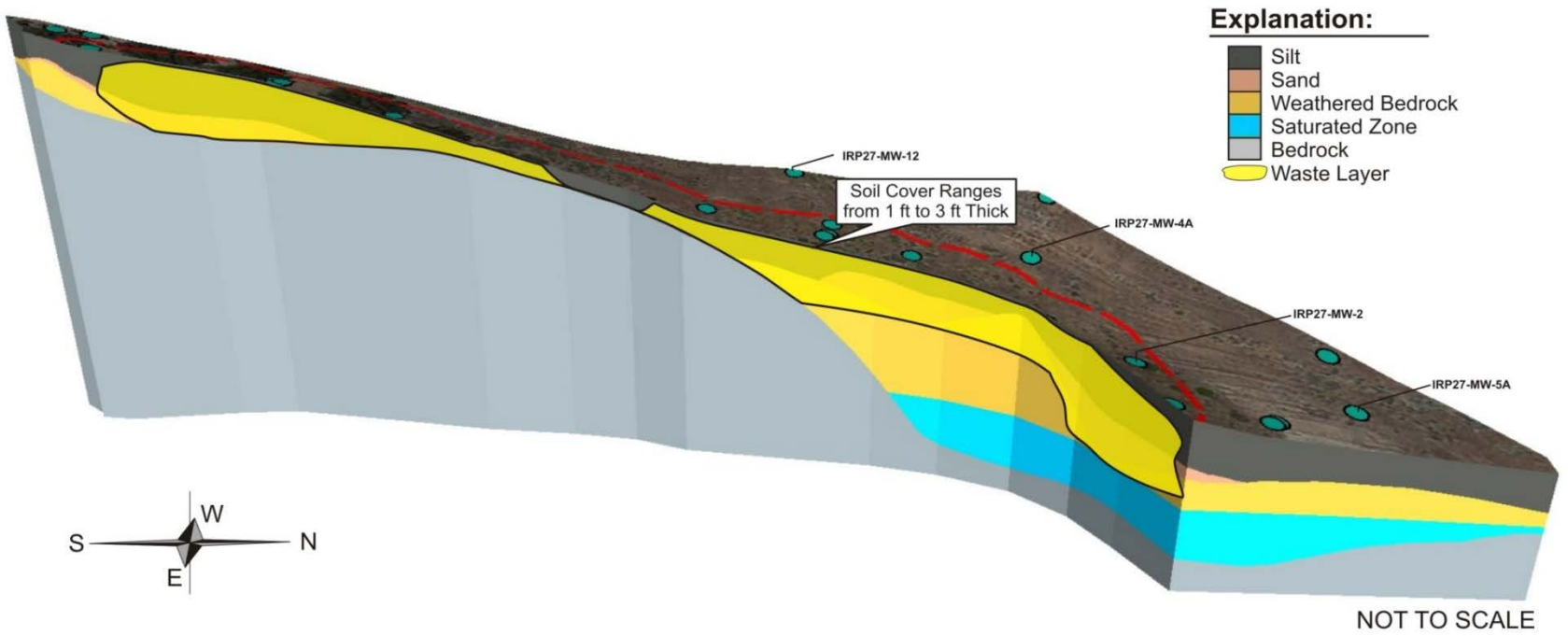
IRP SITE 27 – SURFACE WATER FLOW DIRECTIONS

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 11



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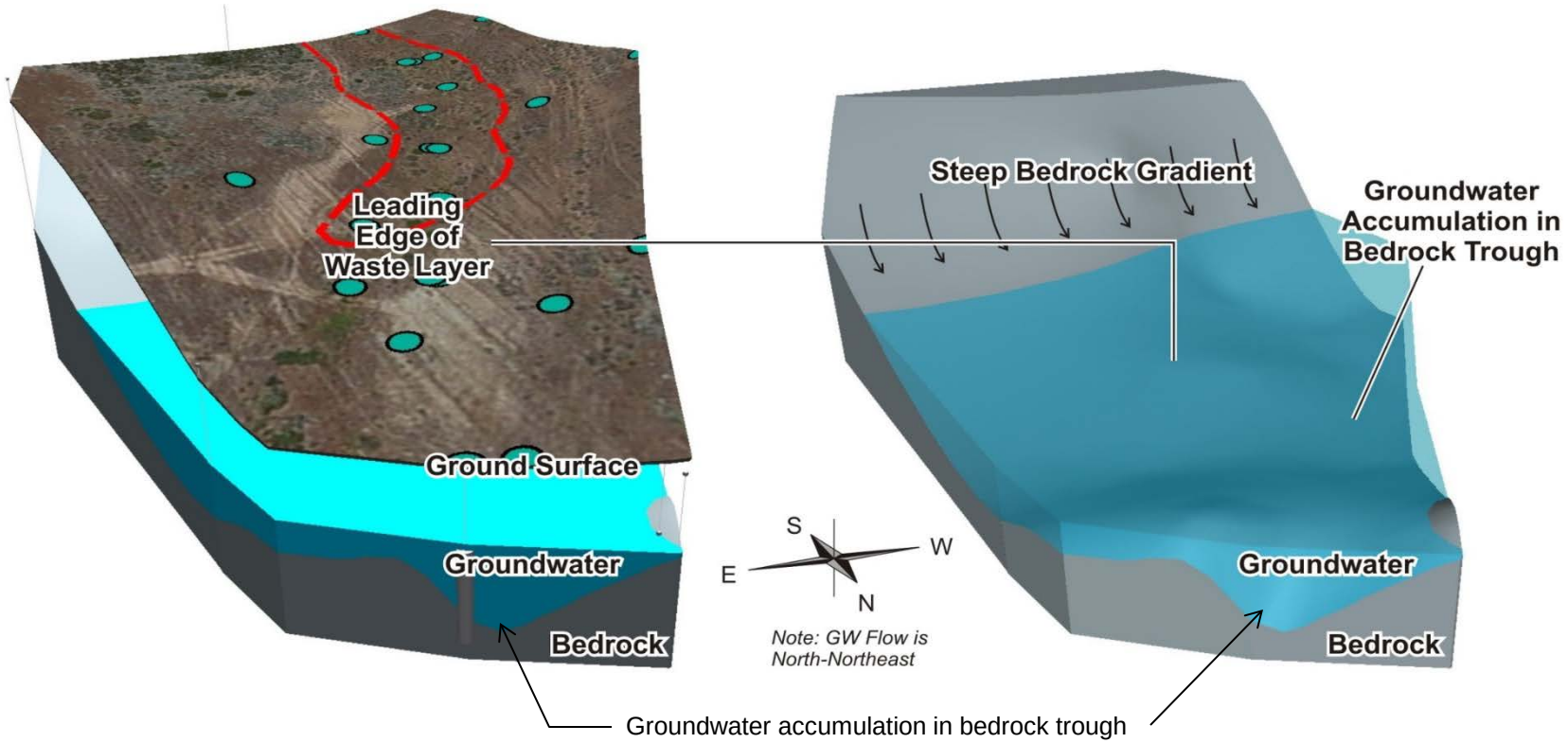
IRP SITE 27 – THREE DIMENSIONAL GEOLOGIC CROSS SECTION

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 12

NORTHERN EXTENT OF IRP SITE 27
Showing the Ground Surface, Groundwater and Competent Bedrock

NORTHERN EXTENT OF IRP SITE 27
Showing Groundwater Overlying the Competent Bedrock



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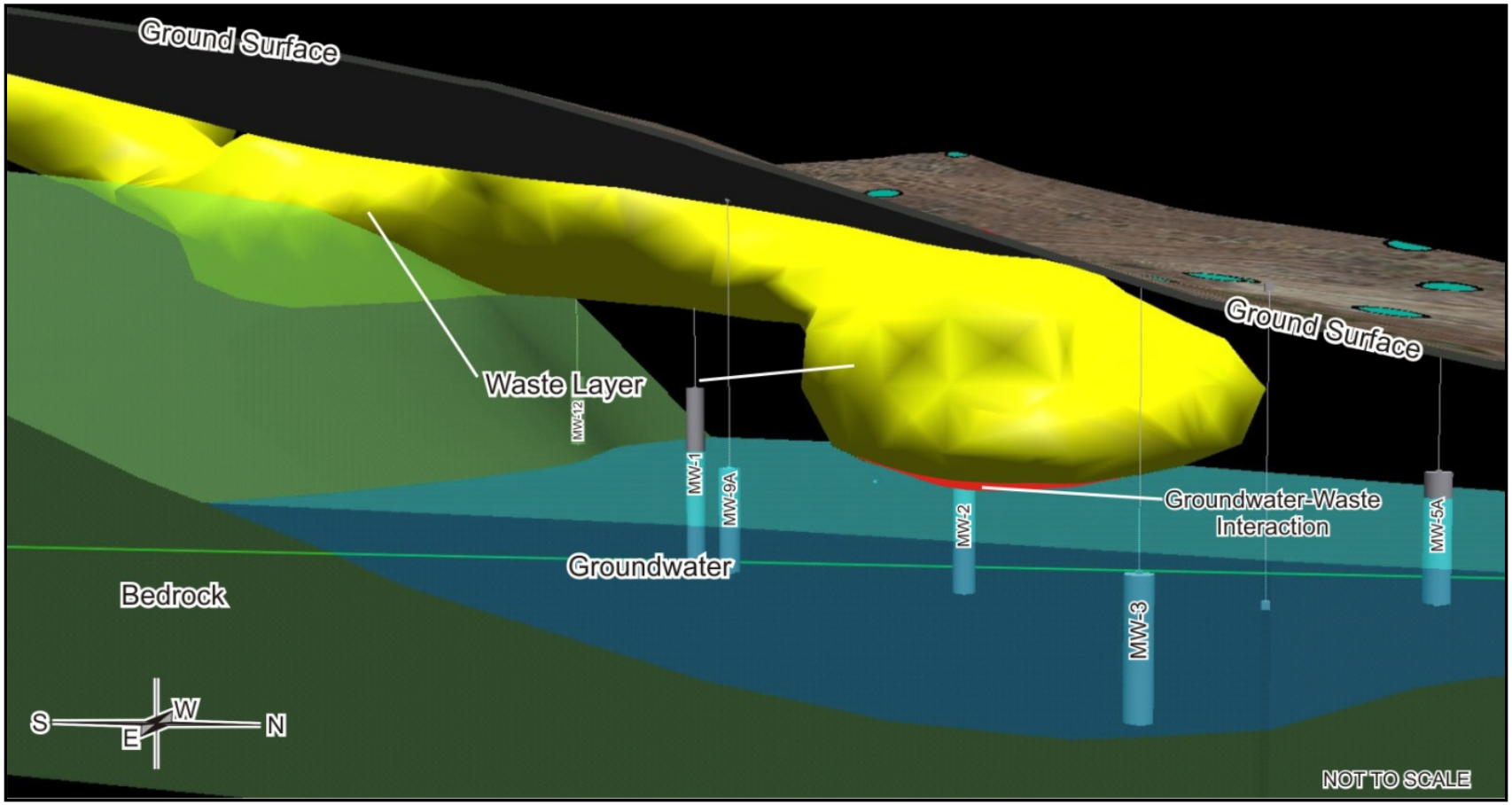
IRP SITE 27 – THREE-DIMENSIONAL MODEL OF NORTHERN PORTION OF SITE

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 13



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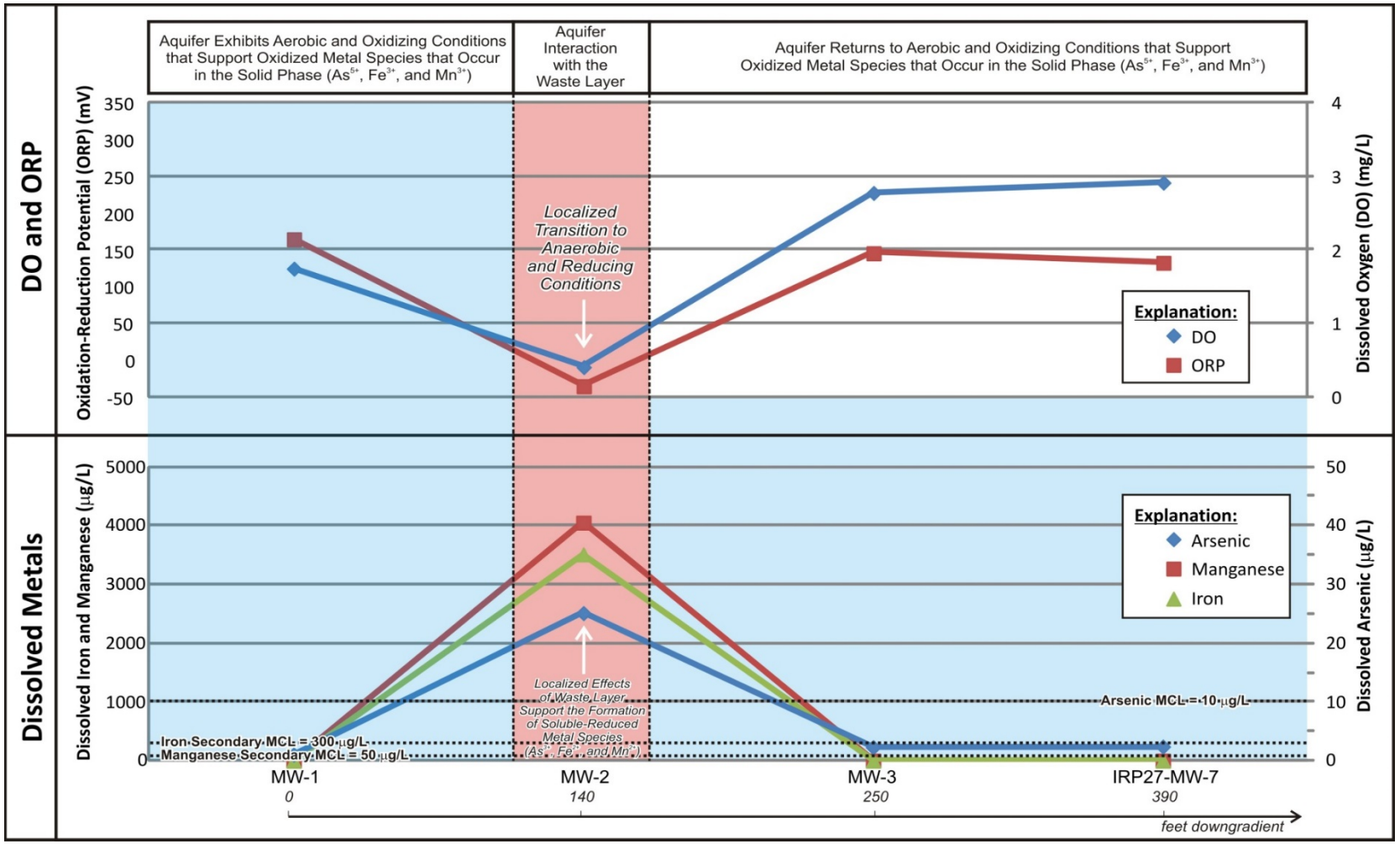
IRP SITE 27 – THREE DIMENSIONAL DEPICTION OF GROUNDWATER - WASTE INTERACTION AT MW-2

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 14



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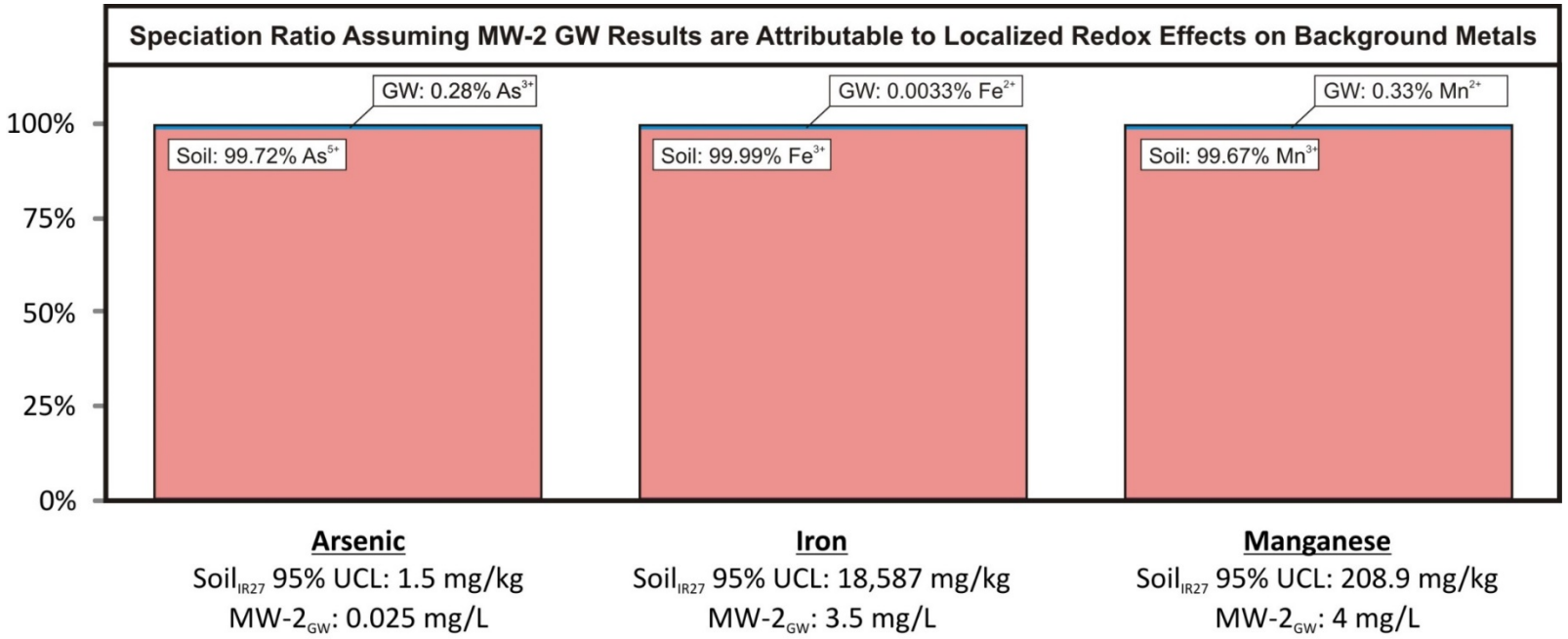
IRP SITE 27 – SUMMARY OF DO, ORP, AND GROUNDWATER RESULTS FOR ARSENIC, IRON, AND MANGANESE IN MW-1, MW-2, MW-3, AND MW-7

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 15



Assumptions: (1) The 95% UCL of the IRP Site 27 soil data was used as background for metals in soil; (2) Groundwater samples are filtered and preserved, suggesting that aqueous concentrations are attributable to soluble, reduced metal species; (3) Unit weight of soil is 145 lb/ft3 and the porosity is 0.4 (conservative assumption for sand); (4) As^{3+} + As^{5+} = Total As; Fe^{2+} + Fe^{3+} = Total Fe; Mn^{2+} + Mn^{3+} = Total Mn.

Findings: There is sufficient naturally occurring mass of arsenic, iron, and manganese near IRP Site 27 to produce the elevated metals results observed at MW-2; only a small fraction of the total mass of arsenic, iron, and manganese is required in a reduced form to produce the corresponding metals concentrations observed in MW-2. The site soil data and redox changes observed in groundwater from MW-2 suggest that the elevated detections in MW-2 are attributable to naturally occurring metals in soil.

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IRP SITE 27 – MASS BALANCE EVALUATION OF ARSENIC, IRON, AND MANGANESE AT MW-2

NAVWPNSTA Seal Beach Det. Fallbrook
Fallbrook, California

FIGURE 16

APPENDIX A

TECHNICAL MEMORANDUM
RESULTS OF SUPPLEMENTAL SOIL BORING INSTALLATION

(Provided on CD)

Technical Memorandum
Results of Supplemental Soil Boring Installation - Extended Remedial Investigation

Installation Restoration Program (IRP) Site 27

Naval Weapons Station Seal Beach Detachment Fallbrook
Fallbrook, California

Prepared for:

Naval Facilities Engineering Command Southwest
1220 Pacific Highway
San Diego, California 92136

Prepared by:

Enviro Compliance Solutions, Inc.
An 8(a), SDB, MBE, and DBE Company
1571 Parkway Loop, Suite B
Tustin, California 92780

Prepared Under:

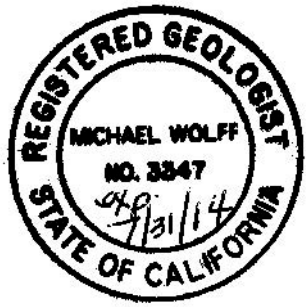
Contract Number: N62583-09-D-0143, DO #0003
DCN: ECS-0143-0003-0204

March 2013

SIGNATURES

TECHNICAL MEMORANDUM
RESULTS OF SUPPLEMENTAL SOIL BORING INSTALLATION
EXTENDED REMEDIAL INVESTIGATION
INSTALLATION RESTORATION PROGRAM (IRP) SITE 27
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT FALLBROOK
FALLBROOK, CALIFORNIA

This Report was reviewed and approved by:



Signature — March 5, 2013 (Date)
Michael Wolff, PG, CEG
Senior Project Manager

Signature — March 5, 2013 (Date)
Dhananjay B. Rawal

LIMITATIONS

The services described in this report were performed consistent with generally accepted professional principles and practices for environmental consulting firms. Except as set forth herein, no other warranty, expressed or implied, is made. Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the purposes, locations, time frames, and project parameters indicated. Professional opinions are based, in part, on interpretation of data from discrete monitoring or sampling locations that may not represent actual conditions at other locations that were not monitored or sampled. In some cases, interpretations may have been based on information supplied by others. This information may not have been independently reviewed. This report may not be relied upon by third parties without written authorization from the author(s).

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TABLE OF CONTENTS

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List of Figures

List of Attachments

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ACRONYMS & ABBREVIATIONS

bgs	below ground surface
DoN	Department of Navy, United States
DOT	Department of Transportation, United States
DTSC	California Department of Toxic Substances Control
ECS	Enviro Compliance Solutions, Inc.
EPA	Environmental Protection Agency, United States
ft	feet
ft^2	square feet
HSA	hollow-stem auger
IAS	initial assessment study
IDW	investigation-derived waste
IRP	Installation Restoration Program
MARRS	MARRS Services, Inc.
MCB	Marine Corps Base
msl	mean sea level
NAVFAC	Naval Facilities Engineering Command, Southwest Division
NAVWPNSTA	Naval Weapons Station
PG	Professional Geologist
RI	remedial investigation
ROICC	resident officer in charge of construction
RWQCB	California Regional Water Quality Control Board, San Diego Region
SAP	Sampling and Analysis Plan
SES-TECH	SES-TECH/Geosyntec Consulting, Inc.
SI	site inspection
SKR	Stephens Kangaroo Rat
TPH	Total Petroleum Hydrocarbons
U.S. FWS	United States Fish and Wildlife Service
VOC	Volatile Organic Compound
Yd^3	cubic yard

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1.0 INTRODUCTION

1.1 Purpose

This Technical Memorandum has been prepared by Enviro Compliance Solutions, Inc. (ECS) on behalf of the Naval Facilities Engineering Command - Southwest Division (NAVFAC). The Memorandum presents the findings from the installation of two supplemental soil borings at Installation Restoration Program (IRP) Site 27 (Site) of Naval Weapons Station (NAVWPNSTA) Seal Beach Detachment (Det.) Fallbrook, located at Fallbrook, California.

The two additional soil borings were agreed to by the Department of the Navy (DoN) and the regulatory agencies (California Regional Water Quality Control Board - San Diego Region [RWQCB], and the California Department of Toxic Substances Control [DTSC]) in a meeting on July 26, 2012 (SES-TECH 2012a). It was agreed by the parties that the southwest boundary of the IRP Site 27 landfill needed additional delineation and that two soil borings should prove sufficient to accomplish this purpose. The site is illustrated in Figure 1, along with the locations of existing soil borings, groundwater monitoring wells, and the two additional soil borings.

The previous investigations of the IRP Site 27 landfill are documented in the Final Site Inspection (SI) Report by MARRS Services, Inc. (MARRS) (MARRS 2009) and in the Final Remedial Investigation (RI) Report by SES-TECH's subcontractor Geosyntec Consulting, Inc. (SES-TECH/Geosyntec) (SES-TECH 2012b).

The additional soil boring installation is supplemental to the RI and as such, was performed pursuant to the methodology and procedures of the Final Remedial Investigation Work Plan (SES-TECH 2010), and the Technical Memorandum Work Plan – Extended Remedial Investigation (ECS 2012).

1.2 Background

Det. Fallbrook is located on the interior side of Marine Corps Base (MCB) Camp Pendleton in the northern area of San Diego County adjacent to the unincorporated community of Fallbrook. Det. Fallbrook is a facility which has supported a variety of activities, including providing ordnance, inspection, maintenance, research, testing, and storage for the DoN fleet. IRP Site 27 is located within the south magazine area of Det. Fallbrook, near Building 366. IRP Site 27 is also referred to as the Eucalyptus Grove Landfill because eucalyptus trees were planted in the cover when the landfill was closed in 1974. The landfill is located within a dry ravine that trends south to north. The elevation at the south end of the landfill is approximately 640 feet (ft) above mean sea level (msl) and the northern end of the landfill is at approximately 580 ft msl.

The soil lithology is comprised of an upper layer of alluvium, consisting of clays, silts, and sands. Alluvium is underlain by an interval of moderately to highly-weathered decomposed granitic material, which is then underlain with bedrock consisting of quartz-granodiorite to tonalite. Bedrock is found approximately 19 to 40 ft below ground surface (bgs). The bedrock is this area is highly fractured. The Elsinore Fault Zone is located approximately 12 miles northeast of IRP Site 27 (MARRS 2009).

Based on historical information presented in the initial assessment study (IAS), the Site was up to 1,000 ft long by 300 ft wide with a depth of up to four ft. Records indicate that the total estimated volume of refuse in the landfill is approximately 24,000 cubic yards (yd^3) based on an estimated 20 to 30 dumpsters of refuse disposed of per week at the Site (MARRS 2009). Based

on an approximate five-year life for the landfill, this span would amount to approximately 10 to 15 yd^3 per day of disposal. The landfill was operated from the late 1960's until 1974 when the DoN began shipping waste off site and the landfill was closed (MARRS 2009). RI evaluation of the Site refined the Site surface dimensions to an approximate area of 80,902 square feet (ft^2) based on the revised inferred landfill extent. Depth to waste encountered in the potholes, soil gas probes, and soil sampling conducted in the RI ranged from approximately one to three ft, indicating an average cover thickness of approximately two ft. Maximum potential waste volume within the ravine was estimated based on thickness differentials present before the existence of the landfill and after the closure of the landfill. The maximum potential waste volume is estimated at 65,728 yd^3 based on revised three-dimensional modeling of the landfill extent performed for the RI.

The potential for groundwater, soil, and soil vapor impacts to IRP Site 27 were identified based on the disposal of small quantities of hazardous waste, including empty paint cans with dried paint residues, fluorescent lights, fluorescent light ballasts, spent silica sandblast grit containing paint chips, paint booth residue, rags with solvent residue, used paint brushes, and asbestos. Wooden pallets that were potentially treated with pentachlorophenol were also disposed of at IRP Site 27 (MARRS 2009).

The RI for IRP Site 27 was completed in 2012 (SES-TECH/Geosyntec). The sole remaining unresolved question arising from the RI investigations was the precise location of the landfill boundary in the southwest portion of the Site (Figure 1). The purpose of the two additional soil borings described in this Technical Memorandum was the delineation of the southwest portion of the landfill boundary.

2.0 SUMMARY OF FIELD ACTIVITIES

Field activities for the installation of two supplemental soil borings were completed per the Technical Memorandum Work Plan – Extended Remedial Investigation (ECS 2012). The results of the investigation are described below.

2.1 Marking and Utility Locating

Prior to the commencement of subsurface work, each boring location was marked in the field, and the boring locations were provided to the DoN for review and clearance. Utility clearance was obtained prior to start of drilling activities by coordinating with the resident officer in charge of construction (ROICC). In addition, Dig Alert was notified prior to start of drilling activities. No utility lines were identified in the area of the two borings by Dig Alert or DoN.

2.2 Soil Boring Installation

Each exploratory boring was initially hand-auger to an approximate depth of 5 feet bgs to minimize the potential damage to subsurface obstructions/utilities. Once each boring location was cleared, the exploratory soil borings were drilled a few feet away from the hand-auger locations by using a CME-75 drill rig using hollow-stem continuous-flight auger (HSA) drilling equipment provided by JDK Drilling, Inc. (C57-887038) of Orange, California. The augers were steam-cleaned prior to and in between drilling each boring.

Both borings were continuously cored using a split barrel sampler within the HSA flight. Following each advance, the continuous core was retrieved and placed on visqueen were it was visually inspected, logged, and photographed. A qualified geologist, working under the supervision of a California-registered Professional Geologist, logged the cores using the lithologic descriptions of the Unified Soil Classification System. The soil cores were logged in detail paying particular attention to visual or olfactory evidence of landfilled waste. The borings were drilled through approximately 10 feet of alluvial deposits to overlying weathered bedrock to a total depth of approximately 25 feet bgs where refusal was encountered.

2.3 Findings

No evidence of groundwater was encountered, and no evidence of landfilled waste was observed visually or by photoionization detector readings in either of the borings. Copies of the soil boring logs are presented in Appendix A. Photographs of the soil cores are presented in Appendix B.

2.4 Backfilling of Exploratory Soil Borings

Each boring was sealed by backfilling with cement grout (5% bentonite), and the upper five feet of each boring was backfilled with hydrated bentonite pellets to prevent the borings becoming conduits for percolation of rainfall at future times.

2.5 Land Surveying

The exploratory soil borings were surveyed for location and elevation by a California licensed surveyor. Survey data is provided in Appendix C.

2.6 Investigation Derived Waste

Investigation-derived waste (IDW) in the form of soil cuttings was stored in 55-gallon, steel U.S. Department of Transportation (DOT) approved drums and secured with ring lids. The drum contents were properly labeled pending waste profiling. A composite sample was collected from each drum sent to EMAX Laboratories for analysis. The samples were analyzed for total petroleum hydrocarbons as diesel by U.S. Environmental Protection Agency (EPA) modified method 8015B, for volatile organic compounds (VOCs) by EPA Method 8260B, and by Title 22 metals by EPA Methods 6020A/7471A. The analytical results indicated that the soil was non-hazardous with the exception of chromium which had a concentration of 51.5 milligrams per kilogram (mg/kg). The soluble threshold limit concentration (STLC) of chromium is 5 mg/kg, therefore; EMAX analyzed the soil sample for STLC for chromium by EPA Method 6010B, and the results showed an STLC concentration of chromium of 0.158 mg/kg, which is below the hazardous threshold of 5 mg/kg. A copy of the laboratory report is included in Appendix D. The soil cuttings were characterized as non-hazardous soil and after discussion and approval from the Navy and ROICC, the soil cuttings were spread onsite at IRP Site 27.

3.0 REFERENCES

MARRS Services, Inc. (MARRS) 2009. *Final Site Inspection Report, IRP Site 27, Naval Weapons Station Seal Beach Det. Fallbrook, Fallbrook, CA.* February.

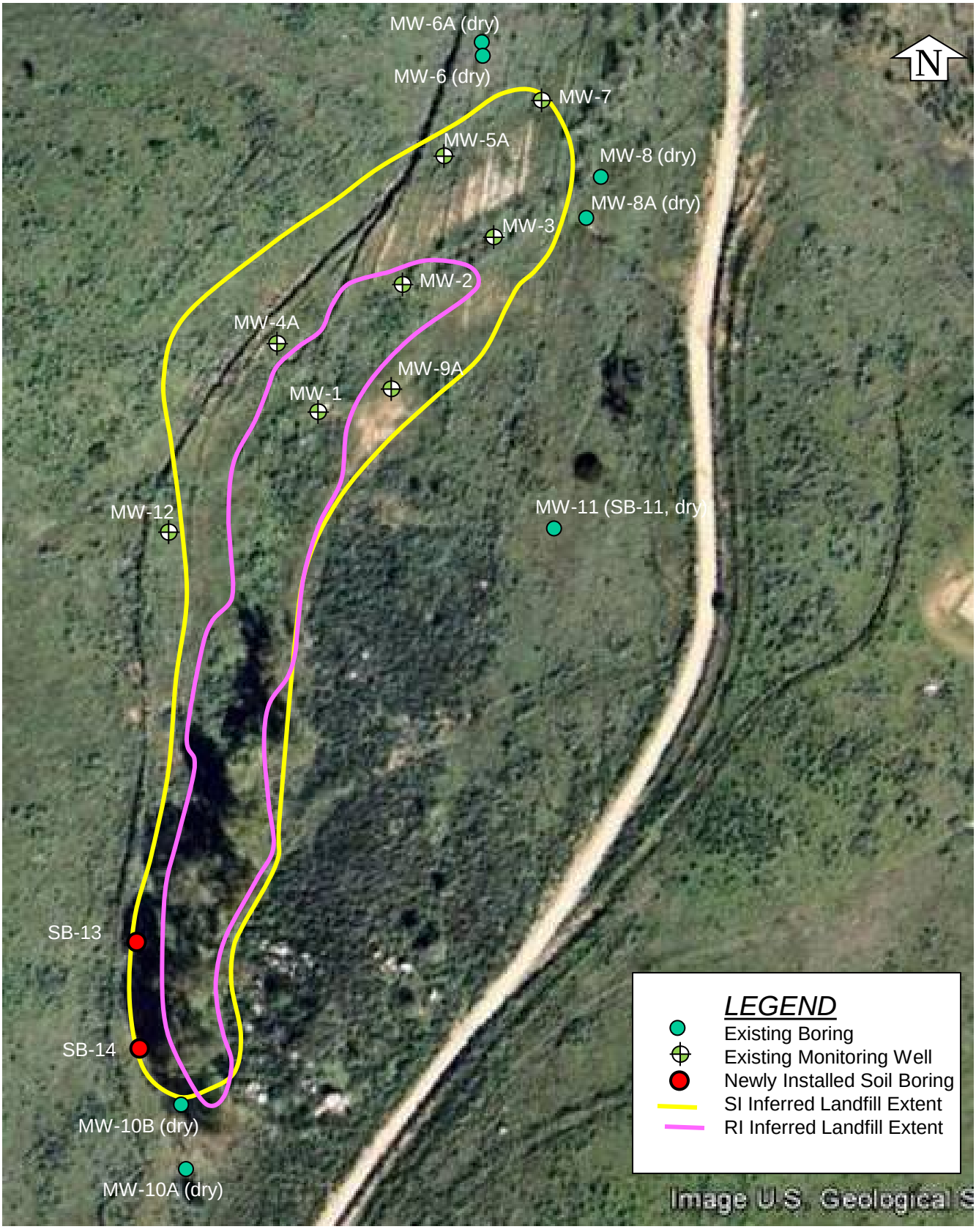
SES-TECH/Geosyntec Consultants, Inc. (SES-TECH) 2010. *Final Remedial Investigation Work Plan, Installation Restoration Program Site 27, Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California.* September.

_____ 2012a. *Final Meeting Minutes July 26, 2012 Between DoN and Regulatory Agencies.*

_____ 2012b. *Final Remedial Investigation Report, Installation Restoration Program Site 27, Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California.* September.

_____ 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G4, Office of Environmental Information.* February.

FIGURES



Enviro Compliance Solutions, Inc.
1571 Parkway Loop, Suite B
Tustin, CA 92780

SOIL BORING LOCATIONS

IRP SITE 27

Naval Weapons Station Seal Beach Detachment Fallbrook, CA

FIGURE
1

APPENDIX A

SOIL BORING LOGS

Enviro Compliance Solutions, Inc.		CLIENT	Navy
SITE	NAVWPNSTA Fallbrook, CA	BORING NO.	IRP-27-SB-13
Boring Location:	IRP-27	Date Started:	11/28/2012 @ 1330
Drilling Contractor:	JDK Drilling, Inc./Sopotyn Lorn	Date Completed:	11/28/2012 @1515
Drilling Method:	Hollow Stem Auger	Ground Elev. (ft):	648.1
Drilling Equipment:	CME 75	Lattitude (N)	33.3484873
Sampling Method:	Continuous Core	Longitude (W)	117.2754542
Sampler Type:	Core Barrel	Logged By:	Victor Salcedo

Depth (ft)	Core Run	Recovery (%)	PID Reading	Time	Lithology	Description	Completion Detail	Remarks
	Run #1	80	0			Silty SAND (SM): brown (10YR 2/2), fine-grained sand, trace roots, dense, slightly moist, no chemical odor		
						Silty SAND (SM): dark yellowish brown (10YR 4/4), fine-grained sand, very dense, slightly moist, no chemical odor		Backfilled with cement grout (5% bentonite)
						CONTINUOUS CORE		
5	Run #2	60	0			Silty SAND (SM): dark yellowish brown (10YR 4/4); fine-grained sand, very dense, slightly moist, no chemical odor		
10	Run #3	60	0			Weathered granitic BEDROCK: light brownish gray (2.5Y 6/2), very dense, dry, no chemical odor		
						the granitic BEDROCK is more friable and disaggregated		
15	Run #4	95	0			weathered granitic BEDROCK, friable and disaggregated, light browninsh gray (2.5Y 6/2), very dense, no chemical odor		
20								
PROJECT NO.		Extended RI				Responsible Professional: Michal Wolff	P.G.#	3347

BORING LOG (continuation page)						**CLIENT**		Navy
SITE: NAVWPNSTA Fallbrook, CA						**BORING NO.**		IRP-27-SB-13
Depth (ft)	Core Run	Recovery (%)	PID Reading	Time	Lithology	Description	Completion Detail	Remarks
	Run #5	80	0			weathered granitic BEDROCK, friable and disaggregated, light browninsh gray (2.5Y 6/2), very dense, no chemical odor **CONTINUOUS CORE**		Backfilled with cement grout (5% bentonite)
25						Stopped drilling. Hit refusal at 25 feet bgs.		
30								
35								
40								
50								

Enviro Compliance Solutions, Inc.		CLIENT	Navy
SITE	NAVWPNSTA Fallbrook, CA	BORING NO.	IRP-27-SB-14
Boring Location:	IRP-27	Date Started:	11/28/2012 @ 1125
Drilling Contractor:	JDK Drilling, Inc./Sopotyn Lorn	Date Completed:	11/28/2012 @ 1255
Drilling Method:	Hollow Stem Auger	Ground Elev. (ft):	654.3
Drilling Equipment:	CME 75	Lattitude (N)	33.3483018
Sampling Method:	Continuous Core	Longitude (W)	117.2754537
Sampler Type:	Core Barrel	Logged By:	Victor Salcedo

Depth (ft)	Core Run	Recovery (%)	PID Reading	Time	Lithology	Description	Completion Detail	Remarks
	Run #1	80	0			Sandy SILT (ML): very dark brown (10YR 2/2), fine-grained sand, non-plastic, trace roots, hard, moist, no chemical odor Silty SAND (SM): dark yellowish brown (10YR 4/4), fine-grained sane, very dense, slightly moist, no chemical odor **CONTINUOUS CORE**		Backfilled with cement grout (5% bentonite)
5	Run #2	100	0			Silty SAND (SM): dark yellowish brown (10YR 4/4), fine-grained sand, very dense, slightly moist, no chemical odor		
10	Run #3	80	0			Weathered granitic BEDROCK: light brownish gray (2.5Y 6/2), very dense, dry, no chemical odor Granitic BEDROCK is more friable and disaggregated		
15	Run #4	100	0			Weathered granitic BEDROCK, friable and disaggregated, light browninsh gray (2.5Y 6/2), very dense, slightly moist, no chemical odor		
20								

PROJECT NO.	Extended RI	Responsible Professional: Michal Wolff	P.G.#	3347

BORING LOG (continuation page) | **CLIENT** Navy

SITE: NAVWPNSTA Fallbrook, CA | **BORING NO.** IRP-27-SB-14

Depth (ft)	Core Run	Recovery (%)	PID Reading	Time	Lithology	Description	Completion Detail	Remarks
	Run #5		0			Weathered granitic BEDROCK, friable and disaggregated, light browninsh gray (2.5Y 6/2), very dense, slightly moist, no chemical odor		Backfilled with cement grout (5% bentonite)
		100				**CONTINUOUS CORE**		
25								
	Run #6	20	0			Stopped drilling. Hit refusal at 26 feet bgs.		
30								
35								
40								
50								

APPENDIX B

SOIL CORE PHOTOGRAPHS

PHOTO 1: Boring IRP-27-SB-13 Soil Core (0-1 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 2: Boring IRP-27-SB-13 Soil Core (1-2 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 3: Boring IRP-27-SB-13 Soil Core (2-3 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 4: Boring IRP-27-SB-13 Soil Core (3-4 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 5: Boring IRP-27-SB-13 Soil Core (5-6 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 6: Boring IRP-27-SB-13 Soil Core (6-7 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 7: Boring IRP-27-SB-13 Soil Core (7-8 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 8: Boring IRP-27-SB-13 Soil Core (10-11 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 9: Boring IRP-27-SB-13 Soil Core (11-12 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 10: Boring IRP-27-SB-13 Soil Core (12-13 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 11: Boring IRP-27-SB-13 Soil Core (15-16 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 12: Boring IRP-27-SB-13 Soil Core (16-17 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 13: Boring IRP-27-SB-13 Soil Core (17-18 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 14: Boring IRP-27-SB-13 Soil Core (18-19 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 15: Boring IRP-27-SB-13 Soil Core (19-20 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 16: Boring IRP-27-SB-13 Soil Core (20-21 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 17: Boring IRP-27-SB-13 Soil Core (21-22 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 18: Boring IRP-27-SB-13 Soil Core (22-23 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 19: Boring IRP-27-SB-13 Soil Core (23-24 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 20: Boring IRP-27-SB-13 Soil Core (24-25 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 21: Boring IRP-27-SB-14 Soil Core (0-2 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 22: Boring IRP-27-SB-14 Soil Core (2-3 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 23: Boring IRP-27-SB-14 Soil Core (3-4 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 24: Boring IRP-27-SB-14 Soil Core (5-6 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 25: Boring IRP-27-SB-14 Soil Core (6-7 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 26: Boring IRP-27-SB-14 Soil Core (7-8 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 27: Boring IRP-27-SB-14 Soil Core (8-9 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 28: Boring IRP-27-SB-14 Soil Core (9-10 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 29: Boring IRP-27-SB-14 Soil Core (10-11 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 30: Boring IRP-27-SB-14 Soil Core (11-12 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 31: Boring IRP-27-SB-14 Soil Core (12-13 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 32: Boring IRP-27-SB-14 Soil Core (13-14 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 33: Boring IRP-27-SB-14 Soil Core (15-16 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 34: Boring IRP-27-SB-14 Soil Core (16-17 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 35: Boring IRP-27-SB-14 Soil Core (17-18 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 36: Boring IRP-27-SB-14 Soil Core (18-19 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 37: Boring IRP-27-SB-14 Soil Core (19-20 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 38: Boring IRP-27-SB-14 Soil Core (20-21 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 39: Boring IRP-27-SB-14 Soil Core (21-22 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 40: Boring IRP-27-SB-14 Soil Core (22-23 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 41: Boring IRP-27-SB-14 Soil Core (23-24 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 42: Boring IRP-27-SB-14 Soil Core (24-25 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 43: Boring IRP-27-SB-14 Soil Core (21-22 foot interval)
NAVWPNSTA Fallbrook, CA

PHOTO 44: Boring IRP-27-SB-14 Soil Core (26-27 foot interval)
NAVWPNSTA Fallbrook, CA

APPENDIX C

LAND SURVEY REPORT

Evans Land Surveying and Mapping

Enviro Compliance Solutions, Inc.

NWS Seal Beach - Fallbrook Detatchment
IRP Sites - 27 , 28 , 29
Fallbrook, California

Soil Boring / Trench Locations
December 06, 2012

Designation	Northing	Easting	Elevation	Description
		IRP SITE 27		
IRP-27-SB-13	2,071,965.5	6,248,519.1	648.1	GS
IRP-27-SB-14	2,071,898.0	6,248,518.6	654.3	GS
		IRP SITE 28 - AREA 1		GS
IRP-28-A1-01	2,076,895.6	6,249,725.3	627.4	GS
IRP-28-A1-02	2,076,885.3	6,249,730.0	627.3	GS
IRP-28-A1-03	2,076,888.2	6,249,736.0	627.5	GS
IRP-28-A1-04	2,076,895.0	6,249,743.9	627.6	GS
IRP-28-A1-05	2,076,901.8	6,249,744.8	627.6	GS
IRP-28-A1-06	2,076,901.7	6,249,732.5	627.9	GS
IRP-28-A1-07	2,076,908.3	6,249,727.1	627.7	GS
IRP-28-A1-08	2,076,912.2	6,249,742.1	627.9	GS
IRP-28-A1-09	2,076,914.4	6,249,751.7	627.8	GS
IRP-28-A1-10	2,076,895.8	6,249,735.5	627.5	GS
		IRP SITE 28 - AREA 2		
IRP-28-A2-11	2,076,787.3	6,249,637.3	625.2	GS
IRP-28-A2-12	2,076,766.1	6,249,648.7	624.4	GS
IRP-28-A2-13	2,076,771.4	6,249,623.5	624.4	GS

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Enviro Compliance Solutions, Inc.

NWS Seal Beach - Fallbrook Detatchment
IRP Sites - 27 , 28 , 29
Fallbrook, California

Soil Boring / Trench Locations
December 06, 2012

Designation	Northing	Easting	Elevation	Description
IRP-28-A2-14	2,076,751.1	6,249,632.9	623.6	GS
IRP-28-A2-15	2,076,756.2	6,249,615.1	624.2	GS
IRP-28-A2-16	2,076,736.8	6,249,617.0	623.6	GS
IRP-28-A2-17	2,076,745.2	6,249,596.0	623.5	GS
IRP-28-A2-18	2,076,724.8	6,249,599.1	623.2	GS
IRP-28-A2-19	2,076,705.2	6,249,577.8	622.3	GS
IRP-28-A2-20	2,076,706.9	6,249,562.3	622.3	GS
		IRP SITE 28 - AREA 3		
IRP-28-A3-21	2,076,256.9	6,249,022.2	604.0	GS
IRP-28-A3-22	2,076,222.2	6,249,040.3	604.5	GS
IRP-28-A3-23	2,076,187.0	6,248,970.7	602.4	GS
IRP-28-A3-24	2,076,235.6	6,248,944.0	602.3	GS
IRP-28-A3-25	2,076,154.1	6,248,927.4	601.0	GS
IRP-28-A3-26	2,076,115.8	6,248,961.7	601.0	GS
IRP-28-A3-27	2,076,105.2	6,248,982.0	600.7	GS
IRP-28-A3-28	2,076,090.0	6,248,948.0	599.9	GS
IRP-28-A3-29	2,076,025.5	6,248,921.9	597.6	GS
IRP-28-A3-30	2,075,942.7	6,248,869.7	595.8	GS

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Evans Land Surveying and Mapping

Enviro Compliance Solutions, Inc.

NWS Seal Beach - Fallbrook Detatchment
IRP Sites - 27 , 28 , 29
Fallbrook, California

Soil Boring / Trench Locations
December 06, 2012

Designation	Northing	Easting	Elevation	Description
		IRP SITE 29		
		SOIL SAMPLES		
IRP-29-TRENCH-01	2,078,247.4	6,252,725.8	612.9	GS
IRP-29-TRENCH-04	2,078,097.8	6,252,748.0	614.3	GS
IRP-29-TRENCH-09	2,078,093.7	6,252,587.0	613.8	GS
IRP-29-TRENCH-10	2,078,081.9	6,252,636.4	614.8	GS
IRP-29-TRENCH-11	2,078,040.4	6,252,672.0	616.8	GS
IRP-29-TRENCH-19	2,078,005.8	6,252,777.4	620.7	GS
		TRENCH # 01		
374	2,078,251.1	6,252,728.4	612.9	GS
375	2,078,251.5	6,252,724.3	612.7	GS
376	2,078,243.1	6,252,723.1	612.7	GS
377	2,078,242.6	6,252,726.6	612.9	GS
		TRENCH # 02		
379	2,078,232.0	6,252,721.2	612.7	GS
380	2,078,230.1	6,252,724.4	612.8	GS
381	2,078,223.1	6,252,719.7	612.7	GS
382	2,078,224.7	6,252,716.5	612.6	GS

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NWS Seal Beach - Fallbrook Detatchment
IRP Sites - 27 , 28 , 29
Fallbrook, California

Soil Boring / Trench Locations
December 06, 2012

Designation	Northing	Easting	Elevation	Description
	TRENCH	**# 03**		
383	2,078,151.6	6,252,706.1	612.7	GS
384	2,078,148.3	6,252,707.9	612.9	GS
385	2,078,145.6	6,252,702.0	613.0	GS
386	2,078,148.8	6,252,700.3	612.7	GS
	TRENCH	**# 04**		
387	2,078,102.8	6,252,748.4	614.2	GS
388	2,078,100.8	6,252,751.6	614.3	GS
389	2,078,093.3	6,252,747.3	614.6	GS
390	2,078,095.6	6,252,744.1	614.4	GS
	TRENCH	**# 05**		
392	2,078,083.6	6,252,747.5	614.9	GS
393	2,078,080.0	6,252,747.7	615.1	GS
394	2,078,079.9	6,252,738.9	615.1	GS
395	2,078,083.5	6,252,738.8	614.9	GS
	TRENCH	**# 06**		
396	2,078,074.1	6,252,741.2	615.5	GS
397	2,078,070.5	6,252,740.5	615.5	GS
398	2,078,072.6	6,252,731.9	615.5	GS
399	2,078,076.2	6,252,732.5	615.4	GS

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Evans Land Surveying and Mapping

Enviro Compliance Solutions, Inc.

NWS Seal Beach - Fallbrook Detatchment
IRP Sites - 27 , 28 , 29
Fallbrook, California

Soil Boring / Trench Locations
December 06, 2012

Designation	Northing	Easting	Elevation	Description
	TRENCH	**# 07**		
360	2,078,007.0	6,252,724.0	619.0	GS
361	2,078,003.6	6,252,725.7	619.6	GS
362	2,078,008.9	6,252,733.8	619.0	GS
363	2,078,011.9	6,252,732.0	618.8	GS
	TRENCH	**# 08**		
364	2,078,005.1	6,252,734.6	619.5	GS
365	2,078,004.6	6,252,738.2	619.4	GS
366	2,077,994.9	6,252,736.6	620.5	GS
367	2,077,995.6	6,252,732.9	620.6	GS
	TRENCH	**# 09**		
341	2,078,098.4	6,252,572.2	613.1	GS
342	2,078,101.6	6,252,574.0	613.3	GS
343	2,078,088.6	6,252,601.3	614.3	GS
344	2,078,085.4	6,252,599.6	614.4	GS
	TRENCH	**# 10**		
347	2,078,060.2	6,252,624.3	615.8	GS
348	2,078,058.5	6,252,627.1	615.9	GS
370	2,078,102.6	6,252,648.9	613.3	GS
371	2,078,104.6	6,252,645.9	612.9	GS

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NWS Seal Beach - Fallbrook Detatchment
IRP Sites - 27 , 28 , 29
Fallbrook, California

Soil Boring / Trench Locations
December 06, 2012

Designation	Northing	Easting	Elevation	Description
	TRENCH	**# 11**		
349	2,078,023.9	6,252,635.2	616.9	GS
350	2,078,020.7	6,252,637.2	617.0	GS
368	2,078,057.2	6,252,707.9	615.8	GS
369	2,078,060.7	6,252,707.1	615.7	GS
	TRENCH	**# 12**		
352	2,078,009.7	6,252,650.2	617.8	GS
353	2,078,004.3	6,252,655.4	618.4	GS
354	2,078,006.7	6,252,658.0	618.2	GS
355	2,078,012.3	6,252,652.7	617.7	GS
	TRENCH	**# 13**		
356	2,077,967.2	6,252,596.4	620.4	GS
357	2,077,964.9	6,252,593.7	620.7	GS
358	2,077,956.9	6,252,600.6	621.1	GS
359	2,077,959.4	6,252,603.4	621.1	GS
	TRENCH	**# 14**		
316	2,078,056.8	6,252,816.2	617.4	GS
317	2,078,042.1	6,252,803.4	617.7	GS
318	2,078,044.3	6,252,800.6	617.4	GS
319	2,078,059.1	6,252,813.4	617.1	GS

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Soil Boring / Trench Locations
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Designation	Northing	Easting	Elevation	Description
	TRENCH	**# 15**		
320	2,078,069.8	6,252,824.4	616.7	GS
321	2,078,068.1	6,252,827.4	616.9	GS
322	2,078,074.5	6,252,831.3	616.8	GS
323	2,078,076.3	6,252,828.1	616.6	GS
	TRENCH	**# 16**		
324	2,078,091.0	6,252,823.1	616.0	GS
325	2,078,094.0	6,252,821.1	615.6	GS
326	2,078,098.5	6,252,827.0	615.9	GS
327	2,078,095.7	6,252,829.0	616.1	GS
	TRENCH	**# 17**		
328	2,078,078.1	6,252,849.9	617.2	GS
329	2,078,074.6	6,252,850.7	617.4	GS
330	2,078,072.8	6,252,843.5	617.2	GS
331	2,078,076.2	6,252,842.7	617.1	GS
	TRENCH	**# 18**		
332	2,077,982.5	6,252,779.4	624.2	GS
333	2,077,979.8	6,252,777.2	624.3	GS
334	2,077,986.2	6,252,771.6	623.2	GS
335	2,077,988.7	6,252,773.9	623.0	GS

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Evans Land Surveying and Mapping

Enviro Compliance Solutions, Inc.

NWS Seal Beach - Fallbrook Detatchment
IRP Sites - 27 , 28 , 29
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Soil Boring / Trench Locations
December 06, 2012

Designation	Northing	Easting	Elevation	Description
	TRENCH	**# 19**		
336	2,078,001.2	6,252,780.5	621.2	GS
337	2,078,003.7	6,252,782.9	621.1	GS
338	2,078,011.5	6,252,773.2	619.8	GS
339	2,078,008.9	6,252,770.6	619.9	GS

Stephen E. Evans PLS 7017

Legend:

TOC = Top Of PVC well Casing
COVER = existing well access Cover
GS = existing Ground Surface

Basis of Coordinates / Elevations:

Horizontal: North American Datum of 1983, (NAD'83)
CCS83, Zone VI, (0406)

Vertical: North American Vertical Datum of 1988, (NAVD'88)

*** NOTE: Current survey data based on a prior survey performed by CalVada Surveying on November 02, 2010, data provided by ECS, Inc.

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APPENDIX G

RESPONSES TO DTSC AND RWQCB COMMENTS ON THE DRAFT VERSION OF THE EXTENDED RI REPORT FOR SITE 27

(Provided on CD)

Document Title:

Draft Extended Remedial Investigation Report, Installation Restoration Program Site 27, Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California (January 2014)

Reviewer: California Department of Toxic Substances Control, Brownfields and Environmental Restoration Program, letter from Stephen Niou, P.E.
Dated: February 25, 2014

Comment No.	Section/ Page No.	Comment	Response
	Cover Letter – General Comment	The Department of Toxic Substances Control (DTSC) reviewed the above referenced document which we received on January 31, 2014. The Navy addressed data gaps from the RI Report (2012) by drilling two soil borings and by conducting two additional rounds of groundwater monitoring. The soil borings were to delineate the area of buried wastes to southwest direction of the landfill while groundwater monitoring was conducted one for dry season and one for wet season. The soil borings shows that landfill waste was not buried to the southwest of the landfill. The borings also indicate that groundwater is absent in that area. The additional groundwater monitoring concludes that groundwater is impacted only in the vicinity of MW-2, MW-3, and MW-12. DTSC concurs with the findings and does not have comments to be forwarded to the Navy.	Thank you for your review and concurrence with this Report.

Document Title:

Draft Extended Remedial Investigation Report, Installation Restoration Program Site 27, Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California (January 2014). Geotracker ID: DOD100151400:BGriffey

Reviewer: California Regional Water Quality Control Board, San Diego Region, Northern Cleanup Unit, letter from Beatrice Griffey, M. Sc., P.G. Dated: July 31, 2013.

Comment No.	Section/ Page No.	Comment	Response
General Comments			
	Cover Letter - General Comment	The "Draft Extended Remedial Investigation Report, Installation Restoration Program Site 27, Naval Weapons Station Seal Beach, Detachment Fallbrook, Fallbrook, California" (Draft Report) prepared by Enviro Compliance Solutions, Inc., dated January 21, 2014, was received by the California Regional Water Quality Control Board, San Diego Region (San Diego Water Board) on February 4, 2014. The Installation Restoration Program Site 27 (Site) involves the historical land disposal of approximately 66 thousand cubic yards of waste generated at the Naval Weapons Station Seal Beach, Detachment Fallbrook (Base) from the 1960s until 1974. The Draft Report presents the findings of environmental remedial investigation activities performed at the Site to delineate the southwestern boundary of Site waste. Additionally, the Draft Report presents the findings of two groundwater investigations conducted during November 2012, considered to be representative of the dry season, and May 2013, considered to be representative of the wet season. Following are the San Diego Water Board's comments on the Draft Report that are categorized as technical or editorial in nature.	Responses to specific comments (RTCs) are presented below.
Technical Comments			
Waste Investigation		The waste investigation indicated the absence of Site waste and groundwater in two borings located along	Thank you for your review and concurrence.

Document Title:

Draft Extended Remedial Investigation Report, Installation Restoration Program Site 27, Naval Weapons Station Seal Beach Detachment Fallbrook, Fallbrook, California (January 2014). Geotracker ID: DOD100151400:BGriffey

Reviewer: California Regional Water Quality Control Board, San Diego Region, Northern Cleanup Unit, letter from Beatrice Griffey, M. Sc., P.G. Dated: July 31, 2013.

	the southwestern boundary of the Site (referred to as SB-13 and SB-14) that were advanced to a maximum depth of 25 feet below grade surface. Based on these findings, it is concluded that buried waste does not extend into this portion of the Site, which the San Diego Water Board agrees with.	
Groundwater Investigation	The derived conclusion regarding the presence of N-nitrosodimethylamine (NDMA) in Site groundwater does not seem to be supported by all the investigation findings. In the Draft Report, Subsection 5.2, Groundwater Sampling Results, it is concluded that the NDMA detection in the monitoring well MW-3 at a concentration of 3.85 ng/L during the November 2012 sampling event, is considered to be an "anomaly." The conclusion is based on the fact that NDMA concentration in MW-3 decreased to 0.517 ng/L during the May 2013 sampling event. The conclusion is based on the findings of two sampling events for a single Site monitoring well, does not address the NDMA detection in monitoring wells MW-1 (0.619 ng/L) and MW-2 (2.75 ng/L) during the November 2012 sampling event, the absence of NDMA in MW-1 and MW-2 during the May 2013 sampling event, and does not take into consideration the natural variability of groundwater analytical data related to fluctuations in the subsurface environment. All of these issues collectively, raise some concern regarding the validity of the conclusion. In the response to comments (RTC), please either provide a detailed, comprehensive, and thorough discussion supporting the original conclusion or a revised conclusion, whichever is appropriate. If a decision is made to	NDMA concentrations have fluctuated over time. For example, during the SI in November 2006, NDMA was reported only in well MW-2 at a concentration of 3.3 ng/L. November was a period of low groundwater levels. During the RI, NDMA concentrations ranged from 0.67 ng/L to 1.09 ng/L (estimated concentrations) in November 2010 when groundwater levels were low, and from 0.38 ng/L to 2.58 ng/L in June 2011, when groundwater levels were higher. During the extended RI, NDMA concentrations were reported in well MW-2 at 2.75 ng/L, and at MW-3 at 3.85 ng/L, in November 2012 when the groundwater levels were low. In May 2013, when groundwater levels were higher, the NDMA concentrations had declined in both of these wells to below reporting limits (0.338 ng/L and 0.517 ng/L, respectively). Based on these data, it can be concluded that NDMA concentrations fluctuate from below laboratory reporting limits on the low side, to levels slightly exceeding the revised screening level of 3 ng/L on the high side. This concentration fluctuation may be inversely related to variations in groundwater levels.

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	support the original conclusion, please include in the requested discussion all of the historical and recent NDMA analytical data for all the Site monitoring wells, to the extent practicable.	The NDMA concentration of 3.85 ng/L in well MW-3 in November 2012 represents the extreme high end of the range of historical NDMA concentrations and was concluded to be an aberration because it is not representative of the normal NDMA concentration conditions. This was the only NDMA concentration in any well that exceeded the revised screening level of 3 ng/L since 2006. The next-to-last sentence of the first paragraph of Section 5.2 has been revised to read: *"The slight exceedance of the revised screening level in the November round is not a concern because NDMA concentrations have historically fluctuated and have been consistently below the revised screening level both before and after the November sampling event."*
	The hydrazine investigation findings and conclusion require additional discussion and clarification. Based on the discussion of the hydrazine investigation findings presented in the Draft Report, Section 6.0, Third Bullet, it appears that there is a possibility that there is an offsite hydrazine source(s). In the RTC, please either provide clarification regarding this matter or a list of potential offsite hydrazine source(s), whichever is appropriate. The requested potential offsite hydrazine source(s) list is necessary to ensure that the hydrazine is included in the laboratory analytical plan for the appropriate future site investigations.	The Navy acknowledges the presence of hydrazine in the surface water and groundwater samples at or near Site 27. This discovery is a concern. However, the analytical data from groundwater samples upgradient and downgradient of the Site 27 landfill (1.1 - 5.3 ug/L) are an order of magnitude lower than the surface water values (38 to 44 ug/L) and are not indicative of a release from the Site 27 landfill. The upgradient groundwater well was coincidently the well with the highest concentration of hydrazine (5.3 ug/L). Notwithstanding, the hydrazine in the upgradient surface water to Site 27 still may pose a concern and requires further investigation beyond the scope of the Site 27 landfill FS to

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Dated: July 31, 2013.

		define its source either to a single release point or to a widespread and anthropogenic release outside of the Site 27 footprint. It should be noted that Fallbrook does not currently engage in activities involving hydrazine. However, rocket fuel is known to contain hydrazine and rocket fuel has been present on the installation in the past. The Navy will add hydrazine to the list of analytes to the Site UXO 1 Remedial Investigation since this site is the only known area where rocket propellants have been used. UXO 1 is also in close proximity to Site 27. Accordingly, the third bullet of Section 6 has been revised to read: *"Hydrazine concentrations in groundwater samples collected in the extended RI ranged from 1.1 to 5.3 mg/L, with the highest detection occurring at background well MW-12. Hydrazine has previously been detected in both surface water and groundwater samples collected at IRP Site 27, both upgradient and downgradient of the former landfill. There is no known source on site, and the compound is present upgradient of the former landfill at greater concentrations than within or downgradient of the former landfill; therefore, it is concluded that IRP Site 27 is not the source of the observed hydrazine.* *There is neither an MCL nor a project action level established for hydrazine. During the RI (SES-Tech, 2012), hydrazine was detected in surface*

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Dated: July 31, 2013.

		water at concentrations ranging from 38 to 44 mg/L, but was dismissed as a concern due to low precipitation and the low residence time of surface water runoff at IRP Site 27. The reporting limit for hydrazine using ASTM Method D1385 is 2 mg/L, which exceeds the EPA Region 9 regional screening level (RSL) for tap water (0.022 mg/L). While the hydrazine concentrations in groundwater at some IRP Site 27 wells exceed the RSL. Institutional controls being considered in Feasibility Study alternatives would prevent exposure to hydrazine in groundwater." Providing a list of potential offsite hydrazine sources is beyond the scope of this IRP Site 27 extended RI.
	The source(s) of metals dissolved in groundwater seems to require clarification. According to Draft Report, Section 6, Fourth Bullet, the metal concentrations in monitoring well MW-2 "… likely arose from the well having been installed by drilling through the waste prism." According to Draft Report, Section 7.4, the metal concentrations in monitoring well MW-2 groundwater is attributed to the dissolution of naturally occurring metals in soil. Therefore, there is some confusion regarding the potential source(s) of metals in MW-2 groundwater that requires clarification in the RTC.	To resolve the apparent discrepancy between Section 6 fourth bullet, and Section 7.4, regarding the reasons for elevated metals concentrations in well MW-2, the third sentence of Section 6, fourth bullet, has been revised to read: *"These metals concentrations could be the result of localized geochemical effects of the landfill waste on the aquifer as discussed further in Section 7.4, or from the well having been installed by drilling through the waste prism, or both."*
	The screening level ecological risk assessment (SLERA) seems to require augmentation to address the potential for Site groundwater to adversely impact	For purposes of data collection, the extended RI followed the definition of study boundaries developed as part of the data quality objectives

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	ecological receptors associated with the nearby ravine and "seasonal pond" (Draft Report, Figure 3), located downgradient of the Site. The SLERA (Draft Report, Subsection 7.3.2) does not address the potential for Site groundwater to "daylight" and become surface water within the ravine located approximately 200 feet northeast and flow into the "seasonal pond" located approximately 1,200 feet north of the Site. Both of these surface water bodies are located downgradient of the Site. The hydrologic communication between groundwater and surface water is known to occur and it is not apparent as to why this matter is not addressed from a SLERA perspective at this Site. In the RTC, please either provide the rationale as to why this matter is not a concern at the Site or a revised Draft Report, Subsection 7.3.2, that discusses the potential for groundwater to adversely impact receptors associated with these two surface water bodies, whichever is appropriate.	(DQO) process detailed in the approved Final RI Work Plan (SES Tech 2010). The study boundaries did not include sampling of surface water in the seasonal pond 1200 feet north of the site, nor in the ravine that is tributary to it. The data are therefore lacking to evaluate the hypothetical recharge of surface water by groundwater if it indeed occurs within these topographic features. From a SLERA perspective, the likelihood of significant effects to ecological receptors, if any, within the ravine or seasonal pond is considered low owing to the low precipitation rate, infrequent occurrence of runoff, low residence time for runoff at the site, the uncertain connection between groundwater at the site and surface water in the seasonal pond, and the expected very low exposure duration that receptors would experience. With respect to potential impacts from hydrazine, hydrazine at the soil surface is probably not an issue due to the low precipitation rate and the rapid breakdown time for hydrazine. The average concentration of hydrazine concentration in the groundwater is at the RSL with some samples being slightly above the RSL. The Navy proposes to maintain hydrazine in the groundwater monitoring plan in the out years. However, since hydrazine is entering the site from an offsite source, remediation efforts at Site 27 will do little reduce hydrazine levels in ground or surface

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			waters. The installation does not engage in activities that would result in hydrazine release. However, hydrazine is known to be present in rocket propellants which have been used at Site UXO 1 until as late as 1982. The Navy proposes to add hydrazine to the list of analytes at UXO 1 and maintain hydrazine on the list of analytes for the groundwater monitoring plan at Site 27.
Editorial Comments			
1.	Page 6, second paragraph, sixth sentence	Provides the findings of the soluble threshold limit concentration (STLC) for chromium noting a mg/kg unit. It seems that the appropriate unit for STLC is mg/L. Please review the subject sentence, and either make the necessary revisions or provide clarification, whichever is appropriate.	The units correction has been made.
2.	Section 6, fourth bullet	Clarification is required regarding the proposed recommendation for MW-1. The sealing and destruction of MW-1 is recommended. The investigation findings presented in the Fourth Bullet is specifically and solely with regards to MW-2, and does not contain any findings supporting the proposed recommendation for MW-1. In the RTC, please either provide clarification regarding this matter or the revised text for the Fourth Bullet, whichever is appropriate.	Section 6, fourth bullet has been revised to read (Note "this" well [below] refers to MW-2): *This well and MW-1, which is also installed through the landfill prism, should be properly sealed and destroyed to prevent them from becoming conduits for contaminant migration in the future."*
3.	The draft report	The Draft Report needs to be expanded to include a series of detailed cross-sections, both parallel and perpendicular to the long axis of the Site waste plume. The cross-sections need to illustrate lateral and vertical spatial relationships between Site	Figures 10 through 14 of the Extended RI Report, and Figures 23 through 26 of the Final RI Report (SES-Tech 2012) together illustrate subsurface conditions in a series of plan view and three-dimensional renderings that are intended to

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		subsurface conditions (lithologies, groundwater, waste, bedrock, etc.) and groundwater monitoring well construction details. The Draft Report contains numerous detailed and relevant discussions regarding Site spatial relationships but does not provide reviewers with a means to visualize the relationships. In the RTC, please include the requested detailed Site cross-sections.	communicate subsurface conditions to the reader. The Final RI Report was intended to be a comprehensive presentation of site data with only limited additional input that was the subject of the extended RI. Agency comments received on the Final RI Report did not indicate a deficiency with regard to the graphical illustrations of the site subsurface. The Navy respectfully suggests that the existing figures are adequate for this purpose.
Conclusion		The San Diego Water Board appreciates Department of the Navy's (DoN) time and efforts addressing environmental issues at Installation Restoration Site 27 and looks forward to continuing to assist DoN with environmental issues at contaminated sites within Naval Weapons Station Seal Beach, Detachment Fallbrook boundaries. In the subject line of any response pertaining to Installation Restoration Program Site 27, please include the reference number DOD100151400:BGriffey.	Thank you for your review.