



Final

**Second Five-Year Review Report
Installation Restoration Program
Sites 2, 3, 5, 16, 17, 18, 24, and Anomaly
Area 3**

**FORMER MARINE CORPS AIR STATION
EL TORO, CALIFORNIA**

September 2014

Prepared for:

**Base Realignment and Closure
Program Management Office West
San Diego, California**

Prepared under:

**Naval Facilities Engineering Command
Contract Number N62473-11-D-2231
Contract Task Order 0002
DCN: AEJV-2231-0002-0009**



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for
Installation Restoration Program Sites 2, 3, 5, 16, 17, 18, 24, and Anomaly
Area 3
Former Marine Corps Air Station El Toro
Irvine
Orange County, California

September 2014



Approved by: 
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Date: 9/24/2014

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ACRONYMS AND ABBREVIATIONS

§	section
µg/L	micrograms per liter
AA 3	Anomaly Area 3
Accord	Accord Engineering, Inc.
AECOM	AECOM Technical Services, Inc.
AEJV	AECOM Envirocon Joint Venture
APHO	aerial photograph
ARAR	applicable or relevant and appropriate requirement
ARIC	area requiring institutional control
ARSR	Annual Remedy Status Report
ASTM	American Society for Testing and Materials
Barajas	Barajas and Associates, Inc.
BCT	BRAC Cleanup Team
bcy	bank cubic yards
BEC	BRAC Environmental Coordinator
bgs	below ground surface
BNI	Bechtel National, Inc.
BO	Biological Opinion
BRAC	Base Realignment and Closure
CA	California
Cal/EPA	California Environmental Protection Agency
CAO	Cleanup and Abatement Order
CE2K	CE2 Kleinfelder Joint Venture
CCMI	CERCLA Component of the Modified Irvine Desalter Project
CCR	California Code of Regulations
CDHS	California Department of Health Services
CDM	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIWMB	California Integrated Waste Management Board (Cal/Recycle)
CLEAN	Comprehensive Long-Term Environmental Action Navy
CO	Carve-Out
COC	chemical of concern
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CRUP	Covenant to Restrict the Use of Property
CSS	coastal sage scrub
cy	cubic yards
DCA	dichloroethane
DCE	dichloroethene
DO	dissolved oxygen
DHS	Department of Health Services, California
DOJ	U.S. Department of Justice

DON	Department of the Navy
DRMO	Defense Reutilization and Marketing Office
DTSC	Department of Toxic Substances Control
Earth Tech	Earth Tech, Inc.
EC	electrical conductivity
ECL	evaluation concentration level
ECLMP	evaluation concentration level monitoring point
ECS	Enviro Compliance Solutions
e.g.	for example (<i>exempli gratia</i>)
ERRG	Engineering/Remediation Resources Group, Inc.
ESD	Explanation of Significant Differences
ET	evapotranspiration
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FFA	Federal Facility Agreement
FFS	Focused Feasibility Study
FML	flexible membrane layer
FOSL	finding of suitability to lease
FS	Feasibility Study
GAC	granular activated carbon
gpm	gallons per minute
HDPE	high density polyethylene
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
HRA	historical radiological assessment
IAS	Initial Assessment Study
IC	institutional control
ID	identification
IDP	Irvine Desalter Project
IDW	investigation derived waste
i.e.	that is (<i>id est</i>)
I-RACR	Interim Remedial Action Completion Report
IRP	Installation Restoration Program
IRWD	Irvine Ranch Water District
JEG	Jacobs Engineering Group, Inc.
JMM	James M. Montgomery Engineers, Inc.
JP	jet propellant
KCH	CH2M Hill and Kleinfelder Joint Venture
LEL	lower explosive limit
LFG	landfill gas
LIFOC	Lease in Furtherance of Conveyance
LLDPE	linear low-density polyethylene
LTM	long-term monitoring

LUC	land-use control
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
mg/kg-d	milligrams per kilogram day
mg/L	milligrams per liter
MNA	monitored natural attenuation
MOU	memorandum of understanding
MPE	multi-phase extraction
MSC	miscellaneous site of concern
MSCR	miscellaneous refuse
msl	mean sea level
MTBE	methyl tertiary butyl ether
NAVFAC Pacific	Naval Facilities Engineering Command, Pacific
NAVFAC SW	Naval Facilities Engineering Command Southwest
NCP	National Contingency Plan
NFA	no further action
NMOC	non-methane organic compound
NPL	National Priorities List
O&M	Operation and Maintenance
OCGP	Orange County Great Park
OCHCA	Orange County Health Care Agency
OCWD	Orange County Water District
OPS	operating properly and successfully
ORP	oxidation-reduction potential
OU	operable unit
PA	principal aquifer
PAH	polycyclic aromatic hydrocarbon
PCAP	Petroleum Corrective Action Program
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PERF	Project Evaluation Review Form
pH	negative logarithm of hydrogen ion concentration
PLC	Programmable Logic Controller
PM	Project Manager
PMO	Program Management Office
POC	point of compliance
ppbv	parts per billion per volume
ppmv	parts per million by volume
PRG	preliminary remediation goal
PVC	polyvinyl chloride
Ra-226	radium-226
RA	remedial action
RAB	Restoration Advisory Board
RACR	Remedial Action Completion Report

RAO	Remedial Action Objective
RCRA	Resource Conservative and Recovery Act
RD	remedial design
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
RPM	Remedial Project Manager
RSE	removal site evaluation
RSL	regional screening level
RWQCB	Regional Water Quality Control Board
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SCAQMD	South Coast Air Quality Management District
SGU	Shallow Groundwater Unit
Shaw	Shaw Environmental, Inc.
SOCWA	Southern California Water Authority
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
TCA	trichloroethane
TCE	trichloroethylene
TDS	total dissolved solids
TO	Task Order
TPH	total petroleum hydrocarbons
U.S. EPA	United States Environmental Protection Agency
U.S. FWS	United States Fish and Wildlife Service
U.S.	United States
VOC	volatile organic compound
Weston	Weston Solutions, Inc.
WIEA	work in easement area
WP	Work Plan

EXECUTIVE SUMMARY

This Report presents the results of the second five-year review for eight sites located at former Marine Corps Air Station (MCAS) El Toro, California. The eight sites addressed in this Report are Installation Restoration Program (IRP) Sites 2, 3, 5, 16, 17, 18, 24, and Anomaly Area 3 (AA 3). The purpose of the five-year review is to evaluate whether the remedy components that are subject to five-year review are functioning as intended by the respective Records of Decision (RODs) (Department of the Navy [DON] 2000, DON 2002a, DON 2003, DON 2008a, DON 2010a) and remain protective of human health and the environment.

Authority for Conducting Five-Year Reviews

The Navy is the lead agency for conducting five-year reviews at former MCAS El Toro under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Navy has prepared this five-year review pursuant to CERCLA Section (§) 121(c) and the National Contingency Plan (NCP). In addition, the United States Environmental Protection Agency's (U.S. EPA's) Five-Year Review Guidance (U.S. EPA 2001), Navy/Marine Corps policy for conducting CERCLA five-year reviews (DON 2011a), U.S. EPA's Institutional Controls Guidance (U.S. EPA 2011a), Five-Year Summary Form Template (U.S. EPA 2011b), and Protectiveness Determinations Guidance (U.S. EPA 2012) were extensively used in preparation of this five-year review report. In accordance with the Navy/Marine Corps policy for conducting CERCLA five-year reviews, the first site on an installation that triggers the five-year review triggers the five-year review clock for the entire installation. As documented in the IRP Site 16 Remedial Design (RD) (CDM Federal Programs Corporation [CDM] 2006), the beginning of the remedial action construction at IRP Site 16 in September 2004 triggered the first five-year review for former MCAS El Toro. The trigger for this second five-year review is the last five-year review finalized in September 2009.

Status of IRP Sites Addressed in the Five-Year Review Report

A summary of the status of the sites addressed in this Five-Year Review Report is presented in the following table.

Table ES-1: Summary of Current Status of IRP Sites 2, 3, 5, 16, 17, 18, 24, and Anomaly Area 3

Site ID	Summary of Current Status
IRP Sites 2 and 17	The selected remedy for the vadose zone at both IRP Sites 2 and 17 includes landfill capping and institutional controls (ICs). The Final interim ROD (DON 2000) documented no further action (NFA) for IRP Site 17 groundwater. Remedial action construction at IRP Sites 2 and 17 was completed in February 2008 and July 2008, respectively. In June 2009, the Navy signed a Final Explanation of Significant Differences (ESD) (DON 2009a) that documents significant and non-significant changes in certain components of the selected remedies for IRP Sites 2 and 17 presented in the Final Interim ROD. In May 2011, the Navy signed a final ESD (DON 2011b) that documents a significant change to the widths of the buffer zones surrounding the landfills from 1,000 feet to 100 feet, and also documented a non-significant change. The Federal Facility Agreement (FFA) signatories concurred with the Remedial Action Completion Report (RACR) for IRP Sites 2 and 17 (Earth Tech 2009a) and that the remedial action objectives (RAOs) have been attained. The remedial action for groundwater is currently in progress at IRP Site 2. Operation and maintenance (O&M)/long-term monitoring (LTM) activities are currently in progress at both sites.
IRP Sites 3 and 5	The selected remedy for the vadose zone at both IRP Sites 3 and 5 includes landfill capping and ICs. The ROD (DON 2008a) documented NFA for groundwater at these sites. Remedial action construction at IRP Sites 3 and 5 was completed in January 2012 and December 2010, respectively. The FFA signatories concurred with the RACR for IRP Sites 3 and 5 (Shaw Environmental, Inc. [Shaw] 2012) and that the RAOs have been attained. O&M/LTM activities are currently in progress at both sites.

Site ID	Summary of Current Status
Anomaly Area 3	The selected remedy for vadose zone at AA 3 includes landfill capping and ICs. The ROD (DON 2010a) documented NFA for groundwater at the site. Remedial action construction at AA 3 was completed in February 2012. The FFA signatories concurred with the RACR for AA 3 (Engineering/Remediation Resources Group, Inc. [ERRG] 2012) and that the RAOs have been attained. O&M/LTM activities are currently in progress at the site.
IRP Site 16	The selected groundwater remedy for IRP Site 16 includes monitored natural attenuation (MNA) and ICs and monitoring for the vadose zone (soil deeper than 10 feet below ground surface [bgs]). The ROD (DON 2003) documented NFA for shallow soil at the site. The U.S. EPA determined that the current body of data is sufficient to evaluate the attainment of RAOs relating to closure of the deep vadose zone (U.S. EPA 2010). As a result, soil gas sampling was discontinued. Upon regulatory concurrence and finalization of the Draft RACR (Trevet and AECOM 2011), closure of the deep vadose zone at IRP Site 16 will be achieved and maintenance of the positive drainage within the Main Pit Area will no longer be required. The installation of groundwater monitoring wells required for implementation of the selected remedy following ROD (DON 2003) signature commenced in September 2004 (CDM 2006). The Operating Properly and Successfully Report (OPS) evaluation for the remedy was completed in September 2007, was implemented as designed, and was operating properly and successfully in accordance with CERCLA Section 120(h)(3). The FFA signatories concurred with the OPS evaluation. Periodic groundwater monitoring is currently in progress.
IRP Sites 18 and 24	The Final Operable Unit (OU)-2A ROD (DON 2006a) documented NFA for the IRP Site 24 vadose zone based on the protection of human health and the environment. The selected groundwater remedy in the ROD (DON 2002a) at both IRP Sites 18 and 24 includes groundwater extraction and treatment, and ICs. During the RD, the CERCLA remedy was modified and the changes were documented in an ESD signed in June 2006 (DON 2006b). Another ESD to the OU-1 and OU-2A Groundwater ROD was prepared in December 2008 to address vapor sampling at the conclusion of groundwater remediation at the vadose zone source area (DON 2008b). Remedial action construction activities at IRP Sites 18 and 24 were completed and Interim Remedial Action Completion Reports (I-RACRs) were issued in March 2008 (Tetra Tech 2008) and August 2007 (Weston 2007a), respectively. The FFA signatories concurred with the I-RACRs. The Final OPS issued in July 2010 provides documentation to demonstrate that the IRP Site 24 groundwater remedy was implemented as designed and was operating properly and successfully in accordance with CERCLA Section 120(h)(3). O&M/LTM activities are currently in progress at both sites.

Five-Year Review Process

In accordance with the U.S. EPA's Comprehensive Five-Year Review Guidance (U.S. EPA 2001), the five-year review process at each of the eight sites addressed in this report consisted of the following components:

Community notification and involvement: Community members and interested parties were notified that five-year reviews would be conducted for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 in a Restoration Advisory Board (RAB) meeting held on 23 April 2014. A public notice for this RAB meeting including the notification for the five-year review presentation was published in the Los Angeles Times and the Orange County Register. The meeting summary of this RAB meeting were distributed in June 2014 to interested parties on the RAB mailing list. Members of the community were briefed regarding the ongoing five-year review process via a presentation during the RAB meeting held on 23 April 2014. In addition, a Second Five-Year CERCLA Review Update was given at the August 20, 2014 RAB meeting. Public notice of this RAB meeting and notification of the update was published in the Los Angeles Times and the Orange County Register. Following completion of the five-year review, this Five-Year Review Report and a brief summary of this Report will be made available to the stakeholders.

Document review: Numerous site related documents were reviewed for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 as part of the five-year review for these sites. The objective of the document review was to obtain relevant information and data that could be used as the basis for assessment of the performance of the remedies implemented at these sites. The types of documents reviewed included RODs and ESD, remedial investigation/feasibility study (RI/FS) reports, RD/remedial action work

plans, OPS, RACRs and as-built drawings, and documents containing monitoring data and information.

Data review:

IRP Sites 2 and 17: The data reported in semiannual/annual reports for IRP Sites 2 and 17 from November 2008 through December 2013 was reviewed. This data included groundwater, unsaturated zone, and perimeter gas monitoring results, and inspection checklists to evaluate compliance with ICs. O&M/LTM activities are currently in progress for IRP Sites 2 and 17 and data from these activities are reported in semiannual/annual reports.

IRP Sites 3 and 5: The data reported in semiannual/annual reports for IRP Sites 3 and 5 from August 2010 through December 2013 was reviewed. This data included groundwater, unsaturated zone, and perimeter gas monitoring results, and inspection checklists to evaluate compliance with ICs. O&M/LTM activities are currently in progress for IRP Sites 3 and 5 and data from these activities are reported in semiannual/annual reports.

Anomaly Area 3: The data reported in semiannual/annual reports for AA 3 from April 2012 through December 2013 was reviewed. This data included groundwater and perimeter gas monitoring results, and inspection checklists to evaluate compliance with ICs. O&M/LTM activities are currently in progress for AA 3 and data from these activities are reported in semiannual/annual reports.

IRP Site 16: The data reviewed for IRP Site 16 consisted of groundwater MNA data, vadose zone monitoring data, and inspection checklists to evaluate compliance with ICs. The primary source for these data was the Groundwater Monitoring Data Summary Reports and Annual Long-Term Monitoring Reports that generally provided data for the site from January 2009 through December 2013.

IRP Sites 18 and 24: Quarterly groundwater monitoring and system operation data summaries, annual remedy status reports, and a technical memorandum on capture zone evaluation were reviewed to evaluate the remedial progress at IRP Sites 18 and 24. Data collected included system operation data, compliance sampling results, and groundwater monitoring data. This five-year review for IRP Sites 18 and 24 is based on a review of the available data collected as part of system O&M for a period of approximately 5 years, starting from March 2009 to December 2013.

Site Inspections: Site inspections were conducted on 6 March and 13 March 2014 for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 as part of the five-year review to provide information about the status of these sites, and to visually confirm and document the conditions of the remedies, the sites, and the surrounding areas. This inspection was conducted by a team comprising of representatives from the Navy and O&M/Five-Year Review contractors.

Interviews: Interviews were conducted as part of the five-year review with various stakeholders to provide additional information about the status of IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3. The interviewees included representatives from the regulatory agencies, O&M contractors, and RAB members.

Protectiveness Determination: Based on the technical assessments of the remedies at IRP Site 2, 3, 5, 16, 17, 18, 24, and AA 3 protectiveness statements were made for each site. The technical assessments are summarized below.

Technical Assessment Summary

The technical assessment conducted as part of the five-year review process focused on responses to the following three key questions presented in the U.S. EPA's Comprehensive Five-Year Review

Guidance (U.S. EPA 2001). Based on the document/data review, site inspections, and interviews, the Five-Year Review concluded the following for the sites evaluated.

1. Question A: Is the remedy functioning as intended by the decision documents? Yes
2. Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid? Yes
3. Question C: Has any other information come to light that could call into question the protectiveness of the remedy? No

The results of the technical assessments are summarized below.

IRP Sites 2 and 17: Based on the documents reviewed, the site inspection, and interviews, the remedies at IRP Sites 2 and 17 are functioning as intended by the ROD and as modified by the ESDs. The engineering components of the remedies are operating and functioning as designed. Based on the documents reviewed and site inspections, there was no evidence of activities at IRP Sites 2 and 17 that are inconsistent with the land-use restrictions presented in the ROD and the O&M Plan for the sites. The evaluation of applicable or relevant and appropriate requirements (ARARs) documented in the ROD indicated that there were no significant changes to the standards/requirements identified as ARARs in the IRP Sites 2 and 17 ROD that could affect the protectiveness of the remedies at the two sites. Additionally, no newly promulgated standards were identified that could affect the protectiveness of the remedies at IRP Sites 2 and 17.

The exposure pathways assumed in the risk assessment conducted during the Phase II RI have not changed. The remedy for IRP Site 17 and vadose zone of IRP Site 2 has been implemented for waste isolation and containment, and is not intended to meet any site-specific, risk-based cleanup level; therefore, review of toxicity and other contaminant characteristics used to determine the original cleanup level was not required. There is no other information that calls into question the protectiveness of the remedy.

IRP Sites 3 and 5: Based on the documents reviewed, the site inspection, and interviews, the remedies at IRP Sites 3 and 5 are functioning as intended by the ROD. The engineering components of the remedies are operating and functioning as designed. Based on the documents reviewed and site inspections, there was no evidence of activities at IRP Sites 3 and 5 that are inconsistent with the land-use restrictions for the sites. The evaluation of ARARs documented in the ROD indicated that there were no significant changes to the standards/requirements identified as ARARs in the IRP Sites 3 and 5 ROD that could affect the protectiveness of the remedies at the two sites. Additionally, no newly promulgated standards were identified that could affect the protectiveness of the remedies at IRP Sites 3 and 5.

The exposure pathways assumed in the risk assessment have not changed. The remedy for IRP Sites 3 and 5 has been implemented for waste isolation and containment, and is not intended to meet any site-specific, risk-based cleanup level; therefore, review of toxicity and other contaminant characteristics used to determine the original cleanup level was not required. There is no other information that calls into question the protectiveness of the remedy.

Anomaly Area 3: Based on the documents reviewed, the site inspection, and the interviews, the remedy at AA 3 is functioning as intended by the ROD. The engineering components of the remedies are operating and functioning as designed. Based on the documents reviewed and site inspections, there was no evidence of activities at AA 3 that are inconsistent with the land-use restrictions for the site. The evaluation of ARARs documented in the ROD indicated that there were no significant changes to the standards/requirements identified as ARARs in the AA 3 ROD that

could affect the protectiveness of the remedy. Additionally, no newly promulgated standards were identified that could affect the protectiveness of the remedy at AA 3.

The exposure pathways assumed in the risk assessment have not changed. The remedy for AA 3 has been implemented for waste isolation and containment, and is not intended to meet any site-specific, risk-based cleanup level; therefore, review of toxicity and other contaminant characteristics used to determine the original cleanup level was not required. There is no other information that calls into question the protectiveness of the remedy.

IRP Site 16: Based on the documents and data reviewed, site inspections, and the interviews, the remedy at IRP Site 16 is functioning as intended by the ROD and the RD. The major portion of the contaminant mass in the shallow soil was removed during the multi-phase extraction (MPE) pilot test conducted at the site. Soil removal conducted in 2010 under the Petroleum Corrective Action Program (PCAP) further removed contaminant mass in shallow soil. In addition, soil vapor extraction (SVE) implemented as part of the PCAP at miscellaneous site of concern (MSC) B3 removed volatile organic compounds (VOCs) from the deeper soil including trichloroethylene (TCE) associated with IRP Site 16. The Draft 2013 IRP Site 16 Annual Report (Trevet 2014) stated that the known distribution of TCE continues to be updated as the monitoring well network is optimized. The TCE distribution shows the plume extending more to the north and west than was previously documented. Therefore, monitoring and continued optimization of the monitoring well network along the western boundary of the area requiring institutional control [ARIC] is underway.

MNA and ICs are adequate to demonstrate protectiveness and effectiveness of the final remedy and continue to mitigate human health risks associated with the impacted groundwater. The review of documents and site-inspections indicate that no activities have been conducted at the site that are inconsistent with land-use restrictions documented in the RD (CDM 2006).

Based on the evaluation of ARARs documented in the ROD, it was concluded that there were no significant changes to the standards/requirements identified as ARARs in the IRP Site 16 ROD that could affect the protectiveness of the remedy at the site. Additionally, no newly promulgated standards were identified that could affect the protectiveness of the remedy at IRP Site 16.

The exposure pathways assumed in the risk assessment conducted for IRP Site 16 have not changed. The toxicity value for TCE has changed since the risk assessment was completed for IRP Site 16. However, the remediation goal for TCE for IRP Site 16 groundwater has been set at its maximum contaminant level (MCL); therefore, no change to the remediation goal is required due to the change in toxicity values. The toxicity value for TCE has changed from those used in the vapor intrusion risk assessment completed for IRP Site 16 in 2004 (Bechtel National, Inc. [BNI] 2004). This comparison indicates that although the toxicity value for TCE has changed, the magnitude of the effect on the vapor intrusion risk estimate is not significant enough to alter the overall conclusions of the 2004 Vapor Intrusion Risk Assessment Report (BNI 2004). The use of the latest toxicity criteria for TCE will result in a decrease in the cancer risk value and an increase in the hazard quotient (HQ) estimated in 2004; however, the HQ will still remain below 1. There is no other information that calls into question the protectiveness of the remedy at IRP Site 16.

IRP Sites 18 and 24: Based on the documents and data reviewed, site inspections, and the interviews, the remedies implemented at IRP Sites 18 and 24 are functioning as intended by the ROD as modified by the ESDs. Based on the performance data collected since remedy initiation, the extraction well-field is performing as designed. A comparison of the extent of TCE plumes between April 2008 and March 2013 shows attenuation of TCE contaminant in both the principal aquifer (PA) and the Shallow Groundwater Unit (SGU). For the PA, migration of the plume was minimal, and the plume as a whole experienced a reduction of VOCs. Within the SGU, TCE concentrations

decreased across the plume, and the lateral width of concentrations exceeding 50 micrograms per liter ($\mu\text{g/L}$) decreased. The plume itself did not migrate beyond the SGU extraction system, indicating remedy effectiveness (CH2M Hill Kleinfelder, A Joint Venture [KCH] 2014). Based on 2013 sampling data for the SGU, the hot spot (TCE concentrations exceeding 500 $\mu\text{g/L}$) removal appears to have been accomplished after seven years of operation. Review of the documents and site-inspections indicates that no activities have been conducted in the areas overlying IRP Sites 18 and 24 that are inconsistent with the land-use restrictions.

Based on the evaluation of ARARs documented in the ROD, it was concluded that there were no significant changes to the standards/requirements identified as ARARs in the IRP Sites 18 and 24 ROD that could affect the protectiveness of the remedies. Additionally, no newly promulgated standards were identified that could affect the protectiveness of the remedies at IRP Sites 18 and 24.

The exposure pathways assumed in the risk assessments conducted for groundwater at IRP Sites 18 and 24 have not changed. The toxicity values have changed for multiple chemicals of potential concern (COPCs) since the risk assessment was completed for IRP Sites 18 and 24. However, the remediation goals for chemicals of concern (COCs) for IRP Sites 18 and 24 groundwater have been set at MCLs; therefore, no changes to these goals are required due to changes in the toxicity values. The VOCs in groundwater at IRP Site 18 are not expected to pose a threat to human health via the vapor intrusion pathway. Low concentrations of VOCs in the principle aquifer at IRP Site 18 occur at depths of approximately 200 feet below ground surface. Therefore, the pathway for exposure to vapor intrusion is incomplete for IRP Site 18. Toxicity values for multiple COPCs have changed from those used in the vapor intrusion risk assessment completed for IRP Site 24 in 2004 (BNI 2004). Based on an analysis of toxicity criteria, the magnitude of changes to vapor intrusion risk estimates based on revisions to toxicity criteria would not be enough to alter the overall conclusions of the 2004 Vapor Intrusion Risk Assessment Report (BNI 2004). The use of the latest toxicity criteria for the primary COC (TCE) will result in a decrease in the cancer risk value and an increase in the HQ estimated in 2004; however, the HQ will still remain below 1. There is no other information that calls into question the protectiveness of the remedies at IRP Sites 18 and 24.

Protectiveness Statements

Based on the technical assessments summarized above, the remedies at IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 are protective of human health and the environment.

Issues, Recommendations and Follow-up Actions

No issues were identified for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 that currently or in the future would prevent the respective remedies at these sites from being protective of human health and/or the environment. Therefore, no recommendations or follow-up actions are required to ensure protectiveness of the remedies. However, consistent with U.S. EPA Guidance (U.S. EPA 2001), recommendations are made that do not directly relate to achieving or maintaining the protectiveness of the remedies, but pertain to activities such as O&M of the remedies and coordination with other agencies.

**Second Five-Year Review Summary Form
Former Marine Corps Air Station El Toro, California**

SITE IDENTIFICATION

Site Name: El Toro Marine Corps Air Station

EPA ID: CA6170023208

Region: 9

State: CA

City/County: Irvine/Orange

SITE STATUS

NPL Status: Final

Multiple OUs?

Yes

Has the site achieved construction completion?

No

REVIEW STATUS

Lead agency: Other Federal Agency

If "Other Federal Agency" was selected above, enter Agency name: Department of the Navy

Author name (Federal or State Project Manager): Department of the Navy, Base Realignment and Closure Program Management Office West

Author affiliation: Department of the Navy

Review period: September 2009 – December 2013

Date of site inspection: 6 and 13 March 2014

Type of review: Statutory

Review number: 2

Triggering action date: September 2009 (Last five-year review)

Due date (five years after triggering action date): September 2014

Five-Year Review Summary Form (continued)

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:

Since no issues have been identified for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 that currently prevent the remedies at these sites from being protective, or may do so in future, no recommendations or follow-up actions are required to ensure protectiveness of the remedies. However, consistent with the U.S. EPA Guidance (U.S. EPA 2001), recommendations have been made that pertain to activities such as operation and maintenance (O&M) of the remedies and coordination with other agencies.

Issues and Recommendations Identified in the Five-Year Review:

OU(s): IRP Sites 2 and 17	Issue Category: No Issue			
	Issue:			
	Recommendation: Continue to evaluate monitoring and other O&M data, and make specific recommendations to further optimize monitoring per the Final O&M Plan (Earth Tech 2009b). Contact information on signs needs to be updated.			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	No	Federal Facility	Federal Facility	2014-2019

OU(s): IRP Sites 3 and 5	Issue Category: No Issue			
	Issue:			
	Recommendation: Continue to evaluate monitoring and other O&M data, and make specific recommendations to further optimize monitoring per the Final O&M Plan (Shaw 2010).			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	No	Federal Facility	Federal Facility	2014-2019

OU(s): Anomaly Area 3	Issue Category: No Issue			
	Issue:			
	Recommendation: Continue to evaluate monitoring and other O&M data, and make specific recommendations to further optimize monitoring per the Final O&M Plan (ERRG 2011a). Place a protective cap on the settlement monuments which were observed during the site inspection without protective caps.			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	No	Federal Facility	Federal Facility	2014-2019

OU(s): IRP Site 16	Issue Category: No Issue			
	Issue:			
	Recommendation: <ul style="list-style-type: none"> • Based on the updated TCE distribution and as a result of declining groundwater levels, a comprehensive optimization of the groundwater monitoring network is recommended. • Land-use control (LUC) implementation should continue as it is currently performed. 			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	No	Federal Facility	Federal Facility	2014-2019

OU(s): IRP Sites 18 and 24	Issue Category: No Issue			
	Issue:			
	Recommendation: <ul style="list-style-type: none"> • Continue to evaluate monitoring and other O&M data, and make specific recommendations to further optimize the groundwater extraction and treatment systems pursuant to the Performance Monitoring and Sampling and Analysis Plan (Earth Tech 2007). • Complete and finalize ongoing groundwater flow and transport modeling to evaluate the effects of current pumping rates from the Irvine Desalter Project (IDP) wells on the TCE plume in the principal aquifer (PA). Use the results of modeling as a basis for a new Explanation of Significant Differences (ESD) to revise the flow rates for the IDP wells presented in the 2006 ESD (DON 2006b). • Update numerical flow and transport models for the Shallow Groundwater Unit (SGU) and PA, and recalibrate to better match the site conditions and data collected as part of remedy implementation. Use this recalibrated model to evaluate remedy effectiveness and optimization. 			

Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	No	Federal Facility	Federal Facility	2014-2019

Five-Year Review Summary Form (continued)**Protectiveness Statement(s) – Operable Unit 2B Sites**

<i>Operable Unit:</i> IRP Sites 2 and 17	<i>Protectiveness Determination:</i> Protective	<i>Addendum Due Date (if applicable):</i> Click here to enter date.
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Protectiveness Statement:
The remedy at IRP Sites 2 and 17 is protective of human health and the environment.

Protectiveness Statement(s) – Operable Unit 2C Sites

<i>Operable Unit:</i> IRP Sites 3 and 5	<i>Protectiveness Determination:</i> Protective	<i>Addendum Due Date (if applicable):</i> Click here to enter date.
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Protectiveness Statement:
The remedy at IRP Sites 3 and 5 is protective of human health and the environment.

<i>Operable Unit:</i> Anomaly Area 3	<i>Protectiveness Determination:</i> Protective	<i>Addendum Due Date (if applicable):</i> Click here to enter date.
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Protectiveness Statement:
The remedy at AA 3 is protective of human health and the environment.

Protectiveness Statement(s) – Operable Unit 3B Site

<i>Operable Unit:</i> IRP Site 16	<i>Protectiveness Determination:</i> Protective	<i>Addendum Due Date (if applicable):</i> Click here to enter date.
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Protectiveness Statement:
The remedy at IRP Site 16 is protective of human health and the environment.

Protectiveness Statement(s) – Operable Unit 1 and 2A Sites

<i>Operable Unit:</i> IRP Sites 18 and 24	<i>Protectiveness Determination:</i> Protective	<i>Addendum Due Date (if applicable):</i> Click here to enter date.
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Protectiveness Statement:
The remedy at IRP Sites 18 and 24 is protective of human health and the environment.

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1. Introduction

This Report presents the results of the second five-year review for eight sites located at former Marine Corps Air Station (MCAS) El Toro (also referred to as the Base and Station), California. The eight sites addressed in this Report are Installation Restoration Program (IRP) Sites 2, 3, 5, 16, 17, 18, 24, and Anomaly Area 3 (AA 3). The purpose of the five-year review is to evaluate whether the remedy components that are subject to five-year reviews are functioning as intended by the respective Records of Decision (RODs) (Department of the Navy [DON] 2000, DON 2002a, DON 2003, DON 2008a, DON 2010a) and remain protective of human health and the environment. The methods, findings, and conclusions of the reviews conducted are documented in this Five-Year Review Report.

The data analysis in support of the five-year review and this Report were prepared by AECOM-Envirocon Joint Venture (AEJV) on behalf of the Navy Base Realignment and Closure (BRAC), Program Management Office (PMO) West and the Naval Facilities Engineering Command Southwest (NAVFAC SW). This work was authorized by the NAVFAC SW under Task Order (TO) 0002 of the Performance Based Environmental Multiple Award Contracts, contract number N62473-11-D-2231.

1.1 BACKGROUND

Former MCAS El Toro was commissioned in 1943 as a Marine Corps pilot fleet operation training facility, and closed in July 1999 as a part of the BRAC Act. The first indication of contamination at the Base was discovered during routine water quality monitoring in 1985, when the Orange County Water District (OCWD) found trichloroethylene (TCE) in groundwater samples from an irrigation well located approximately 3,000 feet downgradient of former MCAS El Toro. In June 1988, the United States Environmental Protection Agency (U.S. EPA) recommended adding MCAS El Toro to the National Priorities List (NPL) of the Superfund/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Program due to volatile organic compound (VOC) groundwater contamination at the Base boundary and in agricultural wells west of the Base. Former MCAS El Toro was added to the NPL on 15 February 1990. In October 1990, the Marine Corps/Navy signed a Federal Facility Agreement (FFA) with the U.S. EPA Region 9, the State of California Department of Health Services (DHS) (now referred to as California EPA/Department of Toxic Substances Control [DTSC]), and the California Regional Water Quality Control Board, Santa Ana Region (RWQCB) (FFA 1990). The FFA is a cooperative agreement that:

- Assures environmental impacts are investigated and appropriate response actions are taken to protect human health and the environment;
- Establishes a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions;
- Facilitates cooperation, exchange of information, and participation of the parties; and
- Assures adequate assessment, prompt notification, and coordination between Federal and State agencies.

The implementation of the FFA is included as one of the responsibilities of the BRAC Cleanup Team (BCT). The BCT consists of representatives from the Navy BRAC PMO West, U.S. EPA, DTSC, and the RWQCB. The team was established to manage and coordinate environmental restoration and compliance programs related to the closure of former MCAS El Toro.

Environmental response action activities pursuant to CERCLA are being performed at several sites within former MCAS El Toro under the IRP. The purpose of the Navy IRP is to reduce the risk to human health and the environment from past waste disposal operations and hazardous material spills from Navy activities in a cost-effective manner consistent with the Defense Environmental Restoration Program requirements (DON 2001a).

Twenty-five IRP Sites have been investigated at former MCAS El Toro. Twenty-four of these sites are grouped into three operable units (OUs). IRP Site 23 was evaluated in a Resource Conservation and Recovery Act (RCRA) Facility Assessment under the FFA and, as a result, was eliminated as an environmental concern under the IRP.

This five-year review addresses IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3, which are discussed throughout this report. A brief synopsis of the IRP status of sites within former MCAS El Toro that are not addressed in this Five-Year Review Report is presented in Table 1-1.

Table 1-1: IRP Status for Sites within former MCAS El Toro Not Addressed in this Five-Year Review Report

Operable Unit	Site ID	Site Description	Summary of Remedial Activities and Status of Remedial Measures
OU-2A	IRP Site 25	Major Drainages	<p>IRP Site 25 included major drainages within former MCAS El Toro. After the Phase II remedial investigation (RI) showed that IRP Site 25 was not a source of regional groundwater contamination, the site was recommended for "no action" and included with several OU-3 sites in a no-action ROD that was signed in September 1997 (DON 1997a).</p> <p>Five-year review is not required for IRP Site 25 since no action was selected in the ROD for this site, and hazardous substances, pollutants, or contaminants do not remain on the site above levels that allow for unlimited use and unrestricted exposure.</p>
OU-2B	IRP Site 2 (groundwater)	Magazine Road Landfill	<p>A ROD selecting the remedy for IRP Sites 1 and 2 (groundwater) was finalized in January 2012 (DON 2012), and the Remedial Design (RD)/Remedial Action Work Plan was finalized in January 2014 (AEJV 2014). The remedial action construction for these sites began in March 2014.</p> <p>Five-year review is not required for IRP Site 2 since remedial action construction phase is currently in progress. This remedial action construction phase is expected to be completed in 2014. An evaluation of the performance of this remedy will be performed during the next five-year review.</p>
OU-3A	IRP Site 4	Ferrocene Spill Area	<p>Based on results of RIs and Feasibility Studies (FSs), IRP Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, and 22 were found to present no unacceptable risks to human health or the environment, and recommended for no action. These sites were addressed along with IRP Site 25 in the final no action ROD (DON 1997a).</p> <p>Five-year review is not required for IRP Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, and 22 since no action was selected in the ROD for all of these sites, and hazardous substances, pollutants, or contaminants do not remain on the sites above levels that allow for unlimited use and unrestricted exposure.</p>
	IRP Site 6	Drop Tank Drainage Area No. 1	
	IRP Site 9	Crash Crew Pit No. 1	
	IRP Site 10	Petroleum Disposal Area	
	IRP Site 13	Oil Change Area	
	IRP Site 15	Suspended Fuel Tanks	
	IRP 20	Hobby Shop (OU-3)	
	IRP Site 21	Materials Management Group, Building 320	
	IRP Site 22	Tactical Air Fuel Dispensing System	

Operable Unit	Site ID	Site Description	Summary of Remedial Activities and Status of Remedial Measures
OU-3A (contd.)	IRP Site 11	Transformer Storage Area (OU-3)	For IRP Site 11, the final response action was documented in a ROD signed in September 1999. The ROD selected soil excavation and disposal as the remedial action for Units 1 and 2 and no further action (NFA) for Unit 3 (DON 1999). The remedial action at IRP Site 11 was completed in 2005 and the Final Remedial Action Report was issued in September 2006 (Accord and Earth Tech 2006). The Final Remedial Action Report documented that no additional response actions are needed to protect human health and the environment at IRP Site 11, and the site can be released for unrestricted reuse. Five-year review is not required for IRP Site 11 since the site was released for unlimited use and unrestricted exposure.
	IRP Site 8	Defense Reutilization and Marketing Office (DRMO) Storage Yard (OU-3)	IRP Sites 8 and 12 were addressed in a ROD signed in March 2007 (DON 2007a). This ROD presented the selected remedy for non-radiological constituents of concern for IRP Site 12, and radiological and non-radiological constituents of concern for IRP Site 8. The remedial action construction for these sites began in January 2009, and the Final Remedial Action Completion Report was issued in April 2012 (AECOM 2012a), which has been concurred upon by the regulatory agencies. The Final Remedial Action Report documented that the RAOs have been attained and no additional response actions are needed to protect human health and the environment at IRP Sites 8 and 12, and the sites can be released for unrestricted reuse. Five-year review is not required for IRP Sites 8 and 12 since the sites were released for unlimited use and unrestricted exposure.
	IRP Site 12	Sludge Drying Beds (OU-3)	
	IRP 19	Aircraft Expeditionary Refueling Site (OU-3)	IRP Site 19 consisted of 4 units. Unit 1 was closed by the RWQCB, Santa Ana Region on 14 May 1997. Unit 4 was addressed as part of the underground storage tank program. The underground storage tanks associated with Unit 4 were closed in September 2003 and September 2004. The ROD documenting NFA for Units 2 and 3 was signed in September 1997 (DON 1997a). Five-year review is not required for IRP Site 19 since the ROD documented NFA for Units 2 and 3 and CERCLA hazardous substances, pollutants, or contaminants do not remain on the site above levels that allow for unlimited use and unrestricted exposure.
OU-3B	IRP Site 1	Soil - Explosive Ordnance Disposal Training Range	IRP Site 1 is currently in the RI/FS stage of the CERCLA process. The Phase II RI (Earth Tech 2006a) was completed in January 2006 and a Revised Draft FS report was issued in September 2012 (AECOM 2012b).
		Groundwater	A ROD selecting the remedy for the IRP Sites 1 and 2 (groundwater) was finalized in January 2012 (DON 2012), and the RD/Remedial Action Work Plan was finalized in January 2014 (AEJV 2014). The remedial action construction for these sites began in March 2014. Five-year review is not required for IRP Site 1 since remedial action construction phase is in progress. This remedial action construction phase is expected to be completed in 2014. An evaluation of the performance of this remedy will be performed during the next five-year review.
	IRP Site 7	Drop Tank Drainage Area No. 2 (OU-3)	IRP Sites 7 and 14 were addressed in a no action ROD that was signed in June 2001 (DON 2001b).
	IRP Site 14	Battery Acid Disposal Area (OU-3)	Five-year review is not required for IRP Sites 7 and 14 since no action was selected in the ROD for the sites and hazardous substances, pollutants, or contaminants do not remain on the sites above levels that allow for unlimited use and unrestricted exposure.

1.2 FIVE-YEAR REVIEW AUTHORITY AND GENERAL APPROACH

The Navy has prepared this five-year review pursuant to CERCLA Section (§) 121(c) and the National Contingency Plan (NCP). In addition, U.S. EPA's Five Year Review Guidance (U.S. EPA 2001), Navy/Marine Corps policy for conducting CERCLA five-year reviews (DON 2011a), U.S. EPA's Institutional Controls Guidance (U.S. EPA 2011a) (Supplement to the Comprehensive Five-Year Review Guidance), Five-Year Summary Form Template (U.S. EPA 2011b), and Protectiveness Determinations Guidance (U.S. EPA 2012) were extensively used in preparation of this Five-Year Review Report.

CERCLA §121 states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

In addition, the NCP, Title 40 of the Code of Federal Regulations (CFR) §300.430(f)(4)(ii) states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

Pursuant to CERCLA § 121(c) and the NCP, this five-year review has been conducted at former MCAS El Toro to evaluate if the remedies at IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 are or will be protective of human health and the environment. In accordance with the Navy/Marine Corps policy for conducting CERCLA five-year reviews (DON 2011a), the first site on an installation that triggers the five-year review triggers the five-year review clock for the entire installation. As documented in the IRP Site 16 RD (CDM Federal Programs Corporation [CDM] 2006), the beginning of the remedial action construction at IRP Site 16 in September 2004 triggered the first five-year review for former MCAS El Toro. In order to streamline and synchronize the five-year reviews, other sites including IRP Sites 2, 3, 5, 17, 18, 24, and AA 3 were evaluated since the response actions at these sites have either been completed or cleanup is ongoing. This approach is consistent with § 27.3 of the FFA and the U.S. EPA's Five Year Review Guidance (U.S. EPA 2001).

2. Site Description and Background

2.1 IRP SITES 2 AND 17

2.1.1 Physical Characteristics

Former MCAS El Toro is located in south central Orange County, California, approximately 8 miles southeast of the city of Santa Ana and 12 miles northeast of Laguna Beach (Figure 2-1). IRP Site 2, Magazine Road Landfill, is located in the eastern portion of former MCAS El Toro (Figure 2-2) within OU-2B. Solid waste generated at former MCAS El Toro and some solid waste from former MCAS Tustin was disposed at IRP Site 2 from the late 1950s until about 1980. IRP Site 2 consisted of the Magazine Road Landfill, which contained surficial waste from unauthorized dumping (Figure 2-3).

IRP Site 17, Communication Station Landfill, is located in the eastern portion of former MCAS El Toro (Figure 2-2). IRP Site 17 consisted of the Communication Station Landfill and Areas B and C, which contained surface accumulation of construction debris from former Marine Corps activities (Figure 2-3). The IRP Site 17 landfill served as a disposal facility for Basewide activities from 1981 to 1983. However, aerial photographs (APHOs) indicate landfilling possibly began in 1970 and continued through 1986.

2.1.2 Land and Resource Use

Historically, land-use surrounding former MCAS El Toro has been largely agricultural. However, the land to the south, southeast, and southwest has been developed over the past 10 years for commercial, light-industrial, and residential uses. Currently, expanding commercial areas are located adjacent to the southerly portion of the former Station. Additional residential areas are located to the northwest and west of the former Station. Adjacent land to the northeast and northwest is used for agriculture.

2.1.3 Site History

2.1.3.1 IRP SITE 2

The suspected types of wastes disposed into IRP Site 2 landfill during its operation included construction debris, municipal-type waste from Base operations, batteries, waste oils, hydraulic fluids, paint residues, transformers, and waste solvents. It is also possible that equipment painted with radium paint, or other low-level radiological materials consistent with former Base operations, may have been inadvertently disposed into the IRP Site 2 landfill.

Based on the Phase I RI (Jacobs Engineering Group, Inc. [JEG] 1993) and Phase II RI (Bechtel National, Inc. [BNI] 1996a) investigations, waste was placed in Areas A and B during the operational life of IRP Site 2 landfill (Figure 2-3).

2.1.3.2 IRP SITE 17

IRP Site 17 landfill was actively used from 1981 to 1983 as a Stationwide disposal facility. APHOs indicate that landfilling activities were underway as early as 1970 and continued through 1986. Suspected waste types disposed at the site included domestic waste rubble, cooking grease, oils and fuels from sumps, and empty drums. It is also possible that equipment painted with radium paint, or other low-level radiological materials consistent with Base operations, may have been inadvertently disposed into the IRP Site 17 landfill. Based on the Phase I RI (JEG 1993) and Phase II RI (BNI 1996b) investigations, waste was placed in the main landfill area of IRP Site 17.

Table 2-1 lists important events for former MCAS El Toro that are common to IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3. The list of important events unique to IRP Sites 2 and 17 is presented in Table 2-2.

Table 2-1: Chronology of Site Events – Former MCAS El Toro

Event	Date
Initial Assessment Study (IAS) (Brown and Caldwell 1986) completed. — IAS identified 17 sites within former MCAS El Toro as potential sources of contamination.	1985
Site Inspection Plan of Action (James M. Montgomery Engineers, Inc. [JMM] 1988) issued. — This plan recommended 19 sites for investigation.	August 1988
Former MCAS El Toro added to the NPL.	February 1990
FFA (U.S. EPA, California, DON 1990) signed by the Marine Corps/Navy with the U.S. EPA Region 9, the California DHS (part of which is currently the DTSC), and the RWQCB. — The FFA is a cooperative agreement that assures that environmental impacts at former MCAS El Toro are investigated and appropriate response actions are taken to protect human health and the environment. The FFA also provides procedural framework and schedule for developing, implementing, and monitoring appropriate response actions.	October 1990
Formation of BCT.	October 1990
Former MCAS El Toro placed on BRAC III list.	March 1993
Former MCAS El Toro closed under BRAC Act.	July 1999

Table 2-2: Chronology of Site Events – OU-2B, IRP Site 2 Vadose Zone and IRP Site 17

Event	Date
Approximate duration of operation of IRP Site 2 landfill.	Late 1950s to about 1980
Approximate duration of operation of IRP Site 17 landfill.	1970 to about 1986
Phase I RI Draft Technical Memorandum (JEG 1993) issued. — IRP Sites 2 and 17 were discovered and added to the IRP as part of Phase I RI process.	May 1993
Phase II RI (Bechtel National, Inc. (BNI) 1996a) completed for IRP Site 2. — Phase II RI established the nature and extent of contamination at IRP Site 2 and presented the results for human health and ecological risk assessments.	March 1996
Phase II RI (BNI 1996b) completed for IRP Site 17. — Phase II RI established the nature and extent of contamination at IRP Site 17 and presented the results for human health and ecological risk assessments.	September 1996
FS (BNI 1997a) completed for IRP Site 2. — FS evaluated the alternatives for remediation of IRP Site 2 and addressed risks to human health and the environment at the site.	March 1997
FS (BNI 1997b) completed for IRP Site 17. — FS evaluated the alternatives for remediation of IRP Site 17 and addressed risks to human health and the environment at the site.	February 1997
Final Proposed Plan (DON 1998) issued for IRP Sites 2 and 17. — The Proposed Plan presented the Navy's preferred alternative (single layer soil cap with institutional controls [ICs] and monitoring) for remediation of IRP Sites 2 and 17.	May 1998
Final Interim ROD (DON 2000) signed by the Navy and regulatory agencies. — The Final Interim ROD documented the selected remedy (single layer soil cap with ICs and monitoring) for IRP Site 17 and the vadose zone of IRP Site 2. The ROD also documented that the selected remedy for VOC-impacted groundwater at IRP Site 2 will be presented in a separate ROD.	July 2000
Radiological investigations conducted for groundwater at IRP Sites 2 and 17	December 2001

Event	Date
<ul style="list-style-type: none"> — The groundwater evaluations concluded that the landfills are not adversely impacting the groundwater by releasing radionuclides, and radiological constituents are not considered chemicals of potential concern (COPCs) for groundwater at IRP Sites 2 and 17 (Earth Tech 2000; Earth Tech 2001a). 	
<p>Supplemental/Pre-design investigations completed at IRP Sites 2 and 17.</p> <ul style="list-style-type: none"> — Supplemented investigations were conducted to further refine the lateral extent of landfill boundaries at IRP Sites 2 and 17. 	June 2002
<p>Biological Opinion (BO) and BO Amendment issued by United States Fish and Wildlife Service (United States Fish and Wildlife Service [U.S. FWS] 2002, 2004) for IRP Sites 2 and 17.</p> <ul style="list-style-type: none"> — The focus of BO was twofold: (1) protection of the coastal California gnatcatcher (<i>Poliopitila californica</i>), a Federally threatened species, and (2) replacement and protection of the coastal sage scrub (CSS) critical habitat throughout IRP Sites 2 and 17 associated with the gnatcatcher. 	December 2002, September 2004
RD Work Plan (Earth Tech 2005) finalized for IRP Site 17 remedy and vadose zone remedy at IRP Site 2.	November 2005
Remedial Action Work Plan (Engineering/Remediation Resources Group, Inc. [ERRG] 2005; ERRG 2008) finalized for IRP Site 17 remedy and vadose zone remedy at IRP Site 2.	December 2005
Remedial action initiated at IRP Site 2.	September 2005
<p>Radiological investigations conducted for soil at IRP Sites 2 and 17</p> <ul style="list-style-type: none"> — The investigations pertaining to soil at IRP Sites 2 and 17 concluded that the selected remedy of landfill capping documented in the ROD (DON 2000) would protect human health from unacceptable exposure to Radium-226 (Ra-226) (Earth Tech 2006b). 	May 2006
Remedial action initiated at IRP Site 17.	November 2007
Remedial action construction complete at IRP Site 2.	February 2008
Remedial action construction complete at IRP Site 17.	July 2008
<p>Remediation Verification Report finalized for IRP Site 2 (ERRG 2009a)</p> <ul style="list-style-type: none"> — The Remediation Verification Report contains construction-related documentation such as as-built drawings, survey maps, and certification reports for IRP Site 2. 	February 2009
<p>Remediation Verification Report finalized for IRP Site 17 (ERRG 2009b)</p> <ul style="list-style-type: none"> — The Remediation Verification Report contains construction-related documentation such as as-built drawings, survey maps, and certification reports for IRP Site 17. 	February 2009
<p>Remedial Action Completion Report [RACR] (Earth Tech 2009a) finalized for IRP Sites 2 and 17.</p> <ul style="list-style-type: none"> — The RACR documented that construction activities are complete for IRP Site 2 vadose zone remedy and IRP Site 17 remedy. The RACR also documented that landfill remedies at both sites achieve the remedial action objectives (RAOs) presented in the ROD. 	March 2009
<p>Operation and Maintenance (O&M) Plan (Earth Tech 2009b) finalized for IRP Sites 2 and 17.</p> <ul style="list-style-type: none"> — The O&M Plan presents the methods and procedures for LTM and maintenance of IRP Sites 2 and 17 landfill remedies. 	March 2009
<p>Explanation of Significant Differences (ESD) (DON 2009a) finalized.</p> <ul style="list-style-type: none"> — The ESD documented that the Final Interim ROD (DON 2000) will serve as final ROD for IRP Site 17 and vadose zone of IRP Site 2. The ESD also documented significant and non-significant changes to certain components of the selected remedies for IRP Sites 2 and 17 presented in the Final Interim ROD. 	June 2009
<p>First Five-Year Review Report (DON 2009b)</p> <ul style="list-style-type: none"> — This report presented the first five-year review for Sites 2, 16, 17, 18, and 24. Protectiveness of remedial actions was evaluated and found to remain protective. Recommendations made for each site did not directly relate to achieving or maintaining the protectiveness of the remedies, but pertained to O&M of the remedies and coordination with other agencies. 	September 2009
<p>Annual LTM Reports prepared for IRP Sites 2 and 17 from November 2008 through December 2012 (AECOM 2010, 2011; CE2 Kleinfelder Joint Venture [CE2K] 2013 a, b)</p> <ul style="list-style-type: none"> — These annual reports documented and evaluated data collected at IRP Sites 2 and 17 from November 2008 through December 2012. 	December 2010, October 2011, November 2013, December 2013
<p>ESD (DON 2011b) finalized.</p> <ul style="list-style-type: none"> — The ESD documented that the buffer zone around each of the landfills should be reduced 	May 2011

Event	Date
from 1,000 feet to 100 feet and clarified that land disturbance prohibitions also apply to soil stockpiled for future landfill repairs.	
Final Work Plan Addendum No. 1 (CE2K 2011) — The Final Work Plan Addendum No.1 documented that the upgradient monitoring wells will be sampled every 5 years to evaluate the potential presence of constituents migrating from upgradient sources.	May 2011
Final Addendum 2 to the Final Operation and Maintenance Plan Sampling and Analysis Plan (SAP) IRP Sites 2 and 17 (CE2K 2012)	March 2012

2.1.4 Initial Response

The Navy conducted time-critical removal actions to mitigate potential exposure to landfill debris and waste as a result of ongoing erosion. These removal actions were undertaken at IRP Sites 2 and 17 from 1996 to 1997 (NAVFAC SW 1996). Actions included fencing the sites, removing drums and other debris from the surface of the landfill, and constructing drainage features to reduce the erosion that had been occurring at both sites.

2.1.5 Basis for Taking Action

IRP Sites 2 and 17 were historically used as landfills for waste disposal. Phases I and II RIs (BNI 1996a and 1996b), and supplemental investigations delineated the landfill boundaries and identified several COPCs at IRP Sites 2 and 17. The human health and ecological risk assessments estimated the risks/hazards at these two sites if no actions were taken. The U.S. EPA's presumptive remedy approach for landfills provided the basis for vadose zone remedial actions at IRP Sites 2 and 17, which included landfill capping and ICs so as to minimize contact with the waste, minimize infiltration and potential contaminant leaching to groundwater, and to control landfill gas migration. The interim ROD (DON 2000) documented NFA for IRP Site 17 groundwater. The remedial action construction for groundwater is currently in progress at IRP Site 2.

2.2 IRP SITES 3 AND 5

2.2.1 Physical Characteristics

IRP Site 3, Original Landfill, is located in the eastern portion of former MCAS El Toro (Figure 2-4) within OU-2C. It is the former original MCAS El Toro landfill, which operated as a cut-and-fill disposal facility and received wastes from 1943 until 1955. IRP Site 3 was divided into four units; Unit 1 was the principal area of the landfill operations and was located to the east and west of Agua Chinon Wash. A review of APHOs showed that Unit 1 contained one main waste area (Waste Area A) and several smaller, outlying waste areas (Waste Areas B through F). Unit 4 is the site of the former incinerator. Units 2 and 3 were not part of the operational landfill, but were included in the IRP Site 3 study area boundary. Unit 2 consists of an unlined channel (Agua Chinon Wash). This unit crosses Unit 1 and does not contain landfill wastes. Unit 2 was included in the study area because erosion in this unit could impact the integrity of landfill wastes in Unit 1. Unit 3 is not a part of the operational landfill and does not contain landfill wastes.

IRP Site 5, Perimeter Road Landfill, is located on the Tustin Plain near the foothills of the Santa Ana Mountains, approximately 300 feet northwest of the Borrego Canyon Wash (Figure 2-4) within OU-2C. It was operated as a cut-and-fill disposal facility that received waste from approximately 1955 to the late 1960s. Wastes were typically burned in place to reduce volume prior to burial; there are no available records indicating the types and quantities of wastes that were burned. Reportedly, almost any waste generated at former MCAS El Toro may have been disposed at IRP Site 5, including burnable trash, municipal solid waste, cleaning fluids, scrap metals, paint residues, and unspecified fuels, oils, and solvents.

2.2.2 Land and Resource Use

Based on the land use map for the Orange County Great Park (OCGP) Plan, IRP Site 3 is located in an area designated as a riparian corridor, and IRP Site 5 is located in an area designated as open space/golf course.

2.2.3 Site History

During the RIs (JEG 1993 and BNI 1997c and 1997d), shallow and subsurface soil, landfill gas (LFG), air, and groundwater sampling was conducted for the assessment of the nature and extent of non-radiological COPCs. Supplemental investigations were performed in preparation of the ROD using trench excavations to better delineate the extent of waste at IRP Sites 3 and 5 landfill sites. The Final ROD documented the Navy's and EPA's co-selection of no further remedial action for groundwater at IRP Sites 3 and 5 and further action for soil at IRP Site 3, Units 1 and 4, and IRP Site 5.

2.2.3.1 IRP SITE 3

The suspected types of wastes disposed into IRP Site 3 landfill during its operation included metals, incinerator ash, solvents, paint residues, hydraulic fluids, engine coolants, construction debris, oil wastes, municipal soil waste, and various inert solid waste. It is also possible that equipment painted with radium paint, or other low-level radiological materials consistent with former Base operations, may have been inadvertently disposed into the IRP Site 3 landfill. Based on trenching conducted as a part of supplemental investigations in preparation of the ROD, the Final ROD documented that waste was contained in Unit 1 at IRP Site 3. Units 2 and 3 were not part of the operational landfill and do not contain buried waste. Unit 4 contained incinerated landfill waste not delineated as part of the preliminary design investigation; however, it was included for removal and consolidation into Unit 1 as part of the final remedy.

2.2.3.2 IRP SITE 5

The Final ROD (DON 2008a) indicated that waste was placed within IRP Site 5.

The list of important events unique to IRP Sites 3 and 5 are presented in Table 2-3.

Table 2-3: Chronology of Site Events – OU-2C, IRP Sites 3 and 5

Event	Date
Approximate duration of operation of IRP Site 3 Original landfill.	1943 to 1955
Approximate duration of operation of IRP Site 5 Perimeter Road landfill.	1955 to 1960s
Investigation derived waste (IDW) soils spread over IRP Site 5.	1997
Phase I Remedial Investigation Draft Technical Memorandum (JEG 1993). — IRP Sites 3 and 5 were discovered and added to the IRP as part of Phase I RI process.	May 1993
Phase II RI (BNI 1997c and 1997d) completed for IRP Sites 3 and 5. — Phase II RI established the nature and extent of contamination at IRP Sites 3 and 5 and presented the results for human health and ecological risk assessments.	April 1997
FS (BNI 1997e and 1997f) completed for IRP Sites 3 and 5. — FS evaluated the alternatives for remediation of IRP Sites 3 and 5 and to address risks to human health and the environment at the sites.	September 1997
Final Radiological Release Report (Weston 2006) for IRP Sites 3 and 5. — Based on radiological survey data, soil sample results, and dose and risk calculations, it was concluded that Ra-226 activity in surface soil (up to 18 inches below ground surface [bgs]) does not pose unacceptable risk to a hypothetical residential receptor at	December 2006

Event	Date
<p>IRP Sites 3 and 5. The Sites were recommended for radiological release for the installation and implementation of ICs (Weston 2006). In addition, it was concluded in the FS Addendum (Earth Tech 2006c) and ROD (DON 2008a) that the selected landfill capping remedy documented in the ROD would protect human health from potential exposure to Ra-226. The investigations concluded that the waste is not adversely impacting the groundwater by releasing radionuclides, and radiological constituents are not considered COPCs for groundwater at IRP Sites 3 and 5.</p>	
<p>FS Addendum (Earth Tech 2006c) for IRP Sites 3 and 5.</p> <ul style="list-style-type: none"> — FS addendum used results from exploratory trenching to update IRP Sites 3 and 5 landfill boundaries; installation of perimeter soil gas monitoring wells at IRP Sites 3 and 5 with 1 year of quarterly soil gas sampling and analysis, and assess potential radiological contamination at IRP Sites 3 and 5. 	December 2006
<p>Revised Final Proposed Plan (DON 2007b) issued for IRP Sites 3 and 5.</p> <ul style="list-style-type: none"> — The Revised Proposed Plan presented the Navy's preferred alternative (single barrier cap with ICs and monitoring) for remediation of IRP Sites 3 and 5. 	January 2007
<p>Final ROD (DON 2008a) signed by the Navy and regulatory agencies.</p> <ul style="list-style-type: none"> — The Final ROD documented the selected remedy (no further remedial action for groundwater at IRP Sites 3 and 5 and further action for soil at IRP Site 3, Units 1 and 4, and IRP Site 5). — Selected Remedy requires: single barrier cap with a flexible membrane liner and waste consolidation at IRP Site 3 with erosion prevention and storm water control measures; ICs including land-use restrictions to limit access and/or activities; installation of passive/active LFG collection and/or venting and monitoring system; installation of passive gas control gravel trenches; and long-term monitoring of LFG and groundwater. 	February 2008
<p>RD/Remedial Action Work Plan (Shaw Environmental, Inc. [Shaw] 2009) for Sites 3 and 5.</p>	August 2009
<p>Remedial action initiated.</p>	13 August 2009
<p>O&M/Long-Term Monitoring Plan (Shaw 2010) finalized for Sites 3 and 5.</p> <ul style="list-style-type: none"> — The O&M Plan presents the methods and procedures for LTM and maintenance of IRP Sites 3 and 5. 	November 2010
<p>Remedial action construction complete with Final Inspections on December 2010 at IRP Site 5 and January 2012 at IRP Site 3.</p>	December 2010 – Site 5 January 2012 – Site 3
<p>Final Status Survey Plan (Shaw 2011) for IRP Site 3</p> <ul style="list-style-type: none"> — Data obtained from the implementation of this Final Status Survey Plan supports the assertion that the site meets the remedial objectives at IRP Site 3. 	July 2011
<p>Remedial Action Completion Report (RACR) (Shaw 2012) finalized for IRP Sites 3 and 5.</p> <ul style="list-style-type: none"> — The RACR documented that construction activities are complete for IRP Sites 3 and 5 (installation of landfill cap at IRP Sites 3 and 5 with waste consolidation at IRP Site 3; installation of LFG monitoring probes and an LFG venting system and modification to the in place groundwater monitoring network). The RACR also documented that remedial actions (RAs) achieved the RAOs presented in the ROD. 	August 2012
<p>1st Year Long-Term Monitoring Report, August 2010-July 2011, Operation and Maintenance, Operable Unit 2C, IRP Sites 3 and 5; the report summarizes observations and interprets data gathered between August 2010 and July 2011 (Shaw 2013), at IRP Sites 3 and 5.</p>	January 2013
<p>Operation and Maintenance and Long-Term Monitoring Program Data Sampling Report (August 2011 – December 2012) (CE2K 2013c), Operable Unit 2C, IRP Sites 3 and 5.</p> <ul style="list-style-type: none"> — The O&M/LTM Report documents the long-term operation, maintenance, and monitoring of the landfill cover constructed as part of the RA at Sites 3 and 5; the report summarizes observations and interprets data gathered between August 2011 and December 2012. 	November 2013
<p>Draft 2013 Operation and Maintenance and Long-Term Monitoring Program Data Sampling Report (January – December 2013) (CE2K 2014), Operable Unit 2C, Sites 3 and 5.</p> <ul style="list-style-type: none"> — The O&M/LTM Report documents the long-term operation, maintenance, and monitoring of the landfill cover constructed as part of the RA at Sites 3 and 5; the report summarizes observations and interprets data gathered between January and December 2013. 	August 2014

2.2.4 Initial Response

No removal or early actions have been conducted at IRP Sites 3 and 5.

2.2.5 Basis for Taking Action

IRP Sites 3 and 5 were historically used as landfills for waste disposal. Phase I and II RIs (JEG 1993 and BNI 1997c and 1997d), and supplemental investigations delineated the landfill boundaries and identified several COPCs at IRP Sites 3 and 5. The human health and ecological risk assessments estimated the risks/hazards at these two sites if no actions were taken. The U.S. EPA's presumptive remedy approach for landfills provided the basis for vadose zone remedial actions at IRP Sites 3 and 5, which included landfill capping and ICs so as to minimize contact with the waste, minimize infiltration and potential contaminant leaching to groundwater, and to control landfill gas migration. The ROD (DON 2008a) documented NFA for groundwater at these sites.

2.3 ANOMALY AREA 3

2.3.1 Physical Characteristics

AA 3 is located in the northeastern portion of former MCAS El Toro (Figure 2-2) within OU-2C. Historically, AA 3 was used as a source of borrow material. The borrow pits and trenches were backfilled with construction debris between 1972 and 1988 (based on a review of historical APHOs and topographic maps) and later covered with fill soil averaging approximately 4.5 feet thick, with isolated areas of soil cover as little as 2 feet thick over the construction debris. Interviews with former Base personnel indicate that construction debris generated during construction of the IDW area at IRP Site 3 was also placed at AA 3.

2.3.2 Land and Resource Use

The AA 3 former borrow pit is located near Pusan Way and adjacent to the Agua Chinon Wash in the northeastern portion of former MCAS El Toro (Figure 2-5). The site is bounded by a fence along the southwestern and northwestern edges, with an access gate located on the southwestern property line, which serves as the primary access point to AA 3. The site is bounded by a steep bank along the northeastern edge and the Agua Chinon Wash along the southwestern edge. The site is designated as miscellaneous refuse (MSCR) 1, a "former refuse disposal area" in the BRAC Business Plan update (DON 2010a).

2.3.3 Site History

MSCR AA 3 refers to seven anomaly areas (APHO 59, APHO 60, APHO 61, APHO 62, APHO 63, APHO 64, and APHO 65) identified by Science Applications International Corporation (SAIC) during a review of APHOs taken between 1946 and 1992. Based on the historical APHOs review and topographic maps, placement of construction debris occurred between 1972 and 1988.

Results of air, soil, soil gas, groundwater, sediment, and surface water sampling indicated impact from the construction debris is limited to methane in soil gas in the central portion of the site; no other media were identified as being impacted.

The list of important events unique to AA 3 are presented in Tables 2-4.

Table 2-4: Chronology of Site Events – OU-2C, Anomaly Area 3

Event	Date
Placement of construction debris at AA 3.	1972 to 1988
Final Radiological Release Report (Weston 2006) for AA 3 — Results from the radiological assessment indicate that the level of Ra-226 exposure at the surface of AA 3 is in the range of the Station background for a residential receptor. AA 3 was therefore considered to meet the radiological criteria for unrestricted use. California Department of Health Services (CDHS) concurred that AA 3 may be released for unrestricted use.	December 2006
Final RI/FS Report (Earth Tech and Barajas 2009) — RI established the nature and extent of contamination at AA 3 and presented the results for human health and ecological risk assessments. — FS evaluated the alternatives for remediation of AA 3.	July 2009
Final Proposed Plan (DON 2009c) issued for AA 3. — The Proposed Plan presented the Navy's preferred alternative for remediation of AA 3.	August 2009
Final ROD (DON 2010a) signed by the Navy and regulatory agencies. — The Final ROD documented the selected remedy (limited grading and waste consolidation with erosion prevention and storm water control measures; ICs including land-use restrictions to limit access and/or activities; installation of passive/active LFG venting and monitoring system; and LTM of LFG and groundwater).	August 2010
RD/Remedial Action Work Plan (ERRG 2011b) for AA 3.	July 2011
Remedial action initiated at AA 3.	July 2011
O&M/LTM Plan (ERRG 2011a) finalized for AA 3. — The O&M Plan presents the methods and procedures for LTM and maintenance of AA 3.	September 2011
Remedial action construction complete at AA 3.	February 2012
RACR (ERRG 2012) finalized for AA 3. — The RACR documented that construction activities are complete for AA 3 (limited grading and waste consolidation with construction of a finger dike to control stormwater; installation of LFG monitoring probes and LFG venting system and modification to the in place groundwater monitoring network). The RACR also documented that the remedial action achieved the RAOs presented in the ROD.	November 2012
Final 2012 Annual Operation and Maintenance and Long-Term Monitoring Report (ERRG 2013), Operable Unit 2C, AA 3. — The O&M/LTM Report documents the first year of long-term operation, maintenance, and monitoring of the landfill cover constructed as part of the RA at AA 3; the report summarizes observations and interprets data gathered between February and December 2012, following RA completion in February 2012; and documents the effectiveness of the RA at AA 3.	September 2013
Draft 2013 Annual Operation and Maintenance and Long-Term Monitoring Report (ERRG 2014), Operable Unit 2C, AA 3. — This report summarizes data collected during three quarterly landfill cover inspections and one associated maintenance event, two semiannual groundwater sampling events, and three quarterly LFG monitoring events performed between January 2013 and December 2013.	July 2014

2.3.4 Initial Response

No removal or early actions have been conducted at AA 3.

2.3.5 Basis for Taking Action

Remedial action was taken to protect the public health, welfare, and the environment from actual or potential releases of hazardous substances into the environment. Based on previous investigations documented in the RI, the ROD concluded that an adequate characterization of the nature and extent

of releases has been completed and human health and ecological risks have been quantified and are within acceptable risk management ranges. However, due to the presence of construction-related debris at the site, the proximity of waste to groundwater, and the presence of elevated methane concentrations in the central portion of the site, a vadose zone response action was necessary for continued protection of human health and the environment. Thus the U.S. EPA's presumptive remedy approach for landfills provided the basis for vadose zone remedial action at AA 3, which included landfill capping and ICs. The ROD (DON 2010a) documented NFA for groundwater at the site.

2.4 IRP SITE 16

2.4.1 Physical Characteristics

IRP Site 16, former Crash Crew Training Pit No. 2, is located in the northwestern quadrant of former MCAS El Toro (Figure 2-2) within OU-3B. The facility consisted of three unlined earthen pits or trenches within an area of approximately 1.9 acres located near Runway 21 (designated as Units 1 and 2), and a drainage channel oriented parallel to the runway and located approximately 150 feet northwest of the training pits/trenches (designated as Unit 3) (Figure 2-6). Two of the pits were used for fire-fighting training between 1972 and 1985 and the third pit reportedly served as a storage reservoir for residual fuel. Following cessation of training activities in 1985, the pits/trenches were filled in. The main training pit was roughly circular in shape, measuring approximately 67 feet in diameter and 2 feet to 3 feet in depth. The second training pit was a 3-foot-wide trench that was 10 feet in length. The third pit (used as a fuel reservoir) was 12 feet wide, 35 feet long, and 5 feet deep.

2.4.2 Land and Resource Use

Since Base closure in 1999, the land has remained unused. At the time the ROD was prepared in 2003, the anticipated land-use for IRP Site 16 was as a regional park for recreation.

2.4.3 Site History

Crash Crew Training Pit No. 2 was used to train Base emergency response personnel in fire-fighting techniques in the event of an accident. During training exercises at the main training pit, the pit was reportedly filled with water, covered with a mixture of combustible waste liquids from the reservoir pit and then ignited. The fires at the main pit were generally extinguished with water. Handheld fire extinguisher training was conducted at the second (smaller) training pit. Substances used to fuel the fires reportedly consisted of residual fuels including jet propellant grade 5 (JP-5) and aviation gasoline, waste lubricants (crank case oil) and other combustible liquid wastes. Small amounts of napalm and white phosphorus may also have been used.

The principal contaminant in the subsurface at IRP Site 16 was TCE, presumably from the waste liquids used for fueling the training fires. It was estimated that 275,000 gallons of residual liquids may have been placed into the three training pits; and speculated that up to 10 percent or 27,500 gallons may have seeped into the soil surrounding and underlying the training pits.

Most of the contamination was found to be in the upper 2 feet of soil, although VOCs were also detected at depth and in groundwater approximately 160 feet bgs. It was concluded that the use of large quantities of water as the primary fire suppressant during the training exercises at Unit 1 promoted the movement of residual aqueous phase VOCs downward to the water table causing TCE to impact the groundwater at concentrations exceeding the maximum contaminants level (MCL). TCE is present at concentrations exceeding drinking water standards (MCL) in a plume that extends

from approximately 200 feet upgradient of the main training pit to approximately 330 feet downgradient of the main training pit area.

The list of important events unique to IRP Site 16 are presented in Table 2-5.

Table 2-5: Chronology of Site Events – OU-3B, IRP Site 16

Event	Date
Phase I RI Draft Technical Memorandum (JEG 1993) issued.	May 1993
Phase II RI (BNI 1997j) completed. — Phase II RI established the nature and extent of contamination in soil and groundwater at IRP Site 16 and presented the results for human health risk assessment.	June 1997
Multi-Phase Extraction (MPE) pilot test and aquifer testing conducted at IRP Site 16. — The pilot test was conducted to evaluate the effectiveness of MPE to remediate VOCs in soil and groundwater. — Aquifer testing was conducted at IRP Site 16 to estimate aquifer properties (hydraulic conductivity) of the uppermost saturated zone and to provide data to estimate the groundwater seepage velocity for tracking advective transport and natural attenuation of TCE in groundwater by dispersion and diffusion.	October 2000 to April 2001
Phase II FFS (BNI 2002a) completed. — The FFS was conducted to evaluate potential remedial alternatives for IRP Site 16 soil and groundwater. The FFS recommended further action for groundwater, NFA for shallow soil, and vadose zone monitoring to confirm VOC concentrations are not increasing.	August 2002
Final Proposed Plan (DON 2002b) issued. The Proposed Plan presented the Navy's preferred alternative (monitored natural attenuation [MNA] with ICs) for remediation of IRP Site 16.	September 2002
ROD (DON 2003) signed by the Navy. — The ROD documented the selected remedy (MNA with ICs) for IRP Site 16.	July 2003
Groundwater monitoring well installation completed and MNA started.	September 2004
Pre-design evaluation of MNA and vadose zone monitoring. — A pre-design evaluation of MNA was conducted at IRP Site 16 to: 1) evaluate the extent to which chemical and biological processes may be occurring within the TCE plume; 2) evaluate hydraulic conductivity; and 3) initiate vadose zone monitoring to confirm soil gas concentrations. The pre-design evaluation concluded that the subsurface conditions were not conducive to promoting chemical/biological degradation of TCE. Therefore, the primary mechanisms for natural attenuation are physical processes (e.g., advection, dispersion and diffusion), rather than chemical or biological degradation.	May 2005
RD (CDM 2006) finalized.	March 2006
Main training pit backfilled and site grading completed as part of the selected remedy.	June 2006
Groundwater monitoring well recommended in the RD installed.	October 2006
Operating properly and successfully (OPS) evaluation completed (CDM 2007). — An OPS evaluation was performed to document that the remedy in place was installed and is being implemented in accordance with the RD and is: 1) protective of human health and the environment; 2) enforceable; 3) based on reliable technology; and operating within a site that has been adequately characterized.	September 2007
2006 Annual LTM Report (CDM 2008a) issued. — This report documented remedial actions conducted at IRP Site 16 in 2006.	October 2008
2007 Final Annual LTM Report (CDM 2008b) — This report documented remedial actions conducted at IRP Site 16 in 2007.	July 2009
First Five-Year Review Report (DON 2009b) — This report presented the first five-year review for Sites 2, 16, 17, 18, and 24. Protectiveness of remedial actions was evaluated and found to remain protective. Recommendations made for each site did not directly relate to achieving or maintaining the protectiveness of the remedies, and pertained to O&M of the remedies and coordination with other agencies.	September 2009

Event	Date
Final Round 29 (March 2009) Data Summary Report (Jonas and Associates 2009) — This report presented results of groundwater and soil gas monitoring conducted at the site during March 2009 (Round 29).	December 2009
Final Finding of Suitability to Transfer #5 for Carve-Outs (COs) I-F, 1-K, I-N, I-O, I-S, II-E, II-L, II-M, II-R, and Building 746 (DON 2010b) — This report documented that the site is an area that is suitable to transfer to other owners, with stipulations.	February 2010
Excavation of petroleum-impacted soils as part of the Petroleum Corrective Action Program (PCAP) — The site was backfilled with clean fill and graded to divert rainfall run-off away from the source area.	August 2010
Final Round 31 (Spring 2010) Data Summary Report (Trevet 2010)	September 2010
Draft Remedial Action Completion Report, Deep Vadose Zone (Trevet and AECOM 2011) — This report documented closure of the deep vadose zone.	February 2011

2.4.4 Basis for Taking Action

The basis for taking remedial action at IRP Site 16 is the presence of TCE in groundwater at concentrations that exceed the MCL. The RI concluded that exposure routes for contact with TCE are complete and that TCE at concentrations exceeding the MCL presents an unacceptable human health risk to human receptors from ingestion, direct contact and vapor inhalation associated with groundwater use. A response action was recommended for the site because if the TCE was to be left unaddressed, it may pose an unacceptable health risk to human receptors downgradient, beyond the boundaries of the former training pit area.

2.4.4.1 SUMMARY OF INDOOR AIR RISKS

A risk evaluation for vapor intrusion into indoor air was performed in 2004 using confirmation soil gas samples collected from the site in January 2002 (approximately 10 months after completion of the MPE pilot test). COPCs identified at IRP Site 16 were the three VOCs detected in the soil gas samples (TCE, 1,1,2-trichloro-1,1,2-trifluoroethane, and trichloromethane). Estimates of the volatile emissions of these COPCs from the contaminated soil to indoor air were modeled using the Johnson and Ettinger Model. Risks to adult and child receptors based on both residential and industrial settings were estimated from the modeled emissions. Both cancer and non-cancer risks/hazards were found to be within acceptable limits.

It was concluded from these results that no actions were required and no restriction to land reuse at IRP Site 16 were necessary for vapor intrusion. Although the evaluation determined that TCE was the main risk/hazard driver for vapor intrusion at IRP Site 16, the risks/hazards were believed to be overestimated due to the conservative assumptions used during the evaluation. The U.S. EPA and the State of California concurred with the conclusions based on the indoor air risk evaluation.

2.5 IRP SITES 18 AND 24

2.5.1 Physical Characteristics

2.5.1.1 IRP SITE 18

IRP Site 18, Regional VOC Groundwater Plume, is located southwest of the former MCAS El Toro boundary, downgradient of IRP Site 24 and is entirely off-Base (Figure 2-2). IRP Site 18, Regional VOC Groundwater Plume, is defined as the area where TCE concentrations exceed 5 micrograms per liter ($\mu\text{g/L}$) in the principal aquifer [PA] (Figure 2-7). The contaminated groundwater at IRP Site 18 originated from the SGU at IRP Site 24, which migrated into the PA near the southwestern Base boundary, and extends into the PA off-Base approximately 2.6 miles to the west of the former Base

boundary. As of 2013, the TCE plume at IRP Site 18 has detached from its origin at IRP Site 24. The Site 18 plume within the PA has an estimated length of approximately 6,850 feet and a width of approximately 3,500 feet. In some areas VOC contamination reaches depths of 450 feet bgs.

2.5.1.2 IRP SITE 24

IRP Site 24, VOC Source Area, encompasses approximately 200 acres (Figure 2-2). The site was largely industrialized and contains two large aircraft hangars (Buildings 296 and 297) and several smaller buildings that were used historically for aircraft and vehicle maintenance and repair (Figure 2-7). Maintenance activities (e.g., aircraft washing, degreasing) conducted adjacent to and within these buildings are believed to be the source of the VOC contamination in site soil and groundwater.

2.5.2 Land and Resource Use

2.5.2.1 IRP SITE 18

Land above the IRP Site 18 groundwater plume has historically been used for agricultural activities. However, recently the land-use has changed to mixed-use with agricultural, commercial, and residential areas. IRP Site 18 includes mostly developed land consisting of residential, commercial, parks and light industrial facilities. Some undeveloped parcels and agricultural areas also exist on land overlying the IRP Site 18 groundwater plume.

The Irvine Ranch Water District (IRWD) developed the Irvine Desalter Project (IDP) to remove total dissolved solids (TDS) and nitrates to allow for utilization of regional groundwater for domestic use.

2.5.2.2 IRP SITE 24

IRP Site 24 currently consists of unused aircraft hangars, aircraft maintenance facilities, supply and storage facilities, and some unused administrative facilities. During preparation of the ROD in 2002, the proposed reuse for IRP Site 24 was industrial. Since then, this reuse plan has been revised and the major portion of the property containing IRP Site 24 will become part of the OCGP. In 2012, the Navy coordinated with the OCGP for construction of the South Lawn, which included the installation of several utility lines.

Neither the shallow groundwater unit (SGU) nor the PA at IRP Site 24 is used as a source of municipal drinking water. Groundwater treated from the IRP Site 18 PA is used for irrigation.

2.5.3 Site History

The initial indication of the occurrence of a release at the Base was the discovery of TCE in groundwater at an irrigation well located approximately 3,000 feet downgradient of former MCAS El Toro during routine water quality monitoring in 1985 by the OCWD. In 1985, the Navy began an IAS to locate potential release sites on the Base. The IAS report identified 17 sites as potential sources of contamination (Brown and Caldwell 1986).

The site was highly industrialized and contains two large aircraft hangars (Buildings 296 and 297) and several smaller buildings that were used for aircraft and vehicle maintenance and repair. These activities generated waste solvents that are believed to be the source of the VOC contamination at IRP Site 24.

A variety of contaminants in groundwater, soil, surface water, and sediment were identified during the Phase I RI. The source of contamination for regional groundwater was found to be in the southwest quadrant of the Base. The Phase II RI, conducted in 1995 and 1996, demonstrated that

soil at IRP Site 24 was the source of the regional VOC contamination and that human health risk from potential exposure to the groundwater exceeded the U.S. EPA guidelines. However, the exposure pathway is considered incomplete because the groundwater beneath IRP Site 24 is not being used for potable purposes or for irrigation (BNI 1997g).

Past operations and practices at former MCAS El Toro contributed to soil and groundwater VOC contamination at IRP Site 24. Industrial activities at IRP Site 24, such as dust suppression with waste liquids, paint stripping, degreasing, vehicle and aircraft washing, and waste disposal practices, involved the use of solvents containing VOCs such as TCE and tetrachlorethylene (PCE). Waste solvents may have reached the surface or subsurface through leakage, run-off, storm drains, or direct application to the soil with secondary release into the regional groundwater aquifer. The precise origin, nature, and use of TCE released at the site and the circumstances and quantities of individual releases are not documented. TCE usage at former MCAS El Toro is believed to have been discontinued in the mid-1970s.

The VOC-contaminated groundwater at IRP Site 18 originated from the SGU at IRP Site 24, and migrated into the PA near the southwestern Base boundary, extending into the PA off-Base approximately 2.6 miles from the former Base boundary. Releases associated with agricultural land-use likely contributed to the elevated concentrations of TDS and nitrate that are found throughout the basin.

The list of important events unique to IRP Sites 18 and 24 are presented in Table 2-6.

Table 2-6: Chronology of Site Events – OU-1, IRP Site 18 and OU-2A, IRP Site 24

Event	Date
First indication of VOC release.	1985
OCWD groundwater investigation (Herndon and Reilly 1989) concluded that former MCAS El Toro was the source of TCE contamination in groundwater downgradient of the Base.	1986
Cleanup and Abatement Order (CAO) 87-89 was issued by the RWQCB for former MCAS El Toro.	1987
Perimeter study investigation was completed by JMM to address the RWQCB CAO. <ul style="list-style-type: none"> — This investigation reported VOCs in the shallow groundwater unit (SGU) near the southwestern boundary of former MCAS El Toro (JMM 1988). 	1988
Operation of interim pump-and-treat system near the Base boundary.	June 1989-September 1993
RWQCB rescinds the CAO.	April 1993
Phase I RI Draft Technical Memorandum (JEG 1993) issued. <ul style="list-style-type: none"> — This RI evaluated potential releases and risks associated with sites in OU1, OU2, and OU3. The Phase I RI concluded that the source of regional groundwater contamination was the southwest quadrant of the Base, but it did not indicate specific sources. A preliminary risk assessment was conducted. IRP Sites 24 and 25 were added during Phase I RI. 	May 1993
OU1, IRP Sites 18 and 24 RI report (JEG 1994) issued. <ul style="list-style-type: none"> — Phase I RI at OU1 identified a plume of TCE in groundwater originating beneath the area now designated as IRP Site 24 and the potential VOC sources by collecting soil gas samples. Metal evaluation concluded that the elevated metal concentrations were results of ambient conditions. 	July 1994
Interim-action RI/FS report for groundwater contamination designated as OU1 issued (JEG 1996). <ul style="list-style-type: none"> — Interim-action RI/FS documented results of Phase I RI at OU1 and evaluated potential actions to reduce impact of VOCs in groundwater. 	1996
Phase II RI for IRP Site 24 VOC contamination (BNI 1997g) complete. <ul style="list-style-type: none"> — The Phase II RI at IRP Site 24 characterized the nature and extent of VOCs in soil and groundwater, and collected data for a baseline human health assessment. 	June 1997

Event	Date
FS for vadose zone contamination at IRP Site 24 (BNI 1997h) complete. <ul style="list-style-type: none"> — The FS presented the analysis of alternatives for remediation of vadose zone of IRP Site 24 and to address risks to human health and the environment. 	March 1997
Interim ROD for vadose zone contamination at IRP Site 24 (DON 1997b) finalized. <ul style="list-style-type: none"> — The interim ROD documented the selected remedy for vadose zone contamination at IRP Site 24. 	September 1997
FS for groundwater contamination at IRP Site 24 (BNI 1997i) finalized. <ul style="list-style-type: none"> — The FS presented the analysis of alternatives for remediation of groundwater at IRP Site 24 and to address risks to human health and the environment. 	December 1997
Groundwater remediation pilot test implemented at IRP Site 24 (BNI 1998). <ul style="list-style-type: none"> — The pilot test collected additional data to assist in the remedial alternative design to minimize VOC migration in the SGU and from SGU to PA. Standard and vacuum-enhanced groundwater extraction and groundwater injection were evaluated. 	June 1997-July 1998
Radiological investigations conducted for groundwater <ul style="list-style-type: none"> — The evaluation for radionuclides confirmed that radionuclides in groundwater are naturally occurring and are not due to historical activities (Earth Tech 2000; Earth Tech 2001a). 	December 2001
Technical Memorandum, Evaluation of OU1 Remediation Alternative 8A with Respect to NCP Criteria (BNI 2001). <ul style="list-style-type: none"> — This evaluation was to optimize conceptual design of IRP Site 18 alternative, which led to the development of Alternative 8A that uses separate treatment systems for groundwater extracted from areas inside and outside the TCE plume in the PA. The technical memorandum presented the results of the evaluation of Alternative 8A using a groundwater model, the evaluation against the NCP criteria, and comparison with other alternatives for OU1. 	2001
Implementation of IRP Site 24 vadose zone remediation.	1998-2000
Preliminary assessment of VOCs at Building 307 (located within the boundary of IRP Site 24 (Earth Tech 2001b). <ul style="list-style-type: none"> — This assessment was to identify and characterize the possible presence of VOCs in soil gas, soil, and groundwater as a result of laundry and dry cleaning operations at Building 307. The results confirmed that there has not been a significant release at Building 307. 	September 2001
The OCWD, IRWD, and the Settling Federal Agencies, comprising of the U.S. Department of Justice (DOJ) and Navy, reached a Settlement Agreement (DOJ 2001). <ul style="list-style-type: none"> — The Settlement Agreement documented the Modified IDP operated by OCWD/IRWD would accept and treat VOC-impacted groundwater from IRP Site 24 and the PA. 	June 2001
ROD for OU1 and OU2A (DON 2002a) finalized. <ul style="list-style-type: none"> — This ROD presented the selected remedy for groundwater as pump-and-treat / incorporated Settlement Agreement with the IDP requirements. 	June 2002
Groundwater modeling for OU1 and OU2A (Earth Tech 2003) completed. <ul style="list-style-type: none"> — The groundwater modeling was performed to assist the design of the groundwater extraction strategy for the VOC plume pursuant to the ROD. 	October 2003
Pre-design Investigation for SGU Remedy at IRP Site 24 (Earth Tech 2004) completed. <ul style="list-style-type: none"> — The pre-design investigation was conducted to reduce the uncertainties in groundwater modeling; assess whether soil vapor extraction (SVE) is technically feasible and cost-effective to enhance the groundwater remedy; and select a layout for conveyance piping network. 	May 2004
100 Percent Design Submittal (Weston 2005a) finalized for IRP Site 24. <ul style="list-style-type: none"> — The 100 Percent Design Submittal provided the engineering design, specifications, and implementation methodology for remedial action at IRP Site 24, VOC Source Area. 	March 2005
Remedial Construction started at IRP Site 24.	February 2005
IDP construction started.	April 2005

Event	Date
100 Percent Design Submittal (Tetra Tech 2006) finalized for IDP. <ul style="list-style-type: none"> — The 100 Percent Design Submittal provided rationale and supporting engineering documentation for RD package for the IDP. 	January 2006
Remedial construction completed at IRP Site 24.	February 2006
ESD finalized for IRP Site 18, Regional VOC Plume (OU-1) and IRP Site 24, VOC Source Area (DON 2006b). <ul style="list-style-type: none"> — This ESD addressed the changes to the CERCLA Components of the Modified IDP (CCMI). 	February 2006
IDP construction completed.	July 2006
O&M Manual (Tetra Tech 2007a) finalized for SGU Treatment Plant, IDP.	June 2007
O&M Manual (Tetra Tech 2007b) finalized for PA Treatment Plant, IDP.	June 2007
Interim-RACR (I-RACR) (Weston 2007a) finalized for IRP Site 24, VOC Source Area, Groundwater Remedy. <ul style="list-style-type: none"> — The I-RACR documented that construction activities are complete for IRP Site 24 groundwater remedy. 	August 2007
Performance Monitoring, and SAP (Earth Tech 2007) finalized. <ul style="list-style-type: none"> — The Plan outlined performance monitoring of OU1 and OU2A Groundwater Remedy to assess effectiveness of the remedy. 	August 2007
O&M Manual (Weston 2007b) finalized for SGU well field and conveyance system, IRP Site 24.	August 2007
I-RACR (Tetra Tech 2008) finalized for IDP. <ul style="list-style-type: none"> — The I-RACR documented that construction activities were complete for IDP. 	March 2008
Annual Status Reports prepared for IRP Sites 18 and 24 Groundwater Remedy from September 2007 to December 2013 (Weston 2008, 2009, 2010a, 2011, 2012a, 2013, and ECS 2014). <ul style="list-style-type: none"> — These annual reports documented and evaluated the data collected during groundwater monitoring and operation of the SGU remedy. — These reports also presented an evaluation of water level elevations, analytical solutions, and numerical flow modeling to estimate the zone of hydraulic capture resulting from groundwater extraction (Earth Tech 2009c). 	October 2008, May 2009, August 2010, December 2011, May 2012, October 2013, July 2014
ESD finalized for IRP Sites 18 and 24, Vadose Zone Resampling (DON 2008b). <ul style="list-style-type: none"> — This ESD was prepared to explain differences between the Interim and Final RODs for soil at IRP Site 24 that are associated with groundwater. The primary focus of the ESD was resampling of the vadose zone at the conclusion of groundwater remediation to assure that soil has not been recontaminated from VOCs in groundwater. 	December 2008
Final Technical Memorandum on Capture Zone Evaluation for IRP Sites 18 and 24 Groundwater Remedy (Earth Tech 2009c) <ul style="list-style-type: none"> — This document evaluated the performance monitoring data at IRP Sites 18 and 24, and concluded that the system has operated as designed, and capture of the on-Station SGU VOC plume is nearly complete, and that capture of the PA plume is complete. This memorandum recommended installation and implementation of the SGU contingency wells, which is consistent with the Final RD, to address minor areas of apparent incomplete capture at the former Station boundary. 	May 2009
First Five-Year Review Report (DON 2009b) <ul style="list-style-type: none"> — This report presents the first five-year review for IRP Sites 2, 16, 17, 18, and 24. Protectiveness of remedial actions was evaluated, and recommendations were made for each site. The recommendations did not directly relate to achieving or maintaining the protectiveness of the remedies, but pertained to O&M of the remedies and coordination with other agencies. 	September 2009
Final Operating Properly and Successfully Report, IRP Site 24 VOC Source Area Groundwater Remedy (Weston 2010b) <ul style="list-style-type: none"> — This report provides documentation to demonstrate that the IRP Site 24 groundwater remedy was implemented as designed and was operating properly and successfully in accordance with CERCLA Section 120(h)(3). Appendix A of this report (I-RACR Addendum) documented installation and operation of four contingency wells (24SGU-36 through 24SGU-39) at the Station boundary of IRP Site 24 to complete SGU plume capture. 	July 2010

2.5.4 Initial Response

After the detection and discovery of VOCs in the SGU near the Base boundary in 1987, an interim groundwater pump and treatment system was installed under the CAO by the RWQCB. The system pumped groundwater from three extraction wells between June 1989 and September 1993. The extracted groundwater was treated through granular activated carbon (GAC) with the effluent used to irrigate the Base golf course. On 13 April 1993, the RWQCB rescinded the CAO, because the required actions were complete and the Navy had entered into the FFA to investigate and remediate environmental impacts associated with past and present activities at former MCAS El Toro. In September 1993, the pump and treat system was shut down (JEG 1996).

Remediation of the vadose zone at IRP Site 24 was conducted from 1999 to 2001 pursuant to the selected remedy documented in the OU-2A interim ROD (DON 1997b). The selected remedy included SVE to address VOCs in soil. Following remedy implementation, the Closure Report (Earth Tech 2002) concluded that VOC concentrations in soil gas had been reduced below the groundwater protective threshold limits. The Final OU-2A ROD (DON 2006a) documented NFA for the IRP Site 24 vadose zone based on the protection of human health and the environment.

2.5.5 Basis for Taking Action

2.5.5.1 IRP SITE 18

The basis for taking remedial action at IRP Site 18 are the presence of VOCs in groundwater at concentrations that exceed the MCLs. A response action was recommended for the site because if the VOCs were to be left unaddressed, they may pose an unacceptable health risk to human receptors exposed to the groundwater.

2.5.5.2 IRP SITE 24

The basis for taking remedial action at IRP Site 24 is the presence of VOCs in groundwater at concentrations that exceed the MCLs. A response action was recommended for the site because if the VOCs were to be left unaddressed, it may pose an unacceptable health risk to human receptors.

2.5.5.3 IRP SITE 24 INDOOR AIR RISK

A human health risk evaluation was performed for IRP Site 24 to evaluate the potential exposure to indoor air that could accumulate in buildings constructed at the site under residential and industrial worker land-use scenarios (BNI 2004).

The estimated cancer risk for a hypothetical resident adult exposed to indoor air COPCs at IRP Site 24 was quantified at 7.8×10^{-6} (using U.S.EPA criteria) and 3.1×10^{-7} (using California Environmental Protection Agency [Cal/EPA] criteria). The estimated hazard index (HI) under this scenario was 0.011.

On the basis of the modeled risk evaluation results, it was concluded that IRP Site 24 does not pose unacceptable risks to human health via the air inhalation exposure pathway. Therefore, no action is required and no restrictions on reuse of the site are necessary relative to this potential route. The U.S. EPA and the Cal/EPA concurred with the conclusions of the indoor air risk evaluation.

3. Remedial Actions

This section summarizes the remedial actions for the eight IRP sites presented in this Five-Year Review Report. It includes discussions on remedy selection, implementation and where relevant, O&M. Discussions are provided individually for each of the subject sites.

3.1 IRP SITES 2 AND 17

3.1.1 Remedy Selection

The remedy selection processes for the response actions at IRP Sites 2 and 17 were presented in the following documents:

- Proposed Plan issued by the Navy in May 1998 (DON 1998); and
- ROD signed by the Navy in April 2000 (DON 2000).

The ROD for IRP Sites 2 and 17 was signed by the Navy on 13 April 2000. This ROD documented the following RAOs for IRP Sites 2 and 17 developed based on the Phase I and Phase II RIs, the baseline human-health risk assessments (HHRAs), and a review of applicable or relevant and appropriate requirements (ARARs):

- Prevent direct contact with the landfill wastes;
- Control run-on, run-off, and erosion;
- Monitor LFG migration;
- Minimize infiltration and potential contaminant leaching to groundwater;
- Prevent surface water in washes from contacting the landfill;
- Prevent contaminated sediments from entering the washes and being carried off-site;
- Reduce risk to sensitive habitats that support special-status species of plants and wildlife; and
- Prevent domestic use of groundwater containing VOCs above MCLs (IRP Site 2).

The last RAO pertaining to restriction of domestic use of VOC-impacted groundwater was developed for IRP Site 2 groundwater. The groundwater use at IRP Site 2 is presently restricted through restrictions placed on the transferred portions of the IRP Site 2 property. These restrictions are specified in the memorandum of understanding (MOU) with the Federal Bureau of Investigation (FBI) (Federal Aviation Administration [FAA] and FBI 2012). In addition, the remedial action for VOCs in IRP Site 2 groundwater has been addressed in a separate ROD.

Based on the evaluation of remedial alternatives presented in the ROD, Alternative 3, Single Layer Soil Cap with ICs and Monitoring, was selected as the remedy for the vadose zones of IRP Sites 2 and 17. The selected remedy for vadose zones of IRP Sites 2 and 17 as documented in the Final Interim ROD (DON 2000) included the below-mentioned components. Each component applies to both IRP Sites 2 and 17 unless otherwise noted.

- A single-layer, minimum 4-foot-thick monolithic soil cap to prevent contact with landfill materials and to reduce infiltration into landfill contents.
- On-site waste consolidation prior to capping.

- Erosion control features to control surface water flow and protect the integrity of the cap.
- Fencing, signs, and gates with locks to restrict access to the sites.
- Land-use restrictions to protect the integrity of the landfill cap, restrict irrigation, prevent use of groundwater at IRP Site 2, assure that contact with landfill materials does not occur, and allow Navy, FFA signatories, and California Integrated Waste Management Board (CIWMB) (now referred as Cal/Recycle) and/or its Local Enforcement Agency access to the sites for the purpose of conducting or overseeing monitoring and maintenance.
- Natural resource/habitat mitigation measures will be coordinated with the U.S FWS.
- Monitoring of soil gas and soil moisture to detect any migration of contaminants from the landfills.
- Groundwater monitoring to detect any releases of contaminants from the landfills. Monitoring wells will be secured to prevent damage.
- The cap, drainage features, settlement monuments, and security features will be inspected and maintenance will be performed as necessary to assure the integrity of the landfill cap and prevent unauthorized access.
- Periodic reviews (every 5 years) to evaluate the monitoring results and verify that the action remains protective of human health and the environment.

The ROD documented that groundwater at IRP Site 17 does not require remediation. The ROD for IRP Sites 2 and 17 was designated as interim because:

- Ongoing radiological investigations were not complete at the time the ROD was issued. Therefore, the results of these investigations could not be incorporated into the remedy selection.
- The selection of the remedy for IRP Site 2 groundwater was postponed pending completion of additional investigations, including sampling for perchlorate.
- The evaluation of results for perchlorate confirmation sampling for IRP Site 17 groundwater was not complete.

The radiological investigations for groundwater and soil, and perchlorate confirmation sampling for groundwater at IRP Sites 2 and 17 were completed subsequent to the issuance of the Final Interim ROD. The evaluation of radionuclides in groundwater at IRP Sites 2 and 17 was conducted as a part of a Stationwide radionuclide assessment at former MCAS El Toro (Earth Tech 2000; Earth Tech 2001a). Based on this investigation, it was concluded that radionuclides in groundwater at former MCAS El Toro are naturally occurring, and are not COPCs for groundwater at IRP Sites 2 and 17.

The radiological investigations for soil at IRP Sites 2 and 17 were completed in November and December 2001 (Weston 2004). This evaluation presented in a Technical Memorandum (Earth Tech 2006b) confirmed prior assessments presented in the regulatory agency-concurred Final RD Submittal for IRP Sites 2 and 17 (Earth Tech 2005) that the selected vadose zone remedies for the two sites are protective of human health and the environment with respect to radionuclides.

Results from confirmation sampling for perchlorate in groundwater at IRP Site 17 indicate that perchlorate did not exceed laboratory reporting limits at the site. These sampling results are presented in the Final O&M Plan for IRP Sites 2 and 17 (Earth Tech 2009b). Therefore, it was concluded that no modification to the selected remedy is required to protect human health and the environment with respect to perchlorate in groundwater at IRP Site 17.

In June 2009, the Navy signed a Final ESD (DON 2009a) that documents that the Final Interim ROD for IRP Sites 2 and 17 will serve as the final ROD for IRP Site 17 and vadose zone of IRP Site 2. In addition, the ESD documents significant and non-significant changes in certain components of the selected remedies for IRP Sites 2 and 17 presented in the Final Interim ROD. These components include land-use restrictions, a post-closure monitoring plan, and a remedial action selection strategy for IRP Site 2 groundwater. In May 2011, the Navy signed a final ESD (DON 2011b) that documents a significant change to the widths of the buffer zones surrounding the landfills from 1,000 feet to 100 feet. The ESD also documented a non-significant change (i.e., the restriction pertaining to prohibition of land disturbing activities into or on the surface of the landfills has been modified), to clarify that it also prohibits land disturbing activities on the soil stockpiled for repairs at each landfill.

A ROD selecting the remedy for IRP Sites 1 and 2 (groundwater) was finalized in January 2012 (DON 2012), and the RD/Remedial Action Work Plan was finalized in January 2014 (AEJV 2014). The remedial action construction for these sites began in March 2014.

3.1.2 Remedy Implementation

The remedial action implementation at IRP Sites 2 and 17 consists of the following components:

Remedial Design;

- Remedial Construction; and
- ICs.

3.1.2.1 REMEDIAL DESIGN

The RD for IRP Sites 2 and 17 was finalized in November 2005 (Earth Tech 2005). As part of the pre-design investigation, Earth Tech performed exploratory trenching and potholing to confirm the waste placement boundary at both sites. The waste placement boundaries were revised based on this evaluation, and the results of the investigation were presented in Attachment C of the Final Design Submittal (Earth Tech 2005). These revised boundaries were used to design and construct the landfill caps at IRP Sites 2 and 17.

3.1.2.2 REMEDIAL CONSTRUCTION

The remedial construction activities at IRP Sites 2 and 17 started in September 2005 and November 2007, respectively. The remedial construction was completed at IRP Sites 2 and 17 in February 2008 and July 2008, respectively. The post-construction site maps of IRP Sites 2 and 17 are presented on Figures 3-1 and 3-2, respectively. The RACR for IRP Sites 2 and 17 (Earth Tech 2009a) was finalized in March 2009 to document the following:

- The construction activities are complete and landfill remedies are in place at both sites.
- The landfill remedies achieve the RAOs specified in the ROD (DON 2000) for IRP Site 17 and vadose zone of IRP Site 2.
- The final inspections of the constructed remedies were conducted by the Navy and the RD/Oversight Contractor in February 2008 (IRP Site 2) and July 2008 (IRP Site 17).
- The landfill remedies at both sites are protective of human health and the environment.

The implementation of the remedial action components for IRP Sites 2 and 17 are presented in detail in the RACR. They consist of landfill cover construction (which encompasses waste consolidation

from Areas C and D into Areas A and B; subgrade and foundation layer preparation; evapotranspiration (ET) cover installation; construction of drainage and rip rap energy dissipater features; well and settlement monument installation; site access road construction; security fence and signage installation; erosion control and site restoration; biological monitoring; and land surveying) and the implementation of ICs.

3.1.2.3 IMPLEMENTATION OF ICs

In accordance with Section 9.2 of the ROD and the O&M Plan, ICs are required at IRP Sites 2 and 17 to:

- Maintain the integrity of the landfill caps by preventing excavations;
- Minimize infiltration of surface waters;
- Prevent land-use that presents unacceptable risk to human health and the environment due to residual contamination;
- Protect groundwater monitoring equipment; and
- Preserve access to the sites and associated monitoring equipment for the Navy and the FFA signatories.

A Land-Use Control (LUC) Plan was prepared as an attachment to the O&M Plan for IRP Sites 2 and 17 (Earth Tech 2009b). This LUC Plan presents a description, and implementation, maintenance, and enforcement procedures for ICs for the vadose zone of IRP Site 2, and the vadose zone and groundwater of IRP Site 17. The LUC Plan shows the areas requiring institutional controls (ARICs) at IRP Sites 2 and 17 and presents the land-use restrictions. The ARICs for IRP Sites 2 and 17 include former operational landfill areas for which landfill caps have been constructed (hereinafter referred to as capped landfill areas) and areas surrounding the landfill cap boundaries, also referred to as the buffer zones. Pursuant to the 2011 ESD, the width of the buffer zone surrounding each landfill is 100 feet (DON 2011b) (see Figure 2-3).

The land-use restrictions restrict activities that may adversely affect the integrity of the landfill cap and present unacceptable risk to human health due to potential exposure to residual contamination. In addition, the land-use restrictions prevent removal or damage to remedy components including monitoring equipment; and preserve access to the sites by the Navy and FFA signatories.

In addition to land-use restrictions, the LUC Plan also discusses legal mechanisms for the implementation of ICs. This portion of former MCAS El Toro was transferred to the FAA as part of a Federal agency-to-agency transfer (DON and FAA 2001). A portion of the area transferred to FAA (including IRP Sites 2 and 17) was managed by the Department of the Interior as a habitat reserve (City of Irvine 2003 and City of Irvine 2008). Portions of areas within 1,000 feet of the IRP Sites 2 and 17 landfills lie within Carve-Outs II-V and II-F, which were leased in 2005 to Heritage Fields, LLC (Orange County Great Park Corporation and Lennar Corporation) (DON and Heritage Fields, LLC 2005a). In 2012, the FAA transferred IRP Sites 2 and 17 to the FBI under a subsequent Federal agency-to-agency transfer as documented in an MOU (FAA and FBI 2012). This MOU is being used as a mechanism for the implementation of ICs by the Navy for the areas owned by the FBI.

3.1.3 Operation and Maintenance

The Navy is conducting O&M of IRP Sites 2 and 17 landfill caps in accordance with the O&M Plan finalized in February 2009 (Earth Tech 2009b). A total of 12 monitoring events at IRP Sites 2 and 17 have been conducted and reported from November 2008 through October 2013. The sampling results

from the first four quarterly rounds of sampling were designated as baseline. These events included groundwater sampling, unsaturated zone monitoring (IRP Site 17 only), LFG monitoring, and inspections of covers and ICs. The data collected from these O&M events were analyzed and presented in semiannual/annual Reports.

The dates for the 12 rounds of sampling were:

- Event 1: November 2008;
- Event 2: March 2009;
- Event 3: June 2009;
- Event 4: October 2009;
- Event 5: March 2010;
- Event 6: September 2010;
- Event 7: March 2011;
- Event 8: September 2011;
- Event 9: March 2012;
- Event 10: September 2012;
- Event 11: March 2013; and
- Event 12: October 2013.

The O&M activities for the landfill caps may be divided into the following three categories:

- Cover inspection and maintenance;
- Groundwater, unsaturated zone (soil moisture), and LFG monitoring; and
- ICs inspections and maintenance.

3.1.3.1 O&M REQUIREMENTS - COVER INSPECTION AND MAINTENANCE

In accordance with the O&M Plan (Earth Tech 2009b), the following landfill features are being inspected and maintained as part of the O&M:

- CSS and Mulefat;
- Settlement Monuments;
- Erosion;
- Drainage System;
- Groundwater Monitoring Wells;
- LFG Monitoring Probes;
- Lysimeters;
- Site Security Features; and
- Access Roads.

3.1.3.2 O&M REQUIREMENTS - GROUNDWATER, UNSATURATED ZONE (SOIL MOISTURE), AND LFG MONITORING

Groundwater Monitoring

A Detection Monitoring Program has been implemented at IRP Sites 2 and 17 landfills to meet substantive requirements of Title 27 California Code of Regulations (CCR) §20420. The objectives of the groundwater monitoring are:

- Assess the performance of the landfill cover system and ICs;
- Evaluate if releases are migrating beyond compliance monitoring locations;
- Monitor constituents exceeding standards;
- Provide data to optimize monitoring requirements during the 30-year post-closure compliance period;
- Appraise compliance with the RAOs; and
- Satisfy regulatory requirements for landfill closure.

The detailed Groundwater Monitoring Plan is presented in the O&M Plan. The data obtained from groundwater monitoring were analyzed according to the methods and procedures described in the O&M Plan.

Unsaturated Zone (Soil Moisture) Monitoring

The LTM program objectives that pertain to the unsaturated zone for protection of groundwater quality (after the remedy has been implemented) are: (1) to evaluate the performance of the remedy and (2) to act as the first assessment of when landfill wastes may potentially leach to groundwater during the post-closure monitoring period of the landfills.

Lysimeters were not installed at IRP Site 2 due to a relatively small separation between the waste and groundwater; therefore, no soil moisture monitoring was conducted for IRP Site 2. The detailed Groundwater Monitoring Plan is presented in the O&M Plan. The data obtained from soil moisture monitoring were analyzed according to the methods and procedures described in the O&M Plan.

Landfill Gas Monitoring

The LTM program objective for LFG is to monitor for the migration of LFG to the perimeter of the landfill boundaries at IRP Sites 2 and 17. The detailed LFG Monitoring Plan is presented in the O&M Plan.

3.1.3.3 O&M REQUIREMENTS – ICs INSPECTION AND MAINTENANCE

Site inspections are conducted at IRP Sites 2 and 17 to evaluate compliance with ICs. The O&M Plan contains a checklist for documenting compliance/non-compliance with land-use restrictions and reporting the results of ICs inspections. The current users of the ARICs at IRP Sites 2 and 17 complete these checklists for each IC inspection event. These checklists are submitted with Annual Monitoring Reports to the FFA signatories.

3.1.3.4 PROBLEMS ENCOUNTERED

One of the groundwater monitoring wells at IRP Site 2 (02PZ01), had a constriction at approximately 18 feet below the top of casing that prevented use of groundwater sampling

equipment. Groundwater samples could not be collected from this well; however, depth to water measurements could be made. Because well 02PZ01 was planned for use as an early warning well, the loss of this well is not expected to affect the evaluation of protectiveness or effectiveness of the remedy as data from it is not used to assess compliance. Evaluation of the groundwater elevation data collected during the first four monitoring events indicated that this well did not provide unique and critical data. Therefore, based on discussions with the regulators, this well was abandoned in December 2009 (AECOM 2010).

Intense rains between October 2009 through February 2010 caused erosion at both landfills during the 2010 wet season. At IRP Site 2, the implementation of temporary erosion control measures such as removing and replacing torn sand bags was sufficient to reduce erosion. At IRP Site 17, the combination of intense rains and a lack of vegetative cover in some areas caused rills, erosion, and ponding at various locations. Permanent erosion control measures such as installation of fiber rolls were implemented in March 2010, and repairs have been made to reduce/prevent erosion of the landfill side slopes. Fiber rolls and sand bags were also installed in areas where rills had formed in the past. The permanent erosion controls implemented in March 2010 along with the growth of vegetation over time aided in reducing erosion at IRP Site 17 during subsequent rain events.

Enhancements to the drainage system were also implemented in March 2010 at IRP Site 17 to more efficiently convey run-off from the landfill surface. These enhancements included the placement of turf reinforced matting within the earthen V-ditches; and the placement of concrete block armoring to convey run-off across the access roads and at two locations where run-off enters the shotcrete V-ditches along the eastern side of the landfill. The drainage enhancements fared well during subsequent rain events.

3.2 IRP SITES 3 AND 5

3.2.1 Remedy Selection

The remedy selection processes for the response actions at IRP Sites 3 and 5 were presented in the following documents:

- Revised Proposed Plan issued by the Navy in January 2007 (DON 2007b); and
- ROD signed by the Navy in February 2008 (DON 2008a).

The ROD for IRP Sites 3 and 5 was signed by the Navy on 12 February 2008. The ROD documented RAOs for IRP Sites 3 and 5 developed based on the RIs, the baseline HHRAs, and a review of ARARs. Additional information collected following the RIs and summarized in the FS Addendum (Earth Tech 2006c) was used to update the RAOs as follows:

- Minimize the potential for surface waters in the washes from contacting the landfill (IRP Site 3 only);
- Prevent direct contact with the landfill wastes;
- Control run-on, run-off, and erosion;
- Monitor LFG migration;
- Minimize infiltration and potential contaminant leaching to groundwater; and
- Prevent surface water in washes from contacting the landfill (IRP Site 3 only).

Based on the evaluation of remedial alternatives presented in the ROD, Alternative 4d, Single Barrier Cap with ICs and Monitoring, was selected as the remedy for IRP Sites 3 and 5 as documented in the Final ROD (DON 2008a) and included the below components. Each component applies to both IRP Sites 3 and 5 unless otherwise noted.

- A single-barrier cap with a flexible membrane layer (FML) to prevent contact with landfill materials and to reduce infiltration into landfill contents.
- On-site waste consolidation from Unit 1 and Unit 4 prior to capping at IRP Site 3.
- Erosion control features to control surface water flow and protect the integrity of the cap.
- Temporary fencing, signs, and locks to restrict access to the sites until the remedy is in place.
- Land-use restrictions to protect the integrity of the landfill cap, prevent use of groundwater, assure that contact with landfill materials does not occur, and allow Navy, FFA signatories, and CIWMB (now referred as Cal/Recycle) and/or its Local Enforcement Agency access to the sites for the purpose of conducting or overseeing monitoring and maintenance.
- Monitoring of LFG and groundwater to be conducted to detect any release of contaminants from the landfills. Monitoring wells will be secured to prevent damage.
- A LFG collection and/or venting system will be installed to actively collect and vent LFG as necessary and passively vent or monitor gas during inactive periods.
- Passive gas control gravel trenches will be installed within the compliance monitoring zone during remedy implementation as an added measure of safety.
- A CIWMB (now referred as Cal/Recycle) monitoring protocol with compliance LFG monitoring probes will be implemented within 50 feet of the landfill waste boundary to facilitate perimeter monitoring and assess migration of the LFG.
- The cap, drainage features, and settlement monuments will be inspected and maintenance will be performed as necessary to assure the integrity of the landfill cap.
- Periodic reviews (every 5 years) to evaluate the monitoring results and verify that the action remains protective of human health and the environment.

The ROD documented that groundwater at IRP Sites 3 and 5 does not require remediation.

3.2.2 Remedy Implementation

The remedial action implementation at IRP Sites 3 and 5 consists of the following components:

- Remedial Design;
- Remedial Construction; and
- ICs.

3.2.2.1 REMEDIAL DESIGN

The RD for IRP Sites 3 and 5 was finalized in August 2009 (Shaw 2009).

3.2.2.2 REMEDIAL CONSTRUCTION

The remedial construction activities at IRP Sites 3 and 5 started in August 2009 and construction was completed at IRP Sites 3 and 5 in January 2012 and December 2010, respectively. The

post-construction site maps of IRP Sites 3 and 5 are presented on Figures 3-3 and 3-4, respectively. The RACR for IRP Sites 3 and 5 (Shaw 2012) was finalized in August 2012 to document the following:

- The construction activities are complete and landfill remedies are in place at both sites.
- The landfill remedies achieve the RAOs specified in the ROD (DON 2008a) for IRP Sites 3 and 5.
- The final inspections of the constructed remedies were conducted by the Navy and the RD/Oversight Contractor in January 2012 (IRP Site 3) and December 2010 (IRP Site 5).
- The landfill remedies at both sites are protective of human health and the environment.

The implementation of the remedial action components for IRP Sites 3 and 5 presented in detail in the RACR consisted of landfill cover construction (which encompasses waste consolidation at IRP Site; final cover construction; geomembrane liner installation; protective soil cover installation; well and settlement monument installation; site access road construction; landfill gas collection system; erosion control and site restoration; and land surveying) and implementation of ICs.

3.2.2.3 IMPLEMENTATION OF ICs

The ROD for IRP Sites 3 and 5 requires implementation of ICs in the form of LUCs to:

- Maintain the integrity of the landfill caps by preventing excavations;
- Prevent land-use that presents unacceptable risk to human health and the environment due to potential residual contamination;
- Protect LFG and groundwater monitoring equipment; and
- Preserve access to the sites and associated monitoring equipment for the Navy and the FFA signatories.

A LUC Plan was prepared that presents description, implementation, maintenance, and enforcement procedures for ICs for IRP Sites 3 and 5. The LUC Plan, which was included as an attachment to the O&M Plan for IRP Sites 3 and 5 (Shaw 2010), shows the ARICs at IRP Sites 3 and 5 and presents the land-use restrictions. The ARICs for IRP Sites 3 and 5 include the former operational landfill areas for which landfill caps have been constructed (hereinafter referred to as capped landfill areas) and areas surrounding the landfill cap boundaries, also referred to as the buffer zones.

In addition to land-use restrictions, the LUC Plan also discusses legal mechanisms for the implementation of ICs. This portion of former MCAS El Toro has been leased to a private developer in accordance with the Finding of Suitability to Lease (FOSL) (DON 2004) and Lease in Furtherance of Conveyance (LIFO) (DON 2005). Proprietary controls, in the form of lease restrictions contained in the LIFO between the United States of America and Lennar for the former MCAS El Toro, California (DON 2005), serve as interim ICs to implement the IC objectives and land-use restrictions until the property is conveyed. Through the LIFO, the Navy will maintain conditions at IRP Sites 3 and 5 consistent with the IC objectives chosen for the selected remedy. The interim land-use restrictions are administratively handled through the LIFO until the property is conveyed by deed to the Lennar (as the Lessee).

3.2.3 Operation and Maintenance

The Navy is conducting O&M of IRP Sites 3 and 5 landfill caps in accordance with the O&M Plan that included a SAP finalized in November 2010 (Shaw 2010) and addenda to the SAP (CE2K 2011; 2012). A total of nine monitoring events at IRP Sites 3 and 5 have been conducted and reported from August 2010 through December 2013. The monitoring well and lysimeter sampling have different event numbers because the groundwater monitoring wells were sampled quarterly during Year 1 then semiannually thereafter, whereas the lysimeters were only sampled semiannually. LTM activities include groundwater sampling; unsaturated zone monitoring; LFG monitoring; and inspections of covers and ICs. The data collected from these O&M events were analyzed and presented in semiannual/annual Reports.

Three LTM reports have been issued for IRP Sites 3 and 5: the report issued in January 2013 covers the period from August 2010 to July 2011 (Shaw 2013), the report issued in November 2013 covers the period from August 2011 through December 2012 (CE2K 2013c), and the report issued in August 2014 covers the period from January 2013 through December 2013 (CE2K 2014). The dates for the 9 rounds of sampling were:

- Event 1: September 2010;
- Event 2: December 2010;
- Event 3: April 2011;
- Event 4: July 2011;
- Event 5: September/October 2011;
- Event 6: March/April 2012;
- Event 7: September 2012;
- Event 8: March 2013; and
- Event 9: October 2013.

The O&M activities for the landfill caps may be divided into the following categories:

- Cover inspection and maintenance;
- Groundwater, unsaturated zone (soil moisture), and LFG monitoring; and
- ICs inspections and maintenance.

3.2.3.1 O&M REQUIREMENTS - COVER INSPECTION AND MAINTENANCE

In accordance with the O&M Plan (Shaw 2010), the following landfill features are being inspected and maintained as part of the O&M:

- Vegetative Cover;
- Settlement Monuments;
- Erosion;
- Drainage System;
- Groundwater Monitoring Wells;

- LFG Monitoring Probes/Wells and Landfill Gas Treatment System;
- Lysimeters;
- Site Security Features; and
- Access Roads.

3.2.3.2 O&M REQUIREMENTS - GROUNDWATER, UNSATURATED ZONE (SOIL MOISTURE), AND LFG MONITORING

Groundwater Monitoring

A Detection Monitoring Program has been implemented for IRP Sites 3 and 5 landfills to meet substantive requirements of Title 27 CCR §20420. The objectives of the groundwater monitoring are:

- Assess the performance of the landfill cover system and ICs;
- Evaluate if potential releases are migrating beyond compliance monitoring locations;
- Monitor constituents exceeding standards;
- Provide data to optimize monitoring requirements during the 30-year post-closure compliance period;
- Appraise compliance with the RAOs; and
- Satisfy regulatory requirements for landfill closure.

The detailed Groundwater Monitoring Plan is presented in the O&M Plan. The data obtained from groundwater monitoring is analyzed according to the methods and procedures described in the O&M Plan.

Unsaturated Zone (Soil Moisture) Monitoring

The LTM program objectives that pertain to the protection of groundwater quality (after the remedy has been implemented) are: (1) to evaluate the performance of the remedy and, (2) to act as the first assessment of when landfill wastes may potentially leach to groundwater during the post-closure monitoring period of the landfills.

The detailed Monitoring Plan is presented in the O&M Plan. The data obtained from soil moisture monitoring were analyzed according to the methods and procedures described in the O&M Plan that includes the SAP.

Landfill Gas Monitoring

The LTM program objective for LFG is to monitor for the migration of LFG to the perimeter of the landfill boundaries at IRP Sites 3 and 5. The data obtained from LFG monitoring were analyzed according to the methods and procedures described in the O&M Plan.

3.2.3.3 O&M REQUIREMENTS – ICs INSPECTION AND MAINTENANCE

Site inspections were conducted at IRP Sites 3 and 5 to evaluate compliance with ICs. The O&M plan contains a checklist for documenting compliance/non-compliance with land-use restrictions and reporting the results of ICs inspections. The current users of the ARICs at IRP Sites 3 and 5, FAA

and current Lessee, complete these checklists for each IC inspection event. These checklists were submitted to the FFA signatories.

3.2.3.4 PROBLEMS ENCOUNTERED

The following variances from the Final O&M Plan were noted during the August 2010 through December 2013 reporting period:

- Two groundwater monitoring wells at IRP Site 3 (03_UGMW26B and 04_DGMW66A) could not be sampled in the September 2012 sampling event because groundwater levels were below the intakes of the dedicated pumps. These two pumps were lowered prior to sampling in the subsequent (March 2013) semiannual event.
- During the March and October 2013 sampling events, the following pumps (additional depth noted) were lowered: 03_UGMW26B (8 feet) and 04_DGMW66A (4 feet), 03_DGMW64A (4.5 feet), 03_DGMW65XA (0.75-foot), 05_DGMW41B (8 feet), 05_UGMW27B (9 feet), and 05_DGMW67A (9 feet).
- One landfill gas probe at IRP Site 3 (03TR03) was inadvertently not measured in the September 2012 sampling event.

No variances or repairs other than backfilling of animal burrows were noted during site inspections at both sites as reported in LTM reports.

3.3 ANOMALY AREA 3

3.3.1 Remedy Selection

The remedy selection process for the response action at AA 3 was presented in the following documents:

- Proposed Plan issued by the Navy in August 2009 (DON 2009c); and
- ROD signed by the Navy in August 2010 (DON 2010a).

The ROD for AA 3 was signed by the Navy on 9 August 2010. The ROD documented the following RAOs for AA 3 developed based on the RI, the baseline HHRA, and a review of ARARs:

- Minimize direct contact with the landfill wastes;
- Control run-on, run-off, and erosion;
- Minimize infiltration and potential contaminant leaching to groundwater;
- Mitigate any LFG migration; and
- Minimize contact between surface water in Agua Chinon Wash and the landfill waste.

Based on the evaluation of remedial alternatives presented in the ROD, Alternative 2, Limited Grading, Monitoring, and ICs, was selected as the remedy for AA 3. The selected remedy for AA 3 as documented in the Final ROD (DON 2010a) included the following components:

- Limited grading of the existing cover and minor waste consolidation, constructing a finger dike, and placing riprap to prevent erosion of the cover and to control storm water in the vicinity of Agua Chinon Wash.

- ICs in the form of land-use restrictions to limit access and/or activities at the site to protect public health and the environment.
- A passive/active LFG venting and monitoring system which would be activated as necessary to minimize or control potential LFG migration within a 100-foot buffer zone surrounding the landfill.
- Long-term environmental monitoring for approximately 30 years or until monitoring data indicate that the waste no longer presents a risk to human health and the environment. Monitoring requirements will be reevaluated for appropriateness at five-year intervals to ensure that waste materials (primarily construction debris) do not impact groundwater or release unacceptable levels of LFG beyond the 100-foot protective buffer zone surrounding the landfill.
- No action for groundwater at AA 3, although groundwater monitoring is included as a component of the selected remedy to assess the effectiveness of the capping remedy.

The ROD documented that air, soil, and groundwater media at AA 3 do not require remediation; but requires LTM of LFG and groundwater.

3.3.2 Remedy Implementation

The remedial action implementation at AA 3 consists of the following components:

- Remedial Design;
- Remedial Construction; and
- ICs.

3.3.2.1 REMEDIAL DESIGN

The RD for AA 3 was finalized in July 2011 (ERRG 2011b).

3.3.2.2 REMEDIAL CONSTRUCTION

The remedial construction activities at AA 3 started in July 2011 and were completed in February 2012. The post-construction site map of AA 3 is presented on Figure 3-5. The RACR for AA 3 (ERRG 2012) was finalized in November 2012 to document the following:

- The construction activities are complete and landfill remedy is in place.
- The landfill remedy achieves the RAOs specified in the ROD (DON 2010a).
- The final inspections of the constructed remedy were conducted by the Navy and the RD/Oversight Contractor in February 2012.
- The landfill remedy is protective of human health and the environment.

The implementation of the remedial action components for AA 3 presented in detail in the RACR (ERRG 2012) consisted of limited waste removal activities that included: groundwater monitoring; well destruction; existing soil cover removal; debris excavation and backfilling; emplacement of soil cover with compaction and grading; installation of LFG vent wells and monitoring probes; construction of a LFG collection trench; erosion controls that included: construction of a finger dike between the consolidated debris area and the Agua Chino Wash; improvements to the existing

erosional gully system and drainage swale construction; final grading with revegetation; land surveying; and implementation of ICs.

3.3.2.3 IMPLEMENTATION OF ICs

The ROD for AA 3 requires implementation of ICs in the form of LUCs to limit exposure of future landowners or users of the property to hazardous substances and to maintain the integrity of the remedy. The area requiring ICs is the entire Carve-out (CO) II-C area, an approximately 13-acre area that was leased to a private developer under the July 2005 LIFO (DON 2005).

In accordance with the ROD (DON 2010a) and the O&M Plan (ERRG 2011a), ICs are required at AA 3 to ensure compliance with land-use and access restrictions. These controls are implemented in the form of lease restrictions contained in the LIFO (DON 2005). As per the ROD (DON 2010a), the Navy has determined that it will rely on proprietary controls in the form of environmental restrictive covenants as provided in the Navy/DTSC 2000 MOA at the time of conveyance of the property. More specifically, IC objectives will be achieved through land use and activity restrictions which will be incorporated into two separate legal instruments as provided in the Navy/DTSC 2000 MOA: (1) Restrictive covenants included in one or more “quitclaim deed(s)” from the Navy to the property recipient. (2) Restrictive covenants included in one or more “Covenant(s) to Restrict Use of Property” entered into by the Navy and DTSC as provided in the Navy/DTSC 2000 MOA and consistent with the substantive provisions of CCR Title 22 § 67391.1. In addition, as described in the ROD, the restricted land-uses and activities for AA 3 are prohibited unless reviewed and approved in writing in advance by the FFA Signatories and CIWMB (now referred as Cal/Recycle). A LUC Plan was prepared that presents a description, and implementation, maintenance, and enforcement procedures for ICs for AA 3. The LUC Plan, which was included as an attachment to the O&M Plan for AA 3 (ERRG 2011a), shows the ARIC at AA 3 and presents the land-use restrictions. In addition, the LUC Plan preserves access to the sites by the Navy and FFA signatories and discusses legal mechanisms for the implementation of ICs.

3.3.3 Operation and Maintenance, and Long-Term Monitoring

The Navy is conducting O&M of AA 3, which includes landfill cover and IC inspection and maintenance, and groundwater and LFG monitoring in accordance with the O&M Plan finalized in September 2011 (ERRG 2011a). A total of seven monitoring events at AA 3 have been conducted from April 2012 through December 2013. The groundwater monitoring and LFG sampling have different event numbers because the groundwater monitoring wells were sampled semiannually whereas the LFG monitoring was conducted quarterly. LTM activities include groundwater sampling, LFG monitoring, and inspections of covers and ICs. The data collected from these O&M events were analyzed and presented in semiannual/annual Reports.

The first O&M report was issued in September 2013 and presented results for quarterly landfill cover inspections, semiannual groundwater sampling and quarterly LFG sampling performed between February and December 2012 (ERRG 2013). The second O&M report was issued in July 2014 (ERRG 2014), and summarizes data collected during three quarterly landfill cover inspections and one associated maintenance event; two semiannual groundwater sampling events; and three quarterly LFG monitoring events performed between January 2013 and December 2013.

The dates for the 7 rounds of sampling were:

- Event 1: April 2012;
- Event 2: July 2012;

- Event 3: October 2012;
- Event 4: December 2012;
- Event 5: May 2013;
- Event 6: August 2013; and
- Event 7: November 2013.

The O&M activities for the landfill caps may be divided into the following categories:

- Cover inspection and maintenance;
- Groundwater and LFG monitoring; and
- ICs inspections and maintenance.

3.3.3.1 O&M REQUIREMENTS - COVER INSPECTION AND MAINTENANCE

In accordance with the O&M Plan (ERRG 2011a), the following landfill features are being inspected and maintained as part of the O&M:

- Soil Cover;
- Settlement Monuments;
- Drainage System;
- Groundwater Monitoring Wells;
- LFG Vent Wells, Trench Risers, and Monitoring Probes;
- LFG Extraction and Treatment System;
- Site Security Features;
- Maintenance Path; and
- ICs.

3.3.3.2 O&M REQUIREMENTS - GROUNDWATER AND LFG MONITORING

Groundwater Monitoring

A Detection Monitoring Program has been implemented for AA 3 to assess if groundwater quality is being degraded. Monitoring has been performed semiannually for 2 years. The ROD conservatively estimated that groundwater monitoring may be conducted at AA 3 for approximately 30 years or until monitoring data indicate that monitoring is no longer needed to protect human health and the environment. Once adequate data are collected, and with the concurrence of the FFA signatories, groundwater monitoring will be discontinued. Statistical analyses of groundwater data are conducted to identify any statistically significant increases in chemical concentrations in groundwater over time. The objectives of the groundwater monitoring are:

- Assess the performance of the landfill cover system and ICs;
- Evaluate if concentrations of analytes are within statistically established prediction limits (i.e., is there evidence of groundwater contamination);

- Provide data to optimize monitoring requirements during the 30-year post-closure compliance period;
- Appraise compliance with the RAOs; and
- Satisfy regulatory requirements for landfill closure.

The detailed Groundwater Monitoring Plan is included in the O&M Plan. The data obtained from groundwater monitoring are analyzed according to the methods and procedures described in the O&M Plan.

Landfill Gas Monitoring

The LTM program objective for LFG is to monitor for the migration of LFG to the perimeter of the landfill boundary at AA 3. LFG concentrations will be deemed as stabilized if: (1) four consecutive quarters of monitoring indicate that concentrations of methane are less than one half of the established threshold (5 percent of lower explosive limit [LEL] or 50,000 parts per million by volume [ppmv]), and (2) four consecutive quarters of monitoring indicate that concentrations of non-methane organic compounds (NMOCs) are consistent with previous site data for NMOCs, which indicated that NMOCs are not present at concentrations that pose an unacceptable risk to human health and the environment. The ROD conservatively estimated that LFG monitoring will be conducted at AA 3 for approximately 30 years or until monitoring data indicate that the waste does not present a risk to human health and the environment. The data obtained from LFG monitoring are analyzed according to the methods and procedures described in the O&M Plan.

3.3.3.3 O&M REQUIREMENTS – ICs INSPECTION AND MAINTENANCE

Site inspections were conducted at AA 3 to evaluate compliance with ICs. The O&M Plan contains a checklist for documenting compliance/non-compliance with land-use restrictions and reporting the results of ICs inspections. The current users of the ARICs at AA 3 completed these checklists for each IC inspection event. These checklists were submitted to the FFA signatories.

3.3.3.4 PROBLEMS ENCOUNTERED

The vegetative cover at AA 3 was installed in February 2012. Animal burrows were identified during the inspections in 2012 and 2013. All identified burrows were filled and compacted to the existing grade with the on-site soil that was displaced to dig the burrow. On 4 January 2013, additional seeding was conducted in select areas exhibiting inadequate growth based on observations made during the December 2012 cover inspection. Based on the observations made during the November 2013 cover inspection, which showed similar vegetative coverage (97 percent), it was necessary to mow dead and dormant vegetation to facilitate regrowth of the vegetation during the upcoming growing season and maintain the existing vegetative coverage. The mowing activities were conducted between 26 and 27 November 2013. The cut vegetative material was spread evenly across the site to help facilitate regrowth of the vegetation during the upcoming growing season.

3.4 IRP SITE 16

3.4.1 Remedy Selection

The remedy selection processes for the response action at IRP Site 16 were documented in the following documents:

- Proposed Plan issued by the Navy in September 2002 (DON 2002b); and
- ROD signed by the Navy in July 2003 (DON 2003).

The RAOs for the selected remedy implemented at IRP Site 16, as discussed in the ROD (DON 2003), include the following:

- Monitor concentrations of VOCs in soil vapor within the vadose zone to confirm that concentrations do not increase with time;
- Restore the beneficial uses of the shallow aquifer underlying IRP Site 16 to the extent practicable while preventing or minimizing VOC migration beyond current boundaries at concentrations exceeding site cleanup levels; and
- Protect human health by preventing the extraction of shallow VOC-impacted groundwater for domestic use until the site cleanup goals are achieved.

On the basis of the IRP Site 16 RI (BNI 1997j), FFS (BNI 2002a), and MPE pilot test results (BNI 2002b), the Navy, in coordination with U.S. EPA, DTSC and RWQCB, selected groundwater MNA and ICs as the final remedy for IRP Site 16. The selection of this remedy is documented in the IRP Site 16 ROD (DON 2003) that was finalized and signed by the Navy on 22 July 2003. It was determined that this remedy would be protective of human health or welfare, and the environment. The final remedy for IRP Site 16 includes the following elements:

- MNA of groundwater to confirm that TCE concentrations have decreased over time;
- Vadose zone monitoring to confirm that TCE concentrations in the vadose zone do not impact groundwater quality;
- Site grading to fill in the training pit and promote proper drainage of storm water; and
- Implementation of ICs to protect the monitoring wells and monitoring equipment, prevent the use of impacted groundwater and maintain the site.

3.4.2 Remedy Implementation

3.4.2.1 WELL CONSTRUCTION

Monitoring wells in the current groundwater monitoring well network at IRP Site 16 were installed in September 2004 (nine wells), October 2006 (one well), 2011 (five wells), and 2013 (four wells). Six of the nine wells installed in 2004 (16_MW08 through 16_MW16) were screened at the water table and two were screened approximately 30 feet below the water table. Monitoring well 16_MW17 was installed in 2006 at the request of regulatory agencies, in a location approximately 175 feet west of the training pit area. The wells installed in 2011 (16_MW18, 16_MW19, 16_MW21, 16_MW22, and 16_MW23) were added to replace previously-removed wells and to further support remedy performance monitoring. The wells installed in 2013 (16_MW24, 16_MW25, 16_MW26, and 16_MW28) were added to support performance monitoring within the ARIC. Figure 3-6 shows the current monitoring well locations.

3.4.2.2 MNA OF GROUNDWATER

Long-term groundwater monitoring for MNA was initiated in 10 selected wells at IRP Site 16 in September 2004 and is presently conducted semiannually in accordance with the *Final Remedial Design for Monitored Natural Attenuation with Institutional Controls* (CDM 2006). Groundwater samples are collected using dedicated pumps and a micro-purging technique and analyzed for total petroleum hydrocarbons (TPH) and VOCs. Groundwater quality data are evaluated for trend to confirm that TCE concentrations in groundwater decrease with time through natural processes, and do not migrate beyond the ARIC, which is defined as the migration/dispersion distance predicted by the site groundwater fate and transport model, plus 300 feet. The target groundwater cleanup goal is

the MCL for TCE (5 µg/L). Figure 3-6 shows the current interpretation of the extent of the TCE groundwater plume through the December 2013 monitoring event.

3.4.2.3 VADOSE ZONE MONITORING

Vadose zone monitoring consisting of sampling and analysis of soil gas from the head space within four selected MPE pilot test and groundwater monitoring wells for VOCs was conducted on a semiannual basis between October 2004 and March 2008 (with two exceptions: Rounds 25 and 28). A summary of the results of vadose zone monitoring and the proposed closure and exit strategy for deep vadose zone soil were presented to regulatory agencies in May 2009. The U.S. EPA determined that the current body of data is sufficient to evaluate the attainment of RAOs relating to closure of the deep vadose zone (U.S. EPA 2010). As a result, soil gas sampling was discontinued. Upon regulatory concurrence and finalization of the Draft RACR (Trevet and AECOM 2011), closure of the deep vadose zone at IRP Site 16 will be achieved and maintenance of the positive drainage within the Main Pit Area will no longer be required.

3.4.2.4 SITE GRADING

In June 2006, the main Crash Crew Training Pit at IRP Site 16 was backfilled with clean soil and the surface was graded to promote storm water drainage. The pit backfilling and grading activity are documented in the *Site Grading Summary Report, IRP Site 16, Former MCAS El Toro* (ECS 2007). The other two training pits were reportedly backfilled in the past soon after use of the training pits stopped. Additional clean fill was placed and graded in 2007 after site activity disturbed the surface soil. Following excavation of petroleum-impacted soil during the PCAP excavation in 2010, the site was backfilled with clean fill and graded to divert rainfall run-off away from the source area and toward the drainage swale in accordance with the ROD.

3.4.2.5 IMPLEMENTATION OF ICS

ICs implemented at IRP Site 16 include land-use and lease/deed restrictions, periodic inspections, site maintenance, and notification and reporting requirements. The procedures and requirements for these controls are detailed in the *Final Remedial Design for Monitored Natural Attenuation with Institutional Controls* (CDM 2006). The LUCs and restrictions are implemented to prevent potential exposure to TCE in groundwater, protect the integrity of the monitoring wells and maintain surface drainage. LUCs specifically prohibit any new well installation and the use of groundwater from within the ARIC until the site achieves the target groundwater cleanup goal (TCE MCL). The ICs also prohibit the disturbance of the existing monitoring wells and equipment at the site without specific approval from the Navy and the regulators, and requires maintenance of the ground surface to maintain proper drainage away from the former training pits.

At IRP Site 16, site security refers to the protection and security of the remedial action components. Security is maintained through ICs, inspections, and maintenance of well security features (e.g. well covers, locked well caps, etc.). These features are inspected during each sampling event and in general during annual LUC inspections.

The area containing IRP Site 16 was transferred in part to the City of Irvine and in part to the Five Point Communities, Inc., in 2012. ICs in the form of land-use restrictions are enforceable at the site through the “Covenant to Restrict the Use of Property” (CRUP) recorded against the property on 5 May 2010 and the Quitclaim Deed (DON 2011c). In accordance with provisions in the Quitclaim Deed and in the CRUP, the City of Irvine and Five Point Communities, Inc. conducted annual inspections documenting compliance with ICs and LUCs.

Petroleum hydrocarbons in soil at IRP Site 16 have been addressed under the former MCAS El Toro PCAP.

In 2007 an OPS evaluation was performed for the IRP Site 16 final remedy. Information from the ongoing MNA and vadose zone monitoring were evaluated to demonstrate that the selected remedy is operating successfully and as intended. The OPS Evaluation Report (CDM 2007) concluded that the final remedy has been implemented in accordance with the approved RD and is:

- Protective of human health and the environment;
- Enforceable (through implementation of the ICs that include LUCs and deed restrictions);
- Based on reliable technology (MNA); and
- Operating within a site that has been adequately characterized.

In addition to satisfying the above OPS criteria, the evaluation also concluded that the following U.S. EPA core criteria for successful MNA groundwater remedies were satisfied:

- Construction of the source control portion of the remedy (via MPE pilot test); and
- Monitoring information showing that natural attenuation is working (via MNA sampling).

3.4.3 System Operation and Maintenance

System O&M activities at IRP Site 16 consist of semiannual groundwater MNA sampling, site inspections, and maintenance and reporting. O&M is conducted in accordance with the *Final Remedial Design for Monitored Natural Attenuation with Institutional Controls* (CDM 2006). It was initiated in September 2004 and is ongoing. Since its initiation as a part of the final remedy at IRP Site 16 in September 2004 and through the end of 2013, 19 groundwater MNA sampling events and up to 7 vadose zone monitoring events have been completed.

The RD specifies that groundwater be sampled from 10 selected wells during each monitoring event. Groundwater sampling is to be performed following the low flow-minimum drawdown (micro-purge) procedure, and selected MNA parameters are to be measured in the field during well purging. All groundwater samples are required to be analyzed for TPH and VOCs, and soil gas samples are required to be analyzed for VOCs following appropriate test methods.

Groundwater TCE data are compared to the MCL to confirm that the TCE plume remains within the ARIC. During each monitoring event, the site is inspected to ensure compliance with the ICs. The wells are inspected to verify that they are in good condition and are secure. The ground surface is inspected to ensure proper drainage of storm water away from the training pits is maintained. Inspection results are reported with the monitoring data, along with recommendations for any maintenance, if needed.

The monitoring of existing wells having various screen intervals and the fluctuating water table has resulted in inconsistencies in the vadose zone sampling interval among the wells and between samples. This was in part due to instances where vadose zone monitoring could not be performed at one or more wells because of the entire screen interval being below the water table. The variable sample intervals have introduced uncertainty into the comparability of the analytical results that has contributed to a high degree of scatter in the data, which adversely affects the trend analysis. This condition was not anticipated during development of the RD. If water levels continue to drop at the current rate, replacement of non-performing monitoring wells will be evaluated as part of the Site's ongoing monitoring well network optimization.

3.5 IRP SITES 18 AND 24

3.5.1 Remedy Selection

The remedy selection processes for the response actions at IRP Sites 18 and 24 were documented in the documents listed below:

- Proposed Plan issued by the Navy in November 2001 (DON 2001c); and
- Groundwater ROD signed by the Navy in June 2002 (DON 2002a).

The ROD presented the RAOs for IRP Sites 18 and 24 VOC plumes as listed below (DON 2002a).

IRP Site 18 groundwater:

- Reduce VOC concentrations in the SGU and the PA to Federal or State cleanup levels;
- Contain migration of VOCs above cleanup levels in the PA; and
- Prevent domestic use of groundwater containing VOCs at concentrations exceeding cleanup levels.

IRP Site 24 groundwater:

- Reduce VOC concentrations in the SGU to Federal or State cleanup levels;
- Prevent use of groundwater containing VOCs at concentrations exceeding cleanup levels; and
- Prevent VOCs at concentrations above cleanup levels from migrating beyond the SGU.

The selected remedy for the OU-1 and OU-2A VOC plumes includes groundwater extraction and treatment, and ICs (DON 2002a) integrated with the IDP. The remedy included the following components:

- Construction, operation, and maintenance of a groundwater extraction system to remove VOCs from groundwater in the SGU and PA;
- Treatment of VOC-contaminated groundwater from the SGU and PA using air stripping and reverse osmosis at a central treatment plant;
- Discharge of treated groundwater to injection well IDP-1 or for reclaimed water use;
- Treatment of VOC vapors with GAC filters to meet air quality standards before discharge to the atmosphere;
- Performance monitoring during the remedial action;
- Confirmatory groundwater sampling at the end of remediation to confirm that VOC concentrations meet Federal and State cleanup levels; and
- ICs to prevent use of contaminated groundwater, protect equipment, and allow access to the Navy, OCWD/IRWD, and regulatory agency personnel.

During the RD, the CERCLA remedy was modified and the changes were documented in an ESD signed in June 2006 (DON 2006b). The changes include the following:

- Elimination of reverse osmosis as a treatment process for VOC-impacted groundwater;

- Use of separate treatment facilities for the SGU and PA groundwater;
- Revised location for extraction well ET-2;
- Revised extraction rates for ET-1, ET-2, and IRWD-78; and
- Inclusion of the Southern California Water Authority (SOCWA) brine line as an alternative disposal option for clean, treated groundwater from the SGU.

Another ESD to the OU-1 and OU-2A Groundwater ROD was prepared in December 2008 to address vapor sampling at the conclusion of groundwater remediation at the vadose zone source area (DON 2008b). The vadose zone source area is located in the immediate vicinity of Hangars 296 and 297. Soil vapor sampling will be conducted in the vicinity of Hangars 296 and 297 at the completion of the IRP Site 18 and IRP Site 24 groundwater remedy. Results from this sampling will then be used as the basis for documenting whether average VOC concentrations remain below groundwater-protective threshold limits specified in the Final OU-2A ROD (DON 2006a).

3.5.2 Remedy Implementation

3.5.2.1 IRP SITE 18

The remedial action implementation at IRP Site 18 consists of the following components:

- Remedial Design;
- Remedial Construction; and
- ICs.

Remedial Design

A groundwater extraction and treatment system for IRP Site 18 was designed and constructed in accordance with the selected remedy documented in the Final Groundwater ROD (DON 2002a). The 100 Percent Design was submitted to the BCT on 31 May 2005 (Tetra Tech 2006).

Remedial Construction

Remedy construction began in April 2005 and was completed in July 2006. The remedy at IRP Site 18 includes three wells, ET-1, ET-2, and IRWD 78, which extract groundwater from the PA. In addition, the IRWD constructed a treatment plant to treat the extracted VOC-impacted groundwater. The PA Treatment Plant is currently treating extracted water from ET-1 and discharging the treated water into the IRWD non-potable system. TCE concentrations in the groundwater from wells ET-2 and IRWD 78 are below 5 µg/L; therefore, groundwater extracted from these wells is not treated for VOCs and is pumped directly to the IRWD non-potable system.

The major construction activities conducted as part of remedy implementation for IRP Site 18 were rehabilitation of the three extraction wells (ET-1, ET-2, and IRWD 78) used for extraction of groundwater from the PA; installation of new pumps, motors, and ancillary equipment; construction of the PA Treatment Plant; system shakedown upon completion of the construction; and system startup to confirm proper operation upon completion of the construction.

Implementation of ICs

ICs for the off-Base portion of the groundwater plume are intended to protect residents from use of VOC-impacted groundwater for domestic purposes until cleanup goals are achieved. The ICs for the

off-Base portion of VOC groundwater plume are based on local permit programs administered by the Orange County Health Care Agency (OCHCA) and IRWD. These agencies require that any person planning to construct a water well must apply for and obtain a permit for construction of such well. These agencies are also authorized to include necessary conditions in the permit to assure adequate protection of public health. The Navy has received commitments from OCHCA and IRWD to provide the Navy with copies of any well permit applications received or permits issued within the geographic scope of the off-Base groundwater plume (the areal extent exceeding Federal and State MCLs) until remediation of the plume has been completed.

Two well construction permits have been issued since the beginning of remedy implementation. The wells associated with these two permits were constructed within the groundwater plume for IRP Sites 18 and 24 during 2011; however, none of the wells are classified as water wells used for irrigation or private/domestic drinking. The wells are being used for monitoring or air sparging/soil vapor extraction, as explained below:

- The OCHCA Permit # 11-08-19 was issued to DON for the replacement of abandoned monitoring well 07DBMW43A with new monitoring well 07DBMW43B as components of the Navy's IRP.
- The OCHCA Permit # 11-06-22 was issued to Exxon Mobil Oil Corporation for the installation of one monitoring and three air sparge/soil vapor extraction wells.

3.5.2.2 IRP SITE 24

The remedial action implementation at IRP Site 24 consists of the following components:

- Remedial Design;
- Remedial Construction; and
- ICs.

Remedial Design

A groundwater extraction and treatment system for IRP Site 24 was designed and constructed in accordance with the selected remedy documented in the Final Groundwater ROD (DON 2002a). The 100 Percent Design (Weston 2005a) was submitted to the BCT in March 2005.

Remedial Construction

Remedial construction activities began in February 2005 and were implemented in accordance with the Final Remedial Action Work Plan (Weston 2005b), and the 100-Percent Design Submittal (Weston 2005a).

The remedy implementation by the Navy for IRP Site 24 included installation of 35 extraction wells (24SGU-01 through 24SGU-35) to extract groundwater from the SGU, conveyance piping, storage, and pumping facilities. In addition, four existing wells (24EX3, 24EX4, 24EX5, and 24EX6) were converted to groundwater extraction wells and modified for SVE enhancement (see Figure 2-7). Conveyance piping conveys groundwater from extraction wells to the transfer station (also known as the Compound). The transfer station is used to pump groundwater from the former MCAS El Toro boundary to the Treatment Facility constructed by the IRWD for SGU groundwater. The treated effluent from the SGU is currently pumped to the SOCWA brine line for ocean disposal.

The major construction activities conducted as part of remedy implementation for IRP Site 24 include; SGU extraction well and monitoring well installation; high-voltage line installation; SGU conveyance system installation; transfer station installation; construction of the treatment plant for SGU groundwater consisting of a packed column air-stripper to separate VOCs from the groundwater; system shakedown upon completion of the construction; and system startup to confirm proper operation upon completion of the construction.

In addition, between December 2009 and January 2010, four contingency wells, 24SGU-36 through 24SGU-39, were installed at the Station boundary of IRP Site 24 to complete SGU plume capture, based on the Final 100 Percent Design Submittal. The four contingency wells are each designed to operate at a flow rate of 25 gallons per minute (gpm), higher flow rates than the previously installed wells. These four contingency wells were brought on-line in March 2010 as documented in the *Draft Final Interim Remedial Action Completion Report Addendum* (included as Appendix A of the report [Weston 2010]).

Implementation of ICs

The Navy coordinates ICs with property owners and Lessees within the IRP Site 24 area to ensure that construction activities that are planned or underway do not impact components of the IRP Site 24 extraction and conveyance system. IRP Site 24 lies within CO III-B-3 (see Figure 2-2). The Navy currently leases portions of the area containing IRP Site 24.

Provisions preserving access to the property for the Navy and regulatory personnel to conduct investigations, surveys, sampling, monitoring, and remedial actions in the leased portions are set forth in the LIFOC.

Provisions requiring protection of groundwater extraction, injection, and monitoring wells and associated piping and equipment are set forth in the LIFOC. To prevent Lessee personnel from mistaking remediation equipment for utilities infrastructure, the following protection was added: all system pull boxes and vaults are stenciled "US Navy Property—Do Not Open." High voltage pull boxes were also identified as high voltage. The land-use restrictions identified in the ROD for IRP Site 24 will be incorporated into the deed when the property overlying the on-Station portion of IRP Site 24 is conveyed to a non-Federal entity. In addition, when the on-Station portion of IRP Site 24 is conveyed to a non-Federal entity, the land-use restrictions identified in the ROD will also be incorporated into CRUP entered into by the Navy and DTSC as provided in the Navy/DTSC 2000 MOA.

The Lessee is required to complete a Project Evaluation Review Form (PERF) for any work proposed in the leased portion of the property. A PERF is submitted to the Navy for approval and to the U.S. EPA, RWQCB, and DTSC for their concurrence.

For the IRP Site 24 portions that have been transferred to the City of Irvine, land-use restrictions are enforceable through the CRUP and the Quitclaim Deed. In accordance with provisions in the Quitclaim Deed and in the CRUP, the OCGP conducts annual inspections documenting compliance with ICs and LUCs, completes compliance certificates, and submits to the Navy.

The Navy coordinates ICs with property owners and Lessees within the IRP Site 24 ARIC to ensure that construction activities that are planned or underway on transferred property do not impact components of the IRP Site 24 extraction and conveyance system. In 2012, the Navy coordinated with the OCGP for the construction of the South Lawn, which included the installation of several utility lines within the easement area. The OCGP provided a Work in Easement Area (WIEA) (WIEA-001) to the Navy for review to ensure adequate protective measures are in place for the IRP

Site 24 extraction and conveyance system. The Navy personnel periodically visit the construction site to ensure the WIEA protective measures are in place and are effective. WIEA-001 was amended on 8 February 2012 to incorporate the rerouting of the 12-kV line that was initially installed for the IRP Site 24 extraction and conveyance system.

The SGU Transfer Station is surrounded by a chain-link fence with three strands of barbed wire. The gate is locked when the site is not manned. The control room building located within this fenced area is also locked when not manned.

The extraction well vault covers and high voltage pull boxes are protected with security locks (specialized locking bolts). Monitoring well caps are tagged and locked.

Operating Properly and Successfully Demonstration

In July 2010, the Navy issued the Final OPS Report, IRP Site 24 VOC Source Area Groundwater Remedy (Weston 2010b) that provided documentation to demonstrate that the IRP Site 24 groundwater remedy was implemented as designed and is OPS in accordance with CERCLA Section 120(h)(3). The remedy at IRP Site 24 satisfied the six core evaluation criteria for groundwater remedies. The U.S. EPA provided concurrence with the Navy demonstration that the IRP Site 24 remedy is OPS in a letter dated 9 September 2010.

3.5.3 System Operation and Maintenance

In addition to the routine system inspection and maintenance specified in the O&M Manuals (Tetra Tech 2007a, Tetra Tech 2007b, Weston 2007b), a total of 26 remedy evaluation monitoring events at IRP Sites 18 and 24 have been conducted from March 2006 through September 2013. Sampling conducted in September 2006 was considered the initial (baseline) sampling event for monitoring the effectiveness of the remedy at IRP Sites 18 and 24. The dates for the monitoring events are summarized in Table 3-1 below:

Table 3-1. Summary of Groundwater Monitoring Events

Event Number	Date	Event Number	Date	Event Number	Date
1	March 2006	10	December 2008	19	March 2011
2	September 2006	11	March 2009	20	June 2011
3	December 2006	12	June 2009	21	September 2011
4	March 2007	13	September 2009	22	December 2011
5	August 2007	14	December 2009	23	March 2012
6	October 2007	15	March 2010	24	September 2012
7	January 2008	16	June 2010	25	March 2013
8	April 2008	17	September 2010	26	September 2013
9	July 2008	18	December 2010	--	--

System O&M activities are currently conducted in accordance with the following plans:

1. The *Performance Monitoring and Sampling and Analysis Plan* (Earth Tech 2007), which presents a sampling plan to evaluate remedy performance and progress versus RAOs.

2. The *SGU Wellfield and Conveyance System O&M Plan* (Weston 2007b) identifies O&M details from the SGU wellfield and conveyance system to the point of connection with the IRWD SGU treatment plant.
3. The *SGU Treatment System O&M Plan* (Tetra Tech 2007a) provides O&M details for the SGU treatment system and conveyance from the point of connection from the Navy to the SGU treatment system and discharge via reinjection or ocean outfall.
4. The *PA Treatment System O&M Plan* (Tetra Tech 2007b) provides O&M details for the PA extraction wells, conveyance system, PA Treatment Plan, and discharge to the non-potable system.

The ongoing optimization of the monitoring program is performed in accordance with the *Performance Monitoring and Sampling and Analysis Plan* (Earth Tech 2007). Each year, data from the monitoring wells associated with the IRP Sites 18 and 24 monitoring program are statistically evaluated for trends, and recommendations are presented in the annual remedy status reports (e.g., Weston 2013) regarding optimization of the program for the following year.

3.5.3.1 O&M REQUIREMENTS – SYSTEM OPERATION

Under normal operating conditions, extracted groundwater is continuously pumped to the equalization tanks and then subsequently pumped to the SGU treatment system. The extraction pumps, transfer pumps, variable frequency drives, and water level in the equalization tank is controlled by instrument signals sent to and interpreted by the Programmable Logic Controller (PLC).

The equalization tanks are vented to the atmosphere through two 55-gallon vapor adsorption drums, operated in series. The influent, midpoint, and effluent of these drums are monitored on a weekly basis. Once breakthrough is noted at the midpoint, the GAC in the drums is changed out within two weeks of breakthrough detection.

During well field operations, the flow rate of each extraction well pump is monitored and evaluated for indication of possible biofouling. Possible silt accumulation is monitored in well field pipelines.

System data are downloaded from the PLC and collected from field instrument readings on a regular basis.

Routine inspections are conducted on a scheduled basis to enhance the life and performance of equipment. All maintenance activities are recorded in the Maintenance Log. Routine maintenance and inspection includes weekly, monthly and annual schedules. Inspection Checklists are used to record both scheduled and unscheduled maintenance for the equipment, valves, and instruments associated with the system. Routine weekly inspections are performed and documented on the O&M Report and Facility Operations Log. Routine monthly, quarterly, semiannual, or annual wellhead inspections are documented on the Monthly Inspection Checklist.

3.5.3.2 O&M REQUIREMENTS – GROUNDWATER MONITORING

The monitoring and extraction wells associated with the remedy are shown on Figure 2-7. The monitoring network consists of 151 monitoring locations (including 10 multiport WestBay multiport monitoring wells with a total of 63 individual ports and 88 single, cluster, or nested monitoring wells) and 43 extraction well locations.

In accordance with the *Performance Monitoring and Sampling and Analysis Plan* (Earth Tech 2007), optimization of well sampling and monitoring frequencies is conducted regularly.

3.5.3.3 O&M REQUIREMENTS – SGU TREATMENT PLANT SAMPLING

Evaluation concentration level (ECL) monitoring is performed quarterly upstream of the point of connection between the Navy's transfer station and IRWD's SGU Treatment Plant. This sampling point is identified as the evaluation concentration level monitoring point (ECLMP). Continued sampling at the ECLMP was recommended in the Draft 2013 Annual Remedy Status Report (ARSR) (ECS 2014).

Water discharged from the SGU Treatment Plant is sampled by IRWD to monitor compliance with the discharge permit requirements. Water discharged to the SOCWA brine line is monitored in accordance with RWQCB Order No. R9-2006-0055. Air discharged from the SGU Treatment Plant is also monitored to ensure compliance with South Coast Air Quality Management District (SCAQMD) Rule 1401 as specified in the O&M Plan (Tetra Tech 2007a).

3.5.3.4 O&M REQUIREMENTS – PA TREATMENT PLANT

The PA extraction wells (ET-1, ET-2 and IRWD-78 [well IRWD-78 was replaced in April 2012 due to well deterioration and diminishing pumping rates]) are sampled quarterly for VOCs by OCWD. If the VOC concentrations are below MCLs in ET-2 and IRWD-78, the extracted water will continue to be distributed directly into the non-potable system. If VOC concentrations exceed the MCLs, the water will be pumped to the PA Treatment Plant (located at ET-1) using the existing transmission pipelines prior to distribution to the non-potable system.

Intake to the PA Treatment Plant is sampled quarterly by OCWD for VOCs, general chemistry, metals, radionuclides, and other organic constituents to monitor compliance with the ECLs.

Water discharged from the PA Treatment Plant is sampled to monitor compliance with the criteria for discharge into the non-potable system as described in the PA O&M Plan (Tetra Tech 2007b). Air discharged from the PA Treatment Plant is also monitored to ensure compliance with SCAQMD Rule 1401 as specified in the O&M Plan (Tetra Tech 2007b).

3.5.3.5 O&M REQUIREMENTS – INSTITUTIONAL CONTROLS

ICs associated with the remedy apply primarily to access restrictions and protection of treatment system components. Annual inspection and reporting is performed to document compliance with ICs. The annual inspection documents the status of compliance with the ICs in the Environmental Restriction Covenant and Agreements, and quitclaim deeds protecting on-Base extraction, injection, and drinking water wells, monitoring wells, and associated piping and equipment. Results of the IC inspections, including the LUC Compliance Certificates, are submitted with the ARSRs.

3.5.3.6 PROBLEMS ENCOUNTERED

SGU Extraction and Conveyance System

During the initial months of operation, the SGU extraction and conveyance system experienced a few shutdowns, primarily in response to shutdowns of the IRWD SGU Treatment Plant. The average uptime efficiency for the year 2006 was 62 percent. The average uptime increased to 85 percent from April 2007 through August 2007, and to 94.2 percent for the period from September 2007 to August 2008. In 2013, the system operated at an average uptime efficiency of 96.9 percent.

Several months after startup, the pump discharge strainers in certain wells became plugged more frequently than others. The strainers are now monitored based on operational needs by noting the

increase in discharge pressure; the strainers are cleaned out as frequently as necessary to maintain pump operation.

The volume of groundwater extracted from the SGU in 2013 (fiscal year 1 October 2012 through 30 September 2013) was 207,839,128 gallons (measured at the transfer pump flow totalizer) compared to 125,232,340 gallons removed during the first year of operation (which was affected by the IRWD SGU Treatment Plant shutdowns). The annual IRWD SGU Treatment Plant contractual treatment volume is 208,000,000 gallons.

The ECLMP has been sampled at a frequency ranging from monthly to quarterly to evaluate compliance with the ECLs. During 2013, two compounds exceeded their respective ECLs: trichlorotrifluoroethane (Freon-113), with persistent exceedance, and silica (with isolated exceedance). However, these exceedances are within the range of analytical error. The Navy and IRWD have worked closely to assess the possible implications of ECL exceedances. To date, the ECL exceedances have been minor or sporadic. In addition, there were no consequences for these exceedances as the IRWD Treatment Plant has sufficient capacity to treat the extracted groundwater at these concentrations without applying additional treatment methods. The ECL exceedances have not adversely impacted either the IRWD treatment processes or the SGU Treatment Plant's capacity to achieve its discharge requirements.

The most frequent operational issue for the IRP Site 24 extraction system during the initial years of operation was the flooding of some well vaults during periods of heavy rain, which in some cases occurred as a result of clogged storm drains. In other cases, water seeped in through the bottom of some of the well vaults. The Navy's O&M contractor identified the wells with this condition and engineered a solution to prevent flooding from occurring in the future.

There have also been a few incidents where groundwater conveyance system components were damaged by tenants of the Lessee (OCGP). The Navy and OCGP have worked together to establish measures to ensure the Lessee tenants protect the conveyance system components.

SGU and PA Treatment Plants

The following significant events were encountered during the *startup phase* and initial operational years of the SGU and PA Treatment Plants:

- Air heaters at both SGU and PA Treatment Plants failed due to excessive moisture buildup. The heaters were replaced and the installation was modified to minimize moisture buildup.
- The PA Treatment Plant air stripper could not operate at the maximum design flow rate of 1,000 gpm because of the flooding of the air stripper trays and activation of the relief valve at flows greater than 850 gpm. In July 2009, visual inspection of the air strippers was conducted. Severe calcium, and possibly iron fouling was observed in both air stripping towers (IRWD 2009a). The scaled trays of the air strippers were disassembled, cleaned and reassembled in October 2009 (IRWD 2010). Scale inhibitor systems were installed and tested at both locations, and were found to be effective in preventing scale build-up. In addition, inlet water nozzles were removed from the air stripper manifolds in August 2009, which significantly reduced the backpressure, and flow rate through the air strippers increased to over 1,000 gpm without compromising the VOC removal process (IRWD 2009b).
- In the second quarter of 2009, IRWD encountered severe iron bacteria growth in well IRWD-78, which limited the outflow from this well (IRWD 2009a). The IRWD

- evaluated alternatives for well rehabilitation; however, it was concluded that rehabilitation might not increase the well capacity to the expected flow rate of 600 gpm because of the well dynamics and prior well development history. Therefore, the existing well IRWD-78 was destroyed, and replaced with a new well IRWD-78, which was put in operation in April 2012.
- Influent water to the SGU system was found to have perchlorate concentrations ranging from 6 µg/L to 9.3 µg/L. While these concentrations are lower than the ECL, they exceeded the permit limits for injection at IDP-1. Therefore, injection well IDP-1 could not be placed into service.
 - Carbon replacement was not performed in accordance with the documented O&M procedures at either the SGU or PA Treatment Plants. This led to incomplete treatment of TCE vapors and their subsequent discharge into the atmosphere from the SGU Treatment Plant between October 2007 and April 2008 and between December 2008 and March 2009; and discharge from the PA Treatment Plant between February 2008 and March 2009. Starting from June 2010, a regular GAC changeout pattern was established; the GAC vessels in the SGU unit were replaced every two to five months, and the GAC vessels in the PA unit were replaced every 7 to 12 months. The GAC media changeout procedures were finalized in October 2010 and SGU and PA Treatment Plan O&M Manuals were updated accordingly. Although the carbon replacement was not performed at the recommended intervals during the early stage, the treatment systems did not pose unacceptable risks to human health according to SCAQMD health risk criteria.

4. Progress Since the Last Review

4.1 IRP SITES 2 AND 17

The first five-year review report (DON 2009b) concluded that the remedies at IRP Sites 2 and 17 are being implemented in accordance with the ROD (DON 2000) and are protective of human health and the environment. The report further found that potential exposure to waste at IRP Sites 2 and 17 has been addressed through construction of landfill caps that isolate and contain the waste and impacted soil, installation of access restrictions and warning signs, and implementation of ICs; and long-term protectiveness of the remedial actions will be ensured by O&M activities including cover inspection and maintenance; and groundwater, LFG, and unsaturated zone monitoring.

Therefore, no recommendations or follow-up actions were required to ensure protectiveness of the remedies. However, consistent with the U.S. EPA Guidance (U.S. EPA 2001), recommendations were made that did not directly relate to achieving or maintaining the protectiveness of the remedies, but pertained to activities such as O&M of the remedies and coordination with other agencies. These recommendations and the current status for each are presented in Table 4-1.

Table 4-1: IRP Sites 2 and 17 – Status of Recommendations from the First Five-Year Review

No.	Recommendation	Party Responsible for Implementing Recommendation	Current Status
1	OCGP is planning on opening discussions with the Department of the Interior/FAA regarding access to the areas in the vicinity of IRP Sites 2 and 17 for guided (docent-lead) tours. It is recommended that the Navy coordinate with the FAA in its discussions with OCGP regarding access to the areas in the vicinity of IRP Sites 2 and 17 for guided tours. It should be ensured that the remedies at IRP Sites 2 and 17 remain protective of any potential receptors due to the planned use of IRP Sites 2 and 17 for guided tours. The Navy in coordination with the FAA should consider limiting OCGP access for guided tours to access roads at the sites.	Navy and FAA	OCGP has not initiated docent-lead tours. Prior to conducting these tours, the Navy will coordinate with FAA/FBI and OCGP.

4.2 IRP SITES 3 AND 5

This was the first five-year review for IRP Sites 3 and 5.

4.3 ANOMALY AREA 3

This was the first five-year review for AA 3.

4.4 IRP SITE 16

The first five-year report (DON 2009b) concluded that based on the technical assessment, the MNA remedy at IRP Site 16 is being implemented in accordance with the ROD (DON 2003) and is protective of human health and the environment. Further, until MNA attains groundwater cleanup goals at the site, exposure pathways that could result in unacceptable risks to human receptors are being controlled with ICs.

Consistent with the U.S. EPA Guidance (U.S. EPA 2001), Table 4-2 presents the recommendations and their current status that did not directly relate to achieving or maintaining the protectiveness of the remedy; but rather pertained to activities such as O&M of the remedy and coordination with other agencies.

Table 4-2: IRP Site 16– Status of Recommendations from the First Five-Year Review

No.	Recommendation	Party Responsible for Implementing Recommendation	Current Status
1	The Navy and regulatory agencies are working together to finalize the vadose zone monitoring strategy for IRP Site 16.	Navy	Proposed closure and exit strategy for vadose zone soil was presented to regulatory agencies in May 2009. A determination by U.S. EPA that the current body of data is sufficient to evaluate attainment of RAOs related to closure of the deep vadose zone was made in 2010. As a result, soil gas sampling has been discontinued. Upon Regulatory concurrence and finalization of the Draft RACR (Trevet and AECOM 2011), closure of the deep vadose zone at IRP Site 16 will be achieved.
2	The planned soil excavation activities as part of PCAP to remove residual petroleum hydrocarbons will have short-term, incidental impacts on two elements of the IRP Site 16 groundwater remedy. These two elements include approximately six monitoring wells and the positive drainage required over the main pit area. It is recommended that the Navy restore the site to ensure positive drainage over the main pit area and replace the impacted wells as appropriate to ensure effective monitoring and attainment of RAOs presented in the ROD.	Navy	Soil excavation activities as part of the PCAP was completed in 2010. The site was backfilled with clean fill and graded to divert run-off away from the source area and toward the drainage swale in accordance with the ROD. The affected wells were properly abandoned, and then additional wells were added as required (see Section 3.4.2.1).
3	Continue to evaluate lateral extent of VOCs in groundwater and augment groundwater monitoring network as required to confirm distribution of TCE to the west and northwest.	Navy	The Navy continues to review the adequacy of the monitoring well network and has installed additional monitoring wells. Additional wells may be added as required to confirm the distribution of TCE to the west and northwest.

4.5 IRP SITES 18 AND 24

The first five-year review report (DON 2009b) concluded that the remedies at IRP Sites 18 and 24 are being implemented in accordance with the ROD (DON 2002a) and are protective of human health and the environment. The report further found that the groundwater extraction and treatment implemented to attain groundwater cleanup objectives at IRP Sites 18 and 24 is operating properly. In the interim, exposure pathways that could result in unacceptable risks to human receptors are being controlled with ICs.

Consistent with the U.S. EPA Guidance (U.S. EPA 2001), Table 4-3 presents the recommendations and their current status that did not directly relate to achieving or maintaining the protectiveness of the remedy; but rather pertained to activities such as O&M of the remedy and coordination with other agencies.

Table 4-3: IRP Sites 18 and 24 – Status of Recommendations from the First Five-Year Review

No.	Recommendation	Party Responsible for Implementing Recommendation	Current Status
1	Continue to evaluate monitoring and other O&M data, and make specific recommendations to further optimize the groundwater extraction and treatment systems per the Performance Monitoring and Sampling and Analysis Plan (Earth Tech 2007).	Navy	Monitoring and system O&M data were evaluated and recommendations for remedy optimization were made in the ARSRs.
2	Continue to ensure periodic communication/coordination between the Navy, IRWD, and OCWD for evaluation of the performance of the IRP Sites 18 and 24 Treatment Plants.	Navy, IRWD, and OCWD	IRWD issued quarterly O&M Reports to the Navy, RWQCB, U.S. EPA, and DTSC. Regular meetings were held among the IRWD, OCWD, and the Navy.
3.	Ensure timely completion of detailed O&M Reports presenting data for the IRP Site 18 groundwater extraction system and for the IRP Sites 18 and 24 Treatment Plants.	IRWD	IRWD issued quarterly O&M Reports to the Navy and regulatory agencies.
4	Ensure O&M Manual procedures are followed so that the treatment systems and in particular the activated carbon units for vapor-phase treatment operate as designed.	IRWD	Starting from June 2010, a regular GAC changeout pattern was established; the GAC vessels in the SGU unit were replaced every 2 to 5 months, and the GAC vessels in the PA unit were replaced every 7 to 12 months. The GAC media changeout procedures were finalized in October 2010, and SGU and PA Treatment Plan O&M Manuals were updated accordingly.
5	Evaluate long-term effects on plume capture if the lower PA extraction rates documented in the last six months persist.	IRWD	Additional groundwater flow and transport modeling was conducted to support a new ESD (IRWD 2012). Various phases of this modeling have been completed and the report is in preparation. This modeling study will serve as the basis for a new ESD that will revise the flow rates for the IDP wells presented in the 2006 ESD (DON 2006b) (see Section 5.4.5 for details).

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5. Five-Year Review Process

This section discusses the activities performed during the five-year review process for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3. The status of these sites is summarized in Table 5-1. The Navy conducted a five-year review at these sites in accordance with the following guidance documents:

- *Comprehensive Five-Year Review Guidance* (U.S. EPA 2001);
- *Department of Navy Policy for Conducting Five-Year Reviews Under the Installation Restoration Program* (DON 2011a);
- *Recommended Evaluation of Institutional Controls: Supplement to the Comprehensive Five-Year Review Guidance* (U.S. EPA 2011a);
- *Five-Year Summary Form Template* (U.S. EPA 2011b); and
- *Clarifying the use of Protectiveness Determinations for CERCLA Five-Year Reviews* (U.S. EPA 2012).

The five-year review process at each of the eight sites addressed in this report consisted of the following components:

- Administrative component;
- Community notification and involvement;
- Document review;
- Data review;
- Site Inspection;
- Interviews; and
- Protectiveness determination.

Table 5-1 : Summary of Status of IRP Sites 2, 3, 5, 16, 17, 18, 24, and Anomaly Area 3

Site ID	Summary of Current Status
IRP Sites 2 and 17	The selected remedy for the vadose zone at both IRP Sites 2 and 17 includes landfill capping and ICs. The ROD (DON 2000) documented NFA for IRP Site 17 groundwater. Remedial action construction at IRP Sites 2 and 17 was completed in February 2008 and July 2008, respectively. In June 2009, the Navy signed a Final ESD (DON 2009a) that documents significant and non-significant changes in certain components of the selected remedies for IRP Sites 2 and 17 presented in the Final Interim ROD. In May 2011, the Navy signed a final ESD (DON 2011b) that documents a significant change to the widths of the buffer zones surrounding the landfills from 1,000 feet to 100 feet, and also documented a non-significant change. The FFA signatories concurred with the RACR for IRP Sites 2 and 17 (Earth Tech 2009a) and that the RAOs have been attained. The remedial action for groundwater is currently in progress at IRP Site 2. O&M/LTM activities are currently in progress at both sites.
IRP Sites 3 and 5	The selected remedy for vadose zone at both IRP Sites 3 and 5 includes landfill capping and ICs. The ROD (DON 2008a) documented NFA for groundwater at these sites. Remedial action construction at IRP Sites 3 and 5 was completed in January 2012 and December 2010, respectively. The FFA signatories concurred with the RACR for IRP Sites 3 and 5 (Shaw 2012) and that the RAOs have been attained. O&M/LTM activities are currently in progress at both sites.
Anomaly Area 3	The selected remedy for vadose zone at AA 3 includes landfill capping and ICs. The ROD (DON 2010a) documented NFA for groundwater at the site. Remedial action construction at AA 3 was completed in February 2012. The FFA signatories concurred with the RACR for AA 3 (ERRG 2012) and that the RAOs have been attained. O&M/LTM activities are currently in progress at the site.
IRP Site 16	The selected groundwater remedy for IRP Site 16 includes MNA and ICs and monitoring for the

Site ID	Summary of Current Status
	vadose zone (soil deeper than 10 feet bgs). The ROD (DON 2003) documented NFA for shallow soil at the site. The U.S. EPA determined that the current body of data is sufficient to evaluate the attainment of RAOs relating to closure of the deep vadose zone (U.S. EPA 2010). As a result, soil gas sampling was discontinued. Upon regulatory concurrence and finalization of the Draft RACR (Trevet and AECOM 2011), closure of the deep vadose zone at IRP Site 16 will be achieved and maintenance of the positive drainage within the Main Pit Area will no longer be required. The installation of groundwater monitoring wells required for implementation of the selected remedy following the ROD (DON 2003) signature commenced in September 2004 (CDM 2006). The OPS Evaluation Report evaluation for the remedy was completed in September 2007, was implemented as designed, and was operating properly and successfully in accordance with CERCLA Section 120(h)(3). The FFA signatories concurred with the OPS evaluation. Periodic groundwater monitoring is currently in progress.
IRP Sites 18 and 24	The Final OU-2A ROD (DON 2006a) documented NFA for the IRP Site 24 vadose zone based on the protection of human health and the environment. The selected groundwater remedy in the ROD (DON 2002a) at both IRP Sites 18 and 24 includes groundwater extraction and treatment, and ICs. During the RD, the CERCLA remedy was modified and the changes were documented in an ESD signed in June 2006 (DON 2006b). Another ESD to the OU-1 and OU-2A Groundwater ROD was prepared in December 2008 to address vapor sampling at the conclusion of groundwater remediation at the vadose zone source area (DON 2008b). Remedial action construction activities at IRP Sites 18 and 24 were completed and I-RACRs were issued in March 2008 (Tetra Tech 2008) and August 2007 (Weston 2007a), respectively. The FFA signatories concurred with the I-RACRs. The Final OPS issued in July 2010 provides documentation to demonstrate that the IRP Site 24 groundwater remedy was implemented as designed and was operating properly and successfully in accordance with CERCLA Section 120(h)(3). O&M/LTM activities are currently in progress at both sites.

5.1 ADMINISTRATIVE COMPONENTS

The lead agency for this five-year review is the Navy. The five-year review team for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 was led by the Navy BRAC PMO West, Remedial Project Managers (RPMs) and the BRAC Environmental Coordinator (BEC). The members of the five-year review team included:

- AECOM – Included technical experts such as civil/environmental engineers, geologists, hydrogeologists, and risk assessors.

During February and March 2014, the five-year review team established the review schedule for each of the five IRP sites addressed in this Report. The components of the five-year review included:

- Community notification and involvement;
- Review of relevant documents pertaining to IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3;
- Review and analysis of relevant data presented in the reports for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3;
- Inspection of IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3;
- Interviews; and
- Preparation of this Five-Year Review Report.

The schedule for five-year review of IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 called for a draft Five-Year Review Report to be issued in June 2014 and the final report to be issued prior to September 2014.

5.2 COMMUNITY NOTIFICATION AND INVOLVEMENT

In 1994, the Restoration Advisory Board (RAB) was established to give interested parties from local communities a channel for participation in the environmental restoration process at former MCAS El Toro. Since 1994, there have been over 90 RAB meetings. These RAB meetings typically occur every two months and are scheduled in the evenings after normal working hours (6:30 to 9:00 p.m.) at the City of Irvine City Hall, Conference and Training Center. The meetings are open to the public and include representatives from the Navy, City and County offices, and regulatory agencies. By sharing information from the regular meetings with the groups they represent, RAB members help increase awareness of the IRP process; in addition, members of the public can contact RAB members to obtain information or express concerns to be discussed at subsequent meetings.

Community members and interested parties were notified that the five-year reviews will be conducted for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 in a RAB meeting held on 23 April 2014 via a presentation. A public notice for this RAB meeting including the notification for the five-year review presentation was published in the Los Angeles Times and the Orange County Register. The agenda for this RAB meeting was mailed out to the RAB mailing list (approximately 360 recipients) approximately two weeks before the meeting. The meeting summary of this RAB meeting was mailed in June 2014 to interested parties on the RAB mailing list. In addition, a Second Five-Year CERCLA Review Update was given at the August 20, 2014 RAB meeting. Public notice of this RAB meeting and notification of the update was published in the Los Angeles Times and the Orange County Register.

The community members, represented by RAB, were also interviewed during the five-year review process for IRP sites addressed in this Report to get their views about current site conditions, problems, or related concerns (see Section 5.6 for details).

Following completion of the five-year review, a brief summary of the Five-Year Review Report will be made available to the stakeholders. This summary will include short descriptions of the remedial actions at IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3, and the results of the five-year review including the determinations of whether the remedies at the sites are protective of human health and the environment. The summary will also provide the location of site information repository where a complete copy of the report can be obtained, and provide the date of the next five-year review.

A brief summary of the results of the five-year review will also be presented to the RAB members and interested community members in a RAB meeting.

5.3 DOCUMENT REVIEW

Numerous site related documents were reviewed for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 as part of the five-year reviews for these sites. The objective of the document review was to obtain relevant information and data that could be used as the basis for assessment of the performance of the remedies implemented at the IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3. The type of documents reviewed included the following:

- Documents containing the basis for the response action including remedy decision documents such as RODs and ESDs, RI/FS reports, toxicological and chemical characteristics databases, and Federal and State statutory and regulatory requirements identified as ARARs in the remedy decision documents.
- Documents containing information about design and implementation of the remedy including RD/remedial action work plans, OPS, RACRs, and as-built drawings.

- Operational summaries provided by IRWD.
- Documents containing monitoring data and information that can be used to assess whether the remedial action continues to operate and function as designed. These documents include routine monitoring reports, and reports documenting that the remedy is OPS.

The document review list for each of the five subject IRP Sites is presented in Section 11 at the end of this Report.

5.4 DATA REVIEW

5.4.1 IRP Sites 2 and 17

O&M activities are currently being conducted semiannually at IRP Sites 2 and 17. The data from these activities from 2009 through 2013 including groundwater, unsaturated zone, and perimeter gas monitoring results are reported in semiannual/annual reports. These data were reviewed as part of this five-year review for IRP Sites 2 and 17, as presented in the sections below.

The monitoring for compliance with ICs has been conducted at IRP Sites 2 and 17 in accordance with the LUC Plan presented in Appendix C of the O&M Plan (Earth Tech 2009b), and the ESDs (DON 2009a and 2011b). The evaluation of compliance with the ICs based on this monitoring is presented in the sections below.

5.4.1.1 LANDFILL INSPECTIONS AND MAINTENANCE

Based on the results from inspections performed semiannually and following significant events, the landfill features (i.e., landfill covers, vegetation, settlement monuments, erosion, drainage system, groundwater monitoring wells, LFG probes, lysimeters, site security features, and access roads) at IRP Sites 2 and 17 were found to be in good condition.

However, minor repairs were made to the access roads at IRP Sites 2 and 17 and drainage enhancements at IRP Site 17 were constructed in March 2010 to ensure these features are maintained and remain in good condition.

Success in establishing CSS and Mulefat at IRP Site 2 received concurrence by the U.S. FWS in April 2013 following five years of monitoring and meeting the success criterion for average native cover. Vegetation at IRP Site 17 is currently exceeding its success criterion for expected average native cover.

5.4.1.2 SETTLEMENT MONUMENTS

The O&M Plan established a criterion that settlement will be deemed stabilized if no change in elevation of over 0.1-foot was recorded between three successive survey events. The difference in elevations for the settlement monuments at IRP Sites 2 and 17 between the first four quarterly events in 2009 indicated that settlement of the landfills has stabilized (AECOM 2010). Therefore, consistent with the O&M Plan, the settlement monuments were inspected and surveyed annually for Years 2 (2010) through 5 (2013). The difference in elevations of the settlement monuments at IRP Sites 2 and 17 between the previous three events indicates that settlement of waste is not occurring at a rate that would cause significant localized depressions or would compromise the integrity of the landfill. The Navy is in the process of conducting an aerial topographic survey for IRP Sites 2 and 17.

5.4.1.3 GROUNDWATER LEVEL DATA

Since March 2011, groundwater elevations at IRP Site 2 have continued to drop. Groundwater elevations in October 2013 dropped an average of 1.65 feet relative to March 2013, and have dropped an average of 3.08 feet since LTM Event #1 (November 2008). During the 2013 reporting period there was less-than-average precipitation. The general groundwater flow direction at IRP Site 2 is southwestward in the upgradient (northern) portion of the Site (under the landfill cap) and south-southwestward in the downgradient (southern) portion of the Site, consistent with previous LTM events. The horizontal hydraulic gradient in 2013 was consistent with previous reporting periods.

Since November 2008, groundwater elevations at IRP Site 17 have consistently dropped. Groundwater elevations in October 2013 dropped an average of 0.72-foot relative to March 2013, and have dropped an average of 8.74 feet since LTM Event #1 (November 2008). The general groundwater flow direction at IRP Site 17 is southwestward, and the horizontal hydraulic gradient is consistent with previous reporting periods.

5.4.1.4 GROUNDWATER CONCENTRATION DATA

Seven monitoring wells are included in the groundwater monitoring well network for IRP Site 2 and three monitoring wells are included in the groundwater monitoring well network for IRP Site 17. Currently, groundwater sampling is conducted semiannually from the four downgradient monitoring wells at IRP Site 2 (two early detection monitoring and two downgradient point of compliance monitoring wells) and two downgradient monitoring wells at IRP Site 17 (one early detection monitoring and one downgradient point of compliance [POC] monitoring wells). Groundwater monitoring was conducted quarterly for the first year from November 2008 through October 2009 and semiannually from 2010 through 2013. Groundwater samples are analyzed for VOCs, total metals, dissolved metals (October 2013 only), and general chemistry (including TDS, negative logarithm of hydrogen ion concentration [pH], specific conductance, chloride, sulfate, sulfide, and nitrate as nitrogen). In addition, semivolatile organic compounds (SVOCs), herbicides, pesticides, and polychlorinated biphenyls (PCBs) were analyzed during the first quarterly event in 2009. Deviations from the SAP have been minor and did not affect data quality or usability. Based on the results of the groundwater sampling conducted from 2009 through 2013, none of the VOCs were reported at concentrations exceeding their respective State or Federal MCLs in any of the groundwater monitoring wells sampled at IRP Sites 2 and 17.

None of the general chemistry parameters were reported at concentrations exceeding their respective MCLs or prediction limits developed in the 1st Annual LTM Report (AECOM 2010) at IRP Site 2 during 2013, except nitrate which was reported in early detection monitoring well 02PZ02 at concentrations slightly exceeding its Federal MCL of 10 milligrams per liter (mg/L). Nitrate concentrations have equaled or exceeded the MCL in five of the previous six events, and have fluctuated by approximately 150 percent. None of the general chemistry parameters were reported at concentrations exceeding their intrawell prediction limits at IRP Site 17 monitoring wells or lysimeters during the 2nd semiannual event in 2013, except chloride and sulfate. Chloride was reported at a concentration of 158 mg/L in the downgradient POC monitoring well 17NEW01 in October 2013, slightly exceeding its intrawell prediction limit of 156 mg/L. Sulfate was reported at a concentration exceeding its intrawell prediction limit in the downgradient POC monitoring well 17NEW01 in March 2013, but was less than its intrawell prediction limit in October 2013.

In the sampling events conducted from 2009 through 2010, none of the metals were reported in filtered groundwater samples at concentrations exceeding their respective State or Federal MCLs in any of the downgradient early detection groundwater monitoring wells sampled at IRP Sites 2 and

17; or their intrawell prediction limits in the downgradient POC groundwater monitoring wells. Subsequently, in January 2011, there was a spike in total metal concentrations noted in some wells at IRP Sites 2 and 17. The DTSC recommended analyzing the filtered groundwater samples, so the last round of sampling (October 2013) analyzed filtered and unfiltered groundwater samples. Filtering did reduce many of the metal concentrations to below their MCLs and prediction limits, and was determined to be more applicable for comparison. This change is being recommended as part of the 2013 Annual LTM Report, and it has no effect on the protectiveness or effectiveness of the remedy.

5.4.1.5 LANDFILL GAS DATA

The IRP Site 2 LFG monitoring network consists of five perimeter gas monitoring wells surrounding the former landfill. The IRP Site 17 LFG monitoring network consists of three lysimeters and three perimeter gas monitoring wells surrounding the former landfill. Based on the laboratory analytical results for VOCs and fixed gases, stability was demonstrated over the first four quarters of perimeter gas sampling from IRP Sites 2 and 17. Therefore, in accordance with the O&M Plan, laboratory analyses for VOCs and methane gas ceased at the end of the first four quarterly events (AECOM 2010), and subsequently perimeter wells have been monitored for VOCs and methane gas using field instrumentation during Years 2 through 5 (2010 through 2013).

Total measurable VOCs were not detected in any of the six IRP Site 2 LFG perimeter gas monitoring wells in two semiannual LTM Events #11 and #12 conducted in 2013. Methane was detected in two of the six LFG perimeter gas monitoring wells in LTM Event #11 (maximum reading was 0.1 percent), but not in any of the measurement locations in LTM Event #12. These data are consistent with the data reported in Years 2009 through 2012, and indicate no evidence of LFG exceeding the compliance limit of 5 percent or 50,000 ppmv at IRP Site 2.

Total measurable VOCs were detected in three of the six LFG measurement locations (maximum reading of 6.7 ppmv) in LTM Event #11, and in two LFG measurement locations (maximum reading of 0.9 ppmv) in LTM Event #12. Methane was detected in three of the six LFG measurement locations in March 2013 (maximum reading was 0.1 percent), and was not detected in any of the measurement locations in October 2013. These data are consistent with the data reported in years 2009 through 2012, and indicate no evidence of LFG exceeding the compliance limit of 5 percent or 50,000 ppmv at IRP Site 17.

5.4.1.6 UNSATURATED ZONE DATA

At IRP Site 17, soil moisture samples were to be collected from three lysimeters and analyzed to characterize if constituents are inconsistent with background values. Lysimeter sampling is currently conducted semiannually in two lysimeters at IRP Site 17 in accordance with the O&M Plan (Earth Tech 2009b). Because it had previously proven difficult to obtain sufficient water from lysimeter 17LYS2, the Navy recommended to discontinue monitoring lysimeter 17LYS2, and the BCT concurred during the biweekly call held on 26 June 2013. Soil moisture monitoring was conducted quarterly for the first year in 2009 and semiannually from 2010 through 2013. Samples were analyzed for total metals and general chemistry (including TDS, pH, specific conductance, chloride, sulfate, sulfide, nitrate as nitrogen, and alkalinity). In addition, SVOCs were analyzed during the first quarterly event in 2009. Deviations from the SAP have been minor and did not affect data quality or usability.

In vadose zone water, only calcium, manganese, lead, and silver were reported at concentrations exceeding their respective intrawell prediction limits in the downgradient intermediate lysimeter 17LYS1 at IRP Site 17. Results for these elements show that concentrations have fluctuated with no apparent correlations. In addition, these constituents did not exceed the intrawell prediction limits

established for the downgradient POC groundwater monitoring well 17NEW01. None of the general chemistry parameters exceeded their respective intrawell prediction limits at the downgradient intermediate lysimeter 17LYS1 with the exception of chloride during the 10th sampling event conducted in September 2012. The exceedance was not verified during the subsequent LTM events, indicating that there has been no statistically-significant increase; therefore, the landfill is in compliance with the regulatory requirements.

None of the metals or general chemistry parameters exceeded their respective intrawell prediction limits at the downgradient lysimeter 17LYS3 with the exception of chloride during the 5th sampling event conducted in March 2010, and chloride during the 10th sampling event conducted in September 2012. The exceedances were not verified during the subsequent LTM events indicating that there has been no statistically-significant increase; therefore, the landfill is in compliance with the regulatory requirements.

5.4.1.7 COMPLIANCE WITH ICs

The major portion of the ARICs at IRP Sites 2 and 17 was owned by the FAA (see Figure 2-3). In 2012, the FAA transferred this portion of the property to the FBI under a subsequent Federal agency-to-agency transfer (FAA and FBI 2012). The FBI is required to complete and submit to Navy the LUC inspection checklists included in the LUC Plan for documenting compliance/non-compliance with land-use restrictions. The data review conducted as part of this five-year review indicated that IC inspection checklists were completed and submitted by the ARIC owners. These checklists were presented to the regulatory agencies in the annual monitoring reports for IRP Sites 2 and 17.

A review of completed checklists indicates that no activities were conducted in the ARICs within the boundary of FAA (until 2012) or FBI property that are inconsistent with the land-use restrictions documented in the LUC Plan.

5.4.2 IRP Sites 3 and 5

O&M activities are currently conducted semiannually at IRP Sites 3 and 5. The data from these activities from August 2010 through December 2013 including groundwater, unsaturated zone, and perimeter gas monitoring results are reported in semiannual/annual reports. These data were reviewed as part of this five-year review for IRP Sites 3 and 5, as presented in the sections below.

The monitoring for compliance with ICs has been conducted in accordance with the LUC Plan included as an attachment to the O&M Plan for IRP Sites 3 and 5 (Shaw 2010). The evaluation of compliance with the ICs based on this monitoring is presented in the sections below.

5.4.2.1 LANDFILL INSPECTIONS AND MAINTENANCE

Based on the results from inspections performed semiannually, the landfill features (i.e., landfill covers, vegetation, settlement monuments, erosion, drainage system, groundwater monitoring wells, LFG probes, landfill gas treatment system, lysimeters, site security features, and access roads) at IRP Sites 3 and 5 were found to be in good condition.

No evidence of erosion was observed at either IRP Site 3 or IRP Site 5. As noted on the Inspection and Maintenance Checklists, numerous animal burrows were noted at both IRP Sites 3 and 5, although the burrows appeared to be inactive in the most recent inspections conducted in October 2013. In accordance with Section 3.1 of the Final O&M/LTM Plan, a maintenance program is ongoing to reduce the burrowing animal population. Baited traps are used to reduce potential

impact to non-target species. Burrows are periodically filled and compacted to the specific grade with native soil from the surrounding buffer zone. Monitoring to identify and fill new burrows will continue during inspections.

No nonroutine maintenance was required or conducted at either site during the August 2010 through December 2013 reporting period.

5.4.2.2 SETTLEMENT MONUMENTS

Because the difference in elevations for the monuments at both sites stabilized over the first three successive events (i.e., no change in elevation of over 0.1-foot), the surveying frequency after July 2011 changed from quarterly to annually in accordance with the Final O&M/LTM Plan.

The difference in elevations of the settlement monuments at IRP Sites 3 and 5 between the LTM events from September 2010 to October 2013 indicates that settlement of waste is not occurring at a rate that would cause significant localized depressions or would compromise the integrity of the landfills.

5.4.2.3 GROUNDWATER LEVEL DATA

Between September 2010 and October 2013, groundwater elevations in the IRP Site 3 monitoring wells declined by an average of 6.9 feet per well. For the October 2013 reporting period, the general groundwater flow direction at IRP Site 3 is northwestward, which is consistent with previous monitoring events.

Between September 2010 and October 2013, groundwater elevations in IRP Site 5 monitoring wells declined by an average of 5.3 feet per well. For the October 2013 reporting period, the general groundwater flow direction is westward, which is consistent with previous events.

5.4.2.4 GROUNDWATER CONCENTRATION DATA

In accordance with the Final O&M Plan (Shaw 2010), groundwater monitoring was conducted quarterly for the first year and semiannually for the following years. Currently, groundwater sampling is conducted semiannually for VOCs from the four monitoring wells (including three downgradient POC wells and one upgradient background well) at IRP Site 3, and five monitoring wells (including four downgradient POC wells and one upgradient background well) at IRP Site 5. Deviations from the SAP have been minor and did not affect data quality or usability.

VOCs were not detected in upgradient background well 03_UGMW26B in the LTM events. None of the detected VOCs in the downgradient POC wells (03_DGMW64A, 03_DGMW65XA, and 04_DGMW66A) exceeded their respective intrawell prediction limits or MCLs.

None of the detected VOC concentrations at IRP Site 5 exceeded intrawell prediction limits or MCLs, with the exception of chloroform in upgradient monitoring well 05_UGMW27B and TCE at downgradient monitoring well 05_DGMW67A.

- TCE, measured in downgradient POC well 05_DGMW67A at 6.5 µg/L in October 2011, exceeded the State and Federal MCL of 5 µg/L. This TCE concentration was nearly identical to the concentration in two previous samples (groundwater LTM Events #3 and #4), which was communicated to the regulatory agencies in the 1st Annual LTM report (Shaw 2013). Concentrations over the last five sampling events were 3.7, 3.8, 1.7, 2.8, and 1.3 µg/L, all below the intrawell prediction limit of 10.6 µg/L for well 05_DGMW67A, and

the MCL. In 2013, the sampling frequency for this well was reduced from quarterly to semiannually based on recommendations in the 2nd Annual LTM report (CE2K 2013c).

- Chloroform concentrations in upgradient monitoring well 05_UGMW27B slightly exceeded the 1.9 µg/L intrawell prediction limit in both LTM events in 2013 but did not exceed the 80 µg/L MCL.

5.4.2.5 LANDFILL GAS DATA

LFG monitoring using perimeter gas monitoring wells was performed on a quarterly basis during 2011. The LFG concentrations were considered stable as specified in the O&M Plan with sampling performed semiannually since 2011.

The concentrations of total VOCs in LFG at 14 monitoring locations ranged from non-detect to 1.1 ppmv in 2013. Methane was not detected at any of the measurement locations at IRP Site 3 in either the March or October 2013 sampling events. These data were consistent with the data reported in years 2010 through 2012, and indicate that there is no evidence of LFG exceeding the compliance limit beyond the IRP Site 3 boundaries.

At IRP Site 5, total VOCs in LFG at 19 monitoring locations were not detected in any of the March 2013 measurements; and were detected at two measurement locations in October 2013 (maximum concentration 0.2 ppmv). Methane was not detected at any of the measurement locations in 2013. These data were consistent with the data reported for IRP Site 5 in years 2010 through 2012, and indicate that there is no evidence of LFG exceeding the compliance limit beyond the IRP Site 5 boundaries.

5.4.2.6 UNSATURATED ZONE DATA

Lysimeter sampling is conducted semiannually for VOCs at two lysimeters each at IRP Sites 3 and 5 in accordance with the O&M/LTM Plan (Shaw 2010).

Soil moisture samples from the two IRP Site 3 lysimeters contained low concentrations of six VOCs (2-butanone, acetone, bromodichloromethane, chloroform, methyl tertiary butyl ether [MTBE], and TCE) in one or both of the 2013 sampling events. None of the VOCs found in the soil moisture samples in 2013 were present in downgradient POC well samples at concentrations exceeding the groundwater intrawell prediction limits. Soil moisture analytical data were consistent with concentrations detected in recent prior monitoring events conducted from 2010 through 2012.

At IRP Site 5, acetone was the only VOC detected in soil moisture from lysimeter 05LYS3 in 2013, and only in the October 2013 LTM event. Methylene chloride was the only VOC detected in soil moisture from lysimeter 05LYS2 in 2013, and only in the March 2013 LTM event. None of the VOCs detected in soil moisture samples in 2013 were present in downgradient POC well samples at concentrations exceeding the groundwater intrawell prediction limits. Soil moisture analytical data were consistent with concentrations detected in recent prior monitoring events conducted from 2010 through 2012.

5.4.2.7 COMPLIANCE WITH ICs

This portion of former MCAS El Toro has been leased to Heritage Fields, LLC (OCGP Corporation and Lennar Corporation) in accordance with the FOSL (DON 2004) and LIFOC (DON 2005) pending the completion of ongoing environmental investigations and/or response actions. The interim land-use restrictions in these areas are administratively handled through the LIFOC. The

interim land-use restrictions in the LIFO meet the objectives of the ICs presented in the ROD (DON 2008a). Based on the evaluation of ICs compliance monitoring reports submitted to date, no activities have been conducted at IRP Sites 3 and 5 that may adversely affect the integrity of the landfill caps and present unacceptable risk to human health due to potential exposure to residual contamination.

5.4.3 Anomaly Area 3

O&M activities are conducted in accordance with the Final O&M/LTM Plan (ERRG 2011a) at AA 3. The data from these activities from February 2012 through December 2013 including groundwater, and landfill gas monitoring results are reported in semiannual/annual reports. These data were reviewed as part of this five-year review for AA 3, as presented in the sections below.

Monitoring for compliance with ICs has been conducted in accordance with the Final O&M/LTM Plan for AA 3 (ERRG 2011a). The evaluation of compliance with the ICs based on this monitoring is presented in the sections below.

5.4.3.1 LANDFILL INSPECTIONS AND MAINTENANCE

Based on quarterly inspections conducted during this monitoring period at AA 3, all landfill features, including the soil cover, settlement monuments, drainage systems, groundwater monitoring wells, LFG vent wells, LFG collection trenches, LFG monitoring probes, site security, and maintenance path, were in good condition and did not require maintenance. Installation and operation of the active LFG extraction and treatment system was not required during the February 2012 through December 2013 monitoring period because LFG monitoring results indicated that neither methane nor NMOCs were present in LFG. LFG monitoring data will continue to be evaluated during future monitoring events to determine whether an active LFG extraction and treatment system should be implemented. If implemented, the system will be subject to inspection and maintenance, as are all other remedy components.

Animal burrows were identified in 2013 near the finger dike, gas collection trenches GTR-01 and GTR-03, and monitoring well MW13. Burrows were located in both the cover and the sidewalls of the perimeter drainage channel and ranged from 2 to 6 inches in diameter. All burrows were filled and compacted to the existing grade (with on-site soil that was displaced to dig the burrow) to reduce the potential for erosion in disturbed areas.

During the May 2013 inspection event, one minor issue was noted (and promptly repaired) at the sign located on the main entrance gate. Specifically, one of the four clasps that secured the sign to the gate was missing during the inspection, but was replaced on the following day. In addition, a second (redundant) clasp was placed at each corner of the sign to provide additional reinforcement. All other areas (fences, gates, and remaining signs) were found to be intact and in good condition. During each of the two subsequent inspection events, the fences, gates, and signs were found to be intact and in good condition, and no additional maintenance was required.

No non-routine O&M visits were required during 2012 and 2013; however, the vegetative cover was mowed and select portions were reseeded to achieve the target vegetation density (97 percent vegetative growth across the cover).

5.4.3.2 SETTLEMENT MONUMENTS

The survey data in January 2013 and December 2013 indicated that none of the three settlement monuments have settled to any significant degree since they were installed in January 2012

following the remedial action construction activities. These data indicate that settlement does not compromise the integrity of the landfill.

5.4.3.3 GROUNDWATER LEVEL DATA

Depths to groundwater in monitoring wells were measured during the semiannual monitoring events to calculate the groundwater elevations and evaluate groundwater flow direction and gradients. Between April 2012 and November 2013, groundwater elevations in the AA 3 monitoring wells declined by an average of 1.5 feet per well. Groundwater generally flows from east to west across the site.

5.4.3.4 GROUNDWATER CONCENTRATION DATA

Currently, groundwater sampling is conducted semiannually for VOCs, SVOCs, metals, TPH, and general minerals from the eight monitoring wells at AA 3. Analytical results from the semiannual monitoring events in 2012 and 2013 confirmed that concentrations of metals, VOCs, SVOCs, and TPH in groundwater were not impacted by site activities and were consistent with historical results.

Concentrations of several metals measured in POC monitoring wells MW01 and MW09A during the third semiannual monitoring event in 2013 exceeded their interwell and intrawell prediction limits. Consistent with the decision rules, wells MW01 and MW09A were resampled during the fourth semiannual monitoring event, and the metals concentrations were compared with their interwell and intrawell prediction limits. With the exception of iron at POC monitoring well MW01, concentrations of all metals that had exceeded their interwell and intrawell prediction limits during the third semiannual monitoring event did not exceed these limits during the fourth semiannual monitoring event, thus indicating that metals concentrations in these wells remain consistent with historical concentrations reported at AA 3.

The iron concentrations (5,400 µg/L and 14,000 µg/L, respectively) measured in POC monitoring well MW01 during the third and fourth semiannual monitoring events exceeded the interwell and intrawell prediction limits, which indicates statistically significant concentrations relative to historical data. The iron concentrations measured at other POC monitoring wells are significantly lower than the recent concentrations at well MW01, which indicates that the elevated iron concentrations are isolated spatially within AA 3. Also, the iron concentration (14,000 µg/L) measured during the fourth semiannual monitoring event, while anomalously high compared with historical data, does not significantly exceed the regional screening level (RSL) (established by U.S. EPA) for tap water (11,000 µg/L). Considering the high variability of iron concentrations measured to date at POC monitoring well MW01, additional data are needed to evaluate the significance of iron concentrations relative to the RSL for tap water.

Concentrations of three additional metals (arsenic, chromium, and vanadium) at POC monitoring well MW01 exceeded their interwell and intrawell prediction limits during the fourth semiannual monitoring event; POC monitoring well MW01 will be resampled during the next (fifth) semiannual monitoring event, and arsenic, chromium, and vanadium concentrations will be compared with the interwell and intrawell prediction limits before a statistically significant result is confirmed.

5.4.3.5 LANDFILL GAS DATA

Field instruments were used to measure methane and NMOCs at the passive collection trench risers and six perimeter gas monitoring probes surrounding the landfill footprint. Neither methane nor NMOCs were detected in any of the monitoring probes or collection trench risers during the

monitoring events performed in 2012 and 2013, indicating compliance with the SAP of the Final O&M/LTM Plan (ERRG 2011a).

5.4.3.6 LEASED PROPERTY

AA 3 is located within CO II-C, an approximately 13-acre area that was leased to a private developer under the July 2005 LIFO (DON 2005). AA 3 is also part of OU-2C, which is an administrative unit established under the IRP. The site is designated as MSCR 1, a “former refuse disposal area” in the BRAC Business Plan update (DON 2010a). Based on the evaluation of ICs compliance monitoring reports submitted to date, no activities have been conducted at AA 3 that may adversely affect the integrity of the landfill caps and present unacceptable risk to human health due to potential exposure to residual contamination.

5.4.4 IRP Site 16

Data reviewed for IRP Site 16 consisted of groundwater MNA data and information concerning implementation and maintenance of the ICs. The primary source for these data was the Monitoring Data Summary Reports and Annual LTM Reports that generally provided data for the site from 2009 through 2013. Groundwater data reviewed included water level data, laboratory analytical results for TPH and VOCs for groundwater samples collected from monitoring wells, and field measurements of specific groundwater quality parameters.

5.4.4.1 GROUNDWATER LEVEL DATA

Groundwater elevation data have been collected from the IRP Site 16 wells in accordance with the Final RD (CDM 2006). Groundwater levels have fluctuated seasonally and with the amount of precipitation. There has been an overall average decline in water levels of approximately 19.5 feet since the remedy was implemented in September 2004. The groundwater gradient (reported to the northwest at 0.006 feet per foot) has been consistent in both direction and magnitude during this timeframe and is consistent with the Stationwide groundwater gradient; however, fluctuations in the water table were sufficient to potentially cause inconsistent soil gas sampling intervals within the wells selected for vadose zone monitoring.

5.4.4.2 GROUNDWATER CONCENTRATION DATA

Groundwater sampling has been conducted semiannually at IRP Site 16 in general accordance with the Final RD. Deviations from the SAP have been minor and did not affect data quality or usability. Groundwater concentration data do not exhibit clear or consistent trends associated with natural attenuation due to natural biological/chemical degradation of the VOCs. The primary mechanisms occurring at the site to attenuate TCE in groundwater are physical processes (including dispersion, dilution, adsorption, and volatilization), rather than biological degradation. This observation is consistent with the results of previous investigations at IRP Site 16 documented in the ROD (DON 2003).

The Draft 2013 IRP Site 16 Annual Report (Trevet 2014) stated that the known distribution of TCE continues to be updated as the monitoring well network is optimized. The TCE distribution in 2013 shows the plume extending more to the north and west than was previously documented. Therefore, monitoring and continued optimization of the monitoring well network along the western boundary of the ARIC is underway.

5.4.4.3 GROUNDWATER MNA PARAMETER DATA

The groundwater MNA parameters monitored for IRP Site 16 consist of temperature, pH, specific electrical conductivity (EC), oxidation-reduction potential (ORP) and dissolved oxygen (DO). These parameters have been measured in the field semiannually during well purging in accordance with the Final RD. To date, temperature, pH, specific EC, and DO concentrations have not indicated the occurrence of natural biodegradation. Based on analytical results from multiple rounds of sampling for these MNA indicator parameters, it was concluded that the VOC attenuation mechanisms occurring at the site continue to be predominantly physical processes (e.g., advection, dispersion and diffusion) rather than by biological degradation, which is consistent with the ROD and the technical assessments performed during the RD for IRP Site 16. However, during the December 2013 sampling round, ORP was below the RD threshold of 50 millivolts in 8 of 22 wells. Additionally, methane (at low estimated concentrations) was detected across the site and cis-1,2- dichloroethene (DCE) was reported in the source area. These data suggest that reductive dechlorination may be occurring in some portions of the plume, although a Mann-Kendall statistical analysis of TCE data indicates an increasing or probably increasing trend in six wells (16_MW05, 16_MW08, 16_MW09, 16_MW13, 16_MW15, and 16_MW19).

5.4.4.4 COMPLIANCE WITH ICS

In 2012, the area comprising IRP Site 16 was transferred in part to the City of Irvine and in part to Five Point Communities, Inc. Land-use restrictions are enforceable at the site through the CRUP recorded against the property on 5 May 2010 and the Quitclaim Deed (DON 2011c). Prior to transfer, and for a portion of the period covered by this Five-Year Review, IRP Site 16 was leased to Heritage Fields, LLC. During this period of time, interim land-use restrictions at IRP Site 16 were administratively handled through a LIFO. Under the LIFO, the Lessee was required to fill out a PERF for any work proposed in the leased portion of the property. The land-use restrictions in the CRUP and the previous LIFO prevent activities that may adversely impact the remedy components or may present unacceptable risks to human health and the environment. Based on the evaluation of PERFs submitted and the annual inspections completed by Five Point Communities, Inc., no activities have been conducted at IRP Site 16 that may adversely affect the remedy integrity and present unacceptable risk to human health. Additionally, no evidence of activities inconsistent with land-use restrictions was observed during the site-inspections conducted as part of this Five-Year Review.

5.4.5 IRP Sites 18 and 24

This five-year review is based on the review of the available data collected as part of system O&M for IRP Sites 18 and 24 since the previous five-year review from 2009 to 2013. Quarterly groundwater monitoring and system operation data summaries, ARSRs, and a technical memorandum on capture zone evaluation were reviewed to evaluate the remedial progress. Data collected included system operation data, compliance sampling results, and groundwater monitoring data.

The monitoring well network includes 151 sampling locations (groundwater wells or individual ports in multidepth Westbay wells). There are 103 wells/ports within the SGU, and 48 wells/ports located in the PA. Measurement of water levels and collection of groundwater samples is currently conducted semiannually or annually. Additionally, sampling for VOCs in 43 extraction wells and ECL monitoring at the SGU and PA treatment systems is conducted quarterly. Fourteen additional monitoring events during 2009 to 2013 have occurred since the previous five-year review in 2009.

5.4.5.1 GROUNDWATER EXTRACTION FLOW RATES

The extraction wells of the SGU extraction system are designed to operate at flow rates ranging from 10 to 18 gpm. The average pumping rates over the period of September 2009 to September 2013 for each well ranged from 3 to 20 gpm (CH2M Hill Kleinfelder, A Joint Venture [KCH 2014]). The four contingency wells (24SGU-36 through 24SGU-39) are each designed to operate at a flow rate of approximately 25 gpm, and the actual average pumping rates over the period of September 2009 to September 2013 for each of these four contingency wells ranged from 18 to 23 gpm (KCH 2014).

During 2012 and 2013, the four contingency wells and other boundary or near-boundary wells (24SGU-28 through 24SGU-35) were operated continuously, except for occasional maintenance outages. Operation of the remaining extraction wells was prioritized based on TCE concentrations. High priority wells (with TCE concentrations greater than 200 µg/L) were operated during the first three weeks of the month and low-priority wells (TCE concentrations less than 200 µg/L) were operated during the last week of the month to maintain a combined average flow rate of 400 gpm or less.

Of the three wells (ET-1, ET-2, and IRWD-78) used for extraction of groundwater from the PA, TCE concentrations exceeded MCLs in groundwater extracted from ET-1. The monthly average pumping rates from well ET-1 during the period of March 2009 to December 2013 were mostly greater than 900 gpm, approaching the design flow rate of 1,000 gpm, except for some occasional low pumping rates in 2009 (IRWD 2009c). The monthly average pumping rates in well IRWD-78 (297 to 421 gpm) from April 2009 to February 2011 were significantly lower than its design flow rate of 600 gpm. This well was destroyed in March 2011; a new well, IRWD-78, was installed at the previous location and started pumping operation in April 2012. The monthly average pumping rates from new well IRWD-78 ranged from 756 to 819 gpm, exceeding its design flow rate of 600 gpm. The monthly pumping rates in well ET-2 from March 2009 to December 2013 were lower than its design flow rate of 1,300 gpm (ranging from 591 to 1,008 gpm) except in February 2013 (when the well was pumped at 1,305 gpm). Despite the overall lower-than-designed pumping rates, effective hydraulic capture was achieved as evaluated in the Capture Zone Evaluation Report (KCH 2014), and discussed briefly in Section 5.4.5.3.

It should be noted that the IRWD has completed various phases of groundwater flow and transport modeling to evaluate the effects of different pumping scenarios on the TCE plume in the PA (IRWD 2011). Based on this modeling, the IRWD recommended that the IDP wells continue to pump 10 months during the calendar year at the following target flow rates: ET-1 at 975 gpm; ET-2 at 800 gpm; and new IRWD-78 at 750 gpm (IRWD 2011). These flow rates were shown to fully capture the TCE plume and prevent downgradient transport of TCE beyond Culver Drive. The modeling results were discussed with the Navy in June 2012, and a consensus was reached that additional groundwater flow and transport modeling is required to support a new ESD (IRWD 2012). Various phases of this modeling have been completed and results have been documented in a report, which as of December 2013 was under internal review by the IRWD. This modeling study will serve as the basis for a new ESD that will revise the flow rates for the IDP wells presented in the 2006 ESD (DON 2006b).

5.4.5.2 VOC MASS REMOVAL FROM SGU AND PA

The total VOC mass removed from the SGU since system startup until December 2013 is estimated at approximately 1,719 pounds. During this five-year review period (from September 2008 to December 2013), a total of approximately 1,127 pounds of VOC was removed. Compared to the average mass removal rate of approximately 30 pounds per month during the first five-year review period (from April 2007 to August 2008), the VOC mass removal rate during this five-year review

period (from September 2008 to December 2013) is lower (ranging from approximately 10 pounds per month to 29 pounds per month).

Groundwater is extracted from the PA using three wells, ET-1, ET-2, and IRWD-78. Since ET-2 and IRWD-78 are located in areas of the PA where TCE concentrations are generally below the MCL, mass removal from wells ET-2 and IRWD 78 is significantly less than that from well ET-1. Since startup, the total VOC mass removed from well ET-1 has been approximately 142 pounds. For 2013, the estimated total VOC mass removed from the PA was 32.16 pounds, with mass removed from each well as follows: well ET-1, 18.38 pounds; well ET-2, 2.76 pounds; and well IRWD-78, 11.02 pounds.

Groundwater extracted from the SGU and PA is treated at the SGU and PA Treatment Plants, that are operated by the IRWD. TCE is first removed from extracted groundwater using air-strippers that transfer it into vapor phase. Vapor phase TCE is then treated using two GAC filters in series. An evaluation of treatment system data indicates that the air-strippers at the SGU and PA Treatment Plants are removing TCE from extracted groundwater at removal efficiencies approaching 100 percent (IRWD 2014).

Air stripping was effective in removing VOCs from extracted groundwater, with effluent TCE concentrations less than 2 µg/L in both SGU and PA Treatment Plants.

The operation of the vapor phase GAC in both SGU and PA water treatment systems experienced an unstable period until June 2010. A review of influent and effluent TCE concentrations for the vapor-phase GAC filters indicated breakthrough of VOCs through both the primary and secondary filters. Carbon replacement was not performed at required frequencies at either the SGU or PA Treatment Plants between October 2007 and May 2010. This led to the release of TCE vapor concentrations up to 210 parts per billion by volume (ppbv) (in January 2010) and 24 ppbv (in February 2010) from the SGU Treatment Plant and from the PA Treatment Plant, respectively. Starting from June 2010, a regular GAC changeout pattern was established; the GAC vessels in the SGU unit are replaced every 2 to 5 months, and the GAC vessels in the PA unit are replaced every 7 to 12 months. Although the carbon replacement was not performed at the recommended intervals during the early stage (up to May 2010), the treatment systems did not pose unacceptable risks to human health according to the SCAQMD health risk criteria (see below).

Both treatment systems are operated under SCAQMD Permits that require treatment of VOCs to comply with SCAQMD Rule 1401 and not pose an unacceptable risk to human health for nearby receptors. An evaluation of the risks associated with these VOC discharges was performed using the methodology and calculator developed by the SCAQMD. This evaluation, based on available monitoring data, assumed the GAC filters were operating at zero percent efficiency (i.e., no treatment of vapor phase TCE) and maximum TCE air discharge rates. Results from this risk evaluation indicated that TCE vapors discharged into the atmosphere did not pose unacceptable risks to human health for potential residential and/or commercial receptors. Risk estimates for the SGU and PA Treatment Plants did not exceed the SCAQMD Rule 1401 risk threshold of 10 in 1 million (1×10^{-5}). Therefore, the treatment systems met the thresholds of SCAQMD ARARs identified in the ROD for IRP Sites 18 and 24.

5.4.5.3 GROUNDWATER ELEVATION MONITORING AND HYDRAULIC CAPTURE

The design and extraction strategy was to initially focus extraction in areas with higher VOC concentrations near and downgradient of the source area with extraction subsequently increasing toward the Base boundary. A review of groundwater elevation data and modeling results indicates

that the extraction wellfield is performing as designed. Despite the general decline of groundwater elevation from the start of system operation to December 2013 in upgradient wells that are not likely affected by the extraction system (averaged 13.26 feet), a greater decrease of groundwater elevation was observed in wells located within the influence of the extraction system (averaged 18.78 feet). A groundwater elevation depression was achieved within the radius of influence of the extraction wells, and inward groundwater flow gradients have been established, resulting in capture of the on-Station portion of the SGU plume (KCH 2014).

Analytical modeling methods were used to analyze groundwater capture by the on-site extraction system, using pumping rates from 2008 to 2013. The modeling results indicate that the current extraction barrier and pumping rates are sufficient to capture the SGU plume (KCH 2014).

A comparison of TCE plumes between April 2008 and March 2013 shows attenuation of TCE contaminant in both the PA and the SGU. For the PA, migration of the plume was minimal, and the plume as a whole experienced a reduction in VOCs from April 2008 to March 2013, suggesting containment of contaminants by the PA Treatment System. Within the SGU, TCE concentrations decreased across the plume, and the lateral width of concentrations exceeding 50 µg/L decreased. The plume itself did not migrate beyond the SGU extraction system, indicating remedy effectiveness (KCH 2014).

As reported in the 2012 ARSR (Weston 2013), the SGU TCE plume boundaries are a close match to the 10-year prediction developed as part of the 2009 capture zone evaluation (AECOM 2009). The results are consistent with the simulations performed in support of Final RD and indicate that the remedy will achieve RAOs. Hot spot removal (TCE concentrations exceeding 500 µg/L) was expected to be complete within the initial 10 years of remedy implementation. Based on 2012 and 2013 sampling data, after six years of operation the hot spot removal appears to have been accomplished (the highest TCE concentration detected was 360 µg/L), though the permanence of these reductions has not yet been established.

5.4.5.4 COMPLIANCE WITH ICS

On-Base Portion of the SGU Plume

The Navy currently leases a part of the on-Base portion of the area overlying SGU plume to Heritage Fields, LLC (OCGP Corporation and Lennar Corporation) (see Figure 2-2). The interim land-use restrictions for this area are administratively handled through a LIFOC until the time this property overlying the SGU plume is conveyed by deed to the Lessee (DON and Heritage Fields 2005a and DON and Heritage Fields 2005c). The interim land-use restrictions in the LIFOC prevent activities that may adversely impact the SGU remedy components or may present unacceptable risks to human health and the environment. The Lessee is required to fill out a PERF for any work proposed in the leased portion of the property. Based on the review of documentation provided in the ARSRs (Weston 2009; 2011; 2012a; 2013), no activities have been conducted in the area overlying the SGU plume that may adversely affect the remedy or present unacceptable risk to human health.

Portions of IRP Site 24 have been transferred to the City of Irvine, and the land-use restrictions are enforceable through the CRUP and the Quitclaim Deed. The Navy coordinates with property owners within these areas to ensure that construction activities that are planned or underway on transferred property do not impact components of the IRP Site 24 extraction and conveyance system. The Navy reserved certain easements to ensure adequate protective measures are in place for the IRP Site 24 extraction and conveyance system. The Navy requires property owners to prepare a WIEA document that provides protective measures for construction

within the easement area. Lessees are required to prepare a PERF to document protective measures within the Navy's leased areas.

In 2012, the Navy coordinated with the OCGP for the construction of the South Lawn, which included the installation of several utility lines within the easement area. The OCGP provided a WIEA (WIEA-001) to the Navy for review to ensure adequate protective measures are in place for the IRP Site 24 extraction and conveyance system. The Navy personnel periodically visit the construction site to ensure the WIEA protective measures are in place and effective. WIEA 001 was amended on 8 February 2012 to incorporate the rerouting of the 12-kV line that was initially installed for the IRP Site 24 extraction and conveyance system.

The LUCs compliance certificates completed by the Navy, OCGP Corporation, Heritage Fields El Toro, Council of Orange County Society of St. Vincent de Paul, and City of Orange from 2009 through 2013 are documented in the ARSRs and were reviewed as part of this five-year review. These compliance certificates do not indicate any activities that are not in compliance with the ICs.

Off-Base Portions of VOC Groundwater Plumes

The ICs for the off-Base portion of the VOC groundwater plumes associated with IRP Sites 18 and 24 (see Figure 2-2) are based on local permit programs administered by OCHCA and IRWD. The OCHCA and IRWD have completed compliance checklists for calendar years 2009 through 2013. These checklists indicate that during this five-year review period (2009 to 2013), two well construction permits were issued; permit number 11-08-19 for the Navy, permitting replacement of abandoned monitoring well 07DBMW43A with new monitoring well 07DBMW43B; and permit number 11-06-22, for Exxon Mobil Oil Corporation, permitting installation of one monitoring and three air sparge/soil vapor extraction wells. These wells were constructed within the groundwater plume for IRP Sites 18 and 24 during 2011; however, none of the wells are classified as water wells used for irrigation or private/domestic drinking water.

5.5 SITE INSPECTION

Site inspections were conducted for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 as part of the five-year review to provide information about the status of these sites, and to visually confirm and document the conditions of the remedies, the sites, and the surrounding areas. The inspection events were conducted on 6 March and 13 March 2014. These inspection events were conducted by a team consisting of representatives from the Navy and the Five-Year Review Contractor.

Table 5-2 presents a list of participants for the site inspection. During these inspections, representative features of the implemented remedies at IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 including selected groundwater/perimeter gas monitoring wells, VOC treatment system components, and landfill cover components such as vegetation and drainage features were inspected. The results of the site inspections are documented in the subsections below.

Table 5-2: Details of Site Inspections

Site	Inspection Date	Inspection Participants
IRP Site 2	13 March 2014	Navy
IRP Site 3	6 March 2014	<ul style="list-style-type: none"> Morgan Rogers (RPM)
IRP Site 5	13 March 2014	<ul style="list-style-type: none"> Marc Smits (RPM)
IRP Site 16	6 March 2014	Navy Five-Year Review Contractor
IRP Site 17	13 March 2014	<ul style="list-style-type: none"> Crispin Wanyoike (Project Manager, AECOM)
IRP Site 18	6 March 2014	<ul style="list-style-type: none"> Gaurav Dhody (Senior Project Engineer, AECOM)
IRP Site 24	6 March 2014	<ul style="list-style-type: none"> Chris Cavers (Senior Project Engineer, AECOM)
Anomaly Area 3	6 March 2014	Navy O&M Contractor <ul style="list-style-type: none"> Peter Stang (Project Manager, IRP Site 16, Trevet) Dhananjay Rawal (Project Manager, IRP Site 24, ECS) Arseny Kalinsky (Project Manager, IRP Sites 18 and 24, IRWD)

5.5.1 IRP Sites 2 and 17

Site inspections were conducted at IRP Sites 2 and 17 to assess the condition of the remedies including fences and caution signs for access control; the integrity of the caps; the condition of monitoring wells; and features for storm water control. The results of the inspection events at IRP Sites 2 and 17 were compiled in one inspection checklist for each site and are included in Appendix A. Photographs taken during the inspection event on 13 March 2014 are presented in Appendix B.

The inspections indicated that cracks, settlement, holes, and bulges were generally not evident on IRP Sites 2 and 17 landfill covers. No evidence of settlement, degradation, erosion, undercutting, obstruction, or excessive vegetation growth was observed during inspection of the drainage system at IRP Sites 2 and 17. The groundwater and perimeter gas monitoring wells and lysimeters are in good condition and functioning as designed. No evidence of activities was observed at IRP Sites 2 and 17 during the inspections of these sites that were inconsistent with land-use restrictions presented in the O&M Plan. As documented previously, minor repairs to the access roads at IRP Sites 2 and 17 and drainage enhancements at IRP Site 17 were conducted in March 2010 to ensure these features are maintained and remain in good condition.

The Navy received concurrence by the U.S. FWS in April 2013 that IRP Site 2 meets the success criterion for average native cover following five years of monitoring. Vegetation at IRP Site 17 is currently exceeding its success criterion for expected average native cover.

5.5.2 IRP Sites 3 and 5

Site inspections were conducted at IRP Sites 3 and 5 to assess the condition of the remedies including fences and caution signs for access control; the integrity of the caps; the condition of monitoring wells; and features for storm water control. The results of the inspection events at IRP Sites 3 and 5 were compiled in one inspection checklist for each site and are included in Appendix A. Photographs taken during the inspection events on 6 March and 13 March 2014 are presented in Appendix B.

The inspections indicated that cracks, settlement, holes, and bulges were generally not evident on IRP Sites 3 and 5 landfill covers. No evidence of settlement, degradation, erosion, undercutting, obstruction, or excessive vegetation growth was observed during the inspection of the drainage

system at IRP Sites 3 and 5. The groundwater and perimeter gas monitoring wells and lysimeters are in good condition and functioning as designed. No evidence of activities was observed at IRP Sites 3 and 5 during the inspections of these sites that were inconsistent with land-use restrictions presented in the O&M Plan.

5.5.3 Anomaly Area 3

Site inspections were conducted at AA 3 to assess the condition of the remedies including fences and caution signs for access control; the integrity of the caps; the condition of monitoring wells; and features for storm water control. The results of the inspection events at AA 3 are compiled into the inspection checklist included in Appendix A. Photographs taken during the inspection event on 6 March are presented in Appendix B.

The inspection indicated that cracks, settlement, holes, and bulges were generally not evident on AA 3 landfill cover. No evidence of settlement, degradation, erosion, undercutting, obstruction, or excessive vegetation growth was observed during inspection of the drainage system at AA 3. The groundwater and perimeter gas monitoring wells are in good condition and functioning as designed. No evidence of activities was observed at AA 3 during the inspections of these sites that were inconsistent with land-use restrictions presented in the O&M Plan. However, some settlement monuments were observed to be without a protective cap during the site inspection.

5.5.4 IRP Site 16

Site inspections were conducted at IRP Site 16 to assess the condition of the remedy including groundwater monitoring wells and sampling pumps/tubing. The results of the inspection events at IRP Site 16 were compiled in one inspection checklist, which is included in Appendix A. Photographs taken during the inspection event on 6 March 2014, are presented in Appendix B.

The inspections indicated that components of the IRP Site 16 remedy including groundwater monitoring wells are in good condition and functioning as designed. Site conditions indicate that ICs are being properly implemented. Adjacent land-use changes include crop production.

The Navy's O&M contractor for IRP Site 16 noted that site grading has been successfully maintained to direct rainfall run-off from the former source area; that ICs continue to be successfully implemented; and that cis-1,2-dichloroethene, a degradation product associated with TCE, has been observed in a single well (16_MW18) in recent monitoring events.

5.5.5 IRP Site 18

Site inspections were conducted for IRP Site 18 by the Navy and IRWD to assess the condition of the remedy components including extraction/monitoring wells; pumps; treatment system components; electrical enclosures/panels; and access restrictions such as fencing and gates. The results of the inspection events at IRP Site 18 were compiled in one inspection checklist, which is included in Appendix A. Photographs taken during the inspection event in March 2014, are presented in Appendix B.

The inspection events indicated that the components of the groundwater extraction remedy at IRP Site 18 including monitoring/extraction wells, pumps, wellhead plumbing, extraction system pipelines, valves, electrical enclosures, tanks, and treatment system components (air stripper, GAC, and pumps) are in good condition.

5.5.6 IRP Site 24

Site inspections were conducted at IRP Site 24 to assess the condition of the remedy including extraction/monitoring wells; pumps; treatment system components; electrical enclosures/panels; and access restrictions such as fencing and gates. The results of the inspection events at IRP Site 24 were compiled in two inspection checklists, which are included in Appendix A. The first inspection checklist was substantially completed by the Navy's O&M contractor and pertains to the groundwater extraction and conveyance system. The second inspection checklist was substantially completed by the IRWD and pertains to the SGU Treatment System. Photographs taken during the inspection event in March 2014 are presented in Appendix B.

The inspections indicated that components of the groundwater extraction remedy at IRP Site 24 including monitoring/extraction wells, pumps, wellhead plumbing, extraction system pipelines, valves, electrical enclosures, equalization tanks, and SGU Treatment System components (air stripper, GAC and pumps) are in good condition. The IRWD representative indicated that TCE is being effectively removed from groundwater by the air stripper. The overall observations of the IRWD regarding operation of the remedy, VOC mass removed, and VOC concentrations, are reflected in the discussion of data review for IRP Site 24 in Section 5.4.5. Site conditions at IRP Site 24 indicate that ICs are being properly implemented.

The Navy's O&M contractor indicated that there have been no significant issues with the SGU extraction and conveyance system operation to date. The overall observations of the Navy's O&M contractor regarding operation of the remedy, VOC mass removed, VOC concentrations, and hydraulic capture of the plume are reflected in the discussion of data review for IRP Site 24 in Section 5.4.5.

5.6 INTERVIEWS

Interviews were conducted as part of the five-year review with various stakeholders to provide additional information about the status of IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3. A list of interviewees is presented in Table 5-3.

Table 5-3: List of Interviewees - IRP Sites 2, 3, 5, 16, 17, 18, 24, and Anomaly Area 3

Interviewee Name	Title	Affiliation	IRP Site
<i>Regulatory Agencies</i>			
Mary Aycock	RPM	U.S. EPA	2, 3, 5, 16, 17, 18, 24, and AA 3
Patricia Hannon	RPM	RWQCB, Santa Ana Region	2, 3, 5, 16, 17, 18, 24, and AA 3
Eileen Mananian	RPM	DTSC	2, 3, 5, 16, 17, 18, 24, and AA 3
<i>RAB</i>			
Robert Woodings	RAB Co-Chair	RAB, Former MCAS El Toro	2, 3, 5, 16, 17, 18, 24, and AA 3
Marcia Rudolph	RAB Subcommittee Chair	RAB, Former MCAS El Toro	2, 3, 5, 16, 17, 18, 24, and AA 3

Interviewee Name	Title	Affiliation	IRP Site
<i>Navy O&M Contractors</i>			
Doug Bielskis	Project Manager, O&M Contractor	ERRG	AA 3
Jim Dill	Project Manager, O&M Contractor	CE2K	2, 3, 5, and 17
Pete Stang	Project Manager, O&M Contractor	Trevet	16
Dhananjay Rawal	Project Manager, O&M Contractor	ECS	24
<i>Other</i>			
James Werkmeister	Manager, Environmental Affairs	Five Point Communities	2, 3, 5, 16, 17, 24, and AA 3
Cliff Wallace	Manager of Planning and Environmental Services	OCGP	2, 3, 5, 16, 17, 18, and 24
Tom Brown	Facility Manager	FBI	2 and 17
Roy Herndon	Chief Hydrogeologist	OCWD	18 and 24
Arseny Kalinsky	Project Manager, O&M	IRWD	18 and 24
Zoila Verdaguer-Finch	County Executive Officer	Orange County Public Works	2 and 24
Jerry Creekpaum	Chief Operations Officer	Second Harvest Food Bank of Orange County	24

Detailed interview documentation for each IRP site addressed in this Five-Year Review is presented in Appendices C through L. The documentation includes the listing of interviewees for each site; date and time of the interview; contact information; and responses to interview questions. No major regulatory or community concerns or effects were identified during the interview.

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6. Technical Assessment

In accordance with the U.S. EPA Guidance on five-year reviews (U.S. EPA 2001), technical assessment for this Five-Year Review focused on responses to the following three key questions for each of the eight subject IRP Sites:

- 1) Question A: Is the remedy functioning as intended by the decision documents?
- 2) Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?
- 3) Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The responses to these questions are discussed for each of the eight IRP Sites below.

6.1 IRP SITES 2 AND 17

6.1.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

The results of document review, site inspections, and interviews indicate that the remedy is functioning as intended by the ROD (DON 2000), as modified by the ESDs (DON 2009a and DON 2011b). As documented in the RACR (Earth Tech 2009a), construction of the landfill caps at IRP Sites 2 and 17 and implementation of land-use restrictions achieve the RAOs developed for the two sites. The RACR presented a detailed discussion of the attainment of the RAOs by implementation of the landfill capping remedies. The landfill caps were constructed pursuant to the ROD and design specifications presented in the RD submittal for IRP Sites 2 and 17 (Earth Tech 2005). In 2012, the FAA transferred IRP Sites 2 and 17 to the FBI under a subsequent Federal agency-to-agency transfer (FAA and FBI 2012). The land-use restrictions are being implemented through the MOU (FAA and FBI 2012) at IRP Sites 2 and 17. The MOU documents land-use restrictions for the IRP Sites 2 and 17 areas owned by FBI. During the site inspections, the Navy's O&M contractor did not observe evidence of any activities that were inconsistent with the land-use restrictions specified in the O&M Plan (Earth Tech 2009b). A review of completed checklists indicates that no activities were conducted in the ARICs within the boundary of FBI property that are inconsistent with the land-use restrictions documented in the LUC Plan.

The observations made during site inspections (see Section 5.5.1) did not indicate any activities inconsistent with land-use restrictions documented in the LUC Plan. The site inspections also indicated that all engineering components of the remedy including landfill cap, monitoring wells, access restrictions (fence and/or signs), and drainage features are operating and functioning as designed. No damage to engineering features of the remedies was observed.

O&M activities are currently being conducted to monitor the effectiveness of the landfill capping remedy at IRP Sites 2 and 17. These activities include cover inspection and maintenance, and monitoring of groundwater, soil moisture, and LFG. These O&M activities will ensure that remedies at IRP Sites 2 and 17 remain protective of human health and the environment.

6.1.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs used at the Time of Remedy Selection Still Valid?

The assumptions made during the remedy selection for IRP Sites 2 and 17 are consistent with current site conditions and remain essentially unchanged. The remedies at the two sites are in place and the RAOs presented in the ROD are still applicable and appropriate. No changes to site conditions have occurred that would affect the remedy performance.

Changes in ARARs

The ARARs identified in the IRP Sites 2 and 17 ROD were reviewed to evaluate if there are any changes in these standards that may affect the protectiveness of the remedies at the two sites (see Table M-1 in Appendix M). Based on this evaluation, it was concluded that there were no significant changes to the standards/requirements identified as ARARs in the IRP Sites 2 and 17 ROD that could affect the protectiveness of the remedies at the two sites. Additionally, no newly promulgated standards were identified that could affect the protectiveness of the remedies at IRP Sites 2 and 17.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

The HHRA for IRP Sites 2 and 17 was performed assuming recreational and residential exposure scenarios. Exposure of a recreational child was considered to be limited to contaminants in surface soil. The resident was assumed to live adjacent to and downgradient of the landfill sites and potentially exposed to impacted groundwater. These exposure pathways represent conservative exposure scenarios and have not changed. Therefore, revisions/changes to exposure pathways are not warranted.

The landfill containment remedies for IRP Site 17 and vadose zone of IRP Site 2 were implemented to prevent contact with waste and were not intended to meet any site-specific, risk-based cleanup level; therefore, review of toxicity and other contaminant characteristics used to determine the original cleanup level was not required.

6.1.3 Question C: Has any other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

To date, there has been no new information, that has come to light to suggest a change in the protectiveness of the final remedies implemented for IRP Sites 2 and 17.

6.1.4 Technical Assessment Summary

Based on the documents reviewed, the site inspection, and the interviews, the remedies at IRP Sites 2 and 17 are functioning as intended by the ROD, and as modified by the 2009 and 2011 ESDs. The engineering components of the remedies are operating and functioning as designed. Based on the documents reviewed and site inspections, there was no evidence of activities at IRP Sites 2 and 17 that are inconsistent with the land-use restrictions presented in the O&M Plan. The evaluation of ARARs documented in the ROD indicated that there were no significant changes to the standards/requirements identified as ARARs in the IRP Sites 2 and 17 ROD that could affect the protectiveness of the remedies at the two sites. Additionally, no newly promulgated standards were identified that could affect the protectiveness of the remedies at IRP Sites 2 and 17.

The exposure pathways assumed in the risk assessment conducted during the Phase II RI have not changed. The remedy for IRP Site 17 and vadose zone of IRP Sites 2 is implemented for waste isolation and containment, and is not intended to meet any site-specific, risk-based cleanup level; therefore, review of toxicity and other contaminant characteristics used to determine the original cleanup level was not required. There is no other information that calls into question the protectiveness of the remedy.

6.2 IRP SITES 3 AND 5

6.2.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

The results of document review, site inspections, and interviews indicate that the remedy is functioning as intended by the ROD (DON 2008a). As documented in the RACR (Shaw 2012), construction of the landfill caps at IRP Sites 3 and 5 and implementation of land-use restrictions achieve the RAOs developed for the two sites. The RACR presented a detailed discussion of attainment of the RAOs by implementation of the landfill capping remedies.

The landfill caps were constructed pursuant to the ROD and design specifications presented in the RD submittal for IRP Sites 3 and 5 (Shaw 2009). This portion of former MCAS El Toro has been leased to Heritage Fields, LLC (OCGP Corporation and Lennar Corporation) in accordance with the FOSL (DON 2004) and LIFO (DON 2005) pending the completion of ongoing environmental investigations and/or response actions. The interim land-use restrictions in these areas are administratively handled through a LIFO. The interim land-use restrictions in the LIFO meet the objectives of the ICs presented in the ROD (DON 2008a). Based on the site inspections conducted and evaluation of ICs Compliance Monitoring Reports submitted to date, no activities have been conducted at IRP Sites 3 and 5 that may adversely affect the integrity of the landfill caps and present unacceptable risk to human health due to potential exposure to residual contamination.

The observations made during site inspections (see Section 5.5.2) did not indicate any activities inconsistent with land-use restrictions documented in the LUC Plan. The site inspections also indicated that all engineering components of the remedy including landfill cap, monitoring wells, access restrictions (fence and/or signs), and drainage features are operating and functioning as designed. No damage to engineering features of the remedies was observed.

O&M activities are currently being conducted to monitor the effectiveness of the landfill capping remedy at IRP Sites 3 and 5. These activities include cover inspection and maintenance, and monitoring of groundwater, soil moisture, and LFG. These O&M activities ensure that remedies at IRP Sites 3 and 5 remain protective of human health and the environment.

6.2.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs used at the Time of Remedy Selection Still Valid?

The assumptions made during the remedy selection for IRP Sites 3 and 5 are consistent with current site conditions and remain essentially unchanged. The remedies at the two sites are in place and the RAOs presented in the ROD are still applicable and appropriate. No changes to site conditions have occurred that would affect the remedy performance.

Changes in ARARs

The ARARs identified in the IRP Sites 3 and 5 ROD were reviewed to evaluate if there are any changes in these standards that may affect the protectiveness of the remedies at the two sites (see Table M-2 in Appendix M). Based on this evaluation, it was concluded that there were no significant changes to the standards/requirements identified as ARARs in the IRP Sites 3 and 5 ROD that could affect the protectiveness of the remedies at the two sites. Additionally, no newly promulgated standards were identified that could affect the protectiveness of the remedies at IRP Sites 3 and 5.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

The HHRA was performed assuming recreational, residential, and industrial exposure scenarios for IRP Site 3; and recreational and residential exposure scenarios for IRP Site 5. Recreational exposure

by a child and industrial exposure by a site worker were considered to be limited to contaminants in surface soil. The resident was assumed to live adjacent to and downgradient of the landfill sites and potentially exposed to impacted groundwater. These exposure pathways represent conservative exposure scenarios and have not changed. Therefore, revisions/changes to exposure pathways are not warranted.

The landfill containment remedies for IRP Sites 3 and 5 were implemented to prevent contact with waste and were not intended to meet any site-specific, risk-based cleanup level; therefore, review of toxicity and other contaminant characteristics used to determine the original cleanup level was not required.

6.2.3 Question C: Has any other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

To date, there has been no new information, that has come to light to suggest a change in the protectiveness of the final remedies implemented for IRP Sites 3 and 5.

6.2.4 Technical Assessment Summary

Based on the documents reviewed, the site inspection, and the interviews, the remedies at IRP Sites 3 and 5 are functioning as intended by the ROD. The engineering components of the remedies are operating and functioning as designed. Based on the documents reviewed and site inspections, there was no evidence of activities at IRP Sites 3 and 5 that are inconsistent with the land-use restrictions presented in the O&M Plan. The evaluation of ARARs documented in the ROD indicated that there were no significant changes to the standards/requirements identified as ARARs in the IRP Sites 3 and 5 ROD that could affect the protectiveness of the remedies at the two sites. Additionally, no newly promulgated standards were identified that could affect the protectiveness of the remedies at IRP Sites 3 and 5.

The exposure pathways assumed in the risk assessment have not changed. The remedy for IRP Sites 3 and 5 is implemented for waste isolation and containment, and is not intended to meet any site-specific, risk-based cleanup level; therefore, review of toxicity and other contaminant characteristics used to determine the original cleanup level was not required. There is no other information that calls into question the protectiveness of the remedy.

6.3 ANOMALY AREA 3

6.3.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

The results of document review, site inspections, and interviews indicate that the remedy is functioning as intended by the ROD (DON 2010a). As documented in the RACR (ERRG 2012), construction of the landfill cap at AA 3 and implementation of land-use restrictions achieve the RAOs developed. The RACR presented a detailed discussion of attainment of the RAOs by implementation of the landfill capping remedies.

Based on the evaluation of ICs Compliance Monitoring Reports submitted to date, no activities have been conducted at AA 3 that may adversely affect the integrity of the landfill cap and present unacceptable risk to human health due to potential exposure to residual contamination.

The observations made during site inspections (see Section 5.5.3) did not indicate any activities inconsistent with land-use restrictions documented in the LUC Plan. The site inspections also indicated that all engineering components of the remedy including landfill cap, monitoring wells,

access restrictions (fence and/or signs), and drainage features are operating and functioning as designed. No damage to engineering features of the remedies was observed.

O&M activities are currently being conducted to monitor the effectiveness of the landfill capping remedy at AA 3. These activities include cover inspection and maintenance; and monitoring of groundwater, and LFG. These O&M activities ensure that remedies at AA 3 remain protective of human health and the environment.

6.3.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs used at the Time of Remedy Selection Still Valid?

The assumptions made during the remedy selection for AA 3 are consistent with current site conditions and remain essentially unchanged. The remedy at the site is in place and the RAOs presented in the ROD are still applicable and appropriate. No changes to site conditions have occurred that would affect the remedy performance.

Changes in ARARs

The ARARs identified in the AA 3 ROD were reviewed to evaluate if there are any changes in these standards that may affect protectiveness of the remedy at this site (see Table M-3 in Appendix M). Based on this evaluation, it was concluded that there were no significant changes to the standards/requirements identified as ARARs in the AA 3 ROD that could affect the protectiveness of the remedy at the site. Additionally, no newly promulgated standards were identified that could affect the protectiveness of the remedy at AA 3.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

The human health risk assessment for AA 3 was performed for several potential reuse scenarios: visitors to the site, construction workers, agricultural and industrial workers, park users, and residents (the most conservative scenario). These exposure pathways represent conservative exposure scenarios and have not changed. Therefore, revisions/changes to exposure pathways are not warranted.

The landfill containment remedies for AA 3 were implemented to prevent contact with waste and were not intended to meet any site-specific, risk-based cleanup level; therefore, review of toxicity and other contaminant characteristics used to determine the original cleanup level was not required.

6.3.3 Question C: Has any other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

To date, there has been no new information, that has come to light to suggest a change in the protectiveness of the final remedy implemented for AA 3.

6.3.4 Technical Assessment Summary

Based on the documents reviewed, the site inspection, and the interviews, the remedy at AA 3 is functioning as intended by the ROD. The engineering components of the remedy are operating and functioning as designed. Based on the documents reviewed and site inspections, there was no evidence of activities at AA 3 that are inconsistent with the land-use restrictions presented in the O&M Plan. The evaluation of ARARs documented in the ROD indicated that there were no significant changes to the standards/requirements identified as ARARs in the AA 3 ROD that could affect the protectiveness of the remedy at the site. Additionally, no newly promulgated standards were identified that could affect the protectiveness of the remedy at AA 3.

The exposure pathways assumed in the risk assessment have not changed. The remedy for AA 3 is implemented for waste isolation and containment, and is not intended to meet any site-specific, risk-based cleanup level; therefore, review of toxicity and other contaminant characteristics used to determine the original cleanup level was not required. There is no other information that calls into question the protectiveness of the remedy.

6.4 IRP SITE 16

6.4.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

The results of documents and data review, site inspections, and interviews indicate that the final remedy (MNA and ICs) implemented for TCE in groundwater at IRP Site 16 is functioning as intended by the ROD and RD. The major portion of the contaminant mass in the shallow soil was removed during the MPE pilot test conducted at the site. Soil removal conducted in 2010 under the PCAP further removed contaminant mass in the shallow soil. In addition, SVE implemented as part of the PCAP at MSC B3 removed VOCs from deeper soil including the TCE associated with IRP Site 16. The Draft 2013 IRP Site 16 Annual Report (Trevet 2014) stated that the known distribution of TCE continues to be updated as the monitoring well network is optimized. The TCE distribution shows the plume extending more to the north and west than was previously documented. Therefore, monitoring and continued optimization of the monitoring well network along the western boundary of the ARIC is underway.

MNA and ICs are adequate to determine the protectiveness and effectiveness of the final remedy and continue to mitigate human health risks associated with the impacted groundwater.

An ARIC has been established and LUCs have been implemented at the site within this area that:

- Prohibit well installation and use of groundwater from the ARIC without approval;
- Prohibit disturbance of the MNA well network and equipment without approval; and
- Require maintenance of the ground surface to promote proper surface drainage away from the former training pits.

In 2012, the area comprising IRP Site 16 was transferred in part to the City of Irvine and in part to Five Point Communities, Inc. Land-use restrictions are enforceable at the site through the CRUP recorded against the property on 5 May 2010 and the Quitclaim Deed (DON 2011c). Prior to transfer, and for a portion of the period covered by this Five-Year Review, IRP Site 16 was leased to Heritage Fields, LLC. During this period of time, interim land-use restrictions at IRP Site 16 were administratively handled through a LIFOC. Under the LIFOC, the Lessee was required to fill out a PERF for any work proposed in the leased portion of the property. The land-use restrictions in the CRUP and the previous LIFOC prevent activities that may adversely impact the remedy components or may present unacceptable risks to human health and the environment. Based on the evaluation of PERFs submitted and the annual inspections completed by Five Point Communities, Inc., no activities have been conducted at IRP Site 16 that may adversely affect the remedy integrity and present unacceptable risk to human health. Additionally, no evidence of activities inconsistent with land-use restrictions was observed during the site-inspections conducted as part of this Five-Year Review.

The observations made during the site inspections (Section 5.5.4) indicated that components of the IRP Site 16 remedy including groundwater monitoring wells are in good condition and functioning as designed, and ICs are being properly implemented. In addition, based on site inspections, site security features related to remedy components were present and provided the required protection.

Site grading to maintain positive drainage has been implemented at IRP Site 16 and is performing as required.

Although the IRP Site 16 remedy is functioning as designed, opportunities exist to improve the evaluation of remedy performance. These opportunities are ongoing and pertain to augmenting the existing groundwater monitoring network consistent with the recommendations presented in Table 4-2.

6.4.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs used at the Time of Remedy Selection Still Valid?

The assumptions made during the remedy selection for IRP Site 16 are consistent with current site conditions and remain essentially unchanged. The conceptual site model and RAOs presented in the ROD are still applicable and appropriate. No new future land-uses have been identified and no changes to site conditions have occurred that would affect the remedy effectiveness.

Changes in Cleanup Level. The target cleanup level for TCE in groundwater is based on the MCL for TCE of 5 µg/L. This water quality standard remains unchanged from the ROD signing date.

Changes in Exposure Pathways and Toxicity. No additional routes of exposure to chemicals in the subsurface at IRP Site 16 have been identified since implementation of the remedy. The previous human health risk evaluation results were based on conservative assumptions that tended to overestimate risk. Risk/hazards from other site contaminants, including potential chemical degradation byproducts of TCE, continue to be insignificant or inconsequential because of incomplete exposure pathways, or relatively low concentrations. The toxicity value has changed for TCE (chemical of concern [COC]) since the risk assessment was completed for IRP Site 16. However, the remediation goal for TCE for IRP Site 16 groundwater has been set at the MCL; therefore, no change to this remediation goal is required due to change in the toxicity values.

The toxicity value for TCE has changed from those used in the vapor intrusion risk assessment completed for IRP Site 16 in 2004 (BNI 2004). Table 6-1 presents a comparison of the 2004 and the latest toxicity criteria used for the vapor intrusion exposure route for TCE. This comparison indicates that although the toxicity value for TCE has changed, the magnitude of the effect on the vapor intrusion risk estimate is not significant enough to alter the overall conclusions of the 2004 Vapor Intrusion Risk Assessment Report (BNI 2004). The use of the latest toxicity criteria for the COC (TCE) will result in a decrease in the cancer risk value and an increase in the hazard quotient (HQ) estimated in 2004; however, the HQ will remain below 1.

Changes to Risk. Risk evaluation results used as the basis for the remedy selection for IRP Site 16 in the ROD were not re-evaluated for this Five-Year Review. Because TCE concentrations in groundwater have not changed appreciably, associated risks/hazards are expected to be similar to the risks/hazards previously estimated.

The risks due to potential vapor intrusion into indoor air were calculated in 2004 for IRP Site 16 (see Section 2.4.4.1). These risks were estimated to be within acceptable limits. No significant changes to these risk estimates are expected based on the following:

- TCE concentrations have not changed appreciably; and
- The assumptions and methodology used in the previous risk evaluation are still valid.

Therefore, the earlier conclusion of the risk assessment that IRP Site 16 does not pose unacceptable risk to human health due to vapor intrusion and inhalation of indoor air is still valid.

Changes to ARARs. ARARs identified in the ROD for IRP Site 16 were reviewed to determine whether any updates to the regulations were enacted that could potentially affect the protectiveness of the remedy. Requirements, regulations, and standards either have not changed since the ROD signing date, or the changes do not affect the protectiveness of the remedy as currently being implemented. The individual ARARs identified in the ROD are summarized in Table M-4 of Appendix M.

6.4.3 Question C: Has any other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

To date, there has been no new information, that has come to light to suggest a change in the protectiveness of the final remedy implemented for IRP Site 16.

6.4.4 Technical Assessment Summary

Based on the documents and data reviewed, site inspections, and the interviews, the remedy at IRP Site 16 is functioning as intended by the ROD and the RD. The known distribution of TCE continues to be updated as the monitoring well network is optimized. The TCE distribution shows the plume extending more to the north and west than was previously documented. Therefore, monitoring and continued optimization of the monitoring well network along the western boundary of the ARIC is underway.

The review of the documents and site-inspections indicate that no activities have been conducted at the site that are inconsistent with land-use restrictions documented in the RD (CDM 2006). Site grading to maintain positive drainage has been implemented and is performing as required.

Based on the evaluation of ARARs documented in the ROD, there have been no significant changes to the standards/requirements identified as ARARs in the IRP Site 16 ROD that could affect the protectiveness of the remedy at the site. Additionally, no newly promulgated standards were identified that could affect the protectiveness of the remedy at IRP Site 16.

The exposure pathways assumed in the risk assessment conducted for IRP Site 16 have not changed. The toxicity value for TCE has changed since the risk assessment was completed for IRP Site 16. However, the remediation goal for TCE for IRP Site 16 groundwater has been set at its MCL; therefore, no change to the remediation goal is required due to the change in toxicity values. The use of the latest toxicity criteria for TCE will result in a decrease in the cancer risk value and an increase in the HQ estimated in 2004; however, the HQ will still remain below 1. There is no other information that calls into question the protectiveness of the remedy at IRP Site 16.

6.5 IRP SITES 18 AND 24

6.5.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

Based on the results of documents and data review, site inspections, and interviews, the final remedies implemented for TCE in groundwater at IRP Sites 18 and 24 are functioning as intended by the ROD and the ESDs. The IDP wells (ET-1, ET-2, and IRWD-78) are operating at extraction flow rates different from those specified in the 2006 ESD (DON 2006b). The IRWD is in the process of completing various phases of groundwater flow and transport modeling to evaluate the impacts of actual extraction flow rates from the IDP wells on the TCE plume in the PA. This modeling study will serve as the basis for a new ESD that will revise the target flow rates for the IDP

wells. However, as discussed below, even with different pumping flow rates, groundwater monitoring data show that the TCE plume in the PA exhibited minimal migration and an overall reduction in concentrations.

The IRP Site 24 (SGU Plume) extraction strategy in the design was to initially focus extraction in areas with higher VOC concentrations near to and downgradient from the source areas, with extraction subsequently increasing at the Base boundary. Based on an evaluation of water level elevations, groundwater flow data, and modeling simulations, the extraction wellfield is performing as designed, resulting in capture of the on-site portion of the SGU plume. Consistent with this design and extraction strategy, and as documented in the *Draft Final Interim Remedial Action Completion Report Addendum* (Appendix A to the Final Operating Properly and Successfully Report [Weston] 2010b), contingency wells along the Base boundary were installed to enhance plume capture at and downgradient of the former Base boundary.

The groundwater modeling results project complete capture of the VOC plume in the PA over a 40-year period based on average extraction rates sustained through August 2007. Although the extraction rates of both the SGU and PA units during this second five-year review period have on average been lower than values used in the predictive model or stipulated in decision documents, the capture zone evaluation concluded that effective hydraulic capture was achieved for both groundwater units (KCH 2014).

Based on the groundwater monitoring data obtained during this five-year review period, attenuation of TCE contaminants was observed in both PA and SGU units. The PA TCE plume exhibited minimal migration and overall reduction of VOCs from April 2008 to March 2013. The SGU TCE plume boundaries in 2012 are a close match to the 10-year prediction developed as part of the 2009 capture zone evaluation (AECOM 2009). Hot spot removal (TCE concentrations exceeding 500 µg/L) was achieved after six years of operation based on 2012 sampling data, though the permanence of reductions below 500 µg/L has not yet been established.

As noted in the discussion of data review in Section 5.4.5, the SGU and PA treatment facilities are effectively removing VOCs from groundwater. O&M procedures for the SGU and PA Treatment Plants have been followed except for occasional periods when emissions of vapor phase VOCs occurred due to GAC exhaustion without timely replacement during the first two years of treatment plant operation. Although the vapor phase GAC exhaustion resulted in occasional incomplete treatment and discharge of TCE vapors from both Treatment Plants, screening risk assessments indicate that these vapors did not pose unacceptable risks to human health for the potential residential or commercial receptors. A regular GAC changeout pattern was established since June 2010 (see Section 5.4.5.2 for details).

The groundwater extraction and treatment systems are inspected on a weekly basis. Routine monthly and annual inspection and maintenance are also performed to optimize the system so that it operates as continuously as possible. The Performance Monitoring and Sampling and Analysis Plan (Earth Tech 2007) provides a sufficient framework for optimization of groundwater monitoring locations.

ICs have been implemented for the land areas overlying IRP Sites 18 and 24 to protect potential receptors (e.g., residents) from use of VOC-impacted groundwater and to protect remediation equipment. Part of the area overlying the on-Base portion of the IRP Site 24 plume is leased to Heritage Fields, LLC, and land-use restrictions in the area are implemented through LIFOs (DON and Heritage Fields 2005a and DON and Heritage Fields 2005c). The Lessee is required to complete a PERF for any work proposed in the leased portion of the property. Based on the evaluation of PERFs submitted to date, no activities have been conducted

at IRP Site 24 that may adversely affect the remedy integrity or present unacceptable risk to human health.

For the IRP Site 24 portions that have been transferred to the City of Irvine, OCGP completed compliance certificates for ICs and LUCs. These checklists were presented to the regulatory agencies in the Annual Remedy Status Reports and indicate that land use restrictions for IRP Site 24 have been in compliance.

The ICs for the off-Base portion of VOC groundwater plumes are based on local permit programs administered by OCHCA and IRWD. OCHCA and IRWD have completed checklists for calendar years 2009 through 2013. Permits for two monitoring and three air sparge/soil vapor extraction wells were issued. These wells were constructed within the groundwater plume for IRP Sites 18 and 24 during 2011; however, none of the wells are classified as water wells used for irrigation or private/domestic drinking. These checklists were presented to the regulatory agencies in the Final Annual Remedy Status Reports for 2009-2013 for IRP Sites 18 and 24 (Weston 2011, 2012a, 2013).

6.5.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs used at the Time of Remedy Selection Still Valid?

The assumptions made during the remedy selection for IRP Sites 18 and 24 are consistent with current site conditions and remain essentially unchanged. The remedy is in place and the RAOs presented in the ROD are still applicable and appropriate. No changes to site conditions have occurred that would affect the remedy performance.

Changes in Cleanup Level. There have been no changes in MCL values for the COCs since the signing date of the ROD. Therefore, the results of protectiveness evaluations are still valid.

Changes in Exposure Pathways and Toxicity. No additional routes of exposure to chemicals in groundwater at IRP Sites 18 and 24 have been identified. The toxicity values have changed for multiple COPCs since the risk assessment was completed for IRP Sites 18 and 24. However, the remediation goals for COCs for IRP Sites 18 and 24 groundwater have been set at MCLs; therefore, no change to these goals is required due to changes in the toxicity values.

Toxicity values for multiple COPCs have changed from those used in the vapor intrusion risk assessment completed for IRP Site 24 in 2004 (BNI 2004). Table 6-1 presents a comparison of the 2004 toxicity criteria used for the vapor intrusion exposure route and the latest toxicity criteria. Based on an analysis of toxicity criteria listed in this table, the magnitude of changes to vapor intrusion risk estimates based on revisions to toxicity criteria would not be enough to alter the overall conclusions of the 2004 Vapor Intrusion Risk Assessment Report (BNI 2004). The use of the latest toxicity criteria for the primary COC (TCE) would result in a decreased cancer risk value and an increased HQ as compared to 2004 risk estimates; however, the HQ would remain below 1.

Table 6-1: Preliminary Evaluation of Changes in Toxicity Values -- Vapor Intrusion Risk Evaluation for IRP Sites 16 and 24

Chemical	2004 Toxicity Criteria ^a		Latest Toxicity Criteria ^b	
	Cancer Slope Factor 1/(mg/kg-d)	Reference Dose (mg/kg-d)	Cancer Slope Factor 1/(mg/kg-d)	Reference Dose (mg/kg-d)
Carbon tetrachloride	5.25E-02	7.00E-04	2.1E-02	2.86E-02
Chloroform	8.05E-02	8.60E-04	8.05E-02	2.8E-02
1,2-Dichloroethane	9.01E-02	1.40E-03	9.1E-02	2.0E-03
1,1-Dichloroethene	NA	5.71E-02	NA	5.71E-02
Tetrachloroethene	1.00E-02	1.70E-01	9.1E-04	1.14E-02
Trichlorotrifluoroethane	Not applicable (NA)	8.57E+00	NA	8.57E+00
1,1,2-Trichloroethane	5.60E-02	4.00E-03	5.6E-02	5.71E-5
Trichloroethene	4.00E-01	1.00E-02	1.44E-02	5.7E-04
Trichlorofluoromethane	NA	2.00E-01	NA	2.0E-01

Notes:

^a BNI 2004^b Based on the toxicity criteria listed in the November 2013 version of the U.S. EPA Region 9, Regional Screening Levels Summary Table (www.epa.gov/region9/superfund/prg/)

Changes in Risk. Risk evaluation methodologies have not changed during the current review period, and assumptions used in the remedy selection for the OU-1 (IRP Site 18) and OU-2A (IRP Site 24) groundwater have not been changed. Risk estimates used as the basis for the remedy selection in the ROD were not re-calculated for this Five-Year Review. Since TCE concentrations in the subsurface have not changed appreciably, associated risks/hazards are presumed to have remained similar.

The risks due to potential vapor intrusion into indoor air were estimated in 2004 for IRP Site 24 and it was concluded that groundwater COCs at IRP Site 24 do not pose unacceptable risks to human health via the air inhalation exposure pathway (BNI 2004) (see Section 2.5.5.1). No significant changes to these risk estimates are expected based on the following:

- Residual TCE concentrations in the vadose zone are not expected to have changed appreciably from the concentrations at the time of 2004 vapor intrusion risk evaluation (BNI 2004). In addition, groundwater TCE concentrations are either the same or less than the concentrations during the 2004 vapor intrusion risk evaluation.
- Soil gas confirmation sampling will be performed in the former VOC source area upon completion of the groundwater remedy.
- The assumptions and methodology used in the previous risk evaluation are still valid.

Therefore, the earlier conclusion from the 2004 risk assessment, i.e., that groundwater COCs at IRP Site 24 do not pose unacceptable risk to human health due to vapor intrusion and inhalation of indoor air is still valid.

Similarly, groundwater COCs at IRP Site 18 do not pose a threat to public health via the potential vapor intrusion pathway because of the following reasons:

- Low concentrations of VOCs occur in the PA at depths of approximately 200 feet bgs. Sampling performed at shallower depths (i.e., less than 200 feet), indicates that VOCs are not present in groundwater at concentrations exceeding the MCLs. In most of the shallow depth intervals, the concentrations of VOCs do not exceed reporting limits (typically less

than 1 µg/L). Therefore, the pathway for exposure due to vapor intrusion is incomplete for IRP Site 18.

- The results of the risk assessment indicate that groundwater COCs at IRP Site 24 do not pose unacceptable risk to human health due to vapor intrusion and inhalation of indoor air. Based on the rationale that IRP Site 24 with much higher concentrations of VOCs present at shallower depths compared to IRP Site 18 do not pose unacceptable risk to human health due to vapor intrusion, and the pathway for vapor intrusion is incomplete at IRP Site 18; therefore, the VOCs in groundwater are not expected to pose a threat to human health via the vapor intrusion pathway.

Changes to ARARs. ARARs identified in the ROD for IRP Sites 18 and 24 were reviewed to evaluate whether any updates to the regulations could potentially affect the protectiveness of the remedy. Based on this evaluation, it is concluded that the requirements, regulations, and standards either have not changed since the ROD signing date, or the changes do not affect the protectiveness of the remedy as currently being implemented. The individual ARARs identified in the ROD are summarized in Table M-5 of Appendix M.

6.5.3 Question C: Has any other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

To date, there has been no new information, that has come to light to suggest a change in the protectiveness of the final remedies implemented for IRP Sites 18 and 24.

6.5.4 Technical Assessment Summary

Based on the documents and data reviewed, site inspections, and the interviews, the remedies implemented at IRP Sites 18 and 24 are functioning as intended by the ROD as modified by the ESDs. Based on evaluation of groundwater elevation data and modeling results, the extraction wellfield is performing as designed with capture of the on-site portion of the SGU plume. The contingency wells along the former Base boundary were installed and are operating to enhance plume capture at and downgradient of the Base boundary. The O&M data show hot spot removal of the TCE at concentrations above 500 µg/L based on 2012 and 2013 sampling data.

The PA TCE plume exhibited minimal migration and overall reduction of VOCs from 2009 to 2013. The review of the documents and site-inspections indicate that no activities have been conducted in the areas overlying IRP Sites 18 and 24 groundwater plumes that are inconsistent with the land-use restrictions.

Based on the evaluation of ARARs documented in the ROD, there were no significant changes to the standards/requirements identified as ARARs in the IRP Sites 18 and 24 ROD that could affect the protectiveness of the remedies. Additionally, no newly promulgated standards were identified that could affect the protectiveness of the remedies at IRP Sites 18 and 24.

The exposure pathways assumed in the risk assessments conducted for groundwater at IRP Sites 18 and 24 have not changed. The toxicity values have changed for multiple COCs since the risk assessment was completed for IRP Sites 18 and 24. However, the remediation goals for COCs for IRP Sites 18 and 24 groundwater have been set at MCLs; therefore, no changes to these goals are required due to changes in the toxicity values. The use of the latest toxicity criteria for the primary COC (TCE) will result in a decrease in the cancer risk value and an increase in the HQ estimated in 2004; however, the HQ will still remain below 1. There is no other information that calls into question the protectiveness of the remedies at IRP Sites 18 and 24.

7. Issues

No issues have been identified for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 that currently or in the future would prevent the respective remedies at these sites from being protective of human health and/or the environment.

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8. Recommendations and Follow-up Actions

Since no issues have been identified for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3 that prevent the remedies at these sites from being protective currently or in future, no recommendations or follow-up actions are required to ensure protectiveness of the remedies. However, consistent with the U.S. EPA Guidance (U.S. EPA 2001), recommendations have been made that do not directly relate to achieving or maintaining the protectiveness of the remedies, but pertain to activities such as O&M of the remedies and coordination with other agencies. Table 8-1 summarizes the recommended follow-up actions for IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA 3.

Table 8-1: Follow-Up Action Recommendations

No.	Recommendation	Party Responsible for Implementing Recommendation	Oversight Agency	Milestone Date
<i>IRP Sites 2 and 17</i>				
1.	Continue to evaluate monitoring and other O&M data, and make specific recommendations to further optimize monitoring per the Final O&M Plan (Earth Tech 2009b).	Navy	U.S. EPA, DTSC, and RWQCB	2014-2019
2.	Contact information on signs needs to be updated.			
<i>IRP Sites 3 and 5</i>				
1.	Continue to evaluate monitoring and other O&M data, and make specific recommendations to further optimize monitoring per the Final O&M Plan (Shaw 2010).	Navy	U.S. EPA, DTSC, and RWQCB	2014-2019
<i>Anomaly Area 3</i>				
1.	Continue to evaluate monitoring and other O&M data, and make specific recommendations to further optimize monitoring per the Final O&M Plan (ERRG 2011a).	Navy	U.S. EPA, DTSC, and RWQCB	2014-2019
2.	Place a protective cap on the settlement monuments which were observed during the site inspection without protective caps.			
<i>IRP Site 16</i>				
1.	Based on the updated TCE distribution and as a result of declining groundwater levels, a comprehensive optimization of the groundwater monitoring network is recommended.	Navy	U.S. EPA, DTSC, and RWQCB	2014-2019
2.	LUC implementation should continue as it is currently performed.	Navy	U.S. EPA, DTSC, and RWQCB	2014-2019
<i>IRP Sites 18 and 24</i>				
1.	Continue to evaluate monitoring and other O&M data, and make specific recommendations to further optimize the groundwater extraction and treatment systems pursuant to the Performance Monitoring and Sampling and Analysis Plan (Earth Tech 2007).	Navy	U.S. EPA, DTSC, and RWQCB	2014-2019
2.	Complete and finalize ongoing groundwater flow and transport modeling to evaluate the effects of current pumping rates from the IDP wells on the TCE plume in the PA. Use the results of modeling as a basis for a new ESD to revise the flow rates for the IDP wells presented in the 2006 ESD (DON 2006b).	IRWD, Navy		
3.	Update numerical flow and transport models for the SGU and PA, and recalibrate to better match the site conditions and data collected as part of remedy implementation. Use this recalibrated model to evaluate remedy effectiveness and optimization.	Navy		

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9. Protectiveness Statement

9.1 IRP SITES 2 AND 17

The remedy at IRP Sites 2 and 17 is protective of human health and the environment.

9.2 IRP SITES 3 AND 5

The remedy at IRP Sites 3 and 5 is protective of human health and the environment.

9.3 ANOMALY AREA 3

The remedy at AA 3 is protective of human health and the environment.

9.4 IRP SITE 16

The remedy at IRP Site 16 is protective of human health and the environment.

9.5 IRP SITES 18 AND 24

The remedy at IRP Sites 18 and 24 is protective of human health and the environment.

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10. Next Review

The next five-year review for former MCAS El Toro will be required by September 2019, five years from the date of this review.

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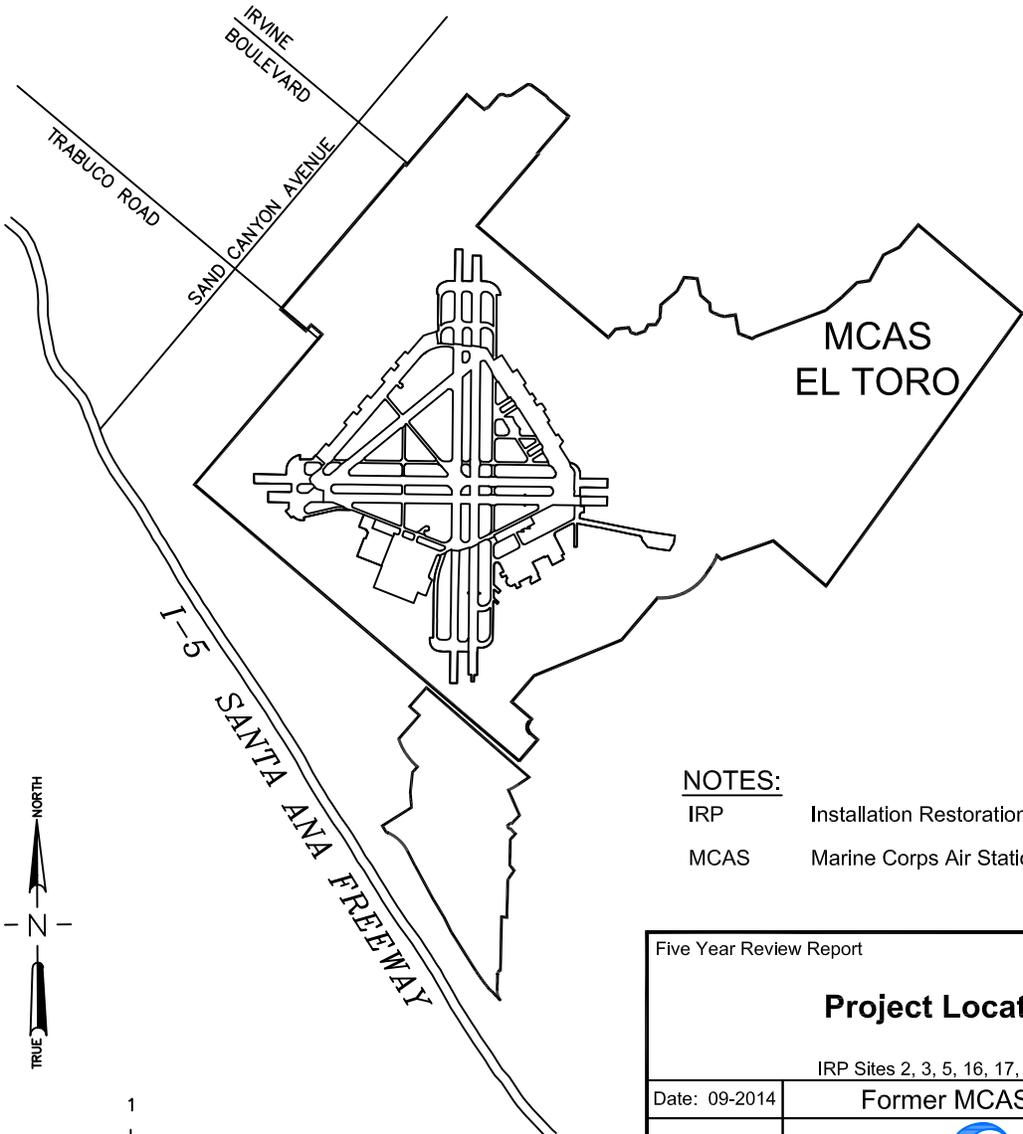
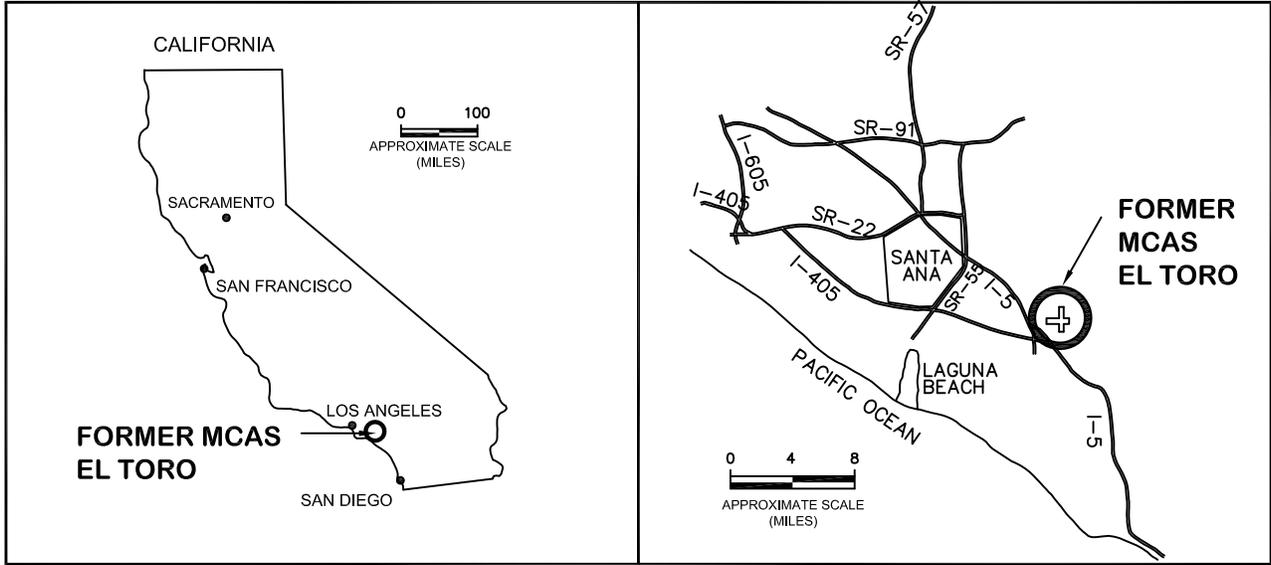
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- . 2007b. *Final Operation and Maintenance Manual, Shallow Groundwater Unit Wellfield and Conveyance System, Installation Restoration Program Site 24, Former Marine Corps Air Station El Toro, Irvine, California*. August.
- . 2008. *Annual Remedy Status Report, Installation Restoration Program Sites 18 and 24 Groundwater Remedy, September 2006-August 2007*. October.
- . 2009. *Final Annual Remedy Status Report, Installation Restoration Program Sites 18 and 24, Groundwater Remedy, September 2007-August 2008, Former Marine Corps Air Station El Toro, Irvine, CA*. May.
- . 2010a. *Final Annual Remedy Status Report, Installation Restoration Program Sites 18 and 24, Groundwater Remedy, September 2008-December 2009, Former Marine Corps Air Station El Toro, Irvine, CA*. September.
- . 2010b. *Final Operating Properly and Successfully Report, Installation Restoration Program Site 24 VOC Source Area Groundwater Remedy, Former Marine Corps Air Station El Toro, Irvine, California*. July.
- . 2011. *Final Annual Remedy Status Report, Installation Restoration Program Sites 18 and 24 Groundwater Remedy, January 2010 – December 2010, Former Marin Corps Air Station El Toro, Irvine, California*. August. **[IRP Sites 18 and 24]**.
- . 2012a. *Final Annual Remedy Status Report, Installation Restoration Program Sites 18 and 24 Groundwater Remedy, January 2011 – December 2011, Former Marin Corps Air Station El Toro, Irvine, California*. December. **[IRP Sites 18 and 24]**.
- . 2012b. *Technical Memorandum Recommended 2012 Optimization of Performance Monitoring for the IRP Sites 18 and 24 Groundwater Monitoring Program Former MCAS El Toro, California*. May. **[IRP Sites 18 and 24]**.
- . 2013. *Final Annual Remedy Status Report, Installation Restoration Program Sites 18 and 24 Groundwater Remedy, January 2012 – December 2012, Former Marin Corps Air Station El Toro, Irvine, California*. October. **[IRP Sites 18 and 24]**.

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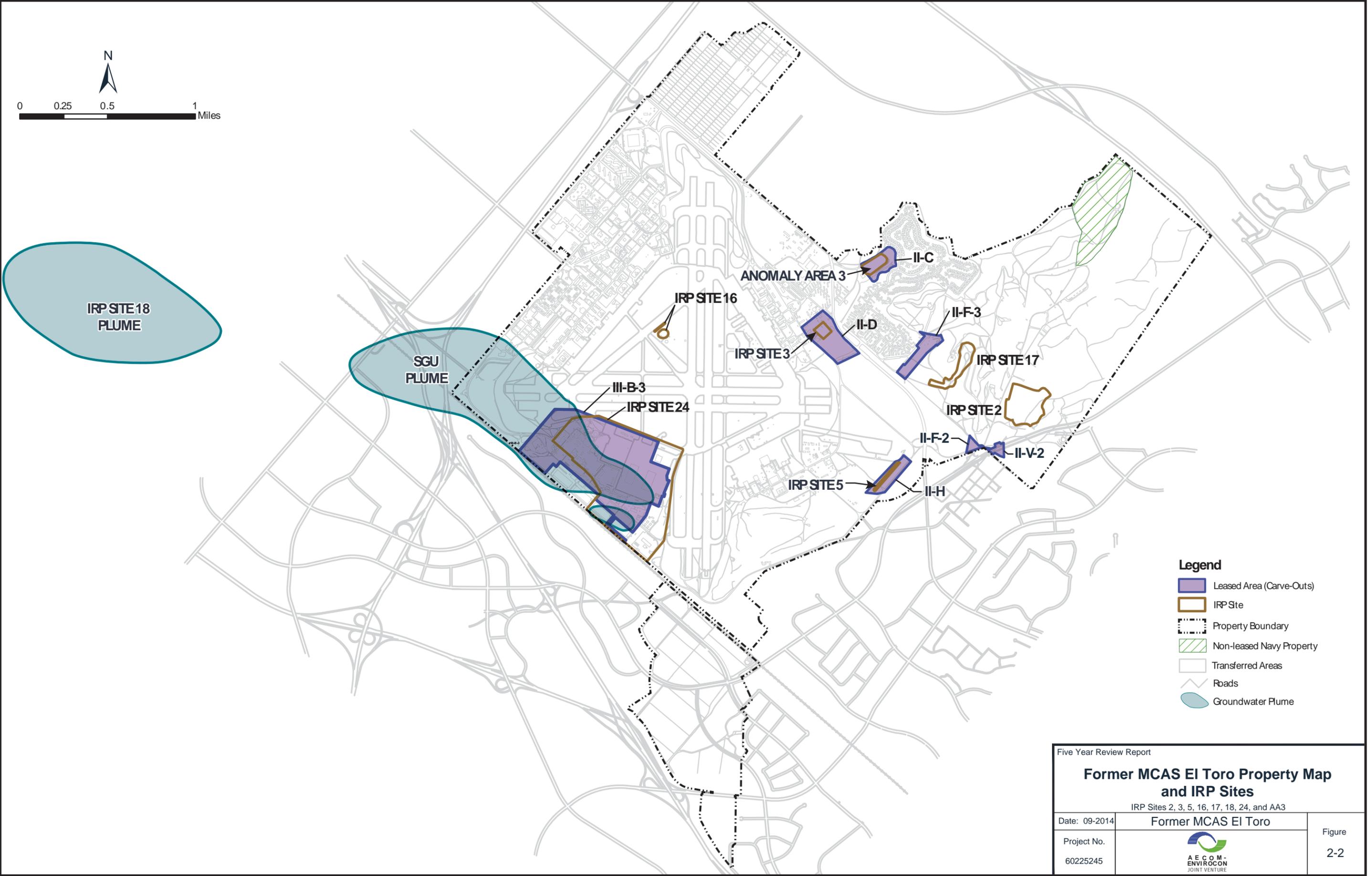
Figures

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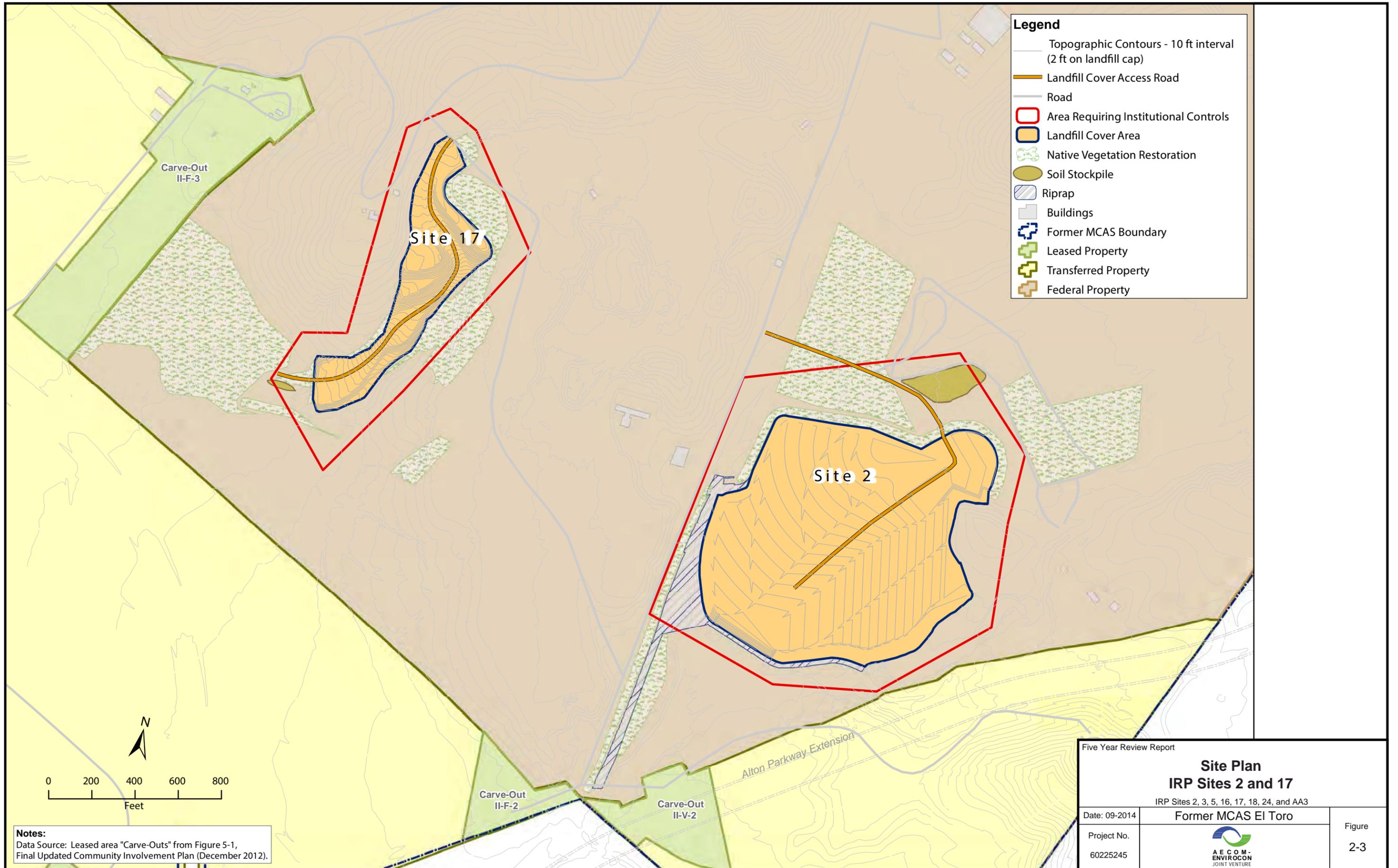
- NOTES:**
- IRP Installation Restoration Program
 - MCAS Marine Corps Air Station

Five Year Review Report		
Project Location Map		
IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA3		
Date: 09-2014	Former MCAS El Toro	
Project No. 60225245		Figure 2-1

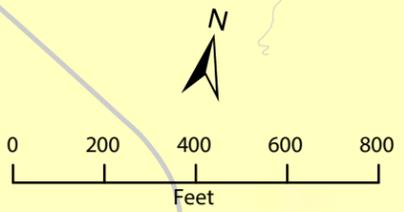


- Legend**
- Leased Area (Carve-Outs)
 - IRP Site
 - Property Boundary
 - Non-leased Navy Property
 - Transferred Areas
 - Roads
 - Groundwater Plume

Five Year Review Report		
Former MCAS El Toro Property Map and IRP Sites		
IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA3		
Date: 09-2014	Former MCAS El Toro	
Project No. 60225245		Figure 2-2

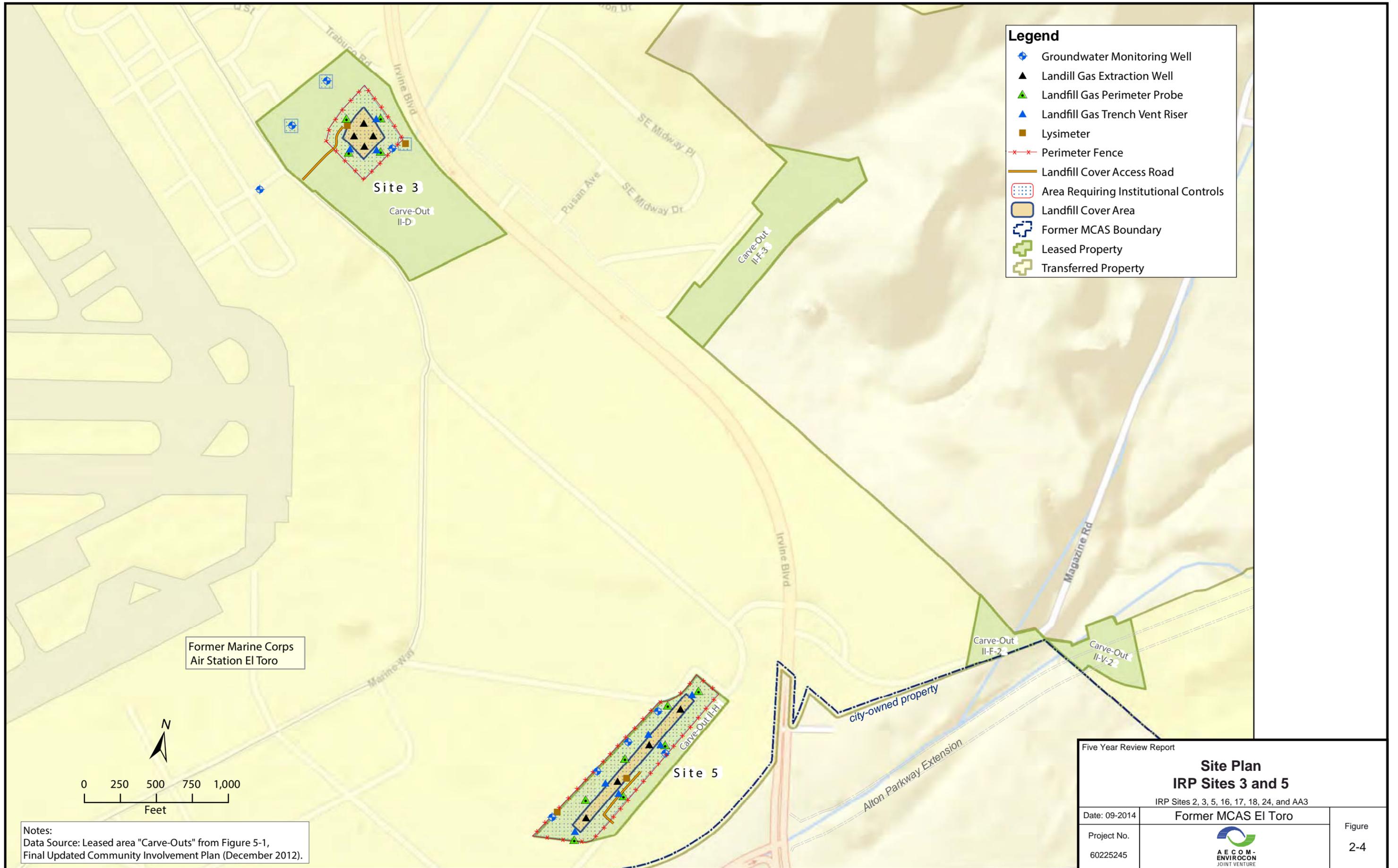


- Legend**
- Topographic Contours - 10 ft interval (2 ft on landfill cap)
 - Landfill Cover Access Road
 - Road
 - Area Requiring Institutional Controls
 - Landfill Cover Area
 - Native Vegetation Restoration
 - Soil Stockpile
 - Riprap
 - Buildings
 - Former MCAS Boundary
 - Leased Property
 - Transferred Property
 - Federal Property

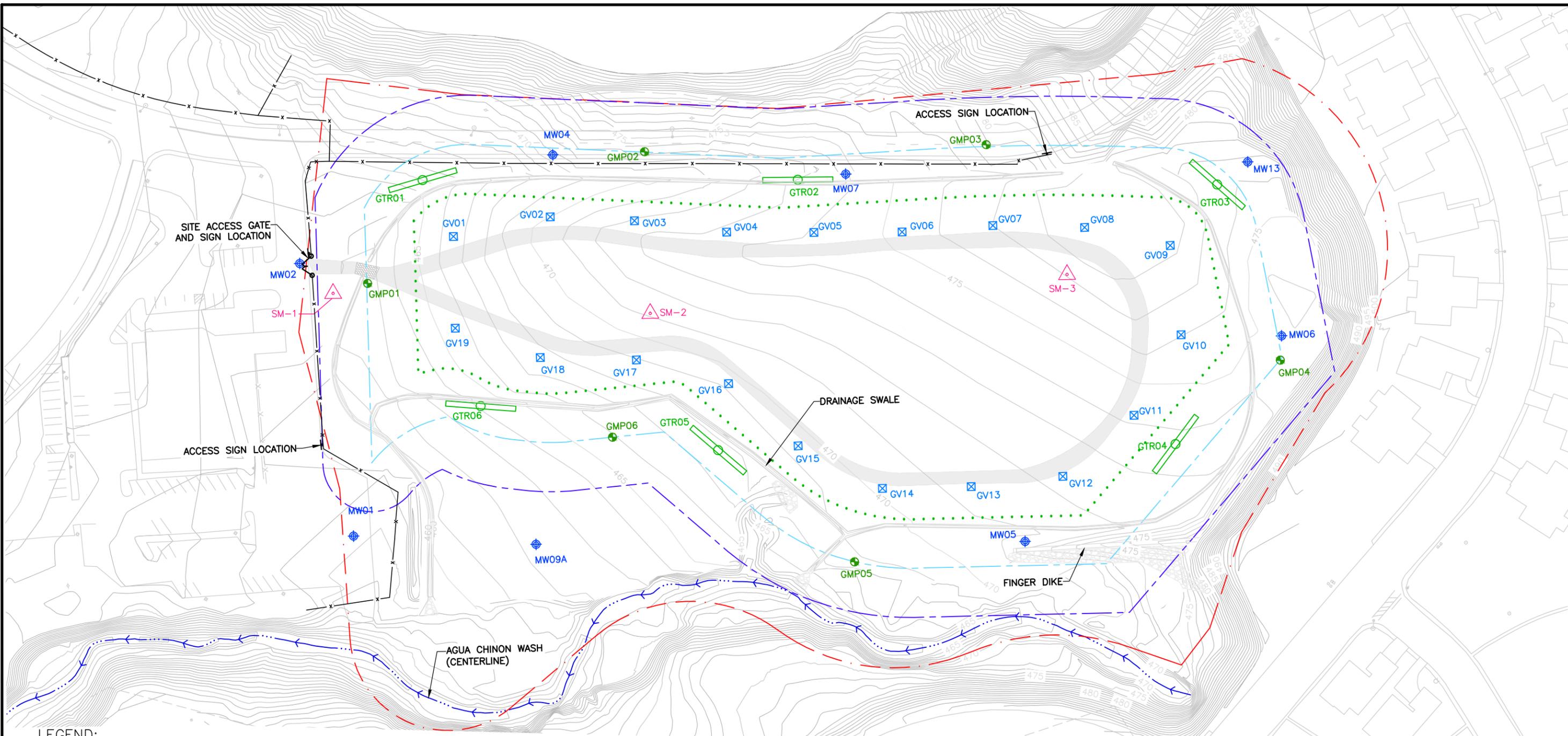


Notes:
 Data Source: Leased area "Carve-Outs" from Figure 5-1, Final Updated Community Involvement Plan (December 2012).

Five Year Review Report		
Site Plan		
IRP Sites 2 and 17		
IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA3		
Date: 09-2014	Former MCAS El Toro	
Project No. 60225245		Figure 2-3

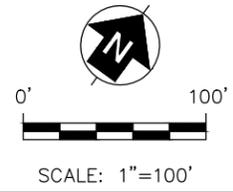


File: P:\60225245 - PERMAC II El Toro Sites 1 and 2 GW7.0 Deliverables\7.6 Reports\2nd-Five-Year Review\Final\Figures\Figure 2-5 Site Plan Anomaly Area 3 v4 [20140611].ai



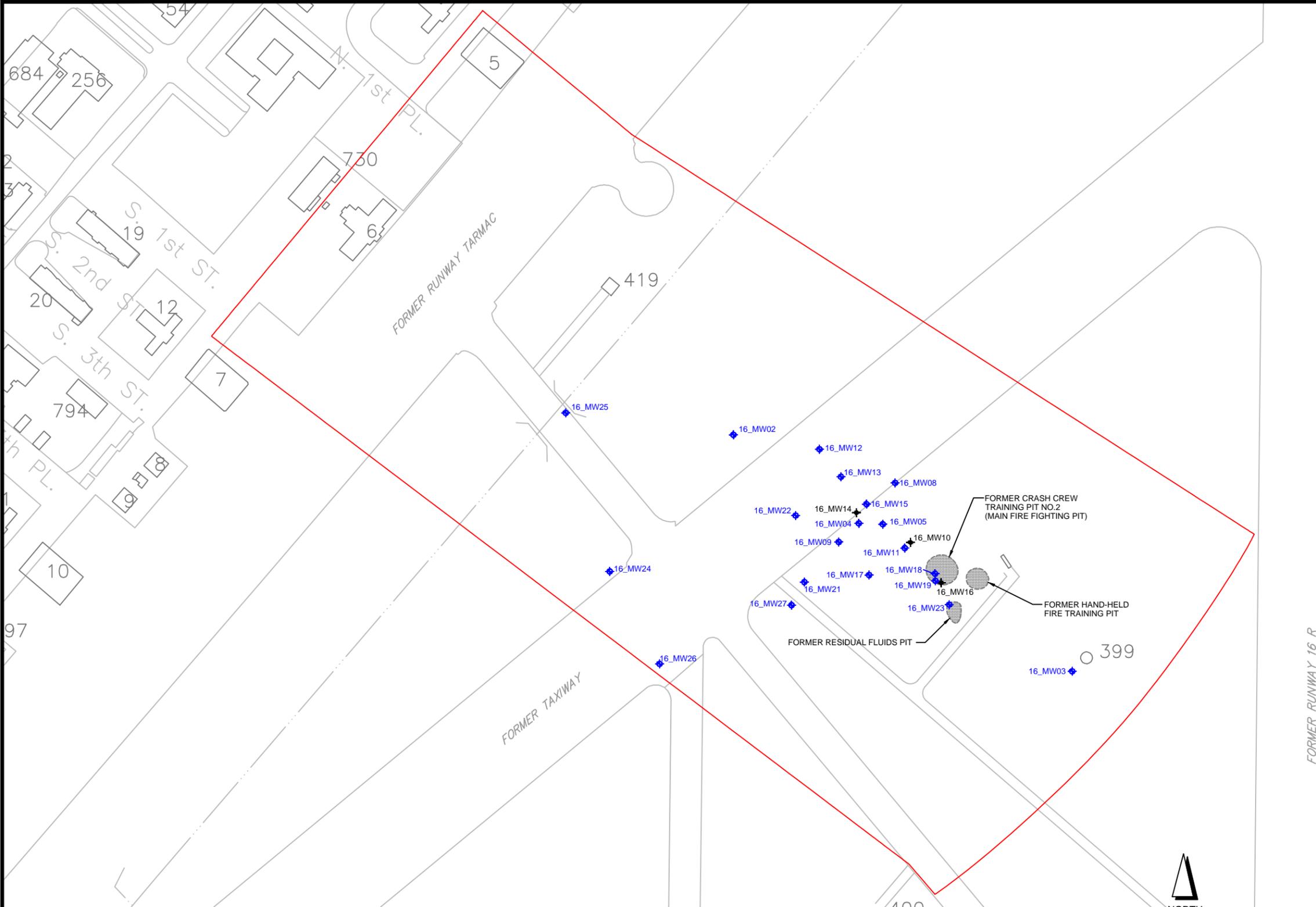
LEGEND:

- - - CARVE-OUT II-C BOUNDARY (AREA REQUIRING INSTITUTIONAL CONTROLS)
 - - - - - WASTE LIMIT AFTER CONSOLIDATION
 - - - - - 50' COMPLIANCE MONITORING ZONE BOUNDARY
 - - - - - 100' BUFFER ZONE
 - TOPOGRAPHIC CONTOUR LINE
 - RIPRAP
 - MAINTENANCE PATH
 - FILTER ROCK
 - X-X- FENCE
 - GMP01 LANDFILL GAS PERIMETER MONITORING PROBE (TYPICAL)
 - ⊕ MW01 GROUNDWATER MONITORING WELL (TYPICAL)
 - △ SM-1 SETTLEMENT MONUMENT (TYPICAL)
 - ⊠ GV01 LFG VENT (TYPICAL)
 - GTR01 LFG COLLECTION TRENCH (TYPICAL)
- NOTE: LFG = LANDFILL GAS



Five Year Review Report		
Site Plan Anomaly Area 3		
IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA3		
Date: 09-2014	Former MCAS El Toro	
Project No. 60225245		Figure 2-5

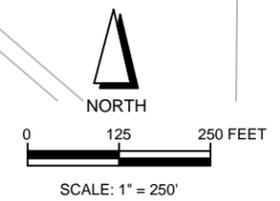
File: W:\work\60225245\CADD\Projects\Fig 2-6 - Site 16 Plan.dwg Time: Sep 09, 2014 - 10:54am



- LEGEND**
- 16_MW11 ◆ Groundwater Monitoring Well Used for LTM
 - 16_MW10 + Groundwater Monitoring Well with Deep Screen Interval used for LTM

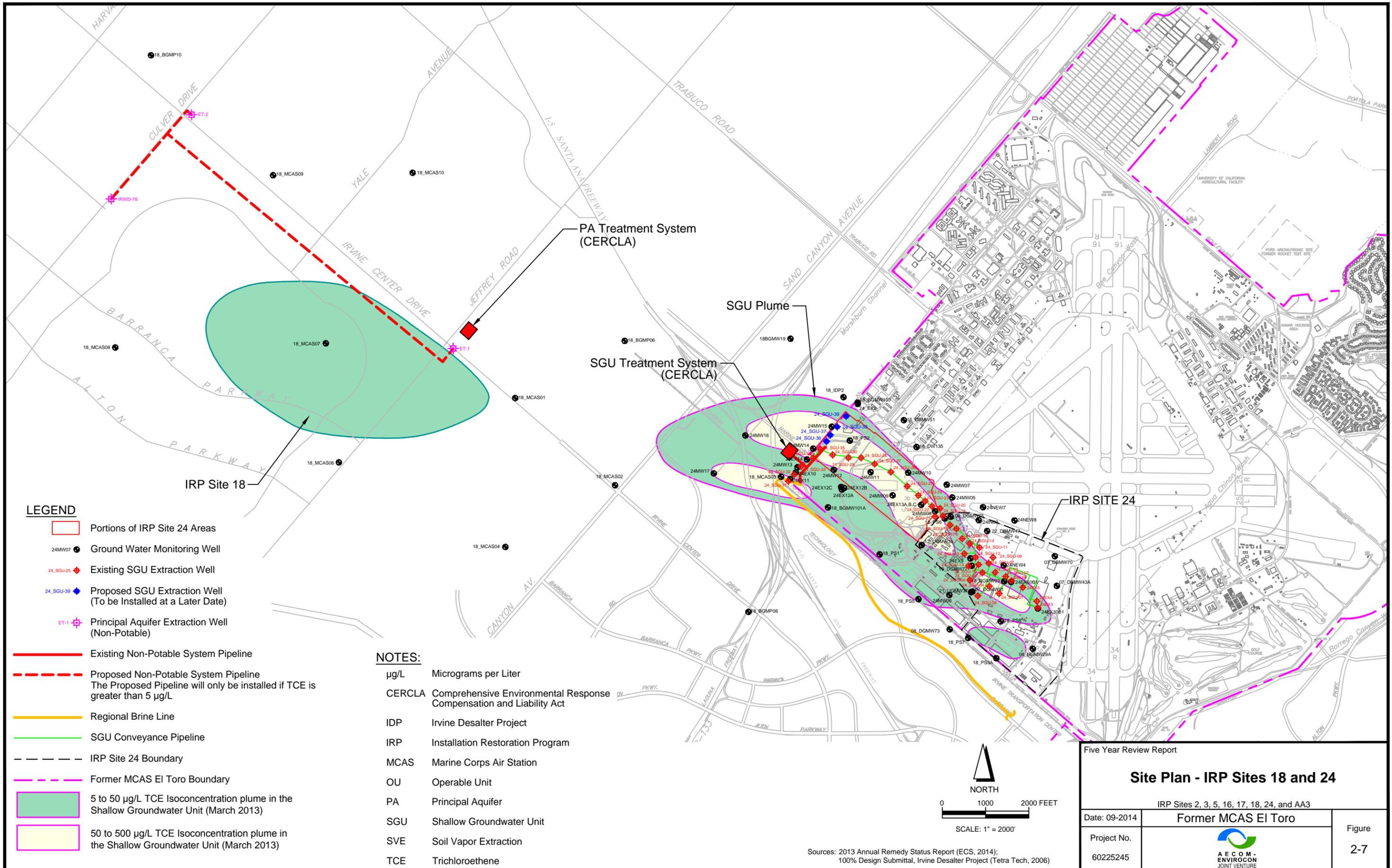
- Boundary of Area Requiring Institutional Controls
- Building with ID Number

- ACRONYMS / ABBREVIATIONS:**
- CDM CDM FEDERAL PROGRAMS CORPORATION
 - IRP INSTALLATION RESTORATION PROGRAM
 - LTM LONG TERM MONITORING
 - MCAS MARINE CORPS AIR STATION
 - MPE MULTI-PHASE EXTRACTION



SOURCE:
 CDM 2006. FINAL REMEDIAL DESIGN FOR NATURAL ATTENUATION WITH INSTITUTIONAL CONTROLS, OPERABLE UNIT 3, IRP SITE 16, CRASH CREW TRAINING PIT NO.2, FORMER MARINE CORPS AIR STATION EL TORO, CALIFORNIA.

Five Year Review Report		
Site Plan - IRP Site 16		
IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA3		
Date: 09-2014	Former MCAS El Toro	
Project No. 60225245		Figure 2-6

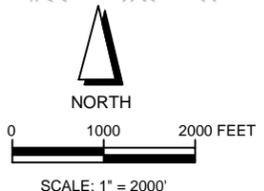


LEGEND

- Portions of IRP Site 24 Areas
- 24MW07 Ground Water Monitoring Well
- ◆ 24_SGU-25 Existing SGU Extraction Well
- ◆ 24_SGU-39 Proposed SGU Extraction Well (To be Installed at a Later Date)
- ✦ ET-1 Principal Aquifer Extraction Well (Non-Potable)
- Existing Non-Potable System Pipeline
- Proposed Non-Potable System Pipeline
The Proposed Pipeline will only be installed if TCE is greater than 5 µg/L
- Regional Brine Line
- SGU Conveyance Pipeline
- IRP Site 24 Boundary
- Former MCAS El Toro Boundary
- 5 to 50 µg/L TCE Isoconcentration plume in the Shallow Groundwater Unit (March 2013)
- 50 to 500 µg/L TCE Isoconcentration plume in the Shallow Groundwater Unit (March 2013)

NOTES:

- µg/L Micrograms per Liter
- CERCLA Comprehensive Environmental Response Compensation and Liability Act
- IDP Irvine Desalter Project
- IRP Installation Restoration Program
- MCAS Marine Corps Air Station
- OU Operable Unit
- PA Principal Aquifer
- SGU Shallow Groundwater Unit
- SVE Soil Vapor Extraction
- TCE Trichloroethene

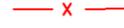


Five Year Review Report		
Site Plan - IRP Sites 18 and 24		
IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA3		
Date: 09-2014	Former MCAS El Toro	
Project No. 60225245		Figure 2-7

Sources: 2013 Annual Remedy Status Report (ECS, 2014);
100% Design Submittal, Irvine Desalter Project (Tetra Tech, 2006)

P:\60225245 - PERMAC II El Toro Sites 1 and 2 GW\7.0 Deliverables\7.6 Reports\2nd-Five-Year Review\Final\Figures\CADD\Fig 3-1 - Site 2 Post Construction.dwg

LEGEND:

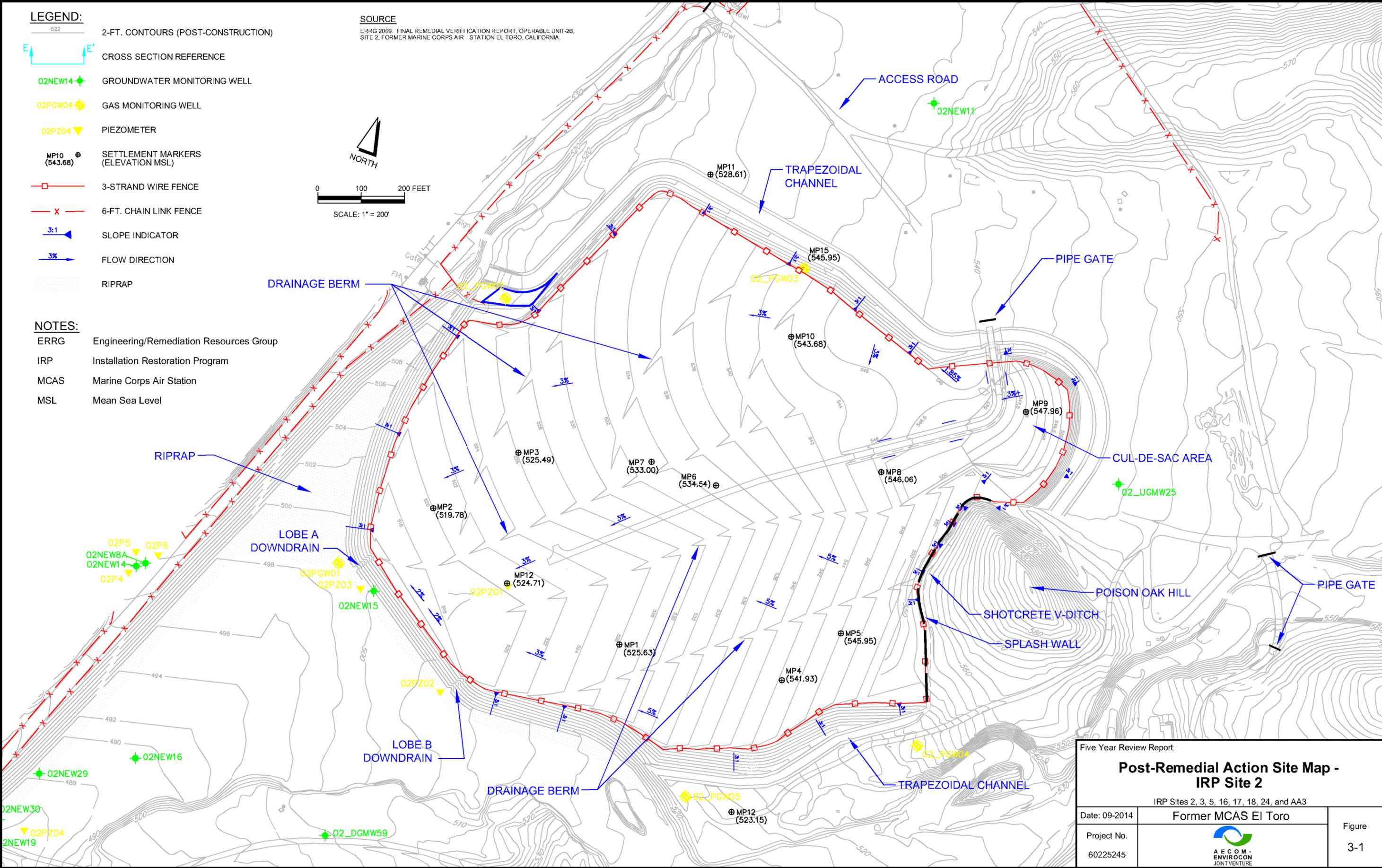
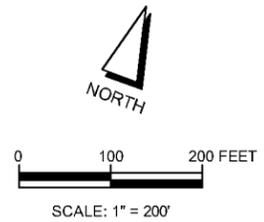
-  2-FT. CONTOURS (POST-CONSTRUCTION)
-  CROSS SECTION REFERENCE
-  GROUNDWATER MONITORING WELL
-  GAS MONITORING WELL
-  PIEZOMETER
-  SETTLEMENT MARKERS (ELEVATION MSL)
-  3-STRAND WIRE FENCE
-  6-FT. CHAIN LINK FENCE
-  SLOPE INDICATOR
-  FLOW DIRECTION
-  RIPRAP

NOTES:

- ERRG Engineering/Remediation Resources Group
- IRP Installation Restoration Program
- MCAS Marine Corps Air Station
- MSL Mean Sea Level

SOURCE

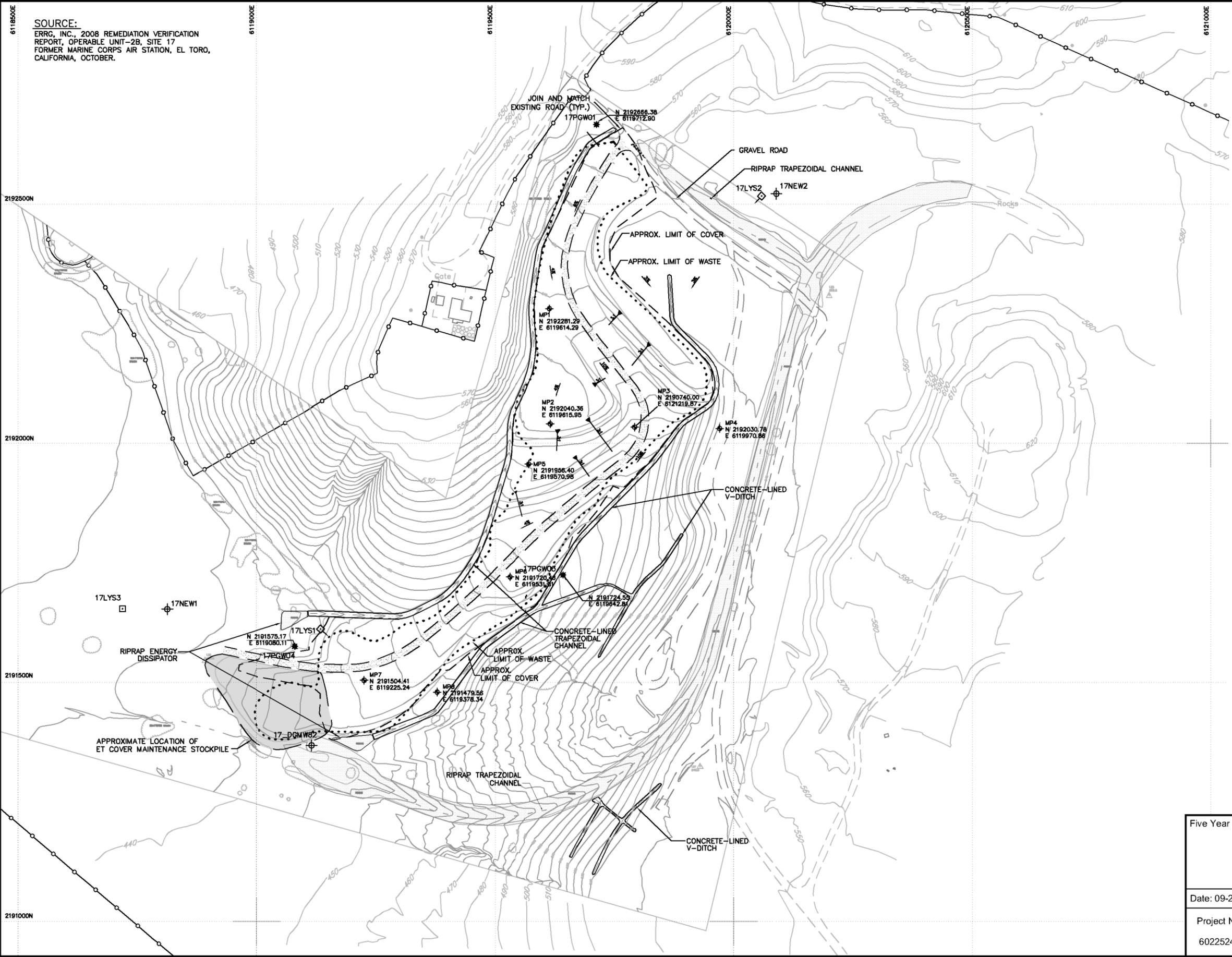
ERRG 2009. FINAL REMEDIAL VERIFICATION REPORT, OPERABLE UNIT-2B, SITE 2, FORMER MARINE CORPS AIR STATION EL TORO, CALIFORNIA.



Five Year Review Report		
Post-Remedial Action Site Map - IRP Site 2		
IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA3		
Date: 09-2014	Former MCAS El Toro	
Project No. 60225245		Figure 3-1

P: \60225245 - PERMAC II El Toro Sites 1 and 2 GW\7.0 Deliverables\7.6 Reports\2nd-Five-Year Review\Final\Figures\CADD\Fig 3-2 - Site 17 Post Construction.dwg

SOURCE:
 ERG, INC., 2008 REMEDIATION VERIFICATION
 REPORT, OPERABLE UNIT-2B, SITE 17
 FORMER MARINE CORPS AIR STATION, EL TORO,
 CALIFORNIA, OCTOBER.

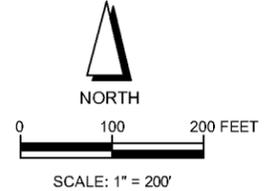


LEGEND

- 2-FT CONTOUR (FINAL GRADE)
- 10-FT CONTOUR (FINAL GRADE)
- GEODETIC GRID LINE
- APPROX. LIMIT OF COVER
- APPROX. LIMIT OF WASTE
- GRADE BREAK
- CONCRETE-LINED CHANNELS/DITCHES
- RIPRAP
- ACCESS ROAD
- SETTLEMENT MONUMENT
- FENCE LINE
- BUILDING
- VEGETATION
- POWER POLE
- SLOPE (HORIZONTAL TO VERTICAL)
- SLOPE AND FLOW DIRECTION
- GROUNDWATER MONITORING WELL
- LYSIMETER DRILLED AT 30° ANGLE (SHOWS ANGLE DIRECTION)
- GAS MONITORING PROBE
- SETTLEMENT MONUMENT

NOTES:
 1. FINAL CONTOURS SHOWN ARE ELEVATIONS AFTER PLACEMENT OF FOUNDATION LAYER AND EVAPOTRANSPIRATION SOIL COVER OVER PREPARED SUBGRADE.

ERG Engineering/Remediation Resource Group, Inc.
 ET Evapotranspiration
 IRP Installation Restoration Program
 MCAS Marine Corps Air Station



Five Year Review Report

Post-Remedial Action Site Map - IRP Site 17

IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA3

Date: 09-2014	Former MCAS El Toro	Figure
Project No. 60225245		3-2

DRAWING NUMBER 129894-B97

APPROVED BY M. AYALA 2/29/12

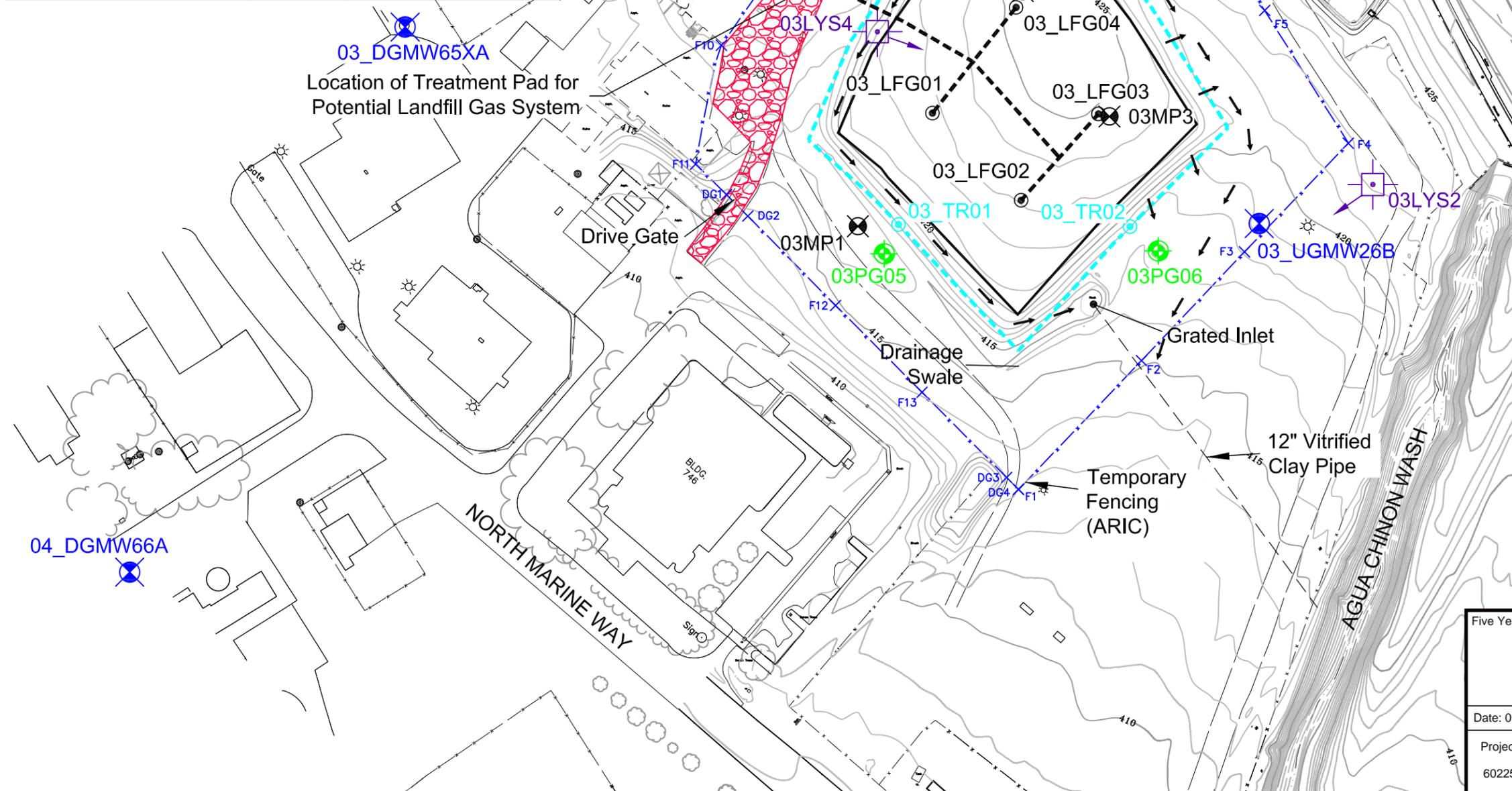
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DRAWN BY SCHAEFFER 2/29/12

OFFICE CONCORD

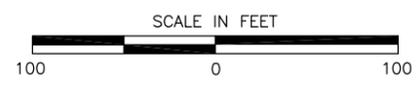
X-REF SITE

PERIMETER SITE FENCING				
LOCATION	EASTING (FT)	NORTHING (FT)	ELEV. (FT)	PT
S CORNER	6115642.705	2192778.081	412.99	F1
BETWEEN S CORNER AND E CORNER	6115742.902	2192882.878	415.09	F2
BETWEEN S CORNER AND E CORNER	6115826.989	2192971.348	418.10	F3
E CORNER	6115911.643	2193059.666	421.87	F4
BETWEEN E CORNER AND N CORNER	6115843.348	2193167.598	422.60	F5
BETWEEN E CORNER AND N CORNER	6115750.102	2193296.631	423.20	F6
N CORNER	6115647.759	2193431.272	423.38	F7
BETWEEN N CORNER AND W CORNER	6115576.702	2193355.189	421.99	F8
BETWEEN N CORNER AND W CORNER	6115494.031	2193263.931	420.89	F9
W CORNER	6115400.413	2193139.274	419.01	F10
SW CORNER	6115379.472	2193042.683	416.94	F11
DRIVE GATE	6115404.635	2193017.827	413.98	DG1
DRIVE GATE	6115422.050	2193000.377	413.77	DG2
BETWEEN SW CORNER AND S CORNER	6115493.513	2192927.644	414.80	F12
BETWEEN SW CORNER AND S CORNER	6115564.034	2192857.098	414.09	F13
DRIVE GATE	6115633.027	2192787.801	413.90	DG3
DRIVE GATE	6115642.613	2192778.173	412.99	DG4



LEGEND

- SURFACE WATER DRAINAGE PATH
- ~ FINAL SITE TOPOGRAPHY
- ▭ EXTENT OF FINAL COVER SYSTEM
- EXISTING FENCE
- +— INSTALLED PERIMETER SITE FENCING
- +— EXISTING ACCESS ROAD
- ▨ INSTALLED GRAVEL ACCESS ROAD
- ⊗ SURVEY MONUMENT
- GAS MONITORING TRENCH WITH VENT
- GAS EXTRACTION WELL
- LANDFILL GAS CONVEYANCE PIPE
- GAS MONITORING WELL
- ⊗ GROUNDWATER MONITORING WELL
- ⊠ LYSIMETER
- ARIC AREA REQUIRING INSTITUTIONAL CONTROL
- F1/DG1 ⊗ PERIMETER SITE FENCING SURVEY POINT



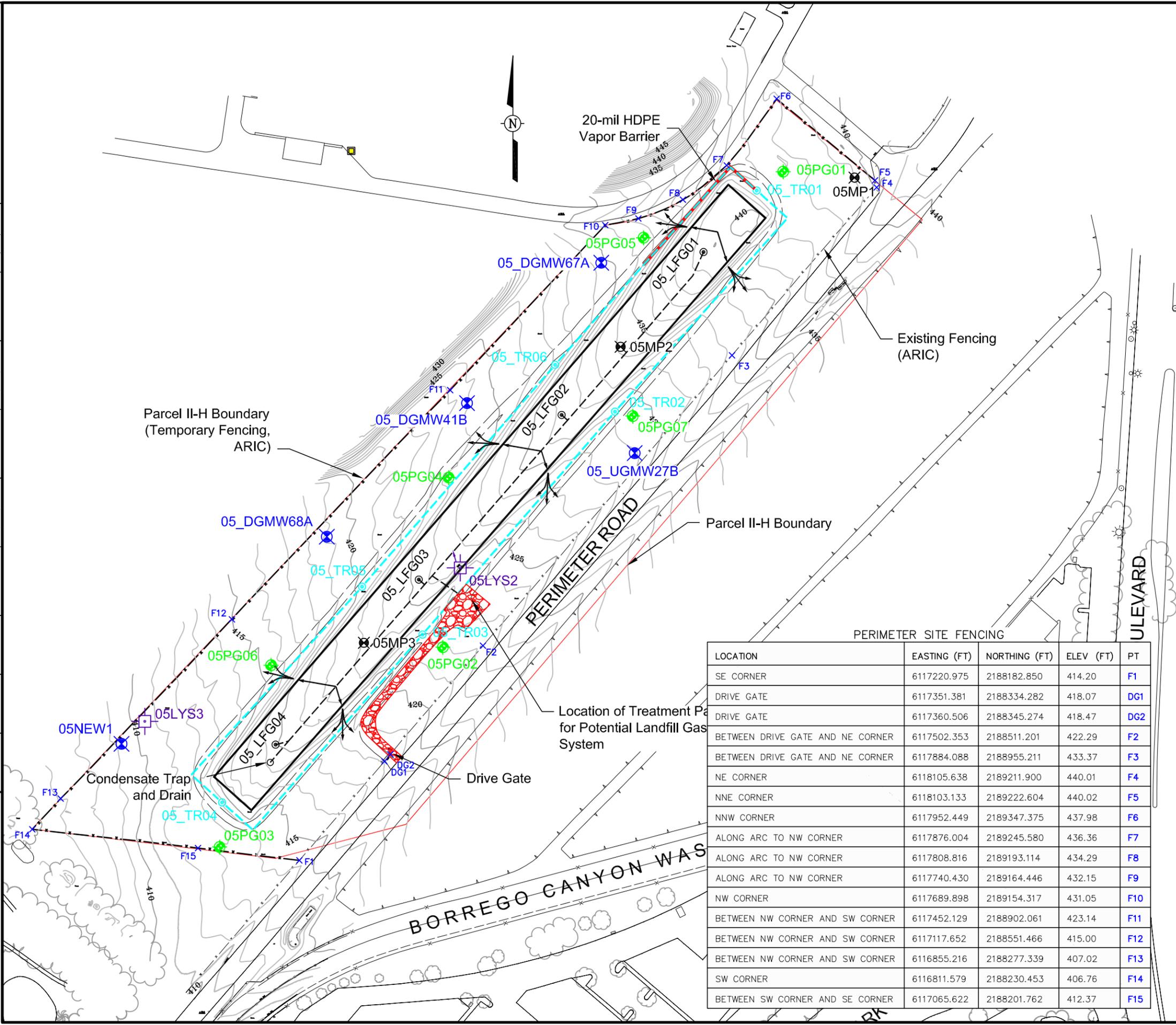
Five Year Review Report

Post-Remedial Action Site Map

IRP Site 3

IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA3

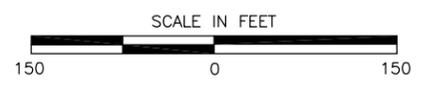
Date: 09-2014	Former MCAS EI Toro	Figure
Project No. 60225245		3-3



- LEGEND**
- SHEET FLOW OFF LANDFILL
 - FINAL SITE TOPOGRAPHY
 - EXTENT OF FINAL COVER SYSTEM
 - PARCEL II-H BOUNDARY
 - EXISTING FENCE
 - INSTALLED PERIMETER SITE FENCING
 - EXISTING ACCESS ROAD
 - INSTALLED GRAVEL ACCESS ROAD
 - SURVEY MONUMENT
 - GAS MONITORING TRENCH WITH VENT
 - GAS MONITORING TRENCH WITH VAPOR BARRIER
 - GAS EXTRACTION WELL
 - LANDFILL GAS CONVEYANCE PIPE
 - GAS MONITORING WELL
 - GROUNDWATER MONITORING WELL
 - LYSIMETER
 - ARIC AREA REQUIRING INSTITUTIONAL CONTROL
 - PERIMETER SITE FENCING SURVEY POINT

PERIMETER SITE FENCING

LOCATION	EASTING (FT)	NORTHING (FT)	ELEV (FT)	PT
SE CORNER	6117220.975	2188182.850	414.20	F1
DRIVE GATE	6117351.381	2188334.282	418.07	DG1
DRIVE GATE	6117360.506	2188345.274	418.47	DG2
BETWEEN DRIVE GATE AND NE CORNER	6117502.353	2188511.201	422.29	F2
BETWEEN DRIVE GATE AND NE CORNER	6117884.088	2188955.211	433.37	F3
NE CORNER	6118105.638	2189211.900	440.01	F4
NNE CORNER	6118103.133	2189222.604	440.02	F5
NNW CORNER	6117952.449	2189347.375	437.98	F6
ALONG ARC TO NW CORNER	6117876.004	2189245.580	436.36	F7
ALONG ARC TO NW CORNER	6117808.816	2189193.114	434.29	F8
ALONG ARC TO NW CORNER	6117740.430	2189164.446	432.15	F9
NW CORNER	6117689.898	2189154.317	431.05	F10
BETWEEN NW CORNER AND SW CORNER	6117452.129	2188902.061	423.14	F11
BETWEEN NW CORNER AND SW CORNER	6117117.652	2188551.466	415.00	F12
BETWEEN NW CORNER AND SW CORNER	6116855.216	2188277.339	407.02	F13
SW CORNER	6116811.579	2188230.453	406.76	F14
BETWEEN SW CORNER AND SE CORNER	6117065.622	2188201.762	412.37	F15



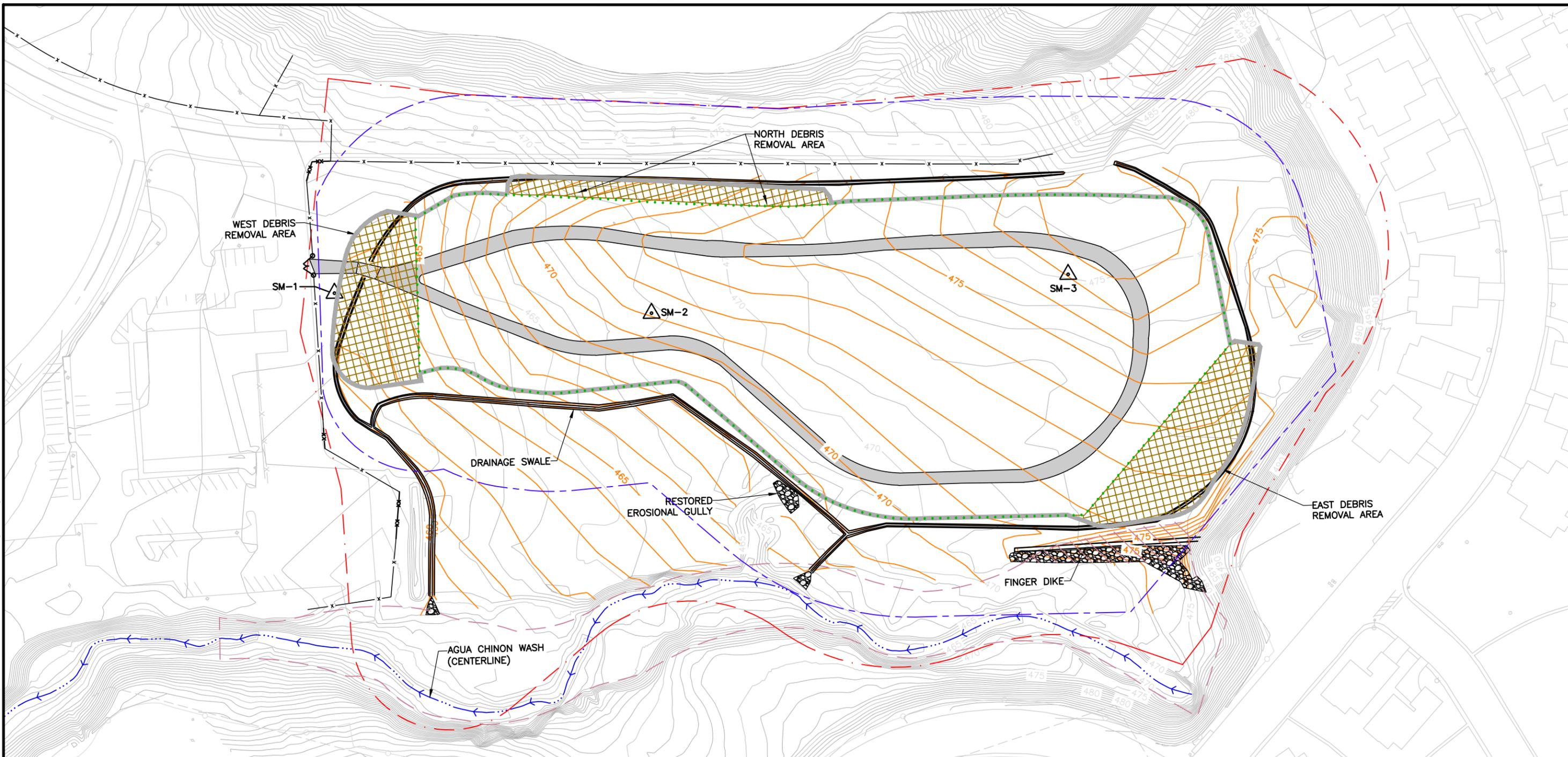
Five Year Review Report

Post-Remedial Action Site Map
IRP Site 5

IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA3

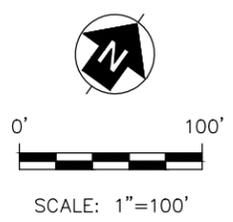
Date: 09-2014	Former MCAS EI Toro	Figure 3-4
Project No. 60225245		

P:\60225245 - PERMAC II El Toro Sites 1 and 2 GW7.0 Deliverables\7.6 Reports\2nd-Five-Year Review\Final\Figures\Figure 3-5 Post-Remedial Action Site Map - Anomaly Area 3 v5 [20140612].ai



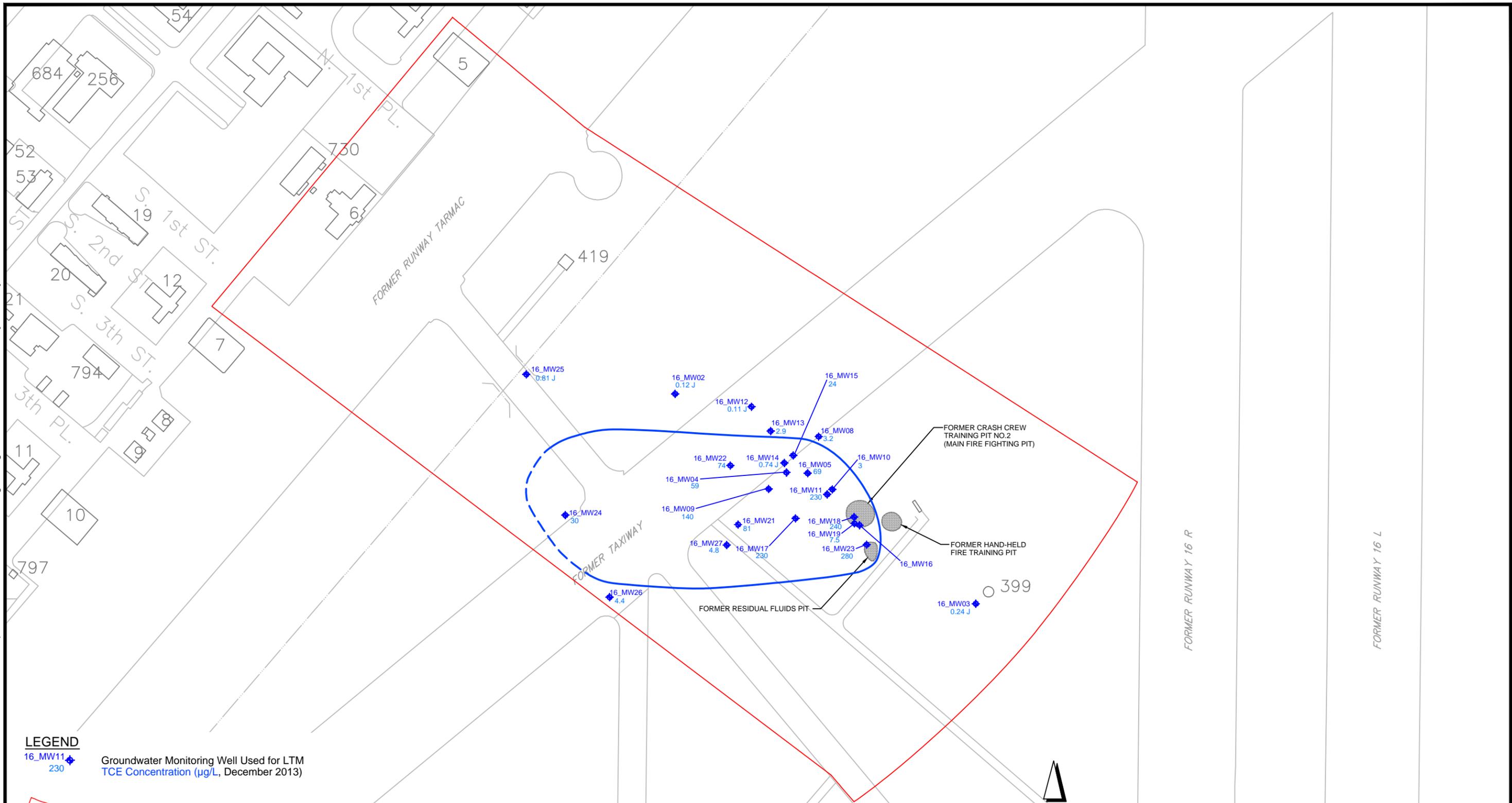
LEGEND:

- - - CARVE-OUT II-C BOUNDARY (AREA REQUIRING INSTITUTIONAL CONTROLS)
- FORMER WASTE LIMIT
- . . . WASTE LIMIT AFTER CONSOLIDATION
- - - 100' BUFFER ZONE
- - - 100-YEAR FLOODPLAIN BOUNDARY
- 465 PRE-CONSTRUCTION TOPOGRAPHIC CONTOUR LINE
- 475 POST-CONSTRUCTION TOPOGRAPHIC CONTOUR LINE
- △ SETTLEMENT MONUMENT
- DEBRIS REMOVAL AREA
- RIPRAP
- MAINTENANCE PATH
- FILTER ROCK
- X-X- EXISTING FENCE
- XX- FENCE REPAIRED
- - - EXISTING FENCE REMOVED BY DEVELOPER



Five Year Review Report		
Post-Remedial Action Site Map		
Anomaly Area 3		
IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA3		
Date: 09-2014	Former MCAS El Toro	
Project No. 60225245		Figure 3-5

P:\60225245 - PERMAC II El Toro Sites 1 and 2 GW\7.0 Deliverables\7.6 Reports\2nd-Five-Year Review\Final\Figures\Figure 3-6 Site 16 GW TCE Conc [20140612].ai

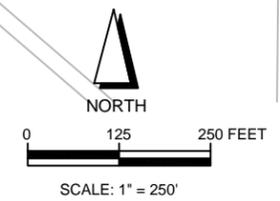


LEGEND

-  Groundwater Monitoring Well Used for LTM TCE Concentration (µg/L, December 2013)
-  Boundary of Area Requiring Institutional Controls
-  Building with ID Number
-  Extent of TCE in Shallow Groundwater exceeding 5 µg/L (Dashed where approximate)

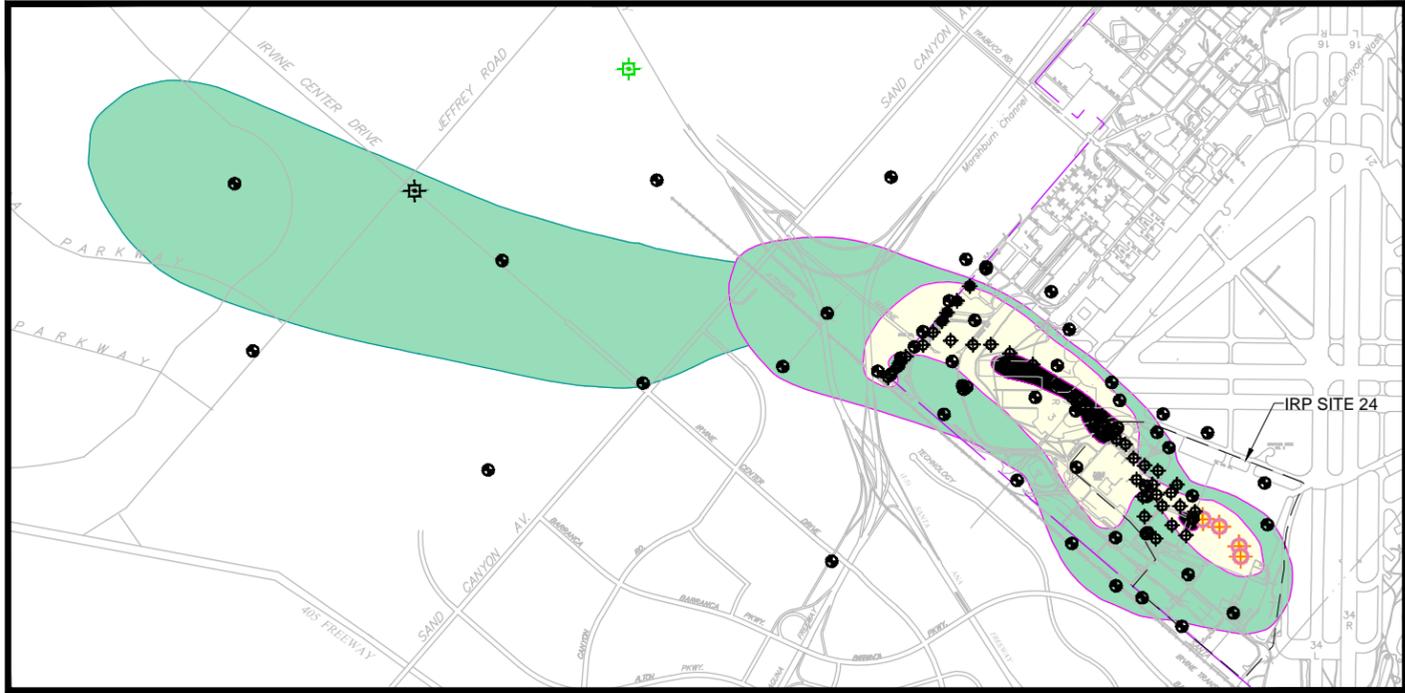
ACRONYMS / ABBREVIATIONS:

- µg/L MICROGRAMS PER LITER
- IRP INSTALLATION RESTORATION PROGRAM
- J ESTIMATED CONCENTRATION
- LTM LONG TERM MONITORING
- MCAS MARINE CORPS AIR STATION
- TCE TRICHLOROETHENE

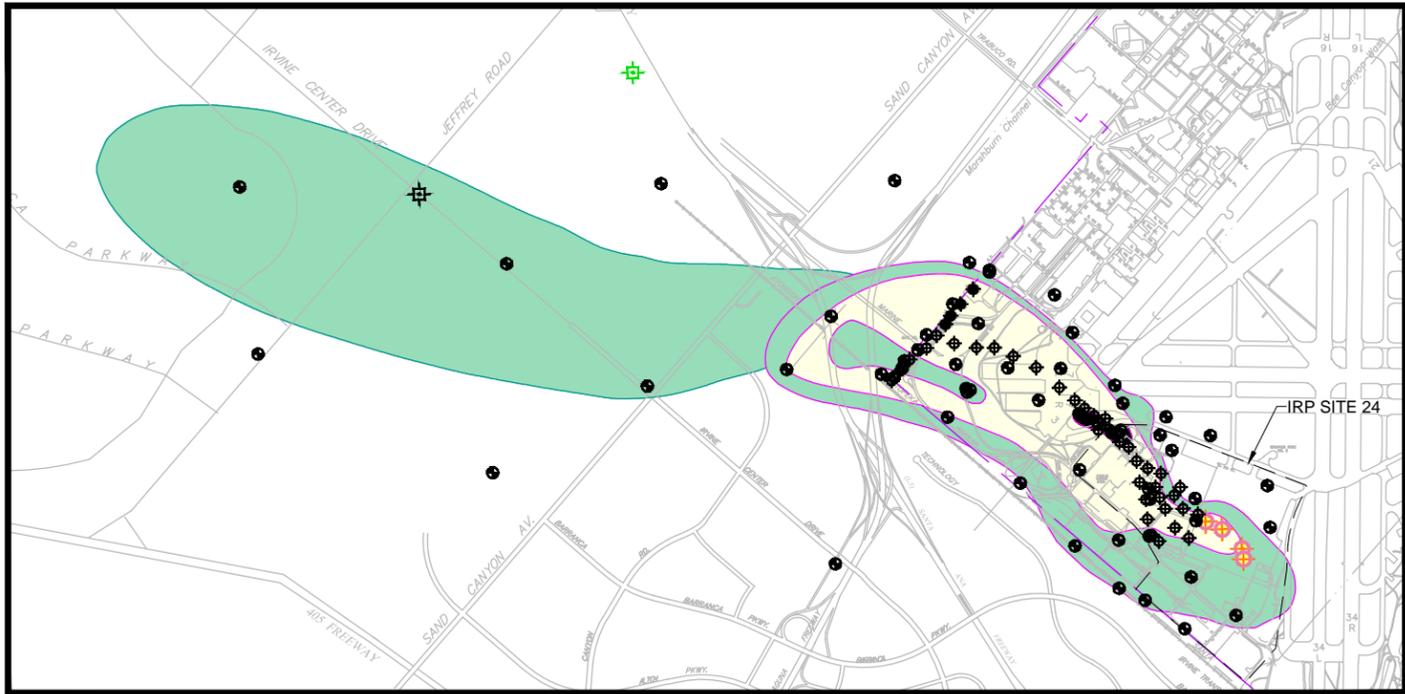


SOURCE:
 Trevet 2014. Preliminary Draft.
 2013 Annual Long-Term Groundwater Monitoring Report for Operable Unit 3, IRP Site 16, Crash Crew Training Pit No. 2, Former Marine Corps Air Station El Toro, Irvine, California.

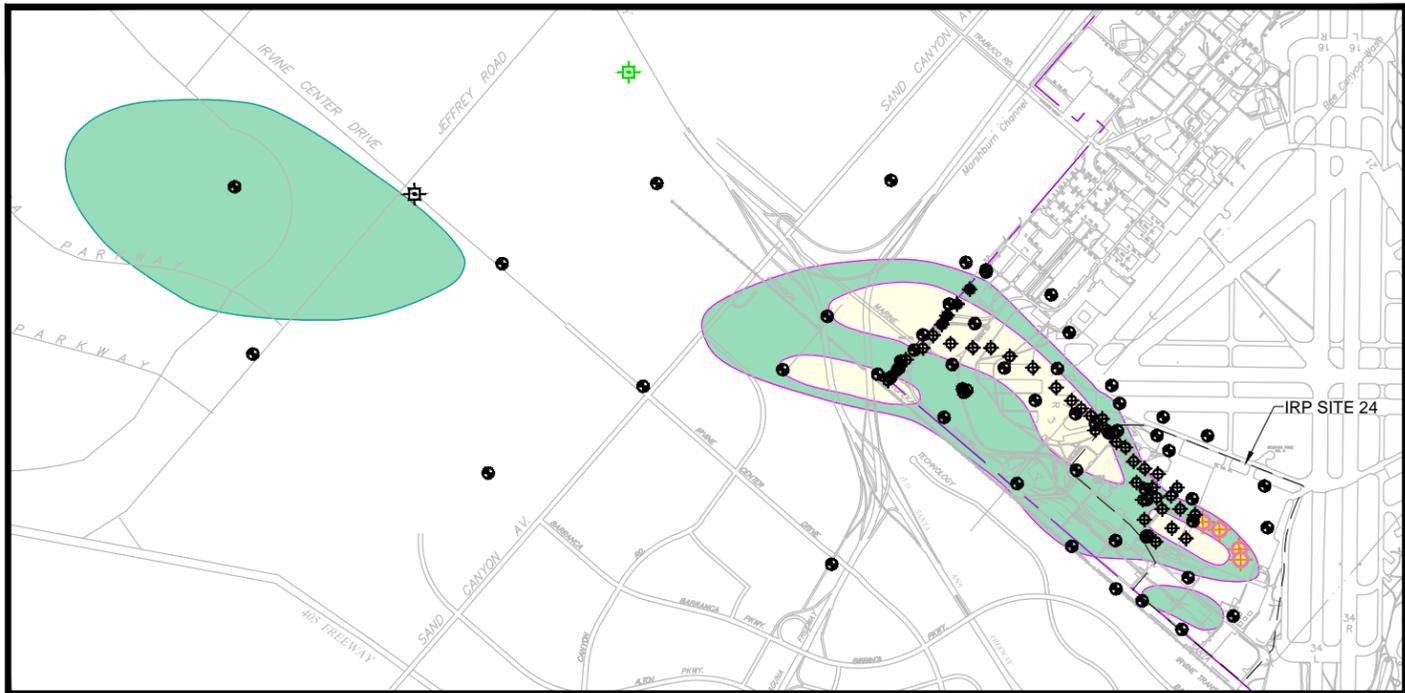
Five Year Review Report		
IRP Site 16		
Groundwater TCE Concentrations		
December 2013		
IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA3		
Date: 09-2014	Former MCAS El Toro	
Project No. 60225245		Figure 3-6



SEPTEMBER 2006 BASELINE



JULY 2008 (END OF 2ND YEAR OF OPERATION)



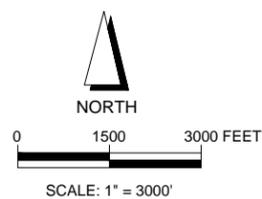
MARCH 2013 (AFTER 6.5 YEARS OF OPERATION)

LEGEND

- Monitoring Well
- ◆ Existing SGU Extraction Well
- ◆ Proposed SGU Extraction Well (To be Installed at a Later Date)
- ⊕ Principal Aquifer Extraction Well (Non-Potable)
- ⊕ Principal Aquifer Extraction Well (Potable)
- ⊕ Well to be used for Evaluation of SVE Enhancement
- IRP Site 24 Boundary
- - - Former MCAS El Toro Boundary
- SGU Plume Boundary
- Principal Aquifer Plume Boundary
- 5 µg/L TCE Isoconcentration Contour
- 10 µg/L TCE Isoconcentration Contour
- 50 µg/L TCE Isoconcentration Contour
- 500 µg/L TCE Isoconcentration Contour

NOTES:

- µg/L Microgram per Liter
- IDP Irvine Desalter Project
- IRP Installation Restoration Program
- OU Operable Unit
- TCE Trichloroethene



Five Year Review Report		
TCE Isoconcentration Contours Over Time		
IRP Sites 18 and 24		
IRP Sites 2, 3, 5, 16, 17, 18, 24, and AA3		
Date: 09-2014	Former MCAS El Toro	
Project No. 60225245		
		Figure 5-1