Final

Performance Monitoring and Sampling and Analysis Plan OU1 and OU2 Groundwater Remedy

FORMER MARINE CORPS AIR STATION EL TORO, CALIFORNIA

August 2007

Prepared for:
Base Realignment and Closure
Program Management Office West
San Diego, California

Prepared under:
Contract Number No. N62742-94-D-0048
Contract Task Order 0068
DCN: ET-0048-0068-0003

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Prepared by:

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Final
Performance Monitoring and
Sampling and Analysis Plan
(including Field Sampling Plan/Quality Assurance Project Plan)
OU1 and OU2A Groundwater Remedy
Former MCAS El Toro, California

Contract No. N62742-94-D-0048
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DCN: ET-0048-0068-0003

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PAGE NO. iv

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Navy Responses to DTSC Follow-On Comments Site 18 and 24 Performance Monitoring and Sampling and Analysis Plan MCAS El Toro

RTC, General Comment No. 1: GSU remains concerned that vertical transport is occurring in the wells listed in the original comment. If the Navy believes these wells to be beneficial to its understanding of the plume, GSU will reserve judgment.

NAVY RESPONSE: Comment noted. These wells were installed to account for significant drawdown anticipated with the extraction of groundwater. Since implementation of the remedy, drawdown due to the extraction wells has been measured at greater than 7 feet in some areas of the capture zone. These wells will be evaluated for decommissioning based on the flowchart (Figure 3-3) in the Performance Monitoring and Sampling and Analysis Plan (PMP). Where possible, wells with longer screens will be preferentially removed versus wells with shorter screens (e.g., short- and long-screen wells located adjacent to one another).

RTC, General Comment No. 6: GSU reiterates the original request. Concern about emerging contaminants (ECs) post-dates the ROD, and will continue to be an issue as new ECs become a concern to the State of California. GSU believes that each of the listed ECs may plausibly have been used at MCAS El Toro, and that prudent management of the risk, by occasional sampling of the extraction wells, is fully warranted.

NAVY RESPONSE: Detection of any of the ECs will not change the remedial action objectives or performance of the remedy as documented in the Record of Decision (ROD). The remedy is designed to remove compounds, primarily trichloroethylene (TCE) from groundwater, and prevent migration of these compounds in groundwater. Since TCE has been identified as the primary contaminant of concern, capture of TCE will also result in the capture of other compound that may be present in the groundwater. Per the Settlement Agreement, extraction wells will be sampled and analyzed for the compounds identified in Table 2-1 of the PMP.

RTC, Specific Comment No. 1: GSU does not concur that the Navy has sufficient data to make this assertion, and has repeatedly pointed out this data gap to the Navy in previous comments. The Navy should modify or eliminate this language.

NAVY RESPONSE: The text will be revised to "VOC contamination migrated from the soil to the SGU at IRP Site 24 and to the regional principal aquifer at IRP Site 18, which is defined as the area where TCE concentrations are greater than 5 micrograms per liter (ug/L) in the principal aquifer as shown in Figure 1-3."

Document Title:

Draft Performance Monitoring and Sampling and Analysis Plan, OU1 and OU2A Groundwater Remedy, Former Marine Corps Air Station El Toro, California, September 2006

Comment No.	Section/ Page No.	Comment	Response
Comment from John Broderick, Regional Water Quality Control Board, November 27, 2006			
1		The State Water Resources Control Board (SWRCB) has adopted regulations requiring the electronic submittal of information (ESI) over the internet, for cleanup programs. Since January 1, 2005, parties responsible for cleanup at sites overseen by the Regional Board have been required to submit the following information electronically: • Groundwater analytical data; • Surveyed locations of monitoring wells; • Boring logs describing monitoring well construction, and; • Portable data format (PDF) copies of all reports. Go to http://geotracker.waterboards.ca.gov/ for information on obtaining a password, data format, and instructions for electronic submittal of information. Please submit an electronic copy of the plan, the subsequent reports, and the soil and groundwater analytical data to the SWRCB GeoTracker website.	CERCLA § 121(d)(2) requires compliance with applicable or relevant and appropriate state requirements [ARARs] when they are more stringent than federal rules and have been "promulgated" at the state level. Although GeoTracker reporting requirements have been promulgated, the DON deems them as procedural in nature, as they only address the method of reporting. The GeoTracker regulation does not address substantive environmental requirements, as ARARs are required to do. Consequently, the Regional Board cannot require the DON to comply with GeoTracker reporting requirements when DON is conducting cleanups under CERCLA. However, the DON is evaluating the feasibility of exporting electronic data from our centralized database so that we can voluntarily share data with the Water Boards. The DON will be sending a formal response on this issue in the near future. We appreciate your continued support in this endeavor.

Document Title:

Draft Performance Monitoring and Sampling and Analysis Plan, OU1 and OU2A Groundwater Remedy, Former Marine Corps Air Station El Toro, California, September 2006

Comment No.	Section/ Page No.	Comment	Response
Comment from Rich Muza, U.S. EPA (received via email to Marc Smits December 12, 2006)			
1		After our phone discussion late last week, Herb Levine and I took a look at the text of Section 4 in the Draft Performance Monitoring and Sampling and Analysis Plan. We are satisfied with the information provided and withdraw our one comment from EPA's December 4th letter asking for additional information on data and system evaluation.	Comment acknowledged.

Document Title:

Draft Performance Monitoring and Sampling and Analysis Plan, OU1 and OU2A Groundwater Remedy, Former Marine Corps Air Station El Toro, California, September 2006

Comment No.	Section/ Page No.	Comment	Response
Comment from Quang Than, DTSC dated December 20, 2006			
1		DTSC requests that the Navy adds a new sub-section 2.2.1.3 to update the implementation status of the institutional controls described in the Operable Unit 1 (OU1) and OU2A Record of Decision (ROD). This new sub-section should contain information such as whether any water wells have been constructed within the off-Station VOC plume since issuance of the ROD, if so have the Orange County Health Care Agency (OCHCA) and the Irvine Ranch Water District (IRWD) forwarded copies of the well permits to the Navy, whether the Navy has been providing updated maps of the VOC groundwater plume annually to OCCHD and IRWD.	The purpose of the Performance Monitoring and Sampling and Analysis Plan is to identify data to be collected, and the analysis methods to be performed to evaluate remedy progress versus RAOs. The implementation status of the institutional controls will be updated in the forthcoming Interim Remedial Action Completion Report, which will detail the remedial action conducted to date.
General Comments from Dave Murchison, DTSC Geological Services Unit			
1		GSU notes that a number of proposed monitoring wells have very long screens, and that several of these wells are located in the source areas and other high contamination zones of the plume. The presence of these wells allows rapid migration of contaminated water into less contaminated zones, and migration of relatively clean water into contaminated zones. This condition is contrary to current standards of good remedial practice. The Navy should propose to remove the long-screened wells in the central parts of the plume and replace them with short screen or multilevel monitoring wells. The affected wells include 24MW07, 24IN03, 24EX6OB1, 24EX3OB1, 07DGMW91, 21_UGMW37, 24EX9, 10_DGMW77, 24EX13A/B/C (all three screens), 24NEW4, 22_DBMW47, and 09_DGMW75.	The referenced wells represent currently beneficial components of the comprehensive monitoring well network for the active remedy. Data collected to date does not indicate that these wells have adversely affected plume migration. All of the well screens, with the exception of the bottom of 24EX13C which is screened in the upper portion of the intermediate zone, are located within the SGU. The on-Station portion of the remedy includes aggressive groundwater extraction from the entire vertical profile of the SGU. Thus, VOCs within the SGU will be addressed by the remedy. Furthermore, groundwater extraction will induce significant drawdown within the SGU, requiring long screens to monitor groundwater levels and evaluate hydraulic containment. Short screens may be rendered dry as dewatering progresses. The BCT engaged in a considerable amount of discussion regarding the monitoring well network during remedy

Document Title:

Draft Performance Monitoring and Sampling and Analysis Plan, OU1 and OU2A Groundwater Remedy, Former Marine Corps Air Station El Toro, California, September 2006

Comment No.	Section/ Page No.	Comment	Response
			design. Several technical meetings and conference calls were held between the submission of the 60% Design Report and the 90% Design Report to finalize the proposed monitoring well network. As a result of the discussions, the DON proposed (and installed) the following short-screened, multi-level monitoring wells specifically for monitoring the OU1 and OU2A remedy: 24MW08 (Westbay, 6 screens from SGU to PA) 24MW09 (nested, 4 screens within SGU) 24MW10 (nested, 4 screens within SGU) 24MW11 (nested, 4 screens within SGU) 24MW12 (nested, 4 screens within SGU) 24MW13 (nested, 4 screens within SGU) 24MW14 (nested, 4 screens within SGU) 24MW15 (nested, 4 screens within SGU) 24MW16 (Westbay, 6 screens from SGU to PA) 24MW17 (Westbay, 6 screens from SGU to PA) The monitoring network, including the new wells described above, was presented in the 100% Design Submittal, which was finalized in 2004 with BCT concurrence. No further revision to the monitoring well network is required at this time.
2		GSU notes that wells 07_DBMW70 and 15_DBMW51 are located well outside the plume boundary, and that other wells located closer to the plume should suffice for defining the plume boundary during the remedy. GSU is of the opinion that these wells need not be included in the sampling and analysis program.	Wells 07_DBMW70 and 15_DBMW51 will be sampled quarterly for the initial year of system operation. Based on the sampling results, a recommendation will be made in the initial Annual Remedy Status Report regarding the continuance of sampling at various monitoring wells, including 07_DBMW70 and 15_DBMW51.
3		GSU requests that screens 18_DW135, 18_DW250, 18_DW350, 18_DW450, and 18_DW540 be included in the monitoring program. The Plan proposes including 18_DW135 in order to monitor the northern margin of the SGU plume. GSU points	Well screens 18_DW135, 250, 350, 450, and 540, located along the VOC plume boundary, were monitored from January 1992 through March 2003 during Stationwide groundwater monitoring. With the exception of a reported concentration of 1 µg/L

Document Title:

Draft Performance Monitoring and Sampling and Analysis Plan, OU1 and OU2A Groundwater Remedy, Former Marine Corps Air Station El Toro, California, September 2006

Comment No.	Section/ Page No.	Comment	Response
		out that the deeper screens at 450 and 540 feet bgs, located in the Principal Aquifer have persistently returned concentrations of 1 to 3 µg/L TCE. These are the furthest upgradient detections in the Principal Aquifer, and should continue to be monitored during the remedy.	in July 1993, TCE was not detected at 18_DW250. Similarly, with the exception of an apparent anomalous detection in June 2000, TCE was not detected at 18_DW350. Due to a lack of historical detections and peripheral location, well screens 18_250, and 350 will not provide meaningful data for evaluating the SGU remedy, and do not warrant addition to the performance monitoring well network. However, although VOC concentrations have not been detected above MCLs at 18_DW450 and 18_DW540, the two well screens will be added to the monitoring network, and sampled, analyzed, and evaluated in accordance with the procedures detailed in the Performance Monitoring and Sampling and Analysis Plan.
4		GSU requests that any wells within the plume not proposed for continued monitoring or extraction be removed to prevent vertical migration of water during the remediation.	A comprehensive evaluation of the MCAS El Toro monitoring well network is currently being conducted to identify wells to be demolished. Wells not required for ongoing monitoring or extraction within Site 24 and at other IRP sites will be removed.
5		GSU does not concur with the proposal to eliminate VOCs from further analysis in a particular extraction well if the VOC is not detected for four successive sampling events. GSU regards this proposal as insufficiently protective, since analytes will be migrating toward extraction wells in the subsurface and may increase with time. GSU suggests that VOCs not detected in any of the active extraction wells for a period of four quarters or more may be eliminated from routine analysis, but requests that the full suite of VOCs be tested during the first four quarters, and at least once every 5 years thereafter. VOCs detected in any extraction well should remain on the list of routine analytes.	The second sentence of Section 3.4.1.2 has been modified to read: "Any VOC not detected in four consecutive *quarterly* sampling events will be deleted from the analyte list...". Analysis will include the full suite of VOC analytes in accordance with EPA method 8260B for the first year of operation. Additionally, the full suite of VOC analytes will be reported for active extraction wells every 5 years for inclusion in the 5-year review report.
6		GSU requests that all extraction wells be tested once	A substantial amount of groundwater sampling and

Document Title:

Draft Performance Monitoring and Sampling and Analysis Plan, OU1 and OU2A Groundwater Remedy, Former Marine Corps Air Station El Toro, California, September 2006

Comment No.	Section/ Page No.	Comment	Response
		every 5 years for the emerging chemicals 1,4-dioxane, bis-phenol-A, phthalates, perchlorate, nonylphenols, nitrosodimethylamine, and brominated flame retardants.	analysis has been performed at IRP Site 24 in association with previous investigations. As a result, the OU1 and OU2A Record of Decision (ROD) clearly identified COCs and monitoring requirements to be addressed by the remedy. The COCs are comprised exclusively of VOCs. In accordance with the Settlement Agreement, perchlorate and phthalates will be monitored at the point of connection between the DON and IRWD (i.e., ECLs). Perchlorate and phthalates will be monitored quarterly from the cumulative flow from the SGU wells. If the concentration exceeds the ECL established in the Settlement Agreement, additional sampling will be performed to identify specific concentrations at the extraction wells. Monitoring of the additional requested constituents would require the preparation of a ROD Amendment, or an Explanation of Significant Differences (ESD). However, it is the DON's position that, with the exception of perchlorate, there is no technically valid rationale for the inclusion of these constituents. In general, the DON uses several criteria to determine if sampling for a specific chemical is warranted at a site. These criteria combine aspects of identifying contaminants of potential concern (COPCs) and aspects of the data quality objective (DQO) process. DON's primary goal when sampling environmental media is to collect useable data that is relevant to the site specific risk assessments that form the basis for CERCLA decisions. The following criteria are used by DON to determine when sampling for emerging contaminants is appropriate. • Based on site history, is there reason to suspect a release of the compound?

Document Title:

Draft Performance Monitoring and Sampling and Analysis Plan, OU1 and OU2A Groundwater Remedy, Former Marine Corps Air Station El Toro, California, September 2006

Comment No.	Section/ Page No.	Comment	Response
			• Is there reason to suspect that site related releases were significant enough to pose a potential risk to human health or the environment? • Considering the fate and transport characteristics of the chemical and the potential exposure pathways at the site, are the appropriate media proposed for sampling? • Is there an appropriate analytical method that can be used? • Are there data (e.g. toxicity criteria) that can form the basis for decision making once environmental data is collected? If these criteria are satisfied, then the DON will consider sampling if the emergent contaminant was not eliminated from consideration by previous studies. The DON will not sample for emerging contaminants in situations where there is no basis for suspecting a site related release.
Specific Comments from Dave Murchison			
1	Section 1.2, page 1-5, Site Description	Page 1-5 states that TCE contamination in the principal aquifer is located entirely off-Station. GSU does not concur with this statement, since VOCs have been detected in the Principal Aquifer well upgradient of the Station boundary. The contractor should modify or eliminate this language.	The sentence states "TCE concentrations…greater than 5 micrograms per liter (µg/L) in the principal aquifer..is located entirely off-Station…". TCE concentrations have not been detected above 5 µg/L in the principal aquifer on-Station, including recent sampling at 24MW08 (<0.5 µg/L) and 18_BGMW03 (<1 µg/L) in the source area. The language is consistent with the OU1 and OU2A ROD (DON 2002) and ESD (DON 2006), and has not been modified or eliminated.

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

UFP-QAPP Worksheet Tables	U.S. EPA QAPP* Element and Section Number		This SAP		VAR
#1 Title and Approval Page	A1	Title and Approval Sheet		Title and Approval Sheet	
#2 QAPP Identifying Information	A2	Table of Contents	v ix – xi	Quality Assurance Project Plan Elements Table of Contents	
#3 Distribution List	A3	Distribution List	vii	Distribution List	
#4 Project Personnel Sign-Off Sheet	A4	Project/Task Organization	viii Sec. 2.6	Project Personnel Sign-Off Sheet; Special Training	
#5 Project Organization Chart	A4	Project/Task Organization	Fig 2-2	Project Organization	
#6 Communication Pathways	A4	Project/Task Organization	Sec 2.5	Communication	
#7 Personnel Responsibilities and Qualifications	A4	Project/Task Organization	Sec 2.4	Organization	
#8 Special Personnel Training Requirements	A8	Special Training/Certification	Sec 2.6	Special Training	
#9 Project Scoping Sessions Participants Sheet			Sec 2.1.4	Settlement Agreement	
#10 Problem Definition	A5	Problem Definition/Background	Sec 3.2.1	Problem Statement	
#11 Project Quality Objectives/Systematic Planning Process Statements	A7	Quality Objectives and Criteria	Sec 3.2	Data Quality Objectives	
#12 Measurement Performance Criteria	B5	Quality Control	Sec 3.5 Table 3-8	Sample Collection	
#13 Secondary Data Criteria and Limitations	B9	Non-direct Measurements	Sec 3.2.3	Information Inputs	
#14 Summary of Project Tasks	A6	Project/Task Description	Table 3-1	Summary of Project Tasks	
#15 Reference Limits and Evaluation	B4	Analytical Methods	Table 2-1	Reference Limit Table	
#16 Project Schedule/Timeline			Sec 2.7	Project Schedule	
#17 Sampling Design and Rationale	B1	Sampling Process Design (Experimental Design)	Sec 3.2.7	Sampling Design	
#18 Sampling Locations and Methods	B2	Sampling Methods	Sec 3.5 Table 3-2 Table 3-3 Table 3-4	Sample Collection	
#19 Analytical SOP Requirement Table	B4	Analytical Methods	Table 3-6	Analytical SOP Requirements	
#20 Field Quality Control Sample Summary	B3	Sample Handling and Custody	Table 3-7	Field Quality Control Sample Summary	

UFP-QAPP Worksheet Tables	U.S. EPA QAPP* Element and Section Number		This SAP		VAR
#21 Project Sampling SOP Reference					1
#22 Field Equipment Calibration, Maintenance, Testing, and Inspection	B6	Instrument/Equipment Testing, Inspection, and Maintenance	Table 3-9	Field Equipment Calibration	
#23 Analytical SOP Reference	B4	Analytical Methods	Table 3-10	Analytical SOP Reference	
#24 Analytical Instrument Calibration Table	B7	Instrument/Equipment Calibration and Frequency	Sec 3.6	Analytical Services	2
#25 Analytical Instrument and Equipment, Maintenance, Testing, and Inspection	B7	Instrument/Equipment Calibration and Frequency	Sec 3.6	Analytical Services	2
#26 Sampling Handling System	B3	Sample Handling and Custody	Sec 3.5	Sample Collection	
#27 Sample Custody Requirements	B3	Sample Handling and Custody	Sec 3.5	Sample Collection	
#28 QC Samples	B5	Quality Control	Sec 3.6	Analytical Services	
#29 Project Documents and Records	A9	Documents and Records	Sec 3.7	Project Documents and Records	
#30 Analytical Services	B4	Analytical Methods	Sec 3.6	Analytical Services	
#31 Planned Project Assessment	C1	Assessments and Response Actions	Sec 3.9	Assessments and Oversight	
#32 Assessment Findings and Response Actions	C1	Assessments and Response Actions	Sec 3.9	Assessments and Oversight	
#33 QA Management Reports Table	C2	Reports to Management	Sec 3.9.3	Quality System Reporting	
#34 Sampling and Analysis Verification (Step 1) Process	D2.	Verification and Validation Methods	Sec 3.10 Table 3-12	Data Review	
#35 Sampling and Analysis Validation (Steps 2a and 2b) Process	D2.	Verification and Validation Methods	Sec 3.10.1	Data Verification	
#36 Sampling and Analysis Validation (Steps 2a and 2b) Summary	D2.	Verification and Validation Methods	Sec 3.10.2 Table 3-13	Data Validation	
#37 Data Usability Assessment	D3.	Reconciliation With User Requirements	Sec 3.10.3	Reconciliation With User Requirements	

Note:
VAR – Indicated items are in variance with the guidance of the UFP-QAPP.
1 Sampling SOPs will be provided by the selected Contractor in the SAP Amendment.
2 Incorporated DOD QSM and Laboratory Quality Manual by reference.
* U.S. EPA. 2001. EPA Requirements for Quality Assurance Project Plans. EPA QA/R-5. March.

I certify that this SAP is in compliance with the latest version of the UFP-QAPP and the EPA QA/R-5 except as noted.

Signature: Date: June 22, 2007

Chris Barr, Project Quality Manager

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(Worksheet #3)

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	Project Manager	Contractor		
	Quality Manager	Contractor		
	Field Manager	Contractor		
	Laboratory Representative	Laboratory		
	Validation Representative	Validation		

PROJECT PERSONNEL SIGN-OFF SHEET
(Worksheet #4)

The undersigned acknowledge receipt and will implement the plan and requirements of this Sampling and Analysis Plan.

Project Personnel	Organization	Title	Signature	Date

FINAL
ADDENDUM 1
SAMPLING AND ANALYSIS PLAN
(FIELD SAMPLING PLAN AND QUALITY ASSURANCE PROJECT PLAN) TO
FINAL PERFORMANCE MONITORING AND SAMPLING AND ANALYSIS PLAN
OU1 AND OU2A GROUNDWATER REMEDY

DATED 01 OCTOBER 2008

THIS RECORD IS ENTERED IN THE DATABASE AND FILED AS

RECORD NO. M60050_004447

CONTENTS

APPENDICES

FIGURES

TABLES

PAGE NO. xii

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ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
BCT	BRAC Cleanup Team
Bgs	below ground surface
BNI	Bechtel National, Inc.
BRAC	Base Realignment and Closure
Cal/EPA	California Environmental Protection Agency
CAS	Chemical Abstracts Service
CCMI	CERCLA Component of the Modified IDP
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
COC	chemical of concern
CSM	conceptual site model
CTO	contract task order
DCA	dichloroethane
DCE	dichloroethene
DEH	Department of Environmental Health
DHS	Department of Health Services
DL	detection limit
DOJ	Department of Justice
DON	Department of the Navy
DQI	Data Quality Indicator
DQO	data quality objective
DTSC	Department of Toxic Substances Control
ECL	evaluation concentration level
ELAP	Environmental Laboratory Accreditation Program
ESD	Explanation of Significant Differences
EWI	Environmental Work Instruction
FS	feasibility study
ft	feet
gpm	gallons per minute
ID	identification
IDP	Irvine Desalter Project
IRCDQM	Installation Restoration Chemical Data QualityManual
IRP	Installation Restoration Program
IRWD	Irvine Ranch Water District
JEG	Jacobs Engineering Group
LOC	location of concern
LRA	Local Reuse Authority
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
MDL	minimum detection limit
MTBE	Methyl tertiary butyl ether
MS/MSD	matrix spike/matrix spike duplicate
n.a.	not applicable
NA	not applicable
NAVFAC	Naval Facilities Engineering Command
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

NEDD	Navy Electronic Data Deliverable
NFECSW SDIEGO	Naval Facilities Engineering Command, Southwest Division
NPV	net present value
NS	not surveyed
OCHCA	Orange County Health Care Agency
OCWD	Orange County Water District
O&M	operations and maintenance
OU	Operable Unit
pCi/L	pico-Curie per gram
PA	principal aquifer
PCE	tetrachloroethene
pH	negative log of the hydrogen ion concentration
POC	point of concentration
QAPP	Quality Assurance Project Plan
QAO	Quality Assurance Officer
QA/QC	quality assurance/quality control
QSM	Quality System Manual
RACR	remedial action completion report
RAO	remedial action objective
RD	remedial design
RI	remedial investigation
ROD	record of decision
RPD	relative percent difference
RPM	Remedial Project Manager
RWQCB	Regional Water Quality Control Board
S&A	Sampling and Analysis
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SCAQMD	South Coast Air Quality Management District
SFA	Settling Federal Agencies
SGU	Shallow Groundwater Unit
SOCWA	South Orange County Wastewater Authority
SOP	Standard Operation Procedure
SVE	soil vapor extraction
TBD	to be determined
TCA	trichloroethane
TCE	trichloroethene
TDS	total dissolved solids
TI	technical impracticability
TPH	total petroleum hydrocarbons
UFP	Uniform Federal Policy
U.S.	United States
USEPA	United States Environmental Protection Agency
VAR	variance
VOC	volatile organic compound

1. INTRODUCTION AND BACKGROUND

This Performance Monitoring and Sampling and Analysis Plan (Plan) identifies the monitoring criteria and analysis methods to evaluate the performance of the Operable Unit (OU) 1 and OU2A remedy for the shallow groundwater unit (SGU) and principal aquifer at Former Marine Corps Air Station (MCAS), El Toro, California. The *OU1 and OU2A Record of Decision* (ROD) (Department of Navy [DON] 2002) specifies groundwater extraction and treatment (i.e., pump-and-treat) and institutional controls as the selected remedy for groundwater in the SGU and principal aquifer (DON 2002). This Plan has been prepared in accordance with the guidance described in *Methods for Monitoring Pump-and-Treat Performance* (United States Environmental Protection Agency [USEPA] 1994), *Guidance for Optimizing Remedial Action Operation* (DON 2001a), *Guidance for Optimizing Remedy Evaluation, Selection and Design* (DON 2004), and *Guide to Optimal Groundwater Monitoring* (DON 2000).

This Plan is a component of the comprehensive Operation and Maintenance (O&M) Plan for the OU1 and OU2A remedy, which in addition to this Plan, also includes detailed procedures and methods for the activation, service, and continuance of all equipment associated with the performance of the remedy. The comprehensive O&M Plan includes the following four subsets:

1. The Performance Monitoring and Sampling and Analysis Plan, which identifies sampling locations, procedures, frequencies, data quality objectives (DQOs), and data analysis methods to evaluate remedy performance and progress versus remedial action objectives (RAOs).
2. The SGU Wellfield and Conveyance System O&M Plan (Weston 2007) identifies O&M details from the SGU wellfield and conveyance system to the point of connection with the Irvine Ranch Water District (IRWD) SGU treatment plant.
3. The SGU Treatment System O&M Plan provides O&M details for the SGU treatment system and conveyance from the point of connection from the DON to the SGU treatment system and discharge via reinjection or ocean outfall, (Tetra Tech 2007a).
4. Principal Aquifer Treatment System O&M Plan which provides O&M details for the principal aquifer extraction wells, conveyance system, principal aquifer treatment plant, and discharge to the non-potable system (Tetra Tech 2007b).

The DON will be responsible for the O&M and optimization of the SGU extraction wellfield and conveyance system to the point of connection with the IRWD's conveyance system. The DON will also be responsible for the monitoring and sampling of SGU extraction wells, and the monitoring and sampling of SGU and principal aquifer monitoring wells. The DON will be responsible for monitoring and implementing institutional controls on the former Station, the preparation of status reports, and the five-year review reports.

The IRWD and Orange County Water District (OCWD) will accept, take ownership of, and treat, dispose/discharge groundwater extracted by the DON. The transfer of ownership will be defined as the point of connection from the DON SGU conveyance pipeline to the OCWD/IRWD conveyance pipeline located at the boundary of former MCAS El Toro. The IRWD will be responsible for the O&M of the SGU treatment system, including the conveyance system from the point of connection with the DON, and discharge conveyance from the SGU treatment plant. The IRWD will perform all necessary monitoring, sampling, and reporting associated with the operation of the SGU treatment system. The OCWD/IRWD will be responsible for the O&M, sampling, and optimization of the principal aquifer extraction wellfield, the principal aquifer treatment plant, conveyance from the principal aquifer wells to the principal aquifer treatment plant and non-potable system, and conveyance from the principal aquifer treatment plant to the non-potable system. The IRWD will be

responsible for all monitoring, sampling, and reporting associated with the principal aquifer treatment plant.

This Plan was prepared for the DON, Southwest Division, Naval Facilities Engineering Command, Southwest Division (abbreviated as NAVFAC Southwest or NFECSW SDIEGO; formerly abbreviated as SWDIV) as authorized by the United States (U.S.) Navy, Naval Facilities Engineering Command Pacific (NAVFAC Pacific) under contract task order (CTO) number 0068 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) II program, contract number N62742-94-D-0048. It complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) in Title 40 of the Code of Federal Regulations (CFR), Part 300.

1.1 PLAN EXECUTION

This Plan comprises the technical specifications to meet the requirements of the ROD. The Plan fulfills the technical aspects of a sampling and analysis plan, as required by the Navy in Environmental Work Instruction (EWI) #2 (April 2006), and complies with the substantive guidance of the Uniform Federal Policy for Quality Assurance Project Plans.

Any organization tasked with executing the technical aspects of this plan must obtain the approval of the Navy Quality Assurance Officer for changes to this plan by submitting a Plan Amendment that will address the following elements including:

- Distribution List (UFP-QAPP Worksheet # 3)
- Organization (UFP-QAPP Worksheet # 5) (Figure 2-2)
- Identification of laboratory and validation subcontractors
- Specific schedule and deliverables
- Laboratory SOP references
- Changes to laboratory reporting limits
- Any other change which is a substantive revision to the plan.

Any other changes to this Plan must be incorporated into and approved in the Plan Amendment.

1.2 SITE DESCRIPTION

Former MCAS El Toro is located in a semi-urban, agricultural area of southern California, approximately 8 miles south of Santa Ana and 12 miles northeast of Laguna Beach (Figure 1-1). Former MCAS El Toro covers approximately 4,740 acres. Land use around Former MCAS El Toro includes commercial, light industrial, and residential.

The Station was closed on 02 July 1999. From 1994 to 2002, the County of Orange, the designated Local Reuse Authority (LRA), proposed a commercial aviation reuse for the Station. This proposal was submitted as a Base Realignment and Closure (BRAC) Reuse Plan (DON 2001b). In March 2002, County voters overturned the LRA proposal with the passage of Measure W, a referendum that changed the Orange County General Plan for the Station to a non-aviation use and recreational theme, with limited development intensities. After the March 2002 vote, the LRA decided that it would not prepare another BRAC reuse plan for the property. In 2003, the city of Irvine annexed the Station property. The city of Irvine has not prepared a BRAC reuse plan. Consequently, the DON decided to dispose of the property without any particular reuse or redevelopment plan and that reuse would ultimately be determined by local zoning applicable at the time of public sale.

In July 2005, the DON completed the process of conveying by deed approximately 2,798 acres of the Station through public sale to a private developer. Along with the deeded property, a lease in furtherance of conveyance also conveyed carve-out areas, which comprise approximately 921 acres.

SENSITIVE RECORD

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FIGURE 1-1 – FORMER MCAS EL TORO LOCATION MAP

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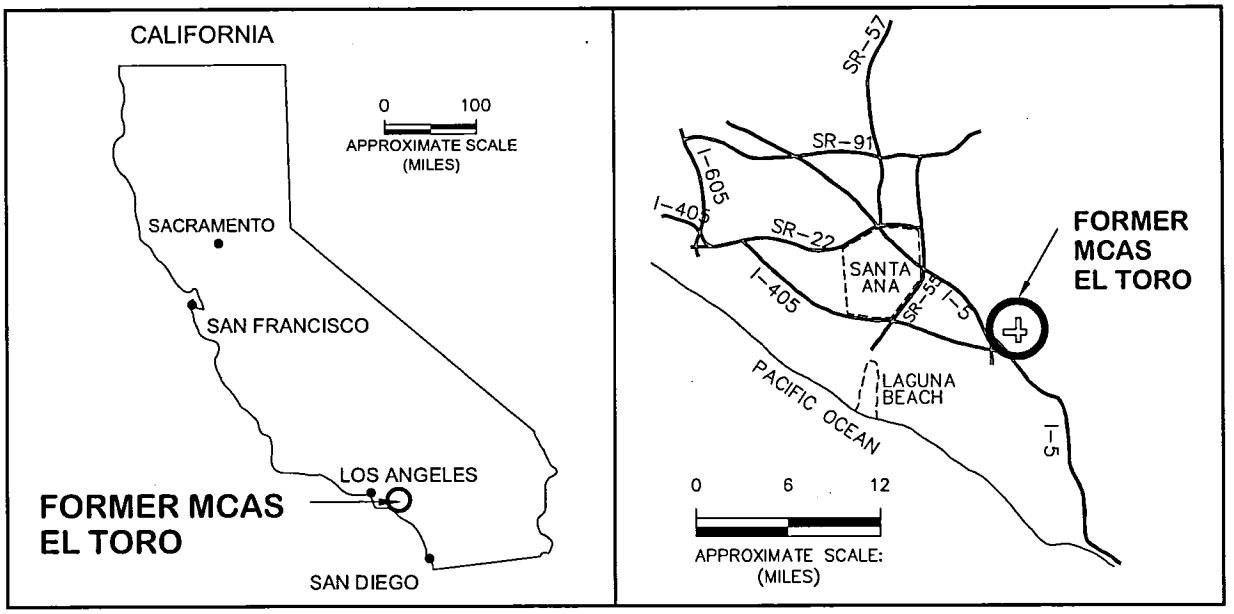

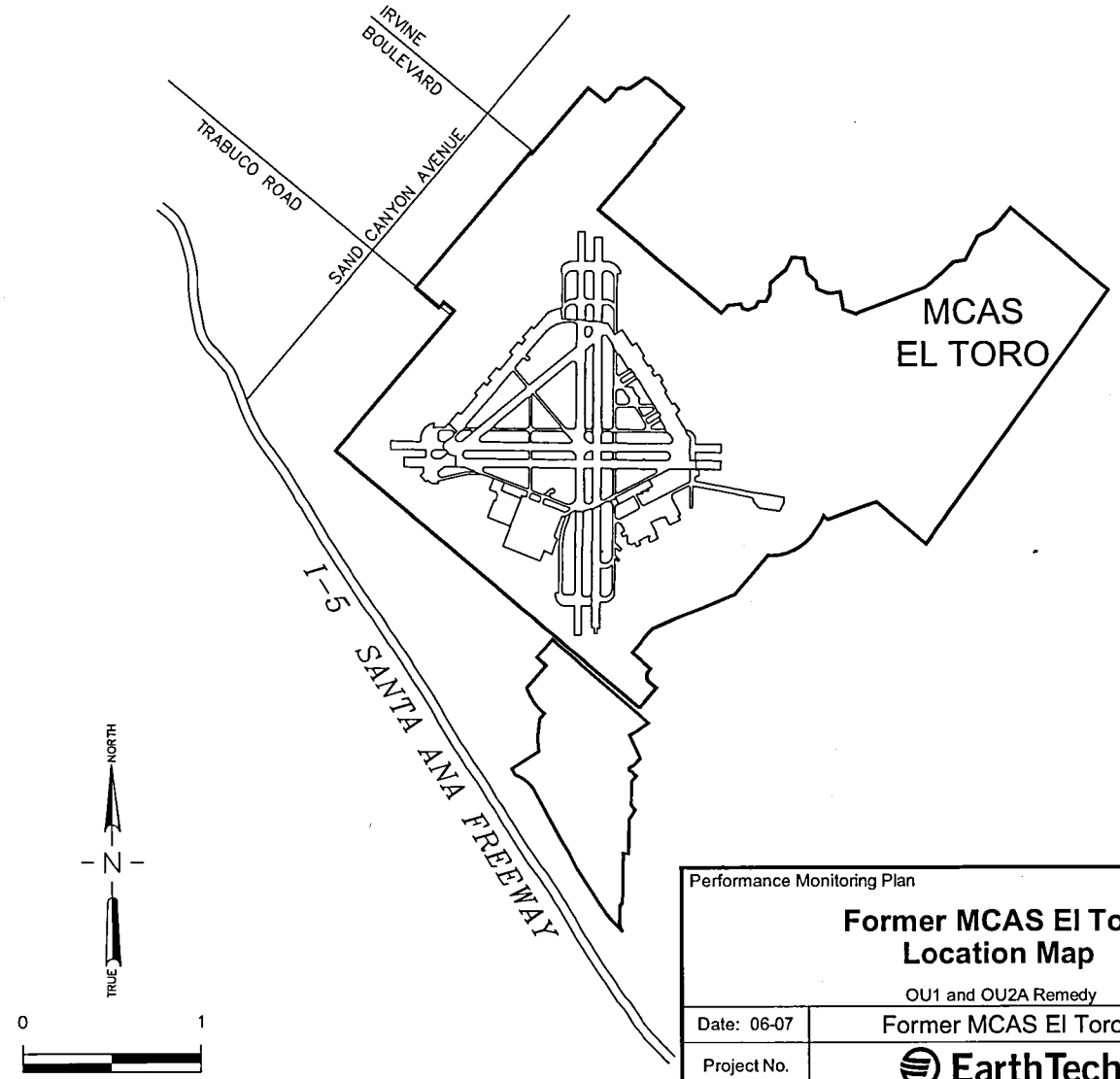

Performance Monitoring Plan

Former MCAS El Toro
Location Map

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure 1-1
Project No. 29307	EarthTech, A tyco International Ltd. Company	

File: L:\...307\cad\OU1 and OU2A Remedy\Draft Final\FIGURE 1-1.dwg Time: Jun 21, 2007 ...7pm

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These carve-out areas include locations of concern (LOCs) where further evaluation, implementation of response actions, or completion of response actions is required. Installation Restoration Program (IRP) Site 24 is located within carve-out III-B (Figure 1-2).

A Phase I Remedial Investigation (RI), a Phase II RI/Feasibility Study (FS), and various site-specific investigations and studies identified volatile organic compound (VOC) contamination, mainly trichloroethene (TCE) and tetrachloroethene (PCE) in soil and groundwater, at former Station. VOC contamination migrated from the soil to the SGU at IRP Site 24 and to the regional principal aquifer at IRP Site 18, which is defined as the area where TCE concentrations are greater than 5 micrograms per liter (µg/L) in the principal aquifer as shown in Figure 1-3. IRP Site 24 encompasses the VOC source area in the southwest quadrant of Former MCAS El Toro (Figure 1-3). A cross section of the regional VOC plume is shown on Figure 1-4.

OU1 is comprised of IRP Site 18, the regional VOC groundwater plume, and OU2A includes IRP Site 24, the VOC source area. The *OU1 and OU2A ROD* presents the selected remedy for groundwater at IRP Sites 18 and 24. Modifications to the selected remedy were necessary after finalization and submittal of the *OU1 and OU2A ROD.* The modifications to the selected remedy were described and documented in the *Explanation of Significant Differences* (ESD) for OU1 and OU2A (DON 2006).

The design of the OU1 and OU2A remedy was performed conjunctively by the DON and OCWD/IRWD. The DON prepared the design of the SGU extraction wellfield and conveyance system to the point of connection with IRWD at former MCAS El Toro boundary (Weston 2005). OCWD/IRWD provided the design of the SGU treatment system, the principal aquifer extraction wells, the principal aquifer treatment system, and all associated conveyance (Tetra Tech 2006).

Currently, all infrastructure for the remedy is in place, and system components are undergoing functional testing and integration prior to full-scale remedy implementation, which is planned for October, 2006. This Plan and the associated O&M Plans provide rationale, strategy, and guidance for implementing the remedy in accordance with RAOs set forth in the *OU1 and OU2A ROD.*

IRP Site 24 comprises soil and groundwater. The VOC source area at IRP Site 24 was addressed in the *Interim ROD* (DON 1997) that documented selection of soil vapor extraction (SVE), the USEPA presumptive remedy for VOC-contaminated soil, as the remedy. The remedy for soil was implemented in accordance with the *Interim ROD* and documented in a closure report (Earth Tech 2002) submitted to the regulatory agencies. The regulatory agencies concurred with the closure report, which concluded that the remedial action objectives (RAOs) for soil have been fulfilled. The ROD documenting no further action for IRP Site 24 soil has been approved by regulatory agencies (DON 2006).

1.3 GEOLOGY AND HYDROGEOLOGY

Former MCAS El Toro is situated on the Tustin Plain, a broad basin filled with marine and alluvial sediments deposited on marine sedimentary bedrock (Fife 1974). The Tustin Plain is bounded by bedrock, exposed in the Santa Ana Mountains to the north and east, and the San Joaquin Hills to the south. Former MCAS El Toro lies within the Irvine Groundwater Management Zone. Four hydrostratigraphic units were identified during the *Phase I Remedial Investigation/Feasibility Study* (Jacobs Engineering Group [JEG] 1996):

- SGU (water-bearing; unconfined)
- Intermediate zone (confining)
- Principal aquifer (water-bearing)
- Semiconsolidated materials (sparsely water-bearing)

The SGU consists primarily of sands with interbedded silts and clays, and averages approximately 100 to 150 feet in thickness. Groundwater yield from the shallow unit is highly variable, reflecting the heterogeneity of the sediments.

The intermediate zone is comprised mainly of silts and clays with interbedded sands and gravels. The thickness of the intermediate zone ranges from approximately 70 feet to 140 feet (JEG 1996). Although the vertical thickness and low permeability suggest that the intermediate zone acts as an aquitard throughout much of the Irvine Groundwater Management Zone, subsurface data also indicate that it is not a single, continuous, extensive geologic unit (JEG 1996). The intermediate zone is present in the vicinity of the VOC plume, although it is not always readily identifiable. The movement of VOCs indicates that the intermediate zone restricts, but does not prevent, groundwater flow between the overlying SGU and the underlying principal aquifer.

The principal aquifer consists primarily of sands and gravels with interbedded silts and clays. The thickness reaches a maximum of approximately 1,200 feet in the western portion of the Irvine Groundwater Management Zone. The principal aquifer yields appreciable amounts of water, and is currently used as a source for irrigation water.

The semiconsolidated materials represent bedrock beneath the unconsolidated deposits and effectively serve as the lower boundary of the Irvine Groundwater Management Zone groundwater flow system.

Groundwater flow in the vicinity of Former MCAS El Toro is generally toward the west-northwest in both the SGU and the principal aquifer. Groundwater elevations in the Irvine Groundwater Management Zone are generally higher in the east and decrease toward the west. Additionally, groundwater elevation data indicate an upward vertical gradient within the SGU in the vicinity of IRP Site 24 (Earth Tech 2004), and a downward vertical gradient from the SGU to the principal aquifer off-Station, primarily the result of irrigation well pumping (Bechtel National, Inc. [BNI] 1999).

1.4 IRVINE DESALTER PROJECT

The Irvine Desalter Project (IDP) is a water development plan designed by the OCWD and IRWD. The IDP will develop a drinking and reclaimed water supply from the principal aquifer downgradient of Former MCAS El Toro. An overview of the IDP is shown on Figure 1-5. The IDP will consist of two components:

Non-potable System – VOC-contaminated groundwater from the SGU will be extracted, treated at the SGU treatment plant, and reinjected into the principal aquifer at IDP-1 and/or discharged to the South Orange County Wastewater Authority (SOCWA) ocean outfall and/or conveyed for use as recycled water. Contaminated water from the principal aquifer will be extracted, treated at the principal aquifer treatment plant, and conveyed for use as recycled water. The non-potable component of the IDP is integral to the DON's CERCLA remedy. Details regarding the IDP as it applies to the CERCLA remedy are provided in Section 2.

Potable System – Groundwater from outside the principal aquifer VOC plume will be extracted and treated to remove total dissolved solids (TDS) and nitrates. Treated water will then be supplied for domestic purposes. This system does not fall under the jurisdiction of the DON's CERCLA remedy.

A settlement agreement for the CERCLA component of the IDP was signed by the DON, Department of Justice (DOJ), OCWD, and IRWD. A copy of the settlement agreement is provided in the *OU1 and OU2A ROD* (DON 2002) and Explanation of Significant Differences (ESD) (DON 2006).

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FIGURES 1-2 AND 1-3

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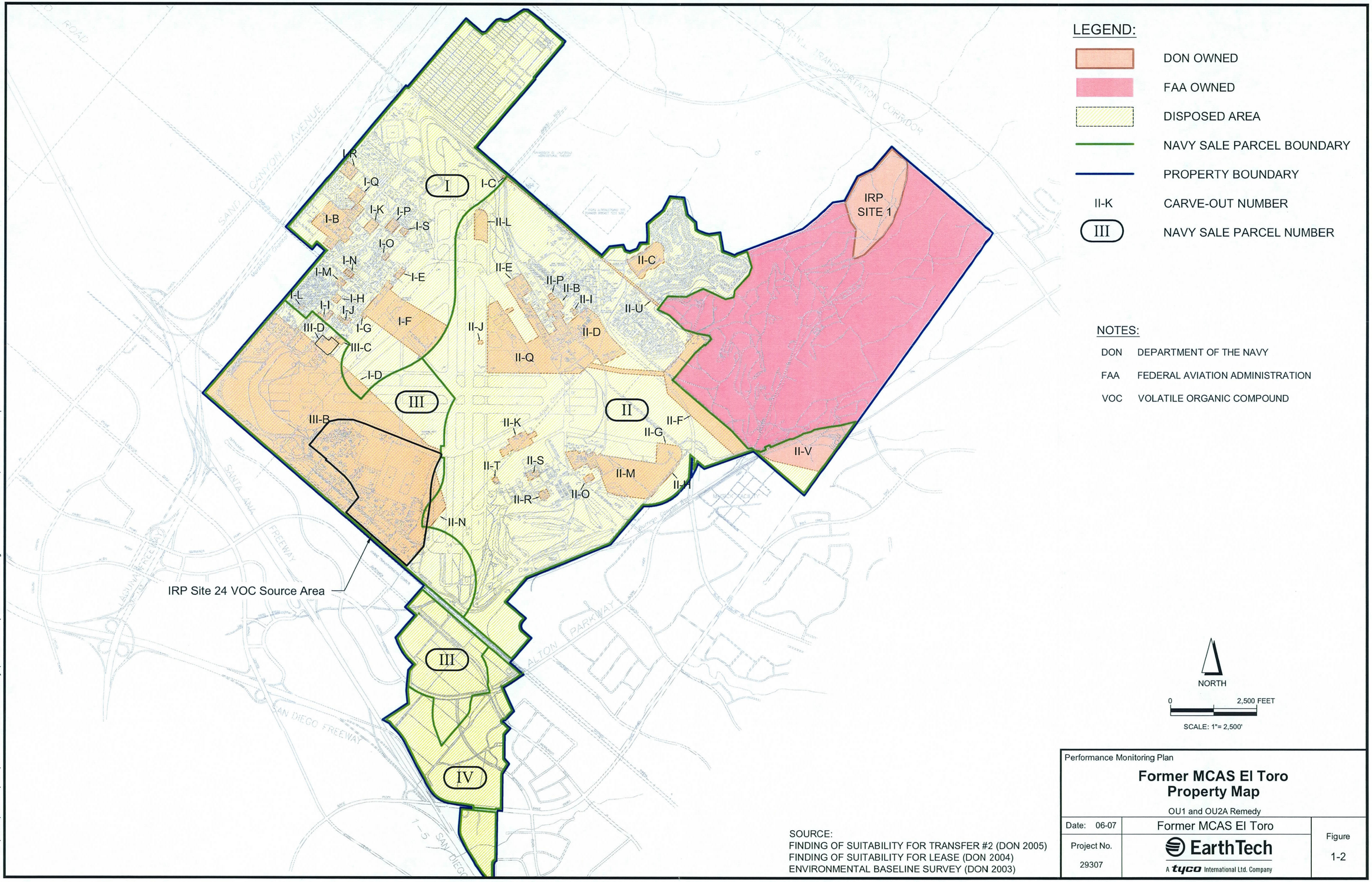

LEGEND:

- DON OWNED
- FAA OWNED
- DISPOSED AREA
- NAVY SALE PARCEL BOUNDARY
- PROPERTY BOUNDARY
- II-K — CARVE-OUT NUMBER
- III — NAVY SALE PARCEL NUMBER

NOTES:

DON	DEPARTMENT OF THE NAVY
FAA	FEDERAL AVIATION ADMINISTRATION
VOC	VOLATILE ORGANIC COMPOUND

NORTH

0 2,500 FEET

SCALE: 1"= 2,500'

SOURCE:
FINDING OF SUITABILITY FOR TRANSFER #2 (DON 2005)
FINDING OF SUITABILITY FOR LEASE (DON 2004)
ENVIRONMENTAL BASELINE SURVEY (DON 2003)

Performance Monitoring Plan

Former MCAS El Toro Property Map

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure 1-2
Project No. 29307	EarthTech, A tyco International Ltd. Company	

File: L:\work\29307\cad\OU1 and OU2A Remedy\Draft Final\FIGURE 1-2.dwg Time: Jun 21, 2007 - 2:07pm

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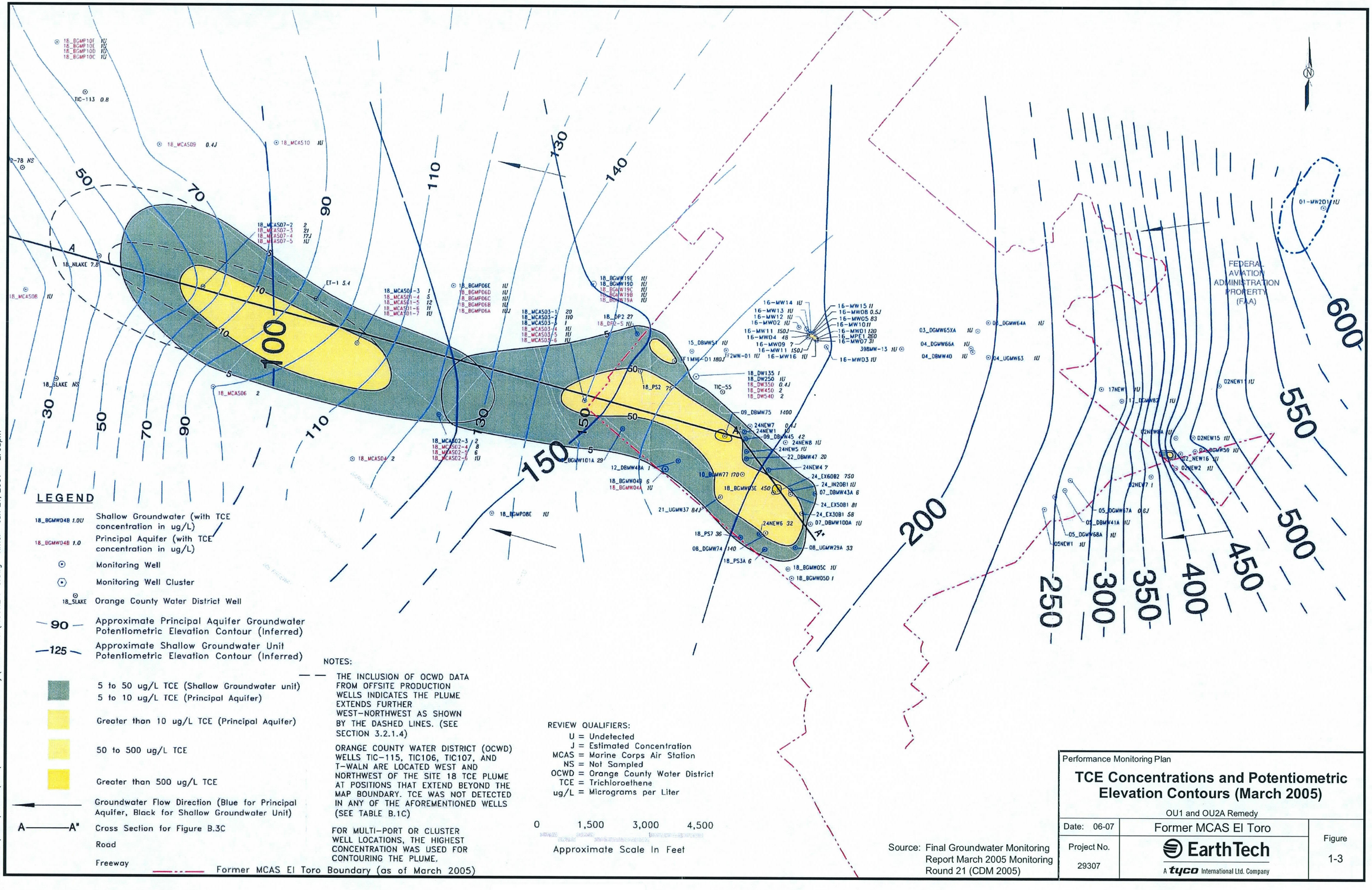

LEGEND

- 18_BGMW04B 1.0U — Shallow Groundwater (with TCE concentration in ug/L)
- 18_BGMW04B 1.0 — Principal Aquifer (with TCE concentration in ug/L)
- Monitoring Well
- Monitoring Well Cluster
- 18_SLAKE — Orange County Water District Well
- 90 — Approximate Principal Aquifer Groundwater Potentiometric Elevation Contour (Inferred)
- 125 — Approximate Shallow Groundwater Unit Potentiometric Elevation Contour (Inferred)
- 5 to 50 ug/L TCE (Shallow Groundwater unit)
- 5 to 10 ug/L TCE (Principal Aquifer)
- Greater than 10 ug/L TCE (Principal Aquifer)
- 50 to 500 ug/L TCE
- Greater than 500 ug/L TCE
- Groundwater Flow Direction (Blue for Principal Aquifer, Black for Shallow Groundwater Unit)
- A——A' Cross Section for Figure B.3C
- Road
- Freeway
- Former MCAS El Toro Boundary (as of March 2005)

NOTES:

THE INCLUSION OF OCWD DATA FROM OFFSITE PRODUCTION WELLS INDICATES THE PLUME EXTENDS FURTHER WEST-NORTHWEST AS SHOWN BY THE DASHED LINES. (SEE SECTION 3.2.1.4)

ORANGE COUNTY WATER DISTRICT (OCWD) WELLS TIC-115, TIC106, TIC107, AND T-WALN ARE LOCATED WEST AND NORTHWEST OF THE SITE 18 TCE PLUME AT POSITIONS THAT EXTEND BEYOND THE MAP BOUNDARY. TCE WAS NOT DETECTED IN ANY OF THE AFOREMENTIONED WELLS (SEE TABLE B.1C)

FOR MULTI-PORT OR CLUSTER WELL LOCATIONS, THE HIGHEST CONCENTRATION WAS USED FOR CONTOURING THE PLUME.

REVIEW QUALIFIERS:

U = Undetected
J = Estimated Concentration
MCAS = Marine Corps Air Station
NS = Not Sampled
OCWD = Orange County Water District
TCE = Trichloroethene
ug/L = Micrograms per Liter

0 1,500 3,000 4,500

Approximate Scale In Feet

Source: Final Groundwater Monitoring Report March 2005 Monitoring Round 21 (CDM 2005)

Performance Monitoring Plan

TCE Concentrations and Potentiometric Elevation Contours (March 2005)

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure 1-3
Project No. 29307	EarthTech, A tyco International Ltd. Company	

File: L:\work\29307\cad\OU1 and OU2A Remedy\Draft Final\FIGURE 1-3.dwg Time: Jun 21, 2007 - 2:08pm

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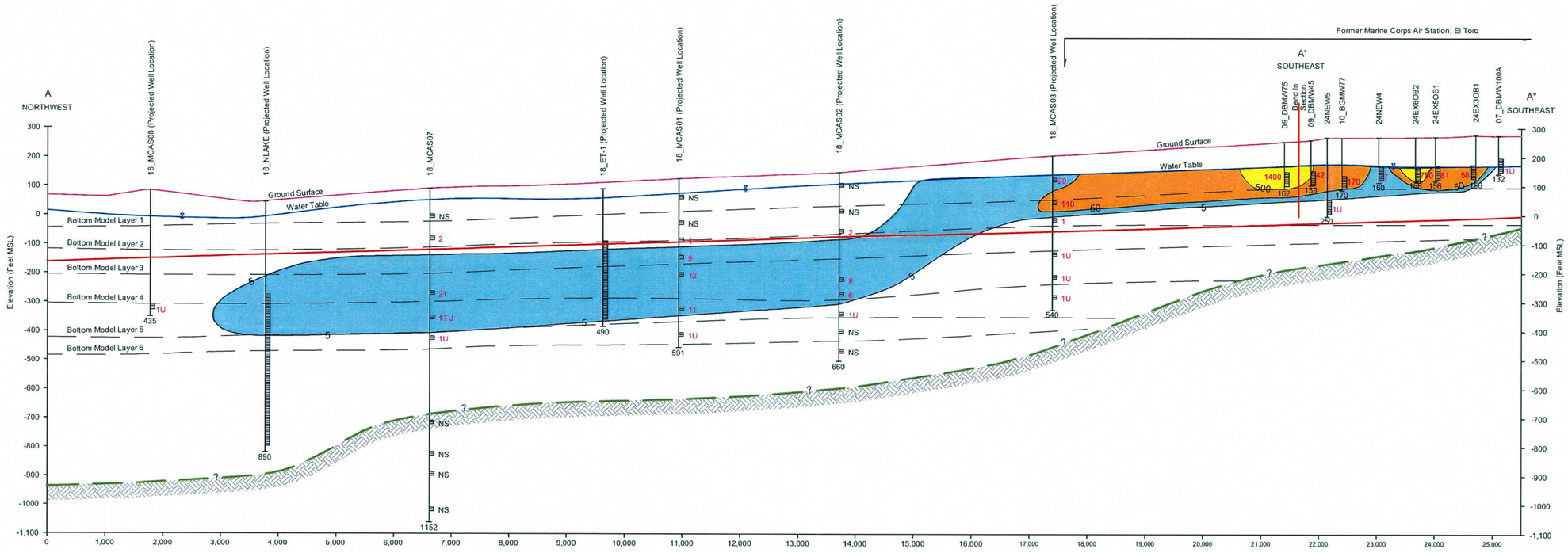

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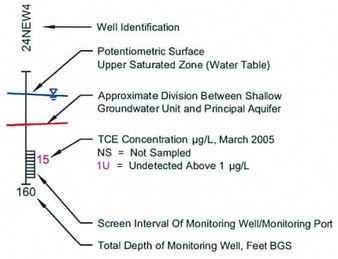

TCE Concentrations in Groundwater

- 5.0 to 50.0 µg/L TCE
- 50.0 to 500.0 µg/L TCE
- Greater Than 500.0 µg/L TCE
- 5 — Inferred Isoconcentration Contour µg/L
- Semiconsoilidated Low-Permeability Sediments
- Model Layer (Earth Tech 2003)

TCE = Trichloroethylene
µg/L = Micrograms Per Liter
J = Estimated Concentration
VOC = Volatile Organic Compound

Vertical Exaggeration 5x
0 1000 2000
Horizontal Scale in Feet

Performance Monitoring Plan

Regional Cross Section of VOC Plume (March 2005)

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure 1-4
Project No. 29307	EarthTech, A tyco International Ltd. Company	

File: L:\work\29307\cad\OU1 and OU2A Remedy\Draft Final\FIGURE 1-4.dwg Time: Jun 21, 2007 - 2:09pm

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FIGURE 1-5 – OVERVIEW OF IRVINE DESALTER PROJECT

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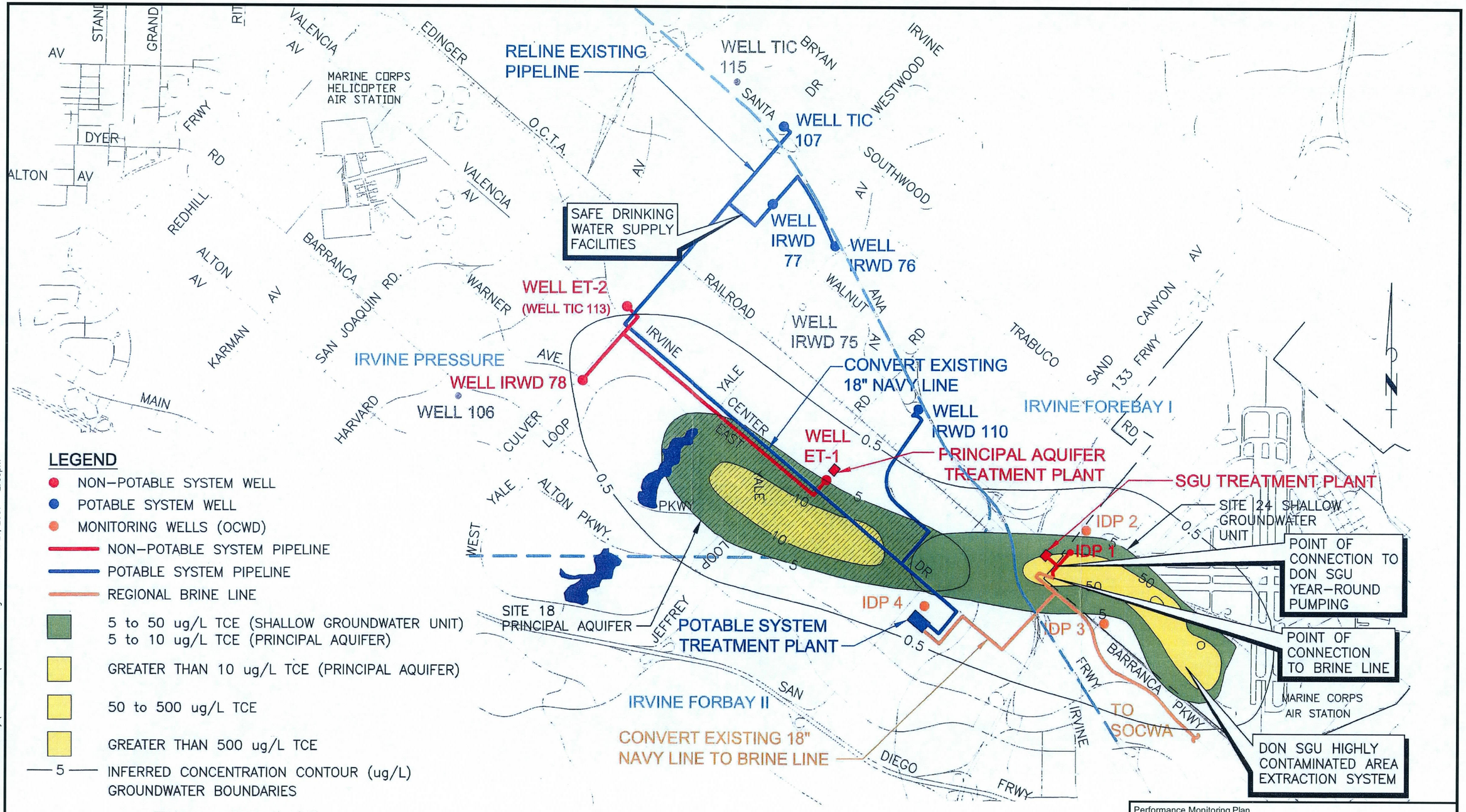

LEGEND

- NON–POTABLE SYSTEM WELL
- POTABLE SYSTEM WELL
- MONITORING WELLS (OCWD)
- NON–POTABLE SYSTEM PIPELINE
- POTABLE SYSTEM PIPELINE
- REGIONAL BRINE LINE
- 5 to 50 ug/L TCE (SHALLOW GROUNDWATER UNIT)
  5 to 10 ug/L TCE (PRINCIPAL AQUIFER)
- GREATER THAN 10 ug/L TCE (PRINCIPAL AQUIFER)
- 50 to 500 ug/L TCE
- GREATER THAN 500 ug/L TCE
- 5 — INFERRED CONCENTRATION CONTOUR (ug/L) GROUNDWATER BOUNDARIES
- ETMCAS PROPERTY LINE
- GROUNDWATER BOUNDARIES

0 3000 6000

Source: 100% Design Submittal, Irvine Desalter Project (Tetra Tech, 2006)

Performance Monitoring Plan

Overview of Irvine Desalter Project

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure
Project No. 29307	EarthTech, A tyco International Ltd. Company	1-5

File: L:\work\29307\cad\OU1 and OU2A Remedy\Draft Final\FIGURE 1-5.dwg Time: Jun 21, 2007 - 2:09pm

2. OU-1 AND OU-2A SELECTED REMEDY

The selected remedy for the OU-1 and OU-2A VOC plume is groundwater extraction and treatment, and institutional controls (DON 2002) and will be integrated with the IDP. Extraction scenarios were conceptually derived during the FS (BNI 1997) and were refined during the remedial design (RD). Detailed design specifications for the SGU portion of the remedy are presented in the *100% Design Submittal, Shallow Groundwater Unit Remedy, IRP Site 24, Volatile Organic Compound Source Area* (Weston 2005) and *100% Design Submittal, Irvine Desalter Project* (Tetra Tech 2006). Detailed design specifications for the principal aquifer portion of the remedy are presented in the *100% Design Submittal, Irvine Desalter Project* (Tetra Tech 2006).

The selected CERCLA remedy as described in the *OU1 and OU2A ROD* (DON 2002) includes the following:

- Construction, operation, and maintenance of a groundwater extraction system to remove VOCs from groundwater in the SGU and principal aquifer,
- Treatment of VOC-contaminated groundwater from the SGU and principal aquifer 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 granular activated carbon filters to meet air quality standards before discharge to the atmosphere,
- Performance monitoring during the remedial action, as described in this Plan,
- Confirmatory groundwater sampling at the end of the remediation to confirm that VOC concentrations meet Federal and State cleanup levels,
- Institutional controls to prevent use of contaminated groundwater, protect equipment, and allow access to the DON, OCWD/IRWD, and regulatory agency personnel.

During remedial design, the CERCLA remedy was modified, although the changes did not fundamentally alter the scope, performance, or cost of the remedy. The changes were documented in the *ESD* (DON 2006) and include the following:

- Elimination of reverse osmosis as a treatment process for the VOC impacted groundwater,
- Use of separate treatment facilities for the SGU and principle aquifer groundwater,
- Revised location for extraction well ET-2,
- Revised extraction rates for ET-1, ET-2, and IRWD-78,
- Inclusion of the SOCWA brine line as an alternative disposal option for treated groundwater from the SGU.

This Plan is intended to outline the requirements for the performance monitoring of the CERCLA remedy. Extraction and treatment system design is summarized in the following subsections.

2.1 GROUNDWATER EXTRACTION AND TREATMENT

The locations of the extraction wells and the proposed extraction strategy are based upon the results of the numerical groundwater flow and contaminant transport model developed for the SGU and principal aquifer. The groundwater modeling was initially presented in the *Technical Memorandum,*

Groundwater Modeling OU1 and OU2A (Earth Tech 2003). The technical memorandum included detailed documentation of input data, calibration procedures, simulation results, and the locations of proposed SGU and principal aquifer extraction well locations. The model was subsequently updated to account for revised locations of ET-2, Well 75, and Well 77; revised pumping rates for several principal aquifer extraction wells (both potable and non-potable); and the use of IDP-1 for the injection of treated groundwater into the principal aquifer. The revised groundwater modeling results were presented in the *100% Design Submittal, Irvine Desalter Project* (Tetra Tech 2006).

The results of the groundwater modeling indicate that the proposed groundwater extraction strategy will result in compliance with the RAOs for the SGU and principal aquifer. Due to a limitation in the average total extraction rate allowed by the settlement agreement (395 gallons per minute [gpm]), the SGU remedy will not result in capture of all VOCs in the off-Station portion of the SGU plume, although the highest off-Station concentrations will likely be captured. However, groundwater modeling results suggest that off-Station VOCs not removed by the SGU extraction wells will ultimately be captured by the principal aquifer extraction wells (Earth Tech 2003).

2.1.1 Shallow Groundwater Unit (IRP Site 24)

Groundwater will be extracted from the SGU VOC plume (IRP Site 24), using 39 wells (Figure 2-1). The SGU (IRP Site 24) extraction well locations are based upon groundwater flow and contaminant transport simulation results presented in the *OU1 and OU2A Groundwater Modeling Technical Memorandum* (Earth Tech 2003). The SGU extraction wells are anticipated to yield approximately 10 gpm within the IRP Site 24 source area, and approximately 20 gpm along the Station boundary (Earth Tech 2003). The extracted water will be conveyed to IRWD's SGU treatment plant to remove VOCs using air stripping, and subsequently distributed for non-potable uses. The SGU treatment plant will be located along the western boundary of Former MCAS El Toro, at the point of connection with the DON's conveyance pipeline. According to the *OU1 and OU2A ROD* (DON 2002), the amount of SGU groundwater to be accepted and treated at the IDP treatment plant should be the lesser of the volume furnished by the DON or 208,000,000 gallons per year at a maximum flow rate of 440 gpm through 550 gpm or such other rate as agreed to by the parties. A flow rate of 208,000,000 gallons per year is equivalent to an annual average flow rate of 395 gpm. Treatment of VOC-contaminated groundwater will be performed using air stripping. Resultant vapors will be treated with vapor-phase activated carbon filters prior to discharge to the atmosphere. A portion of the treated SGU water will be injected into the principal aquifer using IDP-1 (approximately 125 gpm), and the remainder will be discharged via the brine line to the SOCWA ocean outfall (Figure 1-5). In addition, the treated SGU water may be integrated into IRWD's non-potable system.

The SGU strategy utilizes aggressive extraction and hydraulic isolation in the high concentration source area, coupled with hydraulic containment at the Station boundary. The SGU is lithologically heterogeneous, especially in the source area, with alternating coarse and fine-grained zones. Although water and contaminants can be readily removed from the coarse-grained zones, extended remediation times are likely in the source area as contaminants diffuse from the fine-grained zones to the coarse-grained zones. However, downgradient of the source areas, contaminant migration is primarily due to advection within the coarse-grained units. In addition, at the downgradient locations, concentration gradients are subdued and diffusion-limited conditions are not anticipated to be significant. The proposed SGU extraction wells have been designed to extract groundwater from the entire vertical zone of contamination. Although the majority of water will be produced from the coarse-grained units, VOCs from the fine-grained units will be removed as they diffuse into the coarse-grained units. Mass removal enhancement using SVE will be evaluated for implementation in the vicinity of Hangars 296 and 297 after sufficient dewatering of the SGU has been accomplished. SVE will be performed at wells 24EX3OB1, 24EX4, 24EX5, and 24EX6OB1, as shown on Figure 2-1.

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FIGURE 2-1 – SHALLOW GROUNDWATER UNIT EXTRACTION WELL LOCATIONS

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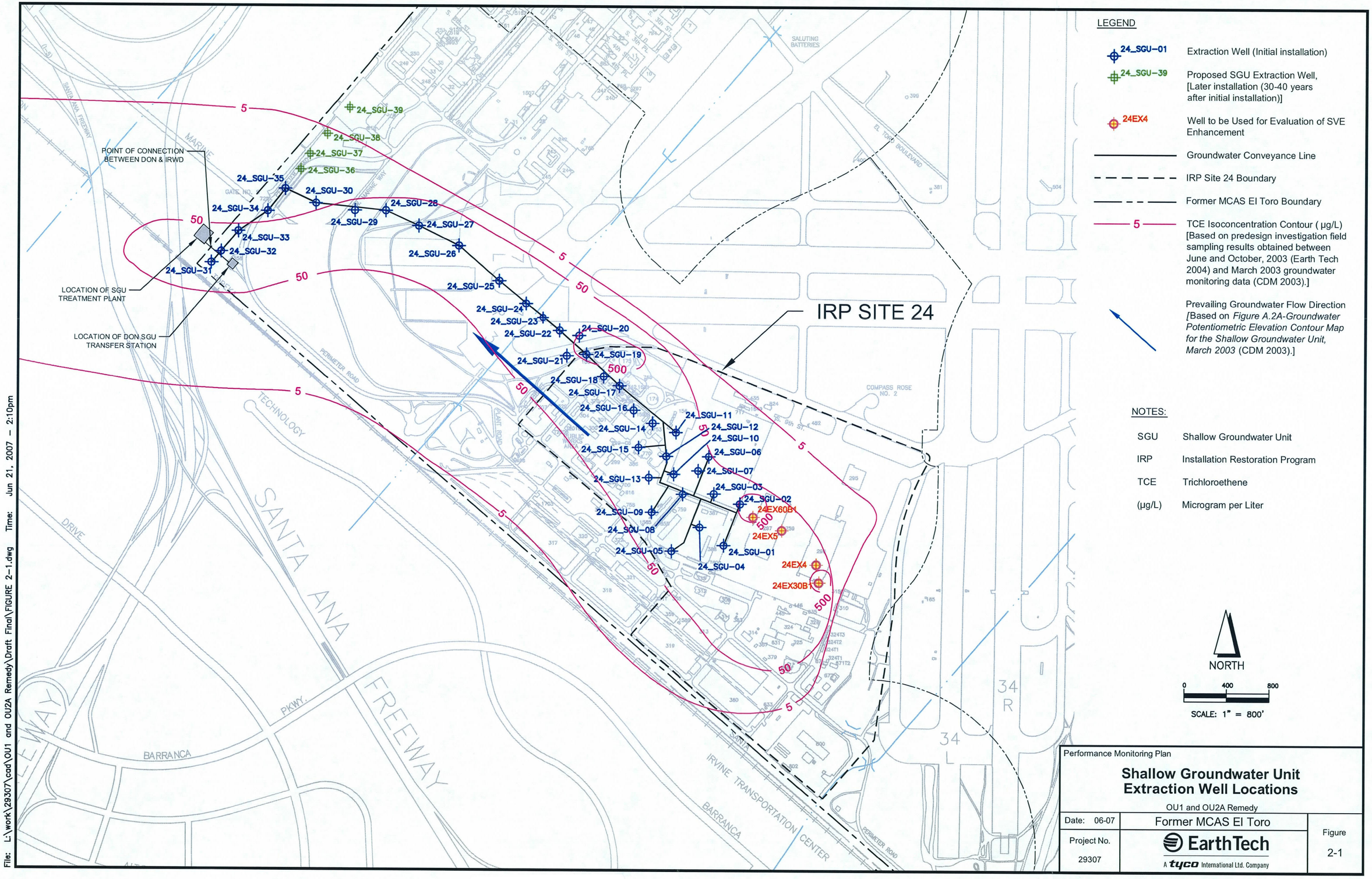

Performance Monitoring Plan

Shallow Groundwater Unit Extraction Well Locations

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure 2-1
Project No. 29307	EarthTech, A tyco International Ltd. Company	

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2.1.2 Principal Aquifer (IRP Site 18)

VOC contaminated groundwater from the principal aquifer (IRP Site 18) will be extracted from three wells (ET-1, ET-2, and IRWD-78) as shown on Figure 1-5. The wells will be pumped for 10 months per year at the following average groundwater extraction rates: 1,000 gpm from ET-1; 1,300 gpm from ET-2; 600 gpm from IRWD-78 (total rate of 2,900 gpm). Additional wells (i.e., TIC-115) may be integrated with the potable system in the future if their inclusion does not adversely impact the CERCLA remedy as demonstrated by groundwater flow simulation. Based on the results of groundwater modeling (Tetra Tech 2006), VOC concentrations within water extracted from ET-2 and IRWD-78 are not expected to exceed MCLs; therefore, groundwater from ET-2 and IRWD-78 will be pumped directly into the non-potable system, although provisions for potential treatment are described in Section 3.4.1.2. Groundwater from ET-1 will be conveyed to the principal aquifer non-potable treatment plant (CERCLA component) to remove VOCs to concentrations below drinking water maximum contaminant levels (MCLs) (i.e., TCE < 5.0 µg/L) using air stripping. Following treatment, the water will be distributed for non-potable uses. Vapors from the air stripper will be treated with vapor-phase activated carbon filters prior to discharge to the atmosphere. The principal aquifer treatment plant is located at the site of ET-1. Additionally, groundwater will be extracted from four wells (IRWD-76, IRWD-77, IRWD-107, IRWD-110) outside the VOC plume (non-CERCLA component). This water will be conveyed to the IDP potable system treatment plant for removal of TDS and nitrate, and subsequently distributed for domestic (potable) use. The principal aquifer extraction wells and treatment plant locations associated with both the CERCLA and non-CERCLA components of the OU1 and OU2A remedy and the IDP are shown on Figure 1-5.

The principal aquifer strategy involves aggressive pumping from ET-1, ET-2, and IRWD-78 to capture and hydraulically contain the off-Station VOCs in excess of the MCLs. The principal aquifer produces high yields, thus the pumping rates are significantly higher than the SGU. The combined pumping rate from ET-1, ET-2, and IRWD-78 is anticipated to be approximately 2,900 gpm. ET-1 will extract the majority of the off-Station VOCs. ET-2 and IRWD-78 will provide hydraulic containment of the 5 µg/L TCE contour, preventing downgradient migration beyond the approximate location of Culver Drive (Tetra Tech 2006). Additionally, IDP-1 will be used to inject up to 125 gpm of treated SGU groundwater into the principal aquifer. Although the water injected at IDP-1 will have a relatively high concentration of TDS, the modeling results indicate that it will be extracted by IRWD-110 and ET-1, thus will not result in the degradation of water quality in the Irvine Groundwater Management Zone (Tetra Tech 2006).

2.1.3 CERCLA Components of the IDP

The CERCLA component of the Modified IDP (CCMI) consists of the following OCWD/IRWD and DON assets of the Non-Potable System:

a. OCWD/IRWD Assets (to be owned/operated by OCWD/IRWD, with response action costs to be reimbursed by the U. S. pursuant to the Settlement Agreement):

   1. Non-Potable System Principal Aquifer (PA) VOC treatment plant (including air strippers and off-gas granular-activated carbon units) for VOC-contaminated groundwater extracted from PA groundwater.
   2. Non-Potable System SGU VOC treatment plant (including air strippers and off-gas granular-activated carbon units) for VOC-contaminated groundwater extracted from SGU groundwater.

3. Non-Potable System PA and SGU treatment plant sites' real property, buildings, site improvements, telemetry, transformers and other electrical improvements, and monitoring and control systems.
4. Extraction Wells IRWD-78, ET-1, and ET-2, and Injection Well IDP-1.
5. Pumping and pipeline conveyance system from Wells IRWD-78, ET-1, and ET-2 to the Non-Potable System PA VOC treatment plant (reference red line on Figure 1-5).
6. Pumping and pipeline conveyance system from the point of connection with the DON to the Non-Potable System SGU VOC treatment plant, and from the Non-Potable System SGU VOC treatment plant to Injection Well IDP-1 and to connection to the SOCWA brine line (reference red line on Figure 1-5).
7. Monitoring Wells IDP-2, IDP-3, and IDP-4.

b. DON Assets (to be designed, constructed, owned/operated and paid by the DON):

1. DON's extraction wells for interception and removal of VOC-contaminated groundwater in the SGU.
2. DON's SGU pumps, tank, site improvements, telemetry, transformers and other electrical improvements, and monitoring and control systems (including data link).
3. DON's pumping and pipeline conveyance from the SGU extraction wells to the DON SGU transfer station and from the DON SGU transfer station to the pipeline conveyance system's point of connection at Former MCAS El Toro Station boundary.
4. DON's monitoring wells associated with the remediation of the VOC plume in the SGU and PA.

2.1.4 Settlement Agreement

The OCWD, IRWD, and the Settling Federal Agencies (SFA) comprised of the DOJ and the DON reached a Settlement Agreement (DOJ 2001) regarding the Modified IDP to accept and treat groundwater from IRP Site 24 and the principal aquifer for VOC removal. Treatment of extracted groundwater contaminated with VOCs is considered the CCMI. Groundwater extracted from the SGU will be conveyed by the DON to a point of connection to be located at Former MCAS El Toro boundary. At the point of connection, IRWD will accept the water and transport it to the SGU treatment plant for removal of VOCs.

The Settlement Agreement was incorporated as part of the *OU1 and OU2A* ROD (DON 2002). The Agreement provides that the United States will bear the VOC treatment costs, and OCWD and IRWD will continue to bear the costs associated with reclaimed water supply treatment requirements, including those for TDS and nitrates. The Settlement Agreement specifies the quantity and quality of contaminated water that can be treated by the SGU and principal aquifer treatment plants. These groundwater quality parameters are referred to as evaluation concentration levels (ECLs) and are discussed in the following section.

2.1.5 Evaluation Concentration Levels

In addition to the RAOs, the contaminant concentrations in the cumulative flow from the extraction wells will be monitored to ensure compliance with the ECLs established in the Settlement Agreement. The ECLs have been established for the point of connection of the DON's SGU conveyance pipeline to the modified-IDP pipeline (i.e., SGU treatment plant influent), and for the intake to the principal aquifer treatment plant (formerly referred to as the central VOC treatment

plant). The ECLs were established in the settlement agreement between the DON, DOJ, OCWD, and the IRWD. Extracted groundwater from the SGU remedy wells will be sampled downstream of the transfer pump and upstream of the point of connection to the modified IDP pipeline. The parameters to be monitored and their respective ECLs are presented below in Table 2-1. ECL sampling frequencies and system shutdown considerations are presented in Section 3.

Table 2-1: Reference Limits Table - Evaluation Concentration Levels (Worksheet #15)

Analytical Group	Analyte	CAS Number	Project Action Limit (SGU) [a]	Project Action Limit (PA)[b]	Project Quantitation Limit (SGU) [a]	Analytical Method MDL
			µg/L	µg/L	µg/L	µg/L
VOCs	1,1,1-TCA	71-55-6	200	15.4	1	0.2
	1,1,2-TCA	79-00-5	5	---	1	0.2
	1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.2	---	1	0.2
	1,1-DCA	75-34-3	5	---	1	0.2
	1,1-DCE	75-35-4	6	---	1	0.2
	1,2-DCA	107-06-2	1.8	0.14	0.1[c,d]	0.2[d]
	1,2-DCE (total)	540-59-0	10	---	1	0.2
	cis-1,2-DCE	156-59-2	6	---	1	0.2
	Benzene	71-43-2	4.5	0.35	0.2[c]	0.2
	Carbon Disulfide	75-15-0	1.8	---	1	0.2
	Carbon Tetrachloride	56-23-5	3.6	0.28	0.2[c]	0.2
	Chloroform	67-66-3	80	6.4	1	0.2
	Ethylbenzene	100-41-4	680	52.5	1	0.2
	Methyl Chloride	74-87-3	2.8	---	1	0.2
	Methylene Chloride	75-09-2	5	---	1	0.5
	PCE	127-18-4	5.2	0.5	0.2[c]	0.2
	Phenol	108-95-2	17.7	---	10	5
	TCE	79-01-6	237	22	1	0.2
	Toluene	108-88-3	150	11.6	1	0.2
	Xylene (total)	1330-20-7	1750	---	2	0.5
			mg/L	mg/L		
General Chemistry	Alkalinity (as calcium carbonate)	NA	302	290	5	1
	Calcium	7440-70-2	287	169	1	0.2
	Chloride	16887-00-6	393	264	0.2	0.1
	Bicarbonate	71-52-3	363	---	5	1
	Bicarbonate (as calcium carbonate)	471-34-1	302	---	5	1
	Potassium	7440-09-7	5	4	1	0.2
	Sodium	7440-23-5	188	195	1	0.2
	Nitrate	14797-55-8	181	67	0.1	0.05
	Nitrate (as N)	14797-55-8	30.2	8	0.1	0.05
	Nitrate/Nitrite (as N)	NA	33.5	---	0.1	0.05
	Sulfate	14808-79-8	479	376	0.5	0.25
	Silica	7631-86-9	60	59	2	1
	Total dissolved solids	NA	2,147	1450	10	5
	pH	12408-02-5	NA	>5.9<9.1	-	-

Table 2-1: Reference Limits Table - Evaluation Concentration Levels (Worksheet #15)

Analytical Group	Analyte	CAS Number	Project Action Limit (SGU) [a]	Project Action Limit (PA)[b]	Project Quantitation Limit (SGU) [a]	Analytical Method MDL
	Metals and Cyanide		µg/L	µg/L	µg/L	µg/L
	Silver	7440-22-4	100	---	1	0.5
	Aluminum	7429-90-5	50	40	25[d]	200[d]
	Arsenic	7440-38-2	2.1	10	1	0.5
	Barium	7440-39-3	200	68	1	0.5
	Cadmium	7440-43-9	5	4	1	0.5
	Cyanide	57-12-5	200	---	10	5
	Cobalt	7440-47-3	9.2	---	1	0.5
	Chromium (total)	7440-47-3	50	9	1	0.5
	Copper	7440-50-8	50	70	1	0.5
	Iron	7439-89-6	300	240	200[c]	200
	Mercury	7439-97-6	2	0.6	0.5	0.1
	Magnesium	7439-95-4	91,200	---	50	200[d]
	Manganese	7439-96-5	79.3	110	1	0.5
	Nickel	7440-02-0	233	---	1	0.5
	Lead	7439-92-1	50	8	1	0.5
	Antimony	7440-36-0	27.1	---	1	0.5
	Selenium	7782-49-2	33.2	19	1	0.5
	Vanadium	7440-62-2	25.7	---	1	0.5
	Zinc	7440-66-6	200	---	10	5
	Radionuclides		pCi/L	pCi/L		
	Gross Beta	12587-47-2	50	11.5	N/A	N/A
	Gross Alpha	12587-46-1	15	6.3	N/A	N/A
	Other Organic Constituents		µg/L	µg/L		
	2-hexanone	591-78-6	3.5	---	10	5
	4-methyl- 2-pentanone,	108-11-2	16.5	---	10	5
	Benzyl butyl phthalate	85-68-7	100	---	10	5
	Bis(2-ethylhexyl)phthalate	117-81-7	17.7	---	10	5
	di-n-octyl phthalate	117-84-0	7.0	---	5[c]	5
	Styrene	100-42-5	100	---	1	0.2
	TPH diesel	NA	513	---	500	100
	TPH VOA	NA	132	---	100	20
	Perchlorate	14797-73-0	23	1.8	0.5	0.01
	Methyl tertiary butyl ether (MTBE)	1634-04-4	5	---	1	0.2

Notes:
[a] ECL at Point of Connection of DON's SGU Conveyance Pipeline. Based on the ROD and settlement agreement (DON 2002).
[b] ECL at Intake to Principal Aquifer Treatment Plant Based on the ROD and settlement agreement (DON 2002).
[c] Laboratory will report to the MDL.
[d] A laboratory specific method modification will be required to achieve project required reporting limits and MDLs.

µg/L – microgram per liter
DCA – dichloroethane
DCE – dichloroethene
DON – Department of the Navy
ECL – evaluation contaminant level
NA – not applicable
PCE – tetrachloroethene
pCi/L – pico-Curie per Liter
pH – negative log of the hydrogen ion concentration
ROD – record of decision
SGU – shallow groundwater unit
TCA – trichloroethane
TPH – total petroleum hydrocarbons
VOCs – volatile organic compounds
--- – no ECL established

2.2 INSTITUTIONAL CONTROLS

Institutional controls are also included in the selected remedy to protect groundwater extraction and conveyance equipment, and prevent use of contaminated water. In addition, the institutional controls allow site access for the DON, OCWD/IRWD, and regulatory personnel. The institutional controls are described in the *OU1 and OU2A ROD*, and are summarized below.

2.2.1.1 OFF-STATION GROUNDWATER PLUME

Institutional controls for the off-Station portion of the plume are intended to protect residents from using groundwater from the SGU and principal aquifer for domestic purposes, and agricultural workers from exposure to SGU groundwater, until RAOs have been attained. The institutional controls are based on local permitting programs administered by the Orange County Health Care Agency (OCHCA) and the IRWD.

- Any person planning to construct a water well within the off-Station VOC plume must apply for and obtain a permit for construction. The OCHCA and the IRWD are authorized to include any necessary conditions in the permit to assure adequate protection of public health (*Orange County Code*, Article 2, Construction and Abandonment of Water Wells, and *IRWD Rules and Regulations*, Section 16, Water Wells).

- The OCHCA and the IRWD will provide the DON with copies of any well permit applications received or permits issued within the geographic scope of the off-Station groundwater plume exceeding Federal and State MCLs until remediation of the plume has been completed.

- The DON shall provide annually to OCHCA and IRWD, updated maps delineating the VOC groundwater plume until remediation has been completed.

- The DON shall provide annually to the USEPA, DTSC, and the RWQCB, copies of permit applications and permits that it has received from the OCHCA and IRWD during the previous year, beginning one year from the issuance of the OU1 and OU2A ROD, and ending when remediation has been completed.

2.2.1.2 ON-STATION GROUNDWATER PLUME

Institutional controls for the on-Station portion of the plume are intended to protect residents from use of VOC contaminated groundwater until the RAOs have been attained in the SGU; protect the groundwater extraction, injection, and monitoring wells and associated piping and equipment; and assure access to the site by the DON and regulatory agencies to allow for implementation, operation and maintenance, and monitoring of the remedy. Institutional controls associated with the IRP Site 24 VOC plume apply to the entire area encompassed by carve-out III-B (Figure 1-2).

- The DON will provide access to the Station property to OCWD/IRWD for implementation of the IDP. Leases to the property will contain provisions for continuing access, rights-of-way licenses, and easements as necessary.
- The DON has informed the lessee that a treatment system will be operating as prescribed in the OU1 and OU2A ROD, and that the operator has the right to collect soil samples to confirm that lessee operations have not released hazardous substances that could impact the treatment system.
- The OCWD/IRWD will provide reasonable access to the DON, USEPA, and the DTSC to sample pretreated and treated groundwater as necessary.

- Land-use restrictions will be implemented through two legal instruments: 1) Environmental Restriction Covenant and Agreements with the DTSC addressing on-Station real property containing the IRP Site 24 SGU groundwater plume and associated buffer zone and 2) quitclaim deeds between the transferee and the DON conveying on-Station real property containing the IRP Site 24 SGU groundwater plume and associated buffer zone. Both the DON and the DTSC have legal authority to enforce the land-use restrictions and will share responsibility for their enforcement.
- OCHCA and IRWD will assure that permits are applied for and obtained for any new water wells in the on-Station VOC groundwater plume and will take necessary enforcement action to assure permits are obtained and complied with.
- The DON shall provide annually to the USEPA, DTSC, and the RWQCB, copies of permit applications and permits that it has received from OCHCA and IRWD during the previous year, beginning one year from the issuance of the OU1 and OU2A ROD, and ending when remediation has been completed.
- The DON shall monitor and inspect the status of compliance with the land-use restrictions in the Environmental Restriction Covenant and Agreements and quitclaim deeds protecting on-Station extraction, injection, and monitoring wells, and associated piping and equipment concurrently with inspections of such engineering controls and equipment. The DON will report the results of the inspections to the USEPA, DTSC, and the RWQCB.
- If a violation of land-use restrictions is identified and/or documented by either the DON or the DTSC, the identifying entity will provide notification within 10 working days. The DON, USEPA, DTSC, and the RWQCB will then consult to determine a course of action.

2.3 REMEDIAL ACTION OBJECTIVES

The RAOs for the IRP Site 18 and IRP Site 24 VOC plumes are listed below (DON 2002).

IRP Site 18 groundwater:

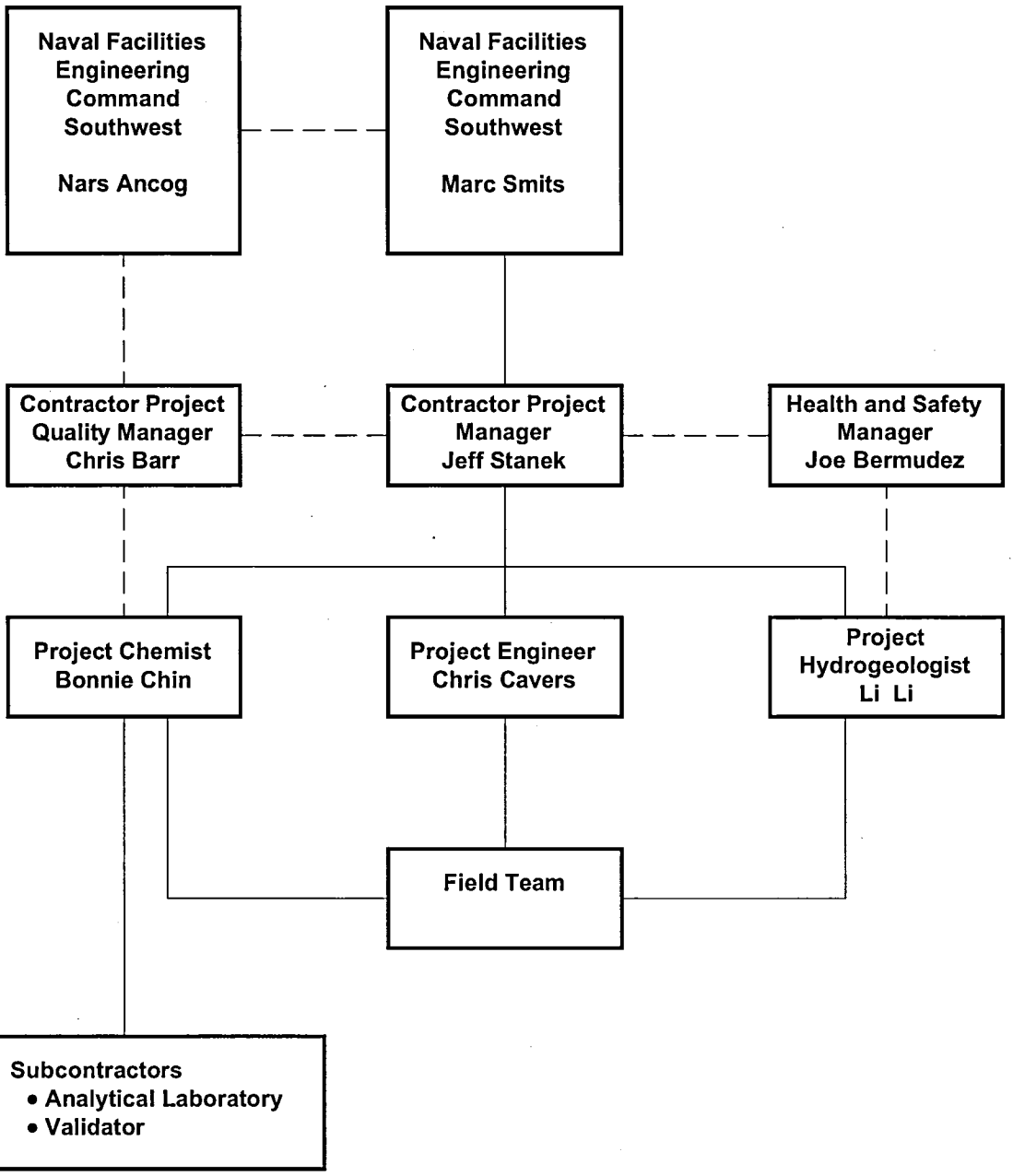
- Reduce VOC concentrations in the SGU and the principal aquifer to Federal or State cleanup levels
- Contain migration of VOCs above cleanup levels in the principal aquifer
- Prevent domestic use of groundwater containing VOCs at concentrations exceeding cleanup levels.

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
- Prevent VOCs at concentrations above cleanup levels from migrating beyond the SGU.

2.4 ORGANIZATION

The remedy performance monitoring will be completed at the direction of the Navy through qualified contractors. An organization chart is provided in Figure 2-2 to illustrate the key positions and responsibilities.



LEGEND

——— Line of responsibility

— — — Line of communication

Performance Monitoring Plan

Organization Chart

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure 2-2
Project No. 29307	EarthTech, A tyco International Ltd. Company	

File: L:\wo...07\cad\OU1 and OU2A Remedy\Draft Final\FIGURE 2-2.dwg Time: Jun 21, 200... 0pm

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The Navy Remedial Project Manager (RPM) will manage the contractor assigned to execute the Performance Monitoring and Sampling and Analysis Plan.

The Navy QAO will approve the project SAP and receive reports of quality management activities from the project quality manager. The QAO may audit or review any activity that may affect the project quality. The QAO has the authority to stop work if non-conformance is identified.

The Project Manager will ensure the work described in this document is carried out. The Project Manager is responsible for execution of the scope of work in the applicable contract, including schedule, communication with the Navy and deliverable content and quality.

The Project Quality Manager is responsible for ensuring and overseeing quality assurance activities performed during the project. The Project Quality Manager will ensure the activities described in this document are performed, verify the qualifications and training of responsible individuals, identify and initiate corrective action for nonconformance and communicate with the Navy QAO when issues arise which effect the Navy or the performance of the scope of the contract. The Project Quality Manager is independent of cost and schedule responsibility and has the authority to stop work in the event a non-conformance which would affect project quality is identified.

The Project Chemist to manage laboratory and data validation services by preparing the scopes of work for subcontracted services, reviewing and monitoring the delivery of samples and the receipt of deliverable from subcontractors, resolving technical issues and overseeing field operation with respect to ensuring sample quality and integrity.

The Project Hydrogeologist will develop the reports based on hydrological data assembled during the dat gathering stages. Plume maps, modeling and system operation planning will be overseen by the hydrogeologist.

The Project Engineer will review modeling and chemical data to determine system opration parameters. The Project Engineer will oversee production of periodic monitoring reports and project deliverables.

The Field Team will collect the field measurements and samples and execute the field sampling plan as described.

The Project Health and Safety Coordinator will manage site and project safety. The Health and Safety Coordinator will prepare and oversee execution of the site specific health and safety plan and ensure that personnel are adequately trained for their responsibilities.

2.5 COMMUNICATION

The Navy RPM will be the primary point of contact between the Settling Federal Agencies and the OCWD/IRWD for exchanges of technical and operating information required in the Settlement Agreement. The Navy RPM will direct the contractor assigned to execute the Performance Monitoring and Sampling and Analysis Plan.

The contractor project manager will execute the contract as specified by the Navy. The contractor will assign a qualified project quality manager to verify that the work performed meets the contract, NFESC-SW requirements, and this Plan. The project manager will supervise staff responsible for oversight of the subcontracted laboratory, the project geologist, engineer and the health and safety coordinator, however designated.

2.6 SPECIAL TRAINING

Personnel assigned will be required to acknowledge this Plan by signing the project sign-off sheet (Worksheet #4). All personnel will be trained in accordance with the Project Health and Safety Plan, including training required by OSHA for Hazardous Waste Operations, as applicable. Personnel assigned will be trained to operate sampling ports, perform required field measurements, collect samples in accordance with applicable analytical methods, and package and ship the samples under chain-of-custody to the designated subcontract laboratory. Specific procedures for operation of associated equipment may be found in the respective O&M Plans.

2.7 SCHEDULE

The infrastructure for the remedy is in place and undergoing functional testing. Full scale implementation is planned for October 2006. Table 2-2 presents the general project schedule. More refined schedule information will be determined by the startup and operation activities.

Table 2-2: General Project Schedule

Activity	Start	Frequency (as applicable)	End
Treatment System Shakedown	Sept 2006		Oct 2006
SGU Monitoring and Modeling	Oct 2006	Quarterly	Oct 2011
Treatment Monitoring	Oct 2006	Biweekly	Oct 2011
Extraction Wells	Oct 2006	Monthly	Oct 2011
Reporting and System Optimization	Oct 2006	Annually	Oct 2011
5 Year Review			Oct 2011

3. PERFORMANCE MONITORING OBJECTIVES

3.1 OVERVIEW

Performance monitoring will be conducted in order to evaluate the effectiveness of the remedy to meet the RAOs. The performance monitoring criteria and objectives have been developed in accordance with the DON (DON 2000, 2001, 2004) and the USEPA guidance (USEPA 1994). Specific monitoring objectives include:

- Evaluate the extent of hydraulic containment of the VOC plume
- Assess the progress of aquifer restoration
- Provide data to optimize system performance
- Appraise compliance with the RAOs

Due to the dynamic nature of remedy implementation and progress, this Performance Monitoring Plan establishes the initial locations and frequencies for the collection of performance monitoring data. Monitoring locations and frequencies will be reevaluated and revised accordingly during the remedial program to ensure that data requirements are satisfied effectively and efficiently.

A degree of flexibility has been incorporated into this Performance Monitoring Plan by including an iterative decision flow process. This will allow successive monitoring events to be based on the results of previous monitoring, thereby optimizing data collection and system performance. In addition, the performance monitoring program will be reviewed as a component of the Annual Remedy Status Report and during the 5-year review process mandated by CERCLA.

3.2 DATA QUALITY OBJECTIVES

The data quality objectives process (USEPA 2000) was used to develop the performance monitoring program and establish a basis for ongoing optimization of the data collection and system performance. The results of the iterative process for this Plan are presented in the following sections.

3.2.1 Problem Statement

With the implementation of the remedy as described in the ROD, data is required to evaluate remedy performance versus RAOs, monitor compliance with ECLs for the water delivered to the treatment plants, and confirm compliance with water and vapor discharge requirements.

3.2.2 Principal Decisions

Data collected in this program will be used to resolve the following decisions:

1. Is the remedy performing in accordance with design specifications and RAOs?
2. What modifications to system operations will optimize removal of VOCs (as listed in Table 2-1) from the SGU and principal aquifer?
3. Are influent concentrations to the SGU treatment system and principal aquifer treatment system within ECLs (Target Analytes shown in Table 2-1) specified in the Settlement Agreement and the ROD?
4. Are VOC concentrations in water extracted from ET-2 and IRWD-78 above MCLs?
5. Are water and vapor discharges from both treatment plants in compliance with the established criteria?
6. Can the remedy be enhanced by the addition of SVE?

3.2.3 Decision Inputs

The criteria, approach and design of this Performance Monitoring Plan is based on the ROD and Settlement Agreement.

Input required to resolve decision questions are:

- Analytical sampling and water level data from extraction wells and monitoring wells,
- Influent and effluent concentrations at the treatment plants at the established points of compliance,
- Performance data (flow volumes and rates, well production data and water levels) from the treatment systems.

3.2.4 Study Boundaries

RAOs and ECLs were identified in the *OU1 and OU2A ROD* and Settlement Agreement. The sampling design incorporates these requirements. The scope of the designed remedy, monitoring and extraction wells are shown in Figure 3-1 and Figure 3-2. The study boundaries include the extent of VOCs in excess of the MCLs in both the SGU and principal aquifer. The temporal boundary includes the duration necessary for the remedy to result in compliance with RAOs.

3.2.5 Decision Rules

In general, the decision rules below correlate with the decision questions presented in Section 3.2.2, Principal Decisions.

1. ***If*** VOC concentrations (Table 2-1) in the SGU and principal aquifer are being reduced in accordance with RAOs, VOC migration has been prevented in the SGU and principal aquifer in accordance with the RAOs, and domestic use of groundwater containing VOCs in excess of cleanup levels is prohibited in accordance with RAOs, ***then*** system performance is consistent with remedy design (Decision Question 1).
2. ***If*** VOC removal efficiency (i.e., mass removed per unit volume) from the SGU and/or the principal aquifer can be increased (i.e., optimized) while still satisfying RAOs, ***then*** appropriate operating procedures will be modified (Decision Question 2).
3. ***If*** concentrations of Target Analytes in the treatment system influents are less than the ECLs, ***then*** the extracted water meets treatment system design criteria set forth during remedy design (Decision Question 3).
4. ***If*** concentrations of Target Analytes exceed the ECLs, ***then*** notification and/or and corrective action in accordance with the Settlement Agreement will be initiated (Decision Question 3).
5. ***If*** concentrations of VOCs in water extracted from ET-2 and/or IRWD-78 exceed MCLs, ***then*** water from ET-2 and/or IRWD-78 will be pumped to the principal aquifer treatment plant for treatment (Decision Question 4).
6. ***If*** concentrations of analytes in the discharges exceed the criteria specified in the respective O&M Manual, ***then*** the plant will be shut down and the problem identified and resolved (Decision Question 5).
7. ***If*** VOCs removal can be enhanced via SVE from wells in the source area, ***then*** SVE will be implemented for mass removal (Decision Question 6).

SENSITIVE RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

FIGURES 3-1 AND 3-2

FOR ADDITIONAL INFORMATION, CONTACT:

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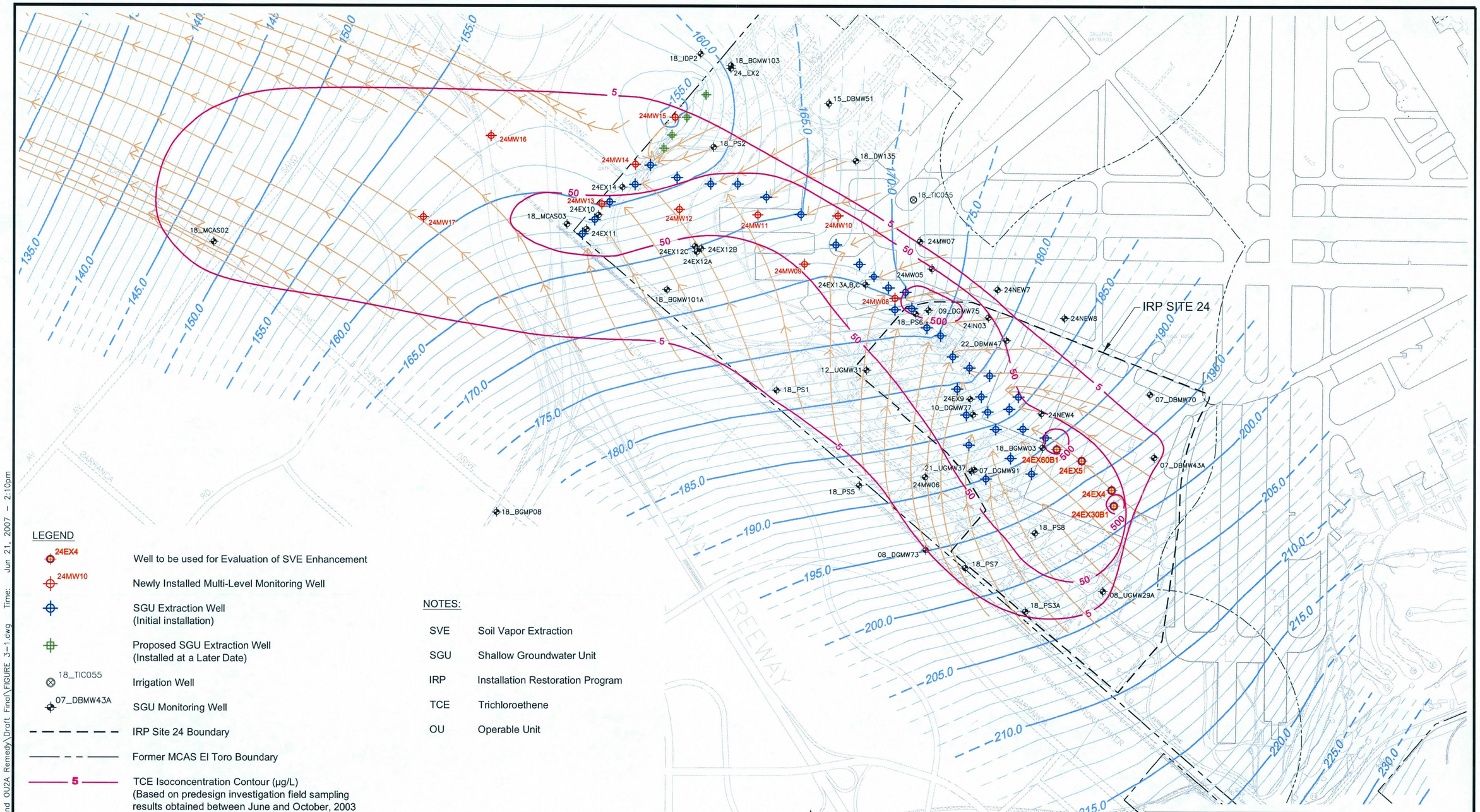
SENSITIVE



LEGEND

- 24EX4 — Well to be used for Evaluation of SVE Enhancement
- 24MW10 — Newly Installed Multi-Level Monitoring Well
- SGU Extraction Well (Initial installation)
- Proposed SGU Extraction Well (Installed at a Later Date)
- 18_TIC055 — Irrigation Well
- 07_DBMW43A — SGU Monitoring Well
- IRP Site 24 Boundary
- Former MCAS El Toro Boundary
- 5 — TCE Isoconcentration Contour (µg/L) (Based on predesign investigation field sampling results obtained between June and October, 2003 [Earth Tech 2004] and March 2003 groundwater monitoring data [CDM 2003].)
- Simulated Groundwater Pathlines in the SGU Based on OU1 and OU2A Groundwater Flow Model. Arrow Represents 10 Simulation Years (Earth Tech 2003)
- 180.0 — Simulated Groundwater Elevations (in 40 Years) in the SGU Based on OU1 and OU2A Groundwater Flow Model. (Earth Tech 2003)

NOTES:

SVE	Soil Vapor Extraction
SGU	Shallow Groundwater Unit
IRP	Installation Restoration Program
TCE	Trichloroethene
OU	Operable Unit

Performance Monitoring Plan

SGU Extraction and Monitoring Well Locations

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure 3-1
Project No. 29307	EarthTech — A tyco International Ltd. Company	

File: L:\work\29307\cad\OU1 and OU2A Remedy\Draft Final\FIGURE 3-1.dwg Time: Jun 21, 2007 - 2:10pm

SENSITIVE

3-3

PAGE NO. 3-4

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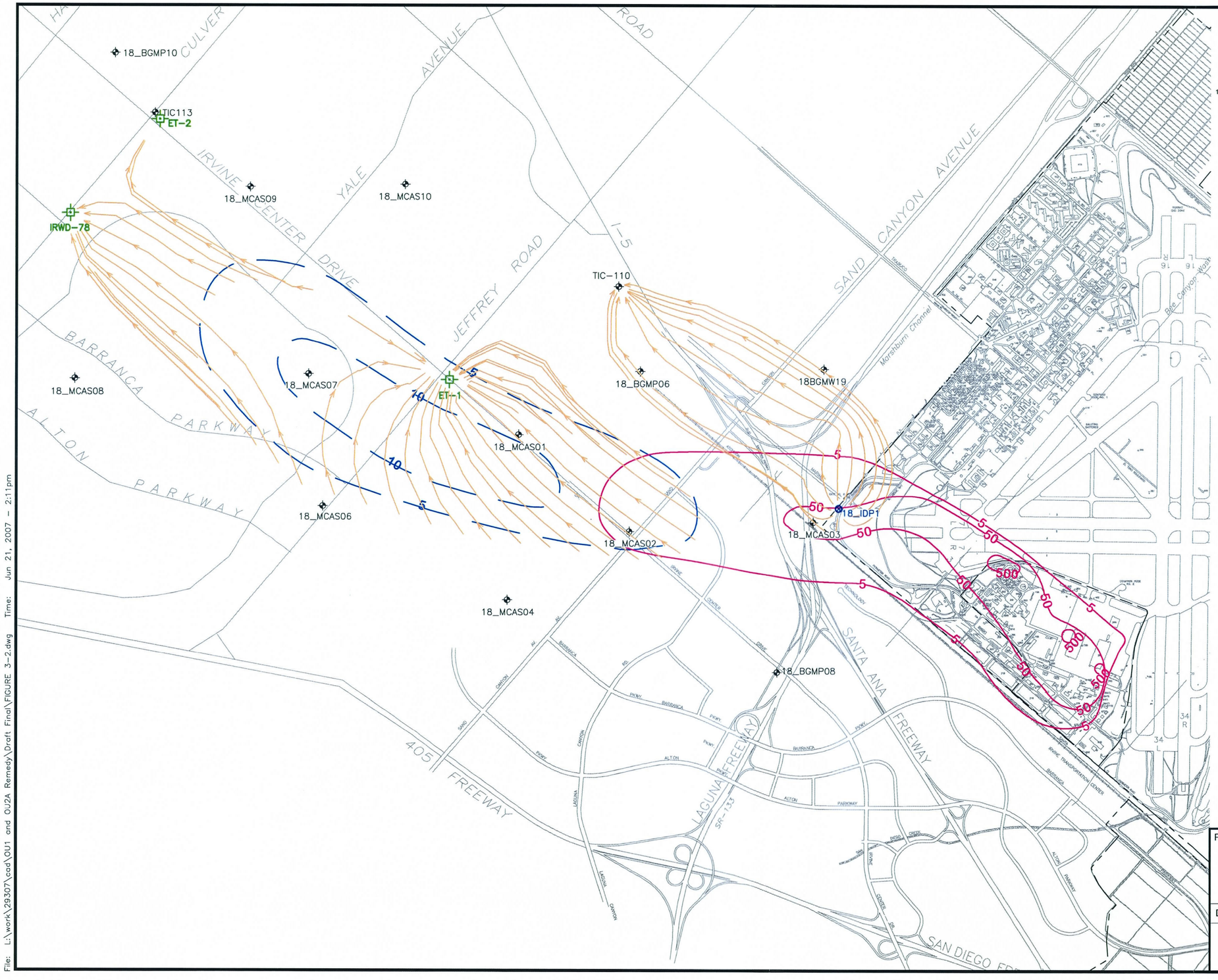

LEGEND

- ET-1 — Principal Aquifer Plume Extraction Well
- 18_MCAS-01 — Existing Groundwater Monitoring Well
- 18_IDP1 — Injection Well
- Former MCAS El Toro Boundary
- IRP Site 24 Boundary
- 5 — TCE Isoconcentration Contour in the Shallow Groundwater Unit (µg/L) [Based on predesign investigation field sampling results obtained between June and October, 2003 (Earth Tech 2004) and March 2003 groundwater monitoring round (CDM 2003).]
- 5 — TCE Isoconcentration Contour in the Principal Aquifer (µg/L) [Based on March 2003 groundwater monitoring data (CDM 2003).]
- Simulated Groundwater Pathlines in the Principal Aquifer Based on OU1 and OU2A Groundwater Flow Model (Earth Tech, 2003) and the Modified IDP's as Described in the 60% Supplemental Design Memorandum (Tetra Tech 2004)

NOTES:

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

NORTH

0 1,000 2,000 FEET

SCALE: 1"= 2,000'

Performance Monitoring Plan

Principal Aquifer Extraction and Monitoring Well Locations

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure 3-2
Project No. 29307	EarthTech, A tyco International Ltd. Company	

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PAGE NO. 3-6

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Additional clarification to the preceding decision rules are provided in the detailed O&M procedures (Weston 2007, Tetra Tech 2007a,b).

3.2.6 Decision Errors

Each of the decision questions described in 3.2.2 has the potential for being incorrectly resolved based on the data. The following is an analysis of potential errors in the data that may result in an incorrect decision:

Decision Question 1. Remedy performance versus RAOs

a. Measurements that incorrectly show that RAOs are being met may result in premature shutdown of the extraction system(s).

b. Measurements that incorrectly show that RAOs are not being met will result in unnecessary resampling and unnecessary system operation.

Decision Question 2: Optimization of System Performance

a. Measurements which result in changes to operations when not appropriate may cause inefficient or ineffective system performance.

b. Measurements which do not support changes to operations when they are warranted may result in inefficient or ineffective system performance.

Decision Question 3. Compliance with ECLs

a. Measurements that incorrectly show the water delivered to the SGU and principal aquifer treatment plants is in compliance with the ECLs may result in non-compliance with treatment limitations.

b. Measurements that incorrectly show the water delivered to the SGU and principal aquifer treatment systems is out of compliance with the ECLs will result in unnecessary resampling and perhaps system shutdown.

Decision Question 4. Compliance with MCLs at ET-2 and/or IRWD-78

c. Measurements that incorrectly show the water from ET-2 and IRWD-78 is below MCLs may result in non-compliance with the ESD.

d. Measurements that incorrectly show the water from ET-2 and IRWD-78 is above MCLs will result in unnecessary conveyance and/or treatment costs.

Decision Question 5. Treatment plant discharge compliance

a. Measurements that incorrectly show that water or vapor discharge is in compliance with established requirements may result in violations of the discharge permits.

b. Measurements that incorrectly show that water or vapor discharge is out of compliance with the established requirements will result in unnecessary resampling and perhaps system shutdown.

Decision Question 6. Remedy enhancement

a. If measurements demonstrate remedy enhancement by SVE when it is not occurring, or overestimates VOC removal, unwarranted operation (and cost) of the system may result.

b. If measurements do not demonstrate remedy enhancement when it is in fact occurring, the system may be shut down prematurely, resulting in additional time and costs.

3.2.7 Sampling Design

A summary of the overall sampling design is presented in the following sections. The specific O&M plans for the SGU and principal aquifer wellfields and treatment systems will implement the data quality objective (DQO) discussion presented, augmenting it with specific operational thresholds to achieve the program objectives and control for the potential decision errors and consequences described in 3.2.6.

Table 3-1: Summary of Project Tasks (Worksheet #14)

Sampling and Analysis Tasks : Extraction and Monitoring Wells for Remedy Performance Evaluation, SGU Treatment Plant, PA Treatment Plant, Treatment Systems Offgas
Quality Control Tasks: Sampling: Field Duplicates, Trip Blanks. Analysis: DON QSM.
Data Management: Data will be accumulated in a project database and provided to stakeholders in periodic reports, as specified in the ROD.
Documents and Records: Field observations, sample collection measurements and chain-of-custody will be maintained by contractor.
Data Packages: Level IV Packages (EWI #1)
Assessment/Audit Tasks: Field sample collection will be audited by the Contractor Quality Manager. Laboratory oversight will be through data package validation.
Data Review Tasks: Laboratory will review in accordance with internal and DON QSM requirements. Laboratory reports will be subject to third-party validation (as specified in EWI#1). Data will be incorporated into reports as specified in the ROD.

3.3 MONITORING WELL NETWORK

The monitoring wells associated with the OU1 and OU2A remedy are listed in Table 3-2 and shown on Figure 3-1 (SGU) and Figure 3-2 (principal aquifer). The monitoring well network provides comprehensive geographic coverage of the VOC plume in the SGU and principal aquifer. The network includes 45 on-Station (IRP Site 24) monitoring wells with 80 screens/ports, and 18 off-Station (IRP Site 18) monitoring wells with 70 screens/ports. Thus, the initial monitoring well network for the OU1 and OU2A remedy includes a total of 147 sampling locations. The monitoring network will be reviewed annually and revised as necessary to maximize monitoring efficiency and data quality.

Most of the monitoring wells have been routinely monitored and sampled as a component of the CERCLA groundwater monitoring program. However, 10 multi-level monitoring wells (24MW08, 24MW09, 24MW10, 24MW11, 24MW12, 24MW13, 24MW14, 24MW15, 24MW16, and 24MW17) were installed specifically to monitor remedy performance. The recently installed multi-level wells were constructed with short (i.e., 10 feet) discrete screens at multiple depth intervals to provide high resolution, vertical profiles of VOC concentrations within the regional VOC plume. Furthermore, the multi-level wells will provide differential water level measurement from each screen, thus allowing for evaluation of vertical flow gradients. Multi-level monitoring well 24MW08 was installed immediately downgradient of the source area, and is equipped with a Westbay sampling system at six intervals, including the SGU, intermediate zone, and principal aquifer. Multi-level Monitoring Wells 24MW09 through 24MW14 consist of four depth zones extending throughout the SGU, coincident with the depths specifically targeted by the SGU extraction wells. Multi-level

Monitoring Wells 24MW16 and 24MW17 were installed within the off-Station portion of the SGU plume, and are equipped with Westbay sampling systems at six intervals each, including the SGU, intermediate zone, and principal aquifer. Monitoring Wells 24MW16 and 24MW17 will provide specific data pertaining to SGU plume containment at the Station boundary.

The extraction well details are listed in Table 3-3 and their locations are shown on Figure 3-1 (SGU) and Figure 3-2 (principal aquifer). The CERCLA remedy includes 39 SGU extraction wells, and 3 principal aquifer extraction wells.

PAGE NO. 3-10

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Table 3-2: Monitoring Well Details (Worksheet #18)

Well ID	Diameter (inches)	Total Depth (ft bgs)	Screen Interval (ft bgs)	Screen Interval (ft above msl)	Evaluation Rationale/Remarks
On-Station Monitoring Wells					
24EX10	6	165	115-160	63.1-108.1	Located within the 50 µg/L TCE isoconcentration contour adjacent to the southwestern boundary of the Station. Will provide assessment of VOC concentrations and hydraulic containment.
24EX11	6	220	135-180	41.2-86.2	Located within the 50 µg/L TCE isoconcentration contour adjacent to the southwestern boundary of the Station. Will provide assessment of VOC concentrations and hydraulic containment.
24EX14	6	195	115–185	44.0-114.0	Located adjacent to the 50 µg/L TCE isoconcentration contour adjacent to southwestern boundary of the Station. Will provide assessment of VOC concentrations and hydraulic containment.
18_PS2	4	133	103–133	111.6-141.6	Located near the northern edge of the plume at the Station boundary. Will provide assessment of VOC concentrations and hydraulic containment.
18_DW135	4	135	115–135	133.0-153.0	Located at the northern edge of the TCE plume. Will provide assessment of VOC concentrations.
18_DW450	4	450	420-450	-180.9-150.9	Located at the northern edge of the TCE plume. Will provide assessment of VOC concentrations.
18_DW540	4	540	490-540	-270.5-220.5	Located at the northern edge of the TCE plume. Will provide assessment of VOC concentrations.
24MW05A/B	3	180	100–135 140-170	140.7-175.7 105.6-135.6	Located near the northeastern edge of the 50 µg/L TCE isoconcentration contour downgradient of source area. Will provide assessment of VOC concentrations and hydraulic containment.
24MW07	4	205	120-200	77.2-157.2	Located along plume margin northwest of source area. Will provide assessment of VOCs and hydraulic containment.
24IN03	6	169	90.5–160	119.8-189.3	Located in source area. Will provide assessment of VOC concentrations and hydraulic containment.
24EX6OB1	4	156	106–151	132.5-177.5	Located within 500 µg/L TCE isoconcentration contour in source area. Will provide assessment of VOC concentrations and hydraulic containment. Will serve as SVE well for remedy enhancement.
07_DBMW43A	4	146	101–141	152.3-192.3	Located on the eastern boundary of the plume. Will provide assessment of VOC concentrations.
24EX3OB1	4	155	105–150	138.8-183.8	Located within 500 µg/L TCE isoconcentration contour in source area. Will provide assessment of VOC concentrations and hydraulic containment. Will serve as SVE well for remedy enhancement.
08_UGMW29A	4	105	75–100	172.3-197.3	Located near the southern boundary of the plume. Will provide assessment of VOC concentrations.
18_PS3A	4	110	70–105	159.1-194.1	Located near the southern boundary of the plume and adjacent to the southwestern boundary of the Station Will provide assessment of VOC concentrations.
18_PS8	4	145	125–145	136.8-156.8	Located cross gradient from source area. Will provide assessment of VOC concentrations and hydraulic containment.
08_DGMW73	4	135	90–130	134.0-174.0	Located near the southern edge of the VOC plume. Will provide assessment of VOC concentrations.
18_PS7	4	126	106–126	138.7-158.7	Located adjacent to the southwestern boundary of the VOC plume. Will provide assessment of VOC concentrations.

Table 3-2: Monitoring Well Details (Worksheet #18)

Well ID	Diameter (inches)	Total Depth (ft bgs)	Screen Interval (ft bgs)	Screen Interval (ft above msl)	Evaluation Rationale/Remarks
07_DGMW91	4	155	110–150	123.7-163.7	Located near the southwestern edge of the 50 µg/L TCE isoconcentration contour near source area. Will provide assessment of VOC concentrations and hydraulic containment.
18_PS5	4	126	106–126	129.1-149.1	Located adjacent to the southwestern boundary of the VOC plume. Will provide assessment of VOC concentrations.
21_UGMW37	4	135	89–130	128.3-169.3	Located near the southwestern edge of the 50 µg/L TCE isoconcentration contour near source area. Will provide assessment of VOC concentrations and hydraulic containment.
24MW06	4	190	170-190	71.4-91.4	Located southwest of source area. Will provide assessment of VOC concentrations and hydraulic containment.
24EX9	6	200	120-200	74.5-154.5	Located within source area. Will provide assessment of VOC concentations and hydraulic containment.
10_DGMW77	4	175	150–170	95.0-115.0	Located within source area. Will provide assessment of VOC concentrations and hydraulic containment.
18_PS1	4	122	102–122	119.7-139.7	Located adjacent to the southwestern boundary of the VOC plume. Will provide assessment of VOC concentrations.
12_UGMW31	4	150	105–145	111.0-151.0	Located southwest of the 50 µg/L TCE isoconcentration contour near source area. Will provide assessment of VOC concentrations and hydraulic containment.
18_BGMW101A	4	103	68–98	135.1-165.1	Located near the southwestern boundary of the Station. Will provide assessment of VOC concentrations and hydraulic containment.
24EX13A/B/C	6	270	110–160 170-210 230-270	104.1-154.1 54.7-94.7 -5.5-34.49	Located immediately downgradient of source area. Will provide assessment of VOC concentrations and hydraulic containment.
24EX12A/B/C	6	260	115–160 165-210 220-260	79.3-124.3 31.2-76.2 -20.9-19.1	Located between source area and Station boundary. Will provide assessment of VOC concentrations and hydraulic containment.
24NEW4	4	153.5	108-148	134.1-174.1	Located within source area. Will provide assessment of VOC concentrations and hydraulic containment.
24NEW7	4	163.5	118-158	127.4-167.4	Located outside of plume boundary north of source area. Will provide assessment of VOC concentrations and hydraulic containment.
24NEW8	4	167.5	122-162	129.9-169.9	Located outside of plume boundary north of source area. Will provide assessment of VOC concentrations and hydraulic containment.
22_DBMW47	4	161	116-156	121.3-161.3	Located adjacent to source area. Will provide assessment of VOC concentrations and hydraulic containment.
07_DBMW70	4	170	125-165	128.9-168.9	Located outside of northeastern plume boundary. Will provide assessment of VOC concentrations.
09_DGMW75	5	159	114-154	116.4-156.4	Located within 500 µg/L TCE isoconcentration contour within source area. Will provide assessment of VOC concentrations and hydraulic containment. Will serve as SVE well for remedy enhancement.

Table 3-2: Monitoring Well Details (Worksheet #18)

Well ID	Diameter (inches)	Total Depth (ft bgs)	Screen Interval (ft bgs)	Screen Interval (ft above msl)	Evaluation Rationale/Remarks
18_PS6	4	151	130-150	119.2-139.2	Located within 500 µg/L TCE isoconcentration contour within source area. Will provide assessment of VOC concentrations and hydraulic containment.
15_DBMW51	4	170	125-165	104.7-144.7	Located outside of northern plume boundary. Will provide assessment of VOC concentrations.
24EX2OB	2	207	107-205	-	Located outside of northern plume boundary. Will provide assessment of VOC concentrations.
18_BGMW103	4	158	118-158	93.2-133.2	Located outside of northern plume boundary. Will provide assessment of VOC concentrations.
18_BGMW03	6	490	124-164 222-242 280-300 370-390	115.5-155.5 37.7-57.7 -20.4- -0.4 -110.4- -90.4	Located within the VOC source area. Will provide assessment of hydraulic containment and VOC concentrations in the SGU and upper portion of the principal aquifer.
24MW08	4	375	105-115 160-170 200-210 250-260 290-300 340-350	155.6-165.6 100.6-110.6 60.6-70.6 10.6-20.6 -29.4- -19.4 -79.4- -69.4	24MW08 is equipped with a Westbay sampling system for high-resolution measurement of VOC concentrations and groundwater elevations immediately downgradient of the VOC source area. The screens are in the SGU and the upper portion of the principal aquifer.
24MW09	2	245	105-115 140-150 171-181 230-240	140.0-150.0 105.0-115.0 74.0-84.0 15.0-25.0	24MW09 includes multiple short screens for high-resolution measurement of VOC concentrations and groundwater elevations between the source area and the Station boundary.
24MW10	2	245	105-115 130-140 170-180 230-240	149.4-159.4 124.4-134.4 84.4-94.4 24.4-34.4	24MW10 includes multiple short screens for high-resolution measurement of VOC concentrations and groundwater elevations between the source area and the Station boundary.
24MW11	2	225	90-100 130-140 175-185 210-220	151.3-161.3 111.3-121.3 66.3-76.3 31.3-41.3	24MW11 includes multiple short screens for high-resolution measurement of VOC concentrations and groundwater elevations between the source area and the Station boundary.
24MW12	2	225	79-89 127-137 165-175 203-213	148.8-158.8 100.8-110.8 62.8-72.8 24.8-34.8	24MW12 includes multiple short screens for high-resolution measurement of VOC concentrations and groundwater elevations between the source area and the Station boundary.
24MW13	2	225	70-80 111-121	144.5-154.5 103.5-113.5	24MW13 includes multiple short screens for high-resolution measurement of VOC concentrations and groundwater elevations at the Station boundary.

Table 3-2: Monitoring Well Details (Worksheet #18)

Well ID	Diameter (inches)	Total Depth (ft bgs)	Screen Interval (ft bgs)	Screen Interval (ft above msl)	Evaluation Rationale/Remarks
			158-168	56.5-66.5	
			212-222	2.4-12.5	
24MW14	2	225	75-85	147.9-157.9	24MW14 includes multiple short screens for high-resolution measurement of VOC concentrations and groundwater elevations at the Station boundary.
			115-125	107.9-117.9	
			170-180	52.9-62.9	
			211-221	11.9-21.9	
24MW15	2	235	75-85	158.6-168.6	24MW15 includes multiple short screens for high-resolution measurement of VOC concentrations and groundwater elevations at the Station boundary.
			125-135	108.6-118.6	
			170-180	63.6-73.6	
			220-230	13.6-23.6	
Off-Station Monitoring Wells					
18_IDP2	4	340	155-195	45-85	Located near northern plume periphery adjacent to Station boundary. Will provide assessment of VOC concentrations.
			300-340	-100--60	
18_MCAS01	4.5	582	60-70	74.7-84.7	Located within principal aquifer plume upgradient of ET-1. Will provide assessment of VOC concentrations and hydraulic capture.
			150-160	-15.3- -5.3	
			210-220	-75.3- -65.3	
			270-280	-135.3- -125.3	
			330-340	-195.3- -185.3	
			450-460	-315.3- -305.3	
			540-550	-405.3- -395.3	
18_MCAS02	4.5	647	40-50	113.9-123.9	Located within the transition zone between the downgradient edge of the SGU plume, and upgradient edge of the principal aquifer plume. Will provide assessment of VOC concentrations and hydraulic capture.
			130-140	23.9-33.9	
			200-210	-46.1- -36.1	
			370-380	-216.1- -206.1	
			420-430	-266.1- -256.1	
			490-500	-336.1- -326.1	
			550-560	-396.1- -386.1	
			620-630	-466.1- -456.1	
18_MCAS03	4.5	531	80-90	127.5-137.5	Located at Station boundary. Will provide assessment of VOC concentrations and hydraulic capture.
			160-170	47.5-57.5	
			220-230	-12.5- -2.5	
			340-350	-132.5- -122.5	
			420-430	-212.5- -202.5	
			490-500	-282.5- -272.5	

Table 3-2: Monitoring Well Details (Worksheet #18)

Well ID	Diameter (inches)	Total Depth (ft bgs)	Screen Interval (ft bgs)	Screen Interval (ft above msl)	Evaluation Rationale/Remarks
18_MCAS04	4	240	181-238	-95- -38	Located south of principal aquifer plume. Will provide assessment of VOC concentrations and hydraulic capture.
18_BGMP08	4	485	61-71 126-136 297-307 379-389 439-449	133.4-123.4 68.4-58.4 -102.6- -112.6 -184.6- -194.6 -244.6- -254.6	Located south of the SGU plume. Will provide assessment of VOC concentrations and hydraulic capture.
18_MCAS06	4	285	167–222	-107- -52	Located south of principal aquifer plume. Will provide assessment of VOC concentrations and hydraulic capture.
18_MCAS07	4.5	1152	90-100 190-200 350-360 440-450 510-520 800-810 910-920 980-990 1080-1090	2.9-12.9 -97.1- -87.1 -257.1- -247.1 -347.1- -337.1 -417.1- -407.1 -707.1- -697.1 -817.1- -807.1 -887.1- -877.1 -987.1- -977.1	Located between ET-1 and ET-2. Will provide assessment of VOC concentrations and hydraulic capture.
18_MCAS08	4	435	390–410	-324- -304	Located southwest of the principal aquifer plume. Will provide assessment of VOC concentrations and hydraulic capture.
18_MCAS09	4	450	372–445	-367- -294	Located northwest of the principal aquifer plume. Will provide assessment of VOC concentrations and hydraulic capture.
18_MCAS10	4	400	355-375	-271- -251	Located north of the principal aquifer plume. Will provide assessment of VOC concentrations and hydraulic capture.
18_BGMP06	4	455	105-115 168-178 295-305 380-390 445-455	60.4-70.4 -2.6-7.4 -129.6- -119.6 -214.6- -204.6 -279.6- -269.6	Located northeast of the principal aquifer plume. Will provide assessment of VOC concentrations and hydraulic capture.
18_BGMP10	4	1015	218-228 429-439 563-573 752-762	-169.8- -159.8 -380.8- -370.8 -514.8- -504.8 -703.8- -693.8	Located northwest of the principal aquifer plume. Will provide assessment of VOC concentrations and hydraulic capture.

Table 3-2: Monitoring Well Details (Worksheet #18)

Well ID	Diameter (inches)	Total Depth (ft bgs)	Screen Interval (ft bgs)	Screen Interval (ft above msl)	Evaluation Rationale/Remarks
			887-897	-838.8- -828.8	
			1001-1011	-952.8- -942.8	
18BGMW19	4.5	470	98-138	94.3-134.3	Located north of SGU plume boundary. Will provide assessment of VOC concentrations.
			150-170	61.9-81.9	
			257-277	-45.0- -25.0	
			400-420	-188.0- -168.0	
			448-468	-236.0- -216.0	
24MW16	4	328	80-90	NS	24MW16 is equipped with a Westbay sampling system for high-resolution measurement of VOC concentrations and groundwater elevations off-Station.
			120-130		
			160-170		
			200-210		
			240-250		
			290-300		
24MW17	4	337	75-85	NS	24MW17 is equipped with a Westbay sampling system for high-resolution measurement of VOC concentrations and groundwater elevations off-Station.
			110-120		
			165-175		
			205-215		
			250-260		
			300-310		

Notes:
See Table 3-4 for methods and analyses.
µg/L = microgram per liter
bgs = below ground surface
ft = feet
ID = Identification
NS = not surveyed
O&M = operations and maintenance
SGU = shallow groundwater unit
SVE = soil vapor extraction
TBD = to be determined
TCE = trichloroethene
VOC = volatile organic compound

Table 3-3: Extraction Well Details (Worksheet #18)

Well ID	Diameter (inches)	Total Depth (ft bgs)	Screen Interval (ft bgs)	Screen Interval (ft above msl)	Evaluation Rationale/Remarks
Shallow Groundwater Unit Extraction Wells					
24_SGU-01	6	211	96-206	74.5-184.5	VOC source area extraction well
24_SGU-02	6	175	100-170	110.4-180.4	VOC source area extraction well
24_SGU-03	6	214	99-214	64.8-179.8	VOC source area extraction well
24_SGU-04	6	214	99-209	69.5-179.5	VOC source area extraction well
24_SGU-05	6	211	96-206	68.8-178.8	VOC source area extraction well
24_SGU-06	6	205	100-200	79.7-179.7	VOC source area extraction well
24_SGU-07	6	230	104-224	54.4-174.4	VOC source area extraction well
24_SGU-08	6	215	100-210	65.7-175.7	VOC source area extraction well
24_SGU-09	6	223	98-218	54.8-174.8	VOC source area extraction well
24_SGU-10	6	204	99-199	76.7-176.7	VOC source area extraction well
24_SGU-11	6	221	106-216	62.6-172.6	VOC source area extraction well
24_SGU-12	6	224	99-219	55.4-175.4	VOC source area extraction well
24_SGU-13	6	223	98-218	54.9-174.9	VOC source area extraction well
24_SGU-14	6	231	106-226	43.8-163.8	VOC source area extraction well
24_SGU-15	6	224	99-219	51.0-171.0	VOC source area extraction well
24_SGU-16	6	190	105-185	88.4-168.4	VOC source area extraction well
24_SGU-17	6	185	105-180	90.9-165.9	VOC source area extraction well
24_SGU-18	6	231	106-226	44.8-164.8	VOC source area extraction well
24_SGU-19	6	236	111-231	37.7-157.7	VOC source area extraction well
24_SGU-20	6	236	111-231	NS	VOC source area extraction well
24_SGU-21	6	199	104-194	NS	VOC source area extraction well
24_SGU-22	6	224	99-219	NS	VOC source area extraction well
24_SGU-23	6	224	99-219	NS	Extraction well between VOC source area and Station boundary
24_SGU-24	6	229	99-224	NS	Extraction well between VOC source area and Station boundary
24_SGU-25	6	229	99-224	NS	Extraction well between VOC source area and Station boundary
24_SGU-26	6	230	160-225	NS	Extraction well between VOC source area and Station boundary

Table 3-3: Extraction Well Details (Worksheet #18)

Well ID	Diameter (inches)	Total Depth (ft bgs)	Screen Interval (ft bgs)	Screen Interval (ft above msl)	Evaluation Rationale/Remarks
24_SGU-27	6	160	90-155	NS	Extraction well between VOC source area and Station boundary
24_SGU-28	6	216	146-211	NS	Extraction well between VOC source area and Station boundary
24_SGU-29	6	151	81-146	NS	Extraction well between VOC source area and Station boundary
24_SGU-30	6	226	151-221	NS	Extraction well between VOC source area and Station boundary
24_SGU-31	6	145	70-140	NS	Station boundary extraction well
24_SGU-32	6	210	140-205	NS	Station boundary extraction well
24_SGU-33	6	150	70-145	NS	Station boundary extraction well
24_SGU-34	6	215	145-210	NS	Station boundary extraction well
24_SGU-35	6	150	75-145	NS	Station boundary extraction well
24_SGU-36	TBD	TBD	TBD	TBD	Station boundary extraction well to be installed as contingency per 100% design
24_SGU-37	TBD	TBD	TBD	TBD	Station boundary extraction well to be installed as contingency per 100% design
24_SGU-38	TBD	TBD	TBD	TBD	Station boundary extraction well to be installed as contingency per 100% design
24_SGU-39	TBD	TBD	TBD	TBD	Station boundary extraction well to be installed as contingency per 100% design
Principal Aquifer Extraction Wells					
ET-1	16	500	220-490	-365--95	Located within the principal aquifer VOC plume. Will provide primary mass removal of VOCs from the principal aquifer.
ET-2 (TIC-113)	16	1100	280-1080	-1021--221	Located downgradient of the leading edge of the aquifer plume. Will provide assessment of VOC concentrations and hydraulic capture.
IRWD-78	18	690	240–680	-611--171	Located downgradient of the leading edge of the aquifer plume. Will provide assessment of VOC concentrations and hydraulic capture.

Notes:
See Table 3-4 for methods and analyses.
bgs = below ground surface
ft = feet
ID = Identification
IRWD = Irvine Ranch Water District
NS = not surveyed
SGU = shallow groundwater unit

3.4 SAMPLING AND MONITORING PARAMETERS AND FREQUENCIES

A summary of sampling and monitoring parameters and frequencies is provided in Table 3-4 and Table 3-5 and is described in the following subsections. Analyte lists for the various sampling parameters will be consistent with Table 2-1.

Table 3-4 Sampling Locations, Methods, Procedures (Worksheet #18)

Sampling Location	Matrix	Analytical Group	Sampling SOP Reference
SGU Extraction Wells	Water	VOCs	Section 3.5
PA Extraction Wells	Water	VOCs	Section 3.5
SGU Monitoring Wells	Water	VOCs	Section 3.5
PA Monitoring Wells	Water	VOCs	Section 3.5
SGU Treatment Plant Influent	Water	VOCs, General Chemistry, Metals, Radionuclides, Other organics	Section 3.5
PA Treatment Plant Influent	Water	VOCs, General Chemistry, Metals, Radionuclides, Other organics	Section 3.5

Notes:
SGU shallow groundwater unit

3.4.1 System Performance

The analyte lists have been developed based on the known chemicals of concern (COCs) within the VOC plume and the ECLs as specified in Section 2.1.5. However, analyte lists will be streamlined based on sampling data as described in Section 3.4.1.1.

Table 3-5: Sampling and Monitoring Parameters and Frequencies

Parameter	SGU Extraction Wells	PA Extraction Wells	SGU Monitoring Wells	PA Monitoring Wells	SGU Treatment Plant Influent ECL Monitoring[a]	Principal Aquifer Treatment Plant Influent ECL Monitoring[a]
Flow Rate	Continuously	Continuously	NA	NA	Continuously	Continuously
Water Level	Continuously	Continuously	Quarterly[b]	Quarterly	-----	-----
VOCs	Monthly, Quarterly[c]	Quarterly	Quarterly, semi-annually, annually[c]	Quarterly, semi-annually, annually[c]	Every 2 weeks, monthly, quarterly[c]	Quarterly
General Chemistry	NA	NA	NA	NA	Quarterly, semi-annually, annually[c]	Quarterly, semi-annually, annually[c]
Metals	NA	NA	NA	NA	Quarterly, semi-annually, annually[c]	Quarterly, semi-annually, annually[c]
Radionuclides	NA	NA	NA	NA	Quarterly, semi-annually, annually[c]	Quarterly, semi-annually, annually[c]
Other Organics	NA	NA	NA	NA	Quarterly, semi-annually, annually[c]	Quarterly, semi-annually, annually[c]

Notes:
[a] SGU treatment system ECL monitoring will be performed immediately upstream of the point of connection from the DON and IRWD; the ECL monitoring point for the principal aquifer system is identified in the O&M Plan (Tetra Tech 2007b).
[b] Water levels will be measured weekly from SGU monitoring wells at startup and after any significant change to the extraction strategy.
[c] Frequency to be determined or revised based on established trends.

3.4.1.1 MONITORING WELLS

The monitoring wells in Table 3-2 will be sampled for VOCs and monitored for water level prior to startup and quarterly for one year after startup. The baseline and quarterly monitoring and sampling results will be evaluated and used to optimize system monitoring and performance. VOCs not detected for four consecutive sampling events will be eliminated from the analyte list to streamline data management, evaluation, and reporting. Sampling will be conducted at sufficient intervals to allow for system optimization and remedy performance evaluation; however, due to the long term nature of the OU1 and OU2A remedy, sampling will be optimized to increase cost efficiency while maintaining sufficiency for evaluating the achievement of RAOs. Based on the initial year of results, sampling frequencies will be modified as shown on Figure 3-3, which is based upon the *OU1 and OU2A ROD* (DON 2002). After the initial year of remedy implementation and collection of four quarterly sampling events, data from each well will be evaluated based on concentrations and observed trends. Trends will be evaluated using time series plots and Mann-Kendrall trend analyses, and used to revise sampling frequencies accordingly. In general, wells without established trends or with high variability will continue to be sampled quarterly. Wells with established trends will be sampled semi-annually or annually depending on the location of the well with respect to the plume and its necessity for evaluating COC migration.

Since the wellfield extraction rates will likely be adjusted during remedy implementation as a result of optimization and routine O&M, water levels will be monitored quarterly. However, the frequencies and locations of water level monitoring, and VOC sampling will be continually evaluated, and revisions will be recommended as necessary as a component of the Annual Remedy Status Reports and/or the five-year review process described in Section 3.5.

3.4.1.2 EXTRACTION WELLS

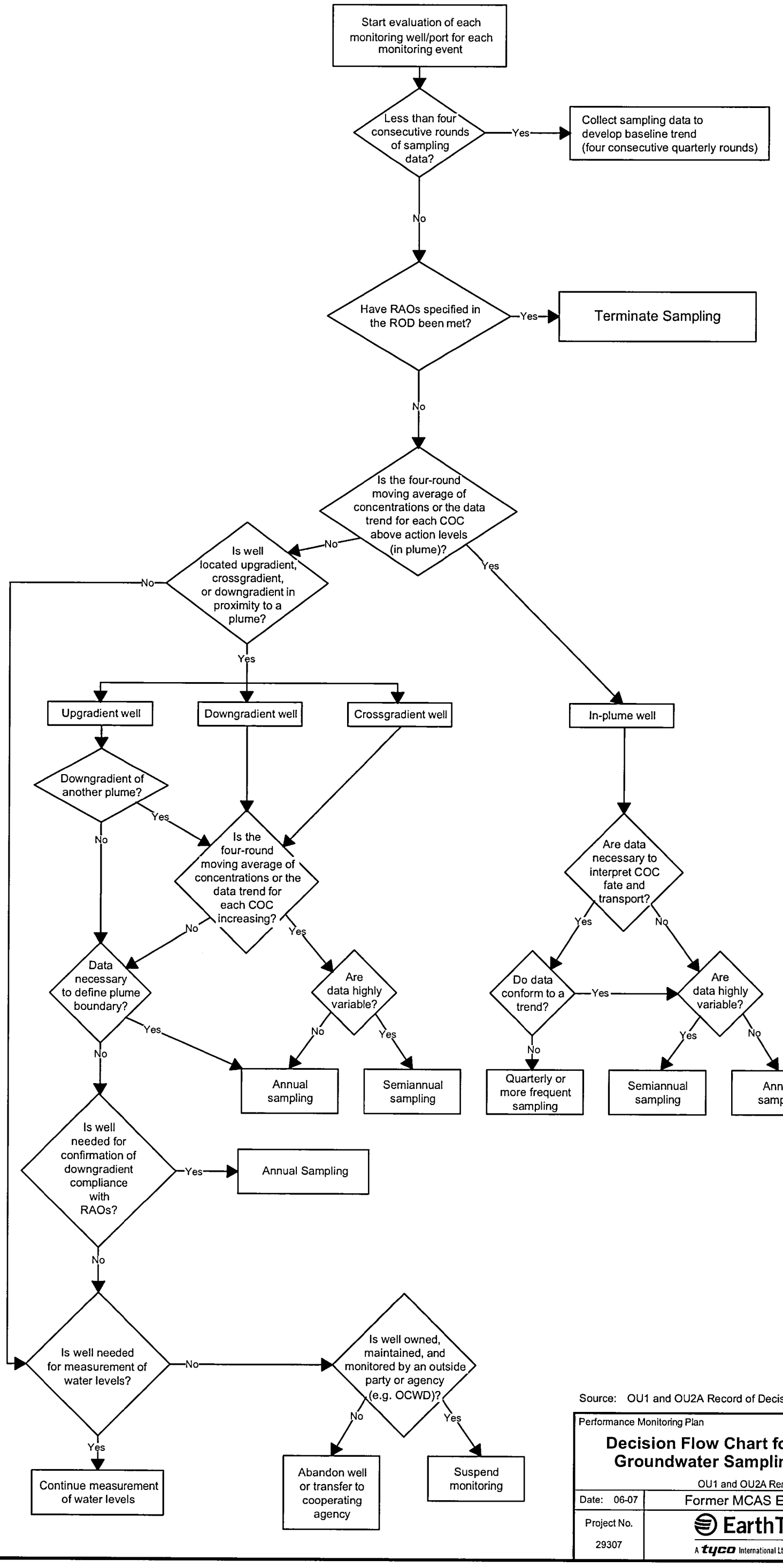
SGU extraction wells will be sampled for VOCs daily for the first week of system operation, weekly for the following month, and monthly thereafter for the first year of remedy implementation. After the first year of remedy implementation, the frequency of VOC sampling from each of the SGU extraction wells will be evaluated based on the Mann-Kendrall trend analysis. If a trend is apparent based on four consecutive monthly samples, then VOC sampling will be conducted quarterly. If no trend is apparent, sampling will continue monthly. The sampling results will be used to formulate the most efficient pumping strategy for the SGU.

The principal aquifer extraction wells (ET-1, ET-2, and IRWD-78) will be sampled quarterly for VOCs by OCWD. The sampling results will be used to formulate the most efficient pumping strategy for the principal aquifer, and to determine whether the VOC concentrations in water from ET-2 and IRWD-78 are below MCLs. VOC concentrations from ET-2 and/or IRWD-78 are expected to be below MCLs, and the water will be distributed directly into the non-potable system (Tetra Tech 2007b). However, if VOC concentrations from ET-2 and/or IRWD-78 exceed MCLs, the water will be pumped to the principal aquifer treatment plant (located at ET-1) using the existing transmission pipelines prior to distribution to the non-potable system (Tetra Tech 2007b).

Analyte lists for the extraction wells will be streamlined based on sampling data. Any VOC not detected for four consecutive quarterly sampling events will be deleted from the analyte list for the respective extraction wells. This will ease data management efforts and focus data analysis and interpretation to the COCs.

3.4.1.3 SGU TREATMENT PLANT

A schematic of the SGU extraction and treatment system is provided on Figure 3-4. Initially, intake to the SGU treatment plant (i.e., immediately prior to the point of connection from the DON to the



Source: OU1 and OU2A Record of Decision (DON, 2002)

Performance Monitoring Plan

Decision Flow Chart for Determining Groundwater Sampling Frequency

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure
Project No. 29307	EarthTech, A tyco International Ltd. Company	3-3

PAGE NO. 3-22

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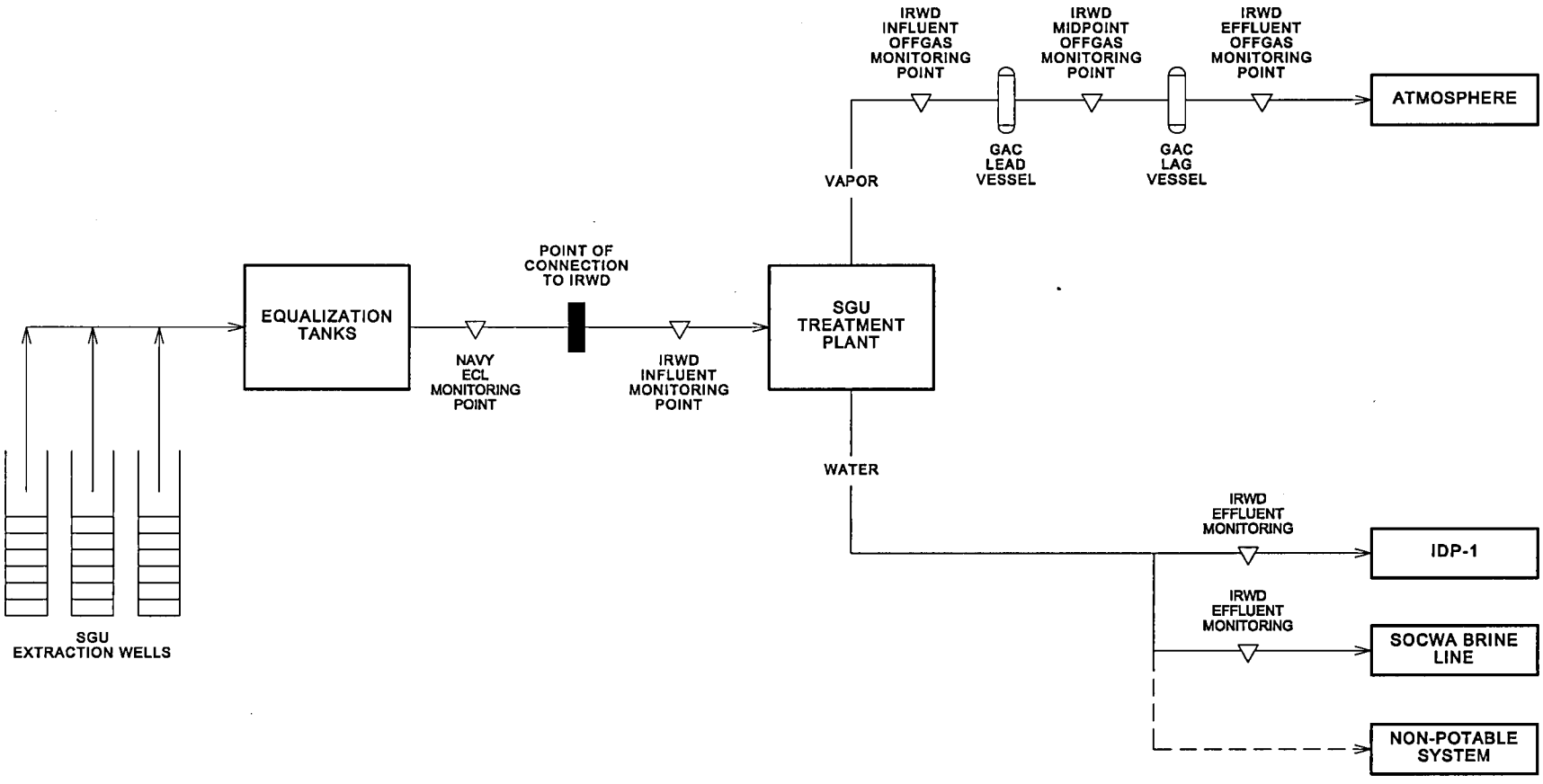

NOTES:

ECL	EVALUATION CONCENTRATION LEVEL
SGU	SHALLOW GROUNDWATER UNIT
IRWD	IRVINE RANCH WATER DISTRICT
SOCWA	SOUTH ORANGE COUNTY WASTEWATER AUTHORITY

Performance Monitoring Plan

SGU System Schematic

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure 3-4
Project No. 29307	EarthTech, A tyco International Ltd. Company	

PAGE NO. 3-24

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IRWD) will be sampled every two weeks for VOCs, and quarterly for general chemistry, metals, radionuclides, and other organic constituents as specified in Table 2-1 to monitor compliance with the ECLs. The sampling frequency will be revised based on the Mann-Kendrall trend analysis. If a trend is apparent based on four consecutive biweekly samples, then VOC sampling as a component of ECL monitoring will be conducted monthly. If a trend is apparent based on four consecutive monthly samples for general chemistry, metals, radionuclides, and other organic constituents, then sampling will be performed biannually. Similarly, the sampling frequency for VOCs may be revised to quarterly, and the sampling frequency for general chemistry, metals, radionuclides, and other organic constituents may be revised to annually depending on subsequent sampling results and trend analysis. Additionally, if the SGU extraction strategy is changed significantly, ECL monitoring may be performed more frequently (i.e., every 2 weeks for VOCs) until stabilization has been established.

The ECLs will be used as evaluation criteria for temporary shutdown of the SGU treatment system. If any of the respective ECLs specified in Table 2-1 are exceeded, an additional, confirmatory influent sample, and an effluent sample will be immediately collected and analyzed. If no ECLs are exceeded in the confirmatory sample, and treatment standards are not exceeded in the effluent sample, sampling at the respective treatment plant will resume at the routine sampling frequency.

As specified in the Settlement Agreement (DOJ 2001), if ECLs are exceeded at the SGU treatment system in the confirmatory sample, the party discovering the exceedance(s) will promptly notify the DON, USEPA, the Department of Toxic Substances Control (DTSC), Department of Health Services (DHS), and the Regional Water Quality Control Board (RWQCB). In this case, the OCWD/IRWD may temporarily shut down the operation of the SGU treatment system without further notice.

Within seven calendar days following the initial notification, the parties will determine whether through adjusting flow rates, blending, or similar measures the SGU treatment system can continue to adequately treat extracted groundwater to ensure compliance with applicable Federal and State drinking water standards at the point of distribution into IDP-1, the SOCWA outfall, and/or the non-potable water supply infrastructure following treatment. If the standards can be met, the OCWD/IRWD will immediately resume operations.

If OCWD/IRWD determine that the treatment standards cannot be met at the point of distribution into IDP-1, the SOCWA outfall, and/or the non-potable water supply infrastructure following treatment, the OCWD/IRWD may continue temporary shutdown of the SGU treatment system. In such case, the OCWD/IRWD will develop a response plan within 60 calendar days for approval by the DON and concurrence by the USEPA and the California Environmental Protection Agency (Cal/EPA) (including DTSC, DHS, and RWQCB). Potential response actions will be developed based on flow rates and concentrations from individual wells, and may include reduction of flow from wells with higher concentrations of ECL analytes and/or increased flow from a well with lower concentrations of ECL analytes. Response actions and restart sequences are detailed in the O&M plan for the SGU treatment system (Tetra Tech 2007a). A flow chart depicting the decision process for ECL monitoring is provided on Figure 3-5. The response plan will propose all practicable means available to minimize the extent and duration of termination of all or a portion of the SGU groundwater extraction and/or treatment activities, along with a timetable for resumption of operations.

Water discharged from the SGU treatment plant will be sampled to monitor compliance with the discharge criteria. Discharge to IDP-1 will comply with the criteria specified in RWQCB Order No. R8-2003-085 (RWQCB 2003) listed in the SGU treatment system O&M Plan (Tetra Tech 2007a). Discharge requirements into the SOCWA brine line and non-potable system are also detailed in the SGU treatment system O&M Plan (Tetra Tech 2007a). If any of the respective discharge criteria are exceeded, the treatment plant will be temporarily shutdown until a response action can be identified.

Potential response actions may include an inspection of treatment system components, and/or an evaluation of the treatment system influent concentrations and operating parameters. The treatment system will not be restarted until a response action has been identified that will result in compliance with discharge criteria. Response actions and restart sequences are detailed in the O&M plan for the SGU treatment system (Tetra Tech 2007a).

In addition to discharged water, air discharged from the SGU treatment plant will be monitored to assure compliance with South Coast Air Quality Management District (SCAQMD) Rule 1401 as specified in the O&M plan (Tetra Tech 2007a). The O&M Plan also provides sampling and analysis details and procedures for the air monitoring.

3.4.1.4 Principal Aquifer Treatment Plant

A schematic of the principal aquifer extraction and treatment system is provided on Figure 3-6. Intake to the principal aquifer treatment plant will be sampled quarterly by IRWD for VOCs, general chemistry, metals, radionuclides, and other organic constituents as specified in Table 2-1 to monitor compliance with the ECLs. The ECLs will be used as evaluation criteria for temporary shutdown of the principal aquifer treatment system. If any of the respective ECLs specified in Table 2-1 are exceeded, an additional, confirmatory influent sample, and an effluent sample will be immediately collected and analyzed. If no ECLs are exceeded in the confirmatory sample, and treatment standards are not exceeded in the effluent sample, sampling will resume quarterly. If ECLs are exceeded in the confirmatory sample, then the procedures described in Section 3.4.1.3, as specified in the Settlement Agreement, will be implemented until an appropriate response action has been identified. Potential response actions for the principal aquifer treatment system are detailed in the O&M Plan, and may include revised pumping from ET-1, and/or blending of water from ET-2 and/or IRWD-78 (Tetra Tech 2007b).

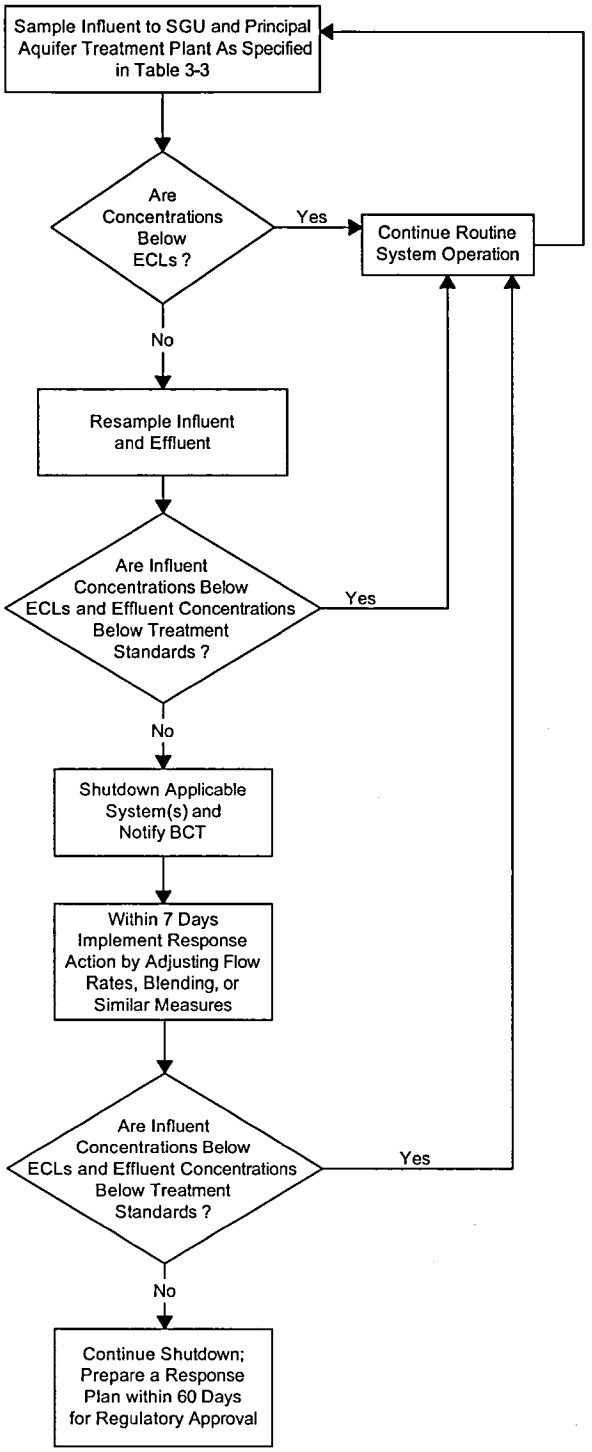
Water discharged from the principal aquifer treatment plant will be sampled to monitor compliance with the criteria for discharge into the non-potable system as described in the principal aquifer O&M Plan (Tetra Tech 2007b). Response actions and restart sequences as a result of exceedances of discharge criteria from the principal aquifer treatment plant are also detailed in the O&M plan. A flow chart depicting the decision process for ECL monitoring is provided on Figure 3-5.

In addition to discharged water, air discharged from the principal aquifer treatment plant will be monitored to assure compliance with South Coast Air Quality Management District (SCAQMD) Rule 1401 as specified in the O&M plan (Tetra Tech 2007b). The O&M Plan also provides sampling and analysis details and procedures for the air monitoring.

3.4.2 Institutional Controls

Institutional controls will be monitored to confirm that they continue to provide the protection as described in the remedy. Since the institutional controls associated with the OU1 and OU2A remedy apply primarily to access restrictions and protection of treatment system components, noncompliance or ineffectual application of institutional controls will be apparent during routine O&M of the remedial system. Additionally, annual inspection and reporting will be performed for the duration of the remedy. The annual inspection will identify the status of compliance with the institutional controls in the Environmental Restriction Covenant and Agreements and quitclaim deeds protecting on-Station extraction, injection, and drinking water wells, monitoring wells, and associated piping and equipment.

As specified in the ROD (DON 2002), if a violation of institutional controls is identified by the DON, the DON will provide notification to USEPA, DTSC, and the RWQCB within 10 working days. The DON, USEPA, DTSC, and the RWQCB will then consult to determine a course of action.



Notes:

SGU	Shallow Groundwater Unit
ECL	Evaluation Concentration Limit
O & M	Operation and Maintenance
BCT	BRAC Cleanup Team

Performance Monitoring Plan

Decision Process Flow Chart for ECL

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure 3-5
Project No. 29307	EarthTech, A tyco International Ltd. Company	

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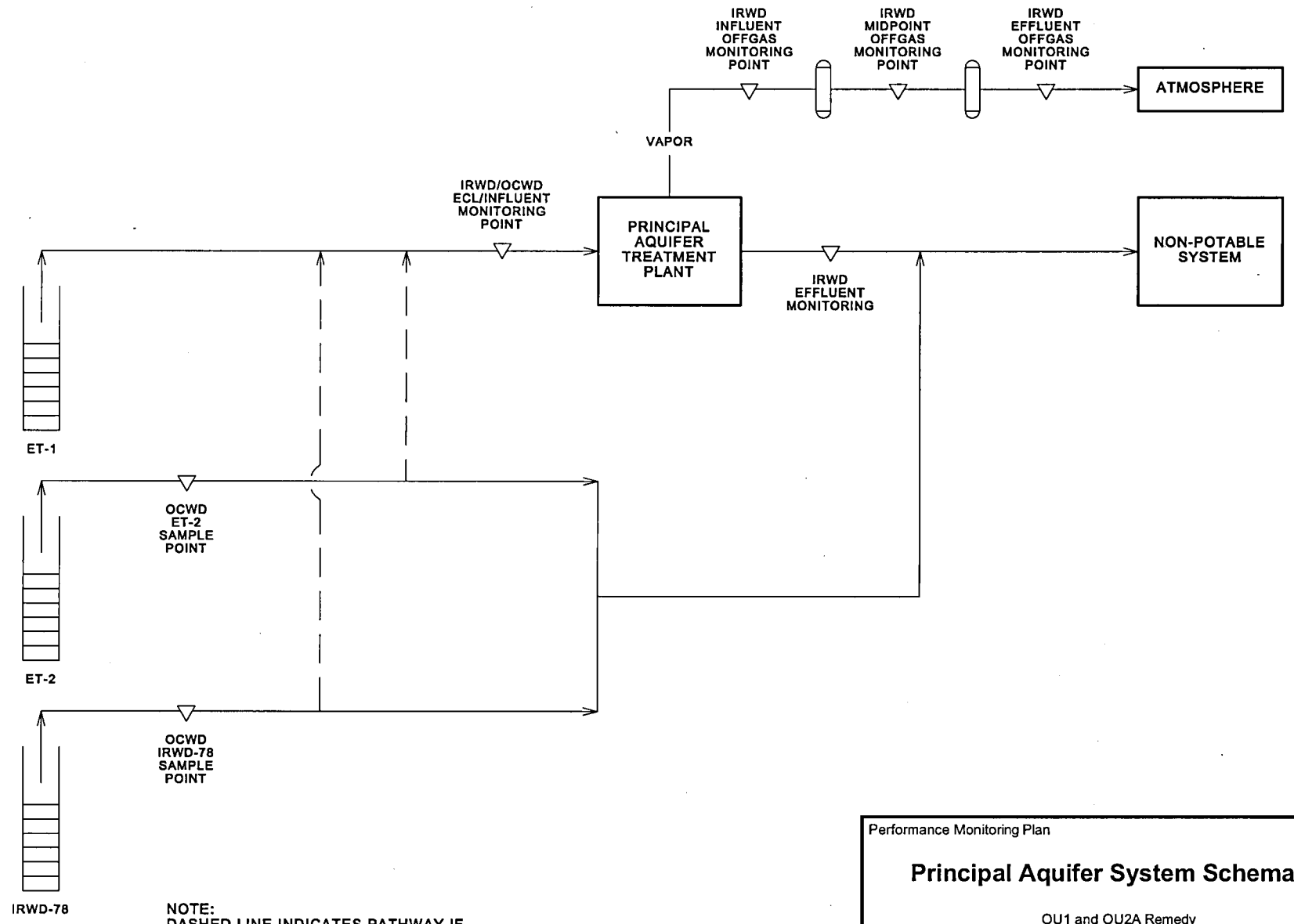

Performance Monitoring Plan

Principal Aquifer System Schematic

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure 3-6
Project No. 29307	EarthTech, A tyco International Ltd. Company	

PAGE NO. 3-30

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3.4.3 VOC Source Area Remedy Enhancement

SVE will be performed at wells situated in the Site 24 VOC source area to evaluate the presence of residual VOCs in the dewatered zone, and to appraise the effectiveness of SVE as a means of residual VOC mass removal. SVE will be implemented for mass removal evaluation after sufficient dewatering has occurred within the VOC source area. Wells to be used during SVE evaluation include 24EX3OB1, 24EX4, 24EX5, and 24EX6OB1 in former VOC source area (i.e., Hangars 296 and 297). The SVE wells are located within the source areas with the highest known VOC concentrations in groundwater (Figure 3-1). SVE will be terminated if VOC concentrations are below groundwater protective thresholds as specified in the Site 24 Interim Vadose Zone ROD.

Soil vapor samples will be collected upon initiation of SVE at each vapor extraction well. Vapor samples will be collected at the following intervals after startup of SVE from each well: 4 hours, 8 hours, 12 hours, and 24 hours. Vapor samples will then be collected every 24 hours thereafter until asymptotic concentrations have been established. The vapor samples will be collected in SUMMA canisters and analyzed in accordance with USEPA Method TO-15 for VOCs. The results of the vapor sampling will be used to evaluate the technical and economical benefit of SVE as a remedy enhancement. The maximum measured vapor concentrations will be compared to the groundwater protective threshold concentrations established for IRP Site 24 in the Final ROD for the vadose zone (DON 2005). If the maximum VOC concentrations do not exceed the groundwater protective thresholds, SVE will not be resumed. If maximum concentrations exceed the groundwater protective thresholds, decay curves, mass removal rates, and concentration rebound will be evaluated for the applicable well(s) to indicate whether SVE will result in effective mass removal and added protection or benefit to groundwater quality.

3.4.4 Optimization of Performance Monitoring

The performance monitoring program will be reviewed annually. The monitoring program will be optimized to achieve monitoring objectives, maintain cost efficiency, while maintaining data quality and program efficiency. The monitoring program will be evaluated for the following:

- Total number of monitoring locations,
- Frequencies and durations of monitoring,
- Analyte lists and quality assurance/quality control (QA/QC) samples,
- Sampling procedures,
- Data evaluation, management, and reporting.

Proposed revisions to the monitoring program will be presented in the annual status reports described in Section 3.5.2. In general, monitoring frequencies and locations will be reduced as long-term trends are established and recognized as described in Section 3.4.1.1. Additionally, analyte lists will be streamlined based on sampling data. Any VOC not detected for four consecutive sampling events will be deleted from the analyte list for the respective wells. This will ease data management efforts and focus data analysis and interpretation to the COCs. Trend analyses will be described in the annual remedy status reports to support revisions to the Performance Monitoring Plan. Trend analyses will be performed using time-series plots and temporal statistical analyses using the Mann-Kendall trend test as described in the *Guide to Optimal Groundwater Monitoring* (DON 2000). Additional temporal and spatial trend analysis may be performed using the groundwater flow and contaminant transport model developed during remedy design (Earth Tech 2003).

3.5 SAMPLE COLLECTION

Samples will be collected from designated sampling points in accordance with the following procedures. Designated sampling points include taps on the treatment and extraction system, monitoring wells with low-flow bladder pumps, and Westbay sampling systems. Samples will be collected directly into specified containers provided by the subcontracted laboratory. Samples will be handled, transported and managed under chain-of-custody in the field by the contractor in accordance with these procedures or as defined in a contractor Amendment to this plan.

A sampling log of the following will be maintained for each sample collected.

- Record of instrument calibration or verification
- Identification of well
- Static water level depth
- Purge volume and pumping rate
- Time that the well was purged
- Sample identification numbers
- Well evacuation procedure/equipment
- Date and time of collection
- Field measurement data
- Field observations on sampling event;
- Name of collector

3.5.1 Sample Collection and Custody

Samples will be collected by the Field Team and maintained on ice and secured from tampering until transfer to a shipper or laboratory representative. Upon collection, a chain-of-custody document will be completed, including sample identification, date time and smapler, required analyses, bottles, preservation and notes relevant to laboratory analysis. Sample coolers transferred by shipper will be sealed and custody documentation included inside the cooler.

Sample identification will consist of a unique number for each sample which will be associated with sampling location information in the filed logbooks. The chain-of-custody form will be submitted to the laboratory along with the samples and the laboratory will complete the sample receipt acceptance, inspection and custody documentation in accordance with DoD QSM requirements.

Sample archiving and disposal will be conducted in accordance with the laboratory procedures manual and the DoD QSM.

3.5.2 Field Equipment Calibration

Instruments used to monitor parameters to determine when purging is completed will be calibrated and used in accordance with manufactures instructions. Parameters to be monitored are show in Table 3-6. A multi-parameter instrument with a flow through cell is connected to the discharge port of the sample pump and readings collected and recorded in the field records.

Conductivity, turbidity, dissolved oxygen and pH are calibrated using a fresh calibration solution as shown in Table 3-6. Calibration is documented in the field logbook and subsequent calibration verification conducted in accordance with Table 3-7.

1. Set up instrument, connecting probes and tubing as required.
2. Place fresh calibration solution in sample cup and place probes in solution.
3. Adjust instrument in accordance with manufacturers' instructions.
4. Remove probes from calibration solution and verify operation with second solution.
5. Record calibration activity, calibration solution reference information, date of solution expiration and results of verification readings in the field logbook.

Table 3-6 Field Parameter Stabilization

Field Equipment	Acceptance Criteria
Temperature	± 1°C
pH	± 0.5 units
Conductivity	± 10%
Turbidity	± 10%
Dissolved oxygen	±0.5 mg/L
Oxidation-reduction potential	±10 mV

3.5.3 Treatment System and Extraction Well Sample Points

Designated sample points at the treatment systems, extraction wells and designated monitoring points in the system will be samples by turning on a tap and collecting the sample directly into the required sample containers. If an extraction well is off-line, it will be turned on and operated for a minimum of 20 minutes to ensure a sample representative of the formation is collected.

The sampler will open the sample port and allow water to flow at a steady rate for enough time to clear stagnant water from the valve and associated piping. The flow will be throttled back enough to minimize turbulence and aeration when filling the containers. Each container will be filled to the neck of the bottle, without overflowing, and capped. Samples for VOC analysis will be collected in VOA vials, pre-preserved with hydrochloric acid. The vial is to be filled until a meniscus of water extends above the top of the container. The cap is carefully placed on top and secured. The sampler must then tap the bottle and inspect for air bubbles. If there is a bubble larger than approximately 1 millimeter, the sample must be recollected in a new, unused vial. Samples which effervesce, are heated or form bubbles (off-gassing or carbonates) may not be collected without bubbles. Field notes and the chain-of-custody must identify these samples. Samples will be immediately placed on ice for subsequent transfer to the laboratory under chain-of-custody.

3.5.4 Monitoring Well Sampling Points

Monitoring wells will be sampled using low flow techniques and either a permanently installed pump bladder pump or a pump that is transferred from well to well, decontaminated between uses.

Sampling procedures at a site will consist of:

1. measurement of well depth to ground water,
2. purging of static water within the well and well bore, and
3. obtaining a ground-water sample.

The depth to standing water shall be measured to the nearest 0.01 foot to provide baseline hydrologic data and verify purge rates do not exceed well recharge capacity. Water levels should be measured twice in quick succession and each measurement recorded. Each piece of equipment shall be decontaminated prior to entering the well.

Purging shall be accomplished by removing ground water from the well at low flow rates using the bladder pump operated in accordance with manufacturers instructions. The rate at which ground water is removed from the well during purging ideally should be less than 0.2 to 0.3 L/min. Wells should be purged at or below their recovery rate.

In-line flow cells will be used to monitor temperature, pH, specific conductivity, dissolved oxygen, redox potential, and turbidity. The instrument will be calibrated in accordance with manufacturers instructions and monitored as shown in Table 3-7.

Table 3-7 Field Equipment Calibration (Worksheet #22)

Field Equipment	Calibration Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference
Temperature	Initial calibration	Beginning of field mobilization	± 1°C	Recalibrate or repair	Field team leader	Section 3.5.1
	Continuing calibration	Daily (beginning of field day)	± 1°C	Recalibrate or repair	Field team leader	Section 3.5.1
pH	Initial calibration	Daily (beginning of field day)	± 0.5 units	Recalibrate or repair	Field team leader	Section 3.5.1
	Continuing calibration	> 1hour between meter use	± 0.5	Recalibrate or repair	Field team leader	Section 3.5.1
	Final calibration	Daily (end of field day)	± 0.5 units	Record	Field team leader	Section 3.5.1
Conductivity	Initial calibration	Daily (beginning of field day)	± 10%	Recalibrate or repair	Field team leader	Section 3.5.1
	Continuing calibration	> 1hour between meter use	± 10%	Recalibrate or repair	Field team leader	Section 3.5.1
	Final calibration	Daily (end of field day)	± 10%	Record	Field team leader	Section 3.5.1
Turbidity	Initial calibration	Daily (beginning of field day)	± 10%	Recalibrate or repair	Field team leader	Section 3.5.1
	Final calibration	Daily (end of field day)	± 10%	Record	Field team leader	Section 3.5.1
Dissolved oxygen	Initial calibration	Daily (beginning of field day)	±0.5 mg/L	Recalibrate or repair	Field team leader	Section 3.5.1
	Continuing calibration	> 1hour between meter use	±0.5 mg/L	Recalibrate or repair	Field team leader	Section 3.5.1
	Final calibration	Daily (end of field day)	±0.5 mg/L	Record	Field team leader	Section 3.5.1
Oxidation-reduction potential	Initial calibration	Daily (beginning of field day)	±10 mV	Recalibrate or repair	Field team leader	Section 3.5.1
	Continuing calibration	> 1hour between meter use	±10 mV	Recalibrate or repair	Field team leader	Section 3.5.1
	Final calibration	Daily (end of field day)	±10 mV	Record	Field team leader	Section 3.5.1

During the well purging procedure, water level measurements shall be collected to assess the hydraulic effects of purging. At least four to six readings shall be taken during the purging process. Purging shall be considered complete when two or three consecutive field parameter measurements stabilize within the ranges shown in Table 3-6. Groundwater removed during purging shall be pumped into the transfer compound equalization tanks, and subject to ECL monitoring consistent with the water pumped from the SGU extraction wells.

The flow rate (purge rate) must be adjusted to yield 100 to 300 milliliter (ml) per minute. Avoid settings that produce pulsating streams of water instead of a steady stream. For samples requiring

filtration an in-line high capacity filter is used. Samples are collected into the sample containers provided by the laboratory, minimizing aeration and agitation.

3.5.5 Westbay Sampling Points

Assemble the appropriate equipment and supplies. Set up the down-hole winch over the monitoring well. Attach the controller to the winch control panel. Attach the sampler to the end of cable winch line. (Refer to the Westbay Operations Manual.) Attach (up to four) one-liter stainless steel sampling bottles to the sampler probe. Retrieve groundwater samples. Collect a VOC sample by opening the valve on the bottom of the Westbay sample bottle and adjusting the flow to slowly fill the vial until a reverse meniscus forms above the top of the vial. Screw on the cap, invert, and tap the bottle to check for the presence of air bubbles. If air bubbles are present, collect the sample again.

Table 3-8 Analytical SOP Requirements (Worksheet #19)

Matrix	Analytical Group	Preparation/ Analytical Method Reference	Containers	Preservation	Holding Time (preparation / analysis)
Water	VOC-TL, VOC-OT	EPA 5030B/ EPA 8260B	3 40 ml VOA Vials	HCl to pH<2	14 days
Water	SVOC-TL, SVOC-OT	EPA 3520/EPA 8270C	2 1-L Amber glass	Cool 4°C	7 days/40 days
Water	PH	EPA 150	1 1L HDPE	None	Immediate
Water	ALK	EPA 310			14 days
Water	ION	EPA 300			14 days
Water	SIO2	EPA 370			28 days
Water	PERCH	EPA 331			28 days
Water	CN	EPA 335	500 ml HDPE	NaOH to pH>10	14 days
Water	TPHD	EPA 3520/EPA 8015B	2 1-L Amber glass	Cool 4°C	7 days/40 days
Water	TPHV	EPA 5030B/ EPA 8015B	3 40 ml VOA Vials	HCl to pH<2	14 days
Water	RAD	EPA 900	1 1L HDPE	HNO_3 to pH <2	6 months
Water	MET	EPA 3010A/6010	1 1L HDPE	HNO_3 to pH <2	6 months
Water	HG	EPA 7471			28 days

Field quality control samples will be collected as shown in Table 3-9. As the sampling schedule will be adjusted periodically, based on an annual review, the planned frequency is also shown. This frequency will be maintained throughout the sampling program.

Table 3-9 Field Quality Control Sample Summary (Worksheet #20)

Matrix	Analytical Group	Analytical/ Preparation Reference	Planned No. of Sampling Locations	Field Dup. Pairs	MS[1]	Field Blanks	Equip. Rinsates	Trip Blanks[2]	Total
Water	VOC-TL, VOC-OT	EPA 5030B/ EPA 8260B	190	10 (1:10)	19 (1:10)	0	0	38	248
Water	SVOC-TL, SVOC-OT	EPA 3520/EPA 8270C	8	1	1	0	0	0	10
Water	PH	EPA 150	8	1	1	0	0	0	10
Water	ALK	EPA 310	8	1	1	0	0	0	10
Water	ION	EPA 300	8	1	1	0	0	0	10

Table 3-9 Field Quality Control Sample Summary (Worksheet #20)

Matrix	Analytical Group	Analytical/ Preparation Reference	Planned No. of Sampling Locations	Field Dup. Pairs	MS[1]	Field Blanks	Equip. Rinsates	Trip Blanks[2]	Total
Water	SIO2	EPA 370	8	1	1	0	0	0	10
Water	PERCH	EPA 331	8	1	1	0	0	0	10
Water	CN	EPA 335	8	1	1	0	0	0	10
Water	TPHD	EPA 3520/EPA 8015B	8	1	1	0	0	0	10
Water	TPHV	EPA 5030B/ EPA 8015B	8	1	1	0	0	0	10
Water	RAD	EPA 900	8	1	1	0	0	0	10
Water	MET	EPA 3010A/6010	8	1	1	0	0	0	10
Water	HG	EPA 7471	8	1	1	0	0	0	10

[1]Number of locations where additional sample volume is required.
[2]One per cooler containing VOC water samples.
[4] Sufficient sample is provided for laboratory MS/MSD

Table 3-10 Measurement Performance Criteria – Field Quality Control (Worksheet #12)

Analytical Group	QC Sample	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	Assesses Error for Sampling (S), Analytical (A) or both (S&A)
VOCs in Water	Trip blank	1 per cooler	Comparability, representativeness	<DL	S&A
All	Field Duplicates	1 per 20 field samples	Precision – field and laboratory	RPD <50%	S&A

DL – detection limit

3.6 ANALYTICAL SERVICES

Samples will be submitted for analytes shown in Table 2-1. Analytical methods for this program are presented in Table 3-11. All work will be performed in accordance with the requirements of the DON QSM and the NFESC approved laboratory Quality Assurance Manual, including laboratory quality control, calibration and data management. Results will be reported to the Project Chemist approximately 14 calendar days from sample receipt.

Table 3-11 Analytical SOP References (Worksheet #23)

Matrix	Preparation/ Analytical Method Reference	Analytical Group	Instrument
Water	EPA 5030B/ EPA 8260B	VOC-TL, VOC-OT	Purge and trap/gas chromatography/mass spectrometry
Water	EPA 3520/EPA 8270C	SVOC-TL, SVOC-OT	Extraction/ gas chromatography/mass spectrometry
Water	EPA 150	PH	Electrometric
Water	EPA 310	ALK	Titration
Water	EPA 300	ION	Ion chromatography
Water	EPA 370	SIO2	Colorimetric
Water	EPA 331	PERCH	Ion chromatograph/ mass spectrometry

Table 3-11 Analytical SOP References (Worksheet #23)

Matrix	Preparation/ Analytical Method Reference	Analytical Group	Instrument
Water	EPA 335	CN	Distillation/colorimetric
Water	EPA 3520/EPA 8015B	TPHD	Extraction//gas chromatography/ Flame ionization detector
Water	EPA 5030B/ EPA 8015B	TPHV	Purge and trap/ gas chromatography/ Flame ionization detector
Water	EPA 900	RAD	Gas flow proportional counter
Water	EPA 3010A/6010	MET	Inductively coupled plasma atomic emission spectrometry
Water	EPA 7471	HG	Cold vapor atomic absorption

3.7 PROJECT DOCUMENTS AND RECORDS

Project files will be maintained in accordance with contract requirements and contractor SOPs. Location of the files are presented in Table 3-12

Table 3-12 Project Documents and Records (Worksheet #29)

Documents and Records	Where Maintained
Field notes/logbook	Administrative Record, Project file
Chain-of-custody forms	Administrative Record, Project file and laboratory
Laboratory raw data package	Administrative Record, Project file, laboratory
Audit/assessment checklists/reports	Project file and laboratory
Laboratory corrective action forms/reports	Project file and laboratory
Laboratory equipment calibration logs	Laboratory
Sample preparation logs	Laboratory and project file
Run logs	Laboratory and project file
Sample disposal records	Laboratory
Validated data	Administrative Record, Project file

3.8 DATA MANAGEMENT

The following sections describe the requirements for management of hard copy and electronic data. Table 3-12 (Worksheet #29) summarizes where critical project documents and records will be maintained.

3.8.1 Hard Copy

A full data package will be required from the laboratories, which will be prepared in accordance with the instructions provided in the EPA Contract Laboratory Program (CLP) statement of work (EPA 1999).

The laboratories will maintain all relevant raw data and documentation, including but not limited to logbooks, data sheets, electronic files, and final reports for at least seven years. NAVFAC Southwest will be notified 30 days before disposal of any relevant laboratory records.

The contractor will maintain copies of all chain-of-custody forms until receipt of the laboratory report. The copy of the chain-of-custody will be retained until the final acceptance of the laboratory

report and data validation, at which time the chain-of-custody with the laboratory report will become the official record. One copy of the laboratory report will be logged in upon receipt and maintained in the project files. An electronic (pdf format) version of the laboratory report will be received from the laboratory and will be posted to a secure project file transfer server. The second hard copy of the laboratory report will be submitted for third-party validation.

3.8.2 Electronic Data

Field information (e.g., date and sample ID, etc) will be uploaded from field-generated electronic files. Upon receipt, electronic data will be reviewed to ensure that results for all samples and analyses are reported. Following data review, data verification will be conducted to ensure that the electronic data deliverable is consistent with the hard copy report submitted by the laboratory. Finally, data validation will be conducted to check for irregularities in analyte identities, concentrations, and units.

Any discrepancies encountered as a result of this review will be corrected or reconciled before the data are uploaded into the central database. The uploaded data will also be processed to compare the fields against a list of required values. If any errors are identified, the file will be manually edited or regenerated by the laboratory. If no errors are identified, the data will be uploaded into the database. The laboratory database will be merged with the field database, and reports will be generated from the merged database. All electronic data will be transmitted in the Navy Electronic Data Deliverable (NEDD) format in accordance with Environmental Work Instruction #6 (NFECSW 2005).

3.9 Assessments and Oversight

Project quality assurance will be a function of the project quality manager, who is assigned the authority to inspect all activities and may stop work if activities detrimental to the quality of the work product are detected. The quality manager may perform field inspections or may delegate responsibility for it to a qualified individual. Project personnel will evaluate compliance of the laboratory QA program and procedures with IRCDQM requirements (NFESC 1999). Oversight may include internal and external audits, documentation of findings, and reports of corrective action.

3.9.1 Performance, System and Field Audits

The NAVFAC Southwest QAO, project manager, and QA manager or senior technical staff may schedule and/or perform audits. The QA manager or other auditors will be independent of the data collection activities. The project QA manager will coordinate a management review of any deficiencies that are noted. The auditor or audit team may issue a corrective-action request form to identify and schedule specific corrective actions to be undertaken and completed by the project team. The auditor is responsible to verify that any required corrective actions are completed.

3.9.1.1 Field Audits

A field audit will be performed quarterly by the project quality manager. Items to be examined include availability and implementation of approved field procedures, instrument calibration, equipment operation, COC procedures and instructions, and nonconformance documentation. The NAVFAC Southwest QAO may also conduct a field audit of this project, addressing the items described above. The QA manager will prepare a memorandum to the project file to document the outcome of the audits and track any required corrective actions.

3.9.1.2 Laboratory Performance Audits

Contracted laboratories must be certified by the state of California through the DEH's Environmental Laboratory Accreditation Program (ELAP). In addition, the laboratories must successfully complete

the NFESC laboratory evaluation process prior to receiving any samples from the project for analysis. The laboratory evaluation will be based on the latest version of the IRCDQM.

3.9.2 Corrective Action Procedures

The QA Manager will document problems and the corrective actions to provide a complete record of QA activities and help identify necessary preventive actions. Non-conformances that effect the findings or recommendation sof the project or that have impacts to Navy work outside of the project will be reported to the Navy QAO.

3.9.2.1 Field Audits

Field nonconformance conditions are occurrences or measurements that do not meet established requirements or criteria and will affect data quality. Examples of nonconformance include issues such as:

- Incorrect use of field equipment
- Improper sample collection, preservation, and shipment procedures
- Incomplete field documentation, including COC records
- Incorrect decontamination procedures
- Incorrect collection of QC samples

Corrective action procedures will depend on the severity of the nonconformance. In cases where field personnel implement immediate and complete corrective action, the corrective action will be recorded in the field logbook.

Nonconformance issues that have substantial impact on data quality require completion of a corrective action request form. An auditor or any individual who suspects that any aspect of data integrity is being affected by a field nonconformance may fill out this form. Each form is limited to a single nonconformance. Multiple forms will be used for documentation if additional problems are identified.

Copies of the corrective action request form will be distributed to the project team. If a nonconformance issue is identified, the project team will meet to discuss steps to resolve the problem. Items to be discussed will include:

- Determine when and how the problem developed
- Assign responsibility for problem investigation and documentation
- Determine the corrective action to eliminate the problem
- Design a schedule for completing the corrective action
- Document and verify that the corrective action has eliminated the problem

The QA manager may require data acquisition to be limited or discontinued until the corrective action is complete and the nonconformance is eliminated. The QA manager may also request the reanalysis of any or all data acquired since the system was last in conformance.

3.9.2.2 Laboratory Procedures

Internal laboratory procedures for corrective action and a description of nonconformance situations requiring corrective action are contained in the laboratory QA plan. At a minimum, corrective action will be implemented when any of the following three conditions occur:

- Control limits are exceeded

- Method QC requirements are not met
- Sample holding times are exceeded

Nonconformance situations will be reported to the quality manager and a record of corrective action provided.

The sample collection systems will be evaluated by the quality manager for conformance to the project scope of work and project SOPs. A memorandum to the project file, documenting the nature and extent of the audit, will serve as the project record. The quality manager has the authority to stop work in the event a non-conformance critical to data usability is identified. The subcontractor will be required to correct all non-conformances and provide objective evidence of the correction, either through additional on-site reviews or documentation provided to the quality manager and the project manager.

3.9.3 Quality System Reporting

Quarterly reporting of quality assurance reviews to the project manager will be the responsibility of the quality manager. The quality manager will provide e-mail or memorandum to the project manager of quality assurance activities as they are performed, identifying deviations from planned quality assurance activities, uncorrected exceedances of quality control measurements and findings of data verification and validation which would warrant additional quality surveillance to ensure the data collected was sufficient for the use intended.

3.10 DATA REVIEW

This section describes the procedures used to review, verify and validate field and fixed laboratory data collected during this investigation. It also includes procedures by which on-site measurements and data will be reviewed and assessed. The purpose of data review, verification, and validation for this project are to ensure data collected meet the DQOs outlined in this document and data quality is sufficient to support the project decisions.

Review of project data will include an initial completeness assessment to determine whether all required measurements are collected and data deliverables are present (e.g., case narratives, chain-of-custodies, etc.).

To ensure that field decisions are being made based on data of known quality, real-time measurements, including QC sample results, will be reviewed by the project manager and QA manager. Quality Control data will be included with the daily field analytical data to facilitate the association of QC samples with the analytical batches run during the day. These data will be reviewed by the QA manager on a regular basis to ensure that data quality objectives are attained. Final field analysis reports and data submissions will include second level review by subcontractor supervisory personnel, in accordance with the subcontractor quality assurance requirements.

Fixed laboratory data generated during this investigation will be subject to two levels of review within the laboratory. A peer and supervisory-level review will be completed to verify analyte identification, quantitation, and QC data. The review process will be performed in accordance with the laboratory quality assurance manual and will be in compliance with the DON QSM.

3.10.1 Data Verification

Field and laboratory data will be managed using both manual and electronic systems. Data stored, evaluated, and reported electronically will be subject to 100 percent manual verification against hard copy reports. Field data and field measurements collected will be entered in the project database. All

manually entered data will be verified by a second reviewer. Verification of electronic deliverables from the laboratory will be performed by the data validation subcontractor as part of the overall validation process. Any errors or inconsistencies will be resolved immediately by clarifying the issue with the appropriate field personnel. All field personnel will be responsible for the following the sampling and documentation procedures described in this SAP. Table 3-13 presents a summary of the data verification process for this project.

Table 3-13 Verification Process (Worksheet #34)

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Chain of custody forms	Chain-of-custody forms will be reviewed internally upon their completion and verified against the packed sample coolers they represent. A copy of the chain-of-custody retained in the project file, and the original and remaining copies taped inside the cooler for shipment.	I	Field team leader
Audit reports	Upon report completion, a copy of all audit reports will be placed in the project file. If corrective actions are required, a copy of the documented corrective action taken will be attached to the appropriate audit report in the project file.	I	Project Manager
Field notes/logbook	Field notes will be reviewed internally and placed in the project file. A copy of the field notes will be attached to the final report.	I	Field team leader
Laboratory data	Laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal. All received data packages will be verified externally according to the data validation procedures specified in the subcontractor quality system requirements.	I, E	Laboratory Validation Organization

Incomplete information and discrepancies associated with historical data will be addressed as a factor in the uncertainty associated with the decision-making process.

3.10.2 Data Validation

Data validation will be by the project team and a subcontractor will address the validation activities as specified in the UFP-QAPP Tables 10 and 11. Analytical data validation for fixed-base laboratory data collected during this investigation will be performed in accordance with SWDIV Environmental Work Instruction EWI#1 (SWDIV 2001). In accordance with the NAVFAC Southwest policy, an independent party with experience performing data validation for Navy projects will perform the validation.

Step IIa validation activities to be performed by the team will include: deliverables, analytes, chain-of-custody, field transcription, proficiency testing, and audits. The findings, as they impact the conclusions and recommendations, of these reviews will be documented in the data assessment section of the project report.

Data validation will be performed by **an independent, third-party** and will include Step IIa activities: deliverables, analytes, chain-of-custody and sample handling, data qualifiers, laboratory transcription (Level D review), field duplicate comparison, proficiency testing (as applicable), standards, and records of communication. The findings and recommendations will be incorporated into the validation report, submitted to the quality manager.

Validation will be performed in accordance with the standard operating procedures of the subcontractor. Data will be validated at 80 percent EPA Level III and 20 percent EPA Level IV. Data

validation will be performed in accordance with the Navy IRCDQM (NFESC 1999), the EPA CLP National Functional Guidelines for Organic and Inorganic Data Review (EPA 1999 and 2004), and the QC criteria specified in this document.

Table 3-14 Validation Summary Table (Worksheet #36)

Matrix	Analytical Group	Concentration Level	Validation Criteria	Validator
Water	VOC-TL, VOC-OT	All	EPA 5030B/ EPA 8260B	TBD
Water	SVOC-TL, SVOC-OT	All	EPA 3520/EPA 8270C	
Water	PH	All	EPA 150	
Water	ALK	All	EPA 310	
Water	ION	All	EPA 300	
Water	SIO2	All	EPA 370	
Water	PERCH	All	EPA 331	
Water	CN	All	EPA 335	
Water	TPHD	All	EPA 3520/EPA 8015B	
Water	TPHV	All	EPA 5030B/ EPA 8015B	
Water	RAD	All	EPA 900	
Water	MET	All	EPA 3010A/6010	
Water	HG	All	EPA 7471	

Analytical data may be qualified based on data validation reviews. Qualifiers will be consistent with the applicable EPA functional guidelines and will be used to provide data users with an estimate of the level of uncertainty associated with the results qualified or "flagged". The following qualifiers may be assigned during the validation process:

- J – estimated concentration
- R – rejected value (unusable)
- U – not detected (e.g., not detected above the reporting limit)
- UJ –estimated concentration not detected above the reporting limit shown.

Step IIb Validation activities will be performed by the team on the basis of the validation report, the laboratory report case narrative, field notes and review of sampling procedures. The Step IIb review will verify compliance with this QAPP and the project and contractual requirements.

3.10.3 Reconciliation with User Requirements

The project team will evaluate field observations and the data and present it in a report as described later. Analytical results will be evaluated through the validation and verification steps discussed in this SAP. As part of the process for developing the findings and recommendations of the report, the Quality Manager will provide input on the suitability of the results for the purposes intended. The investigation results will be evaluated against the project DQOs and requirements of the data users or decision makers.

Limitations on the use of the data will be addressed as a factor in the uncertainty associated with the decision-making process. Where the validation qualifiers impact the overall data interpretation and

project recommendations, the reports will discuss the issue and the effect on the conclusions and recommendations

3.11 REPORTING

3.11.1 Quarterly Treatment System Monitoring Reports

The IRWD will submit quarterly treatment system monitoring reports to the DON, USEPA, DTSC, RWQCB, and the OCWD. The reports will provide the total volume of water, influent and effluent flow rates, influent and effluent water concentrations, and effluent vapor concentrations applicable to the SGU treatment system and the principal aquifer treatment system during the reporting period. The reports will also specify VOC concentrations in water from the principal aquifer extraction wells, discharge point of the water extracted from each extraction well,. and the discharge point for water from both treatment plants. The Quarterly Treatment System Monitoring Reports will include copies of the laboratory reports applicable to both systems. The primary objectives of the Quarterly Treatment System Monitoring Reports is to document compliance with treatment and discharge requirements at both of the treatment plants, and indicate whether treatment system components are functioning in accordance with design specifications.

3.11.2 Quarterly Data Summary Reports

Quarterly monitoring well data summary reports will be prepared by the DON for the first year of remedy implementation. The quarterly data summary reports will provide tabulations of detected COCs and measured groundwater levels at each monitoring well.

3.11.3 Annual Remedy Status Reports

The DON will provide an annual remedy status report to the USEPA, DTSC, RWQCB, IRWD, and the OCWD. The primary objectives of the annual report are to evaluate and document remedy progression toward attainment of RAOs, and to present or document optimization strategies to increase remedy efficiency. The report will include, but not be limited to, the following:

- Operations summary for the SGU and principal aquifer systems, including total pumping rates, durations, and volumes from each extraction well; injection rates, durations and volumes at the injection well; flow rates, durations, and volumes treated at each facility; average influent and effluent water concentrations at each system; and effluent vapor concentrations at each system,
- Estimated mass of VOCs removed from groundwater in the SGU and principal aquifer,
- Summary tables of all analyses performed during the applicable year,
- Updated maps of VOC concentrations in the SGU and principal aquifer,
- Updated maps of groundwater elevations in the SGU and principal aquifer,
- Evaluation of plume hydraulic containment and aquifer restoration,
- Revisions to the performance monitoring locations and frequencies, and the basis for the revisions (i.e., monitoring optimization),
- System optimization measures implemented during the reporting period,
- Description and evaluation of remedy enhancement (i.e., SVE) performed during the reporting period,

- Copies of well permit applications and well permits received from the OCHCA and the IRWD during the previous year,
- Written certification that the institutional controls are in place and effective.

3.11.4 Five-Year Review

In compliance with CERCLA requirements and EPA guidance (USEPA 2001), a five-year review process will be applied to the OU1 and OU2A remedy. The five-year review will provide an evaluation of the status and performance of the remedy versus the RAOs specified in the *OU1 and OU2A ROD* to assure that the remedy is performing as intended, and remains protective of human health and the environment. The five-year review will also provide an evaluation of the sampling and monitoring parameters and frequencies, and the status and performance of the institutional controls. The five-year review report will provide recommendations for remedy implementation, including continued or revised operating strategies and sampling and analysis parameters and frequencies. The report will also include an evaluation of the applicability of RAOs, and an evaluation of remedy progress and suitability of attaining RAOs. Annual remedy status reports and the five year reviews will be performed until the RAOs have been achieved.

3.11.5 Responsibilities During Remedy Implementation and Operation

Roles and responsibilities for the remedy implementation and monitoring are listed in Table 3-15. In summary, the DON will be responsible for the O&M and optimization of the SGU extraction wellfield and conveyance system to the point of connection with the IRWD's conveyance system. The DON will also be responsible for the monitoring and sampling of SGU extraction wells, and the monitoring and sampling of SGU and principal aquifer monitoring wells. The DON will be responsible for monitoring institutional controls within the former Station, the preparation of the annual status reports, and the five-year review reports.

The IRWD will be responsible for the O&M of the SGU treatment system, including the conveyance system from the point of connection with the DON, and the conveyance from the SGU treatment plant to IDP-1 and to the SOCWA brine line. The IRWD will perform all necessary monitoring and sampling associated with the operation of the SGU treatment system, including influent and effluent flow measurement, influent water sampling, and effluent water and vapor sampling. The IRWD will sample and dispose of the granular activated carbon as necessary. The IRWD will be responsible for all monitoring, sampling, and reporting in association with water and vapor discharge requirements.

The IRWD will be responsible for the O&M, sampling, and optimization of the principal aquifer extraction wellfield, the principal aquifer treatment plant, conveyance from the principal aquifer wells to the principal aquifer treatment plant and non-potable system, and conveyance from the principal aquifer treatment plant to the non-potable system. The IRWD will perform all necessary monitoring and sampling associated with the operation of the principal aquifer treatment system, including influent and effluent flow measurement, influent water sampling, and effluent water and vapor sampling. The IRWD will sample and dispose of the granular activated carbon as necessary. The IRWD will be responsible for all monitoring, sampling, and reporting in association with water and vapor discharge requirements.

The IRWD will prepare quarterly monitoring reports summarizing the SGU and principal aquifer treatment system operations.

Table 3-15: Responsibilities for Remedy Implementation and Operation

Description	Responsible Party	
	DON	IRWD/OCWD
Shallow Ground Water Unit Extraction Wells		
O&M	X	
Sampling/monitoring	X	
Well Field Extraction System Optimization	X	
Shallow Groundwater Unit Monitoring Wells		
Sampling/monitoring	X	
Shallow Groundwater Unit Conveyance		
From SGU wells to POC	X	
From POC to SGU treatment plant		X
Conveyance to IDP-1 and SOCWA		X
Shallow Groundwater Unit Treatment Plant		
O&M		X
Sampling/monitoring		X
Carbon disposal		X
Principal Aquifer Extraction Wells		
Well Field Extraction System Optimization		X
O&M		X
Sampling/monitoring		X
Principal Aquifer Monitoring Wells		
Sampling/monitoring	X	
Principal Aquifer Conveyance		
From extraction wells to treatment plant		X
From treatment plant to non-potable system		X
Principal Aquifer Treatment System		
O&M		X
Sampling/monitoring		X
Carbon disposal		X
Institutional Controls		
Monitoring	X	X
Reporting	X	
Reporting		
Discharge permit requirements		X
Quarterly Treatment System Monitoring Reports		X
Quarterly Data Summary Reports (first year of operation)	X	
Annual Remedy Status Reports	X	
5-Year Review Reports	X	

Notes:
DON = U.S. Department of the Navy
IRWD = Irvine Ranch Water District
O&M = operations and maintenance
OCWD = Orange County Water District
POC = point of connection
SGU = shallow groundwater unit
SOCWA = South Orange County Wastewater Authority

4. DATA EVALUATION AND SYSTEM OPTIMIZATION

4.1 HYDRAULIC CONTAINMENT MONITORING

Groundwater elevation monitoring and data analysis will be performed to evaluate the hydraulic containment induced by the OU1 and OU2A remedy. Hydraulic containment refers to the achievement of hydrodynamic control such that hydraulic gradients are inward to the extraction wellfield, thereby minimizing the downgradient migration of VOCs.

4.1.1 Groundwater Elevation Monitoring

Groundwater elevations will be measured in order to assess the three-dimensional flow regime induced by groundwater extraction. Water levels will be measured with an electronic sounder to an accuracy of +0.1-foot, and converted to feet above mean sea level based on the surveyed elevation of each well. Wells to be measured are listed on Table 3-2. The monitoring well network will provide comprehensive data to evaluate horizontal and vertical flow within the SGU and principal aquifer. Groundwater levels will be measured within a representative time frame in order to represent spatial rather than temporal variations.

Groundwater elevations will be measured weekly from the monitoring and continuously from extraction wells within the SGU upon system startup for a minimum of one month and until pseudo steady-state conditions have been established. Pseudo steady-state conditions will be assumed to have developed when measured groundwater levels do not fluctuate more than $\pm$0.5 foot in any of the monitoring wells within a week, although this criterion may be revised based on observed fluctuations. Monitoring of groundwater elevations will be performed quarterly upon establishment of pseudo steady-state conditions. However, elevations will be measured more frequently as required if the groundwater extraction strategy is significantly modified, or after a prolonged shutdown of the wellfield. The elevation monitoring would then resume on a quarterly schedule upon dissipation of observed transient effects and reestablishment of pseudo steady-state conditions. The elevation data will be used to optimize system performance and monitoring efficiency. If pseudo steady-state trends can be established, the spatial density and temporal frequency of elevation monitoring will be suitably reduced.

The majority of the principal aquifer monitoring wells are multi-port (i.e., Westbay) wells, and will be monitored quarterly upon system startup.

4.1.2 Evaluation of Hydraulic Containment

4.1.2.1 POTENTIOMETRIC SURFACE MAPPING

The groundwater elevations will be mapped and used to generate flow nets for the SGU and principal aquifer. Flow nets will be generated in plan view (horizontal direction) and cross section (vertical direction). Plan view flow nets will be generated separately for the SGU and the principal aquifer using wells screened within the respective formations. The cross sectional flow nets will include both the SGU and principal aquifer, and will be produced using wells screened exclusively within either formation. Wells with screens that intersect both the SGU and principal aquifer will not be used for generation of flow nets. The flow nets will be used to evaluate hydraulic gradients, capture zones of individual wells, cumulative capture within the SGU and principal aquifer, and vertical flow within and between the principal aquifer and SGU.

The potentiometric surface maps will be based on water levels measured directly from the monitoring well network and the inactive extraction wells. Since water levels from the active extraction wells will reflect aquifer and well losses, water levels will not be used from active

extraction wells unless required to fill a significant data gap. In such case, water levels in the vicinity of the pumping wells will be estimated in accordance with the following well hydraulics equations:

Theis Equation

$$s(r,t) = \frac{Q}{4\pi T} W(u)$$

where:

s (r,t) = drawdown at a distance (r) from a pumping well at time (t) after pumping has started
Q = pumping rate
T = transmissivity (values of T will be obtained from the groundwater flow model)
W(u) = well function

Thiem Equation

$$Q = \frac{2\pi T(s_w - s_1)}{\ln(r_1 - r_w)}$$

where:

s_w = drawdown in the pumping well with radius r_w
s_1 = drawdown in monitoring well located at distance r_1

Drawdown will be estimated for a distance equivalent to the wellbore radius of the applicable pumping well. The estimated drawdown value will be converted to elevation and used for potentiometric surface mapping. The Theis equation will be applied to transient conditions, and the Thiem equation will be used for steady-state conditions. Transmissivity will be estimated based on the hydraulic conductivity values used in the OU1 and OU2A groundwater flow model.

4.1.2.2 Numerical Flow Modeling and Particle Tracking

As described in the *OU1 and OU2A Groundwater Modeling Technical Memorandum* (Earth Tech 2003), a comprehensive, three-dimensional, numerical groundwater flow and contaminant transport model was developed for the Irvine Groundwater Management Zone. A 10-year transient flow calibration was performed for the period of January 1992 through March 2002, and included both the SGU and principal aquifer. The calibration included 120 quarterly stress periods incorporating seasonal variations in agricultural pumping. Particle tracking and simulation of TCE transport served as the primary basis for wellfield design. In order to reduce uncertainty regarding pumping rates from the SGU, a pre-design investigation was performed that included the installation and sampling of 10 extraction wells (24EX9, 24EX10, 24EX11, 24EX12A, 24EX12B, 24EX12C, 24EX13A, 24EX13B, 24EX13C, 24EX14) and two monitoring wells (24MW06, 24MW07). Aquifer tests were performed at seven of the extraction wells and the results were incorporated into the groundwater flow and contaminant transport model (Earth Tech 2004). The model was subsequently updated to account for revised locations of ET-2, Well 75, and Well 77; revised pumping rates for several

principal aquifer extraction wells (both potable and non-potable); and the use of IDP-1 for the injection of treated groundwater into the principal aquifer. The revised groundwater modeling results were presented in the *100% Design Submittal, Irvine Desalter Project* (Tetra Tech 2006).

Actual pumping rates from the SGU and principal aquifer during system operation will be input to the flow model, and the simulated water levels will be compared with the measured water levels. The flow model will be recalibrated as necessary to improve simulation accuracy. Particle tracking results will be used in conjunction with the measured data (i.e., potentiometric surface maps and flow nets) to evaluate the extent of hydraulic containment versus VOC extent within the principal aquifer and SGU.

4.1.2.3 CONCENTRATION TRENDS

TCE concentrations in groundwater will be monitored during system operation to evaluate aquifer restoration and to indicate whether temporal or spatial variations in contaminant distributions are consistent with the observed hydraulic containment. Wells to be monitored for VOCs are listed in Table 3-2. Of particular use for hydraulic containment evaluation will be the multi-level monitoring wells (24MW08 through 24MW17), which will allow for discrete, depth-specific, high-resolution measurement of contaminant concentrations and hydraulic heads in several depth intervals within the plume. Off-Station Monitoring Wells 24MW16 and 24MW17 will be used to confirm hydraulic containment at the Station boundary.

Similar to the elevation monitoring, temporal and spatial measurement of VOCs will be performed more frequently at system startup and reduced as trends become apparent. Specifically, wells with high concentrations or increasing trends will be pumped preferentially to wells with low or asymptotic concentrations, unless it results in an exceedance of ECLs or adverse effect on hydraulic containment. Additionally, concentration data will be used to modify operating parameters to increase system efficiency (i.e., maximize mass removal).

4.2 AQUIFER RESTORATION MONITORING

The remedy is designed to provide compliance with the RAOs as specified in the *OU1 and OU2A ROD*. This section outlines criteria to measure system performance with regard to aquifer restoration. The collection of appropriate restoration data will allow for system optimization as described in Section 4.3.

4.2.1 Mass Removal Rates

The treatment system influent and effluent will be sampled regularly to assess treatment system performance and contaminant concentration trends. In addition, the total influent flow rate, and specific pumping rates from individual wells will also be measured and recorded. The data will provide for mass removal estimates, assess compliance with ECLs, and identify necessary treatment system modifications.

The rate of contaminant mass removal (M_{ri}) will be estimated by multiplying the average dissolved influent concentration (C_{wi}) at the SGU and principal aquifer treatment plants by the average influent total flow rate (Q_T) at each treatment system:

$$M_{ri} = Q_T C_{wi}$$

The rate of contaminant mass removal (M_{ri}) will also be estimated using data collected at each extraction well to support system optimization:

$$M_{ri} = \Sigma_j^n q_j C_{wi}$$

where:

n = the number of pumping wells
q_j = the pumping rate of well (j)
C_{wi} = the dissolved concentration of contaminant pumped from well (j).

The rate of contaminant mass removal will be calculated more frequently using influent data from the treatment systems. However, specific well data will be used periodically to evaluate extraction well performance for system optimization. Mass removal estimates will be provided for both the SGU and principal aquifer, and presented in the annual remedy status reports and five-year review reports. Wells with low mass removal rates may be turned off unless it would adversely affect hydraulic containment.

4.2.2 Contaminant Concentration and Distribution Trends

TCE distribution trends will be evaluated to assess restoration progress within the SGU and principal aquifer. The wells listed in Table 3-2 will be sampled quarterly for the initial year of system operation. Spatial and temporal sampling frequencies will be reduced based on the trends observed during the first year of operation as indicated on Figure 3-3. The samples will be collected from the monitoring wells in accordance with DON standard operating procedures as described in Appendix A. Samples from the extraction wells will be collected from sampling ports at each wellhead. The samples from the multi-level wells (i.e., Westbay), will be collected in accordance with the manufacturer's specifications. Time series plots will be generated for individual wells to visually depict trends (i.e., contaminant tailing).

The contaminant concentration distribution will be mapped for each measurement event and used to evaluate the progress of aquifer restoration. The contaminant mass removed (based on total influent concentrations and volumes) will be compared to the estimated dissolved mass-in-place. The dissolved mass-in-place (M_w) will be estimated for both the SGU and principal aquifer as follows:

$$M_w = A\eta C_w b$$

where:

A = the plume area,
η = the formation porosity
C_w = the contaminant concentration
b = the plume thickness

A baseline mass-in-place will be estimated prior to system startup and will be used to gauge remedial progress. The determination regarding the frequency of subsequent mass-in-place estimates will be based on mass removal rates and changes in contaminant distribution observed during system operation. Mass-in-place estimates will be provided for both the SGU and principal aquifer, and presented in the annual status reports and five-year review reports.

The aquifer restoration progress will be assessed by comparing the rates of contaminant mass removal with the dissolved mass-in-place estimates. The trend of the mass removal rate curve versus time and mass-in-place will allow for a relative indication of system performance and need for optimization, and may provide an estimation of time required to remove the dissolved contaminants. However, due to the scale of the OU1 and OU2A plume and the hydrogeologic complexities, considerable uncertainty will be attendant with any mass estimates and estimates of time required for aquifer restoration. In the SGU, initial mass removal rates are anticipated to be high, and are

expected to decrease as the aggressive pumping in the source area removes the higher dissolved TCE concentrations. Additionally, mass removal rates from the SGU are expected to decrease due to mass transfer limitations of contaminants from the fine-grained units to the coarse-grained units, and as pumping rates decline due to dewatering of the aquifer.

4.3 GUIDANCE FOR SYSTEM OPTIMIZATION

Remedy performance data will be used to optimize system performance. Optimization is an iterative and systematic process to maximize remedial effectiveness and cost efficiency while maintaining program and data quality. Extraction strategies will be revised based on performance data to maximize mass removal and provide effective hydraulic containment. System optimization will be performed in accordance with the process described in *Guidance for Optimizing Remedial Action Operation* (DON 2001a). General optimization strategies are described below; however, specific optimization measures will be applied based upon system performance data.

4.3.1 Review and Evaluate Remedial Action Objectives

The first step of the optimization process will include a review and evaluation of the RAOs to determine whether they remain appropriate for the site. The review will initially include an update and verification of the conceptual site model (CSM) using the O&M and performance monitoring data. The CSM will be updated with the latest COC distributions, exposure routes and receptors, and land use considerations. The function and purpose for each monitoring well within the network will be evaluated based on plume changes. The RAOs will then be reviewed based on remedy performance and effectiveness. If data indicate that the RAOs specified in the ROD will not be attainable by the remedy, the RAOs and/or remedy will require modification. In accordance with EPA guidance (USEPA 1999), any substantive changes to the remedy, including changes to the RAOs, will require documentation in a post-ROD submittal. Significant changes require documentation in an ESD, and fundamental changes require documentation in a ROD Amendment.

4.3.2 Evaluate Remedy Effectiveness

Remedy performance will initially be evaluated as described in Sections 4.1 and 4.2. During optimization, remedy performance will be specifically evaluated for effectiveness. The evaluation will consider the remedial progress toward the RAOs, the operating efficiency and suitability of the system, and whether the system is capable of attaining the RAOs. Specific parameters indicating remedial progress to be evaluated include COC concentrations and distributions, mass removal rates, development of hydrodynamic capture, changes in plume size and shape, and evidence of natural attenuation processes. Indicators of effective remedial progress include decreasing COC concentrations, high mass removal rates, inward hydrodynamic gradients, decreasing plume size, and the presence of degradation products to support natural attenuation. Indicators of ineffective remedial progress include asymptotic COC concentrations, low or asymptotic mass removal rates, inability to establish inward hydrodynamic gradients, expanding plume size, and lack of degradation products.

System performance data will be evaluated to indicate whether the system and its components are operating in accordance with design specifications. Individual extraction rates, injection rates, and influent and effluent concentrations at each treatment system will be examined and compared to design assumptions and specifications. The system performance will also be evaluated for suitability in achieving the RAOs. The capture zone induced by the wellfield will be compared to plume size, and COC concentrations extracted by the wellfield will be compared with residual COC concentrations. Detailed evaluation of hydraulic containment (i.e., particle tracking) will be performed using the OU1 and OU2A groundwater flow and contaminant transport model.

4.3.3 Evaluate Cost Effectiveness

Cost and performance data will be evaluated to quantify the cost effectiveness of the system. Costs for system operation to be considered include routine equipment O&M, sampling and monitoring, utilities, and capital costs of system upgrades or modifications. The plots of cumulative costs versus cumulative mass removed, and cost per unit mass removed versus time will be generated. The plots will identify trends in cost and performance efficiency. Since many of the SGU monitoring wells are not equipped with low-flow sampling pumps, remedy optimization will include recommendations for installation of low-flow sampling pumps in applicable wells as a cost saving measure. An initial recommendation will be made after the first year of remedy implementation.

4.3.4 Identify System Modifications and Remediation Alternatives

If the remedial effectiveness and cost efficiency evaluations indicate that remedial progress is limited and that the remediation system is not operating at optimal efficiency, modifications to the existing system will be identified to enhance system performance and reduce O&M costs. However, modifications to the existing system will be identified only if the system is considered suitable for achieving the RAOs.

Common operational problems and strategies associated with groundwater pump and treat systems are listed in Table 4-1. Typical deficiencies include declining or insufficient extraction rates, inadequate plume capture, contaminant migration, and contaminant tailing due to diffusion-limited conditions or presence of a continuing source. Typical optimization strategies include revising pumping rates and schedules to provide more effective plume capture and mass removal; modifying system components (i.e., larger well pumps) for improved performance; and adding components for improved performance (ie., new extraction wells).

Flow patterns indicated by the potentiometric surface maps and particle tracking analyses will be examined to identify areas of insufficient capture, or stagnation zones developed during system operation. If areas of insufficient plume capture or stagnation zones are identified, alternate pumping may be implemented to enhance hydraulic gradients and increase mass removal efficiency. The OU1 and OU2A groundwater flow and contaminant transport model will be used to evaluate potential optimization strategies. Pulsed pumping may be used to increase the ratio of contaminant mass removed versus the pumped volume of groundwater. Pulsed pumping will be particularly useful in increasing mass removal efficiency during diffusion-limited conditions. Extraction wells with low contaminant concentrations (i.e., low mass removal rates) may be cycled off and monitored monthly. If the VOC concentrations increase significantly from the pre-shutdown concentration, pumping will be resumed until the concentrations are reduced to pre-shutdown levels. Pulsed pumping may be integrated with stagnation zone mitigation strategies, and will be evaluated using the OU1 and OU2A groundwater flow and contaminant transport model. If revised pumping strategies do not solve operational deficiencies, the use of additional extraction wells will be considered and evaluated.

Significant considerations for optimizing pumping strategies for the OU1 and OU2A remedy involve the average SGU pumping rate of approximately 400 gpm and the ECL concentrations specified in the Settlement Agreement, and the non-potable water use demands for the principal aquifer system. Evaluation and development of applicable optimization strategies will integrate system design parameters, the requirements specified in the Settlement Agreement, non-potable water use goals, and RAOs.

Optimization strategies to reduce O&M costs will also be considered to increase cost efficiency while maintaining remedial progress and data quality. O&M cost categories, including labor,

analytical, utilities, repairs and preventative maintenance, will be evaluated to identify cost minimization strategies.

If the performance data indicate that the current remedy will not result in achievement of the RAOs, alternative remedial strategies will be identified and evaluated. Remedial alternatives may be identified as a complement to the present remedy, or may involve sequencing of multiple alternatives. If an alternative remedy cannot increase remedial effectiveness and cost efficiency, alternate regulatory mechanisms will be considered. These include revision of the RAOs, land use controls, and/or a technical impracticability (TI) waiver. Alternative remedial strategies will be protective of human health and the environment.

Table 4-1: Common Deficiencies and Optimization Strategies for Pump and Treat Systems

Operational Deficiency	Potential Causes	Response/Optimization Strategy
Declining extraction rates	• Mineral incrustation • Biological fouling	• Redevelop well • Rehab well with acid/biocide
Insufficient extraction rates	• Improperly sized pumps • Inadequate well development • Low aquifer yield	• Install new pumps • Redevelop wells • Install new wells
Sand or silt in wells	• Improperly placed pumps • Improper sand pack and/or screen • Inadequate well development	• Raise pumps • Redevelop well • Install replacement wells
Migrating plume	• Insufficient extraction rates • Frequent or prolonged shutdowns • Inadequate number of extraction wells • Inadequate location of extraction wells	• Increase extraction rates • Increase system uptime (preventative maintenance) • Install additional wells
Contaminant concentrations fail to decline	• Insufficient extraction rates • Source areas have not been controlled	• Increase extraction rates • Install additional wells • Implement source control measures • Evaluate alternative technologies
Contaminant concentrations are asymptotic and/or exhibit significant rebound	• Establishment of diffusion-limited conditions • Development of stagnation zones • Extraction wells located/screened within low concentrations	• Pulsed-pumping • Alternating extraction • Deactivate low concentration wells • Install additional or replacement wells

4.3.5 Develop and Prioritize Optimization Strategies

Optimization strategies can be utilized to improve remedial performance, increase cost efficiency, enhance progression of the remedy versus the RAOs, and maintain protectiveness of human health and the environment. The strategies will be prioritized using a cost benefit analyses based on net present value (NPV) as follows (DON 2001a):

$$NPV = RF_{RP,I,n}$$

where:

R = annual O&M costs
$RF_{RP,I,n}$ = capital recovery factor, given 1 percent interest rate and n years
F_{RP} = $((1+i)^n-1/(i*(1+i)^n)$

Capital costs are added to the NPV of O&M costs to calculate total NPV costs. The cost benefit analysis will allow for the evaluation of costs for each alternative over the projected remedial duration.

4.3.6 Prepare Optimization Report and Implement Optimization Strategy

An Optimization Report will be prepared to detail the results of the optimization process. This Report will include remedy performance data, an evaluation of the RAOs, updates to the CSM, and an evaluation of remedy effectiveness, suitability, and cost efficiency. The Report will identify applicable modifications to the current remedy, and if necessary, remedial alternatives. Optimization strategies will be recommended and prioritized, and an implementation plan will be presented for the most cost effective strategy. Optimization reports will be integrated with applicable 5-year review reports or annual status reports, depending on optimization frequency.

Optimization strategies will be implemented upon regulatory agency concurrence. If an optimization strategy involves significant differences to the current remedy, or an alternative remedy, an ESD or ROD amendment will be prepared as appropriate.

4.4 Well Deactivation and Rebound Evaluation

Wells will be deactivated based on reduction below the MCLs, or the development of asymptotic conditions (i.e., contaminant tailing). Extraction wells will be shut down if the extracted VOC concentrations, and the VOC concentrations from monitoring wells within the capture zone, have been below MCLs for four consecutive sampling events. Extraction wells will also be shut down if the extracted VOC concentrations, and the VOC concentrations from monitoring wells within the capture zone, have remained asymptotic over the course of four consecutive sampling events.

Upon shut down of an extraction well(s), groundwater elevations will be measured every month until the transient effects of shut down have dissipated. VOC sampling will then be resumed at the pre-shut down sampling interval to confirm pre-shutdown concentrations. If the VOC concentrations in the extraction wells and monitoring wells do not exceed MCLs for two consecutive sampling events, the extraction well will be deactivated. If the VOC concentrations are above MCLs, but do not indicate an increasing trend as determined by the Mann-Kendrall trend analyses over four consecutive sampling events, then the well will be deactivated. If the VOC concentrations are above MCLs and indicate an increasing trend as determined by the Mann-Kendrall trend analyses over four sampling events, the well will be restarted and monitoring and sampling will be resumed at the pre-shut down intervals. Additionally, if the well is an extraction well required for inducing hydraulic containment of the VOC plume, or a monitoring well required to confirm hydraulic containment of the VOC plume, the well will be retained for extraction and/or monitoring. Multiple cycles of dewatering and re-saturation may be required to mobilize residual VOCs from fine-grained sediments, necessitating the potential implementation of pulsed pumping strategies.

4.5 Evaluating Remedy Completion

The OU1 and OU2A remedy is designed to meet the RAOs set forth in the ROD as described in Section 2.3 of this Plan. Due to the long-term nature of the proposed remedy, the monitoring criteria, system performance, and the RAOs will be reevaluated annually in the remedy status reports, and

every five years as mandated by CERCLA. Remedy success will be based upon a dynamic and iterative evaluation of remedy performance and suitability versus the RAOs. The remedy or the RAOs may require modification based upon system performance data. A decision flow chart depicting the iterative process for evaluating remedy completion is shown on Figure 4-1. Remedy completion will be documented in a Remedial Action Completion Report (RACR). The RACR will verify that all construction activities are complete; RAOs have been attained; institutional controls are in place as appropriate; a final inspection is complete; and the site is protective of human health and the environment.

PAGE NO. 4-10

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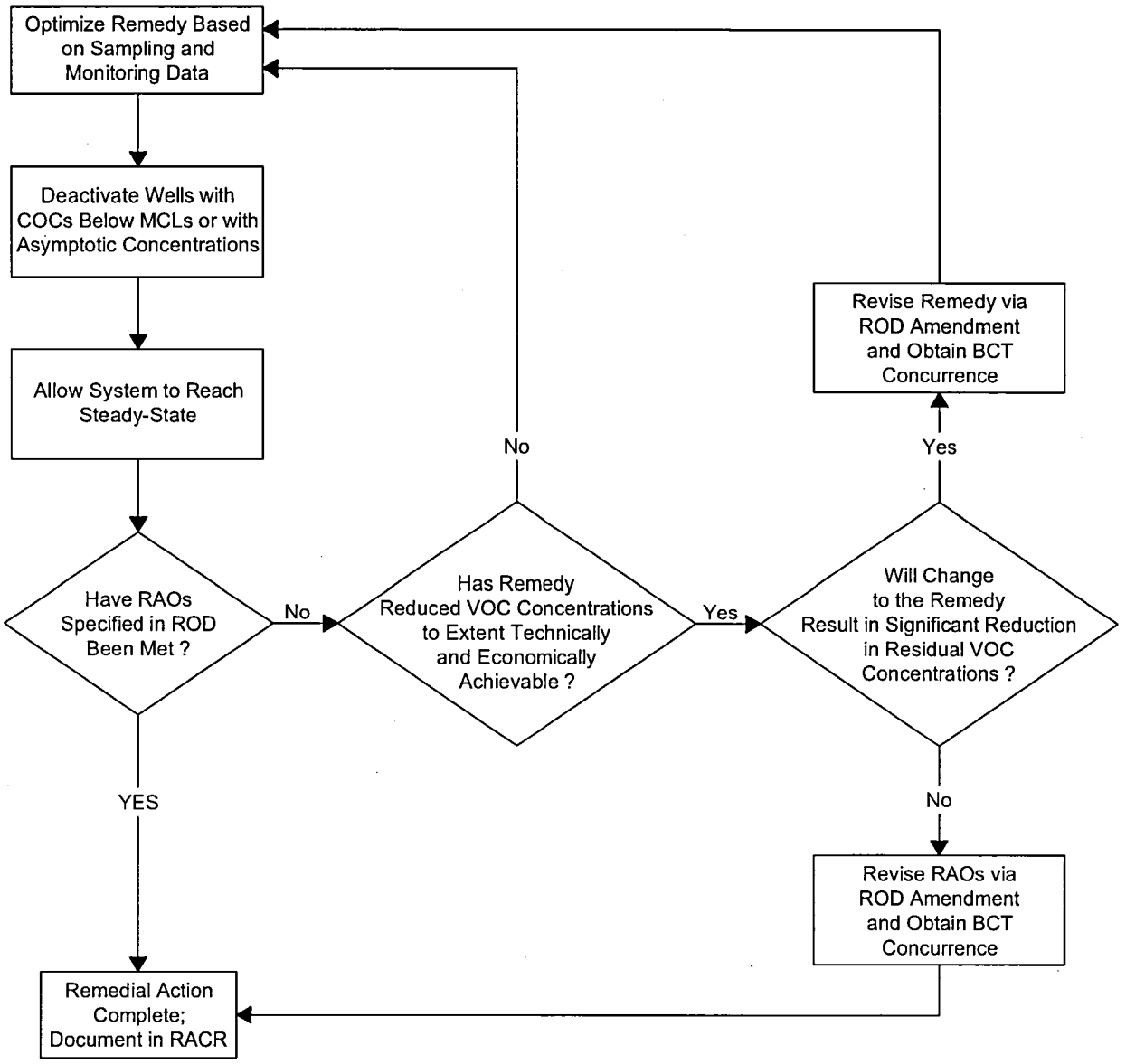

Notes:

RAO	Remedial Action Objective
ROD	Record of Decision
BCT	BRAC Cleanup Team
RACR	Remedial Action Completion Report

Performance Monitoring Plan

Decision Flow Chart for Evaluating Remedy Completion

OU1 and OU2A Remedy

Date: 06-07	Former MCAS El Toro	Figure 4-1
Project No. 29307	EarthTech A tyco International Ltd. Company	

File: L:\work\2...\OU1 and OU2A Remedy\Draft Final\FIGURE 4-1.dwg Time: Jun 21, 2007 - 2:11pm

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Appendix A
IC/LUC Checklist

Attachment A1
OU1 and OU2A LUC Compliance Certificate
Former Marine Corps Air Station
El Toro, California
EPA I.D. No. CA6170023208

Property Owner: _____

This evaluation is the final Navy certification just prior to site conveyance (yes or no) _____

If for an annual inspection, this evaluation covers the period from_____ through _____

Certification Checklist

	In Compliance	Non-Compliance	See Comment
1) The requirements of LUC RD Section 6.b and 6.c have been met.	☐	☐	☐
2) No installation of new groundwater wells of any type within the area requiring institutional controls[a].	☐	☐	☐
3) No groundwater use for any purpose[a].	☐	☐	☐
4) No altering, disturbing, or removing groundwater monitoring wells and associated equipment within the area requiring institutional controls[a].	☐	☐	☐
5) No subsurface excavation, digging, drilling, or other disturbance of the main pit area[a].	☐	☐	☐
6) Any violations of these LUCs were reported within 3 business days of discovery and an explanation provided of those actions taken or to be taken was provided within 10 days of discovery.	☐	☐	☐

I, the undersigned, hereby certify that the above-described land use restrictions have been complied with for the period noted. Alternately, any known deficiencies and completed or planned actions to address such deficiencies are described in the attached Explanation of Deficiencies.

_____ _____
Signature Date

Comments:

[a] – Future property owner may provide plans to the DON, U.S EPA, DTSC, and RWQCB for review and approval if the plans do not impact land use restrictions provided in the LUC RD.
Mail completed form(s) to the DON, U.S. EPA, DTSC, and RWQCB in January of each calendar year.